TransGrid

Jacobs

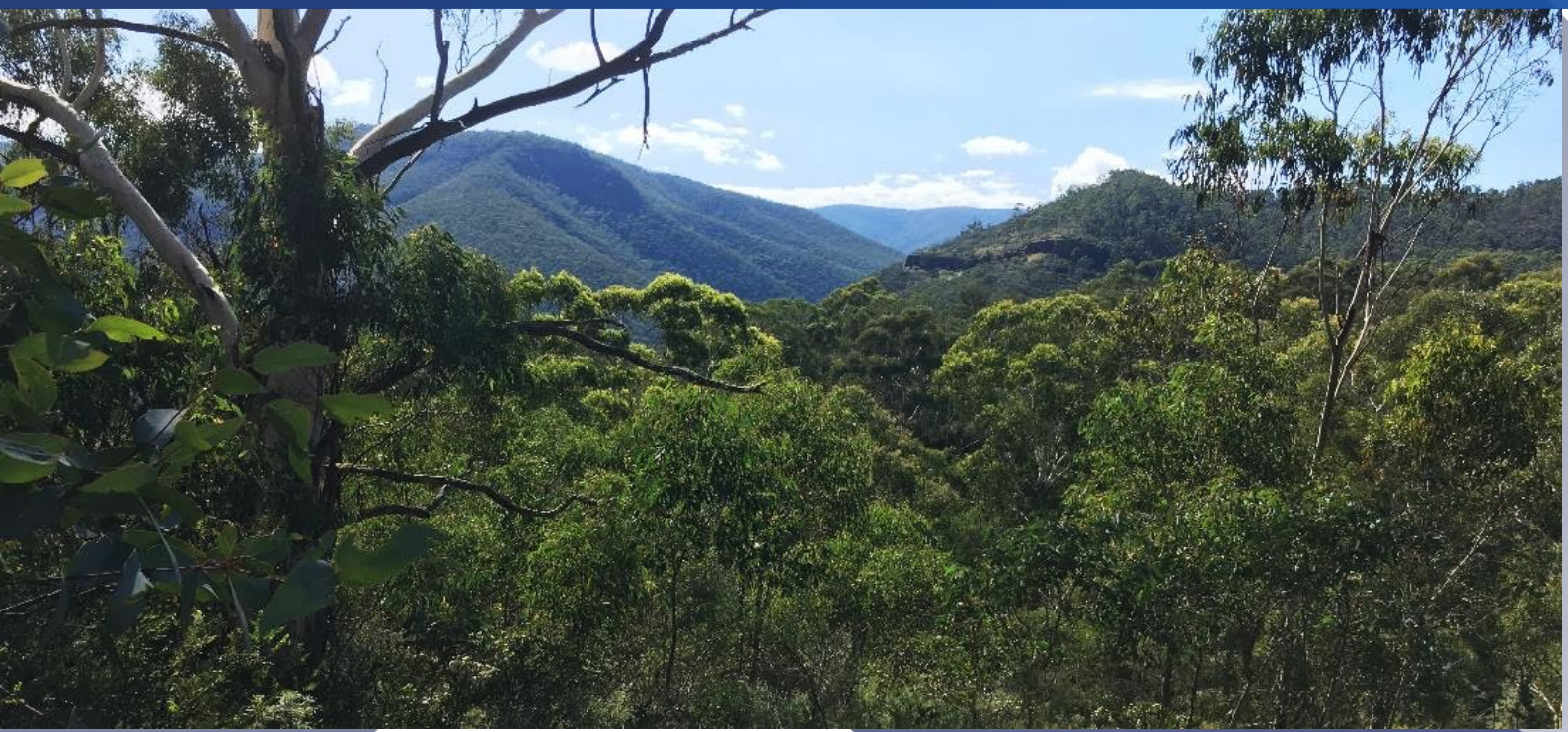
Environmental Impact Statement

Snowy 2.0 Transmission Connection Project

Environmental Impact Assessment

(February 2021)

Volume 2



Executive Summary

In 2020 Snowy Hydro Limited (Snowy Hydro) obtained approval to expand the existing Snowy Mountains Hydro-electric Scheme (Snowy Scheme) by linking the existing Tantangara and Talbingo reservoirs through a series of underground tunnels and constructing a new underground hydro-electric power station (referred to as 'Snowy 2.0'). Snowy 2.0 is expected to increase the generation capacity of the Snowy Scheme by almost 50 percent, providing an additional 2,000 megawatts (MW) of generating capacity, and making approximately 350,000 megawatt hours (MWh) of large scale storage available to the National Electricity Market (NEM).

To connect Snowy 2.0 to the NEM, a new transmission connection is required. NSW Electricity Networks Operations Pty Ltd as a trustee for NSW Electricity Operations Trust (known as 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 the Snowy 2.0 Transmission Connection Project (the project) to enable the grid connection of Snowy 2.0 to the NEM. The project has been declared Critical State Significant Infrastructure (CSSI) under the State Environmental Planning Policy (State and Regional Development) 2011 as part of the CSSI declaration for the Snowy 2.0 and Transmission Project in clause 9 of Schedule 5.

The key elements of the project are shown on **Figure E-1** and include:

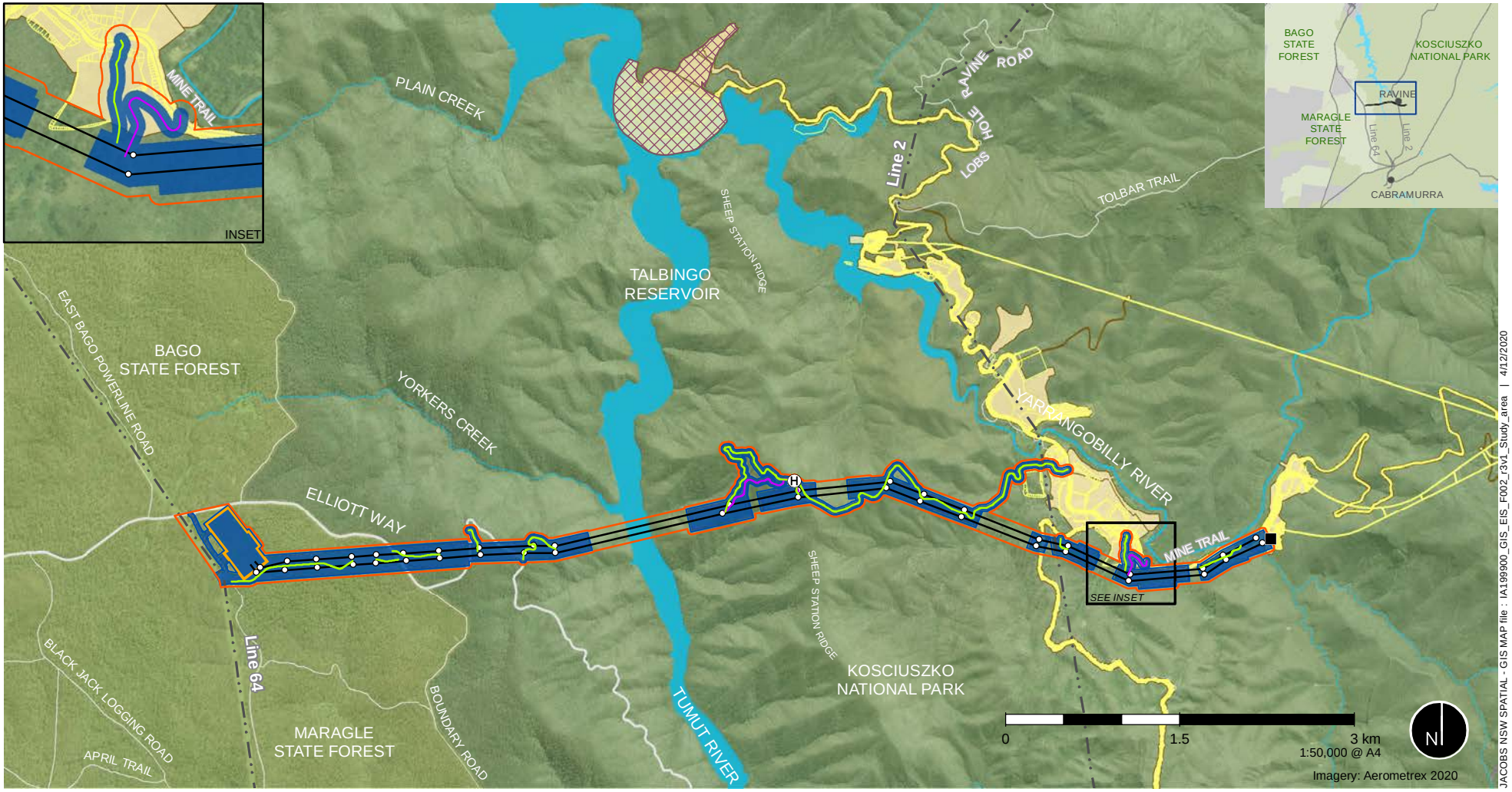
- A new 500/330 kilovolt (kV) substation located within Bago State Forest and adjacent to TransGrid's existing Transmission Line 64 (Line 64)
- Two 330 kV double-circuit overhead transmission lines, approximately nine kilometres long, linking the Snowy 2.0 cable yard in Kosciuszko National Park (KNP) to the new substation
- A short overhead transmission line connection between the substation and Line 64
- Construction of new access tracks and upgrade of existing access tracks where required to facilitate the construction of the transmission lines and substation and service ongoing maintenance activities
- Establishment of temporary sites and infrastructure needed during construction including crane pads, site compounds, a helipad, equipment laydown areas, and tensioning and pulling sites for the stringing of overhead conductors and earthwires.

