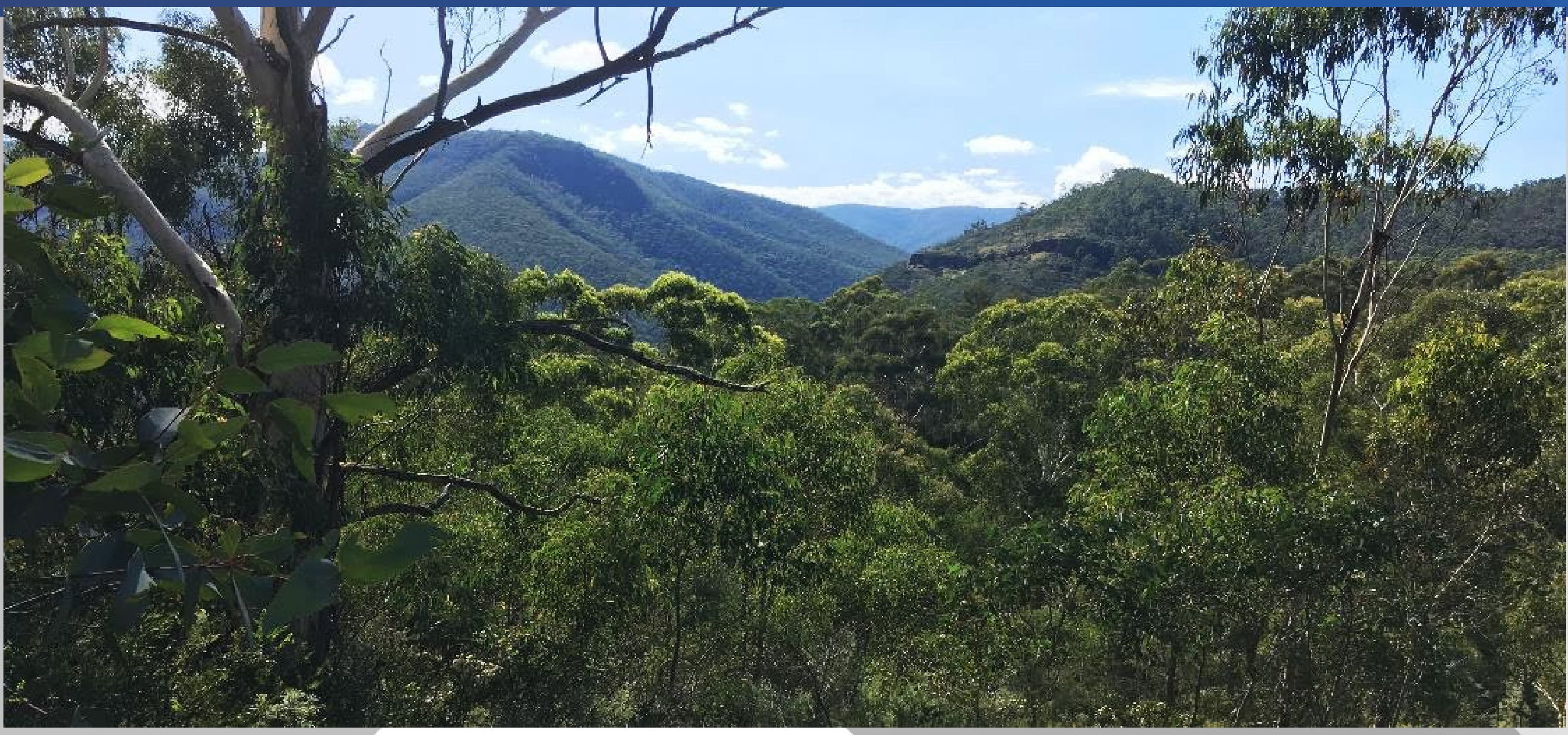
# Appendix B Biodiversity development assessment

Snowy 2.0 Transmission Connection Project

Environmental Impact Assessment

( February 2021)



Jacobs

# Snowy 2.0 Transmission Connection Project

## Biodiversity Development Assessment Report

Rev 4

TransGrid

February 2021

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# Glossary of terms

| Term | Definition |
|---|---|
| Biodiversity Assessment Method (BAM) | The Biodiversity Assessment Method (BAM) is the assessment manual that outlines how an accredited person assesses impacts on biodiversity at development sites. It is a scientific document that provides:<br>▪ A consistent method for the assessment of biodiversity on a proposed development or major project, or clearing site<br>▪ Guidance on how a proponent can avoid and minimise potential biodiversity impacts<br>▪ The number and class of biodiversity credits that need to be offset to achieve a standard of 'no net loss' of biodiversity. |
| Biodiversity credits | Ecosystem credits or species credits |
| Biodiversity credit report | The report produced by the Biodiversity Assessment Method Calculator that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a development site. |
| Biodiversity offsets | Management actions that are undertaken to achieve a gain in biodiversity values on areas of land in order to compensate for losses to biodiversity values from the impacts of development. |
| Biodiversity Offsets Scheme | A NSW government framework which creates a transparent, consistent and scientifically based approach to biodiversity assessment and offsetting for development that is likely to have a significant impact on biodiversity. |
| Biodiversity Offset Strategy | A strategy for offsetting residual impacts associated with a development. |
| Biodiversity Assessment Method Calculator (BAM-C) | The computer program that provides decision support to assessors and proponents by applying the BAM, and which calculates the number and class of biodiversity credits required to offset the impacts of a development. |
| Bioregion | Bioregions are relatively large land areas characterised by broad, landscape-scale natural features and environmental processes that influence the functions of entire ecosystems. They capture the large-scale geophysical patterns across Australia. These patterns in the landscape are linked to fauna and flora assemblages and processes at the ecosystem scale. |
| Construction envelope | A construction envelope is used in this BDAR for the purpose of assessing the potential for impacts on biodiversity over a slightly larger area than the current location of the disturbance area (see **Figure 2-1** and **Figure 2-2**). The construction envelope represents the limits of where disturbance may occur during construction of the project to allow for flexibility for the final siting of project infrastructure. As detailed design continues, final siting of the infrastructure (i.e. the disturbance area) can move within the assessed construction envelope subject to recommended environmental management measures and provided it does not exceed the limits defined by the construction envelope. This boundary differs from the project area as it only includes a 30 m buffer on the disturbance area boundary and does not include land that would be spanned by transmission lines where no clearing is required (i.e. gullies). |
| Cumulative impact | The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively |

| Term | Definition |
|---|---|
| | significant actions taking place over a period of time. Refer to the project SEARs for cumulative impact assessment requirements. |
| Direct impact | An impact on biodiversity values that is a direct result of vegetation clearance and loss of habitat for a development. It is predictable, usually occurs at or near to the disturbance area and can be readily identified during the planning, design, construction, and operational phases of a development. |
| Disturbance area | The disturbance area encompasses the maximum extent of physical disturbance likely to be required to accommodate construction activities and infrastructure needed to build the project (see **Figure 2-1** and **Figure 2-2**). The exact location of the disturbance area would be situated within the extent of the construction envelope (as described below) following detailed design. The disturbance area is also the vegetation clearing limit that TransGrid is seeking project approval for under Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979*. The disturbance area has been used for direct impact calculations, using proposed track option A and excluding areas within the approved Snowy 2.0 disturbance footprint (05.02.2020). For the purpose of this assessment, the construction envelope carries the same meaning as the 'development site' and 'subject land', as defined by the BAM |
| Ecosystem credit | As defined by the BAM, a measurement of the value of EECs, CEECs and threatened species habitat for species that can be reliably predicted to occur with a PCT. Ecosystem credits measure the loss in biodiversity values at a development site (disturbance area) and the gain in biodiversity values at a biodiversity stewardship site. |
| Ecosystem credit species | A measurement of the value of threatened species habitat for species that can be reliably predicted to occur by vegetation surrogates (i.e. PCTs) and landscape features, or for which targeted survey has a low probability of detection. |
| Habitat | An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component. |
| Indirect impact | An impact on biodiversity values that occurs when development related activities affect threatened species, threatened species habitat, or ecological communities in a manner other than direct impact. Compared to direct impacts, indirect impacts often:<br>▪ occur over a wider area than just the site of the development<br>▪ have a lower intensity of impact in the extent to which they occur compared to direct impacts<br>▪ occur off site<br>▪ have a lower predictability of when the impact occurs<br>▪ have unclear boundaries of responsibility. |
| Indirect impact buffer | A 20-metre buffer placed on the construction envelope to assess to the indirect impacts on vegetation structure associated with creating new edges through vegetation (i.e. edge effects) |
| Local population | As defined by the BAM, the population that occurs in the study area. In cases where multiple populations occur in the study area and/or a population occupies part of the study area, impacts on the entirety of each population must be assessed separately. |

| Term | Definition |
|---|---|
| Matter of national environmental significance (MNES) | A matter of national environmental significance (MNES) protected by a provision of Part 3 of the EPBC Act. |
| Mitigation measure | Action to reduce the severity of an impact. |
| NSW (Mitchell) landscape | Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1: 250,000. |
| Patch | A patch is defined in the BAM as an area of intact native vegetation that occurs on the subject land. The patch may extend onto adjoining land beyond the disturbance area of the subject land, and for woody ecosystems, includes native vegetation separated by ≤100 m from the next area of intact native vegetation. For non-woody vegetation, this gap is reduced to ≤30 m. |
| Plant community type (PCT) | A NSW plant community type identified using the plant community type (PCT) classification system. The PCT classification was created in 2011 by consolidating two existing community-level classifications: the NSW Vegetation Classification and Assessment database; and the BioMetric Vegetation Types database used in NSW regulatory programs. The PCT classification is now maintained in the BioNet Vegetation Classification application. It is a way to classify vegetation types. |
| Population | As defined by the BAM, a group of organisms, all of the same species, occupying a particular area. |
| Project area | The project area represents the limits of where disturbance may occur during construction to allow for flexibility for the final siting of project infrastructure. Final siting of the infrastructure (i.e. the disturbance area) can move within the assessed project area subject to recommended environmental management measures and provided it does not exceed the limits defined by the project area. |
| Snowy 2.0 | haveSnowy 2.0' is the pumped hydro-electric expansion of the Snowy Scheme |
| Snowy 2.0 BOS | Snowy 2.0 Main Works Biodiversity Offset Strategy (EMM Consulting, 2020b) |
| Snowy 2.0 disturbance footprint (05.02.2020): | The extent of physical disturbance likely to be required to accommodate construction activities and infrastructure needed to build Snowy 2.0 |
| Species credits | As defined by the BAM, 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. |
| Species credit species | Threatened species that are assessed according to Section 6.4 of the BAM |
| Subject land | As defined by the BAM, land to which the BAM is applied in Stage 1 to assess the biodiversity values of the land. For the purpose of this assessment, the subject land is referred to as the disturbance area. |
| Study area | Study area: The study area is the area of land that includes the construction envelope and a suitable buffer to capture the biodiversity values outside of the project area (see<br>**Figure** 2-1 and **Figure 2-2**). The boundary of the study area shown in the figures of the BDAR includes a 200 m buffer from the edge of the construction envelope, plus land (i.e. gullies) that would be spanned by transmission lines. |
| Target species | A species that is the focus of a study or intended beneficiary of a conservation action or connectivity measure. |

| Term | Definition |
|---|---|
| Threatened Biodiversity Data Collection | Part of the BioNet database, published by EESG and accessible from the BioNet website at www.bionet.nsw.gov.au. |
| Threatened species | A species listed under the BC Act, Fisheries Management Act 1994 (FM Act) or Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). |
| Threatened ecological community | A community of different species associated with one another and sharing the same habitat, that is listed under the BC Act, FM Act and Commonwealth EPBC Act. Threatened ecological communities are listed as endangered or critically endangered under the BC Act, or may be listed as vulnerable, endangered or critically endangered under the Commonwealth EPBC Act. |
| 1,500-m landscape buffer | The assessment area surrounding the disturbance area includes the area of land in the 1,500-m landscape buffer around the disturbance area. The study area is situated within the 1,500-m landscape buffer. The landscape buffer is an assessment area used to identify landscape features surrounding the disturbance area to provide site context and to inform the likely habitat suitability of the disturbance area. |

| Abbreviations | |
|---|---|
| asl | Above sea level |
| BAM | Biodiversity Assessment Method |
| BAM-C | Biodiversity Assessment Method Calculator |
| BC Act | *Biodiversity Conservation Act 2016* (NSW) |
| BCD | Biodiversity Conservation Department |
| BDAR | Biodiversity Development Assessment Report |
| BOS | Biodiversity Offset Strategy |
| CEMP | Construction Environmental Management Plan |
| DoAWE | Commonwealth Department of Agriculture, Water and the Environment |
| DoEE | Commonwealth Department of Environment and Energy (now the Department of Agriculture, Water and the Environment) |
| DPIE | Department of Planning, Industry and Environment (NSW) |
| DPI | Department of Primary Industries (NSW) |
| EEC | Endangered ecological community |
| EESG | Environment, Energy and Science Group (NSW DPIE) |
| EIS | Environmental Impact Statement |
| EP&A Act | *Environmental Planning and Assessment Act 1979* (NSW) |
| EPBC Act | *Environmental Protection and Biodiversity Conservation Act 1999* (Commonwealth) |
| FCNSW | Forestry Corporation New South Wales |
| FM Act | *Fisheries Management Act 1994* (NSW) |
| GDE | Groundwater Dependent Ecosystem (Commonwealth Department of Agriculture, Water and the Environment) |

| Abbreviations | |
|---|---|
| IBRA | Interim Biogeographic Regionalisation for Australia |
| KNP | Kosciuszko national park |
| MNES | Matters of National Environmental Significance |
| NPWS | National Parks and Wildlife Service |
| OEH | Office of Environment and Heritage (replaced by EESG) |
| PCT | Plant Community Type |
| PMST | Protected Matters Search Tool |
| PoM | Plan of Management |
| SEARs | Secretary's Environmental Assessment Requirements |
| SEPP | State Environmental Planning Policy |
| SSI | State Significant Infrastructure |
| TECs | Threatened Ecological Communities |
| TBDC | Threatened Biodiversity Data Collection (BioNet) |
| VIS | Vegetation information system (BioNet Vegetation Classification) |

# Executive Summary

TransGrid is seeking approval under Part 5 Division 5.2 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) for the construction and operation of an overhead transmission line connection and substation (the project) to enable the grid connection of the Snowy 2.0 pumped hydro generation project (Snowy 2.0). The project has been declared critical State Significant Infrastructure (SSI) under State Environmental Planning Policy (State and Regional Development) 2011.

The NSW Biodiversity Offsets Scheme applies to SSI projects unless the Secretary of the Department of Planning, Industry and Environment (DPIE) and the Chief Executive of Environment, Energy and Science Group (EESG) determine that the project is not likely to have a significant impact. This document is the Biodiversity Development Assessment Report (BDAR) for the project as required under the Biodiversity Assessment Method (BAM). This BDAR documents the methods and results of the biodiversity assessment undertaken for the project in line with the relevant State and Commonwealth environmental and threatened species legislation and policy. This BDAR addresses Stage 1 and Stage 2 of the BAM.

The eastern extent of the project is defined by the location of Snowy 2.0 cable yard at Lobs Hole in Kosciuszko National Park (KNP). The project then spans west across Talbingo Reservoir to TransGrid's existing Transmission Line 64 (330 kilovolt overhead transmission line between Upper Tumut and Lower Tumut switching stations) in Bago State Forest. Line 64 is the point of connection of the project to the National Electricity Market (NEM).

The total length of the overhead transmission line connection is approximately nine kilometres (km) with the project having a total worst-case disturbance area of approximately 143 hectares (ha), that would be located within a larger construction envelope (approximately 224 ha in size), which represents the limits of where disturbance may occur during construction. The disturbance area is a smaller indicative area of impact inside the construction envelope. As detailed design continues, final siting of the infrastructure (i.e. the disturbance area) can move within the assessed construction envelope subject to recommended environmental management measures and provided it does not exceed the limits defined by the construction envelope. Project direct impacts have been calculated using the disturbance area, with approximately 6.9 ha located within the approved Snowy 2.0 disturbance footprint (05.02.2020).

**Landscape**

The project is located within a predominately natural landscape containing a diversity of habitats with high biodiversity value. The project area traverses two IBRA bioregions which approximately correspond to national park and state forest boundaries; the Australian Alps Bioregion (Bago State Forest) and the South Eastern Highlands Bioregion (KNP).

Areas of geological significance have been identified within the 1,500 metre (m) landscape buffer, however none would be directly impacted by the project. No areas of land that the Minister for Energy and Environment has declared as an area of outstanding biodiversity value in accordance with section 3.1 of the *Biodiversity Conservation Act 2016* (BC Act) would be affected.

There is approximately 3,931 ha of native vegetation (woody and non-woody vegetation) within a 1,500 m landscape buffer (total area of 4,052 ha) surrounding the construction envelope, equating to a percent native vegetation cover in the landscape of 97%.

**Assessment Methods**

Extensive ecological surveys have been undertaken for this BDAR between October 2018 and October 2020 in accordance with the BAM and includes:

- Preliminary site visits and mapping
- Identification and detailed mapping of plant community types (PCTs) involving:
  - Stratification of PCTs in survey units (vegetation zones)
  - Plot based floristic vegetation survey and vegetation integrity assessment
- Threatened species habitat assessment
- Targeted threatened species surveys, including:
  - Parallel transects undertaken across suitable habitats within the construction envelope for threatened flora species within prescribed survey periods (seasons)
  - Targeted fauna survey methods were employed including live trapping, baited remote sensor camera traps, call broadcasting, ultrasonic call recording (bats), spotlighting and timed area searches.

**Native vegetation and habitats**

Seven PCTs were identified within the disturbance area, each containing up to four vegetation zones as follows:

- PCT 285: Broad-leaved Sally grass – sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion, with just one vegetation zone (moderate condition – Blackberry infestation)
- PCT 296: Brittle Gum – peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion, with four vegetation zones including native grassland, good condition – drier *Eucalyptus nortonii* dominant slope, good condition – wetter sheltered slopes and moderate condition – Blackberry infestation
- PCT 300: Ribbon Gum – Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment, with just one vegetation zone (good condition)
- PCT 302: Riparian Blakely's Red Gum – Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion, with two vegetation zones including native grassland and moderate condition
- PCT 729: Broad-leaved Peppermint – Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion, with four vegetation zones including native grassland, regrowth shrubland, good condition (dry slopes) and good condition wetter sheltered slopes
- PCT 999: Norton's Box – Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion, with two vegetation zones including regrowth shrubland, and good condition – drier *Calytrix tetragona*
- PCT 1196: Snow Gum – Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion, with two vegetation zones including native grassland and good condition.

None of this vegetation corresponds with a threatened ecological community listed under the BC Act or EPBC Act.

The above listed PCTs correspond with four vegetation classes (Keith 2004) that represent different broad habitat types used to stratify fauna survey, including:

- Upper Riverina Dry Sclerophyll Forests
- Southern Tableland Dry Sclerophyll Forests
- Southern Tableland Wet Sclerophyll Forests
- Subalpine Woodlands.

**Groundwater Dependent Ecosystems**

The level of groundwater dependence of vegetation communities in the disturbance area and broader study area was identified using the *Atlas of Groundwater Dependent Ecosystems* (GDEs) (Bureau of Meteorology, 2017) and the *Risk Assessment Guidelines for Groundwater Dependent Ecosystems* released by the NSW DPI (Kuginis *et al.*, 2012). Within the disturbance area:

- PCT 285 and PCT 296 are likely to be opportunistic facultative GDEs (i.e. partial dependence on the subsurface presence of groundwater when available)
- PCT 302 is likely to be a proportional facultative GDE (partial dependence on the subsurface presence of groundwater from a consistent source).

The project is considered unlikely to affect groundwater to an extent that facultative GDEs would be detrimentally impacted.

**Threatened species**

No threatened plant species were identified during surveys of the disturbance area. This includes extensive surveys undertaken for a list of orchid species developed in consultation with the DPIE, EESG Threatened Species Officers. An expert report was commissioned for *Thelymitra atronitida*, which determined that this species is unlikely to occur. No flora species are assumed to be present.

Fauna surveys identified the following threatened species:

- Birds: Gang-gang Cockatoo, Masked Owl, Diamond Firetail, Varied Sittella, Flame Robin, Scarlet Robin and Dusky Woodswallow
- Mammals: Yellow-bellied Glider populations on the Bago Plateau, Squirrel Glider and Eastern Pygmy Possum.

Other species credit fauna assumed to occur and included in the impact assessment include:

- Powerful Owl
- Booroolong Frog (BC Act and EPBC Act).

**Biodiversity Impacts**

Impact calculations have been split between the two IBRA bioregions over which the project is situated (Australian Alps Bioregion and South Eastern Highlands Bioregion) for the purpose of determining separate offsetting requirements in the Biodiversity Assessment Method BAM-C (BAM-C). Impact calculations do not account for areas within the approved Snowy 2.0 disturbance footprint (05.02.2020). The direct impacts to biodiversity values that would occur as a result of the project construction includes the clearing of about 135.6 ha of native vegetation comprising seven PCTs across two bioregions as described in **Table ES.1.1**.

Table ES.1.1: Direct impacts to native vegetation from the project (SEH = Southern Eastern Highlands Bioregion, AA = Australian Alps Bioregion)

| PCT ID No. | PCT name | Threatened ecological community | Area (ha) in disturbance area | | Area (ha) in construction envelope | |
|---|---|---|---|---|---|---|
| | | | SEH | AA | SEH | AA |
| 296 | Brittle Gum – peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion | No | 21.15 | - | 37.35 | - |
| 300 | Ribbon Gum – Narrow-leaved (Robertsons) Peppermint montane fern – grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | No | 32.51 | 10.77 | 49.46 | 15.15 |
| 302 | Riparian Blakely's Red Gum – Broad-leaved Sally woodland – tea-tree – bottlebrush – wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion | No | 3.12 | - | 9.18 | - |
| 729 | Broad-leaved Peppermint – Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion | No | 34.72 | - | 61.57 | - |
| 999 | Norton's Box – Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion | No | 7.61 | - | 13.43 | - |
| 285 | Broad-leaved Sally grass – sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion | No | - | 1.77 | - | 2.24 |
| 1196 | Snow Gum – Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion | No | - | 23.95 | - | 31.23 |
| | | **TOTALS** | **99.11** | **36.49** | **170.99** | **48.64** |
| | | | **135.6** | | **219.63** | |

The project would involve the loss of habitat within the disturbance area for the following species credit species:

- Gang-gang Cockatoo – 69.6 ha of breeding habitat (over both bioregions)
- Powerful Owl – 43.28 ha of breeding habitat (over both bioregions)
- Masked Owl – 3.12 ha of breeding habitat (confined to South Eastern Highlands Bioregion)
- Booroolong Frog – 3.12 ha (confined to South Eastern Highlands Bioregion)
- Eastern Pygmy-possum – 133.06 ha (over both bioregions)
- Yellow-bellied Glider population on the Bago Plateau – 61.22 ha (over both bioregions)
- Squirrel Glider – 68.13 ha (over both bioregions).

The disturbance area also provides habitat features for a range of ecosystem credit fauna species and foraging habitat only for several dual-credit fauna species.

Twenty-nine waterways or unnamed drainage lines are crossed by the project area (i.e. not all will be directly impacted). Six of these are stream order three or greater and have also been mapped as Key Fish Habitat. The project would only directly impact three of these waterways: Sheep Station Creek, Cave Gully and Wallaces Creek. There is potential for indirect impacts to surrounding aquatic habitats from unmitigated erosion and contaminated (e.g. hydraulic fluids, oils, drilling fluids) run-off from construction and operation. The implementation of mitigation measures (i.e. track design, erosion and sediment control, spill control) would be implemented to control sediment and pollutants from any significant runoff events.

The project has potential to result in prescribed biodiversity impacts, namely impacts to connectivity and movement for gliding mammals (i.e. fragmentation by clearing along the transmission line corridor and collision with razor wire fences around the substation) and impacts on water quality for aquatic species including Booroolong Frog. Measures to minimise and mitigate these potential impacts have been discussed.

Due to the creation of new edges through remnant vegetation, there is also expected to be indirect impacts to around 39.3 ha of retained vegetation adjacent to the cleared transmission line corridor via edge effects.

Other potential indirect impacts that may occur due to the project include collision and electrocution of fauna with transmission lines, increased fire risk and increases in noise, vibration, dust, light and contaminants. The measures provided in this BDAR are likely to suitably mitigate these potential impacts.

**Mitigation and offset strategies**

The impacts described are addressed in a mitigation strategy to be formalised into a Construction Environmental Management Plan (CEMP) and applied during the construction and operational phases.

A credit requirement has been generated by the BAM-C for the two bioregions assessed:

- South Eastern Highlands Bioregion (KNP):
  - 2,822 ecosystem credits
  - 8,983 species credits
- Australian Alps Bioregion (Bago State Forest):
  - 1,161 ecosystem credits
  - 6,432 species credits.

The project impacts and offset obligations have been calculated based on the concept design, as is normal for a major project at this stage of the process. Therefore, project impacts and offset obligations would be revised following detailed design and would include consideration of areas where total clearing and permanent infrastructure is not required (i.e. the permanent easement). This approach is consistent with the approved Snowy 2.0 Main Works EIS (EMM Consulting, 2019).

TransGrid proposes to use the same framework which has been developed for the Snowy 2.0 Main Works Biodiversity Offset Strategy (EMM Consulting, 2020b) (Snowy 2.0 BOS) and included in the Snowy 2.0 Main Works Infrastructure Approval (SSI 9687) ; namely, the proponent would make payments to the NPWS to offset the residual biodiversity impacts of the project, and NPWS would use these funds to enhance the biodiversity and conservation values of KNP. This framework for the Snowy 2.0 project would allow NPWS to carry out actions to substantially improve catchment health, strengthen ecosystems, protect threatened species and communities and deliver long-term strategic conservation benefits for the KNP ((Department of Planning, Industry and Environment Department of Planning 2020d).

## Important note about your report

In preparing this report Jacobs has relied upon and presumed accurate any information, or confirmation of the absence thereof, provided by TransGrid and/or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate or incomplete then it is possible that our observations and conclusions as expressed in this report may change. Jacobs derived the data in this report from information sourced from TransGrid and/or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations and findings expressed in this report, to the extent permitted by law.

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# 1. Introduction

## 1.1 Project background

TransGrid is the manager and operator of the major high-voltage electricity transmission network in New South Wales (NSW) and the Australian Capital Territory (ACT).

TransGrid is seeking approval under Part 5 Division 5.2 of the *Environmental Planning and Assessment Act 1979* (EP&A Act) for the construction and operation of an overhead transmission connection and substation to enable the grid connection of the Snowy 2.0 pumped hydro generation project (Snowy 2.0).

The Snowy 2.0 Transmission Connection Project (the project) has been declared critical State Significant Infrastructure (SSI) under the State Environmental Planning Policy (State and Regional Development) 2011, and is subject to assessment and determination by the Minister for Planning. This Biodiversity Development Assessment Report (BDAR) has been developed as a component of the Environmental Impact Statement (EIS) for the project.

## 1.2 Purpose of this technical report

This BDAR has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs) issued for the project on 1 November 2019 by the Planning Secretary of the NSW Department of Planning, Industry and Environment (DIPE).

The SEARs relevant to this BDAR are presented in **Table 1.1.**

Table 1.1: Secretary's environmental assessment requirements – Biodiversity

| SEARs | Section addressed |
|---|---|
| an assessment of the biodiversity impacts of the project on terrestrial, aquatic and groundwater-dependent ecosystems, including listed Commonwealth and State threatened species and communities and listed Commonwealth migratory species | The BDAR has identified the following biodiversity values, in, that may be impacted by the project:<br>▪ Terrestrial – **Chapter 6** and **Chapter 7**<br>▪ Aquatic – **Section 8**<br>▪ Groundwater dependent ecosystems – **Section 6.5**<br>The BDAR has identified biodiversity values listed under the EPBC Act (Commonwealth) that may be impacted by the project in **Chapter 9**.<br>An assessment of the biodiversity impacts of the project are detailed in **Chapter 11**. |
| A strategy to offset any residual impacts of the project focusing on enhancing the biodiversity values of the Kosciuszko National Park (KNP) in the medium to long term | Residual impacts of the project that require offsets are described in **Chapter 13** and **Chapter 14**<br>A Biodiversity Offset Strategy (BOS) is provided in **Chapter 15**. |

# 2. Description of the project

## 2.1 Project components

The project would involve the construction and operation of an overhead transmission line connection and substation to connect the Snowy 2.0 project to the National Electricity Market.

The key elements of the project would include:

- A new 500/330 kilovolt (kV) substation located within Bago State Forest and adjacent to TransGrid's existing Line 64, which forms a 330 kV connection between Upper Tumut and Lower Tumut switching stations. The substation switchyard would occupy a footprint of approximately 300 metres (m) wide by 600 m long inclusive of an approximate 25 to 45 m wide cleared asset protection zone (APZ) surrounding the switchyard. The substation would include a three metre high palisade security fencing on all sides of the substation. The substation would be surrounded by a security fence
- Upgrade and widening of an existing access road off Elliott Way to the new substation including the construction of a new driveway into the 330 kV and 500 kV switchyards
- Two new 330 kV overhead double-circuit transmission lines from the Snowy Hydro 2.0 cable yard to the new substation:
  - Total length of each line would be approximately nine kilometres (km)
  - Located in a corridor ranging in width from approximately 120 m to 200 m
  - Each line would comprise approximately 21 steel lattice structures up to 75 m in height
- Short overhead 330 kV transmission line connection (approximately 300 m in length) comprising approximately two transmission structures and eight steel poles between the substation and Line 64
- Construction of approximately 10 kms of new access tracks (Option A) or 8 kms (Option B) to the transmission structures and upgrade to existing access tracks where required. Option A minimises disturbance within a mapped high risk naturally occurring asbestos (NOA) zone. The access tracks would remain following the completion of construction to service ongoing maintenance activities along the transmission lines
- Establishment of a helipad (approximately 30 m wide by 30 m long) to support the transmission line construction activities carried out at higher elevations and steep terrain along Sheep Station Ridge
- Ancillary activities, including the establishment of tensioning and pulling sites for conductor and earth wire stringing, construction benches, site compounds, and equipment laydown areas.

The project location and key components of the project are shown in **Figure 2-1** and **Figure 2-2** respectively.

A detailed description of the project is provided in Chapter 5 of the EIS.

## 2.2 Project location

The eastern extent of the project is defined by the location of the Snowy 2.0 cable yard at Lobs Hole in Kosciuszko National Park (KNP). The cable yard serves as the transition point between the underground cables carrying electricity generated by Snowy 2.0 to the overhead transmission connection. The cable yard forms part of Snowy 2.0.

From the cable yard, the transmission connection extends west through KNP and Sheep Station Ridge, which is characterised by steep, mountainous terrain before traversing Talbingo Reservoir. The transmission connection then continues west, passing Elliott Way at three locations before entering Bago State Forest to the substation site, refer to **Figure 2-2.**

The existing landscape character of much of the project area consists of undisturbed and mountainous terrain, forested valleys, and is the only true alpine environment in NSW (NSW National Parks and Wildlife

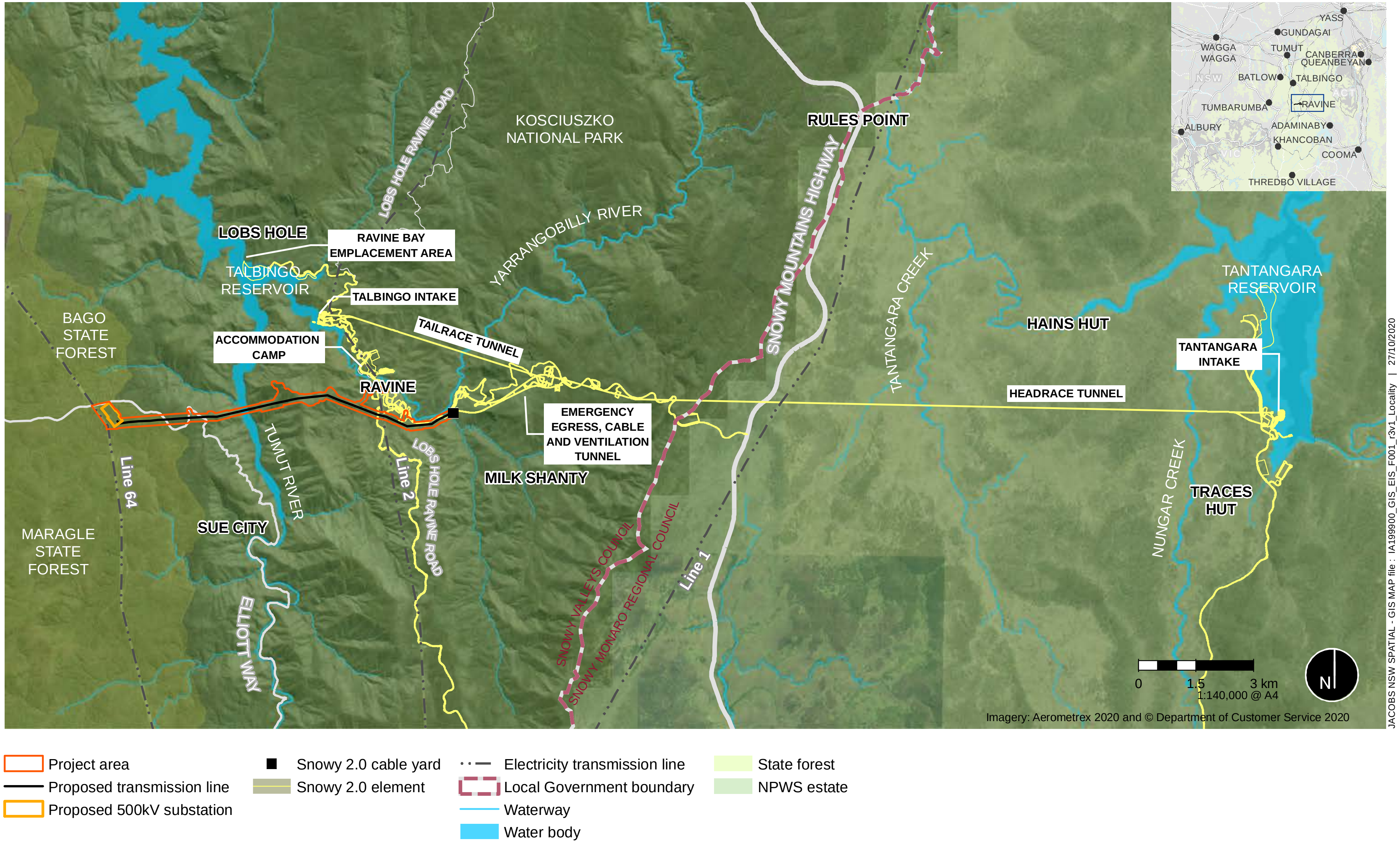
Service (NPWS) 2003). This landscape contains limited human disturbance however existing transmission line easements, minor access tracks, and infrastructure associated with the Talbingo Reservoir are located within and surrounding the project area.

### 2.2.1 Definitions

The following areas are discussed throughout the report and are defined as:

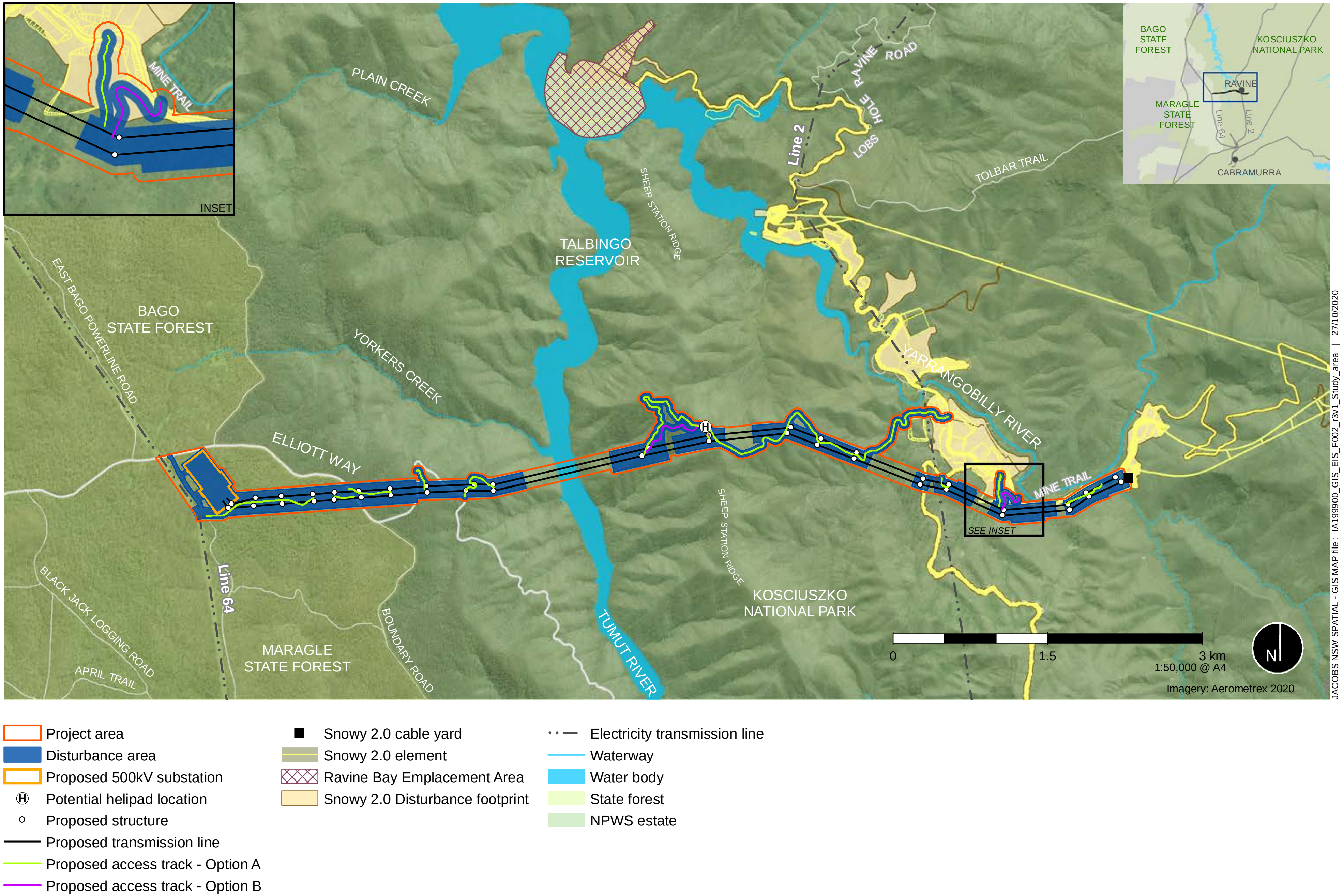
- The project: Refers to the concept design for the Snowy 2.0 Transmission Connection project, which includes two double circuit 330 kV transmission lines, substation, access tracks and ancillary infrastructure
- Project area: The project area represents the limits of where disturbance may occur during construction to allow for flexibility for the final siting of project infrastructure. Final siting of the infrastructure (i.e. the disturbance area) can move within the assessed project area subject to recommended environmental management measures and provided it does not exceed the limits defined by the project area
- Disturbance area: The disturbance area encompasses the maximum extent of physical disturbance likely to be required to accommodate construction activities and infrastructure needed to build the project (see **Figure 2-1** and **Figure 2-2)**. The exact location of the disturbance area would be situated within the extent of the construction envelope (as described below). The disturbance area is also the vegetation clearing limit that TransGrid is seeking project approval for under Part 5, Division 5.2 of the EP&A Act. The disturbance area has been used for direct impact calculations, using proposed track option A and excluding areas within the approved Snowy 2.0 disturbance footprint (05.02.2020). For the purpose of this assessment, the construction envelope carries the same meaning as the 'development site' and 'subject land', as defined by the Biodiversity Assessment Method (BAM)
- Construction envelope: A larger "construction envelope" has been introduced and used in this BDAR for the purpose of assessing the potential for impacts on biodiversity over a slightly larger area than the current location of the disturbance area (see **Figure 2-1** and **Figure 2-2**). The construction envelope represents the limits of where disturbance may occur during construction of the project to allow for flexibility for the final siting of project infrastructure. As detailed design continues, final siting of the infrastructure (i.e. the disturbance area) can move within the assessed construction envelope subject to recommended environmental management measures and provided it does not exceed the limits defined by the construction envelope. This boundary differs from the project area as it only includes a 30 m buffer on the disturbance area boundary and does not include land that would be spanned by transmission lines where no clearing is required (i.e. gullies)
- Snowy 2.0 disturbance footprint (05.02.2020): encompasses the extent of physical disturbance likely to be required to accommodate construction activities and infrastructure needed to build Snowy 2.0
- Study area: The study area is the area of land that includes the construction envelope and a suitable buffer used to capture the biodiversity values outside of the project area (see **Figure 2-1** and **Figure 2-2**). The boundary of the study area shown in the figures of the BDAR includes a 200 m buffer from the edge of the construction envelope, plus land that would be spanned by transmission lines.
- 1,500-metre landscape buffer: The assessment area surrounding the development site (or subject land) includes the area of land in the 1,500-metre landscape buffer around the development site. The study area is situated within the 1,500-metre landscape buffer. The landscape buffer is an assessment area required by the BAM to identify landscape features (see **Chapter 5**) surrounding the development site to provide site context and to inform the likely habitat suitability of the development site (see **Figure 5-1** and **Figure 5-2**)
- Bioregion: The study area is located across two IBRA bioregions: namely The South Eastern Highlands Bioregion and the Australian Alps Bioregion (Thackway and Cresswell, 1995) and within the Bondo and Snowy Mountains sub-regions respectively. The majority of the project is located in the Bondo sub-region of the South Eastern Highlands Bioregion. For consistency with the requirements of the BAM, this assessment has been divided by the boundary of the two bioregions, with impacts assessed and reported separately for each bioregion

- Locality: This is defined as the bioregion sub-regions in which the project is located; that is, the Bondo sub-region of the South Eastern Highlands Bioregion and the Snowy Mountains sub-region of the Australian Alps Bioregion.




**Data source:**
Jacobs 2020, TransGrid, EMM 2020
© Department Finance, Services and Innovation 2018

**Figure 2-1** | Project location




**Data source:**
Jacobs 2020, TransGrid, EMM 2020,


**Figure 2-2** | Project overview

### 2.2.2 Construction activities

The construction works would commence with the construction of the access tracks to the substation and structure locations. Construction of the helipad is also expected to commence in the initial stages. Once suitable access has been established, construction of the substation and transmission line would commence and occur concurrently.

A summary of the construction activities is provided in **Table 2.1.**

Table 2.1: Summary of construction activities

| Construction activity | Description |
| --- | --- |
| Pre-construction, site establishment and vegetation clearance | ▪ Site mobilisation once relevant approvals have been granted, property acquisitions have been finalised Forestry Corporation of NSW (FCNSW) and National Parks and Wildlife Service (NPWS) and agreements with construction contractors has been achieved<br>▪ Surveying and marking out the approved disturbance area and any environmental avoidance areas<br>▪ Installation of appropriate stormwater and diversion drainage and erosion and sedimentation control works prior to ground disturbance and vegetation clearing<br>▪ Inform recreational users of KNP, Bago State Forest and Talbingo Reservoir of the construction activities, the extent of work areas and the locations of environmental exclusion areas with project notifications, including warning signs of construction activities and notifications of access restrictions<br>▪ Establishment of the construction compound and equipment laydown areas at the substation site and at Lobs Hole*. |
| Access tracks | ▪ Vegetation clearing within the approved corridor. This is expected to be carried out both manually in the areas of steeper slopes and machine clearing where access can be safely achieved<br>▪ Grubbing and bulk earthworks (cut and fill) using an excavator<br>▪ Installation of suitable drainage structures and sediment retention basins where required<br>▪ Laying and compaction of a suitable rock aggregate/road base<br>▪ Grading and/or reshaping of existing tracks where required, within the existing access track width (no road widening)<br>▪ Minor excavations followed by laying and compaction of crushed rock or gravel, to improve the track surface and drainage. |
| Substation | ▪ Vegetation clearing across the substation site and surrounding asset protection zone (APZ). This would involve the stripping and stockpiling of topsoil for later use within the disturbance footprint. Vegetation clearing is expected to be carried out utilising a bulldozer equipment with a tree pusher, however would be confirmed in consultation with the FCNSW<br>▪ Establishment of a site compound and laydown area within the cleared APZ. The site compound would be in placed throughout the construction period and is expected to contain a demountable office, meal room, and toilet/shower facilities, equipment laydown areas, vehicle and equipment storage, maintenance sheds, chemical/fuel stores and stockpile areas<br>▪ Minor earthworks to establish the site amenities; which would include cut and fill to establish a level area for the site facilities and temporary storage areas and establishment of the permanent site access road |

| Construction activity | Description |
|---|---|
| | ▪ Earthworks:<br>- Excavation works to remove excess material, provide a level surface, and create the required trenches for drainage, earthing, and electrical conduits. Some spoil from the excavation may be reused on site for filling and compaction (including benching areas of the site where required). Excavation works would be carried out using equipment such as excavators, dozers and crushing plant. Furthermore, depending on the underlying geology, blasting may be required to facilitate the break-up of rock, should it be present<br>- Bulk earthworks to establish the level surface for the substation bench<br>- Approximately 11,300 cubic metres of excess spoil would be generated from the levelling of the substation site and construction of the access road. Any soil which cannot be reused onsite as fill material, landscaping or other means would be disposed of off-site at a suitably licenced facility and/or at a location(s) as agreed with the FCNSW<br>- Where excavated spoil is not appropriate for reuse on site, additional spoil would be imported to site. Where this is required, this would be sourced from suitably licenced quarry and certified as pathogen and weed free Excavated Natural Material (ENM) or Virgin Excavated Natural Material (VENM).<br>▪ Civil and building works:<br>- Civil works involving the establishment of concrete footings for the high voltage equipment and buildings, construction of stormwater drainage and oil containment infrastructure and cable trenches and subsurface cables<br>▪ Construction of onsite buildings (e.g. control room) and services installed including general lighting, power and ventilation<br>▪ Installation of security fencing on all sides of the substation. The security fence would be about 3 m high and be comprised of a galvanised steel (or similar) material and topped with barbed or razor wire. |
| Transmission line | ▪ Vegetation clearing within the approved transmission line corridor where the overhead conductors would not meet safe clearance heights above the underlying vegetation<br>▪ Grading and/or reshaping of existing access tracks where required<br>▪ Vegetation clearing and bulk earthworks to establish the level helipad<br>▪ Establishment of the transmission structure work sites involving:<br>- Clearing of an approximate 40 m by 60 m area around each transmission structure location to allow for the laydown of materials and equipment and facilitate access for vehicles, plant and machinery during structure construction<br>- Bulk earthworks (cut and fill) to establish level construction benches within the worksite to allow for the safe operation of plant and equipment (namely elevated works platforms and cranes) during structure construction<br>- Geotechnical investigation works using a mobile drill rig at each structure location to determine the most appropriate footing design |

| Construction activity | Description |
|---|---|
| | - Bulk earthworks and excavations to establish the structure footings involving the installation of steel framework and backfilling with concrete or pile type footings involving boring four boreholes at each structure leg location and backfilling with concrete<br>- Steel lattice structures would be transported to each structure location via heavy vehicle in parts and assembled on site using mobile cranes<br>▪ Stringing of conductor and overhead earth wire which would involve:<br>- Establishment of level tensioning and pulling sites within the approximate 50 m by 50 m structure worksite or at suitable locations within the within the transmission corridor<br>- Attachment of sheaves (or pulleys) to the top of the structures in readiness for stringing work using an elevated work platform<br>- Pulling out a lightweight draw wire across the section of line being strung using a drone, vehicle/machine (such as dozer) or helicopter, followed by the placement of the draw wire through the sheaves<br>- Attachment of the draw wire to the earth wire or conductor drum (depending on which is being strung) and pulling it through the sheaves under tension using specialised tensioning and pulling equipment<br>- Termination of the conductor/earth wire at each end clipping it into position followed by the removal of the sheaves. |
| Commissioning | ▪ Testing of all high voltage equipment at the substation and ensuring all protection, control and metering equipment is operating correctly<br>▪ Completion of all necessary cut-in works to Line 64 and relevant testing undertaken<br>▪ Placement of the new transmission lines and substation into standby in readiness for Snowy 2.0 to be completed<br>▪ Once Snowy 2.0 becomes operational, energisation of the high voltage equipment and the project placed into service |
| Rehabilitation and demobilisation | ▪ Removal of all non-permanent infrastructure and equipment from the work sites and site compounds<br>▪ Decommissioning and dismantling of the site compounds at the substation and Lobs Hole<br>▪ Site stabilisation and landscaping involving:<br>▪ Stabilisation of exposed areas and slopes<br>▪ Installation and maintenance of erosion and sediment controls at the work sites to manage impacts post-construction<br>▪ Seeding soil slopes to assist stabilisation<br>▪ Planting vegetation on any higher risk slopes<br>▪ Mulching of stabilised and revegetated areas where required. |
| *The site compound at Lobs Hole would be located within the Snowy 2.0 disturbance footprint (05.02.2020). | |

### 2.2.3 Construction staging and timing

Construction of the project is anticipated to commence in early 2022 and take approximately 39 months to complete. Estimated timing for the main construction activities is set out in **Figure 2-3**. Further details on the estimated timing and staging of the main project activities is described in Section 5.3 of the EIS.

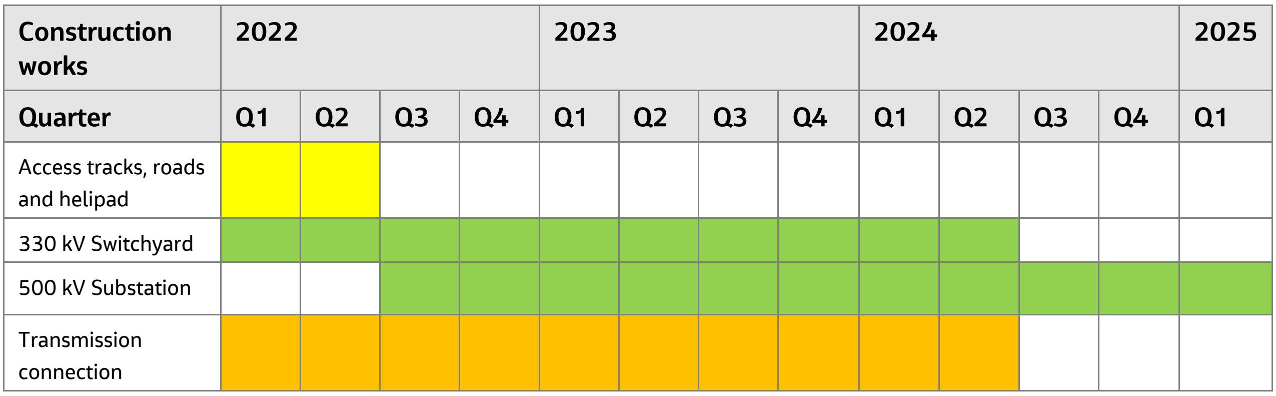


Figure 2-3: Indicative timing for the construction of key project components

### 2.2.4 Construction working hours

Given the isolated location and the construction of Snowy 2.0 occurring in parallel, construction works are expected to be carried out 12 hours per day, seven days per week between the hours of 6 am and 6 pm.

### 2.2.5 Rehabilitation and demobilisation

Following construction, all non-permanent infrastructure such as equipment laydown areas and site compounds would be decommissioned and removed from site. The rehabilitation activities would consider the overarching phases with key activities to be carried out both during and post construction as outlined in the Rehabilitation Strategy provided in **Table 2.2**. The Rehabilitation Strategy would form the basis of the Rehabilitation Plan which would be prepared to guide the long-term rehabilitation of applicable parts of the project area where permanent infrastructure and management (i.e. clearing under transmission lines) is not required. The Rehabilitation Plan would be developed in consultation with NPWS and the FC NSW. The Rehabilitation Plan would be consistent with the approved Snowy 2.0 Rehabilitation Plan prepared for Snowy Hydro for work within the Snowy 2.0 disturbance footprint (05.02.2020).

All rehabilitation activities would be in accordance with the project Rehabilitation Plan which will be developed for the project.

Table 2.2: Rehabilitation Strategy

| Rehabilitation phases | Rehabilitation activities |
|---|---|
| Site preparation | During the preparation of the worksites including the substation, access tracks and transmission structure sites, the following activities would be carried out:<br>▪ Collection and stockpiling of organic matter from removal of vegetation during construction, including topsoil, woodchip and organic matter for use in rehabilitation. |
| Site stabilisation and landscaping | Site stabilisation activities would be carried out both during and post construction and would include the following:<br>▪ Stabilisation of exposed areas and slopes and prepare the sites for revegetation<br>▪ Installation of erosion and sediment controls at the work sites to manage impacts both during and post construction<br>▪ Seeding soil slopes to assist in stabilisation |

| Rehabilitation phases | Rehabilitation activities |
|---|---|
| | ▪ Planting vegetation on any higher risk slopes<br>▪ Mulching of stabilised and revegetated areas where required. |
| Maintenance and monitoring | Ongoing maintenance and monitoring of rehabilitation works would include:<br>▪ Monitoring of stabilised slopes and revegetated areas<br>▪ Monitoring on the performance of erosion and sediment controls<br>▪ Weed control and monitoring<br>▪ Maintaining any fencing placed around rehabilitation areas<br>▪ Re-mulching of stabilised and revegetated areas where required. |
| Demobilisation | Following the completion of construction, demobilisation activities would be carried out and would likely include:<br>▪ Removal of any temporary fencing around the works sites and site compound areas<br>▪ Disassembling and removal on any temporary on-site infrastructure including site offices, amenities, equipment storage, and maintenance sheds within the site compound areas<br>▪ Removal of all construction equipment and machinery from the site compound areas and work sites<br>▪ Removal and disposal of any remaining stockpiles and other waste materials from the site compounds and other laydown areas<br>▪ Removal of any temporary environmental controls (e.g. erosion and sediment controls) which are no longer required.<br>The rehabilitation phases described above would coincide with the work site demobilisation activities. |

## 2.3 Operation and maintenance

The substation and transmission connection would be inspected by field staff on a regular basis. Key activities undertaken during operation would include:

- Regular inspection and maintenance of electrical equipment at the substation including structural integrity of all footings and support structures
- General inspection and maintenance of other components within the substation including the stormwater management system, fire detection system, onsite buildings and drainage infrastructure
- Regular inspection and maintenance of the transmission structures, footings, fittings, conductors and overhead earth wires
- Vegetation removal and trimming along the transmission easement and APZ surrounding the substation to maintain appropriate clearances between ground vegetation and the overhead transmission lines and around the substation to manage bushfire risk
- Removal of trees which have the potential to strike the overhead conductors if they were to fall (referred to as hazard trees) as required.

It is expected that only light vehicles and small to medium plant would need to access the substation site and the transmission line easement for these activities. The new substation would not accommodate full-time staff or contractors, and the regular collection of waste would not be required. Any waste generated during operation of the substation would be minimal and disposed of on an 'as need' basis.

# 3. Legislation and policy

In accordance with Part 7.9 of the *Biodiversity Conservation Act 2016* (BC Act), an application for approval under Division 5.2 of the EP&A Act to carry out State Significant Infrastructure must be accompanied by a BDAR unless the Planning Agency Head and the Environment Agency Head determine that the project is not likely to have any significant impact on biodiversity values. The SEARs issued for the project (**Section 1.2** of this report) have determined the need for a BDAR in accordance with Section 5.16 of the EP&A Act.

The Biodiversity Offsets Scheme applies to SSI projects unless the Secretary of DPIE and the Chief Executive of the Environment, Energy and Science Group (EESG) determine that the project is not likely to have a significant impact. This document is the BDAR for the project as required under the Biodiversity Assessment Method (BAM). This BDAR documents the results of the biodiversity assessment undertaken for the project in line with the relevant State and Commonwealth environmental and threatened species legislation and policy. This BDAR has been prepared by Lukas Clews (accreditation number BAAS17060) and Brenton Hays (accreditation number BAAS19068), who are accredited under Section 6.10 of the BC Act as Biodiversity Assessment Method Assessors to apply the BAM in connection with the preparation of Biodiversity Stewardship Site Assessment Reports, BDARs, and Biodiversity Certification Assessment Reports pursuant to Part 6 of the BC Act. Internal technical review of this BDAR was conducted by Chris Thomson (accreditation number BAAS18058).

The BAM is structured around three primary stages:

- Stage 1 – Biodiversity assessment
- Stage 2 – Impact assessment (biodiversity values and prescribed impacts)
- Stage 3 – Improving biodiversity values.

This BDAR consists of Stage 1 and Stage 2 of the BAM. Stage 3 is only applicable for the purposes of an application for a biodiversity stewardship agreement so is not covered in this BDAR.

Biodiversity Assessment Method Calculator (BAM-C) case numbers 00014677/BAAS19068/20/00021924 and 00014677/BAAS19068/20/00021925 are associated with this BDAR.

This BDAR also addresses potential impacts to biodiversity listed under the *Fisheries Management Act 1994* (FM Act) and Matters of National Environmental Significance (MNES) identified in the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

An EPBC Act referral (2018 / 8363) was made to the former Commonwealth Department of Environment and Energy (DoEE) (now the Department of Agriculture, Water and the Environment (DoAWE)) on 28 February 2019 to consider whether the project would be considered to be a controlled action. On 5 April 2019, the former DoEE determined the project to be a 'controlled' action (referral reference number 2018/8363) on the basis of potential impacts to the following MNES:

- Listed threatened species and communities (section 18 & section 18A);
- Listed migratory species (section 20 & section 20A); and
- The heritage values of a National Heritage place (section 15B & section 15C).

The NSW Government confirmed the action would be assessed via the "Bilateral agreement made under section 45 of the EPBC Act relating to environmental assessment between Commonwealth of Australia and the State of New South Wales" (Bilateral Agreement) (2015). This agreement accredits the assessment process under Division 5.2 of the EP&A Act. As the project is considered a controlled action, the Australian Minister for the Environment would need to issue a separate approval for the project to DPIE.

# 4. Methodology

## 4.1 Personnel

The work to prepare this BDAR was undertaken by appropriately qualified and experienced ecologists as outlined in **Table 4.1**.

Table 4.1: Personnel, role and qualifications

| Name | Role | Qualifications |
|---|---|---|
| Lukas Clews | Associate Ecologist – Technical lead, Vegetation Integrity Surveys and targeted plant searches, reporting, GIS | Master of Scientific Studies<br>Graduate Certificate in Applied Science<br>Bachelor of Science<br>Diploma in Conservation and Land Management<br>Certified Environmental Practitioner (CenvP) by the Environment Institute of Australia and New Zealand (EIANZ)<br>Accredited under Section 6.10 of the BC ACT as a Biodiversity Assessment Method Assessor (No. BAAS17060) |
| Chris Thomson | Principal Ecologist – Fauna surveys, reporting, technical review of BDAR. | Graduate Certificate in Natural Resources<br>Bachelor of Applied Science<br>Accredited under Section 6.10 of the BC ACT as a Biodiversity Assessment Method Assessor (No. BAAS18058) |
| Brenton Hays | Senior Ecologist – Vegetation Integrity Surveys, fauna surveys, reporting and GIS | Bachelor of Environmental Science and Management (Hons)<br>Accredited under Section 6.10 of the BC ACT as a Biodiversity Assessment Method Assessor (No. BAAS19068) |
| Paul Rossington | Senior Ecologist – Vegetation Integrity Surveys and targeted plant searches | Master of Wildlife Management<br>Bachelor of Science (Biology)<br>Accredited under Section 6.10 of the BC ACT as a Biodiversity Assessment Method Assessor (No. BAAS18065) |
| Jon Carr | Ecologist – Vegetation Integrity Surveys and targeted plant searches | Bachelor of Environmental Science and Management<br>Accredited under Section 6.10 of the BC ACT as a Biodiversity Assessment Method Assessor (No. BAAS18009) |
| Tim Maher | Ecologist – Vegetation Integrity Surveys and targeted plant searches, fauna surveys, reporting | Master of Research (Plant Ecology)<br>Bachelor of Advanced Science (Biology) |
| Matt Consterdine | Ecologist – Vegetation Integrity Surveys and targeted plant searches, fauna surveys | Bachelor of Environmental Science and Management<br>Accredited under Section 6.10 of the BC ACT as a Biodiversity Assessment Method Assessor (No. BAAS20027) |

| Name | Role | Qualifications |
|---|---|---|
| Lauren Ascah | Ecologist – Vegetation Integrity Surveys and fauna surveys | Bachelor of Science (First Class Hons)<br>Bachelor of Science, Ecology (University of Calgary) |

## 4.2 Background research and data sources

A background review of existing information was undertaken to identify the existing environment within a nominal search area of 10 km and the broader locality including relevant bioregion subregions. The review focussed on database searches, relevant ecological reports pertaining to the survey area and relevant GIS layers. The review was used to prepare a list of Plant Community Types (PCTs), and assess the likelihood of occurrence of threatened species, populations and communities as well as important habitat for migratory species in the survey area and locality. The searches were also undertaken to identify any Areas of Outstanding Biodiversity Value in the study area.

The following databases were searched:

- BioNet - the website for the Atlas of NSW Wildlife and Threatened Species Profile Database – last searched 2 October 2020
- NSW Department of Primary Industries (DPI) freshwater threatened species distribution maps – last reviewed 29 September 2020
- DoAWE's Protected Matters Search Tool – last searched 2 October 2020
- NSW BioNet Vegetation Classification database – last reviewed 2 October 2020
- Bureau of Meteorology's Atlas of Groundwater Dependent Ecosystems (GDE) – last searched 2 October 2020
- Department of Environment's directory of important wetlands Tool – last reviewed 2 October 2020.

Regional vegetation mapping, geology and soil mapping projects were reviewed including:

- *Native Vegetation of the Southern Forests: South-east Highlands, Australian Alps, South-west Slopes, and SE Corner Bioregions* (Gellie, 2005)
- *Plant Communities of the South Eastern Highlands and Australian Alps within the Murrumbidgee Catchment of New South Wales Version 1.1* (Office of Environment and Heritage, 2011)
- *Southern CRA / Riverina Highlands Vegetation Mapping Extension* (Maguire *et al.*, 2000)
- *Riverina Regional Native Vegetation Map Version v1.0 - VIS_ID 4469* (Office of Environment and Heritage, 2016b)
- *Wagga Wagga 1:250 000 Geological Map* (Adamson and Loudon, 1966)
- *Wagga Wagga 1:250 000 Metallogenic Map* (Degeling, 1977)
- *Australian Soil Classification (ASC) Soil Type map of NSW* (State Government of NSW and Office of Environment and Heritage (OEH), 2012).

The mapping provided in the *Riverina Regional Native Vegetation Map Version v1.0 - VIS_ID 4469* (Office of Environment and Heritage, 2016b) was found to be unreliable in terms of polygon boundaries and PCT identification so this dataset was not used extensively during the field work but was referred to as a resource of potential PCTs that could be present in the broader area.

Preliminary and provisional determinations to list species and ecological communities as threatened under the BC Act were viewed on the EESG NSW Threatened Species Scientific Committee website. At the time of writing, there are no preliminary or provisional listings of relevance to the project. The annual Final Priority Assessment List of nominated species and ecological communities that have been approved for assessment by the Minister responsible for the EPBC Act was last reviewed in September 2020.

A meeting with EESG Senior Threatened Species Officer Geoff Robertson in October 2018 also provided valuable information on the threatened species of concern from the region which helped target the field work and assessment.

#### 4.2.1 Snowy 2.0

The BDARs completed for the Snowy 2.0 Exploratory Works (EMM Consulting, 2017) and Snowy 2.0 Main Works EIS (EMM Consulting, 2019) were reviewed and the results were used to inform the preparation of this BDAR. The vegetation mapping, data from vegetation integrity plots, and threatened species data were gathered and used to inform the field survey program. Three vegetation integrity plots from the Snowy 2.0 Exploratory Works BDAR (EMM Consulting, 2017) and Snowy 2.0 Main Works BDAR (EMM Consulting, 2017) have been used to supplement the work undertaken for this BDAR as the disturbance area for this project overlaps with approximately 6.9 hectares (ha) of approved Snowy 2.0 disturbance area (05.02.2020). These shared project areas have been surveyed and mapped in this BDAR, however since they already form part the Snowy 2.0 Main Works development application and the impacts subsequently already assessed, the areas have been removed from impact calculations for this BDAR. It is noted that the Snowy 2.0 Main Works disturbance boundary will change over time as the project progresses and impacts are minimised based on final clearing areas. Therefore, this BDAR will seek to recalculate impacts and offsets once the final Snowy 2.0 Main Works disturbance boundary is confirmed and detailed design for the transmission line (this project) is complete.

### 4.3 Preliminary site visits and scoping

An initial site visit was undertaken within the study area over two days in March 2018 to ground-truth the results of the background research and undertake an initial rapid high-level habitat assessment. This site visit involved a drive through the study area on accessible roads and tracks. Areas visited included Lobs Hole Ravine Road, Link Road, Goat Ridge Road and Elliott Way in the KNP. Elliott Way, Boundary Road and Black Jack Logging Road and the east Bago Powerline Road in the Maragle and Bago State Forest were also driven. A more detailed walk over survey of some potential transmission line routes, structure locations and access tracks within the KNP was undertaken over four days in April 2018 with designers and engineers from TransGrid. This visit included walking through sections of the Bago State Forest and to the top of Sheep Station Ridge in the KNP to plan potential helipad locations and access tracks.

During the initial site visits in March and April 2018, notes were made on PCTs and boundaries between PCTs, and incidental observations of fauna were made. These initial site visits undertaken for preliminary assessments allowed for the scoping of field surveys.

### 4.4 Mapping extent of native vegetation

The extent of native vegetation in the construction envelope was mapped using aerial imagery. Polygons were digitised in a GIS (ArcGIS 10.7) at a scale of between 1:1,000 and 1:5,000. The vegetation extent within the construction envelope has been mapped in detail although some boundary errors may still exist.

#### 4.4.1 Definition of native vegetation

Under the BAM, native vegetation has the same meaning as in section 1.6 of the BC Act which states that native vegetation and clearing native vegetation have the same meanings as in Part 5A of the *Local Land Services Act 2013* (LLS Act). Part 5A 60B of the LLS Act defines the meaning of native vegetation as any of the following types of plants native to New South Wales:

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 NSW if it was established in NSW before European settlement.

Some cleared areas within the construction envelope do contain native trees, understorey plants, and groundcover species. Regrowth native grasslands and shrublands are common in the construction envelope. While these areas are heavily disturbed, they do contain native vegetation. As such, these areas have been assigned to the most likely original PCT, which can be determined with reasonable confidence based on adjacent PCTs and position in the landscape.

### 4.5 Plant community type identification

The types and distributions of PCTs within the construction envelope were identified and mapped progressively during the field surveys. The identification of PCTs presented here is in accordance with the NSW PCT classification as described in the BioNet Vegetation Classification. Each PCT was assigned to the relevant corresponding Threatened Ecological Community (TEC) where applicable. A plot-based floristic vegetation survey as described in Section 5.2 of the BAM was undertaken across the construction envelope, supplemented with rapid vegetation assessments of dominant species in accessible areas of the broader study area, to identify the PCTs or most likely PCTs. The plot-based floristic vegetation surveys were undertaken over the period of 14 November 2018 to February 2019. An additional two-day survey was undertaken within the proposed substation site in October 2018 (see **Table 4.2** for a summary of survey timing).

Table 4.2 Summary of survey timing

| Survey date | Number days |
|---|---|
| Preliminary site visit, PCT identification, mapping and scoping surveys | |
| 22nd – 23rd March 2018 | 2 |
| 16th – 18th April 2018 | 3 |
| 4th – 5th October 2018 | 2 |
| Main survey period (PCT mapping and VI surveys) | |
| 13th – 16th November 2018 | 4 |
| 10th – 12th December 2018 | 3 |
| 30th – 31st January 2019 | 2 |
| 1st – 5th February 2019 | 5 |

Some PCTs in the study area are currently poorly described in the BioNet Vegetation Classification, with few species identified in each structural layer. Other described PCTs provide a single broad definition of several seemingly distinct vegetation types. In many cases there is no distinct linear boundary to assist in determining the distribution of different PCTs within the construction envelope. To aid in the identification of PCTs, existing vegetation mapping and classification relevant to the study area was reviewed. The detailed descriptions of vegetation units provided in the *Native Vegetation of the Southern Forests: South-east Highlands, Australian Alps, South-west Slopes, and SE Corner Bioregions* (Gellie, 2005) and the *Plant Communities of the South Eastern Highlands and Australian Alps within the Murrumbidgee Catchment of New South Wales Version 1.1* (Office of Environment and Heritage, 2011) appears to be the most accurate and was used to aid PCT identification and mapping. The PCTs and mapping provided in the BDAR for the Snowy 2.0 Exploratory Works and Main Works EISs (EMM Consulting, 2017 and 2019) also provided valuable information on determining the PCTs most likely to be present. To supplement available vegetation mapping, a digital terrain model was created in the GIS based on contour data. This assisted in differentiating between the hill tops, hill slopes of varying steepness and aspect, lower lying flat areas, and drainage lines. This review of information informed the stratification of native vegetation for the survey design.

### 4.5.1 Stratification of native vegetation into survey units

Using existing vegetation mapping, prior to the fieldwork commencing, survey sites (plots/midlines) were randomly located within each area of mapped vegetation to provide a representative assessment of the vegetation. Plots were also positioned to provide a wide spatial coverage of the construction envelope. Once the identification of PCTs had been finalised, each PCT was then divided into vegetation zones; each comprising an area of native vegetation in the construction envelope that is the same PCT and has a similar broad condition state. The PCTs identified within the construction envelope are described in detail in Section 4 of this BDAR.

The field survey was able to provide good spatial coverage and survey effort for each PCT present on the site, meeting the requirements of the BAM. The vegetation within the construction envelope has been assigned to a PCT as listed in the BioNet Vegetation Classification database based on the observed species composition, vegetation structure, landscape position, and underlying geology and soils. In most cases, the vegetation on site does not perfectly align with any PCT listed in the BioNet Vegetation Classification database so the vegetation has been allocated to the PCT with which it most closely aligns.

There is approximately 135.6 ha of native vegetation within the disturbance area, including 36.49 ha in the Australian Alps Bioregion and 99.11 ha in the South Eastern Highlands Bioregion. A summary of the PCTs identified in each bioregion is provided in **Table 6.1**.

### 4.5.2 Plot-based floristic vegetation survey and vegetation integrity assessment

A plot-based full floristic survey and vegetation integrity assessment was undertaken in accordance with the BAM using a series of 20 x 20 m plots (or 400 $m^2$ equivalent area), each nested inside a 20 x 50 m plot (or equivalent 1,000 $m^2$ area). In some situations, along narrow PCT patches, 10 x 40 m floristic plots were used. The location of each plot/mid-line completed during the survey is illustrated in **Figure 4-1.** Plots/mid-lines were established to provide a representative assessment of the vegetation integrity of the vegetation zone, accounting for the level of variation in the broad condition state of the vegetation zone. The emphasis was on identifying broad condition states within each PCT and no attempt was made at fine scale mapping in areas of variable vegetation density.

A summary of the survey effort completed in each vegetation zone in each bioregion is provided in **Table 4.3**. Vegetation zones and plot assessment have been divided by bioregion because there are two BAM-Cs associated with this BDAR (refer to **Section 5.1** for more information). The minimum survey requirements was met for all vegetation zones and exceeded for zones with larger areas so that the variation within each zone could be adequately sampled. The plot based floristic survey was designed to build upon the survey work already completed in the east of the construction envelope for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a) and replication of survey sites was avoided. Data from the Snowy 2.0 Exploratory Works and Main Works EISs (EMM Consulting, 2018 and 2019) has been used in this BDAR where it was applicable to the construction envelope.

Separate vegetation zones have been created to assess indirect impacts on areas of retained vegetation where new edges are being created (refer to **Section 11.1.2**) for more details). Considering these zones are contiguous with the areas that will be directly impacted, relevant plot data collected for the direct impact zones has been used to calculate vegetation integrity scores for indirect impact zones in the BAM-C.

Ninety-four vegetation integrity assessment plots were completed throughout the construction envelope and broader areas since investigations began. In the early stages, the investigation area was larger in an attempt to identify where impacts could be avoided and minimised. As such, not all plots are now within the construction envelope, however the habitats are contiguous. Plots that are located outside of the study area have been excluded and therefore only 78 plots of 94 have been used for this assessment. Data from one plot (Plot 35) has been used twice for two vegetation zones of the same PCT and condition recorded in the two bioregions (i.e. AA-2 and SEH-5). Three vegetation integrity assessment plots from the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a) were used to supplement the survey effort where the study areas overlapped.

Table 4.3: PCT and vegetation zones identified in the construction envelope and indirect impact buffer (20 m)

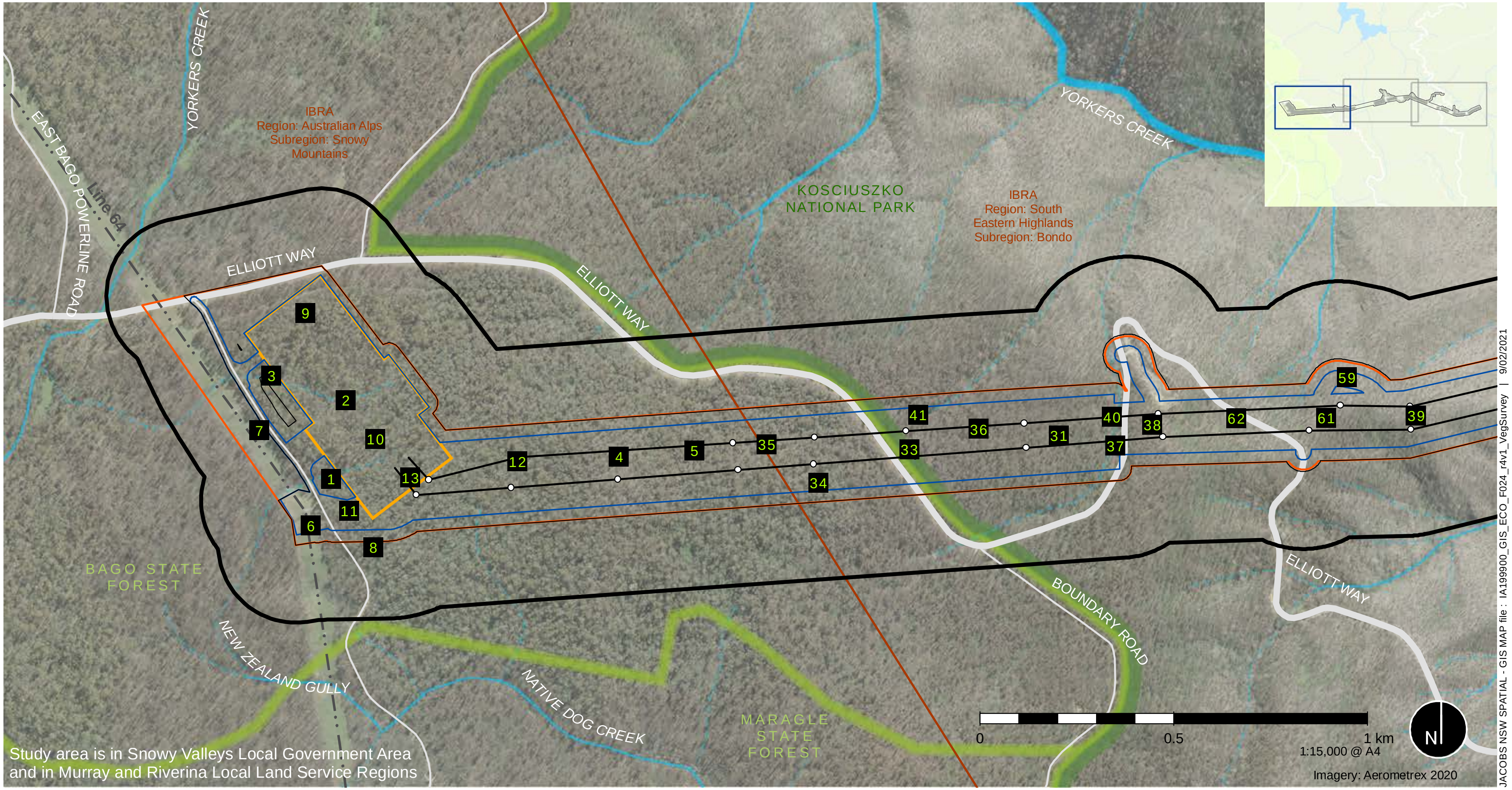
| Vegetation Zone | PCT ID No. | PCT name | Broad condition class | Vegetation zone area in direct disturbance area (ha) | Minimum number of plots/ mid-lines required (Table 4 BAM) | Number of plots/ mid-lines completed |
|---|---|---|---|---|---|---|
| **Australian Alps Bioregion** | | | | | | |
| **Within the disturbance area** | | | | | | |
| AA-1 | 285 | Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion | Moderate - Blackberry infestation | 1.77 | 1 | 3 |
| AA-2 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | 10.77 | 3 | 3 (Includes Plot 35 which is technically within the South Eastern Highlands Bioregion though in the same contiguous patch of PCT 300) |
| AA-3 | 1196 | Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion | Native Grassland | 0.76 | 1 | 2 |
| AA-4 | | | Good | 23.19 | 4 | 6 |

| Vegetation Zone | PCT ID No. | PCT name | Broad condition class | Vegetation zone area in direct disturbance area (ha) | Minimum number of plots/ mid-lines required (Table 4 BAM) | Number of plots/ mid-lines completed |
|---|---|---|---|---|---|---|
| **Within indirect impact buffer (20 m)** | | | | | | |
| AA-5 | 285 | Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion | Moderate - Blackberry infestation | 0.33 | 1 | 3*(Includes Plot 35 which is technically within the South Eastern Highlands Bioregion though in the same contiguous patch of PCT 300) |
| AA-6 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | 2.88 | 2 | 3* |
| AA-7 | 1196 | Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion | Good | 3.68 | 2 | 6* |
| **South Eastern Highlands Bioregion** | | | | | | |
| **Within the disturbance area** | | | | | | |
| SEH-1 | 296 | Brittle Gum - peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion | Native Grassland | 0.13 | 1 | 1 |
| SEH-2 | | | Good condition – drier *Eucalyptus nortonii* dominant slope | 4.67 | 2 | 3 |
| SEH-3 | | | Good condition – wetter sheltered slopes | 14.96 | 3 | 12 (Includes EMM plot 1025) |
| SEH-4 | | | Moderate – Blackberry infestation | 1.38 | 1 | 1 |

| Vegetation Zone | PCT ID No. | PCT name | Broad condition class | Vegetation zone area in direct disturbance area (ha) | Minimum number of plots/ mid-lines required (Table 4 BAM) | Number of plots/ mid-lines completed |
|---|---|---|---|---|---|---|
| SEH-5 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | 32.5 | 4 | 12 |
| SEH-6 | | | Native Grassland | 0.55 | 1 | 1 |
| SEH-7 | 302 | Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion | Moderate | 2.57 | 2 | 5 (Includes EMM plot 1018 and 1048) |
| SEH-8 | 729 | Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion | Native Grassland | 1.10 | 1 | 3 |
| SEH-9 | | | Shrubland - regrowth | 0.78 | 1 | 4 |
| SEH-10 | | | Good - dry open slopes & ridgetops | 16.04 | 3 | 8 |
| SEH-11 | | | Good - wetter sheltered slopes | 16.79 | 3 | 8 |
| SEH-12 | 999 | Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion | Shrubland - regrowth | 1.23 | 1 | 2 |
| SEH-13 | | | Good - drier Calytrix tetragona | 6.38 | 3 | 8 |
| **Within indirect impact buffer (20 m)** | | | | | | |
| SEH-14 | 296 | Brittle Gum - peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion | Good – drier *Eucalyptus nortonii* dominant slope | 1.34 | 1 | 3* |
| SEH-15 | | | Good– wetter sheltered slopes | 4.74 | 3 | 12 (Includes EMM plot 1025)* |

| Vegetation Zone | PCT ID No. | PCT name | Broad condition class | Vegetation zone area in direct disturbance area (ha) | Minimum number of plots/ mid-lines required (Table 4 BAM) | Number of plots/ mid-lines completed |
|---|---|---|---|---|---|---|
| SEH-16 | | | Moderate – Blackberry infestation | 0.08 | 1 | 1* |
| SEH-17 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | 9.57 | 3 | 12* |
| SEH-18 | 302 | Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion | Moderate | 1.05 | 1 | 5 (Includes EMM plot 1018 and 1048)* |
| SEH-19 | 729 | Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion | Good - dry open slopes & ridgetops | 5.33 | 2 | 8* |
| SEH-20 | | | Good - wetter sheltered slopes | 7.98 | 3 | 8* |
| SEH-21 | 999 | Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion | Good - drier *Calytrix tetragona* | 2.25 | 2 | 8* |

*Plot data from direct impact vegetation zones was used to calculate vegetation integrity indirect impact vegetation zones




Project area
Disturbance area
BDAR study area
Construction envelope
Proposed 500kV substation
Proposed structure
Proposed transmission line

3 Vegetation integrity plot

Electricity transmission line
Minor road
Major road
Waterway
IBRA
NPWS estate
State Forest

**Data sources:**
Jacobs 2020,
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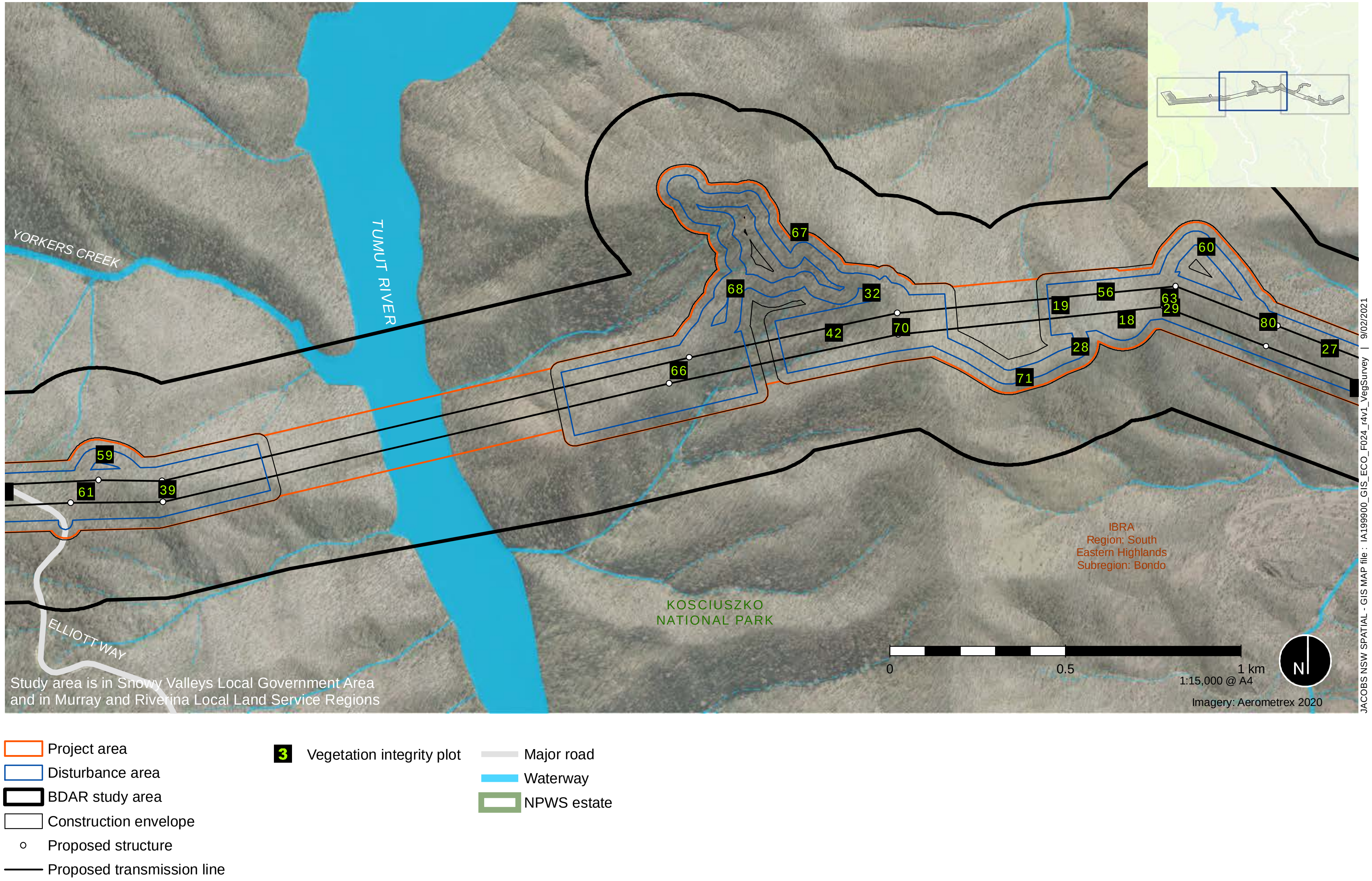
**Figure 4-1** | Location of plot based floristic vegetation survey and vegetation integrity assessments




**Data sources:**
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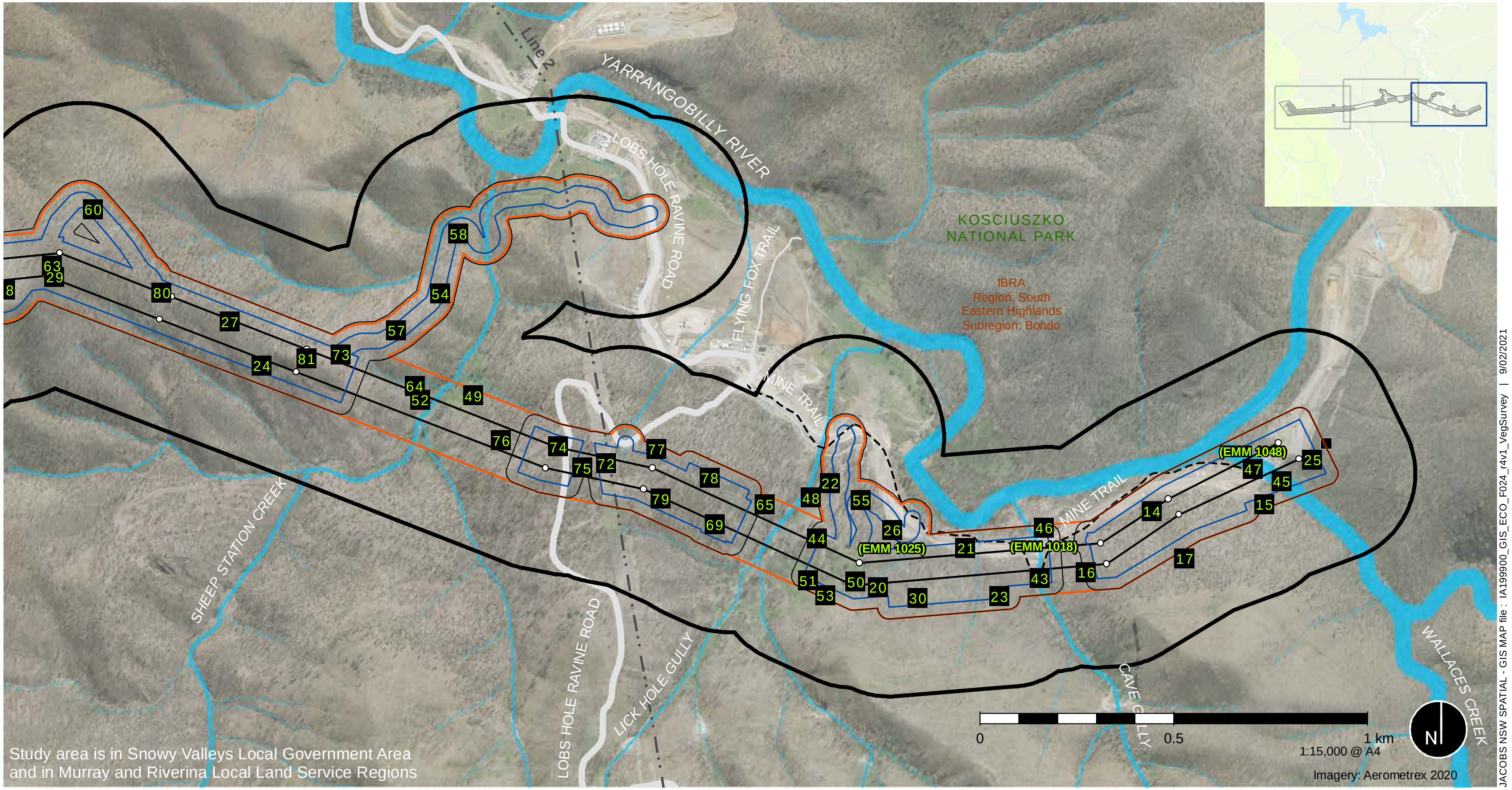
**Figure 4-1** | Location of plot based floristic vegetation survey and vegetation integrity assessments




Project area
Disturbance area
BDAR study area
Construction envelope
Proposed structure
Proposed transmission line

Snowy 2.0 cable yard

3 Vegetation integrity plot

Electricity transmission line
Minor road
Major road
Trail
Waterway
NPWS estate

**Data sources:**
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**Figure 4-1** | Location of plot based floristic vegetation survey and vegetation integrity assessments

## 4.6 Patch size

A patch is defined in the BAM as an area of intact native vegetation that occurs on the subject land (construction envelope). The patch may extend onto adjoining land beyond the construction envelope, and for woody ecosystems, includes native vegetation separated by ≤100 m from the next area of intact native vegetation. For non-woody vegetation, this gap is reduced to ≤30 m. Patch size for each vegetation zone located on the construction envelope was mapped in accordance with Subsection 5.3.2 of the BAM using the following steps:

1) Identify vegetation zones that will be included in the same patch.
2) Identify the boundary of any adjoining intact native vegetation which extends beyond the limit of the construction envelope.
3) Digitise each patch in a GIS using separate polygons where multiple patches exist.
4) Calculate the area of each patch in ha in a GIS.

The patch was then allocated to a patch size class (<5 ha, 5–24 ha, 25–100ha or >100 ha). Patch size class is used as a filter in the BAM-C to predict threatened species likely to occur or use habitat on construction envelope. The results of the patch size assessment are presented in **Section 6.3**.

## 4.7 Threatened species habitat assessment – creating a candidate species list

Once the subject land (construction envelope) had been assessed for landscape context, and the PCTs present and vegetation integrity were known, the list of candidate threatened species for assessment was developed. As outlined in Section 6.4.1.3 of the BAM, the following criteria (a – f) were used to predict the threatened species that require assessment:

a) the distribution of the species includes the IBRA subregion which the construction envelope is, in the opinion of the assessor, mostly located within, and
b) the construction envelope is within any geographic constraints of the distribution of the species within the IBRA subregion, and
c) the species is associated with any of the PCTs identified by the assessor under Chapter 5 as occurring within the construction envelope, and
d) the native vegetation cover within an assessment area 1,500 m wide surrounding the boundary of the subject site as determined by the assessor in accordance with Subsection 4.3.2 of the BAM is equal to or greater than the minimum class that is required for the species (unless the development is, or is part of, a linear shaped development), and
e) the patch size which the vegetation zone is part of, as identified in Subsection 5.3.2 of the BAM is equal to or greater than the minimum specified for that species, and
f) the species is identified as an ecosystem or species credit species in the Threatened Biodiversity Data Collection.

A threatened species was predicted as requiring assessment if that species meets all the criteria a) to f) that are relevant to the species. The BAM-C was used to derive the list of candidate species based on criteria a) to f). If any one of the criteria a) to f) relevant to a species was not met, the construction envelope was considered not to be suitable habitat for the threatened species and no further assessment was undertaken for that species.

In addition to the output from the BAM-C, data from the surveys undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a) was reviewed and the results were used to inform the candidate species list. The recent surveys undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs provide a more up to date view of the species that are known to be present in the construction envelope and which species are likely to occur. The results of the BioNet search and the

Commonwealth Department of Agriculture, Water and the Environment's Protected Matters Search Tool (PMST) search were also used to inform development of the candidate species list to ensure those species that are only listed under the EPBC Act (i.e. Greater Glider) were considered appropriately.

As the project is a linear shaped project that crosses two bioregions, a separate habitat suitability assessment was undertaken for each IBRA subregion that the construction envelope crossed, i.e. one habitat suitability assessment for the South Eastern Highlands Bioregion and one habitat suitability assessment for the Australian Alps Bioregion.

Some species returned from the database searches (i.e. BioNet and the Protected Matters Search Tool – see **Appendix A** for the full list) were removed from the assessment due to the absence of suitable habitat in the construction envelope. The study area lacks high alpine plains, so species restricted to these areas were removed from the assessment based on the lack of these habitat types on the construction envelope. Conversely, some species were added to the assessment based on consultation with EESG (refer **Section 4.2**), review of recent database records, and the presence of potential habitat.

The threatened species habitat suitability assessment is provided in **Section 7** and **Appendix A**. The candidate list of threatened species for assessment is provided in **Section 7**.

## 4.8 Targeted threatened species surveys

After the candidate species list had been developed (see **Section 5.3**), targeted threatened species surveys were undertaken within the construction envelope. The surveys undertaken for candidate threatened species of plants and animals are outlined in **Section 4.8.1**.

### 4.8.1 Threatened plant surveys

After the PCTs and finer scale habitats within the construction envelope had been identified, and the threatened species habitat assessment had been undertaken, threatened plant surveys were undertaken targeted to the following candidate species:

- *Caladenia montana*
- *Calotis glandulosa*
- *Pomaderris cotoneaster*
- *Pterostylis alpina*
- *Pterostylis foliata*
- *Pterostylis oreophila*
- *Thelymitra alpicola*
- *Thelymitra atronitida*
- *Thesium australe.*

The threatened flora surveys were guided by the methodology and effort described in the *Surveying threatened plants and their habitats - NSW survey guide for the Biodiversity Assessment Method* (Department of Planning, Industry and Environment, 2020a) and the *Draft Survey Guidelines for Australia's Threatened Orchids* (Department of the Environment, 2013). The application of the described guidelines is not mandatory, but they provide an indication of the effort that is likely required. The main method adopted was walking parallel search transects (approximately 5-10 m spacing between observers) and with reference to the species prescribed survey timing in the Threatened Biodiversity Data Collection (TBDC). This approach was used to adequately cover the large areas of potential habitat for the above listed species.

To identify habitats that were potentially suitable for terrestrial orchids and other target species including *Pomaderris cotoneaster, Calotis glandulosa* and *Thesium australe*, transects were walked through all PCTs within the construction envelope. Where an orchid was encountered, the specimen was identified to species or genus level if possible and a waypoint taken to enable a map to be made of areas that appear suitable for orchid species.

*Pomaderris cotoneaster* is known from a variety of habitats and no distinct habitat association for this species has been determined, however the only associated PCT within the construction envelope listed on the TBDC is

PCT 300. As such, searches for plants from the genus *Pomaderris* were undertaken during all transects and floristic plot surveys.

*Thesium australe* is known to occur in the region and a reference population on Larry's Ridge north of Cabramurra was visited in February 2019. Plants were found during this survey, indicating that *Thesium australe* was detectable during the survey of the construction envelope. Transects were walked through grassy woodlands and dry sclerophyll forests in the construction envelope with searches undertaken in grassy areas, areas of native grassland, and in easements, particularly in areas where *Themeda triandra* (a species with which *Thesium australe* is often found in association) was dominant.

*Calotis glandulosa* was targeted along roadsides and in bare areas while walking through PCT 1196 and driving along the roads. *Calotis glandulosa* was flowering during the survey period and reference populations were visited along the Snowy Mountains Highway at Providence Portal to confirm flowering.

Comprehensive surveys for threatened orchids targeted PCT 1196, PCT 300, PCT 285, PCT 729 and PCT 296 (each identified as suitable habitat types for the species listed above in the Threatened Biodiversity Data Collection). Targeted surveys for orchids were conducted during 2018 (October, November, December), 2019 (January, February, October, November and December) and 2020 (October) to adequately cover the seasonal survey requirements for each of the above species.

It is acknowledged that the 2018/2019 summer was exceptionally dry and conditions for orchid survey were not considered to be optimal. Subsequent follow-up surveys were conducted under more optimum conditions during October, November and December 2019. These supplementary surveys were considered by Jacobs ecologists to be appropriate for orchid growth, given the high numbers of common orchid species and very high counts of individual orchid plants identified throughout the surveyed areas (refer **Section 7.4.1**). Additionally, a large portion of the study area was also resurveyed in later October 2020 to pick up newly identified habitat for *Caladenia montana*. Conditions were ideal for both orchid growth and detection during this survey, due to favourable disturbance caused by the Dunns Road bushfire in January (see **Section 5.9**) and the following above average rainfall in most months of 2020 (recorded at Cabramurra SMHEA AWS).

Searches for *Pterostylis oreophila* and *Thelymitra alpicola* were carried out in potentially suitable habitats within areas of PCT 1196 Snow Gum and PCT 285 Broad-leaved Sally and along Sub-alpine watercourses (containing thickets of Mountain Tea-tree) in the Australian Alps Bioregion portion of the construction envelope. Such habitats exist along New Zealand Gully and various unnamed watercourses in Bago State Forest and KNP.

Various reference sites for *Thelymitra alpicola, Thelymitra atronitida, Pterostylis foliata* and *Pterostylis alpina* were examined in Bago State Forest to determine if these species were flowering, although the target species were unable to be located at these sites. No reference sites for *Caladenia montana* were available to check for this species near the substation site during surveys in 2019 or 2020.

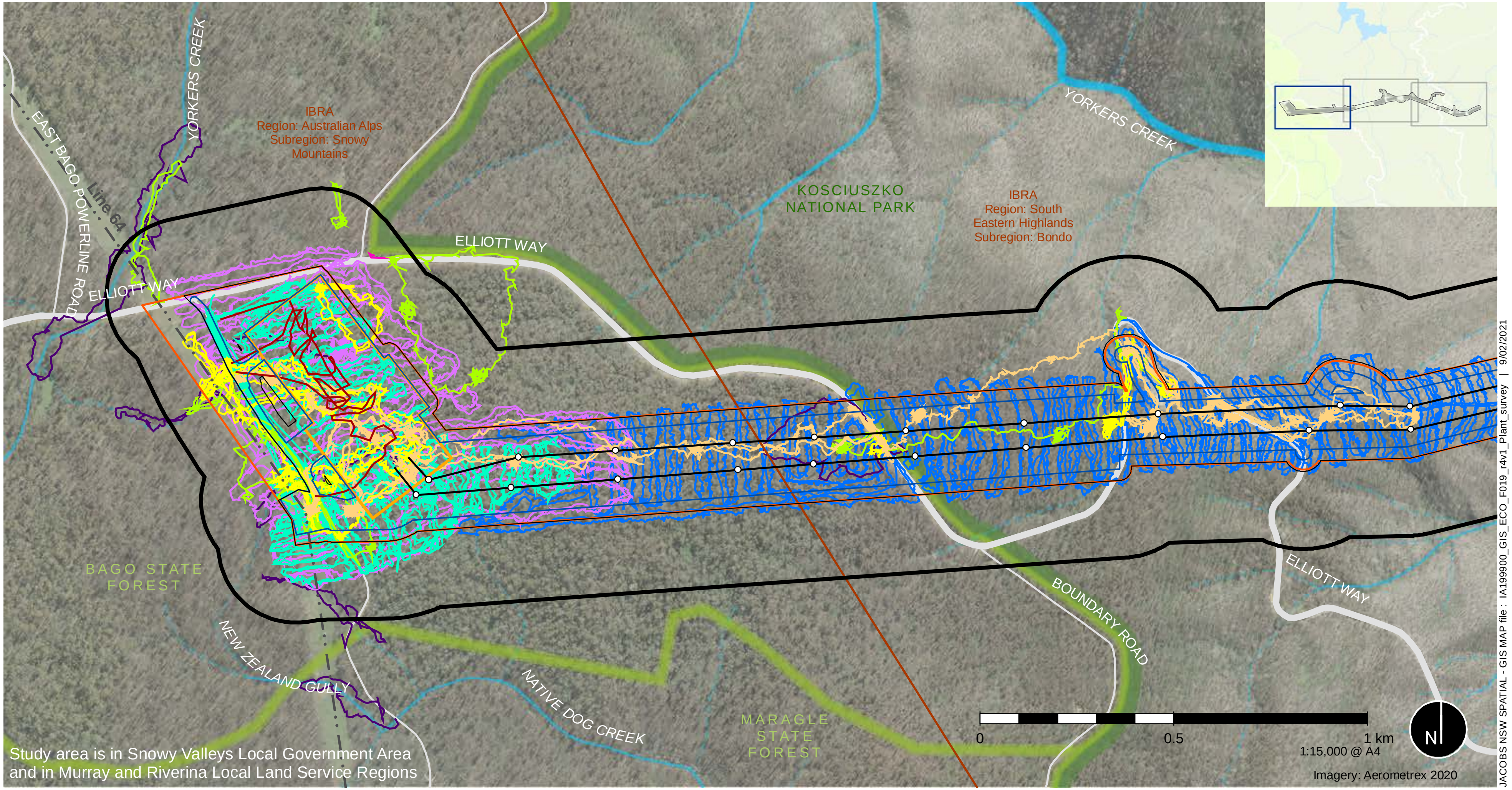
Approximately 702 km was walked during the flora surveys over 2018, 2019 and 2020 by teams of two to six ecologists. A summary of the distance covered on foot and approximate number of hours expended during each field survey event is provided in **Table 4.4**. A summary of the survey effort based on the area of habitat for each target plant species is provided in **Table 4.5**.

The location of tracks walked during the threatened plant surveys and specific search areas for orchids and *Thesium australe* are illustrated in **Figure 4-2**.

Table 4.4: Summary of walking transect length

| Survey timing | Transect length | Approx. search time | No. people | Person hours |
|---|---|---|---|---|
| 4th – 5th October 2018 | 3 km | 3 hrs | 2 | 6 hrs |
| 13th – 16th November 2018 | 99 km | 32 hrs | 4 | 128 hrs |
| 10th – 12th December 2018 | 66 km | 24 hrs | 2 | 48 hrs |
| 30th – 31st January 2019 | 29 km | 16 hrs | 2 | 32 hrs |
| 1st – 5th February 2019 | 37 km | 40 hrs | 2 | 80 hrs |
| 10th – 15th October 2019 | 82 km | 40 hrs | 2 | 80 hrs |
| 4th – 10th November 2019 | 45 km | 48 hrs | 2 | 96 hrs |
| 4th – 8th December 2019 | 30 km | 32 hrs | 2 | 64 hrs |
| 27th – 31st October 2020 | 310 km | 40 hrs | 8 | 320 hrs |

Note: Transect length rounded to the nearest km and estimated from tracks made on hand-held GPS units so is subject to error due to normal issues such as quality of satellite reception and any device malfunction. Actual distance covered is greater as not all observers were always carrying a GPS unit.




Project area
Disturbance area
BDAR study area
Construction envelope
Proposed 500kV substation
Proposed structure
Proposed transmission line

Threatened plant transects
October 2018
November 2018
December 2018
January 2019
February 2019
October 2019
November 2019
December 2019
October 2020

Electricity transmission line
Minor road
Major road
Waterway
IBRA
NPWS estate
State Forest

**Data sources:**
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**Figure 4-2** | Location of targeted threatened plant surveys

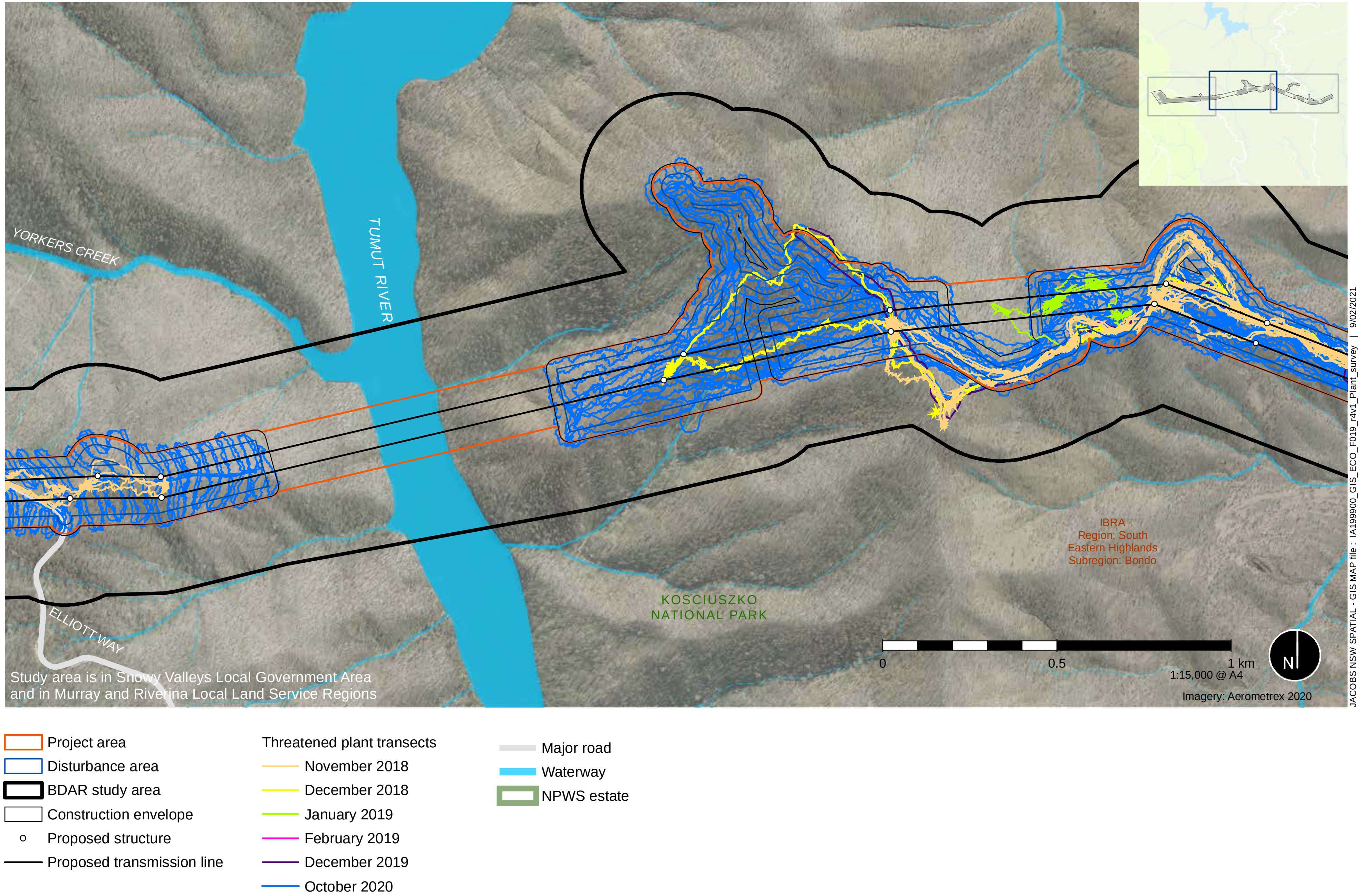


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**Figure 4-2** | Location of targeted threatened plant surveys

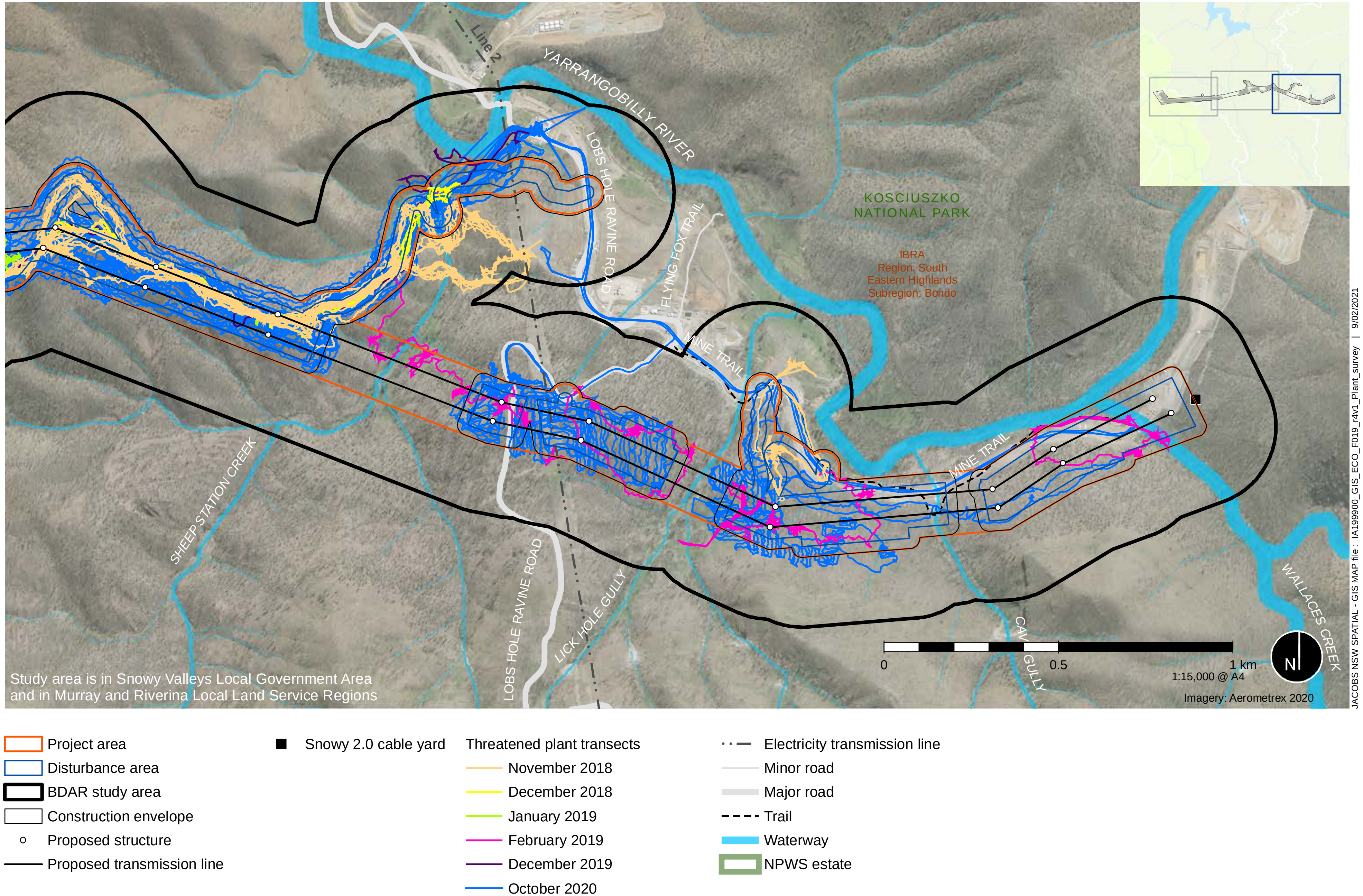


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**Figure 4-2** | Location of targeted threatened plant surveys

Table 4.5: Summary of survey effort for threatened plant species

| Species name | Common name | EPBC Act | BC Act | Required survey period (TBDC) | Habitat area (ha) in construction envelope | Survey guideline* | Approx. effort |
|---|---|---|---|---|---|---|---|
| *Caladenia montana* | - | - | V | October – November | 31.22 (PCT 1196)<br>62.77 (PCT 300)<br>57.53 (PCT 729)<br>12.78 (PCT 999)<br>31.44 (PCT 296) | Potential total length of field traverse based on 10-metre spaced transects:<br>25-50 km (PCT 1196)<br>~50 km (PCT 300)<br>~50 km (PCT 729)<br>10-25 km (PCT 999)<br>25-50 km (PCT 296) | <u>November 2018:</u><br>8.9 km in PCT 1196<br>9.5 km in PCT 300<br><u>November 2019:</u><br>6.5 km in PCT 300<br>35.8 km in PCT 1196<br><u>October 2020:</u><br>54.8 km in PCT 296<br>81.5 km in PCT 300<br>130 km in PCT 729<br>42.77 km in PCT 999<br>1.6 km in PCT 1196 |
| *Calotis glandulosa* | Mauve Burr-daisy | V | V | October – March | 31.22 (PCT 1196) | Potential total length of field traverse based on 10-metre spaced transects:<br>25-50 km (PCT 1196) | <u>November 2018:</u><br>32 km in PCT 1196<br><u>October 2020:</u><br>1.6 km in PCT 1196 |
| *Pomaderris cotoneaster* | Cotoneaster Pomaderris | E | E | October – November | 62.77 (PCT 300) | Potential total length of field traverse based on 20-metre spaced transects:<br>~25 km (PCT 300) | <u>November 2018:</u><br>9.5 km in PCT 300<br>224.5 km across study area in other potential habitats during entire survey period<br><u>October 2020:</u><br>81.5 km in PCT 300 |
| *Pterostylis alpina* | Alpine Greenhood | - | V | August, September and November (the TBDC does not list October though this is likely an error) | 31.22 (PCT 1196) | Potential total length of field traverse based on 10-metre spaced transects:<br>25-50 km (PCT 1196) | <u>October and November 2018:</u><br>8.9 km in PCT 1196<br>9.5 km in PCT 300<br><u>October 2019:</u><br>5.8 km in PCT 285<br>0.66 km in PCT 300<br>75 km in PCT 1196 |

| Species name | Common name | EPBC Act | BC Act | Required survey period (TBDC) | Habitat area (ha) in construction envelope | Survey guideline* | Approx. effort |
|---|---|---|---|---|---|---|---|
| | | | | | | | November 2019:<br>2.4 km in PCT 285<br>6.5 km in PCT 300<br>35.8 km in PCT 1196<br>October 2020:<br>54.8 km in PCT 296<br>81.5 km in PCT 300<br>130 km in PCT 729<br>42.77 km in PCT 999<br>1.6 km in PCT 1196 |
| *Pterostylis foliata* | *Slender Greenhood* | - | V | October – November | 31.22 (PCT 1196) | Potential total length of field traverse based on 10-metre spaced transects:<br>25-50 km (PCT 1196) | October and November 2018:<br>11.9 km in PCT 1196<br>9.5 km in PCT 300<br>October 2019:<br>5.8 km in PCT 285<br>0.66 km in PCT 300<br>75 km in PCT 1196<br>November 2019:<br>2.4 km in PCT 285<br>6.5 km in PCT 300<br>35.8 km in PCT 1196<br>October 2020:<br>54.8 km in PCT 296<br>81.5 km in PCT 300<br>130 km in PCT 729<br>42.77 km in PCT 999<br>1.6 km in PCT 1196 |
| *Pterostylis oreophila* | Blue-tongued Greenhood | CE | CE | December – January | 2.23 (PCT 285) | Potential total length of field traverse based on 10-metre spaced transects:<br>2-10 km (PCT 285) | December 2018 to January 2019:<br>6.1 km in PCT 285 from |

| Species name | Common name | EPBC Act | BC Act | Required survey period (TBDC) | Habitat area (ha) in construction envelope | Survey guideline* | Approx. effort |
|---|---|---|---|---|---|---|---|
| *Thelymitra alpicola* | Alpine Sun Orchid | - | V | November – January | 2.23 (PCT 285) | Potential total length of field traverse based on 10-metre spaced transects:<br>2-10 km (PCT 285) | November 2018 to January 2019:<br>10 km in PCT 285 from<br><u>November 2019:</u><br>2.4 km in PCT 285<br>6.5 km in PCT 300<br>35.8 km in PCT 1196<br><u>December 2019:</u><br>2.4 km in PCT 285<br>1.5 km in PCT 296<br>3.5 km in PCT 300<br>5.1 km in PCT 729<br>15.4 km in PCT 999<br>2.4 km in PCT 1196 |
| *Thelymitra atronitida* | Black-hooded Sun Orchid | - | CE | November – December | 31.22 (PCT 1196) | Potential total length of field traverse based on 10-metre spaced transects:<br>25-50 km (PCT 1196) | <u>November and December 2018:</u><br>22.6 km in PCT 1196<br>9.5 km in PCT 300<br><u>November 2019:</u><br>2.4 km in PCT 285<br>6.5 km in PCT 300<br>35.8 km in PCT 1196<br><u>December 2019:</u><br>2.4 km in PCT 285<br>1.5 km in PCT 296<br>3.5 km in PCT 300<br>5.1 km in PCT 729<br>15.4 km in PCT 999<br>2.4 km in PCT 1196 |
| *Thesium australe* | Austral Toadflax | V | V | November – February | 31.22 (PCT 1196) | Potential total length of field traverse based on 10-metre spaced transects:<br>25-50 km (PCT 1196) | <u>November 2018 to January 2019:</u><br>26 km in PCT 1196<br>202 km across study area in other potential habitats |

Note: * = The number of required survey kms is taken from the *Surveying threatened plants and their habitats - NSW survey guide for the Biodiversity Assessment Method* (Department of Planning Industry and Environment, 2020). *Pomaderris cotoneaster* and *Thesium australe* were searched for throughout the construction envelope and the searches were not restricted to specific PCTs. PCTs adjacent to known associated habitat types were also searched for the target species.

#### 4.8.2 Threatened animals

The list of threatened species-credit animal species targeted during surveys was developed with information collected about the site context of the construction envelope (Section 4.3 of the BAM), on PCTs and vegetation integrity attributes in (Section 5 of the BAM), and data obtained from the Threatened Biodiversity Data Collection (Section 6.1 of the BAM). The details of this process are provided in **Section 7.3** of this BDAR. The threatened animal survey plan was also developed in consultation with the then Office of Environment and Heritage (OEH) in November 2018 prior to the commencement of surveys. Consultation included a review of proposed survey design by Miles Boak, Miranda Kerr and Glen Stroud from the then OEH. The following animal species were targeted during surveys:

- Diurnal birds: Pink Robin, Painted Honeyeater, Gang-gang Cockatoo, Little Eagle, Square-tailed Kite, White-bellied Sea-Eagle
- Nocturnal birds: Barking Owl, Powerful Owl, Masked Owl, Sooty Owl
- Small terrestrial mammals: Eastern Pygmy-possum, Smoky Mouse
- Large terrestrial mammals: Spotted-tailed Quoll
- Arboreal mammals: Yellow-bellied Glider, Greater Glider, Squirrel Glider, Brush-tailed Phascogale, Koala
- Bats: Large Bent-winged Bat, Southern Myotis
- Amphibians: Alpine Tree Frog.

Surveys for terrestrial fauna included a range of techniques aimed at identifying the type and distribution of fauna habitats within the construction envelope, and the presence and distribution of threatened species. The primary focus was on targeting threatened species identified as candidate species credit species, however survey data was collected for all species. Surveys included diurnal and nocturnal effort using a stratified sampling approach that aimed to sample the range of habitats present. Opportunistic observations of threatened species were also recorded during survey activities and generally while present in the study area. Surveys were focussed on areas within the construction envelope and where possible also occurred in adjacent habitats that extended beyond the construction envelope which would be indirectly impacted by the project. The location of tracks walked during the threatened animal surveys are illustrated in **Figure 4-3**.

Surveys were conducted during the summer season of 2018-19 using a combination of sampling techniques based on the methodology and effort as outlined in the document *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (Department of Environment and Conservation, 2004) and later guidelines including:

- T*hreatened species survey and assessment guidelines: field survey methods for fauna – Amphibians* (Department of Environment and Climate Change, 2009)
- '*Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method* (Office of Environment and Heritage, 2018)
- *Survey Guidelines for Australia's Threatened Bats* (Department of the Environment Water Heritage and the Arts, 2010a)
- *Survey Guidelines for Australia's Threatened Birds* (Department of the Environment Water Heritage and the Arts, 2010b)
- *Survey Guidelines for Australia's Threatened Frogs* (Department of the Environment Water Heritage and the Arts, 2010c)
- *Survey Guidelines for Australia's Threatened Mammals* (Department of the Environment Water Heritage and the Arts, 2011a)
- *Survey Guidelines for Australia's Threatened Reptiles* (Department of the Environment Water Heritage and the Arts, 2011b).

Details of the specific survey techniques and effort applied is outlined in this section of the BDAR and described in relation to the location and habitat types sampled and the target species.

#### 4.8.2.1 Habitat stratification and site selection

The extent of the fauna survey area was initially identified from an overlay of the construction envelope onto an aerial photograph and consideration of the footprint of the substation and location of transmission structures, access tracks and ancillary areas and appropriate buffers on infrastructure as discussed. Following definition of the study area, habitat stratification was applied to ensure that fauna surveys sampled the full range of habitats types within the study area. The approach focused on identifying the vegetation formation and class (Keith 2004) of all the PCTs present and then biophysical attributes, in this regard elevation, as well as slope and aspect.

The eucalypt-dominated sclerophyll forests are the most widespread fauna habitat across the study area and occupy a range of different slope gradients and aspects. Stratification of habitats into survey units relied on vegetation formation (Keith 2004), aspect and slope, and PCT. Wet or moist habitats are mostly restricted to sheltered slopes and gullies and represented special areas in conjunction with rocky cliffs and potential cave sites. The stream environments associated with creeks were also sampled.

The survey approach focused firstly on establishing twelve primary survey sites sampling each of the stratification units. A survey site typically included a live-trapping grid approximately 1.5 ha in area, from which terrestrial and arboreal mammals were targeted. Bird and reptile census, spotlighting, call playback and koala scat search techniques were also conducted at each primary site. In addition to the primary sites, a high density of camera traps was deployed along the project alignment, focusing in remote areas near structure sites and access tracks not easily accessible daily. A range of supplementary measures were then used generally, and across the project alignment; this included bat trapping, spotlighting, koala scat search and bird and reptile survey sites. A summary of the habitat types sampled, approximate area of each habitat type and survey techniques applied is provided in **Table 4.6**.

Some of the survey effort discussed in the proceeding sections has been categorised per bioregion (i.e. mammal trap sites) and in some cases stratification units in the Australian Alps Bioregion were not directly sampled. However, the habitats between the two bioregions on the west side of the Tumut River are contiguous and therefore survey effort undertaken in the South Eastern Highlands Bioregion is applicable in this area.

Table 4.6: Summary of broad habitat types within the construction envelope and summary of survey methods applied

| Vegetation formation (Keith 2004) | Vegetation Class (Keith 2004) | Description, extent | Area (ha) in construction envelope | | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | South Eastern Highlands | Australian Alps | | | | | | | |
| Dry Sclerophyll Forests (Shrub/grass sub-formation) | Upper Riverina Dry Sclerophyll Forest | Predominantly occurs in the eastern portion of the study area on moist flats with elevation ranging from 1040-1070 m, typically ephemeral drainage lines, with limited standing water, includes PCT285 & PCT302 | 6.57 | 2.24 | √ | √ | √ | √ | √ | √ | √ |
| Dry Sclerophyll Forests (Shrubby sub-formation) | Southern Tableland Dry Sclerophyll Forests | | 102.24 | 0 | √ | √ | √ | √ | √ | √ | √ |
| Wet Sclerophyll Forests (Grassy sub-formation) | Southern Tableland Wet | | 47.63 | 15.14 | √ | √ | √ | √ | √ | √ | √ |

| Vegetation formation (Keith 2004) | Vegetation Class (Keith 2004) | Description, extent | Area (ha) in construction envelope | | A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | South Eastern Highlands | Australian Alps | | | | | | | |
| | Sclerophyll Forests | | | | | | | | | | |
| Grassy Woodlands | Subalpine Woodlands | | 0 | 31.23 | √ | √ | √ | √ | – | √ | √ |

A - Tree-based Elliott traps (small to medium arboreal mammals)
B - Ground-based Elliott traps (small terrestrial mammals)
C - Camera traps (set on ground and in low trees and shrubs)
D - Harp traps (microchiropteran–bats)
E - Call playback (nocturnal mammals and large forest–owls)
F - Diurnal bird census
G - Timed nocturnal searches (nocturnal birds, frogs and mammals)

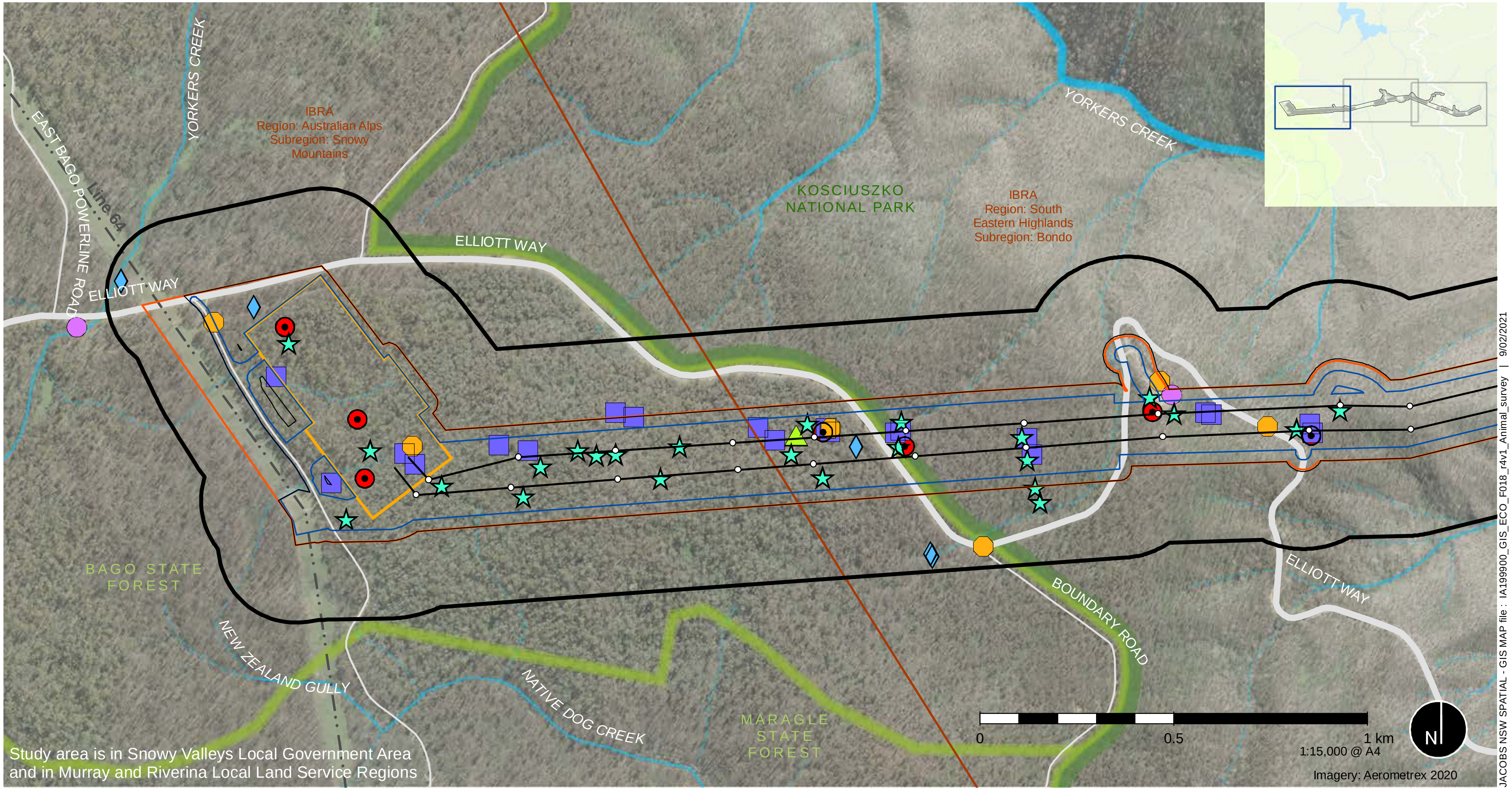
#### 4.8.2.2 Timing, season and weather conditions

Fauna surveys were conducted over a total of 21 days sampling in the summer season of 2018-19 over the months of December-February. A summary of the field survey times, average temperature during the survey period and total rainfall conditions experienced during each period are provided in **Table 4.7**.

Conditions during the December 2018 survey were warm to hot with rainfall experienced on two of the days. Conditions during the January / February 2019 survey were hot with temperatures in the Ravine area exceeding 40˚C with storms and rainfall occurring on several nights.

Table 4.7: Summary of timing, weather and rainfall conditions for fauna surveys

| Survey period | Duration | Weather station | Daily Temp ($^{0}$C) | | Average Temp ($^{0}$C) | | Total rainfall during survey period (mm) |
|---|---|---|---|---|---|---|---|
| | | | Min | Max | Min | Max | |
| 4/12/2018 to 14/12/2018 | 10 days | Tumbarumba Post Office | 7.4 | 33.6 | 12 | 29 | 60.2 |
| | | Cabramurra | 4.3 | 23.5 | 11 | 20 | 49.4 |
| 22/01/2019 to 2/2/2019 | 11 days | Tumbarumba Post Office | 12 | 39.5 | 17 | 33 | 26.2 |
| | | Cabramurra | 7.5 | 30.6 | 15 | 24 | 25.8 |



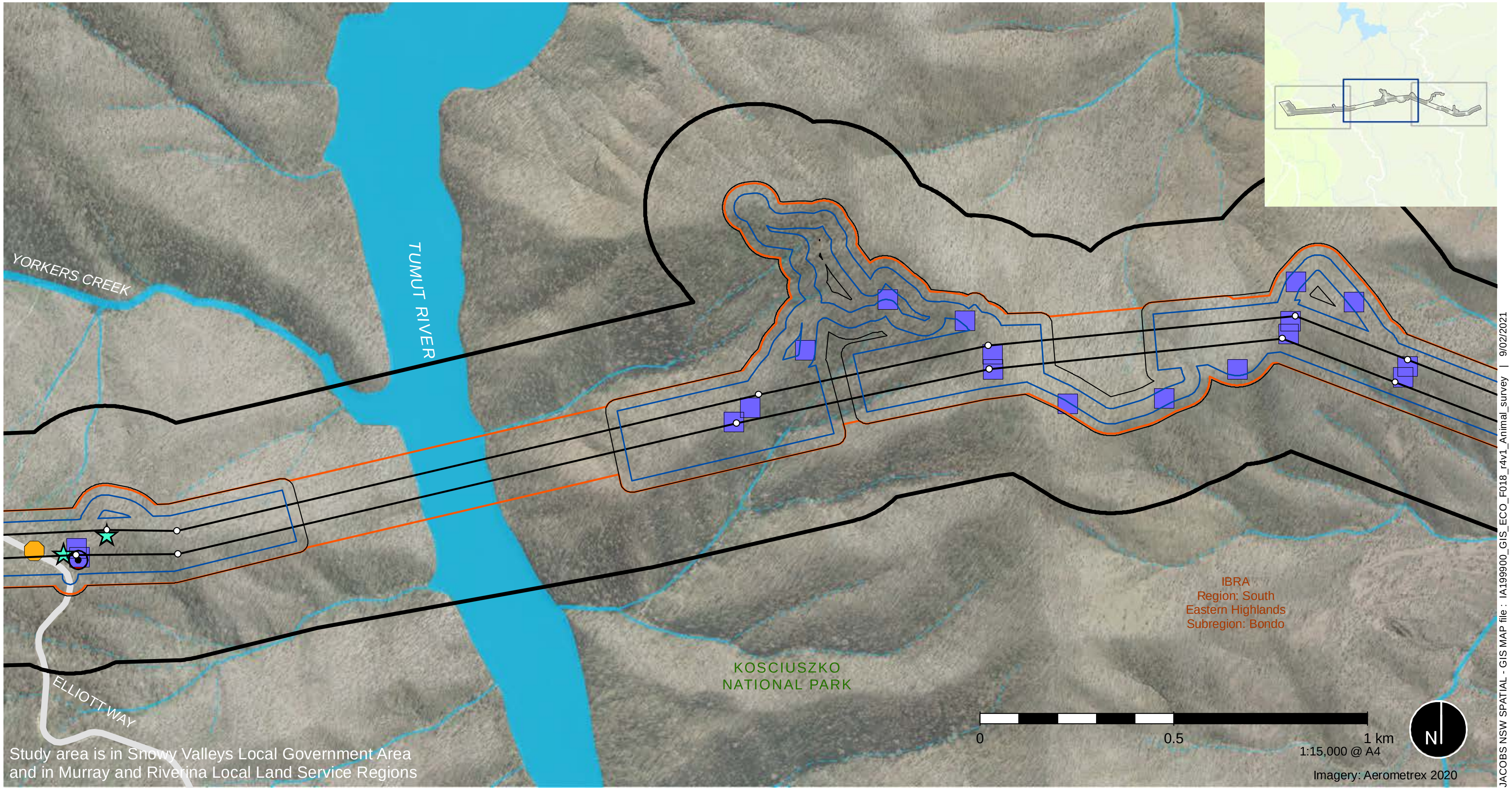

Project area
Disturbance area
BDAR study area
Construction envelope
Proposed 500kV substation
Proposed structure
Proposed transmission line

Fauna survey sites
- Bat call detector
- Camera trap
- Harp trap
- Koala scat search
- Timed reptile search
- Call broadcast (large forest owls, Koala, Squirrel Glider)
- Mammal trapping, timed bird / reptile surveys, call playback

Electricity transmission line
Minor road
Major road
Waterway
IBRA
NPWS estate
State Forest

**Data sources:**
Jacobs 2020,


**Figure 4-3** | Location of targeted threatened animal surveys




- Project area
- Disturbance area
- BDAR study area
- Construction envelope
- Proposed structure
- Proposed transmission line

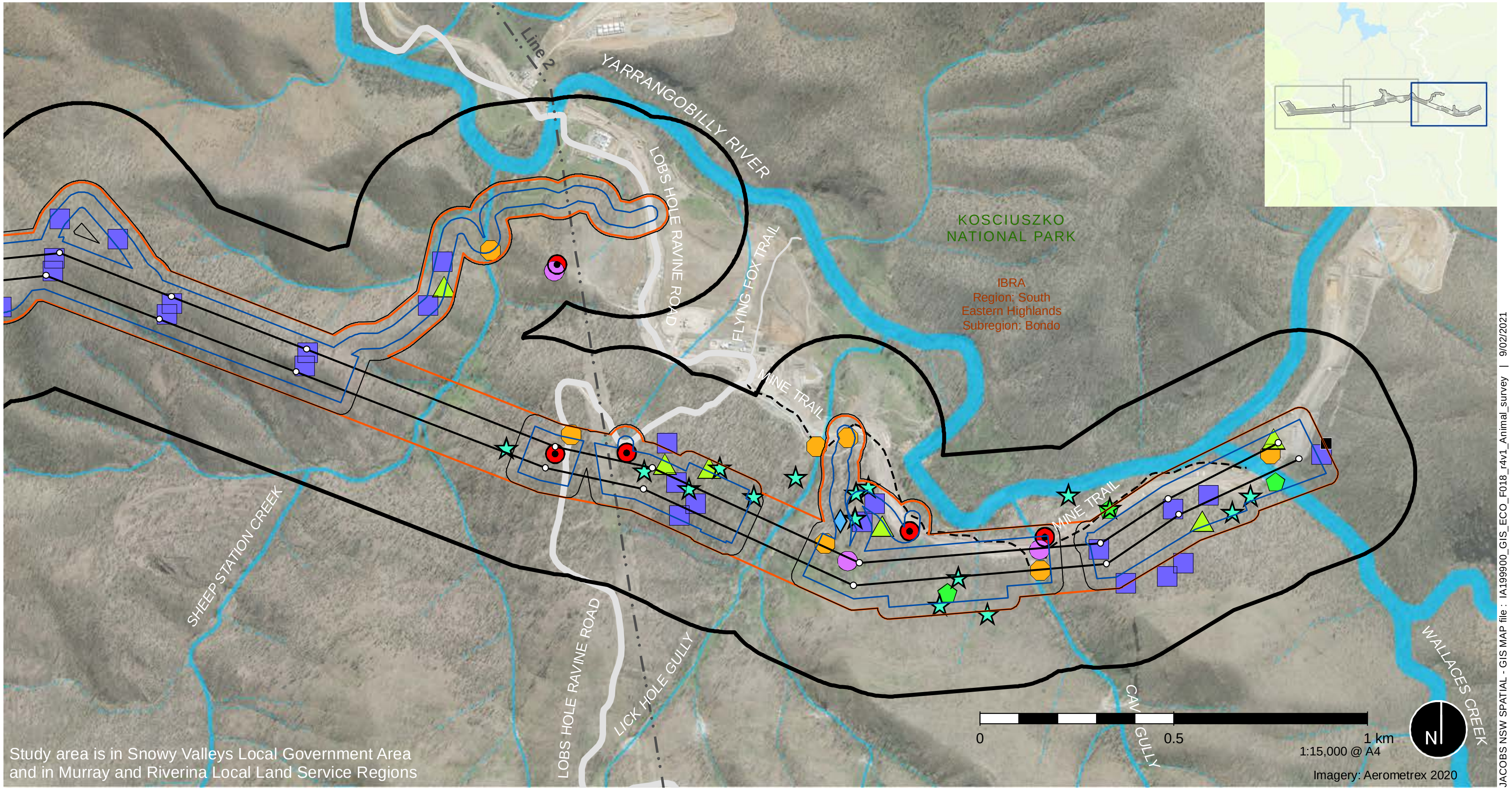
Fauna survey sites

- Camera trap
- Koala scat search
- Call broadcast (large forest owls, Koala, Squirrel Glider)
- Mammal trapping, timed bird / reptile surveys, call playback

- Major road
- Waterway
- NPWS estate

**Data sources:**
Jacobs 2020,


**Figure 4-3** | Location of targeted threatened animal surveys




Project area
Disturbance area
BDAR study area
Construction envelope
Proposed structure
Proposed transmission line

Snowy 2.0 cable yard

Fauna survey sites
- Bat call detector
- Camera trap
- Harp trap
- Koala scat search
- Timed bird survey
- Timed reptile search
- Call broadcast (large forest owls, Koala, Squirrel Glider)
- Mammal trapping, timed bird / reptile surveys, call playback

Electricity transmission line
Minor road
Major road
Trail
Waterway
NPWS estate

**Data sources:**
Jacobs 2020,
© Department Finance, Services and Innovation 2018

**Figure 4-3** | Location of targeted threatened animal surveys

#### 4.8.2.3 Diurnal birds

The survey for diurnal birds focused on the Gang-gang Cockatoo (breeding habitat) and Pink Robin. The Painted Honeyeater was also included as it was identified from the EPBC Act search. Other threatened bird species listed as ecosystem credit species were also noted when encountered and their locations mapped.