The eastern extent of the project is defined by the Snowy 2.0 cable yard location at Lobs Hole in KNP, which has been approved separately as part of the Snowy 2.0 Main Works Infrastructure Approval (SSI-9867). The project then spans west across Talbingo Reservoir to TransGrid's existing Line 64 in Bago State Forest. Line 64 is the point of connection for the project to the NEM. The project would also provide a connection point into TransGrid's southern network reinforcement project (HumeLink), which when completed would strengthen the southern network, including reducing constraints on Line 64, and would allow the export of the full capacity of Snowy 2.0 across the broader transmission system. HumeLink is not the subject of this EIS or application.

Subject to obtaining necessary approvals, construction of the project is anticipated to commence in early 2022 and take approximately 39 months to complete.

The project is a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), with the relevant controlling provisions being national heritage places, listed threatened species and communities and listed migratory species. The project will be assessed under the Bilateral Agreement process between the Commonwealth and NSW Governments. Therefore, a single Environmental Impact Statement (EIS) has been prepared to address the requirements set out by the NSW Department of Planning, Industry and Environment (DPIE) and the Commonwealth Department of Agriculture, Water and the Environment.

This EIS has been prepared addressing the Secretary's Environmental Assessment Requirements (SEARs) issued by DPIE on 1 November 2019 and focuses on the key issues of biodiversity, heritage, water, land, transport, amenity, air, hazards and socio-economic impacts. The EIS has not found any issues that would preclude the approval of the project by the consent authority.



- Project area
- Disturbance area
- Proposed 500kV substation
- Potential helipad location
- Proposed structure
- Proposed transmission line
- Proposed access track - Option A
- Proposed access track - Option B
- Snowy 2.0 cable yard
- Snowy 2.0 element
- Ravine Bay Emplacement Area
- Snowy 2.0 Disturbance footprint
- Electricity transmission line
- Waterway
- Water body
- State forest
- NPWS estate

Figure E-1 | Project overview

Data source:
Jacobs 2020, TransGrid, EMM 2020,
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Need for the project

The need for the project is driven by the fundamental requirement that new generation assets need to be connected to the transmission network to be able to operate within the NEM. Consequently, a new transmission connection is required for the transmission of electricity generated by Snowy 2.0 into the existing transmission network.

Alternatives

The primary requirement of the project is to provide a high voltage connection from Snowy 2.0 into TransGrid's transmission network. To achieve this a number of options were considered for the connection. These options included alternative substation locations and connection points, underground cables and various overhead transmission line routes. The preferred project option, which is the subject of this EIS, consists of an overhead transmission connection connecting the Snowy 2.0 cable yard within KNP to Line 64 via a new substation located within Bago State Forest. The overhead transmission connection approach is a proven method in the steep alpine terrain characteristic of the project area. Compared to the other options, the overhead transmission solution would involve considerably less excavation works and spoil generation. While vegetation clearing along the transmission corridor would be required to ensure safe operational clearances, areas of remnant alpine forest can be retained within the gully areas. In addition, the overhead transmission connection would allow for safer worksites to be established, which would generally be confined to structure locations and along access tracks.

Objectives

Based on the strategic context and need for the project, the objectives of the project are to:

- Connect a declared CSSI (Snowy 2.0) project to the NEM
- Meet TransGrid's operational requirements and its commitments to Snowy Hydro to construct and operate the transmission connection in a manner that is safe, reliable and secure
- Be consistent with the principles in *TransGrid's Environment Policy* (TransGrid, 2018), including the integration of 'environmental management considerations into the planning, design, siting, construction, maintenance, operation so as to avoid and minimise potential environmental impacts as far as practicable'
- Take into account and address key stakeholder and community needs and expectations with respect to the protection of the environment, heritage features (both Aboriginal and non-Aboriginal), recreational aspects of KNP and visual amenity.

Summary of key findings of the EIS

This EIS was prepared by Jacobs Group (Australia) Pty Ltd (Jacobs) on behalf of TransGrid to support the CSSI application and Commonwealth approval of the project. The EIS considered potential environmental, social and economic impacts and benefits of the project, and describes measures identified to minimise and avoid impacts. A summary of the findings of assessments for the key issues identified in the SEARs is provided below.

Biodiversity

The project is located within a predominately natural landscape containing a diversity of habitats with high biodiversity value. A number of threatened species including Gang-gang Cockatoo, Masked Owl, Diamond Firetail, Varied Sittella, Flame Robin, Scarlet Robin and Dusky Woodswallow, Yellow-bellied Glider, Squirrel Glider and Eastern Pygmy Possum were identified during the field surveys. No threatened ecological communities or threatened plant species listed under the *Biodiversity Conservation Act 2016* (BC Act) or EPBC Act were identified during these field surveys.

The project would require the clearing of approximately 135.6 hectares of native vegetation within KNP and Bago State Forest, which provides habitat for threatened species. The project would also impact on connectivity for some species due to the clearing for the transmission corridor and associated access tracks. Other potential indirect impacts that may occur include water quality impacts, collision of fauna with transmission lines,

increased fire risk and increases in noise, vibration, dust and light. No significant impacts to biodiversity are expected.

Where impacts on biodiversity cannot be avoided or minimised, appropriate offsets would be provided. A Biodiversity Offset Strategy has been prepared for the project.

Heritage

There are three potential archaeological deposits (PAD) and one Aboriginal heritage site listed on Aboriginal Heritage Information Management System (AHIMS) (ST PAD 01, ST PAD 01, ST PAD 03 and AHIMS# 56-6-0477) located within the disturbance area which would be directly impacted by the project. Although impacts to Aboriginal items are unavoidable, mitigation strategies including salvage would aim to recover a representative sample of the sites subject to impact and contribute further to our understanding of Aboriginal occupation.

The project is located within the curtilage of two heritage places on the National Heritage List, being the Australian Alps National Parks and Reserves, and the Snowy Scheme. These heritage places are a matter of national environmental significance (MNES) under the EPBC Act. The project would not physically impact any of the physical components of the Snowy Scheme but the project area includes about 195 hectares or 0.028 per cent of KNP, which is one of 11 parks and reserves that comprise the larger Australian Alps National Parks and Reserves heritage place and which also contains components of the Snowy Scheme. Due to the projects relatively small footprint within the curtilage of these two items the project would not impact the existing heritage values of either item.

Ten other items of non-Aboriginal heritage were identified within the disturbance area and would be impacted by the project. Although some impacts to historical items are unavoidable, mitigation strategies including archival recording are proposed and would aim to contribute further to our understanding of historical occupation and events.

Water

Potential impact to water quality would primarily be during construction due to the clearing of vegetation and disturbance to land. While minor local effects would be likely to occur as a result of the project, the regional effects on surface water flows, water quality, groundwater resources and flooding are expected to be negligible with the implementation of mitigation measures.

Land

Key impacts relevant to land include erosion and sedimentation from earthworks, and contamination risks associated with Naturally Occurring Asbestos (NOA) and historical land uses at Lobs Hole which may be encountered during earthworks. The NOA risk and impacts from earthworks would be managed with the implementation of mitigation measures during construction.