The surveys were largely undertaken outside of the breeding habitat survey period for the White-bellied Sea-Eagle and Little Eagle. However, the survey period was appropriate to detect any breeding habitat for the Square-tailed Kite.

The diurnal bird surveys were undertaken by using the standard technique of timed area searches. All birds observed or heard were recorded in areas of 1 ha over a 20-minute period. Twenty timed searches were undertaken within the construction envelope. The timed area searches were undertaken within an hour of dawn and dusk. Target species were also noted while moving through the vegetation undertaking other activities.

Potential breeding habitat for raptors including the White-bellied Sea-Eagle, Little Eagle and Square-tailed Kite were searched for while moving through the habitats across the entire construction envelope. Observers searched for any large stick nests in the top of the canopy of large trees in the forest habitats.

Commonwealth survey guidelines for other threatened bird species suggest a survey requirement for 10 hours of bird surveys over five days (two hours per day) for sites less than 50 ha in size. Commonwealth survey guidelines for raptor nest searches suggest 8 hours over 4 days (2 hours per day) for sites less than 50 ha. The survey undertaken for this BDAR exceeds the recommended survey effort with 10 days of survey undertaken in December 2018 and 11 days of survey undertaken in January and February 2019. Nest searches were undertaken throughout the entire survey period. A summary of the survey effort undertaken for threatened birds is provided in **Table 4.8**.

Table 4.8: Summary of survey effort for threatened diurnal birds

| Common name | Species name | EPBC Act | BC Act | Survey period limitation | Survey timing | No. survey sites | No. people | Survey effort |
|---|---|---|---|---|---|---|---|---|
| Pink Robin | *Petroica rodinogaster* | - | V | All year | 4th-14th December 2018 (10 days)<br><br>22nd–January - 2nd February 2019 (11 days) | 20 timed searches<br><br>Opportunistic observation throughout survey period<br><br>Observation to locate large stick nests undertaken throughout survey period | Varied from 1 to 2 observers at each site | Timed searches = approximately 13.2 person hours<br><br>Approximately 61 km of ground was covered during the survey, walking and driving, during which time all large trees with stick nests were surveyed |
| Painted Honeyeater | *Grantiella picta* | V | V | September – January | | | | |
| Gang-gang Cockatoo | *Callocephalon fimbriatum* | - | V | October – January | | | | |
| Little Eagle | *Hieraaetus morphnoides* | - | V | August – October (breeding habitat survey) | | | | |
| Square-tailed Kite | *Lophoictinia isura* | - | V | September – January (breeding habitat survey) | | | | |
| White-bellied Sea-Eagle | *Haliaeetus leucogaster* | M | V | July – December (breeding habitat survey) | | | | |

Note: The main fauna survey period was conducted outside of the breeding survey period for the Little Eagle and White-bellied Sea-Eagle so the survey for these species focused on locating large stick nests in the top of tree canopies.

#### 4.8.2.4 Nocturnal birds

The survey for nocturnal birds focused on the Barking Owl, Powerful Owl, Masked Owl and Sooty Owl. The assessment for Barking Owl and Masked Owl were limited to the South Eastern Highlands portion of the construction envelope while the Powerful Owl may occur in both the South Eastern Highlands and the Australian Alps. The Sooty Owl is not associated with any of the PCTs within the study area, however, calls for this species were broadcast during surveys at all locations due to the presence of one recorded sighting at the Yarrangobilly Caves in 2011.

As the field surveys were undertaken outside of the breeding period for these three owl species, it was not possible to positively identify nesting sites. However, surveys for these species were still undertaken as it is possible to record the owls using the habitats outside of the breeding season. The likelihood of breeding habitat being present was determined by the presence of suitable habitat (i.e. PCTs) and as a precautionary measure, the mapping of large hollow bearing trees (noted as ecologists walked through the project alignment). All rocky outcrops and overhangs were also surveyed for within the construction envelope. Larger caves and cliffs outside of the construction envelope were identified from aerial imagery and also inspected. Evidence of previous inhabitancy (owl pellets, scat whitewash, animal carcasses, etc) was searched for beneath large hollow bearing trees and cave-like habitat, when encountered. Where these features were found in the construction envelope, the habitat was assumed to be breeding habitat for these species. Existing breeding habitat for the Masked Owl was identified during the recent surveys undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a). As such, this same breeding habitat has also been identified in this BDAR. Due to the positive identification of the Masked Owl within the Lobs Holes Ravine area (EMM Consulting, 2017 and 2020a), calls of the Masked Owl were purposefully not played to avoid disturbing resident owls.

Owl call playback was completed at 16 call playback sites which included each of the primary survey sites and four additional sites. Call broadcast occurred twice at each site, for a total of 32 survey nights. Where possible call playback sites were established near suitable habitat features (i.e. large hollow bearing trees) and included forest and riparian ecotones. Calls were played intermittently for each target species followed by a 10-minute listening period. Spotlights were turned off during call broadcast to avoid spooking owls. Call playback was followed by a 10-minute spotlight of the canopy in the vicinity of the call playback site in an attempt to detect any owls attracted to the calls. All birds observed or heard were recorded. Calls of each species were alternated on different nights to not disturb owls that might be present.

A summary of survey effort for threatened owls is provided in **Table 4.9**.

Table 4.9: Summary of survey effort for threatened nocturnal birds

| Common name | Species name | EPBC Act | BC Act | Survey period limitation | Survey timing | No. survey sites / technique | No. nights | Survey effort |
|---|---|---|---|---|---|---|---|---|
| Barking Owl | *Ninox connivens* | - | V | May – December (breeding habitat survey) | 4th-11th December 2018<br><br>22nd January - 2nd | 16 call playback survey sites<br><br>16 Spotlighting transect sites | 32 survey nights spotlighting | 32 nights of call playback<br><br>Approximately 74 person hours spotlighting |

| Common name | Species name | EPBC Act | BC Act | Survey period limitation | Survey timing | No. survey sites / technique | No. nights | Survey effort |
|---|---|---|---|---|---|---|---|---|
| Powerful Owl | *Ninox strenua* | - | V | May – August (breeding habitat survey) | February 2019 | Transects undertaken to identify large hollow-bearing trees<br><br>Owl pellets searched for beneath large trees<br><br>Study area examined for cliff lines and caves | | Approximately 61 km of ground was covered during the survey, walking and driving, during which time large hollow-bearing trees and any caves or cliff lines were surveyed for |
| Masked Owl | *Tyto novaehollandiae* | - | V | May – August (breeding habitat survey) | | | | |
| Sooty Owl | *Tyto tenebricosa* | - | V | April – August (breeding habitat survey) | | | | |

Note: The main fauna survey period was conducted outside of the breeding survey period for the Powerful Owl, Masked Owl and Sooty Owl. The survey aimed to detect presence of these species and identify any large trees with large hollows >20cm diameter and any caves or cliff lines that may be suitable as breeding habitat.

#### 4.8.2.5 Small terrestrial mammals

The targeted survey for threatened small mammal species focused on the Smoky Mouse and Eastern Pygmy Possum. There was also a low chance of finding Broad-toothed Rat during the trapping program although the habitat within the construction envelope was considered unsuitable for this species and the species was targeted incidentally. EMM (2020) had reported a small area of potential habitat for Broad-toothed Rat, along Mines Trail at the junction of the Caves Creek, which is also within the current study area. Subsequent trapping did not confirm presence of the species, and the habitat is an isolated native grassland, not suited to the species.

The trapping program for small terrestrial mammals involved the integrated approach of ground-based live-trapping (Elliott type A, 33 x 10 x 9 cm) at each of the 12 primary sites and remote cameras (n=66) across remainder the study area. Tree mounted Elliott type B traps (15 x 16 x 45 cm) were also used at each site to target arboreal mammals and these were considered a potential incidental technique for Eastern Pygmy-possum (effort for arboreal mammals is discussed in **Section 4.8.2.7**). A summary of the overall survey effort is provided in **Table 4.10**.

Ground traps were set along two parallel lines consisting of between 12 and 13 traps (25 in total at each site) separated by at least 100 m. Traps were placed 10-15 m apart along each trap line, providing a trapping grid of 1.0-1.5 ha. Due to the likely low density of the target species and higher densities of more common species such as Agile Antechinus within the habitats, trapping intensity was increased above the recommended 100 trap nights per stratification unit. Traps were baited with a standard bait mix of peanut butter, rolled oats and honey and rebaited when necessary. The Elliott traps were left open for a maximum period of four nights and checked every morning within two hours of sunrise. This was an important consideration given the high temperatures experienced during the summer trapping period. Traps were packed with materials such as leaf litter to allow any trapped animals to keep warm overnight.

Camera traps were placed in the remaining habitats away from the primary sites, with a concentrated effort near structure sites and access tracks likely to be disturbed from the project. Baits stations were attached to a stake located approximately 1.5 m away from the camera that was positioned approximately 30 cm above the ground mounted on a tree. The cameras were set on a timer to operate between 8 pm to 6 am. The cameras were left operational for a period of 46 to 47 nights in the Australian Alps Bioregion. While the baits would have eventually deteriorated over this period the cameras remained active. The number of survey nights was decreased to 10 nights for the survey in the South Eastern Highlands Bioregion as 10 nights was deemed sufficient to record the species present, this was based on previous targeted camera trap surveys for the Smoky Mouse reported in Nelson *et al* (2009). To maximise the chance of detecting the Smoky Mouse, cameras were set on maximum sensitivity, with two photos taken per trigger, and a two-second delay between triggers. Camera traps were the main form of mammal survey undertaken in the more remote parts of the construction envelope such as Sheep Station Ridge where live trapping was not practicable.

Predator scats were collected opportunistically throughout the survey and sent to Georgeanna Story at Scats About for hair analysis.

The recommended survey effort for small terrestrial mammals is 100 Elliott trap nights per stratification unit up to 50 ha in size (plus additional effort for every additional 100 ha) (Department of Environment and Conservation, 2004) and two remote cameras placed out for one week in areas up to 5 ha in size (with this effort repeated for every additional 5 ha of habitat present), as described for Smoky Mouse by Department of the Environment Water Heritage and the Arts (2011a).

A summary of the survey effort undertaken for small mammals is provided in **Table 4.10**. The survey effort is also further described below separated into bioregions.

Table 4.10: Summary of survey effort for small terrestrial mammals across whole project construction envelope

| Common name | Species name | EPBC Act | BC Act | Survey period limitation | Survey timing | No. survey sites | No. nights | Survey effort |
|---|---|---|---|---|---|---|---|---|
| Eastern Pygmy-possum | *Cercartetus nanus* | - | V | October – March | 4th-11th December 2018 (west side of Tumut River – both bioregions)<br><br>22nd January - 2nd February 2019 (east side of Tumut River – South Eastern Highlands Bioregion) | 12 trap sites, 3 sites in Australian Alps Bioregion and 9 sites in South Eastern Highlands (25 ground and 6 tree mounted traps at each site)<br><br>53 camera trap sites (43 ground and 10 tree mounted), 8 cameras in the Australian Alps Bioregion portion and 45 cameras in the South Eastern Highlands Bioregion portion of study area<br><br>16 spotlighting sites (2 people) | Each Elliott trap site operated for 4 nights<br><br>57 nights of camera trapping (47 nights on west side of Tumut River and 10 nights on east side)<br><br>34 person nights spotlighting | 100 ground and 24 tree mounted trap nights at each site (1,200 ground trap nights, 288 tree trap nights across the study area)<br><br>1,266 camera trap nights across the study area<br><br>Approximately 74 person hours spotlighting |
| Smoky Mouse | *Pseudomys fumeus* | E | CE | All year | | | | |

Note: Survey effort has been categorised per bioregion and in some cases stratification units in the Australian Alps Bioregion were not directly surveyed. However, the habitats between the two bioregions on the west side of the Tumut River are contiguous and therefore survey effort undertaken in the South Eastern Highlands Bioregion is applicable in this area.

**Australian Alps**

Within the Australian Alps portion of the construction envelope, there is approximately 31.23 ha of Sub-alpine Woodland (PCT 1196) identified as potential habitat for the Smoky Mouse and Eastern Pygmy Possum. There is also approximately 15.14 ha of Southern Tableland Wet Sclerophyll Forests (PCT 300), and 2.24 ha of Upper Riverina Dry Sclerophyll Forest (PCT 285) that may be suitable as habitat for the Smoky Mouse and the Eastern Pygmy Possum. A summary of the survey effort is provided in **Table 4.11**.

Within the Sub-alpine Woodland (PCT 1196) habitat, three primary trap sites were established, each consisting of 25 Elliott A type traps. The trap lines also ran through the narrow drainage lines of Upper Riverina Dry Sclerophyll Forest (PCT 285) sampling this habitat. Two trap sites were operational for four nights while one was operational for three nights. This resulted in a total effort of 275 ground trap nights targeting small terrestrial mammals in the Sub-alpine Woodland and narrow bands of Upper Riverina Dry Sclerophyll Forest habitat. Three remote cameras were stationed within the Sub-alpine Woodland habitat and one remote camera was stationed in the narrow drainage lines of Upper Riverina Dry Sclerophyll Forest and left operational for 47 nights. This resulted in 188 camera trap nights in Sub-alpine Woodland habitat and 47 camera trap nights in the narrow drainage lines of Upper Riverina Dry Sclerophyll Forest.

No ground trap sites were established in the Southern Tableland Wet Sclerophyll Forests (PCT 300) habitat type within the Australian Alps Bioregion boundary. However, three ground trap sites were established, each consisting of 25 traps, in contiguous habitat located within the South Eastern Highlands Bioregion portion of the construction envelope, which is considered applicable to both bioregions. The three trap sites were operational for four nights resulting in an effort of 300 trap nights. Thirteen remote cameras were stationed within this habitat (three within the Australian Alps Bioregion and ten in contiguous habitat within the South Eastern bioregion) and left operational for 47 nights. This resulted in 517 camera trap nights in contiguous Southern Tableland Wet Sclerophyll Forests habitat type.

Table 4.11: Summary of survey effort for small mammals in the Australian Alps portion of the construction envelope

| Vegetation formation | Vegetation class / habitat type | Area (ha) in construction envelope | Required survey effort* | Survey completed |
|---|---|---|---|---|
| Dry Sclerophyll Forests (Shrub/grass sub-formation) | Upper Riverina Dry Sclerophyll Forests | 2.24 | 100 ground trap nights<br>14 camera trap nights | Elliot trap lines were part of the Subalpine woodland sites<br>47 camera trap nights |
| Wet Sclerophyll Forests (Grassy sub-formation) | Southern Tableland Wet Sclerophyll Forests | 15.14 | 100 trap nights<br>42 camera trap nights | 300 ground trap nights undertaken in contiguous habitat in SE Highlands Bioregion<br>141 camera trap nights, plus an additional 376 camera trap nights in contiguous habitat in SE Highlands Bioregion |
| Grassy Woodlands | Subalpine Woodlands | 31.23 | 100 trap nights<br>70 camera trap nights | 275 ground trap nights<br>188 camera trap nights |

Note: * = survey effort rounded up to nearest 50 ha. Survey effort has been categorised per bioregion and in some cases stratification units in the Australian Alps Bioregion were not directly surveyed. However, the habitats between the two bioregions on the west side of the Tumut River are contiguous and therefore survey effort undertaken in the South Eastern Highlands Bioregion is applicable in this area.

**South Eastern Highlands**

Within the South Eastern Highlands portion of the construction envelope, there is approximately 102.24 ha of Southern Tableland Dry Sclerophyll Forests (PCT 296, 729 and 999), 6.57 ha of Upper Riverina Dry Sclerophyll Forests (PCT 302), and 47.63 ha of Southern Tableland Wet Sclerophyll Forest habitat (PCT 300) that is likely to be suitable for the Eastern Pygmy Possum. Based off the work undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a), the Smoky Mouse was not found in habitats below 1,100 m above sea level (asl). The South Eastern Highlands portion of the construction envelope is below 1,000 m asl and the Smoky Mouse is not considered to be a candidate species for assessment in this portion of the construction envelope. A summary of the survey effort is provided in **Table 4.12**.

Within the Southern Tableland Dry Sclerophyll Forests (PCT 296, 729 and 999) habitat, five ground trap sites were established, each consisting of 25 traps. Trap sites were operational for four nights. This resulted in a total effort of 400 ground trap nights targeting small terrestrial mammals in the Southern Tableland Dry Sclerophyll Forests habitat type. Thirty-five cameras were stationed within the Southern Tableland Dry Sclerophyll Forest habitat type (four cameras on the west of the Talbingo Reservoir, 31 cameras to the east of the Talbingo Reservoir). The four cameras to the west of the Talbingo Reservoir were operational for 46 nights while the 31 cameras on the east of the Talbingo Reservoir were operational for 10 nights. This resulted in a total effort of 494 camera trap nights in this habitat type in the South Eastern Highlands portion of the construction envelope.

One trap site was established in the Upper Riverina Dry Sclerophyll Forests (PCT 302) habitat type, consisting of 25 traps. The trap site was operational for four nights resulting in a total effort of 100 ground trap nights targeting small terrestrial mammals in the Upper Riverina Dry Sclerophyll Forests habitat type. No cameras were established in this habitat types, however this is supplemented by two cameras placed on the margin of Southern Tableland Wet Sclerophyll Forests, which resulted in a sample effort of 20 traps nights.

Three ground trap sites established in the Southern Tableland Wet Sclerophyll Forests (PCT 300) habitat type on the west side of the Talbingo Reservoir resulted in 300 trap nights. No live traps were established in the Southern Tableland Wet Sclerophyll Forests (PCT 300) habitat type on the east side of the Talbingo Reservoir. The impracticalities of checking the traps each morning and setting traps each night in this remote area on the crest and the western slopes of Sheep Station Ridge meant that a live-trapping program could not be undertaken safely or according to animal ethics regulations. As such, remote camera traps were stationed along the construction envelope in this area of habitat and relied on for the survey. Two cameras were established in this habitat, and five on the margins of the PCT boundary, and were operational for 10 nights. This resulted in a total effort of 70 camera trap nights in this habitat type on the east side of the Talbingo Reservoir in the South Eastern Highlands portion of the construction envelope. In addition, eight cameras were established for 47 nights on the west side of the Talbingo Reservoir, resulting in an effort of 376 traps nights. The total camera trap effort within Southern Tableland Wet Sclerophyll Forests of the South Eastern Highlands portion of the construction envelope is 396 trap nights.

Table 4.12: Summary of survey effort for small mammals in the South Eastern Highlands portion of the construction envelope

| Vegetation formation | Vegetation class / habitat type | Area (ha) in construction envelope | Required survey effort* | Survey completed |
|---|---|---|---|---|
| Dry Sclerophyll Forests (Shrub/grass sub-formation) | Upper Riverina Dry Sclerophyll Forests | 6.57 | 100 ground trap nights<br>14 camera trap nights | 100 ground trap nights<br>20 camera trap nights sampled from margin of Southern Tableland Wet Sclerophyll Forests |
| Dry Sclerophyll Forests (Shrubby sub-formation) | Southern Tableland Dry Sclerophyll Forests | 102.24 | 200 ground trap nights | 500 ground trap nights<br>494 camera trap nights |

| Vegetation formation | Vegetation class / habitat type | Area (ha) in construction envelope | Required survey effort* | Survey completed |
|---|---|---|---|---|
| | | | 182 camera trap nights | |
| Wet Sclerophyll Forests (Grassy sub-formation) | Southern Tableland Wet Sclerophyll Forests | 47.63 | 100 ground trap nights<br>98 camera trap nights | No live-trapping due to remoteness of terrain<br>396 camera trap nights. 20 of these camera trap nights were on the east side of the Talbingo Reservoir, plus an additional 50 trap nights on the margin of Southern Tableland Wet Sclerophyll Forests |

Note: * = survey effort rounded up to nearest 5 ha.

#### 4.8.2.6 Large terrestrial mammals

The targeted survey for large terrestrial mammals focused on the Spotted-tailed Quoll. The Spotted-tailed Quoll is an ecosystem credit species for the purpose of this BDAR but is also listed as a vulnerable species under the EPBC Act so survey was undertaken for this species. The Spotted-tailed Quoll is considered likely to inhabit all of the habitats within the construction envelope. Suitable den sites may be present within the Sub-alpine Woodland (PCT 1196) habitat and Southern Tableland Wet Sclerophyll Forest habitat (PCT 300) as these areas contain a large number of fallen hollow bearing trees and large woody debris on the ground. The rocky areas within the Southern Tableland Dry Sclerophyll Forests (PCT 296, 729 and 999) habitat type may also be suitable for den sites.

The 43 ground-based camera traps as described in **Section 2.7.2.3** were also used to detect the Spotted-tailed Quoll, by including an additional meat bait (sardines). Spotlighting transects were also undertaken in 16 locations throughout the construction envelope. The survey effort undertaken for the Spotted-tailed Quoll is outlined in **Table 4.13**.

Table 4.13: Summary of survey effort for larger terrestrial mammals

| Common name | Species name | EPBC Act | BC Act | Survey period limitation | Survey timing | No. survey sites | No. nights | Survey effort |
|---|---|---|---|---|---|---|---|---|
| Spotted-tailed Quoll | *Dasyurus maculatus* | E | V | September - February | 4th-11th December 2018<br>22nd January - 2nd February 2019 | 43 ground camera trap sites<br>16 spotlighting sites (2 people) | 57 nights of camera trapping (47 nights on west side, 10 nights on east side of study area)<br>32 person nights spotlighting | 981 ground camera trap nights across the study area<br>Approximately 74 person hours spotlighting |

#### 4.8.2.7 Arboreal mammals

The targeted survey for threatened arboreal mammal species focused on the following five species:

- Yellow-bellied Glider
- Greater Glider
- Squirrel Glider
- Brush-tailed Phascogale
- Koala.

The Eastern Pygmy-possum was also surveyed for as described in **Section 4.8.2.5**. Several techniques were utilised for these species in an integrated approach to maximise the chances of detection within the construction envelope.

The trapping program targeting the Yellow-bellied Glider, Greater Glider, Squirrel Glider, and Brush-tailed Phascogale (also the Eastern Pygmy Possum) involved tree mounted Elliott B traps and remote cameras placed on the ground and on trees and flowering shrubs. Spotlighting and call playback were also utilised.

Each trapping grid consisted of 6 tree mounted traps set on brackets 3-4 m above ground along two parallel lines separated by at least 100 m. Traps were placed 50 m apart along each trap line forming a one ha trapping grid centred over the ground-based trap grid. Traps were baited with a standard bait mix of peanut butter, rolled oats and honey and rebaited when necessary. A honey-water mix was sprayed on the tree trunk above the trap each morning. Traps were left open for four nights and checked every morning within two-hours of sunrise. The tree traps were packed with materials such as leaf litter to allow any trapped animals to keep warm overnight.

Camera traps were placed in the remaining habitats away from the primary sites, with a concentrated effort near structure sites and access tracks likely to be disturbed from the project. Tree mounted cameras were placed between 1.5 and 1.7 m above the ground and bait stations were attached to the tree trunk or branch approximately 1.5 m away from the camera. Ground based cameras were set 30 cm from ground level with baits placed on stakes 1.5 m from the camera. The cameras were set on a timer to operate between 8 pm to 6 am and left operational for a period of 46 to 47 nights in habitats on the west side of the Talbingo Reservoir in both bioregions. While the baits would have eventually deteriorated over this period, the cameras remained active. The number of survey nights was decreased to 10 nights for most of the survey on the east side of the Talbingo Reservoir as 10 nights was deemed sufficient to record the species present. Camera traps were the main form of mammal survey undertaken in the more remote parts of the construction envelope such as Sheep Station Ridge where live trapping was not practicable.

Koala surveys consisted of scat searches underneath suitable food tree species (i.e. *Eucalyptus viminalis* and *Eucalyptus rubida*). A rapid assessment method was used as described in Woosnam-Merchez *et al.* (2012) whereby sites were pre-selected to sample the range of habitat types and biophysical attributes within the study area. The observers tracked to each waypoint and completed a dedicated scat search up to 5 m around the base of the nearest tree and continued searching trees radiating out from the waypoint until a minimum of 20 trees were searched at each site. Koalas were also targeted by call playback and spotlighting.

A summary of the overall survey effort is provided in **Table 4.14**.

Table 4.14: Summary of survey effort for arboreal mammals

| Common name | Species name | EPBC Act | BC Act | Survey period limitation | Survey timing | No. survey sites | No. nights / people | Survey effort |
|---|---|---|---|---|---|---|---|---|
| Yellow-bellied Glider | *Petaurus australis* | - | V, EP | All year | 4th-11th December 2018<br><br>22nd January - 2nd February 2019 | 12 trap sites (6 tree mounted Elliott B traps at each site)<br><br>10 tree mounted camera trap sites<br><br>16 call playback survey sites<br><br>16 spotlighting sites | Each trap site operated for 4 nights (except Site 7 which was 3 nights)<br><br>57 nights of camera trapping (47 nights on west side, 10 nights on east side of Talbingo Reservoir)<br><br>16 nights of call playback<br><br>16 nights spotlighting | 24 tree mounted trap nights at each site (210 tree mounted Elliott trap nights)<br><br>285 tree mounted camera trap nights<br><br>16 nights of call playback<br><br>Approximately 74 person hours spotlighting |
| Greater Glider | *Petauroides volans* | V | - | All year | | | | |
| Squirrel Glider | *Petaurus norfolcensis* | - | V | All year | | | | |
| Brush-tailed Phascogale | *Phascogale tapoatafa* | - | V | All year | | | | |
| Koala | *Phascolarctos cinereus* | V | V | All year | | 40 Koala scat search sites<br><br>16 call playback survey sites<br><br>16 spotlighting sites | 2 people conducting each Koala scat survey<br><br>32 call playback events<br><br>16 nights spotlighting | 800 trees inspected for Koala scats throughout the study area (20 trees at each site).<br><br>16 nights of call playback<br><br>74 person hours spotlighting |

The recommended survey effort for arboreal mammals is 24 Elliott trap nights over 3 to 4 consecutive nights per stratification unit up to 50 ha in size (plus additional effort for every additional 100 ha) (Department of Environment and Conservation, 2004). No guidelines are provided for the use of remote cameras for these species. Spotlight transects were undertaken by two observers over a total of 16 nights. Each night involved a dedicated 2-person hour search at one of the primary trap grids followed by an additional 2-3 person hours walking spotlight transects located either in proximity to the trapping grid, or selecting vehicle and walking tracks located in other part of the construction envelope, these varied in length from 1-5 km. The total search effort equated to 74-person hours.

At minimum, two call playback sites were conducted each night (16 sites in total) and these were positioned at the trapping grid, with an additional site selected at least 2 km from the trapping grid. Each site was sampled twice over the survey period resulting in 32 survey events.

Spotlighting was supplemented with call playback for arboreal mammals such as Squirrel Glider, Yellow-bellied Glider, and Koala that respond to vocalisations.

The survey effort undertaken during the surveys is described below separated into bioregions.

**Australian Alps**

Within the Australian Alps portion of the construction envelope, there is approximately 31.23 ha of Sub-alpine Woodland (PCT 1196) identified as potential habitat for the Squirrel Glider, Yellow-bellied Glider, Greater Glider and potentially Koala. There is also approximately 15.14 ha of Southern Tableland Wet Sclerophyll Forests (PCT 300), and 2.24 ha of Upper Riverina Dry Sclerophyll Forest (PCT 285) within the Australian Alps portion of the construction envelope that may be suitable as habitat for these species. These habitats are also likely to be suitable for the Eastern Pygmy Possum. A summary of the survey effort is provided in **Table 4.15**.

Within the Sub-alpine Woodland (PCT 1196) habitat, three tree mounted Elliott trap sites were established, each consisting of six type traps. The trap lines also ran through the narrow drainage lines of Upper Riverina Dry Sclerophyll Forest (PCT 285) sampling this habitat. Two trap sites were operational for four nights while one was operational for three nights. This resulted in a total effort of 66 tree-trap nights targeting arboreal mammals in the Sub-alpine Woodland and narrow bands of Upper Riverina Dry Sclerophyll Forest habitat. Three remote cameras were stationed within the Sub-alpine Woodland habitat and one remote camera was stationed in the narrow drainage lines of Upper Riverina Dry Sclerophyll Forest and left operational for 47 nights. This resulted in 188 camera trap nights in Sub-alpine Woodland habitat and 47 camera trap nights in the narrow drainage lines of Upper Riverina Dry Sclerophyll Forest.

In the Southern Tableland Wet Sclerophyll Forests (PCT 300) habitat type, three tree mounted trap sites were established, each consisting of six traps, in contiguous habitat located within the South Eastern Highlands Bioregion portion of the construction envelope (west of the Talbingo Reservoir). The three trap sites were operational for four nights resulting in an effort of 72 tree trap nights. Thirteen remote cameras were stationed within this habitat (three within the Australian Alps Bioregion and ten in contiguous habitat within the South Eastern bioregion) and left operational for 47 nights. This resulted in 517 camera trap nights in contiguous Southern Tableland Wet Sclerophyll Forests habitat type.

Table 4.15: Summary of trapping survey effort for arboreal mammals in the Australian Alps portion of the construction envelope

| Vegetation formation | Vegetation class / habitat type | Area (ha) in construction envelope | Required survey effort | Survey completed |
|---|---|---|---|---|
| Dry Sclerophyll Forests (Shrub/grass sub-formation) | Upper Riverina Dry Sclerophyll Forests | 2.24 | 24 tree trap nights | Elliot trap lines were part of the Subalpine woodland sites<br>47 camera trap nights |
| Wet Sclerophyll Forests (Grassy sub-formation) | Southern Tableland Wet Sclerophyll Forests | 15.14 | 24 tree trap nights | 72 trap nights<br>517 camera trap nights (3 cameras in Australian Alps and 10 within contiguous habitat in South Eastern Highlands Bioregion) |
| Grassy Woodlands | Subalpine Woodlands | 31.23 | 24 tree trap nights | 66 trap nights<br>188 camera trap nights |

Spotlight transects were undertaken by two observers over a total of nine nights. Each night involved a dedicated 2-person hour search at one of the primary trap grids followed by an additional 2-3 person hours walking spotlight transects located either in proximity to the trapping grid, or selecting vehicle and waking tracks located in other part of the project footprint, these varied in length from 1-5 km. The total search effort is summarised in **Table 4.16** and equated to 36-person hours.

Three call playback sites were conducted and these were positioned at the trapping grid, with an additional two site around drainage lines in Upper Riverina Dry Sclerophyll Forests. An additional seven call playback sites were undertaken in contiguous habitat on the west side of the Talbingo Reservoir within the South Eastern Highlands Bioregion.

Due to the confirmed presence of Yellow-bellied Glider at the substation site, the position of hollow-bearing trees was marked within the construction envelope and were searched on two separate nights, including stag watching habitat trees to determine if the species was denning in this location.

Table 4.16: Summary of spotlighting and call playback survey effort for arboreal mammals in the Australian Alps portion of the construction envelope

| Vegetation formation | Vegetation class / habitat type | Area (ha) in construction envelope | Required survey effort | Survey completed |
|---|---|---|---|---|
| Dry Sclerophyll Forests (Shrub/grass sub-formation) | Upper Riverina Dry Sclerophyll Forests | 2.24 | 2 x 1 hour and 1 km up to 200 ha stratification unit on two separate nights | 6-person hours over two separate nights |
| Wet Sclerophyll Forests (Grassy sub-formation) | Southern Tableland Wet Sclerophyll Forests | 15.14 | 2 x 1 hour and 1km up to 200 ha stratification unit on two separate nights | 14-person hours over three sperate nights |
| Grassy Woodlands | Subalpine Woodlands | 31.23 | 2 x 1 hour and 1 km up to 200 ha stratification unit on two separate nights | 16-person hours over four separate nights |

**South Eastern Highlands**

Within the South Eastern Highlands portion of the construction envelope, there is approximately 102.24 ha of Southern Tableland Dry Sclerophyll Forests (PCT 296, 729 and 999), 6.57 ha of Upper Riverina Dry Sclerophyll Forests (PCT 302), and 47.63 ha of Southern Tableland Wet Sclerophyll Forest habitat (PCT 300) that is likely to be suitable for the Squirrel Glider, Brush-tailed Phascogale, and Koala. This habitat is also suitable for the Eastern Pygmy Possum. Only the west side of the Talbingo Reservoir is suitable for the Greater Glider and Yellow-bellied Glider, which is contiguous with habitats in Bago State Forest. A summary of the survey effort is provided in **Table 4.17**.

Within the Southern Tableland Dry Sclerophyll Forests (PCT 296, 729 and 999) habitat, four tree mounted trap sites were established, each consisting of six traps. The trap sites were operational for four nights resulting in a total effort of 96 tree trap nights targeting arboreal mammals in the Southern Tableland Dry Sclerophyll Forests habitat type. One trap site (24 tree trap nights) was also established within this habitat on the west side of the Talbingo Reservoir. Thirty-three cameras were stationed within the Southern Tableland Dry Sclerophyll Forest habitat type (four cameras on the west of the Talbingo Reservoir, 29 cameras to the east of the Talbingo Reservoir). The two cameras to the west of the Talbingo Reservoir were operational for 46 nights while the 25 cameras on the east of the Talbingo Reservoir were operational for 10 nights. This resulted in a total effort of 494 camera trap nights in this habitat type in the South Eastern Highlands portion of the construction envelope.

One Elliott trap site was established in the Upper Riverina Dry Sclerophyll Forests (PCT 302) habitat type, consisting of six tree mounted traps. The trap site was operational for four nights. This resulted in a total effort of 24 tree trap nights targeting arboreal mammals in the Upper Riverina Dry Sclerophyll Forests habitat type. No cameras were established in this habitat type, however this was supplemented by two cameras placed on the margin of Southern Tableland Wet Sclerophyll Forests, which resulted in a sample effort of 20 traps nights.

Three tree trap sites established in the Southern Tableland Wet Sclerophyll Forests (PCT 300) habitat type on the west side of the Talbingo Reservoir resulted in 72 trap nights. No live traps were established in the

Southern Tableland Wet Sclerophyll Forests (PCT 300) habitat type on the east side of the Talbingo Reservoir. The impracticalities of checking the traps each morning and setting traps each night in this remote area on the crest and the western slopes of Sheep Station Ridge meant that a live-trapping program could not be undertaken safely or according to animal ethics regulations. As such, remote camera traps were stationed along the construction envelope in this area of habitat and relied on for the survey. Two cameras were established in this habitat, and five on the margins of the PCT boundary, and were operational for 10 nights. This resulted in a total effort of 70 camera trap nights in this habitat type on the east side of the Talbingo Reservoir in the South Eastern Highlands portion of the construction envelope. In addition, eight cameras were established for 47 nights on the west side of the Talbingo Reservoir, resulting in an effort of 376 traps nights. The total camera trap effort within Southern Tableland Wet Sclerophyll Forests of the South Eastern Highlands portion of the construction envelope is 396 trap nights.

Table 4.17: Summary of survey effort for arboreal mammals in the South Eastern Highlands portion of the construction envelope

| Vegetation formation | Vegetation class / habitat type | Area (ha) in construction envelope | Required survey effort | Survey completed |
|---|---|---|---|---|
| Dry Sclerophyll Forests (Shrub/grass sub-formation) | Upper Riverina Dry Sclerophyll Forests | 6.57 | 24 trap nights | 24 trap nights<br>20 camera trap nights sampled from margin of Southern Tableland Wet Sclerophyll Forests |
| Dry Sclerophyll Forests (Shrubby sub-formation) | Southern Tableland Dry Sclerophyll Forests | 102.24 | 48 trap nights | 120 trap nights<br>494 camera trap nights |
| Wet Sclerophyll Forests (Grassy sub-formation) | Southern Tableland Wet Sclerophyll Forests | 47.63 | 24 trap nights | No live-trapping due to remoteness of terrain<br>396 camera trap nights. 20 of these camera trap nights were on the east side of the Talbingo Reservoir, plus an additional 50 trap nights on the margin of Southern Tableland Wet Sclerophyll Forests |

Spotlight transects were undertaken by two observers over a total of nine nights. Each night involved a dedicated 2-person hour search at one of the primary trap grids followed by an additional 2-3 person hours walking spotlight transects located either in proximity to the trapping grid, or selecting vehicle and waking tracks located in other part of the construction envelope; these varied in length from 1-5 km. The total search effort equated to 36-person hours.

At total of 20 call playback sites (12 on the east side and eight on the west side of the Talbingo Reservoir) were conducted and these were positioned at the trapping grids, with an additional site selected in between.

#### 4.8.2.8 Bats

The target species for the threatened bat surveys was the Large Bent-winged Bat and Southern Myotis. Before the survey commenced, literature including *A bat survey in State Forests on the south-west slopes region of New South Wales with suggestions of improvements for future surveys* (Law *et al.*, 1998), and databases, were reviewed to determine the likely bat species that would be encountered during the survey.

The *'Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method* (Office of Environment and Heritage, 2018) outlines the required survey methods and effort required for the Southern Myotis. The survey requirements include using harp traps or mist nets placed in areas of potential habitat set beside or preferably over pools of water along creeks or rivers, particularly in flat or areas of low relief if present. A roost search should be undertaken including searching any bridges, tunnels, culverts or other structures identified as potential breeding habitat for bats or signs of bats (guano etc). The survey undertaken for this BDAR used the combined approach of capture via harp traps supplemented with ultrasonic call recording with acoustic detectors (Anabat). Harp traps and acoustic recorders were set up along watercourses (i.e. Wallaces Creek) and corridors expected to be flight routes for the target species. Traps were set in the late afternoon and checked early the following morning. Any bats caught were removed in the early morning, biometric data taken and then bats placed in a cool shaded location and released at dusk. Mist nests were not used. However, a harp trap was set over Wallaces Creek to capture any Southern Myotis that may be foraging along the creek. The harp trap appropriately covered most of the creek width. Echolocation calls were sent to Greg Ford from Balance! Environmental for analysis.

The Large Bent-winged Bat is an ecosystem credit species for foraging habitat and is a species credit species where breeding habitat will be impacted. The *'Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method* (Office of Environment and Heritage, 2018) indicates that the focus of the survey should be to determine whether any breeding habitat for the Large Bent-winged Bat is present and whether it would be impacted. For the purpose of the BAM, breeding habitat is specific habitat features that are used, or presumed likely to be used, by threatened bat species as maternity sites. Breeding habitat is considered present if there is:

- Potential breeding habitat
- Breeding individuals of the target species on the subject land (construction envelope).

Potential breeding habitat for the Large Bent-winged Bat is identified as caves, tunnels, mines or other structures known or suspected to be used by the Large Bent-winged Bat including species records in the NSW BioNet Atlas with microhabitat code 'IC – in cave'; observation type code 'E nest-roost'; with numbers of individuals greater than 500; or identified from the scientific literature. Within the broader region, the Yarrangobilly Caves and perhaps the Tumut 2 Surge Shaft may be breeding habitats for the Large Bent-winged Bat, but the project will not impact these areas. The literature indicates that the area around Bago State Forest is generally lacking in caves as evidenced by the low occurrence of the Large Bent-winged Bat (see Law *et al.*, 1998). There were no rock crevices, holes or caves suitable as breeding habitat for the Large Bent-winged Bat identified within the construction envelope during the survey. However, in the broader study area, the cliff line to the south of Mine Trail has potential for caves and was searched for roost site potential. There were no caves identified as potential breeding habitat so targeted survey of the cave was not undertaken and harp traps were not placed at the cave exit.

The surveys were undertaken within the optimal survey period for the Large Bent-winged Bat and Southern Myotis as outlined in the BAM-C and Threatened Species Profile Database. The surveys were undertaken during favourable weather conditions with hot calm conditions experienced during the survey period. The survey undertaken for these species is summarised in **Table 4.18**.

Table 4.18: Summary of survey effort for bats

| Common name | Species name | EPBC Act | BC Act | Survey period limitation | Survey timing | No. survey sites | No. nights | Survey effort |
|---|---|---|---|---|---|---|---|---|
| Large Bent-winged Bat | *Miniopterus orianae oceanensis* | - | V | November – February | 4th-11th December 2018<br><br>22nd January - 2nd February 2019 | 5 Anabat sites<br><br>8 harp trap sites | 18 Anabat nights<br><br>Harp traps set for 2 nights at each site | 18 Anabat nights (approx. 215 hours of continuous recording)<br><br>16 harp trap nights |
| Southern Myotis | *Myotis macropus* | - | V | October – March | | | | |

#### 4.8.2.9 Amphibians

The target species for the threatened frog surveys were the Booroolong Frog (*Litoria booroolongensis*) and the Alpine Tree Frog (*Litoria verreauxii alpina*). However, the Booroolong Frog is already known from Yarrangobilly Creek, so was not the focus of these targeted surveys. The survey used the combined approach of visual encounter surveys (spotlighting) and call playback techniques. However, due to the dry environmental conditions at the time of survey, a lack of suitable habitat along most of the construction envelope, and existing data on the confirmed Booroolong Frog habitat in the Yarrangobilly River, Wallaces Creek and Sheep Station Creek from the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a), detailed frog surveys according to accepted best practice guidelines were not undertaken. This BDAR relies on the recent high-quality data for Booroolong Frog collected for the BDAR for the Snowy 2.0 Exploratory Works and Main Works EISs (EMM Consulting, 2017 and 2020a). This project overlaps the same habitats in the east of the study area around the Yarrangobilly River, Sheep Station Creek, Lick Hole Gully and Cave Gully.

The *Survey Guidelines for Australia's Threatened Frogs* (Department of the Environment Water Heritage and the Arts, 2010c) indicates that the optimal survey conditions for Alpine Tree Frog is following summer rains (one week after heavy rainfall – generally accepted as >50 millimetres (mm) in seven days) at the time of peak activity for the species. Rainfall in the seven days prior to and during the December 2018 survey was well below optimal for surveying for the Alpine Tree Frog. The Commonwealth survey guidelines stipulate that the survey should be a minimum of two nights under ideal conditions, repeated on at least four separate occasions during the activity period. Due to the overall dry environmental conditions, the required survey for Alpine Tree Frog could not be met. Additionally, the habitat within the construction envelope was sub-optimal for this species so extensive survey effort was not planned. However, some survey effort for frogs was undertaken despite the poor survey conditions (see **Table 4.19**).

The frog surveys focused on the habitats in the Australian Alps Bioregion to the west of the Talbingo Reservoir and were undertaken in December 2018. The frog surveys that were undertaken targeted the higher altitude Subalpine Woodlands (PCT 1196) and streams including New Zealand Gully, the unnamed watercourse in the Bago State Forest (PCT 285), and the unnamed watercourse alongside Elliott Way in the KNP (PCT 300). These streams appear to be ephemeral and breeding habitats are not present. The drainage lines were relatively dry apart from some poor condition pools created by horse damage in the Line 64 easement. Therefore, the chance of encountering calling frogs was limited. The threatened Alpine Tree Frog (*Litoria verreauxii alpina*) appears to grade into the nominate race *Litoria verreauxii verreauxii* and intermediate forms occur between 1,000 m and 1,300 m in elevation. The surveys therefore focused on locating any frogs resembling *Litoria verreauxii* in the broader sense.

Table 4.19: Summary of survey effort for amphibians

| Common name | Species name | EPBC Act | BC Act | Survey period limitation | Survey timing | No. survey sites | No. nights | Survey effort |
|---|---|---|---|---|---|---|---|---|
| Alpine Tree Frog | *Litoria verreauxii alpina* | V | E | November - December | 4th-11th December 2018 | 5 waterway site visual encounter surveys (spotlighting) and call playback | 4 nights spotlighting | 2 hours call playback |

## 4.9 Survey limitations

The desktop assessment and field survey undertaken for this BDAR provide a limited view into the ecological values of the whole study area. The diversity of flora and fauna species recorded from this study should not be seen to be comprehensive. It is unlikely that every species present within the construction envelope has been recorded. The field survey aimed to sample the construction envelope and a comprehensive inventory of species was not made. A period of several seasons or years is often needed to identify all the species present in an area, especially as some species are only apparent at certain times of the year e.g. orchids or migratory birds and require specific weather conditions for optimum detection e.g. breeding and flowering periods. The conclusions of this report are therefore based upon available data and are indicative of the environmental condition of the construction envelope at the time of the survey. It should be recognised that site conditions, including the presence of threatened species, can change with time. To address this limitation, the assessment has aimed to identify the presence and suitability of the habitat for threatened species. All surveys have been conducted in accordance with the BAM and best practice guidelines listed in **Section 4.8.1**.

Many of the PCTs identified within the construction envelope and surrounds are not currently described well in the BioNet Vegetation Classification database and have been identified with a very low classification confidence level. As such, the vegetation within the construction envelope has been assigned to the most likely PCT as they are described in the BioNet Vegetation Classification database. PCT 300 appears to be a very broad PCT that captures a significant proportion of the vegetation in the construction envelope. The dominance of *Eucalyptus rubida* and *Eucalyptus nortonii* in the canopy of the vegetation east of the Tumut River with a shrubby midstorey makes assignment to a PCT difficult and there is no clear matching PCT in the BioNet Vegetation Classification database. In many cases, there are no clear lines defining the transition between PCTs, so the mapping provided in this BDAR is supported by on ground floristic surveys and observations of potential ecotones. Plant communities are naturally variable and the boundaries between different PCTs on this site overlap considerably with a gradual transition from one community to another. However, a choice must be made to map and assign a PCT to an area of the site. As mapping necessitates that a hard boundary is drawn to separate PCTs, boundaries of PCTs and vegetation zones have been mapped as best as possible based on observations made during the field survey and based on patterns observed on aerial photography. It is likely that the boundaries of PCTs and vegetation zones will change with time and in response to long-term variation in biophysical conditions on the site such as rainfall and surface drainage patterns.

The spring and summer 2018 / 2019 survey period occurred at a time of relatively widespread dry environmental conditions across NSW. Below average rainfall was recorded in 2018 at the Tumbarumba Post Office, Tooma (Eudlo), and Yarrangobilly Caves weather stations with 295.4 mm, 136.4 mm, and 240.8 mm below average rainfall recorded at each station respectively. As such, no attempt at a targeted orchid survey or frog survey was made during this period and supplementary surveys targeted more optimum conditions.

There were also some limitations to the survey techniques able to be used on site arising from the remoteness of some of the habitats. Elliott trap sites were not established on the crest and slopes of Sheep Station Ridge as it was not practical to check the traps each morning and set the traps each night in this remote area. For work health and safety reasons and animal ethics reasons, remote camera traps were stationed along the construction envelope in this area of habitat and relied on for the survey.

During the survey period, a hunting exclusion zone was established in the Bago State Forest around the survey area. However, the hunting exclusion zone was incorrectly mapped and did not show the full extent of our survey area as an exclusion zone. This could not be altered before the survey commenced and consequently, the distribution of Elliott Trap sites and other survey methods within the Bago State Forest were somewhat restricted. Spotlighting within the Bago State Forest was also somewhat restricted on two nights in December 2018 due to active hunting that was occurring within the survey area. During the survey period, ecologists heard nearby gunshots and observed blood trails from wounded animals within the survey area while spotlighting. Consequently, the nocturnal survey work within the Bago State Forest was limited for work health and safety reasons, however the required survey effort was still achieved.

# 5. Landscape features

## 5.1 IBRA bioregions and sub-regions

The project is located across two bioregions: the South Eastern Highlands Bioregion and the Australian Alps Bioregion (Thackway and Cresswell, 1995), and within the Bondo and Snowy Mountains sub-regions respectively. The majority of the project is located in the Bondo sub-region of the South Eastern Highlands Bioregion. The South Eastern Highlands Bioregion covers the dissected ranges and plateau of the Great Dividing Range that are topographically lower than the Australian Alps, which lie to the southwest. The highlands are part of the Lachlan fold belt that runs through the eastern states as a complex series of metamorphosed Ordovician to Devonian sandstones, shales and volcanic rocks intruded by numerous granite bodies. In NSW, the Australian Alps Bioregion is entirely surrounded by the South Eastern Highlands Bioregion. The alpine area comprises granites that have formed faulted, stepped ranges at the point where the South Eastern Highlands in NSW turn west into Victoria. More recent volcanic activity produced basalts and, in the Pleistocene, the cold climate superimposed glacial features on the landscape. The bioregion was the only part of the mainland to have been affected by Pleistocene glaciation and contains a variety of unique glacial and periglacial landforms above 1,100 m altitude.

The BAM states that if the subject land is located within more than one IBRA subregion, the IBRA subregion selected should be the one within which the largest proportion of impact/improvement will occur, with justifications provided in the BDAR (section 6.4.1.6 of the BAM). The BAM does not specify how to deal with a project that occurs across multiple IBRA regions. Therefore, a precautionary approach has been taken for this assessment, and two separate BAM-C case assessments have been created: one for the Australian Alps Bioregion and one for the South Eastern Highlands Bioregion. The boundaries of the IBRA regions case assessments were established using the spatial dataset 'Interim Biogeographic Regionalisation for Australia (IBRA), Version 7 (Regions)' (Department of the Environment and Energy, 2016).

## 5.2 BioNet NSW Landscapes (Mitchell landscapes)

The project crosses a variety of landscapes as mapped by the NPWS (2002) and described by the NSW Department of Environment and Climate Change (2001) as follows from east to west (refer to **Figure 5-1**):

- Pinbeyan – Ravine Ranges (approximately 48 per cent of the project) - Structurally controlled ranges with prominent bluffs to 120 m and plateau top on a synclinal fold in Upper Devonian rhyolite, andesitic basalt, tuff, sandstone, shale, slate, limestone, conglomerate and siltstone. Elevation 500 to 1,400 m, local relief 700 m. Extensive rock outcrop. Steep debris slope below cliffs with rubbly brown sandy loam grading to red-brown texture-contrast soils on lower slopes
- Cootamundra – Tumut Serpentinite and Ultramafics (approximately five per cent of the project) - Narrow ridges of extended linear outcrops of Devonian schistose serpentine, amphibolite and associated ultramafic rocks and sediments, general elevation 400 to 700 m, local relief 120 m. Dark structured clay loam and clay with unusual mineral content
- Tooma Granite Ranges (approximately 43 per cent of the project) – Rounded hills, ranges and plateau on Silurian gneissic granite with well-defined rectangular drainage pattern controlled by jointing. General elevation 700 to 1400 m. Red and yellow gritty texture-contrast soils merging to gradational profiles at about 1,000 m.

The broader study area, outside of the construction envelope, also includes a small area of the Cabramurra - Kiandra Basalt Caps and Sands. This landscape is represented by Tertiary basalt flow remnants capping hills on the high plains. Fluvial quartz gravels, sands and silts of former river channels are exposed beneath the basalt. Soil materials and sediments from the basalt and quartz sands extend down slope over Ordovician meta-sediments or Silurian-Devonian granites toward the alpine valleys. Most basalt outcrops are columnar jointed and formed periglacial block streams during the Pleistocene. General elevation 1,400 to 1,650, local relief to 200 m. Uniform and gradational, organic rich, brown clay loams, often stony.

## 5.3 Rivers, streams and estuaries

The construction envelope is located within the Murrumbidgee catchment. The broader study area contains the second order streams of Yorkers Creek, Native Dog Gully and New Zealand Gully that are fed by six mapped smaller ephemeral first order streams. Yorkers Creek becomes a larger third order and fourth order stream as it flows to the north and east and joins the major waterway of the Tumut River at the Talbingo Reservoir (sixth order stream). In the south of the substation site, New Zealand Gully flows into Native Dog Creek which flows south becoming a larger third order stream until it meets New Maragle Creek where it becomes a larger fourth order stream that flows south and east into the Tumut River.

East of the Talbingo Reservoir, the project would be built on ridges that are drained by unnamed first and second order streams. The unnamed streams on the western side of Sheep Station Ridge flow west down the steep slopes into the major waterway of the Tumut River at the Talbingo Reservoir. On the eastern side of Sheep Station Ridge the area is drained by a number of unnamed first and second order streams that join the third order stream of Sheep Station Creek. East of Lobs Hole Ravine Road the landscape is drained by first and second order streams that flow into Lick Hole Gully and further east Cave Gully which are second and third order streams respectively. Lick Hole Gully and Cave Gully flow north into the major seventh order stream of the Yarrangobilly River which flows north west into the Talbingo Reservoir. Further to the east the project crosses more first and second order streams and the larger fifth order stream of Wallaces Creek that flows north into the Yarrangobilly River.

West of the Talbingo Reservoir, the structures would be built on ridges that are drained by unnamed first order streams that join larger second order streams that flow down the steep terrain and terminate in the Tumut River to the east. All waterways are displayed in **Figure 8-1**.

## 5.4 Wetlands

There are no naturally occurring wetlands in the construction envelope. The transmission lines will span across the Talbingo Reservoir, which is not a naturally occurring wetland, however, does offer wetland habitat features.

## 5.5 Connectivity of habitat

According to the BAM, for development sites, the assessor must identify the connectivity of different areas of habitat that may facilitate the movement of threatened species across their range. The habitat within the construction envelope has a high degree of connectivity to other large areas of habitat within the KNP and Bago State Forest. The project is predominantly located within the KNP with the western end situated in the Bago State Forest. KNP is largely vegetated across its 690,000 ha extent and intact remnant vegetation extends across the Australian Alps and into the South Eastern Highlands. The Talbingo Reservoir provides a barrier to east west movement for some fauna groups.

South from the construction envelope, there is habitat connectivity south into Victoria in national parks, state forests and on private land from the Snowy Mountains and Monaro, to the Victorian Highlands, Victorian Alps, South East Coastal Ranges, Kybean-Gaurock subregion, and into the East Gippsland Lowlands subregion to the coast on the south east corner. Connectivity to the north exists through the Bondo subregion extending through to the Inland Slopes and Murrumbateman subregions where agricultural land becomes dominant and habitats are largely cleared or fragmented. From the construction envelope within the Snowy Mountains in the west, vegetation stretches into the Bondo and Inland Slopes subregions where the habitats become fragmented by agricultural development. Eastern connectivity exists through the Bondo subregion, Snowy Mountains, and into the Monaro where habitats become fragmented by agricultural development. There are high levels of physical, and functional, habitat connectivity surrounding the construction envelope. However, some species will not be adapted to all environments and restricted environments do exist within this larger connected landscape.

## 5.6 Areas of geological significance and soil hazard features

Areas of geological significance generally include karst, caves, crevices and cliffs. Many of these geological features occur within proximity to the construction envelope and there are some areas of rock outcrop with crevices. Areas of rock outcrop within the construction envelope, including granite tors, are shown in **Figure 5-1**.

The KNP contains well-known periglacial features including terracing, solifluction lobes, sliding and shattered boulders and block streams (also known as scree slopes or boulder streams). The block streams are recognised as a significant natural feature of the KNP and are listed under 'Rocks and Landforms' in Schedule 1 (Significant Natural and Cultural Features) of the Kosciuszko Plan of Management (KNP PoM) (Department of Environment and Conservation, 2006). Block streams occur to the south of the construction envelope along Lobs Hole Ravine Road but will not be impacted by the construction envelope.

The Devonian shallow-water sediments in the Ravine Basin, within which the eastern portion of the construction envelope is situated, are listed under 'Rocks and Landforms' in Schedule 1 (Significant Natural and Cultural Features) of the KNP PoM. There is an outcropping of the Devonian age Lick Hole Formation located along the lower section of Lobs Hole Ravine Road to the south of the construction envelope. The strata consist of grey friable shale with a high density of calcareous, rounded nodules. Some nodules appear to display the remains of branching structure and are assumed to be corals. Fossils of trilobites, brachiopods and molluscs are also present (EMM Consulting, 2018a).

In terms of Karst areas, the tufa deposits and fossil sequence at Ravine are recognised in the KNP PoM as a significant natural feature. There are numerous tufa deposits near the construction envelope within two main areas (refer to **Figure 5-1**). The Cave Gully deposit is located in Cave Gully approximately 1 km upstream of the Lobs Hole Copper Mine. The Lick Hole Gully Tufa is deposited near the headwaters of Lick Hole Gully and are visible from Lobs Hole Ravine Road. The Ravine Copper Mine (Lobs Hole Mine) is recognised as a geoheritage site in the KNP PoM. These tufa deposits occur to the south of the construction envelope but will not be directly impacted and are considered to be too far away (approximately 300 m) from the project boundary to be impacted by vibrations. Karst features are considered to be rare within the Lick Hole Formation as there is a general lack of massive limestone (EMM Consulting, 2018a).

The red and yellow earths formed from deeply weathered granodiorite in the western portion of the construction envelope are subject to localised sheet, gully and wind erosion following vegetation disturbance. Hydrogeological mapping to the west of the disturbance area in the alpine areas of the upper Murray Catchment show that the Tumbarumba Hydrogeological Unit (which the western extent of the disturbance area on granodiorite geology is likely to cover) has a low salt store that has moderate availability. The overall salinity hazard in this area is low. There is no acid sulfate soil risk mapping available. The soil assessments undertaken for the Snowy 2.0 Exploratory Works and Main Works EISs (EMM Consulting, 2018 and EMM Consulting 219) indicate that east of Lobs Hole Ravine Road, shallow Tenosols occur on the mid to upper slopes and crests of the undulating hills and have low to moderate erosion potential and are moderately dispersive throughout the profile. Deeper Kandosols are found on the gentler mid to upper slopes and these have a low to moderate erosion potential and are moderately dispersive in the B horizon. Dermosols are also present along Lobs Hole Ravine Road (reddish pink colour soils) and these have low to moderate erosion potential with the bottom 30 cm of the profile being moderately dispersive (EMM Consulting, 2018b and Carno, 2018). Some smaller areas of Haplic Epipedal Black Vertosol soils occur along the Yarrangobilly River floodplain (EMM Consulting, 2018b).

## 5.7 Areas of outstanding biodiversity value

Areas of declared critical habitat that were listed under the now repealed *Threatened Species Conservation Act 1995* have become declared areas of outstanding biodiversity value in NSW with the commencement of the BC Act. To date, there are only four declared areas of outstanding biodiversity value and these areas are not located in or near the project.

The construction envelope does not contain any areas of outstanding biodiversity value listed on the register of declared areas of outstanding biodiversity value.

## 5.8 Native vegetation extent

To assess percent current extent of native vegetation, a buffer of 1,500 m was placed around the boundary of the project area. While the transmission line is a linear feature, the disturbance area contains a mix of linear features such as the easement and access tracks, and individual site-based features including structure locations and the substation site. As such, a 500 m buffer of the centre line would not be appropriate to capture all the project features. Therefore, the 1,500 m buffer (landscape buffer) around all features was chosen.

Native over storey vegetation was digitised off an aerial photograph to determine the extent of native vegetation cover within the 1,500 m landscape buffer (see **Figure 5-1**). Obviously cleared areas were excluded from the mapping. However, the calculations are subject to a degree of error as the mapping is desktop based and subject to little ground truthing. The extent of native vegetation cover within the 1,500 m landscape buffer was then calculated in ArcGIS Desktop (10.7.1).

The 1,500 m landscape buffer is approximately 4,052 ha in size. There is approximately 3,931 ha of native vegetation (woody and non-woody vegetation including native grasslands) within the 1,500 m landscape buffer. This results in a percent native vegetation cover in the landscape of 97.01 per cent. Native vegetation cover in the landscape is very high in the >70 per cent cover class. These calculations are an approximation only and there are dirt roads that exist throughout the 1,500 m buffer that are not mapped as they have canopy cover. The purpose of the percentage vegetation cover calculation is to create a figure of native vegetation cover that is used in the BAM-C to predict threatened species likely to occur or use habitat on a site. Minor adjustments to polygon boundaries will not affect the >70 per cent cover class present within the landscape buffer.

## 5.9 2019/2020 Dunns Road bushfire

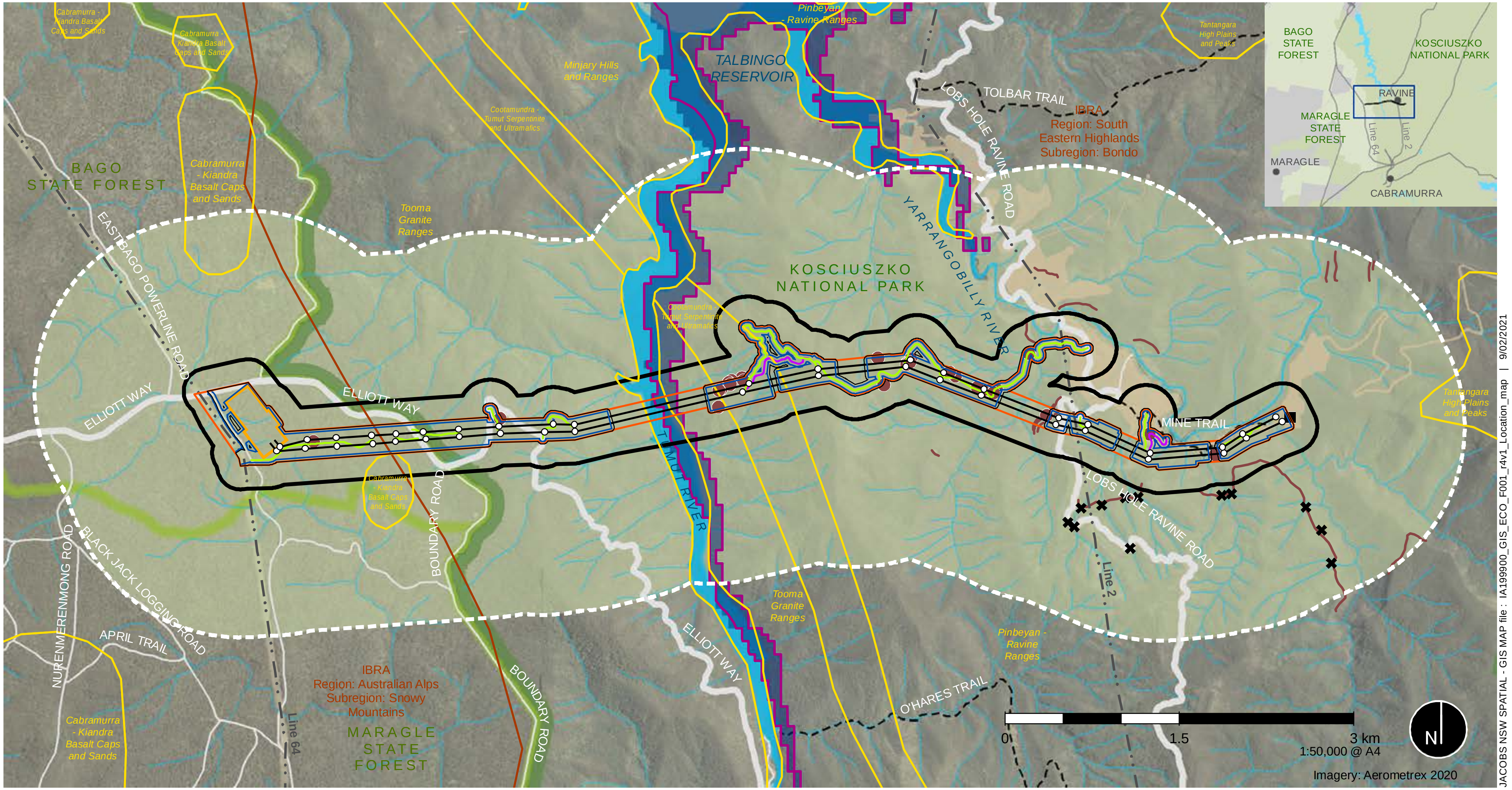
The Dunns Road bushfire that impacted the project study area started on 27 December 2019 from a lightning strike in a private pine plantation near Adelong. The fire covered a total area of 333,980 ha (NPWS 2020). The severity of this fire across the project study area is shown in **Figure 5-2**, which displays the spatial dataset 'Google Earth Engine Burnt Area Map' (Department of Planning, Industry and Environment, 2020b) that identifies four burn area classes. Most of the study area has been mapped as the top two classes: 'Very High – canopy completely consumed' and 'High – canopy and understorey likely to be completely burnt'. In the study area and broader locality, lower fire intensity is mapped in Bago and Maragle State Forests compared to KNP.

The NSW government developed the 'Guideline for applying the Biodiversity Assessment Method at severely burnt sites' (Department of Planning, Industry and Environment, 2020c) following the 2019-2020 bushfires. The aim of the Guideline is to provide assessors with a reasonable, evidence-based and transparent process for identifying severely burnt native vegetation and provides a range of approaches for applying the BAM on land impacted by severe  or catastrophic bushfire, i.e. bushfire of high to extreme intensity resulting in significant modification of vegetation structure and composition such that the original vegetation type and condition is no longer identifiable. The guidelines state that the 'Google Earth Engine Burnt Area Map' can be used to assess as site. Based on this mapping, most of the study area affected by the Dunns Road bushfire would meet the definition or severely burnt.

All fieldwork undertaken for this BDAR required to identify and assess native vegetation and threatened species habitat was completed prior to the 2019-2020 fires, so the Guideline (Department of Planning, Industry and Environment, 2020c) largely does not apply to this assessment. Targeted surveys for *Caladenia montana* were the only survey that was undertaken after the Dunns Road bushfire (October 2020), and this did not require the implementation of the Guideline. However, in line with the Guideline, **Figure 5-4** shows recent aerial imagery from after the Dunns Road fire (imagery date April 2020) and likely sites of resource flows and sinks as recognised by the Guideline (i.e. potential locations where moisture and nutrients are likely to accumulate and support more rapid regeneration of vegetation and a higher carrying capacity). Within the construction envelope and study area, likely sites of resource flows and sinks are assumed to be:

- Low lying areas containing swampy and riparian vegetation. These are mapped in **Figure 5-4** using the distribution of Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion (PCT 285) and Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion (PCT 302) identified during surveys
- Mapped waterways, as these are likely to transport and accumulate nutrients.

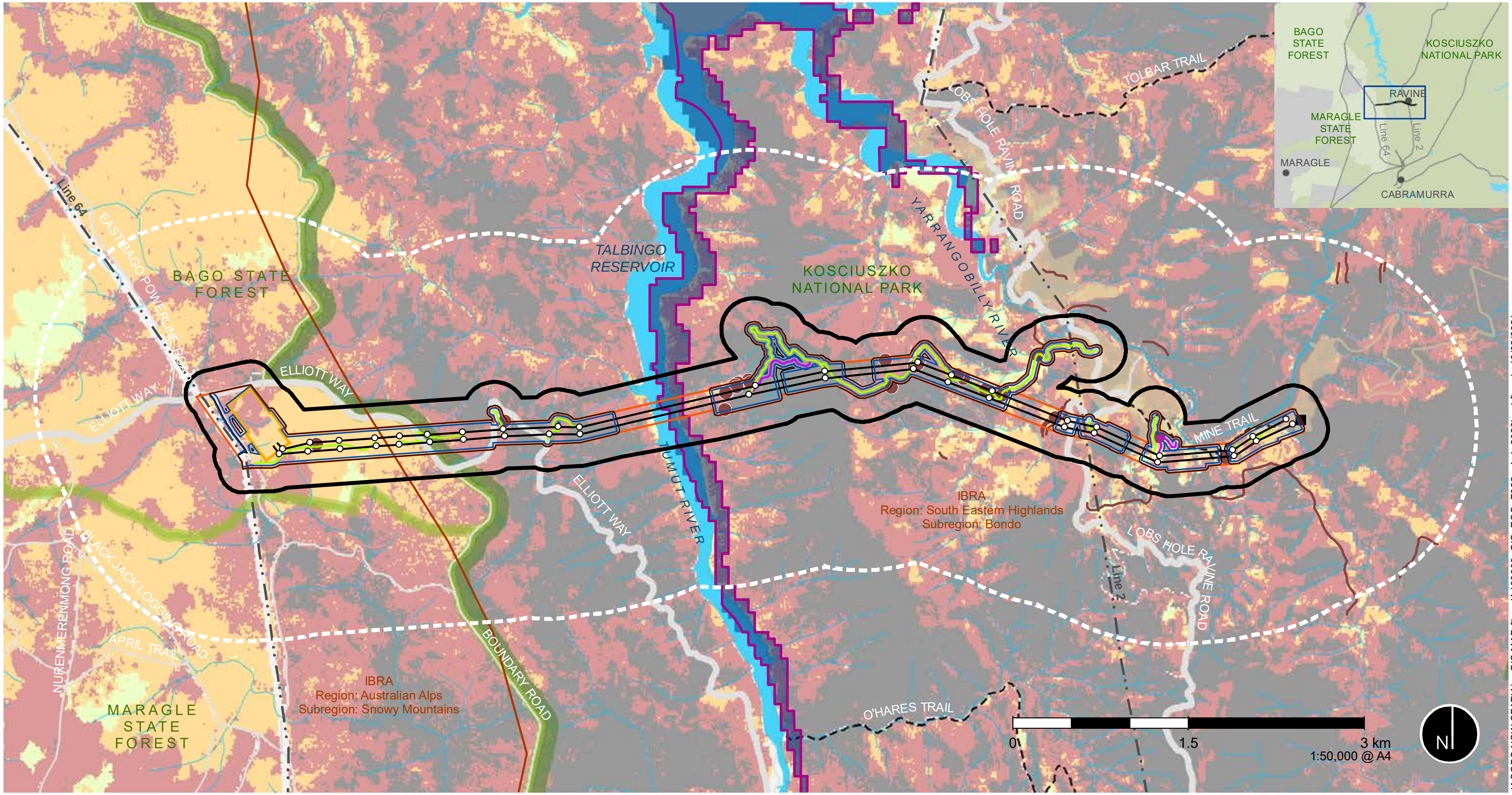
These possible sites of resource flows and sinks are therefore likely to be important for the recovery of all bushfire affected vegetation in the locality. Clearing of these areas for the project may threatened the natural process of post-fire recovery over a broader area. The impacts of the Dunns Road bushfire may also increase the potential for some indirect impacts associated with the project. Severely burnt areas will likely take many years to return to a similar state prior to the Dunns Road bushfire, and in this period of time are susceptible to impacts from weed invasion and soil erosion. These impacts have been discussed further in **Section 11.2.**




Project area
Disturbance area
BDAR study area
Construction envelope
Proposed structure
Proposed transmission line
Proposed access track - Option A
Proposed access track - Option B
Proposed 500kV substation
Snowy 2.0 cable yard
Snowy 2.0 disturbance footprint (05.02.2020)
IBRA
Mitchell landscape
Landscape buffer (1500m)
Native vegetation extent
Wetlands (EPI)
Wetlands of NSW
Tufa deposit
Rock outcrop
Cliff
Electricity transmission line
Waterway
Water body
NPWS estate
State Forest

**Data source:**
Jacobs 2020, TransGrid 2020, EMM 2020, DPE 2018,
© Department Finance, Services and Innovation 2018

**Figure 5-1** | Location map (pre 2019/2020 fire)




JACOBS NSW SPATIAL - GIS MAP file : IA199900_GIS_ECO_F022_r4v1_2020bushfire | 10/02/2021

Project area
Disturbance area
BDAR study area
Construction envelope
Proposed structure
Proposed transmission line
Proposed access track - Option A
Proposed access track - Option B
Proposed 500kV substation

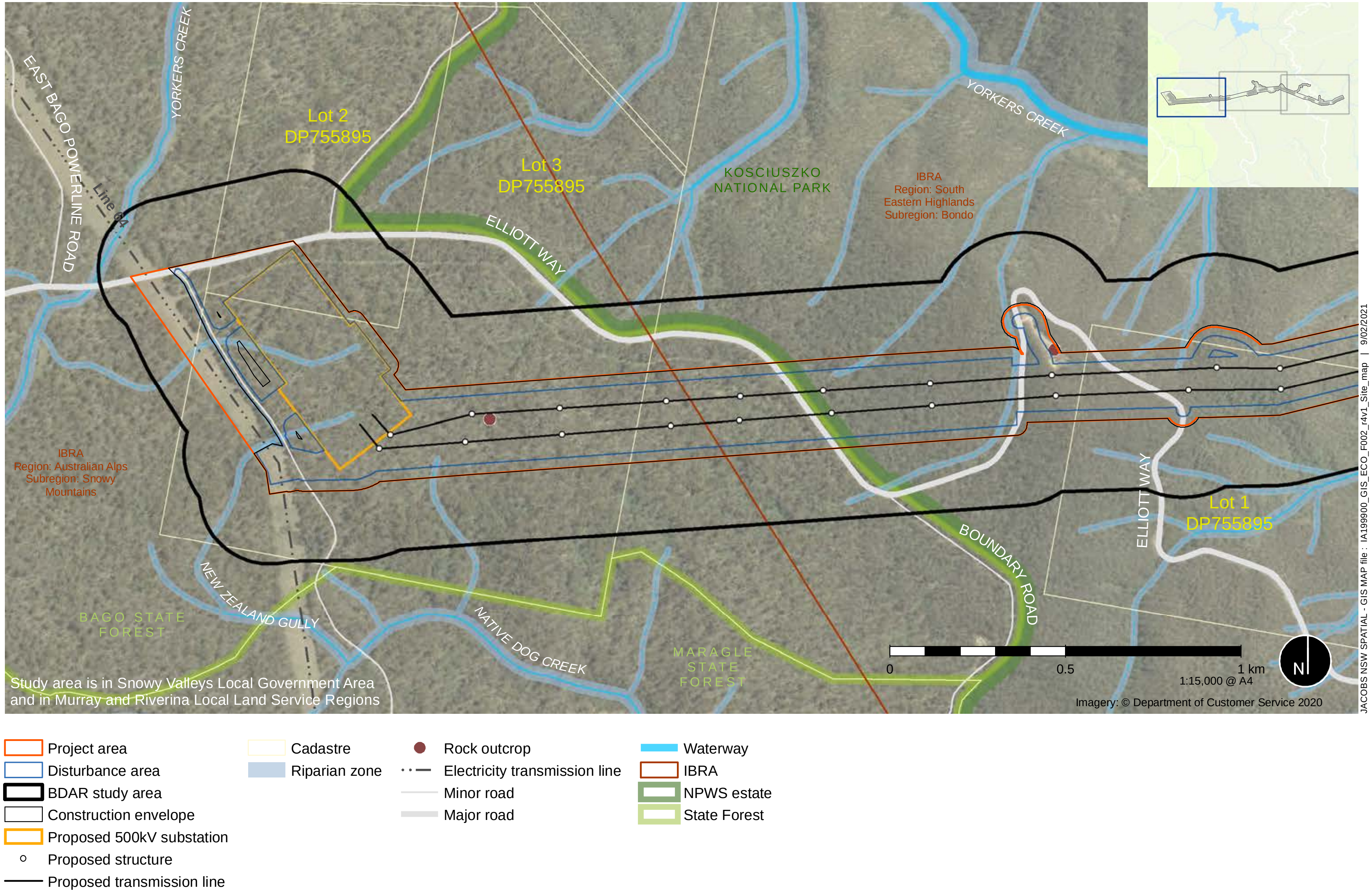
Snowy 2.0 cable yard
Snowy 2.0 Disturbance footprint (05.02.2020)
IBRA
Landscape buffer (1500m)
Wetlands (EPI)
Wetlands of NSW

Fire intensity mapping – Burnt area classes (Dunns Road bushfire 2019/2020)
Low: burnt understory with unburt canopy
Medium: the canopy is partially burnt
High: canopy and understory likely to be completely burnt
Very High: canopy completely consumed
Not Native Vegetation: not mapped

Rock outcrop
Cliff
Electricity transmission line
Waterway
Water body
NPWS estate
State Forest

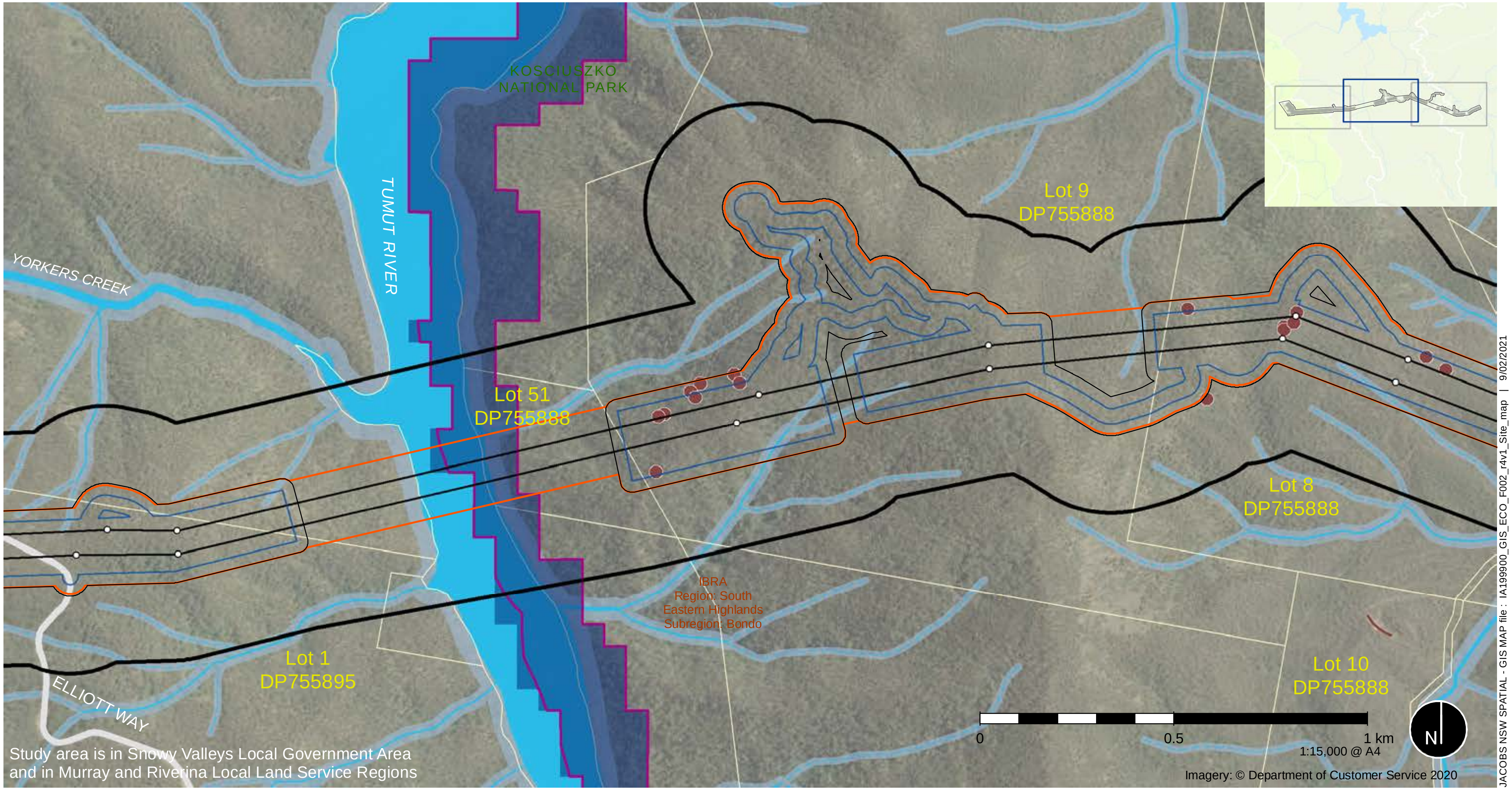
**Data source:**
Jacobs 2020, TransGrid 2020, EMM 2020, DPE 2018, UNSW/DPIE 2020,
© Department Finance, Services and Innovation 2018

**Figure 5-2** | Location map showing post 2019/2020 bushfire




**Data sources:**
Jacobs 2020, TransGrid 2020, DPE 2018,
© Department Finance, Services and Innovation 2018

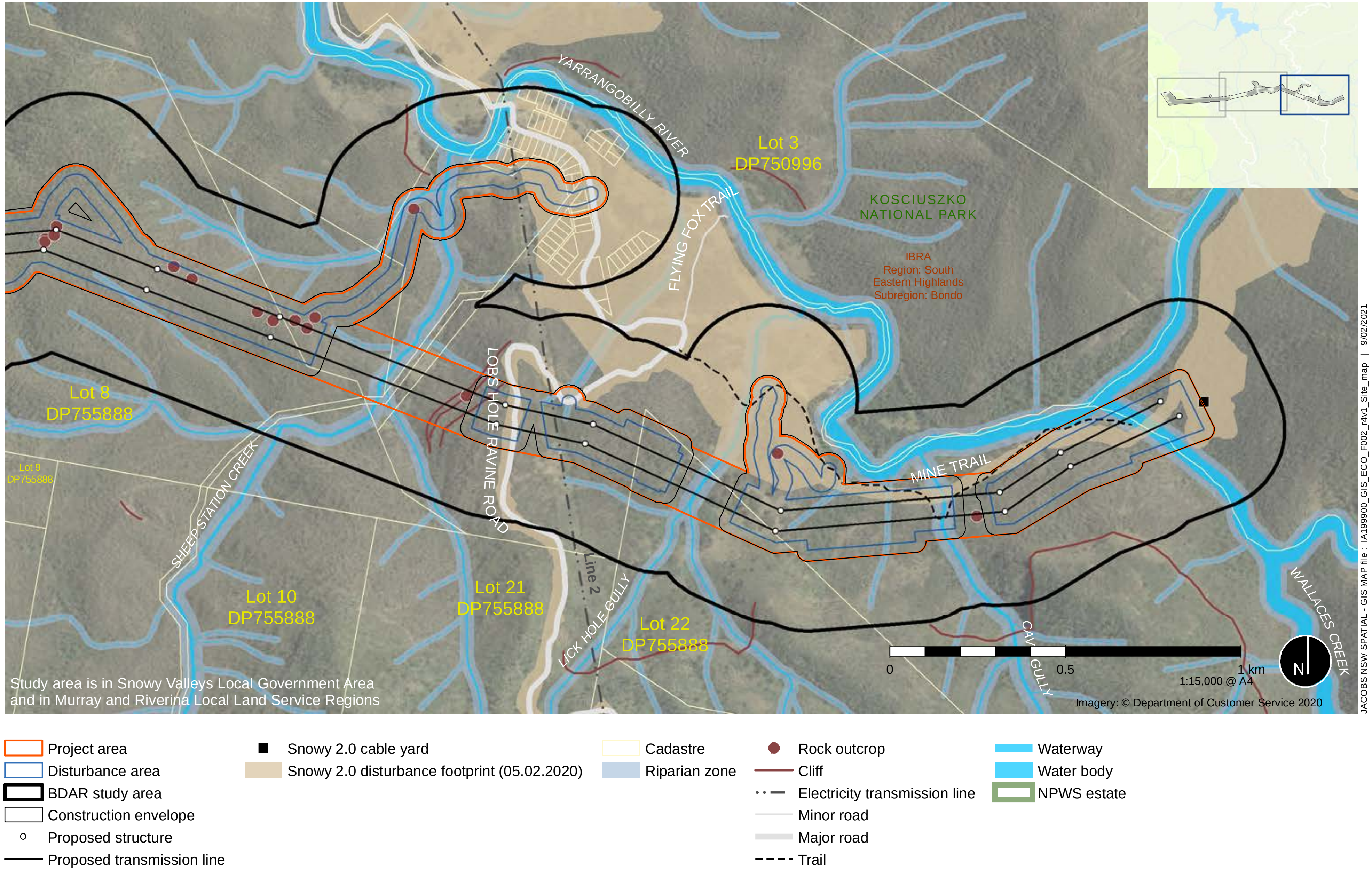
**Figure 5-3** | Site map (pre 2019/2020 fire)




Project area
Disturbance area
BDAR study area
Construction envelope
Proposed structure
Proposed transmission line
Cadastre
Wetlands (EPI)
Wetlands of NSW
Riparian zone
Rock outcrop
Cliff
Major road
Waterway
Water body
NPWS estate

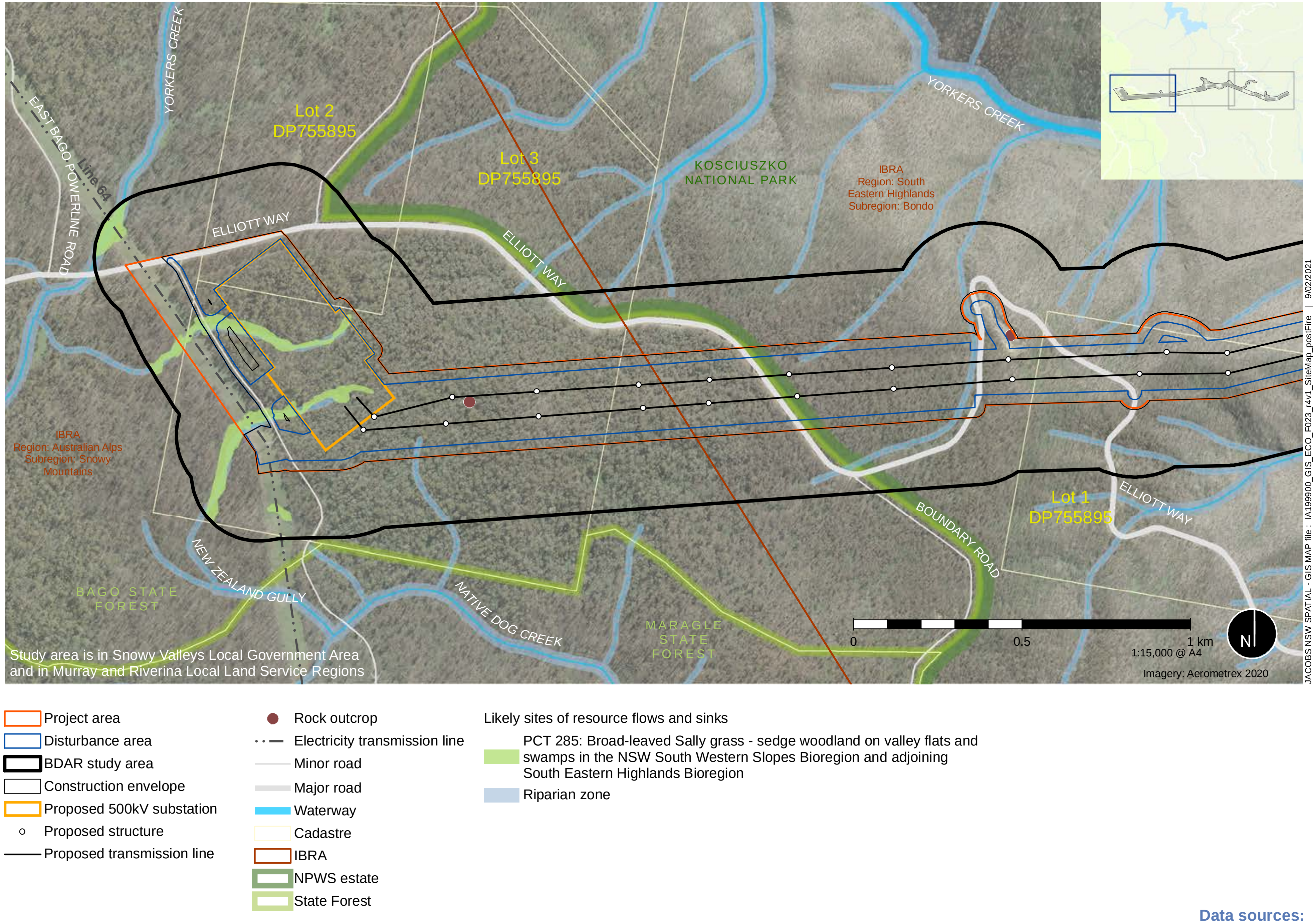
**Data sources:**
Jacobs 2020, TransGrid 2020, DPE 2018,
© Department Finance, Services and Innovation 2018

**Figure 5-3** | Site map (pre 2019/2020 fire)



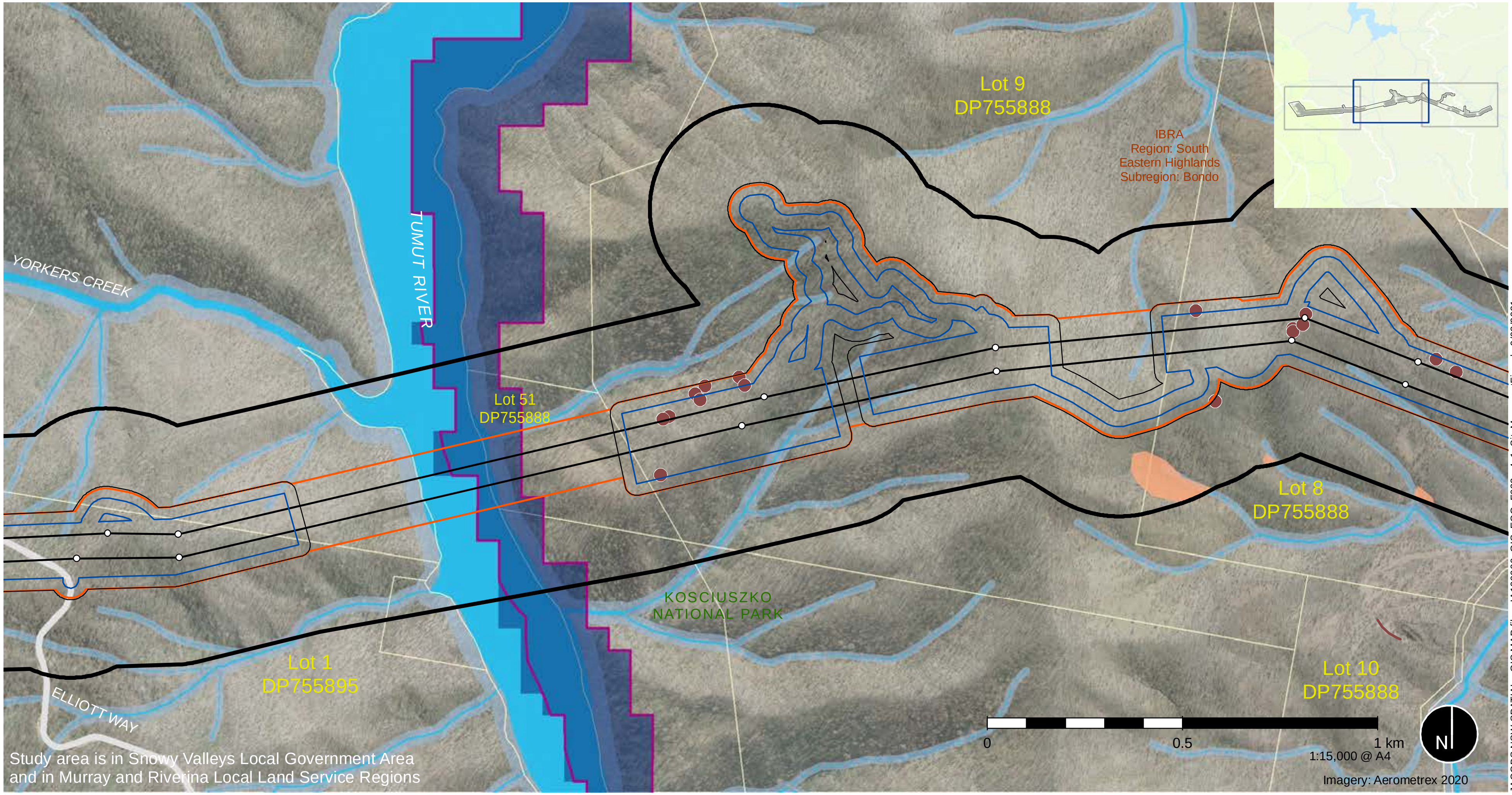

**Data sources:**
Jacobs 2020, TransGrid 2020, DPE 2018,
© Department Finance, Services and Innovation 2018

**Figure 5-3** | Site map (pre 2019/2020 fire)




**Data sources:**
Jacobs 2020, TransGrid 2020, DPE 2018,


**Figure 5-4** | Site map (post 2019/2020 fire)




JACOBS NSW SPATIAL - GIS MAP file : IA199900_GIS_ECO_F023_r4v1_SiteMap_postFire | 9/02/2021

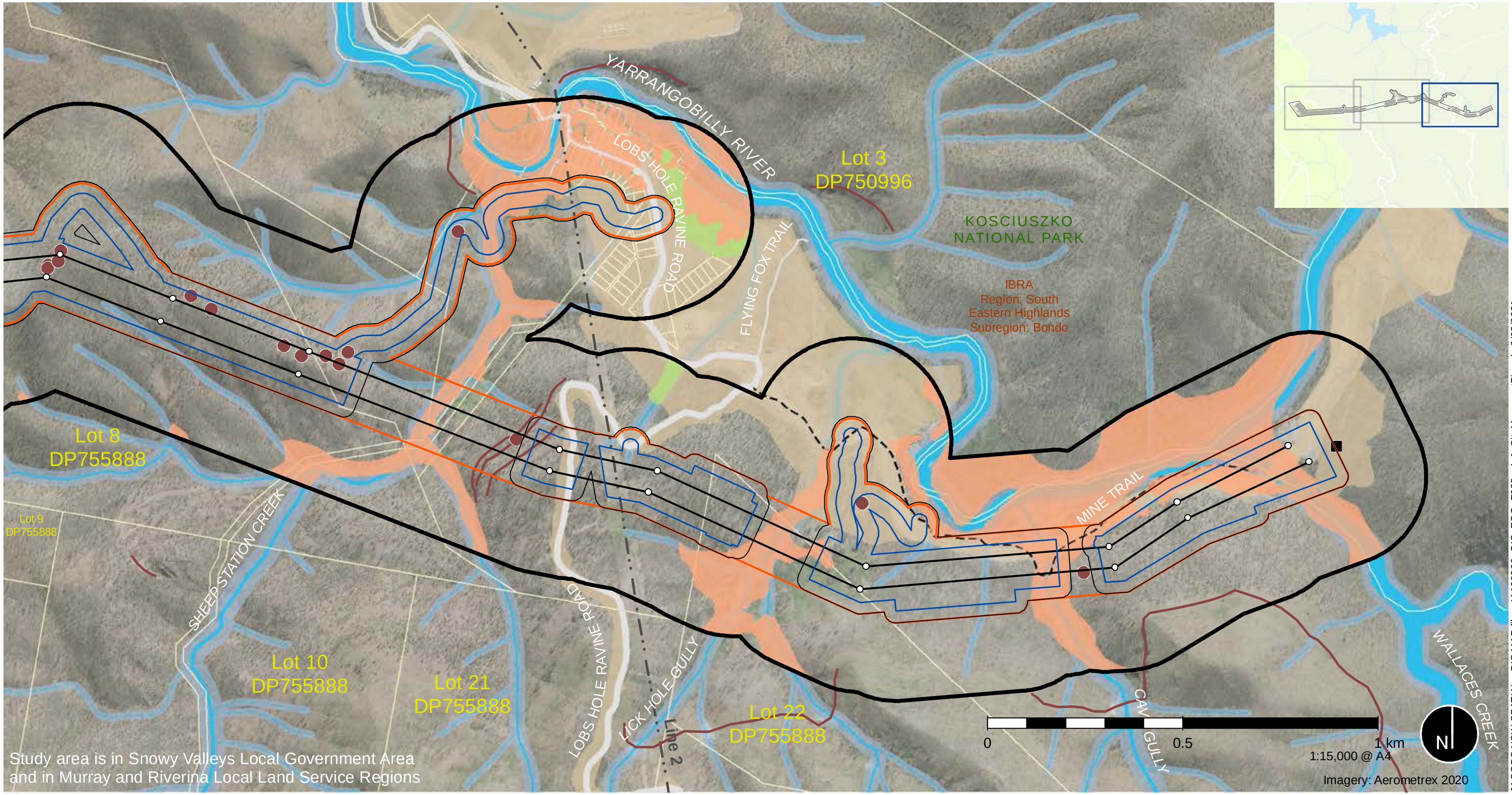
- Project area
- Disturbance area
- BDAR study area
- Construction envelope
- Proposed structure
- Proposed transmission line
- Rock outcrop
- Cliff
- Major road
- Waterway
- Wetlands (EPI)
- Wetlands of NSW
- Cadastre
- NPWS estate

Likely sites of resource flows and sinks

- PCT 302: Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion
- Riparian zone

**Data sources:**
Jacobs 2020, TransGrid 2020, DPE 2018,


**Figure 5-4** | Site map (post 2019/2020 fire)




JACOBS NSW SPATIAL - GIS MAP file : IA199900_GIS_ECO_F023_r4v1_SiteMap_postFire | 9/02/2021

- Project area
- Disturbance area
- BDAR study area
- Construction envelope
- Proposed structure
- Proposed transmission line
- Snowy 2.0 cable yard
- Snowy 2.0 disturbance footprint (05.02.2020)
- Rock outcrop
- Cliff
- Electricity transmission line
- Minor road
- Major road
- Trail
- Waterway
- Cadastre
- NPWS estate

Likely sites of resource flows and sinks

- PCT 285: Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion
- PCT 302: Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion
- Riparian zone

**Data sources:**
Jacobs 2020, TransGrid 2020, DPE 2018,


**Figure 5-4** | Site map (post 2019/2020 fire)

# 6. Native vegetation and vegetation integrity

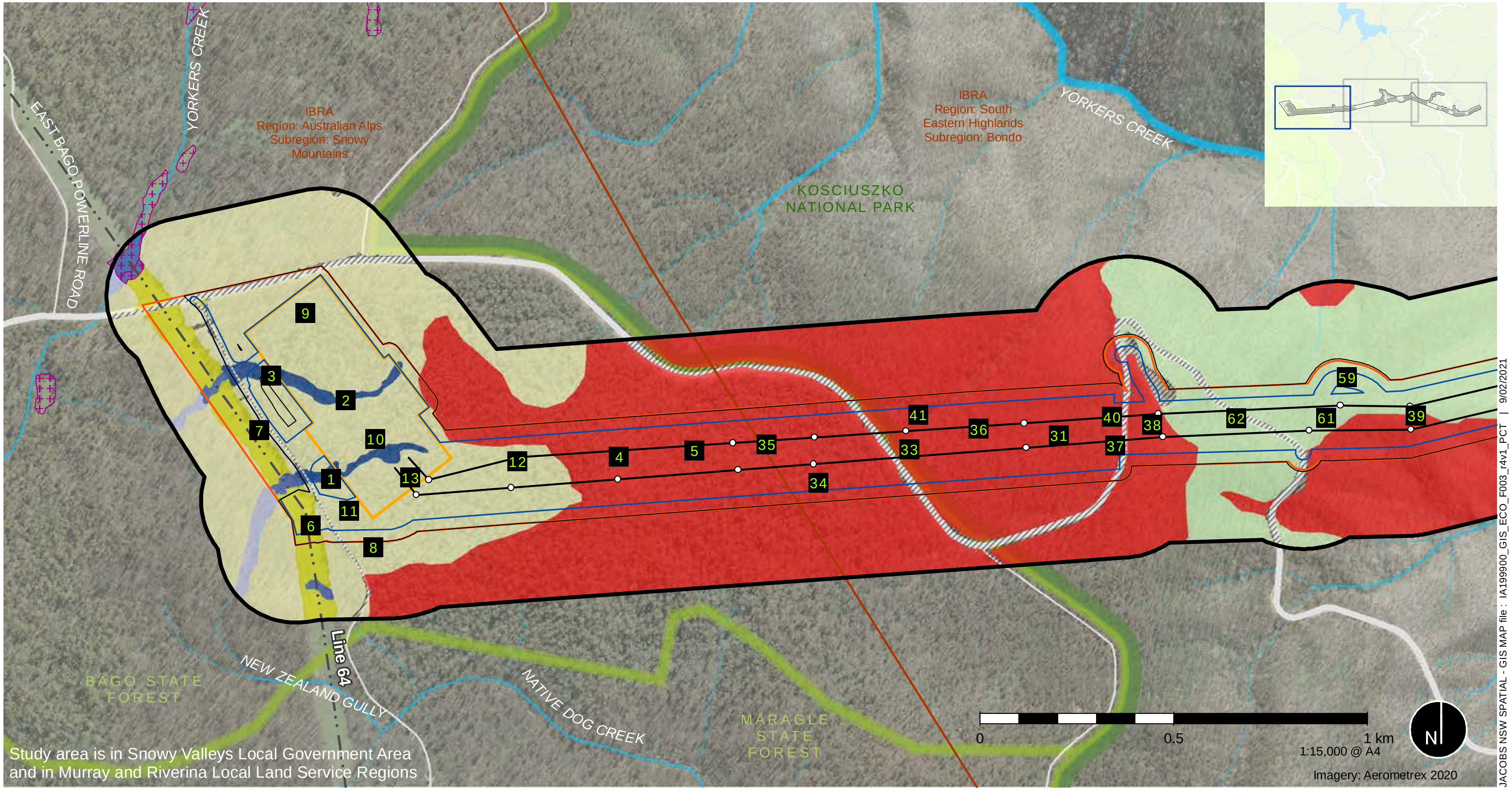
## 6.1 Plant community types

This BDAR describes PCTs in terms of their floristic composition, geological substrate and relevant regional vegetation classification. The PCTs identified within the disturbance area and broader construction envelope are listed in **Table 6.1** and their distribution is outlined in **Figure 6-1**. The mapping of PCTs has also been extended to the larger study area to provide context. Descriptions of the vegetation that occurs in the disturbance area and broader construction envelope are provided in the following sections matched to the most likely PCT as described in the BioNet Vegetation Classification database. In most cases, the vegetation on site does not perfectly align with any PCT listed in the BioNet Vegetation Classification database so the vegetation has been allocated to the PCT with which it most closely aligns. Vegetation integrity plot data is provided in **Appendix B** and **Appendix C**.

Table 6.1: PCTs types identified within the construction envelope, split over two bioregions (SEH = Southern Eastern Highlands Bioregion, AA = Australian Alps Bioregion)

| PCT ID No. | PCT name | Vegetation formation (Keith 2004) | Vegetation class (Keith 2004) | Threatened ecological community | Area (ha) in disturbance area | | Area (ha) in construction envelope | |
|---|---|---|---|---|---|---|---|---|
| | | | | | SEH | AA | SEH | AA |
| 296 | Brittle Gum – peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion | Dry Sclerophyll Forests (shrubby sub-formation) | Southern Tableland Dry Sclerophyll Forests | No | 21.15 | - | 37.35 | - |
| 300 | Ribbon Gum – Narrow-leaved (Robertsons) Peppermint montane fern – grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Wet Sclerophyll Forests (Grassy sub-formation) | Southern Tableland Wet Sclerophyll Forests | No | 32.51 | 10.77 | 49.46 | 15.15 |
| 302 | Riparian Blakely's Red Gum – Broad-leaved Sally woodland – tea-tree – bottlebrush – wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion | Dry Sclerophyll Forests (Shrub/grass sub-formation) | Upper Riverina Dry Sclerophyll Forests | No | 3.12 | - | 9.18 | - |
| 729 | Broad-leaved Peppermint – Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion | Dry Sclerophyll Forests (shrubby sub-formation) | Southern Tableland Dry Sclerophyll Forests | No | 34.72 | - | 61.57 | - |
| 999 | Norton's Box – Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion | Dry Sclerophyll Forests (shrubby sub-formation) | Southern Tableland Dry Sclerophyll Forests | No | 7.61 | - | 13.43 | - |
| 285 | Broad-leaved Sally grass – sedge woodland on valley | Dry Sclerophyll | Upper Riverina Dry | No | - | 1.77 | - | 2.24 |

| PCT ID No. | PCT name | Vegetation formation (Keith 2004) | Vegetation class (Keith 2004) | Threatened ecological community | Area (ha) in disturbance area | | Area (ha) in construction envelope | |
|---|---|---|---|---|---|---|---|---|
| | | | | | SEH | AA | SEH | AA |
| | flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion | Forests (Shrub/grass sub-formation) | Sclerophyll Forests | | | | | |
| 1196 | Snow Gum – Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion | Dry Sclerophyll Forests (Shrub/grass sub-formation) | Subalpine Woodlands | No | - | 23.95 | - | 31.23 |
| | | | | **TOTALS** | **99.11** | **36.49** | **170.99** | **48.64** |
| | | | | | **135.6** | | **219.63** | |




Project area
Disturbance area
BDAR study area
Construction envelope
Proposed 500kV substation
Proposed structure
Proposed transmission line

Vegetation integrity plot
Electricity transmission line
Minor road
Major road
Waterway
IBRA
NPWS estate
State Forest

Threatened ecological community
Montane Peatlands and Swamps Threatened Ecological Community (Environmental Protection Authority 2016)

Plant community type and condition

PCT 1196: Snow Gum - Mountain Gum shrubby open forest:
- Good
- Native grassland

PCT 285: Broad-leaved Sally grass - sedge woodland:
- Good
- Moderate
- Shrubland - regrowth
- Moderate - Blackberry infestation

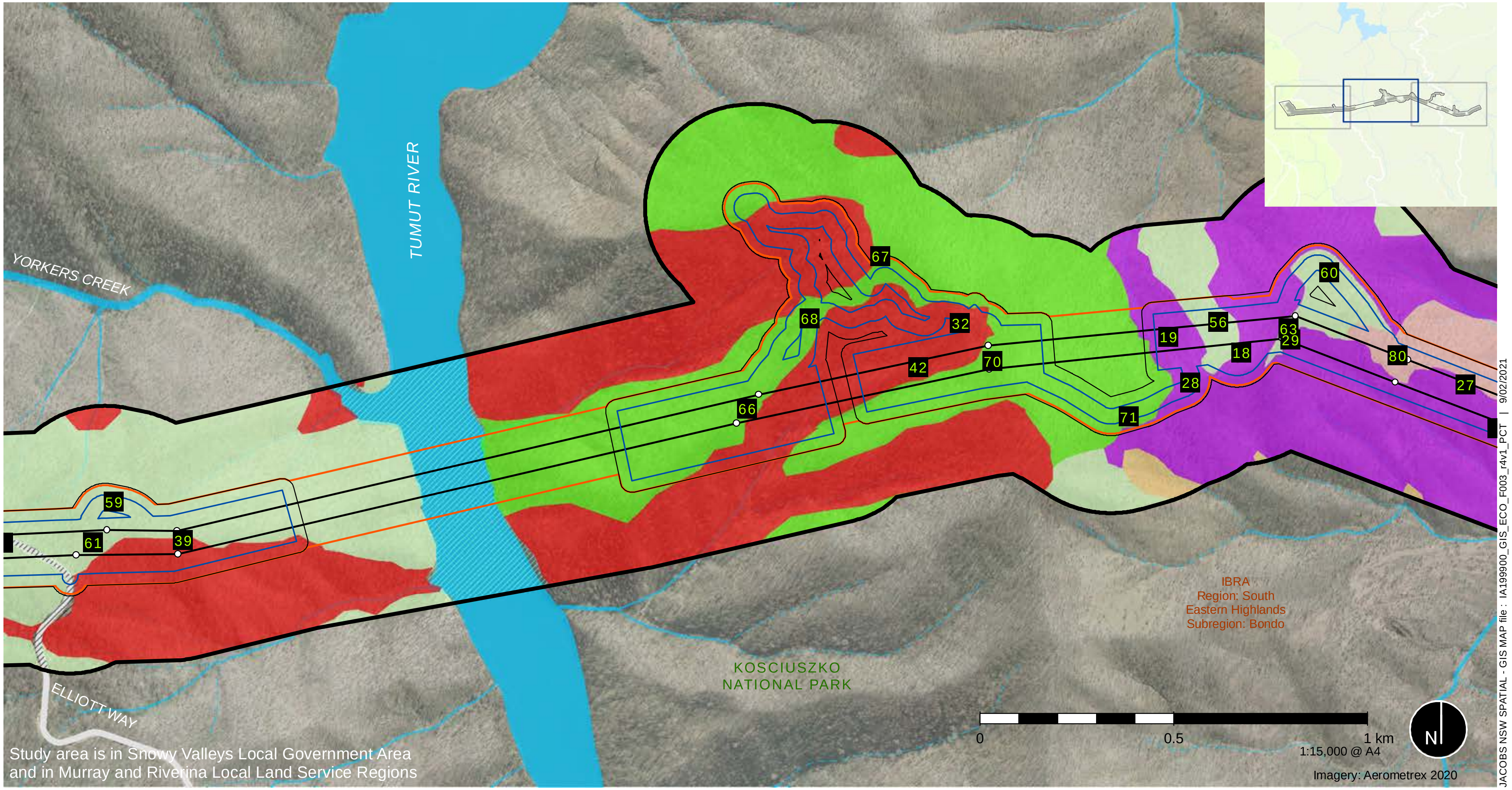
PCT 300: Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest:
- Good

PCT 729: Broad-leaved Peppermint - Candlebark shrubby open forest:
- Good - dry open slopes & ridgetops

Other:
- Cleared

**Data sources:**
Jacobs 2020, DPE 2018,


**Figure 6-1** | Map of plant community types, vegetation zones and threatened ecological communities




Project area

Disturbance area

BDAR study area

Construction envelope

Proposed structure

Proposed transmission line

3 Vegetation integrity plot

Major road

Waterway

NPWS estate

Plant community type and condition

PCT 296: Brittle Gum - peppermint open forest:

Good - wetter sheltered slopes

PCT 300: Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest:

Good

PCT 302: Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland:

Moderate

PCT 729: Broad-leaved Peppermint - Candlebark shrubby open forest:

Good - dry open slopes & ridgetops

Good - wetter sheltered slopes

PCT 999: Norton's Box - Broad-leaved Peppermint open forest:

Good - drier Calytrix tetragona

Other:

Water

Cleared

**Data sources:**
Jacobs 2020, DPE 2018,
© Department Finance, Services and Innovation 2018

**Figure 6-1** | Map of plant community types, vegetation zones and threatened ecological communities

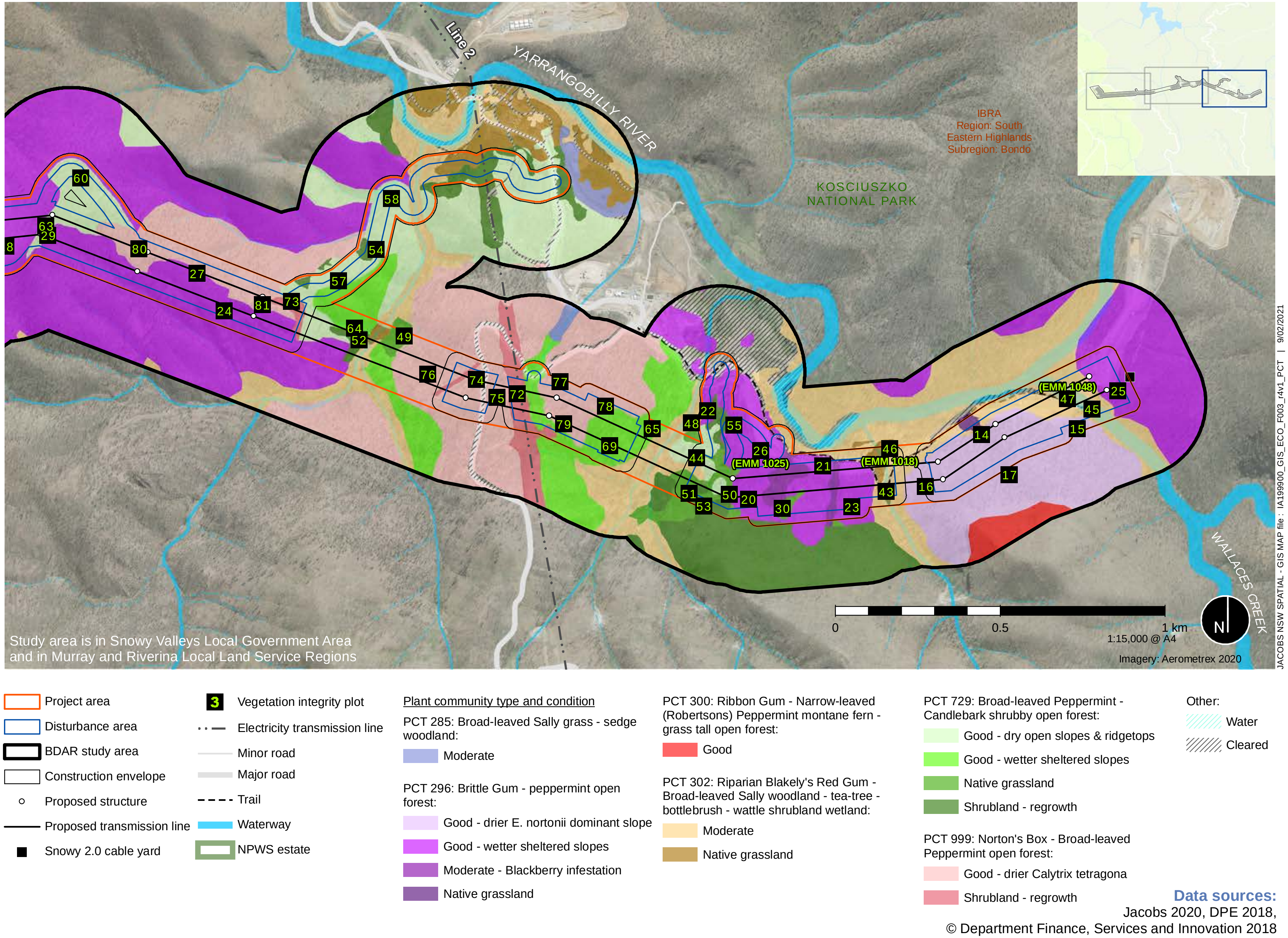



**Figure 6-1** | Map of plant community types, vegetation zones and threatened ecological communities

### 6.1.1 Broad-leaved Sally grass – sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion

**Vegetation formation:** Dry Sclerophyll Forests (Shrub/grass sub-formation)

**Vegetation class:** Upper Riverina Dry Sclerophyll Forests **PCT ID:** 285

**Threatened ecological community (BC Act and EPBC Act):** Not a TEC

**Vegetation zones (condition) and plots:**

- Moderate – Blackberry infestation: Plots 1, 2, 3.

The Broad-leaved Sally grass – sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion PCT is described in the BioNet Vegetation Classification database as a mid-high woodland dominated by Broad-leaved Sally (*Eucalyptus camphora* subsp. *humeana*) sometimes with Black Sally (*Eucalyptus stellulata*) grading into open forest dominated by Robertson's Peppermint (*Eucalyptus robertsonii* subsp. *robertsonii*), Blakely's Red Gum (*Eucalyptus blakelyi*) or Apple Box (*Eucalyptus bridgesiana*). The shrub layer is usually sparse and includes the tall shrubs *Acacia dealbata, Acacia melanoxylon, Acacia kettlewelliae, Leptospermum continentale* and the low shrubs *Mirbelia oxylobioides, Hibbertia obtusifolia, Hovea linearis, Cassinia aculeata, Epacris breviflora* and rarely *Bossiaea foliosa*. The tall tree fern *Dicksonia antarctica* occurs in some narrow creeks and *Pteridium esculentum* may occur. The ground cover is usually dense being dominated by grasses such as *Poa labillardierei* var. *labillardierei*, Mic*rolaena stipoides* var. *stipoides* and *Echinopogon ovatus*. The sedge *Carex appressa* is most often present and in some wetter sites *Eleocharis sphacelata* and *Carex fascicularis* occur, along with *Phragmites australis*. Rushes including *Juncus holoschoenus* and *Juncus sarophorus* also occur at wet sites. Forbs include *Senecio bathurstianus, Hydrocotyle laxiflora, Ranunculus lappaceus, Geranium neglectum* and *Acaena novae-zelandiae* are common. The Broad-leaved Sally grass – sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion PCT occurs on alluvial or colluvial organic grey to brown podzolic clay loam soils, on poorly drained valley flats, surrounding swamps or lining creeks in hill or mountain landscapes generally above 600 m altitude in the southern section of the NSW South Western Slopes and adjoining South Eastern Highlands Bioregions. The underlying lithology is mainly granite or granodiorite. In the case of the examples in the west of the construction envelope, this PCT also occurs in the Australian Alps.

Within the construction envelope, and broader study area (refer to **Figure 6-1**), this vegetation matches the description of the Western Montane/Sub-alpine Wet Heath/Herb Grass Woodland (Vegetation Group 124) as described by Gellie (2005). This vegetation also aligns with the description for the Small-fruited Hakea - Drumstick Heath - Swamp Heath subalpine wet heathland of the Australian Alps and western South Eastern Highlands Bioregions (map unit u193) as described by the Office of Environment and Heritage (2011). Within the construction envelope, vegetation considered most likely to be representative of the Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion PCT occurs in two narrow drainage lines (New Zealand Gully and the unnamed drainage line to the north that flows into Yorkers Creek) at the western extent in the Bago State Forest at the location of the substation (**Photo 6-1** to **Photo 6-4**). Shrublands also exist in the easement of the existing Line 64 (**Photo 6-3**and **Photo 6-4**). This PCT is also present in other drainage lines in the broader study area including unnamed drainage lines that flow into Yorkers Creek, sections of Yorkers Creek, and parts of the Sheep Station Creek and Yarrangobilly River floodplains in the east.

This vegetation is most likely to be representative of PCT 285 for the following reasons:

- This canopy is characterised by *Eucalyptus camphora* subsp. *humeana* with a range of other eucalypts depending on location including *Eucalyptus pauciflora, Eucalyptus robertsonii* subsp. *robertsonii, Eucalyptus dalrympleana, Eucalyptus stellulata,* and *Eucalyptus viminalis*. Some areas of canopy are sparse, and trees appear as emergent or trees may absent (such as in the Line 64 easement, refer **Photo 6-3** and **Photo 6-4**) due to management

- The shrub layer is sparse to dense depending on level of disturbance and is characterised by the presence of *Leptospermum lanigerum* (**Photo 6-2** and **Photo 6-3**), *Leptospermum continentale, Baeckea utilis, Bossiaea foliosa, Coprosma hirtella, Daviesia latifolia, Epacris breviflora, Olearia erubescens, Platylobium formosum, Hakea microcarpa, Rubus parvifolius* and small individuals of *Acacia melanoxylon*. The midstorey of this PCT in the construction envelope is largely dominated by the exotic species *Rubus fruticosus* sp. agg
- The ground cover is outcompeted by *Rubus fruticosus* sp. agg. in many locations (**Photo 6-1**). However, the characteristic species *Carex appressa* is common along with *Juncus australis, Juncus sarophorus, Lepidosperma laterale, Lomandra longifolia, Acaena novae-zealandiae, Geranium solanderi, Stellaria pungens, Themeda australis, Ranunculus lappaceus,* and *Asperula conferta*.

Other PCTs that have *Eucalyptus camphora* as a part of the canopy include Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion (PCT 302) and Carex - Juncus sedgeland/wet grassland of the South Eastern Highlands Bioregion (PCT 765). The assemblage of vegetation dominated by *Eucalyptus camphora* in the construction envelope lacks most of the canopy or midstorey species typically found in PCT 302. The vegetation could fit the description of PCT 765 based on species complement, however the vegetation in the construction envelope has more of a woodland structure. A summary of the vegetation structure and floristics of PCT 285 is given below in **Table 6.2**. This list of species reflects the local variation gathered from multiple floristic plots undertaken within the construction envelope and also includes incidental observations while moving through the vegetation in the broader study area.

Table 6.2: Floristic and structural summary of PCT 285 within the construction envelope

| Vegetation layer | Dominant species |
|---|---|
| Tree canopy (upper stratum) | *Eucalyptus camphora, Eucalyptus dalrympleana, Eucalyptus pauciflora, Eucalyptus robertsonii, Eucalyptus viminalis, Acacia melanoxylon* present in the canopy in varying combinations. |
| Midstorey (mid-stratum) | Characterised by shrubs including *Leptospermum lanigerum, Leptospermum continentale, Astroloma humifusum, Baeckea utilis, Bossiaea foliosa, Coprosma hirtella, Daviesia latifolia, Epacris breviflora, Olearia erubescens, Persoonia chamaepeuce, Pimelea curviflora, Platylobium formosum, Hakea microcarpa, Rubus parvifolius.* |
| Groundcovers (ground stratum) | Grass and grass like species including *Poa sieberiana, Juncus sarophorus, Juncus australis, Carex appressa, Luzula flaccida, Rytidosperma penicillatum, Themeda triandra, Austrostipa pubescens, Lomandra longifolia, Lepidosperma laterale, Lachnagrostis filiformis, Dichelachne crinita, Poa helmsii. Empodisma minus* was observed in other examples in the broader study area.<br>Forbs including *Hydrocotyle sibthorpioides*, *Coronidium monticola, Veronica* sp. A, *Gonocarpus micranthus, Viola betonicifolia, Cotula* sp., *Gratiola peruviana, Acaena novae-zelandiae, Isotoma fluviatilis, Geranium solanderi, Euchiton* sp., *Stylidium graminifolium, Cymbonotus lawsonianus, Senecio prenanthoides, Pterostylis decurva, Pterostylis monticola, Asperula conferta, Wahlenbergia stricta, Solenogyne gunnii, Lagenifera stipitata, Centipeda* sp., *Brachyscome spathulata, Hypericum gramineum, Dichondra repens, Tricoryne elatior, Oreomyrrhis eriopoda, Ranunculus lappaceus, Stellaria pungens, Arthropodium milleflorum.*<br>Ferns including *Doodia aspera* can dominate the ground layer under dense patches of *Leptospermum* spp. *Blechnum nudum* is also present.<br>Species in the ‘other’ growth forms include *Glycine clandestina*.<br>*Sphagnum cristatum* is present in wetter situations. |
| Exotic species | *Centaurium erythraea, Erythranthe moschata, Prunella vulgaris, Trifolium repens, Hypochaeris radicata, Medicago polymorpha.* |
| High Threat Weeds | *Rubus fruticosus* sp. agg., *Rosa rubiginosa, Holcus lanatus, Hypericum perforatum, Acetosella vulgaris, Leucanthemum vulgare.* |

Photo 6-1: PCT 285 with canopy of *Eucalyptus camphora* and *Eucalyptus pauciflora* and dense infestation of *Rubus fruticosus*

Photo 6-2: PCT 285 in the western portion of the construction envelope showing canopy of *Eucalyptus camphora* and dense shrub layer of *Leptospermum lanigerum*.

Photo 6-3: PCT 285 beneath Line 64 showing dense layer of *Leptospermum lanigerum* with canopy species removed.

Photo 6-4: PCT 285 in the western portion of the construction envelope in the Line 64 easement showing young regrowth of *Leptospermum* spp. and *Epacris brevifolia* with a dense groundcover of *Hydrocotyle sibthorpioides*.

### 6.1.2 Brittle Gum – peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion

**Vegetation formation:** Dry Sclerophyll Forests (shrubby sub-formation)

**Vegetation class:** Southern Tableland Dry Sclerophyll Forests **PCT:** 296

**Threatened ecological community (BC Act and EPBC Act):** Not a TEC

**Vegetation zones (condition) and plots:**

- Native Grassland: Plot 14
- Good – drier *Eucalyptus nortonii* dominant slope: Plots 15, 16, 17
- Good – wetter sheltered slopes: Plots 18, 19, 20, 21, 22, 23, 24, 25, 26 (EMM 1025), 27, 28, 29
- Moderate – Blackberry infestation: Plot 30.

The Brittle Gum – peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion PCT is described in the BioNet Vegetation Classification database as a mid-high to tall open forest dominated by Brittle Gum (*Eucalyptus mannifera* subsp. *mannifera*) with Broad-leaved Peppermint (*Eucalyptus dives*) and Red Stringybark (*Eucalyptus macrorhyncha*). Robertson's Peppermint (*Eucalyptus robertsonii*) may also be present in protected areas. Shrubs are sparse to mid-dense and may be diverse. They include *Hibbertia obtusifolia, Monotoca scoparia, Platylobium formosum* subsp. *formosum, Acacia dealbata, Acacia rubida* and *Melichrus urceolatus*. The ground cover is sparse to mid-dense with grasses such as *Joycea pallida* and *Poa sieberiana* and forbs such as *Senecio tenuiflorus, Dianella revoluta* var. *revoluta, Gonocarpus tetragynus, Pomax umbellata, Dichopogon strictus* and *Poranthera microphylla*. Climbers such as *Hardenbergia violacea* and *Billardiera scandens* may be present. Occurs at altitudes over 500 m on light grey to brown podzolic loam or clay soils derived from granite or metasediments on steep hillslopes in hill or mountain landform patterns in the Woomargama to Tumut regions in the upper slopes sub-region of the NSW South-western Slopes Bioregion and adjacent South Eastern Highlands Bioregion.

Within the construction envelope, and broader study area (refer to **Figure 6-1**), this vegetation somewhat matches the description of the Tablelands Dry Shrub/Grass Forest (Vegetation Group 110) as described by Gellie (2005). This vegetation also aligns with the description for the Broad-leaved Peppermint - Brittle Gum - Red Stringybark tall shrub-grass dry sclerophyll open forest of lower ranges of the western South Eastern Highlands and upper South Western Slopes Bioregions (map unit u105) as described by the Office of Environment and Heritage (2011), but *Eucalyptus macrorhyncha* is not present. *Eucalyptus dives* is the dominant species. *Eucalyptus nortonii* also occurs and is occasionally dominant. *Eucalyptus mannifera* is present in isolated patches and is generally not a dominant part of the canopy, except in some areas (**Photo 6-7**). Within the construction envelope, vegetation considered most likely to be representative of the Brittle Gum – peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion PCT occurs in the South Eastern Highlands Bioregion on the slopes to the Tumut River, the slopes of Sheep Station Ridge (**Photo 6-5** and **Photo 6-6**), and the slopes off Lobs Hole Ravine Road and Mine Trail (**Photo 6-7** to **Photo 6-9**). PCT 296 intergrades extensively with PCT 729, PCT 302 and PCT 999 and the boundaries between these PCTs are not distinct.

This vegetation is most likely to be representative of PCT 296 for the following reasons:

- This canopy is largely dominated by *Eucalyptus dives* (**Photo 6-5** and **Photo 6-6**). However, on some slopes *Eucalyptus nortonii* dominates (**Photo 6-8**). *Eucalyptus mannifera* is present in isolated patches (**Photo 6-7**). Other eucalypts including *Eucalyptus rubida, Eucalyptus robertsonii* and *Eucalyptus viminalis* also occur occasionally
- The midstorey of the vegetation matches the description of PCT 296 well with *Hibbertia obtusifolia, Monotoca scoparia, Platylobium formosum, Melichrus urceolatus, Acacia dealbata, Dillwynia phylicoides, Boronia nana, Hovea linearis, Daviesia latifolia, Cassinia aculeata, Acacia buxifolia* subsp. *buxifolia,*

*Acacia pravissima, Indigofera australis, Persoonia chamaepeuce, Cassinia longifolia, Grevillea polybractea,* and *Bursaria spinosa*

- The ground cover contains species characteristic of PCT 296 including *Poa sieberiana*, *Lomandra filiformis*, *Gonocarpus tetragynus*, *Wahlenbergia stricta*, and *Dianella revoluta*.

Other candidate PCTs for this vegetation that have *Eucalyptus dives* as a part of the canopy include the Broad-leaved Peppermint - Nortons Box - Red Stringybark tall open forest on red clay on hills in the southern part of the NSW South Western Slopes Bioregion (PCT 297). Some parts of the vegetation within the construction envelope fit the descriptions of PCT 297 and PCT 296 equally well.

Four condition variants of PCT 296 were identified within the construction envelope including:

- Good – drier *Eucalyptus nortonii* dominant slope (**Photo 6-8**)
- Good – wetter sheltered slopes (**Photo 6-5** and **Photo 6-6**)
- Moderate – Blackberry infestation
- Native Grassland (**Photo 6-9**).

A summary of the vegetation structure and floristics of PCT 296 is given below in **Table 6.3**. This list of species reflects the local variation gathered from multiple floristic plots undertaken within the construction envelope and also includes incidental observations while moving through the vegetation in the broader study area.

Table 6.3: Floristic and structural summary of PCT 296 within the construction envelope

| Vegetation layer | Dominant species |
|---|---|
| Tree canopy (upper stratum) | *Eucalyptus dives* is the dominant canopy species within this PCT on the construction envelope and in the broader study area. Other species of eucalypt present in varying combinations include *Eucalyptus nortonii* which can become dominant, *Eucalyptus rubida, Eucalyptus robertsonii* and *Eucalyptus viminalis. Eucalyptus mannifera* is not a dominant species within the construction envelope but occurs in small scattered patches. *Acacia dealbata* is a common tree species throughout the PCT. |
| Midstorey (mid-stratum) | Characterised by shrubs including *Acacia pravissima, Astroloma humifusum, Banksia canei, Brachyloma daphnoides, Bursaria spinosa, Cassinia aculeata, Cassinia longifolia, Choretrum pauciflorum, Coprosma hirtella, Daviesia latifolia, Grevillea rosmarinifolia, Leucopogon fletcheri, Mirbelia oxylobioides, Monotoca scoparia, Pimelea linifolia, Platylobium formosum, Tetratheca bauerifolia, Calytrix tetragona.* |
| Groundcovers (ground stratum) | Grass and grass like species including *Poa sieberiana, Lomandra glauca, Lomandra multiflora, Lomandra longifolia, Lomandra filiformis, Lepidosperma laterale, Themeda triandra.*<br>Forbs including *Diuris sulphurea, Geranium solanderi, Gonocarpus tetragynus, Patersonia* sp., *Wahlenbergia stricta, Asperula scoparia, Dianella revoluta, Euphrasia collina sub*sp. *paludosa, Geranium obtusisepalum, Picris angustifolia, Ranunculus lappaceus, Stackhousia monogyna, Stylidium graminifolium, Thelymitra megcalyptra, Veronica cinerea, Veronica derwentiana, Viola betonicifolia.*<br>Ferns including *Pteridium esculentum* and *Cheilanthes sieberi* are occasional.<br>Species in the 'other' growth forms include *Hardenbergia violaceae, Glycine clandestina* and *Cassytha glabella*. |
| Exotic species | *Centaurium erythraea, Hypochaeris radicata.* |
| High Threat Weeds | *Rubus fruticosus* sp. agg., *Rosa rubiginosa, Hypericum perforatum.* |

Photo 6-5: PCT 296 on the eastern slope of Sheep Station Ridge showing a patch dominated by *Eucalyptus dives* with *Eucalyptus mannifera* occasional

Photo 6-6: PCT 296 on the eastern slope of Sheep Station Ridge showing a typical patch dominated by *Eucalyptus dives*.

Photo 6-7: PCT 296 to the south of Mine Trail showing dominance of *Eucalyptus mannifera*.

Photo 6-8: PCT 296 to the south of Mine Trail showing dominance of *Eucalyptus nortonii* in the canopy.

Photo 6-9: PCT 296 to the south of Mine Trail in Lobs Hole ravine showing a small disturbed area now dominated by shrubs and grasses.

### 6.1.3 Ribbon Gum – Narrow-leaved (Robertsons) Peppermint montane fern – grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment

**Vegetation formation:** Wet Sclerophyll Forests (Grassy sub-formation)

**Vegetation class:** Southern Tableland Wet Sclerophyll Forests **PCT:** 300

**Threatened ecological community (BC Act and EPBC Act):** Not a TEC

**Vegetation zones (condition) and plots:**

- Good condition: Plots 4, 5, 31, 32, 33, 34, 35, 36, 37, 38, 38, 40, 41, 42, 67.

The Ribbon Gum – Narrow-leaved (Robertsons) Peppermint montane fern – grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment PCT is described in the BioNet Vegetation Classification database as a tall to very tall open forest dominated by Ribbon Gum (*Eucalyptus viminalis*) with Robertson's Peppermint (*Eucalyptus robertsonii*) and occasionally Broad-leaved Peppermint (*Eucalyptus dives*). The shrub layer may be very sparse after fire or mid-dense if not burnt for decades. It includes *Acacia dealbata, Cassinia aculeata, Lomatia myricoides, Platylobium formosum subs*p. *formosum, Acrotriche serrulata, Senecio velleioides, Coprosma quadrifida, Coprosma hirtella* and *Acacia melanoxylon*. Ferns may be abundant and *Polystichum proliferum* may be common. Bracken Fern (*Pteridium esculentum*) may be abundant in regularly burnt sites. The ground cover includes grasses such as *Poa meionectes, Microlaena stipoides* var. *stipoides, Austrofestuca eriopoda* and *Elymus scaber* var. *scaber*. Forbs include *Stellaria pungens, Lagenifera stipitata, Senecio* sp. E, *Plantago varia, Acaena novae-zelandiae, Viola betonicifolia, Dianella revoluta* var. *revoluta*, *Dianella tasmanica, Hydrocotyle laxiflora* and *Dichondra repens*. The rushes *Luzula densiflora* or *Luzula flaccida* may be common. The climbers *Glycine clandestina* and *Clematis aristata* may be present. Occurs on deep red-brown loam soils derived from granite and sedimentary substrates on sheltered hillslopes in a mountain landform pattern in elevations between 700 and 1150 m on the south-western edge of the South Eastern Highlands Bioregion including in KNP and in the southern Upper Slopes sub-region of the NSW South-western Slopes Bioregion.

Within the construction envelope, and broader study area (refer to **Figure 6-1)**, this vegetation matches the description of the Tableland Acacia/Fern/Grass Forest (Vegetation Group 1-4) as described by Gellie (2005). This vegetation also aligns with the description for the Ribbon Gum - Robertson's Peppermint very tall wet sclerophyll open forest primarily of the Bondo Subregion of the South Eastern Highlands and the northern Australian Alps Bioregions (map unit u52) as described by the Office of Environment and Heritage (2011). Within the construction envelope, vegetation considered most likely to be representative of the Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment PCT occurs in the west of the construction envelope in the Bago State Forest and on east facing slopes to the Talbingo Reservoir in the KNP (**Photo 6-10** to **Photo 6-15**). On the eastern side of the Talbingo Reservoir PCT 300 occurs on Sheep Station Ridge and the west facing slope to the Talbingo Reservoir. In the broader study area, PCT 300 likely occurs over many of the disturbed slopes off Lobs Hole Ravine Road to the south of the construction envelope as evidenced by the widespread presence of *Eucalyptus viminalis*. PCT 300 intergrades extensively with PCT 1196 in the western portion of the construction envelope in the Bago State Forest. There is also considerable overlap in species with PCT 296 and PCT 729 and the boundaries between these PCTs are not distinct.

This vegetation is most likely to be representative of PCT 300 for the following reasons:

- This canopy is variable being dominated by *Eucalyptus robertsonii* with *Eucalyptus viminalis, Eucalyptus dalrympleana, Eucalyptus rubida, Eucalyptus mannifera* and *Eucalyptus dives* occurring infrequently to being codominant in areas
- The midstorey of the vegetation matches the description of PCT 300 well with *Acacia dealbata, Cassinia aculeata, Lomatia myricoides, Platylobium formosum, Tetratheca ciliata, Coprosma quadrifida, Coprosma hirtella,* and *Acacia melanoxylon*
- The ground cover contains species characteristic of PCT 300 including *Pteridium esculentum, Acaena novae-zealandiae, Stellaria pungens, Polystichum proliferum, Lagenifera stipitata, Rubus parvifolius. Luzula flaccida, Viola betonicifolia, Dianella revoluta, Dianella tasmanica, Stackhousia monogyna, Wahlenbergia stricta, Microlaena stipoides, Elymus scaber, Hypericum gramineum, Glycine clandestina, Oxalis perennans, Geranium solanderi, Hydrocotyle laxiflora, Asperula scoparia, Clematis aristata,* and *Gonocarpus tetragynus*.

Other candidate PCTs for this vegetation that have *Eucalyptus robertsonii* as a part of the canopy include the Robertsons Peppermint - Broad-leaved Peppermint - Nortons Box - stringybark shrub-fern open forest of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion (PCT 295). However, the lack of *Eucalyptus macrorhyncha, Eucalyptus nortonii* and *Eucalyptus bicostata* indicates that PCT 295 does not fit the description of the vegetation within the construction envelope.

A summary of the vegetation structure and floristics of PCT 300 is given below in **Table 6.4**. This list of species reflects the local variation gathered from multiple floristic plots undertaken within the construction envelope and also includes incidental observations while moving through the vegetation in the broader study area.

Table 6.4: Floristic and structural summary of PCT 300 within the construction envelope

| Vegetation layer | Dominant species |
|---|---|
| Tree canopy (upper stratum) | *Eucalyptus robertsonii* is the dominant canopy species within this PCT on the construction envelope and in the broader study area. Other species of eucalypt present in varying combinations include *Eucalyptus viminalis* which can become dominant, *Eucalyptus dalrympleana, Eucalyptus pauciflora, Eucalyptus dives, Eucalyptus mannifera, Eucalyptus rubida. Acacia dealbata* and *Acacia melanoxylon* are a common tree species throughout the PCT. |

| Vegetation layer | Dominant species |
|---|---|
| Midstorey (mid-stratum) | Characterised by shrubs including *Acacia pravissima, Astroloma humifusum, Bossiaea foliosa., Brachyloma daphnoides, Bursaria spinosa, Cassinia aculeata, Cassinia longifolia, Choretrum pauciflorum, Coprosma hirtella, Daviesia latifolia, Daviesia ulicifolia, Dodonaea viscosa, Exocarpos strictus, Gompholobium* sp., *Grevillea arenaria* subsp. *Canescens, Grevillea rosmarinifolia, Hibbertia obtusifolia, Indigofera australis, Leucopogon fletcheri, Leucopogon lanceolatus, Leucopogon virgatus, Lomatia myricoides, Melichrus urceolatus, Platylobium formosum, Tetratheca ciliata.* |
| Groundcovers (ground stratum) | Grass and grass like species including *Carex gaudichaudiana, Dichelachne* sp., *Echinopogon ovatus, Lepidosperma curtisiae, Lomandra filiformis, Lomandra longifolia, Lomandra multiflora, Luzula alpestris, Luzula flaccida, Microlaena stipoides, Poa helmsii, Poa sieberiana, Themeda triandra.*<br>Forbs including *Acaena novae-zelandiae, Acaena ovina, Ajuga australis, Arthropodium milleflorum, Asperula conferta, Asperula scoparia, Brunoniella australis, Caladenia gracilis, Cardamine paucijuga, Chiloglottis valida, Chrysocephalum semipapposum, Dianella revoluta, Dianella tasmanica, Dichondra repens, Epilobium billardierianum, Euchiton sphaericus, Euphrasia collina* subsp. *paludosa, Geranium obtusisepalum, Geranium solanderi, Gonocarpus tetragynus, Gratiola peruviana, Hydrocotyle laxiflora, Hypericum gramineum, Mentha laxiflora, Oxalis exilis, Picris angustifolia, Plantago* sp., *Pterostylis longifolia, Ranunculus lappaceus, Ranunculus pimpinellifolius, Ranunculus pumilio, Rumex brownii, Senecio gunnii, Senecio prenanthoides, Stackhousia monogyna, Stellaria pungens, Stylidium graminifolium, Thelymitra* spp., *Veronica derwentiana, Viola betonicifolia, Viola eminens, Wahlenbergia stricta.*<br>Ferns including *Pteridium esculentum* and *Polystichum proliferum* are common.<br>Species in the 'other' growth forms include *Hardenbergia violaceae, Glycine clandestina, Cassytha* sp. and *Clematis aristata*. |
| Exotic species | *Centaurium erythraea, Hypochaeris radicata.* |
| High Threat Weeds | *Rubus fruticosus* sp. agg., *Rosa rubiginosa, Hypericum perforatum.* |

Photo 6-10: PCT 300 to the south of Elliott Way in the Bago State Forest showing dominance of *Eucalyptus robertsonii* with *Eucalyptus dalrympleana* and *Eucalyptus viminalis*

Photo 6-11: PCT 300 on the western slope of Sheep Station Ridge showing dominance of *Eucalyptus robertsonii*

Photo 6-12: PCT 300 south of Elliott Way in Bago State Forest showing dominance of *Eucalyptus robertsonii* and open midstorey

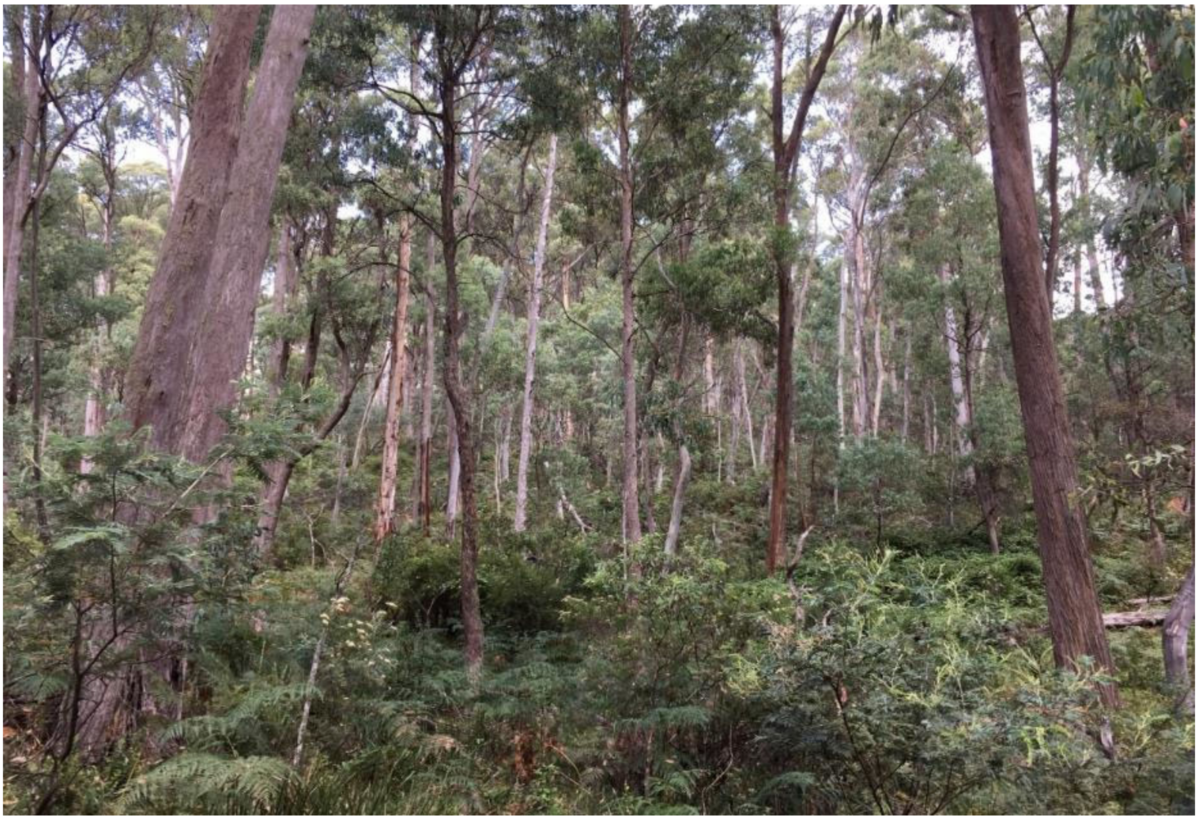


Photo 6-13: PCT 300 south of Elliott Way in the Bago State Forest showing dominance of *Eucalyptus robertsonii* with *Eucalyptus dalrympleana* and *Eucalyptus viminalis* and a denser shrub layer

Photo 6-14: PCT 300 north of Elliott Way showing dominance of *Eucalyptus viminalis* in the drainage line

Photo 6-15: PCT 300 along Elliott Way in the broader study area showing dominance of *Eucalyptus viminalis* in a drainage line

### 6.1.4 Riparian Blakely's Red Gum – Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion

**Vegetation formation:** Dry Sclerophyll Forests (Shrub/grass sub-formation)

**Vegetation class:** Upper Riverina Dry Sclerophyll Forests **PCT:** 302

**Threatened ecological community (BC Act and EPBC Act):** Not a TEC

**Vegetation zones (condition) and plots:**

- Native Grassland: Plot 43
- Moderate condition: Plots 44, 45, 46 (EMM 1018), 47 (EMM 1048), 48.

The Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion PCT is described in the BioNet Vegetation Classification database as a riparian woodland containing Blakely's Red Gum (*Eucalyptus blakelyi*), Broad-leaved Sally (*Eucalyptus camphora* subsp. *humeana*), Apple Box (*Eucalyptus* bridgesiana) or Ribbon Gum (*Eucalyptus viminalis*) with a closed or mid-dense tall shrubland understorey along creeks that is dominated by species of tea tree including *Leptospermum obovatum, Leptospermum brevipes* and occasionally *Leptospermum grandifolium* and *Bursaria spinosa, Callistemon sieberi, Acacia melanoxylon, Melicytus dentatus, Acacia dealbata* and in some locations *Acacia kettlewelliae* and *Pomaderris angustifolia*. The ground cover on the banks and adjoining flats of the watercourses may be dense or mid-dense and includes the mat-rush *Lomandra longifolia* with the rush *Juncus usitatus*, the grasses *Microlaena stipoides* var. *stipoides*, *Poa labillardierei* var. *labillardierei, Poa ensiformis* and *Lachnagrostis filiformis* and the sedges *Carex appressa, Carex gaudichaudiana, Carex fascicularis* and *Isolepis subtilissima*. The wetland forbs *Gratiola peruviana* and *Ludwigia peploides* subsp. *montevidensis* occur along creeks along with the tall

Common Reed (*Phragmites australis*). Forbs include *Viola caleyana, Mentha australis, Alternanthera denticulata, Hydrocotyle peduncularis* and *Persicaria* spp. Occurs on shallow, brown to grey podsolic loamy clays or humic gleys over gravel often derived from granite or granodiorite substrates lining creeks and on adjoining flats in the southern part of the Upper Slopes sub-region of the NSW South-western Slopes Bioregion extending into the South Eastern Highlands Bioregion. Mainly confined to the Tumut - Tumbarumba districts. The species composition varies with altitude and grazing history as grazing reduces shrub layer. Often heavily infested with weeds including Blackberry (*Rubus discolor*) and Willow (*Salix* spp.).

Within the construction envelope, and broader study area (refer to **Figure 6-1**), this vegetation does not have a matching vegetation group as described by Gellie (2005). This vegetation aligns well with the description for the Ribbon Gum very tall woodland on sandy alluvial soils along drainage lines of the eastern South Eastern Highlands Bioregion (map unit p520) as described by the Office of Environment and Heritage (2011); however, this map unit is described as having a sparse to absent shrub layer while the vegetation in the construction envelope has a dense shrub layer.

Within the construction envelope, PCT 302 occurs in the east in the KNP along the major waterway of the Yarrangobilly River (**Photo 6-19**) and the smaller waterways of Wallaces Creek, Lick Hole Gully, Cave Gully (**Photo 6-16** to **Photo 6-18**) and Sheep Station Creek. PCT 302 extends out of the construction envelope into the broader study area along these waterways. PCT 302 intergrades extensively with PCT 285 where a broader floodplain is present such as along areas of Sheep Station Creek and on the Yarrangobilly River floodplain, and PCT 729 and PCT 296 where the drainage lines become narrow bands within steeper terrain in areas to the south of Mine Trail and the upper reaches of Sheep Station Creek away from the confluence with the Yarrangobilly River. In most cases the boundaries between these PCTs are not distinct and there is considerable overlap in species with *Eucalyptus viminalis* growing up slope from the adjacent drainage line.

This vegetation is most likely to be representative of PCT 302 for the following reasons:

- This canopy is dominated by *Eucalyptus viminalis* with *Eucalyptus camphora* also common. Other eucalypts including *Eucalyptus stellulata, Eucalyptus rubida,* and *Eucalyptus robertsonii* are occasional

  The midstorey of the vegetation matches the description of PCT 302 well with characteristic species *Acacia melanoxylon, Bursaria spinosa, Callistemon sieberi, Pomaderris angustifolia, Pomaderris aspera, Melicytus dentatus, Acacia dealbata, Dodonaea viscosa,* and *Acacia pravissima* all present. The shrub layer is dense
- The ground cover contains species characteristic of PCT 302 including *Lachnagrostis filiformis, Carex gaudichaudiana, Juncus usitatus, Carex appressa, Carex fascicularis, Lomandra longifolia, Microlaena stipoides, Phragmites australis, Pteridium esculentum, Themeda triandra, Dichelachne micrantha, Alternanthera denticulata, Persicaria prostrata, Mentha australis, Ranunculus lappaceus, Epilobium billardierianum, Gratiola peruviana,* and *Lythrum salicaria*.

Other candidate PCTs for this vegetation that have *Eucalyptus viminalis* as a part of the canopy include the Riparian Ribbon Gum - Robertsons Peppermint - Apple Box riverine very tall open forest of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion (PCT 299). The *Riverina Regional Native Vegetation Map Version v1.0 - VIS_ID 4469* (Office of Environment and Heritage, 2016b) indicates that the vegetation along the Yarrangobilly River is likely to be PCT 299. However, within the construction envelope, and broader study area, this vegetation more closely matches the description of PCT 302 due to the dense and species rich shrub layer. PCT 302 appears to be a very variable community and the PCT name is misleading in the context of the riparian vegetation in the construction envelope and broader study area.

Two condition variants of PCT 302 were identified within the construction envelope including:

- Moderate (**Photo 6-16**, **Photo 6-17** and **Photo 6-19**)
- Native Grassland (**Photo 6-18**).

A summary of the vegetation structure and floristics of PCT 302 is given below in **Table 6.5**. This list of species reflects the local variation gathered from multiple floristic plots undertaken within the construction envelope and also includes incidental observations while moving through the vegetation in the broader study area.

Table 6.5: Floristic and structural summary of PCT 302 within the construction envelope

| Vegetation layer | Dominant species |
|---|---|
| Tree canopy (upper stratum) | *Eucalyptus viminalis* is the dominant canopy species within this PCT on the construction envelope and in the broader study area. *Eucalyptus camphora* is also common. Other eucalypts including *Eucalyptus stellulata, Eucalyptus rubida*, and *Eucalyptus robertsonii* are occasional. *Acacia dealbata* and *Acacia melanoxylon* are also common tree species throughout the PCT. |
| Midstorey (mid-stratum) | Characterised by shrubs including *Acacia pravissima, Bursaria spinosa, Cassinia aculeata, Cassinia longifolia, Dodonaea viscosa, Acacia pruinosa, Gynatrix pulchella, Pimelea pauciflora, Rhytidosporum* sp., *Callistemon sieberi, Pomaderris angustifolia, Pomaderris aspera, Melicytus dentatus, Exocarpos strictus, Banksia canei, Leptospermum lanigerum.* |
| Groundcovers (ground stratum) | Grass and grass like species including *Poa helmsii, Lachnagrostis filiformis, Carex gaudichaudiana, Juncus usitatus, Carex appressa, Carex fascicularis, Lomandra longifolia, Microlaena stipoides, Phragmites australis, Themeda triandra, Dichelachne micrantha, Rytidosperma penicillatum, Anthosachne scabra, Echinopogon ovatus, Poa sieberiana, Hemarthria uncinata, Poa labillardierei.*<br>Forbs including *Alternanthera denticulata, Persicaria prostrata, Mentha australis, Ranunculus lappaceus, Ranunculus pimpinellifolius, Epilobium billardierianum, Gratiola peruviana, Lythrum salicaria, Acaena novae-zelandiae, Ajuga australis, Rumex brownii, Chrysocephalum semipapposum, Geranium solanderi, Poranthera microphylla, Oxalis perennans, Myosotis australis, Dichondra repens, Galium gaudichaudii, Hydrocotyle laxiflora, Stellaria pungens.*<br>Ferns including *Pteridium esculentum* and *Blechnum* spp. are common.<br>Species in the 'other' growth forms include *Glycine clandestina, Cassytha* sp. and *Clematis aristata*. |
| Exotic species | *Centaurium erythraea, Hypochaeris radicata, Prunella vulgaris, Erythranthe moschata, Aira elegantissima, Cirsium vulgare.* |
| High Threat Weeds | *Rubus fruticosus* sp. agg., *Rosa rubiginosa, Hypericum perforatum, Holcus lanatus.* |

Photo 6-16: PCT 302 along Cave Gully showing dominance of *Eucalyptus viminalis* with *Rubus fruticosus* sp. agg.

Photo 6-17: PCT 302 along Cave Gully showing dense *Rubus fruticosus* sp. agg. infestation along the drainage line and dense native shrub layer in the background

Photo 6-18: PCT 302 along Cave Gully opposite Mine Trail showing absent canopy and dense ground cover of *Poa helmsii*

Photo 6-19: PCT 302 along the Yarrangobilly River north of Sheep Station Creek showing canopy of *Eucalyptus viminalis* and dense shrub layer

### 6.1.5 Broad-leaved Peppermint – Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion

**Vegetation formation:** Dry Sclerophyll Forests (Shrubby sub-formation)

**Vegetation class:** Southern Tableland Dry Sclerophyll Forests **PCT:** 729

**Threatened ecological community (BC Act and EPBC Act):** Not a TEC

**Vegetation zones (condition) and plots:**

- Native Grassland: Plots 49, 50, 51
- Shrubland - regrowth: Plots 52, 53, 54, 55
- Good - dry open slopes & ridgetops: Plots 56, 57, 58, 59, 60, 61, 62, 63, 70, 71.

Good - wetter sheltered slopes: Plots 64, 65, 66, 68, 69The Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion PCT is not currently described well in the BioNet Vegetation Classification database. This PCT is identified with a very low classification confidence level and no detailed description of the vegetation is provided.

Within the construction envelope, and broader study area (refer to **Figure 6-1**), this vegetation matches the Tablelands Shrub/Tussock Grass Forest (Vegetation Group 75) as described by Gellie (2005). This vegetation aligns well with the description for the Broad-leaved Peppermint - Candlebark tall dry sclerophyll open forest of quartz-rich ranges of the upper South East Highlands and lower Australian Alps Bioregions (map unit u21) as described by the Office of Environment and Heritage (2011). However, the vegetation in the construction envelope does not have *Eucalyptus bridgesiana*.

Within the construction envelope, PCT 729 occurs in the west in the KNP on the steep east facing slopes to the Talbingo Reservoir, and in the east on the western and eastern slopes of Sheep Station Ridge, and slopes to the south of Mine Trail and east of Lobs Hole Ravine Road (**Photo 6-20** to **Photo 6-24**). PCT 729 intergrades extensively with PCT 296 and the boundaries between these two PCTs is very indistinct. Some areas dominated by *Eucalyptus dives* could be assigned to either PCT. This PCT also intergrades with PCT 302 where drainage lines are present and there are areas where *Eucalyptus rubida* and *Eucalyptus viminalis* intermix in the canopy. There is a more abrupt ecotone where PCT 729 occurs next to PCT 999 with a distinct canopy species change and change in midstorey structure. Where this PCT occurs on more sheltered slopes the midstorey is dominated by a dense cover of *Banksia canei* (**Photo 6-21**). Elsewhere in drier ridge tops and slopes the midstorey is more open and dominated by *Calytrix tetragona* and *Brachyloma daphnoides* (**Photo 6-24)**.

While the Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion PCT is not currently described well in the BioNet Vegetation Classification database, the vegetation within the construction envelope is considered to be most likely representative of PCT 729 for the following reasons:

- This canopy is dominated by *Eucalyptus dives* with *Eucalyptus rubida* occurring variably as occasional, co-dominant or as the dominant canopy species. Other eucalypts including *Eucalyptus viminalis, Eucalyptus robertsonii, Eucalyptus nortonii,* and *Eucalyptus mannifera* also occur at ecotones
- The midstorey of the vegetation matches the description of PCT 729 well with characteristic species *Acacia dealbata, Brachyloma daphnoides,* and *Cassinia longifolia*
- The ground cover contains species characteristic of PCT 729 including *Dianella revoluta, Dichelachne rara, Hovea linearis, Lomandra longifolia, Poa sieberiana,* and *Stackhousia monogyna*.

The other candidate PCT for this vegetation is the Brittle Gum – peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion (PCT 296). However, *Eucalyptus rubida* is conspicuous in the vegetation and can be dominant. *Brachyloma daphnoides* is conspicuous in the shrub layer and this species is not noted for PCT 729 in the BioNet Vegetation Classification database.

Four condition variants of PCT 729 were identified within the construction envelope including:

- Good – dry open slopes and ridgetops (**Photo 6-24**)
- Good – wetter sheltered slopes (**Photo 6-21**)
- Shrubland regrowth (**Photo 6-22**)
- Native Grassland (**Photo 6-23**).

A summary of the vegetation structure and floristics of PCT 729 is given below in **Table 6.6**. This list of species reflects the local variation gathered from multiple floristic plots undertaken within the construction envelope and also includes incidental observations while moving through the vegetation in the broader study area.

Table 6.6: Floristic and structural summary of PCT 729 within the construction envelope

| Vegetation layer | Dominant species |
|---|---|
| Tree canopy (upper stratum) | *Eucalyptus dives* is the dominant canopy species within this PCT on the construction envelope and in the broader study area. *Eucalyptus rubida* occurs variably as occasional, co-dominant or as the dominant canopy species. Other eucalypts including *Eucalyptus viminalis, Eucalyptus robertsonii, Eucalyptus nortonii*, and *Eucalyptus mannifera* also occur at ecotones. *Acacia dealbata* is prominent and *Callitris endlicheri* is occasional. |
| Midstorey (mid-stratum) | Characterised by shrubs including *Astroloma humifusum, Banksia canei* (can be very dense), *Bossiaea foliosa, Brachyloma daphnoides, Bursaria spinosa, Calytrix tetragona, Cassinia aculeata, Cassinia longifolia, Choretrum pauciflorum, Chorizema parviflorum, Coprosma hirtella, Daviesia latifolia, Daviesia mimosoides, Dillwynia crispii, Dillwynia phylicoides, Exocarpos cupressiformis, Exocarpos strictus, Gompholobium huegelii, Grevillea arenaria* subsp. *canescens, Grevillea rosmarinifolia, Hibbertia obtusifolia, Hovea lanceolata, Indigofera australis, Leucopogon fletcheri, Leucopogon virgatus, Mirbelia oxylobioides, Monotoca scoparia, Omphacomeria acerba, Persoonia chamaepeuce, Pimelea curviflora, Pimelea linifolia, Platylobium formosum, Rhytidosporum* sp., *Tetratheca bauerifolia.* |
| Groundcovers (ground stratum) | Grass and grass like species including *Dichelachne* sp., *Lepidosperma laterale, Lomandra filiformis, Lomandra longifolia, Lomandra multiflora, Luzula* sp., *Microlaena stipoides, Poa labillardierei, Poa sieberiana, Rytidosperma* sp., *Themeda triandra.*<br>Forbs including *Ajuga australis, Asperula conferta, Asperula scoparia, Brachyscome scapigera, Caladenia congesta, Caladenia gracilis, Chrysocephalum apiculatum, Crassula sieberiana, Daucus glochidiatus, Dianella revoluta, Diuris sulphurea, Euchiton involucratus, Euphrasia collina* subsp. *paludosa, Geranium obtusisepalum, Gonocarpus tetragynus, Hovea heterophylla, Hydrocotyle laxiflora, Hypericum gramineum, Oxalis perennans, Picris angustifolia, Plantago gaudichaudii, Poranthera microphylla, Prasophyllum brevilabre, Pterostylis longifolia, Pterostylis nutans, Ranunculus lappaceus, Senecio quadridentatus, Senecio prenanthoides, Stackhousia monogyna, Stellaria pungens, Stylidium graminifolium, Thelymitra megcalyptra, Veronica derwentiana, Viola betonicifolia, Wahlenbergia stricta, Xerochrysum bracteatum.*<br>Ferns including *Pteridium esculentum* and *Cheilanthes sieberi* are common.<br>Species in the 'other' growth forms include *Glycine clandestina, Amyema pendula, Hardenbergia violacea*, and *Cassytha* spp. |
| Exotic species | *Centaurium erythraea, Hypochaeris radicata, Prunella vulgaris, Aira elegantissima.* |
| High Threat Weeds | *Rubus fruticosus* sp. agg., *Rosa rubiginosa, Hypericum perforatum, Holcus lanatus.* |

Photo 6-20: PCT 729 south of Mine Trail showing the canopy of *Eucalyptus rubida*

Photo 6-21: PCT 729 to the west of Sheep Station Creek showing the canopy dominated by *Eucalyptus dives* and a dense shrub layer of *Banksia canei*

Photo 6-22: PCT 729 to the south of Mine Trail showing an area of regenerating shrubland

Photo 6-23: PCT 729 to the south of Mine Trail showing an area of native grassland dominated by *Themeda triandra*

Photo 6-24: PCT 729 to the west of Sheep Station Creek showing dominance of *Eucalyptus dives* in the canopy and shrub layer dominated by *Brachyloma daphnoides*

#### 6.1.6 Nortons Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion

**Vegetation formation:** Dry Sclerophyll Forests (Shrub/grass sub-formation)

**Vegetation class:** Upper Riverina Dry Sclerophyll Forests **PCT:** 999

**Threatened ecological community (BC Act and EPBC Act):** Not a TEC

**Vegetation zones (condition) and plots:**

- Shrubland - regrowth: Plots 72, 73
- Good - drier *Calytrix tetragona*: Plots 74, 75, 76, 77, 78, 79, 80, 81.

The Nortons Box – Broad - leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion PCT is not currently described well in the BioNet Vegetation Classification database. This PCT is identified with a very low classification confidence level and no detailed description of the vegetation is provided.

Within the construction envelope, and broader study area (refer to **Figure 6-1**), this vegetation matches the Montane Dry Shrub/Tussock Grass Forest (Vegetation Group 79) as described by Gellie (2005). This vegetation aligns well with the description for the Norton's Box - Broad-leaved Peppermint shrubby mid-high open forest on granite substrates primarily in the Namadgi Region (map unit u18) as described by the Office of Environment and Heritage (2011).

Within the construction envelope, PCT 999 occurs in the east in the KNP on the steep dry north and west facing slopes and ridgetops to the east and west of Sheep Station Creek and East of Lobs Hole Ravine Road. PCT 999 intergrades with PCT 729 and PCT 296 but the boundary between these vegetation types is relatively distinct with an obvious change in dominant canopy species and change in midstorey structure evident.

While the Nortons Box – Broad - leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion PCT is not currently described well in the BioNet Vegetation Classification database, the vegetation within the construction envelope is considered to be most likely representative of PCT 999 for the following reasons:

- This canopy is dominated by *Eucalyptus nortonii* with *Eucalyptus dives* occurring occasionally. *Eucalyptus rubida* and *Eucalyptus robertsonii* occur at ecotones. *Callitris endlicheri* occurs in scattered patches being most abundant on the steep slopes west of Sheep Station Creek
- The midstorey of the vegetation matches the description of PCT 999 well with characteristic species *Calytrix tetragona, Cassinia longifolia* present. *Calytrix tetragona* dominates the shrub layer
- The ground cover contains species characteristic of PCT 999 including *Austrostipa scabra, Desmodium varians, Dianella revoluta, Dichelachne micrantha, Elymus scaber, Geranium solanderi, Poa sieberiana,* and *Themeda triandra*.

The other candidate PCT for this vegetation is the Red Stringybark - Broad-leaved Peppermint - Nortons Box heath open forest of the upper slopes subregion in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion (PCT 311). However, due to the absence of *Eucalyptus macrorhyncha* from the construction envelope and broader study area, and absence of midstorey species such as *Xanthorrhoea glauca*, combined with the dominance of *Calytrix tetragona* in the midstorey, the vegetation is considered most likely to be representative of PCT 999.

Two condition variants of PCT 999 were identified within the construction envelope including:

- Good – drier *Calytrix tetragona* (**Photo 6-25** to **Photo 6-27** and **Photo 6-30**)
- Shrubland - regrowth (**Photo 6-28**).

A summary of the vegetation structure and floristics of PCT 999 is given below in **Table 6.7**. This list of species reflects the local variation gathered from multiple floristic plots undertaken within the construction envelope and also includes incidental observations while moving through the vegetation in the broader study area.

Table 6.7: Floristic and structural summary of PCT 729 within the construction envelope

| Vegetation layer | Dominant species |
|---|---|
| Tree canopy (upper stratum) | *Eucalyptus nortonii* is the dominant canopy species within this PCT on the construction envelope and in the broader study area. *Eucalyptus dives* can be co-dominant in areas. *Eucalyptus rubida* and *Eucalyptus robertsonii* occur at ecotones. Callitris endlicheri occurs in scattered patches. |
| Midstorey (mid-stratum) | Characterised by shrubs including *Acacia buxifolia, Acacia gunnii, Acacia pravissima, Banksia canei, Brachyloma daphnoides, Calytrix tetragona* (dominant), *Cassinia aculeata, Cassinia longifolia, Dillwynia phylicoides, Hibbertia obtusifolia, Leucopogon virgatus, Leucopogon fletcheri, Monotoca scoparia, Pimelea linifolia, Platylobium formosum, Rhytidosporum* sp., *Tetratheca bauerifolia.* |
| Groundcovers (ground stratum) | Grass and grass like species including *Austrostipa scabra, Dichelachne micrantha, Elymus scaber, Poa sieberiana, Themeda triandra, Lomandra filiformis, Lomandra glauca, Lomandra gracilis, Lomandra longifolia, Luzula* sp.<br>Forbs including *Boronia nana, Caladenia congesta, Caladenia gracilis, Gonocarpus tetragynus, Hovea* sp., *Hypericum gramineum, Prasophyllum brevilabre, Wahlenbergia stricta, Dianella revoluta, Geranium solanderi.*<br>Ferns including *Cheilanthes sieberi* are occasional.<br>Species in the 'other' growth forms include *Desmodium varians, Glycine clandestina, Hardenbergia violacea,* and *Cassytha* spp. |
| Exotic species | *Centaurium erythraea, Aira elegantissima.* |
| High Threat Weeds | *Hypericum perforatum* |

Photo 6-25: PCT 999 adjacent to Lobs Hole Ravine Road showing dominance of *Eucalyptus nortonii* in the canopy and shrub layer dominated by *Calytrix tetragona*

Photo 6-26: PCT 999 on the steep slope to the west of Lobs Hole Ravine Road showing dominance of *Eucalyptus nortonii* in the canopy and shrub layer dominated by *Calytrix tetragona*

Photo 6-27: PCT 999 on the steep slope to the west of Lobs Hole Ravine Road showing dominance of *Eucalyptus nortonii* in the canopy and exposed rocky outcrop

Photo 6-28: PCT 999 on the steep slope to the west of Lobs Hole Ravine Road showing an area with cleared canopy dominated by a dense shrub layer of *Calytrix tetragona*

Photo 6-29: PCT 999 on the ridge to the west of Sheep Station Creek dominated by *Eucalyptus nortonii*

#### 6.1.7 Snow Gum – Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion

**Vegetation formation:** Grassy Woodlands

**Vegetation class:** Subalpine Woodlands **PCT:** 1196

**Threatened ecological community (BC Act and EPBC Act):** Not a TEC

**Vegetation zones (condition) and plots:**

- Native Grassland: Plots 6, 7
- Good - drier *Calytrix tetragona*: Plots 8, 9, 10, 11, 12, 13.

The Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion PCT is described in the BioNet Vegetation Classification database as an open to tall open forest with an open shrubby understorey and grassy ground layer, widespread on montane to sub alpine slopes and ridges. This PCT is not currently described well in the BioNet Vegetation Classification database and is identified with a very low classification confidence level and no detailed description of the vegetation is provided.

Within the construction envelope, and broader study area (refer to **Figure 6-1**), this vegetation matches the description of the Tablelands Acacia/Grass/Herb Dry Forest (Vegetation Group 101) as described by Gellie (2005) but may also fit the description of the Tablelands Acacia Moist Herb Forest (Vegetation Group 95), Montane Acacia/Dry Shrub/Herb/Grass Forest (Vegetation Group 97), Western Montane Moist Shrub Forest (Vegetation Group 98). This vegetation also aligns with the description for the Mountain Gum - Snow Gum ± Robertson’s Peppermint grass-forb very tall woodland to open forest of the Australian Alps and South Eastern Highlands Bioregions (map unit u22) as described by the Office of Environment and Heritage (2011).

Within the construction envelope, vegetation considered most likely to be representative of the Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion PCT occurs in the west within the Bago State Forest at the location of the substation. Native Grasslands also exist in the easement of the existing Line 64 (refer **Photo 6-33**). This PCT is present in the broader study area to the north, west and south of the construction envelope.

This vegetation is most likely to be representative of PCT 1196 for the following reasons:

- This canopy is characterised by *Eucalyptus pauciflora* with *Eucalyptus dalrympleana* and *Eucalyptus robertsonii*
- The shrub layer is sparse to dense depending on level of disturbance and is characterised by the presence of *Acacia dealbata, Coprosma hirtella, Daviesia latifolia, Daviesia ulicifolia, Olearia erubescens,* and *Platylobium formosum*
- The ground cover contains the characteristic species *Acaena novae-zelandiae, Acaena ovina, Asperula scoparia, Dianella tasmanica, Lomandra longifolia, Luzula flaccida, Microlaena stipoides, Poa sieberiana, Stellaria pungens, Stylidium graminifolium, Brachyscome spathulata, Lagenifera stipitata,* and *Viola betonicifolia*.

Other PCTs that have *Eucalyptus pauciflora* as a part of the canopy are either known from higher altitude alpine areas, other bioregions (e.g. New England Tablelands) or have *Eucalyptus rubida, Eucalyptus viminalis* or *Eucalyptus delegatensis* as a conspicuous component of the canopy. The vegetation in the construction envelope could also match the description for the Mountain Gum – Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion (PCT 953). However, PCT 953 is more of a shrubby dry sclerophyll forest as opposed to the subalpine vegetation in the construction envelope and PCT 953 contains several shrub species that are absent from this vegetation. Furthermore, the vegetation in the construction envelope is characterised by several ground cover species that are not found in PCT 953.

Two condition variants of PCT 1196 were identified within the construction envelope including:

- Good (**Photo 6-30** to **Photo 6-32**)
- Native Grassland (**Photo 6-33**).

A summary of the vegetation structure and floristics of PCT 1196 is given below in **Table 6.8**. This list of species reflects the local variation gathered from multiple floristic plots undertaken within the construction envelope and also includes incidental observations while moving through the vegetation in the broader study area.

Table 6.8: Floristic and structural summary of PCT 1196 within the construction envelope

| Vegetation layer | Dominant species |
|---|---|
| Tree canopy (upper stratum) | *Eucalyptus pauciflora, Eucalyptus dalrympleana, Eucalyptus robertsonii, Acacia melanoxylon, Acacia dealbata*. |
| Midstorey (mid-stratum) | Characterised by shrubs including *Acacia pravissima, Astroloma humifusum, Bossiaea foliosa, Cassinia aculeata, Cassinia longifolia, Coprosma hirtella, Daviesia latifolia, Daviesia ulicifolia, Exocarpos cupressiformis, Lomatia myricoides, Olearia erubescens, Persoonia chamaepeuce, Platylobium formosum, Tetratheca bauerifolia, Tetratheca ciliata.* |
| Groundcovers (ground stratum) | Grass and grass like species including *Austrodanthonia pilosa, Lachnagrostis filiformis, Lomandra filiformis, Lomandra laxa, Lomandra longifolia, Luzula flaccida, Microlaena stipoides, Poa sieberiana, Poa labillardierei, Themeda triandra, Cymbopogon refractus, Dichelachne* sp., *Deyeuxia* sp., *Elymus scaber,*<br>Forbs including *Acaena novae-zelandiae, Acaena ovina, Ajuga australis, Arthropodium* sp., *Asperula scoparia, Brachyscome scapigera, Calotis scabiosifolia, Caladenia gracilis, Caladenia alpina, Chiloglottis valida, Chrysocephalum apiculatum, Coronidium scorpioides, Corybas* sp., *Cotula australis, Craspedia* sp., *Cymbonotus lawsonianus, Dianella revoluta, Dianella tasmanica,* |

| Vegetation layer | Dominant species |
|---|---|
| | *Dichondra repens, Euchiton involucratus, Euphrasia collina* subsp. *paludosa, Galium gaudichaudii, Gastrodia sesamoides, Geranium obtusisepalum, Geranium solanderi, Geranium* sp. 2, *Gonocarpus tetragynus, Herpolirion novae-zelandiae, Hydrocotyle laxiflora, Hydrocotyle pedicellosa, Hydrocotyle tripartita, Hypericum gramineum, Lagenifera stipitata, Lobelia purpurascens, Microseris lanceolata, Oxalis perennans, Picris angustifolia, Plantago debilis, Poranthera microphylla, Pterostylis decurva, Pterostylis longifolia, Pterostylis monticola, Diuris monticola, Ranunculus lappaceus, Senecio quadridentatus, Senecio prenanthoides, Solenogyne bellioides, Stackhousia monogyna, Stellaria pungens, Stylidium graminifolium, Veronica calycina, Veronica derwentiana, Viola betonicifolia, Viola hederacea, Wahlenbergia stricta*.<br>Ferns including *Pteridium esculentum* are occasionally present.<br>Species in the 'other' growth forms include *Clematis aristata, Glycine clandestina, Glycine microphylla, Glycine tabacina, Cullen* sp. |
| Exotic species | *Centaurium erythraea, Erythranthe moschata, Prunella vulgaris, Trifolium repens, Hypochaeris radicata, Medicago polymorpha.* |
| High Threat Weeds | *Rubus fruticosus* sp. agg., *Rosa rubiginosa, Holcus lanatus, Hypericum perforatum, Acetosella vulgaris, Leucanthemum vulgare.* |

Photo 6-30: PCT 1196 within the Bago State Forest at the substation site showing dominance of *Eucalyptus pauciflora* with few large trees and abundant regeneration of younger trees

Photo 6-31: PCT 1196 within the Bago State Forest showing dominance of *Eucalyptus pauciflora* with shrubby midstorey

Photo 6-32: PCT 1196 within the Bago State Forest showing *Eucalyptus pauciflora* with *Eucalyptus dalrympleana*

Photo 6-33: PCT 1196 beneath Line 64 showing the native grassland

## 6.2 Vegetation zones and vegetation integrity score

A summary of the vegetation zones identified within the disturbance area, including the corresponding vegetation integrity (VI) score developed from the BAM-C, is presented in **Table 6.9** for vegetation zones in the South Eastern Highlands Bioregion and **Table 6-10** for vegetation zones in the Australian Alps Bioregion. The area of the vegetation zone within the larger construction envelope has also been provided for a broader understanding of vegetation condition, however the disturbance area has been used for the area calculation of the vegetation zone (see **Section 11.1.1** for discussion). Importantly, there are no different vegetation zones in the larger construction envelope.

Separate vegetation zones have been created to assess indirect impacts on areas of retained vegetation where new edges are being created around the disturbance area (refer to **Section 11.1.2** for more details). Considering these zones are contiguous with the areas that will be directly impacted, relevant plot data collected for the direct impact zones has been used to calculate vegetation integrity scores for indirect impact zones in the BAM-C.

The VI survey plot data is provided in **Appendix B** and **Appendix C**.

Table 6.9: Vegetation zones and vegetation integrity scores for the South Eastern Highlands Bioregion

| Vegetation Zone | PCT ID No. | PCT name | Broad condition class | Area (ha) in disturbance area | Area (ha) in construction envelope | VI score* |
|---|---|---|---|---|---|---|
| **Vegetation zones within direct construction envelope** | | | | | | |
| SEH-1 | 296 | Brittle Gum - peppermint open forest of the Woomargama to Tumut | Native Grassland | 0.13 | 0.3 | 39.5 |
| SEH-2 | | | Good – drier *Eucalyptus* | 4.67 | 6.97 | 88.7 |

| Vegetation Zone | PCT ID No. | PCT name | Broad condition class | Area (ha) in disturbance area | Area (ha) in construction envelope | VI score* |
|---|---|---|---|---|---|---|
| | | region, NSW South Western Slopes Bioregion | *nortonii* dominant slope | | | |
| SEH-3 | | | Good – wetter sheltered slopes | 14.96 | 28.39 | 75.3 |
| SEH-4 | | | Moderate – Blackberry infestation | 1.38 | 1.69 | 49.1 |
| SEH-5 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | 32.5 | 49.46 | 81.3 |
| SEH-6 | 302 | Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion | Native Grassland | 0.55 | 1.22 | 14.6 |
| SEH-7 | | | Moderate | 2.57 | 7.96 | 61.3 |
| SEH-8 | 729 | Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion | Native Grassland | 1.11 | 1.71 | 23.4 |
| SEH-9 | | | Shrubland - regrowth | 0.78 | 3.19 | 36.6 |
| SEH-10 | | | Good - dry open slopes & ridgetops | 16.05 | 27.23 | 81.5 |
| SEH-11 | | | Good - wetter sheltered slopes | 16.79 | 29.44 | 76 |
| SEH-12 | 999 | Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion | Shrubland - regrowth | 1.23 | 2.01 | 31.5 |
| SEH-13 | | | Good - drier *Calytrix tetragona* | 6.38 | 11.42 | 58.9 |
| **Vegetation zones within indirect impact area (20 m buffer of disturbance area)** | | | | | | |
| SEH-14 | 296 | Brittle Gum - peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion | Good – drier *Eucalyptus nortonii* dominant slope | 1.34 | - | 88.4 |
| SEH-15 | | | Good – wetter sheltered slopes | 4.74 | - | 74.5 |

| Vegetation Zone | PCT ID No. | PCT name | Broad condition class | Area (ha) in disturbance area | Area (ha) in construction envelope | VI score* |
|---|---|---|---|---|---|---|
| SEH-16 | | | Moderate – Blackberry infestation | 0.08 | - | 48.9 |
| SEH-17 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | 9.57 | - | 80.2 |
| SEH-18 | 302 | Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion | Moderate | 1.05 | - | 61.4 |
| SEH-19 | 729 | Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion | Good - dry open slopes & ridgetops | 5.33 | - | 81.9 |
| SEH-20 | | | Good - wetter sheltered slopes | 7.98 | - | 76 |
| SEH-21 | 999 | Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion | Good - drier Calytrix tetragona | 2.25 | - | 58.8 |

*Note: VI score has been calculated using the area within the disturbance area

Table 6.10: Vegetation zones and vegetation integrity scores for the Australian Alps Bioregion

| Vegetation Zone | PCT ID No. | PCT name | Broad condition class | Area (ha) in disturbance area | Area (ha) in construction envelope | VI score* |
|---|---|---|---|---|---|---|
| **Vegetation zones within direct construction envelope** | | | | | | |
| AA-1 | 285 | Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion | Moderate - Blackberry infestation | 1.77 | 2.24 | 78.7 |
| AA-2 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | 10.77 | 15.15 | 83.7 |

| Vegetation Zone | PCT ID No. | PCT name | Broad condition class | Area (ha) in disturbance area | Area (ha) in construction envelope | VI score* |
|---|---|---|---|---|---|---|
| AA-3 | 1196 | Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion | Native Grassland | 0.76 | 1.02 | 38.6 |
| AA-4 | 1196 | Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion | Good | 23.19 | 30.23 | 84.9 |
| **Vegetation zones within indirect impact area (20 m buffer of disturbance area)** | | | | | | |
| AA-5 | 285 | Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion | Moderate - Blackberry infestation | 0.33 | - | 78.9 |
| AA-6 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | 2.88 | - | 83.2 |
| AA-7 | 1196 | Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion | Good | 3.68 | - | 84.7 |

*Note: VI score has been calculated using the area within the disturbance area

## 6.3 Patch size

The main barrier that breaks apart vegetation within the construction envelope is the existing Talbingo Reservoir which is approximately 180 m wide underneath the transmission line connection corridor. The Talbingo Reservoir divides the vegetation into two patches that are each more than 100 ha in size. As such, the two patches received the maximum patch size class of >100 ha.

The Elliott Way road corridor is not wide enough to constitute a break in a patch and vegetation on either side of Elliott Way is classed as part of the same patch. This also applies to vegetation either side of Lobs Hole Ravine Road. Importantly, the native grassland in the Line 64 easement contains all structural layers (strata) characteristic of PCT 1196. There is regeneration of tree and shrub species so the easement does not constitute a break in the patch for the purposes of patch size calculation under the BAM.

## 6.4 Threatened ecological communities

There are five threatened ecological communities (TECs) as listed under the BC Act that could occur in the broader study area based on the database searches and the regional PCT mapping (see **Section 9.3** for discussion on EPBC Act TECs). These TECs are as follows:

- Coolac-Tumut Serpentinite Shrubby Woodland in the NSW South Western Slopes and South Eastern Highlands Bioregions
- Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps Bioregions
- Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions
- Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions
- White Box Yellow Box Blakely's Red Gum Woodland.

The assessment concludes that none of these TECs occurs in the disturbance area or construction envelope. Discussion and justification for this conclusion is provided below.

### 6.4.1 Coolac-Tumut Serpentinite Shrubby Woodland in the NSW South Western Slopes and South Eastern Highlands Bioregions

This TEC corresponds directly to the Drooping Sheoak - *Ricinocarpos bowmannii* - grasstree tall open shrubland of the Coolac - Tumut Serpentinite Belt PCT. This TEC is mapped as occurring in the east of the broader study area north of Roundtop Mountain and adjacent to Lobs Hole Ravine Road which is on limestone and shale geology. These mapped areas along Lobs Hole Ravine Road were visited in the field and found not to contain the TEC but instead disturbed areas consisting of sparse to dense regrowth of *Eucalyptus rubida, Eucalyptus viminalis, Acacia dealbata, Dodonaea viscosa, Bursaria spinosa, Calytrix tetragona,* and *Exocarpus strictus*. The characteristic species *Allocasuarina verticillata*, *Acacia implexa*, *Xanthorrhoea glauca* and *Ricinocarpos bowmanii* were not present in the areas visited. Based on the site visits the mapping of this TEC is considered inaccurate. This TEC does not occur in the construction envelope and is unlikely to occur in the broader study area.

### 6.4.2 Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps Bioregions

This TEC corresponds directly to the Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion PCT. This TEC is mapped as occurring in the higher altitude alpine areas in the west of the broader survey area near Yorkers Creek on the Bago plateau in the Bago State Forest. This TEC is mapped more extensively in that area (refer to **Figure 6-1**) by the Montane Peatlands and Swamps layer (Environmental Protection Authority, 2016) and may also occur in areas mapped as the Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion PCT in the Bago and Maragle State Forests.

This patch of creek line vegetation along Yorkers Creek to the north of the construction envelope in the Line 64 easement (refer to **Figure 6-1**) was visited during the surveys and it was found to contain species characteristic of the Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps Bioregions TEC. Mature *Eucalyptus camphora* and *Eucalyptus pauciflora* trees are present at the edges of the vegetation and also as scattered seedlings throughout. A characteristic dense shrub layer consisting of *Leptospermum lanigerum, Epacris breviflora, Baeckea utilis, Hakea microcarpa* is present in a band along the drainage line. Groundcover species including *Empodisma minus,* and *Juncus* spp. occur with *Carex* spp., *Poa* spp., and a range of herbs and wildflowers typical of the TEC including the key indicator species *Gonocarpus micranthus* and *Sphagnum cristatum*. The vegetation and the portion of Yorkers Creek in this area is quite damaged from horses and the ground layer vegetation is heavily grazed. As the vegetation is in an altered state from the creation and maintenance of the Line 64 easement it cannot be definitively stated whether this vegetation along Yorkers

Creek is part of the TEC or whether it has been derived from the Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion PCT (PCT 285).

This patch is upstream and north of Elliots Way so is unlikely to be affected by surface water flow from the project. However, there is another smaller mapped patch on Yorkers Creek around 500 m downstream of the second order stream that flows from the substation site. This mapped area was not verified from surveys but has the potential to be indirectly impacted by surface water flow from the project. The potential for indirect impacts to this potential TEC would be managed by standard erosion control measures and drainage design around the substation site.

The regrowth shrubland representative of PCT 285 along New Zealand Gully within the construction envelope in the Line 64 easement shares many of the same species as the vegetation along Yorkers Creek. However, the vegetation along New Zealand Gully is clearly derived from PCT 285 as evidenced by the adjacent vegetation along New Zealand Gully either side of the easement and the evidence of cut trees lying in the creek under the dense shrub layer. The vegetation within the easement was originally a sclerophyll forest lining a narrow drainage line and was not a peatland or swamp. As such, the Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps Bioregions TEC does not occur in the construction envelope.

#### 6.4.3 Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions

The western portion of the broader study area in the Maragle and Bago State Forests have mapped areas of Olivine Basalt geology. However, these areas are within the Australian Alps Bioregion so the vegetation in these areas of basalt would not be considered part of the Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions TEC. Furthermore, the vegetation in this western portion of the construction envelope is located on Biotite Granodiorite geology. The portion of the construction envelope that lies within the South Eastern Highlands Bioregion is located on a mix of shale, limestone, quartzite and siltstone geology. While this PCT is named the Tableland Basalt Forest in the Sydney Basin and South Eastern Highlands Bioregions it may also occur on loam or clay soils derived from mudstones, granites, alluvium and other substrates at altitudes between 600 – 900 m above sea level.

The vegetation within the South Eastern Highlands Bioregion portion of the construction envelope does not match well with the descriptions for this TEC and none of the PCTs mapped in or near the construction envelope correspond with this TEC.

#### 6.4.4 Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions

The Tablelands Snow Gum, Black Sallee, Candlebark and Ribbon Gum Grassy Woodland in the South Eastern Highlands, Sydney Basin, South East Corner and NSW South Western Slopes Bioregions TEC is mapped in the western portion of the broader study area in the Maragle and Bago State Forests associated with the drainage of Yorkers Creek and tributaries. Extensive areas of vegetation in the KNP in the east of the survey area are also mapped by regional mapping projects as PCTs that correspond to parts of this TEC.

While *Eucalyptus rubida, Eucalyptus pauciflora,* and *Eucalyptus viminalis* are common species within the PCTs in the construction envelope, the vegetation types present within the construction envelope do not match well with the description for this TEC. Furthermore, the TEC falls within the structural formation of Grassy Woodlands and the vegetation classes of Subalpine Woodlands and Tableland Clay Grassy Woodlands. The PCTs within the construction envelope that are dominated by *Eucalyptus rubida* and *Eucalyptus viminalis* are dry and wet sclerophyll forests and not part of the Subalpine Woodlands or Tableland Clay Grassy Woodlands vegetation classes. The vegetation dominated by *Eucalyptus pauciflora* within the construction envelope and broader study area is within the Australian Alps Bioregion so is therefore not considered to be part of this TEC.

#### 6.4.5 White Box Yellow Box Blakely's Red Gum Woodland

This TEC corresponds directly to the Blakely's Red Gum - Yellow Box grassy tall woodland of the NSW South Western Slopes Bioregion PCT. This TEC is mapped (based on spatial modelling) in the Ravine area east of the Flying Fox Trail and west of the Yarrangobilly River by the available regional mapping projects.

The construction envelope does not contain any PCTs dominated by *Eucalyptus albens, Eucalyptus melliodora*, or *Eucalyptus blakelyi*. These tree species were not recorded within the construction envelope or broader study area during the vegetation surveys. Therefore, the White Box Yellow Box Blakely's Red Gum Woodland does not occur in or around the construction envelope.

### 6.5 Groundwater dependent ecosystems

The level of groundwater dependence of vegetation communities in the construction envelope and broader study area has been identified using the *Atlas of Groundwater Dependent Ecosystems* (GDEs) (Bureau of Meteorology, 2017) and the *Risk Assessment Guidelines for Groundwater Dependent Ecosystems* released by the NSW DPI (Kuginis *et al.*, 2012).

Extensive groundwater and GDE assessments have recently been undertaken as part of the Snowy 2.0 Main Works BDAR (EMM Consulting, 2020a), including a stygofauna assessment undertaken by Macquarie University. Information collected in those assessments for PCTs relevant to this project has been discussed here.

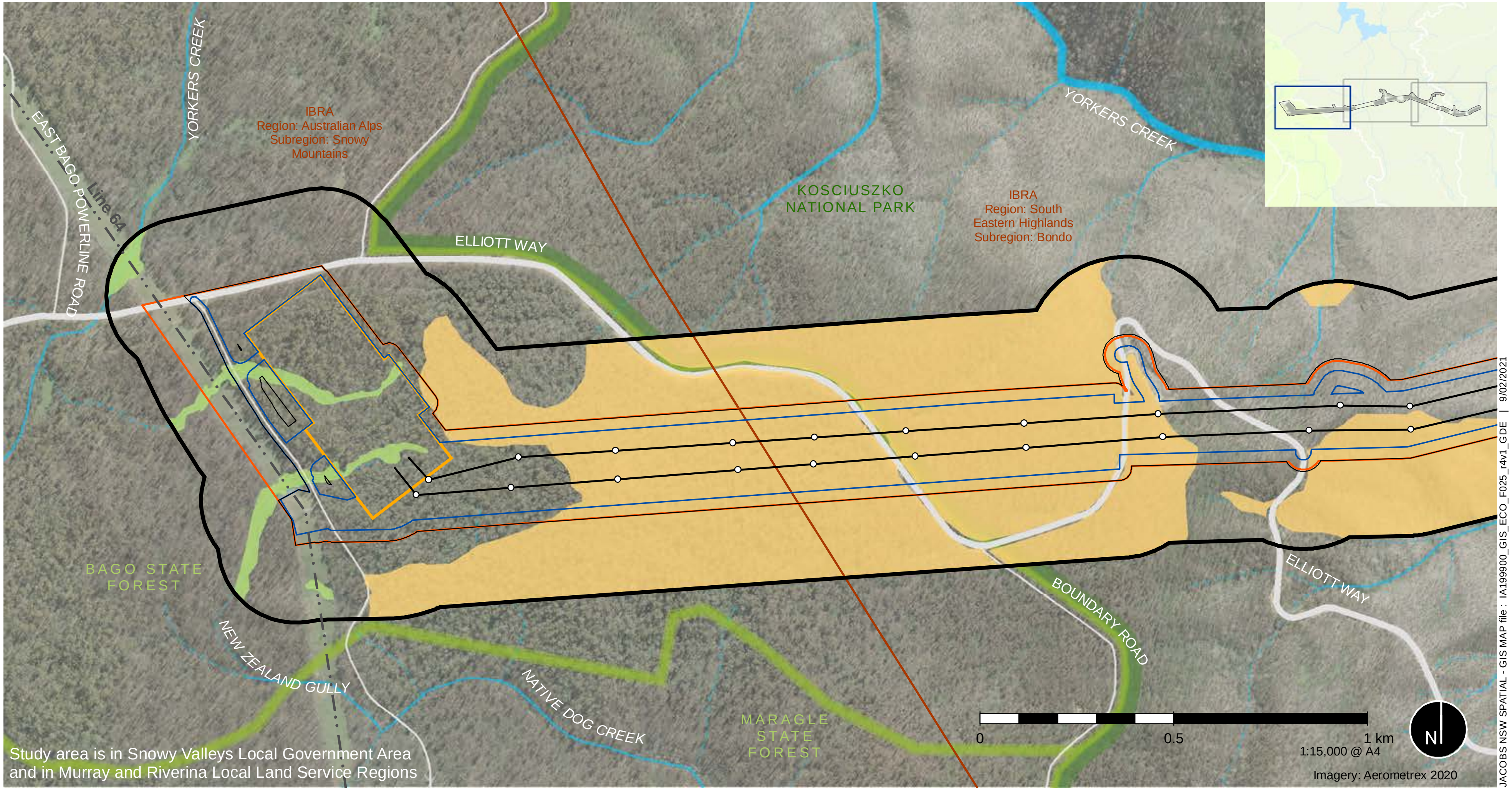
There are a number of high and moderate potential aquatic GDEs and terrestrial GDEs mapped within the study area and broader surrounds by the Atlas of GDEs (Bureau of Meteorology, 2017). The mapped aquatic GDEs are generally situated along the larger named water courses. Within and near the construction envelope, the mapped aquatic GDEs include vegetation along Yorkers Creek, Native Dog Gully, New Zealand Gully and Appletree Gully to the west of the Talbingo Reservoir and vegetation along the Tumut River, Sheep Station Creek, Lick Hole Gully, Cave Gully, Wallace Creek, Stable Creek and the Yarrangobilly River to the east. The Atlas of GDEs (Bureau of Meteorology, 2017) identifies portions of the construction envelope as containing some areas of moderate to high potential groundwater dependent terrestrial vegetation. The Atlas of GDEs dataset uses the same polygons as the *Riverina Regional Native Vegetation Map Version v1.0 - VIS_ID 4469* (Office of Environment and Heritage, 2016b) which has been shown to be inaccurate. However, the construction envelope and the broader study area does contain some areas of moderate to high potential terrestrial GDEs including areas of:

- Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion (PCT 285)
- Brittle Gum - peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion PCT (PCT 296)
- Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion (PCT 302).

The Snowy 2.0 Main Works BDAR (EMM Consulting, 2020a) identified potential groundwater dependence of vegetation by intersecting PCT mapping with groundwater depth mapping to put PCTs. For PCTs relevant to this project the assessment identified two likely types of GDEs:

- Proportional facultative – PCT 285 and PCT 302
- Opportunistic facultative – PCT 300
- PCT 296, PCT 729, PCT 999 and PCT 1196 were found to be non-dependent

However, the assessment (EMM Consulting, 2020a) also found some groundwater associations from non-dependent PCTs, therefore the method may not be entirely accurate. Based on this assessment and the data provided in the GDE Atlas (Bureau of Meteorology, 2017), none of the PCTs are likely to have a total reliance on groundwater. However, PCT 285, PCT 296, PCT 300 and PCT 302 are likely to be facultative GDEs that depend on the subsurface presence of groundwater (often accessed via the capillary fringe – subsurface water just above the water table) in some locations but not in others, particularly where an alternative source of water (i.e. rainfall) cannot be accessed to maintain ecological function. These may use groundwater during periods of low flow or drought. The level of groundwater dependency will likely change between the PCTs in different areas, i.e. proportional to opportunistic depending on the current groundwater level. Within the study area, PCT 285 and PCT 302 are likely to have the highest groundwater dependency as they are located on alluvial and colluvial soils along the Yarrangobilly River and tributaries. Base flow (that part of stream flow derived from groundwater discharge and bank storage) may contribute year-round to flows in the Yarrangobilly River that supports the riparian vegetation, but it is likely that this vegetation can also exist without the input of groundwater, as long as there is no prolonged drought.




Project area
Disturbance area
BDAR study area
Construction envelope
Proposed 500kV substation
Proposed structure
Proposed transmission line

Likely facultative GDEs

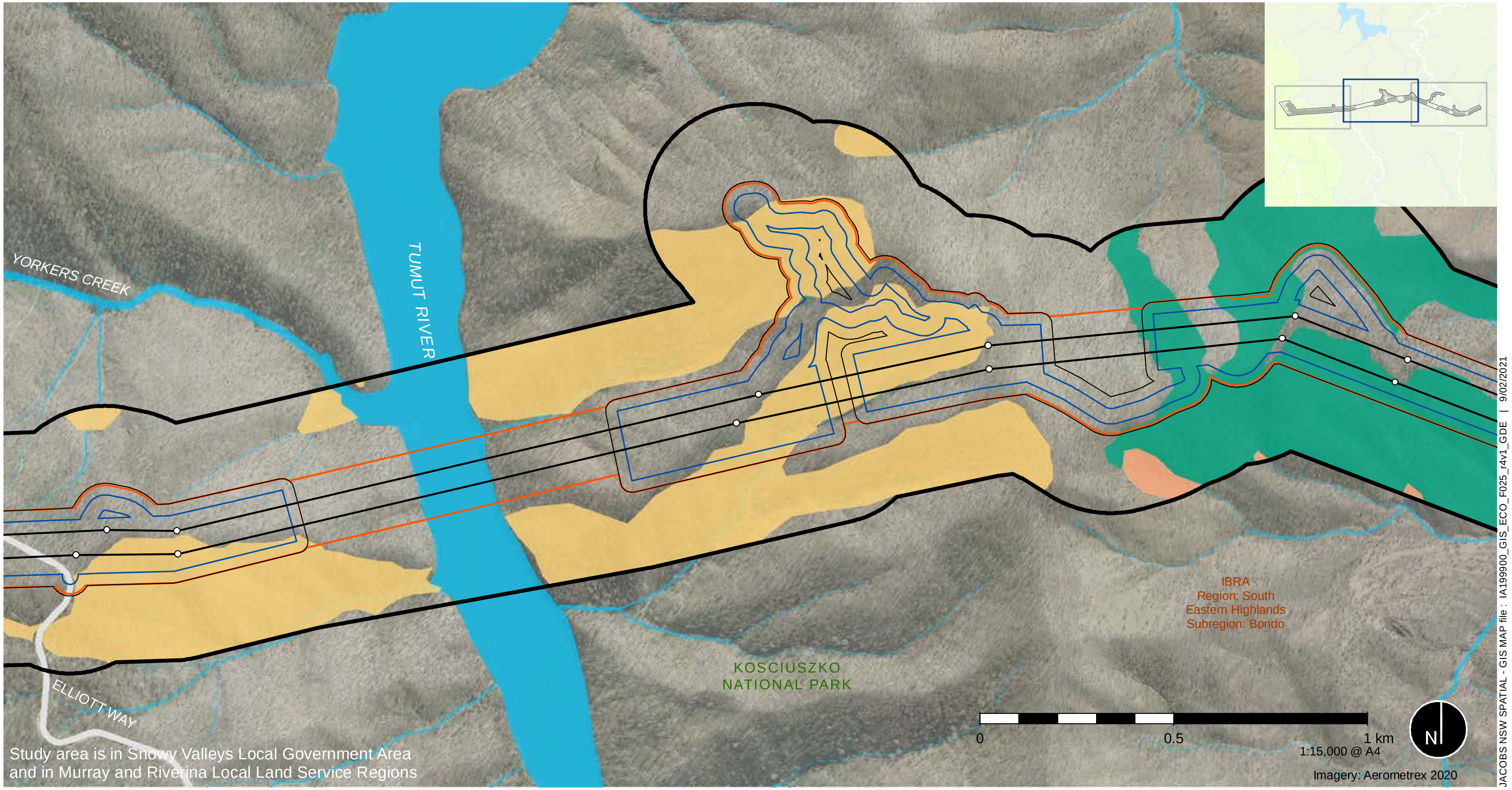
PCT 285: Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion

PCT 300: Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment

Electricity transmission line
Minor road
Major road
Waterway
IBRA
NPWS estate
State Forest

**Data sources:**
Jacobs 2020, DPE 2018,


**Figure 6-2** | Groundwater dependent ecosystems




Project area
Disturbance area
BDAR study area
Construction envelope
Proposed structure
Proposed transmission line

Likely facultative GDEs
PCT 296: Brittle Gum - peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion
PCT 300: Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment
PCT 302: Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion

Electricity transmission line
Major road
Waterway
NPWS estate

**Data sources:**
Jacobs 2020, DPE 2018,
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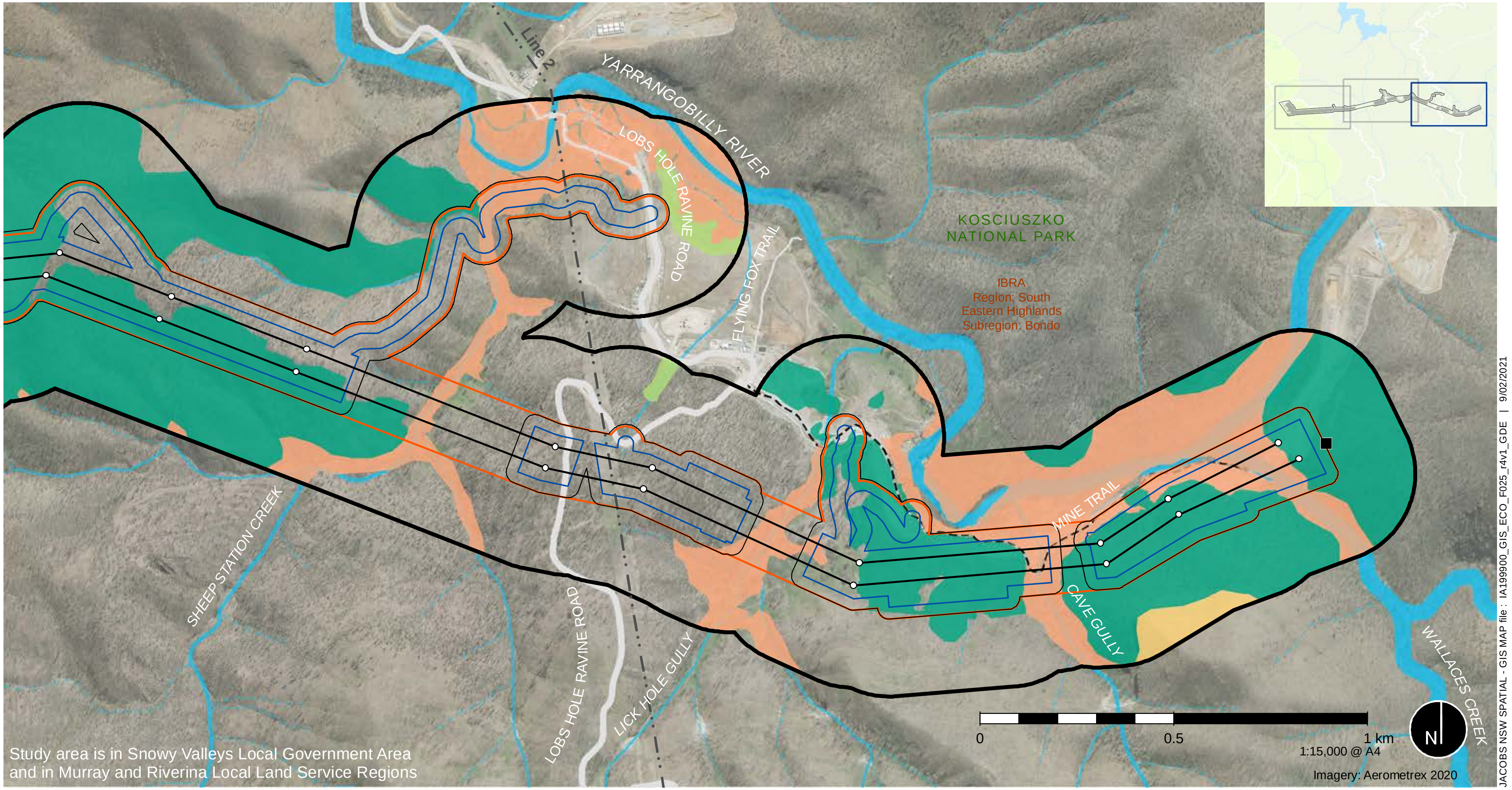
**Figure 6-2** | Groundwater dependent ecosystems




Project area
Disturbance area
BDAR study area
Construction envelope
Proposed structure
Proposed transmission line

Snowy 2.0 cable yard

Likely facultative GDEs

PCT 296: Brittle Gum - peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion

PCT 285: Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion

PCT 300: Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment

PCT 302: Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion

Electricity transmission line
Minor road
Major road
Trail
Waterway
NPWS estate

**Data sources:**
Jacobs 2020, DPE 2018,
© Department Finance, Services and Innovation 2018

**Figure 6-2** | Groundwater dependent ecosystems

# 7. Habitat suitability for threatened species

The BAM-C was used to derive the list of candidate species for this assessment, and the results were also supplemented with database searches, including a review of the Threatened Biodiversity Data Collection, to identify the threatened species that have been recorded by previous surveys or are considered likely to occur in the broader study area and construction envelope. The initial site visits undertaken in March and April 2018 also provided an opportunity to rapidly observe the types of habitats and the quality of the broad habitat types within the broader study area and surrounds.

This section provides a description of the habitat types within the construction envelope and broader study area and provides the results of the habitat suitability assessment for threatened species as outlined in Section 6 of the BAM. As the project is largely a linear type project (although some components such as the substation are better described as site based) that crosses two IBRA bioregions (South Eastern Highlands and the Australian Alps), separate habitat suitability assessments have been completed for each IBRA bioregion.

## 7.1 Habitat types

The broad habitat types identified within the construction envelope, along with the corresponding PCT, are outlined in **Table 7.1**. The area of these broad habitat types within the South Eastern Highlands and Australian Alps are identified individually. There were four broad habitat types identified within the construction envelope including:

- Upper Riverina Dry Sclerophyll Forests (see **Photo 7-1) –** this habitat is typically an open dry sclerophyll forest (shrub/grass sub-formation) with an open sclerophyllous shrub stratum and a patchy groundcover of grasses. This habitat occurs on the drier areas of undulating terrain or steep rocky slopes on soils of moderate fertility. The riparian vegetation along the Yarrangobilly River and tributaries also falls into this habitat type.
- Southern Tableland Dry Sclerophyll Forests (see **Photo 7-2**) **–** this habitat is an open dry sclerophyll forest (shrubby sub-formation) with a forest or woodland structure and an open to sparse sclerophyll shrub stratum and open groundcover of grasses. The forests are stunted on exposed stony hills and taller on deeper soils in undulating terrain. This habitat occurs on stony ridges and exposed slopes on infertile soils.
- Southern Tableland Wet Sclerophyll Forests (see **Photo 7-3**) **–** this habitat type is a wet sclerophyll forest (grassy sub-formation) with a tall open canopy and a variable density of shrubs (a mixture of sclerophyllous and mesophyllous species). There is a diverse, relatively continuous herbaceous-grassy groundcover. It occurs on sloping hills and valleys, and occasionally on the steeper slopes of gorges and scarps.
- Subalpine Woodlands (see **Photo 7-4**) **–** this habitat type is a grassy woodland with an open canopy. The understorey includes a variable sclerophyll shrub stratum and ground cover dominated by tussock grasses and a variety of herbs. This habitat type occurs at the higher elevations of 1000-1800 m in frost-hollows on the tablelands. This habitat receives moderate rainfall, frequent frosts and occasional snow.

**Figure 7-1** shows the location of the habitat types within the construction envelope and broader study area.

Table 7.1: Summary of broad habitat types within the construction envelope

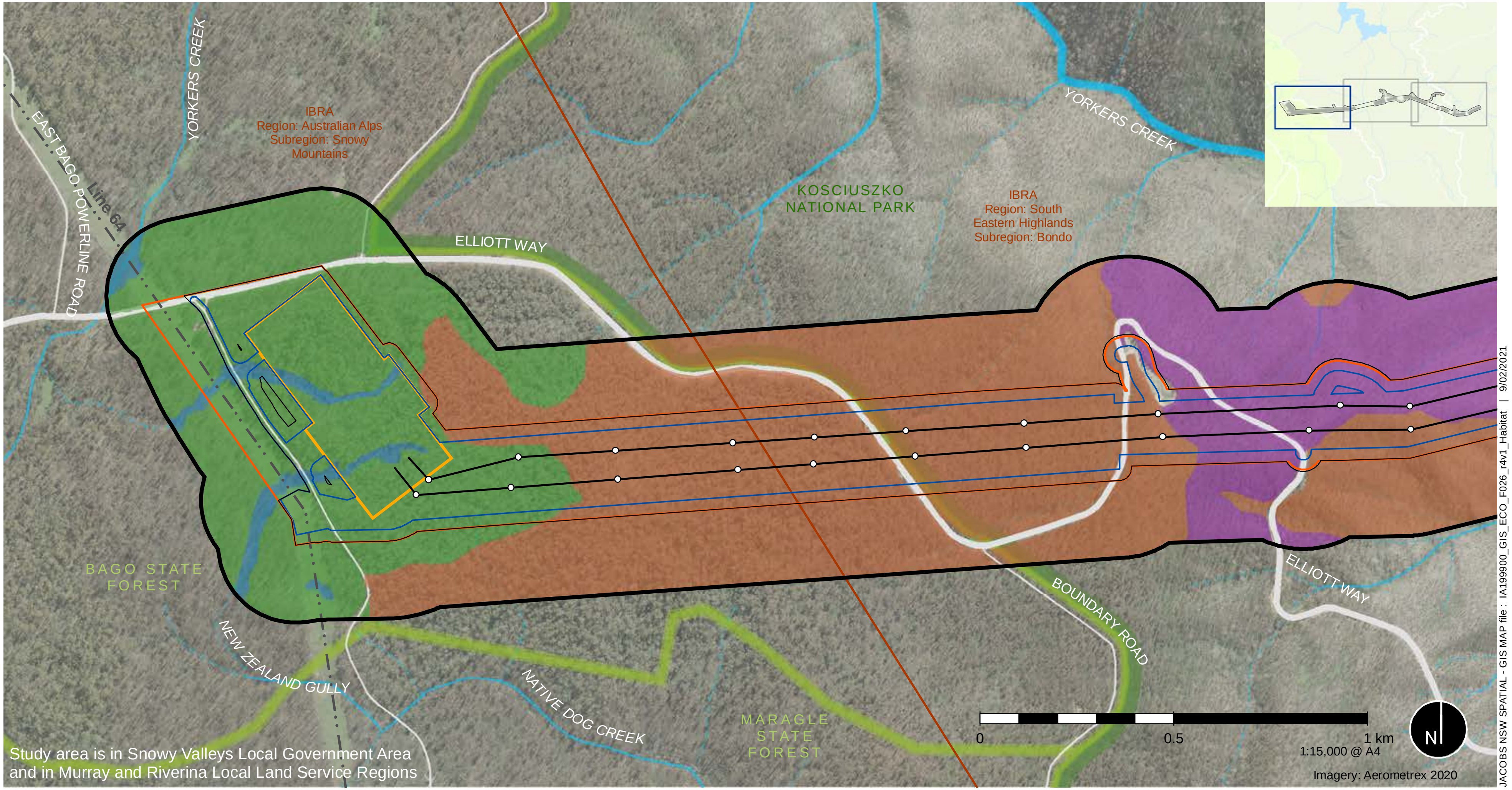
| PCT IDs | Vegetation formation (Keith 2004) | Vegetation class (Keith 2004) / habitat type | Area (ha) in construction envelope | |
|---|---|---|---|---|
| | | | South Eastern Highlands | Australian Alps |
| 285<br>302 | Dry Sclerophyll Forests (Shrub/grass sub-formation) | Upper Riverina Dry Sclerophyll Forests | 6.57 | 2.24 |
| 729<br>296<br>999 | Dry Sclerophyll Forests (Shrubby sub-formation) | Southern Tableland Dry Sclerophyll Forests | 102.24 | None |
| 300 | Wet Sclerophyll Forests (Grassy sub-formation) | Southern Tableland Wet Sclerophyll Forests | 47.63 | 15.14 |
| 1196 | Grassy Woodlands | Subalpine Woodlands | None | 31.23 |

Photo 7-1: An example of the Upper Riverina Dry Sclerophyll Forest habitat type within the broader study area along the Yarrangobilly River

Photo 7-2: An example of the Southern Tableland Dry Sclerophyll Forest habitat type within the construction envelope

Photo 7-3: An example of the Southern Tableland Wet Sclerophyll Forest habitat type within the construction envelope

Photo 7-4: An example of the Subalpine Woodland habitat type within the construction envelope in the Bago State Forest




Project area
Disturbance area
BDAR study area
Construction envelope
Proposed 500kV substation
Proposed structure
Proposed transmission line

Habitat type
Southern Tableland Dry Sclerophyll Forests
Southern Tableland Wet Sclerophyll Forests
Subalpine Woodlands
Upper Riverina Dry Sclerophyll Forests

Electricity transmission line
Minor road
Major road
Waterway
IBRA
NPWS estate
State Forest

**Data sources:**
Jacobs 2020, DPE 2018,
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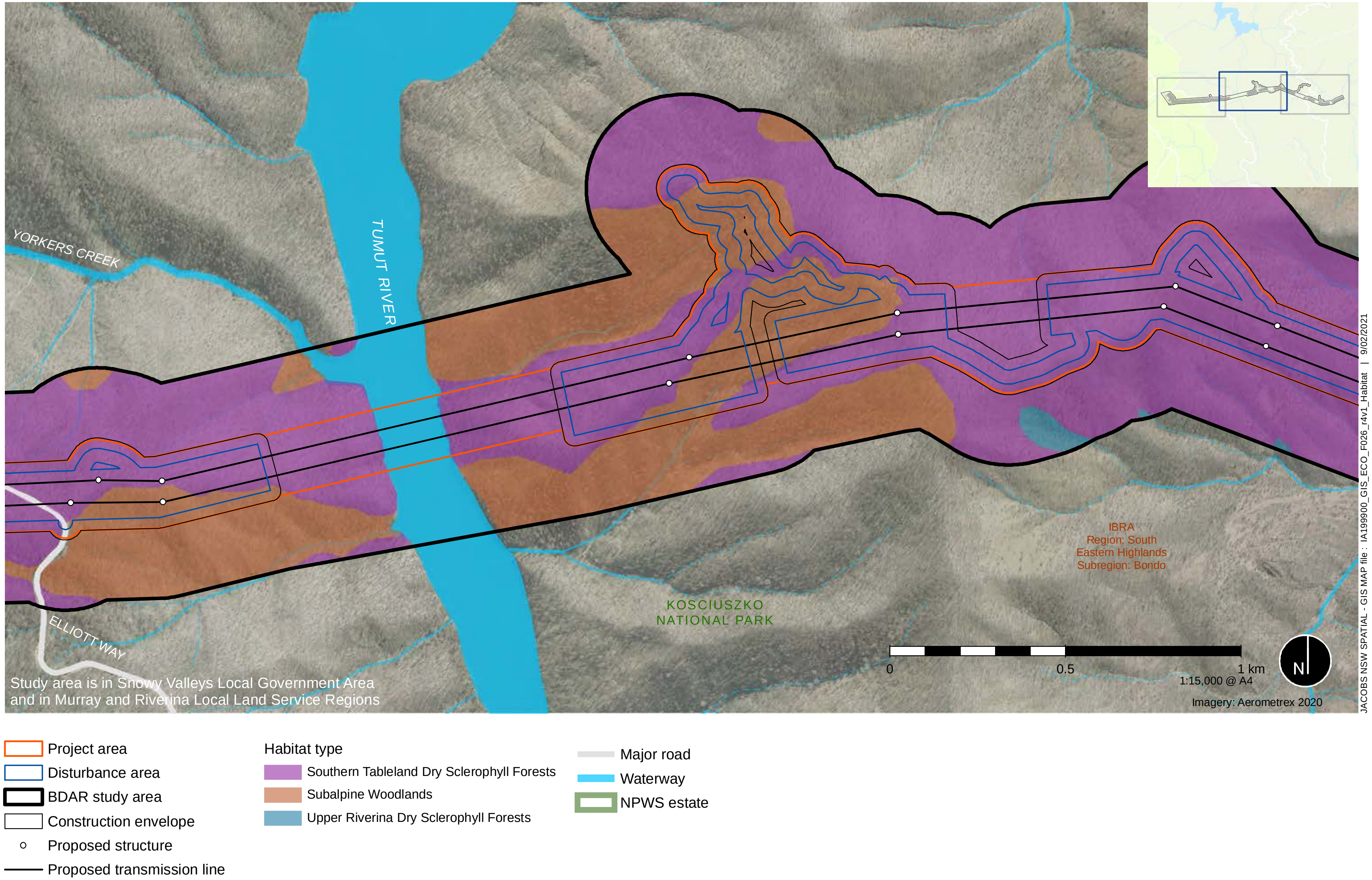
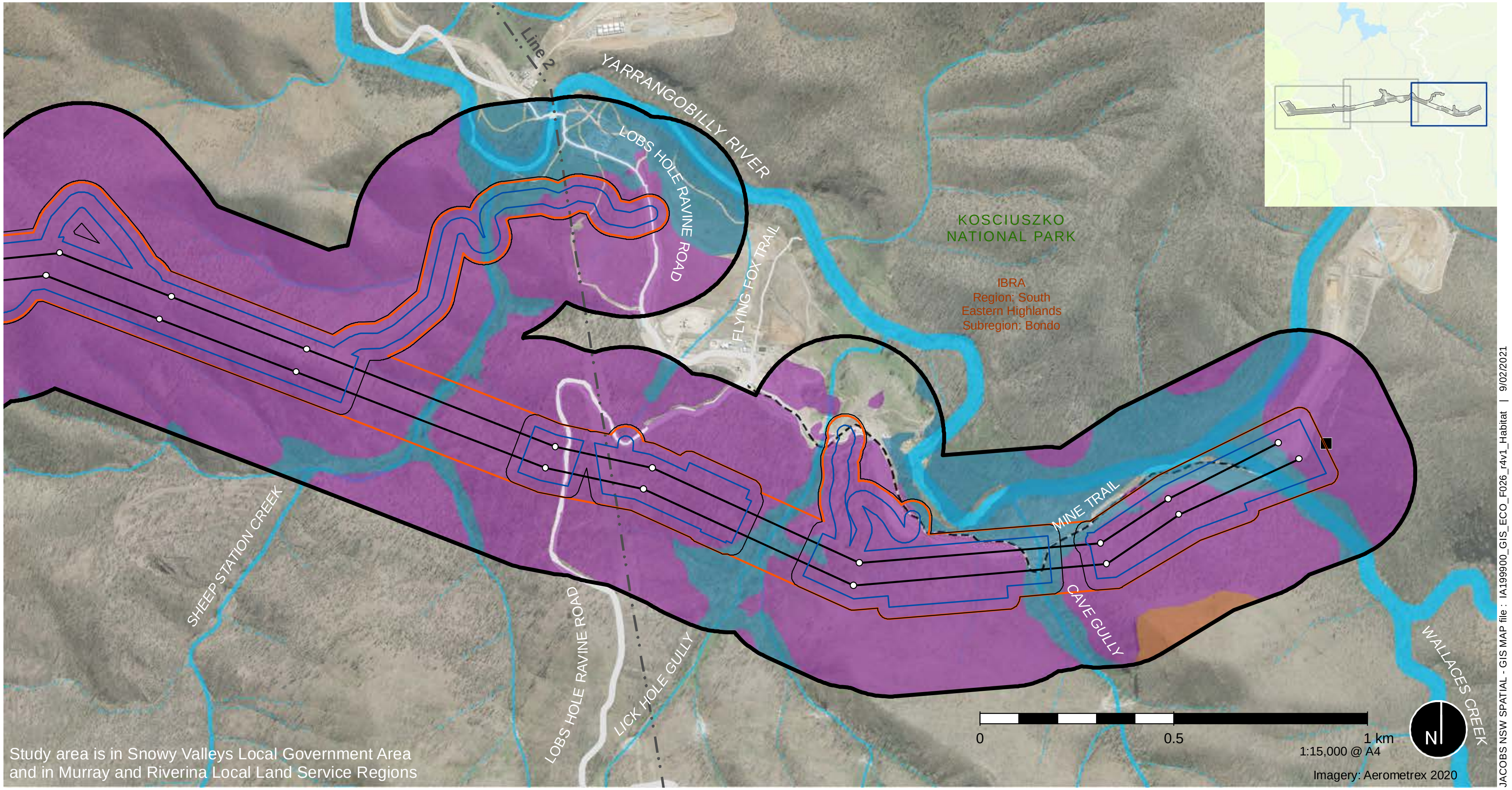
**Figure 7-1** | Broad habitat types within the study area




**Data sources:**
Jacobs 2020, DPE 2018,


**Figure 7-1** | Broad habitat types within the study area




Project area
Disturbance area
BDAR study area
Construction envelope
Proposed structure
Proposed transmission line

Snowy 2.0 cable yard

Habitat type
Southern Tableland Dry Sclerophyll Forests
Subalpine Woodlands
Upper Riverina Dry Sclerophyll Forests

Electricity transmission line
Minor road
Major road
Trail
Waterway
NPWS estate

**Data sources:**
Jacobs 2020, DPE 2018,
© Department Finance, Services and Innovation 2018

**Figure 7-1** | Broad habitat types within the study area

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

Ecosystem credit species are those threatened species where the likelihood of occurrence of a species or elements of the species' habitat can be predicted by vegetation surrogates and landscape features, or for which targeted survey has a low probability of detection. Ecosystem credit threatened species have been assessed in conjunction with information about site context (Section 4.3 and Subsection 5.3.2 of the BAM), PCTs and vegetation integrity attributes (Chapter 5 of the BAM), and data from the Threatened Biodiversity Data Collection (Section 6.1 of the BAM).

The BAM-C was used to generate a list of the predicted threatened species that met the criteria outlined in Section 6.4.1.3 of the BAM. Two BAM-Cs were used, one for the South Eastern Highlands Bioregion and for the Australian Alps Bioregion to ensure all species were captured appropriately in the assessment. In addition to the output from the BAM-C, data from the surveys undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a) was reviewed and the results were used to inform the candidate species list. The recent surveys undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs provide a more up to date view of the species that are known to be present in the subject site and which species are likely to occur. The results of the BioNet search and the Commonwealth Department of Environment's Protected Matters Search Tool search were also used to inform development of the species list.

The initial list of predicted ecosystem credit species is provided in **Table 7.2**. The full threatened species habitat suitability assessment is provided in Appendix A. Once the initial list of predicted ecosystem credit species was generated, the geographic limitations of each species (where applicable) were examined to see if they were met. Geographic limitations usually relate to altitude or topographic features and different geographic limitations can be described for different IBRA bioregion and subregions across a species' distribution (hence the importance of running two BAM-C case studies for this BDAR). Where the construction envelope is not within the geographic limitation described for a species, the species was removed from the predicted list of threatened species and no further assessment was undertaken.

In accordance with Paragraphs 6.4.1.9 – 6.4.1.16 (Step 2) of the BAM, an onsite assessment was undertaken to determine the presence of any habitat constraints or microhabitats for the threatened species predicted to occur in the construction envelope. Some species do not have any identified habitat constraints, in which case this step was not undertaken. The only ecosystem credit species with a habitat constraint applicable to this assessment is the Yellow-bellied Glider. The Yellow-bellied Glider requires the habitat to contain hollow bearing trees, and the hollows need to be >25cm in diameter. The habitats within the construction envelope in the South Eastern Highlands and Australian Alps Bioregions contain these features so the Yellow-bellied Glider required assessment as an ecosystem credit species except in zones that lack hollow bearing trees.

The justification for including or excluding ecosystem credit species from the assessment is provided in **Table 7.2**

Under the BAM, targeted survey is not required for ecosystem credit species. However, in some circumstances, the Threatened Biodiversity Data Collection may identify that a species requires assessment for ecosystem credits and species credits (a dual credit species). This occurs where part of the habitat is assessed as a species credit (e.g. breeding habitat, or mapped locations identified as important area that is used by a species). The remaining part of the habitat is assessed as an ecosystem credit (e.g. foraging habitat, unmapped locations used by a species). Therefore, some species are listed in both **Table 7.2** and **Table 7.3** as an ecosystem credit species and a species credit species.

Table 7.2: Summary of predicted ecosystem credit species that were assessed

| Species name | Common name | EPBC Act | BC & FM Act | South Eastern Highlands | Australian Alps | Justification for inclusion / exclusion | Sensitivity to gain class |
|---|---|---|---|---|---|---|---|
| **Birds** | | | | | | | |
| *Artamus cyanopterus cyanopterus* | Dusky Woodswallow | - | V | ✓ | ✓ | Included in all zones | Moderate |
| *Callocephalon fimbriatum* | Gang-gang Cockatoo (foraging) | - | V | ✓ | ✓ | Included in all zones | Moderate |
| *Chthonicola sagittate* | Speckled Warbler | - | V | ✓ | x | Included in all zones | High |
| *Climacteris picumnus victoriae* | Brown Treecreeper (eastern subspecies) | - | V | ✓ | x | Included in all zones | High |
| *Daphoenositta chrysoptera* | Varied Sittella | - | V | ✓ | ✓ | Included in all zones | Moderate |
| *Haliaeetus leucogaster* | White-bellied Sea-Eagle (foraging) | M | V | ✓ | ✓ | Excluded from all zones except those associated with PCT 302 along the Yarrangobilly River. | High |
| *Hieraaetus morphnoides* | Little Eagle (foraging) | - | V | ✓ | ✓ | Included in all zones | Moderate |
| *Lophoictinia isura* | Square-tailed Kite (foraging) | - | V | ✓ | x | Included in all zones | Moderate |
| *Melanodryas cucullata cucullata* | Hooded Robin (south-eastern form) | - | V | ✓ | x | Included in all zones | Moderate |
| *Ninox connivens* | Barking Owl (foraging) | - | V | ✓ | x | Included in all zones | High |
| *Ninox strenua* | Powerful Owl (foraging) | - | V | ✓ | ✓ | Included in all zones | High |
| *Pachycephala olivacea* | Olive Whistler | - | V | ✓ | ✓ | Included in all zones. | Moderate |
| *Petroica boodang* | Scarlet Robin | - | V | ✓ | ✓ | Included in all zones | Moderate |
| *Petroica phoenicea* | Flame Robin | - | V | ✓ | ✓ | Included in all zones | Moderate |
| *Stagonopleura guttata* | Diamond Firetail | - | V | ✓ | ✓ | Included in all zones | Moderate |
| *Tyto novaehollandiae* | Masked Owl (foraging) | - | V | ✓ | x | Included in all zones | High |

| Species name | Common name | EPBC Act | BC & FM Act | South Eastern Highlands | Australian Alps | Justification for inclusion / exclusion | Sensitivity to gain class |
|---|---|---|---|---|---|---|---|
| **Mammals** | | | | | | | |
| *Dasyurus maculatus* | Spotted-tailed Quoll | E | V | ✓ | ✓ | Included in all zones | High |
| *Falsistrellus tasmaniensis* | Eastern False Pipistrelle | - | V | ✓ | ✓ | Included in all zones | High |
| *Miniopterus orianae oceanensis* | Large Bent-winged Bat (foraging) | - | V | ✓ | ✓ | Included in all zones | High |
| *Petaurus australis* | Yellow-bellied Glider | - | V | ✓ | ✓ | Excluded from native grassland and regrowth shrubland zones as this species would not occur in this habitat in its current condition | High |
| *Phascolarctos cinereus* | Koala (foraging) | V | V | ✓ | ✓ | Excluded from native grassland and regrowth shrubland zones as this species would not occur in this habitat in its current condition | High |
| **Reptiles** | | | | | | | |
| *Varanus rosenbergi* | Rosenberg's Goanna, Heath Monitor | - | V | ✓ | ✓ | Included in all zones | High |

Key: CE = critically endangered, E = endangered, V = vulnerable, M = migratory

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

Habitat suitability is identified as the degree to which the habitat needs of threatened species are present at a particular site. Species credit species have been assessed in conjunction with information collected about the site context of the construction envelope (Section 4.3 of the BAM), on PCTs and vegetation integrity attributes in (Section 5 of the BAM), and data obtained from the Threatened Biodiversity Data Collection (Section 6.1 of the BAM).

Threatened species for which the likelihood of occurrence of the species, or elements of suitable habitat for the species, cannot be confidently predicted by vegetation surrogates, and landscape features and which can be reliably detected by survey, are identified in the Threatened Biodiversity Data Collection as species credit species. Based on the assessment of habitat in the construction envelope, and review of databases, published information, and work undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a), the following species credit species as outlined in **Table 7.3** are considered 'candidate species' for the assessment. The full threatened species habitat suitability assessment is provided in **Appendix A**.

Table 7.3: Summary of candidate species credit species returned by the BAM-C

| Species name | Common name | EPBC Act | BC & FM Act | South Eastern Highlands | Australian Alps | Sensitivity to gain class |
|---|---|---|---|---|---|---|
| **Plants** | | | | | | |
| *Caladenia montana* | Caladenia montana | - | V | x | ✓ | Moderate |
| *Calotis glandulosa* | Mauve Burr Daisy | V | V | x | ✓ | High |
| *Pomaderris cotoneaster* | Cotoneaster Pomaderris | E | E | ✓ | x | High |
| *Prasophyllum bagoense* | Prasophyllum bagoense | CE | CE | x | ✓ | Very High |
| *Prasophyllum keltonii* | Kelton's Leek Orchid | CE | CE | x | ✓ | Very High |
| *Pterostylis alpina* | Pterostylis alpina | - | V | x | ✓ | High |
| *Pterostylis foliata* | Slender Greenhood | - | V | x | ✓ | High |
| *Thelymitra atronitida* | Black-hooded Sun Orchid | - | CE | x | ✓ | N/A |
| *Thesium australe* | Austral Toadflax | V | V | x | ✓ | Moderate |
| **Birds** | | | | | | |
| *Callocephalon fimbriatum* | Gang-gang Cockatoo (breeding) | - | V | x | ✓ | High |
| *Haliaeetus leucogaster* | White-bellied Sea-Eagle (breeding) | M | V | ✓ | ✓ | High |
| *Hieraaetus morphnoides* | Little Eagle (breeding) | - | V | ✓ | ✓ | Moderate |
| *Lophoictinia isura* | Square-tailed Kite (breeding) | - | V | ✓ | x | Moderate |
| *Ninox connivens* | Barking Owl (breeding) | - | V | ✓ | x | High |
| *Ninox strenua* | Powerful Owl (breeding) | - | V | ✓ | ✓ | High |
| *Petroica rodinogaster* | Pink Robin | - | V | ✓ | ✓ | High |
| *Tyto novaehollandiae* | Masked Owl (breeding) | - | V | ✓ | x | High |
| **Frogs** | | | | | | |
| *Litoria booroolongensis* | Booroolong Frog | E | E | ✓ | x | High |
| *Litoria spenceri* | Spotted Tree Frog | E | CE | ✓ | ✓ | Very High |
| *Litoria verreauxii alpina* | Alpine Tree Frog | V | E | x | ✓ | High |
| *Pseudophryne corroboree* | Southern Corroboree Frog | CE | CE | x | ✓ | Very High |
| *Pseudophryne pengilleyi* | Northern Corroboree Frog | CE | CE | x | ✓ | Very High |

| Species name | Common name | EPBC Act | BC & FM Act | South Eastern Highlands | Australian Alps | Sensitivity to gain class |
|---|---|---|---|---|---|---|
| **Mammals** | | | | | | |
| *Cercartetus nanus* | Eastern Pygmy-possum | - | V | ✓ | ✓ | High |
| *Miniopterus orianae oceanensis* | Large Bent-winged Bat (breeding) | - | V | ✓ | ✓ | Very High |
| *Petaurus norfolcensis* | Squirrel Glider | - | V | ✓ | ✓ | High |
| *Phascogale tapoatafa* | Brush-tailed Phascogale | - | V | ✓ | x | High |
| *Phascolarctos cinereus* | Koala (breeding) | V | V | ✓ | ✓ | High |
| *Pseudomys fumeus* | Smoky Mouse | E | CE | x | ✓ | High |
| **Reptiles** | | | | | | |
| *Cyclodomorphus praealtus* | Alpine She-oak Skink | E | E | x | ✓ | High |
| *Liopholis guthega* | Guthega Skink | E | E | x | ✓ | High |

Key: CE = critically endangered, E = endangered, V = vulnerable, M = migratory

### 7.3.1 Identifying geographic and habitat constraints

Once the initial list of predicted candidate species credit species was generated, the geographic limitations of each species (where applicable) were examined to see if they were met. Where the construction envelope is not within the geographic limitation described for a species, the species was removed from the predicted list of threatened species and no further assessment was undertaken. In accordance with Paragraphs 6.4.1.9 – 6.4.1.16 (Step 2) of the BAM, an onsite assessment was undertaken to determine the presence of any habitat constraints or microhabitats for the threatened species predicted to occur on the construction envelope. Some species do not have any identified habitat constraints, in which case this step was not undertaken. The species included or excluded based on geographic or habitat constraints listed in the BAM-C are outlined below in **Table 7.4.** Justification for exclusion of these species based on this information is provided in **Section 7.3.2**.

Table 7.4: Summary of candidate species credit species with geographic or habitat constraints

| Species name | Common name | EPBC Act* | BC Act* | South Eastern Highlands | Australian Alps | Sensitivity to gain class | Habitat constraint | Geographic limitation* | Included or excluded? |
|---|---|---|---|---|---|---|---|---|---|
| **Plants** | | | | | | | | | |
| *Calotis glandulosa* | Mauve Burr Daisy | V | V | x | ✓ | High | - | North of Eucumbene – Yes | Included |
| *Pomaderris cotoneaster* | Cotoneaster Pomaderris | E | E | ✓ | x | High | - | South of the northern Kosciuszko NP boundary – Yes | Included |

| Species name | Common name | EPBC Act* | BC Act* | South Eastern Highlands | Australian Alps | Sensitivity to gain class | Habitat constraint | Geographic limitation* | Included or excluded? |
|---|---|---|---|---|---|---|---|---|---|
| **Birds** | | | | | | | | | |
| *Callocephalon fimbriatum* | Gang-gang Cockatoo (breeding) | - | V | X | ✓ | High | Hollow bearing trees - yes<br>Eucalypt tree species with hollows greater than 9 cm diameter – Yes | - | Included |
| *Haliaeetus leucogaster* | White-bellied Sea-Eagle (breeding) | M | V | ✓ | ✓ | High | Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines – Yes | - | Included |
| *Hieraaetus morphnoides* | Little Eagle (breeding) | - | V | ✓ | ✓ | Moderate | Nest trees - live (occasionally dead) large old trees within vegetation) – Yes | - | Included |
| *Ninox strenua* | Powerful Owl (breeding) | - | V | ✓ | ✓ | High | Hollow bearing trees - yes<br>Living or dead trees with hollow greater than 20cm diameter – Yes | - | Included |
| **Frogs** | | | | | | | | | |
| *Litoria spenceri* | Spotted Tree Frog | CE | CE | ✓ | ✓ | Very High | Waterbodies - yes<br>River environment with rocky habitat or within 500 m of a rocky river – Yes | - | Excluded – refer to **Section 7.3.2** |

| Species name | Common name | EPBC Act* | BC Act* | South Eastern Highlands | Australian Alps | Sensitivity to gain class | Habitat constraint | Geographic limitation* | Included or excluded? |
|---|---|---|---|---|---|---|---|---|---|
| *Litoria verreauxii alpina* | Alpine Tree Frog | V | E | x | ✓ | High | - | Above 1,000 m asl – Yes | Included |
| *Pseudophryne corroboree* | Southern Corroboree Frog | CE | CE | x | ✓ | Very High | Swamps - no<br>Within 200 m of high montane sub-alpine bog or ephemeral pool environments – No | Above 1,000 m asl – Yes | Excluded – refer to **Section 7.3.2** |
| *Pseudophryne pengilleyi* | Northern Corroboree Frog | CE | CE | x | ✓ | Very High | - | Above 700 m asl – Yes | Excluded – refer to **Section 7.3.2** |
| **Mammals** | | | | | | | | | |
| *Miniopterus orianae oceanensis* | Large Bent-winged Bat (breeding) | - | V | ✓ | ✓ | Very High | Caves - no<br>Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding including species records with microhabitat code "IC - in cave – no<br>Observation type code "E nest-roost – No<br>With numbers of individuals >500 - no | - | Included |
| *Phascogale tapoatafa* | Brush-tailed Phascogale | - | V | ✓ | x | High | Hollow bearing trees – Yes | - | Included |
| *Phascolarctos cinereus* | Koala (breeding) | V | V | ✓ | ✓ | High | Areas identified via survey as important habitat (see comments) – No | - | Included |

| Species name | Common name | EPBC Act* | BC Act* | South Eastern Highlands | Australian Alps | Sensitivity to gain class | Habitat constraint | Geographic limitation* | Included or excluded? |
|---|---|---|---|---|---|---|---|---|---|
| **Reptiles** | | | | | | | | | |
| *Liopholis guthega* | Guthega Skink | E | E | x | ✓ | High | Granite substrate and decomposing granite soils - yes<br>Rocky areas including sub-surface boulders – Yes | - | Excluded – refer to **Section 7.3.2** |

*Key: CE = critically endangered, E = endangered, EP = endangered population, V = vulnerable, asl = above sea level

### 7.3.2 Candidate species removed from the assessment

#### 7.3.2.1 *Prasophyllum bagoense* and *Prasophyllum keltonii*

*Prasophyllum bagoense* and *Prasophyllum keltonii* were removed from the assessment as the construction envelope does not provide suitable habitat for these two species. These orchid species are only known from the McPhersons Plain area to the west of the construction envelope. Reference sites in the Bago State Forest where known populations of *Prasophyllum bagoense* and *Prasophyllum keltonii* exist were visited during the December 2018 survey period with Geoff Robertson, EESG Senior Threatened Species Officer, to gain a better understanding of the habitats of these species. *Prasophyllum bagoense* and *Prasophyllum keltonii* were flowering during the December 2018 survey period. These two species have a highly restricted distribution and specific habitat preferences and no alpine or sub-alpine peatlands, damp herbfields and fens, or alpine grassland/herbfield and open heathlands are present in the construction envelope. The construction envelope is covered in dense forest habitat, so these two species were removed from the assessment.

#### 7.3.2.2 Spotted Tree Frog

The Spotted Tree Frog (*Litoria spenceri*) has two identified habitat constraints: waterbodies, and river environment with rocky habitat or within 500 m of a rocky river. These habitat constraints are met in the South Eastern Highlands portion of the construction envelope due to the presence of the Yarrangobilly River nearby. However, there are no suitable waterbodies or rocky river environments in the Australian Alps portion of the construction envelope, so the Spotted Tree Frog was not included as a candidate species in this portion of the construction envelope. Only two populations of the Spotted Tree Frog have been identified in New South Wales and these populations are located at Bogong Creek and in the upper Murray River, both within KNP and there is no evidence to suggest that the Spotted Tree Frog was more widely distributed in the past (NSW National Parks & Wildlife Service, 2001). These populations are not within or near the construction envelope and will not be impacted by the project. As such, the Spotted Tree Frog was removed from consideration as a species credit species and the Spotted Tree Frog has not been assessed.

#### 7.3.2.3 Southern Corroboree Frog and Northern Corroboree Frog

Two other threatened frog species returned by the BAM-C for the Australian Alps portion of the construction envelope were the Southern Corroboree Frog (*Pseudophryne corroboree*) and the Northern Corroboree Frog (*Pseudophryne pengilleyi*). The Southern Corroboree Frog has a habitat constraint of swamps and being within 200 m of high montane sub-alpine bog or ephemeral pool environments. Both habitat constraints are not met in the construction envelope. The Southern Corroboree Frog also has the geographic limitation of above 1,000 m asl and the Northern Corroboree Frog has the geographic limitation of above 700 m asl which are met in the Australian Alps portion of the construction envelope. However, the remaining habitats of the

Southern Corroboree Frog and the Northern Corroboree Frog are very well known, and the construction envelope is not located near the habitats of either species. As such, the Southern Corroboree Frog and the Northern Corroboree Frog was removed from consideration as species credit species and they have not been assessed.

##### 7.3.2.4 Alpine She-oak Skink

The Alpine She-oak Skink (*Cyclodomorphus praealtus*) is restricted to sub-alpine and alpine grasslands and in NSW it has only been observed within KNP between Smiggin Holes and Kiandra. The Alpine She-oak Skink has very specific habitat requirements, preferring tree-less or very lightly treed areas that contain tussock grasses, low heath or a combination of both (i.e. alpine to sub-alpine grasslands or heath). The construction envelope does not contain any alpine to sub-alpine grasslands or heath and therefore is not considered to provide suitable habitat for the Alpine She-oak Skink. This species was removed from the assessment based on the absence of suitable habitat from the construction envelope.

##### 7.3.2.5 Guthega Skink

The Guthega Skink (*Liopholis guthega*) has the habitat constraint of granite substrate and decomposing granite soils, and rocky areas including sub-surface boulders. The Australian Alps portion of the construction envelope contains granodiorite substrate and some rocky areas including sub-surface boulders. However, the Guthega Skink is restricted to locations above 1,600 m asl in the Australian Alps, near Mt Kosciuszko, NSW, and the Bogong High Plains, Victoria. The construction envelope is well below this altitude with the highest point in the Australian Alps portion of the construction envelope being 1,190 m asl. The habitat for the Guthega Skink within NSW appears to be very restricted and not present in the construction envelope so this species was removed from the assessment.

#### 7.3.3 Candidate species added to the assessment

##### 7.3.3.1 Yellow-bellied Glider population on the Bago Plateau

The *Petaurus australis* – endangered population (Yellow-bellied Glider population on the Bago Plateau) was not returned from the BAM-C despite the western portion of the construction envelope being in the Bago State Forest. The Yellow-bellied Glider population on the Bago Plateau was added to the assessment for the Australian Alps portion of the construction envelope.

##### 7.3.3.2 Southern Myotis

Southern Myotis was included in the assessment as there are records of this species from the Tumut River (2010 and 2014) and the Yarrangobilly River and surrounding vegetation may provide suitable habitat for this species. The absence of other Southern Myotis records in the locality is more than likely due to lack of survey effort rather than actual absence. The Southern Myotis was added to the assessment for the South Eastern Highlands portion of the construction envelope. Suitable habitat for the Southern Myotis is identified as the range of PCTs associated with the species (as per the TBDC) within 200 m of any medium to large permanent creeks, rivers, lakes or other waterways (i.e. with pools/ stretches 3 m or wider) (Office of Environment and Heritage, 2018). The Southern Myotis was added to the assessment for the South Eastern Highlands portion of the construction envelope.

##### 7.3.3.3 Thelymitra alpicola

In the Threatened Species Profile Database, *Thelymitra alpicola* (Alpine Sun Orchid) is identified as associated with the Montane wet heath and bog of the eastern tablelands, South Eastern Highlands Bioregion (PCT 939). There are no areas of PCT 939 within the construction envelope. However, there are areas of potentially suitable habitat at the ecotone of PCT 285 and PCT 1196 within the Australian Alps portion of the construction envelope. There is no suitable habitat for this species in the South Eastern Highlands portion of the construction envelope.

A reference site for *Thelymitra alpicola* in the Bago State Forest was visited with Geoff Robertson, EESG Senior Threatened Species Officer, in December 2018 and the habitat in this location is similar to that which occurs along New Zealand Gully and the other unnamed watercourse in the west of the construction envelope. Potential habitat for this species is also present along Yorkers Creek to the north of the construction envelope. As the range of habitat types for *Thelymitra alpicola* is not fully known, this species has been included in the Australian Alps assessment as a precautionary measure.

#### 7.3.3.4 Pterostylis oreophila

In New South Wales, the *Pterostylis oreophila* (Blue-tongued Greenhood) is known from a few small populations within KNP and a population of about 40 plants (possibly now extinct) in Bago State Forest and adjoining Crown Leases south of Tumut. This species grows along sub-alpine watercourses under more open thickets of Mountain Tea-tree in muddy ground very close to water and less commonly grows in peaty soils and sphagnum mounds.

*Pterostylis oreophila* is associated with Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion (PCT 637), Montane wet heath and bog of the eastern tablelands, South Eastern Highlands Bioregion (PCT 939) and water bodies, rivers, lakes, streams (not wetlands). There may be potential habitat for this species in the western sub-alpine parts of the construction envelope near watercourses where thickets of Tea-tree occur such as along New Zealand Gully where PCT 285 is present. This species was raised as a candidate species during consultation with EESG Senior Threatened Species Officer Geoff Robertson and has been included as a candidate species for assessment as a precautionary measure. However, this species was not able to be added to the Australian Alps Bioregion BAM-C case as it does not appear in the search list. For the purpose of assessment, this species was initially targeted during field surveys.

#### 7.3.3.5 Sooty Owl

Sooty Owl was not identified by either BAM-C and this species is not associated with any of the PCTs within the project study area. The Sooty Owl is primarily known from dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. The study area likely does not contain high-quality habitat for this species, however there is one record within 10 km of the project, from the Entrance to Glory Hole Cave at the Yarrangobilly Cave in 2011. The validity of this record is unknown, however there are several caves within 500 m of the study area and therefore the Sooty Owl may occur on occasion. As a precautionary measure, this species was added to the assessment and targeted during owl surveys.

### 7.3.4 Other species of special consideration

#### 7.3.4.1 Thelymitra atronitida

*Thelymitra atronitida* (Black-hooded Sun Orchid) is known to occur in the Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion (PCT 1196). PCT 1196 occurs in the western Australian Alps portion of the construction envelope. There is some taxonomic confusion surrounding *Thelymitra atronitida* within NSW. The Bago State Forest population falls within the circumscription of *Thelymitra atronitida* in a critical revision of the *Thelymitra pauciflora* complex by Jeanes (2004) but there is a possibility that the Bago State Forest population may on further research be found to be taxonomically distinct (NSW Threatened Species Scientific Committee, 2011) and the plants collected within the Bago State Forest may have been misidentified. The determination to list *Thelymitra atronitida* as a critically endangered species is made on the basis of the Cape Solander and Bago State Forest populations being conspecific (belonging to the same species) (NSW Threatened Species Scientific Committee, 2011). An expert report has been commissioned for this species (see **Appendix F**). The report by Belinda Pellow (AMBS Ecology) concludes that the Bago population of *Thelymitra atronitida* may be an incorrect identification (and may be common species *Thelymitra pauciflora*).

#### 7.3.4.2 Greater Glider

The Greater Glider is known to occur in the Bago State Forest. Suitable habitat is likely widespread in the construction envelope west of the Tumut River in the tall wet forests, particularly PCT 300. PCT 1196 is also likely to provide suitable habitat for the Greater Glider. The Greater Glider is listed as a Vulnerable species under the Commonwealth EPBC Act but is not listed as a threatened species under the BC Act. As such, this species has been assessed in this BDAR but cannot be added to the BAM-C. This species is further discussed in **Section 7.4.2.15**.

## 7.4 Threatened species survey results

### 7.4.1 Threatened plant species

No threatened plant species were recorded during the surveys. Each of the target species is discussed below.

#### 7.4.1.1 Terrestrial orchids

Surveys for the candidate threatened terrestrial orchid species were undertaken in suitable habitats throughout the 2018, 2019 and 2020 survey periods:

- *Caladenia montana*
- *Pterostylis alpina*
- *Pterostylis foliata*
- *Pterostylis oreophila*
- *Thelymitra alpicola*
- *Thelymitra atronitida.*

None of these species were identified within the construction envelope from a series of systematic targeted surveys undertaken for this BDAR (refer to **Section 4.8.1** for survey details).

The spring and summer 2018 / 2019 survey period occurred at a time of relatively widespread dry environmental conditions across NSW. Below average rainfall was recorded throughout the region in 2018 and many species of terrestrial orchids flower poorly in dry years. The below average rainfall in the region likely had a negative influence on the detectability of terrestrial orchids during the survey period. As such, comprehensive orchid surveys were not conducted. However, areas of broadly suitable habitat were identified based on the presence of more common congeneric orchid species. *Caladenia carnea, Caladenia alpina, Caladenia gracilis* and *Caladenia congesta* were recorded throughout PCT 1196 and PCT 300 during the November 2018 surveys, suggesting that the habitat is broadly suitable for species of *Caladenia*. It was assumed that PCT 1196 and PCT 300 may provide suitable habitat for *Caladenia montana* however surveys did not identify this species. Similarly, species of *Pterostylis* orchids including *Pterostylis monticola, Pterostylis longifolia, Pterostylis nutans* and *Pterostylis decurva* were found to be common throughout PCT 1196, PCT 285 and PCT 300 during this survey period. *Pterostylis alpina* and *Pterostylis foliata* were not recorded.

*Thelymitra megcalyptra* and *Thelymitra alpina* (common species) were frequently recorded throughout PCT 1196, PCT 300, PCT 729 and PCT 296 during November 2018. Samples were taken and confirmation of identification for these species was provided by botanists at the Royal Botanic Gardens. *Thelymitra juncifolia* (also a common species) was recorded at the edge of PCT 285 within the Line 64 easement. No evidence of threatened *Thelymitra atronitida* was observed. There is taxonomic uncertainty surrounding the plants identified as *Thelymitra atronitida* in the Bago State Forest and an expert report has been commissioned for this species (see **Appendix F**). The report by Belinda Pellow (AMBS Ecology) concludes that the Bago population of *Thelymitra atronitida* may be an incorrect identification (and may be common species *Thelymitra pauciflora*).

To address sub-optimal conditions in the 2018 surveys, further systematic surveys were targeted in the 2019 flowering period (October, November and December). These covered large areas of the construction envelope targeting suitable habitats outlined above. Conditions were favourable for the target species for the 2019 survey, with preceding rainfall events, as determined by the presence of high numbers and a wide diversity of common orchid species in flower. Common species recorded included *Chiloglottis valida, Corybas* sp., *Diuris sulphurea, Thelymitra alpina*, *Caladenia alpina, Caladenia carnea, Pterostylis nutans, Pterostylis longifolia and Pterostylis monticola.* Ecologists recorded a large number of orchid plants and over 600 locations containing orchid colonies or individual orchid plants were mapped in the construction envelope (suggesting conditions for orchid germination were sufficient during surveys).

Flowering *Pterostylis* orchids which closely resembled the threatened species *Pterostylis alpina* were found within PCT 1196, within the construction envelope. A sample was taken to the National Herbarium in Canberra. The herbarium identified this species to be *Pterostylis monticola* (common species). Again, *Pterostylis foliata* was not recorded.

*Pterostylis oreophila* and *Thelymitra alpicola* were not recorded despite targeted surveys within suitable habitats (within areas of PCT 1196 Snow Gum and PCT 285 Broad-leaved Sally). Sub-alpine watercourses (containing thickets of Mountain Tea-tree) along New Zealand Gully and various unnamed watercourses in Bago State Forest and KNP were thoroughly searched (As shown in **Figure 4-2**).

Reference sites for *Pterostylis foliata* and *Pterostylis alpina,* in Bago State Forest, were also checked, with no successful recordings (despite coinciding with flowering seasons).

Surveys for *Caladenia montana* in October 2020 identified several club spider orchid species of the genus *Caladenia*. Samples were sent to Mark Clements at the Australian National Botanical Gardens in Canberra during the surveys. This species is difficult to distinguish from other similar species by morphology alone and therefore genetic analysis is required. The results of the genetic analysis for the samples sent to the Australian National Botanical Gardens are still pending.

The absence of these candidate threatened species from the construction envelope (and adjacent areas), despite comprehensive survey, means each has been excluded from the impact calculations in both the South East Highlands Bioregion BAM-C and the Australian Alps Bioregion BAM-C associated with this BDAR (in accordance with paragraphs 6.4.1.17 – 6.4.1.19 (Step 3) of the BAM).

#### 7.4.1.2 Calotis glandulosa

*Calotis glandulosa* was not recorded within the construction envelope during the surveys. *Calotis glandulosa* was also not recorded during survey work undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a). *Calotis glandulosa* was flowering during the survey period and conspicuous suggesting that if this species were present in the area, it would have been found during surveys. There are no existing records of *Calotis glandulosa* from the Bago State Forest and the construction envelope is located to the west of the known distribution of this species. Therefore, there is a high level of confidence that *Calotis glandulosa* does not occur in the construction envelope.

#### 7.4.1.3 Pomaderris cotoneaster

There is a high level of confidence that *Pomaderris cotoneaster* does not occur within the construction envelope. *Pomaderris cotoneaster* was not recorded within the construction envelope during the surveys undertaken for this BDAR and it was also not recorded during the survey work undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a). A congener, *Pomaderris velutina* which is superficially like *Pomaderris cotoneaster,* was recorded outside of the construction envelope in the broader study area along the Yarrangobilly River with other species of *Pomaderris* including *Pomaderris aspera* and *Pomaderris angustifolia*. The habitats, particularly PCT 302 and to a lesser extent PCT 300, appear suitable for species of *Pomaderris* but *Pomaderris cotoneaster* was not recorded in the construction envelope during the surveys.

#### 7.4.1.4 Thesium australe

*Thesium australe* was not recorded within the construction envelope during the survey period despite targeted searches in areas of potentially suitable habitat. *Thesium australe* was also not recorded during survey work undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a). *Thesium australe* is known to occur in the region and the population on Larry's Ridge north of Cabramurra was visited and plants found in February 2019 indicating that *Thesium australe* was detectable during the survey. Transects were walked through grassy woodlands and dry sclerophyll forests in the construction envelope with searches undertaken in grassy areas, areas of native grassland, and in easements, particularly in areas where *Themeda triandra* (a species with which *Thesium australe* is often found in association) was dominant. The grassy canopy gaps in PCT 729 and PCT 296 and the native grassland in the easement under Line 64 and the easements off Lobs Hole Ravine Road were searched without finding *Thesium australe*.

### 7.4.2 Threatened animal species

#### 7.4.2.1 Gang-gang Cockatoo (breeding)

The survey for Gang-gang Cockatoo focused on locating potential breeding habitats. Breeding habitat for the Gang-gang Cockatoo is identified by the presence of suitable habitat (i.e. PCTs) and the presence of a nest or observations of a pair of birds on site.

Gang-gang Cockatoos were commonly observed along the length of the construction envelope with most records made in the Australian Alps portion of the construction envelope and in areas to the east of Lobs Hole Ravine Road in the South Eastern Highlands portion of the construction envelope. The Gang-gang Cockatoo was regularly observed foraging in family groups along roadsides in the alpine areas of the broader locality. Birds were commonly seen flying over the construction envelope in pairs or family groups that suggests some habitats within the construction envelope are likely to be suitable as breeding habitat for the Gang-gang Cockatoo. PCT 300, PCT 1196 and PCT 302 contain large hollow bearing trees that are likely to be suitable for nesting. During surveys for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a), Gang-gang Cockatoo pairs were observed investigating tree hollows in PCT 1196 and PCT 302. The species polygon for the Gang-gang Cockatoo breeding habitat is provided in **Figure 7-2**.

#### 7.4.2.2 White-bellied Sea-Eagle (breeding)

Breeding habitat for the White-bellied Sea-Eagle is indicated by live large old trees within 1 km of rivers, lakes, large dams or creeks, wetlands and coastlines that contain a large stick nest within the tree canopy. Breeding habitat for this species can also be indicated by an adult with nest material, or adults observed duetting within the breeding period. The survey for the White-bellied Sea-Eagle focused on locating potential nest sites.

The White-bellied Sea-Eagle is known to occur in the locality and has been recorded around the Tumut River, Tantangara Reservoir, and the Jounama Pondage at Talbingo. While foraging habitat is present, the White-bellied Sea-Eagle was not recorded in the construction envelope during the surveys and no large trees containing large stick nests were located within the construction envelope. This suggests that breeding habitat for the White-bellied Sea-Eagle is not present in the construction envelope at the time of the assessment. These results are consistent with the results from the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a).

#### 7.4.2.3 Little Eagle (breeding)

Breeding habitat for the Little Eagle is indicated by live (occasionally dead) 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. The survey for the Little Eagle focused on locating potential nest sites.

The Little Eagle is known to occur in the locality having been recorded along the Tumut River and the Jounama Pondage at Talbingo, the McPherson's Plains area and areas within the KNP. While foraging habitat is present, the Little Eagle was not recorded in the construction envelope during the surveys and no large trees containing large stick nests were located within the construction envelope. This suggests that breeding habitat for the Little Eagle is not present in the construction envelope at the time of the assessment. These results are consistent with the results from the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a).

#### 7.4.2.4 Square-tailed Kite (breeding)

To identify breeding habitat for the Square-tailed Kite, it is necessary to locate a Square-tailed Kite sitting on a stick nest or in attendance of a stick nest. The survey for the Square-tailed Kite focused on locating potential nest sites.

There are no records of the Square-tailed Kite near the construction envelope and this species was not recorded during the surveys. No large trees containing large stick nests were located within the construction envelope. This suggests that breeding habitat for the Square-tailed Kite is not present in the construction envelope at the time of the assessment. These results are consistent with the results from the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a).

#### 7.4.2.5 Barking Owl (breeding)

Breeding habitat for the Barking Owl is indicated by the presence of suitable habitat (i.e. PCTs) and:

1) the presence of male and female or
2) calling to each other (duetting) or
3) find nest or
4) existing breeding habitat has been identified.

Despite the presence of seemingly suitable habitat within the South Eastern Highlands portion of the construction envelope, the Barking Owl was not recorded during the surveys. These results are consistent with the results from the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a) where the Barking Owl was not found despite targeted call playback surveys in areas of seemingly suitable habitat. Given the extent of recent survey for the Barking Owl around Lobs Hole Ravine Road and the failure to detect this species, it is considered unlikely to occur in the construction envelope and breeding habitat is not present.

#### 7.4.2.6 Powerful Owl (breeding)

Breeding habitat for the Powerful Owl is indicated by the presence of suitable habitat (i.e. PCTs) and:

1) the presence of male and female or
2) calling to each other (duetting) or
3) find nest or
4) existing breeding habitat has been identified.

Despite the presence of seemingly suitable habitat within the construction envelope, the Powerful Owl was not recorded during the surveys. These results are consistent with the results from the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a) where the Powerful Owl was not found despite targeted call playback surveys in areas of seemingly suitable habitat. Given the extent of recent survey for the Powerful Owl around Lobs Hole Ravine Road and the failure to detect this species, it is considered unlikely to occur in this portion of construction envelope and breeding habitat is not likely to be present.

Survey work undertaken in the Bago and Maragle State Forests in the late 1990s (see Kavanagh and Stanton, 1998) suggests that the Powerful Owl is present in these areas but at low abundance. The results showed that the Powerful Owl is less likely to be found in higher elevation forests with a clear preference shown for sites below 900 m asl (Kavanagh and Stanton, 1998). The results also suggested vegetation preferences for the Powerful Owl with an apparent preference for 'wet peppermint type' forests (likely equating to PCT 300) over the 'alpine gum' type forests (likely equating to PCT 1196) (Kavanagh and Stanton, 1998).

Suitable habitat in the form of PCT 300 is present in the construction envelope. This PCT contains some large hollow bearing trees that may be suitable for use as breeding habitat by the Powerful Owl. As the surveys undertaken for this BDAR were undertaken outside of the breeding survey period for the Powerful Owl, it has been assumed that breeding habitat is present throughout the entire extent of PCT 300. Given the relatively low number of owl-suitable hollows identified during surveys (compared to the large number of smaller hollows), the inclusion of the entire extent of PCT 300 as potential breeding habitat is highly precautionary and likely larger than realistic if a 200-metre buffer was applied to potential habitat trees (as per the BAM). Therefore, dry forest PCTs (such as PCT 302, PCT 296 and PCT729, which are recognised by the TBDC as associated habitat) have not been included in the species polygon based on analysis of extensive survey work and habitat assessment previously undertaken in the region (Kavanagh and Stanton, 1998). The species polygon for the Powerful Owl breeding habitat has therefore been developed based on a precautionary approach using recent relevant peer reviewed data and is provided in **Figure 7-2**.

#### 7.4.2.7 Masked Owl (breeding)

Existing breeding habitat for the Masked Owl was identified during the recent surveys undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a). As such, this same breeding habitat has also been identified in this BDAR. The Masked Owl was also recorded on two occasions calling just after dusk in the January surveys conducted for this BDAR, suggesting there is a resident breeding pair near Cave Gully. As the surveys undertaken for this BDAR were undertaken outside of the breeding survey period for the Masked Owl, it has been assumed that breeding habitat is present within PCT 302. The species polygon for the Masked Owl breeding habitat is provided in **Figure 7-2**.

#### 7.4.2.8 Sooty Owl (breeding)

Breeding habitat for the Sooty Owl is indicated by the presence of suitable habitat (i.e. PCTs) and:

- Caves or cliff lines/ledges, or
- Living or dead trees with hollows greater than 20 centimetres diameter.

The Sooty Owl was not identified during surveys. The habitats in the study area are not considered highly suitable for this species as it is associated with rainforest and moist eucalypt forests. There have been no caves or cliff lines/ledges identified in the construction envelope. Very few of the hollows identified were greater than 20 centimetres. There is just one recorded sighting of this species within 10 km of the project from the Yarrangobilly Caves in 2011. The validity of this record cannot be verified. The recent surveys undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a) did not identify this species. The Sooty Owl was not identified during extensive owl surveys in Bago and Maragle State Forests in the late 1990s (see Kavanagh and Stanton, 1998). As such it is considered unlikely that the construction envelope contains breeding habitat for the Sooty Owl and it has been excluded from the assessment.

#### 7.4.2.9 Pink Robin

The Pink Robin has been sporadically recorded in the locality in the past but was not recorded within the construction envelope during the bird surveys undertaken for this BDAR. Likewise, the Pink Robin was not recorded during the surveys undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a). As this species has not been recorded during these two surveys, it is considered unlikely to occur in the construction envelope.

#### 7.4.2.10 Booroolong Frog

The Booroolong Frog is known to inhabit the Yarrangobilly River, Wallaces Creek and Sheep Station Creek as identified in the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a). The Yarrangobilly River was identified as providing optimal breeding habitat for the Booroolong Frog, with a series of cobble banks and bedrock structures along stream margins, with slow flowing water connected by larger, slow flowing pools (EMM Consulting, 2017 and 2020a). The breeding habitat in Wallaces Creek is considered to be much more limited, with only small sections providing suitable breeding habitat and it is likely this area provides sub optimal breeding habitat as well as connective and dispersal habitat (EMM Consulting, 2017 and 2020a). Sheep Station Creek is also likely to be suboptimal as breeding habitat for the Booroolong Frog.

During targeted surveys undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a), the Booroolong Frog was observed up to 130 m from the Yarrangobilly River during a high rainfall event that saw key breeding habitat flooded. During this period, most frogs were observed within the riparian zone (i.e. within 50 m of the River (EMM Consulting, 2017 and 2020a). Based on that information, the Yarrangobilly River, Sheep Station Creek and Wallaces Creek have been identified as breeding habitat, while areas within 50 m of this breeding habitat was been identified as potential dispersal and refuge habitat. These criteria were used to develop the species polygon for the Booroolong Frog which has been adapted for use in this BDAR.

Due to the extensive Booroolong Frog surveys undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a), no further survey work was undertaken for this BDAR. The species polygon for the Booroolong Frog as adapted from the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a) is provided in **Figure 7-3**.

#### 7.4.2.11 Alpine Tree Frog

The survey for Alpine Tree Frog was not undertaken during optimal conditions for detecting the species due to the dry environmental conditions. However, despite this, there is a general lack of suitable habitat to target surveys for the Alpine Tree Frog within the construction envelope. The ephemeral streams within the construction envelope including New Zealand Gully, the unnamed watercourse in the Bago State Forest, and the unnamed watercourse alongside Elliott Way in the KNP do not contain suitable breeding habitats such as pools. The drainage lines were relatively dry apart from some small turbid pools created by horse damage in the Line 64 easement. Therefore, the chance of encountering calling frogs during the survey was limited.

The higher altitude areas of PCT 1196 peak at 1,190 m asl with PCT 300 present on the eastern slope to the edge of the Australian Alps Bioregion at 1,000 m asl near the quarry along Elliott Way. The threatened Alpine Tree Frog (*Litoria verreauxii alpina*) appears to grade into the nominate race *Litoria verreauxii verreauxii* and intermediate forms occur between 1,000 m and 1,300 m in elevation, so the surveys focused on finding any frogs resembling *Litoria verreauxii* in the broader sense. However, the surveys did not find any frogs resembling *Litoria verreauxii* within the construction envelope.

The construction envelope is at the very edge of the altitudinal range for the Alpine Tree Frog as this species is generally found in alpine and sub-alpine areas above 1,100 m asl. As the construction envelope does not support stream habitats that contain streamside pools, or other still waterbodies suitable for the species, the Alpine Tree Frog is considered unlikely to occur.

#### 7.4.2.12 Eastern Pygmy-possum

The Eastern Pygmy-possum was recorded during the recent surveys undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a) so the presence of the Eastern Pygmy-possum in the eastern portion of the construction envelope to the east of Lobs Hole Ravine Road was known before work on this BDAR began. During the surveys for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a), the Eastern Pygmy-possum was found widely within PCT 296, PCT 300, PCT 302, PCT 729 and PCT 1196.

During the surveys undertaken for this BDAR, the Eastern Pygmy-possum was found in three locations in the South Eastern Highlands portion of the study area east of the Talbingo Reservoir, around Lobs Hole Ravine Road and north of Wallaces Creek, found in PCT 296 and PCT 999 (**Photo 7-6**). The Eastern Pygmy-possum was also found in PCT 729 to the west of the Talbingo Reservoir caught on camera traps set in the habitats off Elliott Way (**Photo 7-5**). Areas with a dense midstorey of *Banksia canei* appeared to be the preferred habitat for the Eastern Pygmy-possum. Based on the distribution of suitable habitat within the construction envelope, it is likely that the Eastern Pygmy-possum also occupies the slopes of Sheep Station Ridge although the remote cameras did not record this species in that area. The Eastern Pygmy-possum was not found within the Australian Alps portion of the construction envelope during the surveys. However, one Eastern Pygmy-possum was found on the side of the road on Bradleys Drive to the north of Elliott Way within vegetation dominated by *Eucalyptus pauciflora*. This is an interesting record for this species as records from the Bago State Forest are limited despite the number of surveys that have been undertaken on the area by State Forests (see Kavanagh and Stanton, 1998). Despite the lack of Eastern Pygmy-possum captures within PCT 1196 or PCT 300 in the Australian Alps portion of the construction envelope, the capture of an Eastern Pygmy-possum to the west of the broader study area in the locality suggests that a low-density population of the Eastern Pygmy-possum is likely to be present within the Australian Alps portion of the construction envelope. The species polygon for the Eastern Pygmy-possum is provided in **Figure 7-3**.

Photo 7-5: The Eastern Pygmy-possum was recorded during the survey on a camera trap

Photo 7-6: The Eastern Pygmy-possum was recorded during spotlighting

#### 7.4.2.13 Yellow-bellied Glider population on the Bago Plateau

The *Petaurus australis* - endangered population (Yellow-bellied Glider population on the Bago Plateau) was recorded during the surveys within the Bago State Forest in the Australian Alps portion of the construction envelope. Yellow-bellied Gliders were found within PCT 1196 and PCT 300.

The Yellow-bellied Glider population on the Bago Plateau is disjunct owing to the steep valleys and unsuitable habitat surrounding the Bago Plateau and, in addition, because of cleared agricultural land to the west and the Tumut River and Talbingo Reservoir to the east. For the purposes of the Endangered population listing, the Bago Plateau population is defined to occur above the 900 m asl elevation contour and north of a line coinciding with the southern boundary of Maragle State Forest. The western portion of the construction envelope where the Yellow-bellied Glider was recorded during the surveys is located at the south eastern edge of this Endangered population distribution. Yellow-bellied Gliders live in small social groups (2–6 individuals) that occupy exclusive territories of 25 to 84 ha in New South Wales. As such, it is likely that the construction envelope crosses through the territories of several social groups from the population. The species polygon for the Yellow-bellied Glider population on the Bago Plateau is provided in **Figure 7-4**.

#### 7.4.2.14 Squirrel Glider

One sighting of a Glider was made during a spotlighting survey undertaken above the Mines Trail for this BDAR. This relatively large Petaurid species was sighted low in the canopy emerging from a tree hollow after dusk. An image of a *Petaurus* sp. was also captured by a remote camera, feeding on the flowers of *Banksia canei* in the habitats off Lobs Hole Ravine Road. This individual was identified by Dr Damien Michael (Charles Sturt University) as Sugar Glider (*P. breviceps*). The Squirrel Glider has not been recorded from extensive surveys undertaken during Exploratory Works and Main Works investigations (EMM Consulting, 2017 and 2020a) within the same habitats, although Sugar Glider was apparently captured (N. Garvey EMM, *pers comm*). Considering this and the uncertainty around the sightings within this area, the Squirrel Glider is assumed to not be present on the east side of the Talbingo Reservoir.

One further record of the another Petaurid species was made during spotlighting surveys along Boundary Road to the south of Elliott Way during the surveys undertaken for this BDAR on the west side of the Talbingo Reservoir in tall Snow Gum - Mountain Gum shrubby open forest. While it cannot be definitively determined whether this glider was a Squirrel Glider as it was not captured, and the animal was high in the tree canopy, the relative size of the animal and characteristic morphology, including large flouncy tail and pointed face suggested that it may be a Squirrel Glider.

A precautionary approach to this assessment has been undertaken and have assumed that this glider west of the Talbingo Reservoir was a Squirrel Glider. There are recent apparently valid records of Squirrel Glider from the Bago State Forest which indicates that a low-density Squirrel Glider population is likely to be present. State Forest ecologists recorded a vocalising Squirrel Glider during a logging compartment survey at the intersection of Paddys River Road and Dingo Dam Road in 2013. A Squirrel Glider was observed on the trunk of a *Eucalyptus dalrympleana* tree on the Brandy Marys Bago State Forest Crown Leases in 2005. There are records of Squirrel Gliders rescued from barbed wire fences from the Brandy Mary's leases near Plain Creek from 2004 and 2005. From this information we have assumed that suitable habitat for the Squirrel Glider is present within the Bago State Forest and contiguous vegetation within in the construction envelope all the way to the Talbingo Reservoir, corresponding to associated habitats including PCT 285, PCT 729, PCT 1196 and PCT 300. The species polygon for the Squirrel Glider is provided in **Figure 7-4.**

#### 7.4.2.15 Greater Glider

The Greater Glider was not recorded within the construction envelope or broader study area during the surveys undertaken for this BDAR. Likewise, the Greater Glider was not recorded during the surveys undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a). Despite the lack of records from these surveys, the Greater Glider has potential to occur in the taller wetter forests (i.e. PCT 300) and sub-alpine woodland (PCT 1196) habitats. These habitats appear to provide suitable forging resources for the Greater Glider in the form of eucalypts species *Eucalyptus dalrympleana, Eucalyptus viminalis,* and *Eucalyptus robertsonii* and trees large enough to contain hollows of suitable size for the Greater Glider.

Additionally, there are credible records of the Greater Glider from wet forest dominated by *Eucalyptus dalrympleana* and *Eucalyptus robertsonii* in the Bago State Forest to the north and west of the study area, including records from State Forest surveys. There are records of the Greater Glider in habitats like that which occur in the construction envelope from the north adjacent to the Line 64 easement. The records are from 1995, 2004, 2007, 2008, and 2009. The distribution of the Greater Glider is known to be patchy even in seemingly optimal habitats (see Kavanagh, 2000). Therefore, the Greater Glider may have been temporarily absent from the habitats within the construction envelope during the survey period.

The Greater Glider is not listed under the BC Act and therefore cannot be added to the BAM-C. No species polygon has been developed for the Greater Glider, but it is considered likely to occur in PCTs 300 and 1196 around the Bago State Forest (i.e. only west of the Talbingo Reservoir). This species has been further assessed in **Section 9.5**.

#### 7.4.2.16 Brush-tailed Phascogale

Based on the surveys undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a) and the surveys undertaken for this BDAR, the Brush-tailed Phascogale is considered unlikely to occur in the construction envelope. Records of the Brush-tailed Phascogale within the KNP are very scarce, and this species was not recorded during the surveys for this BDAR or for the Snowy 2.0 Exploratory Works and Main Works BDARs.

#### 7.4.2.17 Koala (breeding)

Records of the Koala are very scarce within the locality. Isolated Koala records exist from Batlow (1940), Tumbarumba (1970), Lake Eucumbene (1962) and some spatially inaccurate records from Maragle State Forest (2004) and Talbingo (2006). The construction envelope and locality are not recognised as a major Koala population centre. A Koala was observed crossing the Snowy Mountains Highway near Blowering Dam in 2016.

No Koalas or scats were found during the surveys undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a). Likewise, no Koalas or scats were found within the construction envelope during the surveys undertaken for this BDAR despite searches of seemingly suitable food tree species. Surveys targeted the primary Koala food tree species for the Central and Southern Tablelands which is *Eucalyptus viminalis*. The secondary food tree species *Eucalyptus rubida* was also searched. *Eucalyptus viminalis* and *Eucalyptus rubida* are dominant tree species in the South Eastern Highlands portion of the construction envelope (PCT 302 and PCT 729). These species are also found in PCT 300 within the South Eastern Highlands and Australian Alps portions of the construction envelope. Koala foraging habitat appears to be widespread within the construction envelope and broader locality, and it is likely that dispersing Koalas will move through the construction envelope and broader study area. However, the area currently appears incapable of supporting a high-density Koala population and breeding habitat is not present.