Transport

Construction would result in temporary impacts on traffic and access, and an increase in heavy and light vehicle movements on the local road network. The additional traffic movements during construction are not expected to impact the safety and function of the existing road network. Traffic management during construction would ensure public safety through the provision of traffic controls and community consultation.

Air

Potential air quality impacts would relate to increased dust generated during construction, particularly due to the clearing of vegetation and earthworks. These impacts are expected to be minor and minimised with the implementation of management measures.

Amenity

The amenity values of the project area are reflective of its location within a national park and state forest setting.

Noise and visual impacts would be greatest during construction. As public access would be restricted during construction, these impacts would largely not be experienced by the public.

The landscape character and visual impact assessment determined that the introduction of new permanent elements into the landscape would result in a change to the landscape character and visual setting of KNP and Bago State Forest. The greatest visual impact would occur where the transmission corridor is established and requires the clearing of vegetation in proximity to publicly accessible roads and viewpoints. Opportunities for the mitigation of visual impacts are limited due to the nature of the existing topography and vegetation limiting the introduction of landscape screening.

The noise and vibration assessment concluded that construction noise levels (including blasting) would be within criteria for identified sensitive receivers, and that the additional construction traffic movements would not result in unacceptable changes in traffic noise levels at identified sensitive receivers along the haulage routes. It also concluded that operational noise from the substation and transmission lines would not result in unacceptable impacts at the identified sensitive receivers.

Hazards, risk and public safety

Potential hazards and public safety risks from the project, including electric magnetic fields (EMF), transport and storage of dangerous goods and hazard substances, bushfire and flooding risks have been assessed.

The project would introduce additional risks for on-site ignitions which may result in a fire escaping to the surrounding state forests or KNP. These may arise from electrical failure, contact between conductors and vegetation, or hot works during construction or operation causing ignition at the project area.

Public access to majority of the project area would be restricted during construction, limiting public exposure to hazards and risks. Mitigation measures have been identified to enable the project to achieve compliance with the relevant requirements for bushfire protection such as establishing asset protection zones (APZs) and maintaining emergency access and egress routes.

Social economic

The social and economic impacts would mainly be associated with the construction of the project. Economic benefits are anticipated for local businesses and accommodation owners due to increased demand for goods and services. There are however potential impacts anticipated in relation to the availability of accommodation for tourists and visitors during peak tourist periods and increased pressure on community services and facilities from the construction workforce. Near the project area, potential impacts include noise, dust and visual impacts and temporary changes to boating access on Talbingo Reservoir and impacts to community values relating to scenic and landscape amenity as a result of vegetation clearing.

During operation, the project would support the efficient and reliable transmission of additional renewable energy from Snowy 2.0, and improved security and reliability of the NEM and lower energy costs for consumers. Locally, impacts would mainly be associated with changes in land use within the project area, including loss of this land for recreation and any potential long term future forestry uses.

Cumulative impacts

The project would have a cumulative impact with Snowy 2.0 and other projects in the region during construction. The cumulative impacts would be associated with biodiversity, traffic and amenity (visual, noise and dust), water quality and bushfire risk. The project and Snowy 2.0 will implement mitigation measures to reduce or ameliorate these impacts and the majority of these impacts would be temporary and localised to the Lobs Hole Ravine area and would unlikely contribute to impact in the broader region.

During operation there would be a cumulative visual impact from Snowy 2.0 and the project due to more infrastructure being visible in the landscape around Lobs Hole Ravine area.

Environmental mitigation and management

To manage the potential impacts identified by the EIS, and in some cases avoid them completely, a range of mitigation measures have been identified that would be implemented during construction and operation. A construction environmental management plan (CEMP) including sub-plans would detail how specific environmental issues are to be managed during construction in accordance with the mitigation measures provided in the EIS. The CEMP would provide a framework for establishing how these measures would be implemented and who would be responsible for their implementation. The CEMP would also incorporate the conditions of approval from the NSW Minister for Planning and Public Spaces and Commonwealth Minister for the Environment, if granted.

Community consultation

TransGrid engaged with key stakeholders throughout development of the project, including government (local, State and Commonwealth), the local community, service providers, local industry and business groups, affected landowners, environmental groups, and the Aboriginal community. Engagement activities started in 2018 during project development.

DPIE will place this EIS on public exhibition for six weeks to allow the community the opportunity to review the EIS and make a submission. The EIS will be available for viewing and download on the DPIE Major Projects website (www.planningportal.nsw.gov.au/major-projects).

After reviewing submissions, TransGrid will prepare a submissions report that responds to the issues raised. Any changes to the project in response to submissions and other factors would be documented in a preferred infrastructure report or an amendment report. The Commonwealth and NSW Governments would then carry out a regulatory assessment and determine whether the project should be approved, and any conditions to be applied to the consent, should it be granted.

Justification

The project has been declared CSSI and is essential to connect Snowy 2.0 to the NEM. The project would also provide a connection point into the future southern network reinforcement project (HumeLink), which when completed would strengthen the southern network, including reducing constraints on Line 64, and would allow the export of the full capacity of Snowy 2.0 across the broader transmission system. The benefits of connecting Snowy 2.0 to the NEM, are considered to outweigh any identified adverse impacts of the project. While some environmental impacts cannot be avoided, they would be minimised where possible through the implementation of mitigation measures and offsetting.

This EIS considered and assessed the potential impacts of the project to construct and operate a nine kilometre long overhead transmission connection and substation that would connect Snowy 2.0 to the NEM. It has been prepared to support TransGrid's application for approval of the project in accordance with the requirements of Part 5, Division 5.2 of the EP&A Act, and as a controlled action under the EPBC Act. The EIS addresses the environmental assessment requirements of the SEARS, dated 1 November 2019.

This EIS demonstrates that the project could be undertaken without any significant long term impacts on the local environment. As such, the project is considered to be in the public interest.

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Certification

Submission of environmental impact statement prepared under Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979*.

Environmental impact statement prepared by

Name:	Tina Donovan
Qualifications:	Bachelor of Science (Resource and Environmental Management) and Bachelor of Applied Science (Chemistry and Microbiology)
Address:	Jacobs Group (Australia) Pty Ltd Level 4, 12 Stewart Avenue, Newcastle West, NSW 2302

Responsible person:

Name:	Chris Page, TransGrid Project Manager
Address:	180 Thomas Street, Sydney, NSW, 2000

Proposed development:

Snowy 2.0 Transmission Connection Project

Address of the land on which the infrastructure to which the statement relates:

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. The project then spans west across Talbingo Reservoir to TransGrid's existing Transmission Line 64 in Bago State Forest.

Description of the infrastructure to which the statement relates:

The project would involve the construction and operation of a nine kilometre long overhead transmission connection and substation to connect Snowy 2.0 to the National Electricity Market.

Environmental impact statement:

An environmental impact statement is attached addressing all matters in accordance with Part 5, Division 5.2 of the *Environmental Planning and Assessment Act 1979*.

Declaration: I certify that I have prepared the contents of this environmental impact statement in response to the Secretary's environmental assessment requirements dated 1 November 2019 and the relevant provisions of Schedule 2 of the Environmental Planning and Assessment Regulation 2000. The environmental impact statement contains all available information that is relevant to the environmental assessment of the development, activity or infrastructure to which the statement relates. To the best of my knowledge the information contained in the environmental impact statement is not is neither false or misleading.