#### 7.4.2.18 Smoky Mouse

Prior to the surveys undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a), the Smoky Mouse was not known from the locality. During surveys for the Snowy 2.0 Exploratory Works and Main Works BDARs, the Smoky Mouse was captured in 13 locations in the higher elevation habitats above 1,100 m along Lobs Hole Ravine Road (EMM Consulting, 2017 and 2020a). The Smoky Mouse was only captured in the sub-alpine woodland habitat of PCT 1196 and was not found in the drier habitats below 1,100 m in elevation.

PCT 1196 is present in the western portion of the construction envelope within the Bago State Forest in the Australian Alps Bioregion. This area of habitat within the construction envelope was considered likely to be suitable for the Smoky Mouse based off the recent work undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (see EMM Consulting, 2017 and 2020a). PCT 285 and PCT 300 may also be suitable based off the information in the EESG Threatened Biodiversity Data Collection. Despite a trapping program targeting PCT 1196, PCT 285 and PCT 300 using remote cameras (126 camera trap nights) and ground Elliott traps (300 trap nights), the Smoky Mouse was not recorded within the construction envelope during the surveys undertaken for this BDAR. Species captured in the Elliott traps in the habitats included Bush Rat and Agile Antechinus. The camera traps recorded Bush Rat, Agile Antechinus, Brushtail Possum, Wombat, macropods, Superb Lyrebirds, and pests including deer, pigs, and cats (see Appendix D for all trapping results). Two trap sites were placed in PCT 1196 in an attempt to capture the Smoky Mouse and its absence within the trapping grids is considered to be associated with the comparatively lower condition of the habitat in this location compared to Lobs Hole Ravine, associated with the presence and abundance of feral horses and weeds.

#### 7.4.2.19 Spotted-tailed Quoll

The Spotted-tailed Quoll was not recorded within the construction envelope during the surveys undertaken for this BDAR. Likewise, the Spotted-tailed Quoll was not recorded during the surveys undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a).

Despite the lack of records from recent surveys, there are a number of Spotted-tailed Quoll records to the north of the construction envelope within the Bago State Forest Brandy Marys Crown Lease area and McPhersons Plain (from 2001 to 2004). The Spotted-tailed Quoll occurs at low densities and individuals have a large home range, so it is likely that the construction envelope lies within the home range of one or more Spotted-tailed Quolls. The habitats contain suitable habitat including potential den sites in areas with boulders, rocky outcrops, small caves (particularly the South Eastern Highlands portion), and large woody debris and hollow-bearing trees (large hollow logs and hollow-bearing trees are abundant in the Australian Alps portion).

#### 7.4.2.20 Large Bent-winged Bat (breeding)

The Large Bent-winged Bat is an ecosystem credit species for foraging habitat and is a species credit species where breeding habitat will be impacted. Following the *'Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method* (Office of Environment and Heritage, 2018) the focus of the survey was on finding any breeding habitat for the Large Bent-winged Bat within or adjacent to the construction envelope.

For the purpose of the BAM, breeding habitat is specific habitat features that are used, or presumed likely to be used, by threatened bat species as maternity sites. Breeding habitat is considered present if there is:

1) potential breeding habitat, and
2) breeding individuals of the target species on the subject land (construction envelope).

The Large Bent-winged Bat was not caught in the harp traps during the surveys. However, the Large Bent-winged Bat was recorded (definite and possible call identification) in December 2018 on the Anabats placed in PCT 1196 and PCT 729. In January 2019, the Large Bent-winged Bat was recorded (definite and possible call identification) on Anabats placed in PCT 729 and PCT 302. It is likely that the Large Bent-winged Bat forages widely throughout the habitats in the construction envelope.

There were no caves, tunnels, mines or other structures known or suspected to be used by the Large Bent-winged Bat found within or adjacent to the construction envelope during the surveys. The literature indicates that the area around Bago State Forest is generally lacking in caves as evidenced by the low occurrence of the Large Bent-winged Bat (see Law *et al.*, 1998). Any crevices, holes and small 'caves' found in the construction envelope during the survey (**Photo 7-7** and **Photo 7-8**) were examined for the presence of bats (i.e. urine stains, fresh guano, remains) however no evidence of bat roosting was found. As such, there were no rock crevices, holes or caves suitable as breeding habitat for the Large Bent-winged Bat identified within the construction envelope during the survey.

In the broader study area, the cliff line to the south of Mine Trail (**Photo 11-1** and **Photo 11-2**) and Cave Gully (**Photo 11-3** and **Photo 11-4**) have potential for caves and this area was examined for roost site potential. There were no caves identified as potential breeding habitat so targeted survey of the cave was not undertaken and harp traps were not placed at any cave exits.

Photo 7-7: The small overhang and crevices / cave off Mine Trail were examined for evidence of bats during the survey

Photo 7-8: The small overhang and crevices / cave off Mine Trail were examined for evidence of bats during the survey

#### 7.4.2.21 Southern Myotis

The Southern Myotis is an ecosystem credit species. Following the *'Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method* (Office of Environment and Heritage, 2018) the focus of the survey was firstly to identify any suitable habitats (i.e. the range of PCTs associated with the species (as per the TBDC) within 200 m of any medium to large permanent creeks, rivers, lakes or other waterways (i.e. with pools/ stretches 3 m or wider). While PCT 302 is not listed as a PCT association for the Southern Myotis on the TBDC, we assumed that the habitat ay be suitable due to the habitat characteristics and records of Southern Myotis from similar habitats in the locality along the Tumut River.

There are no bridges, tunnels, culverts or other structures present in the construction envelope that would be suitable as potential breeding habitat for the Southern Myotis. However, in the broader study area the cliff line to the south of Mine Trail has potential for caves and was examined for roost site potential including the limestone cave south of Mine Trail. There were no caves identified as potential breeding habitat so targeted survey of the cave was not undertaken and harp traps were not placed at the cave exit.

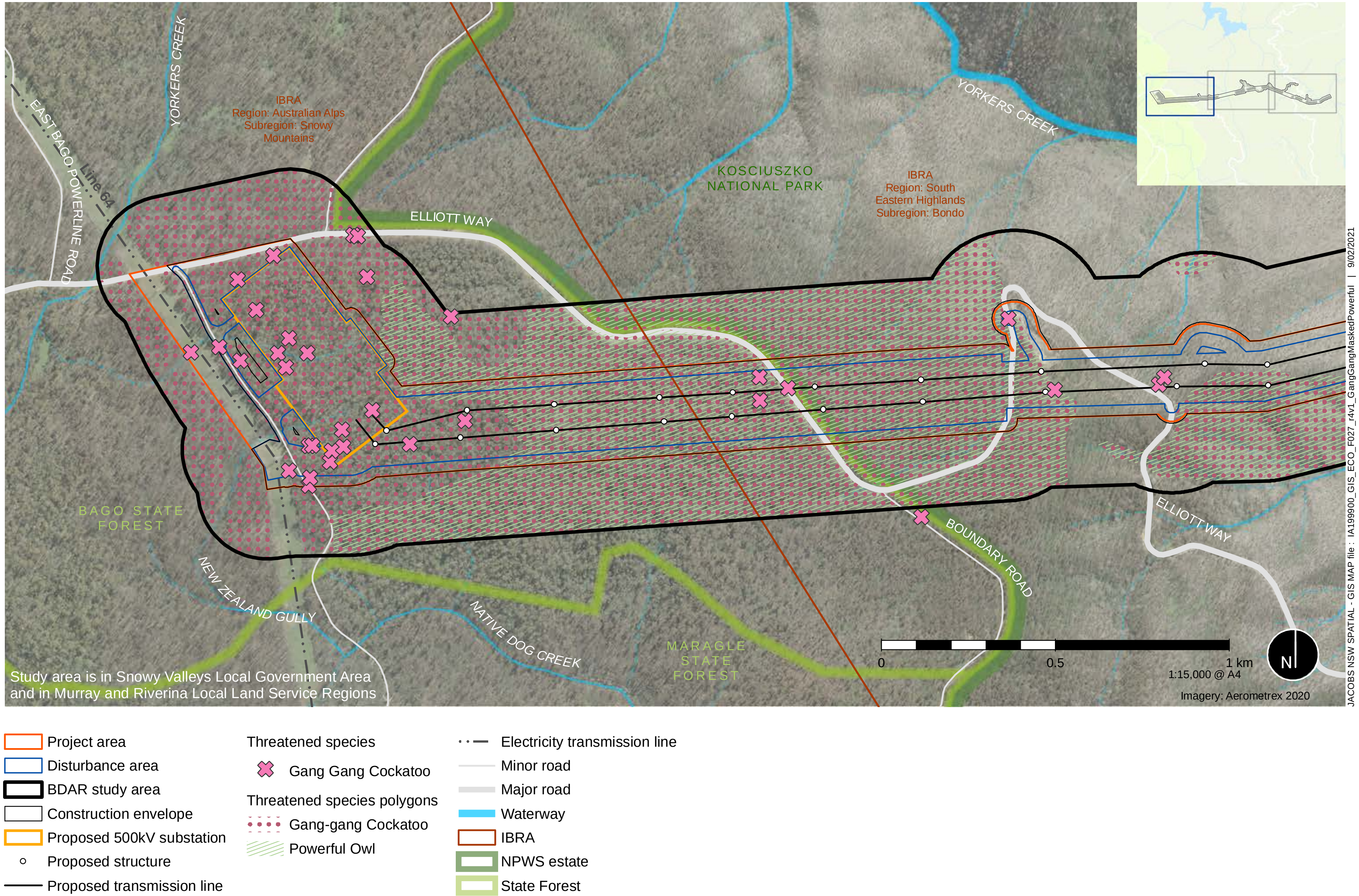
A harp trap was placed over Wallaces Creek during the survey in an attempt to capture the Southern Myotis. An Anabat was also placed on Wallaces Creek with the harp trap. The Southern Myotis was not caught in the harp traps during the surveys. Likewise, there were no calls recorded on the Anabats that may have been from the Southern Myotis. The absence of records during this survey, and the survey undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a), combined with general lack of Southern Myotis records from the locality indicates that this species may be unlikely to occur in the construction envelope.

### 7.4.3 Serious and irreversible impact entities

The concept of serious and irreversible impacts (SAII) is fundamentally about protecting threatened entities that are most at risk of extinction from potential projects. The Biodiversity Offsets Scheme recognises that there are some types of serious and irreversible impacts that the community expects will not occur except where the consent authority considers that this type of impact is outweighed by the social and economic benefits that the project will deliver to the State. The principles for determining SAII are outlined in the Biodiversity Conservation Regulation 2017.

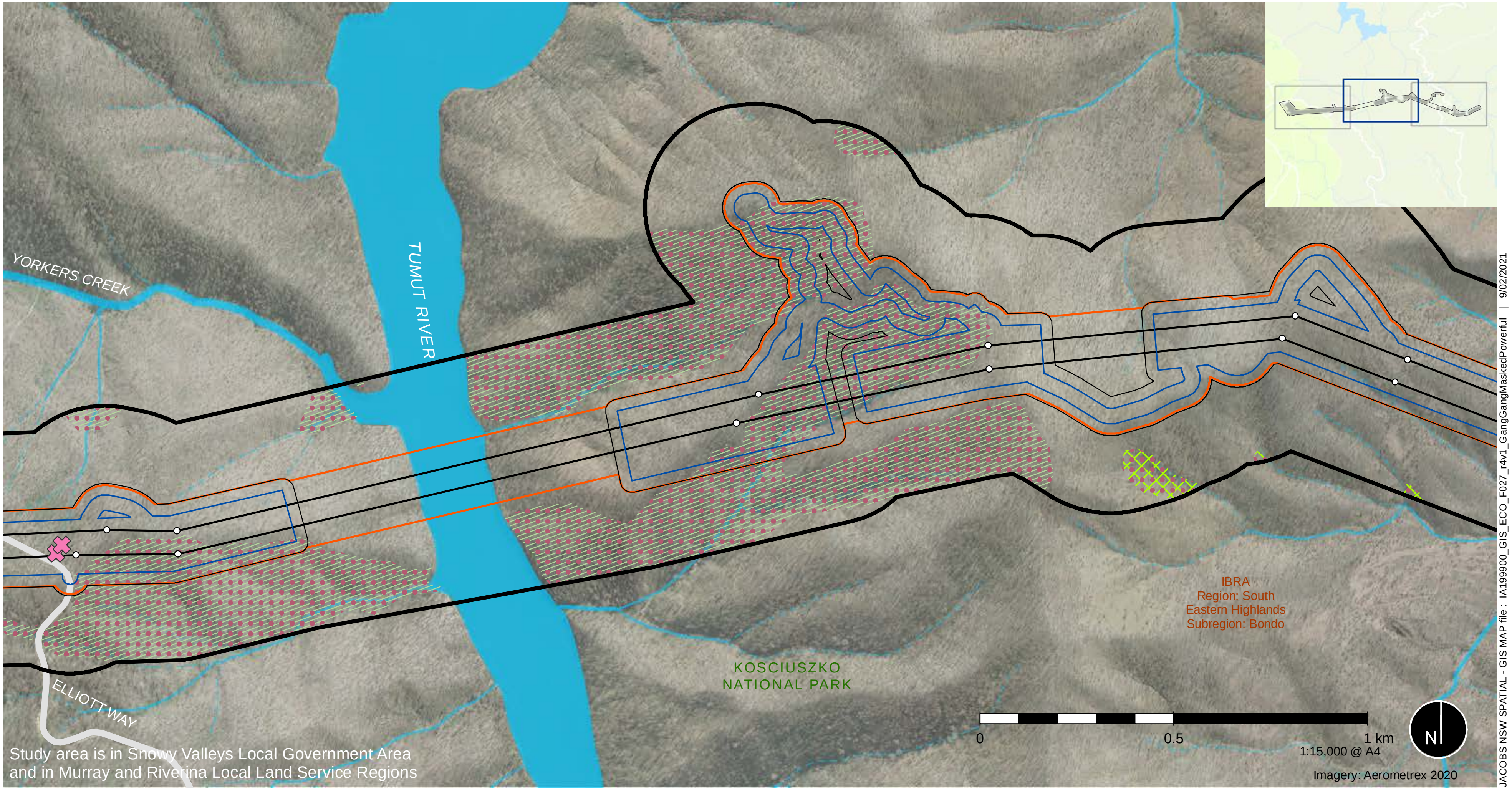
The BC Act permits the Minister for Planning to give consent to or approve State Significant Infrastructure which is likely to have serious or irreversible impacts. The Minister must take those impacts into consideration and determine whether there are any additional and appropriate measures that will minimise those impacts if consent or approval is to be granted. Potential species (and their habitat) that meet the SAII principles and criteria are outlined in the *Guidance, criteria and lists of potential serious and irreversible impacts* as made by the Chief Executive of EESG.

Of the threatened species identified and assessed as present within the study area and construction envelope, none are listed in the TBDC or BAM-C as being SAII entities or are considered to meet the SAII principles. On this basis, the project is unlikely to result in serious and irreversible impacts.




**Data sources:**
Jacobs 2020, DPE 2018,
© Department Finance, Services and Innovation 2018

**Figure 7-2** | Threatened species polygons for Gang-gang Cockatoo, Masked Owl and Powerful Owl




Project area
Disturbance area
BDAR study area
Construction envelope
Proposed structure
Proposed transmission line

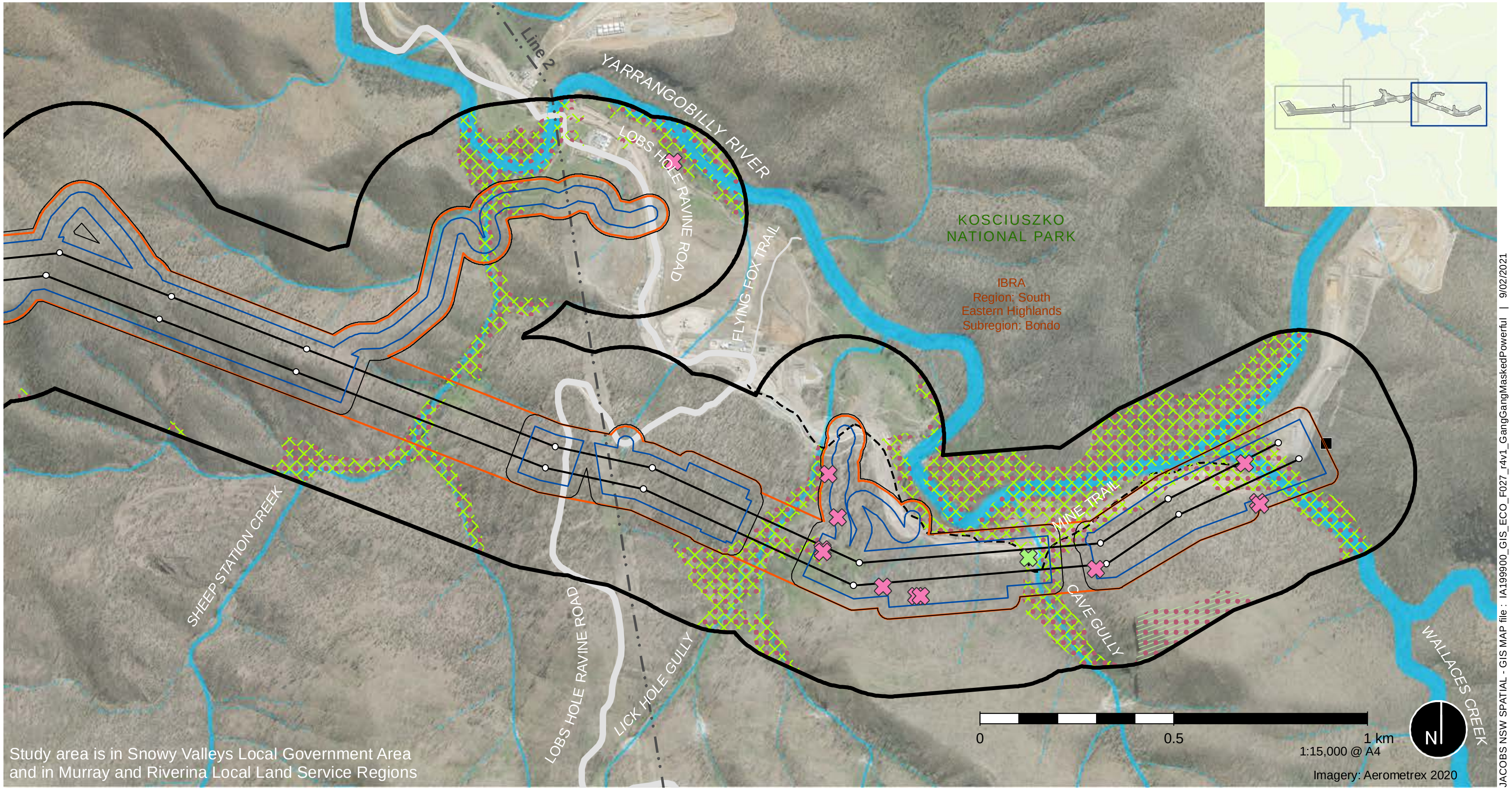
Threatened species
Gang Gang Cockatoo

Threatened species polygons
Gang-gang Cockatoo
Masked Owl
Powerful Owl

Electricity transmission line
Major road
Waterway
NPWS estate

**Data sources:**
Jacobs 2020, DPE 2018,
© Department Finance, Services and Innovation 2018

**Figure 7-2** | Threatened species polygons for Gang-gang Cockatoo, Masked Owl and Powerful Owl




Project area
Disturbance area
BDAR study area
Construction envelope
Proposed structure
Proposed transmission line
Snowy 2.0 cable yard

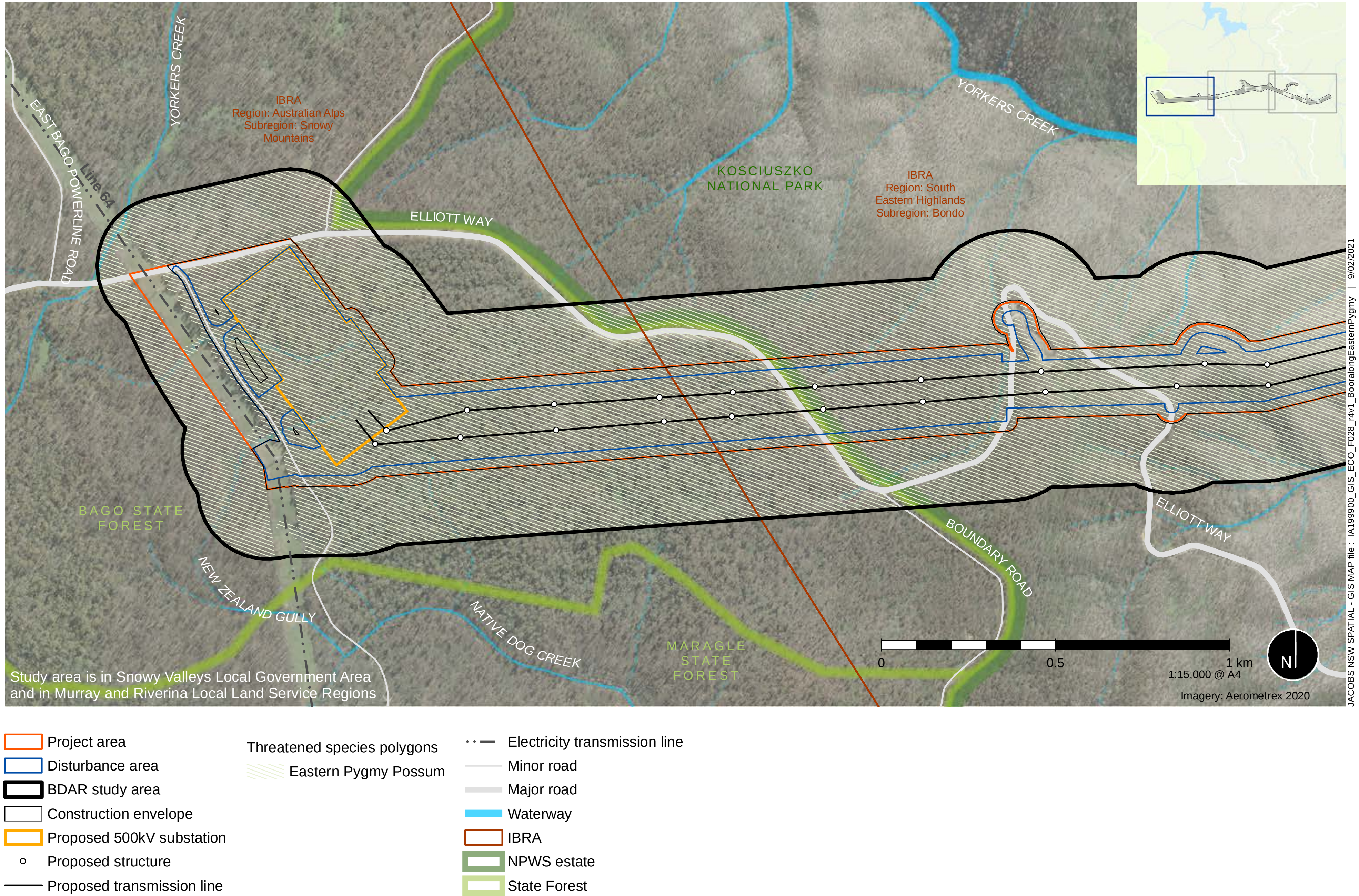
Threatened species
Gang Gang Cockatoo
Masked Owl

Threatened species polygons
Gang-gang Cockatoo
Masked Owl
Powerful Owl

Electricity transmission line
Minor road
Major road
Trail
Waterway
NPWS estate

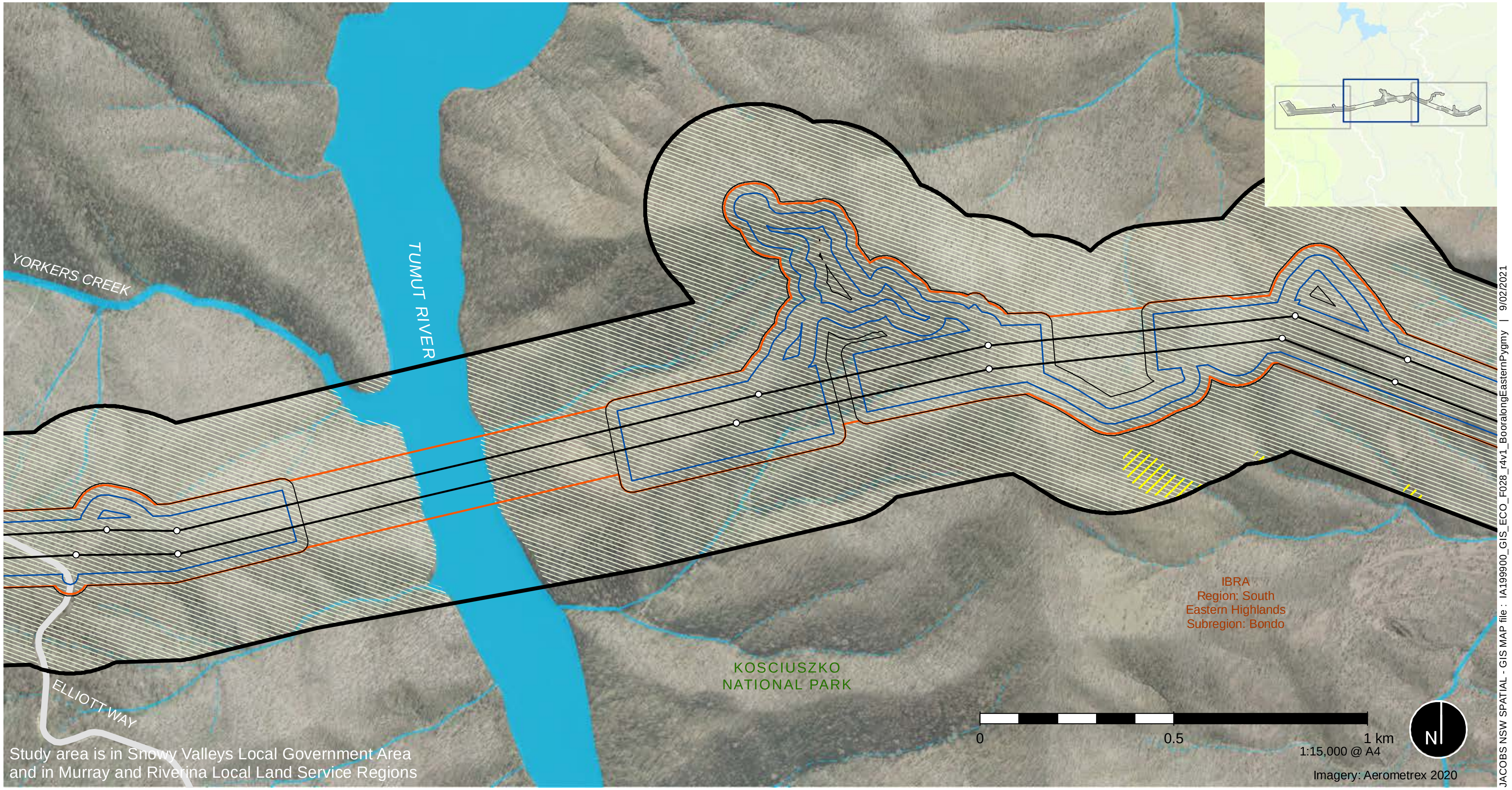
**Data sources:**
Jacobs 2020, DPE 2018,
© Department Finance, Services and Innovation 2018

**Figure 7-2** | Threatened species polygons for Gang-gang Cockatoo, Masked Owl and Powerful Owl




**Data sources:**
Jacobs 2020,


**Figure 7-3** | Threatened species polygon for Booroolong Frog and Eastern Pygmy Possum



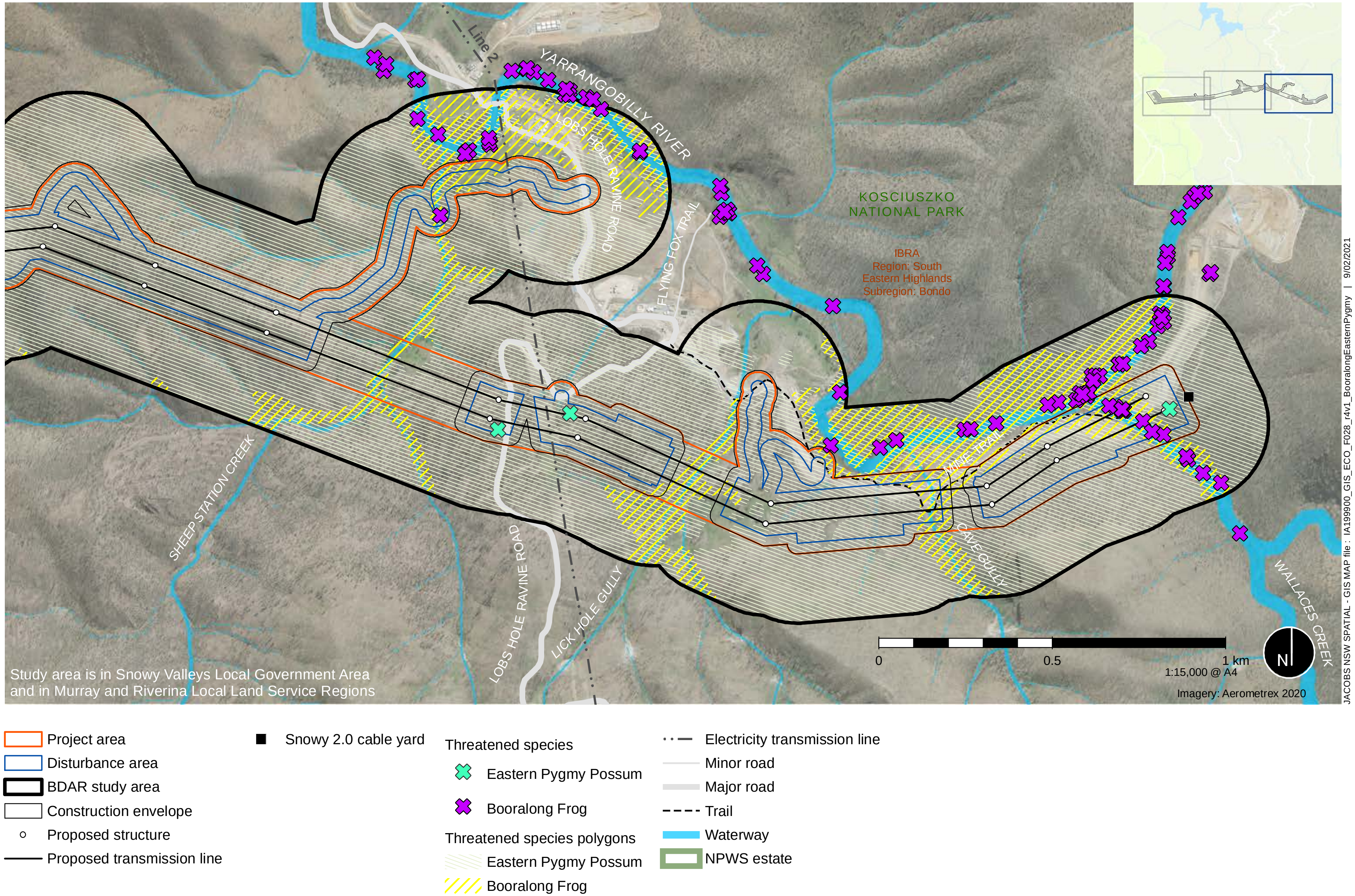

Project area
Disturbance area
BDAR study area
Construction envelope
Proposed structure
Proposed transmission line

Threatened species polygons
Eastern Pygmy Possum
Booralong Frog

Electricity transmission line
Major road
Waterway
NPWS estate

**Data sources:**
Jacobs 2020,
© Department Finance, Services and Innovation 2018

**Figure 7-3** | Threatened species polygon for Booroolong Frog and Eastern Pygmy Possum




**Data sources:**
Jacobs 2020,
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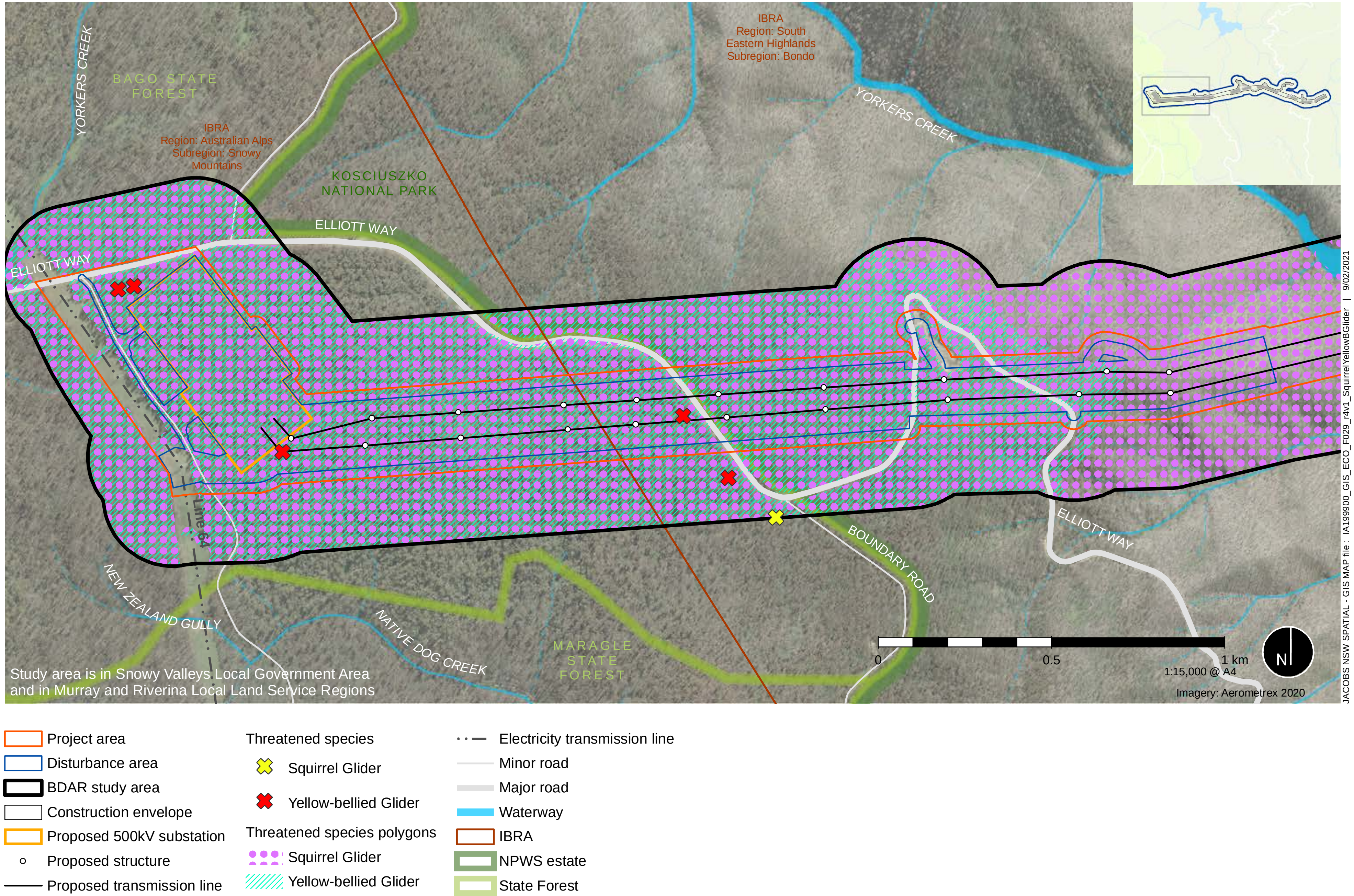
**Figure 7-3** | Threatened species polygon for Booroolong Frog and Eastern Pygmy Possum




**Data sources:**
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**Figure 7-4** | Threatened species polygon for Squirrel Glider and Yellow-bellied Glider population on the Bago Plateau

# 8. Aquatic assessment

The construction envelope is located within the Murrumbidgee catchment. The western portion of the construction envelope in the Australian Alps Bioregion contains the second order streams of Yorkers Creek, Native Dog Gully and New Zealand Gully that are fed by smaller ephemeral first order streams (SIX maps). Yorkers Creek becomes a larger third order and fourth order stream as it flows to the north and east and joins the major waterway of the Tumut River at the Talbingo Reservoir (sixth order stream). In the south of the substation site, New Zealand Gully flows into Native Dog Creek which flows south becoming a larger third order stream until it meets New Maragle Creek where it becomes a larger fourth order stream that flows south and east into the Tumut River. West of the Talbingo Reservoir, the new structures would be built on ridges that are drained by unnamed first order streams that join larger second order streams that flow down the steep terrain and terminate in the Tumut River to the east.

East of the Talbingo Reservoir, the project would be built on ridges that are drained by unnamed first and second order streams. The unnamed streams on the western side of Sheep Station Ridge flow west down the steep slopes into the major waterway of the Tumut River at the Talbingo Reservoir. On the eastern side of Sheep Station Ridge, the area is drained by a number of unnamed first and second order streams that join the third order stream of Sheep Station Creek. East of Lobs Hole Ravine Road, the landscape is drained by first and second order streams that flow into Lick Hole Gully and further east, Cave Gully, which are both second and third order streams. Lick Hole Gully and Cave Gully flow north into the major seventh order stream of the Yarrangobilly River, which flows north west into the Talbingo Reservoir. Further to the east the construction envelope crosses more first and second order streams and the larger fifth order stream of Wallaces Creek that flows north into the Yarrangobilly River.

Aquatic habitats within the construction envelope and broader study area were assessed against the DPI's *Policy and Guidelines for Fish Habitat Conservation and Management* (NSW Department of Primary Industries, 2013) and *Why Do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003). Sensitive receiving environments were identified based on proximity to the following considerations:

- The presence of Key Fish Habitat (NSW DPI, 2013)
- Waterway classification (Fairfull and Witheridge, 2003)
- Habitat for threatened aquatic species listed under the FM Act and EPBC Act.

Searches of databases, existing mapping and other literature was used to identify the locations of these sensitive receptors. Sources included:

- Fisheries Spatial Data Portal
- Protected Matters Search Tool
- Snowy 2.0 Exploratory Works Aquatic Ecology Assessment (Cardno, 2018).

Twenty-nine waterways or unnamed drainage lines are crossed by the project area (i.e. not all will be directly impacted). Six of these waterways are stream order three or greater. Wallaces Creek, Tumut River and Yarrangobilly River are major waterways. These waterways have also been mapped as Key Fish Habitat including:

- Tumut River (and Talbingo Reservoir) – 6th order
- Sheep Station Creek – 3rd order
- Lick Hole Gully – 3rd order
- Cave Gully – 3rd order
- Yarrangobilly River – 7th order
- Wallaces Creek – 6th order.

Eighteen generally unnamed gullies/drainage lines also occur within the study area, these gullies are first order, ephemeral and most have little to no channel definition. Site inspections were not undertaken at the majority of these locations, as they are not considered key fish habitat and are ephemeral streams only likely to contain water for brief periods following high rainfall events. Yarrangobilly River is included in this assessment as it occurs close to the construction envelope at the eastern edge and several tributaries that may be impacted by the project drain to it. These aquatic habitats listed above are recognised as important to the sustainability of the recreational and commercial fishing industries, the maintenance of fish populations generally and the survival and recovery of threatened aquatic species. A map of aquatic habitats in the broader study area is provided in **Figure 8-1**. The aquatic habitat assessment is provided below.

## 8.1 Aquatic habitat assessment

An assessment of the habitat within each of the named waterways and a selection of representative unnamed waterways located in the construction envelope is provided. All waterways mapped are displayed in **Figure 8-1.**

### 8.1.1 New Zealand Gully

New Zealand gully is an ephemeral first order stream which drains to Native Dog Creek in the southwestern edge of the study area (see **Figure 8-1**). New Zealand Gully is densely overgrown with minimal channel definition (**Photo 8-1** and **Photo 8-2**). The gully appears to be absent of surface water flows for a significant period. The stream is not mapped as key fish habitat and threatened fish are not predicted to occur. New Zealand Gully is not considered key fish habitat and has not been identified as a sensitive receiving environment.

Photo 8-1: New Zealand Gully showing dense vegetation cover and lack of water

Photo 8-2: New Zealand Gully showing dense vegetation cover and lack of water

### 8.1.2 Unnamed tributary of Yorkers Creek

The tributary of Yorkers Creek is a moderately disturbed first order tributary of the Tumut River which flows adjacent to the project (see **Figure 8-1**). Access by hooved animals (horses, pigs) have created bank erosion and affected water quality at this site (**Photo 8-3** and **Photo 8-4**). The creek contains unstable mud substrate and aquatic habitat including refuge pools and large instream woody snags. The creek is mapped as key fish habitat. Threatened fish are not predicted to occur, however Murray Crayfish are likely to be present downstream approximately 4 km in the Tumut River. Yorkers Creek is assessed as Type 3 moderately sensitive key fish habitat due to the variety of habitat present. With respect to fish passage, the creek is identified as Class 3, minimal key fish habitat. Yorkers Creek has not been identified as a sensitive receiving environment.

Photo 8-3: The unnamed tributary of Yorkers Creek and Yorkers Creek showing horse damage

Photo 8-4: The unnamed tributary of Yorkers Creek and Yorkers Creek showing horse damage

### 8.1.3 Talbingo Reservoir and Tumut River

Talbingo Reservoir (**Photo 8-5**) is a large waterbody which connects Tumut River and Yarrangobilly River approximately 2.5 km downstream of the project (see **Figure 8-1**). A variety of aquatic habitat was present including gravel beds, undercut banks, aquatic macrophytes and overhanging vegetation. Two threatened fish are predicted to occur in the Talbingo Reservoir including Murray Crayfish and Macquarie Perch. Threatened Trout Cod have also been stocked in the reservoir as recently as 2016 (Cardno, 2018). Talbingo reservoir has been assessed as Type 1, highly sensitive key fish habitat due to the likelihood of containing threatened fish. With respect to fish passage, the reservoir has been classified Class 1, major key fish habitat. The Talbingo Reservoir has been identified as a sensitive receiving environment.

Tumut River is a permanently flowing, sixth order stream which drains to Talbingo reservoir. The waterway contains fish habitat including dense overhanging vegetation, instream riffles and undercut banks (**Photo 8-6**). The river is mapped as key fish habitat. Murray Crayfish are predicted to occur within this section of the Tumut River. Tumut River is assessed as Type 1, highly sensitive key fish habitat due to the likelihood of containing threatened fish. With respect to fish passage, it is classified Class 1, major key fish habitat. Tumut River has been identified as a sensitive receiving environment.

Photo 8-5: Talbingo Reservoir upstream of the construction envelope

Photo 8-6: Tumut River upstream of the construction envelope

### 8.1.4 Sheep Station Creek

Sheep Station Creek is an ephemeral third order stream which flows under a section of the project area not directly impacted, then under a proposed access track and drains to the Yarrangobilly River (see **Figure 8-1**). Sheep Station Creek was dry during site inspections (**Photo 8-7** and **Photo 8-8**), however when flowing, the aquatic habitat includes gravel beds and undercut banks. The creek is mapped as key fish habitat. Threatened fish are likely to occur in the Yarrangobilly River which is located approximately 100 m downstream. Threatened species include Murray Crayfish and Macquarie Perch. Sheep Station Creek is assessed as Type 3, minimally sensitive key fish habitat. While it contains important habitat characteristics such as instream gravel beds and is connected to nearby threatened fish distributions, it is ephemeral. With respect to fish passage, the creek has been assessed as Class 3, minimal key fish habitat due to its ephemeral nature and sporadic refuge. Sheep Station Creek has been identified as a sensitive receiving environment.

Photo 8-7: Sheep Station Creek within the construction envelope

Photo 8-8: Sheep Station Creek within the construction envelope

### 8.1.5 Lick Hole Gully

Lick Hole Gully **(Photo 8-8**) is an ephemeral third order tributary of Yarrangobilly River which flows under the project area and is parallel to a proposed access track (see **Figure 8-1**). The tributary is mapped as key fish habitat. Threatened fish are not predicted to occur however, Macquarie Perch are predicted to occur approximately 450 m downstream in the Yarrangobilly River. In the absence of field surveys and visible fish habitat (**Photo 8-9**), the tributary is assessed as Type 3, minimal key fish habitat. With respect to fish passage, the tributary is considered Class 3, minimally sensitive key fish habitat. Lick Hole Gully is not considered a sensitive receiving environment.

Photo 8-9: Lick Hole Gully showing the dense vegetation cover and crossing of Mine Trail

Photo 8-10: Lick Hole Gully waterway contained minor fish habitat features

### 8.1.6 Cave Gully

Cave Gully is an ephemeral third order tributary of the Yarrangobilly River which flows under a portion of the disturbance area near Mine Trail (see **Figure 8-1**). It was dry at the time of inspection (**Photo 8-11** and **Photo 8-12**). When the tributary is flowing, aquatic habitat including gravel beds and undercut banks are present. The tributary is mapped as key fish habitat. Threatened fish are not predicted to occur in the creek however, Macquarie Perch are predicted to occur approximately 100 m downstream in the Yarrangobilly River. Cave Gully is assessed as Type 3, minimally sensitive key fish habitat due to apparently ephemeral flow and absence of aquatic macrophytes at the sites inspected. With respect to fish passage, the tributary is considered Class 3, minimally sensitive key fish habitat. Cave Gully is not considered a sensitive receiving environment.

Photo 8-11: Cave Gully showing the densely vegetated area south of Mine Trail and cleared area north of Mine Trail

Photo 8-12: Cave Gully showing the densely vegetated area south of Mine Trail and cleared area north of Mine Trail

#### 8.1.7 Yarrangobilly River

Yarrangobilly River is a permanently flowing sixth order stream that runs parallel to the northern boundary of the project in Lobs Hole (see **Figure 8-1**). The Yarrangobilly River has a number of tributaries that occur within the project area including Lick Hole Gully, Cave Gully, Wallaces Creek and Sheep Station Creek. A variety of aquatic habitat was present including woody debris, gravel beds, riffle-pool sequences and overhanging vegetation (**Photo 8-13** and **Photo 8-14**). Macquarie Perch are predicated to occur within this section of the river. The waterway is also mapped as key fish habitat. Vulnerable Murray Crayfish have also been observed in Yarrangobilly River during field assessments (Cardno, 2018). Yarrangobilly River has been assessed as Type 1, highly sensitive key fish habitat (DPI, 2013). With respect to fish passage, it is identified as Class 1, major key habitat. Yarrangobilly River has been identified as a sensitive receiving environment.

Photo 8-13: Yarrangobilly River showing a pool and riffle sequence

Photo 8-14: Yarrangobilly River showing a pool and riffle sequence

### 8.1.8 Wallaces Creek

Wallaces Creek is a sixth order tributary of the Yarrangobilly River that flows under the most eastern end of the construction envelope near the Snowy 2.0 cable yard (see **Figure 8-1**). A variety of aquatic habitat was present including gravel beds, rocks greater than 500 mm in size, woody debris, instream macrophytes and overhanging vegetation (**Photo 8-15** and **Photo 8-16**). Wal–aces Creek is mapped as key fish habitat and is within 500 m of predicted threatened fish occurrence - Macquarie Perch. Additionally, vulnerable Murray Crayfish have been observed in Wallaces Creek during field assessments (Cardno, 2018). The waterway has been assessed as Type 1, highly sensitive key fish habitat with respect to fish passage. Wallaces Creek has been identified as Class 1, major key fish habitat. Wallaces Creek is considered a sensitive receiving environment.

Photo 8-15: Wallaces Creek within the construction envelope showing in stream boulders and woody debris

Photo 8-16: Wallaces Creek within the construction envelope showing in stream boulders and woody debris

### 8.1.9 Unnamed creek lines on Sheep Station Ridge

There are a number of mapped first and second order steep creek lines that occur across the remainder of the construction envelope (see **Figure 8-1**). These are highly ephemeral rocky drainage gullies on steep slopes (**Photo 8-17** and **Photo 8-18**) that do not hold water for long periods of time. These creeks are mostly located on Sheep Station Ridge and consist of small and shallow rocky pools that likely fill after rain and dry out quickly (**Photo 8-17**). The creeks are not mapped as key fish habitat. Threatened fish are likely to occur in the Tumut River which is located approximately 500 m downstream from the construction boundary on Sheep Station Ridge. Threatened species known to occur in the Tumut River include Murray Crayfish and Trout Cod. These unnamed creeks are assessed as Type 3, minimally sensitive key fish habitat. While they contain important habitat characteristics such as instream gravel beds and is connected to nearby threatened fish distributions, they are highly ephemeral. With respect to fish passage, the creek has been assessed as Class 4, unlikely key fish habitat due to the it’s steep and ephemeral nature and sporadic refuge. These creeks have been identified as sensitive receiving environments due to their connectivity to the Tumut River.

Photo 8-17: Unnamed second order creek on Sheep Station Ridge that flows into the Tumut River

Photo 8-18: Steep terrain on which these unnamed creeks are located

## 8.2 Threatened fish

The Aquatic Ecology Assessment (Cardno, 2018) indicates that the dominant fish species in the Yarrangobilly River and Wallaces Creek are the non-native Brown Trout, Rainbow Trout and Red Fin Perch. Juvenile Galaxias sp. were caught in the Yarrangobilly River. The Murray Crayfish (*Euastacus armatus*), a threatened species listed under the FM Act, was caught in the Yarrangobilly River and Wallaces Creek. Gambusia and Goldfish were also caught (Cardno, 2018).

Considering the level of recent survey and assessment that has been undertaken for Snowy 2.0 Exploratory Works (Cardno, 2018), and the low potential for direct impacts to aquatic habitats from this project, this threatened fish assessment has involved a desktop review and habitat assessment. No targeted fish surveys have been undertaken. The desktop searches, including a review of work undertaken for the Snowy 2.0 Exploratory Works Aquatic Ecology Assessment (Cardno, 2018) identified the following threatened fish species that have been recorded by previous surveys and are known to occur in the Tumut River / Talbingo Reservoir (or have been previously stocked) and Yarrangobilly River:

- Macquarie Perch (*Macquaria australasica*)
- Silver Perch (*Bidyanus bidyanus*)
- Trout Cod (*Maccullochella macquariensis*)
- Murray Cod (*Maccullochella peelii*)
- Murray Crayfish (*Euastacus armatus*).

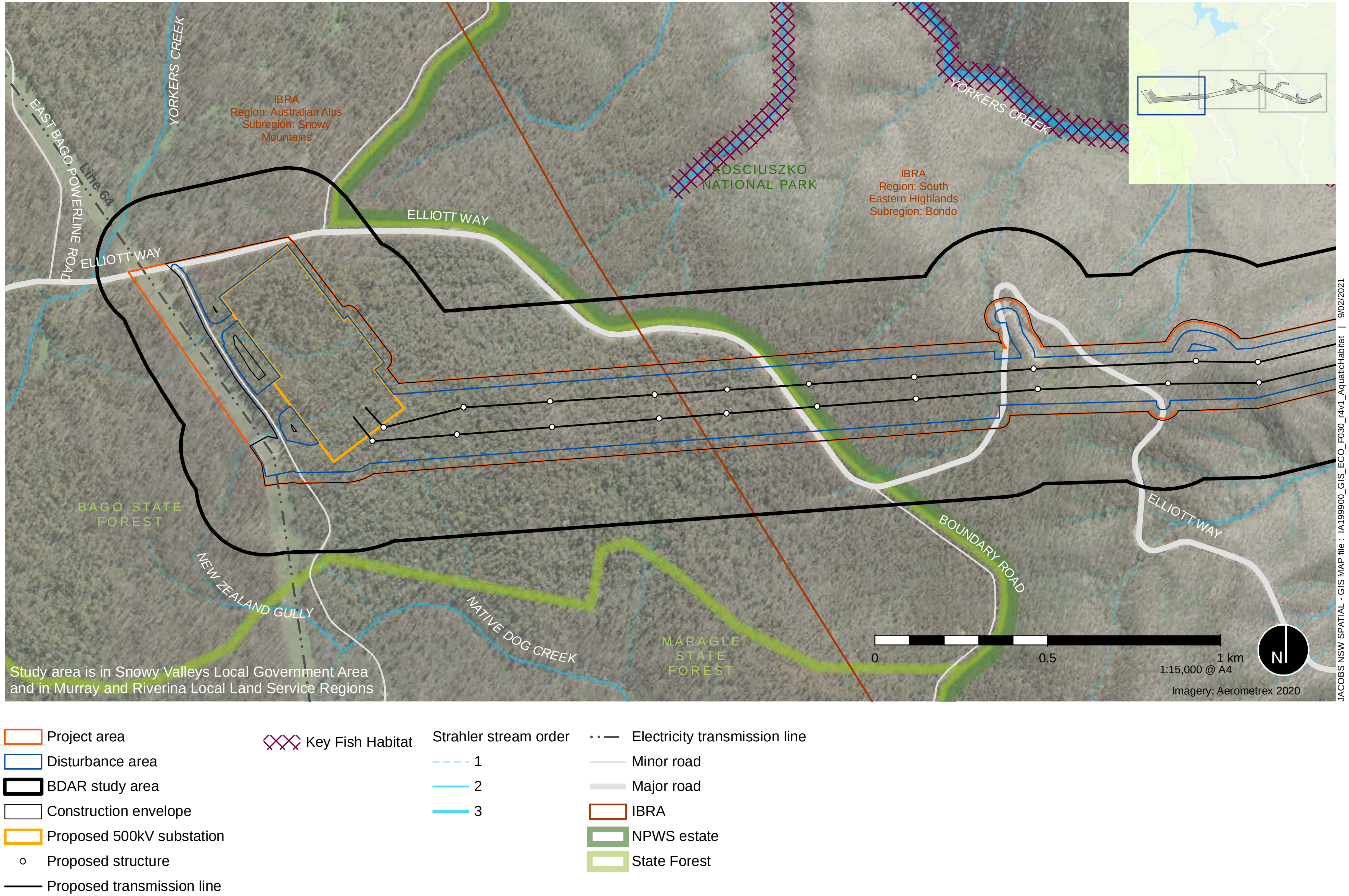
Despite fish stocking of threatened Trout Cod and Macquarie Perch within the Talbingo Reservoir, these species were not located during the Cardno (2018) surveys and it is unknown if self-sustaining populations occur within the study area. The Trout Cod is considered unlikely to be found outside of the Talbingo Reservoir while the Macquarie Perch may also occur in the Yarrangobilly River (Cardno, 2018). As the Murray Cod and Silver Perch have been stocked in Blowering Dam, there is a low chance that these two species may have also been introduced to the Talbingo Reservoir. The Murray Crayfish is known to occur in the Yarrangobilly River and Wallaces Creek. Signage at the Talbingo Reservoir indicates the presence, or potential presence of these species (**Photo 8-19** and **Photo 8-20**).

Based on the assessment and review of the work undertaken for the Snowy 2.0 Exploratory Works and Main Works EISs (Cardno, 2018), only the Murray Crayfish and Macquarie Perch are likely to occur in the habitats that may be affected by works in the construction envelope. The potential impacts to these two species have been assessed using the criteria outlined in the FM Act (see **Appendix H**).

The project is considered unlikely to significantly affect threatened species, populations or ecological communities listed under the FM Act or EPBC Act (see **Appendix G** and **Appendix H**). Mitigation measures will be sufficient to prevent a significant impact (see **Section 12**).

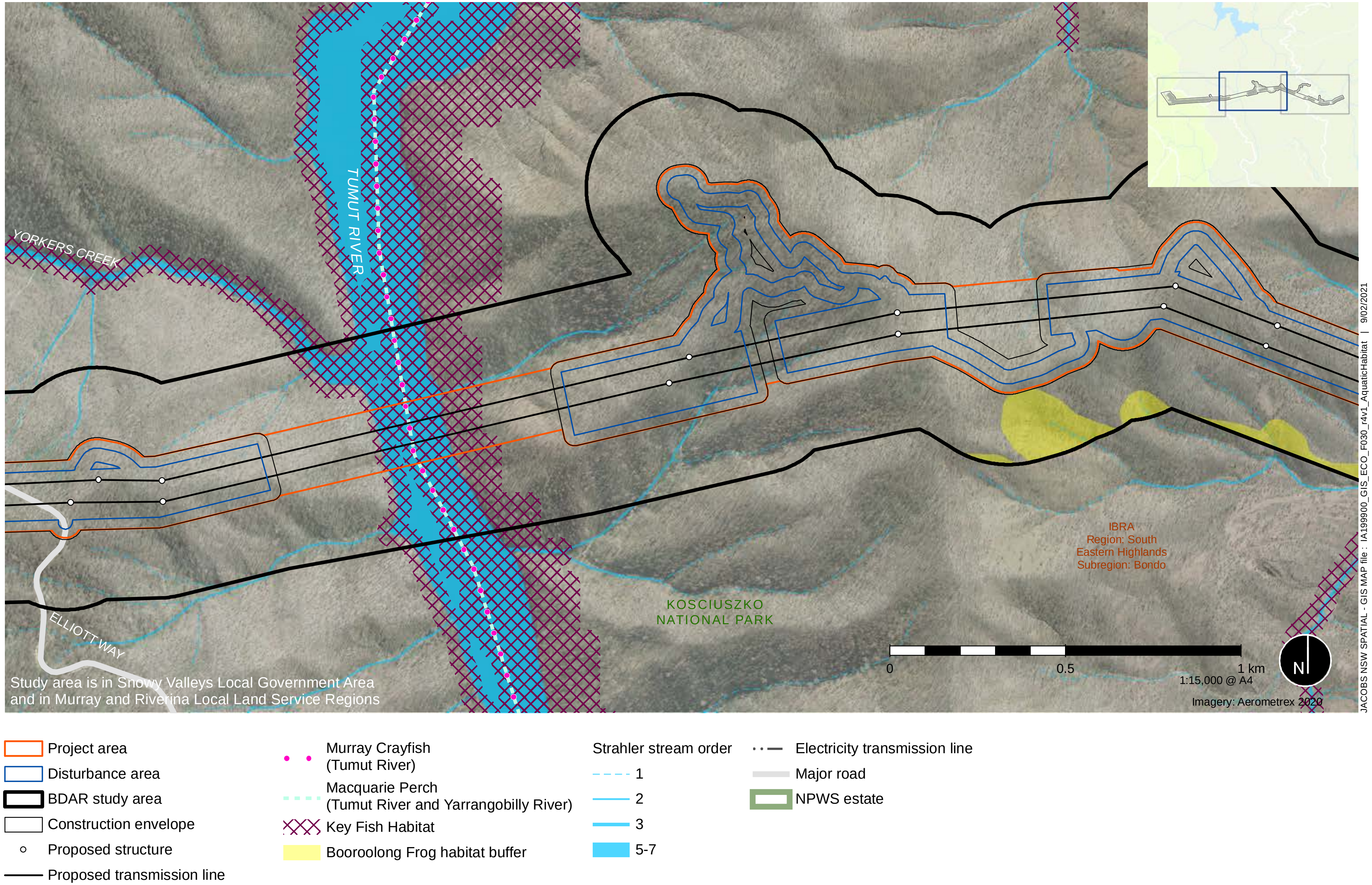

Photo 8-19: Murray Crayfish sign at the Talbingo Reservoir


Photo 8-20: Trout Cod sign at the Talbingo Reservoir



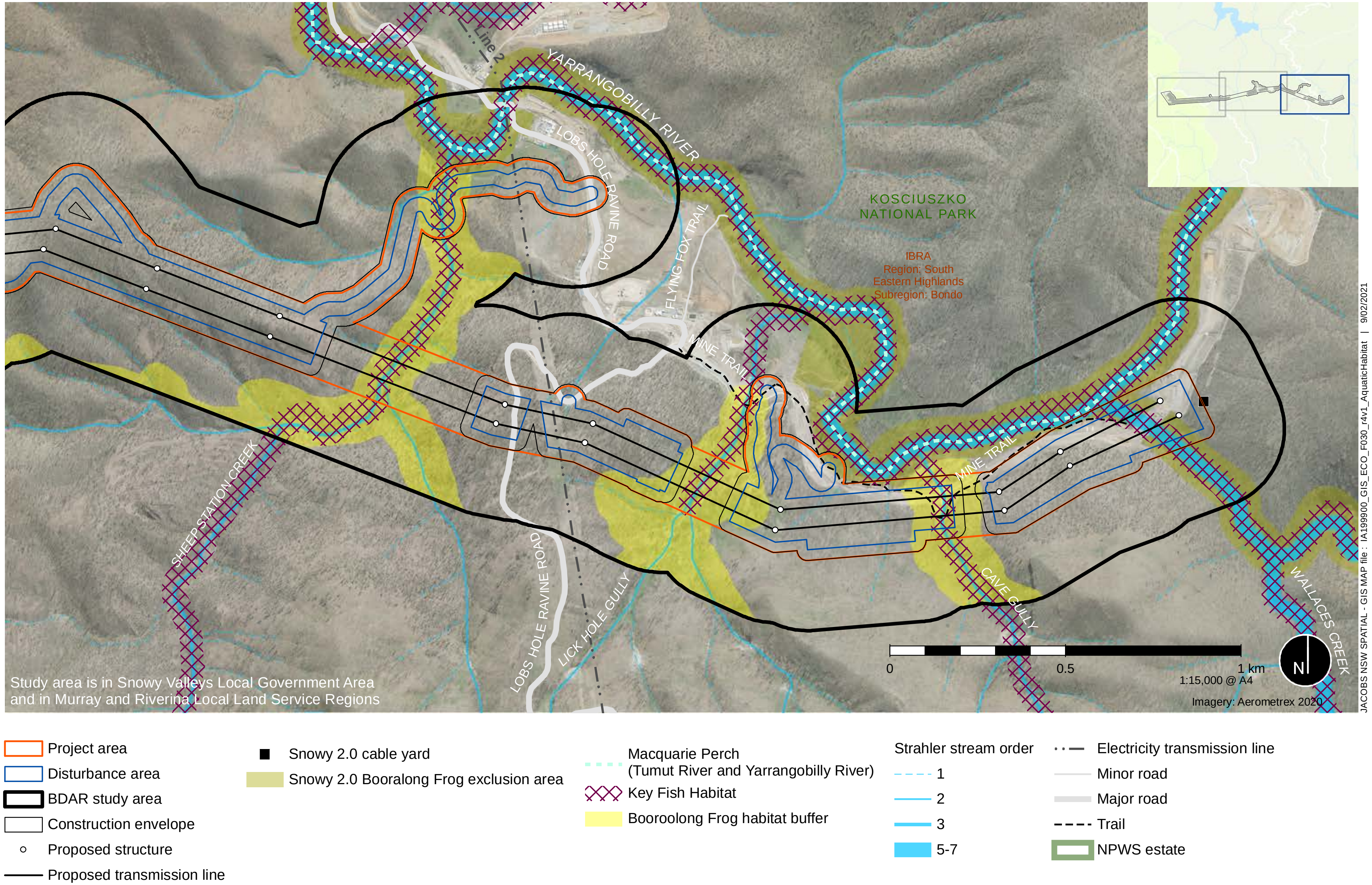

**Data sources:**
Jacobs 2020, EMM 202, DPI 2019, DPE 2018,


**Figure 8-1** | Aquatic habitats




**Data sources:**
Jacobs 2020, EMM 202, DPI 2019, DPE 2018,
© Department Finance, Services and Innovation 2018

**Figure 8-1** | Aquatic habitats




**Data sources:**
Jacobs 2020, EMM 202, DPI 2019, DPE 2018,
© Department Finance, Services and Innovation 2018

**Figure 8-1** | Aquatic habitats

# 9. Matters of National Environmental Significance

The EPBC Act provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places – defined as matters of national environmental significance as follows (as applicable to the project):

- World heritage properties
- National heritage places
- Wetlands of international importance (often called 'Ramsar' wetlands after the international treaty under which such wetlands are listed)
- Nationally threatened species and ecological communities
- Migratory species.

The project was referred under the EPBC Act to the Commonwealth Minister for the Environment and Energy. The Minister determined on 5 April 2019 that approval is required as the action has the potential to have a significant impact on:

- Listed threatened species and communities
- Listed migratory species
- The heritage values of a National Heritage place.

The NSW Government confirmed the action would be assessed under the "Bilateral agreement made under section 45 of the EPBC Act relating to environmental assessment between Commonwealth of Australia and the State of New South Wales" (Bilateral Agreement) (2015). This agreement accredits the assessment process under Division 5.2 of the EP&A Act. The agreement was also amended in March 2020 to include the Australian Government accreditation of the BC Act and endorsement of the NSW Biodiversity Offsets Scheme.

For threatened biodiversity listed under the EPBC Act identified in habitats within the study area or considered at east moderately likely to occur, significance assessments have been completed in accordance with the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (Department of Environment, 2013) (see **Appendix G**) where these species have not already been assessed in accordance with the BC Act. Assessments have been included for some species where non-detection may not mean absence (e.g. Smoky Mouse). Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment that is affected, and upon the intensity, duration, magnitude and geographic extent of the impacts (Department of Environment, 2013). Importantly, for a 'significant impact' to be 'likely', it is not necessary for a significant impact to have a greater than 50 per cent chance of happening; it is sufficient if a significant impact on the environment is a real or not remote chance or possibility (Department of Environment, 2013). This advice has been considered while undertaking the assessments.

## 9.1 World heritage properties and national heritage places

The study area contains the Australian Alps National Parks and Reserves natural listed place and the Snowy Mountains Scheme historic listed place. Impacts to heritage values are not addressed in this BDAR, though are provided in the Aboriginal Cultural Heritage assessment report (Appendix C of the EIS) and Non-Aboriginal heritage assessment report (Appendix G of the EIS).

## 9.2 Wetlands of international importance

The study area does not contain any wetlands of international importance. However, the Protected Matters Search Tool (PMST) returned several wetlands of international importance within 800 km of the project.

- Banrock station wetland complex 700 – 800 km downstream
- Barmah forest 200 – 300 km upstream
- Gunbower forest 300 – 400 km upstream
- Hattah-kulkyne lakes 500 – 600 km downstream
- NSW central murray state forests–200 – 300 km upstream
- Riverland 600 – 700 km downstream
- The Coorong and Lakes Alexandrina and Albert - 700 – 800 km downstream.

The distances from the project are provided in the PMST report. The report also states that all these wetlands are upstream, however the Banrock Station Wetland Complex, Hattah-kulkyne Lakes, Riverland and Coorong and Lakes Alexandrina and Albert are in fact downstream of the Tumut River (i.e. Tumut River – Murrumbidgee River – Murray River after the Boundary Bend confluence).

Due to the distance of these wetlands of international importance from the disturbance area, they are considered unlikely to be affected.

## 9.3 Threatened ecological communities

According to the PMST, the following EPBC Act listed TECs are known to occur, likely to occur, or may occur in the broader study area:

- Alpine Sphagnum Bogs and Associated Fens (Endangered) – known to occur within area
- Natural Temperate Grassland of the South Eastern Highlands (Critically Endangered) – likely to occur within area
- White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland (Critically Endangered) – may occur within area.

The PCTs within the construction envelope as outlined in **Section 6.1** do not correspond to any EPBC Act listed TECs. Some vegetation along Yorkers Creek to the north and outside of the construction envelope around the substation (see **Figure 6-1**) is likely to correspond to the EPBC Act listed Alpine Sphagnum Bogs and Associated Fens TEC. This patch is upstream and north of Elliots Way so is unlikely to be affected by surface water flow from the project. However, there is another smaller mapped patch on Yorkers Creek around 500 m downstream of the second order stream that flows from the substation site. This mapped area was not verified from surveys but has the potential to be indirectly impacted by surface water flow from the project. The potential for indirect impacts to this potential TEC would be managed by standard erosion control measures and drainage design around the substation site.

## 9.4 Threatened plants

Due to the large extent, variability and generally high quality of the habitats present across the broader KNP and Bago State Forest, many EPBC Act listed threatened plant species are known to occur, may occur or are considered likely to occur in the locality. The PMST report identified thirteen plant species with potential to occur in the locality based on records and modelled habitat. Of these, only several species were considered for this assessment (refer to **Section 4.8.1**). This includes:

- *Calotis glandulosa* (Mauve Burr-daisy) – vulnerable under the EPBC Act
- *Pomaderris cotoneaster* (Cotoneaster Pomaderris) – endangered under the EPBC Act
- *Pterostylis oreophila* (Blue-tongued Greenhood) – critically endangered under the EPBC Act
- *Thesium australe* (Austral Toadflax) – vulnerable under the EPBC Act.

No EPBC Act listed threatened plant species were recorded during targeted surveys. Following comprehensive surveys, the EPBC Act listed *Prasophyllum* orchids that occur in the McPherson's Plain area are considered unlikely to occur in the heavily forested habitats that are present in the construction envelope. *Pterostylis oreophila* is not known to occur in the construction envelope, however, has been included as a precaution in this assessment on advice from Geoff Robertson, EESG Senior Threatened Species Officer. *Pterostylis oreophila* was not recorded during targeted surveys undertaken for this BDAR during the appropriate survey period. Considering the bilateral agreement, the survey and assessment undertaken in accordance with the BAM is considered adequate for assessing these species and no assessments of significance have been completed.

## 9.5 Threatened animals

The PMST identified 23 threatened fauna species listed under the EPBC Act with potential to occur in the locality based on records and modelled habitat. No EPBC Act listed fauna species were recorded within the study area during the surveys undertaken for this BDAR. However, the EPBC Act listed threatened fauna species that are considered at least moderately likely to occur in the habitats within the construction envelope are as follows:

- The Spotted-tailed Quoll is known to occur throughout the habitats on the east and west of the Tumut River and breeding habitat is likely to be present. There is approximately 135.6 ha of potential habitat for the Spotted-tailed Quoll within the disturbance area, including around 39.26 ha of surrounding vegetation that would be indirectly impacted by edge effects
- The Smoky Mouse is known to occur in the locality as identified in the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a) and may occur in the sub-alpine woodland habitats in the west of the construction envelope. This species was not recorded during the trapping program undertaken for this BDAR despite an intensive targeted trapping survey and therefore is considered unlikely to be impacted. Although surveys were conducted in accordance with guidelines, there is potential this species is still present and was not identified. There is approximately 27.63 ha of potential sub-alpine woodland habitat for the Smoky Mouse within the disturbance area, including around 3.68 ha of surrounding vegetation that would be indirectly impacted by edge effects
- There are some records of the Greater Glider in the Bago State Forest and the habitats appear to be broadly suitable for this species with suitable foraging and breeding habitat present in the Australian Alps portion of the construction envelope. There is 56.19 ha of potential habitat for the Greater Glider within the disturbance area, including around 11.39 ha of surrounding retained vegetation that would be indirectly impacted by edge effects

- The rivers and streams in the eastern portion of the broader study area are suitable for the Booroolong Frog (recorded in many locations along the Yarrangobilly River and Wallaces Creek) as indicated in the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a). Breeding and dispersal habitat for this species has been previously identified (see EMM Consulting, 2017 and 2020a). There is approximately 3.12 ha of habitat for the Booroolong Frog within the disturbance area. There will also be indirect impacts (e.g. edge effects) to 1.05 ha of surrounding retained vegetation for this species, which is expected to reduce the condition of groundcover. The BAM provides credits required to offset the habitat impacts to this species, however 0.55 ha belonging to one vegetation zone (SEH-6) does not meet the condition threshold to require offsetting and therefore credits have not been calculated (refer to **Section 13.3**).

Significance assessments have been completed for these species in accordance with the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (Department of Environment, 2013) (see **Appendix G**).

A low-density Koala population may be present as suitable food tree species including *Eucalyptus viminalis* and *Eucalyptus rubida* are common. However, surveys for the Koala were undertaken as part of this assessment in accordance with survey guidelines (refer to **Section 4.8.2.7**) and evidence of Koala presence was not identified (refer to **Section 7.4.2.17**). There is approximately 135.6 ha of potential habitat for the Koala within the disturbance area, however the potential for this species to occur is considered low, therefore no significance assessment has been undertaken.

## 9.6 Migratory species

Based on the PMST report and field surveys, eleven listed migratory species may occur in the broader locality (see **Table 9.1**). Surveys for birds were undertaken as part of the field surveys. The surveys included area surveys over 2 ha for 20 minutes each conducted in summer during which time most of the listed migratory species are present in eastern Australia.

'Important habitat' for a migratory species is defined as (DoE 2013):

- Habitat utilised by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species
- Habitat that is of critical importance to the species at particular life-cycle stages
- Habitat utilised by a migratory species which is at the limit of the species range
- Habitat within an area where the species is declining.

An assessment of the likely occurrence of these species and the presence of important habitat is included in **Appendix A**. An assessment of significance for migratory species has been completed in accordance with the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (Department of Environment, 2013) and is provided in **Appendix G**. While some migratory bird species are likely to use the study area and locality, the study area would not be classed as 'important habitat'. A nationally significant proportion of a population would not be supported by the study area. The project would not substantially modify, destroy or isolate an area of important habitat for the migratory species and it would not seriously disrupt the lifecycle of an ecologically significant proportion of a population of migratory birds.

Table 9.1: EPBC Act listed Migratory species that are considered likely to occur

| Species name | Common name | EPBC Act* | Overall likelihood of occurrence |
|---|---|---|---|
| *Apus pacificus* | Fork-tailed Swift | M | Moderate |
| *Gallinago hardwickii* | Latham's Snipe | M | Moderate |
| *Haliaeetus leucogaster* | White-bellied Sea-Eagle | M | Moderate |
| *Hirundapus caudacutus* | White-throated Needletail | M | Moderate |
| *Myiagra cyanoleuca* | Satin Flycatcher | M | Present |
| *Rhipidura rufifrons* | Rufous Fantail | M | High |

*M = Migratory

# 10. Impact avoidance and minimisation

This section of the BDAR demonstrates the efforts taken to avoid and minimise impacts on biodiversity values in accordance with Section 8 of the BAM.

Combined with appropriate mitigation measures and safeguards during construction and operation of the project (which will be outlined in the project's Construction Environmental Management Plan (CEMP), the siting and planning of the project is expected to be sufficient to ensure that the requirements to avoid and minimise impacts on biodiversity values as set out in Section 8 of the BAM are met. Due to the location of the project within a heavily vegetated area of the KNP and Bago State Forest, the potential for avoiding impacts is limited.

A key part of management of biodiversity for this project is the application of the 'avoid, minimise, mitigate and offset' hierarchy as follows:

1) Avoid and minimise impacts as the highest priority
2) Mitigate impacts where avoidance is not feasible or practicable in the circumstance
3) Offset where residual, significant unavoidable impacts would occur (if required).

## 10.1 Avoiding and minimising impacts on native vegetation and habitat during project planning

Due to the location of the project within a heavily vegetated area of the KNP and Bago State Forest, the potential for avoiding impacts is limited. An initial site visit was undertaken within the survey area over two days in March 2018 to ground-truth the results of the background research and undertake an initial rapid high-level habitat assessment. This site visit involved a drive through of the study area on accessible roads and tracks. Areas visited included Lobs Hole Ravine Road, Link Road, Goat Ridge Road and Elliott Way in the KNP. Elliott Way, Boundary Road and Black Jack Logging Road and the East Bago Powerline Road in the Maragle and Bago State Forests were also driven. This initial site visit provided information on the likely impacts to native vegetation and habitat. A more detailed walk over survey of some potential transmission line routes, structure locations and access tracks within the KNP was undertaken over four days in April 2018 with designers and engineers from TransGrid. This visit included walking through sections of the Bago State Forest and to the top of Sheep Station Ridge in KNP to plan potential helipad locations and access tracks.

During the initial site visits in March and April 2018, notes were made on PCTs and boundaries between PCTs, and incidental observations of fauna were made. These initial site visits undertaken with engineers from TransGrid allowed for discussions on impact avoidance and minimisation. Alternative routes were considered. However, there was a realisation that due to the location of the project and the landscape constraints, there would be unavoidable impacts to biodiversity from the project no matter which route was chosen as the transmission lines need to run from the cable yard near the Yarrangobilly River to Line 64 in the Bago State Forest. Importantly however, there will be no impacts to Endangered Ecological Communities (EECs) or Critically Endangered Ecological Communities (CEECs) or areas of outstanding biodiversity value (AOBV).

During the preparation of this BDAR, there have been several iterations of the project area as the project design has been refined, locations of structures moved, and access tracks designed. A key avoidance measure successfully implemented for this project was avoidance of the 50 m buffer zone around the edge of the Yarrangobilly River and Wallaces Creek that has been identified as Booroolong Frog breeding and dispersal habitat (EMM Consulting, 2017 and 2020a). Structures are located off the floodplains and are at least 50 m from waterways where the Booroolong Frog is known to occur. The disturbance area of the project has been reduced to that required for the transmission line corridor, structure locations, access tracks, substation, and any ancillary activities including brake and winch sites, crane pads, helicopter landing pad, site compounds and equipment laydown areas. LiDAR has been used to determine which areas of the alignment need clearing for height clearances to minimise the amount of clearing required. An options assessment has been undertaken as part of the project and is listed in Chapter 3 of the EIS. Options for the following design factors have been considered as part of this process.

### 10.1.1 Structure height

Structure height was considered to reduce the area of clearing required by building taller structures, up to 94 m in height, ensuring safe clearance above the tree canopy. Building the transmission connection at a height above the tree canopy would satisfy the required safe electrical clearances where no vegetation clearing would be required and prevent fragmentation of habitat. From an engineering perspective, the construction of taller structures would be feasible. However, it would result in significant constraints regarding bushfire risks and National Electricity Market (NEM) risks. Without tree clearing under the transmission line, the risk of bushfire causing a catastrophic failure of the four 330 kV circuits increases. Furthermore, the ability to respond to such emergencies would become more difficult as there would be no cleared corridor to provide access. Should a trip of the transmission connection circuits occur, due to increased volume of underlying vegetation, there is the potential for the full loss of generation from Snowy 2.0, which could lead to voltage collapse and widespread consequences across the NEM. The impacts to species from clearing an access corridor is significantly less than what a bushfire could result in. Therefore, the use of 94 m-tall structures was removed from the design due to unacceptable asset and bushfire risks, potentially unacceptable visual impacts, and NEM risks. Where possible, structure heights will be up to 75 m, which has reduced the disturbance area in many locations, and as a result, vegetation will not need to be cleared along the entire length of the transmission line corridor, with large sections spanned.

### 10.1.2 Grid connection point and substation options assessment

Two options were considered for the grid connection point and substation: 'Connection to Transmission Line 2' and 'Connection to Transmission Line 64. 'Connection to Transmission Line 64' was the selected option due to:

- The construction of the new large-scale substation to support the connection would be located outside of the KNP (unlike 'Connection to Transmission Line 2') avoiding potential permanent impacts on biodiversity, heritage and recreational users within the Lobs Hole area of the KNP
- Future transmission line augmentation works required to transmit the full capacity of Snowy 2.0 would also avoid large areas of national park under this option
- A suitable substation location is located immediately adjacent to Line 64 and easily accessible from Elliott Way, therefore avoiding the need for extensive access road construction and further vegetation clearing.

### 10.1.3 Type of connection

Two options were considered for the grid connection point and substation: an underground cable option and an overhead transmission line. The overhead transmission line was selected primarily due to feasibility and overall reduction in environmental impacts, and also results in the retention of vegetation within gully areas as the clearance of the conductor above the tree canopy in these areas is sufficient to address the risk of fire and trees growing into the conductor space.

### 10.1.4 Route selection and access tracks

The preferred route option for the project, compared to the other two options assessed, requires fewer and shorter access tracks, several of which run near or under the proposed transmission line, resulting in a smaller footprint and less impact during construction and maintenance than a perpendicular track. Additionally, around 6.9 ha of the disturbance area is located within the approved Snowy 2.0 disturbance area (05.02.2020), further reducing clearing of vegetation required for this project.

## 10.2 Avoiding and minimising prescribed biodiversity impacts during project planning

Some types of projects may have impacts on biodiversity values in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat. For many of these impacts, the biodiversity values may be difficult to quantify, replace or offset, making avoiding and minimising impacts critical.

The BC Regulation (clause 6.1) identifies actions that are prescribed as impacts to be assessed under the biodiversity offsets scheme:

a) impacts of development on the habitat of threatened species or ecological communities associated with:
    i. karst, caves, crevices, cliffs and other geological features of significance, or
    ii. rocks, or
    iii. human made structures, or
    iv. non-native vegetation
b) impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range
c) impacts of development on movement of threatened species that maintains their life cycle
d) impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including from subsidence or upsidence resulting from underground mining)
e) impacts of wind turbine strikes on protected animals
f) impacts of vehicle strikes on threatened species or on animals that are part of a TEC.

The project will not impact on the known karst area approximately 300 m to the south. Human made structures and non-native vegetation are not a concern for this project. There are some areas of rock outcrop in the disturbance area that cannot be avoided, however micro-siting of tracks may avoid these where possible. There may be impacts to water quality and quantity due to run off and sedimentation into adjacent watercourses and this has been avoided though moving structures off the Yarrangobilly River floodplain. Water quality would be managed through implementation of sediment control measures during construction. The impacts of wind turbines are not applicable to this project. Increased vehicle movements during construction of the project have the potential to result in increased fauna mortality from vehicle strikes and this impact would be managed appropriately.

### 10.2.1 Habitat connectivity and movement for gliding mammals

Impacts to connectivity and species movement cannot be avoided in this landscape and given the proposed removal of vegetation along the width of the transmission line corridor in large sections, there will be potential impacts to movement of fauna, in particular species reliant on the canopy and shrub layers for movement. However, there is potential that fencing associated with the substation may affect the ability of threatened non-flying species to move through the area. TransGrid standard substation security fencing would be installed on all sides of the substation, which is planned to be about 3 m-high galvanised steel topped with barbed or razor wire (more information is provided in Chapter 5 of the EIS). Barbed wire fencing is a well-documented hazard to wildlife, particularly gliding mammals (van der Ree 1999), and is listed as a threat to the Squirrel Glider under the BC Act. This potential impact has been discussed in more detail in **Section 11.2.3** and **Section 11.2.4**.

Where barbed/razor wire is required, measures may also be taken to improve the visibility of barbed/razor wire. Options may include adding visible (and often audible) objects to the fence, such as tape, plastic flags and metal tags (Booth 2007). The potential for entanglement in barbed wire is likely to be greatest within 100 m of the substation fence corners where animals are within gliding distance of other trees. All measures proposed to minimise this impact are described in **Chapter 12**.

# 11. Assessment of impacts

## 11.1 Impacts on native vegetation and habitat

### 11.1.1 Direct impact of clearing native vegetation, threatened ecological communities and threatened species habitat

Consistent with the Snowy 2.0 Main Works BDAR (EMM Consulting, 2020a), direct impacts have been calculated using the disturbance area, which only includes access track option A (the most likely option) and does not account for areas within the approved Snowy 2.0 disturbance footprint (05.02.2020). This represents the maximum clearing threshold required for the project, however the exact location of the disturbance area with the larger construction envelope would not be known until the completion of detailed design, as is normal for a major project at this stage of the process. This BDAR has assessed the larger construction footprint for its biodiversity values so that the disturbance area may move during construction without the need to modify the project, however the calculation of impact areas has been restricted to the disturbance area for this stage of the development assessment. Project impacts and offset obligations would be revised throughout the life of the project. This approach is consistent with the approved Snowy 2.0 Main Works EIS (EMM Consulting, 2019).

While vegetation and habitat clearing will be avoided along sections of the transmission line corridor, including waterways and gullies (approximately 8 ha) and areas already cleared for the Snowy 2.0 Main Works construction (approximately 6.9 ha), the project will result in the direct removal of native vegetation and habitat, along the remaining sections, as well as access tracks, structure locations and the substation site. The estimated clearing of vegetation is approximately 135.6 ha consisting of the following PCTs:

- Broad-leaved Sally grass – sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion (PCT 285)
- Brittle Gum – peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion (PCT 296)
- Ribbon Gum – Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment (PCT 300)
- Riparian Blakely's Red Gum – Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion (PCT 302)
- Broad-leaved Peppermint – Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion (PCT 729)
- Norton's Box – Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion (PCT 999)
- Snow Gum – Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion (PCT 1196).

**Table 11.1** provides a summary of the direct impacts to native vegetation that would occur within the disturbance area. There would be no direct impacts from clearing to any threatened ecological communities. As the transmission line corridor would be cleared for construction, the future vegetation integrity score for areas directly impacted has been set at zero (i.e. total clearing to ground-level).

The direct impacts on threatened species habitat are outlined in

**Table** 11.2.

Targeted surveys undertaken for *Caladenia montana* in October 2020 preliminarily identified plants that match the morphological description for this species (personal communication with Mark Clements from the

Australian National Botanical Gardens). It is understood that samples sent to the Australian Royal Botanical Gardens for identification are undergoing genetic analysis to confirm the identification of the plants found, however the results of this analysis are still pending. Therefore, the calculation of potential impacts on *Caladenia montana* has been delayed until the final determination from the Australian National Botanical Gardens is received.

Table 11.1: Summary of direct impacts to vegetation within the disturbance area

| Vegetation Zone | PCT ID No. | PCT name | Broad condition class | Area (ha) in disturbance area | Current VI score | Future VI score |
|---|---|---|---|---|---|---|
| **Australian Alps Bioregion** | | | | | | |
| AA-1 | 285 | Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion | Moderate - Blackberry infestation | 1.77 | 78.7 | 0 |
| AA-2 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | 10.77 | 83.7 | 0 |
| AA-3 | 1196 | Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion | Native Grassland | 0.76 | 38.6 | 0 |
| AA-4 | 1196 | Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion | Good | 23.19 | 84.9 | 0 |
| | | | Sub-total | 36.49 | - | - |
| **South Eastern Highlands Bioregion** | | | | | | |
| SEH-1 | 296 | Brittle Gum - peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion | Native Grassland | 0.13 | 39.5 | 0 |
| SEH-2 | | | Good – drier *Eucalyptus nortonii* dominant slope | 4.67 | 88.7 | 0 |
| SEH-3 | | | Good – wetter sheltered slopes | 14.96 | 75.3 | 0 |
| SEH-4 | | | Moderate – Blackberry infestation | 1.38 | 49.1 | 0 |
| SEH-5 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | 32.5 | 81.3 | 0 |
| SEH-6 | 302 | Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western | Native Grassland | 0.55 | 14.6 | 0 |
| SEH-7 | | | Moderate | 2.57 | 61.3 | 0 |

| Vegetation Zone | PCT ID No. | PCT name | Broad condition class | Area (ha) in disturbance area | Current VI score | Future VI score |
|---|---|---|---|---|---|---|
| | | Slopes Bioregion and South Eastern Highlands Bioregion | | | | |
| SEH-8 | 729 | Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion | Native Grassland | 1.11 | 23.4 | 0 |
| SEH-9 | | | Shrubland - regrowth | 0.78 | 36.6 | 0 |
| SEH-10 | | | Good - dry open slopes & ridgetops | 16.05 | 81.5 | 0 |
| SEH-11 | | | Good - wetter sheltered slopes | 16.79 | 76 | 0 |
| SEH-12 | 999 | Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion | Shrubland - regrowth | 1.23 | 31.5 | 0 |
| SEH-13 | | | Good - drier *Calytrix tetragona* | 6.38 | 58.9 | 0 |
| | | | Sub-total | 99.11 | - | - |
| | | | TOTAL | 135.6 | - | - |

Table 11.2: Summary of direct impacts on threatened species habitat (species credit species)

| Species name | Common name | EPBC Act | BCAct | Area (ha) in disturbance area | | Sensitivity to gain class |
|---|---|---|---|---|---|---|
| | | | | South Eastern Highlands | Australian Alps | |
| **Birds** | | | | | | |
| *Callocephalon fimbriatum* | Gang-gang Cockatoo (breeding) | - | V | 35.64 | 33.96 | High |
| *Ninox strenua* | Powerful Owl (breeding) | - | V | 32.51 | 10.77 | High |
| *Tyto novaehollandiae* | Masked Owl (breeding) | - | V | 3.12 | 0 | High |
| **Frogs** | | | | | | |
| *Litoria booroolongensis* | Booroolong Frog | E | E | 3.12 | 0 | High |
| **Mammals** | | | | | | |
| *Cercartetus nanus* | Eastern Pygmy-possum | - | V | 97.33 | 35.73 | High |
| *Petaurus australis* - endangered population | Yellow-bellied Glider Population on the Bago Plateau | - | EP | 25.49 | 35.73 | High |
| *Petaurus norfolcensis* | Squirrel Glider | - | V | 32.39 | 35.73 | High |

Key: E = endangered, EP = endangered population, V = vulnerable

### 11.1.2 Indirect impact of clearing native vegetation, threatened ecological communities and threatened species habitat

Section 1.2 of the BAM Stage 2 Manual defines indirect impacts as development related activities not associated with clearing for the development footprint. Paragraph 9.1.4.2 of the BAM lists 17 potential indirect impacts that may result from construction and/or operation of a new development. The majority of these impacts that applicable to this project are discussed below in **Section 11.2**, **Section 11.3**, **Section 11.4** and **Section 11.5**. Though they cannot be quantified, the potential for those indirect impacts can be confidently minimised through the application of mitigation measures. The purpose of this section is to quantify the unavoidable indirect impacts that are associated with the changed abiotic conditions when new edges are created through previously intact vegetation.

These indirect impacts are expected occur in vegetation and habitat retained adjacent to clearing required for the project. This indirect impact specifically refers to negative changes to the structure and function of retained vegetation as a result of changed abiotic factors such as increased light intensity and duration, increased exposure to wind, and weed invasion in edge habitats. These changes can have a negative impact on plant and animal species by changing habitat quality. The assessment of indirect impacts has been guided by Section 2.4.1 of the BAM Stage 2 manual. The case study (Box 2) in Section 2.4.1 describes the use of a 50 m buffer to capture the edge effects caused by a major road infrastructure project.

Within the disturbance area, it is assumed that all vegetation will be removed to ground level for this assessment. Much of the vegetation within the transmission line corridor may regenerate to a low shrub or grass layer. Unlike a major road infrastructure project, there will be very few hard surfaces created that are completely void of some level of vegetation and the level of traffic following completion of construction will be minor. As such, it is expected that the edges effects resulting from the construction of a major road would likely be more substantial than the expected edge effects from this project. Therefore a 50 m buffer is likely to be larger than required for this assessment.

The Snowy 2.0 Main Works BDAR (EMM Consulting, 2020a) describes that investigations undertaken in the early stages of the assessment identified that a distance of 20 m from a new edge exhibited a significantly higher cover of exotic species than a distance of 20-50 m. This 20 m buffer is therefore experiencing different conditions along the edge resulting in a change to the structure and function of the ground layer. Therefore, indirect impacts to the structure and function of the ground layer in retained adjacent vegetation associated with the creation of new edges for this assessment have been calculated based on a 20 m buffer of the disturbance area with the following exemptions:

- Indirect impacts have not been calculated within Snowy 2.0 disturbance footprint (05.02.2020) where impacts have already been assessed (refer **Section 4.2.1**)
- Indirect impacts have not been calculated within existing modified vegetation types such as regrowth native grasslands, and shrublands or within 20 m of existing edges (i.e. roads, dirt trails and modified/disturbed vegetation zones) as these areas are already expected to experience edge effects.

The primary expected indirect impact from this project is an increase in exotic plant cover along the full length of new edges on both sides of the transmission line corridor, particularly in areas already containing any cover of weeds. This equates to an area of approximately 39.23 ha. The largest impacts will be from species such as Blackberry (*Rubus fruticosus* species agg.), which will cause a flow-on effect of a reduction in native groundcover over time. The BAM-C does not allow the user to increase the cover of high-threat weeds, however it is possible to reduce the structure (cover) of native groundcover within a given vegetation zone in order to assign a future vegetation integrity score to the retained vegetation that reflects greater weed abundance and subsequent lower cover of native ground cover. Therefore, indirect impact credits have been calculated based on an assumed reduction in vegetation integrity from the reduction in the structure and function of retained vegetation around new edges over time, using on the following criteria:

- Vegetation zones were established in the BAM-C, specifically to map areas of each PCT located within the 20 m indirect impact zone as described above

- Using the plot data collected for the direct impact vegetation zones, the mean structure and function data was applied to the indirect vegetation areas, with modification as follows:
  - the structure (cover) scores for 'grass', 'forbs', 'ferns' and 'other' growth forms were reduced by 10 per cent of the existing average score, leaving scores for all other growth forms at the current average score
  - functional score for litter cover was reduced by 5 per cent of the existing average score, leaving scores for all other function data at the current average score
  - composition average scores were not changed.

The predicted indirect impacts to retained native vegetation within a 20 m buffer of the disturbance area are identified in **Table 11.3** and indirect impacts to threatened species habitat are listed in **Table 11.4.** Indirect impacts to vegetation are expected to impact the quality of habitat for all threatened species in the long-term, therefore credits have been calculated for all species-credit species included in this assessment.

Table 11.3: Summary of indirect impacts on vegetation within a 20 m buffer of the disturbance area

| Vegetation zone (indirect buffer) | PCT ID | PCT name | Broad–condition class | Area (ha) in 20 m buffer | Current VI score | Future VI score |
|---|---|---|---|---|---|---|
| **Australian Alps Bioregion** | | | | | | |
| AA-5 | 285 | Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion | Moderate - Blackberry infestation | 0.33 | 78.9 | 80.2* |
| AA-6 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | 2.88 | 83.2 | 82.7 |
| AA-7 | 1196 | Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion | Good | 3.68 | 84.7 | 84.5 |
| | | | Sub-total | 6.89 | - | - |
| **South Eastern Highlands Bioregion** | | | | | | |
| SEH-14 | 296 | Brittle Gum - peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion | Good– drier *Eucalyptus nortonii* dominant slope | 1.34 | 88.7 | 88.1 |
| SEH-15 | | | Good– wetter sheltered slopes | 4.74 | 74.5 | 73.7 |
| SEH-16 | | | Moderate – Blackberry infestation | 0.08 | 48.9 | 48.7 |

| Vegetation zone (indirect buffer) | PCT ID | PCT name | Broad–condition class | Area (ha) in 20 m buffer | Current VI score | Future VI score |
|---|---|---|---|---|---|---|
| SEH-17 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | 9.57 | 80.2 | 79.1 |
| SEH-18 | 302 | Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion | Moderate | 1.05 | 61.4 | 61.5* |
| SEH-19 | 729 | Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion | Good - dry open slopes & ridgetops | 5.33 | 81.9 | 82.3* |
| SEH-20 | | | Good - wetter sheltered slopes | 7.98 | 76 | 76* |
| SEH-21 | 999 | Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion | Good - drier *Calytrix tetragona* | 2.25 | 58.8 | 58.7 |
| | | | Sub-total | 32.34 | - | - |
| | | | TOTAL | 39.23 | - | - |

*Following the method outlined in EMM Consulting (2020a), some VI scores increased following the manual adjustment of future vegetation structure and function. This may have been caused by scores being closer to the benchmark for that PCT and also algorithms built into the BAM-C that cause VI scores to change through time.

Table 11.4: Summary of indirect impacts on threatened species habitat (species credit species)

| Species name | Common name | EPBC Act | BC Act | Area (ha) in 20 m buffer | | Sensitivity to gain class |
|---|---|---|---|---|---|---|
| | | | | South Eastern Highlands | Australian Alps | |
| **Birds** | | | | | | |
| *Callocephalon fimbriatum* | *Gang-gang Cockatoo* | - | V | 10.62 | 6.56 | High |
| *Ninox strenua* | *Powerful Owl* | - | V | 9.57 | 2.88 | High |
| *Tyto novaehollandiae* | *Masked Owl* | - | V | 1.05 | 0 | High |
| **Frogs** | | | | | | |
| *Litoria booroolongensis* | Booroolong Frog | E | E | 1.05 | 0 | High |
| **Mammals** | | | | | | |
| *Cercartetus nanus* | Eastern Pygmy-possum | - | V | 32.37 | 6.89 | High |
| *Petaurus australis* - endangered population | Yellow-bellied Glider population on the Bago Plateau | - | E | 4.74 | 6.89 | High |
| *Petaurus norfolcensis* | Squirrel Glider | - | V | 7.37 | 6.89 | High |

## 11.2 Prescribed biodiversity impacts

This section identifies the potential prescribed biodiversity impacts on threatened species associated with the project in accordance with Section 6.7 of the BAM. These are impacts that are in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat.

### 11.2.1 Impacts on the habitat of threatened species or ecological communities associated with karst, caves, crevices, cliffs and other features of geological significance

The Pleistocene glacial landforms in KNP are the only examples of this landform on the mainland of Australia and are of national and international significance (OEH 2012). The periglacial features of the park include terracing, solifluction loces, sliding and shattered boulders and block streams (also known as scree slopes or boulder streams). Periglacial features are more extensive than glacial features in KNP and are widespread. Periglacial evidence is found in most areas above 1,000 m asl and possibly as far down as 600 m asl. There is a block stream along Lobs Hole Ravine Road to the south of the construction envelope. This block stream will be affected by the road upgrade works associated with the Snowy 2.0 project (see EMM Consulting 2017 and 2020a) but will not be impacted by this project.

The tufa deposits and fossil sequence at Ravine are recognised in the KNP PoM as a significant natural feature. There are two tufa deposits near the construction envelope. The Cave Gully deposit (**Photo 11-3** and **Photo 11-4**) is in Cave Gully approximately 1 km upstream of the Lobs Hole Copper Mine. The Lick Hole Gully Tufa is deposited near the headwaters of Lick Hole Gully and are visible from Lobs Hole Ravine Road. These tufa deposits occur to the south of the construction envelope but will not be directly impacted. Karst features are considered to be rare within the Lick Hole Formation as there is a general lack of massive limestone (EMM Consulting, 2018a). **Figure 5-1** and **Figure 5-3** illustrate the locations of rocky outcrops identified during surveys.

A low exposed cliff line is also present to the south of Mine Trail Road (**Photo 11-1**, **Photo 11-2** and **Photo 11-7**) though is outside of the study area and would not be directly impacted by the project.

The candidate list of threatened species using or dependent on these habitat features (species found in the caves, rock fissures, etc. class) includes the Dusky Woodswallow, Spotted-tailed Quoll, Booroolong Frog, Large Bent-winged Bat, Southern Myotis, Masked Owl, and Rosenberg's Goanna. Any caves and rock fissures associated with the tufa deposits at Ravine may support sheltering or roosting habitat for species including the Dusky Woodswallow, Spotted-tailed Quoll, Large Bent-winged Bat, Southern Myotis, Masked Owl, and Rosenberg's Goanna but these areas are outside of the construction envelope and will not be impacted by the project. The Booroolong Frog is dependent on the rocks and crevices in the waterways, but these features will not be directly impacted as the transmission lines will span the waterways and the bridge over Sheep Station Creek will be a single span with no instream structures so rock removal should not be needed. Mitigation measures will be put in place to ensure that sedimentation does not detrimentally affect the in-stream rocks.

Due to the nature of the project, it is considered unlikely that the environmental processes critical to the formation and persistence of the unique natural features of the area of karst, geological features of significance, and cliff fall will be impacted as these key areas are located outside of the construction envelope. The project is not expected to have any consequences for the persistence of the suite of threatened species likely to use these areas as habitat as these features will not be directly affected.

Photo 11-1: The cliff line to the south of Mine Trail was examined for potential roost sites

Photo 11-2: The cliff line to the south of Mine Trail was examined for potential roost sites

Photo 11-3: Cave gully showing limestone

Photo 11-4: Cave gully showing limestone

### 11.2.2 Impacts on the habitat of threatened species or ecological communities associated with rocks

The construction envelope does have some occurrences of rock, mostly in the South Eastern Highlands portion where outcropping of sedimentary rocks occurs on the ridge tops and upper slopes. There are also some rare occurrences of volcanic boulders in the construction envelope within the Australian Alps Bioregion (**Photo 11-5** and **Photo 11-6**) and there is also the quarry off Elliott Way with exposed rock cuttings. **Figure 5-1** and **Figure 5-3** illustrate the locations of rocks including outcrops and any scattered boulders. The figures also show the locations of more significant rock outcrops and cliff lines found outside of the construction envelope including those on the Stable Walls and nearby outcrops. A low exposed cliff line is also present to the south of Mine Trail Road (**Photo 11-1**, **Photo 11-2** and **Photo 11-7**) and is the largest rocky habitat feature in the broader area though is outside of the study area and would not be directly impacted by the project.

The threatened species subject to this assessment that are known to be associated with rocks (species found in the rocky cliffs, major rock outcrops etc. class) include the Dusky Woodswallow, Spotted-tailed Quoll, Little Eagle, Booroolong Frog, Large Bent-winged Bat, Southern Myotis, Masked Owl, and Rosenberg's Goanna. The rocky outcrops and scattered rocks within the construction envelope are likely to be used as refuge and foraging habitat by species including the Spotted-tailed Quoll and Rosenberg's Goanna and the rocky areas are likely to be within a home range of the Little Eagle. However, these three species are unlikely to be dependent on the rocky areas and the rocks are unlikely to be a limiting habitat. No evidence of den sites or latrine sites or sheltering sites were present in the construction envelope. The Little Eagle is not dependent on these rocky areas within the construction envelope for foraging. There are no significant open cliff faces with crevices or caves within the construction envelope that may be suitable as shelter or roosting sites for the Dusky Woodswallow, Large Bent-winged Bat, Southern Myotis, or Masked Owl. Booroolong Frog habitat is restricted to the rocky drainage lines and not the ridges where rock outcrops occur.

The rocky outcrops are unlikely to be removed by the project. The structures will be built on the ridges and the transmission lines will span across the outcrops. Vegetation removal would be required but it is unlikely that the rocky outcrops would be removed. Two of the access roads are positioned over a small rocky outcrop, which would result in impacts to two small rocky outcrops. Although it is assumed that final placement of access roads will aim to avoid these, there is potential for some impacts to small rocky outcrops to occur. These are unlikely to present important habitat for any threatened species and a large number of rocky outcrops will remain around the transmission line corridor following the completion of the project. Therefore, the project is not considered likely to impact rocky habitats to the point where the bioregional persistence of the suite of threatened species likely to use these areas as habitat.

Photo 11-5: Volcanic boulders in the Australian Alps Bioregion and of sedimentary rocks in the South Eastern Highlands Bioregion

Photo 11-6: Volcanic boulders in the Australian Alps Bioregion and of sedimentary rocks in the South Eastern Highlands Bioregion

Photo 11-7: The cliff line to the south of Mine Trail is the largest rocky habitat feature in the broader study area

#### 11.2.3 Impacts on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range

Habitat connectivity is identified as the degree to which a site connects different areas of habitat of threatened species to facilitate the movement of those species across their range. The habitats within and surrounding the construction envelope have a high degree of connectivity to other large areas of habitat within the KNP and Bago State Forest. There are no obvious linear corridors. The project is predominantly located within the KNP, with the western end of the construction envelope situated in the Bago State Forest. The KNP is largely vegetated across its 690,000 ha extent and intact remnant vegetation extends across the Australian Alps and into the South Eastern Highlands. The Talbingo Reservoir provides a barrier to east west movement for some fauna groups. South from the construction envelope, there is habitat connectivity south into Victoria in national parks, state forests and on private land from the Snowy Mountains and Monaro, to the Victorian Highlands, Victorian Alps, South East Coastal Ranges, Kybean-Gaurock subregion, and into the East Gippsland Lowlands subregion to the coast on the south east corner. Connectivity to the north exists through the Bondo subregion extending through to the Inland Slopes and Murrumbateman subregions where agricultural land becomes dominant and habitats are largely cleared or fragmented. From the construction envelope within the Snowy Mountains in the west, vegetation stretches into the Bondo and Inland Slopes subregions where the habitats start to become fragmented by agricultural development. Eastern connectivity exists through the Bondo subregion, Snowy Mountains, and into the Monaro where habitats start to become fragmented by agricultural development.

There are high levels of physical, and functional, habitat connectivity surrounding the construction envelope and all species subject to this assessment would benefit from the high levels of habitat connectivity. However, some species will not be adapted to all environments and restricted environments do exist within this larger connected landscape. Some species are expected to be unaffected by the proposed habitat removal along this linear landscape. A summary of expected connectivity impacts to the species subject to this assessment is as follows:

- Gang-gang Cockatoo - a highly mobile species that can disperse or migrate tens of kilometres (NSW Scientific Committee, 2008a), so population fragmentation is unlikely from the project and habitat connectivity for this species will be unaltered

- Powerful Owl and the Masked Owl - dispersal ability of these owls is 80+ km over partly open country (Department of Environment and Conservation (NSW), 2006), suggesting that the project is unlikely to affect habitat connectivity for these owl species
- Booroolong Frog – bridges will be designed so that streamflow is unaffected so impacts to habitat connectivity for the Booroolong Frog should be relatively minor
- Eastern Pygmy-possum - given the ability of the Eastern Pygmy-possum to utilise disturbed habitats (see Law *et al.*, 2013), it is likely that this species will use the dense shrubby habitats that form beneath the transmission lines within the transmission line corridor and habitat connectivity for this species is not likely to be greatly affected
- Yellow-bellied Glider, Squirrel Glider and Greater Glider – these species are capable of long glides to cross canopy gaps (~70 to 100 m) and are capable of rapid cross-country movement if necessary, to move between habitats so while physical connectivity will be broken by the transmission line corridor and access tracks, functional connectivity for these species should remain.

Linear infrastructure, such as transmission lines, is ubiquitous in the Australian landscape including the KNP and Bago State Forest and is known to be responsible for the loss of habitats and disruption of landscape connectivity. The creation of open and shrubby corridors within areas of intact forest is the key impact to habitat connectivity that would result from the project. The creation of access roads and the transmission line corridor underneath the transmission lines will introduce linear features through environments that can be considered relatively undisturbed and where these features currently do not exist. As such, there is likely to be a level of impact to habitat connectivity, but functional connectivity for most species is unlikely to be affected to the point where the bioregional persistence of these species is placed at risk. Impacts to species movement is discussed further in **Section 11.2.4**.

There is potential that any fencing associated with the project may affect the ability of threatened non-flying species to move through the area, particularly around the substation site. TransGrid standard substation security fencing would be installed on all sides of the substation, which is planned to be 3 m high galvanised steel topped with barbed or razor wire (more information is provided in Chapter 5 of the EIS). Barbed wire fencing is a well-documented hazard to wildlife, particularly gliding mammals (van der Ree, 1999), and is listed as a threat to the Squirrel Glider under the BC Act. Barbed wire has the potential to cause injury or death to Yellow-bellied Glider and Squirrel Glider individuals moving though the habitat if they run into fencing while gliding or climbing. The potential for entanglement in barbed wire is likely to be greatest within 100 m of the substation fence corners where animals are within gliding distance of other trees. Measures to reduce this potential impact are described in **Chapter 12** and include improving the visibility of barbed/razor wire.

Aside from the potentially detrimental impacts to habitat connectivity, corridor creation for some species is likely to occur. The ‘right of way’ of a cleared transmission line corridor may function as a wildlife corridor connecting areas of habitat. The literature indicates that large carnivores exhibit a strong preference to move through rights of way (Donida Biasotto and Kindel, 2018). This has implications for the increased movement of introduced vertebrate pests including foxes and dogs. Introduced herbivores, particularly horses and deer, were observed preferentially grazing in the Line 64 easement in the Australian Alps portion of the construction envelope. This indicates that the creation of a power line easement through currently densely forested areas is likely to create further grazing habitat for horses and deer and may open up areas of habitat that currently have lower pest species densities.

Another unintended consequence of access road creation is the opening up of areas of habitat to illegal hunting. Licensed hunting is popular in the Bago State Forest but so is unlicensed hunting. Hunters were present in the hunting exclusion zone during the field surveys indicating that hunting rules are not adhered to by some hunters. New access tracks into previously inaccessible areas are likely to provide an opportunity for vehicle-based hunters to move into new areas. These newly created access tracks and the transmission line corridor may also allow easier access to core areas of habitat patches and can facilitate poaching and illegal plant extraction (although the likelihood of this occurring is low).

### 11.2.4 Impacts on movement of threatened species that maintains their life cycle

Threatened species movement is identified as the degree to which a particular site contributes to the movement of threatened species to maintain their lifecycle. Each threatened species that may have movement affected by the project is discussed below.

#### 11.2.4.1 Gang-gang Cockatoo

In terms of movements that maintain the lifecycle of the Gang-gang Cockatoo, this species undertakes seasonal altitudinal migration from high forests to lower areas during winter. The Gang-gang Cockatoo is common in the higher altitude areas of the Great Dividing Range during the summer months where the species breeds in tree hollows in moist eucalypt forests. Once breeding has finished, the Gang-gang Cockatoo moves to lower altitude areas for the autumn and winter. The Gang-gang Cockatoo is highly mobile (a partial or altitudinal migrant), but habitat fragmentation possibly inhibits dispersal and foraging efficiency (NSW Scientific Committee, 2008a). The construction envelope is situated in an area where breeding is likely to take place over the summer period. The project is however unlikely to introduce any barriers to the movement of this species and it is likely that seasonal altitudinal movements will still take place during and after construction. The Gang-gang Cockatoo freely flies above the existing transmission lines and the current infrastructure does not prohibit seasonal movements. The Gang-gang Cockatoo is highly mobile and can disperse or migrate tens of km, so population fragmentation is unlikely except where populations are isolated by extensive suburbia (e.g. what has happened in northern Sydney) (NSW Scientific Committee, 2008a).

The impacts of the project are considered unlikely to influence any movements of the Gang-gang Cockatoo that are essential to maintain their life cycle. The project is unlikely to affect the bioregional persistence of the Gang-gang Cockatoo.

#### 11.2.4.2 Powerful Owl and Masked Owl

The Powerful Owl and the Masked Owl are both sedentary species and do not undertake seasonal movements between habitats (Department of Environment and Conservation (NSW), 2006). Resident breeding pairs of Powerful Owls defend exclusive nesting territories within larger, defended home ranges of 400 to 4,000 ha, depending on habitat quality and prey densities (NSW Scientific Committee, 2008b, Department of Environment and Conservation (NSW), 2006). Home range of the Masked Owl has been estimated as 400 to 1,000 ha, variable according to habitat productivity (Department of Environment and Conservation (NSW), 2006). Logged forest (or other cleared areas) is not a barrier to owl movement (Department of Environment and Conservation (NSW), 2006), and dispersal ability of the Masked Owl is greater than 80 km over partly open country (Department of Environment and Conservation (NSW), 2006), suggesting that the project is unlikely to introduce barriers to dispersal or affect gene flow. The likely ability of the owls to disperse over tens of kms through a mosaic of forested and cleared land suggests that there are unlikely to be any barriers to gene flow within NSW (Department of Environment and Conservation (NSW), 2006) and that the project is unlikely to affect the bioregional persistence of either species. Additionally, the Masked Owl may be a disturbance opportunist in terms of its ability to forage along roads, tracks, ecotones, and recently harvested forest or cleared land (Department of Environment and Conservation (NSW), 2006) so the creation of the transmission line corridor and access tracks won’t be a barrier to this species.

The home range of a pair or pairs of Powerful Owls and Masked Owls are likely to be impacted by the project but it is unlikely that movement across the home range would be detrimentally affected. These species will fly over cleared areas and the various project features will not introduce any significant barriers that would impact flight around a home range. The impacts of the project are considered unlikely to influence any movements of the Powerful Owl or Masked Owl that are essential to maintain their life cycle. The consequences of the project in terms of the effects on movement on the bioregional persistence of the Powerful Owl or Masked Owl are likely to be negligible.

#### 11.2.4.3 Booroolong Frog

Booroolong Frogs are heavily reliant on the presence of permanent water and movements are generally local and small scale. The dispersal capabilities and non-breeding habitats of the species are unknown, but the species is relatively sedentary with studies showing that the majority of recaptured individuals moved less than 50 m within a season, with maximum movements of up to 300 m being recorded across seasons (Department of the Environment, 2019a). Consequently, impacts to stream habitats may have a detrimental effect on the ability of the Booroolong Frog to move.

The transmission lines would span Booroolong Frog habitat and the bridge over Sheep Station Creek would be designed to avoid blocking streamflow. As such, impacts to the movement of the Booroolong Frog should be relatively minor and current movement patterns should remain comparatively unaltered. The design of waterway crossings and management measures that would be implemented during construction suggest that the project is considered unlikely to influence any movement of the Booroolong Frog that is essential to maintain its life cycle. The consequences of the project in terms of the effects on movement on the bioregional persistence of the Booroolong Frog are likely to be negligible.

#### 11.2.4.4 Eastern Pygmy-possum

Movements of the Eastern Pygmy-possum within home ranges affected by the project are unlikely to be affected in the long-term. Likewise, the project is not likely to form a permanent barrier that would prevent dispersal of the Eastern Pygmy-possum. Monitoring of Eastern Pygmy-possum populations has shown that population troughs occur in late winter and spring which may be associated with low survival and/or seasonal migration, possibly linked to the cessation of *Banksia* sp. flowering in July and the lack of alternative food sources at this time (see Bladon *et al.*, 2002). This suggests that the species is likely to move between habitats to seek more productive areas on a seasonal basis. The Eastern Pygmy-possum has been shown to select habitats with dense understorey, especially those comprising flowering *Banksia* sp. (Law *et al.*, 2018) and there is potential that dense shrub regrowth after clearing of the transmission line corridor may favour the Eastern Pygmy-possum, particularly if the growth of *Banksia canei* is encouraged. Studies have also shown that Eastern Pygmy-possum does not avoid disturbed habitat within their home ranges and that habitat disturbance such as tree clearing does not significantly influence habitat selection (Law *et al.*, 2013).

Given the ability of the Eastern Pygmy-possum to utilise disturbed habitats, the impacts of the project are considered unlikely to influence any movements of the Eastern Pygmy-possum that are essential to maintain its life cycle. Removal of vegetation within the disturbance area during construction is likely to cause temporary and localised barriers to movement. However, the infrastructure and operation of the project will not create a complete barrier to movement. In time, it is likely that the Eastern Pygmy-possum will use the dense shrubby habitats that form within the transmission line corridor and movements through the habitat are likely to continue. The project is considered unlikely to restrict movement of the Eastern Pygmy-possum to an extent that the bioregional persistence of the species is placed at risk.

#### 11.2.4.5 Yellow-bellied Glider

The Yellow-bellied Glider population on the Bago Plateau is disjunct owing to the steep valleys and unsuitable habitat surrounding the Bago Plateau and, in addition, because of cleared agricultural land to the west and the Tumut River and Talbingo Reservoir to the east. Yellow-bellied Gliders live in small social groups (2–6 individuals) that occupy exclusive territories of 25 to 84 ha in New South Wales. As such, it is likely that the construction envelope crosses through the territories of several social groups from the population. There is unlikely to be any movement of animals in or out of the Bago Plateau population. The transmission line corridor and access tracks are unlikely to create a permanent barrier to movement of the Bago Plateau Yellow-bellied Glider population. Yellow-bellied Gliders are capable of long glides (ca. 100 m) and rapid cross-country movement and Yellow-bellied Gliders have been observed to move at least 400 m in a straight line through logged forest while foraging (Goldingay and Kavanagh, 1991). Yellow-bellied Gliders have been observed to make glides of more than 50 m across a road (Goldingay and Kavanagh, 1991). The openness of some forest areas and gaps such as roads do not appear to inhibit the use of the habitat by the Yellow-bellied

Glider. Barriers to glider movement may exist only when trees (living or dead) are beyond normal gliding distances (e.g., >100 m) (Goldingay and Kavanagh, 1991).

The predicted canopy gap caused by the transmission line corridor on the Bago Plateau is a maximum of 195 m wide. These parts of the disturbance area will temporarily fragment the Yellow-bellied Glider local population and restrict normal movement patterns. However, the project will not completely stop movement either side of the project, as there will be no physical barrier, only a reduction in large trees. Additionally, it is expected that some level of regrowth will occur which may facilitate movement. The substation will require vegetation clearing of an area approximately 370 m by 670 m. The substation will permanently remove an area of habitat currently occupied by one or two social groups and it is likely that individuals will not be able to glide across this location. Measures to maintain connectivity are described in **Chapter 12.**

Given the ability of the Yellow-bellied Glider to cross forest gaps, the impacts of the project are considered unlikely to substantially influence movements of the Yellow-bellied Glider in the long-term that are essential to maintain its life cycle. The project is considered unlikely to restrict movement of the Yellow-bellied Glider population on the Bago Plateau to an extent that the bioregional persistence of the species is placed at risk.

The installation of barbed/razor wire may cause injury or death to the Yellow-bellied Glider from entanglement while climbing and gliding. Barbed wire fencing is a well-documented hazard to wildlife, particularly gliding mammals (van der Ree, 1999). The potential for entanglement in barbed wire is likely to be greatest within 100 m of the substation fence corners where animals are within gliding distance of other trees. Measures to reduce this potential impact are described in **Chapter 12,** and include improving the visibility of barbed/razor wire where installation is necessary.

#### 11.2.4.6 Squirrel Glider

The Squirrel Glider is most likely to occur in low densities within the habitats and the project may cross through the home ranges of several family groups. A family group occupies and defends (by scent-marking) a large territory of at least 3 ha in size (NSW Scientific Committee, 2008c). In a single night, gliders may move up to 1.6 km (van der Ree and Bennett, 2003). Squirrel Glider movements around a home range may be impacted by the project if the transmission line corridor and access tracks create a gap in the canopy that cannot be crossed by gliding. Squirrel Gliders are capable and willing to cross open habitat to reach resources but they typically require sufficient connectivity of tree cover within their maximum gliding distance of around 70 m (van der Ree, 2002, van der Ree and Bennett, 2003, van der Ree *et al.*, 2004).

The predicted canopy gap caused by the transmission line corridor is a maximum of 195 m wide (on the Bago Plateaux), though is typically around 130 m wide through other areas. These parts of the disturbance area will temporarily fragment the Squirrel Glider local population and restrict normal movement patterns. However, the project will not completely stop movement either side of the Transmission line corridor, as there will be no physical barrier, only a reduction in large trees. Additionally, it is expected that some level of regrowth will occur which may facilitate movement. Measures to maintain connectivity are described in **Chapter 12.**

Given the ability of the Squirrel Glider to cross forest gaps, the impacts of the project are considered unlikely to influence any movements of the Squirrel Glider that are essential to maintain its life cycle. Some movement of the Squirrel Glider may be affected but as the species can and will cross open habitats the transmission line corridor and access tracks are not likely to form an impenetrable barrier to this species. The project is considered unlikely to restrict movement of the Squirrel Glider to an extent that the bioregional persistence of the species is placed at risk.

The installation of barbed/razor wire may cause injury or death to the Squirrel Glider from entanglement while climbing and gliding. Barbed wire fencing is a well-documented hazard to wildlife, particularly gliding mammals (van der Ree, 1999), and is listed as a threat to the Squirrel Glider under the BC Act. The potential for entanglement in barbed wire is likely to be greatest within 100 m of the substation fence corners where animals are within gliding distance of other trees. Measures to reduce this potential impact are described in **Chapter 12**, and include improving the visibility of barbed/razor wire where installation is necessary.

#### 11.2.4.7 Greater Glider

The Greater Glider appears to be relatively sedentary and has poor dispersal ability (Threatened Species Scientific Commitee, 2016). For male Greater Gliders, home-range size of populations near Tumut in NSW has been shown to vary from 1.38 – 4.10 ha, with the home range of males being significantly larger than for females (females had home ranges of 1.26 – 2.97 ha) (Pope *et al.*, 2004). Considerable home-range overlap has been observed between male and female Greater Gliders and pairs of females also exhibit home-range overlap (Pope *et al.*, 2004). Males tend to maintain home ranges exclusive of other males, although some have been observed to share common areas (Pope *et al.*, 2004). The greater glider is considered to be particularly sensitive to habitat removal although responses vary according to landscape context and the extent of tree removal and retention (Threatened Species Scientific Commitee, 2016). Due to their low dispersal ability, Greater Gilders may be sensitive to fragmentation, have relatively low persistence in small forest fragments, and disperse poorly across vegetation that is not native forest (Threatened Species Scientific Commitee, 2016).

The predicted canopy gap caused by the transmission line corridor is a maximum of 195 m wide (on the Bago Plateaux), though is typically around 130 m wide through other areas. These parts of the disturbance area will temporarily fragment a Greater Glider local population and restrict normal movement patterns. However, the project will not completely stop movement either side of the Transmission line corridor, as there will be no physical barrier (except for the tower structures), only a reduction in large trees. Gliding animals may have to go down to the ground, which would increase the risk of predation, however functional connectivity is likely to remain after construction of the project is complete. Additionally, it is expected that some level of regrowth will occur which may facilitate movement. Measures to maintain connectivity are described in **Chapter 12.**

Given the gliding ability of the Greater Glider, the canopy gaps created by the transmission line corridor and access tracks may not create a significant barrier to movement for this species and movement through a home range can be expected to continue. The project may affect the movement of the Greater Glider (if it is present in or around the construction envelope) but it is unlikely to influence movements that are essential to maintain its life cycle. The project is considered unlikely to restrict movement of the Greater Glider to an extent that the bioregional persistence of the species is placed at risk.

The installation of barbed/razor wire may cause injury or death to the Greater Glider from entanglement while climbing and gliding. Barbed wire fencing is a well-documented hazard to wildlife, particularly gliding mammals (van der Ree, 1999), and is listed as a threat to the Greater Glider under the EPBC Act. The potential for entanglement in barbed wire is likely to be greatest within 100 m of the substation fence corners where animals are within gliding distance of other trees. Measures to reduce this potential impact are described in **Chapter 12**, and includes improving the visibility of barbed/razor wire where installation is necessary.

### 11.2.5 Impacts on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities

Changes in soil and hydrologic quality are abiotic impacts that may occur due to the project. Unmitigated, erosion and contamination of watercourses may result from earth movement during construction needed for creation of access tracks and vegetation clearing which will influence water runoff dynamics. The project may have impacts on water quality, water bodies and hydrological processes that sustain threatened species, in particular the Booroolong Frog (which is known to inhabit the Yarrangobilly River and Wallaces Creek and tributaries) and any species of threatened fish in the following ways:

- There is potential for release of poor-quality sediment laden water into watercourses within and adjacent to the disturbance area when there are rainfall events during construction
- There is potential for a reduction in stream bank stability following vegetation removal for construction of bridges or clearances for transmission lines, resulting in bank erosion and sedimentation of watercourses

- There is potential for increased water flow into the waterways resulting from vegetation removal and access track construction (channelling of water) and increased erosion. This impact may also occur during operation if access tracks are not correctly designed with erosion protection measures
- There is potential for accidental release of contaminants during construction and maintenance (i.e. chemicals, fuel, oil, hydraulic fluid) that could result in the release of hydrocarbons and metal contaminants into watercourses
- There is potential for release of pesticides and/or herbicides during construction and operation into watercourses which may have detrimental effects.

As identified in the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a), short term reductions in water quality and mobilisation of fine sediments into watercourses within and adjacent to the disturbance area during construction and operation is considered unlikely to result in any long-term detrimental impacts to the aquatic environments. The discharge of fine sediments and contaminants are likely to be short 'pulse' events and the fine sediments would be rapidly flushed out of the system. This would most likely result in negligible impact to threatened species such as the Booroolong Frog.

The greatest potential for a detrimental impact to the aquatic habitat of the Booroolong Frog is deposition of large amounts of sediment during construction that could significantly reduce water quality in the long term. This may occur in areas close to the Yarrangobilly River, and along tracks and the Transmission line corridor where drainage leads into the Talbingo Reservoir and Tumut River. Coarse sediments that would not be flushed from the aquatic system will likely settle in the waterways filling the stream bed with sediment thereby removing any spaces between rocks and boulders reducing the opportunities for the Booroolong Frog to breed. Increased sediment loads can also adversely affect the growth and development of tadpoles, reducing their fitness and recruitment to the terrestrial frog stage (see Gillespie, 2002). This impact is most likely to occur during construction when earthworks are occurring, though there is also potential for this to occur during operation if access tracks are not correctly designed with erosion protection measures.

Controlling impacts to water flow, water quality, and sedimentation associated with run-off from vegetation clearing, newly constructed access tracks, and structures will be key in mitigating the impacts on water quality, water bodies and hydrological processes that sustain threatened species (see **Section 12**).

There is likely to be limited connection with project activities and the GDEs identified within the eastern end of the construction envelope (**Figure 6-2**) as the project components are situated away from the riparian zone of the Yarrangobilly River and Wallaces Creek (and other tributaries) and no activities such as tunnelling are proposed. The project is unlikely to interrupt the hydrological connection between a GDE and the aquifer it depends on. Groundwater quality is unlikely to be reduced. Groundwater recharge is unlikely to be affected. There will however be some direct removal of facultative GDEs during construction (PCT 285, PCT 296, PCT 300 and PCT 302), which will be the main impact of the project on GDEs.

#### 11.2.6 Impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC

There is a chance of fauna injury and mortality during the construction and operation of the project through vehicle collision (i.e. roadkill). Vehicle collision is a direct impact that reduces local population numbers and is a common occurrence in Australia (Department of the Environment, 2019a, Goldingay and Kavanagh, 1991). Mammals, reptiles, amphibians and birds are all at risk of vehicle strike, particularly those common species (e.g. macropods) that are tolerant of disturbance and/or those species that can utilise roadways for movement pathways or as foraging habitat. Rare species and low-density populations of species may be placed at risk of a serious impact if the potential for vehicle strike is not managed in an appropriate manner. Vehicles will be introduced into relatively remote areas of the KNP and sections of the Bago State Forest where roads do not currently exist, although vehicle presence and speeds will be low, suggesting the risks are also low. However, it is likely that some sedentary animal species that live in these habitats will not be accustomed to roads or vehicles. It is also likely that the newly created access tracks through the habitats will provide an attraction point to some species increasing the potential for vehicle strike.

Threatened species most at risk of vehicle strike include the Eastern Pygmy-possum and Gang-gang Cockatoo. Eastern Pygmy-possum is likely to move across the access tracks to reach newly fragmented habitats, as was directly observed during surveys where an individual was identified running along on Bradleys Drive to the north of Elliott Way. Given this species is quite common in the South Eastern Highlands portion of the construction envelope, vehicle strike is moderately likely. Gang-gang Cockatoos frequently forage on the ground on the roadside (as was observed along the Snowy Mountains Highway during surveys) and as such are at high risk of vehicle strike if roadside environments contain suitable grasses for foraging. If the Smoky Mouse is present in the Sub-alpine Woodland habitat and has been missed by the survey, it may also be at risk. The Squirrel Glider, Yellow-bellied Glider and Greater Glider are unlikely to be affected by vehicle strike due to their arboreal habits. If dispersing Koalas or Spotted-tailed Quolls move through the construction envelope they could be at risk of vehicle strike but the likelihood is considered low as population densities of these species are likely to be low.

The risk of vehicle strike will be managed during construction and operation through use of speed limits and restrictions on night time driving. Mitigation measures to reduce the risk of fauna mortality from vehicle strike are provided in **Section 12**.

## 11.3 Collisions and electrocutions of fauna with transmission lines

Collisions and electrocutions of birds and bats with transmission lines is an operational impact that must be considered. Transmission lines carry the unique risk of electrocution. The most commonly reported impacts of transmission lines in the literature is the death and injury of birds due to electrocutions and collisions with wires (see Richardson *et al.*, 2017). The reported impacts of transmission lines associated with electrocution and collision include abandonment of territories where the risk of electrocution is high and increase in scavenger activity, and perhaps the population size of scavengers, near transmission lines because of the availability of bird carcasses (see Richardson *et al.*, 2017). While there was no obvious evidence of electrocuted birds or bats noted opportunistically during surveys (although no targeted surveys were undertaken as part of this assessment) under the existing Line 64 or other transmission lines, there is an increased risk of bird and bat electrocution, particularly to raptors, from the project as a new transmission line will be introduced into the environment.

Transmission lines can be used as a resource by fauna, being used for perching, nesting, roosting, and scavenging of electrocuted birds (Donida Biasotto and Kindel, 2018). Birds can frequently be seen in the locality using transmission lines and structures as perches. However, these structures are unlikely to be used as a significant resource for nesting as no evidence of structures being used as a nest site was observed during the survey.

## 11.4 Fire risk during operation

A bushfire risk assessment has been completed as part of the EIS (Appendix F of the EIS). The installation of a transmission line into a densely vegetated landscape such as the KNP and Bago State Forest will increase the risk of fire ignition. Frequent fires caused by transmission lines could have a detrimental impact on local biodiversity. Bird electrocution is a frequent cause of fires in hot climates (Manville, 2005), as are faulty transmission lines. Fire risk will be managed in accordance with standard TransGrid procedures to minimise the chance of a fire starting from the transmission line. Bushfire mitigation measures are provided in Section 7.10 of the bushfire risk assessment report (Appendix F of the EIS).

## 11.5 Noise, vibration, dust, light and contaminants

### 11.5.1 Noise and vibration impacts

Anthropogenic noise can alter the behaviour of animals or interfere with their normal functioning (Bowles, 1997). During all phases of the project there will be increased noise and vibration levels in the study area and immediate surrounds due to vegetation clearing, ground disturbance, machinery and vehicle movements, and general human presence. The predicted noise and vibration created by the project is outlined in Section 7.8 of the EIS. Noise impacts during operation are expected to be minimal and localised to the substation. The construction of the project would generally occur from 6am to 6pm and is expected to last 2.5 years (30 months) and the key sources of noise will include:

- Construction traffic – predicted impacts include an increase in noise along haulage roads at night. It is concluded that additional traffic movements from project construction activities are not expected to result in unacceptable changes in traffic noise levels at sensitive receivers along the intended haulage routes, however this would result in increased impacts in the immediate surroundings of the project
- Construction vibration – hydraulic rock breakers and vibratory rollers, as well as blasting activities.

Based on the information provided above, construction activities will likely result in an increase in ambient noise levels (mainly an increase from current night noise levels) as well as potentially loud noise and vibration for short periods associated with earth works. The noise and vibration from activities associated with the project will occur periodically over the 2.5-year construction period and will potentially disturb fauna and may disrupt foraging, reproductive, or movement behaviours. During breeding season of hollow-dependent fauna species, some individuals may be disturbed, however significant hollows would be identified during the pre-clearing process and monitored as part of the threatened species monitoring program (see **Section 12**). The impacts from noise emissions are likely to be temporarily localised to the construction areas and immediate surrounds and moving as the construction progresses. These emissions are not considered likely to have a significant, long-term, impact on wildlife populations outside the area of impact. Within the area of impact (including habitats immediately adjacent to the disturbance area), some sensitive species (e.g. woodland birds and hollow-breeding mammals) may avoid the noise and some more tolerant species, including small mammals, will habituate over the longer-term.

### 11.5.2 Dust pollution

Elevated levels of dust may be deposited onto the foliage of vegetation adjacent to the project construction activities. This has the potential to reduce photosynthesis and transpiration and cause abrasion and radioactive heating resulting in reduced growth rates and decreases in overall health of the vegetation. Consequently, changes in the structure and composition of plant communities and consequently the grazing patterns of fauna may occur.

Some level of dust is likely to be generated throughout the lifecycle of the project due to the clearing of vegetation, although dust pollution is likely to be greatest during construction, during periods of substantial earthworks, vegetation clearing, vehicle movements for construction and decommissioning activities and during adverse weather conditions (i.e. high wind). However, deposition of dust on foliage is likely to be highly localised, intermittent, and temporary (particularly during the wetter seasons) and is therefore not considered likely to be a major impact of the project.

### 11.5.3 Light pollution

Ecological light pollution is the descriptive term for light pollution that includes direct glare, chronic or periodic increased illumination, and temporary unexpected fluctuations in lighting (including lights from passing vehicles), that can have potentially adverse effects on wildlife (Longcore and Rich, 2004).

There are no planned night works that will be associated with the construction of the project. The construction hours will be conducted between 6am to 6pm. During winter, lighting may potentially be required in the early mornings and late afternoons.

During operation, the substation will require security lighting at all hours of the night, including interior and exterior lighting. The external low-level lighting would be installed in a manner that aims to minimise light spill to areas beyond the substation boundary fence, however there is likely to be some small amount of light pollution projected into the surrounding vegetation. The ecological light pollution may potentially affect nocturnal fauna by interrupting their life cycle, such as the Squirrel Glider, Yellow-bellied Glider, Greater Glider and Eastern Pygmy Possum, who are expected to remain around the substation. However, the amount of light spill is expected to be very low and the area around the substation is already exposed to some level of disturbance from the road and existing easement. It is likely that any nocturnal animals present will habituate over the long-term. Some species such as light tolerant microchiropteran bats may benefit from the lighting due to increased food availability (e.g. insects attracted to lights) around these areas.

Assuming that lighting is designed and installed to limit light spill, the impact of the residual light spill is unlikely to significantly affect any nocturnal species in the area.

#### 11.5.4 Contaminant pollution

During the construction phase, localised release of contaminants (i.e. hydraulic fluids, oils, drilling fluids, etc.) into the surrounding environment (including drainage lines) may accidentally occur. The most likely result of contaminant discharge will be the localised contamination of soil, waterways, and potential direct physical trauma to flora and fauna that come into contact with contaminants. Accidental release of contaminants is likely to be localised.

### 11.6 Cumulative impacts

The potential biodiversity impacts of the project must be considered as a consequence of the construction and operation of the project within the existing environment. The project will not act alone in causing impacts to biodiversity. The incremental effects of multiple sources of impact (past, present and future) are referred to as cumulative impacts and provide an opportunity to consider the project within a strategic context.

There have been historic disturbances due to settlement of the Ravine area and agriculture, building of infrastructure such as roads and transmission lines. However, the most immediate accumulation of impacts will be the impacts of the project in addition to those of the Snowy 2.0 project. The cumulative direct vegetation removal impacts of the project and the Snowy 2.0 Exploratory Works and Main Works is outlined in **Table 11.5**. The cumulative direct impacts to threatened species from the project and Snowy 2.0 Exploratory Works and Main Works is outlined in **Table 11.6**.

The three Snowy 2.0 components result in a relatively large cumulative impact considering the predominantly natural and undeveloped landscape.

Table 11.5: Cumulative impacts to native vegetation from the project and Snowy 2.0 Exploratory Works and Main Works

| PCT ID No. | Plant community type name | Direct impact from the project (ha) | Direct impact from Snowy 2.0 Exploratory Works (ha)* | Direct impact from Snowy 2.0 Main Works (ha)* | Cumulative impact (ha) |
|---|---|---|---|---|---|
| 285 | Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion | 1.77 | 5.54 | 6.85 | 14.16 |
| 296 | Brittle Gum - peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion | 21.15 | 48.37 | 25.60 | 95.12 |
| 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South | 43.28 | 10.52 | 34.74 | 88.54 |

| PCT ID No. | Plant community type name | Direct impact from the project (ha) | Direct impact from Snowy 2.0 Exploratory Works (ha)* | Direct impact from Snowy 2.0 Main Works (ha)* | Cumulative impact (ha) |
|---|---|---|---|---|---|
| | Western Slopes Bioregion and western Kosciuszko escarpment | | | | |
| 302 | Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion | 3.12 | 12 | 2.83 | 17.95 |
| 729 | Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion | 34.72 | 24.1 | 21.40 | 80.22 |
| 999 | Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion | 7.61 | 1.28 | 12.40 | 21.29 |
| 1196 | Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion | 23.95 | 5.15 | 108.18 | 137.28 |
| | Total | 135.60 | 106.96 | 212.00 | 454.56 |

* EMM CONSULTING 2017 and 2020a

Table 11.6: Cumulative impacts to threatened species from the project and Snowy 2.0 Exploratory Works and Main Works

| Species name | Common name | Direct impact from the project (ha) | Direct impact from Snowy 2.0 Exploratory Works (ha)* | Direct impact from Snowy 2.0 Main Works (ha)* | Cumulative direct impact (ha) |
|---|---|---|---|---|---|
| **Birds** | | | | | |
| *Callocephalon fimbriatum* | Gang-gang Cockatoo (breeding) | 69.6 | 0.91 | 2.08 | 103.57 |
| *Ninox strenua* | Powerful Owl (breeding) | 62.77 | - | - | 62.77 |
| *Tyto novaehollandiae* | Masked Owl (breeding) | 3.12 | 0.91 | - | 7.48 |
| **Frogs** | | | | | |
| *Litoria booroolongensis* | Booroolong Frog | 3.12 | 2.49 | 1.33 | 10.39 |
| **Mammals** | | | | | |
| *Cercartetus nanus* | Eastern Pygmy-possum | 133.06 | 76.17 | 197.95 | 474.8 |
| *Petaurus australis* - endangered population | Yellow-bellied Glider Population on the Bago Plateau | 61.22 | - | - | 61.22 |
| *Petaurus norfolcensis* | Squirrel Glider | 68.13 | - | - | 68.13 |

* EMM CONSULTING 2017 and 2020a

# 12. Mitigating and managing impacts on biodiversity values

Once all practicable steps to avoid or minimise impacts have been implemented at the detailed design phase, mitigation measures will be implemented to further lessen the potential ecological impacts of the project. Mitigation measures are to be undertaken during the construction and operational phases. The proposed techniques, timing, frequency and responsibility for implementing each measure are outlined in **Table 12.1**. Where relevant the mitigation measures proposed for the project have been adapted from the mitigation measures outlined for the Snowy 2.0 Exploratory Works and Main Works projects (EMM Consulting, 2017 and 2020a) as consistency between the two projects is desired. These measures outlined in **Table 12.1** will be incorporated into the Construction Environmental Management Plan (CEMP) for the project. A Biodiversity Management Plan (BMP) will also be developed as part of the CEMP, which will include specific details such as weed and pest management, vegetation and habitat clearing processes and threatened species monitoring. The development of the BMP will be guided by the information provided in this BDAR.

Table 12.1: Proposed mitigation measures

| Impact | Mitigation measure | Timing and duration | Responsibility |
|---|---|---|---|
| Removal of native vegetation and threatened species habitat | A Biodiversity Management Plan will be prepared and implemented prior to construction. It will include the following measures:<br>▪ The boundary of the clearing limits for the transmission connection corridor will be clearly marked on site by a surveyor before construction commences. Exclusion zones, or 'No-Go' zones, will be clearly marked at the edge of the final disturbance boundary to protect the vegetation to be retained from inadvertent direct impacts. Exclusion zones and the edge of the clearing boundary will be marked with high visibility fencing and signage<br>▪ Where possible, within areas of retained vegetation that are not impacted by the Snowy 2.0 Main Works construction, a 50 m buffer around Booroolong Frog habitat will be clearly demarcated by fencing and signage and identified on maps for construction personnel (see<br>▪ **Figure** 8-1). This buffer is separate to the Snowy 2.0 exclusion area around breeding habitat which has its own restriction. The habitat buffer is particularly important for the proposed crossing of Sheep Station Creek. The demarcation would serve to identify the ecological sensitivity of the land and only approved works with adequate controls in place will be permitted to be undertaken<br>▪ Where works will be undertaken within the 50 m riparian buffer zone for the Booroolong Frog (refer to **Figure 8-1**), an ecologist will inspect all vegetation, rocks, logs and other shelter sites to locate any frogs. Frogs will be relocated to a designated relocation site that will be determined during pre-clearing surveys. If works are undertaken outside of the active period (April to September,) frogs will be taken into the care of an appropriately qualified and licensed carer (this will require an agreement to be reached with a carer before works commence)<br>▪ Pre-clearing surveys will be conducted prior to clearing, including translocation of fauna into areas of retained vegetation. Refinement of the actual clearing extent required for the project within the final approved disturbance footprint will be undertaken as necessary. The final clearing extent will be documented. This information will be used to inform and refine the Biodiversity | Pre-construction and during construction | TransGrid and construction contractor |

| Impact | Mitigation measure | Timing and duration | Responsibility |
|---|---|---|---|
| | Offset Strategy and offset requirements for the project. This process involves the preparation of a pre-clearing report<br>▪ All areas not retained for permanent infrastructure within the project area will be rehabilitated in accordance with a rehabilitation plan to be developed in consultation with NSW NPWS and the FCNSW<br>▪ Cleared native vegetation will be mulched and stockpiled for use during rehabilitation.<br>▪ Hollows logs and limbs will be retained for placement within retained vegetation and reuse during rehabilitation. | | |
| Impacts to threatened species | Monitoring of threatened species to ensure impacts arising from the project are within predicted levels. The details of the monitoring will be determined during the preparation of the Biodiversity Management Plan. | During and post construction | TransGrid and construction contractor |
| Changes to runoff regimes resulting in sedimentation due to the removal of habitat | Sedimentation will be managed through implementation of effective sediment control measures. A Soil and Water Management Plan (SWMP) will be prepared and implemented as part of the CEMP. The SWMP will include:<br>The SWMP will include:<br>▪ Erosion and sediment control plans for all stages of construction<br>▪ Details on the construction and management of sediment basin if determined to be required<br>▪ Protection of waterways<br>▪ Any imported fill will be certified at source locations as pathogen and weed free Excavated Natural Material or Virgin Excavated Natural Material)<br>▪ Management of stockpiles and spoil<br>▪ Tannin leachate management controls<br>▪ Management of accidental spills, response and reporting<br>▪ An induction protocol<br>▪ Responsibilities for all management measures.<br>All erosion and sediment control measures will be designed, implemented, progressively rehabilitated and maintained in accordance with relevant sections of Managing Urban Stormwater: Soil and Construction Volume 1 (Landcom, 2004) ('the Blue Book') (particularly Section 2.2) and Managing Urban Stormwater: Soil and Construction Volume 2A – Installation of Services (DECC, 2008).<br>Other specific measures to manage impacts from stormwater run-off are listed in Section 7.2 of the Hydrology Assessment (Appendix I of the EIS). | During construction | TransGrid and construction contractor |
| | No extraction of water from the Yarrangobilly River. | During construction | TransGrid and construction contractor |
| | Revegetation of slopes will be undertaken as soon as possible, in accordance with the rehabilitation plan. Landscaping of pervious surfaces using native indigenous species only. Soil loss will be prevented by immediate stabilisation of exposed surfaces (e.g. use of Jute mesh and/or soil binder). | During construction | TransGrid and construction contractor |

| Impact | Mitigation measure | Timing and duration | Responsibility |
|---|---|---|---|
| Impacts to the movement of gliding mammals | Where possible the barbed wire/razor wire fencing installed around the substation switchyard will have improved visibility measures installed, such as adding visible (and often audible) objects to the fence, for example tape, plastic flags and metal tags (Booth 2007). | Operation | TransGrid and construction contractor |
| Fauna vehicle strike | Vehicle movements will on newly formed access tracks will be limited to20km/h speed limit implemented to reduce the risk of vehicle strike to fauna. | During construction and operation | TransGrid and construction contractor |
| Increase in predatory and pest species and disease | A weed and pathogen monitoring program will be implemented during construction and operation, with weed control to occur if new weed outbreaks are identified within the construction footprint. The details of the monitoring program will be determined during the preparation of the Biodiversity Management Plan. | During and post construction | TransGrid and construction contractor |
| | During the clearing works, weeds will be disposed and managed appropriately to stop the spread of existing weed species. | During construction | TransGrid and construction contractor |
| | Wash down stations will be constructed at suitable locations to wash down vehicles and employee shoes to stop the spread of weeds, pathogens (including amphibian chytrid fungus, *Phytophthora cinnamomi* and exotic rust fungi) and the introduction of new species. | During construction | TransGrid and construction contractor |
| | A pest and predator monitoring program will be implemented to ensure the works do not result in a significant increase in numbers of pest and predatory species. The details of the monitoring program will be determined during the preparation of the Biodiversity Management Plan. | During construction | TransGrid and construction contractor |
| | Waste will be stored appropriately in inaccessible bins and disposed off-site. | During construction and operation | TransGrid and construction contractor |
| Light and noise pollution during night works | Directional lighting will be used for any permanent lighting required (i.e. substation) to minimise light spill as much as possible. | Operation | TransGrid and construction contractor |
| | Artificial lighting required during construction in the early morning and late afternoon in winter will be limited to within approved construction hours. | During construction | TransGrid and construction contractor |

# 13. Thresholds for the assessment and offsetting of impacts of the project

This section of the BDAR identifies the impact thresholds that the assessor must apply including impacts:

- On a potential entity that are serious and irreversible impacts
- For which the assessor is required to determine an offset requirement
- That do not require further assessment by the assessor.

## 13.1 Impacts on a potential entity that are serious and irreversible impacts

No potential SAII entities have been identified within the disturbance area or construction envelope or study area as part of this assessment. No SAII entities are expected to occur within the construction envelope or study area and therefore serious and irreversible impacts are considered unlikely. As such, the additional impact assessment provision outlined in subsection 10.2.3 of the BAM has not been completed.

## 13.2 Impacts for which the assessor is required to determine an offset requirement

The determination of impacts calculated within the disturbance area (see **Section 11.1.1**) which require an offset was undertaken in accordance with section 10.3 of the BAM.

### 13.2.1 Impacts on native vegetation (ecosystem credits)

An offset is required for both direct impacts (clearing) to PCTs, as outlined in **Table 13.1,** and indirect impacts to retained PCTs within 20 m of the disturbance area where new edges will be created, as outlined in **Table 13.2**.

Table 13.1: Direct impacts to PCTs which require an offset

| Vegetation Zone | PCT ID No. | PCT name | Broad condition class | Vegetation zone area (ha) | Current VI score | Future VI score | Change in VI |
|---|---|---|---|---|---|---|---|
| **Australian Alps Bioregion** | | | | | | | |
| AA-1 | 285 | Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion | Moderate - Blackberry infestation | 1.77 | 78.7 | 0 | -78.7 |
| AA-2 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | 10.77 | 83.7 | 0 | -83.7 |
| AA-3 | 1196 | Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion | Native Grassland | 0.76 | 38.6 | 0 | -38.6 |
| AA-4 | | | Good | 23.19 | 84.9 | 0 | -84.9 |

| Vegetation Zone | PCT ID No. | PCT name | Broad condition class | Vegetation zone area (ha) | Current VI score | Future VI score | Change in VI |
|---|---|---|---|---|---|---|---|
| **South Eastern Highlands Bioregion** | | | | | | | |
| SEH-1 | 296 | Brittle Gum - peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion | Native Grassland | 0.13 | 39.5 | 0 | -39.5 |
| SEH-2 | | | Good– drier *Eucalyptus nortonii* dominant slope | 4.67 | 88.7 | 0 | -88.7 |
| SEH-3 | | | Good– wetter sheltered slopes | 14.96 | 75.3 | 0 | -75.3 |
| SEH-4 | | | Moderate – Blackberry infestation | 1.38 | 49.1 | 0 | -49.1 |
| SEH-5 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | 32.5 | 81.3 | 0 | -81.3 |
| SEH-7 | 302 | Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion | Moderate | 2.57 | 61.3 | 0 | -61.3 |
| SEH-8 | 729 | Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion | Native Grassland | 1.11 | 23.4 | 0 | -23.4 |
| SEH-9 | | | Shrubland - regrowth | 0.78 | 36.6 | 0 | -36.6 |
| SEH-10 | | | Good - dry open slopes & ridgetops | 16.05 | 81.5 | 0 | -81.5 |
| SEH-11 | | | Good - wetter sheltered slopes | 16.79 | 76 | 0 | -76 |
| SEH-12 | 999 | Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion | Shrubland - regrowth | 1.23 | 31.5 | 0 | -31.5 |
| SEH-13 | | | Good - drier *Calytrix tetragona* | 6.38 | 58.9 | 0 | -58.9 |

Table 13.2: Indirect impacts to PCTs which require an offset

| Vegetation Zone | PCT ID No. | PCT name | Broad condition class | Vegetation zone area (ha) | Current VI score | Future VI score | Change in VI score |
|---|---|---|---|---|---|---|---|
| **Australian Alps Bioregion** | | | | | | | |
| AA-5 | 285 | Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion | Moderate - Blackberry infestation | 0.33 | 78.9 | 80.2* | +0.3* |
| AA-6 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | 2.88 | 83.2 | 82.7 | -0.5 |
| AA-7 | 1196 | Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion | Good | 3.68 | 84.7 | 84.5 | -0.2 |
| **South Eastern Highlands Bioregion** | | | | | | | |
| SEH-14 | 296 | Brittle Gum - peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion | Good– drier *Eucalyptus nortonii* dominant slope | 1.34 | 88.4 | 88.1 | -0.3 |
| SEH-15 | | | Good– wetter sheltered slopes | 4.74 | 74.5 | 73.7 | -0.8 |
| SEH-16 | | | Moderate – Blackberry infestation | 0.08 | 48.9 | 48.7 | -0.2 |
| SEH-17 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | 9.57 | 80.2 | 79.1 | -1.1 |

| Vegetation Zone | PCT ID No. | PCT name | Broad condition class | Vegetation zone area (ha) | Current VI score | Future VI score | Change in VI score |
|---|---|---|---|---|---|---|---|
| SEH-18 | 302 | Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion | Moderate | 1.05 | 61.4 | 61.5* | +0.1* |
| SEH-19 | 729 | Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion | Good - dry open slopes & ridgetops | 5.33 | 81.9 | 82.3* | +0.4* |
| SEH-20 | | | Good - wetter sheltered slopes | 7.98 | 76 | 76* | 0* |
| SEH-21 | 999 | Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion | Good - drier Calytrix tetragona | 2.25 | 58.8 | 58.7 | -0.1 |

*Following the method outlined in EMM Consulting (2020a), some VI scores increased following the manual adjustment of future vegetation structure and function. This may have been caused by scores being closer to the benchmark for that PCT and also algorithms built into the BAM-C that cause VI scores to change through time.

### 13.2.2 Impacts on threatened species

An offset is required for impacts to threatened species as outlined in **Table 13.3** for the Australian Alps Bioregion and **Table 13.4** for the South Eastern Highlands Bioregion.

Table 13.3: Impacts to threatened species in the Australian Alps Bioregion which require an offset

| Vegetation Zone | PCT ID No. | PCT name | Broad condition class | Vegetation zone area (ha) | Current VI score | Future VI score | Change in VI |
|---|---|---|---|---|---|---|---|
| **Australian Alps Bioregion** | | | | | | | |
| **Gang-gang Cockatoo (breeding)** | | | | | | | |
| AA-2 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | 10.77 | 83.7 | 0 | -83.7 |
| AA-6 | | | | 2.88 | 83.2 | 82.7 | -0.5 |
| AA-3 | 1196 | Snow Gum - Mountain Gum shrubby open forest of | Native Grassland | 0.76 | 38.6 | 0 | -38.6 |

| Vegetation Zone | PCT ID No. | PCT name | Broad condition class | Vegetation zone area (ha) | Current VI score | Future VI score | Change in VI |
|---|---|---|---|---|---|---|---|
| AA-4 | | montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion | Good | 23.19 | 84.9 | 0 | -84.9 |
| AA-7 | | | | 3.68 | 84.7 | 84.5 | -0.2 |
| **Powerful Owl (breeding)** | | | | | | | |
| AA-2 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | 10.77 | 83.7 | 0 | -83.7 |
| AA-6 | | | | 2.88 | 83.2 | 82.7 | -0.5 |
| **Eastern Pygmy-possum** | | | | | | | |
| AA-1 | 285 | Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion | Moderate - Blackberry infestation | 1.77 | 78.7 | 0 | -78.7 |
| AA-5 | | | | 0.33 | 78.9 | 80.2* | +0.3* |
| AA-2 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | 10.77 | 83.7 | 0 | -83.7 |
| AA-6 | | | | 2.88 | 83.2 | 82.7 | -0.5 |
| AA-4 | 1196 | Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion | Good | 23.19 | 84.9 | 0 | -84.9 |
| AA-7 | | | | 3.76 | 84.7 | 84.5 | -0.2 |
| **Yellow-bellied Glider Population on the Bago Plateau** | | | | | | | |
| AA-1 | 285 | Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion | Moderate - Blackberry infestation | 1.77 | 78.7 | 0 | -78.7 |
| AA-5 | | | | 0.33 | 78.9 | 80.2* | +0.3* |
| AA-2 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on | Good | 10.77 | 83.7 | 0 | -83.7 |

| Vegetation Zone | PCT ID No. | PCT name | Broad condition class | Vegetation zone area (ha) | Current VI score | Future VI score | Change in VI |
|---|---|---|---|---|---|---|---|
| AA-6 | | deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | | 2.88 | 83.2 | 82.7 | -0.5 |
| AA-4 | 1196 | Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion | Good | 23.19 | 84.9 | 0 | -84.9 |
| AA-7 | | | | 3.76 | 84.7 | 84.5 | -0.2 |
| **Squirrel Glider** | | | | | | | |
| AA-1 | 285 | Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion | Moderate - Blackberry infestation | 1.77 | 78.7 | 0 | -78.7 |
| AA-5 | | | | 0.33 | 78.9 | 80.2* | +0.3* |
| AA-2 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | 10.77 | 83.7 | 0 | -83.7 |
| AA-6 | | | | 2.88 | 83.2 | 82.7 | -0.5 |
| AA-4 | 1196 | Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion | Good | 23.19 | 84.9 | 0 | -84.9 |
| AA-7 | | | | 3.76 | 84.7 | 84.5 | -0.2 |

*Following the method outlined in EMM Consulting (2020a), some VI scores increased following the manual adjustment of future vegetation structure and function. This may have been caused by scores being closer to the benchmark for that PCT and also algorithms built into the BAM-C that cause VI scores to change through time.

Table 13.4: Impacts to threatened species in the South Eastern Highlands Bioregion which require an offset

| Vegetation Zone | PCT ID No. | PCT name | Broad condition class | Vegetation zone area (ha) | Current VI score | Future VI score | Change in VI |
|---|---|---|---|---|---|---|---|
| **South Eastern Highlands Bioregion** | | | | | | | |
| **Gang-gang Cockatoo (breeding)** | | | | | | | |
| SEH-5 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on | Good | 32.5 | 81.3 | 0 | -81.3 |

| Vegetation Zone | PCT ID No. | PCT name | Broad condition class | Vegetation zone area (ha) | Current VI score | Future VI score | Change in VI |
|---|---|---|---|---|---|---|---|
| SEH-17 | | deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | | 9.57 | 80.2 | 79.1 | -1.1 |
| SEH-7 | 302 | Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion | Moderate | 2.57 | 61.3 | 0 | -61.3 |
| SEH-18 | | | | 1.05 | 61.4 | 61.5* | +0.1* |
| **Powerful Owl (breeding)** | | | | | | | |
| SEH-5 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | 32.5 | 81.3 | 0 | -81.3 |
| SEH-17 | | | | 9.57 | 80.2 | 79.1 | -1.1 |
| **Masked Owl (breeding)** | | | | | | | |
| SEH-7 | 302 | Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion | Moderate | 2.57 | 61.3 | 0 | -61.3 |
| SEH-18 | | | | 1.05 | 61.4 | 61.5* | +0.1* |
| **Booroolong Frog** | | | | | | | |
| SEH-7 | 302 | Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion | Moderate | 2.57 | 61.3 | 0 | -61.3 |
| SEH-18 | | | | 1.05 | 61.4 | 61.5* | +0.1* |
| **Eastern Pygmy-possum** | | | | | | | |
| SEH-2 | 296 | Brittle Gum - peppermint open forest of the Woomargama to Tumut | Good– drier *Eucalyptus nortonii* dominant slope | 4.67 | 88.7 | 0 | -88.7 |
| SEH-14 | | | | 1.34 | 88.7 | 88.4 | -0.3 |

| Vegetation Zone | PCT ID No. | PCT name | Broad condition class | Vegetation zone area (ha) | Current VI score | Future VI score | Change in VI |
|---|---|---|---|---|---|---|---|
| SEH-3 | | region, NSW South Western Slopes Bioregion | Good– wetter sheltered slopes | 14.96 | 75.3 | 0 | -75.3 |
| SEH-15 | | | | 4.74 | 74.5 | 73.7 | -0.8 |
| SEH-4 | | | Moderate – Blackberry infestation | 1.38 | 49.1 | 0 | -49.1 |
| SEH-16 | | | | 0.08 | 48.9 | 48.7 | -0.2 |
| SEH-5 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | 32.5 | 81.3 | 0 | -81.3 |
| SEH-17 | | | | 9.57 | 80.2 | 79.1 | -1.1 |
| SEH-7 | 302 | Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion | Moderate | 2.57 | 61.3 | 0 | -61.3 |
| SEH-18 | | | | 1.05 | 61.4 | 61.5* | +0.1* |
| SEH-9 | 729 | Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion | Shrubland - regrowth | 0.78 | 36.6 | 0 | -36.6 |
| SEH-10 | | | Good - dry open slopes & ridgetops | 16.04 | 81.5 | 0 | -81.5 |
| SEH-19 | | | | 5.33 | 81.9 | 82.3* | +0.4 |
| SEH-11 | | | Good - wetter sheltered slopes | 16.79 | 76 | 0 | -76 |
| SEH-20 | | | | 7.98 | 76 | 76* | 0 |
| SEH-12 | 999 | Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion | Shrubland - regrowth | 1.23 | 31.5 | 0 | -31.5 |
| SEH-13 | | | Good - drier *Calytrix tetragona* | 6.38 | 58.9 | 0 | -58.9 |
| SEH-21 | | | | 2.25 | 58.8 | 58.7 | -0.1 |
| **Yellow-bellied Glider Population on the Bago Plateau** | | | | | | | |
| SEH-5 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on | Good | 19.88 | 81.3 | 0 | -81.3 |

| Vegetation Zone | PCT ID No. | PCT name | Broad condition class | Vegetation zone area (ha) | Current VI score | Future VI score | Change in VI |
|---|---|---|---|---|---|---|---|
| SEH-17 | | deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | | 3.8 | 80.2 | 79.1 | -1.1 |
| SEH-10 | 729 | Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion | Good - dry open slopes & ridgetops | 5.61 | 81.5 | 0 | -81.5 |
| SEH-19 | | | | 0.94 | 81.9 | 82.3* | +0.4 |
| **Squirrel Glider** | | | | | | | |
| SEH-5 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | 22.23 | 81.3 | 0 | -81.3 |
| SEH-17 | | | | 4.84 | 80.2 | 79.1 | -1.1 |
| SEH-10 | 729 | Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion | Good - dry open slopes & ridgetops | 10.16 | 81.5 | 0 | -81.5 |
| SEH-19 | | | | 2.54 | 81.9 | 82.3* | +0.4 |

*Following the method outlined in EMM Consulting (2020a), some VI scores increased following the manual adjustment of future vegetation structure and function. This may have been caused by scores being closer to the benchmark for that PCT and also algorithms built into the BAM-C that cause VI scores to change through time.

## 13.3 Impacts for which the assessor is not required to determine an offset requirement

An offset is not required for impacts where the vegetation integrity score is below those set out in paragraph 10.3.1.1 of the BAM for impacts on native vegetation and paragraph 10.3.2.1 of the BAM for impacts on threatened species. Impacts not requiring offset are described in **Table 13.**5.

The vegetation integrity score for the Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion (PCT 302) Native grassland (vegetation zone SEH-6) is 14.6. As the vegetation integrity score for this vegetation zone is below 15, an offset is not required for this impact to native vegetation. Similarly, as the vegetation integrity score for vegetation zone SEH-6 is below 17, an offset is not required for this impact to habitat for the Booroolong Frog. The location of this vegetation zone is shown in **Figure 6-1.**

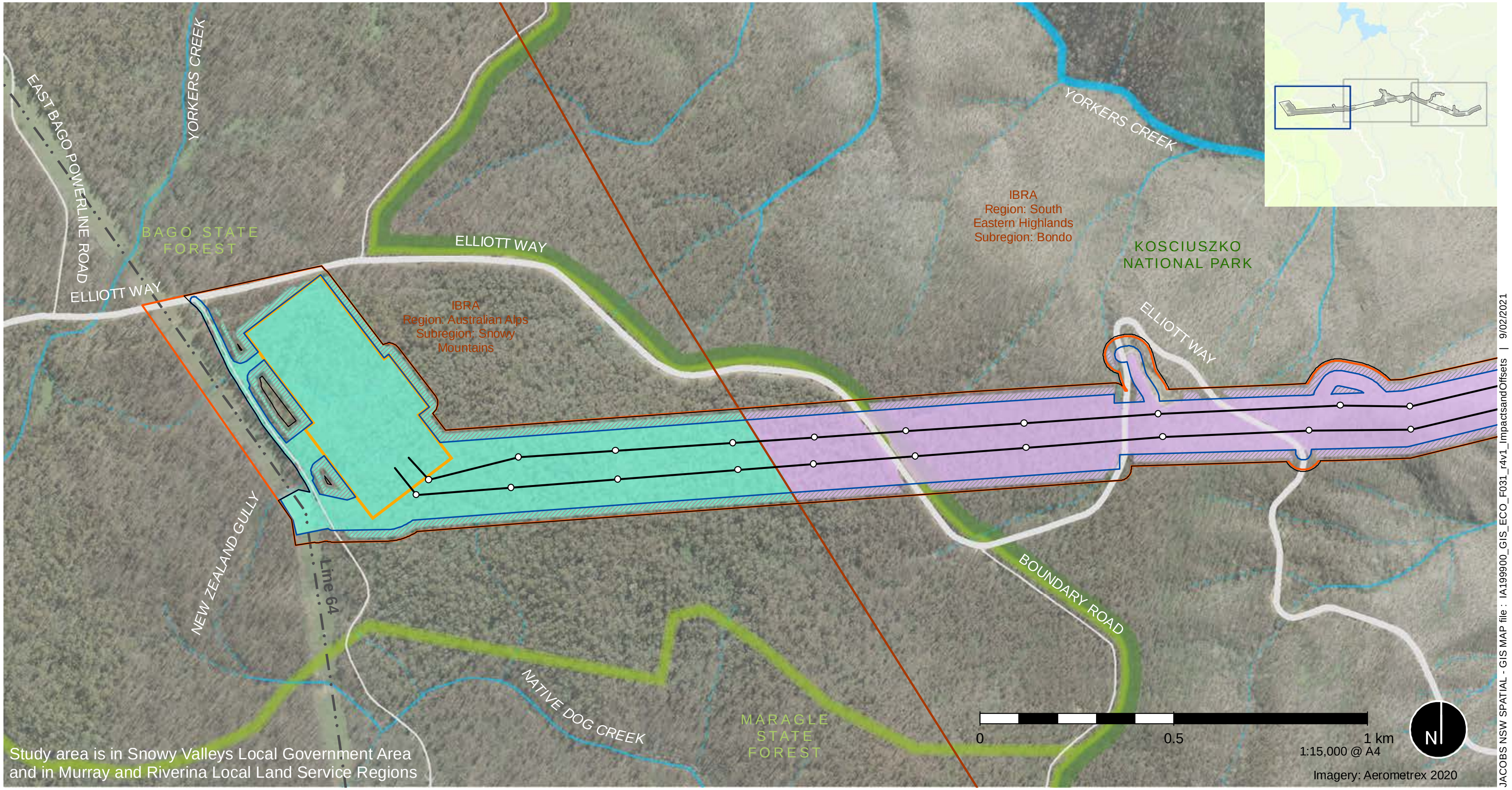
Table 13.5: Impacts which do not require an offset

| Vegetation Zone | PCT ID No. | PCT name | Broad condition class | Vegetation zone area (ha) | Current VI score | VI score threshold* | Offset required |
|---|---|---|---|---|---|---|---|
| **South Eastern Highlands Bioregion** | | | | | | | |
| SEH-6 | 302 | Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion | Native Grassland | 0.55 | 14.6 | ⩾15 | No |
| **Booroolong Frog** | | | | | | | |
| SEH-6 | 302 | Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion | Native Grassland | 0.55 | 14.6 | ⩾17 | No |

*Note: Vegetation integrity score thresholds as set out by section 10.3 of the BAM

## 13.4 Impacts that do not require further assessment by the assessor

An assessor is not required to assess areas of land on the disturbance area for ecosystem credits without native vegetation under Chapter 4 or Chapter 5 of the BAM. This section of the BAM is not applicable to the project.




Project area
Disturbance area
Construction envelope
Proposed 500kV substation
Proposed structure
Proposed transmission line
Snowy 2.0 disturbance footprint (05.02.2020)
Electricity transmission line
Minor road
Major road
Waterway
IBRA
NPWS estate
State Forest
Indirect impact area
PCT impacts - offsets required
Australian Alps Bioregion
South Eastern Highlands Bioregion

**Data sources:**
Jacobs 2020, EMM 202, DPE 2018,
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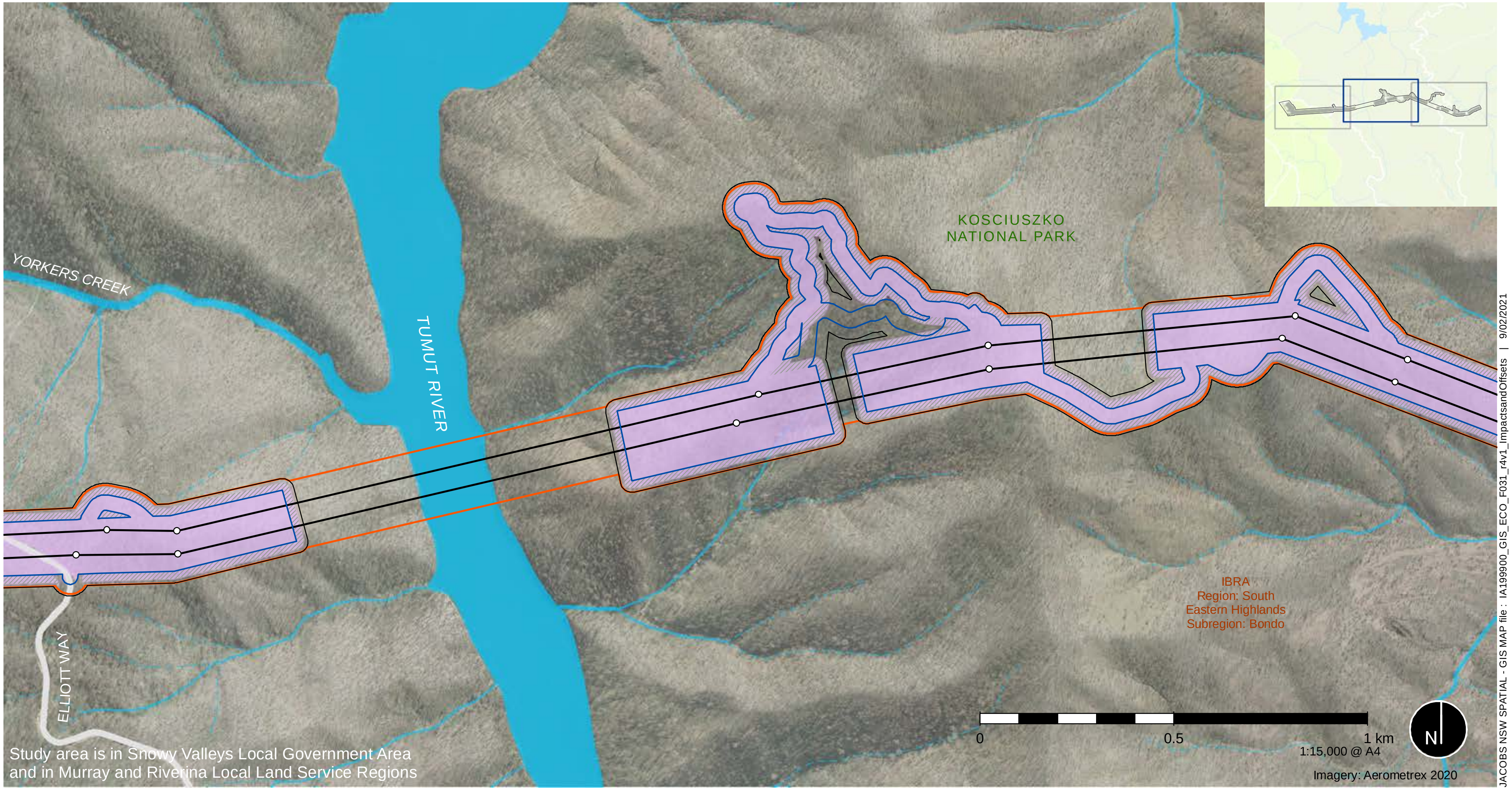
**Figure 13-1** | Impacts to PCTs requiring offsets and impacts not requiring offsets




Project area
Disturbance area
Construction envelope
Proposed structure
Proposed transmission line

Snowy 2.0 disturbance footprint (05.02.2020)

Major road
Waterway
NPWS estate

Indirect impact area

PCT impacts - offsets required

South Eastern Highlands Bioregion

**Data sources:**
Jacobs 2020, EMM 202, DPE 2018,
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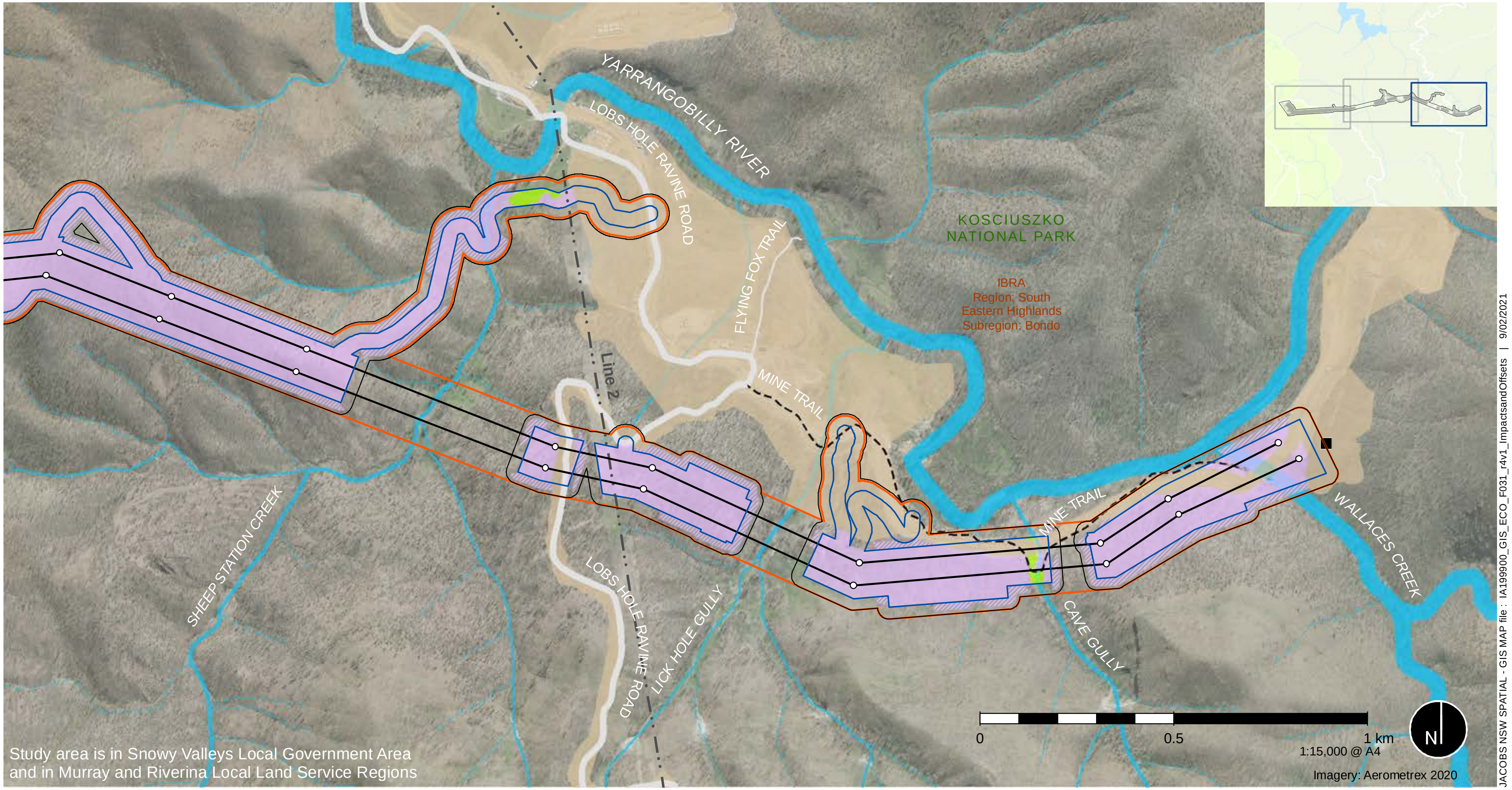
**Figure 13-1** | Impacts to PCTs requiring offsets and impacts not requiring offsets




Project area
Disturbance area
Construction envelope
Proposed structure
Proposed transmission line
Snowy 2.0 cable yard
Snowy 2.0 disturbance footprint (05.02.2020)
Electricity transmission line
Minor road
Major road
Trail
Waterway
NPWS estate
Indirect impact area
PCT impacts - offsets not required
South Eastern Highlands Bioregion
PCT impacts - offsets required
South Eastern Highlands Bioregion

**Data sources:**
Jacobs 2020, EMM 202, DPE 2018,
© Department Finance, Services and Innovation 2018

**Figure 13-1** | Impacts to PCTs requiring offsets and impacts not requiring offsets

# 14. Biodiversity credit requirements

A summary of the biodiversity credit requirements for the project are provided below in **Table 14.1** and **Table 14.2**. The draft credit report is provided in **Appendix I**. Credits have been calculated and displayed separately for each bioregion and include credits associated with the direct and indirect impacts of the transmission connection project.

Following the method for calculating indirect impacts on retained vegetation outlined in the Snowy 2.0 Main Works BDAR (EMM Consulting, 2020a), some VI scores increased after the changes to structure and function data outlined in **Section 11.1.2** were applied to each vegetation zone in the BAM-C. This may be caused by the process of lowering functional data (i.e. leaf litter), which brings the average score closer to benchmarks scores assigned to that PCT. It is noted however, that these increases are marginal and that the BAM-C still generates a credit obligation for these vegetation zones.

As the final determination from the genetic analysis of potential *Caladenia montana* samples has not been received from the Australian Royal Botanic Gardens (refer to **Section 11.1.1** for discussion), the calculation of impacts and offset credits for this species has not yet been undertaken. This component of the BDAR will be updated following public exhibition.

**Table 14.1** provides a summary of the credits required to offset direct impacts to native vegetation that would occur within the disturbance area. As the transmission line corridor would be cleared for construction, the future vegetation integrity score for areas directly impacted has been set at zero (i.e. total clearing to ground-level). Over the long-term and considering future maintenance activities associated with the suppression of tree regrowth, parts of the permanent easement would reasonably be expected to exist as a regrowth shrubland community, and therefore maintain some characteristics of the current vegetation integrity.

Table 14.1: Ecosystem credits required by bioregion and vegetation zone

| Vegetation Zone (*indirect impact zones) | PCT ID No. | PCT name | Broad condition class | TEC | Vegetation zone area (ha) | Change in VI score | Credits | |
|---|---|---|---|---|---|---|---|---|
| **Australian Alps Bioregion** | | | | | | | | |
| AA-1 | 285 | Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion | Moderate - Blackberry infestation | No | 1.77 | -78.7 | 70 | 71 |
| AA-5* | | | | No | 0.33 | +0.3 | 1 | |
| AA-2 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | No | 10.77 | -83.7 | 338 | 339 |
| AA-6* | | | | No | 2.88 | -0.5 | 1 | |
| AA-3 | 1196 | Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion | Native Grassland | No | 0.76 | -38.6 | 11 | 751 |
| AA-4 | | | Good | No | 23.19 | -84.9 | 739 | |
| AA-7* | | | | No | 3.68 | -0.2 | 1 | |
| | | | | | | **Sub-total** | **1,161** | |

| Vegetation Zone (*indirect impact zones) | PCT ID No. | PCT name | Broad condition class | TEC | Vegetation zone area (ha) | Change in VI score | Credits | |
|---|---|---|---|---|---|---|---|---|
| **South Eastern Highlands Bioregion** | | | | | | | | |
| SEH-1 | 296 | Brittle Gum - peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion | Native Grassland | No | 0.13 | -39.5 | 2 | 608 |
| SEH-2 | | | Good–drier *Eucalyptus nortonii* dominant slope | No | 4.67 | -88.7 | 155 | |
| SEH-14* | | | | No | 1.34 | -0.3 | 1 | |
| SEH-3 | | | Good–wetter sheltered slopes | No | 14.96 | -75.3 | 423 | |
| SEH-15* | | | | No | 4.74 | -0.8 | 1 | |
| SEH-4 | | | Moderate – Blackberry infestation | No | 1.38 | -49.1 | 25 | |
| SEH-16* | | | | No | 0.08 | -0.2 | 1 | |
| SEH-5 | 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | Good | No | 32.5 | -81.3 | 991 | 995 |
| SEH-17* | | | | No | 9.57 | -1.1 | 4 | |
| SEH-7 | 302 | Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion | Moderate | No | 2.57 | -61.3 | 69 | 70 |
| SEH-18* | | | | No | 1.05 | +0.1 | 1 | |
| SEH-8 | 729 | Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion | Native Grassland | No | 1.11 | -23.4 | 10 | 992 |
| SEH-9 | | | Shrubland - regrowth | No | 0.78 | -36.6 | 11 | |
| SEH-10 | | | Good - dry open slopes & ridgetops | No | 16.05 | -81.5 | 490 | |
| SEH-19* | | | | No | 5.33 | +0.4 | 1 | |
| SEH-11 | | | Good - wetter sheltered slopes | No | 16.79 | -76 | 479 | |
| SEH-20* | | | | No | 7.98 | 0 | 1 | |
| SEH-12 | 999 | Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion | Shrubland - regrowth | No | 1.23 | -31.5 | 15 | 157 |
| SEH-13 | | | Good - drier | No | 6.38 | -58.9 | 141 | |

| Vegetation Zone (*indirect impact zones) | PCT ID No. | PCT name | Broad condition class | TEC | Vegetation zone area (ha) | Change in VI score | Credits | |
|---|---|---|---|---|---|---|---|---|
| SEH-21* | | | *Calytrix tetragona* | No | 2.25 | -0.1 | 1 | |
| | | | | | | **Sub-total** | **2,822** | |
| | | | | | | **TOTAL (both bioregions)** | **3,983** | |

Table 14.2: Species credits required by vegetation zone

| Vegetation zone | PCT ID | Area (ha) | Habitat condition (VI) change | Credits | |
|---|---|---|---|---|---|
| **Australian Alps Bioregion** | | | | | |
| **Gang-gang Cockatoo (breeding)** | | | | | |
| AA-2 | 300 | 10.77 | -83.7 | 451 | 1,453 |
| AA-6 | | 2.88 | -0.5 | 1 | |
| AA-3 | 1196 | 0.76 | -38.6 | 15 | |
| AA-4 | | 23.19 | -84.9 | 985 | |
| AA-7 | | 3.76 | -0.2 | 1 | |
| **Powerful Owl (breeding)** | | | | | |
| AA-2 | 300 | 10.77 | -83.7 | 451 | 452 |
| AA-6 | | 2.88 | -0.5 | 1 | |
| **Eastern Pygmy-possum** | | | | | |
| AA-1 | 285 | 1.77 | -78.7 | 70 | 1,509 |
| AA-5 | | 0.33 | +0.3* | 1 | |
| AA-2 | 300 | 10.77 | -83.7 | 451 | |
| AA-6 | | 2.88 | -0.5 | 1 | |
| AA-4 | 1196 | 23.19 | -84.9 | 985 | |
| AA-7 | | 3.76 | -0.2 | 1 | |
| **Yellow-bellied Glider Population on the Bago Plateau** | | | | | |
| AA-1 | 285 | 1.77 | -78.7 | 70 | 1,509 |
| AA-5 | | 0.33 | +0.3* | 1 | |
| AA-2 | 300 | 10.77 | -83.7 | 451 | |
| AA-6 | | 2.88 | -0.5 | 1 | |
| AA-4 | 1196 | 23.19 | -84.9 | 985 | |
| AA-7 | | 3.76 | -0.2 | 1 | |
| **Squirrel Glider** | | | | | |
| AA-1 | 285 | 1.77 | -78.7 | 70 | 1,509 |
| AA-5 | | 0.33 | +0.3* | 1 | |
| AA-2 | 300 | 10.77 | -83.7 | 451 | |
| AA-6 | | 2.88 | -0.5 | 1 | |
| AA-4 | 1196 | 23.19 | -84.9 | 985 | |
| AA-7 | | 3.76 | -0.2 | 1 | |
| | | | **Sub-total** | **6,432** | |

| Vegetation zone | PCT ID | Area (ha) | Habitat condition (VI) change | Credits | |
|---|---|---|---|---|---|
| **South Eastern Highlands Bioregion** | | | | | |
| **Booroolong Frog** | | | | | |
| SEH-7 | 302 | 2.57 | -61.3 | 79 | 80 |
| SEH-18 | | 1.05 | +0.1* | 1 | |
| **Gang-gang Cockatoo (breeding)** | | | | | |
| SEH-5 | 300 | 32.5 | -81.3 | 1321 | 1,406 |
| SEH-17 | | 9.57 | -1.1 | 5 | |
| SEH-7 | 302 | 2.57 | -61.3 | 79 | |
| SEH-18 | | 1.05 | +0.1* | 1 | |
| **Powerful Owl (breeding)** | | | | | |
| SEH-5 | 300 | 32.5 | -81.3 | 1321 | 1,326 |
| SEH-17 | | 9.57 | -1.1 | 5 | |
| **Masked Owl (breeding)** | | | | | |
| SEH-7 | 302 | 2.57 | -61.3 | 79 | 80 |
| SEH-18 | | 1.05 | +0.1* | 1 | |
| **Eastern Pygmy-possum** | | | | | |
| SEH-2 | 296 | 4.67 | -88.7 | 207 | 3,730 |
| SEH-14 | | 1.34 | -0.6 | 1 | |
| SEH-3 | | 14.96 | -75.3 | 563 | |
| SEH-15 | | 4.74 | -0.8 | 2 | |
| SEH-4 | | 1.38 | -49.1 | 34 | |
| SEH-16 | | 0.08 | -0.2 | 1 | |
| SEH-5 | 300 | 32.5 | -81.3 | 1321 | |
| SEH-17 | | 9.57 | -1.1 | 5 | |
| SEH-7 | 302 | 2.57 | -61.3 | 79 | |
| SEH-18 | | 1.05 | +0.1* | 1 | |
| SEH-9 | 729 | 0.78 | -36.6 | 14 | |
| SEH-10 | | 16.04 | -81.5 | 654 | |
| SEH-19 | | 5.33 | +0.4* | 1 | |
| SEH-11 | | 16.79 | -76 | 638 | |
| SEH-20 | | 7.98 | 0* | 1 | |
| SEH-12 | 999 | 1.23 | -31.5 | 19 | |
| SEH-13 | | 6.38 | -58.9 | 188 | |
| SEH-21 | | 2.25 | -0.1 | 1 | |
| **Yellow-bellied Glider Population on the Bago Plateau** | | | | | |
| SEH-5 | 300 | 19.88 | -81.3 | 808 | 1,040 |
| SEH-17 | | 3.8 | -1.1 | 2 | |
| SEH-10 | 729 | 5.61 | -81.5 | 229 | |
| SEH-19 | | 0.94 | +0.4* | 1 | |

| Vegetation zone | PCT ID | Area (ha) | Habitat condition (VI) change | Credits | |
|---|---|---|---|---|---|
| **Squirrel Glider** | | | | | |
| SEH-5 | 300 | 22.23 | -81.3 | 903 | 1,321 |
| SEH-17 | | 4.84 | -1.1 | 3 | |
| SEH-10 | 729 | 10.16 | -81.5 | 414 | |
| SEH-19 | | 2.54 | +0.4* | 1 | |
| | | | **Sub-total** | **8,983** | |
| | | | **TOTAL** | **15,415** | |

*Following the method outlined in EMM Consulting (2020a), some VI scores increased following the manual adjustment of future vegetation structure and function. This may have been caused by scores being closer to the benchmark for that PCT and also algorithms built into the BAM-C that cause VI scores to change through time.

# 15. Biodiversity Offset Strategy

The BOS is required to address the SEARs, which state that:

*A strategy to offset any residual impacts of the project focusing on improving the biodiversity and conservation values of the Kosciuszko National Park (KNP) in the medium to long term.*

TransGrid proposes to use the same framework which has been developed for the Snowy 2.0 Main Works Biodiversity Offset Strategy (EMM Consulting, 2020b) (Snowy 2.0 BOS) and included in the Snowy 2.0 Main Works Infrastructure Approval (SSI 9687) ; namely, the proponent will make payments to the NPWS to offset the residual biodiversity impacts of the project, and NPWS will use these funds to enhance the biodiversity and conservation values of the KNP. This framework for the Snowy 2.0 project will allow NPWS to carry out actions to significantly improve catchment health, strengthen ecosystems, protect threatened species and communities and deliver long-term strategic conservation benefits for the KNP (Department of Planning, Industry and Environment Department of Planning, 2020d).

The project would result in clearing of 135.6 ha of native vegetation within the disturbance area. However, the extent of clearing may be reduced through further detailed design and analysis of operational management requirements.

The payments to be made as a part of the project would be proportionate to the level of impact, with consideration to both the disturbance area and degree of clearing required. No financial contributions have yet been finalised for impacts arising from the project. This finalisation process would involve consultation with all key stakeholders and follow the same framework developed for the Snowy 2.0 BOS. Following consultation, financial contributions would be developed proportionate to the impacts within the disturbance area and staged as per the Snowy 2.0 Main Works Infrastructure Approval (SSI 9687).

As the project is considered unlikely to result in a significant impact to any MNES, specific offset actions for Commonwealth-listed species are not considered necessary.

In relation to key fish habitat, NSW DPI (Fisheries) enforces a 'no net loss' habitat policy as a condition of consent and calculates habitat compensation on a minimum 2:1 basis for all key fish habitat (TYPE 1-3) (DPI 2013). Mapped key fish habitat that would be impacted by the project includes areas of PCTs that have had credit calculations generated. Therefore, impacts to key fish habitat would be offset by the ecosystem credit requirements calculated for this project.

# 16. Conclusions

The project is located within a predominantly natural landscape containing a diversity of habitats with high biodiversity value within KNP and Bago State Forest. Design and options assessment have minimised impacts to biodiversity where possible, however the nature of this project means there would be avoidable residual impacts, primarily as a result of direct removal of vegetation. No areas of land that the Minister for Energy and Environment has declared as an area of outstanding biodiversity value in accordance with section 3.1 of the BC Act would be affected. The project has been declared a controlled action under the Commonwealth EPBC Act on the basis of potential impacts to the following MNES:

- Listed threatened species and communities (section 18 & section 18A)
- Listed migratory species (section 20 & section 20A)
- The heritage values of a National Heritage place (section 15B & section 15C).

The direct impacts to biodiversity values that would occur as a result of the project construction includes the clearing 135.6 ha of native vegetation within the disturbance area, comprising seven PCTs as described in **Table 16.1**. None of this vegetation corresponds to a threatened ecological community listed under the BC Act or EPBC Act.

Table 16.1: Direct impacts to native vegetation from the project

| PCT ID No. | PCT name | Threatened ecological community | Vegetation zone area in disturbance area (ha) | |
|---|---|---|---|---|
| | | | South Eastern Highlands Bioregion | Australian Alps Bioregion |
| 285 | Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion | No | - | 1.77 |
| 296 | Brittle Gum - peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion | No | 21.14 | - |
| 300 | Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment | No | 32.51 | 10.77 |
| 302 | Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion | No | 3.12 | - |
| 729 | Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion | No | 34.72 | - |
| 999 | Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion | No | 7.61 | - |
| 1196 | Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion | No | - | 23.95 |
| | | **Total** | **99.11** | **36.49** |
| | | | **135.6** | |

This vegetation also provides habitat for a diversity of threatened fauna species. The following species credit species were identified within the construction envelope during surveys undertaken for this assessment or have been assumed present:

- Gang-gang Cockatoo – identified
- Powerful Owl – assumed present
- Masked Owl – identified
- Booroolong Frog – assumed present
- Eastern Pygmy-possum – identified
- Yellow-bellied Glider population on the Bago Plateau – identified
- Squirrel Glider – assumed present.

The construction envelope also provides habitat features for a range of ecosystem credit species and foraging habitat only for several dual-credit species.

Twenty-nine waterways or unnamed drainage lines are crossed by the project area (i.e. not all will be directly impacted). Six of these waterways are stream order three or greater and have also been mapped as Key Fish Habitat. The project would only directly impact three of these waterways during vegetation clearing, including Sheep Station Creek (which will also involve a bridge crossing for the access track), Cave Gully and Wallaces Creek. There is also potential for indirect impacts to surrounding aquatic habitats from erosion and contaminated run-off from construction and operation. The implementation of mitigation measures (i.e. track design, erosion and sediment control, spill control) would be implemented to control sediment and pollutants from any significant runoff events.

The project has potential to result in prescribed biodiversity impacts, namely impacts to connectivity and movement for gliding mammals (i.e. fragmentation by vegetation clearing and collision with barbed wire fences) and impacts on water quality for aquatic species and the Booroolong Frog. Measures to minimise and mitigate these potential impacts have been discussed.

Due to the creation of new edge areas for remnant vegetation retained adjacent to the cleared transmission line corridor, there is also expected to be indirect edge effects, including an increase in exotic plant species cover and associated decrease in native ground cover. Such impacts were assessed for a 20 m buffer along each edge of the disturbance area, equating to an anticipated 6.89 ha of vegetation in the Australian Alps Bioregion and 32.37 ha of vegetation in the South Eastern Highlands Bioregion.

Other potential indirect impacts that may occur due to the project include collision and electrocution of fauna with transmission lines, increased fire risk and increases in noise, vibration, dust, light and contaminants. The measures provided in this BDAR are designed to mitigate these potential impacts.

An offset would be required for the direct and indirect impacts to native vegetation and species credit habitats. The credit requirement has been calculated using the BAM-C.

The project impacts and offset obligations have been calculated based on the concept design. Therefore, project impacts and offset obligations would be revised following detailed design. This approach is consistent with the approved Snowy 2.0 Main Works EIS (EMM Consulting, 2019).

TransGrid proposes to use the same framework which has been developed for the Snowy 2.0 BOS and included in the Snowy 2.0 Main Works Infrastructure Approval (SSI 9687); namely, the proponent would make payments to the NPWS to offset the residual biodiversity impacts of the project, and NPWS would use these funds to enhance the biodiversity and conservation values of KNP. This framework for the Snowy 2.0 project would allow NPWS to carry out actions to substantially improve catchment health, strengthen ecosystems, protect threatened species and communities and deliver long-term strategic conservation benefits for the KNP ((Department of Planning, Industry and Environment Department of Planning 2020d).

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# Appendix A. Habitat assessment and likelihood of occurrence assessment for threatened species

State and nationally listed threatened species identified from the literature review, database searches and BAM-C, were considered in terms of their likelihood to occur in the habitats present within the survey area based on identified habitat requirements. The habitat suitability assessment for threatened species is provided in **Table A.1** and **and Table A.2**

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Table A.1: Habitat suitability assessment for threatened plant species

| Species name | Common name | EPBC Act | BC Act | Distribution and habitat | Data source | Habitat constraints and Geographic limitations (BAM-C) | Habitat suitability | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|
| *Caladenia montana* | - | - | V | *Caladenia montana* is restricted to high montane areas 700–1000 m a.s.l. where it grows in well-drained loam on slopes and ridges of montane forest among an understorey of shrubs. The species occurs in mainly in the east alps section of the Alpine National Park in Victoria. There are records in the ACT and adjacent areas in NSW, but these are likely to be of *Caladenia fitzgeraldii*. *Caladenia montana* may occur in southern KNP to Victoria. Generally found after fires. | BAM-C<br>EMM (2020) | None | Moderate<br>Habitat on the subject site may be suitable.<br>This species was recorded during surveys for the Snowy 2.0 Main Works in some of the same PCTs. There is a record of *Caladenia montana* in Maragle State Forest from 2005 (although exact location is obscured). There is potential for this species to occur in the higher altitude montane areas in the west of the survey area in the KNP and Maragle and Bago State Forests in the tall wetter forests dominated by *Eucalyptus dalrympleana, E. dives, E. viminalis* and *E. robertsonii*. | High.<br>*Caladenia montana* is identified as a candidate species for assessment and was targeted during surveys. |
| *Calotis glandulosa* | Mauve Burr-daisy | V | V | The distribution of the Mauve Burr-daisy is centred on the Monaro and Kosciuszko regions. There are old and possibly dubious records from near Oberon, the Dubbo area and Mt Imlay. Found in montane and subalpine grasslands in the Australian Alps. Found in subalpine grassland (dominated by *Poa* spp.), and montane or natural temperate grassland dominated by Kangaroo Grass (*Themeda australis*) and Snow Gum (*Eucalyptus pauciflora*) Woodlands on the Monaro and Shoalhaven area. Appears to be a coloniser of bare patches, which explains why it often occurs on roadsides. Apparently common on | PMST<br>BAM-C<br>EMM (2020) | No habitat constraints.<br>Only occurs north of Eucumbene. | Low.<br>Known records and modelled habitat are to the east of the construction envelope on the montane or natural temperate grasslands. This habitat type is not present in the construction envelope. | Moderate.<br>Included as a candidate species for assessment and targeted during surveys. |

| Species name | Common name | EPBC Act | BC Act | Distribution and habitat | Data source | Habitat constraints and Geographic limitations (BAM-C) | Habitat suitability | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|
| | | | | roadsides in parts of the Monaro, though it does not persist for long in such sites. Does not persist in heavily-grazed pastures of the Monaro or the Shoalhaven area. | | | | |
| *Calotis pubescens* | Max Mueller's Burr-daisy | - | E | This species has been recorded from five sites in the Snowy Mountains of NSW (four of which, all in KNP, are extant). It was first recorded in Victoria in the 19th Century but not seen again there until 2009 when a single large population was discovered south-east of Mt Hotham. Grows in subalpine treeless plains in herb-rich grassland (often dominated by *Poa hookeri*); not subject to periodic inundation. Its response to disturbance is largely unknown. | EMM (2020) | - | Low.<br>Only known to occur in the grasslands to the east of the construction envelope on the sub-alpine treeless plains. No suitable habitat occurs in the construction envelope. | Low.<br>Not included as a candidate species for assessment. |
| *Carex raleighii* | Raleigh Sedge | - | E | In NSW Raleigh Sedge is found only in areas above about 1,000 m on the Southern Tablelands. Most populations are in Kosciuszko National Park (e.g. Charlottes Pass area, Muellers Pass, Tantangara area and the upper Tooma and Tumut valleys). Also occurs in vicinity of Snowy Plain (private land and travelling stock reserve) and on the coastal escarpment at the headwaters of Tantawangalo Creek within South East Forests National Park. Grows in sphagnum bogs and high mountain wetlands, as well as damp grasslands and stream-edges of sub-alpine plains. | EMM (2020) | - | Low.<br>There is no suitable habitat for this species in the construction envelope as no alpine or sub-alpine peatlands or fens occur. There may be habitat for this species in the broader study area but it is unlikely to be affected by indirect impacts. | Low.<br>Not included as a candidate species for assessment. |
| *Colobanthus curtisiae* | Curtis' Colobanth | V | - | Curtis' Colobanth occurs in Tasmania, Victoria and New South Wales. Curtis' Colobanth is found in grassland and grassy woodland. The species can also be found in areas subject to a variety of environmental conditions. It is commonly found on gentle slopes with elevations between 160 m in lowland areas and 1,300 m in alpine areas. The | PMST | - | Low.<br>Not known from habitats in or near the construction envelope. | Low.<br>Not included as a candidate species for assessment. |

| Species name | Common name | EPBC Act | BC Act | Distribution and habitat | Data source | Habitat constraints and Geographic limitations (BAM-C) | Habitat suitability | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|
| | | | | species is found in areas of annual rainfall between 530 mm in the Midlands and 1400 mm on Ben Lomond. Curtis' Colobanth is commonly found on soils derived from sandstone as well as clay loams derived from dolerite and basalt. It can persist in remnant grasslands grazed by stock. | | | | |
| *Discaria nitida* | Leafy Anchor Plant | - | V | The Leafy Anchor Plant is confined to the far south of the Southern Tablelands of NSW and the north-east highlands of Victoria. In NSW the Leafy Anchor Plant grows mostly within KNP, south from the Blue Water Holes - Yarrangobilly Caves area to south-west of Jindabyne, at altitudes above 900 m. In NSW 18 sites are known with a total population of about 2,800 plants. Generally, it occurs on or close to stream banks and on rocky areas near small waterfalls. The species occurs in woodland with heathy riparian vegetation and on treeless grassy sub-alpine plains. Most populations survive in sites that appear to be rarely burnt "fire refugia". The species is known to be highly fire sensitive and most plants that have been observed to have been burnt, even lightly, have died and there has been very little post fire recruitment. | BioNet – 7<br>EMM (2020) | - | Low.<br>There is known habitat for this species in the alpine areas to the east of the construction envelope but there is no suitable habitat for this species in or directly adjacent to the construction envelope. The related species *Discaria pubescens* was recorded in the grassland on McPhersons Plain during the surveys but no *Discaria* species were found in the construction envelope. | Low.<br>Not included as a candidate species for assessment. |
| *Diuris ochroma* | Pale Golden Moths | E | V | Recorded in south-eastern NSW on the sub-alpine plains of KNP and the Kybean area. Also recorded in eastern Victoria. Open grassy woodland of *Eucalyptus viminalis / E. pauciflora* or *E. pauciflora / E. parvula* (or secondary grassland). Also found in sub-alpine grassland. | PMST | - | Low.<br>No records of this species exist in the construction envelope and the construction envelope does not contain any modelled habitat. No suitable open grassy woodlands are present. | Low.<br>Not included as a candidate species for assessment. |
| *Euphrasia scabra* | Rough Eyebright | - | E | There are three extant populations in NSW: Bondi State Forest, South East Forests National Park and | BioNet - 2 | - | Low. | Low. |

| Species name | Common name | EPBC Act | BC Act | Distribution and habitat | Data source | Habitat constraints and Geographic limitations (BAM-C) | Habitat suitability | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|
| | | | | near Nunnock Swamp. Total NSW population is between 250 and 500 plants. This number varies with season with few plants appearing in some years. Occurs in or at the margins of swampy grassland or in sphagnum bogs, often in wet, peaty soil. | | | Known from the Yarrangobilly Caves area and the west near Tumbarumba. However, the construction envelope does not contain any suitable swamp habitat for this species. | Not included as a candidate species for assessment. |
| *Genoplesium vernale* | East Lynne Midge-orchid | V | V | The East Lynne Midge Orchid is currently known from only a narrow belt, approximately 12 km wide, of predominantly Dry Sclerophyll Forest from 17 km south of Batemans Bay to 24 km north of Ulladulla. The East Lynne Midge Orchid grows in 'poorer' dry sclerophyll woodland and forest on the south coast of New South Wales between Mogo and Ulladulla. It is confined to areas with good drainage and shallow, low fertility soils. Confined to areas with well-drained shallow soils of low fertility. The plant exists only as a dormant tuber for part of the year, dying back after flowering and fruiting in mid-November to late December. | BioNet – 3<br>PMST | - | Low.<br>There is habitat modelled in the Bago and Maragle State Forests and generalised records exist in the Bago and Maragle State Forests from 2004 and 2005. However, these records are likely to be erroneous. | Low.<br>Not included as a candidate species for assessment. |
| *Glycine latrobeana* | Clover Glycine | V | CE | The Clover Glycine is endemic to south-eastern Australia, where it is widely distributed from Port Pirie in South Australia, through much of Victoria to near Hobart in Tasmania. It was recently discovered in KNP. The Clover Glycine occurs mainly in grassland and grassy woodland habitats, less often in dry forests, and only rarely in heathland. Populations occur from sea level to c. 1,200 m altitude 6 (900 m in Tasmania). The NSW population is in subalpine grassland (at about 1300 m asl). | PMST<br>EMM (2020) | - | Low.<br>Known from the east of the construction envelope on the grasslands near the Tantangara Reservoir. Restricted to the Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion PCT. No suitable habitat for this species is present in the construction envelope. | Low.<br>Not included as a candidate species for assessment. |

| Species name | Common name | EPBC Act | BC Act | Distribution and habitat | Data source | Habitat constraints and Geographic limitations (BAM-C) | Habitat suitability | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|
| *Leucochrysum albicans subsp. tricolor* | Hoary Sunray | E | - | The Hoary Sunray occurs at relatively high elevations in woodland and open forest communities, in an area roughly bounded by Goulburn, Albury and Bega. The species has been recorded in the Yass Valley, Tumut, Upper Lachlan, Snowy River and Galong. It is known from the South Eastern Highlands, Australian Alps and Sydney Basin bioregions. | PMST<br>EMM (2020) | - | Low.<br>Known from the highway near the Providence Portal and Adaminaby areas. Unlikely to occur in the habitat of the construction envelope as known habitat associations are not present. | Low.<br>Not included as a candidate species for assessment. |
| *Pomaderris cotoneaster* | Cotoneaster Pomaderris | E | E | Cotoneaster Pomaderris has a very disjunct distribution, being known from the Nungatta area, northern KNP (near Tumut), the Tantawangalo area in South-East Forests National Park and adjoining freehold land, Badgery's Lookout near Tallong, Bungonia State Conservation Area, the Yerranderie area, Kanangra-Boyd National Park, the Canyonleigh area and Ettrema Gorge in Morton National Park. The species has also been recorded along the Genoa River in Victoria. Cotoneaster Pomaderris has been recorded in a range of habitats in predominantly forested country. The habitats include forest with deep, friable soil, amongst rock beside a creek, on rocky forested slopes and in steep gullies between sandstone cliffs. | BAM-C | No habitat constraints.<br><br>Only occurs south of the northern Kosciuszko NP boundary. | Moderate.<br>The nearest known populations are from the area around Goobarragandra. Potential habitat exists in the Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment PCT. | Moderate.<br>Included as a candidate species for assessment and targeted during surveys as a precautionary measure as data on this species is deficient. |
| *Prasophyllum bagoense* | Prasophyllum bagoense | CE | CE | Currently known from a single population on land covered by a Crown Lease on State Forest near Tumbarumba on the Southern Tablelands of NSW. The species occurs over about 12 ha of sub-alpine grassy plain and wetland at an elevation of about 1,100 m. Its distribution may extend into adjacent woodlands. Bago Leek Orchid is a tuberous ground orchid with leaves that normally regenerate from underground tubers each year in spring. Found in | BioNet – 396<br>PMST<br>BAM-C | - | Low.<br>This species is only known from the McPhersons Plain area. No alpine or sub-alpine peatlands, damp herbfields and fens, or alpine grassland/herbfield and open heathlands are present in the construction envelope. | Low.<br>Not included as a candidate species for assessment. |

| Species name | Common name | EPBC Act | BC Act | Distribution and habitat | Data source | Habitat constraints and Geographic limitations (BAM-C) | Habitat suitability | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|
| | | | | grassy, low heathland dominated by *Poa clivicola*, *Epacris gunnii* and *E. celata* on a subalpine plain bordered by Snow Gum and Mountain Gum. | | | | |
| *Prasophyllum innubum* | Prasophyllum innubum | CE | CE | In New South Wales, Prasophyllum innubum is known from a single population comprising about seven small colonies, totalling about 400 individuals, from a small area about 30 km north-west of Cabramurra and about 17 km south of Talbingo, in the Tumbarumba Local Government Area. The species occurs in Bago State Forest and apparently also on adjacent Crown forestry lease and private freehold. The species is known only from a highly restricted streamside habitat and Sphagnum hummocks, and rarely on adjacent grassy flats, at altitudes of 1150-1180 m. | BioNet – 2<br>PMST<br>EMM (2020) | - | Low.<br>This species is only known from the McPhersons Plain area. No alpine or sub-alpine peatlands, damp herbfields and fens, or alpine grassland/herbfield and open heathlands are present in the construction envelope. | Low.<br>Not included as a candidate species for assessment. |
| *Prasophyllum keltonii* | Kelton's Leek Orchid | CE | CE | Kelton's Leek Orchid is known from a single population that occurs in a small area known as McPhersons Plain, about 30 km north-west of Cabramurra and about 17 km south of Talbingo, in the Tumbarumba Local Government Area. The species is known only from a highly restricted habitat on the treeless McPhersons Plain, an area that includes sub-alpine grassland, sphagnum bogs, and open heathland, at an elevation of 1,100 m. The species has a preference for grassland. The species apparently has a preference for moderately boggy ground, though not sphagnum-dominated areas, but also occurs on some drier patches. | BioNet – 57<br>PMST<br>BAM-C | - | Low.<br>This species is only known from the McPhersons Plain area. No alpine or sub-alpine peatlands, damp herbfields and fens, or alpine grassland/herbfield and open heathlands are present in the construction envelope. | Low.<br>Not included as a candidate species for assessment. |
| *Prasophyllum retroflexum* | Kiandra Leek Orchid | V | V | All populations are thought to occur within Kosciuszko NP (in the Long Plain, Kiandra, Tantangara area). The species occurs in subalpine grasslands and woodlands. | EMM (2020) | - | Low.<br>This species is known from areas to the east of the construction envelope on the subalpine grasslands and woodlands in the | Low.<br>Not included as a candidate species for assessment. |

| Species name | Common name | EPBC Act | BC Act | Distribution and habitat | Data source | Habitat constraints and Geographic limitations (BAM-C) | Habitat suitability | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Long Plain, Kiandra, Tantangara area. No suitable habitat is present in the construction envelope. | |
| *Pterostylis alpina* | Alpine Greenhood | - | V | The Alpine greenhood grows in moist forests on foothills and ranges, extending to montane areas in New South Wales, the Australian Capital Territory and Victoria. In NSW the species occurs in the Southern Tablelands south from Bondo State Forest. | BioNet -1<br>BAM-C<br>EMM (2020) | - | Moderate.<br>There is suitable habitat in the construction envelope in the form of the Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion PCT. Other moist forests may also be suitable, particularly the sheltered slopes. | Moderate.<br>Included as a candidate species for assessment and targeted during surveys as a precautionary measure as data on this species is deficient. |
| *Pterostylis foliata* | Slender Greenhood | - | V | *Pterostylis foliata* is found in NSW, Australian Capital Territory (ACT), Victoria, South Australia, Tasmania and New Zealand (type location). In NSW the species occurs mainly in the Southern Tablelands south from Batlow. In NSW, *Pterostylis foliata* grows in eucalypt forest amongst an understorey of shrubs, ferns and grasses. It grows on loam or clay loam soils found on sheltered sloping to steep ground and populations may be found in localised open seepage areas. Flowering occurs from August to January. | BioNet – 5<br>BAM-C<br>EMM (2020) | None | Moderate.<br>Detailed descriptions of preferred habitat are not available but it is likely to be found in the wetter forests including the Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment PCT and the Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps | Moderate.<br>Included as a candidate species for assessment and targeted during surveys. |

| Species name | Common name | EPBC Act | BC Act | Distribution and habitat | Data source | Habitat constraints and Geographic limitations (BAM-C) | Habitat suitability | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | Bioregion PCT where there are sheltered slopes. | |
| *Pterostylis oreophila* | Blue-tongued Greenhood | CE | CE | In New South Wales, the Blue-tongued Greenhood is known from a few small populations within KNP and a population of about 40 plants (possibly now extinct) in Bago State Forest and adjoining Crown Leases south of Tumut. The known distribution includes parts of the Snowy River, Tumbarumba and possibly Tumut Local Government Areas. Grows along sub-alpine watercourses under more open thickets of Mountain Tea-tree in muddy ground very close to water. Less commonly grows in peaty soils and sphagnum mounds. | BioNet – 3<br>PMST | None | Moderate.<br>There is potential habitat for this species in the western sub-alpine parts of the construction envelope near watercourses where thickets of Tea-tree occur. | Moderate.<br>Included as a candidate species for assessment and targeted during surveys as a precautionary measure. |
| *Rutidosis leiolepis* | Monaro Golden Daisy | V | V | The Monaro Golden Daisy is found in scattered populations on the Monaro, and in low subalpine plains of KNP (e.g. Long Plain and Happy Jacks Plain). Found in Natural Temperate Grassland on the Monaro. Occurs in sub-alpine grasslands in KNP. Grows on basalt, granite and sedimentary substrates. | PMST<br>EMM (2020) | - | Low.<br>This species is known from the treeless plains to the east of the construction envelope. There is no suitable habitat for this species in the construction envelope. | Low.<br>Not included as a candidate species for assessment. |
| *Thelymitra alpicola* | Alpine Sun Orchid | | V | *Thelymitra alpicola* is distributed in south–eastern New South Wales and north–eastern Victoria. The northernmost populations are in the upper Blue Mountains. The remainder of the New South Wales distribution is from the Snowy Mountains extending north–west to Bago State Forest and to the eastern part of the Great Dividing Range south from Braidwood. In KNP and the Bago plateau the species occurs in wet heaths and adjacent to Sphagnum bogs between 1000-1500 m. Associated species include *Hakea microcarpa, Leptospermum myrtifolium, Baeckea utilis, Baeckea* | EMM (2020) | None | Moderate.<br>Potential habitat for *Thelymitra alpicola* is present within and at the edges of PCT 285 and PCT 1196. | Moderate.<br>Included as a candidate species for assessment and targeted during surveys. |

| Species name | Common name | EPBC Act | BC Act | Distribution and habitat | Data source | Habitat constraints and Geographic limitations (BAM-C) | Habitat suitability | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|
| | | | | *gunniana, Epacris breviflora, Epacris paludosa, Baloskion australe* and *Empodisma minus*. | | | | |
| *Thelymitra atronitida* | Black-hooded Sun Orchid | - | CE | In New South Wales, The Black-hooded Sun Orchid is known from two localities, Cape Solander in Botany Bay National Park in southern Sydney, and Bago State Forest south of Tumut. The known occurrences in this state fall in parts of the Sutherland and either or both of the Tumut and Tumbarumba Local Government Areas. At Cape Solander this species is recorded from shallow black peaty soil in coastal heath on sandstone. In the Bago area it is recorded as occurring in open forest with a heathy understorey on well-drained sand or clay-loam soils. | BioNet – 1<br>BAM-C | None | Moderate.<br>*Thelymitra atronitida* is known to occur in the Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion (PCT 1196). PCT 1196 occurs in the western Australian Alps portion of the construction envelope. In the absence of any further publicly available research on *Thelymitra atronitida* within NSW at the time of writing this BDAR we have assumed that *Thelymitra atronitida* exists within the Bago State Forest and we have retained *Thelymitra atronitida* as a candidate species for the assessment. | Moderate.<br>Included as a candidate species for assessment and targeted during surveys. |
| *Thesium australe* | Austral Toadflax | V | V | Found in very small populations scattered across eastern NSW, along the coast, and from the Northern to Southern Tablelands. It is also found in Tasmania and Queensland and in eastern Asia. Occurs in grassland on coastal headlands or grassland and grassy woodland away from the coast. Often found in association with Kangaroo Grass (*Themeda australis*). | BioNet – 7<br>PMST<br>BAM-C | None | Moderate.<br>This species is known to occur in the locality. The population in the power line easement on Larry's Ridge north of Cabramurra was visited and plants found in February 2019. There is potential habitat for *Thesium australe* in the natural grassland patches within the forests and in regrowth grassland under transmission | Moderate.<br>Included as a candidate species for assessment and targeted during surveys. |

| Species name | Common name | EPBC Act | BC Act | Distribution and habitat | Data source | Habitat constraints and Geographic limitations (BAM-C) | Habitat suitability | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | lines and roadsides in the construction envelope. | |
| *Xerochrysum palustre* | Swamp Everlasting | V | - | Swamp Everlasting is endemic to south-eastern Australia, where it is widely distributed from south-eastern New South Wales through Victoria to north-eastern Tasmania. In New South Wales it occurs as far north as the Southern Tablelands and ranges up to about 1,300 m altitude. In Victoria, the species is widely but patchily distributed from the South Australian border to near Bairnsdale, generally below 500 m altitude. Grows in wetlands including sedge-swamps and shallow freshwater marshes, often on heavy black clay soils. | PMST | - | Low.<br>This species is known from the KNP in the high-altitude Alpine Creek, Boggy Plain, Rocky Plain areas. There are no suitable swamp habitats in the construction envelope. | Low.<br>Not included as a candidate species for assessment. |

* Distribution and habitat requirement information adapted from: Australian Government Department of the Environment http://www.environment.gov.au/biodiversity/threatened/index.html, EESG http://www.environment.nsw.gov.au/threatenedspecies/

Key:

CE = critically endangered

E = endangered

EP = endangered population

Ex = extinct

V = vulnerable

Table A.2: Habitat assessment for threatened animal species

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| Bird | *Actitis hypoleucos* | Common Sandpiper | M | - | NA | Found along all coastlines of Australia and in many areas inland, the Common Sandpiper is widespread in small numbers. The species utilises a wide range of coastal wetlands and some inland wetlands, with varying levels of salinity, and is mostly found around muddy margins or rocky shores and rarely on mudflats. | PMST | - | Low.<br><br>No wading bird habitat is present. Not included for assessment |
| Bird | *Anthochaera phrygia* | Regent Honeyeater | CE | CE | Dual credit species.<br><br>Ecosystem (foraging habitat)<br><br>Species (breeding habitat) | The Regent Honeyeater that has a patchy distribution between south-east Queensland and central Victoria. It mostly inhabits inland slopes of the Great Dividing Range, in areas of low to moderate relief with moist, fertile soils. It is most commonly associated with box-ironbark eucalypt woodland and dry sclerophyll forest, but also inhabits riparian vegetation such as sheoak (*Casuarina* spp.) where it feeds on needle-leaved mistletoe and sometimes breeds. It sometimes utilises lowland coastal forest, which may act as a refuge when its usual habitat is affected by drought. It also uses a range of disturbed habitats within these landscapes including remnant patches in farmland and urban areas and roadside vegetation. It feeds primarily on the nectar of eucalypts and mistletoes and, to a lesser extent, lerps and honeydew; it prefers taller and larger diameter trees for foraging. It is nomadic and partly migratory with its movement through the landscape being governed by the flowering of select eucalypt species. | BioNet – 1<br><br>PMST | - | Low.<br><br>Not known to utilise alpine areas but is known from the Bondo subregion of the south eastern highlands. May utilise the habitats dominated by *Eucalyptus mannifera* and *E. viminalis* in east of the disturbance area near the Yarrangobilly river and the Ravine area but unlikely to be frequent. Not included for assessment |
| Bird | *Apus pacificus* | Fork-tailed Swift | M | - | NA | Recorded in all regions of NSW. The Fork-tailed Swift is almost exclusively aerial, flying from less than 1 m to at least 300 m above ground and probably much higher. | PMST | - | Moderate.<br><br>Likely to fly over the disturbance area during |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | migration. Not included for assessment |
| Bird | *Artamus cyanopterus cyanopterus* | Dusky Woodswallow | - | V | Ecosystem | The Dusky Woodswallow has two separate populations. The eastern population is found from Atherton Tableland, Queensland south to Tasmania and west to Eyre Peninsula, South Australia. The other population is found in south-west Western Australia. The Dusky Woodswallow is found in open forests and woodlands and may be seen along roadsides and on golf courses. | BioNet – 18<br>BAM-C<br>EMM (2020) | None | Known to occur and recorded on site during the surveys.<br><br>Habitat for this species is widespread and records of this species are widespread in the region. Included as a predicted species for assessment. |
| Bird | *Calidris acuminata* | Sharp-tailed Sandpiper | M | - | NA | The Sharp-tailed Sandpiper spends the non-breeding season in Australia with small numbers occurring regularly in New Zealand. Most of the population migrates to Australia, mostly to the south-east and are widespread in both inland and coastal locations and in both freshwater and saline habitats. Many inland records are of birds on passage. Prefers muddy edges of shallow fresh or brackish wetlands, with inundated or emergent sedges, grass, saltmarsh or other low vegetation. | PMST | - | Low.<br><br>No wading bird habitat is present. Not included for assessment |
| Bird | *Calidris ferruginea* | Curlew Sandpiper | CE | E | Dual credit species.<br><br>Ecosystem (foraging habitat) | In Australia, Curlew Sandpipers occur around the coasts of all states and are also quite widespread inland, though in smaller numbers. They occur in Australia mainly during the non-breeding period but also during the breeding season when many non-breeding one year old birds remain. Curlew Sandpipers mainly occur on intertidal mudflats in sheltered coastal areas, such as estuaries, bays, inlets and lagoons, and also around non-tidal swamps, lakes and lagoons near the coast, and ponds in saltworks and sewage farms. They are also recorded inland, though less often, including around | PMST | - | Low.<br><br>No wading bird habitat is present. Not included for assessment |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Species (breeding habitat) | ephemeral and permanent lakes, dams, waterholes and bore drains, usually with bare edges of mud or sand. They generally roost on bare dry shingle, shell or sand beaches, sandspits and islets in or around coastal or near-coastal lagoons and other wetlands, occasionally roosting in dunes during very high tides and sometimes in saltmarsh and in mangroves. | | | |
| Bird | *Calidris melanotos* | Pectoral Sandpiper | M | - | NA | In New South Wales (NSW), the Pectoral Sandpiper is widespread, but scattered. Records exist east of the Great Divide, from Casino and Ballina, south to Ulladulla. West of the Great Divide, the species is widespread in the Riverina and Lower Western regions. Prefers shallow fresh to saline wetlands. The species is found at coastal lagoons, estuaries, bays, swamps, lakes, inundated grasslands, saltmarshes, river pools, creeks, floodplains and artificial wetlands. | PMST | - | Low.<br><br>No wading bird habitat is present. Not included for assessment |
| Bird | *Callocephalon fimbriatum* | Gang-gang Cockatoo | - | V | Dual credit species.<br><br>Ecosystem (foraging habitat)<br><br>Species (breeding habitat) | In summer, occupies tall montane forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests with an acacia understorey. Also occur 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, occasionally feeding on exotic plant species on urban fringe areas. Favours old growth forest and woodland attributes for nesting and roosting. Nesting occurs in Spring and Summer with nests located in hollows that are 10 cm in diameter or larger and at least 9 m above the ground in eucalypts. | BioNet – 52<br>BAM-C<br>EMM (2020) | Hollow bearing trees<br><br>Eucalypt tree species with hollows greater than 9 cm diameter<br><br>No geographic limitations. | Known to occur and recorded on site during the surveys.<br><br>Habitat for this species is widespread. Records of this species are widespread in the region and this species was observed using the habitats to the west and east of the Tumut River during the field surveys. Breeding habitat is likely to be present. Included as a candidate and predicted species for assessment. |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| Bird | *Climacteris picumnus victoriae* | Brown Treecreeper (eastern subspecies) | - | V | Ecosystem | Endemic to eastern Australia and occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. It is less commonly found on coastal plains and ranges. Found in eucalypt woodlands (including Box-Gum Woodland) and dry open forest of the inland slopes and plains inland of the Great Dividing Range; mainly inhabits woodlands dominated by stringybarks or other rough-barked eucalypts, usually with an open grassy understorey, sometimes with one or more shrub species; also found in mallee and River Red Gum (*Eucalyptus camaldulensis*) Forest bordering wetlands with an open understorey of acacias, saltbush, lignum, Cumbungi and grasses; usually not found in woodlands with a dense shrub layer; fallen timber is an important habitat component for foraging; also recorded, though less commonly, in similar woodland habitats on the coastal ranges and plains. Hollows in standing dead or live trees and tree stumps are essential for nesting. | BioNet – 3<br>BAM-C<br>EMM (2020) | None | Moderate.<br><br>Habitat for this species is widespread. There are scattered records of this species in the region. Included as a predicted species for assessment. |
| Bird | *Daphoenositta chrysoptera* | Varied Sittella | - | V | Ecosystem | The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in NSW is nearly continuous from the coast to the far west. Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, mallee and Acacia woodland. Feeds on arthropods gleaned from crevices in rough or decorticating bark, dead branches, standing dead trees and small branches and twigs in the tree canopy. Nests in an upright tree fork high in the living tree canopy. | BioNet – 2<br>BAM-C<br>EMM (2020) | None | Moderate.<br><br>Habitat for this species is widespread. There are scattered records of this species in the region. Included as a predicted species for assessment. |
| Bird | *Gallinago hardwickii* | Latham's Snipe | M | - | NA | Recorded along the east coast of Australia from Cape York Peninsula through to south-eastern South Australia. Occurs in | PMST | - | Moderate. |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | permanent and ephemeral wetlands up to 2000 m above sea-level. | EMM (2020) | | Some areas of the Tumut River and Yarrangobilly River are likely to provide suitable habitat for this species. Included in migratory species assessment. |
| Bird | *Grantiella picta* | Painted Honeyeater | V | V | Ecosystem | The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of birds, and almost all breeding, occur on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter it is more likely to be found in the north of its distribution. Inhabits Boree, Brigalow and Box-Gum Woodlands and Box-Ironbark Forests. A specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias. Prefers mistletoes of the genus Amyema. | PMST | - | Low.<br><br>The vegetation in the disturbance area may provide some limited habitat for this species and there are scattered records of this species in the region. However, no large areas of high-quality habitat were identified. Not included for assessment |
| Bird | *Haliaeetus leucogaster* | White-bellied Sea-Eagle | M | V | Dual credit species.<br><br>Ecosystem (foraging habitat)<br><br>Species (breeding habitat) | Distributed along the coastline (including offshore islands) of mainland Australia and Tasmania. Found in coastal habitats (especially those close to the seashore) and around terrestrial wetlands in tropical and temperate regions of mainland Australia and its offshore islands. The habitats occupied by the sea-eagle are characterised by the presence of large areas of open water (larger rivers, swamps, lakes, and the sea). | BioNet – 1<br>PMST<br>BAM-C<br>EMM (2020) | Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines | Moderate.<br><br>This species is likely to hunt and nest in the broader study area along the Yarrangobilly River and Talbingo Reservoir. Included as a candidate and predicted species for assessment. |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | No geographic limitations. | |
| Bird | *Hieraaetus morphnoides* | Little Eagle | - | V | Dual credit species.<br><br>Ecosystem (foraging habitat)<br><br>Species (breeding habitat) | The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW. Occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. | BioNet – 2<br>BAM-C<br>EMM (2020) | Nest trees - live (occasionally dead) large old trees within vegetation)<br><br>No geographic limitations. | Moderate.<br><br>This species is likely to hunt and nest in the disturbance area. Included as a candidate and predicted species for assessment. |
| Bird | *Hirundapus caudacutus* | White-throated Needletail | M | - | NA | Widespread in eastern and south-eastern Australia. Almost exclusively aerial, from heights of less than 1 m up to more than 1000 m above the ground. They also commonly occur over heathland but less often over treeless areas, such as grassland or swamps. | BioNet – 4<br>PMST<br>EMM (2020) | - | Moderate.<br><br>This species may fly over the disturbance area during migration. Included in migratory species assessment |
| Bird | *Lophoictinia isura* | Square-tailed Kite | - | V | Dual credit species.<br><br>Ecosystem (foraging habitat)<br><br>Species (breeding habitat) | 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, Corymbia maculata, 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. | BAM-C<br>EMM (2020) | Nest trees<br><br>No geographical limitations | Moderate.<br><br>Although records are lacking, this species is likely to hunt and nest in the disturbance area based on the presence of suitable habitat. Included as a candidate and predicted species for assessment. |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| Bird | *Melanodryas cucullata cucullata* | Hooded Robin (south-eastern form) | - | V | Ecosystem | The Hooded Robin is widespread, found across Australia, except for the driest deserts and the wetter coastal areas - northern and eastern coastal Queensland and Tasmania. However, it is common in few places, and rarely found on the coast. Prefers lightly wooded country, usually open eucalypt woodland, acacia scrub and mallee, often in or near clearings or open areas. Requires structurally diverse habitats featuring mature eucalypts, saplings, some small shrubs and a ground layer of moderately tall native grasses. The nest is a small, neat cup of bark and grasses bound with webs, in a tree fork or crevice, from less than 1 m to 5 m above the ground. | BAM-C | None | Moderate.<br><br>Some records exist in the locality. The open habitats around the Ravine area and on the Bago Plateau may be suitable. Included as a predicted species for assessment. |
| Bird | *Melithreptus gularis gularis* | Black-chinned Honeyeater (eastern subsp.) | - | V | Ecosystem | Extends south from central Queensland, through NSW, Victoria into south eastern South Australia, though it is very rare in the last state. In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. Occupies mostly upper levels of drier open forests or woodlands dominated by box and ironbark eucalypts, especially Mugga Ironbark (*Eucalyptus sideroxylon*), White Box (*E. albens*), Inland Grey Box (E. *microcarpa*), Yellow Box (*E. melliodora*), Blakely's Red Gum (*E. blakelyi*) and Forest Red Gum (*E. tereticornis*). Also inhabits open forests of smooth-barked gums, stringybarks, ironbarks, river sheoaks (nesting habitat) and tea-trees. | BioNet – 1 | - | Low.<br><br>Some suitable is likely to be present within the disturbance area but there are few records from the locality and the disturbance area is on the south eastern edge of the known distribution. Not included for assessment |
| Bird | *Motacilla flava* | Yellow Wagtail | M | - | NA | Rare but regular visitor around Australian coast, especially in the NW coast Broome to Darwin. Found in open country near swamps, salt marshes, sewage ponds, grassed surrounds to airfields, bare ground; occasionally on drier inland plains. | PMST | - | Low.<br><br>Habitat unsuitable for this species. Not included for assessment |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| Bird | *Myiagra cyanoleuca* | Satin Flycatcher | M | - | NA | Widespread in eastern Australia and vagrant to New Zealand. Inhabit heavily vegetated gullies in eucalypt-dominated forests and taller woodlands, and on migration, occur in coastal forests, woodlands, mangroves and drier woodlands and open forests. | PMST<br>EMM (2020) | - | Moderate.<br><br>Suitable habitat is widespread, and this species has been frequently recorded in the locality. Included in migratory species assessment |
| Bird | *Neophema pulchella* | Turquoise Parrot | - | V | Ecosystem | Range extends from southern Queensland through to northern Victoria, from the coastal plains to the western slopes of the Great Dividing Range. Lives on the edges of eucalypt woodland adjoining clearings, timbered ridges and creeks in farmland. | BioNet – 2 | - | Low.<br><br>The disturbance area is outside of the known range of this species and the habitat in the disturbance area is not considered suitable for this species. Not included for assessment |
| Bird | *Ninox connivens* | Barking Owl | - | V | Dual credit species.<br><br>Ecosystem (foraging habitat)<br><br>Species (breeding habitat) | Found throughout continental Australia except for the central arid regions. Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. | BAM-C | - | Moderate.<br><br>This species is not known from the disturbance area and it is on the edge of the expert distribution. Included as a candidate and predicted species for assessment. |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| Bird | *Ninox strenua* | Powerful Owl | - | V | Dual credit species.<br><br>Ecosystem (foraging habitat)<br><br>Species (breeding habitat) | In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains suggesting occupancy prior to land clearing. Now at low densities throughout most of its eastern range, rare along the Murray River and former inland populations may never recover. The Powerful Owl inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl requires large tracts of forest or woodland habitat but can occur in fragmented landscapes as well. The species breeds and hunts in open or closed sclerophyll forest or woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine (*Syncarpia glomulifera)*, Black She-oak (*Allocasuarina littoralis)*, Blackwood (*Acacia melanoxylon)*, Rough-barked Apple (*Angophora floribunda)*, Cherry Ballart (*Exocarpus cupressiformis*) and a number of Eucalypt species. | BioNet – 8<br>BAM-C<br>EMM (2020) | Hollow bearing trees - yes<br><br>Living or dead trees with hollow greater than 20 cm diameter - yes<br><br>No geographic limitations. | High.<br><br>Suitable habitat is widespread in the tall wet forests within the disturbance area and broader study area. The disturbance area is likely to contain habitat for breeding pairs. Included as a candidate and predicted species for assessment. |
| Bird | *Numenius madagascariensis* | Eastern Curlew | CE, M | - | Dual credit species.<br><br>Ecosystem (foraging habitat)<br><br>Species (breeding habitat) | Within Australia, the Eastern Curlew has a primarily coastal distribution. The species is found in all states, particularly the north, east, and south-east regions including Tasmania. The Eastern Curlew is most commonly associated with sheltered coasts, especially estuaries, bays, harbours, inlets and coastal lagoons, with large intertidal mudflats or sand flats, often with beds of seagrass. | PMST | - | Low.<br><br>Habitat in the disturbance area is not considered suitable for this species. Not included for assessment |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| Bird | *Pachycephala olivacea* | Olive Whistler | - | V | Ecosystem | The Olive Whistler inhabits the wet forests on the ranges of the east coast. It has a disjunct distribution in NSW chiefly occupying the beech forests around Barrington Tops and the MacPherson Ranges in the north and wet forests from Illawarra south to Victoria. In the south it is found inland to the Snowy Mountains and the Brindabella Range. Mostly inhabit wet forests above about 500m. During the winter months they may move to lower altitudes. | BioNet – 3<br>BAM-C<br>EMM (2020) | None | High.<br><br>This species is known to occur in the higher altitude areas (>500m) in the disturbance area. Included as a predicted species for assessment. |
| Bird | *Petroica boodang* | Scarlet Robin | - | V | Ecosystem | The Scarlet Robin lives in dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. This species lives in both mature and re-growth vegetation. It occasionally occurs in mallee or wet forest communities, or in wetlands and tea-tree swamps. This species' nest is built in the fork of tree usually more than 2 m above the ground; nests are often found in a dead branch in a live tree, or in a dead tree or shrub. | BioNet – 9<br>BAM-C<br>EMM (2020) | None | High.<br><br>This species has been recorded in the disturbance area and surround sin the past and suitable habitat for this species is widespread. Included as a predicted species for assessment. |
| Bird | *Petroica phoenicea* | Flame Robin | - | V | Ecosystem | The Flame Robin ranges from near the Queensland border to south east South Australia and also in Tasmania. In NSW, it breeds in upland areas and in winter, many birds move to the inland slopes and plains. It is likely that there are two separate populations in NSW, one in the Northern Tablelands, and another ranging from the Central to Southern Tablelands. Breeds in upland tall moist eucalypt forests and woodlands, often on ridges and slopes. Prefers clearings or areas with open understoreys. The ground layer of the breeding habitat is dominated by native grasses and the shrub layer may be either sparse or dense. Occasionally occurs in temperate rainforest, | BioNet – 75<br>BAM-C<br>EMM (2020) | None | High.<br><br>This species has been recorded in the disturbance area and surrounds in the past and suitable habitat for this species is widespread. Included as a predicted species for assessment. |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | and also in herbfields, heathlands, shrublands and sedgelands at high altitudes. | | | |
| Bird | Petroica rodinogaster | Pink Robin | - | V | Ecosystem | The Pink Robin is found in Tasmania and the uplands of eastern Victoria and far south-eastern NSW, almost as far north as Bombala. On the mainland, the species disperses north and west and into more open habitats in winter, regularly as far north as the ACT area, and sometimes being found as far north as the central coast of NSW. Inhabits rainforest and tall, open eucalypt forest, particularly in densely vegetated gullies. | BAM-C<br>EMM (2020) | None | High.<br><br>This species has been recorded in the survey area and surrounds in the past and suitable habitat for this species is widespread. |
| Bird | *Rhipidura rufifrons* | Rufous Fantail | M | - | NA | Occurs in coastal and near coastal districts of northern and eastern Australia. In east and south-east Australia, the Rufous Fantail mainly inhabits wet sclerophyll forests, often in gullies dominated by Eucalypts such as Tallow-wood (*Eucalyptus microcorys*), Mountain Grey Gum (*E. cypellocarpa*), Narrow-leaved Peppermint (*E. radiata*), Mountain Ash (*E. regnans*), Alpine Ash (*E. delegatensis*), Blackbutt (*E. pilularis*) or Red Mahogany (*E. resinifera*); usually with a dense shrubby understorey often including ferns. | PMST | - | High.<br><br>This species has been recorded in the survey area and surrounds in the past and suitable habitat for this species is widespread. Not included for assessment |
| Bird | *Rostratula australis* | Australian Painted Snipe | E, M | E | Ecosystem | Most records are from the south east, particularly the Murray Darling Basin, with scattered records across northern Australia and historical records from around the Perth region in Western Australia. Prefers fringes of swamps, dams and nearby marshy areas where there is a cover of grasses, lignum, low scrub or open timber. Nests on the ground amongst tall vegetation, such as grasses, tussocks or reeds. | PMST | - | Low.<br><br>Habitat in the disturbance area is not considered suitable for this species. Not included for assessment |
| Bird | *Stagonopleura guttata* | Diamond Firetail | - | V | Ecosystem | Found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum (*Eucalyptus pauciflora*) Woodlands. Also occurs in open forest, mallee, Natural Temperate | BioNet – 1 | None | Moderate. |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Grassland, and in secondary grassland derived from other communities. Often found in riparian areas (rivers and creeks), and sometimes in lightly wooded farmland. Nests are globular structures built either in the shrubby understorey, or higher up, especially under hawk's or raven's nests. Birds roost in dense shrubs or in smaller nests built especially for roosting. | BAM-C<br>EMM (2020) | | Records of this species are scattered all over the region. Suitable habitat is present in the survey area. Included as a predicted species for assessment. |
| Bird | *Tyto novaehollandiae* | Masked Owl | - | V | Dual credit species.<br><br>Ecosystem (foraging habitat)<br><br>Species (breeding habitat) | 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. Dry Eucalypt forests and woodland, typically prefers open forest with low shrub density. Requires old trees for roosting and nesting. | BioNet – 4<br>BAM-C<br>EMM (2020) | None | Moderate.<br><br>Suitable habitat is widespread and there are records from around the locality. Study area may contain nesting individuals. Included as a candidate and predicted species for assessment. |
| Bird | *Tyto tenebricosa* | Sooty Owl | - | V | Dual credit species.<br><br>Ecosystem (foraging habitat)<br><br>Species (breeding habitat) | Occupies the easternmost one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands. Territories are occupied permanently. Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests. | BioNet – 1 | - | Moderate.<br><br>Suitable habitat is widespread in KNP, and this species has been recorded from the gullies near the Tumut River. However habitat in the study area is not optimal and this species is likely confined to wetter forest in KNP. Included as a candidate species for assessment. |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
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| Fish | Euastacus armatus | Murray Crayfish | - | V | NA | The Murray Crayfish is a 'spiny' crayfish endemic to the southern tributaries of the Murray Darling Basin. This iconic species was once widespread in the Murray and Murrumbidgee River systems in South Australia, Victoria, New South Wales and the Australian Capital Territory. The Murray Crayfish is the largest of over 40 species in the genus Euastacus which represents freshwater 'spiny' crayfish; and is the second largest freshwater crayfish in the world. | Known from Tumut River | - | Moderate.<br><br>The indicative distribution of this species is mapped in the south of the survey area, where the Yarrangobilly River meets the Tumut River. |
| Fish | *Maccullochella macquariensis* | Trout Cod | E | E | NA | The Trout Cod is a riverine species, inhabiting a variety of flowing waters in the mid to upper reaches of rivers and streams. Trout Cod use river positions where large cover, in the form of woody debris and boulders, is present in high quantity, close to deeper water and high surface velocity, further from the riverbank. At present only two potentially sustainable populations are known; a naturally occurring population in the Murray River (NSW) downstream of the Yarrawonga Weir between Yarrawonga and Barmah and the translocated population in Seven Creeks below Polly McQuinns Weir (Vic). There have been no recent records in the Murray River downstream from Echuca (NSW, SA), Macquarie River (NSW), Murrumbidgee River (NSW, ACT), and the Goulburn, Broken, Campaspe, Ovens, King, Buffalo and Mitta Mitta Rivers (Vic). The wild populations formerly occurring in these rivers are now probably extinct. Trout Cod and Murray Cod translocated into Cataract Dam (Nepean River NSW) have hybridised, and the cod population existing there is composed largely of hybrids. | PMST | - | Low.<br><br>This species' indicative distribution is restricted to the Murray River, Murrumbidgee River and some tributaries. Not included for assessment |
| Fish | *Maccullochella peelii* | Murray Cod | V | - | NA | The Murray Cod occurs naturally in the waterways of the Murray-Darling Basin (ACT, SA, NSW and Vic) and is known to live in a wide range of warm water habitats that range from clear, rocky streams to slow flowing turbid rivers and | PMST | - | Low. |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
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| | | | | | | billabongs. The upper reaches of the Murray and Murrumbidgee Rivers are considered too cold to contain suitable habitat. Some translocated populations exist outside the species' natural distribution in impoundments and waterways in NSW and Vic which are maintained by the release of hatchery bred fish. | | | This species is not known from the locality. Not included for assessment |
| Fish | *Macquaria australasica* | Macquarie Perch | E | E | NA | The Macquarie Perch is a riverine species that prefers clear water and deep, rocky holes with abundant cover such as aquatic vegetation, large boulders, debris and overhanging banks. In Victorian parts of the Murray-Darling, only small natural populations remain in the upper reaches of the Mitta Mitta, Ovens, Broken, Campaspe and Goulburn Rivers; translocated populations occur in the Yarra River and Lake Eildon. In NSW, natural inland populations are isolated to the upper reaches of the Lachlan and Murrumbidgee Rivers. Populations of the eastern form are confined to the Hawkesbury-Nepean and Shoalhaven river systems. Translocated populations in NSW are found in the Mongarlowe River, Queanbeyan River upstream of the Googong Reservoir and in Cataract Dam. In the ACT, it is restricted to the Murrumbidgee, Paddys and Cotter Rivers | PMST | - | High.<br><br>The indicative distribution of this species is mapped in the south of the survey area, where the Yarrangobilly River meets the Tumut River. Not included for assessment |
| Frogs | *Litoria booroolongensis* | Booroolong Frog | E | E | Species | Restricted to tablelands and slopes in NSW and north-east Victoria at 200–1300 m above sea level. Occurs along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. | BioNet – 62<br>PMST<br>BAM-C<br>EMM (2020) | None | High.<br><br>This species is considered highly likely to inhabit the permanent rivers and streams in the survey area. Recorded as part of the Snowy 2.0 Main Works surveys. Included as a |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
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| | | | | | | | | | candidate species for assessment. |
| Frogs | *Litoria raniformis* | Southern Bell Frog | V | E | Species | The species is currently widespread throughout the Murray River valley and has been recorded from six Catchment Management Areas in NSW: Lower Murray Darling, Murrumbidgee, Murray, Lachlan, Central West and South East. Found mostly amongst emergent vegetation, including *Typha* sp. (bullrush), *Phragmites* sp. (reeds) and *Eleocharis* sp. (sedges), in or at the edges of still or slow-flowing water bodies such as lagoons, swamps, lakes, ponds and farm dams. | PMST | - | Low.<br><br>The survey area is mapped in the expert distribution (maybe) for this species and there are isolated records from Lake Blowering and Adaminaby but the habitat near the alternative and preferred option is not typical. |
| Frogs | *Litoria spenceri* | Spotted Tree Frog | E | CE | Species | The Spotted Tree Frog is extremely rare and occurs in scattered, geographically isolated populations. Historically it was known from two streams in southern NSW on the north-west side of the Great Dividing Range, however both populations appeared to have become locally extinct. One population has been re-established via a reintroduction program. It is also known from 15 locations in north-eastern Victoria. Occur among boulders or debris along naturally vegetated, rocky fast flowing upland streams and rivers. | PMST<br>BAM-C | Waterbodies<br><br>River environment with rocky habitat or within 500 m of a rocky river<br><br>No geographic limitations. | Low.<br><br>Waterbodies, and river environment with rocky habitat or within 500 m of a rocky river are in the South Eastern Highlands portion of the construction envelope but not in the Australian Alps portion. Only two populations of the Spotted Tree Frog have been identified in New South Wales and these populations not within or near the construction envelope and will not be impacted by the project. As such, the Spotted Tree Frog was removed from |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
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| | | | | | | | | | consideration as a species credit species and the Spotted Tree Frog has not been assessed. |
| Frogs | *Litoria verreauxii alpina* | Alpine Tree Frog | V | E | Species | The Alpine Tree Frog occurs in the south-eastern NSW and Victorian high country (alpine and sub-alpine zones) generally above 1100 m asl. Most locations are within National Park and some are close to alpine resorts. Found in a wide variety of habitats including woodland, heath, grassland and herb fields. Breed in natural and artificial wetlands including ponds, bogs, fens, streamside pools, stock dams and drainage channels that are still or slow flowing. It does not climb well, and spends most of its time on the ground. | BioNet – 20<br>PMST<br>BAM-C<br>EMM (2020) | No habitat constraints.<br><br>Above 1,000 m asl | High.<br><br>The survey area is mapped in the expert distribution (likely) for this species and there are many records of this species from around the Talbingo Reservoir and Bago Plateau. Included as a candidate species for assessment. |
| Frogs | *Pseudophryne corroboree* | Southern Corroboree Frog | CE | CE | Species | The Southern Corroboree Frog is limited to sphagnum bogs of the northern Snowy Mountains, in a strip from the Maragle Range in the north-west, through Mt Jagungal to Smiggin Holes in the south. Its range is entirely within KNP. Summer breeding habitat is pools and seepages in sphagnum bogs, wet tussock grasslands and wet heath. Outside the breeding season adults move away from the bogs into the surrounding heath and Snow Gum woodland to overwinter under litter, logs and dense groundcover. | PMST, BAM-C | Swamps<br><br>Within 200 m of high montane sub-alpine bog or ephemeral pool environments<br><br>Above 1,000 m asl | Low.<br><br>The distribution of this species is fairly well known, which is south of the survey area. Not included for assessment. |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
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| Frogs | *Pseudophryne pengilleyi* | Northern Corroboree Frog | CE | CE | Species | The Northern Corroboree Frog occurs in forests, sub-alpine woodlands and tall heath in the Brindabella Ranges from Mt Bimberi to north of Mt Coree, and the Fiery Range from the Snowy Mountains Highway to Wee Jasper. Populations also occur in the pine plantations near Tumut. The distribution is within National Park, State Forest and other public land. Summer breeding habitat is pools and seepages in sphagnum bogs, wet heath, wet tussock grasslands and herbfields in low-lying depressions. Outside the breeding season adults move away from the bogs into the surrounding heath, woodland and forest to overwinter under litter, logs and dense groundcover. | BioNet – 1, BAM-C | No habitat constraints.<br><br>Above 700 m asl | Low.<br><br>The distribution of this species is fairly well known, which is north of the survey area. Not included for assessment. |
| Mammals | *Burramys parvus* | Mountain Pygmy-possum | E | E | Species | The Mountain Pygmy-possum lives only in alpine and subalpine areas on the highest mountains of Victoria and NSW. In NSW the entire range is in a 30 km by 8 km area of KNP between Thredbo and Kerries Ridge, where it occupies less than four square km of habitat. The total population size is less than 500 adults. Two of the four main sub-populations in NSW are found within ski resort areas. Lives on the ground in rocky areas where boulders have accumulated below mountain peaks; frequently associated with alpine heathland shrubs dominated by the Mountain Plum-pine (*Podocarpus lawrencei*). | PMST | - | Low.<br><br>This species is known from discrete, restricted higher altitude habitats to the south of Cabramurra but the preferred option and substation are not located near this habitat. Included as a candidate species for assessment. |
| Mammals | *Cercartetus nanus* | Eastern Pygmy-possum | - | V | Species | Found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath, but in most areas woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently encountered in rainforest. Feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; soft fruits are eaten when flowers are unavailable. Shelters in tree hollows, rotten stumps, holes in | BioNet – 51<br>BAM-C<br>EMM (2020) | None | High.<br><br>Recorded during surveys of the construction envelope and suitable foraging and breeding habitat is widespread, particularly in areas with high abundance of |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
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| | | | | | | the ground, abandoned bird-nests, Ringtail Possum dreys or thickets of vegetation, (e.g. grass-tree skirts); nest-building appears to be restricted to breeding females; tree hollows are favoured but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks. Important habitat requirements include trees with hollows >2cm, loose bark of eucalypts or accumulations of shredded bark in tree forks for nesting; and associated vegetation types and with an understorey containing heath, banksias or myrtaceous shrubs and soft-fruited plants in rainforests. | | | *Banksia canei*. Included as a candidate species for assessment. |
| Mammals | *Dasyurus maculatus* | Spotted-tailed Quoll | E | V | Ecosystem | Wet and dry sclerophyll forests and rainforests, and adjacent open agricultural areas. Generally associated with large expansive areas of habitat to sustain territory size. Requires hollow-bearing trees, fallen logs, small caves, rock crevices, boulder fields and rocky-cliff faces as den sites. | BioNet – 8<br>PMST<br>BAM-C<br>EMM (2020) | None | High.<br><br>There are extensive areas of suitable habitat for this species in the survey area and many records from Bago State Forest and adjacent land. The survey area is likely to contain several individuals and breeding habitat may be present. Included as a predicted species for assessment. |
| Mammals | *Falsistrellus tasmaniensis* | Eastern False Pipistrelle | - | V | Ecosystem | Prefers moist habitats, with trees taller than 20 m. Generally, this species roosts in eucalypt hollows, but has also been found under loose bark on trees or in buildings. | BioNet – 12<br>BAM-C | None | High.<br><br>There are extensive areas of suitable habitat for this species in the survey area and many records from Bago State Forest and adjacent land. |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
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| | | | | | | | | | Breeding habitat is likely to be present. Included as a predicted species for assessment. |
| Mammals | *Mastacomys fuscus* | Broad-toothed Rat | V | V | Species | In NSW the Broad-toothed Rat occurs in two widely separated areas: the wet alpine and subalpine heaths and woodlands in KNP, adjacent Nature Reserves (Bimberi and Scabby NR) and State Forest (Buccleuch SF) in the south of the State, and on the Barrington Tops, north-west of Newcastle. In Victoria - South Gippsland and the Otways - and western Tasmania, it can be found in wet sedge and grasslands at lower elevations. The Broad-toothed Rat lives in a complex of runways through the dense vegetation of its wet grass, sedge or heath environment, and under the snow in winter. This relatively warm under-snow space enables it to be active throughout winter. Sheltering nests of grass are built in the understorey or under logs, where two or three young are born in summer. In winter the rats huddle together in nests, for warmth. | BioNet – 43<br>PMST<br>EMM (2020) | None | Low.<br><br>There are many records of this species to the east of the survey area on the high-altitude plains. EMM (2020) had reported a small area of potential habitat for Broad-toothed Rat, along Mines Trail at the junction of the Caves Creek, which is also within the current study area. Subsequent trapping did not confirm presence of the species, and the habitat is an isolated regrowth grassland, not suited to the species. Not included for assessment |
| Mammals | *Miniopterus orianae oceanensis* | Large Bent-winged Bat | - | V | Dual credit species.<br><br>Ecosystem (foraging habitat) | Occurs on east and north west coasts of Australia. Caves are the primary roosting habitat, but also use derelict mines, storm-water tunnels, buildings and other manmade structures. | BioNet – 2<br>BAM-C<br>EMM (2020) | Caves<br><br>Cave, tunnel, mine, culvert or other structure known or suspected to | High.<br><br>Suitable foraging habitat is widespread. Potential cave roosts are present along the Tumut River. This species has been frequently recorded in the locality. Included as a |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
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| | | | | | Species (breeding habitat) | | | be used for breeding including species records with microhabitat code "IC - in cave<br><br>Observation type code "E nest-roost<br><br>With numbers of individuals >500<br><br>No geographic limitations. | candidate and predicted species for assessment. |
| Mammals | *Myotis macropus (Myotis adversus)* | Southern Myotis | - | V | Species | Generally, this species roost in groups close to water in caves, mine shafts, hollow-bearing trees, and storm water channels, buildings, under bridges and in dense foliage. Forages over streams and pools catching insects and small fish. | BioNet – 1<br><br>EMM (2020) | Hollow bearing trees<br><br>Within 200 m of riparian zone<br><br>Bridges, caves or artificial structures within 200 m | High.<br><br>Suitable foraging habitat is widespread. Potential roosting habitat in hollow-bearing trees and bridges over the Tumut River are present. This species has been frequently recorded in the locality. Included as a candidate species for assessment. |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
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| | | | | | | | | of riparian zone<br><br>This include rivers, creeks, billabongs, lagoons, dams and other waterbodies on or within 200m of the site | |
| Mammals | *Petauroides volans* | Greater Glider | V | - | NA | The Greater Glider occurs in eucalypt forests and woodlands along the east coast of Australia from north east Queensland to the Central Highlands of Victoria from sea level to 1200 m altitude. It feeds exclusively on eucalypt leaves, buds, flowers and mistletoe and favours forests with a diversity of eucalypt species, due to seasonal variation in its preferred tree species. It roosts in tree hollows, with a particular selection for large hollows in large, old trees. Individuals use multiple hollows and a relatively high abundance of tree hollows (at least 4-8 suitable hollows per ha) seems to be needed for the species to persist. Individuals occupy relatively small home ranges with an average size of 1 to 3 ha but the species has relatively low persistence in small forest fragments, and disperses poorly across vegetation that is not native forest. Forest patches of at least 160 km2 may be required to maintain viable populations. | BioNet – 9<br>PMST | - | Moderate.<br><br>There are numerous records of this species from the Bago State Forest. Suitable habitat is likely widespread in the survey area west of the Tumut River in the tall wet forests. Not included for assessment |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
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| Mammals | *Petaurus australis* | Yellow-bellied Glider | - | V | Ecosystem | Found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. Extract sap by incising (or biting into) the trunks and branches of favoured food trees, often leaving a distinctive 'V'-shaped scar. | BioNet – 141<br>BAM-C | None | High.<br><br>There is a known population of Yellow-bellied Glider on the Bago Plateau. This species is likely to use vegetation in the west of the survey area including the tall wet forests in the area of the substation. Included as a predicted species for assessment. |
| Mammals | *Petaurus australis* (endangered population) | Yellow-bellied Glider population on the Bago Plateau | - | EP | Species | The endangered population of the Yellow-bellied Glider occurs on the Bago Plateau; a westward extension of the Kosciuszko highlands in southern New South Wales. The population is disjunct owing to the steep valleys and unsuitable habitat surrounding the Bago Plateau which includes cleared agricultural land to the west and the Tumut River and Talbingo Reservoir to the east. The area of the population includes a large portion of Bago and Maragle State Forests, a small area of KNP and some freehold land. Den, often in family groups, in hollows of large trees. The habitat on the Bago Plateau consists of tall wet sclerophyll forest dominated by *Eucalyptus delegatensis* (Alpine Ash), *E. dalrympleana* (Mountain Gum), *E. radiata* (Narrow-leaved Peppermint) and *E. rubida* (Candlebark). Feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. | BioNet – 139 | - | High.<br><br>There is a known population of Yellow-bellied Glider on the Bago Plateau. This species is likely to use vegetation in the west of the survey area including the tall wet forests in the area of the substation. Not included for assessment |
| Mammals | *Petaurus norfolcensis* | Squirrel Glider | - | V | Species | The species is widely though sparsely distributed in eastern Australia, from northern Queensland to western Victoria. Inhabits mature or old growth Box, Box-Ironbark woodlands | BioNet – 5 | None | Moderate. |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
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| | | | | | | and River Red Gum forest west of the Great Dividing Range and Blackbutt-Bloodwood forest with heath understorey in coastal areas. Prefers mixed species stands with a shrub or Acacia midstorey. | BAM-C | | There are only six records of this species most from the McPhersons Plain area on the Bago plateau where it has been found tangled on fences. Likely to be more widespread than currently known and suitable habitat is present in the survey area. Included as a candidate species for assessment. |
| Mammals | *Phascogale tapoatafa* | Brush-tailed Phascogale | - | V | Species | The Brush-tailed Phascogale has a patchy distribution around the coast of Australia. In NSW it is mainly found east of the Great Dividing Range although there are occasional records west of the divide. Prefer dry sclerophyll open forest with sparse groundcover of herbs, grasses, shrubs or leaf litter. Also inhabit heath, swamps, rainforest and wet sclerophyll forest. Agile climber foraging preferentially in rough barked trees of 25 cm DBH or greater. | BAM-C | Hollow bearing trees<br><br>No geographic limitations. | Moderate.<br>Suitable habitat is widespread though records of the Brush-tailed Phascogale within the KNP are very scarce. Included as a candidate species for assessment. |
| Mammals | *Phascolarctos cinereus* | Koala | V | V | Dual credit species.<br><br>Ecosystem (foraging habitat)<br><br>Species (breeding habitat) | In NSW it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species. | PMST<br>BAM-C | Areas identified via survey as important habitat (see comments)<br><br>No geographic limitations. | Moderate.<br>The survey area is within the expert distribution (maybe) for this species but there are not many records from the locality with some from Talbingo, Tumbarumba and Lake Eucumbene. There may be a low density population that uses the survey area or the habitat may be used by dispersing juvenile males as |

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| | | | | | | | | | there are forests dominated by some primary food tree species (*Eucalyptus viminalis*) and secondary food tree species (*Eucalyptus rubida, Eucalyptus dalrympleana, Eucalyptus nortonii, Eucalyptus bridgesiana, Eucalyptus mannifera*) present. Included as a candidate and predicted species for assessment. |
| Mammals | *Pseudomys fumeus* | Smoky Mouse | E | CE | Species | The Smoky Mouse is currently limited to a small number of sites in western, southern and eastern Victoria, south-east NSW and the ACT. The Smoky Mouse appears to prefer heath habitat on ridge tops and slopes in sclerophyll forest, heathland and open forest from the coast (in Victoria) to sub-alpine regions of up to 1800 m, but sometimes occurs in ferny gullies. | BioNet – 22<br>PMST<br>BAM-C<br>EMM (2020) | None | High.<br><br>The survey area is within the expert distribution (maybe) for this species and it has recently been recorded in the locality during surveys undertaken for the Snowy 2.0 EIS. This species may be more widespread than currently known and there may be large areas of suitable habitat in the shrubby higher altitude Mountain Gum dominated forests in west of the survey area. Included as a candidate species for assessment. |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
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| Mammals | *Pteropus poliocephalus* | Grey-headed Flying-fox | V | V | Dual credit species.<br><br>Ecosystem (foraging habitat)<br><br>Species (breeding habitat) | Generally found within 200 km of the eastern coast of Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, they may be found in unusual locations. Occur in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of a regular food source and are commonly found in gullies, close to water, in vegetation with a dense canopy. Individual camps may have tens of thousands of animals and are used for mating, and for giving birth and rearing young. | PMST | - | Low.<br><br>The closest known camp is >130 km from the survey area and there are no records of this species from the locality. Not included for assessment |
| Reptiles | *Cyclodomorphus praealtus* | Alpine She-oak Skink | E | E | Species | The Alpine She-oak Skink is endemic to NSW and Victoria, where it is restricted to sub-alpine and alpine grasslands. In NSW, the Alpine She-oak Skink has only been observed within KNP between Smiggin Holes and Kiandra. The Alpine She-oak Skink has specific habitat requirements, preferring tree-less or very lightly treed areas that contain tussock grasses, low heath or a combination of both. Within this habitat the species shelters beneath litter, rocks, logs and other ground debris, and has been observed basking on grass tussocks. In NSW, Alpine She-oak Skinks have been observed in alpine to sub-alpine grasslands in flat to gently sloping areas. | BioNet – 18<br>PMST<br>BAM-C<br>EMM (2020) | None | Low.<br>The Alpine She-oak Skink has very specific habitat requirements, preferring tree-less or very lightly treed areas that contain tussock grasses, low heath or a combination of both (i.e. alpine to sub-alpine grasslands or heath). The construction envelope does not contain any alpine to sub-alpine grasslands or heath and therefore is not considered to provide suitable habitat for the Alpine She-oak Skink. Not included for assessment. |
| Reptiles | *Liopholis guthega* | Guthega Skink | E | E | Species | The Guthega Skink is restricted to locations above 1600 m in the Australian Alps, in the vicinity of Mt Kosciuszko, NSW, and the Bogong High Plains, Victoria. The Guthega Skink occurs | BAM-C | Granite substrate and | Low. |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | between 1600 m and 2170 m – in the coldest (winter snow cover) and some of the wettest regions on mainland Australia. Preferred habitats are usually rocky or have sub-surface boulders hidden beneath soil or thick vegetation. The NSW distribution occurs where there is a granite substrate and decomposing granite soils. Individuals have been recorded in a range of vegetation types, including open *Eucalyptus pauciflora* (Snow Gum) woodland with grassy or shrubby understoreys, dry tussock grassland, and tall and short heath. | | decomposing granite soils<br><br>Rocky areas including sub-surface boulders<br><br>No geographic limitations. | The Guthega Skink is restricted to locations above 1,600 m asl in the Australian Alps, near Mt Kosciuszko, NSW, and the Bogong High Plains, Victoria. The construction envelope is well below this altitude with the highest point in the Australian Alps portion of the construction envelope being 1,190 m asl. Not included for assessment. |
| Reptiles | *Varanus rosenbergi* | Rosenberg's Goanna, Heath Monitor | - | V | Ecosystem | Rosenberg's Goanna occurs on the Sydney Sandstone in Wollemi National Park to the north-west of Sydney, in the Goulburn and ACT regions and near Cooma in the south. There are records from the South West Slopes near Khancoban and Tooma River. Also occurs in South Australia and Western Australia. Found in heath, open forest and woodland. Associated with termites, the mounds of which this species nests in; termite mounds are a critical habitat component. Shelters in hollow logs, rock crevices and in burrows, which they may dig for themselves, or they may use other species' burrows, such as rabbit warrens. | BAM-C | None | Moderate.<br><br>This species is known from the southern Highlands and is predicted to occur in the Australian Alps Bioregion. There are records from the South West Slopes near Khancoban and Tooma River. Has been recorded from the KNP from peppermint dominated forest near Black Perry lookout. Large areas of suitable habitat are present in the survey area including critical habitat features such as termite mounds, rocky crevices, hollow logs, and |

| Animal type | Species name | Common name | EPBC Act | BC Act or FM Act | Credit type (BC Act) | Distribution and habitat | Data source | Habitat constraints & Geographic limitations (BAM-C) | Likelihood of occurrence |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | burrows. Included as a predicted species for assessment. |

Distribution and habitat requirement information adapted from: Australian Government Department of the Environment http://www.environment.gov.au/biodiversity/threatened/index.html EESG http://www.environment.nsw.gov.au/threatenedspecies/

Key:

CE = critically endangered / E = endangered / V = vulnerable / M = migratory

# Appendix B. Floristic survey composition and structure data

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 1** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 285** | | | **30** | **25** | 4 | 5 | 6 | 9 | 0 | 1 | **5** | 2 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **129.41** | **104.1** | 21.2 | 70.6 | 11.3 | 0.9 | 0 | 0.1 | **25.31** | 25.01 |
| *Eucalyptus camphora* | 20 | 5 | TG | | 20 | | | | | | | |
| *Leptospermum lanigerum* | 70 | 50 | SG | | | 70 | | | | | | |
| *Senecio prenanthoides* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Carex appressa* | 10 | 250 | GG | | | | 10 | | | | | |
| *Rubus fruticosus agg.* | 25 | 500 | HT | | | | | | | | | 25 |
| *Acacia dealbata* | 0.1 | 10 | TG | | 0.1 | | | | | | | |
| *Senecio pinnatifolius* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Pterostylis monticola* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Geranium solanderi* | 0.1 | 100 | FG | | | | | 0.1 | | | | |
| *Poa sieberiana* | 0.5 | 25 | GG | | | | 0.5 | | | | | |
| *Stellaria pungens* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Acaena novae-zelandiae* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Eryanthe moschatus* | 0.1 | 100 | EX | | | | | | | | 0.1 | |
| *Ranunculus lappaceus* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Acacia melanoxylon* | 1 | 1 | TG | | 1 | | | | | | | |
| *Mentha diemenica* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Eucalyptus pauciflora* | 0.1 | 1 | TG | | 0.1 | | | | | | | |
| *Poa helmsii* | 0.5 | 25 | GG | | | | 0.5 | | | | | |
| *Conyza bonariensis* | 0.1 | 1 | EX | | | | | | | | 0.1 | |
| *Coprosma quadrifida* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Juncus sp.* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Glycine clandestina* | 0.1 | 15 | OG | | | | | | | 0.1 | | |
| *Hakea microcarpa* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Epacris breviflora* | 0.2 | 10 | SG | | | 0.2 | | | | | | |
| *Prunella vulgaris* | 0.1 | 5 | EX | | | | | | | | 0.1 | |
| *Pterostylis decurva* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Schoenus melanostachys* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Carex sp.* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Baeckea utilis* | 0.2 | 20 | SG | | | 0.2 | | | | | | |
| *Holcus lanatus* | 0.01 | 25 | HT | | | | | | | | | 0.01 |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 2** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 285** | | | **37** | **36** | 4 | 7 | 7 | 16 | 0 | 2 | **1** | 1 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **121.2** | **121.1** | 33.3 | 3.1 | 80.9 | 3.5 | 0 | 0.3 | **0.1** | 0.1 |
| *Acacia melanoxylon* | 0.3 | 5 | TG | | 0.3 | | | | | | | |
| *Eucalyptus dalrympleana* | 5 | 6 | TG | | 5 | | | | | | | |
| *Eucalyptus pauciflora* | 20 | 65 | TG | | 20 | | | | | | | |
| *Eucalyptus robertsonii* | 8 | 8 | TG | | 8 | | | | | | | |
| *Bossiaea foliosa* | 0.2 | 50 | SG | | | 0.2 | | | | | | |
| *Cassinia aculeata* | 0.3 | 20 | SG | | | 0.3 | | | | | | |
| *Coprosma hirtella* | 0.2 | 10 | SG | | | 0.2 | | | | | | |
| *Daviesia ulicifolia* | 0.2 | 5 | SG | | | 0.2 | | | | | | |
| *Olearia erubescens* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Persoonia chamaepeuce* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Platylobium formosum* | 2 | 100 | SG | | | 2 | | | | | | |
| *Clematis aristata* | 0.2 | 100 | OG | | | | | | | 0.2 | | |
| *Glycine tabacina* | 0.1 | 25 | OG | | | | | | | 0.1 | | |
| *Rubus fruticosus agg.* | 0.1 | 1 | HT | | | | | | | | | 0.1 |
| *Lomandra filiformis* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Lomandra laxa* | 0.2 | 10 | GG | | | | 0.2 | | | | | |
| *Luzula flaccida* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Microlaena stipoides* | 0.2 | 50 | GG | | | | 0.2 | | | | | |
| *Poa labillardierei* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Poa sieberiana* | 80 | 1000 | GG | | | | 80 | | | | | |
| *Poa sp.* | 0.2 | 50 | GG | | | | 0.2 | | | | | |
| *Acaena novae-zelandiae* | 0.5 | 100 | FG | | | | | 0.5 | | | | |
| *Ajuga australis* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Asperula scoparia* | 0.5 | 150 | FG | | | | | 0.5 | | | | |
| *Chiloglottis valida* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Cymbonotus sp.* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Dianella tasmanica* | 0.2 | 5 | FG | | | | | 0.2 | | | | |
| *Dichondra repens* | 0.1 | 200 | FG | | | | | 0.1 | | | | |
| *Geranium solanderi* | 0.1 | 100 | FG | | | | | 0.1 | | | | |
| *Gonocarpus sp.* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Gonocarpus tetragynus* | 0.1 | 100 | FG | | | | | 0.1 | | | | |
| *Hydrocotyle laxiflora* | 0.1 | 150 | FG | | | | | 0.1 | | | | |
| *Microseris lanceolata* | 0.2 | 100 | FG | | | | | 0.2 | | | | |
| *Ranunculus lappaceus* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Solenogyne bellioides* | 0.1 | 100 | FG | | | | | 0.1 | | | | |
| *Stellaria pungens* | 1 | 150 | FG | | | | | 1 | | | | |
| *Veronica calycina* | 0.1 | 50 | FG | | | | | 0.1 | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Covers** | **Native** | Trees | Shrubs | Grass | Forb | Fern | Other | **Exotic** | HighThreat |
| **Plot 3** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 285** | | | **59** | **52** | 5 | 10 | 6 | 30 | 0 | 1 | **7** | 4 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **90.3** | **74.5** | 44 | 3.9 | 22.5 | 4 | 0 | 0.1 | **15.8** | 15.5 |
| *Acacia melanoxylon* | 3 | 20 | TG | | 3 | | | | | | | |
| *Eucalyptus camphora* | 4 | 7 | TG | | 4 | | | | | | | |
| *Eucalyptus dalrympleana* | 25 | 30 | TG | | 25 | | | | | | | |
| *Eucalyptus pauciflora* | 2 | 20 | TG | | 2 | | | | | | | |
| *Eucalyptus robertsonii* | 10 | 3 | TG | | 10 | | | | | | | |
| *Astroloma humifusum* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Bossiaea foliosa* | 1 | 50 | SG | | | 1 | | | | | | |
| *Coprosma hirtella* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Daviesia latifolia* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Epacris paludosa* | 0.2 | 15 | SG | | | 0.2 | | | | | | |
| *Olearia erubescens* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Persoonia chamaepeuce* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Pimelea curviflora* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Platylobium formosum* | 2 | 40 | SG | | | 2 | | | | | | |
| *Tetratheca labillardierei* | 0.1 | 20 | SG | | | 0.1 | | | | | | |
| *Glycine clandestina* | 0.1 | 4 | OG | | | | | | | 0.1 | | |
| *Holcus lanatus* | 0.2 | 50 | HT | | | | | | | | | 0.2 |
| *Hypericum perforatum* | 0.1 | 1 | HT | | | | | | | | | 0.1 |
| *Rosa rubiginosa* | 0.2 | 1 | HT | | | | | | | | | 0.2 |
| *Rubus fruticosus agg.* | 15 | 100 | HT | | | | | | | | | 15 |
| *Carex gaudichaudiana* | 0.2 | 20 | GG | | | | 0.2 | | | | | |
| *Juncus sp.* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Lomandra filiformis* | 0.1 | 50 | GG | | | | 0.1 | | | | | |
| *Lomandra longifolia* | 2 | 80 | GG | | | | 2 | | | | | |
| *Luzula densiflora* | 0.1 | 40 | GG | | | | 0.1 | | | | | |
| *Poa sieberiana* | 20 | 500 | GG | | | | 20 | | | | | |
| *Acaena novae-zelandiae* | 0.2 | 100 | FG | | | | | 0.2 | | | | |
| *Arthropodium sp.* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Asperula scoparia* | 0.3 | 400 | FG | | | | | 0.3 | | | | |
| *Brachyscome scapigera* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Calotis scabiosifolia var. integrifolia* | 0.1 | 3 | FG | | | | | 0.1 | | | | |
| *Cymbonotus lawsonianus* | 0.1 | 3 | FG | | | | | 0.1 | | | | |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Dianella revoluta* | 0.1 | 2 | FG | | | | | 0.1 | | | | | |
| *Dichondra repens* | 0.1 | 10 | FG | | | | | 0.1 | | | | | |
| *Geranium obtusisepalum* | 0.2 | 200 | FG | | | | | 0.2 | | | | | |
| *Gonocarpus tetragynus* | 0.1 | 50 | FG | | | | | 0.1 | | | | | |
| *Hydrocotyle sibthorpioides* | 0.4 | 400 | FG | | | | | 0.4 | | | | | |
| *Hypericum gramineum* | 0.1 | 1 | FG | | | | | 0.1 | | | | | |
| *Lagenophora stipitata* | 0.1 | 1 | FG | | | | | 0.1 | | | | | |
| *Leptinella filicula* | 0.2 | 200 | FG | | | | | 0.2 | | | | | |
| *Lobelia gibbosa* | 0.1 | 2 | FG | | | | | 0.1 | | | | | |
| *Lobelia purpurascens* | 0.1 | 2 | FG | | | | | 0.1 | | | | | |
| *Oreomyrrhis sp.* | 0.1 | 30 | FG | | | | | 0.1 | | | | | |
| *Plantago debilis* | 0.1 | 1 | FG | | | | | 0.1 | | | | | |
| *Poranthera microphylla* | 0.1 | 100 | FG | | | | | 0.1 | | | | | |
| *Ranunculus lappaceus* | 0.1 | 10 | FG | | | | | 0.1 | | | | | |
| *Senecio sp.* | 0.1 | 1 | FG | | | | | 0.1 | | | | | |
| *Stackhousia monogyna* | 0.1 | 3 | FG | | | | | 0.1 | | | | | |
| *Stellaria pungens* | 0.2 | 300 | FG | | | | | 0.2 | | | | | |
| *Stylidium lineare* | 0.1 | 10 | FG | | | | | 0.1 | | | | | |
| *Veronica calycina* | 0.1 | 150 | FG | | | | | 0.1 | | | | | |
| *Veronica derwentiana* | 0.1 | 1 | FG | | | | | 0.1 | | | | | |
| *Veronica sp.* | 0.1 | 1 | FG | | | | | 0.1 | | | | | |
| *Veronica sp. A* | 0.1 | 1 | FG | | | | | 0.1 | | | | | |
| *Viola betonicifolia* | 0.2 | 300 | FG | | | | | 0.2 | | | | | |
| *Wahlenbergia sp.* | 0.1 | 5 | FG | | | | | 0.1 | | | | | |
| *Eryanthe moschatus* | 0.1 | 60 | EX | | | | | | | | 0.1 | | |
| *Hypochaeris radicata* | 0.1 | 5 | EX | | | | | | | | 0.1 | | |
| *Trifolium repens* | 0.1 | 3 | EX | | | | | | | | 0.1 | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 4** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 300** | | | **26** | **24** | 4 | 2 | 3 | 14 | 0 | 1 | **2** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **152** | **150** | 31.2 | 12.1 | 83 | 18.7 | 0 | 5 | **2** | 0 |
| *Platylobium formosum* | 12 | 110 | SG | | | 12 | | | | | | |
| *Eucalyptus pauciflora* | 30 | 38 | TG | | 30 | | | | | | | |
| *Eucalyptus robertsonii* | 0.1 | 2 | TG | | 0.1 | | | | | | | |
| *Coprosma hirtella* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Poa sieberiana* | 80 | 1000 | GG | | | | 80 | | | | | |
| *Acacia dealbata* | 0.1 | 3 | TG | | 0.1 | | | | | | | |
| *Dianella tasmanica* | 1 | 10 | FG | | | | | 1 | | | | |
| *Stellaria pungens* | 5 | 400 | FG | | | | | 5 | | | | |
| *Lomandra longifolia* | 2 | 25 | GG | | | | 2 | | | | | |
| *Gonocarpus tetragynus* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Glycine clandestina* | 5 | 40 | OG | | | | | | | 5 | | |
| *Veronica calycina* | 5 | 30 | FG | | | | | 5 | | | | |
| *Viola betonicifolia* | 1 | 10 | FG | | | | | 1 | | | | |
| *Asperula conferta* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Dipodium punctatum* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Stylidium graminifolium* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Acacia melanoxylon* | 1 | 1 | TG | | 1 | | | | | | | |
| *Senecio prenanthoides* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Dichondra repens* | 3 | 300 | FG | | | | | 3 | | | | |
| *Geranium solanderi* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Themeda triandra* | 1 | 20 | GG | | | | 1 | | | | | |
| *Acaena ovina* | 2 | 100 | FG | | | | | 2 | | | | |
| *Tricoryne elatior* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Sonchus oleraceus* | 1 | 30 | EX | | | | | | | | 1 | |
| *Hypericum gramineum* | 1 | 50 | FG | | | | | 1 | | | | |
| *Centaurium erythraea* | 1 | 20 | EX | | | | | | | | 1 | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 5** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 300** | | | **39** | **37** | 4 | 8 | 4 | 19 | 0 | 2 | **2** | 1 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **161.3** | **161.1** | 95 | 1.7 | 60.4 | 3.8 | 0 | 0.2 | **0.2** | 0.1 |
| *Acacia dealbata* | 10 | 10 | TG | | 10 | | | | | | | |
| *Eucalyptus dalrympleana* | 10 | 3 | TG | | 10 | | | | | | | |
| *Eucalyptus pauciflora* | 30 | 20 | TG | | 30 | | | | | | | |
| *Eucalyptus robertsonii* | 45 | 8 | TG | | 45 | | | | | | | |
| *Astroloma humifusum* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Cassinia aculeata* | 0.1 | 3 | SG | | | 0.1 | | | | | | |
| *Coprosma hirtella* | 0.5 | 10 | SG | | | 0.5 | | | | | | |
| *Daviesia latifolia* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Exocarpos cupressiformis* | 0.2 | 1 | SG | | | 0.2 | | | | | | |
| *Olearia erubescens* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Platylobium formosum* | 0.5 | 20 | SG | | | 0.5 | | | | | | |
| *Tetratheca bauerifolia* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Clematis aristata* | 0.1 | 10 | OG | | | | | | | 0.1 | | |
| *Glycine clandestina* | 0.1 | 10 | OG | | | | | | | 0.1 | | |
| *Rubus fruticosus agg.* | 0.1 | 1 | HT | | | | | | | | | 0.1 |
| *Lomandra filiformis* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Lomandra longifolia* | 0.2 | 10 | GG | | | | 0.2 | | | | | |
| *Microlaena stipoides* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Poa labillardierei* | 60 | 500 | GG | | | | 60 | | | | | |
| *Acaena novae-zelandiae* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Stylidium graminifolium* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Caladenia gracilis* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Chiloglottis valida* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Cymbonotus lawsonianus* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Dianella revoluta* | 2 | 50 | FG | | | | | 2 | | | | |
| *Dichondra repens* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Euphrasia collina* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Galium gaudichaudii* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Geranium sp. 2* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Hydrocotyle laxiflora* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Lobelia purpurascens* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Picris angustifolia* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Poranthera microphylla* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Stackhousia monogyna* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Stellaria pungens* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Veronica calycina* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Viola betonicifolia* | 0.1 | 15 | FG | | | | | 0.1 | | | | |
| *Wahlenbergia stricta* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Hypochaeris radicata* | 0.1 | 10 | EX | | | | | | | | 0.1 | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Plot 6 | | | # spp | Count | Count | Count | Count | Count | Count | Count | Count | Count |
| PCT 1196 | | | 44 | 33 | 1 | 7 | 10 | 13 | 0 | 2 | 11 | 4 |
| Species | Cover | Abundance | Sum cover | Cover | Sum | Sum | Sum | Sum | Sum | Sum | Sum | Sum |
| | | | 94.6 | 52.7 | 0.1 | 1.7 | 48.1 | 2.6 | 0 | 0.2 | 41.9 | 40.6 |
| *Eucalyptus pauciflora* | 0.1 | 1 | TG | | 0.1 | | | | | | | |
| *Platylobium formosum* | 1 | 35 | SG | | | 1 | | | | | | |
| *Tetratheca ciliata* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Poa sieberiana* | 45 | 1000 | GG | | | | 45 | | | | | |
| *Acaena novae-zelandiae* | 1 | 250 | FG | | | | | 1 | | | | |
| *Glycine clandestina* | 0.1 | 25 | OG | | | | | | | 0.1 | | |
| *Dichondra repens* | 0.1 | 100 | FG | | | | | 0.1 | | | | |
| *Asperula scoparia* | 0.1 | 250 | FG | | | | | 0.1 | | | | |
| *Hypochaeris radicata* | 0.2 | 100 | EX | | | | | | | | 0.2 | |
| *Trifolium arvense* | 0.2 | 350 | EX | | | | | | | | 0.2 | |
| *Hypericum perforatum* | 0.5 | 150 | HT | | | | | | | | | 0.5 |
| *Acetosella vulgaris* | 0.1 | 20 | HT | | | | | | | | | 0.1 |
| *Poa sp.* | 0.5 | 150 | GG | | | | 0.5 | | | | | |
| *Centaurium erythraea* | 0.5 | 500 | EX | | | | | | | | 0.5 | |
| *Geranium solanderi* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Cymbonotus lawsonianus* | 0.5 | 250 | FG | | | | | 0.5 | | | | |
| *Epacris breviflora* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Leptospermum continentale* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Gonocarpus tetragynus* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Elymus scaber* | 0.1 | 25 | GG | | | | 0.1 | | | | | |
| *Rytidosperma pilosum* | 1 | 250 | GG | | | | 1 | | | | | |
| *Holcus lanatus* | 30 | 1000 | HT | | | | | | | | | 30 |
| *Lomandra filiformis* | 0.1 | 20 | GG | | | | 0.1 | | | | | |
| *Rubus fruticosus agg.* | 10 | 50 | HT | | | | | | | | | 10 |
| *Carex inversa* | 0.1 | 25 | GG | | | | 0.1 | | | | | |
| *Lomandra multiflora* | 0.1 | 20 | GG | | | | 0.1 | | | | | |
| *Podolepis hieracioides* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Solenogyne gunnii* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Stellaria pungens* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Dichelachne micrantha* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Oreomyrrhis eriopoda* | 0.1 | 15 | FG | | | | | 0.1 | | | | |
| *Clematis aristata* | 0.1 | 5 | OG | | | | | | | 0.1 | | |
| *Trifolium repens* | 0.1 | 25 | EX | | | | | | | | 0.1 | |
| *Prunella vulgaris* | 0.1 | 5 | EX | | | | | | | | 0.1 | |
| *Viola betonicifolia* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Themeda triandra* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Cassinia aculeata* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Leucopogon microphyllus* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Aira caryophyllea* | 0.1 | 50 | EX | | | | | | | | 0.1 | |
| *Arthropodium milleflorum* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Epilobium billardierianum subsp. Billardierianum* | 0.1 | 200 | FG | | | | | 0.1 | | | | |
| *Lomandra longifolia* | 1 | 8 | GG | | | | 1 | | | | | |
| *Olearia erubescens* | 0.2 | 20 | SG | | | 0.2 | | | | | | |
| *Potentilla recta* | 0.1 | 1 | EX | | | | | | | | 0.1 | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 7** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 1196** | | | **29** | **23** | 1 | 6 | 5 | 10 | 0 | 1 | **6** | 2 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **91.7** | **59.6** | 0.1 | 1.1 | 31.4 | 26.9 | 0 | 0.1 | **32.1** | 12 |
| *Lomandra longifolia* | 1 | 20 | GG | | | | 1 | | | | | |
| *Hypericum perforatum* | 2 | 100 | HT | | | | | | | | | 2 |
| *Centaurium erythraea* | 5 | 500 | EX | | | | | | | | 5 | |
| *Platylobium formosum* | 0.3 | 10 | SG | | | 0.3 | | | | | | |
| *Poa sieberiana* | 30 | 100 | GG | | | | 30 | | | | | |
| *Dichelachne crinita* | 0.1 | 20 | GG | | | | 0.1 | | | | | |
| *Holcus lanatus* | 10 | 100 | HT | | | | | | | | | 10 |
| *Epilobium billardierianum* | 0.2 | 10 | FG | | | | | 0.2 | | | | |
| *Hypochaeris radicata* | 10 | 100 | EX | | | | | | | | 10 | |
| *Olearia erubescens* | 0.3 | 25 | SG | | | 0.3 | | | | | | |
| *Elymus scaber* | 0.1 | 20 | GG | | | | 0.1 | | | | | |
| *Geranium solanderi* | 10 | 1000 | FG | | | | | 10 | | | | |
| *Trifolium pratense* | 5 | 100 | EX | | | | | | | | 5 | |
| *Acaena novae-zelandiae* | 10 | 500 | FG | | | | | 10 | | | | |
| *Dichondra repens* | 0.2 | 50 | FG | | | | | 0.2 | | | | |
| *Asperula conferta* | 1 | 50 | FG | | | | | 1 | | | | |
| *Cymbonotus lawsonianus* | 0.2 | 20 | FG | | | | | 0.2 | | | | |
| *Epacris breviflora* | 0.2 | 5 | SG | | | 0.2 | | | | | | |
| *Glycine clandestina* | 0.1 | 10 | OG | | | | | | | 0.1 | | |
| *Eucalyptus pauciflora* | 0.1 | 3 | TG | | 0.1 | | | | | | | |
| *Stylidium graminifolium* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Petrorhagia dubia* | 0.1 | 1 | EX | | | | | | | | 0.1 | |
| *Themeda triandra* | 0.2 | 10 | GG | | | | 0.2 | | | | | |
| *Veronica calycina* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Leucopogon microphyllus* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Stellaria pungens* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Cassinia aculeata* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Leptospermum lanigerum* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Solenogyne gunnii* | 5 | 100 | FG | | | | | 5 | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 8** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 1196** | | | **41** | **41** | 4 | 7 | 9 | 18 | 1 | 2 | **0** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **124.5** | **124.5** | 57 | 2.8 | 31.3 | 3.2 | 30 | 0.2 | **0** | 0 |
| *Eucalyptus pauciflora* | 20 | 30 | TG | | 20 | | | | | | | |
| *Eucalyptus dalrympleana* | 30 | 2 | TG | | 30 | | | | | | | |
| *Pteridium esculentum* | 30 | 100 | EG | | | | | | 30 | | | |
| *Platylobium formosum* | 0.2 | 20 | SG | | | 0.2 | | | | | | |
| *Coronidium monticola* | 0.2 | 20 | FG | | | | | 0.2 | | | | |
| *Eucalyptus robertsonii* | 2 | 1 | TG | | 2 | | | | | | | |
| *Acacia dealbata* | 5 | 20 | TG | | 5 | | | | | | | |
| *Clematis aristata* | 0.1 | 20 | OG | | | | | | | 0.1 | | |
| *Stellaria pungens* | 0.3 | 50 | FG | | | | | 0.3 | | | | |
| *Acaena novae-zelandiae* | 1 | 50 | FG | | | | | 1 | | | | |
| *Glycine clandestina* | 0.1 | 20 | OG | | | | | | | 0.1 | | |
| *Brachyscome spathulata* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Senecio prenanthoides* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Olearia erubescens* | 0.2 | 10 | SG | | | 0.2 | | | | | | |
| *Poa sieberiana* | 30 | 100 | GG | | | | 30 | | | | | |
| *Viola hederacea* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Lomandra sp.* | 0.1 | 2 | GG | | | | 0.1 | | | | | |
| *Geranium solanderi* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Dianella tasmanica* | 0.2 | 15 | FG | | | | | 0.2 | | | | |
| *Lomandra longifolia* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Opercularia sp.* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Wahlenbergia stricta* | 0.1 | 15 | FG | | | | | 0.1 | | | | |
| *Luzula flaccida* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Viola betonicifolia* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Pterostylis monticola* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Oreomyrrhis eriopoda* | 0.2 | 100 | FG | | | | | 0.2 | | | | |
| *Tetratheca ciliata* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Arthropodium milleflorum* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Daviesia latifolia* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Microlaena stipoides* | 0.5 | 200 | GG | | | | 0.5 | | | | | |
| *Rytidosperma penicillatum* | 0.2 | 20 | GG | | | | 0.2 | | | | | |
| *Goodenia hederacea* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Choretrum pauciflorum* | 2 | 10 | SG | | | 2 | | | | | | |
| *Cassinia arcuata* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Poa helmsii* | 0.1 | 3 | GG | | | | 0.1 | | | | | |
| *Ranunculus lappaceus* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Elymus scaber* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Hypericum gramineum* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Veronica calycina* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Dichelachne crinita* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Pimelea curviflora* | 0.1 | 1 | SG | | | 0.1 | | | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 9** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 1196** | | | **40** | **34** | 4 | 6 | 7 | 15 | 1 | 1 | **6** | 3 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **187.6** | **147.2** | 21 | 21.7 | 100.8 | 2.6 | 1 | 0.1 | **40.4** | 40.1 |
| *Acacia melanoxylon* | 5 | 9 | TG | | 5 | | | | | | | |
| *Eucalyptus camphora* | 10 | 12 | TG | | 10 | | | | | | | |
| *Eucalyptus dalrympleana* | 2 | 1 | TG | | 2 | | | | | | | |
| *Eucalyptus pauciflora* | 4 | 15 | TG | | 4 | | | | | | | |
| *Baeckea utilis* | 0.5 | 10 | SG | | | 0.5 | | | | | | |
| *Coprosma hirtella* | 5 | 50 | SG | | | 5 | | | | | | |
| *Epacris breviflora* | 15 | 50 | SG | | | 15 | | | | | | |
| *Epacris microphylla* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Olearia erubescens* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Platylobium formosum* | 1 | 10 | SG | | | 1 | | | | | | |
| *Desmodium sp.* | 0.1 | 100 | OG | | | | | | | 0.1 | | |
| *Holcus lanatus* | 5 | 100 | HT | | | | | | | | | 5 |
| *Rosa rubiginosa* | 0.1 | 1 | HT | | | | | | | | | 0.1 |
| *Rubus fruticosus agg.* | 35 | 250 | HT | | | | | | | | | 35 |
| *Agrostis sp.* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Carex appressa* | 5 | 100 | GG | | | | 5 | | | | | |
| *Deyeuxia sp.* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Juncus australis* | 60 | 100 | GG | | | | 60 | | | | | |
| *Juncus sarophorus* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Lomandra longifolia* | 0.5 | 30 | GG | | | | 0.5 | | | | | |
| *Poa sieberiana* | 35 | 1000 | GG | | | | 35 | | | | | |
| *Acaena novae-zelandiae* | 0.2 | 50 | FG | | | | | 0.2 | | | | |
| *Ajuga australis* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Asperula scoparia* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Euchiton sp.* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Geranium sp. 2* | 0.2 | 100 | FG | | | | | 0.2 | | | | |
| *Gonocarpus sp.* | 0.1 | 200 | FG | | | | | 0.1 | | | | |
| *Hydrocotyle laxiflora* | 0.2 | 200 | FG | | | | | 0.2 | | | | |
| *Hypericum japonicum* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Lobelia purpurascens* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Oreomyrrhis ciliata* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Ranunculus lappaceus* | 0.5 | 500 | FG | | | | | 0.5 | | | | |
| *Solenogyne bellioides* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Stellaria angustifolia* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Stellaria pungens* | 0.5 | 100 | FG | | | | | 0.5 | | | | |
| *Stylidium graminifolium* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Hypochaeris radicata* | 0.1 | 5 | EX | | | | | | | | 0.1 | |
| *Taraxacum officinale* | 0.1 | 1 | EX | | | | | | | | 0.1 | |
| *Trifolium repens* | 0.1 | 20 | EX | | | | | | | | 0.1 | |
| *Blechnum nudum* | 1 | 25 | EG | | | | | | 1 | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 10** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 1196** | | | **40** | **36** | 2 | 6 | 4 | 22 | 0 | 2 | **4** | 1 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **147.7** | **147.2** | 60.5 | 21.2 | 60.4 | 4.9 | 0 | 0.2 | **0.5** | 0.2 |
| *Acacia melanoxylon* | 0.5 | 250 | TG | | 0.5 | | | | | | | |
| *Eucalyptus pauciflora* | 60 | 80 | TG | | 60 | | | | | | | |
| *Acacia pravissima* | 0.3 | 5 | SG | | | 0.3 | | | | | | |
| *Cassinia aculeata* | 0.5 | 10 | SG | | | 0.5 | | | | | | |
| *Cassinia longifolia* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Coprosma hirtella* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Platylobium formosum* | 20 | 100 | SG | | | 20 | | | | | | |
| *Tetratheca sp.* | 0.2 | 20 | SG | | | 0.2 | | | | | | |
| *clematis aristata* | 0.1 | 20 | OG | | | | | | | 0.1 | | |
| *Glycine clandestina* | 0.1 | 50 | OG | | | | | | | 0.1 | | |
| *Rubus fruticosus agg.* | 0.2 | 5 | HT | | | | | | | | | 0.2 |
| *Lachnagrostis filiformis* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Lomandra longifolia* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Microlaena stipoides* | 0.2 | 20 | GG | | | | 0.2 | | | | | |
| *Poa labillardierei* | 60 | 200 | GG | | | | 60 | | | | | |
| *Acaena novae-zelandiae* | 2 | 20 | FG | | | | | 2 | | | | |
| *Arthropodium sp.* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Bulbine sp.* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Caladenia gracilis* | 0.1 | 4 | FG | | | | | 0.1 | | | | |
| *Chiloglottis valida* | 0.2 | 100 | FG | | | | | 0.2 | | | | |
| *Chrysocephalum apiculatum* | 0.2 | 20 | FG | | | | | 0.2 | | | | |
| *Cymbonotus lawsonianus* | 0.2 | 20 | FG | | | | | 0.2 | | | | |
| *Dianella tasmanica* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Galium gaudichaudii* | 0.2 | 50 | FG | | | | | 0.2 | | | | |
| *Geranium obtusisepalum* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Gonocarpus tetragynus* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Hydrocotyle tripartita* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Hypericum gramineum* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Lobelia purpurascens* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Oxalis perennans* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Picris angustifolia* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Plantago debilis* | 0.3 | 50 | FG | | | | | 0.3 | | | | |
| *Poranthera microphylla* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Ranunculus lappaceus* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Stellaria pungens* | 0.2 | 50 | FG | | | | | 0.2 | | | | |
| *Veronica calycina* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Viola betonicifolia* | 0.2 | 20 | FG | | | | | 0.2 | | | | |
| *Hypochaeris radicata* | 0.1 | 10 | EX | | | | | | | | 0.1 | |
| *Taraxacum officinale* | 0.1 | 3 | EX | | | | | | | | 0.1 | |
| *Trifolium repens* | 0.1 | 10 | EX | | | | | | | | 0.1 | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 11** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 1196** | | | **38** | **34** | 4 | 6 | 3 | 19 | 0 | 2 | **4** | 1 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **136.8** | **136.3** | 65 | 5.9 | 63 | 2.2 | 0 | 0.2 | **0.5** | 0.1 |
| *Acacia dealbata* | 5 | 10 | TG | | 5 | | | | | | | |
| *Eucalyptus dalrympleana* | 10 | 2 | TG | | 10 | | | | | | | |
| *Eucalyptus pauciflora* | 25 | 20 | TG | | 25 | | | | | | | |
| *Eucalyptus robertsonii* | 25 | 5 | TG | | 25 | | | | | | | |
| *Acacia pravissima* | 0.5 | 10 | SG | | | 0.5 | | | | | | |
| *Cassinia aculeata* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Coprosma hirtella* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Olearia erubescens* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Platylobium formosum* | 5 | 60 | SG | | | 5 | | | | | | |
| *Tetratheca bauerifolia* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Clematis aristata* | 0.1 | 10 | OG | | | | | | | 0.1 | | |
| *Glycine clandestina* | 0.1 | 10 | OG | | | | | | | 0.1 | | |
| *Rosa rubiginosa* | 0.1 | 1 | HT | | | | | | | | | 0.1 |
| *Lomandra longifolia* | 1 | 20 | GG | | | | 1 | | | | | |
| *Poa sieberiana* | 60 | 1000 | GG | | | | 60 | | | | | |
| *Poa sp.* | 2 | 30 | GG | | | | 2 | | | | | |
| *Arthropodium sp.* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Caladenia gracilis* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Chiloglottis valida* | 0.3 | 30 | FG | | | | | 0.3 | | | | |
| *Chrysocephalum apiculatum* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Craspedia sp.* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Cymbonotus lawsonianus* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Dianella revoluta* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Dichondra repens* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Galium gaudichaudii* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Geranium obtusisepalum* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Herpolirion novae-zelandiae* | 0.2 | 50 | FG | | | | | 0.2 | | | | |
| *Hydrocotyle laxiflora* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Picris angustifolia* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Ranunculus lappaceus* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Senecio prenanthoides* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Stellaria pungens* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Veronica calycina* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Viola betonicifolia* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Viola hederacea* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Centaurium erythraea* | 0.1 | 2 | EX | | | | | | | | 0.1 | |
| *Hypochaeris radicata* | 0.2 | 20 | EX | | | | | | | | 0.2 | |
| *Trifolium repens* | 0.1 | 1 | EX | | | | | | | | 0.1 | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 12** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 1196** | | | **38** | **36** | 4 | 6 | 4 | 19 | 0 | 3 | **2** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **129.9** | **129.7** | 75 | 11.4 | 40.4 | 2.6 | 0 | 0.3 | **0.2** | 0 |
| *Acacia dealbata* | 10 | 20 | TG | | 10 | | | | | | | |
| *Acacia melanoxylon* | 5 | 2 | TG | | 5 | | | | | | | |
| *Eucalyptus dalrympleana* | 40 | 5 | TG | | 40 | | | | | | | |
| *Eucalyptus pauciflora* | 20 | 30 | TG | | 20 | | | | | | | |
| *Astroloma humifusum* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Cassinia aculeata* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Coprosma hirtella* | 1 | 5 | SG | | | 1 | | | | | | |
| *Olearia erubescens* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Platylobium formosum* | 10 | 50 | SG | | | 10 | | | | | | |
| *Tetratheca bauerifolia* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Clematis aristata* | 0.1 | 10 | OG | | | | | | | 0.1 | | |
| *Glycine clandestina* | 0.1 | 10 | OG | | | | | | | 0.1 | | |
| *Glycine microphylla* | 0.1 | 10 | OG | | | | | | | 0.1 | | |
| *Lomandra longifolia* | 0.2 | 5 | GG | | | | 0.2 | | | | | |
| *Luzula flaccida* | 0.1 | 2 | GG | | | | 0.1 | | | | | |
| *Poa sieberiana* | 40 | 300 | GG | | | | 40 | | | | | |
| *Poa sp.* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Acaena sp.* | 0.5 | 50 | FG | | | | | 0.5 | | | | |
| *Arthropodium sp.* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Bulbine sp.* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Caladenia gracilis* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Chiloglottis valida* | 0.2 | 50 | FG | | | | | 0.2 | | | | |
| *Cotula australis* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Craspedia sp.* | 0.1 | 3 | FG | | | | | 0.1 | | | | |
| *Cymbonotus lawsonianus* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Dianella revoluta* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Dichondra repens* | 0.2 | 50 | FG | | | | | 0.2 | | | | |
| *Galium gaudichaudii* | 0.1 | 30 | FG | | | | | 0.1 | | | | |
| *Hydrocotyle laxiflora* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Hydrocotyle sp.* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Lobelia purpurascens* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Picris angustifolia* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Ranunculus lappaceus* | 0.2 | 20 | FG | | | | | 0.2 | | | | |
| *Stellaria pungens* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Veronica calycina* | 0.1 | 30 | FG | | | | | 0.1 | | | | |
| *Viola betonicifolia* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Centaurium erythraea* | 0.1 | 1 | EX | | | | | | | | 0.1 | |
| *Hypochaeris radicata* | 0.1 | 10 | EX | | | | | | | | 0.1 | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 13** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 1196** | | | **44** | **40** | 4 | 6 | 4 | 24 | 0 | 2 | **4** | 2 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **60.3** | **59.9** | 30 | 10.6 | 15.5 | 3.6 | 0 | 0.2 | **0.4** | 0.2 |
| *Acacia melanoxylon* | 2 | 8 | TG | | 2 | | | | | | | |
| *Eucalyptus dalrympleana* | 1 | 2 | TG | | 1 | | | | | | | |
| *Eucalyptus pauciflora* | 25 | 50 | TG | | 25 | | | | | | | |
| *Eucalyptus robertsonii* | 2 | 6 | TG | | 2 | | | | | | | |
| *Astroloma humifusum* | 0.1 | 3 | SG | | | 0.1 | | | | | | |
| *Cassinia aculeata* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Coprosma hirtella* | 0.2 | 3 | SG | | | 0.2 | | | | | | |
| *Lomatia myricoides* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Platylobium formosum* | 10 | 200 | SG | | | 10 | | | | | | |
| *Tetratheca labillardierei* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Clematis aristata* | 0.1 | 2 | OG | | | | | | | 0.1 | | |
| *Glycine clandestina* | 0.1 | 20 | OG | | | | | | | 0.1 | | |
| *Holcus lanatus* | 0.1 | 3 | HT | | | | | | | | | 0.1 |
| *Rubus fruticosus agg.* | 0.1 | 1 | HT | | | | | | | | | 0.1 |
| *Lomandra filiformis* | 0.1 | 2 | GG | | | | 0.1 | | | | | |
| *Lomandra longifolia* | 0.3 | 40 | GG | | | | 0.3 | | | | | |
| *Microlaena stipoides* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Poa sieberiana* | 15 | 400 | GG | | | | 15 | | | | | |
| *Acaena novae-zelandiae* | 0.2 | 200 | FG | | | | | 0.2 | | | | |
| *Arthropodium sp.* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Asperula scoparia* | 0.2 | 300 | FG | | | | | 0.2 | | | | |
| *Brachyscome scapigera* | 0.1 | 4 | FG | | | | | 0.1 | | | | |
| *Caladenia gracilis* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Corybas sp.* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Dianella revoluta* | 0.1 | 6 | FG | | | | | 0.1 | | | | |
| *Dianella tasmanica* | 1 | 20 | FG | | | | | 1 | | | | |
| *Euchiton involucratus* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Geranium obtusisepalum* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Gonocarpus tetragynus* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Hydrocotyle pedicellosa* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Hypericum gramineum* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Lagenifera stipitata* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Pterostylis sp.* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Ranunculus lappaceus* | 0.1 | 3 | FG | | | | | 0.1 | | | | |
| *Ranunculus sp.* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Senecio quadridentatus* | 0.2 | 30 | FG | | | | | 0.2 | | | | |
| *Senecio sp.* | 0.1 | 100 | FG | | | | | 0.1 | | | | |
| *Stackhousia monogyna* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Stellaria pungens* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Stylidium graminifolium* | 0.1 | 6 | FG | | | | | 0.1 | | | | |
| *Viola betonicifolia* | 0.1 | 100 | FG | | | | | 0.1 | | | | |
| *Wahlenbergia stricta* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Centaurium erythraea* | 0.1 | 2 | EX | | | | | | | | 0.1 | |
| *Hypochaeris radicata* | 0.1 | 20 | EX | | | | | | | | 0.1 | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 14** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 296** | | | **29** | **24** | 2 | 7 | 7 | 7 | 1 | 0 | **5** | 3 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **124** | **123.4** | 4 | 48.1 | 2.7 | 68.5 | 0.1 | 0 | **2.5** | 0.4 |
| *Eucalyptus nortonii* | 2 | 2 | TG | | 2 | | | | | | | |
| *Acacia dealbata* | 0.3 | 5 | TG | | 2 | | | | | | | |
| *brachyloma daphnoides* | 45 | 100 | SG | | | 0.3 | | | | | | |
| *Acacia pravissima* | 0.5 | 2 | SG | | | 45 | | | | | | |
| *Exocarpos strictus* | 0.3 | 10 | SG | | | 0.5 | | | | | | |
| *Cymbopogon refractus* | 2 | 100 | GG | | | | 0.3 | | | | | |
| *Grevillea rosmarinifolia* | 0.3 | 4 | SG | | | 2 | | | | | | |
| *Themeda triandra* | 65 | 1000 | GG | | | | 0.3 | | | | | |
| *dianella revoluta* | 1.5 | 35 | FG | | | | | 65 | | | | |
| *Lepidosperma laterale* | 0.1 | 2 | GG | | | | 1.5 | | | | | |
| *lomandra multiflora* | 0.1 | 2 | GG | | | | 0.1 | | | | | |
| *Bursaria spinosa* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Chrysocephalum semipapposum* | 0.1 | 30 | FG | | | | | 0.1 | | | | |
| *Hypericum perforatum* | 2 | 250 | HT | | | | | | | | | 0.1 |
| *Hypochaeris radicata* | 0.1 | 1 | EX | | | | | | | | 2 | |
| *Hibbertia obtusifolia* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Carex inversa* | 0.2 | 50 | GG | | | | 0.1 | | | | | |
| *Rubus fruticosus agg.* | 0.1 | 2 | HT | | | | | | | | | 0.2 |
| *Cheilanthes sieberi* | 0.1 | 15 | EG | | | | | | 0.1 | | | |
| *Hydrocotyle laxiflora* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Acaena ovina* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Rosa rubiginosa* | 0.1 | 1 | HT | | | | | | | | | 0.1 |
| *Microlaena stipoides* | 3 | 500 | GG | | | | 0.1 | | | | | |
| *Gonocarpus tetragynus* | 0.3 | 200 | FG | | | | | 3 | | | | |
| *Poa sieberiana* | 0.1 | 5 | GG | | | | 0.3 | | | | | |
| *Centaurium erythraea* | 0.1 | 50 | EX | | | | | | | | 0.1 | |
| *Oxalis perennans* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Euchiton involucratus* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Leucopogon fletcheri* | 0.1 | 1 | SG | | | 0.1 | | | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 15** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 296** | | | **36** | **32** | 3 | 10 | 8 | 10 | 1 | 0 | **4** | 2 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **92.8** | **92.4** | 37 | 4.3 | 49.1 | 1.9 | 0.1 | 0 | **0.4** | 0.2 |
| *Eucalyptus nortonii* | 35 | 60 | TG | | 35 | | | | | | | |
| *Eucalyptus mannifera* | 1 | 2 | TG | | 1 | | | | | | | |
| *Acacia pravissima* | 1 | 5 | SG | | | 1 | | | | | | |
| *Cassinia longifolia* | 0.2 | 2 | SG | | | 0.2 | | | | | | |
| *Dianella revoluta* | 1 | 60 | FG | | | | | 1 | | | | |
| *Hypericum perforatum* | 0.1 | 20 | HT | | | | | | | | | 0.1 |
| *Themeda triandra* | 45 | 1000 | GG | | | | 45 | | | | | |
| *Eucalyptus rubida* | 1 | 1 | TG | | 1 | | | | | | | |
| *Lomandra filiformis subsp. coriacea* | 2 | 100 | GG | | | | 2 | | | | | |
| *Centaurium erythraea* | 0.1 | 5 | EX | | | | | | | | 0.1 | |
| *Gonocarpus tetragynus* | 0.1 | 100 | FG | | | | | 0.1 | | | | |
| *Brachyloma daphnoides* | 2 | 100 | SG | | | 2 | | | | | | |
| *Hydrocotyle laxiflora* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Hypericum gramineum* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Microlaena stipoides* | 1 | 300 | GG | | | | 1 | | | | | |
| *Lomandra filiformis subsp. filiformis* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Acaena ovina* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Cheilanthes sieberi* | 0.1 | 50 | EG | | | | | | 0.1 | | | |
| *Hibbertia obtusifolia* | 0.2 | 10 | SG | | | 0.2 | | | | | | |
| *Rubus fruticosus agg.* | 0.1 | 1 | HT | | | | | | | | | 0.1 |
| *Pimelea curviflora* | 0.1 | 30 | SG | | | 0.1 | | | | | | |
| *Lomandra multiflora* | 0.5 | 50 | GG | | | | 0.5 | | | | | |
| *Hypochaeris radicata* | 0.1 | 10 | EX | | | | | | | | 0.1 | |
| *Poa sieberiana* | 0.3 | 50 | GG | | | | 0.3 | | | | | |
| *Wahlenbergia stricta* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Banksia canei* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Stylidium graminifolium* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Dodonaea viscosa* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Monotoca scoparia* | 0.2 | 1 | SG | | | 0.2 | | | | | | |
| *Hovea linearis* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Exocarpos strictus* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Bursaria spinosa* | 0.3 | 5 | SG | | | 0.3 | | | | | | |
| *Chrysocephalum semipapposum* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Stackhousia monogyna* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Rytidosperma caespitosum* | 0.1 | 15 | GG | | | | 0.1 | | | | | |
| *Rytidosperma racemosum* | 0.1 | 30 | GG | | | | 0.1 | | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 16** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 296** | | | **47** | **36** | 0 | 3 | 16 | 17 | 0 | 0 | **11** | 4 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Cover** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **65.2** | **24.2** | 0 | 16.1 | 5.1 | 3 | 0 | 0 | **41** | 30.3 |
| *Epacris breviflora* | 15 | 250 | SG | | | 15 | | | | | | |
| *Poa labillardierei* | 1 | 50 | GG | | | | 1 | | | | | |
| *Themeda triandra* | 0.1 | 25 | GG | | | | 0.1 | | | | | |
| *Eragrostis benthamii* | 0.5 | 500 | GG | | | | 0.5 | | | | | |
| *Deyeuxia quadriseta* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Juncus sp.* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Juncus australis* | 1 | 30 | GG | | | | 1 | | | | | |
| *Luzula flaccida* | | | GG | | | | 0 | | | | | |
| *Poa sieberiana* | 1 | 25 | GG | | | | 1 | | | | | |
| *Prunella vulgaris* | 0.1 | 50 | EX | | | | | | | | 0.1 | |
| *Epilobium billardierianum subsp. Billardierianum* | | | FG | | | | | 0 | | | | |
| *Carex appressa* | 0.5 | 50 | GG | | | | 0.5 | | | | | |
| *Euchiton involucratus* | 0.1 | 200 | FG | | | | | 0.1 | | | | |
| *Hydrocotyle tripartita* | 1 | 1000 | FG | | | | | 1 | | | | |
| *Aira caryophyllea* | 0.1 | 50 | EX | | | | | | | | 0.1 | |
| *Hypericum japonicum* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Gonocarpus micranthus subsp. Micranthus* | 0.5 | 1000 | FG | | | | | 0.5 | | | | |
| *Poa tenera* | 0.1 | 50 | GG | | | | 0.1 | | | | | |
| *Centaurium erythraea* | 0.2 | 100 | EX | | | | | | | | 0.2 | |
| *Baeckea utilis* | 0.1 | 50 | SG | | | 0.1 | | | | | | |
| *Hypochaeris radicata* | 0.1 | 50 | EX | | | | | | | | 0.1 | |
| *Austrostipa sp.* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Leptospermum lanigerum* | 1 | 25 | SG | | | 1 | | | | | | |
| *Stylidium graminifolium* | 0.2 | 50 | FG | | | | | 0.2 | | | | |
| *Asperula conferta* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Rytidosperma pilosum* | 0.1 | 20 | GG | | | | 0.1 | | | | | |
| *Viola betonicifolia* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Solenogyne gunnii* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Geranium solanderi* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Stellaria pungens* | 0.1 | 100 | FG | | | | | 0.1 | | | | |
| *Trifolium arvense* | 0.1 | 100 | EX | | | | | | | | 0.1 | |
| *Carex inversa* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Hypericum perforatum* | 0.1 | 10 | HT | | | | | | | | | 0.1 |
| *Vulpia sp.* | 0.1 | 10 | EX | | | | | | | | 0.1 | |
| *Elymus scaber* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Lomandra longifolia* | 0.2 | 5 | GG | | | | 0.2 | | | | | |
| *Microseris lanceolata* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Ajuga australis* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Rosa rubiginosa* | 0.1 | 1 | HT | | | | | | | | | 0.1 |
| *Dichelachne micrantha* | 0.1 | 25 | GG | | | | 0.1 | | | | | |
| *Coronidium monticola* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Brachyscome sp.* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Spiranthes australis* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Acetosella vulgaris* | 0.1 | 20 | HT | | | | | | | | | 0.1 |
| *Veronica sp.* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Trifolium repens* | 10 | 1000 | EX | | | | | | | | 10 | |
| *Holcus lanatus* | 30 | 1000 | HT | | | | | | | | | 30 |

| | | | Covers | **Native** | Trees | Shrubs | Grass | Forb | Fern | Other | **Exotic** | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 17** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 296** | | | **29** | **24** | 3 | 7 | 5 | 7 | 1 | 1 | **5** | 3 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **82.5** | **81.3** | 22.2 | 46 | 5.2 | 6.4 | 1 | 0.5 | **1.2** | 1 |
| *Acacia dealbata* | 2 | 9 | TG | | 2 | | | | | | | |
| *Acacia melanoxylon* | 0.2 | 1 | TG | | 0.2 | | | | | | | |
| *Acaena novae-zelandiae* | 0.4 | 30 | FG | | | | | 0.4 | | | | |
| *Austrostipa sp.* | 3 | 200 | GG | | | | 3 | | | | | |
| *Brachyloma daphnoides* | 35 | 150 | SG | | | 35 | | | | | | |
| *Bursaria spinosa* | 3 | 4 | SG | | | 3 | | | | | | |
| *Cassinia longifolia* | 5 | 18 | SG | | | 5 | | | | | | |
| *Centaurium erythraea* | 0.1 | 20 | EX | | | | | | | | 0.1 | |
| *Cheilanthes sieberi* | 1 | 50 | EG | | | | | | 1 | | | |
| *Chrysocephalum semipapposum* | 0.5 | 5 | FG | | | | | 0.5 | | | | |
| *Conyza bonariensis* | 0.1 | 1 | EX | | | | | | | | 0.1 | |
| *Dianella revoluta* | 5 | 200 | FG | | | | | 5 | | | | |
| *Dodonaea viscosa subsp. angustissima* | 0.5 | 6 | SG | | | 0.5 | | | | | | |
| *Eucalyptus dives* | 20 | 30 | TG | | 20 | | | | | | | |
| *Exocarpos strictus* | 2 | 16 | SG | | | 2 | | | | | | |
| *Gonocarpus tetragynus* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Hardenbergia violacea* | 0.5 | 2 | OG | | | | | | | 0.5 | | |
| *Hibbertia obtusifolia* | 0.2 | 10 | SG | | | 0.2 | | | | | | |
| *Hydrocotyle laxiflora* | 0.2 | 20 | FG | | | | | 0.2 | | | | |
| *Hypericum perforatum* | 0.3 | 200 | HT | | | | | | | | | 0.3 |
| *Indigofera australis* | 0.3 | 2 | SG | | | 0.3 | | | | | | |
| *Lomandra multiflora* | 1 | 20 | GG | | | | 1 | | | | | |
| *Microlaena stipoides* | 0.2 | 50 | GG | | | | 0.2 | | | | | |
| *Oxalis perennans* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Poa sieberiana* | 0.5 | 100 | GG | | | | 0.5 | | | | | |
| *Rosa rubiginosa* | 0.5 | 3 | HT | | | | | | | | | 0.5 |
| *Rubus fruticosus agg.* | 0.2 | 5 | HT | | | | | | | | | 0.2 |
| *Themeda triandra* | 0.5 | 100 | GG | | | | 0.5 | | | | | |
| *Vittadinia cuneata* | 0.1 | 10 | FG | | | | | 0.1 | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 18** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 296** | | | **41** | **40** | 2 | 15 | 7 | 13 | 0 | 3 | **1** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **38.1** | **38** | 20 | 14.2 | 2 | 1.5 | 0 | 0.3 | **0.1** | 0 |
| *Eucalyptus dives* | 15 | 12 | TG | | 15 | | | | | | | |
| *Eucalyptus rubida* | 5 | 2 | TG | | 5 | | | | | | | |
| *Banksia canei* | 5 | 10 | SG | | | 5 | | | | | | |
| *Indigofera australis* | 0.2 | 50 | SG | | | 0.2 | | | | | | |
| *Hovea linearis* | 0.2 | 100 | FG | | | | | 0.2 | | | | |
| *Brachyloma daphnoides* | 5 | 100 | SG | | | 5 | | | | | | |
| *Lepidosperma laterale* | 0.1 | 25 | GG | | | | 0.1 | | | | | |
| *Hardenbergia violacea* | 0.1 | 50 | OG | | | | | | | 0.1 | | |
| *Galium gaudichaudii* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Dianella revoluta* | 0.2 | 50 | FG | | | | | 0.2 | | | | |
| *Poa sieberiana* | 1 | 50 | GG | | | | 1 | | | | | |
| *Pimelea curviflora* | 0.1 | 25 | SG | | | 0.1 | | | | | | |
| *Glycine clandestina* | 0.1 | 100 | OG | | | | | | | 0.1 | | |
| *Centaurium erythraea* | 0.1 | 10 | EX | | | | | | | | 0.1 | |
| *Rytidosperma pilosum* | 0.1 | 50 | GG | | | | 0.1 | | | | | |
| *Elymus scaber* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Cassinia longifolia* | 0.5 | 20 | SG | | | 0.5 | | | | | | |
| *Acacia pravissima* | 0.2 | 5 | SG | | | 0.2 | | | | | | |
| *Leucopogon virgatus* | 1 | 100 | SG | | | 1 | | | | | | |
| *Daviesia mimosoides* | 1 | 20 | SG | | | 1 | | | | | | |
| *Hypericum gramineum* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Thelymitra sp.* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Themeda triandra* | 0.5 | 100 | GG | | | | 0.5 | | | | | |
| *Hibbertia obtusifolia* | 0.5 | 50 | SG | | | 0.5 | | | | | | |
| *Stylidium graminifolium* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Gonocarpus tetragynus* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Hydrocotyle laxiflora* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Acaena ovina* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Dichelachne crinita* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Cassytha glabella* | 0.1 | 10 | OG | | | | | | | 0.1 | | |
| *Senecio sp.* | 0.1 | 15 | FG | | | | | 0.1 | | | | |
| *Dillwynia sericea* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Astroloma humifusum* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Melichrus urceolatus* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Bursaria spinosa* | 0.2 | 2 | SG | | | 0.2 | | | | | | |
| *Chrysocephalum semipapposum* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Carex inversa* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Desmodium sp.* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Acacia rubida* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Tetratheca bauerifolia* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Euchiton involucratus* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Solenogyne gunnii* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Mirbelia oxylobioides* | 0.2 | 10 | SG | | | 0.2 | | | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 19** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 296** | | | **40** | **38** | 2 | 17 | 7 | 9 | 0 | 3 | **2** | 1 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **55.2** | **55** | 16 | 22.1 | 15.7 | 0.8 | 0 | 0.4 | **0.2** | 0.1 |
| *Eucalyptus dives* | 10 | 20 | TG | | 10 | | | | | | | |
| *Eucalyptus rubida* | 6 | 12 | TG | | 6 | | | | | | | |
| *Mirbelia oxylobioides* | 5 | 30 | SG | | | 5 | | | | | | |
| *Cassinia longifolia* | 4 | 30 | SG | | | 4 | | | | | | |
| *Dillwynia sp.* | 2 | 25 | SG | | | 2 | | | | | | |
| *Brachyloma daphnoides* | 0.5 | 25 | SG | | | 0.5 | | | | | | |
| *Cassytha glabella* | 0.2 | 50 | OG | | | | | | | 0.2 | | |
| *Themeda triandra* | 10 | 200 | GG | | | | 10 | | | | | |
| *Platylobium formosum* | 3 | 150 | SG | | | 3 | | | | | | |
| *Acacia pravissima* | 2 | 16 | SG | | | 2 | | | | | | |
| *Pimelea linifolia* | 0.1 | 15 | SG | | | 0.1 | | | | | | |
| *Hibbertia obtusifolia* | 0.5 | 25 | SG | | | 0.5 | | | | | | |
| *Gonocarpus tetragynus* | 0 | 200 | FG | | | | | 0 | | | | |
| *Daviesia mimosoides* | 0.2 | 5 | SG | | | 0.2 | | | | | | |
| *Persoonia chamaepeuce* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Poa sieberiana* | 5 | 200 | GG | | | | 5 | | | | | |
| *Rytidosperma pilosum* | 0.1 | 25 | GG | | | | 0.1 | | | | | |
| *Pimelea curviflora* | 0.1 | 50 | SG | | | 0.1 | | | | | | |
| *Lomandra longifolia* | 0.2 | 10 | GG | | | | 0.2 | | | | | |
| *Hovea linearis* | 0.1 | 15 | FG | | | | | 0.1 | | | | |
| *Centaurium erythraea* | 0.1 | 20 | EX | | | | | | | | 0.1 | |
| *Senecio pinnatifolius* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Geranium Sp.* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Viola betonicifolia* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Luzula flaccida* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Indigofera australis* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Hypericum perforatum* | 0.1 | 5 | HT | | | | | | | | | 0.1 |
| *Leucopogon virgatus* | 0.1 | 15 | SG | | | 0.1 | | | | | | |
| *Tetratheca bauerifolia* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Hypericum gramineum* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Stylidium graminifolium* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Lomandra filiformis subsp. coriacea* | 0.2 | 50 | GG | | | | 0.2 | | | | | |
| *Lomandra multiflora* | 0.1 | 30 | GG | | | | 0.1 | | | | | |
| *Melichrus urceolatus* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Dianella revoluta* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Hardenbergia violacea* | 0.1 | 5 | OG | | | | | | | 0.1 | | |
| *Cynoglossum australe* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Glycine clandestina* | 0.1 | 30 | OG | | | | | | | 0.1 | | |
| *Monotoca scoparia* | 0.2 | 5 | SG | | | 0.2 | | | | | | |
| *Calytrix tetragona* | 4 | 100 | SG | | | 4 | | | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 20** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 296** | | | **29** | **22** | 3 | 5 | 9 | 5 | 0 | 0 | **7** | 3 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **135.5** | **129.7** | 46 | 1.6 | 81.6 | 0.5 | 0 | 0 | **5.8** | 5.3 |
| *Eucalyptus rubida* | 20 | 25 | TG | | 20 | | | | | | | |
| *Themeda triandra* | 1 | 50 | GG | | | | 1 | | | | | |
| *Microlaena stipoides* | 40 | 1000 | GG | | | | 40 | | | | | |
| *Dichelachne crinita* | 0.2 | 50 | GG | | | | 0.2 | | | | | |
| *Rubus fruticosus agg.* | 5 | 25 | HT | | | | | | | | | 5 |
| *Centaurium erythraea* | 0.1 | 50 | EX | | | | | | | | 0.1 | |
| *Hypericum perforatum* | 0.2 | 200 | HT | | | | | | | | | 0.2 |
| *Elymus scaber* | 10 | 500 | GG | | | | 10 | | | | | |
| *Gonocarpus tetragynus* | 0.1 | 100 | FG | | | | | 0.1 | | | | |
| *Acacia dealbata* | 25 | 60 | TG | | 25 | | | | | | | |
| *Brachyloma daphnoides* | 0.5 | 20 | SG | | | 0.5 | | | | | | |
| *Bursaria spinosa* | 0.2 | 3 | SG | | | 0.2 | | | | | | |
| *Eucalyptus dives* | 1 | 0 | TG | | 1 | | | | | | | |
| *Hydrocotyle laxiflora* | 0.1 | 40 | FG | | | | | 0.1 | | | | |
| *Vulpia myuros* | 0.2 | 100 | EX | | | | | | | | 0.2 | |
| *Exocarpos strictus* | 0.5 | 30 | SG | | | 0.5 | | | | | | |
| *Acaena ovina* | 0.1 | 15 | FG | | | | | 0.1 | | | | |
| *Rytidosperma racemosum* | 30 | 500 | GG | | | | 30 | | | | | |
| *Rosa rubiginosa* | 0.1 | 5 | HT | | | | | | | | | 0.1 |
| *Pimelea linifolia* | 0.2 | 5 | SG | | | 0.2 | | | | | | |
| *Carex longebrachiata* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Juncus sp.* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Aira elegantissima* | 0.1 | 50 | EX | | | | | | | | 0.1 | |
| *Hypericum gramineum* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Eragrostis sp.* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Oxalis perennans* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Panicum effusum* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Hypochaeris radicata* | 0.1 | 5 | EX | | | | | | | | 0.1 | |
| *Cassinia longifolia* | 0.2 | 2 | SG | | | 0.2 | | | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 22** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 296** | | | **32** | **30** | 4 | 13 | 9 | 3 | 0 | 1 | **2** | 2 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **70.1** | **69.9** | 14.1 | 50 | 5 | 0.7 | 0 | 0.1 | **0.2** | 0.2 |
| *Eucalyptus viminalis* | 3 | 3 | TG | | 3 | | | | | | | |
| *Eucalyptus mannifera* | 10 | 5 | TG | | 10 | | | | | | | |
| *Acacia pravissima* | 3 | 50 | SG | | | 3 | | | | | | |
| *Eucalyptus dives* | 1 | 3 | TG | | 1 | | | | | | | |
| *Mirbelia oxylobioides* | 0.5 | 3 | SG | | | 0.5 | | | | | | |
| *Melichrus urceolatus* | 0.2 | 1 | SG | | | 0.2 | | | | | | |
| *Themeda triandra* | 0.1 | 25 | GG | | | | 0.1 | | | | | |
| *Hibbertia obtusifolia* | 0.2 | 50 | SG | | | 0.2 | | | | | | |
| *Lomandra filiformis* | 1 | 50 | GG | | | | 1 | | | | | |
| *Lomandra longifolia* | 3 | 25 | GG | | | | 3 | | | | | |
| *Gonocarpus tetragynus* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Brachyloma daphnoides* | 5 | 150 | SG | | | 5 | | | | | | |
| *Leucopogon fletcheri* | 10 | 200 | SG | | | 10 | | | | | | |
| *Dillwynia sp.* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Microlaena stipoides* | 0.2 | 200 | GG | | | | 0.2 | | | | | |
| *Lomandra filiformis* | 0.2 | 10 | GG | | | | 0.2 | | | | | |
| *Dichelachne micrantha* | 0.1 | 15 | GG | | | | 0.1 | | | | | |
| *Dianella revoluta* | 0.5 | 30 | FG | | | | | 0.5 | | | | |
| *Pimelea linifolia* | 0.2 | 50 | SG | | | 0.2 | | | | | | |
| *Rubus fruticosus agg.* | 0.1 | 1 | HT | | | | | | | | | 0.1 |
| *Rosa rubiginosa* | 0.1 | 1 | HT | | | | | | | | | 0.1 |
| *Lomandra multiflora* | 0.2 | 25 | GG | | | | 0.2 | | | | | |
| *Acacia gunnii* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Poa sieberiana* | 0.1 | 15 | GG | | | | 0.1 | | | | | |
| *Cassytha glabella* | 0.1 | 5 | OG | | | | | | | 0.1 | | |
| *Acacia melanoxylon* | 0.1 | 1 | TG | | 0.1 | | | | | | | |
| *Aristida ramosa* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Senecio prenanthoides* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Leptospermum continentale* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Exocarpos strictus* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Bursaria spinosa* | 0.5 | 10 | SG | | | 0.5 | | | | | | |
| *Calytrix tetragona* | 30 | 500 | SG | | | 30 | | | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 23** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 296** | | | **28** | **23** | 3 | 7 | 9 | 3 | 0 | 1 | **5** | 4 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **58.7** | **58.1** | 4.5 | 45.4 | 7.7 | 0.4 | 0 | 0.1 | **0.6** | 0.5 |
| *Microlaena stipoides* | 5 | 8 | GG | | | | 5 | | | | | |
| *Eucalyptus viminalis* | 0.5 | 2 | TG | | 0.5 | | | | | | | |
| *Acacia pravissima* | 15 | 50 | SG | | | 15 | | | | | | |
| *Cassinia longifolia* | 25 | 150 | SG | | | 25 | | | | | | |
| *Eucalyptus dives* | 1 | 5 | TG | | 1 | | | | | | | |
| *Acacia dealbata* | 3 | 50 | TG | | 3 | | | | | | | |
| *Bursaria spinosa* | 3 | 50 | SG | | | 3 | | | | | | |
| *Brachyloma daphnoides* | 2 | 100 | SG | | | 2 | | | | | | |
| *Hypericum perforatum* | 0.1 | 25 | HT | | | | | | | | | 0.1 |
| *Rubus fruticosus agg.* | 0.2 | 10 | HT | | | | | | | | | 0.2 |
| *Cassytha glabella* | 0.1 | 50 | OG | | | | | | | 0.1 | | |
| *Calytrix tetragona* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Gonocarpus tetragynus* | 0.2 | 500 | FG | | | | | 0.2 | | | | |
| *Hydrocotyle laxiflora* | 0.1 | 200 | FG | | | | | 0.1 | | | | |
| *Rosa rubiginosa* | 0.1 | 1 | HT | | | | | | | | | 0.1 |
| *Dichondra repens* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Echinopogon sp.* | 0.2 | 50 | GG | | | | 0.2 | | | | | |
| *Microlaena stipoides* | 1 | 150 | GG | | | | 1 | | | | | |
| *Exocarpos strictus* | 0.2 | 20 | SG | | | 0.2 | | | | | | |
| *Rytidosperma racemosum* | 1 | 50 | GG | | | | 1 | | | | | |
| *Poa sieberiana* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Monotoca scoparia* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Carex inversa* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Poa helmsii* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Lomandra filiformis subsp. filiformis* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Themeda triandra* | 0.1 | 15 | GG | | | | 0.1 | | | | | |
| *Centaurium erythraea* | 0.1 | 35 | EX | | | | | | | | 0.1 | |
| *Holcus lanatus* | 0.1 | 1 | HT | | | | | | | | | 0.1 |

| | | | Covers | **Native** | Trees | Shrubs | Grass | Forb | Fern | Other | **Exotic** | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 24** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 296** | | | **21** | **21** | 4 | 12 | 2 | 3 | 0 | 0 | **0** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **9.2** | **9.2** | 2.5 | 6.2 | 0.2 | 0.3 | 0 | 0 | **0** | 0 |
| *Acacia dealbata* | 0.1 | 12 | TG | | 0.1 | | | | | | | |
| *Acacia pravissima* | 0.2 | 11 | SG | | | 0.2 | | | | | | |
| *Banksia canei* | 2 | 38 | SG | | | 2 | | | | | | |
| *Calytrix tetragona* | 0.1 | 4 | SG | | | 0.1 | | | | | | |
| *Cassinia aculeata* | 0.1 | 3 | SG | | | 0.1 | | | | | | |
| *Cassinia longifolia* | 0.2 | 22 | SG | | | 0.2 | | | | | | |
| *Eucalyptus dives* | 2 | 12 | TG | | 2 | | | | | | | |
| *Eucalyptus mannifera* | 0.3 | 6 | TG | | 0.3 | | | | | | | |
| *Eucalyptus robertsonii* | 0.1 | 1 | TG | | 0.1 | | | | | | | |
| *Exocarpos strictus* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Gompholobium sp.* | 0.1 | 4 | SG | | | 0.1 | | | | | | |
| *Gonocarpus sp.* | 0.1 | 22 | FG | | | | | 0.1 | | | | |
| *Hibbertia obtusifolia* | 0.1 | 6 | SG | | | 0.1 | | | | | | |
| *Leucopogon virgatus* | 0.1 | 12 | SG | | | 0.1 | | | | | | |
| *Lomandra filiformis* | 0.1 | 6 | GG | | | | 0.1 | | | | | |
| *Monotoca scoparia* | 0.1 | 18 | SG | | | 0.1 | | | | | | |
| *Pimelea linifolia* | 0.1 | 6 | SG | | | 0.1 | | | | | | |
| *Platylobium formosum* | 3 | 150 | SG | | | 3 | | | | | | |
| *Poa sieberiana* | 0.1 | 90 | GG | | | | 0.1 | | | | | |
| *Viola sp.* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Wahlenbergia sp.* | 0.1 | 4 | FG | | | | | 0.1 | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 25** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 296** | | | **26** | **26** | 2 | 16 | 4 | 4 | 0 | 0 | **0** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **67.9** | **67.9** | 16 | 48.4 | 3.1 | 0.4 | 0 | 0 | **0** | 0 |
| *Acacia pravissima* | 0.5 | 40 | SG | | | 0.5 | | | | | | |
| *Asperula gunnii* | 0.1 | 150 | FG | | | | | 0.1 | | | | |
| *Astroloma humifusum* | 0.1 | 50 | SG | | | 0.1 | | | | | | |
| *Banksia canei* | 30 | 200 | SG | | | 30 | | | | | | |
| *Bossiaea foliosa* | 5 | 200 | SG | | | 5 | | | | | | |
| *Brachyloma daphnoides* | 0.1 | 50 | SG | | | 0.1 | | | | | | |
| *Calytrix tetragona* | 0.5 | 30 | SG | | | 0.5 | | | | | | |
| *Dillwynia phylicoides* | 0.2 | 50 | SG | | | 0.2 | | | | | | |
| *Eucalyptus dives* | 15 | 10 | TG | | 15 | | | | | | | |
| *Eucalyptus viminalis* | 1 | 1 | TG | | 1 | | | | | | | |
| *Gonocarpus tetragynus* | 0.1 | 100 | FG | | | | | 0.1 | | | | |
| *Hibbertia obtusifolia* | 0.1 | 50 | SG | | | 0.1 | | | | | | |
| *Hovea heterophylla* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Leucopogon fletcheri* | 4 | 200 | SG | | | 4 | | | | | | |
| *Leucopogon virgatus* | 0.1 | 50 | SG | | | 0.1 | | | | | | |
| *Lomandra filiformis subsp. coriacea* | 0.1 | 20 | GG | | | | 0.1 | | | | | |
| *Lomandra longifolia* | 0.5 | 50 | GG | | | | 0.5 | | | | | |
| *Mirbelia oxylobioides* | 5 | 200 | SG | | | 5 | | | | | | |
| *Monotoca scoparia* | 0.1 | 50 | SG | | | 0.1 | | | | | | |
| *Persoonia chamaepeuce* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Pimelea linifolia* | 0.1 | 50 | SG | | | 0.1 | | | | | | |
| *Platylobium formosum* | 0.5 | 50 | SG | | | 0.5 | | | | | | |
| *Poa sieberiana* | 2 | 500 | GG | | | | 2 | | | | | |
| *Podolobium procumbens* | 2 | 100 | SG | | | 2 | | | | | | |
| *Stylidium graminifolium* | 0.1 | 30 | FG | | | | | 0.1 | | | | |
| *Microlaena stipoides* | 0.5 | 200 | GG | | | | 0.5 | | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 27** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 296** | | | **31** | **30** | 3 | 14 | 5 | 6 | 0 | 2 | **1** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **176** | **175.9** | 62 | 92.3 | 20.8 | 0.6 | 0 | 0.2 | **0.1** | 0 |
| *Eucalyptus dives* | 20 | 7 | TG | | 20 | | | | | | | |
| *Eucalyptus nortonii* | 40 | 12 | TG | | 40 | | | | | | | |
| *Eucalyptus rubida* | 2 | 4 | TG | | 2 | | | | | | | |
| *Acacia buxifolia* | 0.3 | 5 | SG | | | 0.3 | | | | | | |
| *Acacia gunnii* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Banksia canei* | 70 | 50 | SG | | | 70 | | | | | | |
| *Brachyloma daphnoides* | 1 | 20 | SG | | | 1 | | | | | | |
| *Calytrix tetragona* | 10 | 30 | SG | | | 10 | | | | | | |
| *Cassinia longifolia* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Dillwynia phylicoides* | 1 | 10 | SG | | | 1 | | | | | | |
| *Hibbertia obtusifolia* | 0.3 | 20 | SG | | | 0.3 | | | | | | |
| *Leucopogon virgatus* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Monotoca scoparia* | 2 | 5 | SG | | | 2 | | | | | | |
| *Pimelea linifolia* | 0.2 | 50 | SG | | | 0.2 | | | | | | |
| *Platylobium formosum* | 5 | 40 | SG | | | 5 | | | | | | |
| *Rhytidosporum sp.* | 2 | 40 | SG | | | 2 | | | | | | |
| *Tetratheca rubioides* | 0.2 | 20 | SG | | | 0.2 | | | | | | |
| *Cassytha sp.* | 0.1 | 1 | OG | | | | | | | 0.1 | | |
| *Hardenbergia violacea* | 0.1 | 10 | OG | | | | | | | 0.1 | | |
| *Lomandra filiformis* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Lomandra glauca* | 0.1 | 3 | GG | | | | 0.1 | | | | | |
| *Lomandra gracilis* | 0.5 | 20 | GG | | | | 0.5 | | | | | |
| *Lomandra longifolia* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Poa sp.* | 20 | 30 | GG | | | | 20 | | | | | |
| *Boronia nana* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Caladenia congesta* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Gonocarpus tetragynus* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Hovea sp.* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Hypericum gramineum* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Wahlenbergia stricta* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Aira sp.* | 0.1 | 20 | EX | | | | | | | | 0.1 | |

| | | | Covers | **Native** | Trees | Shrubs | Grass | Forb | Fern | Other | **Exotic** | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 28** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 296** | | | **41** | **40** | 3 | 16 | 4 | 16 | 0 | 1 | **1** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **216.5** | **216.4** | 55.2 | 91.3 | 61.3 | 6.6 | 0 | 2 | **0.1** | 0 |
| *Acacia dealbata* | 0.2 | 10 | TG | | 0.2 | | | | | | | |
| *Eucalyptus dives* | 30 | 5 | TG | | 30 | | | | | | | |
| *Eucalyptus rubida* | 25 | 6 | TG | | 25 | | | | | | | |
| *Banksia canei* | 2 | 43 | SG | | | 2 | | | | | | |
| *Bossiaea foliosa* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Brachyloma daphnoides* | 30 | 50 | SG | | | 30 | | | | | | |
| *Cassinia longifolia* | 1 | 5 | SG | | | 1 | | | | | | |
| *Dillwynia phylicoides* | 30 | 50 | SG | | | 30 | | | | | | |
| *Exocarpos cupressiformis* | 10 | 15 | SG | | | 10 | | | | | | |
| *Grevillea arenaria subsp. canescens* | 2 | 20 | SG | | | 2 | | | | | | |
| *Grevillea rosmarinifolia* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Hibbertia obtusifolia* | 0.2 | 20 | SG | | | 0.2 | | | | | | |
| *Leucopogon virgatus* | 5 | 20 | SG | | | 5 | | | | | | |
| *Mirbelia oxylobioides* | 10 | 20 | SG | | | 10 | | | | | | |
| *Persoonia chamaepeuce* | 0.3 | 20 | SG | | | 0.3 | | | | | | |
| *Pimelea curviflora* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Pimelea linifolia* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Platylobium formosum* | 0.2 | 5 | SG | | | 0.2 | | | | | | |
| *Tetratheca bauerifolia* | 0.2 | 10 | SG | | | 0.2 | | | | | | |
| *Cassytha pubescens* | 2 | 10 | OG | | | | | | | 2 | | |
| *Lomandra longifolia* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Microlaena stipoides* | 0.2 | 20 | GG | | | | 0.2 | | | | | |
| *Poa sp.* | 60 | 200 | GG | | | | 60 | | | | | |
| *Themeda triandra* | 1 | 20 | GG | | | | 1 | | | | | |
| *Asperula conferta* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Caladenia gracilis* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Dianella revoluta* | 5 | 50 | FG | | | | | 5 | | | | |
| *Diuris pardina* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Geranium obtusisepalum* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Gonocarpus tetragynus* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Hovea heterophylla* | 0.2 | 10 | FG | | | | | 0.2 | | | | |
| *Hydrocotyle laxiflora* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Plantago gaudichaudii* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Pterostylis longifolia* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Ranunculus lappaceus* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Stellaria pungens* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Stylidium graminifolium* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Thelymitra megacalyptra* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Viola betonicifolia* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Wahlenbergia stricta* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Centaurium erythraea* | 0.1 | 20 | EX | | | | | | | | 0.1 | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 29** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 296** | | | **32** | **32** | 2 | 14 | 5 | 10 | 0 | 1 | **0** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **75.6** | **75.6** | 18 | 45.9 | 10.4 | 1.2 | 0 | 0.1 | **0** | 0 |
| *Eucalyptus dives* | 15 | 20 | TG | | 15 | | | | | | | |
| *Eucalyptus nortonii* | 3 | 4 | TG | | 3 | | | | | | | |
| *Banksia canei* | 40 | 120 | SG | | | 40 | | | | | | |
| *Brachyloma daphnoides* | 2 | 30 | SG | | | 2 | | | | | | |
| *Cassinia longifolia* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Daviesia mimosoides* | 0.2 | 3 | SG | | | 0.2 | | | | | | |
| *Dillwynia phylicoides* | 0.2 | 6 | SG | | | 0.2 | | | | | | |
| *Exocarpos cupressiformis* | 2 | 10 | SG | | | 2 | | | | | | |
| *Hibbertia obtusifolia* | 0.2 | 20 | SG | | | 0.2 | | | | | | |
| *Leucopogon virgatus* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Mirbelia oxylobioides* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Monotoca scoparia* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Persoonia chamaepeuce* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Pimelea linifolia* | 0.2 | 30 | SG | | | 0.2 | | | | | | |
| *Platylobium formosum* | 0.5 | 20 | SG | | | 0.5 | | | | | | |
| *Tetratheca bauerifolia* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Hardenbergia violacea* | 0.1 | 5 | OG | | | | | | | 0.1 | | |
| *Dichelachne sp.* | 0.1 | 20 | GG | | | | 0.1 | | | | | |
| *Lomandra filiformis* | 0.1 | 4 | GG | | | | 0.1 | | | | | |
| *Lomandra longifolia* | 0.2 | 8 | GG | | | | 0.2 | | | | | |
| *Poa sieberiana* | 8 | 150 | GG | | | | 8 | | | | | |
| *Poa sp.* | 2 | 80 | GG | | | | 2 | | | | | |
| *Caladenia congesta* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Geranium obtusisepalum* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Gonocarpus tetragynus* | 0.2 | 50 | FG | | | | | 0.2 | | | | |
| *Hovea heterophylla* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Prasophyllum sp.* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Pterostylis longifolia* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Pterostylis sp.* | 0.1 | 7 | FG | | | | | 0.1 | | | | |
| *Stellaria pungens* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Stylidium graminifolium* | 0.2 | 30 | FG | | | | | 0.2 | | | | |
| *Wahlenbergia stricta* | 0.1 | 3 | FG | | | | | 0.1 | | | | |

| | | | Covers | **Native** | Trees | Shrubs | Grass | Forb | Fern | Other | **Exotic** | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 30** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 296** | | | **17** | **14** | 3 | 7 | 4 | 0 | 0 | 0 | **3** | 3 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **126.7** | **36.1** | 32.1 | 1.5 | 2.5 | 0 | 0 | 0 | **90.6** | 90.6 |
| *Eucalyptus rubida* | 30 | 20 | TG | | 30 | | | | | | | |
| *Microlaena stipoides* | 2 | 500 | GG | | | | 2 | | | | | |
| *Rubus fruticosus agg.* | 90 | 500 | HT | | | | | | | | | 90 |
| *Hypericum perforatum* | 0.5 | 50 | HT | | | | | | | | | 0.5 |
| *Acacia dealbata* | 2 | 20 | TG | | 2 | | | | | | | |
| *Bursaria spinosa* | 0.5 | 5 | SG | | | 0.5 | | | | | | |
| *Exocarpos strictus* | 0.1 | 20 | SG | | | 0.1 | | | | | | |
| *Dodonaea viscosa* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Rytidosperma racemosum* | 0.3 | 100 | GG | | | | 0.3 | | | | | |
| *Rosa rubiginosa* | 0.1 | 1 | HT | | | | | | | | | 0.1 |
| *Pimelea linifolia* | 0.2 | 10 | SG | | | 0.2 | | | | | | |
| *Acacia melanoxylon* | 0.1 | 5 | TG | | 0.1 | | | | | | | |
| *Acacia pravissima* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Juncus sp.* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Cassinia longifolia* | 0.3 | 2 | SG | | | 0.3 | | | | | | |
| *Cassinia aculeata* | 0.2 | 5 | SG | | | 0.2 | | | | | | |
| *Carex longebrachiata* | 0.1 | 10 | GG | | | | 0.1 | | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 31** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 300** | | | **41** | **39** | 2 | 9 | 4 | 20 | 1 | 3 | **2** | 1 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **155.9** | **155.6** | 21 | 59.7 | 42.2 | 12.4 | 20 | 0.3 | **0.3** | 0.1 |
| *Asperula scoparia* | 0.1 | 100 | FG | | | | | 0.1 | | | | |
| *Brachyscome spathulata* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Clematis aristata* | 0.1 | 1 | OG | | | | | | | 0.1 | | |
| *Desmodium varians* | 0.1 | 1 | OG | | | | | | | 0.1 | | |
| *Dipodium punctatum* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Euchiton sp.* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Euphrasia collina* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Glycine clandestina* | 0.1 | 20 | OG | | | | | | | 0.1 | | |
| *Gonocarpus tetragynus* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Hydrocotyle laxiflora* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Lagenifera stipitata* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Leucopogon lanceolatus* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Monotoca scoparia* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Oreomyrrhis sp.* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Pterostylis decurva* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Ranunculus lappaceus* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Rubus fruticosus agg.* | 0.1 | 1 | HT | | | | | | | | | 0.1 |
| *Stylidium graminifolium* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Veronica calycina* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Viola betonicifolia* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Acaena novae-zelandiae* | 0.2 | 50 | FG | | | | | 0.2 | | | | |
| *Asperula conferta* | 0.2 | 50 | FG | | | | | 0.2 | | | | |
| *Exocarpos strictus* | 0.2 | 10 | SG | | | 0.2 | | | | | | |
| *Microlaena stipoides* | 0.2 | 20 | GG | | | | 0.2 | | | | | |
| *Stellaria pungens* | 0.2 | 50 | FG | | | | | 0.2 | | | | |
| *Trifolium repens* | 0.2 | 250 | EX | | | | | | | | 0.2 | |
| *Veronica derwentiana* | 0.2 | 10 | FG | | | | | 0.2 | | | | |
| *Viola hederacea* | 0.2 | 20 | FG | | | | | 0.2 | | | | |
| *Olearia sp.* | 0.3 | 30 | SG | | | 0.3 | | | | | | |
| *Acacia dealbata* | 1 | 20 | TG | | 1 | | | | | | | |
| *Coprosma hirtella* | 2 | 20 | SG | | | 2 | | | | | | |
| *Coprosma quadrifida* | 2 | 10 | SG | | | 2 | | | | | | |
| *Lomandra longifolia* | 2 | 20 | GG | | | | 2 | | | | | |
| *Daviesia latifolia* | 5 | 20 | SG | | | 5 | | | | | | |
| *Dianella tasmanica* | 10 | 50 | FG | | | | | 10 | | | | |
| *Platylobium formosum* | 10 | 40 | SG | | | 10 | | | | | | |
| *Poa labillardierei* | 10 | 200 | GG | | | | 10 | | | | | |
| *Eucalyptus dalrympleana* | 20 | 3 | TG | | 20 | | | | | | | |
| *Pteridium esculentum* | 20 | 50 | EG | | | | | | 20 | | | |
| *Poa sieberiana* | 30 | 200 | GG | | | | 30 | | | | | |
| *Cassinia aculeata* | 40 | 50 | SG | | | 40 | | | | | | |

| | | | Covers | **Native** | Trees | Shrubs | Grass | Forb | Fern | Other | **Exotic** | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 32** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 300** | | | **22** | **22** | 4 | 10 | 3 | 3 | 0 | 2 | **0** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **142.8** | **142.8** | 21.5 | 40 | 76 | 1.3 | 0 | 4 | **0** | 0 |
| *Acacia melanoxylon* | 0.5 | 1 | TG | | 0.5 | | | | | | | |
| *Acacia pravissima* | 1 | 3 | SG | | | 1 | | | | | | |
| *Arthropodium sp.* | 0.2 | 8 | FG | | | | | 0.2 | | | | |
| *Banksia canei* | 10 | 26 | SG | | | 10 | | | | | | |
| *Brachyloma daphnoides* | 0.5 | 15 | SG | | | 0.5 | | | | | | |
| *Cassinia aculeata* | 2 | 12 | SG | | | 2 | | | | | | |
| *Cassinia longifolia* | 1 | 4 | SG | | | 1 | | | | | | |
| *Dianella sp.* | 1 | 20 | FG | | | | | 1 | | | | |
| *Dillwynia phylicoides* | 15 | 45 | SG | | | 15 | | | | | | |
| *Eucalyptus dalrympleana* | 3 | 1 | TG | | 3 | | | | | | | |
| *Eucalyptus dives* | 8 | 15 | TG | | 8 | | | | | | | |
| *Eucalyptus robertsonii* | 10 | 8 | TG | | 10 | | | | | | | |
| *Glycine clandestina* | 1 | 40 | OG | | | | | | | 1 | | |
| *Gompholobium sp.* | 2 | 55 | SG | | | 2 | | | | | | |
| *Leptomeria drupacea* | 0.5 | 2 | SG | | | 0.5 | | | | | | |
| *Leucopogon fletcheri* | 3 | 28 | SG | | | 3 | | | | | | |
| *Lomandra longifolia* | 1 | 12 | GG | | | | 1 | | | | | |
| *Glycine sp.* | 3 | 18 | OG | | | | | | | 3 | | |
| *Platylobium formosum* | 5 | 60 | SG | | | 5 | | | | | | |
| *Poa sieberiana* | 70 | 1000 | GG | | | | 70 | | | | | |
| *Poa sp.* | 5 | 200 | GG | | | | 5 | | | | | |
| *Stellaria pungens* | 0.1 | 40 | FG | | | | | 0.1 | | | | |

| | | | Covers | **Native** | Trees | Shrubs | Grass | Forb | Fern | Other | **Exotic** | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 33** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 300** | | | **27** | **27** | 4 | 8 | 1 | 10 | 1 | 3 | **0** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **36.4** | **36.4** | 23 | 7.6 | 0.2 | 3.3 | 2 | 0.3 | **0** | 0 |
| *Acacia dealbata* | 2 | 60 | TG | | 2 | | | | | | | |
| *Acaena novae-zelandiae* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Cassinia aculeata* | 2 | 75 | SG | | | 2 | | | | | | |
| *Cassinia longifolia* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Cassytha sp.* | 0.1 | 10 | OG | | | | | | | 0.1 | | |
| *Clematis aristata* | 0.1 | 8 | OG | | | | | | | 0.1 | | |
| *Coprosma hirtella* | 2 | 42 | SG | | | 2 | | | | | | |
| *Coprosma quadrifida* | 3 | 45 | SG | | | 3 | | | | | | |
| *Dianella tasmanica* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Dichondra repens* | 0.5 | 1000 | FG | | | | | 0.5 | | | | |
| *Eucalyptus dives* | 15 | 8 | TG | | 15 | | | | | | | |
| *Eucalyptus robertsonii* | 5 | 3 | TG | | 5 | | | | | | | |
| *Eucalyptus viminalis* | 1 | 1 | TG | | 1 | | | | | | | |
| *Exocarpos strictus* | 0.1 | 14 | SG | | | 0.1 | | | | | | |
| *Geranium sp.* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Glycine sp.* | 0.1 | 15 | OG | | | | | | | 0.1 | | |
| *Lomandra longifolia* | 0.2 | 80 | GG | | | | 0.2 | | | | | |
| *Arthropodium sp.* | 0.2 | 205 | FG | | | | | 0.2 | | | | |
| *Platylobium formosum* | 0.1 | 15 | SG | | | 0.1 | | | | | | |
| *Polyscias sambucifolia* | 0.1 | 3 | SG | | | 0.1 | | | | | | |
| *Pteridium esculentum* | 2 | 40 | EG | | | | | | 2 | | | |
| *Rubus sp.* | 0.2 | 10 | SG | | | 0.2 | | | | | | |
| *Senecio sp.* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Stellaria pungens* | 1 | 600 | FG | | | | | 1 | | | | |
| *Veronica plebeia* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Veronica sp.* | 1 | 85 | FG | | | | | 1 | | | | |
| *Viola hederacea* | 0.1 | 60 | FG | | | | | 0.1 | | | | |

| | | | Covers | **Native** | Trees | Shrubs | Grass | Forb | Fern | Other | **Exotic** | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 34** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 300** | | | **22** | **21** | 3 | 6 | 2 | 8 | 1 | 1 | **1** | 1 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **85.2** | **55.2** | 17 | 11.2 | 20.2 | 1.7 | 5 | 0.1 | **30** | 30 |
| *Acacia dealbata* | 5 | 35 | TG | | 5 | | | | | | | |
| *Acaena novae-zelandiae* | 0.1 | 80 | FG | | | | | 0.1 | | | | |
| *Bulbine bulbosa* | 0.1 | 30 | FG | | | | | 0.1 | | | | |
| *Cassinia aculeata* | 4 | 27 | SG | | | 4 | | | | | | |
| *Cassinia longifolia* | 0.5 | 3 | SG | | | 0.5 | | | | | | |
| *Coprosma hirtella* | 1 | 28 | SG | | | 1 | | | | | | |
| *Coprosma quadrifida* | 5 | 20 | SG | | | 5 | | | | | | |
| *Dichondra repens* | 0.1 | 40 | FG | | | | | 0.1 | | | | |
| *Eucalyptus pauciflora* | 2 | 4 | TG | | 2 | | | | | | | |
| *Eucalyptus robertsonii* | 10 | 4 | TG | | 10 | | | | | | | |
| *Geranium obtusisepalum* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Glycine clandestina* | 0.1 | 20 | OG | | | | | | | 0.1 | | |
| *Lomandra longifolia* | 0.2 | 15 | GG | | | | 0.2 | | | | | |
| *Arthropodium sp.* | 0.1 | 6 | FG | | | | | 0.1 | | | | |
| *Platylobium formosum* | 0.5 | 25 | SG | | | 0.5 | | | | | | |
| *Poa sieberiana* | 20 | 500 | GG | | | | 20 | | | | | |
| *Pteridium esculentum* | 5 | 180 | EG | | | | | | 5 | | | |
| *Pterostylis monticola* | 0.1 | 18 | FG | | | | | 0.1 | | | | |
| *Rubus fruticosus agg.* | 30 | 50+ | HT | | | | | | | | | 30 |
| *Rubus sp.* | 0.2 | 20 | SG | | | 0.2 | | | | | | |
| *Stellaria pungens* | 0.1 | 200 | FG | | | | | 0.1 | | | | |
| *Veronica derwentiana* | 1 | 45 | FG | | | | | 1 | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 35** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 300** | | | **23** | **23** | 6 | 7 | 2 | 6 | 1 | 1 | **0** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **50.6** | **50.6** | 17.5 | 3.6 | 25.5 | 1.9 | 2 | 0.1 | **0** | 0 |
| *Acacia dealbata* | 2 | 20 | TG | | 2 | | | | | | | |
| *Acacia melanoxylon* | 1 | 2 | TG | | 1 | | | | | | | |
| *Acaena novae-zelandiae* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Bulbine bulbosa* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Cassinia aculeata* | 0.2 | 2 | SG | | | 0.2 | | | | | | |
| *Cassinia longifolia* | 0.5 | 3 | SG | | | 0.5 | | | | | | |
| *Coprosma hirtella* | 1 | 35 | SG | | | 1 | | | | | | |
| *Coprosma quadrifida* | 0.2 | 5 | SG | | | 0.2 | | | | | | |
| *Daviesia ulicifolia* | 0.5 | 7 | SG | | | 0.5 | | | | | | |
| *Dianella sp.* | 0.5 | 16 | FG | | | | | 0.5 | | | | |
| *Diuris sulphurea* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Eucalyptus dives* | 0.5 | 1 | TG | | 0.5 | | | | | | | |
| *Eucalyptus pauciflora* | 5 | 6 | TG | | 5 | | | | | | | |
| *Eucalyptus robertsonii* | 8 | 17 | TG | | 8 | | | | | | | |
| *Eucalyptus viminalis* | 1 | 3 | TG | | 1 | | | | | | | |
| *Exocarpos strictus* | 0.2 | 1 | SG | | | 0.2 | | | | | | |
| *Glycine clandestina* | 0.1 | 15 | OG | | | | | | | 0.1 | | |
| *Lomandra longifolia* | 0.5 | 18 | GG | | | | 0.5 | | | | | |
| *Arthropodium sp.* | 1 | 100 | FG | | | | | 1 | | | | |
| *Platylobium formosum* | 1 | 80 | SG | | | 1 | | | | | | |
| *Poa sieberiana* | 25 | 800+ | GG | | | | 25 | | | | | |
| *Pteridium esculentum* | 2 | 65 | EG | | | | | | 2 | | | |
| *Stellaria pungens* | 0.1 | 100+ | FG | | | | | 0.1 | | | | |

| | | | Covers | **Native** | Trees | Shrubs | Grass | Forb | Fern | Other | **Exotic** | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 36** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 300** | | | **32** | **32** | 3 | 9 | 2 | 15 | 1 | 2 | **0** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **168** | **168** | 25 | 49 | 75 | 12.9 | 5 | 1.1 | **0** | 0 |
| *Pteridium esculentum* | 5 | 80 | EG | | | | | | 5 | | | |
| *Coprosma hirtella* | 8 | 100 | SG | | | 8 | | | | | | |
| *Dianella tasmanica* | 5 | 140 | FG | | | | | 5 | | | | |
| *Platylobium formosum* | 8 | 135 | SG | | | 8 | | | | | | |
| *Daviesia latifolia* | 8 | 25 | SG | | | 8 | | | | | | |
| *Cassinia aculeata* | 10 | 64 | SG | | | 10 | | | | | | |
| *Exocarpos strictus* | 4 | 28 | SG | | | 4 | | | | | | |
| *Leucopogon lanceolatus* | 1 | 1 | SG | | | 1 | | | | | | |
| *Lomandra longifolia* | 5 | 95 | GG | | | | 5 | | | | | |
| *Eucalyptus robertsonii* | 15 | 21 | TG | | 15 | | | | | | | |
| *Eucalyptus dalrympleana* | 6 | 2 | TG | | 6 | | | | | | | |
| *Glycine clandestina* | 0.1 | 20 | OG | | | | | | | 0.1 | | |
| *Acaena ovina* | 0.1 | 35 | FG | | | | | 0.1 | | | | |
| *Poa sieberiana* | 70 | 1000 | GG | | | | 70 | | | | | |
| *Acacia dealbata* | 4 | 8 | TG | | 4 | | | | | | | |
| *Lomatia myricoides* | 5 | 8 | SG | | | 5 | | | | | | |
| *Coprosma quadrifida* | 3 | 5 | SG | | | 3 | | | | | | |
| *Veronica calycina* | 0.1 | 17 | FG | | | | | 0.1 | | | | |
| *Stellaria pungens* | 2 | 400 | FG | | | | | 2 | | | | |
| *Clematis aristata* | 1 | 15 | OG | | | | | | | 1 | | |
| *Senecio prenanthoides* | 1 | 5 | FG | | | | | 1 | | | | |
| *Dipodium punctatum* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Cassinia longifolia* | 2 | 3 | SG | | | 2 | | | | | | |
| *Veronica derwentiana* | 2 | 15 | FG | | | | | 2 | | | | |
| *Dichondra repens* | 1 | 200 | FG | | | | | 1 | | | | |
| *Arthropodium sp.* | 1 | 23 | FG | | | | | 1 | | | | |
| *Stackhousia monogyna* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Ranunculus lappaceus* | 0.1 | 35 | FG | | | | | 0.1 | | | | |
| *Geranium solanderi* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Stylidium graminifolium* | 0.1 | 3 | FG | | | | | 0.1 | | | | |
| *Hypericum gramineum* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Hydrocotyle laxiflora* | 0.1 | 1 | FG | | | | | 0.1 | | | | |

| | | | Covers | **Native** | Trees | Shrubs | Grass | Forb | Fern | Other | **Exotic** | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 37** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 300** | | | **20** | **19** | 4 | 2 | 3 | 5 | 4 | 1 | **1** | 1 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **151.2** | **131.2** | 50 | 5.2 | 42 | 0.9 | 33 | 0.1 | **20** | 20 |
| *Eucalyptus viminalis* | 20 | 15 | TG | | 20 | | | | | | | |
| *Acacia melanoxylon* | 15 | 40 | TG | | 15 | | | | | | | |
| *Eucalyptus robertsonii* | 5 | 4 | TG | | 5 | | | | | | | |
| *Carex appressa* | 35 | 1000 | GG | | | | 35 | | | | | |
| *Blechnum ambiguum* | 20 | 500 | EG | | | | | | 20 | | | |
| *Mentha diemenica* | 0.2 | 50 | FG | | | | | 0.2 | | | | |
| *Acacia dealbata* | 10 | 45 | TG | | 10 | | | | | | | |
| *Poa helmsii* | 5 | 50 | GG | | | | 5 | | | | | |
| *Rubus fruticosus agg.* | 20 | 25 | HT | | | | | | | | | 20 |
| *Stellaria pungens* | 0.3 | 150 | FG | | | | | 0.3 | | | | |
| *Pteridium esculentum* | 2 | 50 | EG | | | | | | 2 | | | |
| *Clematis aristata* | 0.1 | 15 | OG | | | | | | | 0.1 | | |
| *Acaena novae-zelandiae* | 0.1 | 40 | FG | | | | | 0.1 | | | | |
| *Ranunculus lappaceus* | 0.1 | 15 | FG | | | | | 0.1 | | | | |
| *Poa sieberiana* | 2 | 120 | GG | | | | 2 | | | | | |
| *Coprosma hirtella* | 0.2 | 5 | SG | | | 0.2 | | | | | | |
| *Cassinia aculeata* | 5 | 10 | SG | | | 5 | | | | | | |
| *Dichondra repens* | 0.2 | 130 | FG | | | | | 0.2 | | | | |
| *Polystichum proliferum* | 10 | 90 | EG | | | | | | 10 | | | |
| *Blechnum nudum* | 1 | 5 | EG | | | | | | 1 | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 38** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 300** | | | **24** | **24** | 3 | 13 | 2 | 5 | 0 | 1 | **0** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **160.2** | **160.2** | 65.5 | 73.8 | 20.1 | 0.7 | 0 | 0.1 | **0** | 0 |
| *Eucalyptus dives* | 35 | 10 | TG | | 35 | | | | | | | |
| *Eucalyptus robertsonii* | 30 | 5 | TG | | 30 | | | | | | | |
| *Eucalyptus viminalis* | 0.5 | 3 | TG | | 0.5 | | | | | | | |
| *Choretrum pauciflorum* | 0.2 | 10 | SG | | | 0.2 | | | | | | |
| *Coprosma hirtella* | 0.2 | 15 | SG | | | 0.2 | | | | | | |
| *Daviesia latifolia* | 40 | 100 | SG | | | 40 | | | | | | |
| *Daviesia ulicifolia* | 5 | 20 | SG | | | 5 | | | | | | |
| *Exocarpos strictus* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Grevillea arenaria subsp. canescens* | 10 | 50 | SG | | | 10 | | | | | | |
| *Leucopogon virgatus* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Lomatia myricoides* | 1 | 5 | SG | | | 1 | | | | | | |
| *Monotoca scoparia* | 2 | 20 | SG | | | 2 | | | | | | |
| *Persoonia chamaepeuce* | 5 | 50 | SG | | | 5 | | | | | | |
| *Pimelea linifolia* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Platylobium formosum* | 10 | 20 | SG | | | 10 | | | | | | |
| *Tetratheca bauerifolia* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Clematis aristata* | 0.1 | 1 | OG | | | | | | | 0.1 | | |
| *Lomandra longifolia* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Poa labillardierei* | 20 | 100 | GG | | | | 20 | | | | | |
| *Caladenia gracilis* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Chiloglottis valida* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Dianella revoluta* | 0.2 | 25 | FG | | | | | 0.2 | | | | |
| *Gonocarpus tetragynus* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Stylidium graminifolium* | 0.2 | 20 | FG | | | | | 0.2 | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 39** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 300** | | | **37** | **37** | 4 | 16 | 4 | 10 | 1 | 2 | **0** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **109.9** | **109.9** | 81.1 | 6.8 | 20.4 | 1.1 | 0.2 | 0.3 | **0** | 0 |
| *Acacia dealbata* | 0.1 | 6 | TG | | 0.1 | | | | | | | |
| *Acacia melanoxylon* | 1 | 3 | TG | | 1 | | | | | | | |
| *Eucalyptus robertsonii* | 60 | 50 | TG | | 60 | | | | | | | |
| *Eucalyptus viminalis* | 20 | 10 | TG | | 20 | | | | | | | |
| *Bossiaea foliosa* | 0.2 | 15 | SG | | | 0.2 | | | | | | |
| *Cassinia longifolia* | 2 | 10 | SG | | | 2 | | | | | | |
| *Choretrum pauciflorum* | 0.3 | 10 | SG | | | 0.3 | | | | | | |
| *Coprosma hirtella* | 0.3 | 5 | SG | | | 0.3 | | | | | | |
| *Daviesia latifolia* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Exocarpos strictus* | 0.3 | 5 | SG | | | 0.3 | | | | | | |
| *Grevillea rosmarinifolia* | 1 | 10 | SG | | | 1 | | | | | | |
| *Indigofera australis* | 0.2 | 5 | SG | | | 0.2 | | | | | | |
| *Leucopogon fletcheri* | 0.3 | 10 | SG | | | 0.3 | | | | | | |
| *Leucopogon lanceolatus* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Mirbelia oxylobioides* | 0.5 | 10 | SG | | | 0.5 | | | | | | |
| *Monotoca scoparia* | 0.3 | 1 | SG | | | 0.3 | | | | | | |
| *Olearia erubescens* | 0.5 | 10 | SG | | | 0.5 | | | | | | |
| *Pimelea linifolia* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Platylobium formosum* | 0.5 | 1 | SG | | | 0.5 | | | | | | |
| *Tetratheca bauerifolia* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Glycine clandestina* | 0.1 | 10 | OG | | | | | | | 0.1 | | |
| *Hardenbergia violacea* | 0.2 | 20 | OG | | | | | | | 0.2 | | |
| *Lomandra filiformis* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Lomandra longifolia* | 0.2 | 10 | GG | | | | 0.2 | | | | | |
| *Microlaena stipoides* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Poa labillardierei* | 20 | 50 | GG | | | | 20 | | | | | |
| *Asperula scoparia* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Dianella revoluta* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Gonocarpus tetragynus* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Hydrocotyle laxiflora* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Plantago sp.* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Ranunculus lappaceus* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Senecio sp.* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Stylidium graminifolium* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Veronica derwentiana* | 0.2 | 5 | FG | | | | | 0.2 | | | | |
| *Viola betonicifolia* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Pteridium esculentum* | 0.2 | 10 | EG | | | | | | 0.2 | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 40** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 300** | | | **38** | **36** | 4 | 7 | 4 | 18 | 1 | 2 | **2** | 1 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Cover** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **115.5** | **115.2** | 48 | 29.3 | 10.4 | 19.1 | 8 | 0.4 | **0.3** | 0.2 |
| *Acacia dealbata* | 7 | 20 | TG | | 7 | | | | | | | |
| *Acacia melanoxylon* | 1 | 3 | TG | | 1 | | | | | | | |
| *Eucalyptus robertsonii* | 30 | 10 | TG | | 30 | | | | | | | |
| *Eucalyptus viminalis* | 10 | 2 | TG | | 10 | | | | | | | |
| *Bursaria spinosa* | 0.3 | 4 | SG | | | 0.3 | | | | | | |
| *Cassinia aculeata* | 20 | 40 | SG | | | 20 | | | | | | |
| *Cassinia longifolia* | 0.5 | 6 | SG | | | 0.5 | | | | | | |
| *Choretrum sp.* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Coprosma hirtella* | 8 | 25 | SG | | | 8 | | | | | | |
| *Platylobium formosum* | 0.2 | 30 | SG | | | 0.2 | | | | | | |
| *Rubus parvifolius* | 0.2 | 20 | SG | | | 0.2 | | | | | | |
| *Clematis aristata* | 0.2 | 20 | OG | | | | | | | 0.2 | | |
| *Glycine clandestina* | 0.2 | 60 | OG | | | | | | | 0.2 | | |
| *Rubus fruticosus agg.* | 0.2 | 6 | HT | | | | | | | | | 0.2 |
| *Lomandra filiformis* | 0.1 | 8 | GG | | | | 0.1 | | | | | |
| *Lomandra longifolia* | 0.1 | 4 | GG | | | | 0.1 | | | | | |
| *Poa sieberiana* | 10 | 200 | GG | | | | 10 | | | | | |
| *Poa sp.* | 0.2 | 20 | GG | | | | 0.2 | | | | | |
| *Acaena novae-zelandiae* | 0.1 | 40 | FG | | | | | 0.1 | | | | |
| *Arthropodium sp.* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Asperula scoparia* | 0.8 | 200 | FG | | | | | 0.8 | | | | |
| *Brunoniella australis* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Cardamine paucijuga* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Dianella tasmanica* | 0.1 | 4 | FG | | | | | 0.1 | | | | |
| *Dichondra repens* | 0.3 | 80 | FG | | | | | 0.3 | | | | |
| *Epilobium billardierianum* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Euphrasia collina subsp. paludosa* | 0.1 | 3 | FG | | | | | 0.1 | | | | |
| *Geranium obtusisepalum* | 0.3 | 100 | FG | | | | | 0.3 | | | | |
| *Gonocarpus tetragynus* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Picris angustifolia* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Ranunculus lappaceus* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Senecio gunnii* | 0.2 | 20 | FG | | | | | 0.2 | | | | |
| *Senecio sp.* | 0.4 | 40 | FG | | | | | 0.4 | | | | |
| *Stellaria pungens* | 4 | 300 | FG | | | | | 4 | | | | |
| *Veronica derwentiana* | 12 | 80 | FG | | | | | 12 | | | | |
| *Viola eminens* | 0.1 | 3 | FG | | | | | 0.1 | | | | |
| *Cerastium vulgare* | 0.1 | 3 | EX | | | | | | | | 0.1 | |
| *Pteridium esculentum* | 8 | 100 | EG | | | | | | 8 | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 41** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 300** | | | **32** | **26** | 3 | 4 | 4 | 12 | 2 | 1 | **6** | 1 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **78.6** | **7.9** | 4.1 | 0.6 | 0.6 | 2.1 | 0.4 | 0.1 | **70.7** | 70 |
| *Acacia dealbata* | 0.1 | 2 | TG | | 0.1 | | | | | | | |
| *Eucalyptus robertsonii* | 1 | 1 | TG | | 1 | | | | | | | |
| *Eucalyptus viminalis* | 3 | 2 | TG | | 3 | | | | | | | |
| *Cassinia aculeata* | 0.3 | 7 | SG | | | 0.3 | | | | | | |
| *Coprosma sp.* | 0.1 | 4 | SG | | | 0.1 | | | | | | |
| *Olearia erubescens* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Rubus parvifolius* | 0.1 | 7 | SG | | | 0.1 | | | | | | |
| *Glycine clandestina* | 0.1 | 1 | OG | | | | | | | 0.1 | | |
| *Rubus fruticosus agg.* | 70 | 100 | HT | | | | | | | | | 70 |
| *Carex gaudichaudiana* | 0.3 | 20 | GG | | | | 0.3 | | | | | |
| *Echinopogon ovatus* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Luzula flaccida* | 0.1 | 20 | GG | | | | 0.1 | | | | | |
| *Poa sieberiana* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Ajuga australis* | 0.2 | 60 | FG | | | | | 0.2 | | | | |
| *Dianella tasmanica* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Epilobium billardierianum* | 0.2 | 200 | FG | | | | | 0.2 | | | | |
| *Euchiton sphaericus* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Geranium obtusisepalum* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Gratiola peruviana* | 0.2 | 40 | FG | | | | | 0.2 | | | | |
| *Hydrocotyle laxiflora* | 0.5 | 400 | FG | | | | | 0.5 | | | | |
| *Hypericum japonicum* | 0.2 | 20 | FG | | | | | 0.2 | | | | |
| *Mentha laxiflora* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Ranunculus pimpinellifolius* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Ranunculus pumilio* | 0.2 | 120 | FG | | | | | 0.2 | | | | |
| *Rumex brownii* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Cardamine hirsuta* | 0.1 | 20 | EX | | | | | | | | 0.1 | |
| *Cerastium glomeratum* | 0.1 | 10 | EX | | | | | | | | 0.1 | |
| *Cirsium vulgare* | 0.2 | 20 | EX | | | | | | | | 0.2 | |
| *Taraxacum officinale* | 0.1 | 10 | EX | | | | | | | | 0.1 | |
| *Trifolium repens* | 0.2 | 20 | EX | | | | | | | | 0.2 | |
| *Polystichum proliferum* | 0.3 | 13 | EG | | | | | | 0.3 | | | |
| *Pteridium esculentum* | 0.1 | 2 | EG | | | | | | 0.1 | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 42** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 300** | | | **23** | **22** | 2 | 10 | 2 | 5 | 1 | 2 | **1** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **129.1** | **129** | 50 | 26.7 | 33 | 7.2 | 10 | 2.1 | **0.1** | 0 |
| *Acacia pravissima* | 0.2 | 5 | SG | | | 0.2 | | | | | | |
| *Acaena novae-zelandiae* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Arthropodium milleflorum* | 2 | 310 | FG | | | | | 2 | | | | |
| *Cassinia aculeata* | 10 | 60 | SG | | | 10 | | | | | | |
| *Cassinia longifolia* | 8 | 50 | SG | | | 8 | | | | | | |
| *Centaurium erythraea* | 0.1 | 50 | EX | | | | | | | | 0.1 | |
| *Clematis aristata* | 0.1 | 30 | OG | | | | | | | 0.1 | | |
| *Coprosma hirtella* | 1 | 25 | SG | | | 1 | | | | | | |
| *Dichondra repens* | 2 | 500 | FG | | | | | 2 | | | | |
| *Dodonaea viscosa* | 2 | 170 | SG | | | 2 | | | | | | |
| *Eucalyptus robertsonii* | 45 | 28 | TG | | 45 | | | | | | | |
| *Exocarpos strictus* | 0.2 | 10 | SG | | | 0.2 | | | | | | |
| *Glycine clandestina* | 2 | 170 | OG | | | | | | | 2 | | |
| *Lomandra longifolia* | 3 | 55 | GG | | | | 3 | | | | | |
| *Lomatia myricoides* | 0.1 | 18 | SG | | | 0.1 | | | | | | |
| *Persoonia chamaepeuce* | 0.1 | 50 | SG | | | 0.1 | | | | | | |
| *Pimelea sp.* | 0.1 | 25 | SG | | | 0.1 | | | | | | |
| *Platylobium formosum* | 5 | 120 | SG | | | 5 | | | | | | |
| *Poa sieberiana* | 30 | 800 | GG | | | | 30 | | | | | |
| *Pteridium esculentum* | 10 | 250 | EG | | | | | | 10 | | | |
| *Ranunculus sp.* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Stellaria pungens* | 3 | 500 | FG | | | | | 3 | | | | |
| *Eucalyptus viminalis* | 5 | 1 | TG | | 5 | | | | | | | |

| | | | Covers | **Native** | Trees | Shrubs | Grass | Forb | Fern | Other | **Exotic** | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 43** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 302** | | | **12** | **4** | 0 | 1 | 1 | 1 | 1 | 0 | **8** | 3 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **96.3** | **94.6** | 0 | 0.5 | 90 | 0.1 | 4 | 0 | **1.7** | 1.2 |
| *Poa helmsii* | 90 | 1000 | GG | | | | 90 | | | | | |
| *Pteridium esculentum* | 4 | 250 | EG | | | | | | 4 | | | |
| *Hypericum perforatum* | 1 | 100 | HT | | | | | | | | | 1 |
| *Cirsium vulgare* | 0.1 | 20 | EX | | | | | | | | 0.1 | |
| *Geranium solanderi* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Rubus fruticosus agg.* | 0.1 | 5 | HT | | | | | | | | | 0.1 |
| *Centaurium erythraea* | 0.1 | 25 | EX | | | | | | | | 0.1 | |
| *Conyza bonariensis* | 0.1 | 5 | EX | | | | | | | | 0.1 | |
| *Medicago polymorpha* | 0.1 | 20 | EX | | | | | | | | 0.1 | |
| *Leptospermum lanigerum* | 0.5 | 1 | SG | | | 0.5 | | | | | | |
| *Hypericum androsaemum* | 0.1 | 1 | EX | | | | | | | | 0.1 | |
| *Rosa rubiginosa* | 0.1 | 1 | HT | | | | | | | | | 0.1 |

| | | | Covers | **Native** | Trees | Shrubs | Grass | Forb | Fern | Other | **Exotic** | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 44** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 302** | | | **25** | **18** | 2 | 6 | 7 | 2 | 1 | 0 | **7** | 4 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **122.2** | **88.8** | 65 | 9 | 14.5 | 0.2 | 0.1 | 0 | **33.4** | 32.2 |
| *Eucalyptus viminalis* | 50 | 45 | TG | | 50 | | | | | | | |
| *Themeda triandra* | 2 | 50 | GG | | | | 2 | | | | | |
| *Microlaena stipoides* | 2 | 150 | GG | | | | 2 | | | | | |
| *Acacia melanoxylon* | 15 | 50 | TG | | 15 | | | | | | | |
| *Acetosella vulgaris* | 0.1 | 25 | HT | | | | | | | | | 0.1 |
| *Centaurium erythraea* | 0.1 | 150 | EX | | | | | | | | 0.1 | |
| *Hypericum perforatum* | 2 | 250 | HT | | | | | | | | | 2 |
| *Rubus fruticosus agg.* | 30 | 50 | HT | | | | | | | | | 30 |
| *Calytrix tetragona* | 5 | 100 | SG | | | 5 | | | | | | |
| *Exocarpos strictus* | 3 | 20 | SG | | | 3 | | | | | | |
| *Cheilanthes sieberi* | 0.1 | 1 | EG | | | | | | 0.1 | | | |
| *Aira sp.* | 1 | 500 | EX | | | | | | | | 1 | |
| *Vulpia sp.* | 0.1 | 100 | EX | | | | | | | | 0.1 | |
| *Rosa rubiginosa* | 0.1 | 5 | HT | | | | | | | | | 0.1 |
| *Carex appressa* | 0.2 | 5 | GG | | | | 0.2 | | | | | |
| *Oxalis perennans* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Hydrocotyle laxiflora* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Brachyloma daphnoides* | 0.2 | 15 | SG | | | 0.2 | | | | | | |
| *Cassinia aculeata* | 0.2 | 5 | SG | | | 0.2 | | | | | | |
| *Cassinia longifolia* | 0.5 | 500 | SG | | | 0.5 | | | | | | |
| *Rytidosperma racemosum* | 5 | 250 | GG | | | | 5 | | | | | |
| *Carex inversa* | 0.1 | 50 | GG | | | | 0.1 | | | | | |
| *Acacia pravissima* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Elymus scaber* | 5 | 500 | GG | | | | 5 | | | | | |
| *Poa helmsii* | 0.2 | 1 | GG | | | | 0.2 | | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 45** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 302** | | | **41** | **31** | 5 | 7 | 6 | 8 | 3 | 2 | **10** | 4 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **182.1** | **173** | 101 | 13.2 | 57.3 | 0.8 | 0.5 | 0.2 | **9.1** | 8.4 |
| *Eucalyptus viminalis* | 45 | 11 | TG | | 45 | | | | | | | |
| *Eucalyptus stellulata* | 1 | 7 | TG | | 1 | | | | | | | |
| *Eucalyptus robertsonii* | 3 | 1 | TG | | 3 | | | | | | | |
| *Acacia melanoxylon* | 50 | 100 | TG | | 50 | | | | | | | |
| *Poa helmsii* | 40 | 500 | GG | | | | 40 | | | | | |
| *Austrostipa sp.* | 1 | 200 | GG | | | | 1 | | | | | |
| *Sporobolus sp.* | 15 | 1000 | GG | | | | 15 | | | | | |
| *Banksia canei* | 3 | 3 | SG | | | 3 | | | | | | |
| *Exocarpos strictus* | 2 | 10 | SG | | | 2 | | | | | | |
| *Rubus fruticosus agg.* | 3 | 30 | HT | | | | | | | | | 3 |
| *Rosa rubiginosa* | 0.2 | 10 | HT | | | | | | | | | 0.2 |
| *Pomaderris aspera* | 5 | 30 | SG | | | 5 | | | | | | |
| *Hypochaeris radicata* | 0.2 | 250 | EX | | | | | | | | 0.2 | |
| *Bursaria spinosa* | 1 | 20 | SG | | | 1 | | | | | | |
| *Cassinia aculeata* | 2 | 15 | SG | | | 2 | | | | | | |
| *Acacia dealbata* | 2 | 20 | TG | | 2 | | | | | | | |
| *Hypericum perforatum* | 0.2 | 50 | HT | | | | | | | | | 0.2 |
| *Holcus lanatus* | 5 | 250 | HT | | | | | | | | | 5 |
| *Aira sp.* | 0.1 | 25 | EX | | | | | | | | 0.1 | |
| *Centaurium erythraea* | 0.1 | 50 | EX | | | | | | | | 0.1 | |
| *Geranium sp.* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Glycine clandestina* | 0.1 | 25 | OG | | | | | | | 0.1 | | |
| *Poranthera microphylla* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Oxalis perennans* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Pteridium esculentum* | 0.2 | 20 | EG | | | | | | 0.2 | | | |
| *Carex fascicularis* | 1 | 50 | GG | | | | 1 | | | | | |
| *Juncus sp.* | 0.2 | 5 | GG | | | | 0.2 | | | | | |
| *Prunella vulgaris* | 0.1 | 50 | EX | | | | | | | | 0.1 | |
| *Blechnum minus* | 0.1 | 1 | EG | | | | | | 0.1 | | | |
| *Eryanthe moschatus* | 0.1 | 50 | EX | | | | | | | | 0.1 | |
| *Euchiton involucratus* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Cirsium vulgare* | 0.1 | 2 | EX | | | | | | | | 0.1 | |
| *Senecio quadridentatus* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Epilobium billardierianum* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Microlaena stipoides* | 0.1 | 30 | GG | | | | 0.1 | | | | | |
| *Blechnum wattsii* | 0.2 | 15 | EG | | | | | | 0.2 | | | |
| *Gynatrix pulchella* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Pimelea linifolia* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Wahlenbergia sp.* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Rumex brownii* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Clematis aristata* | 0.1 | 5 | OG | | | | | | | 0.1 | | |
| *Chrysocephalum semipapposum* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Hemarthria uncinata* | 5 | 200 | GG | | | | 5 | | | | | |
| *Carex appressa* | 0.1 | 1 | GG | | | | 0.1 | | | | | |

| | | | Covers | **Native** | Trees | Shrubs | Grass | Forb | Fern | Other | **Exotic** | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 48** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 302** | | | **31** | **20** | 2 | 3 | 6 | 7 | 1 | 1 | **11** | 3 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **43.2** | **10.1** | 5 | 3.6 | 0.6 | 0.7 | 0.1 | 0.1 | **33.1** | 30.4 |
| *Eucalyptus camphora* | 2 | 10 | TG | | 2 | | | | | | | |
| *Eucalyptus viminalis* | 3 | 10 | TG | | 3 | | | | | | | |
| *Acacia pravissima* | 3 | 20 | SG | | | 3 | | | | | | |
| *Cassinia aculeata* | 0.5 | 4 | SG | | | 0.5 | | | | | | |
| *Rhytidosporum sp.* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Clematis aristata* | 0.1 | 2 | OG | | | | | | | 0.1 | | |
| *Hypericum perforatum* | 0.3 | 200 | HT | | | | | | | | | 0.3 |
| *Rosa rubiginosa* | 0.1 | 2 | HT | | | | | | | | | 0.1 |
| *Rubus fruticosus agg.* | 30 | 150 | HT | | | | | | | | | 30 |
| *Carex appressa* | 0.1 | 2 | GG | | | | 0.1 | | | | | |
| *Carex inversa* | 0.1 | 6 | GG | | | | 0.1 | | | | | |
| *Echinopogon ovatus* | 0.1 | 2 | GG | | | | 0.1 | | | | | |
| *Microlaena stipoides* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Poa labillardierei* | 0.1 | 2 | GG | | | | 0.1 | | | | | |
| *Poa sp.* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Acaena novae-zelandiae* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Galium gaudichaudii* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Geranium obtusisepalum* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Hydrocotyle laxiflora* | 0.1 | 100 | FG | | | | | 0.1 | | | | |
| *Myosotis australis* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Oxalis exilis* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Rumex brownii* | 0.1 | 3 | FG | | | | | 0.1 | | | | |
| *Briza maxima* | 0.1 | 1 | EX | | | | | | | | 0.1 | |
| *Centaurium erythraea* | 0.1 | 20 | EX | | | | | | | | 0.1 | |
| *Cirsium vulgare* | 0.1 | 2 | EX | | | | | | | | 0.1 | |
| *Conyza sp.* | 0.1 | 1 | EX | | | | | | | | 0.1 | |
| *Medicago sp.* | 0.1 | 2 | EX | | | | | | | | 0.1 | |
| *Prunus cerasus* | 2 | 13 | EX | | | | | | | | 2 | |
| *Salvia verbenaca* | 0.1 | 1 | EX | | | | | | | | 0.1 | |
| *Taraxacum officinale* | 0.1 | 1 | EX | | | | | | | | 0.1 | |
| *Pteridium esculentum* | 0.1 | 2 | EG | | | | | | 0.1 | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 49** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 729** | | | **34** | **24** | 0 | 7 | 8 | 7 | 0 | 2 | **10** | 4 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **139.4** | **98.1** | 0 | 21.4 | 75.7 | 0.8 | 0 | 0.2 | **41.3** | 40.7 |
| *Themeda triandra* | 75 | 1000 | GG | | | | 75 | | | | | |
| *Rubus fruticosus agg.* | 40 | 200 | HT | | | | | | | | | 40 |
| *Centaurium erythraea* | 0.1 | 100 | EX | | | | | | | | 0.1 | |
| *Dillwynia sericea* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Aira sp.* | 0.1 | 200 | EX | | | | | | | | 0.1 | |
| *Euchiton involucratus* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Carex inversa* | 0.1 | 150 | GG | | | | 0.1 | | | | | |
| *Hypochaeris radicata* | 0.1 | 35 | EX | | | | | | | | 0.1 | |
| *Hypericum perforatum* | 0.5 | 60 | HT | | | | | | | | | 0.5 |
| *vulpia sp.* | 0.1 | 100 | EX | | | | | | | | 0.1 | |
| *Gonocarpus tetragynus* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Rytidosperma sp.* | 0.1 | 50 | GG | | | | 0.1 | | | | | |
| *Acacia pravissima* | 20 | 350 | SG | | | 20 | | | | | | |
| *Oxalis sp.* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Microlaena stipoides* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Rytidosperma pilosum* | 0.1 | 30 | GG | | | | 0.1 | | | | | |
| *Verbascum virgatum* | 0.1 | 1 | EX | | | | | | | | 0.1 | |
| *Acaena ovina* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Lomandra filiformis subsp. coriacea* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Acetosella vulgaris* | 0.1 | 35 | HT | | | | | | | | | 0.1 |
| *Exocarpos strictus* | 0.5 | 50 | SG | | | 0.5 | | | | | | |
| *Scleranthus fasciculatus* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Brachyloma daphnoides* | 0.1 | 3 | SG | | | 0.1 | | | | | | |
| *Astroloma humifusum* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Petrorhagia dubia* | 0.1 | 2 | EX | | | | | | | | 0.1 | |
| *Lomandra filiformis* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Rosa rubiginosa* | 0.1 | 1 | HT | | | | | | | | | 0.1 |
| *Desmodium varians* | 0.1 | 1 | OG | | | | | | | 0.1 | | |
| *Bossiaea foliosa* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Calytrix tetragona* | 0.5 | 20 | SG | | | 0.5 | | | | | | |
| *Coronidium monticola* | 0.2 | 5 | FG | | | | | 0.2 | | | | |
| *Hypericum gramineum* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Schoenus apogon* | 0.1 | 35 | GG | | | | 0.1 | | | | | |
| *Convolvulus erubescens* | 0.1 | 1 | OG | | | | | | | 0.1 | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 50** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 729** | | | **27** | **17** | 1 | 1 | 7 | 7 | 1 | 0 | **10** | 4 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **100** | **78.1** | 1.5 | 0.2 | 75.6 | 0.7 | 0.1 | 0 | **21.9** | 21.2 |
| *Themeda triandra* | 20 | 250 | GG | | | | 20 | | | | | |
| *Microlaena stipoides* | 5 | 500 | GG | | | | 5 | | | | | |
| *Panicum effusum* | 50 | 1000 | GG | | | | 50 | | | | | |
| *Rubus fruticosus agg.* | 20 | 25 | HT | | | | | | | | | 20 |
| *Centaurium erythraea* | 0.1 | 100 | EX | | | | | | | | 0.1 | |
| *Hypericum perforatum* | 1 | 100 | HT | | | | | | | | | 1 |
| *Juncus australis* | 0.2 | 10 | GG | | | | 0.2 | | | | | |
| *Verbascum virgatum* | 0.1 | 5 | EX | | | | | | | | 0.1 | |
| *Acacia dealbata* | 1.5 | 25 | TG | | 1.5 | | | | | | | |
| *Persicaria prostrata* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Modiola caroliniana* | 0.1 | 5 | EX | | | | | | | | 0.1 | |
| *Wahlenbergia gracilis* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Dysphania pumilio* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Vulpia myuros* | 0.2 | 150 | EX | | | | | | | | 0.2 | |
| *Exocarpos strictus* | 0.2 | 5 | SG | | | 0.2 | | | | | | |
| *Rytidosperma caespitosum* | 0.1 | 100 | GG | | | | 0.1 | | | | | |
| *Rytidosperma racemosum* | 0.2 | 50 | GG | | | | 0.2 | | | | | |
| *Rosa rubiginosa* | 0.1 | 5 | HT | | | | | | | | | 0.1 |
| *Cheilanthes sieberi* | 0.1 | 50 | EG | | | | | | 0.1 | | | |
| *Solenogyne gunnii* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Rumex brownii* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Aira elegantissima* | 0.1 | 50 | EX | | | | | | | | 0.1 | |
| *Carex inversa* | 0.1 | 25 | GG | | | | 0.1 | | | | | |
| *Senecio prenanthoides* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Acetosella vulgaris* | 0.1 | 50 | HT | | | | | | | | | 0.1 |
| *Oxalis perennans* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Trifolium arvense* | 0.1 | 15 | EX | | | | | | | | 0.1 | |