Name: Tina Donovan Signature: 

Date: 10 February 2021

Glossary of terms and abbreviations

Acronym	Definition
ABS	Australian Bureau of Statistics
ACHAR	Aboriginal Cultural Heritage Assessment Report
ACHCRP	Aboriginal Cultural Heritage Consultation Requirements for Proponents
AEP	Annual Exceedance Probability
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
ANO	Authorised Network Operator
ANZEC	Australian and New Zealand Environment Council
APZ	Asset protection zone
ARPANSA	Australian Radiation Protection and Nuclear Safety Agency
BAM	Biodiversity Assessment Method
BCD	Biodiversity Conservation Division of the DPIE
BDAR	Biodiversity Development Assessment Report
BTLALC	Brungle-Tumut Local Aboriginal Land Council
CEMP	Construction Environmental Management Plan
CHMP	Cultural Heritage Management Plan
CLM Act	*Contaminated Land Management Act 1997*
CSEP	Community and Stakeholder Engagement Plan
CSSI	Critical State Significant Infrastructure
CTMP	Construction Traffic Management Plan
DAWE	Department of Agriculture, Water and the Environment
DEC	Department of Environment and Conservation
DECC	Department of Environment and Climate Change
DECCW	Department of Environment, Climate Change and Water
DEE	Department of Environment and Energy
DPI	Department of Primary Industries
DPIE	Department of Planning, Industry and Environment
EESG	Environment, Energy and Science group of the DPIE
ECVT	Emergency Cable and Ventilation Tunnel
EIS	Environmental impact statement
EMF	Electric magnetic fields

Acronym	Definition
EMS	Environmental Management System
ENM	Excavated Natural Material
EPA	Environment Protection Authority
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
EPL	Environment Protection Licence
ESD	Ecologically sustainable development
FCNSW	Forestry Corporation of New South Wales
FMP	Flood management plan
FSL	Full supply level
GDE	Groundwater Dependent Ecosystem
HHIMS	Historic Heritage Information Management Systems
HDD	horizontal direction drilling
ICNG	Interim Construction Noise Guideline
ICNIRP	International Commission on Non-Ionizing Radiation Protection
ICOMOS	International Council on Monuments and Sites
KFH	Key fish habitat
KNP	Kosciuszko National Park
LCVIA	Landscape Character and Visual Impact Assessment
LEP	Local Environmental Plan
LGA	Local government area
LSC	Land and soil capability
MAT	Main Access Tunnel
MNES	Matters of National Environmental Significance
MOU	Memorandum of Understanding
MP	Member of parliament
NEM	National Electricity Market
NHL	National Heritage List
NML	Noise Management Levels
NOA	Naturally Occurring Asbestos
NPI	Noise Policy for Industry
NPW Act	*National Parks and Wildlife Act*
NPWS	National Parks and Wildlife Services
NVA	Noise and Vibration Assessment

Acronym	Definition
OEH	Office of Environment and Heritage
OPGW	Optical ground wire
OSOM	Oversize overmass
PAD	Potential archaeological deposit
PCT	Plant community type
PMF	Probable Maximum Flood
POEO Act	*Protection of the Environment Operations Act 1997*
POEO Waste Regulation	*Protection of the Environment Operations (Waste) Regulation 2014*
RAP	Registered Aboriginal Parties
RBL	Rating background level
RNE	Register of the National Estate
RNP	Road Noise Policy
SEIA	Socio-economic impact assessment
SEPP	State Environmental Planning Policy
SHC Act	*Snowy Hydro Corporatisation Act 1997*
SHR	State Heritage Register
SSC	State Suburb Code
SSI	State Significant Infrastructure
SWMP	Soil and Water Management Plan
TBM	Tunnel boring machine
TEC	Threatened ecological communities
TTIA	Traffic and transport impact assessment
V/C ration	volume capacity ratio
VENM	Virgin Excavated Natural Material
WARR Act	*Waste Avoidance and Resource Recovery Act 2001*
ZVI	Zones of Visual Influence

1. Introduction

This chapter provides a general overview of the background for the Snowy 2.0 Transmission Line Connection Project (the project). It also describes the proponent, outlines the project location and provides the purpose and structure of this environmental impact statement (EIS).

1.1 Background

In 2020 Snowy Hydro Limited (Snowy Hydro) obtained approval (application number SSI 9208 and EPBC 2018/8322) to expand the existing Snowy Mountains Hydro-electric Scheme (Snowy Scheme) by linking the existing Tantangara and Talbingo reservoirs through a series of underground tunnels and constructing a new underground hydro-electric power station (referred to as 'Snowy 2.0'). Snowy 2.0 is expected to increase the generation capacity of the Snowy Scheme by almost 50 percent, providing an additional 2,000 of megawatts (MW) of generating capacity, and making approximately 350,000 megawatt hours (MWh) (175 hours of energy storage) of storage available to the National Electricity Market (NEM).

To connect Snowy 2.0 to the NEM, a new transmission connection is required. NSW Electricity Networks Operations Pty Ltd as a trustee for NSW Electricity Operations Trust (known as TransGrid). TransGrid is proposing to construct and operate a new overhead transmission connection and substation to facilitate the connection of Snowy 2.0 to the existing electrical transmission network, approximately 27 kilometres east of Tumbarumba (The Snowy 2.0 Transmission Connection Project, herein referred to as the 'project'). The project would also provide a connection point into TransGrid's southern network reinforcement project (HumeLink), which when completed would strengthen the southern network, including reducing constraints on Line 64, and would allow the export of the full capacity of Snowy 2.0 across the broader transmission system. HumeLink is not the subject of this EIS or application. In recognition of the critical role that Snowy 2.0 would play, the former NSW Minister for Planning (now Minister for Planning and Public Spaces) declared Snowy 2.0 and the project to be Critical State Significant Infrastructure (CSSI) under the provisions of the *NSW Environmental Planning and Assessment Act 1979* (EP&A Act) on 7 March 2018. The declaration acknowledges that Snowy 2.0 and the project are critical to the State for environmental, economic or social reasons. As a CSSI project, the project is subject to Part 5, Division 5.2 of the EP&A Act which requires the preparation of an environmental impact statement (EIS) in accordance with Secretary's Environmental Assessment Requirements (SEARs) (**Appendix A**) and the approval of the NSW Minister for Planning and Public Spaces.

In addition to requiring approval from the NSW Minister for Planning and Public Spaces, the project has been deemed a controlled action under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and will require approval from the Commonwealth Minister for the Environment. The Minister for the Environment has accredited the NSW planning process for the assessment of the project, and it will be assessed under the Bilateral Agreement process between the Commonwealth and NSW Governments. Therefore, a single EIS has been prepared to address the requirements set out by the NSW Department of Planning, Industry and Environment (DPIE) and the Commonwealth Department of Agriculture, Water and the Environment (DAWE).

1.2 The proponent

TransGrid is an Authorised Network Operator (ANO) in NSW and the proponent for the project. TransGrid operates and manages the high voltage transmission network in New South Wales and the Australian Capital Territory, connecting generators (including the existing Snowy Scheme) to distributors and major end users. TransGrid's core role is to connect electricity consumers to a safe, secure and reliable network.

1.3 Project overview

The project would involve the construction and operation of an overhead transmission connection and substation to connect Snowy 2.0 to the NEM.

The key elements of the project include:

- A new 500/330 kilovolt (kV) substation (the substation) located within Bago State Forest and adjacent to TransGrid's existing Transmission Line 64 (Line 64), which forms a 330 kV connection between Upper Tumut and Lower Tumut switching stations
- Two 330 kV double-circuit overhead transmission lines, approximately 9 kilometres long, linking the Snowy 2.0 cable yard in Kosciuszko National Park (KNP) to the substation
- Short overhead transmission line connection between the substation and Line 64
- Construction of new access tracks and upgrade of existing access tracks where required to facilitate the construction of the transmission lines and substation and service ongoing maintenance activities
- Establishment of temporary sites and infrastructure needed during construction including crane pads, site compounds, a helipad, equipment laydown areas, and tensioning and pulling sites for the stringing of overhead conductors and earthwires.

The key aspects of the project and Snowy 2.0 are shown on **Figure 1-1** and **Figure 1-2**. A more comprehensive and detailed description of the project is provided in **Chapter 5**.

1.3.1 Definitions

For the purposes of identifying and assessing environmental impacts of the project, a **disturbance area** has been defined. The disturbance area encompasses the extent of physical disturbance likely to be required to accommodate construction activities and infrastructure needed to build the overhead transmission line, the substation, access tracks and vegetation clearing along the transmission corridor. Operation of the project would have a smaller footprint within the disturbance area consisting of the transmission corridor, substation including the asset protection zone (APZ) and access tracks. The width of the transmission corridor during operation would be between about 120 and 140 metres. The total disturbance area is about 143 hectares, this includes about 43 hectares in Bago State Forest and about 100 hectares in KNP.

A broader **project area** has also been defined. The project area represents the limits within which the disturbance area 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. The total project area is about 259 hectares, this includes 63.8 hectares in Bago State Forest and 195.2 hectares in KNP.