| | | | Covers | **Native** | Trees | Shrubs | Grass | Forb | Fern | Other | **Exotic** | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 51** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 729** | | | **19** | **14** | 1 | 2 | 6 | 4 | 0 | 1 | **5** | 2 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **102.1** | **101.6** | 0.1 | 0.2 | 100.4 | 0.7 | 0 | 0.2 | **0.5** | 0.2 |
| *Themeda triandra* | 90 | 1000 | GG | | | | 90 | | | | | |
| *Hypericum perforatum* | 0.1 | 20 | HT | | | | | | | | | 0.1 |
| *Dichondra repens* | 0.3 | 200 | FG | | | | | 0.3 | | | | |
| *Rubus fruticosus agg.* | 0.1 | 1 | HT | | | | | | | | | 0.1 |
| *Centaurium erythraea* | 0.1 | 10 | EX | | | | | | | | 0.1 | |
| *Hypochaeris radicata* | 0.1 | 10 | EX | | | | | | | | 0.1 | |
| *Calytrix tetragona* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Elymus scaber* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Austrostipa sp.* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Brachyloma daphnoides* | 0.1 | 3 | SG | | | 0.1 | | | | | | |
| *Rytidosperma pilosum* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Hydrocotyle laxiflora* | 0.2 | 20 | FG | | | | | 0.2 | | | | |
| *Gonocarpus tetragynus* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Acacia dealbata* | 0.1 | 1 | TG | | 0.1 | | | | | | | |
| *Desmodium varians* | 0.2 | 50 | OG | | | | | | | 0.2 | | |
| *Microlaena stipoides* | 10 | 500 | GG | | | | 10 | | | | | |
| *Anagallis arvensis* | 0.1 | 1 | EX | | | | | | | | 0.1 | |
| *Oxalis perennans* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Juncus sp.* | 0.1 | 1 | GG | | | | 0.1 | | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 52** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 729** | | | **26** | **21** | 2 | 5 | 6 | 6 | 1 | 1 | **5** | 2 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **112.1** | **111.1** | 5 | 100.8 | 4.4 | 0.7 | 0.1 | 0.1 | **1** | 0.7 |
| *Calytrix tetragona* | 75 | 1000 | SG | | | 75 | | | | | | |
| *Brachyloma daphnoides* | 25 | 250 | SG | | | 25 | | | | | | |
| *Pimelea curviflora* | 0.5 | 200 | SG | | | 0.5 | | | | | | |
| *Centaurium erythraea* | 0.1 | 50 | EX | | | | | | | | 0.1 | |
| *Hypericum perforatum* | 0.5 | 200 | HT | | | | | | | | | 0.5 |
| *Petrorhagia dubia* | 0.1 | 1 | EX | | | | | | | | 0.1 | |
| *Carex inversa* | 0.1 | 25 | GG | | | | 0.1 | | | | | |
| *Plantago varia* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Eucalyptus dives* | 2 | 1 | TG | | 2 | | | | | | | |
| *Eucalyptus rubida* | 3 | 1 | TG | | 3 | | | | | | | |
| *Acaena ovina* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Bursaria spinosa* | 0.2 | 2 | SG | | | 0.2 | | | | | | |
| *Cassytha glabella* | 0.1 | 25 | OG | | | | | | | 0.1 | | |
| *Senecio linearifolius* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Lomandra filiformis subsp. coriacea* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Rytidosperma pilosum* | 1 | 200 | GG | | | | 1 | | | | | |
| *Microlaena stipoides* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Wahlenbergia stricta* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Themeda triandra* | 3 | 250 | GG | | | | 3 | | | | | |
| *Aira elegantissima* | 0.1 | 15 | EX | | | | | | | | 0.1 | |
| *Hydrocotyle laxiflora* | 0.1 | 15 | FG | | | | | 0.1 | | | | |
| *Cheilanthes sp.* | 0.1 | 1 | EG | | | | | | 0.1 | | | |
| *Dichelachne sp.* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Gonocarpus tetragynus* | 0.2 | 35 | FG | | | | | 0.2 | | | | |
| *Rubus fruticosus agg.* | 0.2 | 5 | HT | | | | | | | | | 0.2 |
| *Leucopogon fletcheri* | 0.1 | 1 | SG | | | 0.1 | | | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 53** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 729** | | | **20** | **16** | 1 | 4 | 5 | 6 | 0 | 0 | **4** | 3 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **155** | **149.7** | 0.1 | 145.6 | 2.4 | 1.6 | 0 | 0 | **5.3** | 0.3 |
| *Themeda triandra* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Calytrix tetragona* | 65 | 500 | SG | | | 65 | | | | | | |
| *Bursaria spinosa* | 80 | 1000 | SG | | | 80 | | | | | | |
| *Centaurium erythraea* | 5 | 100 | EX | | | | | | | | 5 | |
| *Hypericum perforatum* | 0.1 | 100 | HT | | | | | | | | | 0.1 |
| *Oxalis sp.* | 0.2 | 50 | FG | | | | | 0.2 | | | | |
| *Gonocarpus tetragynus* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Rubus fruticosus agg.* | 0.1 | 50 | HT | | | | | | | | | 0.1 |
| *Acacia dealbata* | 0.1 | 1 | TG | | 0.1 | | | | | | | |
| *Acaena ovina* | 1 | 50 | FG | | | | | 1 | | | | |
| *Acetosella vulgaris* | 0.1 | 1 | HT | | | | | | | | | 0.1 |
| *Pimelea curviflora* | 0.5 | 500 | SG | | | 0.5 | | | | | | |
| *Lomandra filiformis subsp. coriacea* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Stackhousia monogyna* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Hydrocotyle laxiflora* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Brachyloma daphnoides* | 0.1 | 50 | SG | | | 0.1 | | | | | | |
| *Juncus sp.* | 2 | 100 | GG | | | | 2 | | | | | |
| *Euchiton involucratus* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Rytidosperma racemosum* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Austrostipa sp.* | 0.1 | 5 | GG | | | | 0.1 | | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 54** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 729** | | | **16** | **14** | 3 | 5 | 0 | 5 | 1 | 0 | **2** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **132.2** | **132** | 11.1 | 120.3 | 0 | 0.5 | 0.1 | 0 | **0.2** | 0 |
| *Callitris endlicheri* | 1 | 4 | TG | | 1 | | | | | | | |
| *Eucalyptus dives* | 0.1 | 3 | TG | | 0.1 | | | | | | | |
| *Eucalyptus rubida* | 10 | 3 | TG | | 10 | | | | | | | |
| *Brachyloma daphnoides* | 40 | 200 | SG | | | 40 | | | | | | |
| *Bursaria spinosa* | 0.2 | 1 | SG | | | 0.2 | | | | | | |
| *Calytrix tetragona* | 60 | 400 | SG | | | 60 | | | | | | |
| *Dillwynia phylicoides* | 20 | 50 | SG | | | 20 | | | | | | |
| *Rhytidosporum sp.* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Caladenia congesta* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Gonocarpus tetragynus* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Hypericum gramineum* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Stylidium graminifolium* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Wahlenbergia stricta* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Aira sp.* | 0.1 | 20 | EX | | | | | | | | 0.1 | |
| *Centaurium erythraea* | 0.1 | 10 | EX | | | | | | | | 0.1 | |
| *Cheilanthes sieberi* | 0.1 | 10 | EG | | | | | | 0.1 | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 55** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 729** | | | **22** | **20** | 3 | 8 | 2 | 5 | 0 | 2 | **2** | 1 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **98** | **97.8** | 15.1 | 81.6 | 0.2 | 0.7 | 0 | 0.2 | **0.2** | 0.1 |
| *Acacia dealbata* | 0.1 | 1 | TG | | 0.1 | | | | | | | |
| *Eucalyptus mannifera* | 10 | 2 | TG | | 10 | | | | | | | |
| *Eucalyptus rubida* | 5 | 2 | TG | | 5 | | | | | | | |
| *Acacia pravissima* | 0.2 | 1 | SG | | | 0.2 | | | | | | |
| *Brachyloma daphnoides* | 0.2 | 20 | SG | | | 0.2 | | | | | | |
| *Bursaria spinosa* | 0.3 | 3 | SG | | | 0.3 | | | | | | |
| *Calytrix tetragona* | 80 | 1000 | SG | | | 80 | | | | | | |
| *Cassinia longifolia* | 0.2 | 6 | SG | | | 0.2 | | | | | | |
| *Dillwynia rudis* | 0.5 | 20 | SG | | | 0.5 | | | | | | |
| *Leucopogon sp.* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Rhytidosporum sp.* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Cassytha sp.* | 0.1 | 10 | OG | | | | | | | 0.1 | | |
| *Hardenbergia violacea* | 0.1 | 1 | OG | | | | | | | 0.1 | | |
| *Hypericum perforatum* | 0.1 | 20 | HT | | | | | | | | | 0.1 |
| *Lomandra glauca* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Poa sieberiana* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Diuris sulphurea* | 0.2 | 20 | FG | | | | | 0.2 | | | | |
| *Geranium solanderi* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Gonocarpus tetragynus* | 0.2 | 30 | FG | | | | | 0.2 | | | | |
| *Patersonia sp.* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Wahlenbergia sp.* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Hypochaeris radicata* | 0.1 | 1 | EX | | | | | | | | 0.1 | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 56** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 729** | | | **37** | **36** | 2 | 16 | 5 | 12 | 0 | 1 | **1** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **98.9** | **98.8** | 22.5 | 7.6 | 67.3 | 1.3 | 0 | 0.1 | **0.1** | 0 |
| *Eucalyptus dives* | 18 | 22 | TG | | 18 | | | | | | | |
| *Eucalyptus rubida* | 4.5 | 4 | TG | | 4.5 | | | | | | | |
| *Senecio sp.* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Poa sieberiana* | 1 | 50 | GG | | | | 1 | | | | | |
| *Banksia canei* | 2 | 2 | SG | | | 2 | | | | | | |
| *Themeda triandra* | 65 | 500 | GG | | | | 65 | | | | | |
| *Desmodium sp.* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Persoonia chamaepeuce* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Hibbertia obtusifolia* | 0.5 | 15 | SG | | | 0.5 | | | | | | |
| *Euchiton involucratus* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Galium gaudichaudii* | 0.1 | 15 | FG | | | | | 0.1 | | | | |
| *Rytidosperma pilosum* | 0.2 | 50 | GG | | | | 0.2 | | | | | |
| *Cassinia longifolia* | 1 | 25 | SG | | | 1 | | | | | | |
| *Bursaria spinosa* | 0.2 | 5 | SG | | | 0.2 | | | | | | |
| *Brachyloma daphnoides* | 2 | 100 | SG | | | 2 | | | | | | |
| *Indigofera australis* | 0.2 | 50 | SG | | | 0.2 | | | | | | |
| *Lepidosperma laterale* | 1 | 100 | GG | | | | 1 | | | | | |
| *Acaena ovina* | 0.1 | 15 | FG | | | | | 0.1 | | | | |
| *Dianella revoluta* | 0.2 | 50 | FG | | | | | 0.2 | | | | |
| *Grevillea rosmarinifolia* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Gonocarpus tetragynus* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Senecio pinnatifolius* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Geranium Sp.* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Stylidium graminifolium* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Cassytha glabella* | 0.1 | 5 | OG | | | | | | | 0.1 | | |
| *Pimelea linifolia* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Pimelea curviflora* | 0.1 | 50 | SG | | | 0.1 | | | | | | |
| *Leucopogon virgatus* | 0.5 | 50 | SG | | | 0.5 | | | | | | |
| *Tetratheca bauerifolia* | 0.2 | 3 | SG | | | 0.2 | | | | | | |
| *Melichrus urceolatus* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Lomandra longifolia* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Hypericum gramineum* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Mirbelia oxylobioides* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Centaurium erythraea* | 0.1 | 25 | EX | | | | | | | | 0.1 | |
| *Astroloma humifusum* | 0.2 | 5 | SG | | | 0.2 | | | | | | |
| *Acacia pravissima* | 0.2 | 3 | SG | | | 0.2 | | | | | | |
| *Wahlenbergia stricta* | 0.1 | 5 | FG | | | | | 0.1 | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 57** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 729** | | | **25** | **22** | 2 | 11 | 2 | 6 | 0 | 1 | **3** | 1 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **54.75** | **54.45** | 10.15 | 43.2 | 0.3 | 0.7 | 0 | 0.1 | **0.3** | 0.1 |
| *Eucalyptus dives* | 0.15 | 22 | TG | | 0.15 | | | | | | | |
| *Eucalyptus rubida* | 10 | 10 | TG | | 10 | | | | | | | |
| *Calytrix tetragona* | 40 | 500 | SG | | | 40 | | | | | | |
| *Hypericum gramineum* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Brachyloma daphnoides* | 1 | 30 | SG | | | 1 | | | | | | |
| *Acacia pravissima* | 0.5 | 0.5 | SG | | | 0.5 | | | | | | |
| *Astroloma humifusum* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Melichrus urceolatus* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Dillwynia sp.* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Leucopogon virgatus* | 0.2 | 15 | SG | | | 0.2 | | | | | | |
| *Hardenbergia violacea* | 0.1 | 5 | OG | | | | | | | 0.1 | | |
| *Hibbertia obtusifolia* | 0.1 | 15 | SG | | | 0.1 | | | | | | |
| *Hypericum perforatum* | 0.1 | 20 | HT | | | | | | | | | 0.1 |
| *Cassinia longifolia* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Banksia canei* | 0.5 | 1 | SG | | | 0.5 | | | | | | |
| *Lomandra filiformis* | 0.2 | 50 | GG | | | | 0.2 | | | | | |
| *Gonocarpus tetragynus* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Rytidosperma pilosum* | 0.1 | 15 | GG | | | | 0.1 | | | | | |
| *Senecio quadridentatus* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Centaurium erythraea* | 0.1 | 5 | EX | | | | | | | | 0.1 | |
| *Hovea linearis* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Senecio pinnatifolius* | 0.2 | 200 | FG | | | | | 0.2 | | | | |
| *Geranium Sp.* | 0.1 | 15 | FG | | | | | 0.1 | | | | |
| *Mirbelia oxylobioides* | 0.5 | 10 | SG | | | 0.5 | | | | | | |
| *Aira elegantissima* | 0.1 | 10 | EX | | | | | | | | 0.1 | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 58** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 729** | | | **24** | **21** | 3 | 8 | 4 | 5 | 1 | 0 | **3** | 1 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **79** | **78.7** | 25 | 52.1 | 0.9 | 0.6 | 0.1 | 0 | **0.3** | 0.1 |
| *Eucalyptus dives* | 13 | 22 | TG | | 13 | | | | | | | |
| *Eucalyptus rubida* | 2 | 7 | TG | | 2 | | | | | | | |
| *Wahlenbergia stricta* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Grevillea lanigera* | 0.5 | 5 | SG | | | 0.5 | | | | | | |
| *Eucalyptus viminalis* | 10 | 22 | TG | | 10 | | | | | | | |
| *Exocarpos strictus* | 0.5 | 20 | SG | | | 0.5 | | | | | | |
| *Calytrix tetragona* | 35 | 200 | SG | | | 35 | | | | | | |
| *Hypericum perforatum* | 0.1 | 25 | HT | | | | | | | | | 0.1 |
| *Cheilanthes sieberi* | 0.1 | 1 | EG | | | | | | 0.1 | | | |
| *Brachyloma daphnoides* | 5 | 50 | SG | | | 5 | | | | | | |
| *Lomandra filiformis* | 0.1 | 15 | GG | | | | 0.1 | | | | | |
| *Centaurium erythraea* | 0.1 | 5 | EX | | | | | | | | 0.1 | |
| *Euchiton involucratus* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Aira caryophyllea* | 0.1 | 25 | EX | | | | | | | | 0.1 | |
| *Carex inversa* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Banksia canei* | 5 | 10 | SG | | | 5 | | | | | | |
| *Bursaria spinosa* | 5 | 100 | SG | | | 5 | | | | | | |
| *Rytidosperma racemosum* | 0.2 | 50 | GG | | | | 0.2 | | | | | |
| *Stackhousia monogyna* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Lomandra longifolia* | 0.5 | 15 | GG | | | | 0.5 | | | | | |
| *Acacia pravissima* | 1 | 10 | SG | | | 1 | | | | | | |
| *Senecio prenanthoides* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Geranium Sp.* | 0.2 | 3 | FG | | | | | 0.2 | | | | |
| *Acacia siculiformis* | 0.1 | 1 | SG | | | 0.1 | | | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 59** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 729** | | | **24** | **24** | 2 | 15 | 3 | 4 | 0 | 0 | **0** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **62.4** | **62.4** | 15 | 24 | 23 | 0.4 | 0 | 0 | **0** | 0 |
| *Bossiaea sp.* | 5 | 45 | SG | | | 5 | | | | | | |
| *Brachyloma daphnoides* | 0.5 | 9 | SG | | | 0.5 | | | | | | |
| *Cassinia longifolia* | 1 | 4 | SG | | | 1 | | | | | | |
| *Coprosma hirtella* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Daviesia latifolia* | 12 | 75 | SG | | | 12 | | | | | | |
| *Diuris sp.* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Eucalyptus dives* | 10 | 18 | TG | | 10 | | | | | | | |
| *Eucalyptus mannifera* | 5 | 3 | TG | | 5 | | | | | | | |
| *Exocarpos strictus* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Grevillea rosmarinifolia* | 1 | 85 | SG | | | 1 | | | | | | |
| *Hibbertia obtusifolia* | 0.1 | 3 | SG | | | 0.1 | | | | | | |
| *Indigofera australis* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Leptomeria drupacea* | 0.5 | 6 | SG | | | 0.5 | | | | | | |
| *Leucopogon fletcheri* | 0.5 | 5 | SG | | | 0.5 | | | | | | |
| *Monotoca scoparia* | 2 | 15 | SG | | | 2 | | | | | | |
| *Persoonia chamaepeuce* | 0.8 | 40 | SG | | | 0.8 | | | | | | |
| *Pimelea sp.* | 0.2 | 30 | SG | | | 0.2 | | | | | | |
| *Platylobium formosum* | 0.1 | 14 | SG | | | 0.1 | | | | | | |
| *Poa sp.* | 1 | 30 | GG | | | | 1 | | | | | |
| *Poa sieberiana* | 20 | 500 | GG | | | | 20 | | | | | |
| *Stylidium graminifolium* | 0.1 | 12 | FG | | | | | 0.1 | | | | |
| *Themeda triandra* | 2 | 30 | GG | | | | 2 | | | | | |
| *Viola sp.* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Wahlenbergia sp.* | 0.1 | 3 | FG | | | | | 0.1 | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 60** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 729** | | | **37** | **35** | 3 | 15 | 3 | 12 | 0 | 2 | **2** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **211.6** | **211.3** | 55.1 | 133.9 | 20.5 | 1.4 | 0 | 0.4 | **0.3** | 0 |
| *Eucalyptus dives* | 30 | 10 | TG | | 30 | | | | | | | |
| *Eucalyptus robertsonii* | 0.1 | 1 | TG | | 0.1 | | | | | | | |
| *Eucalyptus rubida* | 25 | 4 | TG | | 25 | | | | | | | |
| *Astroloma humifusum* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Banksia canei* | 45 | 5 | SG | | | 45 | | | | | | |
| *Brachyloma daphnoides* | 20 | 50 | SG | | | 20 | | | | | | |
| *Bursaria spinosa* | 2 | 5 | SG | | | 2 | | | | | | |
| *Cassinia longifolia* | 20 | 50 | SG | | | 20 | | | | | | |
| *Dillwynia phylicoides* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Exocarpos strictus* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Gompholobium huegelii* | 0.3 | 20 | SG | | | 0.3 | | | | | | |
| *Hibbertia obtusifolia* | 0.2 | 20 | SG | | | 0.2 | | | | | | |
| *Indigofera australis* | 0.2 | 10 | SG | | | 0.2 | | | | | | |
| *Leucopogon virgatus* | 0.4 | 20 | SG | | | 0.4 | | | | | | |
| *Mirbelia oxylobioides* | 45 | 50 | SG | | | 45 | | | | | | |
| *Pimelea curviflora* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Rhytidosporum sp.* | 0.3 | 50 | SG | | | 0.3 | | | | | | |
| *Tetratheca bauerifolia* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Cassytha glabella* | 0.3 | 10 | OG | | | | | | | 0.3 | | |
| *Glycine clandestina* | 0.1 | 10 | OG | | | | | | | 0.1 | | |
| *Lepidosperma cf. laterale* | 0.2 | 210 | GG | | | | 0.2 | | | | | |
| *Microlaena stipoides* | 0.3 | 50 | GG | | | | 0.3 | | | | | |
| *Poa sp.* | 20 | 100 | GG | | | | 20 | | | | | |
| *Asperula scoparia* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Dianella revoluta* | 0.3 | 40 | FG | | | | | 0.3 | | | | |
| *Diuris sulphurea* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Geranium obtusisepalum* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Gonocarpus sp.* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Gonocarpus tetragynus* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Hovea heterophylla* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Hydrocotyle laxiflora* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Hypericum gramineum* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Ranunculus lappaceus* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Senecio quadridentatus* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Wahlenbergia sp.* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Aira sp.* | 0.2 | 80 | EX | | | | | | | | 0.2 | |
| *Centaurium erythraea* | 0.1 | 1 | EX | | | | | | | | 0.1 | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 61** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 729** | | | **42** | **41** | 2 | 16 | 4 | 17 | 0 | 2 | **1** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **163.9** | **163.8** | 60 | 57.6 | 44.1 | 1.9 | 0 | 0.2 | **0.1** | 0 |
| *Eucalyptus dives* | 55 | | TG | | 55 | | | | | | | |
| *Eucalyptus rubida* | 5 | 1 | TG | | 5 | | | | | | | |
| *Bossiaea foliosa* | 20 | 100 | SG | | | 20 | | | | | | |
| *Brachyloma daphnoides* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Bursaria spinosa* | 2 | 2 | SG | | | 2 | | | | | | |
| *Cassinia longifolia* | 5 | 10 | SG | | | 5 | | | | | | |
| *Chorizema parviflorum* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Coprosma hirtella* | 20 | 30 | SG | | | 20 | | | | | | |
| *Daviesia latifolia* | 2 | 10 | SG | | | 2 | | | | | | |
| *Exocarpos strictus* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Grevillea rosmarinifolia* | 2 | 20 | SG | | | 2 | | | | | | |
| *Hibbertia obtusifolia* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Leucopogon fletcheri* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Mirbelia oxylobioides* | 0.5 | 10 | SG | | | 0.5 | | | | | | |
| *Persoonia chamaepeuce* | 5 | 50 | SG | | | 5 | | | | | | |
| *Pimelea linifolia* | 0.2 | 30 | SG | | | 0.2 | | | | | | |
| *Platylobium formosum* | 0.3 | 10 | SG | | | 0.3 | | | | | | |
| *Tetratheca bauerifolia* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Glycine clandestina* | 0.1 | 10 | OG | | | | | | | 0.1 | | |
| *Hardenbergia violacea* | 0.1 | 5 | OG | | | | | | | 0.1 | | |
| *Lomandra filiformis* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Lomandra longifolia* | 2 | 30 | GG | | | | 2 | | | | | |
| *Poa labillardierei* | 40 | 200 | GG | | | | 40 | | | | | |
| *Themeda triandra* | 2 | 50 | GG | | | | 2 | | | | | |
| *Asperula scoparia* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Brachyscome scapigera* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Chrysocephalum apiculatum* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Dianella revoluta* | 0.2 | 20 | FG | | | | | 0.2 | | | | |
| *Diuris pardina* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Geranium obtusisepalum* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Gonocarpus tetragynus* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Hydrocotyle laxiflora* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Hypericum gramineum* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Ranunculus lappaceus* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Senecio sp.* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Stackhousia monogyna* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Stellaria pungens* | 0.2 | 50 | FG | | | | | 0.2 | | | | |
| *Stylidium graminifolium* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Thelymitra sp.* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Veronica derwentiana* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Viola betonicifolia* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Centaurium erythraea* | 0.1 | 1 | EX | | | | | | | | 0.1 | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Covers** | **Native** | Trees | Shrubs | Grass | Forb | Fern | Other | **Exotic** | HighThreat |
| **Plot 62** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 729** | | | **44** | **43** | 2 | 16 | 7 | 16 | 1 | 1 | **1** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **79.3** | **79.2** | 30 | 21.5 | 25.7 | 1.8 | 0.1 | 0.1 | **0.1** | 0 |
| *Eucalyptus dives* | 20 | 17 | TG | | 20 | | | | | | | |
| *Eucalyptus rubida* | 10 | 4 | TG | | 10 | | | | | | | |
| *Astroloma humifusum* | 0.2 | 30 | SG | | | 0.2 | | | | | | |
| *Banksia canei* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Brachyloma daphnoides* | 0.1 | 6 | SG | | | 0.1 | | | | | | |
| *Bursaria spinosa* | 0.2 | 4 | SG | | | 0.2 | | | | | | |
| *Cassinia aculeata* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Cassinia longifolia* | 2 | 20 | SG | | | 2 | | | | | | |
| *Choretrum pauciflorum* | 0.7 | 20 | SG | | | 0.7 | | | | | | |
| *Coprosma hirtella* | 2 | 60 | SG | | | 2 | | | | | | |
| *Daviesia latifolia* | 15 | 100 | SG | | | 15 | | | | | | |
| *Grevillea rosmarinifolia* | 0.2 | 50 | SG | | | 0.2 | | | | | | |
| *Leucopogon fletcheri* | 0.2 | 20 | SG | | | 0.2 | | | | | | |
| *Mirbelia oxylobioides* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Monotoca scoparia* | 0.1 | 8 | SG | | | 0.1 | | | | | | |
| *Pimelea linifolia* | 0.2 | 20 | SG | | | 0.2 | | | | | | |
| *Platylobium formosum* | 0.2 | 30 | SG | | | 0.2 | | | | | | |
| *Tetratheca bauerifolia* | 0.1 | 20 | SG | | | 0.1 | | | | | | |
| *Glycine clandestina* | 0.1 | 1 | OG | | | | | | | 0.1 | | |
| *Lepidosperma cf. laterale* | 0.2 | 20 | GG | | | | 0.2 | | | | | |
| *Lomandra filiformis* | 0.1 | 20 | GG | | | | 0.1 | | | | | |
| *Lomandra longifolia* | 5 | 300 | GG | | | | 5 | | | | | |
| *Lomandra multiflora* | 0.1 | 3 | GG | | | | 0.1 | | | | | |
| *Poa sieberiana* | 20 | 1000 | GG | | | | 20 | | | | | |
| *Poa sp.* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Themeda triandra* | 0.2 | 40 | GG | | | | 0.2 | | | | | |
| *Asperula scoparia* | 0.2 | 100 | FG | | | | | 0.2 | | | | |
| *Dianella revoluta* | 0.1 | 4 | FG | | | | | 0.1 | | | | |
| *Diuris pardina* | 0.1 | 3 | FG | | | | | 0.1 | | | | |
| *Euphrasia collina subsp. paludosa* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Geranium obtusisepalum* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Gonocarpus tetragynus* | 0.1 | 40 | FG | | | | | 0.1 | | | | |
| *Hypericum gramineum* | 0.1 | 30 | FG | | | | | 0.1 | | | | |
| *Picris angustifolia* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Ranunculus lappaceus* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Stackhousia monogyna* | 0.1 | 7 | FG | | | | | 0.1 | | | | |
| *Stylidium graminifolium* | 0.2 | 80 | FG | | | | | 0.2 | | | | |
| *Thelymitra megacalyptra* | 0.1 | 3 | FG | | | | | 0.1 | | | | |
| *Vernonia cinerea* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Veronica derwentiana* | 0.1 | 6 | FG | | | | | 0.1 | | | | |
| *Viola betonicifolia* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Wahlenbergia stricta* | 0.1 | 4 | FG | | | | | 0.1 | | | | |
| *Centaurium erythraea* | 0.1 | 2 | EX | | | | | | | | 0.1 | |
| *Pteridium esculentum* | 0.1 | 2 | EG | | | | | | 0.1 | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 63** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 729** | | | **29** | **28** | 2 | 9 | 4 | 10 | 1 | 2 | **1** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **45.3** | **45.2** | 30 | 9.1 | 4.6 | 1.2 | 0.1 | 0.2 | **0.1** | 0 |
| *Eucalyptus dives* | 25 | 15 | TG | | 25 | | | | | | | |
| *Eucalyptus nortonii* | 5 | 4 | TG | | 5 | | | | | | | |
| *Banksia canei* | 3 | 9 | SG | | | 3 | | | | | | |
| *Brachyloma daphnoides* | 5 | 150 | SG | | | 5 | | | | | | |
| *Cassinia longifolia* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Dillwynia crispii* | 0.1 | 8 | SG | | | 0.1 | | | | | | |
| *Hibbertia obtusifolia* | 0.2 | 7 | SG | | | 0.2 | | | | | | |
| *Leucopogon virgatus* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Monotoca scoparia* | 0.4 | 5 | SG | | | 0.4 | | | | | | |
| *Omphacomeria acerba* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Tetratheca bauerifolia* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Amyema pendula* | 0.1 | 1 | OG | | | | | | | 0.1 | | |
| *Hardenbergia violacea* | 0.1 | 1 | OG | | | | | | | 0.1 | | |
| *Dichelachne sp.* | 0.1 | 30 | GG | | | | 0.1 | | | | | |
| *Lomandra longifolia* | 0.4 | 30 | GG | | | | 0.4 | | | | | |
| *Lomandra multiflora* | 0.1 | 8 | GG | | | | 0.1 | | | | | |
| *Poa sieberiana* | 4 | 200 | GG | | | | 4 | | | | | |
| *Caladenia gracilis* | 0.1 | 3 | FG | | | | | 0.1 | | | | |
| *Crassula sieberiana* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Daucus glochidiatus* | 0.1 | 3 | FG | | | | | 0.1 | | | | |
| *Dianella revoluta* | 0.2 | 20 | FG | | | | | 0.2 | | | | |
| *Gonocarpus tetragynus* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Hovea heterophylla* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Senecio quadridentatus* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Senecio sp.* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Stylidium graminifolium* | 0.2 | 60 | FG | | | | | 0.2 | | | | |
| *Wahlenbergia stricta* | 0.1 | 4 | FG | | | | | 0.1 | | | | |
| *Aira sp.* | 0.1 | 2 | EX | | | | | | | | 0.1 | |
| *Hypolepis sp.* | 0.1 | 4 | EG | | | | | | 0.1 | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 64** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 729** | | | **41** | **36** | 5 | 11 | 8 | 12 | 0 | 0 | **5** | 2 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **167.8** | **152.3** | 19 | 69.3 | 62.6 | 1.4 | 0 | 0 | **15.5** | 15.1 |
| *Eucalyptus dives* | 4 | 9 | TG | | 4 | | | | | | | |
| *Eucalyptus robertsonii* | 7 | 2 | TG | | 7 | | | | | | | |
| *Eucalyptus rubida* | 2 | 2 | TG | | 2 | | | | | | | |
| *Eucalyptus viminalis* | 5 | 2 | TG | | 5 | | | | | | | |
| *Exocarpos strictus* | 0.3 | 25 | SG | | | 0.3 | | | | | | |
| *Centaurium erythraea* | 0.2 | 150 | EX | | | | | | | | 0.2 | |
| *Microlaena stipoides* | 30 | 500 | GG | | | | 30 | | | | | |
| *Poranthera microphylla* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Dichondra repens* | 0.1 | 100 | FG | | | | | 0.1 | | | | |
| *Astroloma humifusum* | 0.2 | 10 | SG | | | 0.2 | | | | | | |
| *Acaena ovina* | 0.2 | 50 | FG | | | | | 0.2 | | | | |
| *Cymbonotus lawsonianus* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Leucopogon fletcheri* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Wahlenbergia communis* | 0.2 | 15 | FG | | | | | 0.2 | | | | |
| *Asperula conferta* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Hypericum gramineum* | 0.1 | 100 | FG | | | | | 0.1 | | | | |
| *Callitris endlicheri* | 1 | 4 | TG | | 1 | | | | | | | |
| *Banksia canei* | 1 | 2 | SG | | | 1 | | | | | | |
| *Rytidosperma pilosum* | 2 | 250 | GG | | | | 2 | | | | | |
| *Pimelea linifolia* | 0.2 | 100 | SG | | | 0.2 | | | | | | |
| *Poa sieberiana* | 30 | 250 | GG | | | | 30 | | | | | |
| *Lomandra filiformis subsp. coriacea* | 0.2 | 30 | GG | | | | 0.2 | | | | | |
| *Hibbertia obtusifolia* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Acacia pravissima* | 65 | 250 | SG | | | 65 | | | | | | |
| *Senecio prenanthoides* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Plantago sp.* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Hypericum perforatum* | 15 | 500 | HT | | | | | | | | | 15 |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Tetratheca bauerifolia* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Platylobium formosum* | 2 | 150 | SG | | | 2 | | | | | | |
| *Elymus scaber* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Lomandra filiformis subsp. Filiformis* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Aira elegantissima* | 0.1 | 100 | EX | | | | | | | | 0.1 | |
| *Taraxacum officinale* | 0.1 | 1 | EX | | | | | | | | 0.1 | |
| *Hydrocotyle laxiflora* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Gonocarpus tetragynus* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Galium gaudichaudii* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Rubus fruticosus agg.* | 0.1 | 5 | HT | | | | | | | | | 0.1 |
| *Lomandra multiflora* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Luzula flaccida* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Gompholobium huegelii* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Brachyloma daphnoides* | 0.2 | 15 | SG | | | 0.2 | | | | | | |
| *Rosa rubiginosa* | 0.1 | 1 | HT | | | | | | | | | 0.1 |
| *Pimelea curviflora* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Chrysocephalum semipapposum* | 0.1 | 15 | FG | | | | | 0.1 | | | | |
| *Daviesia mimosoides subsp. mimosoides* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Calytrix tetragona* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Themeda triandra* | 0.5 | 25 | GG | | | | 0.5 | | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 65** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 729** | | | **28** | **25** | 2 | 12 | 7 | 3 | 0 | 1 | **3** | 1 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **83.5** | **83.2** | 1.3 | 70.7 | 10.8 | 0.3 | 0 | 0.1 | **0.3** | 0.1 |
| *Themeda triandra* | 10 | 500 | GG | | | | 10 | | | | | |
| *Eucalyptus dives* | 1 | 2 | TG | | 1 | | | | | | | |
| *Calytrix tetragona* | 65 | 300 | SG | | | 65 | | | | | | |
| *Brachyloma daphnoides* | 2 | 100 | SG | | | 2 | | | | | | |
| *Cassytha glabella* | 0.1 | 50 | OG | | | | | | | 0.1 | | |
| *Dillwynia sp.* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Gonocarpus tetragynus* | 0.1 | 25 | FG | | | | | 0.1 | | | | |
| *Austrostipa sp.* | 0.1 | 3 | GG | | | | 0.1 | | | | | |
| *Mirbelia oxylobioides* | 2 | 25 | SG | | | 2 | | | | | | |
| *Pimelea linifolia* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Acacia pravissima* | 0.2 | 5 | SG | | | 0.2 | | | | | | |
| *Hovea linearis* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Acacia buxifolia* | 0.2 | 5 | SG | | | 0.2 | | | | | | |
| *Lomandra filiformis subsp. coriacea* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Centaurium erythraea* | 0.1 | 5 | EX | | | | | | | | 0.1 | |
| *Hypericum gramineum* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Hypericum perforatum* | 0.1 | 25 | HT | | | | | | | | | 0.1 |
| *Acacia dealbata* | 0.3 | 30 | TG | | 0.3 | | | | | | | |
| *Cassinia longifolia* | 0.5 | 10 | SG | | | 0.5 | | | | | | |
| *Bursaria spinosa* | 0.2 | 2 | SG | | | 0.2 | | | | | | |
| *Pimelea curviflora* | 0.1 | 25 | SG | | | 0.1 | | | | | | |
| *Exocarpos strictus* | 0.2 | 5 | SG | | | 0.2 | | | | | | |
| *Rytidosperma pilosum* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Lomandra filiformis subsp. filiformis* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Vulpia myuros* | 0.1 | 25 | EX | | | | | | | | 0.1 | |
| *Lomandra longifolia* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Astroloma humifusum* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Poa sieberiana* | 0.3 | 25 | GG | | | | 0.3 | | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 66** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 729** | | | **38** | **38** | 3 | 14 | 6 | 12 | 0 | 3 | **0** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Cover** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **128.8** | **128.8** | 61 | 48.7 | 17.1 | 1.6 | 0 | 0.4 | **0** | 0 |
| *Eucalyptus dives* | 40 | 50 | TG | | 40 | | | | | | | |
| *Choretrum sp.* | 30 | 100 | SG | | | 30 | | | | | | |
| *Eucalyptus rubida* | 20 | 8 | TG | | 20 | | | | | | | |
| *Poa sieberiana* | 15 | 400 | GG | | | | 15 | | | | | |
| *Cassinia aculeata* | 10 | 40 | SG | | | 10 | | | | | | |
| *Platylobium formosum* | 4 | 50 | SG | | | 4 | | | | | | |
| *Cassinia longifolia* | 2 | 20 | SG | | | 2 | | | | | | |
| *Brachyloma daphnoides* | 1 | 10 | SG | | | 1 | | | | | | |
| *Eucalyptus robertsonii* | 1 | 2 | TG | | 1 | | | | | | | |
| *Poa sp.* | 1 | 80 | GG | | | | 1 | | | | | |
| *Themeda triandra* | 0.7 | 20 | GG | | | | 0.7 | | | | | |
| *Daviesia sp.* | 0.3 | 6 | SG | | | 0.3 | | | | | | |
| *Dianella revoluta* | 0.3 | 30 | FG | | | | | 0.3 | | | | |
| *Hibbertia obtusifolia* | 0.3 | 15 | SG | | | 0.3 | | | | | | |
| *Gonocarpus tetragynus* | 0.2 | 80 | FG | | | | | 0.2 | | | | |
| *Hardenbergia violacea* | 0.2 | 4 | OG | | | | | | | 0.2 | | |
| *Leucopogon virgatus* | 0.2 | 10 | SG | | | 0.2 | | | | | | |
| *Lomandra longifolia* | 0.2 | 30 | GG | | | | 0.2 | | | | | |
| *Mirbelia oxylobioides* | 0.2 | 4 | SG | | | 0.2 | | | | | | |
| *Persoonia chamaepeuce* | 0.2 | 10 | SG | | | 0.2 | | | | | | |
| *Stylidium graminifolium* | 0.2 | 20 | FG | | | | | 0.2 | | | | |
| *Tetratheca ciliata* | 0.2 | 20 | SG | | | 0.2 | | | | | | |
| *Caladenia gracilis* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Cassytha melantha* | 0.1 | 1 | OG | | | | | | | 0.1 | | |
| *Dichelachne sp.* | 0.1 | 3 | GG | | | | 0.1 | | | | | |
| *Geranium obtusisepalum* | 0.1 | 3 | FG | | | | | 0.1 | | | | |
| *Glycine clandestina* | 0.1 | 2 | OG | | | | | | | 0.1 | | |
| *Grevillea rosmarinifolia* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Hovea heterophylla* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Lomandra filiformis* | 0.1 | 20 | GG | | | | 0.1 | | | | | |
| *Pimelea glauca* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Pterostylis longifolia* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Rhytidosporum sp.* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Senecio gunnii* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Senecio prenanthoides* | 0.1 | 4 | FG | | | | | 0.1 | | | | |
| *Senecio sp.* | 0.1 | 4 | FG | | | | | 0.1 | | | | |
| *Stackhousia monogyna* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Wahlenbergia stricta* | 0.1 | 4 | FG | | | | | 0.1 | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 67** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 300** | | | **27** | **27** | 3 | 11 | 4 | 4 | 1 | 4 | **0** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **123.7** | **123.7** | 33 | 34 | 49 | 2.2 | 5 | 0.5 | **0** | 0 |
| *Banksia canei* | 1 | 2 | SG | | | 1 | | | | | | |
| *Billardiera scandens* | 0.2 | 40 | OG | | | | | | | 0.2 | | |
| *Cassinia aculeata* | 1 | 8 | SG | | | 1 | | | | | | |
| *Cassinia longifolia* | 4 | 10 | SG | | | 4 | | | | | | |
| *Cassytha pubescens* | 0.1 | 50 | OG | | | | | | | 0.1 | | |
| *Cassytha sp.* | 0.1 | 25 | OG | | | | | | | 0.1 | | |
| *Dillwynia phylicoides* | 10 | 110 | SG | | | 10 | | | | | | |
| *Eucalyptus dalrympleana* | 5 | 2 | TG | | 5 | | | | | | | |
| *Eucalyptus dives* | 20 | 36 | TG | | 20 | | | | | | | |
| *Eucalyptus robertsonii* | 8 | 11 | TG | | 8 | | | | | | | |
| *Geranium sp.* | 0.1 | 60 | FG | | | | | 0.1 | | | | |
| *Glycine clandestina* | 0.1 | 30 | OG | | | | | | | 0.1 | | |
| *Gompholobium sp.* | 1 | 18 | SG | | | 1 | | | | | | |
| *Gonocarpus tetragynus* | 1 | 20 | FG | | | | | 1 | | | | |
| *Grevillea rosmarinifolia* | 1 | 3 | SG | | | 1 | | | | | | |
| *Hibbertia obtusifolia* | 1 | 7 | SG | | | 1 | | | | | | |
| *Leptomeria drupacea* | 2 | 6 | SG | | | 2 | | | | | | |
| *Leucopogon fletcheri* | 1 | 6 | SG | | | 1 | | | | | | |
| *Lomandra filiformis* | 2 | 22 | GG | | | | 2 | | | | | |
| *Lomandra longifolia* | 2 | 20 | GG | | | | 2 | | | | | |
| *Monotoca scoparia* | 2 | 15 | SG | | | 2 | | | | | | |
| *Platylobium formosum* | 10 | 90 | SG | | | 10 | | | | | | |
| *Poa sieberiana* | 40 | 500 | GG | | | | 40 | | | | | |
| *Poa sp.* | 5 | 60 | GG | | | | 5 | | | | | |
| *Pteridium esculentum* | 5 | 60 | EG | | | | | | 5 | | | |
| *Stellaria pungens* | 0.1 | 45 | FG | | | | | 0.1 | | | | |
| *Stylidium graminifolium* | 1 | 30 | FG | | | | | 1 | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Covers** | **Native** | Trees | Shrubs | Grass | Forb | Fern | Other | **Exotic** | HighThreat |
| **Plot 68** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 729** | | | **18** | **18** | 3 | 10 | 3 | 2 | 0 | 0 | **0** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **95.7** | **95.7** | 28 | 15.5 | 52 | 0.2 | 0 | 0 | **0** | 0 |
| *Eucalyptus dives* | 15 | 31 | TG | | 15 | | | | | | | |
| *Eucalyptus robertsonii* | 8 | 14 | TG | | 8 | | | | | | | |
| *Eucalyptus rubida* | 5 | 6 | TG | | 5 | | | | | | | |
| *Leptomeria drupacea* | 3 | 11 | SG | | | 3 | | | | | | |
| *Platylobium formosum* | 4 | 50 | SG | | | 4 | | | | | | |
| *Leucopogon fletcheri* | 3 | 25 | SG | | | 3 | | | | | | |
| *Leucopogon virgatus* | 1 | 15 | SG | | | 1 | | | | | | |
| *Banksia canei* | 1 | 2 | SG | | | 1 | | | | | | |
| *Pimelea linifolia* | 1 | 40 | SG | | | 1 | | | | | | |
| *Gompholobium sp.* | 1 | 25 | SG | | | 1 | | | | | | |
| *Stylidium graminifolium* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Poa sieberiana* | 40 | 400 | GG | | | | 40 | | | | | |
| *Stellaria pungens* | 0.1 | 30 | FG | | | | | 0.1 | | | | |
| *Monotoca scoparia* | 1 | 4 | SG | | | 1 | | | | | | |
| *Grevillea sp.* | 0.2 | 4 | SG | | | 0.2 | | | | | | |
| *Lomandra filiformis* | 2 | 25 | GG | | | | 2 | | | | | |
| *Poa sp.* | 10 | 300 | GG | | | | 10 | | | | | |
| *Cassinia longifolia* | 0.3 | 2 | SG | | | 0.3 | | | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 69** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 729** | | | **33** | **30** | 3 | 13 | 5 | 7 | 1 | 1 | **3** | 2 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **42.1** | **41.7** | 8 | 31.5 | 1.3 | 0.7 | 0.1 | 0.1 | **0.4** | 0.3 |
| *Bursaria spinosa* | 0.1 | 3 | SG | | | 0.1 | | | | | | |
| *Eucalyptus dives* | 2 | 4 | TG | | 2 | | | | | | | |
| *Carex appressa* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Dillwynia sp.* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Indigofera australis* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Senecio gunnii* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Exocarpos strictus* | 0.2 | 5 | SG | | | 0.2 | | | | | | |
| *Leptospermum sp.* | 0.2 | 5 | SG | | | 0.2 | | | | | | |
| *Acaena novae-zelandiae* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Bossiaea foliosa* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Euchiton involucratus* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Leucopogon virgatus* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Lomandra filiformis subsp. coriacea* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Oxalis perennans* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Brachyloma daphnoides* | 0.2 | 10 | SG | | | 0.2 | | | | | | |
| *Eucalyptus rubida* | 5 | 11 | TG | | 5 | | | | | | | |
| *Cassytha sp.* | 0.1 | 20 | OG | | | | | | | 0.1 | | |
| *Cheilanthes sieberi* | 0.1 | 20 | EG | | | | | | 0.1 | | | |
| *Pimelea linifolia* | 0.1 | 20 | SG | | | 0.1 | | | | | | |
| *Leucopogon fletcheri* | 0.2 | 20 | SG | | | 0.2 | | | | | | |
| *Acacia pravissima* | 0.1 | 25 | SG | | | 0.1 | | | | | | |
| *Gonocarpus tetragynus* | 0.1 | 30 | FG | | | | | 0.1 | | | | |
| *Rubus fruticosus agg.* | 0.1 | 30 | HT | | | | | | | | | 0.1 |
| *Stellaria pungens* | 0.1 | 30 | FG | | | | | 0.1 | | | | |
| *Rytidosperma pilosum* | 0.1 | 50 | GG | | | | 0.1 | | | | | |
| *Acacia dealbata* | 1 | 50 | TG | | 1 | | | | | | | |
| *Cassinia longifolia* | 20 | 60 | SG | | | 20 | | | | | | |
| *Centaurium erythraea* | 0.1 | 100 | EX | | | | | | | | 0.1 | |
| *Lomandra filiformis subsp. filiformis* | 0.5 | 100 | GG | | | | 0.5 | | | | | |
| *Calytrix tetragona* | 10 | 100 | SG | | | 10 | | | | | | |
| *Hypericum perforatum* | 0.2 | 150 | HT | | | | | | | | | 0.2 |
| *Microlaena stipoides* | 0.5 | 200 | GG | | | | 0.5 | | | | | |
| *Hydrocotyle laxiflora* | 0.1 | 10 | FG | | | | | 0.1 | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 70** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 729** | | | **31** | **30** | 2 | 13 | 2 | 11 | 0 | 2 | **1** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **43.5** | **43.4** | 15 | 11.8 | 15 | 1.4 | 0 | 0.2 | **0.1** | 0 |
| *Eucalyptus dives* | 10 | 25 | TG | | 10 | | | | | | | |
| *Eucalyptus rubida* | 5 | 4 | TG | | 5 | | | | | | | |
| *Banksia canei* | 0.2 | 1 | SG | | | 0.2 | | | | | | |
| *Cassinia longifolia* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Choretrum pauciflorum* | 3 | 60 | SG | | | 3 | | | | | | |
| *Grevillea rosmarinifolia* | 1 | 40 | SG | | | 1 | | | | | | |
| *Hibbertia obtusifolia* | 0.3 | 20 | SG | | | 0.3 | | | | | | |
| *Hovea lanceolata* | 0.5 | 40 | SG | | | 0.5 | | | | | | |
| *Leucopogon virgatus* | 0.2 | 20 | SG | | | 0.2 | | | | | | |
| *Mirbelia oxylobioides* | 2 | 50 | SG | | | 2 | | | | | | |
| *Monotoca scoparia* | 0.2 | 30 | SG | | | 0.2 | | | | | | |
| *Persoonia chamaepeuce* | 0.1 | 3 | SG | | | 0.1 | | | | | | |
| *Pimelea linifolia* | 0.1 | 15 | SG | | | 0.1 | | | | | | |
| *Platylobium formosum* | 4 | 70 | SG | | | 4 | | | | | | |
| *Tetratheca bauerifolia* | 0.1 | 30 | SG | | | 0.1 | | | | | | |
| *Cassytha melantha* | 0.1 | 10 | OG | | | | | | | 0.1 | | |
| *Hardenbergia violacea* | 0.1 | 3 | OG | | | | | | | 0.1 | | |
| *Poa sieberiana* | 10 | 200 | GG | | | | 10 | | | | | |
| *Rytidosperma sp.* | 5 | 100 | GG | | | | 5 | | | | | |
| *Asperula scoparia* | 0.1 | 3 | FG | | | | | 0.1 | | | | |
| *Caladenia gracilis* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Dianella revoluta* | 0.3 | 30 | FG | | | | | 0.3 | | | | |
| *Diuris pardina* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Gonocarpus tetragynus* | 0.2 | 50 | FG | | | | | 0.2 | | | | |
| *Poranthera microphylla* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Prasophyllum brevilabre* | 0.1 | 4 | FG | | | | | 0.1 | | | | |
| *Stylidium graminifolium* | 0.1 | 6 | FG | | | | | 0.1 | | | | |
| *Thelymitra megacalyptra* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Vernonia cinerea* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Wahlenbergia stricta* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Hypochaeris radicata* | 0.1 | 1 | EX | | | | | | | | 0.1 | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 71** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 729** | | | **47** | **44** | 3 | 15 | 6 | 18 | 0 | 2 | **3** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **45** | **44.7** | 22.1 | 5 | 15.4 | 2 | 0 | 0.2 | **0.3** | 0 |
| *Acacia dealbata* | 0.1 | 1 | TG | | 0.1 | | | | | | | |
| *Eucalyptus dives* | 15 | 20 | TG | | 15 | | | | | | | |
| *Eucalyptus rubida* | 7 | 8 | TG | | 7 | | | | | | | |
| *Astroloma humifusum* | 0.3 | 10 | SG | | | 0.3 | | | | | | |
| *Brachyloma daphnoides* | 0.5 | 30 | SG | | | 0.5 | | | | | | |
| *Cassinia longifolia* | 1 | 40 | SG | | | 1 | | | | | | |
| *Choretrum pauciflorum* | 0.1 | 3 | SG | | | 0.1 | | | | | | |
| *Dodonaea viscosa* | 1 | 40 | SG | | | 1 | | | | | | |
| *Exocarpos strictus* | 0.5 | 8 | SG | | | 0.5 | | | | | | |
| *Hibbertia obtusifolia* | 0.2 | 50 | SG | | | 0.2 | | | | | | |
| *Indigofera australis* | 0.5 | 8 | SG | | | 0.5 | | | | | | |
| *Leucopogon fletcheri* | 0.1 | 4 | SG | | | 0.1 | | | | | | |
| *Leucopogon virgatus* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Melichrus urceolatus* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Pimelea curviflora* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Pimelea latifolia* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Platylobium formosum* | 0.3 | 20 | SG | | | 0.3 | | | | | | |
| *Tetratheca bauerifolia* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Glycine clandestina* | 0.1 | 1 | OG | | | | | | | 0.1 | | |
| *Hardenbergia violacea* | 0.1 | 1 | OG | | | | | | | 0.1 | | |
| *Dichelachne sp.* | 0.1 | 20 | GG | | | | 0.1 | | | | | |
| *Lepidosperma curtisiae* | 0.1 | 20 | GG | | | | 0.1 | | | | | |
| *Lomandra filiformis* | 0.1 | 3 | GG | | | | 0.1 | | | | | |
| *Lomandra multiflora* | 0.1 | 2 | GG | | | | 0.1 | | | | | |
| *Poa sieberiana* | 5 | 200 | GG | | | | 5 | | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Poa sp.* | 10 | 300 | GG | | | | 10 | | | | | |
| *Acaena novae-zelandiae* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Arthropodium sp.* | 0.1 | 60 | FG | | | | | 0.1 | | | | |
| *Asperula conferta* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Asperula scoparia* | 0.1 | 3 | FG | | | | | 0.1 | | | | |
| *Chrysocephalum semipapposum* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Dianella revoluta* | 0.3 | 30 | FG | | | | | 0.3 | | | | |
| *Galium Leiocarpum* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Geranium obtusisepalum* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Gonocarpus tetragynus* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Hovea heterophylla* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Oxalis exilis* | 0.1 | 4 | FG | | | | | 0.1 | | | | |
| *Picris angustifolia* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Pterostylis longifolia* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Ranunculus lappaceus* | 0.1 | 4 | FG | | | | | 0.1 | | | | |
| *Stellaria pungens* | 0.1 | 3 | FG | | | | | 0.1 | | | | |
| *Stylidium graminifolium* | 0.1 | 30 | FG | | | | | 0.1 | | | | |
| *Veronica derwentiana* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Wahlenbergia stricta* | 0.1 | 2 | FG | | | | | 0.1 | | | | |
| *Centaurium erythraea* | 0.1 | 2 | EX | | | | | | | | 0.1 | |
| *Petrorhagia nanteuilii* | 0.1 | 3 | EX | | | | | | | | 0.1 | |
| *Trifolium campestre* | 0.1 | 10 | EX | | | | | | | | 0.1 | |

| | | | Covers | **Native** | Trees | Shrubs | Grass | Forb | Fern | Other | **Exotic** | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 72** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 999** | | | **24** | **20** | 1 | 9 | 2 | 6 | 0 | 2 | **4** | 2 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **78.5** | **78.1** | 0.5 | 75.1 | 0.7 | 1.1 | 0 | 0.7 | **0.4** | 0.2 |
| *Banksia canei* | 0.5 | 1 | SG | | | 0.5 | | | | | | |
| *Bossiaea foliosa* | 10 | 50 | SG | | | 10 | | | | | | |
| *Brachyloma daphnoides* | 2 | 100 | SG | | | 2 | | | | | | |
| *Calytrix tetragona* | 60 | 400 | SG | | | 60 | | | | | | |
| *Cassytha sp.* | 0.5 | 200 | OG | | | | | | | 0.5 | | |
| *Centaurium erythraea* | 0.1 | 50 | EX | | | | | | | | 0.1 | |
| *Eucalyptus rubida* | 0.5 | 2 | TG | | 0.5 | | | | | | | |
| *Euchiton involucratus* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Geranium sp. 2* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Hardenbergia violacea* | 0.2 | 10 | OG | | | | | | | 0.2 | | |
| *Hibbertia obtusifolia* | 0.1 | 25 | SG | | | 0.1 | | | | | | |
| *Hovea heterophylla* | 0.2 | 50 | FG | | | | | 0.2 | | | | |
| *Hypericum perforatum* | 0.1 | 10 | HT | | | | | | | | | 0.1 |
| *Hypochaeris radicata* | 0.1 | 20 | EX | | | | | | | | 0.1 | |
| *Leptospermum sp.* | 2 | 20 | SG | | | 2 | | | | | | |
| *Leucopogon fletcheri* | 0.2 | 25 | SG | | | 0.2 | | | | | | |
| *Leucopogon virgatus* | 0.2 | 50 | SG | | | 0.2 | | | | | | |
| *Lomandra filiformis* | 0.5 | 50 | GG | | | | 0.5 | | | | | |
| *Microlaena stipoides* | 0.2 | 100 | GG | | | | 0.2 | | | | | |
| *Oxalis perennans* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Pimelea curviflora* | 0.1 | 30 | SG | | | 0.1 | | | | | | |
| *Stylidium graminifolium* | 0.5 | 100 | FG | | | | | 0.5 | | | | |
| *Rubus fruticosus agg.* | 0.1 | 1 | HT | | | | | | | | | 0.1 |
| *Hydrocotyle laxiflora* | 0.1 | 20 | FG | | | | | 0.1 | | | | |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | **Covers** | **Native** | Trees | Shrubs | Grass | Forb | Fern | Other | **Exotic** | HighThreat |
| **Plot 73** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 999** | | | **12** | **11** | 1 | 3 | 2 | 3 | 1 | 1 | **1** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **103** | **102** | 2 | 97 | 2.1 | 0.3 | 0.1 | 0.5 | **1** | 0 |
| *Eucalyptus nortonii* | 2 | 3 | TG | | 2 | | | | | | | |
| *Brachyloma daphnoides* | 2 | 20 | SG | | | 2 | | | | | | |
| *Calytrix tetragona* | 90 | 2000 | SG | | | 90 | | | | | | |
| *Dillwynia phylicoides* | 5 | 30 | SG | | | 5 | | | | | | |
| *Cassytha sp.* | 0.5 | 10 | OG | | | | | | | 0.5 | | |
| *Austrostipa sp.* | 2 | 200 | GG | | | | 2 | | | | | |
| *Luzula sp.* | 0.1 | 1 | GG | | | | 0.1 | | | | | |
| *Gonocarpus tetragynus* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Hypericum gramineum* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Prasophyllum sp.* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Aira sp.* | 1 | 200 | EX | | | | | | | | 1 | |
| *Cheilanthes sieberi* | 0.1 | 20 | EG | | | | | | 0.1 | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 74** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 999** | | | **20** | **20** | 3 | 10 | 2 | 3 | 0 | 2 | **0** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **106.4** | **106.4** | 32.1 | 73.1 | 0.4 | 0.4 | 0 | 0.4 | **0** | 0 |
| *Eucalyptus dives* | 7 | 8 | TG | | 7 | | | | | | | |
| *Eucalyptus nortonii* | 25 | 13 | TG | | 25 | | | | | | | |
| *Acacia buxifolia* | 0.2 | 5 | SG | | | 0.2 | | | | | | |
| *Cassinia aculeata* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Calytrix tetragona* | 40 | 250 | SG | | | 40 | | | | | | |
| *Brachyloma daphnoides* | 30 | 15 | SG | | | 30 | | | | | | |
| *Dillwynia sericea* | 0.2 | 5 | SG | | | 0.2 | | | | | | |
| *Hibbertia obtusifolia* | 0.3 | 15 | SG | | | 0.3 | | | | | | |
| *Callitris endlicheri* | 0.1 | 1 | TG | | 0.1 | | | | | | | |
| *Lomandra filiformis* | 0.2 | 30 | GG | | | | 0.2 | | | | | |
| *Gonocarpus tetragynus* | 0.2 | 25 | FG | | | | | 0.2 | | | | |
| *Austrostipa sp.* | 0.2 | 15 | GG | | | | 0.2 | | | | | |
| *Cassytha glabella* | 0.3 | 15 | OG | | | | | | | 0.3 | | |
| *Caladenia sp.* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Banksia canei* | 1 | 1 | SG | | | 1 | | | | | | |
| *Leucopogon virgatus* | 0.2 | 3 | SG | | | 0.2 | | | | | | |
| *Leucopogon fletcheri* | 1 | 20 | SG | | | 1 | | | | | | |
| *Indigofera australis* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Hovea linearis* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Hardenbergia violacea* | 0.1 | 1 | OG | | | | | | | 0.1 | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 75** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 999** | | | **32** | **31** | 2 | 10 | 6 | 10 | 0 | 3 | **1** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **43.4** | **43.3** | 35 | 5.2 | 1.8 | 1 | 0 | 0.3 | **0.1** | 0 |
| *Eucalyptus dives* | 5 | 7 | TG | | 5 | | | | | | | |
| *Eucalyptus nortonii* | 30 | 20 | TG | | 30 | | | | | | | |
| *Acacia buxifolia* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Calytrix tetragona* | 2 | 100 | SG | | | 2 | | | | | | |
| *Austrostipa sp.* | 0.1 | 20 | GG | | | | 0.1 | | | | | |
| *Brachyloma daphnoides* | 1 | 35 | SG | | | 1 | | | | | | |
| *Dillwynia sericea* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Lomandra filiformis subsp. coriacea* | 1 | 50 | GG | | | | 1 | | | | | |
| *Poa sieberiana* | 0.3 | 35 | GG | | | | 0.3 | | | | | |
| *Cassytha glabella* | 0.1 | 5 | OG | | | | | | | 0.1 | | |
| *Hovea linearis* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Dianella revoluta* | 0.1 | 35 | FG | | | | | 0.1 | | | | |
| *Gonocarpus tetragynus* | 0.1 | 35 | FG | | | | | 0.1 | | | | |
| *Hibbertia obtusifolia* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Pimelea linifolia* | 0.1 | 50 | SG | | | 0.1 | | | | | | |
| *Leucopogon virgatus* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Hardenbergia violacea* | 0.1 | 10 | OG | | | | | | | 0.1 | | |
| *Hydrocotyle laxiflora* | 0.1 | 35 | FG | | | | | 0.1 | | | | |
| *Rytidosperma pilosum* | 0.1 | 25 | GG | | | | 0.1 | | | | | |
| *Billardiera scandens* | 0.1 | 1 | OG | | | | | | | 0.1 | | |
| *Hypochaeris radicata* | 0.1 | 2 | EX | | | | | | | | 0.1 | |
| *Senecio prenanthoides* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Hovea linearis* | 0.1 | 15 | FG | | | | | 0.1 | | | | |
| *Boronia nana* | 0.1 | 50 | FG | | | | | 0.1 | | | | |
| *Lomandra filiformis subsp. filiformis* | 0.2 | 25 | GG | | | | 0.2 | | | | | |
| *Banksia canei* | 1.5 | 1 | SG | | | 1.5 | | | | | | |
| *Lomandra multiflora* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Coronidium monticola* | 0.1 | 15 | FG | | | | | 0.1 | | | | |
| *Hypericum gramineum* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Tetratheca bauerifolia* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Euchiton involucratus* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Exocarpos strictus* | 0.1 | 1 | SG | | | 0.1 | | | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 77** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 999** | | | **23** | **23** | 2 | 12 | 3 | 3 | 0 | 3 | **0** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **95.9** | **95.9** | 60 | 35 | 0.3 | 0.3 | 0 | 0.3 | **0** | 0 |
| *Eucalyptus nortonii* | 20 | 11 | TG | | 20 | | | | | | | |
| *Eucalyptus dives* | 40 | 25 | TG | | 40 | | | | | | | |
| *Calytrix tetragona* | 20 | 300 | SG | | | 20 | | | | | | |
| *Brachyloma daphnoides* | 5 | 50 | SG | | | 5 | | | | | | |
| *Lomandra multiflora* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Cassytha glabella* | 0.1 | 10 | OG | | | | | | | 0.1 | | |
| *Dillwynia sp.* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Hibbertia obtusifolia* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Leucopogon virgatus* | 0.2 | 20 | SG | | | 0.2 | | | | | | |
| *Leucopogon fletcheri* | 2 | 5 | SG | | | 2 | | | | | | |
| *Gonocarpus tetragynus* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Austrostipa sp.* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Mirbelia oxylobioides* | 5 | 20 | SG | | | 5 | | | | | | |
| *Pimelea linifolia* | 0.1 | 20 | SG | | | 0.1 | | | | | | |
| *Patersonia sp.* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Acacia pravissima* | 2 | 5 | SG | | | 2 | | | | | | |
| *Billardiera scandens* | 0.1 | 1 | OG | | | | | | | 0.1 | | |
| *Hovea linearis* | 0.1 | 1 | FG | | | | | 0.1 | | | | |
| *Hardenbergia violacea* | 0.1 | 1 | OG | | | | | | | 0.1 | | |
| *Acacia buxifolia* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Banksia canei* | 0.3 | 1 | SG | | | 0.3 | | | | | | |
| *Indigofera australis* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Lomandra filiformis* | 0.1 | 1 | GG | | | | 0.1 | | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 78** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 999** | | | **19** | **19** | 2 | 10 | 2 | 4 | 0 | 1 | **0** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **111.2** | **111.2** | 18 | 92.4 | 0.2 | 0.4 | 0 | 0.2 | **0** | 0 |
| *Eucalyptus nortonii* | 8 | 7 | TG | | 8 | | | | | | | |
| *Eucalyptus dives* | 10 | 2 | TG | | 10 | | | | | | | |
| *Calytrix tetragona* | 60 | 500 | SG | | | 60 | | | | | | |
| *Brachyloma daphnoides* | 0.1 | 10 | SG | | | 0.1 | | | | | | |
| *Lomandra multiflora* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Cassytha glabella* | 0.2 | 50 | OG | | | | | | | 0.2 | | |
| *Dillwynia sp.* | 0.1 | 5 | SG | | | 0.1 | | | | | | |
| *Hibbertia obtusifolia* | 0.2 | 10 | SG | | | 0.2 | | | | | | |
| *Leucopogon virgatus* | 0.4 | 10 | SG | | | 0.4 | | | | | | |
| *Leucopogon fletcheri subsp. Brevisepalus* | 30 | 200 | SG | | | 30 | | | | | | |
| *Gonocarpus tetragynus* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Mirbelia oxylobioides* | 0.4 | 5 | SG | | | 0.4 | | | | | | |
| *Pimelea linifolia* | 0.1 | 20 | SG | | | 0.1 | | | | | | |
| *Patersonia sp.* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Acacia pravissima* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Hovea linearis* | 0.1 | 5 | FG | | | | | 0.1 | | | | |
| *Acacia buxifolia* | 1 | 30 | SG | | | 1 | | | | | | |
| *Lomandra filiformis* | 0.1 | 20 | GG | | | | 0.1 | | | | | |
| *Boronia nana* | 0.1 | 5 | FG | | | | | 0.1 | | | | |

| | | | Covers | **Native** | Trees | Shrubs | Grass | Forb | Fern | Other | **Exotic** | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 79** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 999** | | | **19** | **18** | 2 | 9 | 3 | 3 | 0 | 1 | **1** | 1 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **53** | **52.9** | 20 | 31.6 | 0.4 | 0.7 | 0 | 0.2 | **0.1** | 0.1 |
| *Acacia buxifolia* | 0.1 | 1 | SG | | | 0.1 | | | | | | |
| *Acacia pravissima* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Asperula gunnii* | 0.5 | 100 | FG | | | | | 0.5 | | | | |
| *Banksia canei* | 0.5 | 1 | SG | | | 0.5 | | | | | | |
| *Bossiaea foliosa* | 0.1 | 2 | SG | | | 0.1 | | | | | | |
| *Brachyloma daphnoides* | 0.2 | 20 | SG | | | 0.2 | | | | | | |
| *Calytrix tetragona* | 20 | 200 | SG | | | 20 | | | | | | |
| *Cassytha sp.* | 0.2 | 30 | OG | | | | | | | 0.2 | | |
| *Eucalyptus dives* | 10 | 8 | TG | | 10 | | | | | | | |
| *Eucalyptus nortonii* | 10 | 8 | TG | | 10 | | | | | | | |
| *Hovea heterophylla* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Leucopogon fletcheri* | 10 | 100 | SG | | | 10 | | | | | | |
| *Leucopogon virgatus* | 0.5 | 10 | SG | | | 0.5 | | | | | | |
| *Lomandra filiformis subsp. coriacea* | 0.2 | 50 | GG | | | | 0.2 | | | | | |
| *Lomandra filiformis subsp. filiformis* | 0.1 | 5 | GG | | | | 0.1 | | | | | |
| *Rytidosperma pilosum* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Acaena novae-zelandiae* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Rosa rubiginosa* | 0.1 | 5 | HT | | | | | | | | | 0.1 |
| *Podolobium procumbens* | 0.1 | 1 | SG | | | 0.1 | | | | | | |

| | | | Covers | Native | Trees | Shrubs | Grass | Forb | Fern | Other | Exotic | HighThreat |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Plot 80** | | | **# spp** | **Count** | Count | Count | Count | Count | Count | Count | **Count** | Count |
| **PCT 999** | | | **15** | **13** | 2 | 5 | 2 | 4 | 0 | 0 | **2** | 0 |
| **Species** | **Cover** | **Abundance** | **Sum cover** | **Sum** | Sum | Sum | Sum | Sum | Sum | Sum | **Sum** | Sum |
| | | | **147.1** | **146.5** | 55 | 90.8 | 0.3 | 0.4 | 0 | 0 | **0.6** | 0 |
| *Eucalyptus dives* | 5 | 1 | TG | | 5 | | | | | | | |
| *Eucalyptus nortonii* | 50 | 50 | TG | | 50 | | | | | | | |
| *Brachyloma daphnoides* | 5 | 20 | SG | | | 5 | | | | | | |
| *Calytrix tetragona* | 80 | 500 | SG | | | 80 | | | | | | |
| *Cassinia longifolia* | 0.5 | 3 | SG | | | 0.5 | | | | | | |
| *Dillwynia phylicoides* | 5 | 20 | SG | | | 5 | | | | | | |
| *Rhytidosporum sp.* | 0.3 | 30 | SG | | | 0.3 | | | | | | |
| *Luzula sp.* | 0.1 | 10 | GG | | | | 0.1 | | | | | |
| *Poa sp.* | 0.2 | 20 | GG | | | | 0.2 | | | | | |
| *Caladenia congesta* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Gonocarpus tetragynus* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Hypericum gramineum* | 0.1 | 10 | FG | | | | | 0.1 | | | | |
| *Wahlenbergia sp.* | 0.1 | 20 | FG | | | | | 0.1 | | | | |
| *Aira sp.* | 0.5 | 100 | EX | | | | | | | | 0.5 | |
| *Centaurium erythraea* | 0.1 | 10 | EX | | | | | | | | 0.1 | |

# Appendix C. Vegetation integrity assessment plot data

Table C.1: Vegetation integrity assessment plot data for vegetation zones in the South Eastern Highlands Bioregion

| Veg zone | plot | pct | area | Patch size | Condition class | zone | easting | northing | bearing | compTree | compShrub | compGrass | compForbs | compFerns | compOther | strucTree | strucShrub | strucGrass | strucForbs | strucFerns | strucOther | funLargeTrees | funHollowtrees | funLitterCover | funLenFallenLogs | funTreeStem5to10 | funTreeStem10to20 | funTreeStem20to30 | funTreeStem30to50 | funTreeStem50to80 | funTreeRegen | funHighThreatExotic |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SEH-1 | Plot 14 | 296 | 0.13 | 101 | Native_grassland | 55 | 627415.8 | 6037977.10 | 300 | 2 | 7 | 7 | 7 | 1 | 0 | 4.0 | 48.1 | 2.7 | 68.5 | 0.1 | 0.0 | 0 | 0 | 3.2 | 0.0 | 1 | 1 | 1 | 0 | 0 | 1 | 0.4 |
| SEH-2 | Plot 15 | 296 | 4.67 | 101 | Good_dry_slopes | 55 | 627706.8 | 6037994.37 | 268 | 3 | 10 | 8 | 10 | 1 | 0 | 37.0 | 4.3 | 49.1 | 1.9 | 0.1 | 0.0 | 0 | 0 | 79.0 | 50.0 | 1 | 1 | 1 | 1 | 0 | 1 | 0.2 |
| SEH-2 | Plot 16 | 296 | 4.67 | 101 | Good_dry_slopes | 55 | 627246.6 | 6037819.27 | 30 | 2 | 7 | 6 | 8 | 1 | 2 | 15.2 | 1.5 | 36.3 | 0.9 | 0.1 | 10.1 | 0 | 1 | 35.0 | 81.0 | 1 | 1 | 1 | 0 | 0 | 1 | 0.1 |
| SEH-2 | Plot 17 | 296 | 4.67 | 101 | Good_dry_slopes | 55 | 627500 | 6037855.01 | 32 | 3 | 7 | 5 | 7 | 1 | 1 | 22.2 | 46.0 | 5.2 | 6.4 | 1.0 | 0.5 | 7 | 5 | 81.0 | 45.0 | 1 | 1 | 1 | 1 | 1 | 1 | 1.0 |
| SEH-3 | Plot 18 | 296 | 14.96 | 101 | Good_wet_slopes | 55 | 624455.5 | 6038548.92 | 60 | 2 | 15 | 7 | 13 | 0 | 3 | 20.0 | 14.2 | 2.0 | 1.5 | 0.0 | 0.3 | 0 | 0 | 65.0 | 35.0 | 1 | 1 | 1 | 1 | 0 | 1 | 0.0 |
| SEH-3 | Plot 19 | 296 | 14.96 | 101 | Good_wet_slopes | 55 | 624268.2 | 6038590.49 | 200 | 2 | 17 | 7 | 9 | 0 | 3 | 16.0 | 22.1 | 15.7 | 0.8 | 0.0 | 0.4 | 1 | 1 | 57.0 | 84.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.1 |
| SEH-3 | Plot 20 | 296 | 14.96 | 101 | Good_wet_slopes | 55 | 626708.5 | 6037781.17 | 92 | 3 | 5 | 9 | 5 | 0 | 0 | 46.0 | 1.6 | 81.6 | 0.5 | 0.0 | 0.0 | 1 | 0 | 49.0 | 9.0 | 1 | 1 | 1 | 1 | 1 | 1 | 5.3 |
| SEH-3 | Plot 21 | 296 | 14.96 | 101 | Good_wet_slopes | 55 | 626936.2 | 6037881.53 | 249 | 4 | 8 | 8 | 7 | 1 | 0 | 24.5 | 13.3 | 46.0 | 1.1 | 0.1 | 0.0 | 0 | 1 | 65.0 | 55.0 | 1 | 1 | 1 | 0 | 0 | 1 | 0.5 |
| SEH-3 | Plot 22 | 296 | 14.96 | 101 | Good_wet_slopes | 55 | 626585.9 | 6038049.08 | 6 | 4 | 13 | 9 | 3 | 0 | 1 | 14.1 | 50.0 | 5.0 | 0.7 | 0.0 | 0.1 | 3 | 0 | 91.3 | 35.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.2 |
| SEH-3 | Plot 23 | 296 | 14.96 | 101 | Good_wet_slopes | 55 | 627021.6 | 6037758.16 | 71 | 3 | 7 | 9 | 3 | 0 | 1 | 4.5 | 45.4 | 7.7 | 0.4 | 0.0 | 0.1 | 0 | 0 | 87.5 | 45.0 | 1 | 1 | 1 | 1 | 0 | 1 | 0.5 |
| SEH-3 | Plot 24 | 296 | 14.96 | 101 | Good_wet_slopes | 55 | 625117.4 | 625117.402 | 45 | 4 | 12 | 2 | 3 | 0 | 0 | 2.5 | 6.2 | 0.2 | 0.3 | 0 | 0 | 1 | 3 | 80 | 35.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0 |
| SEH-3 | Plot 25 | 296 | 14.96 | 101 | Good_wet_slopes | 55 | 627830 | 6038109.97 | 150 | 2 | 16 | 4 | 4 | 0 | 0 | 16.0 | 48.4 | 3.1 | 0.4 | 0.0 | 0.0 | 0 | 3 | 82.0 | 16.0 | 1 | 1 | 1 | 1 | 0 | 1 | 0.0 |
| SEH-3 | Plot 26 | 296 | 14.96 | 101 | Good_wet_slopes | 55 | 626745 | 6037928.99 | 53 | 3 | 4 | 3 | 1 | 0 | 0 | 36.0 | 96.0 | 17.0 | 0.1 | 0.0 | 0.0 | 0 | 0 | 67.0 | 58.0 | 1 | 1 | 1 | 1 | 0 | 1 | 0.0 |
| SEH-3 | Plot 27 | 296 | 14.96 | 101 | Good_wet_slopes | 55 | 625034.8 | 6038466.31 | 177 | 3 | 14 | 5 | 6 | 0 | 2 | 62.0 | 92.3 | 20.8 | 0.6 | 0.0 | 0.2 | 0 | 1 | 70.0 | 35.0 | 1 | 1 | 1 | 1 | 0 | 1 | 0.0 |
| SEH-3 | Plot 28 | 296 | 14.96 | 101 | Good_wet_slopes | 55 | 624325.3 | 6038471.98 | 22 | 3 | 16 | 4 | 16 | 0 | 1 | 55.2 | 91.3 | 61.3 | 6.6 | 0.0 | 2.0 | 4 | 4 | 74.0 | 17.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.0 |
| SEH-3 | Plot 29 | 296 | 14.96 | 101 | Good_wet_slopes | 55 | 624583.3 | 6038582.18 | 87 | 2 | 14 | 5 | 10 | 0 | 1 | 18.0 | 45.9 | 10.4 | 1.2 | 0.0 | 0.1 | 0 | 2 | 48.0 | 106.0 | 1 | 1 | 1 | 1 | 0 | 1 | 0.0 |
| SEH-4 | Plot 30 | 296 | 1.38 | 101 | Moderate_Blackberry | 55 | 626811.7 | 6037753.29 | 347 | 3 | 7 | 4 | 0 | 0 | 0 | 32.1 | 1.5 | 2.5 | 0.0 | 0.0 | 0.0 | 0 | 2 | 45.0 | 71.0 | 1 | 1 | 1 | 1 | 0 | 1 | 90.6 |
| SEH-5 | Plot 31 | 300 | 32.51 | 101 | Good | 55 | 620801.7 | 6038013.32 | 37 | 2 | 9 | 4 | 20 | 1 | 3 | 21.0 | 59.7 | 42.2 | 12.4 | 20.0 | 0.3 | 6 | 2 | 95.8 | 94.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.1 |
| SEH-5 | Plot 32 | 300 | 32.51 | 101 | Good | 55 | 623730.4 | 623730.364 | 105 | 4 | 10 | 3 | 3 | 0 | 2 | 21.5 | 40 | 76 | 1.3 | 0 | 4 | 4 | 0 | 14.0 | 43.0 | 1 | 1 | 1 | 1 | 1 | 0 | 0.0 |
| SEH-5 | Plot 33 | 300 | 32.51 | 101 | Good | 55 | 620414.8 | 620414.847 | 140 | 4 | 8 | 1 | 10 | 1 | 3 | 23 | 7.6 | 0.2 | 3.3 | 2 | 0.3 | 2 | 4 | 56 | 60.0 | 0 | 1 | 1 | 1 | 1 | 1 | 0.0 |
| SEH-5 | Plot 34 | 300 | 32.51 | 101 | Good | 55 | 620180.1 | 620180.1 | 120 | 3 | 6 | 2 | 8 | 1 | 1 | 17 | 11.2 | 20.2 | 1.7 | 5 | 0.1 | 2 | 0 | 25 | 12.0 | 1 | 1 | 1 | 1 | 1 | 1 | 30.0 |
| SEH-5 | Plot 35 | 300 | 32.51 | 101 | Good | 55 | 620047 | 620046.953 | 38 | 6 | 7 | 2 | 6 | 1 | 1 | 17.5 | 3.6 | 25.5 | 1.9 | 2 | 0.1 | 0 | 0 | 178 | 130.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.0 |
| SEH-5 | Plot 36 | 300 | 32.51 | 101 | Good | 55 | 620593.9 | 6038030.69 | 270 | 3 | 9 | 2 | 15 | 1 | 2 | 25.0 | 49.0 | 75.0 | 12.9 | 5.0 | 1.1 | 12 | 6 | 41.0 | 73.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.0 |
| SEH-5 | Plot 37 | 300 | 32.51 | 101 | Good | 55 | 620947.8 | 620947.81 | 340 | 4 | 2 | 3 | 5 | 4 | 1 | 50.0 | 5.2 | 42.0 | 0.9 | 33.0 | 0.1 | 4 | 4 | 86.0 | 12.0 | 1 | 1 | 1 | 1 | 1 | 1 | 20.0 |
| SEH-5 | Plot 38 | 300 | 32.51 | 101 | Good | 55 | 621041.9 | 6038041.22 | 201 | 3 | 13 | 2 | 5 | 0 | 1 | 65.5 | 73.8 | 20.1 | 0.7 | 0.0 | 0.1 | 7 | 2 | 53.0 | 80.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.0 |
| SEH-5 | Plot 39 | 300 | 32.51 | 101 | Good | 55 | 621724 | 6038065.14 | 353 | 4 | 16 | 4 | 10 | 1 | 2 | 81.1 | 6.8 | 20.4 | 1.1 | 0.2 | 0.3 | 1 | 1 | 56.0 | 50.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.0 |
| SEH-5 | Plot 40 | 300 | 32.51 | 101 | Good | 55 | 620938.2 | 6038061.94 | 177 | 4 | 7 | 4 | 18 | 1 | 2 | 48.0 | 29.3 | 10.4 | 19.1 | 8.0 | 0.4 | 6 | 3 | 80.0 | 165.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.2 |
| SEH-5 | Plot 41 | 300 | 32.51 | 101 | Good | 55 | 620438.4 | 6038066.98 | 189 | 3 | 4 | 4 | 12 | 2 | 1 | 4.1 | 0.6 | 0.6 | 2.1 | 0.4 | 0.1 | 2 | 3 | 3.0 | 40.0 | 1 | 1 | 1 | 0 | 1 | 1 | 70.0 |
| SEH-5 | Plot 42 | 300 | 32.51 | 101 | Good | 55 | 623622 | 6038511.01 | 245 | 2 | 10 | 2 | 5 | 1 | 2 | 50.0 | 26.7 | 33.0 | 7.2 | 10.0 | 2.1 | 8 | 4 | 42.0 | 56.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.0 |
| SEH-6 | Plot 43 | 302 | 0.20 | 101 | Native_grassland | 55 | 627126.3 | 6037804.14 | 150 | 0 | 1 | 1 | 1 | 1 | 0 | 0.0 | 0.5 | 90.0 | 0.1 | 4.0 | 0.0 | 0 | 0 | 50.0 | 0.0 | 0 | 0 | 0 | 0 | 0 | 1 | 1.2 |
| SEH-7 | Plot 44 | 302 | 2.57 | 101 | Moderate | 55 | 626551 | 6037907.02 | 155 | 2 | 6 | 7 | 2 | 1 | 0 | 65.0 | 9.0 | 14.5 | 0.2 | 0.1 | 0.0 | 0 | 2 | 76.0 | 55.0 | 1 | 1 | 1 | 1 | 0 | 1 | 32.2 |
| SEH-7 | Plot 45 | 302 | 2.57 | 101 | Moderate | 55 | 627750.8 | 6038054.31 | 118 | 5 | 7 | 6 | 8 | 3 | 2 | 101.0 | 13.2 | 57.3 | 0.8 | 0.5 | 0.2 | 2 | 0 | 87.0 | 15.0 | 1 | 1 | 1 | 1 | 1 | 1 | 8.4 |
| SEH-7 | Plot 46 | 302 | 2.57 | 101 | Moderate | 55 | 627137 | 6037935.01 | 330 | 3 | 8 | 8 | 1 | 0 | 0 | 47.0 | 6.2 | 61.5 | 0.1 | 0.0 | 0.0 | 0 | 0 | 79.6 | 54.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.0 |
| SEH-7 | Plot 47 | 302 | 2.57 | 101 | Moderate | 55 | 627677 | 6038086.00 | 105 | 2 | 3 | 8 | 3 | 0 | 0 | 9.0 | 1.2 | 10.8 | 0.3 | 0.0 | 0.0 | 0 | 0 | 14.0 | 5.0 | 1 | 1 | 1 | 0 | 0 | 0 | 0.0 |
| SEH-7 | Plot 48 | 302 | 2.57 | 101 | Moderate | 55 | 626535.4 | 6038012.09 | 0 | 2 | 3 | 6 | 7 | 1 | 1 | 5.0 | 3.6 | 0.6 | 0.7 | 0.1 | 0.1 | 1 | 0 | 30.0 | 58.0 | 1 | 1 | 1 | 1 | 1 | 1 | 30.4 |
| SEH-8 | Plot 49 | 729 | 1.11 | 101 | Native_grassland | 55 | 625664 | 6038275.90 | 238 | 0 | 7 | 8 | 7 | 0 | 2 | 0.0 | 21.4 | 75.7 | 0.8 | 0.0 | 0.2 | 0 | 0 | 6.0 | 4.0 | 1 | 1 | 1 | 0 | 0 | 1 | 40.7 |

| Veg zone | plot | pct | area | Patch size | Condition class | zone | easting | northing | bearing | compTree | compShrub | compGrass | compForbs | compFerns | compOther | strucTree | strucShrub | strucGrass | strucForbs | strucFerns | strucOther | funLargeTrees | funHollowtrees | funLitterCover | funLenFallenLogs | funTreeStem5to10 | funTreeStem10to20 | funTreeStem20to30 | funTreeStem30to50 | funTreeStem50to80 | funTreeRegen | funHighThreatExotic |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SEH-8 | Plot 50 | 729 | 1.11 | 101 | Native_grassland | 55 | 626650.9 | 6037795.76 | 340 | 1 | 1 | 7 | 7 | 1 | 0 | 1.5 | 0.2 | 75.6 | 0.7 | 0.1 | 0.0 | 0 | 0 | 9.0 | 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 21.2 |
| SEH-8 | Plot 51 | 729 | 1.11 | 101 | Native_grassland | 55 | 626528.8 | 6037798.72 | 227 | 1 | 2 | 6 | 4 | 0 | 1 | 0.1 | 0.2 | 100.4 | 0.7 | 0.0 | 0.2 | 0 | 0 | 11.0 | 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.2 |
| SEH-9 | Plot 52 | 729 | 0.78 | 101 | Regrowth_shrubland | 55 | 625527.3 | 6038265.64 | 303 | 2 | 5 | 6 | 6 | 1 | 1 | 5.0 | 100.8 | 4.4 | 0.7 | 0.1 | 0.1 | 1 | 0 | 54.0 | 0.0 | 1 | 1 | 0 | 0 | 0 | 1 | 0.7 |
| SEH-9 | Plot 53 | 729 | 0.78 | 101 | Regrowth_shrubland | 55 | 626573.1 | 6037760.15 | 125 | 1 | 4 | 5 | 6 | 0 | 0 | 0.1 | 145.6 | 2.4 | 1.6 | 0.0 | 0.0 | 0 | 0 | 11.0 | 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.3 |
| SEH-9 | Plot 54 | 729 | 0.78 | 101 | Regrowth_shrubland | 55 | 625579.1 | 6038538.71 | 174 | 3 | 5 | 0 | 5 | 1 | 0 | 11.1 | 120.3 | 0.0 | 0.5 | 0.1 | 0.0 | 1 | 2 | 44.0 | 25.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.0 |
| SEH-9 | Plot 55 | 729 | 0.78 | 101 | Regrowth_shrubland | 55 | 626665.6 | 6038006.45 | 251 | 3 | 8 | 2 | 5 | 0 | 2 | 15.1 | 81.6 | 0.2 | 0.7 | 0.0 | 0.2 | 1 | 0 | 19.0 | 6.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.1 |
| SEH-10 | Plot 56 | 729 | 16.05 | 101 | Good_dry_slopes | 55 | 624396.6 | 6038627.96 | 279 | 2 | 16 | 5 | 12 | 0 | 1 | 22.5 | 7.6 | 67.3 | 1.3 | 0.0 | 0.1 | 0 | 1 | 37.0 | 99.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.0 |
| SEH-10 | Plot 57 | 729 | 16.05 | 101 | Good_dry_slopes | 55 | 625465.3 | 6038444.13 | 58 | 2 | 11 | 2 | 6 | 0 | 1 | 10.2 | 43.2 | 0.3 | 0.7 | 0.0 | 0.1 | 0 | 1 | 81.0 | 64.0 | 1 | 1 | 1 | 0 | 0 | 1 | 0.1 |
| SEH-10 | Plot 58 | 729 | 16.05 | 101 | Good_dry_slopes | 55 | 625626 | 6038693.59 | 128 | 3 | 8 | 4 | 5 | 1 | 0 | 25.0 | 52.1 | 0.9 | 0.6 | 0.1 | 0.0 | 0 | 0 | 66.0 | 32.0 | 1 | 1 | 1 | 1 | 0 | 1 | 0.1 |
| SEH-10 | Plot 59 | 729 | 16.05 | 101 | Good_dry_slopes | 55 | 621545.2 | 621545.193 | 280 | 2 | 15 | 3 | 4 | 0 | 0 | 15 | 24 | 23 | 0.4 | 0 | 0 | 2 | 1 | 30 | 9.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.0 |
| SEH-10 | Plot 60 | 729 | 16.05 | 101 | Good_dry_slopes | 55 | 624682.5 | 6038756.07 | 138 | 3 | 15 | 3 | 12 | 0 | 2 | 55.1 | 133.9 | 20.5 | 1.4 | 0.0 | 0.4 | 2 | 1 | 54.0 | 42.0 | 1 | 1 | 1 | 0 | 1 | 0 | 0.0 |
| SEH-10 | Plot 61 | 729 | 16.05 | 101 | Good_dry_slopes | 55 | 621491.6 | 6038058.91 | 54 | 2 | 16 | 4 | 17 | 0 | 2 | 60.0 | 57.6 | 44.1 | 1.9 | 0.0 | 0.2 | 2 | 0 | 52.0 | 65.0 | 1 | 1 | 1 | 1 | 1 | 0 | 0.0 |
| SEH-10 | Plot 62 | 729 | 16.05 | 101 | Good_dry_slopes | 55 | 621260.1 | 6038057.53 | 270 | 2 | 16 | 7 | 16 | 1 | 1 | 30.0 | 21.5 | 25.7 | 1.8 | 0.1 | 0.1 | 4 | 4 | 32.0 | 95.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.0 |
| SEH-10 | Plot 63 | 729 | 16.05 | 101 | Good_dry_slopes | 55 | 624577.4 | 6038610.89 | 228 | 2 | 9 | 4 | 10 | 1 | 2 | 30.0 | 9.1 | 4.6 | 1.2 | 0.1 | 0.2 | 0 | 2 | 42.0 | 71.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.0 |
| SEH-11 | Plot 64 | 729 | 16.79 | 101 | Good_wet_slopes | 55 | 625513 | 6038301.01 | 40 | 5 | 11 | 8 | 12 | 0 | 0 | 19.0 | 69.3 | 62.6 | 1.4 | 0.0 | 0.0 | 0 | 0 | 71.0 | 25.0 | 1 | 1 | 1 | 1 | 0 | 1 | 15.1 |
| SEH-11 | Plot 65 | 729 | 16.79 | 101 | Good_wet_slopes | 55 | 626416.1 | 6037994.38 | 19 | 2 | 12 | 7 | 3 | 0 | 1 | 1.3 | 70.7 | 10.8 | 0.3 | 0.0 | 0.1 | 0 | 0 | 22.0 | 0.0 | 1 | 1 | 0 | 0 | 0 | 1 | 0.1 |
| SEH-11 | Plot 66 | 729 | 16.79 | 101 | Good_wet_slopes | 55 | 623179.7 | 6038404.79 | 211 | 3 | 14 | 6 | 12 | 0 | 3 | 61.0 | 48.7 | 17.1 | 1.6 | 0.0 | 0.4 | 3 | 2 | 75.0 | 92.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.0 |
| SEH-11 | Plot 67 | 300 | 32.51 | 101 | Good | 55 | 623523.7 | 623523.668 | 225 | 3 | 11 | 4 | 4 | 1 | 4 | 33 | 34 | 49 | 2.2 | 5 | 0.5 | 1 | 3 | 40.0 | 57.0 | 1 | 1 | 1 | 1 | 0 | 1 | 0.0 |
| SEH-11 | Plot 68 | 729 | 16.79 | 101 | Good_wet_slopes | 55 | 623341.3 | 623341.286 | 200 | 3 | 10 | 3 | 2 | 0 | 0 | 28 | 15.5 | 52 | 0.2 | 0 | 0 | 1 | 4 | 80.0 | 27.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.0 |
| SEH-11 | Plot 69 | 729 | 16.79 | 101 | Good_wet_slopes | 55 | 626287.6 | 6037943.51 | 70 | 3 | 13 | 5 | 7 | 1 | 1 | 8.0 | 31.5 | 1.3 | 0.7 | 0.1 | 0.1 | 0 | 0 | 50.0 | 0.0 | 1 | 1 | 1 | 1 | 0 | 1 | 0.3 |
| SEH-11 | Plot 70 | 729 | 16.05 | 101 | Good_dry_slopes | 55 | 623813.1 | 6038527.31 | 184 | 2 | 13 | 2 | 11 | 0 | 2 | 15.0 | 11.8 | 15.0 | 1.4 | 0.0 | 0.2 | 1 | 8 | 72.0 | 131.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.0 |
| SEH-11 | Plot 71 | 729 | 16.05 | 101 | Good_dry_slopes | 55 | 624165.5 | 6038383.63 | 273 | 3 | 15 | 6 | 18 | 0 | 2 | 22.1 | 5.0 | 15.4 | 2.0 | 0.0 | 0.2 | 0 | 3 | 20.0 | 74.0 | 1 | 1 | 1 | 1 | 0 | 1 | 0.0 |
| SEH-12 | Plot 72 | 999 | 1.23 | 101 | Regrowth_shrubland | 55 | 626007.1 | 6038100.72 | 90 | 1 | 9 | 2 | 6 | 0 | 2 | 0.5 | 75.1 | 0.7 | 1.1 | 0.0 | 0.7 | 0 | 0 | 46.0 | 32.0 | 1 | 1 | 1 | 0 | 0 | 1 | 0.2 |
| SEH-12 | Plot 73 | 999 | 1.23 | 101 | Regrowth_shrubland | 55 | 625322.2 | 6038381.59 | 237 | 1 | 3 | 2 | 3 | 1 | 1 | 2.0 | 97.0 | 2.1 | 0.3 | 0.1 | 0.5 | 0 | 0 | 10.0 | 10.0 | 1 | 1 | 1 | 0 | 0 | 1 | 0.0 |
| SEH-13 | Plot 74 | 999 | 6.38 | 101 | Good_dry_Calytrix | 55 | 625882.8 | 6038143.98 | 195 | 3 | 10 | 2 | 3 | 0 | 2 | 32.1 | 73.1 | 0.4 | 0.4 | 0.0 | 0.4 | 0 | 5 | 79.0 | 36.0 | 1 | 1 | 1 | 1 | 0 | 1 | 0.0 |
| SEH-13 | Plot 75 | 999 | 6.38 | 101 | Good_dry_Calytrix | 55 | 625945.2 | 6038089.40 | 322 | 2 | 10 | 6 | 10 | 0 | 3 | 35.0 | 5.2 | 1.8 | 1.0 | 0.0 | 0.3 | 4 | 3 | 87.0 | 72.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.0 |
| SEH-13 | Plot 76 | 999 | 6.38 | 101 | Good_dry_Calytrix | 55 | 625736 | 6038160.60 | 60 | 1 | 7 | 7 | 8 | 1 | 1 | 18.0 | 36.7 | 15.6 | 0.8 | 0.1 | 0.1 | 0 | 0 | 84.0 | 10.0 | 1 | 1 | 1 | 0 | 0 | 1 | 0.1 |
| SEH-13 | Plot 77 | 999 | 6.38 | 101 | Good_dry_Calytrix | 55 | 626137.6 | 6038137.81 | 136 | 2 | 12 | 3 | 3 | 0 | 3 | 60.0 | 35.0 | 0.3 | 0.3 | 0.0 | 0.3 | 0 | 0 | 92.0 | 30.0 | 1 | 1 | 1 | 1 | 0 | 1 | 0.0 |
| SEH-13 | Plot 78 | 999 | 6.38 | 101 | Good_dry_Calytrix | 55 | 626274 | 6038062.97 | 232 | 2 | 10 | 2 | 4 | 0 | 1 | 18.0 | 92.4 | 0.2 | 0.4 | 0.0 | 0.2 | 1 | 2 | 88.0 | 75.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.0 |
| SEH-13 | Plot 79 | 999 | 6.38 | 101 | Good_dry_Calytrix | 55 | 626147.1 | 6038009.53 | 270 | 2 | 9 | 3 | 3 | 0 | 1 | 20.0 | 31.6 | 0.4 | 0.7 | 0.0 | 0.2 | 0 | 0 | 43.0 | 21.0 | 1 | 1 | 1 | 1 | 0 | 1 | 0.1 |
| SEH-13 | Plot 80 | 999 | 6.38 | 101 | Good_dry_Calytrix | 55 | 624860 | 6038541.89 | 250 | 2 | 5 | 2 | 4 | 0 | 0 | 55.0 | 90.8 | 0.3 | 0.4 | 0.0 | 0.0 | 0 | 3 | 7.0 | 20.0 | 1 | 1 | 1 | 1 | 0 | 1 | 0.0 |
| SEH-13 | Plot 81 | 999 | 6.38 | 101 | Good_dry_Calytrix | 55 | 625233 | 6038371.32 | 73 | 2 | 4 | 1 | 3 | 0 | 1 | 5.0 | 33.2 | 0.5 | 0.3 | 0.0 | 0.1 | 0 | 2 | 25.0 | 26.0 | 1 | 1 | 1 | 1 | 0 | 1 | 0.0 |

Table C.2: Vegetation integrity assessment plot data for vegetation zones in the Australian Alps Bioregion

| Veg zone | plot | pct | area | Patch size | Condition class | zone | easting | northing | bearing | compTree | compShrub | compGrass | compForbs | compFerns | compOther | strucTree | strucShrub | strucGrass | strucForbs | strucFerns | strucOther | funLargeTrees | funHollowtrees | funLitterCover | funLenFallenLogs | funTreeStem5to10 | funTreeStem10to20 | funTreeStem20to30 | funTreeStem30to50 | funTreeStem50to80 | funTreeRegen | funHighThreatExotic |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AA-1 | Plot 1 | 285 | 1.77 | 101 | Moderate_Blackberry | 55 | 618922.7 | 6037901.76 | 230 | 4 | 5 | 6 | 9 | 0 | 1 | 21.2 | 70.6 | 11.3 | 0.9 | 0.0 | 0.1 | 2 | 2 | 79.8 | 65.0 | 1 | 1 | 1 | 0 | 0 | 0 | 30.3 |
| AA-1 | Plot 2 | 285 | 1.77 | 101 | Moderate_Blackberry | 55 | 618857.1 | 6038329.17 | 168 | 4 | 7 | 7 | 16 | 0 | 2 | 33.3 | 3.1 | 80.9 | 3.5 | 0.0 | 0.3 | 1 | 9 | 71.0 | 197.0 | 1 | 1 | 1 | 0 | 0 | 0 | 1.5 |
| AA-1 | Plot 3 | 285 | 1.77 | 101 | Moderate_Blackberry | 55 | 618769 | 6038168.86 | 225 | 5 | 10 | 6 | 30 | 0 | 1 | 44.0 | 3.9 | 22.5 | 4.0 | 0.0 | 0.1 | 6 | 4 | 56.0 | 0.0 | 1 | 1 | 0 | 1 | 1 | 1 | 20.4 |
| AA-2 | Plot 35 | 300 | 10.81 | 101 | Good | 55 | 620047 | 620046.95 | 38 | 6 | 7 | 2 | 6 | 1 | 1 | 17.5 | 3.6 | 25.5 | 1.9 | 2 | 0.1 | 0 | 0 | 178 | 130.0 | 1 | 1 | 1 | 1 | 1 | 0 | 25.0 |
| AA-2 | Plot 4 | 300 | 10.81 | 101 | Good | 55 | 619667 | 6037958.51 | 110 | 4 | 2 | 3 | 14 | 0 | 1 | 31.2 | 12.1 | 83.0 | 18.7 | 0.0 | 5.0 | 13 | 2 | 19.0 | 96.0 | 1 | 1 | 1 | 1 | 1 | 1 | 40.1 |
| AA-2 | Plot 5 | 300 | 10.81 | 101 | Good | 55 | 619861.1 | 6037975.19 | 76 | 4 | 8 | 4 | 19 | 0 | 2 | 95.0 | 1.7 | 60.4 | 3.8 | 0.0 | 0.2 | 6 | 0 | 48.0 | 210.0 | 1 | 1 | 1 | 0 | 0 | 1 | 15.5 |
| AA-3 | Plot 6 | 1196 | 0.76 | 101 | Native_grassland | 55 | 618871 | 6037781.53 | 159 | 1 | 7 | 10 | 13 | 0 | 2 | 0.1 | 1.7 | 48.1 | 2.6 | 0.0 | 0.2 | 0 | 0 | 2.8 | 0.0 | 0 | 0 | 0 | 1 | 1 | 1 | 1.2 |
| AA-3 | Plot 7 | 1196 | 0.76 | 101 | Native_grassland | 55 | 618737.4 | 6038026.72 | 177 | 1 | 6 | 5 | 10 | 0 | 1 | 0.1 | 1.1 | 31.4 | 26.9 | 0.0 | 0.1 | 0 | 0 | 0.0 | 0.0 | 0 | 0 | 0 | 1 | 1 | 1 | 0.1 |
| AA-4 | Plot 8 | 1196 | 23.15 | 101 | Good | 55 | 619031.7 | 6037725.34 | 9 | 4 | 7 | 9 | 18 | 1 | 2 | 57.0 | 2.8 | 31.3 | 3.2 | 30.0 | 0.2 | 2 | 2 | 95.6 | 76.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.0 |
| AA-4 | Plot 9 | 1196 | 23.15 | 101 | Good | 55 | 618960.6 | 6038105.16 | 250 | 4 | 6 | 7 | 15 | 1 | 1 | 21.0 | 21.7 | 100.8 | 2.6 | 1.0 | 0.1 | 1 | 4 | 43.0 | 54.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.0 |
| AA-4 | Plot 10 | 1196 | 23.15 | 101 | Good | 55 | 619037.2 | 6038005.06 | 298 | 2 | 6 | 4 | 22 | 0 | 2 | 60.5 | 21.2 | 60.4 | 4.9 | 0.0 | 0.2 | 7 | 1 | 44.0 | 500.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.0 |
| AA-4 | Plot 11 | 1196 | 23.15 | 101 | Good | 55 | 618970 | 6037818.92 | 78 | 4 | 6 | 3 | 19 | 0 | 2 | 65.0 | 5.9 | 63.0 | 2.2 | 0.0 | 0.2 | 6 | 0 | 52.0 | 230.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.1 |
| AA-4 | Plot 12 | 1196 | 23.15 | 101 | Good | 55 | 619403.2 | 6037946.99 | 184 | 4 | 6 | 4 | 19 | 0 | 3 | 75.0 | 11.4 | 40.4 | 2.6 | 0.0 | 0.3 | 5 | 0 | 47.0 | 260.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.0 |
| AA-4 | Plot 13 | 1196 | 23.15 | 101 | Good | 55 | 619126.7 | 6037904.89 | 135 | 4 | 6 | 4 | 24 | 0 | 2 | 30.0 | 10.6 | 15.5 | 3.6 | 0.0 | 0.2 | 6 | 7 | 30.0 | 306.0 | 1 | 1 | 1 | 1 | 1 | 1 | 0.2 |

# Appendix D. Fauna survey results

Table D.1: Results of the mammal trapping program in the Australian Alps portion of the construction envelope

| PCT / Vegetation formation | Trap site | Date | Species |
|---|---|---|---|
| PCT 300<br>Wet Sclerophyll Forests (Grassy sub-formation)<br>Southern Tableland Wet Sclerophyll Forests | 1 | Monday, 3 December 2018 | Bush Rat<br>Agile Antechinus |
| | | Tuesday, 4 December 2018 | No captures |
| | | Wednesday, 5 December 2018 | No captures |
| | | Thursday, 6 December 2018 | Bush Rat |
| | 2 | Tuesday, 4 December 2018 | Bush Rat |
| | | Wednesday, 5 December 2018 | Bush Rat |
| | | Thursday, 6 December 2018 | Bush Rat<br>Agile Antechinus |
| | | Friday, 7 December 2018 | Bush Rat x 2<br>Blotched Blue Tongue Lizard |
| | 3 | Monday, 3 December 2018 | Agile Antechinus |
| | | Tuesday, 4 December 2018 | No captures |
| | | Wednesday, 5 December 2018 | No captures |
| | | Thursday, 6 December 2018 | No captures |
| | 4 | Tuesday, 4 December 2018 | No captures |
| | | Wednesday, 5 December 2018 | No captures |
| | | Thursday, 6 December 2018 | No captures |
| | | Friday, 7 December 2018 | Bush Rat Agile Antechinus |
| PCT 1196<br>Grassy Woodlands<br>Subalpine Woodlands | 5 | Wednesday, 5 December 2018 | No captures |
| | | Thursday, 6 December 2018 | Bush Rat |
| | | Friday, 7 December 2018 | Bush Rat |
| | | Saturday, 8 December 2018 | No captures |
| | 6 | Wednesday, 5 December 2018 | No captures |
| | | Thursday, 6 December 2018 | No captures |
| | | Friday, 7 December 2018 | No captures |
| | | Saturday, 8 December 2018 | No captures |
| | 7 | Wednesday, 5 December 2018 | No captures |
| | | Thursday, 6 December 2018 | No captures |
| | | Friday, 7 December 2018 | Bush Rat |
| | | Saturday, 8 December 2018 | No captures |

Table D.2: Results of the mammal trapping program in the Southern Highlands portion of the construction envelope

| PCT / Vegetation formation | Trap site | Date | Species |
|---|---|---|---|
| PCT 729<br>Dry Sclerophyll Forests (Shrubby sub-formation)<br>Southern Tableland Dry Sclerophyll Forests | 8 | Saturday, 26 January 2019 | No captures |
| | | Sunday, 27 January 2019 | No captures |
| | | Monday, 28 January 2019 | Agile Antechinus |
| | | Tuesday, 29 January 2019 | No captures |
| | 9 | Saturday, 26 January 2019 | Agile Antechinus x 3 |
| | | Sunday, 27 January 2019 | Agile Antechinus x 2 |
| | | Monday, 28 January 2019 | Agile Antechinus x 4 |
| | | Tuesday, 29 January 2019 | Agile Antechinus x 2 |
| PCT 302<br>Dry Sclerophyll Forests (Shrub/grass sub-formation)<br>Upper Riverina Dry Sclerophyll Forests | 10 | Wednesday, 30 January 2019 | Agile Antechinus x 3<br>Bush Rat |
| | | Thursday, 31 January 2019 | Agile Antechinus x 6<br>Bush Rat |
| | | Friday, 1 February 2019 | Agile Antechinus x 2<br>Bush Rat |
| | | Saturday, 2 February 2019 | No captures |
| PCT 296<br>Dry Sclerophyll Forests (Shrubby sub-formation)<br>Southern Tableland Dry Sclerophyll Forests | 11 | Wednesday, 30 January 2019 | Agile Antechinus |
| | | Thursday, 31 January 2019 | Agile Antechinus |
| | | Friday, 1 February 2019 | Agile Antechinus<br>Bush Rat |
| | | Saturday, 2 February 2019 | No captures |
| PCT 999<br>Dry Sclerophyll Forests (Shrubby sub-formation)<br>Southern Tableland Dry Sclerophyll Forests | 12 | Wednesday, 30 January 2019 | Agile Antechinus |
| | | Thursday, 31 January 2019 | Agile Antechinus |
| | | Friday, 1 February 2019 | Agile Antechinus |
| | | Saturday, 2 February 2019 | Agile Antechinus |

Table D.3: Results of the spotlighting surveys in the Australian Alps portion of the construction envelope

| PCT / Vegetation formation | Date | Species |
|---|---|---|
| PCT 300<br>Wet Sclerophyll Forests (Grassy sub-formation)<br>Southern Tableland Wet Sclerophyll Forests | Monday, 3 December 2018 | No results |
| | Tuesday, 4 December 2018 | Pheasant Coucal<br>Southern Boobook<br>Crinia signifera<br>Squirrel Glider<br>Yellow-bellied Glider |
| | Wednesday, 5 December 2018 | No results |

| PCT / Vegetation formation | Date | Species |
|---|---|---|
| PCT 1196<br>Grassy Woodlands<br>Subalpine Woodlands | Thursday, 6 December 2018 | Yellow-bellied Glider<br>Brushtail Possum |
| | Friday, 7 December 2018 | Yellow-bellied Glider |
| | Saturday, 8 December 2018 | Spotted Nightjar<br>Southern Boobook |
| | Sunday, 9 December 2018 | Yellow-bellied Glider |
| | Monday 10 December 2018 | Yellow-bellied Glider<br>Brushtail Possum<br>Eastern Pygmy-possum (recorded off site on Bradleys Drive) |

Table D.4: Results of the spotlighting surveys in the Southern Highlands portion of the construction envelope

| PCT / Vegetation formation | Date | Species |
|---|---|---|
| PCT 296<br>Dry Sclerophyll Forests (Shrubby sub-formation)<br>Southern Tableland Dry Sclerophyll Forests | Wednesday, 23 January 2019 | Southern boobook<br>Owlet nightjar<br>Masked owl<br>Brushtail possum<br>Squirrel Glider<br>Tawny Frogmouth |
| PCT 302<br>Dry Sclerophyll Forests (Shrub/grass sub-formation)<br>Upper Riverina Dry Sclerophyll Forests<br><br>PCT 999<br>Dry Sclerophyll Forests (Shrubby sub-formation)<br>Southern Tableland Dry Sclerophyll Forests | Thursday, 24 January 2019 | Brushtail Possum<br>Tawny Frogmouth<br>Southern Boobook<br>Sacred Kingfisher<br>Bronzewing |
| | Friday, 25 January 2019 | No results |
| PCT 729<br>Dry Sclerophyll Forests (Shrubby sub-formation)<br>Southern Tableland Dry Sclerophyll Forests<br><br>PCT 999<br>Dry Sclerophyll Forests (Shrubby sub-formation)<br>Southern Tableland Dry Sclerophyll Forests | Saturday, 26 January 2019 | Brushtail Possum x2<br>Eastern Pygmy-possum<br>Eastern Tiger Snake |
| | Monday, 28 January 2019 | Brushtail Possum<br>Owlet Nightjar<br>Southern Boobook |
| PCT 729<br>Dry Sclerophyll Forests (Shrubby sub-formation)<br>Southern Tableland Dry Sclerophyll Forests<br><br>PCT 999<br>Dry Sclerophyll Forests (Shrubby sub-formation)<br>Southern Tableland Dry Sclerophyll Forests | Tuesday, January 29, 2019 | Brushtail<br>Eastern Pygmy-possum<br>Sothern Boobook<br>Tawny Frogmouth |
| | Wednesday, January 30, 2019 | No results |
| | Thursday, January 31, 2019 | Brushtail Possum<br>Tawny Frogmouth<br>Squirrel Glider<br>Eastern Pygmy-possum<br>*Antechinus agilis*<br>Southern Boobook |

Table D.5: Results of the camera trapping program in the Australian Alps portion of the construction envelope

| PCT / Vegetation formation | Set date | End Date | No. cameras | Species | No. photos |
|---|---|---|---|---|---|
| PCT 300<br>Wet Sclerophyll Forests (Grassy sub-formation)<br>Southern Tableland Wet Sclerophyll Forests | Tuesday, 4 December 2018 | Sunday, 20 January 2019 | 10 | Deer<br>Pig<br>Bush Rat<br>Agile Antechinus<br>Brushtail Possum<br>Wombat<br>Lyrebird<br>Cat<br>Wallaby | 4<br>60<br>151<br>9<br>907<br>37<br>4<br>32<br>329 |
| PCT 1196<br>Grassy Woodlands<br>Subalpine Woodlands | Tuesday, 4 December 2018 | Sunday, 20 January 2019 | 6 | Deer<br>Brushtail Possum<br>wombat<br>Lyrebird<br>Cat<br>Wallaby<br>Kangaroo | 3<br>214<br>74<br>0<br>2<br>2<br>3 |
| PCT 285<br>Dry Sclerophyll Forests (Shrub/grass sub-formation)<br>Upper Riverina Dry Sclerophyll Forests | Tuesday, 4 December 2018 | Sunday, 20 January 2019 | 2 | Deer<br>Brushtail possum<br>Wombat | 8<br>58<br>4 |

Table D.6: Results of the camera trapping program in the South Eastern Highlands portion of the construction envelope

| PCT / Vegetation formation | Set date | End Date | No. cameras | Species | No. photos |
|---|---|---|---|---|---|
| PCT 729<br>Dry Sclerophyll Forests (Shrubby sub-formation)<br>Southern Tableland Dry Sclerophyll Forests | Tuesday, 4 December 2018 | Sunday, 20 January 2019 | 3 | Pig<br>Brushtail Possum<br>Wallaby<br>Bush Rat<br>Agile Antechinus<br>Eastern Pygmy-possum | 37<br>272<br>107<br>75<br>41<br>38 |
| | Tuesday, 22 January 2019 | Friday, 1 February 2019 | 13<br><br>E-cam2<br>E-cam7 | Brushtail Possum<br>Eastern Pygmy-possum<br>Agile Antechinus<br>Wallaby<br>Pig | 330<br>6<br>5<br>233<br>8 |

| PCT / Vegetation formation | Set date | End Date | No. cameras | Species | No. photos |
|---|---|---|---|---|---|
| PCT 302<br>Dry Sclerophyll Forests (Shrub/grass sub-formation)<br>Upper Riverina Dry Sclerophyll Forests | Tuesday, 22 January 2019 | Friday, 1 February 2019 | 0 | No camera in this PCT | 0 |
| PCT 296<br>Dry Sclerophyll Forests (Shrubby sub-formation)<br>Southern Tableland Dry Sclerophyll Forests | Tuesday, 22 January 2019 | Friday, 1 February 2019 | 11<br><br>E-cam27A<br>E-cam8 | Brushtail Possum<br>Agile Antechinus<br>Wallaby<br>Bronzewing<br>Rabbit | 6<br>10<br>25<br>6<br>20 |
| PCT 999<br>Dry Sclerophyll Forests (Shrubby sub-formation)<br>Southern Tableland Dry Sclerophyll Forests | Tuesday, 22 January 2019 | Friday, 1 February 2019 | 7 | Eastern Pygmy-possum<br>Common Ringtail Possum<br>Brushtail Possum<br>Wallaby<br>Agile Antechinus<br>Yellow-faced Honeyeater<br>Eastern Whipbird<br>Squirrel / Sugar Glider | 5<br>1<br>130<br>520<br>2<br>1<br>2<br>2 |
| PCT 300<br>Wet Sclerophyll Forests (Grassy sub-formation)<br>Southern Tableland Wet Sclerophyll Forests | Tuesday, 22 January 2019 | Friday, 1 February 2019 | 2 | Brushtail Possum | 27 |

Table D.7: Results of hair analysis from predator scats

| Scat No. | PCT / Vegetation formation | Species identified from the scat |
|---|---|---|
| Sample 1 | PCT 300<br>Wet Sclerophyll Forests (Grassy sub-formation)<br>Southern Tableland Wet Sclerophyll Forests | Fox scat containing Platypus and Beetle |
| Sample 2 | PCT 300<br>Wet Sclerophyll Forests (Grassy sub-formation)<br>Southern Tableland Wet Sclerophyll Forests | Dog scat containing Eastern Grey Kangaroo |
| Sample 3 | PCT 729<br>Dry Sclerophyll Forests (Shrubby sub-formation)<br>Southern Tableland Dry Sclerophyll Forests | Dog scat containing Horse and seed |

*Note: Scat hair analysis performed by Georgeanna Story from Scats About.*

Table D.8: Results of the bird surveys in the Australian Alps portion of the construction envelope

| PCT / Vegetation formation | Site | Date | Species |
|---|---|---|---|
| PCT 729<br>Dry Sclerophyll Forests (Shrubby sub-formation)<br>Southern Tableland Dry Sclerophyll Forests | 1 | Thursday, December 6, 2018 | Cicada bird<br>Grey Shrike-thrush<br>Yellow-tailed Black Cockatoo<br>Gang-gang Cockatoo<br>Yellow-faced Honeyeater<br>Grey Fantail<br>Red Wattlebird<br>Fan-tailed Cuckoo<br>Shining Bronze Cuckoo<br>Superb lyrebird |
| PCT 300<br>Wet Sclerophyll Forests (Grassy sub-formation)<br>Southern Tableland Wet Sclerophyll Forests | 3 | Friday, December 7, 2018 | Striated Thornbill<br>White-browed Scrubwren<br>White-throated Treecreeper<br>Spotted Pardalote<br>Grey Shrike-thrush<br>Australian Magpie<br>Laughing Kookaburra<br>Yellow-faced Honeyeater<br>White-winged Chough<br>Crimson Rosella<br>Grey Fantail |
| PCT 1196<br>Grassy Woodlands<br>Subalpine Woodlands | 5 | Sunday, December 9, 2018 | Red Wattlebird<br>Yellow-faced Honeyeater<br>Fan-tailed Cuckoo<br>Grey Shrike-thrush<br>Wonga Pigeon<br>Brush Cuckoo<br>Spotted Pardalote |
| | 6 | Sunday, December 9, 2018 | Grey Fantail<br>White-browed Scrubwren<br>Australian Magpie<br>Red Wattlebird<br>Yellow-faced Honeyeater<br>Striated Thornbill<br>Little raven<br>Crimson Rosella<br>Rufous Fantail<br>White-eared Honeyeater<br>Rufous Whistler<br>Wonga Pigeon |

| PCT / Vegetation formation | Site | Date | Species |
|---|---|---|---|
| PCT 1196<br>Grassy Woodlands<br>Subalpine Woodlands | 7 | Monday, December 10, 2018 | Eastern Whipbird<br>White-eared Honeyeater<br>Yellow-faced Honeyeater<br>Silvereye<br>Grey Shrike-thrush<br>Gang-gang Cockatoo<br>Australian Magpie<br>Spotted Pardalote<br>Brush Cuckoo<br>Fan-tailed Cuckoo<br>Nankeen Kestrel<br>Flame Robin<br>Superb fairy wren |
| Various opportunistic recordings | NA | Monday, December 3, 2018 - Monday, December 10, 2018 | Sulphur-crested Cockatoo<br>White-naped Honeyeater<br>Southern boobook<br>spotted nightjar<br>Sacred Kingfisher<br>Satin Bowerbird<br>Satin Flycatcher<br>Pheasant Coucal<br>Pied Currawong<br>Australian Golden Whistler<br>Australian King Parrot<br>Bassian Thrush<br>Eastern Spinebill |

Table D.9: Results of the bird surveys in the South Eastern Highlands portion of the construction envelope

| PCT / Vegetation formation | Site | Date | Species |
|---|---|---|---|
| PCT 302<br>Dry Sclerophyll Forests (Shrub/grass sub-formation)<br>Upper Riverina Dry Sclerophyll Forests | 10 | Thursday, January 24, 2019 | Brown-headed Honeyeater<br>Eastern Whipbird<br>Eurasian Blackbird<br>Fuscous Honeyeater<br>Olive-backed Oriole<br>Silvereye<br>Superb Fairywren<br>White-throated Treecreeper<br>Yellow-faced Honeyeater |
| | Near Lick Hole Gully | Saturday, January 26, 2019 | New Holland Honeyeater<br>Silvereye<br>Fuscous Honeyeater<br>Satin Bowerbird<br>Rufous Whistler<br>Superb Fairy Wren<br>Red-browed Finch |

| PCT / Vegetation formation | Site | Date | Species |
|---|---|---|---|
| PCT 296<br>Southern Tableland Dry Sclerophyll Forests<br>Dry Sclerophyll Forests (Shrubby sub-formation) | 11 | Thursday, January 24, 2019 | Golden Whistler<br>White-throated Treecreeper<br>Black-faced Cuckoo Shrike<br>Fuscous Honeyeater<br>Rufous Whistler<br>Gang-gang Cockatoo<br>Wedge-tailed Eagle |
| PCT 302<br>Dry Sclerophyll Forests (Shrub/grass sub-formation)<br>Upper Riverina Dry Sclerophyll Forests<br>PCT 296<br>Southern Tableland Dry Sclerophyll Forests<br>Dry Sclerophyll Forests (Shrubby sub-formation) | 10, 11 – general observations | January - February, 2019 | Crimson Rosella<br>Olive-backed Oriole<br>Fuscous Honeyeater<br>White-throated Treecreeper<br>Red-browed Finch<br>Satin Bowerbird<br>Tree Martin<br>Sacred Kingfisher<br>Black-faced Cuckoo Shrike<br>Gang-gang Cockatoo<br>Common Bronzewing<br>Brush Cuckoo<br>Diamond Firetail (x3)<br>Yellow-faced Honeyeater<br>Eastern Yellow Robin<br>Superb Fairy Wren<br>Striated Thornbill<br>White-throated Honeyeater<br>Grey Shrike Thrush<br>Silvereye<br>Eastern Whipbird<br>Owlet Nightjar<br>New Holland Honeyeater<br>White-naped Honeyeater<br>Brown-headed Honeyeater<br>Pied Currawong<br>Australian Magpie<br>Southern Boobook<br>Tawny Frogmouth<br>Rufous Whistler<br>Golden Whistler<br>Noisy Friarbird<br>Grey Fantail<br>Spotted Pardalote<br>Striated Pardalote<br>Leaden Flycatcher<br>White-browed Scrubwren<br>Eastern Spinebill<br>King Parrot<br>Rufous Fantail |

| PCT / Vegetation formation | Site | Date | Species |
|---|---|---|---|
| | | | Wonga Pigeon<br>Wedge-tailed Eagle<br>Brown Goshawk<br>Buff-rumped Thornbill<br>Blackbird<br>Peaceful Dove<br>Brown Quail |
| PCT 729<br>Dry Sclerophyll Forests (Shrubby sub-formation)<br>Southern Tableland Dry Sclerophyll Forests | 8 | Sunday, January 27, 2019 | No new species |
| | 9 | Sunday, January 27, 2019 | No new species |
| PCT 999<br>Dry Sclerophyll Forests (Shrubby sub-formation)<br>Southern Tableland Dry Sclerophyll Forests | 12 | Sunday, January 27, 2019 | No new species |

Table D.10: Results of the bat survey (harp trapping) in the Australian Alps portion of the construction envelope

| PCT / Vegetation formation | Site | Date | Species |
|---|---|---|---|
| PCT 1196<br>Grassy Woodlands<br>Subalpine Woodlands | Harp 1 | Wednesday, 5 December 2018 | No captures |
| | | Thursday, 6 December 2018 | *Nyctophilus geoffroyi* |
| PCT 285<br>Dry Sclerophyll Forests (Shrub/grass sub-formation)<br>Upper Riverina Dry Sclerophyll Forests | Harp 2 | Thursday, 6 December 2018 | *Vespadelus darlingtoni* x 15<br>*Vespadelus regulus* x 2<br>*Nyctophilus geoffroyi*<br>*Chalinolobus morio* |
| | | Friday, 7 December 2018 | *Nyctophilus geoffroyi*<br>*Vespadelus darlingtoni* x 5<br>*Vespadelus regulus* x 4 |
| PCT 300<br>Wet Sclerophyll Forests (Grassy sub-formation)<br>Southern Tableland Wet Sclerophyll Forests | Harp 3 | Saturday, 8 December 2018 | *Vespadelus vulturnus*<br>*Chalinolobus morio* |
| | | Sunday, 9 December 2018 | *Vespadelus vulturnus*<br>*Vespadelus darlingtoni* x 3 |
| PCT 300<br>Wet Sclerophyll Forests (Grassy sub-formation)<br>Southern Tableland Wet Sclerophyll Forests | Harp 4 | Friday, 7 December 2018 | *Vespadelus darlingtoni*<br>*Chalinolobus morio*<br>*Nyctophilus geoffroyi* |
| PCT 300<br>Wet Sclerophyll Forests (Grassy sub-formation)<br>Southern Tableland Wet Sclerophyll Forests | Harp 5 | Saturday, 8 December 2018 | *Vespadelus vulturnus*<br>*Chalinolobus morio* |

Table D.11: Results of the bat survey (harp trapping) in the South Eastern Highlands portion of the construction envelope

| PCT / Vegetation formation | Site | Date | Species |
|---|---|---|---|
| | Harp 6 | | No captures |
| PCT 302<br>Dry Sclerophyll Forests<br>(Shrub/grass sub-formation) | Harp 7 | Wednesday, 23 January 23 2019 | *Vespadelus darlingtoni* |
| | | Monday, 28 January 2019 | *Nyctophilus gouldi x 2*<br>*Nyctophilus geoffroyi* x 14<br>*Vespadelus vulturnus* x 6 |
| | | Tuesday, 29 January 2019 | *Vespadelus vulturnus* x 5 |
| | Harp 8 | Monday, 28 January 28 2019 | *Nyctophilus geoffroyi*<br>*Vespadelus darlingtoni*<br>*Vespadelus vulturnus* x 8<br>*Scoteanax rueppellii* or *Falsistrellus tasmaniensis* (escaped before positive ID could be made) |
| | | Tuesday, 29 January 2019 | *Vespadelus vulturnus* x 7<br>*Chalinolobus morio* x 2<br>*Nyctophilus geoffroyi* x 4<br>*Vespadelus darlingtoni* x 2<br>*Nyctophilus gouldi* x 4<br>*Scotorepens orion* |

Table D.12: Results of the reptile surveys in the Australian Alps portion of the construction envelope

| PCT / Vegetation formation | Site | Date | Species |
|---|---|---|---|
| PCT 300<br>Wet Sclerophyll Forests (Grassy sub-formation)<br>Southern Tableland Wet Sclerophyll Forests | 2 | Thursday, 6 December 2018 | Alpine meadow-skink x 3 |
| | 3 | Thursday, 6 December 2018 | Tree-crevice skink<br>Delicate skink<br>Blotched Blue Tongue Lizard |
| | | Monday, 10 December 2018 | Alpine meadow-skink<br>Delicate skink<br>Tree-crevice skink |
| | 4 | Thursday, 6 December 2018 | Delicate skink x 2 |
| PCT 1196<br>Grassy Woodlands<br>Subalpine Woodlands | 5 | December 2018 | Copperhead snake<br>Alpine meadow-skink x 3<br>Delicate skink x 5<br>Pale-Flecked Garden Sunskink x 3 |
| | 6 | December 2018 | Alpine meadow-skink x 1<br>Delicate skink x 3<br>Pale-Flecked Garden Sunskink x 20 |
| | 7 | December 2018 | No results |

Table D.13: Results of the reptile surveys in the South Eastern Highlands portion of the construction envelope

| PCT / Vegetation formation | Site | Date | Species |
|---|---|---|---|
| PCT 729<br>Dry Sclerophyll Forests (Shrubby sub-formation)<br>Southern Tableland Dry Sclerophyll Forests | 1 | Thursday, 6 December 2018 | No results |
| PCT 729<br>Dry Sclerophyll Forests (Shrubby sub-formation)<br>Southern Tableland Dry Sclerophyll Forests | 8 | Wednesday, January 23, 2019 | No results |
| PCT 296<br>Southern Tableland Dry Sclerophyll Forests<br>Dry Sclerophyll Forests (Shrubby sub-formation) | 9 | Thursday, 24 January 2019 | No results |
| PCT 296<br>Southern Tableland Dry Sclerophyll Forests<br>Dry Sclerophyll Forests (Shrubby sub-formation) | 10 | Thursday, 24 January 2019 | No results |
| PCT 296<br>Southern Tableland Dry Sclerophyll Forests<br>Dry Sclerophyll Forests (Shrubby sub-formation) | 11 | Thursday, 24 January 2019 | Jacky Dragon<br>Skink sp. |
| PCT 999<br>Dry Sclerophyll Forests (Shrub/grass sub-formation)<br>Upper Riverina Dry Sclerophyll Forests | 12 | Friday, 25 January 2019 | No results |
| PCT 999<br>Dry Sclerophyll Forests (Shrub/grass sub-formation)<br>Upper Riverina Dry Sclerophyll Forests | 13 | Sunday, 27 January 2019 | No results |
| Opportunistic sightings | Various | Wednesday, 23 January 2019 - Friday, 1 February 2019 | Robust Ctenotus<br>Blotched Blue Tongue Lizard<br>Copper-Tailed Skink<br>Inland Snake-eyed Skink<br>Tiger Snake<br>Red-bellied Black Snake<br>Eastern Small-eyed Snake<br>Australian Water Dragon<br>Jacky Dragon |

# Appendix E. Echolocation call analysis

# Microbat Call Identification Report

| | |
|---|---|
| **Prepared for ("Client"):** | Jacobs |
| **Survey location/project name:** | Snowy Hydro 2.0 Transmission |
| **Survey dates:** | December 2018 |
| **Client project reference:** | IA199900 |
| **Job no.:** | JAC-1903 |
| **Report date:** | 31 May 2019 |

## Methods

### Data supplied

*Balance! Environmental* received 21 raw ZCA files and associated log files recorded by two Anabat Express bat-detectors during two survey periods (4-12 December 2018 and 23-30 January 2019).

### Post-processing

All ZCA files were converted to zero-crossing analysis bat-call sequence files (ZC files) using *Anabat Insight* (Version 1.8.3; Titley Scientific, Brisbane). This process yielded 12,825 ZC files for analysis.

### Call identification

Call analyses were performed in *Anabat Insight* (Titley Scientific, Brisbane), with all **ZC** files passed through a Decision Tree analysis to exclude files containing only background noise and group the remaining bat calls based on zero-crossing analysis parameters (e.g. characteristic frequency (Fc), time between calls (TBC) and pulse curvature).

The preliminary call identities applied by the Decision Tree process were then confirmed or adjusted manually by comparing call spectrograms and derived metrics with those of regionally relevant reference calls from **a**nd/or with published call descriptions (e.g. Pennay *et al*. 2004). Consideration was also given to the probability of species' occurrence based on published distribution information (e.g. Churchill 2008; van Dyck et al. 2013) and on-line database records (e.g. http://www.ala.org.au).

### Reporting standard

The format and content of this report follows Australasian Bat Society standards for the interpretation and reporting of bat call data (Reardon 2003). Species nomenclature follows Jackson and Groves (2015).

## Results & Discussion

Of the 12,825 ZC files generated from the raw detector files, 8987 contained only non-bat background noise. The remaining 3838 ZC files included 4115 bat-calls, two-thirds (2751) of which were positively identifiable, while the other 1364 calls (33%) were unresolved as they had characteristics that were potentially attributable to two or more species.

Fourteen call types were reliably identified (see **Table 1**), 13 to individual species and the other to the *Nyctophilus* genus, two species of which probably occur in the study area (*N. geoffroyi* and *N. gouldi*).

The unresolved calls were allocated to 11 multi-species groups, most of which represented species that were also positively identified elsewhere in the data set. Where calls were attributed to an unresolved group, **Table 1** lists all group members as "possible" for the relevant detector-night unless reliably identified calls were available for one or more of those species for the same detector-night.

**Appendix 1** provides a full list of the unresolved species groups and shows the numbers of calls allocated to each unique species and unresolved group per detector-night.

**Table 1** Bats recorded during the summer 2018-19 surveys for Snowy 2.0 Transmission Project.

♦ = 'definite' - at least one call was attributed unequivocally to the species

□ = 'possible' - calls like those of the species were recorded, but were not reliably identified

**Part A – December surveys**

| Detector: | Anabat 1 | | | Anabat 2 | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date:** | 7/12 | 10/12 | 11/12 | 4/12 | 5/12 | 6/12 | 7/12 | 8/12 | 9/12 | 10/12 | 11/12 |
| *Chalinolobus gouldii* | | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | | □ | □ |
| *Chalinolobus morio* | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | | ♦ | ♦ |
| *Falsistrellus tasmaniensis* | □ | ♦ | □ | □ | □ | □ | | □ | ♦ | | □ |
| *Nyctophilus* sp. | ♦ | ♦ | | ♦ | ♦ | ♦ | | ♦ | | ♦ | ♦ |
| *Scoteanax rueppellii* | | | | □ | □ | | □ | | □ | | □ |
| *Scotorepens greyii* | | □ | □ | | □ | | | □ | | | □ |
| *Scotorepens orion* | □ | □ | | ♦ | ♦ | ♦ | □ | | ♦ | | □ |
| *Vespadelus darlingtoni* | □ | ♦ | □ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ |
| *Vespadelus regulus* | ♦ | ♦ | □ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | □ |
| *Vespadelus vulturnus* | ♦ | □ | □ | ♦ | ♦ | ♦ | ♦ | □ | ♦ | □ | |
| *Miniopterus orianae oceanensis* | □ | □ | □ | ♦ | ♦ | ♦ | □ | ♦ | □ | □ | ♦ |
| *Austronomus australis* | | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ |
| *Ozimops planiceps* | | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | | ♦ | ♦ |
| *Ozimops ridei* | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ |

**Part B – January surveys**

| Detector: | Anabat 1 | | | | | Anabat 2 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Date:** | 23/1 | 24/1 | 25/1 | 28/1 | 29/1 | 23/1 | 24/1 | 25/1 | 26/1 | 27/1 |
| *Chalinolobus gouldii* | ♦ | □ | ♦ | | ♦ | ♦ | ♦ | | ♦ | |
| *Chalinolobus morio* | ♦ | ♦ | ♦ | ♦ | ♦ | | | | | |
| *Falsistrellus tasmaniensis* | ♦ | ♦ | ♦ | ♦ | ♦ | | □ | □ | □ | □ |
| *Nyctophilus* sp. | ♦ | ♦ | ♦ | ♦ | ♦ | | | | ♦ | ♦ |
| *Scoteanax rueppellii* | | | | | | | | | □ | □ |
| *Scotorepens greyii* | | | □ | □ | □ | | □ | | | |
| *Scotorepens orion* | □ | □ | □ | □ | □ | | □ | ♦ | ♦ | ♦ |
| *Vespadelus darlingtoni* | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ |
| *Vespadelus regulus* | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | □ |
| *Vespadelus vulturnus* | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | □ |
| *Miniopterus orianae oceanensis* | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ |
| *Austronomus australis* | ♦ | ♦ | ♦ | | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ |
| *Ozimops planiceps* | ♦ | ♦ | □ | | □ | □ | □ | | □ | |
| *Ozimops ridei* | ♦ | ♦ | ♦ | ♦ | ♦ | ♦ | | ♦ | ♦ | ♦ |
| *Saccolaimus flaviventris* | | ♦ | | | ♦ | | | | | |

**Appendix 2** provides sample spectrograms of calls recorded during the present survey for each identified species or unresolved group

## References


Churchill, S. (2008). *Australian Bats*. Jacana Books, Allen & Unwin; Sydney.

Jackson, S. and Groves, C. (2015). Taxonomy of Australian Mammals. CSIRO Publishing, Melbourne.

Pennay, M., Law, B. and Reinhold, L. (2004). *Bat Calls of New South Wales*. Department of Environment and Conservation, Hurstville.

Reardon, T. (2003). Standards in bat detector based surveys. *Australasian Bat Society Newsletter* **20**, 41-43.

Reinhold, L., Law, B., Ford, G. and Pennay, M. (2001). *Key to the bat calls of south-east Queensland and north-east New South Wales*. Department of Natural Resources and Mines, Brisbane.

van Dyck, S., Gynther, I. and Baker, A. (ed.) (2013). *Field Companion to the Mammals of Australia*. New Holland; Sydney.

**Appendix 1** Bats recorded during the summer 2018-19 surveys for Snowy 2.0 Transmission Project. **Part A – December surveys**

Number of calls detected per detector-night for individual species and unresolved groups.

| **Detector:** | Anabat 1 | | | Anabat 2 | | | | | | | | Species total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date:** | 7/12 | 10/12 | 11/12 | 4/12 | 5/12 | 6/12 | 7/12 | 8/12 | 9/12 | 10/12 | 11/12 | |
| **Positively identified calls** | | | | | | | | | | | | |
| *Chalinolobus gouldii* | | 3 | 3 | 9 | 4 | 1 | 8 | 6 | | | | 34 |
| *Chalinolobus morio* | 4 | 7 | 1 | 19 | 12 | 3 | 4 | 4 | | 3 | 4 | 61 |
| *Falsistrellus tasmaniensis* | | 3 | | | | | | | 1 | | | 4 |
| *Nyctophilus* sp. | 2 | 2 | | 1 | 8 | 6 | | 6 | | 1 | 1 | 27 |
| *Scotorepens orion* | | | | 1 | 3 | 1 | | | 2 | | | 7 |
| *Vespadelus darlingtoni* | | 1 | | 61 | 105 | 115 | 54 | 61 | 10 | 10 | 2 | 419 |
| *Vespadelus regulus* | 4 | 2 | | 38 | 16 | 3 | 16 | 65 | 2 | 1 | | 147 |
| *Vespadelus vulturnus* | 1 | | | 2 | 3 | 1 | 1 | | 1 | | | 9 |
| *Miniopterus orianae oceanensis* | | | | 1 | 7 | 4 | | 1 | | | 1 | 14 |
| *Austronomus australis* | | 48 | 2 | 2 | 109 | 1 | 5 | 4 | 7 | 2 | 4 | 184 |
| *Ozimops planiceps* | | 228 | 82 | 5 | 39 | 5 | 18 | 14 | | 10 | 1 | 402 |
| *Ozimops ridei* | 1 | 6 | 2 | 2 | 34 | 2 | 1 | 4 | 1 | 17 | 3 | 73 |
| *Saccolaimus flaviventris* | | | | | | | | | | | | 0 |
| **Unresolved calls** | | | | | | | | | | | | |
| *F. tasmaniensis / Scotorepens greyii* | | 7 | 1 | | | | | | | | | 8 |
| *F. tasmaniensis / S. greyii / V. darlingtoni* | | | | | 1 | | | 1 | | | 1 | 3 |
| *F. tasmaniensis / S. orion* | 1 | 3 | | 2 | 1 | 1 | | | | | | 8 |
| *S. orion / Scoteanax rueppellii* | | | | 3 | 5 | | 1 | | 2 | | 1 | 12 |
| *V. darlingtoni / V. regulus* | 1 | 4 | 1 | 21 | 19 | 32 | 21 | 72 | 16 | 2 | | 189 |
| *V. darlingtoni / V. regulus / M. o. oceanensis* | 3 | 1 | | | 3 | 1 | 4 | 1 | 4 | 1 | 1 | 19 |
| *V. vulturnus / C. morio* | | 1 | 3 | | | | | | | | | 4 |
| *V. vulturnus / M. o. oceanensis* | | | 1 | 6 | 13 | 7 | | 40 | | 1 | | 68 |
| *O. planiceps / C. gouldii* | | 84 | 46 | 15 | 19 | 2 | 21 | 34 | | 24 | 6 | 251 |
| *O. ridei / C. gouldii* | | 16 | 16 | 2 | | | | | | | | 34 |
| *O. planiceps / O. ridei* | | 26 | 12 | 13 | 63 | 12 | 6 | 8 | | 18 | 2 | 160 |
| Detector-night total | 17 | 442 | 170 | 203 | 464 | 197 | 160 | 321 | 46 | 90 | 27 | 2137 |

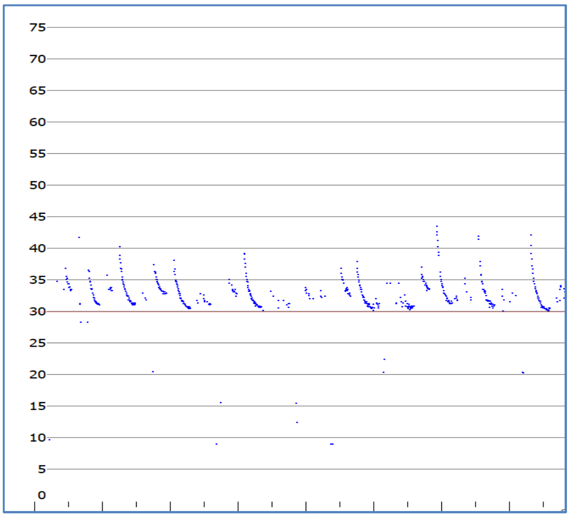
**Appendix 1** Bats recorded during the summer 2018-19 surveys for Snowy 2.0 Transmission Project. **Part B – January surveys**

Number of calls detected per detector-night for individual species and unresolved groups.

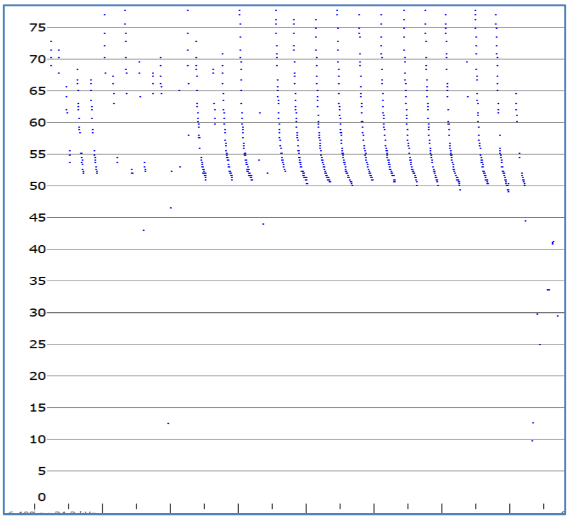
| **Detector:** | Anabat 1 | | | | | Anabat 2 | | | | | Species total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Date:** | 23/1 | 24/1 | 25/1 | 28/1 | 29/1 | 23/1 | 24/1 | 25/1 | 26/1 | 27/1 | |
| **Positively identified calls** | | | | | | | | | | | |
| *Chalinolobus gouldii* | 3 | | 3 | | 2 | 3 | 2 | | 1 | | 14 |
| *Chalinolobus morio* | 1 | 2 | 1 | 6 | 3 | | | | | | 13 |
| *Falsistrellus tasmaniensis* | 3 | 5 | 3 | 16 | 13 | | | | | | 40 |
| *Nyctophilus* sp. | 8 | 24 | 24 | 42 | 55 | | | | 1 | 2 | 156 |
| *Scotorepens orion* | | | | | | | | 1 | 1 | 1 | 3 |
| *Vespadelus darlingtoni* | 168 | 120 | 93 | 51 | 44 | 5 | 3 | 6 | 3 | 4 | 497 |
| *Vespadelus regulus* | 79 | 29 | 12 | 1 | 8 | 2 | 1 | 1 | 2 | | 135 |
| *Vespadelus vulturnus* | 5 | 11 | 3 | 4 | 2 | 1 | 4 | 1 | 1 | | 32 |
| *Miniopterus orianae oceanensis* | 16 | 14 | 5 | 15 | 15 | 1 | 2 | 2 | 3 | 2 | 75 |
| *Austronomus australis* | 5 | 65 | 135 | | 6 | 6 | 19 | 25 | 39 | 2 | 302 |
| *Ozimops planiceps* | 7 | 3 | | | | | | | | | 10 |
| *Ozimops ridei* | 17 | 23 | 24 | 4 | 9 | 2 | | 1 | 8 | 2 | 90 |
| *Saccolaimus flaviventris* | | 1 | | | 2 | | | | | | 3 |
| **Unresolved calls** | | | | | | | | | | | |
| *F. tasmaniensis / Scotorepens greyii* | | | 1 | 1 | | | 1 | | | | 3 |
| *F. tasmaniensis / S. greyii / V. darlingtoni* | | | 1 | 2 | 1 | | | | | | 4 |
| *F. tasmaniensis / S. orion* | 3 | 8 | 7 | 3 | 4 | | 2 | 1 | 2 | 2 | 32 |
| *S. orion / Scoteanax rueppellii* | | | | | | | | | 6 | 3 | 9 |
| *V. darlingtoni / V. regulus* | 84 | 89 | 61 | 45 | 46 | 1 | 1 | 5 | 5 | 6 | 343 |
| *V. darlingtoni / V. regulus / M. o. oceanensis* | 8 | 14 | 2 | 20 | 6 | 7 | 8 | 4 | 6 | | 75 |
| *V. vulturnus / C. morio* | 1 | | 1 | 3 | 1 | | | | | | 6 |
| *V. vulturnus / M. o. oceanensis* | 8 | 9 | 6 | 13 | 20 | | | 3 | 4 | 4 | 67 |
| *O. planiceps / C. gouldii* | 1 | 2 | 3 | | | 1 | 1 | | | | 8 |
| *O. ridei / C. gouldii* | 1 | 4 | 5 | | 8 | 1 | | | | | 19 |
| *O. planiceps / O. ridei* | 21 | 13 | 5 | | 2 | | | | 1 | | 42 |
| Detector-night total | 439 | 436 | 395 | 226 | 247 | 30 | 44 | 50 | 83 | 28 | 1978 |

## Appendix 2 Representative call sequences: Snowy 2.0 Transmission surveys, summer 2018-19.

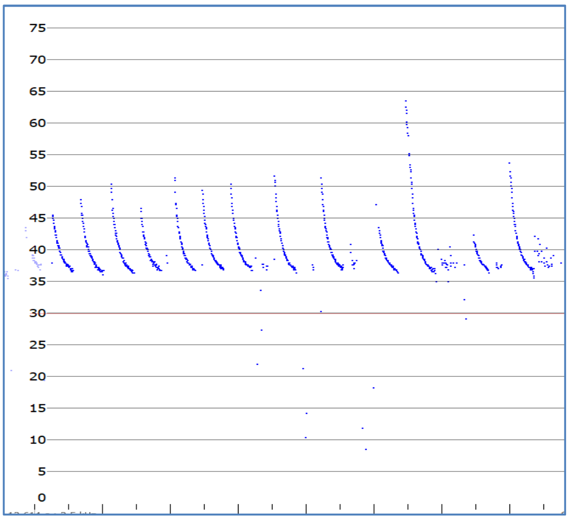
(Scale: 10msec per tick; time between pulses removed)



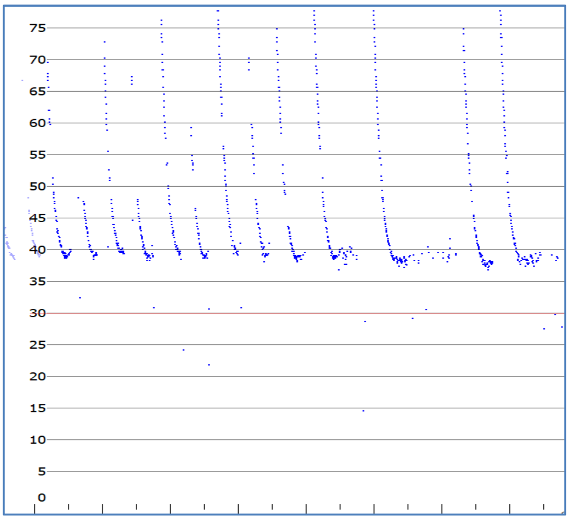

*Chalinolobus gouldii*



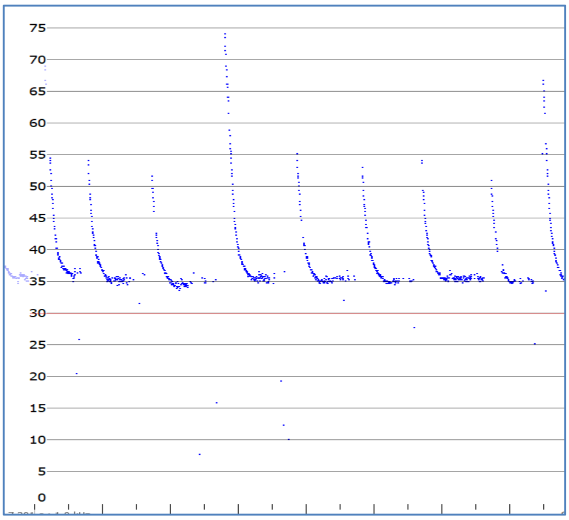

*Chalinolobus morio*



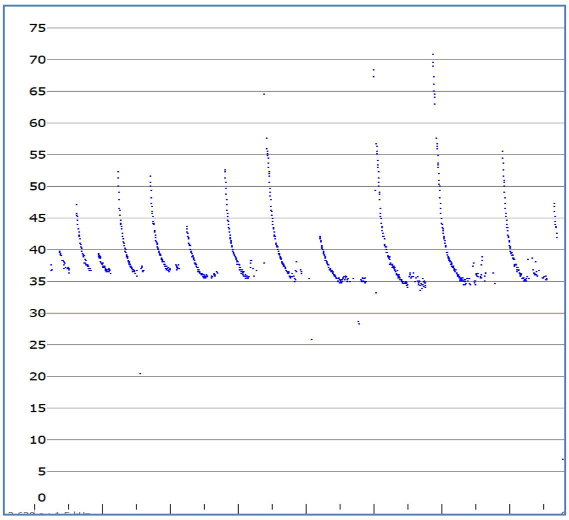

*Falsistrellus tasmaniensis*



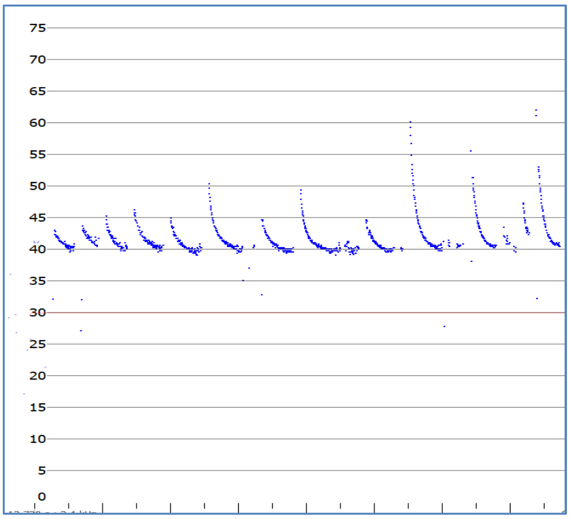

*F. tasmaniensis / Scotorepens greyii*



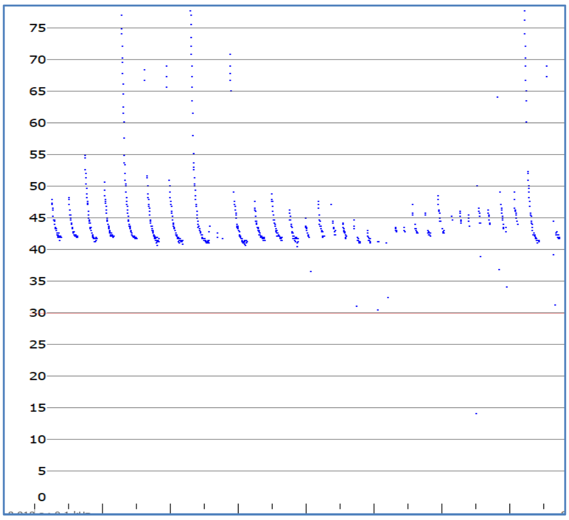

*Scotorepens orion*



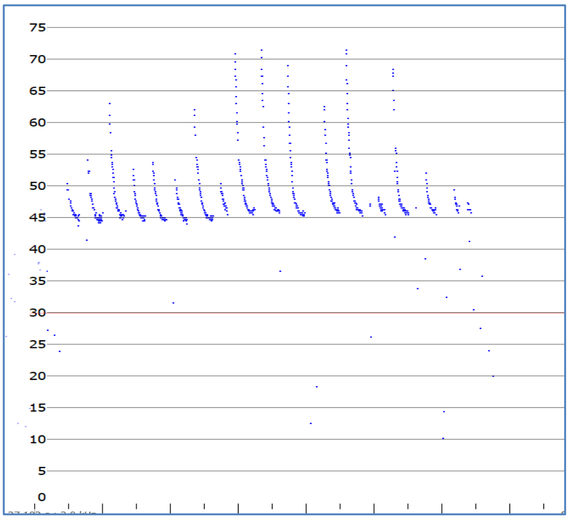

*S. orion / Scoteanax rueppellii*



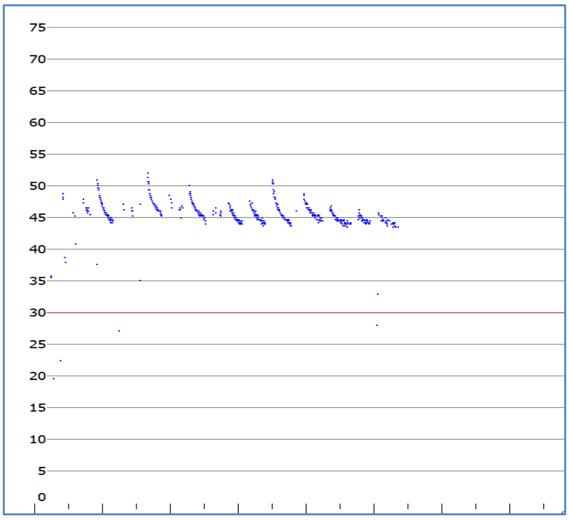

*Vespadelus darlingtoni*



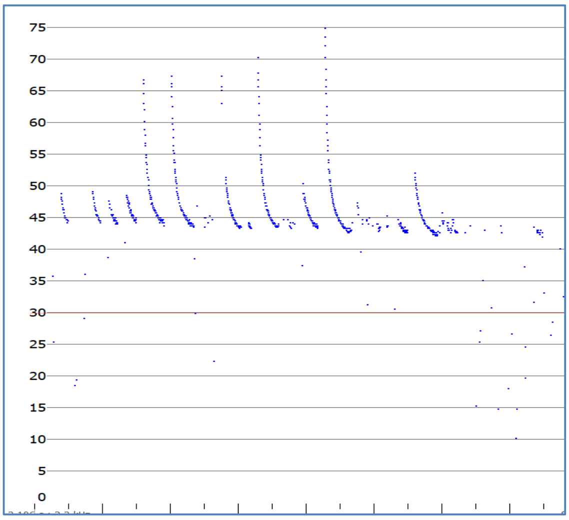

*Vespadelus regulus*



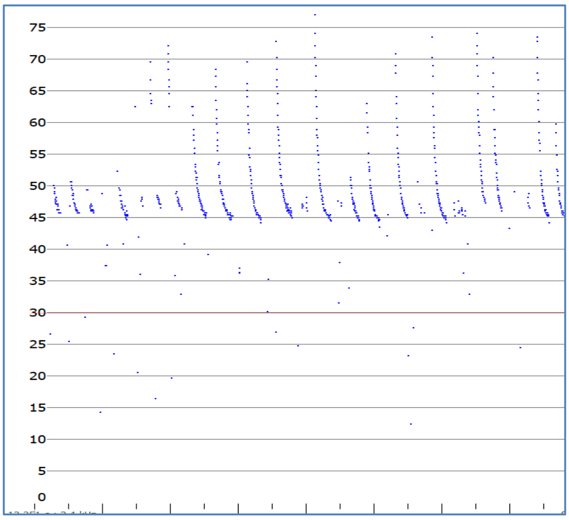

*Vespadelus vulturnus*



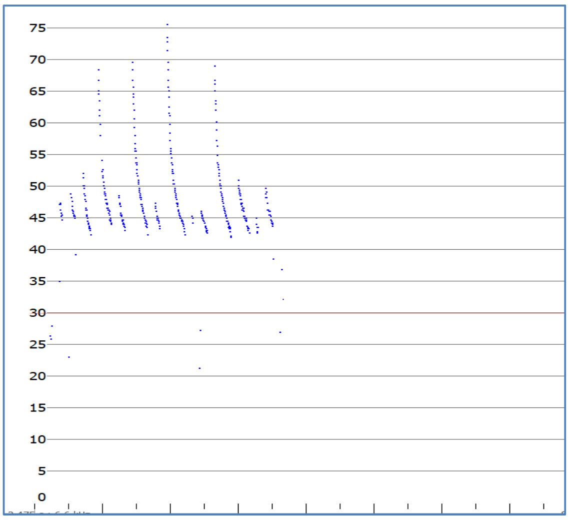

*Miniopterus orianae oceanensis*



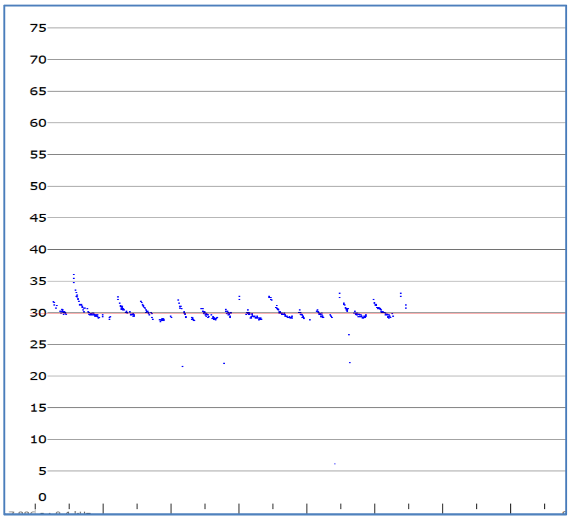

*V. darlingtoni / V. regulus / M. o. oceanensis*



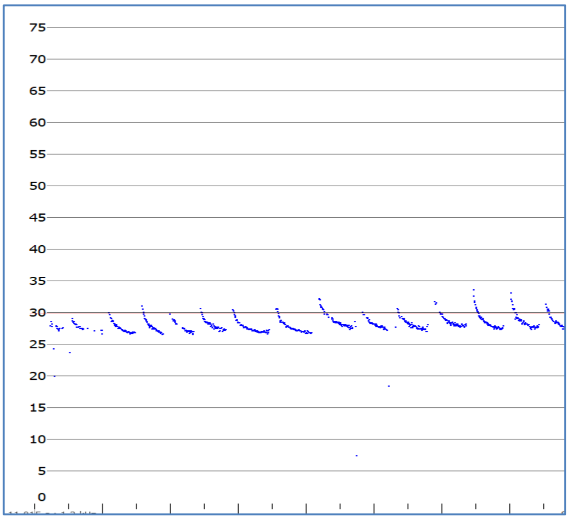

*V. vulturnus. / M. o. oceanensis*



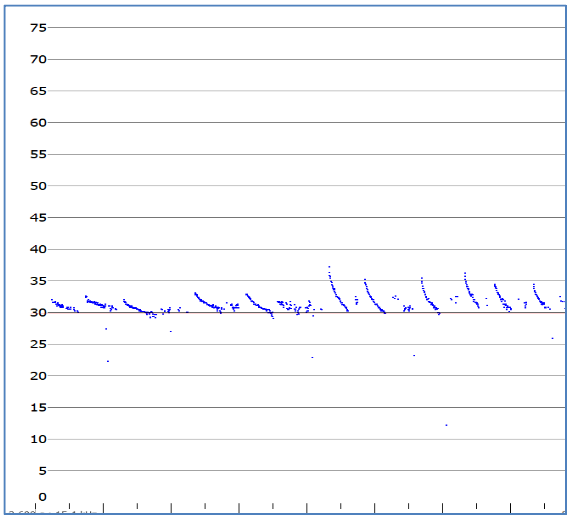

*Nyctophilus* sp.



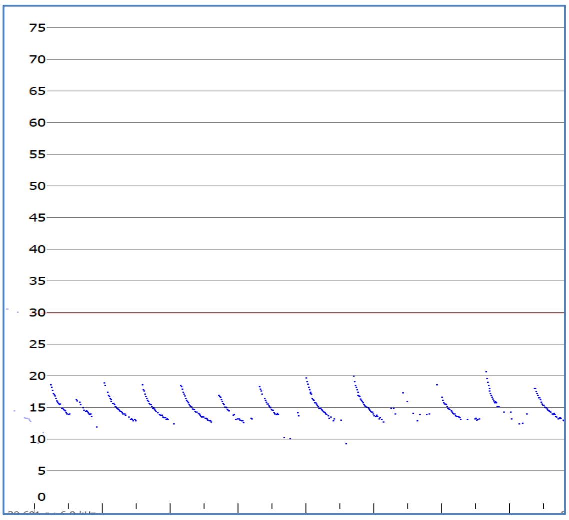

*Ozimops* sp. / *C. gouldii*



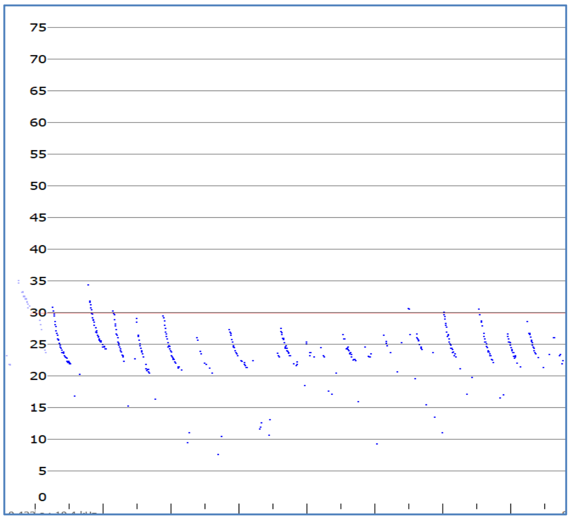

*Ozimops planiceps*




*Ozimops ridei*




*Austronomus australis*




*Saccolaimus flaviventris*

# Appendix F. Thelymitra atronitida expert report

# SoS Data Deficient Species: Targeted Survey Results and Management Recommendations for *Thelymitra atronitida* Jeanes

Prepared by AMBS Ecology & Heritage Pty Ltd
for NSW Office of Environment and Heritage

Final

June 2019

AMBS Reference: 17481

# Document Information

| | |
|---|---|
| **Citation:** | AMBS Ecology & Heritage 2019, *SOS Data Deficient Species: Targeted Survey Results and Management Recommendations for Thelymitra atronitida* Consultancy report to NSW Office of Environment and Heritage |
| **AMBS Ref:** | 17481 |
| **Versions:** | Final Report issued 21 June 2019 |
| **Recipient:** | James Brazill-Boast, NSW Government Office of Environment and Heritage, James.brazillboast@environment.nsw.gov.au |
| **Author** | Diane Callaghan |
| **Approved by:** | Belinda Pellow, David Keith |

# Executive Summary

AMBS Ecology & Heritage Pty Ltd (AMBS) was commissioned by the NSW Office of Environment and Heritage (OEH) to prepare a species-specific report to address priority knowledge gaps for the data deficient species (DDS) *Thelymitra atronitida* Jeanes. Records of *Thelymitra atronitida* occurrence were accessed from BioNet, the Atlas of Living Australia, and the Australasian Virtual Herbarium to determine appropriate survey areas. Contact with numerous experts and former collectors was an essential component of the preliminary assessment. Two locations for this species are recorded in BioNet, Kamay Botany National Park and Bago State Forest. The Bago State Forest herbarium specimen was examined by Dr Mark Clements and determined to be likely misidentified therefore surveys focused on the records from Kamay Botany Bay National Park which were confirmed by Jeanes from collections by Dean Rouse and Peter Weston. Margaret Bradhurst also provided details on orchid sightings at the National Park. Approximate locations of former collections, locality descriptions provided by experts, and likely suitable habitat based on habitat descriptions from previous records, were all used to inform the search areas. Targeted searches were conducted on 13 August and 19 September 2018.

A population of four orchids was found in the vicinity of previous collections by Peter Weston and Dean Rouse. One specimen was collected and determined to be *Thelymitra malvina* M.A. Clem., D.L. Jones & Molloy. This species is not listed as a threatened species in NSW. The specimens were located under unburnt shrubs adjacent to a walking track. Although the extant population was small, it appears to be in good condition. Evident threats to this population include herbivory by introduced vertebrates and human disturbance which could be exacerbated by stochastic environmental events (e.g. weather events or fire). Should a population of *Thelymitra atronitida* be located in this location in the future these threats would apply to the population.

We recommend additional searches during known flowering times in suitable habitat i.e. Sydney Sandstone Heath, in Kamay Botany National Park, to determine whether any other *Thelymitra* specimens recorded match the taxonomic description of *Thelymitra atronitida.* Additional areas identified as suitable habitat (e.g. Nadgee Nature Reserve and southern heathland in NSW) may also be targeted. We also recommend a taxonomic review of this species, given its resemblance in morphology and ecology to the co-occurring *Thelymitra malvina*.

# Contents



# Tables



# Figures



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# 1 Introduction

## 1.1 Background

AMBS Ecology & Heritage Pty Ltd (AMBS) was commissioned by the NSW Office of Environment and Heritage (OEH) to prepare a report to address priority knowledge gaps for the data deficient species (DDS) *Thelymitra atronitida* Jeanes. The data deficient species management stream, as a component of the larger Saving our Species (SoS) program, include threatened species which are currently lacking important knowledge to inform effective management. The primary objective is to fill gaps pertaining to threatened species' ecology, distribution, threats and/or management strategies (OEH 2016). This requires review of all existing information, field surveys, and thorough reporting of results.

## 1.2 Project overview

This report aims to address knowledge gaps for *Thelymitra atronitida* by investigating historical records, literature searches, ecological field techniques, known vegetation mapping, in-house botanical proficiency and expert opinions. A significant portion of this project relied on communications with expert botanists with first-hand experience with the species itself and its associated records.

Deliverables associated with this project were to:

- identify all known records of *Thelymitra atronitida;*
- survey areas where records occur unless suitable habitat is questionable;
- characterise habitat, associated species, and soil types;
- record population size, extent, reproductive status, and health;
- identify any possible threats to existing populations; and
- provide recommendations for managing populations and advise where additional searches or data are required.

Archived email communications, shapefiles of search areas and waypoints, and additional photographs will be provided separately.

## 1.3 Species Description

*Thelymitra atronitida* Jeanes (Black-hooded Sun Orchid) is currently one of 22 priority plants under the SoS DDS program. It was originally described by Jeffrey A. Jeanes in 2000 and is one of many species that form the *Thelymitra pauciflora* R.Br. complex (Bates 2010; Jeanes 2000, 2004). The species is described as a glabrous terrestrial herb, leaf linear to linear-lanceolate, dark green with purplish base, apex acute; scape 30-50 cm tall; flowers 2-8, moderately dark blue with darker longitudinal veins; post-anther lobe tubular, inflated, hooded, dorsally compressed, apex shortly bilobed, lobes toothed, mostly glossy black, apex yellow; lateral lobes with terminal toothbrush-like white hairs (PlantNET accessed 25/04/2019; Plate 1.1).

**Plate 1.1 Distinctive characteristics of *Thelymitra atronitida*, image courtesy of Backhouse et al. (2016).**

This species has a limited known distribution in NSW with only two disjunct populations, Kamay Botany Bay National Park in Kurnell and Bago State Forest in Tumbarumba (AVH 2019). Its' national distribution includes records from the eastern coast of Victoria, Wellington VIC, Cape Barren Island, Kingston TAS, and Coles Bay TAS (AVH 2019, Figure 1.1).

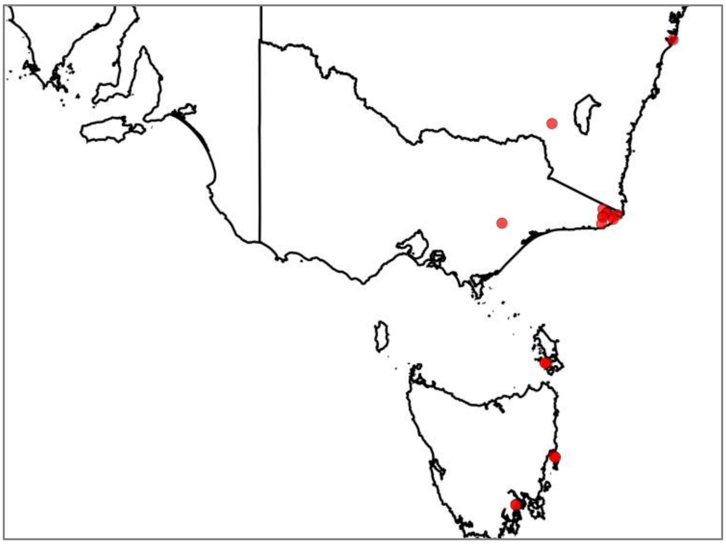


**Figure 1.1 Distribution of *Thelymitra atronitida* (AVH 2019).**

*Thelymitra atronitida* very closely resembles *Thelymitra malvina* M.A. Clem., D.L. Jones & Molloy. The taxonomic key describes *Thelymitra atronitida* as having a glossy black post-anther lobe, white trichomes, two sterile bracts, and pale blue flowers. Alternatively, *Thelymitra malvina* has a dark reddish-brown post-anther lobe, pink or mauve trichomes (rarely white), three sterile bracts, and slate blue to purplish flowers (Jeanes 2004).

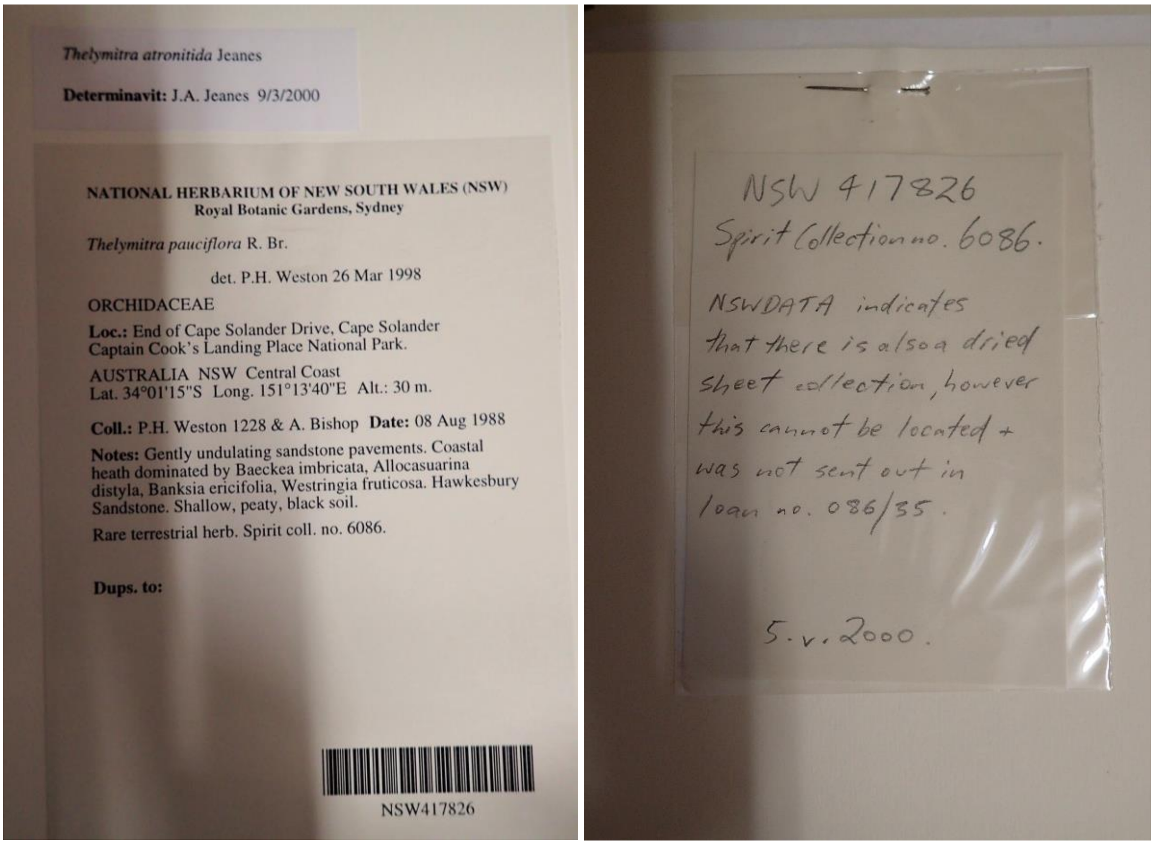
# 2 Methods

## 2.1 Species background research

Records of *Thelymitra atronitida* were accessed from BioNet on 07 March 2018 (Appendix A). These records were compared with records from the Atlas of Living Australia (ALA) and the Australasian Virtual Herbarium (AVH). There are five records of *Thelymitra atronitida* occurring in NSW according to both BioNet and AVH records (Table 2.1, Figure 2.1). The earliest is from Cape Solander (Kamay Botany Bay National Park) on 08 August 1988 (NSW417826, Plate 2.1) and was originally identified as *Thelymitra pauciflora* and later revised by Jeff Jeanes. The habitat was described as "Gently undulating sandstone pavements. Coastal heath dominated by *Baeckea imbricata, Allocasuarina distyla, Banksia ericifolia, Westringia fruticosa*. Hawkesbury Sandstone. Shallow, peaty, black soil." The AVH indicates that according to NSWDATA there should be a dried sheet collection but that only the spirit material could be located (spirit collection no. 6086). The identification of the preserved spirit collection as *Thelymitra atronitida* was confirmed by Dr Mark Clements at the Australian National Herbarium (Clements pers. comm. 29 January 2019). We were unable to contact Jeff Jeanes for more details on the records from both Cape Solander and Bago State Forest.

**Table 2.1 Consolidated records of *Thelymitra atronitida* from NSW.**

| Collector | Date of collection | Record ID | Location description | Coordinates (decimal) |
|---|---|---|---|---|
| A. Bishop, P.H. Weston | 08/08/1988 | NSW417826 (spirit collection 6086) | End of Cape Solander Drive, Cape Solander | -34.019255, 151.228935 |
| P.G. Branwhite | 03/12/1999 | CANB609392 | Bago State Forest | -35.700000, 148.150000 (generalised coordinates) |
| Jim Kelton | 07/02/2004 | Not available | Brandy Marys Bago State Forest Crown Leases | -35.762889, 148.288872 |
| P.G. Branwhite, D. Jones, J. Kelton | 23/6/2005 | Not available | Bago State Forest | -35.632346, 148.182963 |
| Dean Rouse | 14/09/2006 | MEL2296309A | End of Cape Solander Drive, Cape Solander | -34.016750, 151.228278 |


*Thelymitra atronitida* Jeanes

**Determinavit:** J.A. Jeanes 9/3/2000

**NATIONAL HERBARIUM OF NEW SOUTH WALES (NSW)**
**Royal Botanic Gardens, Sydney**

*Thelymitra pauciflora* R. Br.

det. P.H. Weston 26 Mar 1998

ORCHIDACEAE

**Loc.:** End of Cape Solander Drive, Cape Solander
Captain Cook's Landing Place National Park.

AUSTRALIA NSW Central Coast
Lat. 34°01'15"S Long. 151°13'40"E Alt.: 30 m.

**Coll.:** P.H. Weston 1228 & A. Bishop **Date:** 08 Aug 1988

**Notes:** Gently undulating sandstone pavements. Coastal heath dominated by Baeckea imbricata, Allocasuarina distyla, Banksia ericifolia, Westringia fruticosa. Hawkesbury Sandstone. Shallow, peaty, black soil.

Rare terrestrial herb. Spirit coll. no. 6086.

**Dups. to:**

NSW417826

NSW 417826
Spirit Collection no. 6086.
NSWDATA indicates that there is also a dried sheet collection, however this cannot be located + was not sent out in loan no. 086/35.

5.v.2000.

**Plate 2.1 Original and revised record description for NSW417826, National Herbarium of New South Wales.**

A later collection was made in Cape Solander in 2005 by Dean Rouse, and the specimen was identified as *Thelymitra malvina* by Jeanes (MEL2296309A). Jeanes requested additional material from Rouse because the plants looked unusual (Rouse pers. comm. 08 September 2018). The following year, on 14 September 2006, a specimen from the same area was collected by Rouse and identified by Jeanes as *Thelymitra atronitida* (MEL2296487A, Plate 2.2).

**Plate 2.2 *Thelymitra atronitida*, Cape Solander 2006. Courtesy of Dean Rouse.**

Three records of *Thelymitra atronitida* come from a disjunct locality in Bago State Forest (Tumbarumba LGA) on the southern tablelands of NSW. The first specimen was collected on 03 December 1999 by P.G. Branwhite (Plate 2.3Plate 2.3) and identified by David L. Jones of the Australian National Herbarium. The habitat was recorded as open forest with a heathy understorey on well-drained sand or clay-loam soils (OEH 2007). This specimen was originally identified as *Thelymitra pauciflora* R.Br. but later re assigned to *Thelymitra atronitida* by Jeanes. The other two records do not have herbarium ID numbers and may be unvouchered records. They include one collected by J. Kelton in 2004 and another by P.G. Branwhite, J. Kelton, and D. Jones in 2005, the former occurring in Brandy Marys Bago State Forest Crown Leases. The original estimate for the Bago population was 50 plants but further searches have proven unsuccessful, possibly due to logging in the area (*in. litt.*, P. Branwhite 2005, J. Kelton 2006; OEH 2007).

According to information obtained from Jeff Jeanes by the NSW Scientific Committee (2007) during the determination of *Thelymitra atronitida* as a critically endangered species, the incongruent morphology and ecology of the Bago population suggests that it may be taxonomically distinct from the Cape Solander population. Jeanes indicated the unlikelihood of the species occurring in the habitats around Bago- montane grassland, bog or forest (Geoff Robertson pers comm. 08 August 2018). Mark Clements also suggested that the Bago specimens had likely been misidentified (Clements pers. comm. 22 August 2018). Based on this information we focused our search efforts on the records from Kamay Botany Bay National Park and did not search for the populations in Bago State Forest.

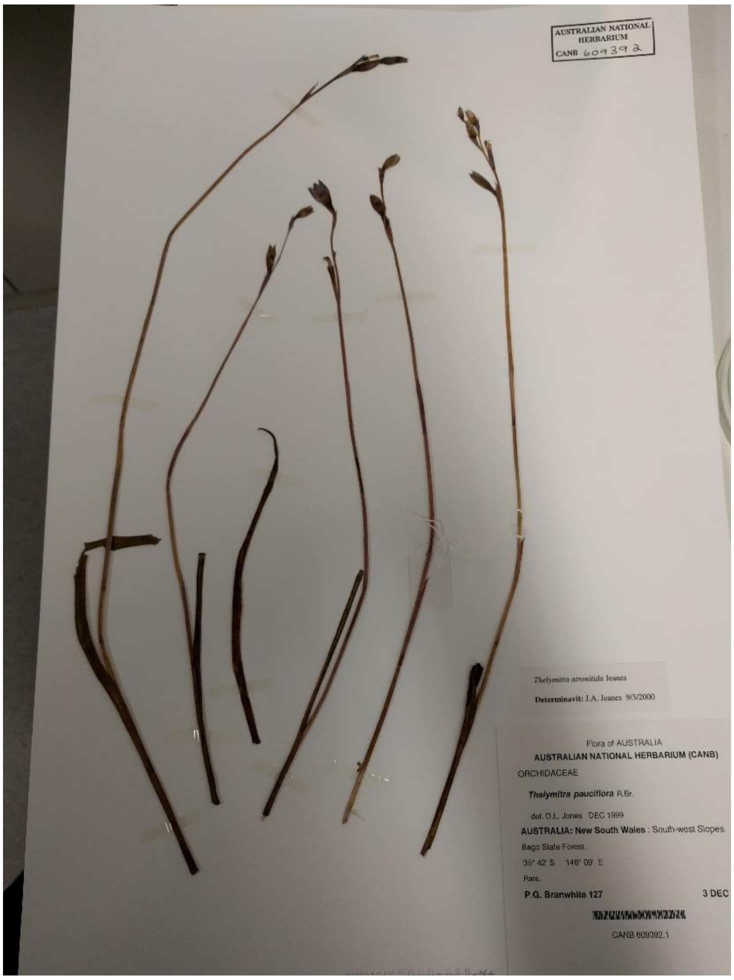



**Plate 2.3 Peter Branwhite specimen 1999, Bago State Forest; image courtesy of the Australian National Herbarium.**

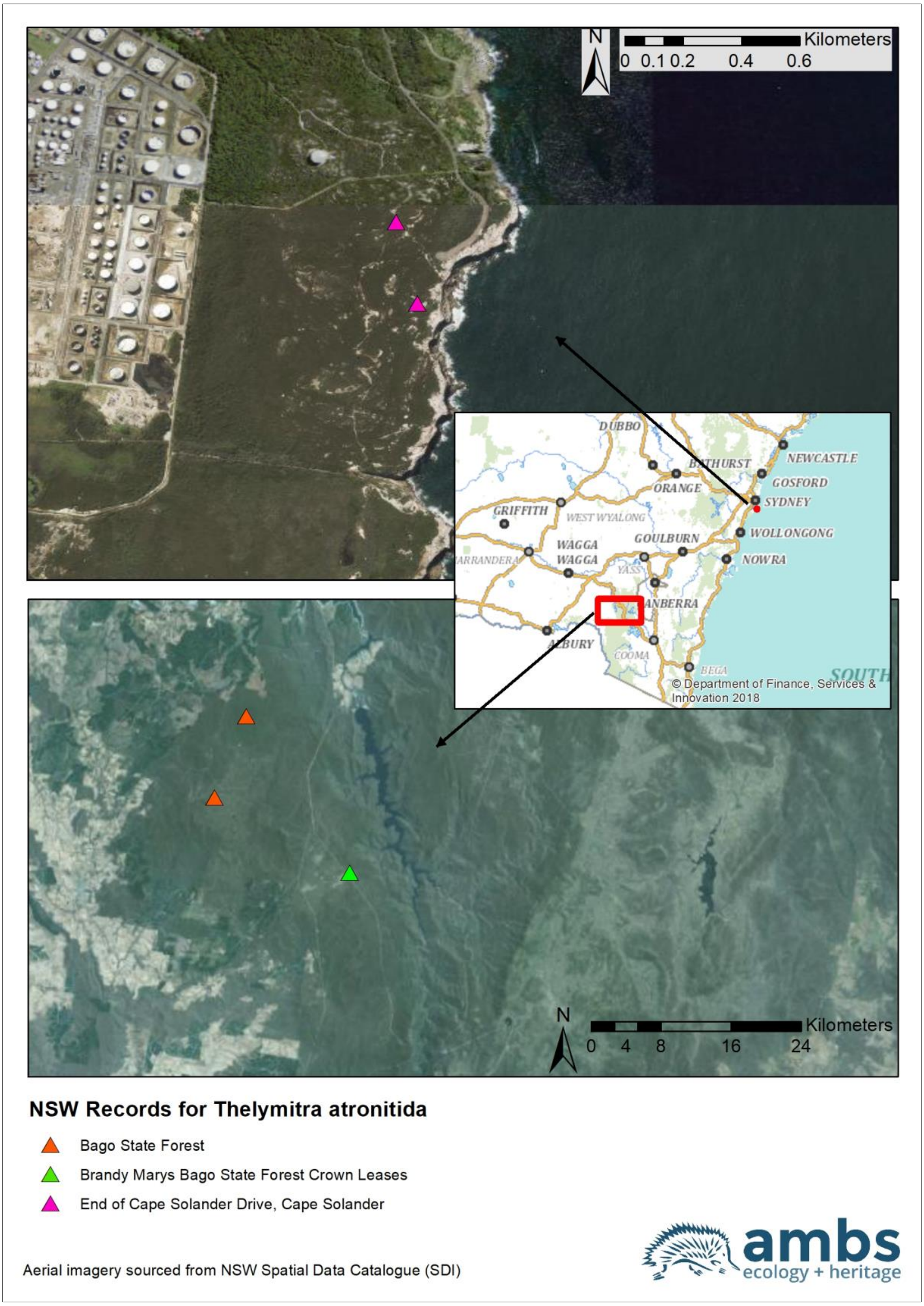



**Figure 2.1 Location of BioNet records for *Thelymitra atronitida.* The upper mapped area shows the Cape Solander records, and the lower shows the Bago State Forest records.**

## 2.2 Survey design

Surveys of the Cape Solander population were undertaken in Spring 2018. The flowering period of *Thelymitra atronitida* is August to December in New South Wales (Jeanes 2004). This timeframe matches dates from the BioNet records for specimen collections in NSW (08/08/1988, 03/12/1999, 14/09/2006). We also contacted Margaret Bradhurst, a local orchid expert, who indicated having seen *Thelymitra atronitida* in flower at Kamay Botany Bay National Park on 24/9/2001 and 11/10/2004 (pers. comm. 20 September 2018). The BioNet BioBanking report provides a smaller window of detection and recommends surveying for this species in November and December (BioNet, accessed 29/4/19).

Surveyed locations were based on the historic records as well as consultation with Dean Rouse, who provided coordinates and a hand drawn map of his collection location in Kamay Botany Bay National Park, and Margaret Bradhurst who provided an approximate description of the location where she had seen the the species flowering near the Yena Track in the Kamay Botany Bay National Park. The original collector, Peter Weston, described the record location as being in heathland near the carpark at the end of Cape Solander Road (Weston pers. comm. 28 May 2018).

Approximate locations of former collections, locality descriptions provided by experts, and likely suitable habitat based on habitat descriptions from previous records, were all used to inform the search areas. Targeted searches were conducted over two field days (13 August and 19 September 2018) throughout Kamay Botany Bay National Park.

We used search methods described by Keith (2000) and the NSW Guide to Threatened Plants (OEH 2016) to estimate population size, structure, and status. In this case, given the small number of individuals found, the applicable method for estimating population size is direct counting.

We used an iPad and GPS to navigate and record all searched areas. Habitat, associated species, disturbance, and possible threats, as well as any information relevant to the species' population size and status, were recorded.

# 3 Results

## 3.1 Summary of results

A population of four orchids was found in the vicinity of the previous collections by Peter Weston and Dean Rouse. One specimen was collected and determined by Dr Matt Renner to be *Thelymitra malvina.* The specimen has been lodged at the National Herbarium of NSW. Although the detected population is small, it appears to be in good condition. Threats include exotic herbivory and human disturbance which could be exacerbated by stochastic environmental events (e.g. climate or fire). *Thelymitra malvina* is not currently listed as a threatened species in NSW or Australia, however information on threats may be of use should *Thelymitra atronitida* be found in this area in the future.

## 3.2 Overview of searched areas

AMBS botanists Belinda Pellow and Ruby Stephens performed a comprehensive survey in the Cape Solander location on 13 August 2018. It should be noted that a significant portion of the park had been burnt by a wildfire in September 2017. No target plants were found during this first survey. A second, more targeted, survey was undertaken on 19 September 2018 after receiving detailed instructions about former plant locality from Dean Rouse and Margaret Bradhurst (Cape Bailey Track and Yena Track, respectively; Figure 3.1). Four adult *Thelymitra* plants were found in the vicinity of Weston and Rouse's records growing under unburnt shrubs of *Baeckea imbricata* adjacent to Cape Bailey walking track (Figure 3.2). All four individuals were in flower and appeared healthy (Plate 3.1**Error! Reference source not found.**).

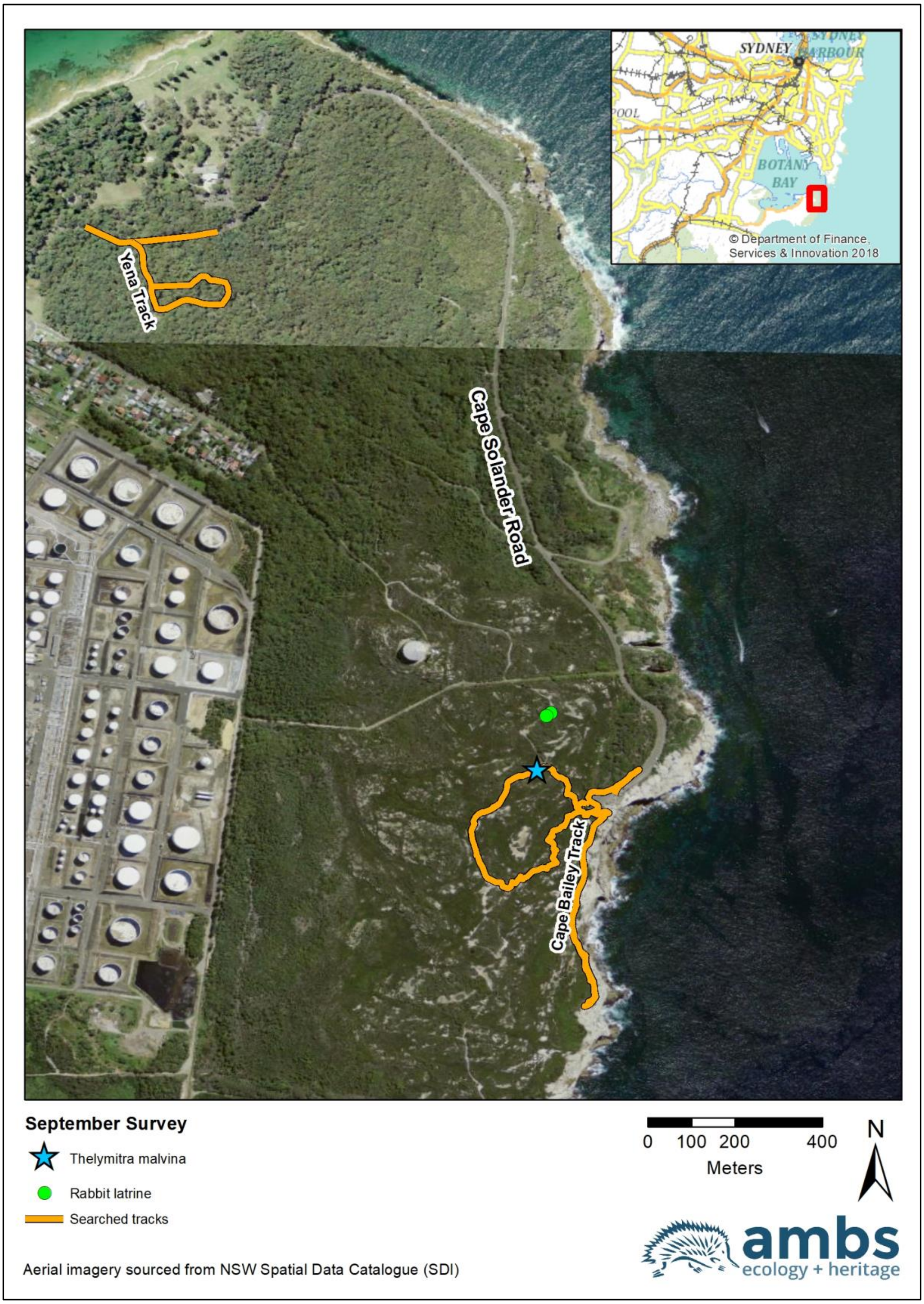



**Figure 3.1 Overview of searched areas within Kamay Botany Bay National Park.**

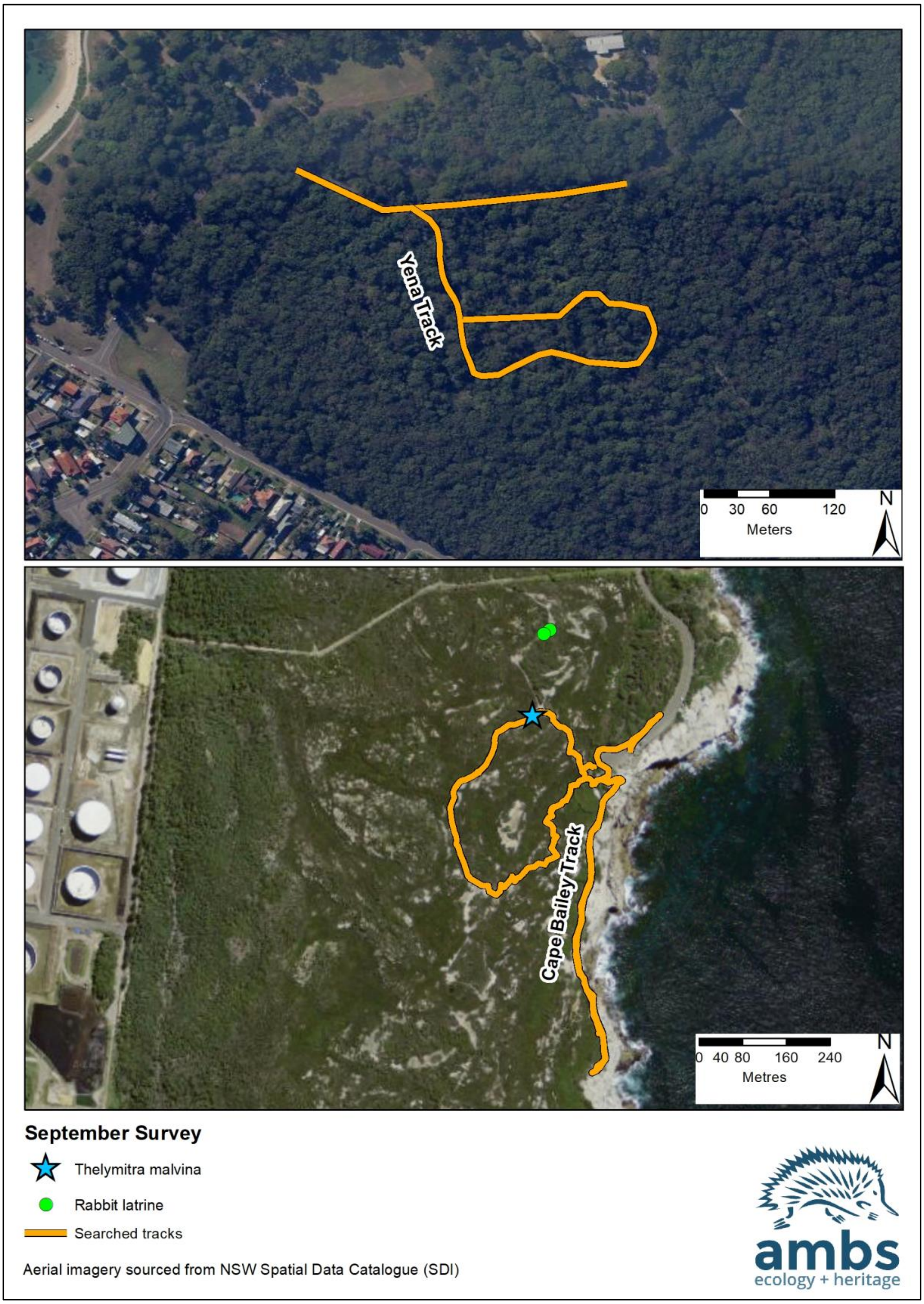



**Figure 3.2 Close-up of searched tracks and adjacent habitat.**

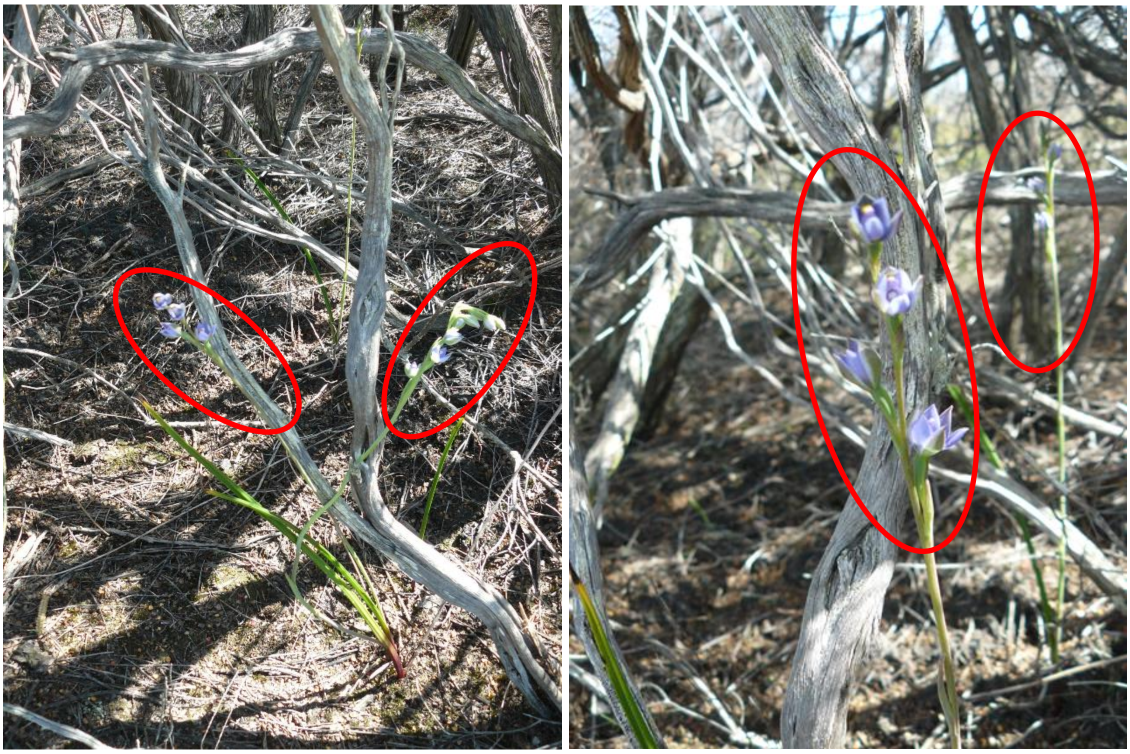


**Plate 3.1 *Thelymitra malvina* flowering inflorescences (circled) in Cape Solander on 19 September 2018.**

## 3.3 Identification of specimens

One specimen was collected during surveys by removing the above-ground portion without disturbing its tuber. The specimen was delivered to Dr Matt Renner at the National Herbarium of NSW who determined it to be the closely related species, *Thelymitra malvina* M.A. Clem., D.L. Jones & Molloy based on the following characteristics: three inflorescence bracts, purple-hued trichomes, entire shallow notch in post-anther lobe (Renner pers. comm. 26 February 2019; Plate 3.2).

**Plate 3.2 Entire inflorescence and individual flower of *Thelymitra malvina* collected from Cape Solander survey during targeted searches.**

Renner compared our specimen with one from Victoria and one collected by Peter Weston in 1988 at Cape Solander. His professional opinion was that neither looked exactly like the *Thelymitra atronitida* illustrated in Jeanes (2004) (Figure 3.3), both lacking the dentate notch margins on the post anther lobe, and that morphology for both was incongruent. Based on morphology alone, Renner concluded that Weston's specimen (inflorescence in spirits) did not differ from ours, having the inflated post anther lobe with a shallow entire notch, but information about colour or bract number was not available making the assessment difficult.

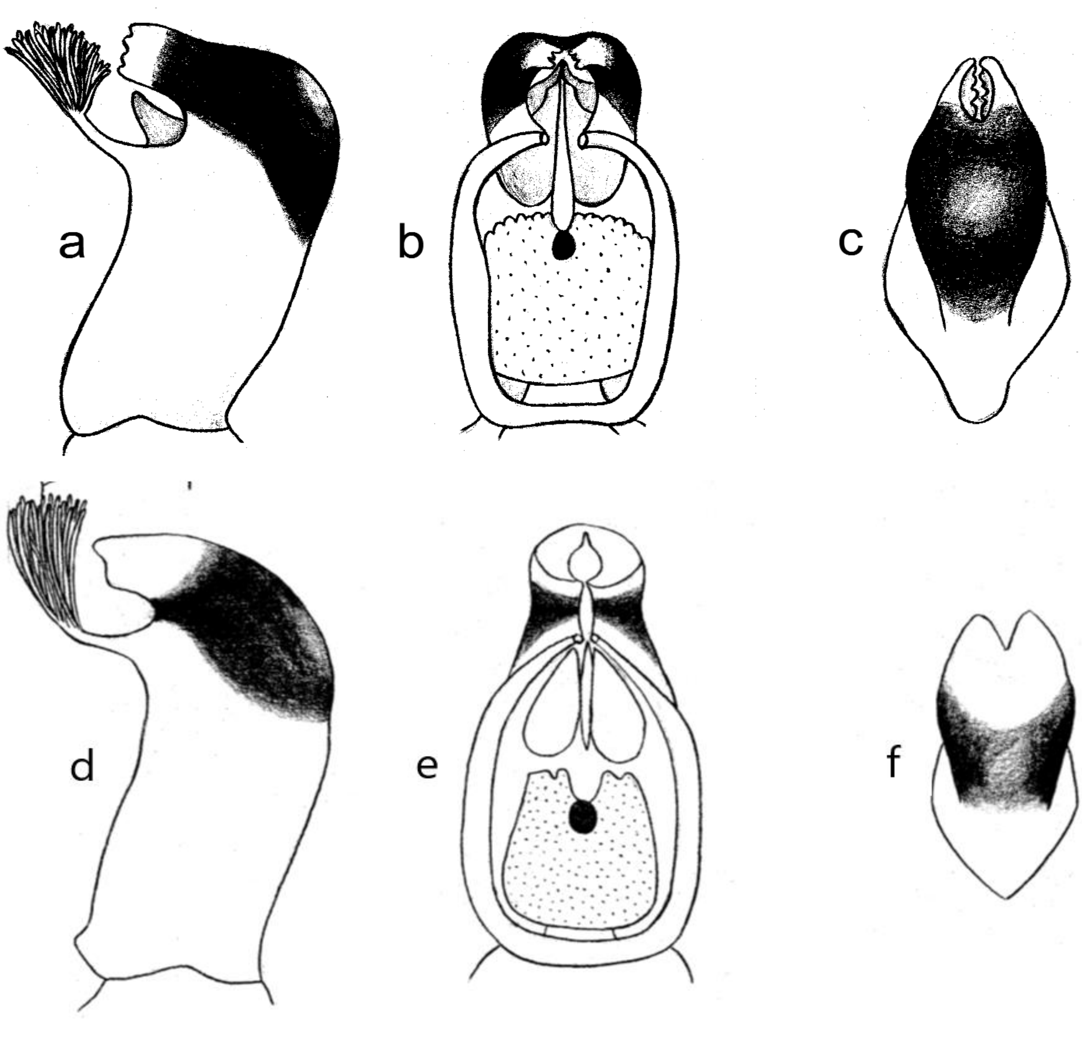



**Figure 3.3 *Thelymitra atronitida*: a. column from side, b. column from front, c. post-anther lobe from rear; *Thelymitra malvina*: d. column from side, e. column from front, f. post-anther lobe from rear (Jeanes 2004).**

The Bago herbarium specimen was examined and compared with an isotype of *Thelymitra atronitida* (preserved in spirits) by Dr Mark Clements on 30 January 2018. He indicated that, although identification based solely on morphology is subjective and tricky (e.g. differences in hood colour, trichome colour, etc.), the Bago specimen did not have the correct morphology or habitat for *Thelymitra atronitida* and was quite likely misidentified previously (Clements pers. comm). Clements is also currently doing genetic work on the genus and will be reviewing other records from the *Thelymitra pauciflora* complex.

The results from the Cape Solander searches suggest that these two distinct, yet closely related species (*Thelymitra atronitida* and *Thelymitra malvina*) may occur sympatrically, but their presence is asynchronous and possibly dependent upon climate, disturbance or some other factor. There is also the possibility that the two species are indeed present and may intergrade resulting in phenotypic variation within a single population, and the characteristics defining the taxonomic differences are unreliable for identification.

## 3.4 Habitat description

### *3.4.1 Land status and mapped vegetation*

Cape Solander is in the Kurnell area in Kamay Botany Bay National Park and is a National Heritage listed region having outstanding value in terms of natural history and native plant diversity. The vegetation communities we searched within the National Park include Sydney Sandstone Heath (open-heath/closed scrub) and Sydney Sandstone Gully Forest (open forest/woodland) (Benson & Howell 1994; Keith 2004; OEH 2015; Figure 3.4).

The Sydney Sandstone Heath vegetation communities are characterised by Hawkesbury sandstone rock plateaus overlain with shallow soils, ranging from earthy sands, yellow and grey earths, lithsols, leached sands, and gleyed podzolics (Chapman & Murphy 1989). Species assemblages are strongly influenced by fire regimes and soil moisture, depth and drainage (Benson & Howell 1994). The dominate species of the open-heath/closed scrub communities are *Banksia ericifolia*, *Darwinia fascicularis*, and *Allocasuarina distyla.*

The Sydney Sandstone Gully Forest has similar soil attributes but with deeper podzolic soils created from material that is washed down into the lower slopes and valleys of the rock formation (Chapman & Murphy 1989). The open-forest/woodland vegetation community is characterised by a canopy of *Eucalyptus piperita*, *Angophora costata*, and/or *Eucalyptus gummifera* and an understorey dominated by a variety of shrubs primarily from the Proteaceae, Fabaceae, and Myrtaceae families (Benson & Howell 1994).

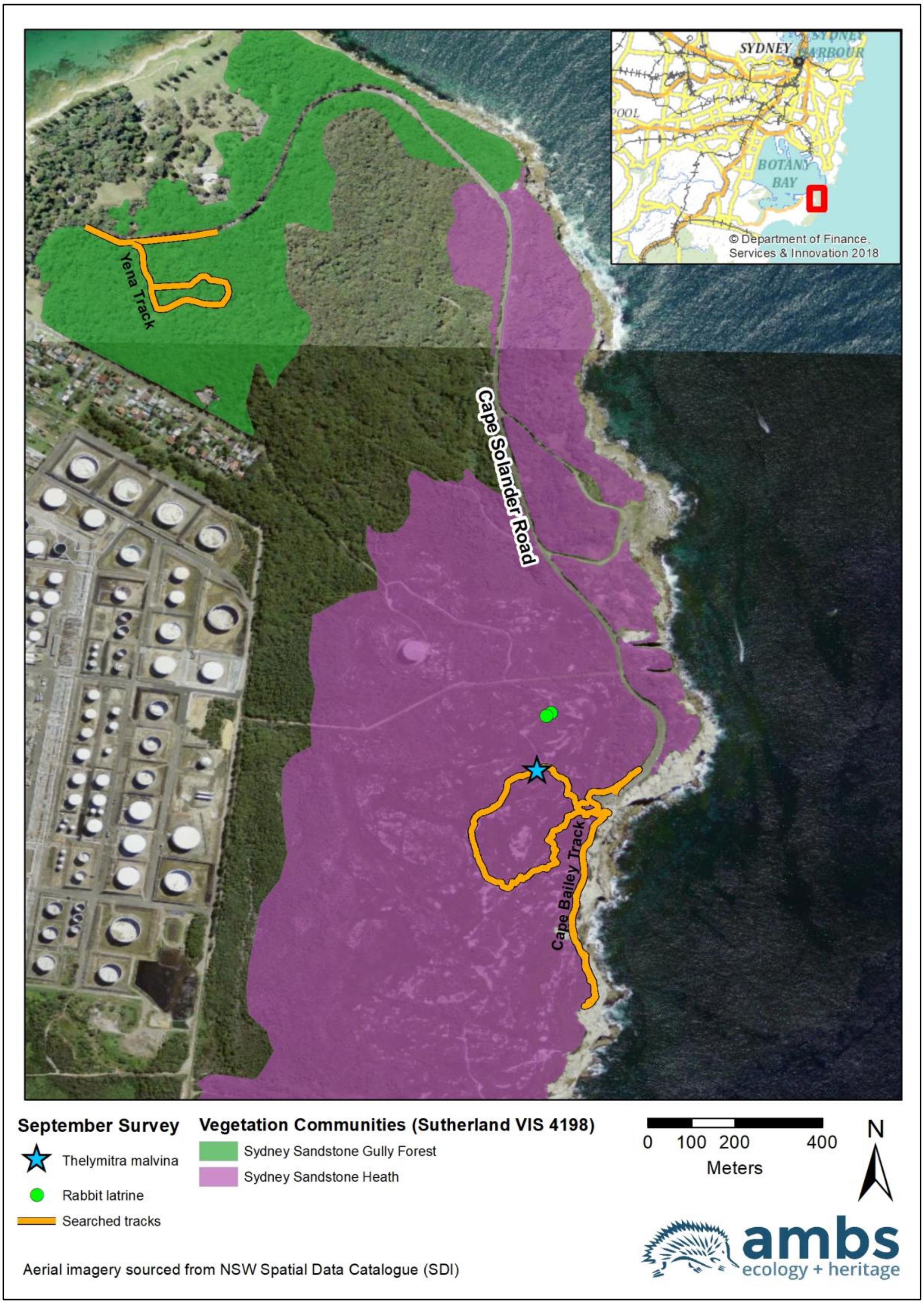



**Figure 3.4 Search areas, location of population and identified threats, and mapped vegetation communities (OEH 2015).**

### *3.4.2 Associated species*

Plants were found in Sydney Sandstone Heath growing under unburnt shrubs of *Baeckea imbricata* immediately adjacent to the Cape Baily Track on the western side of Cape Solander Road (Plate 3.3). The soil is grey, very shallow sand overlying sandstone, with surface leaf litter and twigs from overstorey shrubs. There was evidence of the 2017 wild fire in the vicinity of the population, but no target plants were found in burnt areas (Plate 3.4). Associated plant species at the site include *Philotheca buxifolia*, *Melaleuca nodosa*, *Rulingia hermanniifolia*, *Opercularia aspera*, *Allocasuarina distyla*, *Dampiera stricta*, *Kunzea ambigua*, *Melaleuca armillaris*, *Darwinia fascicularis*, and *Banksia ericifolia*.

**Plate 3.3 Coastal heath plant community associated with the *Thelymitra* population.**

**Plate 3.4 Burnt area in the vicinity of the *Thelymitra* population, with regenerating vegetation.**

The area described by Margaret Bradhurst along the northern coast of the National Park in the vicinity of the Yena Track was also searched, but no target plants were identified (Figure 3.4). This was Sydney Sandstone Gully Forest and was characterised by *Angophora costata*, *Pittosporum undulatum*, *Lomandra longifolia*, *Banksia integrifolia*, *Elaeocarpus reticulatus*, *Entolasia marginata*, *Monotoca elliptica*, *Kunzea ambigua*, *Smilax glyciphylla*, and *Hardenbergia violacea*.

### *3.4.3 Possible threats*

Primary threats to *Thelymitra malvina* and *Thelymitra atronitida*, should it occur in the area, include herbivory by introduced rabbits (Plate 3.5, see location in Figure 3.1) and disturbance to soils and vegetation by people. Plants were found adjacent to a walking track which likely receives heavy use during the warmer months and peak tourist times (Plate 3.6). The cliffs in the Cape Solander region are also known for whale-watching during certain times of the year which makes the area at risk from high visitor densities. With human disturbance also comes the potential for weed invasion, illegal collection, track widening, and trampling.

The effects of fire are unclear and prescribed burning at inappropriate times could be considered a threat. Periodic fires to reduce biomass accumulation and encourage establishment may be beneficial although there is no evidence suggesting that *Thelymitra atronitida* flowers more readily following fire. Most *Thelymitra* species experience a dormancy period during the hot, dry summer months (Jones 2006), but a very hot fire during the early growing season (autumn), when the plant is storing energy in the belowground tubers, could have a negative impact. Flowering is promoted by fire in many species of *Thelymitra* in Tasmania (Wapstra 2008) as well as *Thelymitra xanthotricha* (part of the *Thelymitra pauciflora* complex) in Western Australia (Jeanes 2004), but no such response has been noted for *Thelymitra atronitida* in Tasmania or Victoria. In South Australia *Thelymitra spp*. are often found in slashed firebreaks, but recruitment has not been linked to fire (Bates 2010).

The following additional threats are identified in the BioNet profile for *Thelymitra atronitida*.

- Demographic threats: The small population size and disjunct distribution can lead to demographic stochasticity and a higher risk of local extinction.
- Disturbance: Heavy rainfall may also lead to erosion given the shallow soils present at Cape Solander.
- Lack of knowledge: Deficiency in understanding of species.

**Plate 3.5 Latrine, indicating the presence of European rabbit**

**Plate 3.6 Trail marker for the Cape Baily track in Kamay Botany Bay National Park.**

# 4 Conclusions and Recommendations

We did not find *Thelymitra atronitida* in this survey, despite careful search of the precise site of previous records and the surrounding area. It has been 30 years since the original collection by Peter Weston and nearly 15 years since Dean Rouse collected an individual, identified as *Thelymitra atronitida.* It is possible that the species may have been lost from the area as a result of rabbit herbivory or human disturbance (i.e. illegal collection, trampling, etc.). However, it is premature to infer that the species is locally extinct. Searches at different times or after climatic or environmental cues (e.g. high summer rainfall, bushfire) may yet reveal an extant population.

We recommend the following actions:

1. Future searches for *Thelymitra atronitida* be conducted at Cape Solander between early August and late December, acknowledging that it occurs sympatrically with *Thelymitra malvina* in Victoria and Tasmania (Jeanes 2000). In the event that target plants are found in the future, it would be advisable to install fencing to protect plants from grazing, soil erosion, and human disturbance. We would also recommend additional searches in likely habitat such as the coastal heathlands in far southern NSW (i.e. Nadgee Nature Reserve) which are geographically closer to the known populations in Victoria.

2. Review the identification of previous specimens collected in the Cape Solander and Bago areas. Numerous sources, including the original collectors, raise questions about the identification, given the subtle morphological differences which can be variable within a given species. Peter Weston commented that species within the *Thelymitra pauciflora* complex are difficult to identify using available techniques and that they could all possibly be highly inbred microspecies (Weston pers. comm. 28 May 2018). We recommend further collections and renewed efforts to track down all herbarium specimens (pressed and spirit

preserved) from Cape Solander and Bago State Forest and, if required genetic analysis, to resolve uncertainties on species identification.

3. Despite the current uncertainties on species identification and extant status of *Thelymitra atronitida* at Cape Solander, we recommend precautionary site-specific management to protect and maintain suitable habitat for the species. This requires:

    a. ensuring the walking track is monitored and that future wear, maintenance and upgrade works avoid any degradation or damage to plants or their habitat;
    b. ongoing control of rabbit populations; and
    c. avoiding or minimising occurrence of fires in autumn or winter.

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# Appendix A

BioNet records for *Thelymitra atronitida*

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|---|
| Data from the BioNet BioNet Atlas website which holds records from a number of custodians. The data are only indicative and cannot be considered a comprehensive inventory and may contain errors and omissions. |
| Location accuracy varies. Records of species listed under the Sensitive Species Data Policy are identified in the Sensitivity Class column. |
| Copyright the State of NSW through the Office of Environment and Heritage. |
| Search criteria: Public Report of all Valid Records of Black-hooded Sun Orchid (Species: Thelymitra atronitida) returned a total of 4 records of 1 species. Report generated on 7/03/2018 2:03 PM |

| DatasetName | SightingKey | SpeciesCode | FamilyName | SortOrder | ScientificName | CommonName | NSWStatus | CommStatus | SensitivityClass | DateFirst | DateLast | Status | LocationKey | Description | Latitude_GDA94 | Longitude_GDA94 | Accuracy | SightingNotes | LocationNotes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OEH Data from Scientific Licences dataset | SDMPI0121586 | 11638 | Orchidaceae | 13518 | Thelymitra atronitida | Black-hooded Sun Orchid | E4A | P | 2 | 23/06/2005 | 23/06/2005 | Accepted as valid from quarantine | Withheld | Location Description withheld | -35.6 | 148.2 | 30000 | Sighting Notes withheld | Location Notes withheld |
| OEH Data from Scientific Licences dataset | SSLSI0008096 | 11638 | Orchidaceae | 13518 | Thelymitra atronitida | Black-hooded Sun Orchid | E4A | P | 2 | 21/10/2004 | 7/02/2005 | Accepted as valid from quarantine | Withheld | Location Description withheld | -35.8 | 148.3 | 5000 | Sighting Notes withheld | Location Notes withheld |
| Royal Botanic Gardens Herbarium Specimen Register | NSW417826 | 11638 | Orchidaceae | 13518 | Thelymitra atronitida | Black-hooded Sun Orchid | E4A | P | 2 | 8/08/1988 | 8/08/1988 | Valid and accepted without modification | Withheld | Location Description withheld | -34 | 151.2 | 1000 | Sighting Notes withheld | Location Notes withheld |

| DatasetName | SightingKey | SpeciesCode | FamilyName | SortOrder | ScientificName | CommonName | NSWStatus | CommStatus | SensitivityClass | DateFirst | DateLast | Status | LocationKey | Description | Latitude_GDA94 | Longitude_GDA94 | Accuracy | SightingNotes | LocationNotes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Royal Botanic Gardens Herbarium Specimen Register | NSW706086 | 11638 | Orchidaceae | 13518 | Thelymitra atronitida | Black-hooded Sun Orchid | E4A | P | 2 | 8/08/1988 | 8/08/1988 | Valid and accepted without modification | Withheld | Location Description withheld | -34 | 151.2 | 1000 | Sighting Notes withheld | Location Notes withheld |

# Appendix G. EPBC Act significance assessments

Tests of significance have been conducted for threatened species, populations and communities that were recorded in the study area during field surveys or were identified as having a moderate or higher potential to occur in the study area based on the presence of habitat. For threatened biodiversity listed under the EPBC Act, significance assessments have been completed in accordance with the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (Department of Environment, 2013). Whether or not an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment that is affected, and upon the intensity, duration, magnitude and geographic extent of the impacts (Department of Environment, 2013). Importantly, for a 'significant impact' to be 'likely', it is not necessary for a significant impact to have a greater than 50 per cent chance of happening; it is sufficient if a significant impact on the environment is a real or not remote chance or possibility (Department of Environment, 2013). This advice has been considered while undertaking the assessments.

The EPBC Act listed species subject to this assessment include:

- Spotted-tailed Quoll (*Dasyurus maculatus*)
- Greater Glider (*Petauroides volans*)
- Smokey Mouse (*Pseudomys fumeus*)
- Booroolong Frog (*Litoria booroolongensis*)
- Macquarie Perch (*Macquaria australasica*)
- Migratory species.

When assessing Vulnerable species, the assessment centres around whether the population that would be impacted is an 'important population' or not. An 'important population' is a population that is necessary for a species' long-term survival and recovery (Department of Environment, 2013). This may include populations identified as such in recovery plans, and/or that are:

- Key source populations either for breeding or dispersal
- Populations that are necessary for maintaining genetic diversity, and/or
- Populations that are near the limit of the species range.

This definition of what constitutes an 'important population' has guided the assessments for Vulnerable species below.

## G.1 Spotted-tailed Quoll (*Dasyurus maculatus*)

The Spotted-tailed Quoll (south eastern mainland population) is listed as Endangered under the EPBC Act.

The Spotted-tailed Quoll was not recorded within the construction envelope during the surveys undertaken for this BDAR. Likewise, the Spotted-tailed Quoll was not recorded during the surveys undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a).

Despite the lack of records from recent surveys, there are a number of Spotted-tailed Quoll records to the north of the construction envelope within the Bago State Forest, Brandy Marys Crown Lease area and McPhersons Plain (from 2001 to 2004). The Spotted-tailed Quoll occurs at low densities and individuals have a large home range, so it is likely that the construction envelope lies within the home range of one or more Spotted-tailed Quolls. The habitats contain suitable habitat including potential den sites in areas with boulders, rocky outcrops, small caves (particularly the South Eastern Highlands portion), and large woody debris and hollow-bearing trees (large hollow logs and hollow-bearing trees are abundant in the Australian Alps portion).

An action is likely to have a significant impact on a Critically Endangered or Endangered species if there is a real chance or possibility that it will:

**Lead to a long-term decrease in the size of a population**

The Spotted-tail Quoll typically has a large home range and occupies a diversity of habitat types, including rainforest, open forest, woodland, coastal heath, and inland riparian forest, from the sub-alpine zone to the coastline. The Spotted-tail Quoll is predominantly nocturnal and rests during the day in dens, such as hollow logs, tree hollows, rock outcrops or caves. The project may remove potential habitat for the species however the overall reduction of habitat is a small proportion of the available potential habitat.

The vegetation to be impacted represents only a small percentage of the total extent of important foraging vegetation types present within the locality. Given the relative widespread nature of similar vegetation in the locality the project is not expected to lead to a long-term decrease in the size of a viable local population of this species.

**Reduce the area of occupancy of the species**

The area of occupancy of this species is estimated at 2,512 km2. While 135.6 ha of native vegetation representing potential habitat for this species will potentially be cleared, there is an abundance of suitable breeding and foraging habitat for this species in Bago State Forest, Maragle State Forest and KNP surrounding the study area. The habitat to be removed will not result in a reduction in the area of occupancy for this species.

**Fragment an existing population into two or more populations**

The Spotted-tail Quoll population in the locality would not be fragmented by the project as this species is able to disperse through a wide range of habitat types (including areas without tree canopy). The removal of wooded vegetation along the transmission line corridor would therefore not serve as a permanent barrier. The species regularly moves over very long distances with home ranges of 200-500 ha for females and from 500 to over 4000 ha for males. Therefore, the project will not fragment an existing population into two or more populations.

**Adversely affect habitat critical to the survival of a species**

The Spotted-tail Quoll typically has a large home range and occupies a diversity of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. The vegetation occurring along the transmission line corridor edges to be impacted by the project is not considered to be critical habitat for this species.

**Disrupt the breeding cycle of a population**

Breeding habitat for the Spotted-tail Quoll includes daytime den sites such as hollow logs, tree hollows, rock outcrops or caves.

Hollow logs, tree hollows, rock outcrops are present in the construction envelope and could be used as refuge and foraging habitat by the Spotted-tailed Quoll. However, this species is unlikely to be dependent on these sites for breeding as no evidence of den sites, latrine sites or sheltering sites were present in the construction envelope.

The rocky outcrops are unlikely to be removed by the project. The structures will be built on the ridges and the transmission lines will span across the outcrops. Vegetation removal would be required but it is unlikely that the rocky outcrops would be removed.

A large number of hollow logs, tree hollows and rocky outcrops will remain in areas surrounding the construction envelope following the completion of the project. Any important habitat features (such as large hollow logs) occurring within the construction envelope are to be retained and relocated into adjacent bushland.

Therefore, the project is is unlikely to disrupt the breeding cycle of the Spotted-tail Quoll.

**Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

While 135.6 ha of native vegetation representing potential habitat for this species will be cleared, there is an abundance of high-quality breeding and foraging habitat for this species in Bago State Forest, Maragle State Forest and KNP surrounding the disturbance area. The construction envelope is a linear corridor with a width small enough to maintain the dispersal and movements of Spotted-tail Quoll throughout the locality. Therefore, the habitat to be removed is unlikely to result in a decline of the Spotted-tail Quoll.

**Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat**

The main disturbance regimes affecting habitats in the study area are weed invasion, fragmentation and edge effects and maintenance regimes such as slashing and pruning. The Spotted-tail Quoll is also predated upon by Red Foxes (*Vulpes vulpes*), Dingoes (*Canis lupus dingo*) and Domestic Dogs (*Canis lupus familiaris*), which may utilise cleared areas resulting from the project. Mitigation measures will be implemented to limit the exacerbation of these current disturbance regimes. Any impacts from change of habitat condition associated with altering disturbance regimes in proximity to the transmission line corridor may be offset by this species' ability to move widely throughout the landscape and access disturbed and fragmented habitats. The management of invasive species would be managed under the construction environmental management plan (CEMP) and during operation of the transmission lines.

**Introduce disease that may cause the species to decline, or**

There are no known disease issues affecting this species in relation to the project. The project would be unlikely to increase feral animal abundance or the potential for significant disease vectors to affect local populations.

Infection of native plants by *Phytophthora cinnamomi* has been identified as being spread by construction machinery. This water-borne mould infects the roots of plants and has the potential to cause dieback. Machinery associated with vegetation clearance and subsequent construction has the potential to transmit the fungus to remaining native vegetation remnants of the species. This is a potential indirect impact to the species through the transmission of pathogens into retained habitat near the pipeline. This can be mitigated through the development and implementation of suitable control measures for construction personnel and plant hygiene and is unlikely to have a significant impact. It is the intention to use current best practice hygiene protocols on this project as part of the CEMP to prevent the introduction or spread of pathogens.

The mitigation strategy and environmental management procedures for the project would include guidance for preventing the introduction and/or spread of disease-causing agents such as bacteria and fungi.

**Interfere with the recovery of the species.**

A recovery plan does not exist for the Spotted-tail Quoll. However, the following actions have been identified by the DPIE for recovery of this species:

- Consult with the DPIE / NPWS if Spotted-tail Quolls are raiding poultry, rather than taking direct action
- Consult with the DPIE / NPWS if poison baiting is planned in or near areas where Spotted-tail Quolls are known or likely to occur

- Undertake cat and fox control using poison-baiting techniques least likely to affect quolls
- Retain and protect large, forested areas with hollow logs and rocky outcrops, particularly areas with thick understory or dense vegetation along drainage lines.

The recovery action "Retain and protect large, forested areas with hollow logs and rocky outcrops, particularly areas with thick understory or dense vegetation along drainage lines" will be impacted by the construction envelope. However, the design will reduce this impact by structures being built on the ridges and the transmission lines spanning across the outcrops, avoiding their removal. Dense vegetation will be maintained along drainage lines where possible. While hollow logs in the construction envelope will be removed, a large number of hollow logs, tree hollows will be retained and relocated to adjacent vegetation.

Considering these impacts in the context of the suitable habitat surrounding the construction envelope, the project will not interfere with the recovery of the Spotted-tail Quoll.

**Conclusion**

The Spotted-tail Quoll (*Dasyurus maculatus*) may suffer a small reduction in extent of foraging and shelter habitat from the project. The project is unlikely to reduce the size of a population of the Spotted-tail Quoll or decrease the reproductive success of this species. The project will not interfere with the recovery of the Spotted-tail Quoll. After consideration of the factors above, an overall conclusion has been made that the project is unlikely to result in a significant impact to the Spotted-tail Quoll.

## G.2 Greater Glider (*Petauroides volans*)

The Greater Glider is listed as Vulnerable under the EPBC Act. A key consideration in assessing the significance of impacts to a Vulnerable species is whether the project will impact an 'important population'. As defined in the *EPBC Act Policy Statement 1.1 Significant Impact Guidelines* (Department of Environment, 2013), an 'important population' is a population that is necessary for a species' long-term survival and recovery. This may include populations identified as such in recovery plans, and/or that are:

- Key source populations either for breeding or dispersal
- Populations that are necessary for maintaining genetic diversity, and/or
- Populations that are near the limit of the species range.

The Greater Glider was not recorded within the construction envelope or broader study area during the surveys undertaken for this BDAR. Likewise, the Greater Glider was not recorded during the surveys undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a). Despite the lack of records from these surveys, the Greater Glider has potential to occur in the taller wetter forests (i.e. PCT 300) and sub-alpine woodland (PCT 1196) habitats. Previous surveys in the region suggest this species is only likely to inhabit vegetation within the project area west of the Tumut River (see Kavanagh and Stanton, 1998). These habitats appear to provide suitable forging resources for the Greater Glider in the form of eucalypts species *Eucalyptus dalrympleana, Eucalyptus viminalis,* and *Eucalyptus robertsonii* and trees large enough to contain hollows of suitable size for the Greater Glider.

Additionally, there are credible records of the Greater Glider from wet forest dominated by *Eucalyptus dalrympleana* and *Eucalyptus robertsonii* in the Bago State Forest to the north and west of the study area, including records from State Forest surveys. There are records of the Greater Glider in habitats like that which occur in the construction envelope from the north adjacent to the Line 64 easement. The records are from 1995, 2004, 2007, 2008, and 2009. The distribution of the Greater Glider is known to be patchy even in seemingly optimal habitats (see Kavanagh, 2000). Therefore, the Greater Glider may have been temporarily absent from the habitats within the construction envelope during the survey period.

An action is likely to have a significant impact on a vulnerable species if there is a real chance or possibility that it will:

**Lead to a long-term decrease in the size of an important population**

Only a small amount of habitat impacted by the project has the required old trees with abundant hollows that are the preferred breeding habitat for this species. The project will affect a relatively narrow tract of old trees with potentially suitable hollows. This impact is small in the context of the extent of habitat in the locality and is unlikely to lead to a decrease in size of the population.

Also, the population of the Greater Glider that may use the habitats within the construction envelope would not meet the definition of an 'important population'. There is no adopted or made recovery plan for the Greater Glider so 'important populations' have not been identified in this manner. It is unlikely that the population that may be affected by the project would be a key source population or a stronghold of genetic diversity as the population is likely to be low in numbers. The population that may be affected by the project is not at the limit of the species range.

Therefore, the project would not lead to a long-term decrease in the size of an important population of this species.

**Reduce the area of occupancy of an important population**

Approximately 75.83 ha of suitable habitat for breeding and foraging will be removed. This will not result in an appreciable reduction in the area of occupancy of an important population of the species, given the extent of suitable habitat in the vicinity of the project. Also, no important population of the Greater Glider has been identified in the area.

**Fragment an existing important population into two or more populations**

The extent of habitats within the construction envelope and surrounds does not represent an important population for this species. It is unlikely that the population that may be affected by the project would be a key source population or a stronghold of genetic diversity as the population is likely to be low in numbers and extend throughout a much larger area of KNP.

Linear infrastructure, such as transmission lines, is ubiquitous in the Australian landscape including the KNP and Bago State Forest and is known to be responsible for the loss of habitats and disruption of landscape connectivity. The creation of open and shrubby corridors within areas of intact forest is the key impact to habitat connectivity that would result from the project. The creation of access roads and the transmission line corridor underneath the transmission lines will introduce linear features through environments that can be considered relatively undisturbed and where these features currently do not exist. As such, there is likely to be a level of impact to habitat connectivity, but functional connectivity for most species is unlikely to be affected to the point where the bioregional persistence of these species is placed at risk.

**Adversely affect habitat critical to the survival of a species**

Habitat critical to the survival of a species refers to areas that are necessary for activities such as:

- Foraging, breeding, roosting, or dispersal
- For the long-term maintenance of the species including the maintenance of other species essential to the survival of the species, such as pollinators
- To maintain genetic diversity and long-term evolutionary development
- For the reintroduction of populations or recovery of the species.

The project construction envelope will impact a small and localised section of potential habitat for the species and due to the abundance of high-quality habitat in the general area, the project is unlikely to adversely impact critical habitat that would affect the survival of this species.

**Disrupt the breeding cycle of an important population**

Due to the small amount of potential breeding habitat lost and the low density of Greater Gliders likely to occur in the area, the activity is unlikely to disrupt the breeding cycle of an important population of the Greater Glider.

**Modify, destroy, remove or isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

There is a moderate risk that the project could contribute slightly to weed or plant pathogen invasion and further degradation of the species' habitat in the locality. This risk will be limited through equipment weed and pathogen hygiene and weed control activities and is unlikely to significantly affect the species.

While 75.83 ha of suitable habitat will be cleared, there is an abundance of high-quality breeding and foraging habitat for this species in Bago State Forest, Maragle State Forest and KNP surrounding the study area. Therefore, the relatively small amount of suitable habitat to be removed is unlikely to lead to a species decline.

**Result in invasive species that are harmful to a vulnerable species becoming established in the vulnerable species' habitat**

No invasive species are currently considered to pose a significant threat to this species. However, the management of invasive species would be managed under the CEMP and during operation. Therefore, the project is unlikely to result in the establishment of invasive species that are harmful to this species.

**Introduce disease that may cause the species to decline, or**

Infection of native plants by *Phytophthora cinnamomi* has been identified as being spread by construction machinery. This water-borne fungus infects the roots of plants and has the potential to cause dieback. Machinery associated with vegetation clearance and subsequent construction for the project has the potential to transmit the fungus to remaining native vegetation remnants of the species. This is a potential indirect impact to the species where key Greater Glider feed trees can be infected and die. This can be suitably mitigated through the development and implementation of suitable control measures for vehicle and plant hygiene and is unlikely to have a significant impact. It is the intention to use current best practice hygiene protocols on this project as part of the CEMP to prevent the introduction or spread of pathogens. The project would be unlikely to increase the potential for significant disease vectors to affect a local population of this species.

**Interfere substantially with the recovery of the species**

No recovery plan currently exists for this species. However, the Threatened Species Scientific Committee has proposed the following primary conservation actions:

1) Reduce the frequency and intensity of prescribed burns.
2) Identify appropriate levels of patch retention, habitat tree retention, and logging rotation in hardwood production.
3) Protect and retain hollow-bearing trees, suitable habitat and habitat connectivity.

The project will reduce habitat connectivity in the area and is inconsistent with number 3 of the conservation actions identified for this species. However, the recovery of the Greater Glider as a species is not dependent on the reduced connectivity of habitat in this locality. The project will also contribute slightly to degradation of native vegetation. The impact is not significant in the context of the quality and extent of habitat in the locality. The project is unlikely to interfere with the recovery of the species.

**Conclusion**

The Greater Glider will suffer a small reduction in extent of suitable habitat from the project. The project is considered unlikely to reduce the size of an important population of the Greater Glider or decrease the reproductive success of this species. The project will not interfere with the recovery of the Greater Glider. After consideration of the factors above, an overall conclusion has been made that the project is unlikely to result in a significant impact to the Greater Glider. The impact to Greater Glider habitat from the project is not considered to be of significance having regard to its context and intensity.

## G.3 Booroolong Frog (*Litoria booroolongensis*)

The Booroolong Frog is known to inhabit the Yarrangobilly River, Wallaces Creek and Sheep Station Creek as identified in the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a). The Yarrangobilly River was identified as providing optimal breeding habitat for the Booroolong Frog, with a series of cobble banks and bedrock structures along stream margins, with slow flowing water connected by larger, slow flowing pools (EMM Consulting, 2017 and 2020a). The breeding habitat in Wallaces Creek is considered to be much more limited, with only small sections providing suitable breeding habitat and it is likely this area provides sub-optimal breeding habitat as well as connective and dispersal habitat (EMM Consulting, 2017 and 2020a). Sheep Station Creek is also likely to be sub-optimal as breeding habitat for the Booroolong Frog.

During targeted surveys undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a) the Booroolong Frog was observed up to 130 m from the Yarrangobilly River during a high rainfall event that saw key breeding habitat flooded. During this period most frogs were observed within the riparian zone, i.e. within 50 m of the River (EMM Consulting, 2017 and 2020a). Based on that information, the Yarrangobilly River and Wallaces Creek have been identified as breeding habitat, while areas within 50 m of this breeding habitat was been identified as potential dispersal and refuge habitat.

Surveys undertaken for this BDAR also identified suitable habitat features within riparian vegetation (PCT 302) around Sheep Station Creek, Lick Hole Gully and Cave Gully. One Booroolong Frog sighting has been recorded on Sheep Station Creek within the construction envelope. Considering the connectivity of these waterways with the Yarrangobilly River, they are considered likely to provide suitable foraging habitat during times of suitable rainfall, however may not contain the permanent habitat features required for breeding. Booroolong Frog habitat is shown on **Figure 7-3** and the 50m exclusion area is shown on Figure 8-1.

An action is likely to have a significant impact on a Critically Endangered or Endangered species if there is a real chance or possibility that it will:

**Lead to a long-term decrease in the size of a population**

The Booroolong Frog is known to inhabit the Yarrangobilly River, Wallaces Creek and Sheep Station Creek as identified in the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a). The Lick Hole Gully and Cave Gully waterways may also provide habitat for this species during suitable rainfall. The Booroolong Frog was recorded along the Yarrangobilly River from the Talbingo Reservoir full supply level to the upper reaches of the Yarrangobilly River and in Wallaces Creek (EMM Consulting, 2017 and 2020a). The Booroolong Frog population is thought likely to extend upstream to the Blue Creek fire trail (EMM Consulting, 2017 and 2020a). The size of the population is however not known.

The Yarrangobilly River, and to a lesser extent Wallaces Creek, provides breeding habitat for the Booroolong Frog. The stream edge is the preferred habitat but during high rainfall events the area of suitable habitat expands considerably. During targeted surveys undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a) the Booroolong Frog was observed up to 130 m from the Yarrangobilly River during a high rainfall event that saw key breeding habitat flooded. During this period most frogs were observed within the riparian zone (i.e. within 50 m of the River (EMM Consulting, 2017 and 2020a).

Importantly, the project will not directly impact the optimal Booroolong Frog breeding habitats along the Yarrangobilly River. There will however be a direct impact to riparian vegetation identified as sub-optimal breeding habitat and/or dispersal habitat along Wallaces Creek and Sheep Station Creek due to trimming of vegetation for power line clearance over Wallaces Creek and removal of vegetation for bridge construction over Sheep Station Creek. The other potential impacts to the Booroolong Frog are indirect and relate to the potential for habitat degradation through sedimentation of the waterways.

The project may have impacts on water quality, water bodies and hydrological processes that sustain the Booroolong Frog in the following ways:

- There is potential for release of poor-quality sediment laden water into watercourses within and adjacent to the disturbance area when there are rainfall events during construction
- There is potential for a reduction in stream bank stability following vegetation removal for construction of bridges or clearances for power lines, resulting in bank erosion and sedimentation of watercourses
- There is potential for increased water flow into the waterways resulting from vegetation removal and access track construction (channelling of water) and increased erosion
- There is potential for accidental release of contaminants during construction and maintenance (i.e. chemicals, fuel, oil, hydraulic fluid) that could result in the release of hydrocarbons and metal contaminants into watercourses
- There is potential for release of pesticides and/or herbicides into watercourses which may have detrimental effects.

As identified in the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a), short term reductions in water quality and mobilisation of fine sediments into watercourses within and adjacent to the disturbance area is considered unlikely to result in any long-term detrimental impacts to the aquatic environments. The discharge of fine sediments and contaminants are likely to be short 'pulse' events and the fine sediments would be rapidly flushed out of the system. This would most likely result in negligible impact to threatened species such as the Booroolong Frog. The greatest potential for a detrimental impact to the aquatic habitat of the Booroolong Frog is deposition of large amounts of sediment that could significantly reduce water quality in the long term. Coarse sediments that would not be flushed from the aquatic system will likely settle in the waterways filling the stream bed with sediment thereby removing any spaces between rocks and boulders reducing the opportunities for the Booroolong Frog to breed. Increased sediment loads can also adversely affect the growth and development of tadpoles, reducing their fitness and recruitment to the terrestrial frog stage (see Gillespie, 2002). Controlling impacts to water flow, water quality, and sedimentation associated with run-off from vegetation clearing, newly constructed access tracks, and structures will be key in mitigating the impacts on water quality, water bodies and hydrological processes that sustain threatened species (see Section 12).

**Reduce the area of occupancy of the species**

There is approximately 3.12 ha of habitat for the Booroolong Frog within the disturbance area. There will also be indirect impacts (e.g. edge effects) to 1.56 ha of surrounding retained vegetation for this species, which is expected to reduce the condition of groundcover. However, avoidance of the 50 m buffer zone around the edge of the Yarrangobilly River and Wallaces Creek that has been identified as Booroolong Frog breeding and dispersal habitat (EMM Consulting, 2017 and 2020a) will avoid the optimal habitat for the species in the area.

Also, structures would be located off the floodplains at least 50 m from waterways where the Booroolong Frog is known to occur.

The greatest potential for a permanent impact to the aquatic habitat of the Booroolong Frog is deposition of large amounts of sediment that could significantly reduce water quality in the long term. Coarse sediments that would not be flushed from the aquatic system will likely settle in the waterways filling the stream bed with sediment thereby removing any spaces between rocks and boulders reducing the opportunities for the Booroolong Frog to breed. Impacts to water flow, water quality, and sedimentation associated with run-off from vegetation clearing, newly constructed access tracks, and structures will be mitigated against in the CEMP. Therefore, the design adjustments and mitigation measures for the project make it unlikely to reduce the area of occupancy of the Booroolong Frog.

**Fragment an existing population into two or more populations**

The dispersal capabilities and non-breeding habitats of the species are unknown, but the species is relatively sedentary with studies showing that the majority of recaptured individuals moved less than 50 m within a season, with maximum movements of up to 300 m being recorded across seasons (Department of the Environment, 2019a). Consequently, impacts to stream habitats may have a detrimental effect on the ability of the Booroolong Frog to move.

The power lines would span Booroolong Frog habitat and the bridge over Sheep Station Creek will be designed to avoid blocking streamflow. As such, impacts to the movement of the Booroolong Frog should be relatively minor and current movement patterns should remain comparatively unaltered. The design of waterway crossings and management measures that will be implemented during construction suggest that the project is considered unlikely to influence any movement of the Booroolong Frog that is essential to maintain its life cycle. The consequences of the project in terms of the effects on movement on the bioregional persistence of the Booroolong Frog are likely to be negligible. Therefore, the project is unlikely to fragment an existing population into two or more populations.

**Adversely affect habitat critical to the survival of a species**

Critical habitat for this species as defined by the National Recovery Plan for Booroolong Frog is “rocky sections of permanent streams occupied by the species. Any action that reduces stream permanency (e.g. pumping water) or results in loss of rock crevices (e.g. smothering by weeds or sedimentation), is likely to threaten the persistence of local populations of this species.” These features will not be directly impacted by the project, as the power lines will span the waterways and the bridge over Sheep Station Creek will be a single span with no instream structures so rock removal should not be needed. Design of bridges will also ensure that streamflow is unaffected. Therefore, the project is unlikely adversely affect habitat critical to the survival of the Booroolong Frog.

**Disrupt the breeding cycle of a population**

Importantly, the project will not directly impact the optimal Booroolong Frog breeding habitats along the Yarrangobilly River. Increased sediment loads can also adversely affect the growth and development of tadpoles, reducing their fitness and recruitment to the terrestrial frog stage (see Gillespie, 2002). A key avoidance measure to avoid sedimentation associated with run-off from vegetation clearing is the avoidance of the 50 m buffer zone around the edge of the Yarrangobilly River and Wallaces Creek that has been identified as Booroolong Frog breeding and dispersal habitat (EMM Consulting, 2017 and 2020a). Structures are located off the floodplains and are at least 50 m from waterways where the Booroolong Frog is known to occur. Therefore, the project is unlikely to disrupt the breeding cycle of this Booroolong Frog population.

**Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

There will be approximately 3.12 ha of direct habitat impacts and 1.56 ha of indirect impacts (e.g. edge effects) to surrounding retained vegetation for this species, which is expected to reduce the condition of groundcover. However, the project will not directly impact the optimal Booroolong Frog breeding habitats along the Yarrangobilly River. Also, a 50 m buffer zone around the edge of the Yarrangobilly River and Wallaces Creek that has been identified as Booroolong Frog breeding and dispersal habitat will be avoided by the project. In addition, potential impacts to water flow, water quality, and sedimentation associated with run-off from vegetation clearing, newly constructed access tracks, and structures would be mitigated against in the CEMP.

**Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat**

Nearly all streams currently occupied by the Booroolong Frog are also inhabited by a range of exotic fish species including Brown Trout (*Salmo trutta*), Rainbow Trout (*Oncorhynchus mykiss*), European Carp (*Cyprinus carpio*) Goldfish (*Carassius auratus*), Redfin Perch (*Perca fluviatilis*) and Mosquito Fish (*Gambusia holbrooki*) and all are known to predate the tadpoles of the Booroolong Frog. The Brown Trout (*Salmo trutta*) is already present in Yarrangobilly River. The project will not result in new exotic fish species becoming established in the streams that are habitat for Booroolong Frog adjacent the project.

**Introduce disease that may cause the species to decline, or**

The presence and spread of the Chytrid Fungus is recognised as a Key Threatening Process for this species. Chytrid Fungus is already widespread in NSW. Specific hygiene protocols to minimise the risk of the spread of Chytrid Fungus are detailed in the Frog Hygiene Protocols (DECC, 2008). Measures include, clothing and equipment wash down procedures and the sourcing of suitable materials that are not likely to be contaminated with the Chytrid Fungus. The project mitigation strategy and environmental management procedures would include guidance for preventing the introduction and/or spread of disease-causing agents such as bacteria and fungi.

**Interfere with the recovery of the species**

The National Recovery Plan for Booroolong Frog includes the following recovery objectives:

- Determine the species distribution in areas that have not been the focus of targeted surveys.
- Determine the taxonomic status of northern and southern Booroolong Frog populations and identify further genetic sub-division within these populations
- Reduce the impact of known or perceived threats contributing to the ongoing decline of the Booroolong Frog
- Determine population trends across the species range, and in areas subject to different management regimes
- Identify the potential impacts of climate change and determine management responses to reduce these impacts
- Identify other potentially threatening processes
- Increase community awareness and involvement in the Booroolong Frog recovery program
- Achieve the effective implementation of the recovery plan

Recovery objectives relevant to the project would be managed, using best practice methods, under the construction environmental management plan and during operation.

The project will not interfere with the recovery of this species.

### Conclusion

The alignment of the project has been changed to minimise impacts on the population of the Booroolong Frog and the local population would suffer a small reduction in extent of sub optimal breeding habitat from the disturbance area. The project is considered unlikely to reduce the population size of the Booroolong Frog or decrease the reproductive success of this species. The project would not interfere with the recovery of the Booroolong Frog. After consideration of the factors above, the impact to habitat for the Booroolong Frog from the project is not considered to be of significance having regard to its context and intensity.

## G.4 Smoky Mouse (*Pseudomys fumeus*)

Prior to the surveys undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (EMM Consulting, 2017 and 2020a) the Smoky Mouse was known from one other site in the KNP from captures at spoil dumps (see Schulz and Wilks, 2017). During surveys for the Snowy 2.0 Exploratory Works and Main Works BDARs, the Smoky Mouse was captured in 13 locations in the higher elevation habitats above 1,100 m along Lobs Hole Ravine Road (EMM Consulting, 2017 and 2020a). The Smoky Mouse was only captured in the sub-alpine woodland habitat of PCT 1196 and was not found in the drier habitats below 1,100 m in elevation.

PCT 1196 is present in the western portion of the construction envelope within the Bago State Forest in the Australian Alps Bioregion. This area of habitat within the construction envelope was considered likely to be suitable for the Smoky Mouse based off the recent work undertaken for the Snowy 2.0 Exploratory Works and Main Works BDARs (see EMM Consulting, 2017 and 2020a). PCT 285 and PCT 300 may also be suitable based off the information in the EESG Threatened Biodiversity Data Collection. Despite a trapping program targeting PCT 1196, PCT 285 and PCT 300 using remote cameras and ground Elliott traps, the Smoky Mouse was not recorded within the construction envelope during the surveys undertaken for this BDAR (see Appendix D for trapping results). Despite the lack of captures from the surveys undertaken for this BDAR, the habitat appears suitable and may be utilised by the Smoky Mouse in the future. A characteristic of Smoky Mouse colonies is their ephemeral nature, both spatially and temporally (Menkhorst and Broome, 2008a). Populations of rodents can disappear and reappear rapidly and as a precautionary measure we have undertaken the assessment below.

An action is likely to have a significant impact on a Critically Endangered or Endangered species if there is a real chance or possibility that it will:

**Lead to a long-term decrease in the size of a population**

The Department of the Environment (2019b) indicates that there are no reliable data on which to base Smoky Mouse population estimates or to estimate trends. The species has irruptive demography based on resource availability and has ephemeral spatial and temporal abundance (Menkhorst and Broome, 2008b). Populations can disappear rapidly, possibly caused by resource availability (associated with weather or time since fire), trap-ability, vegetation succession or predation (Menkhorst and Broome, 2008b). The Smoky Mouse was not captured during the trapping program undertaken for this BDAR suggesting that the species does not currently inhabit the areas within which the trap sites were located. This may be due to the habitat quality and structure, with the habitats impacted by horses, pigs, and weeds, being unsuitable for the species. Feral cats are quite abundant in the habitat as evidenced from the camera trap results, so predation pressure is likely to be high. Or, it may just be that the Smoky Mouse was absent from the habitat at the point in time during which the trapping was undertaken due to the irruptive nature of the populations. Either way, the population size is not known.

Long-term survival of Smoky Mouse populations appear to be contingent on recruitment and immigration between subpopulations, and the regional dynamics of resource availability (Menkhorst, 2003). Due to the large area of contiguous similar habitats that appear to be suitable for the Smoky Mouse, the project is considered unlikely to lead to a long-term decrease in the size of a population. If this species is present, there is likely to be a number of sub-populations in the locality. Fluctuations in numbers and patchiness in distribution within apparently suitable habitat are characteristic of many species of Pseudomys (Menkhorst and Broome, 2008a) and it is unlikely that a population would be wholly restricted to the area of habitat to be impacted. The results of the trapping suggest that at the time of the surveys a population was absent but future colonisation of the habitats created by the transmission line corridor is possible as there will likely be areas that develop a dense shrubby health like midstorey composed of leguminous plant species (a habitat structure known to be favoured by the Smoky Mouse).

**Reduce the area of occupancy of the species**

As previously stated there are no data on which to base population estimates or to estimate trends, but some studied populations have clearly declined (Menkhorst and Broome, 2008b). Prior to 1985, the species was thought restricted to Victoria but more recent records from NSW and the ACT, including the recent KNP records, have substantially expanded the known range (Menkhorst and Broome, 2008b). The area of occupancy for this species is not known. However, it is unlikely that the project will reduce the current known area of occupancy as the species is not known from the construction envelope.

**Fragment an existing population into two or more populations**

The Smoky Mouse occurs in small, isolated populations that are probably restricted to patches of quality habitat that combine a rich and diverse range of food items with adequate shelter from wildfire and predators (Menkhorst and Broome, 2008b). Whilst the construction envelope will separate areas of tree canopy, the width of the clearing will likely allow for dispersal between habitats (through dense shrubs and groundcover). The results of the trapping suggest that at the time of the surveys a population was absent so fragmentation of a population is unlikely. Future colonisation of the habitats created by the transmission line corridor is possible if a population exists. The Smoky Mouse may utilise areas that develop a dense / shrubby midstorey composed of leguminous plant species (a habitat structure known to be favoured by the Smoky Mouse).

**Adversely affect habitat critical to the survival of a species**

Knowledge of the habitat requirements of the Smoky Mouse is inadequate to allow a meaningful description of habitat critical to survival, as required under the EPBC Act (Menkhorst and Broome, 2008b). However, there are three identified critical Smoky Mouse regions - The Grampians, South Eastern Highlands and Eden Hinterland (Menkhorst and Broome, 2008a). The recent captures of the Smoky Mouse in the Australian Alps region of the KNP suggest that this region is also important for the species.

The habitat that would be impacted by the project (i.e. PCT 1196) in the Bago State Forest may potentially be suitable for the Smoky Mouse but there are some attributes of the habitat that make it less than optimal. Predation rates from feral cats are likely to be high (due to the high capture rate of cats on remote cameras). Habitat structure is impacted by horses and pigs. The absence of the Smoky Mouse during the trapping period also suggests that a high-density population is currently not present in the construction envelope indicating that the habitat is not optimal for establishment of a breeding group and therefore is unlikely to be critical to the survival of the species.

**Disrupt the breeding cycle of a population**

The Smoky Mouse tend to occur in small discrete colonies based around patches of dense heathy understorey and shelter in small groups (comprising a male and up to five breeding females), in a large, complex burrow system that can be up to 10 $m^2$ and more than 25 m in length, with multiple nesting chambers (Menkhorst and Broome, 2008a). Breeding occurs from September–April, and 1–2 litters, each of 3–4 young, are produced (Menkhorst and Broome, 2008a).

The absence of the Smoky Mouse during the trapping period (undertaken within the known breeding period in December 2018) also suggests that a high-density population is currently not present in the construction envelope. This suggests that the habitat is not optimal for establishment of a breeding group and that the breeding cycle of a population is unlikely to be disrupted. The habitat may however be suitable for transient males as they move between sub-populations in search of mates. Any barriers to movement introduced by the project (e.g. access roads, cleared power line easements) may restrict movements of males between sub-populations but as the presence of the Smoky Mouse is not known in the construction envelope or contiguous habitats the potential impacts on breeding cycles are not known.

**Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The removal of approximately 31.23 ha of potential habitat in the form of PCT 1196 is considered unlikely to result in the decline of the species. Despite a trapping program targeting PCT 1196, PCT 285 and PCT 300 using remote cameras and ground Elliott traps, the Smoky Mouse was not recorded within the construction envelope during the surveys undertaken for this BDAR. This suggest that a high-density population, or breeding population of females, was not present in the construction envelope during the survey period. The habitat may however be suitable for transient males as they move between optimal habitats in search of mates.

As the Smoky Mouse was not recorded during the surveys suggesting that the habitat was not optimal for a resident breeding population at the time of the survey, the project is not considered likely to modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline.

**Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat**

The Smoky Mouse is highly susceptible to predation from introduced predators such as feral cats, foxes and dogs. The Smoky Mouse is particularly susceptible to predation because it has a relatively low reproductive rate, frequently uses vegetation with an open ground layer, and uses communal burrows with well-defined entrances that can be staked out by 'sit and wait' predators (Menkhorst and Broome, 2008b).

Feral cats and dogs are already established and abundant in the habitats within the construction envelope as evidenced by the camera trapping results. Predation pressure from introduced predators is likely to be high. The 'right of way' created by a transmission line and associated access tracks may function as a wildlife corridor connecting areas of habitat. The literature indicates that large carnivores exhibit a strong preference to move through rights of way (Donida Biasotto and Kindel, 2018). This has implications for the increased movement of introduced vertebrate pests and the creation of the transmission line corridor and access tracks through areas that are currently densely forested may open areas of habitat that currently have lower pest species densities.

**Introduce disease that may cause the species to decline, or**

Habitat loss through *Phytophthora cinnamomi* infection is a known threat to the Smoky Mouse. The extent of *Phytophthora cinnamomi* occurrence in the Kosciuszko regions is however not known (Menkhorst and Broome, 2008b) but the habitats possess many of the plant families that are known to be susceptible to *Phytophthora cinnamomi* infection including Ericaceae, Fabaceae, Proteaceae, Dilleniaceae, Elaeocarpaceae, and Lomandraceae. However, the plants within the habitats within the construction envelope and contiguous habitats did not display evidence of any dieback that may be related to *Phytophthora cinnamomi* infection. No significant modification of habitat structure or loss of plant species has occurred suggesting that *Phytophthora cinnamomi* infection is not currently an issue within the habitats to be impacted.

Of concern is the potential introduction and spread of *Phytophthora cinnamomi* during construction. Propagules may be dispersed by vehicles and earth-moving equipment containing infected soil and root material, and by animals such as feral pigs. Mitigation measures will be put in place to ensure that the risk of *Phytophthora cinnamomi* introduction and/or spread is minimised.

**Interfere with the recovery of the species**

The *National Recovery Plan for the Smoky Mouse Pseudomys fumeus* (Menkhorst and Broome, 2008b) outlines the following objectives for recovery of the species:

1) Designate protection zones around known populations
2) Refine knowledge of the distribution and abundance
3) Examine population partitioning
4) Minimise predation by the Red Fox, Feral Cat and Wild Dog
5) Establish small-mammal refuges
6) Develop and test burning regimes to maintain and enhance habitat quality
7) Study habitat preference, diet and the effects of disturbance on population survival and connectivity
8) Establish a captive breeding colony of Smoky Mice
9) Establish and minimise risk of *Phytophthora cinnamomi* infection
10) Increase community awareness and involvement.

The project will not interfere with any of these objectives or the actions identified to achieve them.

**Conclusion**

The absence of the Smoky Mouse during the trapping period (undertaken within the known breeding period in December 2018) suggests that a breeding population, or high-density population, was not present in the construction envelope. The habitat may however be suitable for transient males as they move between sub-populations in search of mates. Due to the lack of captures of the species in the construction envelope and the large area of contiguous similar habitats that appear to be suitable for the Smoky Mouse, the project is considered unlikely to lead to a long-term decrease in the size of a population. It is unlikely that the project will reduce the current known area of occupancy as the species is not known from the construction envelope. It would appear that a breeding group was not present, so the habitat is unlikely to be critical to the survival of the species and the breeding cycle of a population is unlikely to be disrupted. Whilst the construction envelope will separate areas of tree canopy, the width of the clearing will likely allow for dispersal between habitats (through dense shrubs and groundcover). Introduced predators such as cats, foxes and dogs are already well established in the habitats and the project is likely to have little effect on their abundance, but movement may be increased.

Given the absence of the Smoky Mouse during the survey period and the apparently less than optimal habitat quality due to high predator numbers, a significant impact to the Smoky Mouse is not considered likely.

## G.5 Macquarie Perch (*Macquaria australasica*)

Despite fish stocking of Macquarie Perch within the Talbingo Reservoir, these species were not located during surveys and it is unknown if self-sustaining populations occur within the study area. However, based on the habitat assessment and review of the work undertaken for the Snowy 2.0 Exploratory Works and Main Works EISs (Cardno, 2018 and Cardno, 2019), the Macquarie Perch is considered likely to occur in the habitats that may be affected by the construction envelope including Wallaces Creek.

A ‘population of a species’ is defined under the EPBC Act as an occurrence of the species in a particular area. In relation to critically endangered, endangered or vulnerable threatened species, occurrences include but are not limited to:

- A geographically distinct regional population, or collection of local populations, or
- A population, or collection of local populations, that occurs within a particular bioregion

The 'population' of Macquarie Perch subject to this assessment is taken to be the translocated population which may utilise the habitats impacted by the construction envelope including any fish in Wallaces Creek and the Yarrangobilly River and interconnected waterways.

An action is likely to have a significant impact on a Critically Endangered or Endangered species if there is a real chance or possibility that it will:

**Lead to a long-term decrease in the size of a population**

The National Recovery Plan for Macquarie Perch (*Macquaria australasica*) (Department of the Environment and Energy, 2018) identifies that a small population persists in the upper Murrumbidgee River near 'Cooma Gorge' at Binjura Nature Reserve (upstream of Cooma and downstream of Tantangara Dam). The Macquarie Perch was stocked or translocated into the Talbingo Reservoir (NSW Department of Primary Industries, 2016) and any fish present in the Yarrangobilly River or Wallaces Creek would be from this introduction. As described by Cardno (2018), while there is potential for a self-sustaining population of Macquarie Perch to occur within the habitats impacted by the construction envelope, the potential for this population to contribute to the integrity (e.g. population numbers and genetic diversity) of the wider Murray-Darling Basin population is likely to be minimal due to the presence of barriers to fish passage including the Talbingo and Blowering dam walls.

As identified by Cardno (2018), the removal of a small amount of riparian and aquatic habitat is not expected to have a detrimental effect on any population to the extent that it would lead to a long-term decrease in the size of a population. Impacts to water quality in Yarrangobilly River and Wallaces Creek due to run-off of sediment-laden water are likely to be very small, localised and short term (due to the mitigation that will be implemented) and unlikely to lead to a long-term decrease in the size of a population.

**Reduce the area of occupancy of the species**

The current area of occupancy for the Macquarie Perch in the ACT and NSW includes below Cotter Dam (Macquarie Perch are sometimes recorded in the Cotter River), above the Cotter Dam (Macquarie perch are now found in Cotter Reservoir and for a possible 27 km of the Cotter River upstream of the reservoir and downstream of Bendora Reservoir), Goodradigbee River and upper Murrumbidgee River from Cooma to Yaouk, a small population persists in the upper Murrumbidgee River near 'Cooma Gorge' at Binjura Nature Reserve (upstream of Cooma and downstream of Tantangara Dam), the Abercrombie and the Lachlan rivers, east coast catchments of the Hawkesbury-Nepean river system and the Georges River. Macquarie Perch were translocated from the Murray-Darling Basin (most likely from the Murrumbidgee River) to the Mongarlowe River, and the Shoalhaven River itself at Nithsdale, on multiple occasions in the late-1800s. The species was also translocated to Cataract Reservoir (Nepean River catchment) and the Nepean River itself near Sydney using fish captured from the Berembed Weir area of the Murrumbidgee River in around 1916.

It is unlikely that the project would reduce the area of occupancy of the species. If this species is present in Wallaces Creek and the Yarrangobilly River, the extent of the impacts are considered small scale and temporary and would not result in a reduction in the area of occupancy of the species. It is likely that the Macquarie Perch would still use Wallaces Creek and the Yarrangobilly River during and after construction if this species does indeed utilise the waterways.

**Fragment an existing population into two or more populations**

Importantly, the project will not result in the breaking apart of large blocks of high-quality habitat and fish passage will not be blocked. As such, the project is considered unlikely to fragment an existing population into two or more populations.

**Adversely affect habitat critical to the survival of a species**

Habitat critical to the survival of the Macquarie Perch is described as:

- All areas within the species' range which are characterised by flowing runs or riffles and small complex rock piles
- The current area of occupancy of the species (including historically translocated populations in Cataract Reservoir and the Mongarlowe River in New South Wales and the Yarra River in Victoria)
- Any newly discovered locations within the species' natural range which hold populations that extend the area of occupancy for the species
- Unoccupied habitat within the species' natural range into which the species could disperse, be stocked or be translocated.

If the Macquarie Perch is present in Wallaces Creek and the Yarrangobilly River, the habitat would therefore be considered as critical to the survival of the Macquarie Perch. However, as identified by Cardno (2018), the removal of a small amount of riparian and aquatic habitat is not expected to have a detrimental effect on the species. The trimming of riparian vegetation and creation of watercourse crossings is unlikely to result in a long-term detrimental impact due to the application of mitigation measures designed to prevent sedimentation of the waterways.

**Disrupt the breeding cycle of a population**

The project will not disrupt the breeding cycle of the Macquarie Perch. Macquarie Perch undertake upstream migrations to breed in October to January. Temporary noise or minor habitat alteration during this time is unlikely to prevent breeding. More importantly, any crossings will be designed so that fish passage is not blocked. Therefore, breeding movements would not be affected if this species does in fact use Wallaces Creek and the Yarrangobilly River for breeding.

**Modify, destroy, remove, isolate or decrease the availability or quality of habitat to the extent that the species is likely to decline**

The removal of a small amount of riparian and aquatic habitat is not expected to have a detrimental effect on the population. The predicted impact to riparian vegetation (PCT 302) is estimated at 3.12ha. This impact is small scale and it not considered likely to cause the species to decline.

**Result in invasive species that are harmful to a critically endangered or endangered species becoming established in the endangered or critically endangered species' habitat**

Redfin Perch, Wild Goldfish, Eastern Gambusia, Rainbow Trout and Brown Trout are introduced species that are known to occur in the habitats. These species are well established. As such, the project is not likely to result in the establishment of these species or increase their spread through other waterways.

**Introduce disease that may cause the species to decline, or**

The project does not involve the movement of animals or any materials likely to be contaminated by pathogens and are unlikely to result in the introduction of any animal diseases. The project mitigation strategy and environmental management procedures would include guidance for preventing the introduction and/or spread of disease-causing agents.

**Interfere with the recovery of the species**

The National Recovery Plan for Macquarie Perch (*Macquaria australasica*) (Department of the Environment and Energy, 2018) identifies the following actions for recovery of the species:

- Protect Macquarie Perch from competition with and predation by introduced fish species
- Ensure that the impacts of recreational fishing are minimised
- Protect Macquarie Perch populations from outbreaks of disease and parasites

- Restore Macquarie Perch population connectivity by conducting regular assisted gene flow (i.e. translocations) in order to decrease inbreeding, prevent further loss of genetic diversity by drift and improve adaptive potential (consistent with EPBC Act requirements)
- Develop an emergency management response plan for rescue translocations (consistent with EPBC Act requirements)
- Undertake priority habitat rehabilitation, restoration and enhancement work
- Seek to provide appropriate flow regimes in all waters where Macquarie Perch occur below water storages or offtakes
- Undertake works to minimise cold water pollution
- Improve in-stream habitat to improve productivity of lower food web
- Investigate methods to promote spawning and recruitment activity of Macquarie Perch in naturally occurring and stocked populations
- Better understand competition and predation on Macquarie Perch by introduced fish species
- Increase the confidence that the viruses and pathogens impacting Macquarie Perch are all identified and known
- Increase understanding of the degree of impact parasites are having on Macquarie Perch populations
- Research best practice for habitat restoration
- Refine and improve captive breeding techniques for Macquarie Perch
- Undertake a conservation stocking program for Macquarie Perch
- Implement a long-term monitoring program for the Macquarie Perch which is able to record the size and importance of natural, self-sustaining populations and stocked populations
- Increase understanding of spawning and recruitment ecology of the Macquarie Perch and its relationship to habitat
- Increase understanding of how the Macquarie Perch's life cycle is related to flow and temperature
- Investigate the fate of released fingerlings
- Raise awareness for the conservation status of Macquarie Perch in the community
- Engage with private landholders and land managers responsible for the land adjacent to waterways which populations occur and encourage these key stakeholders to support the conservation of the Macquarie Perch.

The project would not interfere with any of the above identified management actions.

**Conclusion**

Given the context and intensity of the potential impact and the low magnitude of the potential impacts to the Macquarie Perch and its potential habitat, a significant impact to the Macquarie Perch is considered unlikely.

## G.6 Migratory species

An area of 'important habitat' for a migratory species is:

- Habitat used by a migratory species occasionally or periodically within a region that supports an ecologically significant proportion of the population of the species, and/or
- Habitat that is of critical importance to the species at particular life-cycle stages, and/or
- Habitat used by a migratory species which is at the limit of the species range, and/or
- Habitat within an area where the species is declining.

Listed migratory species cover a broad range of species with habitat requirements, life cycles and population sizes. Therefore, what is an 'ecologically significant proportion' of the population varies with the species. Some factors that would be considered include the species' population status, genetic distinctiveness and species-specific behavioural patterns (for example, site fidelity and dispersal rates). These factors have been considered in the following assessment.

**Substantially modify (including by fragmenting, altering fire regimes, altering nutrient cycles or altering hydrological cycles), destroy or isolate an area of important habitat for a migratory species**

There is no evidence to suggest that an ecologically significant proportion of the population of any identified migratory species exists within the study area.

**Result in an invasive species that is harmful to the migratory species becoming established in an area of important habitat for the migratory species**

The potential for weed invasion has been considered a low potential, with a project of this nature and appropriate controls have been provided during the construction to reduce this threat as it may have long term implications for the habitat of threatened and migratory species. The management of invasive species would be managed under the construction environmental management plan.

**Seriously disrupt the lifecycle (breeding, feeding, migration or resting behaviour) of an ecologically significant proportion of the population of a migratory species.**

As discussed, there is no evidence to suggest that an ecologically significant proportion of the population of a migratory species exists within the study area.

# Appendix H. Fisheries Management Act 1994 significance assessments

## H.1 Macquarie Perch (*Macquaria australasica*)

Despite fish stocking of Macquarie Perch within the Talbingo Reservoir, this species was not located during the Cardno (2018) surveys and it is unknown if a self-sustaining population occurs. The Macquarie Perch may also occur in the Yarrangobilly River (Cardno, 2018). Based on the habitat assessment and review of the work undertaken for the Snowy 2.0 Exploratory Works and Main Works EISs (Cardno, 2018 and Cardno 2019), the Macquarie Perch is considered likely to occur in the habitats that may be affected by the construction envelope.

In accordance with Section 221ZV of the FM Act, the following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species, populations or ecological communities (unless it is carried out in critical habitat):

**a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,**

The project will not disrupt the breeding cycle of the Macquarie Perch. Macquarie Perch undertake upstream migrations to breed in October to January. Temporary noise or minor habitat alteration during this time is unlikely to prevent breeding. More importantly, any crossings will be designed so that fish passage is not blocked. Therefore, breeding movements would not be affected if this species does in fact use Wallaces Creek and the Yarrangobilly River for breeding. As such, the project is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.

**b) in the case of an endangered population, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,**

Not applicable.

**c) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:**

- **i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- **ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable.

**(d) in relation to the habitat of a threatened species, population or ecological community:**

- **i. (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
- **ii. (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
- **iii. (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the threatened species, population or ecological community in the locality,**

The removal of a small amount of riparian and aquatic habitat is not expected to have a detrimental effect on the population. The predicted impact to riparian vegetation (PCT 302) is estimated at 3.12ha. This impact is small scale and it not considered likely to cause the species to decline.

Importantly, the action will not result in the breaking apart of large blocks of high-quality habitat and fish passage will not be blocked. As such, the project is considered unlikely to fragment or isolate an area of habitat from other areas of habitat.

Wallaces Creek and the Yarrangobilly River are not specifically recognised as an important habitat for the Macquarie Perch (see Department of the Environment and Energy, 2018).

**(e) whether the proposed development or activity is likely to have an adverse effect on any critical habitat (either directly or indirectly),**

No critical habitat has been listed for the Macquarie Perch.

**(f) whether the proposed development or activity is consistent with a Priorities Action Statement,**

The *Priorities Action Statement – Actions for Macquarie Perch* (Department of Primary industries, 2019b) identifies the following recovery actions:

- Advice to consent and determining authorities
  - Provide information on the distribution of the Macquarie Perch to local councils and determining authorities to ensure appropriate consideration during development assessment processes (High priority).
- Collate and review existing information
  - Compile existing information on Macquarie Perch and identify knowledge gaps for the purpose of targeting future research activities (Medium priority)
  - Collate data on the historical distribution of Macquarie Perch including anecdotal and indigenous knowledge (Low priority).
- Community and stakeholder liaison, awareness and education
  - Install signs and/or interpretive displays at appropriate locations to assist with identification and awareness of Macquarie Perch (Medium priority)
  - Encourage community reporting of Macquarie Perch via the NSW DPI Threatened and Pest Species Sightings Program online form (Low priority)
  - Implement education initiatives to improve awareness of the status of the Macquarie Perch and ways to minimise impacts on the species by preparing and distributing appropriate advisory material (Low priority)
  - Foster long-term, two-way knowledge transfer and capacity building to enhance the role of indigenous ecological knowledge in the recovery of Macquarie Perch (Low medium).
- Compliance / enforcement
  - Maximise compliance activities at identified important sites (Medium priority).
- Enhance, modify or implement NRM planning processes to minimize adverse impacts on threatened species
  - Negotiate with relevant authorities to encourage the identification, assessment, and modification of natural resource management plans and policies to minimise impacts on Macquarie Perch habitats and water quality (High priority).
  - Implement relevant State policies and programs (e.g. the NSW Diffuse Source Water Pollution Strategy) in an effort to reduce water pollution (particularly chemical pollution from agricultural pesticides) impacts on Macquarie Perch habitats in NSW (High priority).

- Habitat rehabilitation
  - Undertake work to identify, restore and protect known and potential Macquarie Perch habitats and address key threats such as habitat degradation and water quality decline from expanding development (High priority)
  - Allocate and manage environmental water flows in regulated rivers to restore natural seasonal flow patterns, and to reduce the impact of cold water downstream of dams (High priority)
  - Actively seek funds through grant schemes or other sources to implement riparian vegetation and water quality improvement projects in priority areas (High priority)
  - Undertake priority rehabilitation, restoration and enhancement work (e.g. rehabilitating riparian vegetation, cold water pollution reduction measures, reinstating large woody debris, removal of barriers to fish passage, removal of willows from riverbanks, sediment and erosion control measures) at key sites known to support Macquarie Perch populations (High priority).
- Pest eradication and control
  - Investigate and implement integrated management of introduced species in and adjacent to identified Macquarie Perch habitats and take action to prevent the spread of introduced species into these habitats (High priority).
- Research / monitoring
  - Conduct research on the biology and ecology of Macquarie Perch, particularly the species' ecological role, environmental tolerances, factors influencing population dynamics, age and growth, life cycle and diet (High priority)
  - Monitor Macquarie Perch populations over time to assess trends in abundance and distribution and to identify emerging threatening processes (High priority)
  - Undertake research to identify, prioritise and improve understanding of the threatening processes and causes of decline of Macquarie Perch (High priority)
  - Actively seek grants or investor partnerships to fund research and monitoring programs for Macquarie Perch (High priority)
  - Actively encourage community involvement in aspects of Macquarie Perch research and monitoring programs (Low priority).
- Stocking / translocation
  - Implement the NSW Freshwater Fish Stocking Fishery Management Strategy to prevent significant impacts from stocking on Macquarie Perch populations (High priority)
  - Conduct research to evaluate the effectiveness of translocation of adult fish compared to stocking of juveniles to inform future conservation actions (High priority)
  - Conduct targeted sampling at stocked sites to assess the status of stocked populations including growth and recruitment rates (High priority)
  - Develop an emergency response policy to guide the collection and captive husbandry of Macquarie Perch. The policy should address the circumstances in which wild individuals may be collected, held and re-released, and identify holding facilities, potential funding sources and legal requirements (Low priority)
  - Identify potential candidate sites for possible future translocation of Macquarie Perch (Low priority).
  - Undertake emergency rescues of Macquarie Perch in response to droughts, oil spills/ pollution, detection of biosecurity threats (e.g. disease or pests), or to avoid imminent impacts in accordance with the emergency response policy (Low priority)
  - Review and assess the potential of artificial refuge areas for the protection of Macquarie Perch (Low priority).

- Survey / mapping
  - Conduct targeted surveys to determine the current distribution and abundance of Macquarie Perch (Medium priority)
  - Collect data on the presence/absence of Macquarie Perch during incidental surveys (Medium priority).

The project will not interfere with any of the above recovery actions identified in the Priorities Action Statement.

**(g) whether the proposed development constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**

The Key threatening Processes outlined in Schedule 6 of the FM Act include:

- Degradation of native riparian vegetation along New South Wales watercourses
- Hook and line fishing in areas important for the survival of threatened fish species
- Human-caused climate change
- Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams
- Introduction of fish to waters within a river catchment outside their natural range
- Introduction of non-indigenous fish and marine vegetation to the coastal waters of New South Wales
- Removal of large woody debris from New South Wales rivers and streams
- The current shark meshing program in New South Wales waters

The project will involve removal of some native riparian vegetation. As such, the project will result in the operation of a key threatening process.

**Conclusion**

There will be some removal of riparian vegetation and aquatic habitat, but it is not expected to have a detrimental effect on the population (if indeed the Macquarie Perch utilises the habitats affected by the project). The project is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction. The project is considered unlikely to fragment or isolate an area of habitat from other areas of habitat. Wallaces Creek and the Yarrangobilly River are not specifically recognised as an important habitat for the Macquarie Perch. No critical habitat will be impacted. The project will not interfere with the recovery actions identified for the Macquarie Perch. The degradation of riparian vegetation along New South Wales watercourses is however a Key Threatening Process identified in Schedule 6 of the FM Act. Considering the factors above, the project is considered unlikely to significantly affect the Macquarie Perch.

## H.2 Murray Crayfish (*Euastacus armatus*).

The Murray Crayfish is known to occur in the Yarrangobilly River and Wallaces Creek (see Cardno, 2018).

In accordance with Section 221ZV of the FM Act, the following is to be taken into account for the purposes of determining whether a proposed development or activity is likely to significantly affect threatened species, populations or ecological communities (unless it is carried out in critical habitat):

**a) in the case of a threatened species, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction,**

A viable local population of the Murray Crayfish is known to be present in the habitats to be impacted by the construction envelope. The Murray Crayfish was caught in the Yarrangobilly River and Wallaces Creek during recent surveys (see Cardno, 2018). The species is slow growing, with females taking up to 10 years to reach sexual maturity, and 4 years for males. They can live up to an estimated 28 years of age (Department of Primary industries, 2019a). The lifecycle to sexual maturity is long. Habitat modification can detrimentally impact the Murray Crayfish and may have an adverse effect on the lifecycle of the species.

Importantly for this project, sedimentation must be managed. Sedimentation can fill deeper holes, smother snags and other cover, and bury clay banks required for burrowing (Department of Primary industries, 2019a). Mitigation measures will be put in place to prevent the habitats being impacted by sedimentation so that burrowing will be able to continue. There will be no obstruction to the waterway and the preferred flowing streams will persist in a similar state during and after construction. As such, the life cycle of the species is considered unlikely to be affected to the point where a viable local population would be placed at risk of extinction.

**b) in the case of an endangered population, whether the proposed development or activity is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction,**

Not applicable.

**c) in the case of an endangered ecological community or critically endangered ecological community, whether the proposed development or activity:**

- **i. is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or**
- **ii. is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction,**

Not applicable.

**(d) in relation to the habitat of a threatened species, population or ecological community:**

- **i. (i) the extent to which habitat is likely to be removed or modified as a result of the proposed development or activity, and**
- **ii. (ii) whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed development or activity, and**
- **iii. (iii) the importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the threatened species, population or ecological community in the locality,**

The removal of a small amount of riparian and aquatic habitat is not expected to have a detrimental effect on the population. The predicted impact to riparian vegetation (PCT 302) is estimated at 3.12ha. This impact is small scale and it not considered likely to cause the species to decline.

Importantly, the action will not result in the breaking apart of large blocks of high-quality habitat and fish passage will not be blocked. As such, the project is considered unlikely to fragment or isolate an area of habitat from other areas of habitat.

Wallaces Creek and the Yarrangobilly River are not specifically recognised as an important habitat for the Murray Crayfish.

**(e) whether the proposed development or activity is likely to have an adverse effect on any critical habitat (either directly or indirectly),**

No critical habitat has been listed for the Murray Crayfish.

**(f) whether the proposed development or activity is consistent with a Priorities Action Statement,**

The *Priorities Action Statement – Actions for Murray Crayfish* (Department of Primary industries, 2019c) identifies the following recovery actions:

- Advice to consent and determining authorities
  - Provide information on the distribution of the Murray Crayfish to local councils and determining authorities to ensure appropriate consideration during development assessment processes (Medium priority).
- Collate and review existing information
  - Compile existing information on Murray Crayfish and identify knowledge gaps for the purpose of targeting future research activities (High priority)
  - Collate data on the historical distribution of Murray Crayfish including anecdotal and indigenous knowledge (Low priority).
- Community and stakeholder liaison, awareness and education
  - Install signs and/or interpretive displays at appropriate locations to assist with identification and awareness of Murray Crayfish (High priority)
  - Educate fishers about the open and closed Murray Crayfish fishing seasons and locations as well as bag and size restrictions (High priority)
  - Implement education initiatives to improve awareness of the status of the Murray Crayfish and ways to minimise impacts on the species by preparing and distributing appropriate advisory material (Medium priority)
  - Encourage community reporting of Murray Crayfish via the NSW DPI Threatened and Pest Species Sightings Program online form (Low priority)
  - Foster long-term, two-way knowledge transfer and capacity building to enhance the role of indigenous ecological knowledge in the recovery of Murray Crayfish (Low priority).
- Compliance / enforcement
  - Maximise compliance activities at identified important sites (High priority).
- Enhance, modify or implement NRM planning processes to minimize adverse impacts on threatened species
  - Negotiate with relevant authorities to encourage the identification, assessment, and modification of natural resource management plans and policies to minimise impacts on Murray Crayfish habitats and water quality (High priority)
  - Implement relevant State policies and programs (e.g. the NSW Diffuse Source Water Pollution Strategy) in an effort to reduce water pollution (particularly chemical pollution from agricultural pesticides) impacts on Murray Crayfish habitats in NSW (Medium priority).

- Habitat rehabilitation
  - Undertake work to identify, restore and protect known and potential Murray Crayfish habitats and address key threats such as habitat degradation and water quality decline (High priority)
  - Allocate and manage environmental water flows in regulated rivers to restore natural seasonal flow patterns (High priority)
  - Actively seek funds through grant schemes or other sources to implement riparian vegetation and water quality improvement projects in priority areas (High priority)
  - Undertake priority rehabilitation, restoration and enhancement work (e.g. rehabilitating riparian vegetation, cold water pollution reduction measures, reinstating large woody debris, removal of barriers to fish passage, removal of willows from riverbanks, sediment and erosion control measures) at key sites known to support Murray Crayfish populations (High priority).
- Pest eradication and control
  - Investigate and implement integrated management of introduced species in and adjacent to identified Murray Crayfish habitats and take action to prevent the spread of introduced species into these habitats (High priority).
- Research / monitoring
  - Conduct research on the biology and ecology of Murray Crayfish, particularly the species' ecological role, environmental tolerances, factors influencing population dynamics, age and growth, life cycle and diet (High priority)
  - Undertake research to identify, prioritise and improve understanding of the threatening processes and causes of decline of Murray Crayfish (High priority)
  - Actively seek grants or investor partnerships to fund research and monitoring programs for Murray Crayfish (High priority)
  - Monitor populations of Murray Crayfish over time to assess trends in abundance and distribution and to identify emerging threatening processes (Medium priority)
  - Actively encourage community involvement in aspects of Murray Crayfish research and monitoring programs (Low priority)
  - Undertake research into the translocation and/or captive breeding of Murray Crayfish (Low priority)
  - Obtain and analyse genetic material from remnant populations of Murray Crayfish to identify genetic units to inform conservation breeding or translocation (Low priority).
- Stocking / translocation
  - Implement the NSW Freshwater Fish Stocking Fishery Management Strategy to prevent significant impacts from stocking on Murray Crayfish populations (High priority)
  - Identify potential candidate sites for possible future translocation of Murray Crayfish (Low priority)
  - Undertake emergency rescues of Murray Crayfish in response to droughts, oil spills/ pollution, detection of biosecurity threats (e.g. disease or pests), or to avoid imminent impacts in accordance with the emergency response policy (Low priority)
  - Review and assess the potential of artificial refuge areas for the protection of Murray Crayfish (Low priority).
- Survey / mapping
  - Conduct targeted surveys to determine the current distribution and abundance of Murray Crayfish (High priority)
  - Collect data on the presence/absence of Murray Crayfish during incidental surveys (Medium priority).

The project will not interfere with any of the above recovery actions identified in the Priorities Action Statement.

**(g) whether the proposed development constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.**

The Key threatening Processes outlined in Schedule 6 of the FM Act include:

- Degradation of native riparian vegetation along New South Wales watercourses
- Hook and line fishing in areas important for the survival of threatened fish species
- Human-caused climate change
- Installation and operation of instream structures and other mechanisms that alter natural flow regimes of rivers and streams
- Introduction of fish to waters within a river catchment outside their natural range
- Introduction of non-indigenous fish and marine vegetation to the coastal waters of New South Wales
- Removal of large woody debris from New South Wales rivers and streams
- The current shark meshing program in New South Wales waters

The project will involve removal of some native riparian vegetation. As such, the project will result in the operation of a key threatening process.

**Conclusion**

There will be some removal of riparian vegetation and aquatic habitat, but it is not expected to have a detrimental effect on the population of Murray Crayfish. The project is not likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction. The project is considered unlikely to fragment or isolate an area of habitat from other areas of habitat. Wallaces Creek and the Yarrangobilly River are not specifically recognised as an important habitat for the Murray Crayfish. No critical habitat will be impacted. The project will not interfere with the recovery actions identified for the Murray Crayfish. The degradation of riparian vegetation along New South Wales watercourses is however a Key Threatening Process identified in Schedule 6 of the FM Act. Considering the factors above, the project is considered unlikely to significantly affect the Murray Crayfish.

# Appendix I. Biodiversity credit report

# BAM Credit Summary Report

## Proposal Details

| | | |
|---|---|---|
| Assessment Id | Proposal Name | BAM data last updated * |
| 00014677/BAAS19068/20/00021924 | Snowy 2 Connector - Australian Alps Bioregion | 21/12/2020 |
| Assessor Name | Report Created | BAM Data version * |
| Chris  Thomson | 10/02/2021 | 36 |
| Assessor Number | BAM Case Status | Date Finalised |
| BAAS18058 | Open | To be finalised |
| Assessment Revision | Assessment Type | |
| 0 | Major Projects | |

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

## Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

| Zone | Vegetation zone name | TEC name | Current Vegetation integrity score | Change in Vegetation integrity (loss / gain) | Area (ha) | BC Act Listing status | EPBC Act listing status | Species sensitivity to gain class (for BRW) | Biodiversity risk weighting | Potential SAII | Ecosystem credits |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion** | | | | | | | | | | | |
| 1 | 285_Moderate_Blackberry | Not a TEC | 78.7 | 78.7 | 1.8 | | | High Sensitivity to Potential Gain | 2.00 | | 70 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 285_Moderate_Blackberry0 | Not a TEC | 78.7 | 0.3 | 0.33 | | | High Sensitivity to Potential Gain | 2.00 | | 1 |
| | | | | | | | | | | **Subtotal** | **71** |
| **Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment** | | | | | | | | | | | |
| 2 | 300_Good | Not a TEC | 83.7 | 83.7 | 10.8 | | | High Sensitivity to Potential Gain | 1.50 | | 338 |
| 6 | 300_Good01 | Not a TEC | 83.7 | 0.5 | 2.9 | | | High Sensitivity to Potential Gain | 1.50 | | 1 |
| | | | | | | | | | | **Subtotal** | **339** |
| **Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion** | | | | | | | | | | | |
| 3 | 1196_DNG | Not a TEC | 38.6 | 38.6 | 0.76 | | | High Sensitivity to Potential Gain | 1.50 | | 11 |
| 4 | 1196_Good | Not a TEC | 84.9 | 84.9 | 23.2 | | | High Sensitivity to Potential Gain | 1.50 | | 739 |
| 7 | 1196_Good01 | Not a TEC | 84.9 | 0.2 | 3.7 | | | High Sensitivity to Potential Gain | 1.50 | | 1 |
| | | | | | | | | | | **Subtotal** | **751** |
| | | | | | | | | | | **Total** | **1161** |

## Species credits for threatened species

| Vegetation zone name | Habitat condition (Vegetation Integrity) | Change in habitat condition | Area (ha)/Count (no. individuals) | BC Act Listing status | EPBC Act listing status | Biodiversity risk weighting | Potential SAII | Species credits |
|---|---|---|---|---|---|---|---|---|
| ***Callocephalon fimbriatum / Gang-gang Cockatoo ( Fauna )*** | | | | | | | | |
| 300_Good | 83.7 | 83.7 | 10.8 | Vulnerable | Not Listed | 2 | False | 451 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1196_DNG | 38.6 | 38.6 | 0.76 | Vulnerable | Not Listed | 2 | False | 15 |
| 1196_Good | 84.9 | 84.9 | 23.2 | Vulnerable | Not Listed | 2 | False | 985 |
| 300_Good01 | 0.5 | 0.5 | 2.9 | Vulnerable | Not Listed | 2 | False | 1 |
| 1196_Good01 | 0.2 | 0.2 | 3.7 | Vulnerable | Not Listed | 2 | False | 1 |
| | | | | | | | **Subtotal** | **1453** |
| ***Cercartetus nanus / Eastern Pygmy-possum ( Fauna )*** | | | | | | | | |
| 285_Moderate_Blackberry | 78.7 | 78.7 | 1.8 | Vulnerable | Not Listed | 2 | False | 70 |
| 300_Good | 83.7 | 83.7 | 10.8 | Vulnerable | Not Listed | 2 | False | 451 |
| 1196_Good | 84.9 | 84.9 | 23.2 | Vulnerable | Not Listed | 2 | False | 985 |
| 300_Good01 | 0.5 | 0.5 | 2.9 | Vulnerable | Not Listed | 2 | False | 1 |
| 1196_Good01 | 0.2 | 0.2 | 3.7 | Vulnerable | Not Listed | 2 | False | 1 |
| 285_Moderate_Blackberry0 | 0.3 | 0.3 | 0.33 | Vulnerable | Not Listed | 2 | False | 1 |
| | | | | | | | **Subtotal** | **1509** |
| ***Ninox strenua / Powerful Owl ( Fauna )*** | | | | | | | | |
| 300_Good | 83.7 | 83.7 | 10.8 | Vulnerable | Not Listed | 2 | False | 451 |
| 300_Good01 | 0.5 | 0.5 | 2.9 | Vulnerable | Not Listed | 2 | False | 1 |
| | | | | | | | **Subtotal** | **452** |
| ***Petaurus australis - endangered population / Yellow-bellied Glider population on the Bago Plateau ( Fauna )*** | | | | | | | | |
| 285_Moderate_Blackberry | 78.7 | 78.7 | 1.8 | Endangered Population | Not Listed | 2 | False | 70 |
| 300_Good | 83.7 | 83.7 | 10.8 | Endangered Population | Not Listed | 2 | False | 451 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 1196_Good | 84.9 | 84.9 | 23.2 | Endangered Population | Not Listed | 2 | False | 985 |
| 285_Moderate_Blackberry0 | 0.3 | 0.3 | 0.33 | Endangered Population | Not Listed | 2 | False | 1 |
| 300_Good01 | 0.5 | 0.5 | 2.9 | Endangered Population | Not Listed | 2 | False | 1 |
| 1196_Good01 | 0.2 | 0.2 | 3.7 | Endangered Population | Not Listed | 2 | False | 1 |
| | | | | | | | **Subtotal** | **1509** |
| ***Petaurus norfolcensis / Squirrel Glider ( Fauna )*** | | | | | | | | |
| 285_Moderate_Blackberry | 78.7 | 78.7 | 1.8 | Vulnerable | Not Listed | 2 | False | 70 |
| 300_Good | 83.7 | 83.7 | 10.8 | Vulnerable | Not Listed | 2 | False | 451 |
| 1196_Good | 84.9 | 84.9 | 23.2 | Vulnerable | Not Listed | 2 | False | 985 |
| 285_Moderate_Blackberry0 | 0.3 | 0.3 | 0.33 | Vulnerable | Not Listed | 2 | False | 1 |
| 300_Good01 | 0.5 | 0.5 | 2.9 | Vulnerable | Not Listed | 2 | False | 1 |
| 1196_Good01 | 0.2 | 0.2 | 3.7 | Vulnerable | Not Listed | 2 | False | 1 |
| | | | | | | | **Subtotal** | **1509** |

# BAM Credit Summary Report

## Proposal Details

Assessment Id

00014677/BAAS19068/20/00021925

Proposal Name

Snowy 2 Connector - South East Highlands Bioregion

BAM data last updated *

21/12/2020

Assessor Name

Chris  Thomson

Report Created

10/02/2021

BAM Data version *

36

Assessor Number

BAAS18058

BAM Case Status

Open

Date Finalised

To be finalised

Assessment Revision

2

Assessment Type

Major Projects

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

## Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

| Zone | Vegetation zone name | TEC name | Current Vegetation integrity score | Change in Vegetation integrity (loss / gain) | Area (ha) | BC Act Listing status | EPBC Act listing status | Species sensitivity to gain class (for BRW) | Biodiversity risk weighting | Potential SAII | Ecosystem credits |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Brittle Gum - peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion** | | | | | | | | | | | |
| 1 | 296_Native_grassland | Not a TEC | 39.5 | 39.5 | 0.13 | | | High Sensitivity to Potential Gain | 1.50 | | 2 |
| 2 | 296_Good_dry_slopes | Not a TEC | 88.7 | 88.7 | 4.7 | | | High Sensitivity to Potential Gain | 1.50 | | 155 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 296_Good_wet_slopes | Not a TEC | 75.3 | 75.3 | 15 | | | High Sensitivity to Potential Gain | 1.50 | | 423 |
| 4 | 296_Moderate_Blackberry | Not a TEC | 49.1 | 49.1 | 1.4 | | | High Sensitivity to Potential Gain | 1.50 | | 25 |
| 14 | 296_Good_dry_slopes01 | Not a TEC | 88.7 | 0.3 | 1.3 | | | High Sensitivity to Potential Gain | 1.50 | | 1 |
| 15 | 296_Good_wet_slopes01 | Not a TEC | 75.3 | 0.8 | 4.7 | | | High Sensitivity to Potential Gain | 1.50 | | 1 |
| 16 | 296_Moderate_Blackberry0 | Not a TEC | 49.1 | 0.2 | 0.08 | | | High Sensitivity to Potential Gain | 1.50 | | 1 |
| | | | | | | | | | | **Subtotal** | **608** |
| **Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion** | | | | | | | | | | | |
| 8 | 729_Native_grassland | Not a TEC | 23.4 | 23.4 | 1.1 | | | High Sensitivity to Potential Gain | 1.50 | | 10 |
| 9 | 729_Regrowth_shrubland | Not a TEC | 36.6 | 36.6 | 0.78 | | | High Sensitivity to Potential Gain | 1.50 | | 11 |
| 10 | 729_Good_dry_slopes | Not a TEC | 81.5 | 81.5 | 16 | | | High Sensitivity to Potential Gain | 1.50 | | 490 |
| 11 | 729_Good_wet_slopes | Not a TEC | 76 | 76.0 | 16.8 | | | High Sensitivity to Potential Gain | 1.50 | | 479 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 19 | 729_Good_dry_slopes 01 | Not a TEC | 81.5 | 0.4 | 5.4 | | | High Sensitivity to Potential Gain | 1.50 | | 1 |
| 20 | 729_Good_wet_slopes 01 | Not a TEC | 76 | 0.0 | 8 | | | High Sensitivity to Potential Gain | 1.50 | | 1 |
| | | | | | | | | | | **Subtotal** | **992** |
| **Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion** | | | | | | | | | | | |
| 12 | 999_Regrowth_shrubland | Not a TEC | 31.5 | 31.5 | 1.2 | | | High Sensitivity to Potential Gain | 1.50 | | 15 |
| 13 | 999_Good_dry_Calytrix | Not a TEC | 58.9 | 58.9 | 6.4 | | | High Sensitivity to Potential Gain | 1.50 | | 141 |
| 21 | 999_Good_dry_Calytrix 01 | Not a TEC | 58.9 | 0.1 | 2.2 | | | High Sensitivity to Potential Gain | 1.50 | | 1 |
| | | | | | | | | | | **Subtotal** | **157** |
| **Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest on deep clay loam soils in the upper NSW South Western Slopes Bioregion and western Kosciuszko escarpment** | | | | | | | | | | | |
| 5 | 300_Good | Not a TEC | 81.3 | 81.3 | 32.5 | | | High Sensitivity to Potential Gain | 1.50 | | 991 |
| 17 | 300_Good02 | Not a TEC | 81.3 | 1.1 | 9.6 | | | High Sensitivity to Potential Gain | 1.50 | | 4 |
| | | | | | | | | | | **Subtotal** | **995** |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion** | | | | | | | | | | | |
| 6 | 302_Native_grassland | Not a TEC | 14.6 | 14.6 | 0.55 | | | High Sensitivity to Potential Gain | 1.75 | | 0 |
| 7 | 302_Moderate | Not a TEC | 61.3 | 61.3 | 2.6 | | | High Sensitivity to Potential Gain | 1.75 | | 69 |
| 18 | 302_Moderate01 | Not a TEC | 61.3 | 0.1 | 1 | | | High Sensitivity to Potential Gain | 1.75 | | 1 |
| | | | | | | | | | | **Subtotal** | **70** |
| | | | | | | | | | | **Total** | **2822** |

## Species credits for threatened species

| Vegetation zone name | Habitat condition (Vegetation Integrity) | Change in habitat condition | Area (ha)/Count (no. individuals) | BC Act Listing status | EPBC Act listing status | Biodiversity risk weighting | Potential SAII | Species credits |
|---|---|---|---|---|---|---|---|---|
| ***Callocephalon fimbriatum / Gang-gang Cockatoo ( Fauna )*** | | | | | | | | |
| 300_Good | 81.3 | 81.3 | 32.5 | Vulnerable | Not Listed | 2 | False | 1321 |
| 302_Moderate | 61.3 | 61.3 | 2.6 | Vulnerable | Not Listed | 2 | False | 79 |
| 300_Good02 | 1.1 | 1.1 | 9.6 | Vulnerable | Not Listed | 2 | False | 5 |
| 302_Moderate01 | 0.1 | 0.1 | 1 | Vulnerable | Not Listed | 2 | False | 1 |
| | | | | | | | **Subtotal** | **1406** |
| ***Cercartetus nanus / Eastern Pygmy-possum ( Fauna )*** | | | | | | | | |
| 296_Good_dry_slopes | 88.7 | 88.7 | 4.7 | Vulnerable | Not Listed | 2 | False | 207 |
| 296_Good_wet_slopes | 75.3 | 75.3 | 15 | Vulnerable | Not Listed | 2 | False | 563 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 296_Moderate_Blackberry | 49.1 | 49.1 | 1.4 | Vulnerable | Not Listed | 2 | False | 34 |
| 300_Good | 81.3 | 81.3 | 32.5 | Vulnerable | Not Listed | 2 | False | 1321 |
| 302_Moderate | 61.3 | 61.3 | 2.6 | Vulnerable | Not Listed | 2 | False | 79 |
| 729_Good_dry_slopes | 81.5 | 81.5 | 16 | Vulnerable | Not Listed | 2 | False | 654 |
| 729_Good_wet_slopes | 76.0 | 76.0 | 16.8 | Vulnerable | Not Listed | 2 | False | 638 |
| 999_Good_dry_Calytrix | 58.9 | 58.9 | 6.4 | Vulnerable | Not Listed | 2 | False | 188 |
| 296_Good_dry_slopes01 | 0.3 | 0.3 | 1.3 | Vulnerable | Not Listed | 2 | False | 1 |
| 296_Good_wet_slopes01 | 0.8 | 0.8 | 4.7 | Vulnerable | Not Listed | 2 | False | 2 |
| 296_Moderate_Blackberry0 | 0.2 | 0.2 | 0.08 | Vulnerable | Not Listed | 2 | False | 1 |
| 300_Good02 | 1.1 | 1.1 | 9.6 | Vulnerable | Not Listed | 2 | False | 5 |
| 302_Moderate01 | 0.1 | 0.1 | 1 | Vulnerable | Not Listed | 2 | False | 1 |
| 729_Good_dry_slopes01 | 0.4 | 0.4 | 5.4 | Vulnerable | Not Listed | 2 | False | 1 |
| 729_Good_wet_slopes01 | 0.0 | 0.0 | 8 | Vulnerable | Not Listed | 2 | False | 1 |
| 999_Good_dry_Calytrix01 | 0.1 | 0.1 | 2.2 | Vulnerable | Not Listed | 2 | False | 1 |
| 729_Regrowth_shrubland | 36.6 | 36.6 | 0.78 | Vulnerable | Not Listed | 2 | False | 14 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 999_Regrowth_shrubland | 31.5 | 31.5 | 1.2 | Vulnerable | Not Listed | 2 | False | 19 |
| | | | | | | | **Subtotal** | **3730** |
| ***Litoria booroolongensis / Booroolong Frog ( Fauna )*** | | | | | | | | |
| 302_Moderate | 61.3 | 61.3 | 2.6 | Endangered | Endangered | 2 | False | 79 |
| 302_Moderate01 | 0.1 | 0.1 | 1 | Endangered | Endangered | 2 | False | 1 |
| | | | | | | | **Subtotal** | **80** |
| ***Ninox strenua / Powerful Owl ( Fauna )*** | | | | | | | | |
| 300_Good | 81.3 | 81.3 | 32.5 | Vulnerable | Not Listed | 2 | False | 1321 |
| 300_Good02 | 1.1 | 1.1 | 9.6 | Vulnerable | Not Listed | 2 | False | 5 |
| | | | | | | | **Subtotal** | **1326** |
| ***Petaurus australis - endangered population / Yellow-bellied Glider population on the Bago Plateau ( Fauna )*** | | | | | | | | |
| 300_Good | 81.3 | 81.3 | 19.9 | Endangered Population | Not Listed | 2 | False | 808 |
| 729_Good_dry_slopes | 81.5 | 81.5 | 5.6 | Endangered Population | Not Listed | 2 | False | 229 |
| 300_Good02 | 1.1 | 1.1 | 3.8 | Endangered Population | Not Listed | 2 | False | 2 |
| 729_Good_dry_slopes01 | 0.4 | 0.4 | 0.94 | Endangered Population | Not Listed | 2 | False | 1 |
| | | | | | | | **Subtotal** | **1040** |
| ***Petaurus norfolcensis / Squirrel Glider ( Fauna )*** | | | | | | | | |
| 300_Good | 81.3 | 81.3 | 22.2 | Vulnerable | Not Listed | 2 | False | 903 |
| 729_Good_dry_slopes | 81.5 | 81.5 | 10.2 | Vulnerable | Not Listed | 2 | False | 414 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 300_Good02 | 1.1 | 1.1 | 4.8 | Vulnerable | Not Listed | 2 | False | 3 |
| 729_Good_dry_slopes01 | 0.4 | 0.4 | 2.5 | Vulnerable | Not Listed | 2 | False | 1 |
| | | | | | | | **Subtotal** | **1321** |
| ***Tyto novaehollandiae / Masked Owl ( Fauna )*** | | | | | | | | |
| 302_Moderate | 61.3 | 61.3 | 2.6 | Vulnerable | Not Listed | 2 | False | 79 |
| 302_Moderate01 | 0.1 | 0.1 | 1 | Vulnerable | Not Listed | 2 | False | 1 |
| | | | | | | | **Subtotal** | **80** |

TransGrid