The project traverses Talbingo Reservoir, which naturally splits the project area into two. When defining the area of works, the terms 'project area east' and 'project area west' have been used where required for the purpose of the EIS. These are defined as follows:

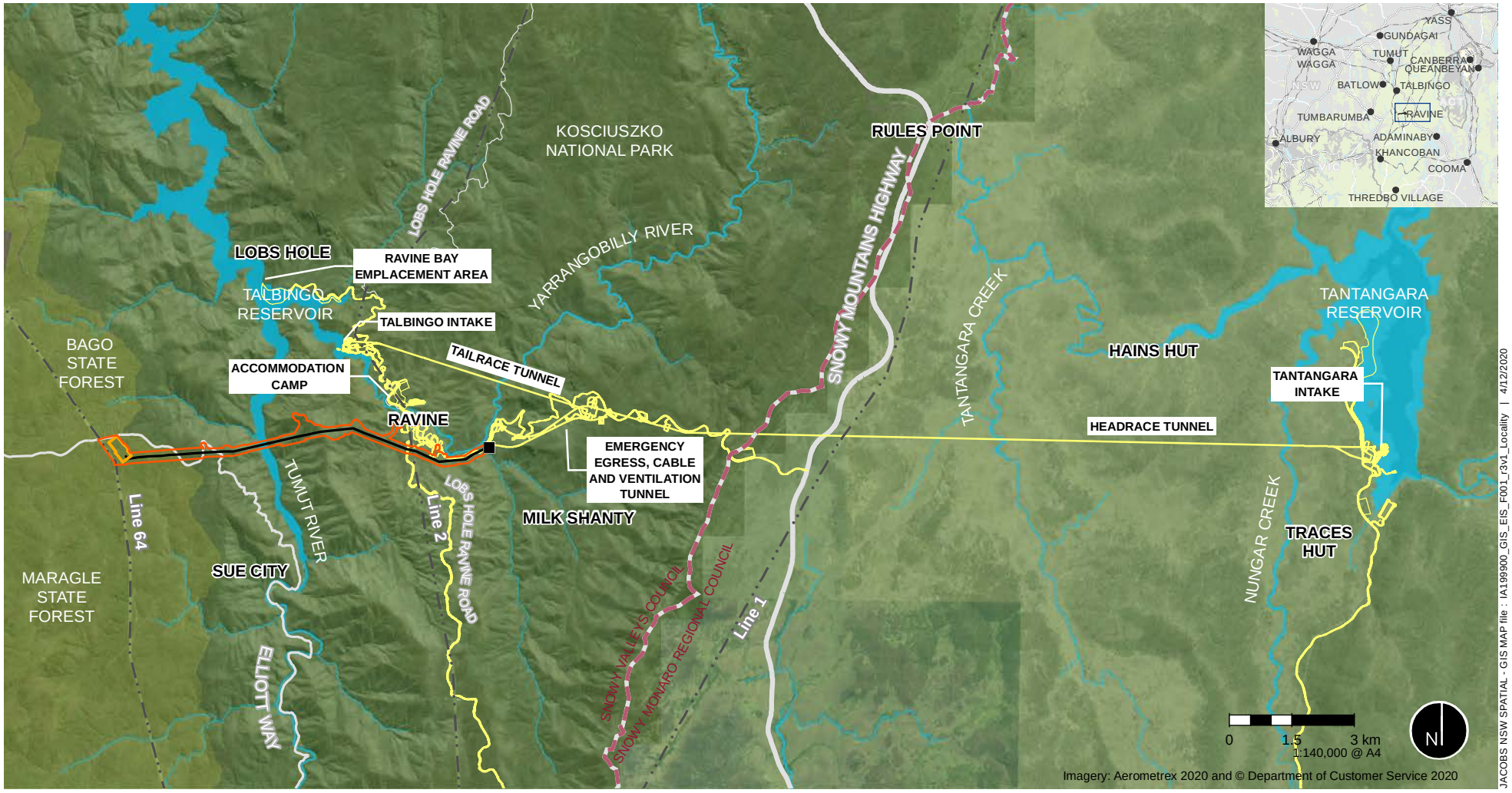
- Project area east: includes the project area and existing surrounding access roads in the area east of Talbingo Reservoir
- Project area west: includes the project area and existing surrounding access roads in the area west of Talbingo Reservoir.

The project area and disturbance area are shown on **Figure 1-2**.

Other terms used throughout the EIS include:

- 'The project' refers to the concept design for the Snowy 2.0 Transmission Connection Project
- 'Snowy 2.0' is the pumped hydro-electric expansion of the Snowy Scheme
- 'Snowy 2.0 disturbance footprint' encompasses the extent of physical disturbance likely to be required to accommodate construction activities and infrastructure needed to build Snowy 2.0

- Transmission corridor. The portion of the disturbance area along the transmission line that is required to support construction. This is expected to be between 120 and 200 metres wide. The final easement would be surveyed following the completion of construction and is expected to be about 120 to 140 metres wide.
- 'The study area' encompasses the project area and the area that may be indirectly impacted by the project. The study area varies for specialist assessments and has been defined throughout **Chapter 7**
- 'The locality' encompasses the area in a 10 kilometre radius of the project.



Project area
Proposed transmission line
Proposed 500kV substation
Snowy 2.0 cable yard
Snowy 2.0 element
Electricity transmission line
Local Government boundary
Waterway
Water body
State forest
NPWS estate

Figure 1-1 | Snowy 2.0 and the project

Data source:
Jacobs 2020, TransGrid, EMM 2020
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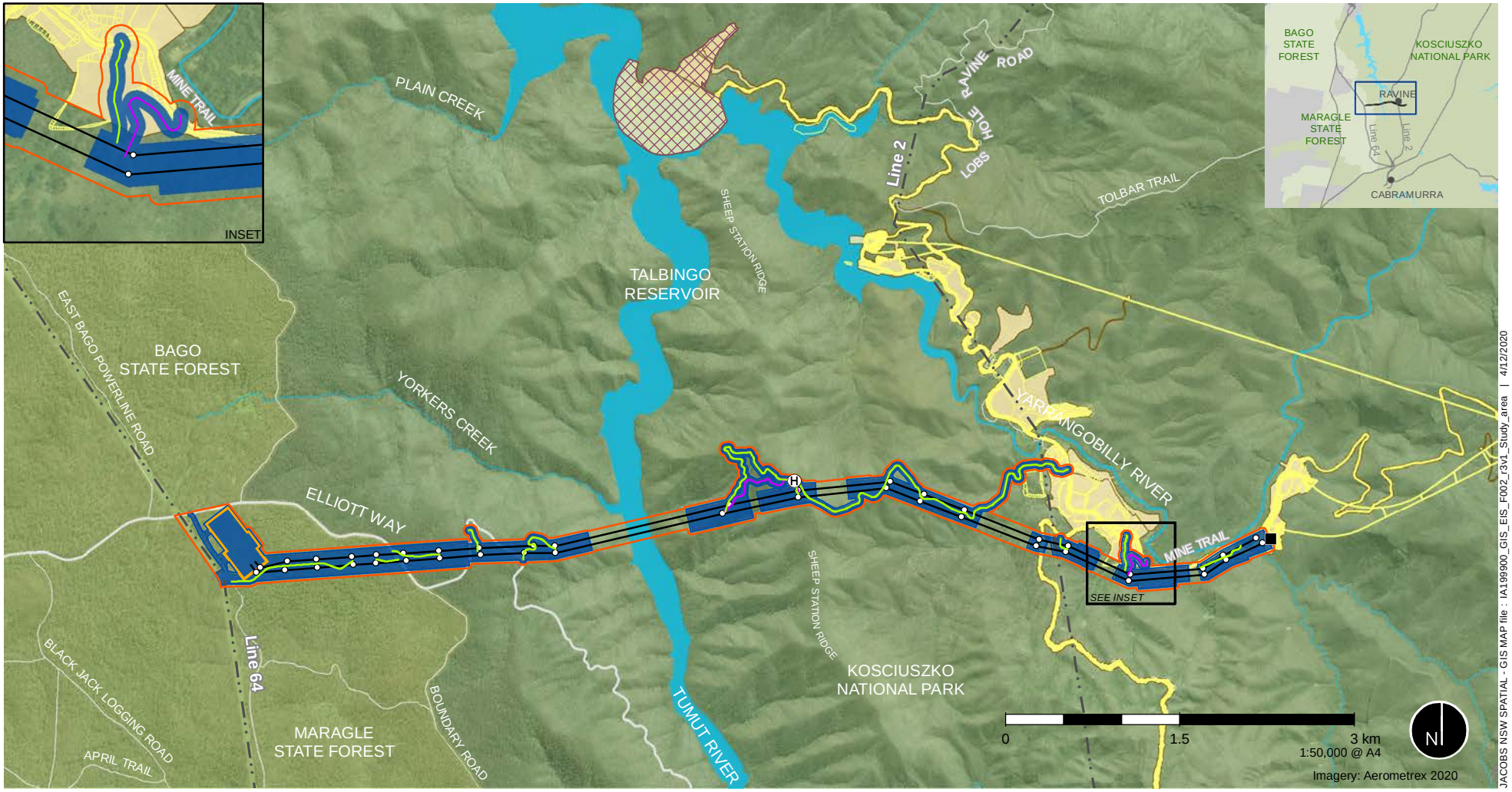

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- Snowy 2.0 element
- Ravine Bay Emplacement Area
- Snowy 2.0 Disturbance footprint
- Electricity transmission line
- Waterway
- Water body
- State forest
- NPWS estate

Figure 1-2 | Project overview

Data source:
Jacobs 2020, TransGrid, EMM 2020,
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1.4 Location and setting

The project is located within the Australian Alps in Southern NSW, about mid-way between Canberra and Albury and located wholly within the Snowy Valleys local government area (LGA) as shown on **Figure 1-3**.

The nearest large towns to the project area are Cooma and Tumut. Cooma is about 80 kilometres south-east of the project area (or 146 kilometres by road from Lobs Hole), and Tumut is about 55 kilometres north of the project area (or 82 kilometres by road from Elliott Way). Other nearby towns include Tumbarumba, Talbingo, Batlow and Cabramurra. These towns in relation to the project are shown on **Figure 1-3**.

The eastern extent of the project is defined by the location of the Snowy 2.0 cable yard at Lobs Hole in KNP. From the cable yard, the transmission connection extends west through KNP and up Sheep Station Ridge characterised by steep, mountainous terrain before traversing Talbingo Reservoir. The transmission connection then continues west, crossing Elliott Way at three locations before entering Bago State Forest to the substation site, as shown on **Figure 1-2**. Elevations across the project area range from 544 metres to 1,190 metres Australian Height Datum (AHD).

Key natural and built features in the project area include:

- KNP, which in the project area is characterised by relatively undisturbed mountainous terrain incised by the steep river valleys of Talbingo Reservoir and Yarrangobilly River. Remnants of the former Ravine township are evident in the eastern extent of the project at Lobs Hole
- TransGrid's Transmission Line 2 (Line 2) which forms a 330 kV connection between Upper Tumut switching station and Yass substation. The proposed double circuit transmission lines would pass over Line 2 in the Lobs Hole area
- Line 64, which forms a 330 kV connection between the Upper Tumut and Lower Tumut switching stations. Line 64 is located in the far west of the project area, adjacent to the substation and is the grid connection point for Snowy 2.0
- Talbingo Reservoir forms part of the Snowy Scheme from damming the Tumut River. The project traverses over Talbingo Reservoir. Talbingo Reservoir is popular for fishing, swimming and boating
- Bago State Forest is located at the western end of the project and is popular for hunting, bird watching, mountain biking and hiking.

The entire project area was subject to the Dunns Road bushfire which occurred between December 2019 and January 2020. The intensity of the bushfire was extreme, with much of the project area being subject to extensive vegetation damage and loss as well as damage to slopes and roads, including Elliott Way.

1.5 Purpose of this document

This EIS was prepared to address the requirements issued by the Secretary of the former NSW Department of Planning and Environment (DPE) (now DPIE) and the relevant provisions of Schedule 2 of the Environmental Planning and Assessment Regulation 2000 (the EP&A Regulation).

The SEARs were issued on 1 November 2019. A copy of the SEARs and an indication of where each requirement is addressed in the EIS is provided in **Appendix A**. Refer to the table of contents for the EIS structure.

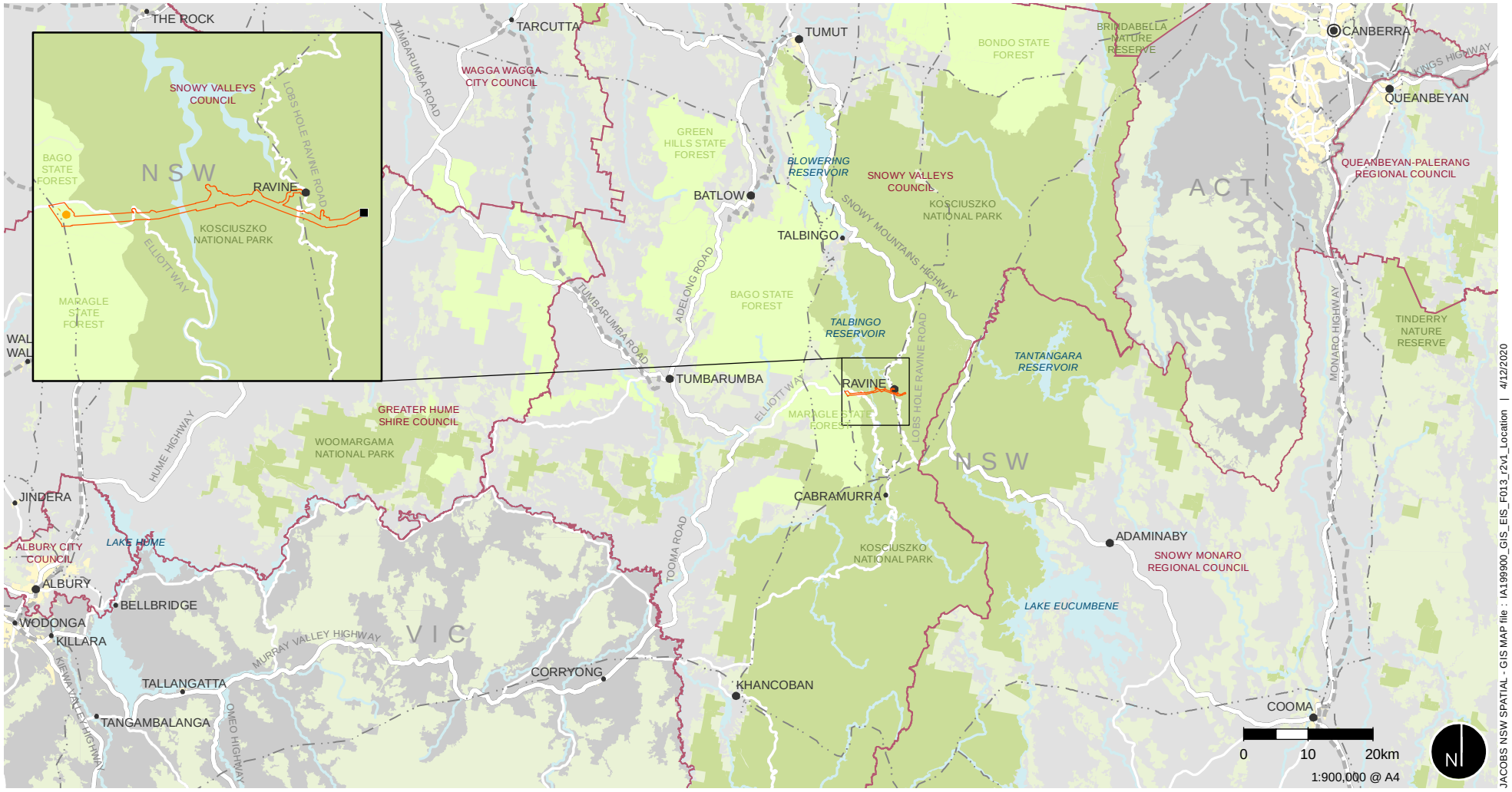


Figure 1-3 | Project location

Data source:
Jacobs 2020, TransGrid, EMM 2020

2. Strategic justification and project need

This chapter outlines the relationship of the project to the strategic planning framework. It also identifies the need for the project and details the project objectives. It addresses the SEARs by describing the relevant strategic context for the project having regard to:

- State and Commonwealth legislation, policies and guidelines, including the Kosciuszko National Park Plan of Management 2006 and current initiatives to improve energy security and reliability in the National Electricity Market
- Any other existing, approved or proposed projects that could result in cumulative impacts with the project.

2.1 Need for the project

As described in **Section 1.1** and in more detail in **Section 2.4**, Snowy 2.0 is a critical project for the NEM as it moves to a low-emissions future. Snowy 2.0 would serve the market and consumers by providing dispatchable generation to address supply volatility, as well as fast-start capability and large-scale storage to address intermittency issues. As the transition to renewables accelerates, reliable supply cannot be achieved without massive energy storage.

In recognition of the need to manage the transition and future energy mix in the NEM, Snowy 2.0 and the project were declared CSSI by the former NSW Minister for Planning under the NSW EP&A Act in March 2018. When announcing the CSSI declaration, the Minister stated that Snowy 2.0 was 'essential for the future security of our energy system, the economy and our environment' with the project declared as critical for the energy security and reliability needs of NSW.

The need for the project is driven by the fundamental requirement that new generation assets need to be connected to the transmission network to be able to operate within the NEM. Consequently, a new transmission connection is required for the transmission of electricity generated by Snowy 2.0 into the existing transmission network. The project is required to provide a high voltage connection from the Snowy 2.0 cable yard into TransGrid's existing 330 kV network. At the same time, TransGrid is taking the opportunity to include, as part of this EIS and application for approval, a higher voltage connection point with TransGrid's proposed southern network reinforcement project (HumeLink) noting that Humelink itself is not the subject of this EIS or application. Both connection points would be collocated within the new substation. The 330 kV and 500 kV yards would be constructed on a single bench with integrated drainage and common or integrated ancillary features. TransGrid considers that it is appropriate and efficient to build the substation as a whole to accommodate both connection facilities. This approach will also minimise the duration of construction impacts at the substation and ancillary impacts on the surrounding localities.

As described in the CSSI declaration outlined in Schedule 5 of the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP), this EIS is for the 'construction and operation of new electricity transmission lines and an electricity substation to the west of the Talbingo Reservoir to connect Snowy 2.0 to the existing electricity transmission network at Nurenmerenmong, east of Tumbarumba'.

2.2 Related projects

2.2.1 Snowy 2.0

Snowy 2.0 would increase pumped hydro-electric capacity within the existing Snowy Scheme by linking the existing Tantangara and Talbingo reservoirs through a series of underground tunnels and a new underground hydro-electric power station. Snowy 2.0 is expected to increase the generation capacity of the Snowy Scheme by almost 50 percent, providing an additional 2,000 MW generating capacity, and making approximately 350,000 MWh of storage available to the NEM. Snowy 2.0 Main Works was approved in 2020.

Further details on Snowy 2.0 are available on Snowy Hydro's website https://www.snowyhydro.com.au/snowy-20/about/.

2.2.2 Line 64 earth wire and optical ground wire uprating

The operation of the new substation (as defined in **Section 5.2.1**) to support the connection of Snowy 2.0 would result in an increase to the fault current on Line 64. The existing earth wire and optical ground wire (OPGW) installed on Line 64 are not rated to withstand this increased fault current and would be subject an unacceptable risk of failure if they are not replaced.

As per Schedule 3(9), clause 5b of SRD SEPP the carrying out of works to upgrade or modify existing electricity transmission lines are not part of the CSSI declaration for Snowy 2.0 and Transmission Project. Therefore TransGrid would seek approval for the replacement of the earth wire and OPGW on Line 64 separately under Part 5 of the EP&A Act. as the proponent and determining authority.

2.2.3 HumeLink

HumeLink project would involve the reinforcement of the transmission network in southern NSW through the construction and operation of a new 500 kV transmission connection between the new substation adjacent to Line 64, Wagga Wagga and Bannaby. The project would allow new energy sources to come online, enable greater sharing of energy between the eastern states, and also unlock the full 2,000 MW capacity of Snowy 2.0.

Combined, the project, Snowy 2.0 and HumeLink would be able to dispatch electricity at virtually any time to meet energy demand, and would facilitate an orderly transition to a decarbonised and secure energy system for NSW and the broader NEM.

HumeLink is in initial project development phase, with community consultation and study corridor refinement currently underway. In accordance with its CSSI declaration, TransGrid would seek an EIS application and approval for HumeLink under Part 5, Division 5.2 of the EP&A Act.

The cumulative impacts of the project with these related project and the other projects in the locality are discussed in **Section 7.13**.

2.3 Project objectives

Based on the strategic context and need for the project, the objectives of the project are to:

- Connect a declared CSSI (Snowy 2.0) project to the NEM
- Meet TransGrid's operational requirements and its commitments to Snowy Hydro to construct and operate the transmission connection in a manner that is safe, reliable and secure
- Be consistent with the principles in *TransGrid's Environment Policy* (TransGrid, 2018), including the integration of 'environmental management considerations into the planning, design, siting, construction, maintenance, operation so as to avoid and minimise potential environmental impacts as far as practicable'
- Take into account and address key stakeholder and community needs and expectations with respect to the protection of the environment, heritage features (both Aboriginal and non-Aboriginal), recreational aspects of KNP and visual amenity.

2.4 Strategic context

The project is consistent with the *2020 Integrated System Plan* (Australian Energy Market Operator (AEMO), 2020) (ISP), the *NSW Transmission Infrastructure Strategy* (DPE, 2018) and the *NSW Electricity Strategy* (Electricity Strategy) (DPIE, 2019) as discussed in following sections.

In addition, a number of Commonwealth and State strategic plans and Acts support the strategic need for Snowy 2.0 to stabilise the NEM and help to transition to decarbonisation and net-zero emissions while

responding to the requirements of the market in relation to reliable and affordable electricity. These strategic plans and Acts include:

- *Renewable Energy (Electricity) Act 2000* (Commonwealth)
- *NSW Climate Change Policy Framework* (Office of Environment and Heritage (OEH), 2016a)
- *Department of Planning, Industry and Environment Net Zero Plan Stage 1: 2020-2030* (State of NSW, 2020).

The project would be consistent with these plans and Acts as the fundamental need for the project is driven by connecting Snowy 2.0 to the NEM.

2.4.1 Integrated System Plan

In July 2018 AEMO released the first ISP. This plan explores how the transmission network service providers and other system participants jointly develop the NEM to meet future needs. The ISP guides governments, industry and consumers on investments needed for an affordable, secure and reliable energy future, while meeting prescribed emissions trajectories, and triggers the processes for actionable ISP projects. The ISP is updated every two years to respond to the latest technology, economic, policy and system developments.

In July 2020, AEMO released the *2020 Integrated System Plan* (2020 ISP). The 2020 ISP provides a holistic NEM-wide view of investment choices and recommends transmission developments over a 20-year horizon that would "optimise consumer benefits as Australia experiences what is acknowledged to be the world's fastest energy transition." The transmission development options were collectively subjected to cost-benefit analyses across multiple scenarios and sensitivities, to ensure that an optimal suite of developments was recommended.

The 2020 ISP (AEMO, 2020) identifies Snowy 2.0 as an important element of the 'roadmap' for the NEM and an immediate priority that would deliver positive net market benefits as soon as it can be built. The project is essential in the connection of Snowy 2.0 to the transmission network and to allow it to operate within the NEM.

The ISP and HumeLink are discussed further in **Section 3.1.2**.

2.4.2 NSW Transmission Infrastructure Strategy

The *NSW Transmission Infrastructure Strategy* (DPE, 2018) (Infrastructure Strategy) is the NSW Government's plan to unlock private sector investment in priority transmission infrastructure projects, which can deliver least-cost energy to customers through to 2040 and beyond. The Infrastructure Strategy forms part of the government's broader plan to make energy more affordable, secure investment in new power stations and network infrastructure, and ensure new technologies deliver benefits for consumers. Building on existing programs to reduce household and business energy bills and secure energy supplies, the Infrastructure Strategy aims to:

- Boost interconnection with Victoria, South Australia and Queensland, and unlock more power from the Snowy Scheme
- Increase NSW's energy capacity by prioritising Renewable Energy Zones in the Central West, South West and New England regions of NSW, which will become a driving force to deliver affordable energy into the future
- Work with other states and regulators to streamline regulation and improve conditions for investment. By increasing transmission capacity and low-cost generation, NSW will support an orderly transition of the energy sector over the next two decades.

The strategy recognises that by increasing the transmission capacity and by providing low-cost generation an orderly transition of the energy sector would be supported. NSW already has a substantial investment pipeline of new wind, solar, gas and generator upgrade projects that have received or are seeking planning approval and driving the energy transformation across the state. The project is essential in the connection of Snowy 2.0 to the NEM that will help support an orderly transition of the energy sector.

2.4.3 NSW Electricity Strategy

The *NSW Electricity Strategy* (DPIE, 2019) (Electricity Strategy) aims to help NSW Government ensure reliable and affordable electricity supply, particularly in peak summer period. The Electricity Strategy seeks to respond to an aging and congested transmission system by:

- Delivering Australia's first coordinated Renewable Energy Zone
- Saving energy especially at times of peak demand
- Supporting the development of new electricity generators
- Setting a target to bolster the state's energy resilience.

The Electricity Strategy aligns closely with the *NSW Government's Net Zero Plan Stage 1: 2020 – 2030*, and encourages an estimated $8 billion of new private investment in NSW's electricity system over the next decade, including $5.6 billion in regional NSW. This investment will support an estimated 1,200 jobs, mostly in regional NSW.

One of the Electricity Strategy's specific aims is to unlock more power from the Snowy Scheme. The project is essential as it would connect Snowy 2.0 to the NEM and provide a connection point for HumeLink. The project would also support the aims of the Electricity Strategy to ensure reliable electricity supply is maintained as old generation assets close.

2.4.4 Kosciuszko National Park Plan of Management

The Kosciuszko National Park Plan of Management (KNP PoM) is a framework which outlines objectives, principles and policies to guide the long-term management of KNP. The KNP PoM identifies five management zones to guide the management and use of the national park. The project is located within KNP back country, minor road corridor and major road corridor management zones. The objectives of these zones are:

- Back Country Zone – to manage it as relatively unmodified country
- Minor Road Corridor Zone – to provide a range of day and overnight recreational opportunities
- Major Road Corridor Zone – to provide a range of high quality interlinked recreational facilities.

The KNP PoM recognises that high voltage power lines that transmit electricity produced by the Snowy Mountains Hydro-electric Scheme traverse the national park. Section 12.6.1 of the KNP PoM sets out the management objectives specific to telecommunication and electricity infrastructure service.

The stated management objective is:

> *"Telecommunication and electricity infrastructure are managed in ways that minimise adverse impacts on the values of the park and other users*".

The KNP PoM policies and actions require that all additional telecommunication and transmission lines be located underground. Options to consider this were explored during the project development, however it was found that unground cabling would not to be feasible due to the depths and gradients involved. Further detail on the options assessment is provided in **Section 3.2**.

All activities within KNP must be consistent with the KNP PoM in accordance with the requirement of the *National Parks and Wildlife Act 1974* (NPW Act, as discussed in **Section 4.1.2**). Consequently, the project is currently not consistent with the back country management zone as outlined in the KNP PoM.

Whilst an amendment to the KNP PoM is required to support the construction and operation of an overhead transmission connection within KNP, this amendment had not been made at the time of writing this EIS.

Notwithstanding this, TransGrid has consulted with NPWS who advised that the KNP PoM would be amended in due course to reflect the requirement to connect Snowy 2.0 to the grid via an overhead transmission connection.

As a transitional measure ahead of amendments to the KNP POM, clause 7 of Schedule 4 to the *Snowy Hydro Corporatisation Act 1997* (SHC Act) provides that for a period of three years from the first Snowy 2.0 approval (7 February 2019 for Exploratory Works Snowy 2.0), section 81(4) does not operate to prohibit operations being undertaken in relation to the Snowy 2.0 project (which includes transmission) that are not in accordance with the KNP PoM.

Despite the project not meeting the PoM goal of installing new electricity infrastructure underground, the project has sought to minimise adverse impacts on the values of the KNP and other users to the extent possible. These approaches are outlined in **Section 3.2**.

3. Project options considered

This chapter describes the various project options that were considered as part of the project development process and explains how and why the project was selected.

3.1 Context

3.1.1 Snowy 2.0

Snowy 2.0 would provide large–scale energy storage and an additional 2,000 MW of dispatchable generating capacity into the NEM.

Snowy Hydro has determined that four circuits of 330 kV transmission would be required to transmit the full generation of 2000 MW of Snowy 2.0. This includes provision for an outage of one of the four circuits (this standard is referred to as 'n-1'). This is important, as without the contingency supported by the fourth circuit, a failure on one of the circuits would result in a loss of output of Snowy 2.0, which could lead to shortfalls in generation across the NEM during periods of high demand.

Snowy Hydro has also determined as part of the design of Snowy 2.0, that the point of transfer/connection between generation and transmission is the Snowy 2.0 cable yard. Snowy Hydro has designed the surface level cable yard to be at Lobs Hole within KNP.

The need, justification and environmental impact of Snowy 2.0, including the generation capacity and the transmission connection point being the Snowy 2.0 cable yard, is contained within the *Snowy 2.0 Main Works EIS* (EMM, 2019) which received planning approval in May 2020.

Both of these aspects establish core criteria for the project being, the requirement to provide the transmission of four 330 kV circuits from the Snowy 2.0 cable yard to a point where the full capacity of the Snowy 2.0 project can be transferred into the NEM.

3.1.2 HumeLink

AEMO has included TransGrid's HumeLink project in the 2020 ISP, which is identified as an "actionable ISP project" as it is "critical to address cost, security and reliability issues". The HumeLink project would improve the flow of electricity between new generation sources and major demand centres in NSW. The reinforcement of the transmission network in southern NSW would provide a crucial hub for the flow of electricity in the NEM and would enable high volume energy transfer around the NEM improving access to affordable electricity for consumers. Importantly, the project would allow the full capacity of the Snowy Scheme expansion to flow into the NEM.

In June 2019 TransGrid commenced the formal Regulatory Investment Test – Transmission process for HumeLink with the publication of a Project Specification Consultation Report. This was followed by a Project Assessment Draft Report in January 2020. This assessment identified that the options with the greatest net benefits involved 500 kV circuits going between Maragle and Bannaby via Wagga Wagga. Maragle is identified as the general locality of a new substation providing the connection between Snowy 2.0 and HumeLink.

The 2020 ISP therefore establishes that a core criterion of the project is to provide a direct connection between Snowy 2.0 and the future HumeLink project. To enable the full capacity of Snowy 2.0 from the 330 kV circuits to be transferred into the 500 kV circuits of HumeLink, a 500/330 kV substation is required.

Due the areas of high bushfire risk the two 500 kV circuits should have separation up to five kilometres apart where reasonably possible. This is due to the criticality of the 500 kV network and to reduce the risk of an outage occurring on both circuits simultaneously.

The project is required to provide an initial (and permanent) connection into the existing 330 kV transmission network. The initial 330 kV connection would require a switching station, which would be co-located within the 500/330 kV substation required for HumeLink.

3.1.3 Snowy 2.0 transmission connection objectives for the preferred option

Considering the context of this project in relation to Snowy 2.0 and HumeLink, this project is required to:

- Transfer four circuits of 330 kV transmission from the Snowy 2.0 cable yard at Lobs Hole to a 500/330 kV substation, at a location suitable for an initial connection into the existing transmission network and also for an ultimate connection with the HumeLink project.

In selecting the solution for this project, TransGrid has taken into consideration identifying a solution which meets the requirements of Snowy 2.0 and also HumeLink, and seeks to minimise the impacts of the interrelated aspects of this connection project – particularly the location of the substation.

TransGrid's key objectives in identifying the preferred option was to identify a solution which:

- Is technically feasible
- Meets network planning and operational requirements
- Minimises costs to the consumer
- Minimises land-use impacts
- Minimises environmental impacts
- Minimises social impacts.

Within the process, TransGrid seeks to demonstrate a continual strategy of seeking to reasonably avoid and minimise impacts, particularly within KNP.

3.2 Project options

The following key aspects were considered and assessed to determine the optimal solution and design option to meet the transmission connection objectives:

- Location of the 500/330 kV substation and connection into the existing transmission network
- Technical options for the transmission connection
- Route selection
- Structure design for an overhead transmission connection.

This process considered key aspects of the design feasibility of each option with consideration of the challenging alpine terrain, environmental impact avoidance and minimisation with particular focus on the environmental, amenity and recreational values of KNP.

3.2.1 Substation location and connection point

The first phase of the options assessment involved determining a suitable location for a 500/330 kV substation which would also provide a suitable initial connection point into the existing transmission network.

The location of the substation is critical, as it affects:

- The length of the transmission connection between Lobs Hole and the substation
- The length of 500 kV transmission augmentation required for HumeLink
- The length of the cut-in between the substation and the existing transmission network
- The total amount and duration of construction works within KNP.

There are no existing 500 kV assets in proximity to Snowy 2.0. The closest existing TransGrid assets in the transmission network are 330 kV transmission lines and switching stations as shown in **Figure 3-1 a**nd include:

- Transmission Line 1
- Transmission Line 2
- Transmission Line 64
- Lower Tumut 330 kV switching station
- Upper Tumut 330 kV switching station.

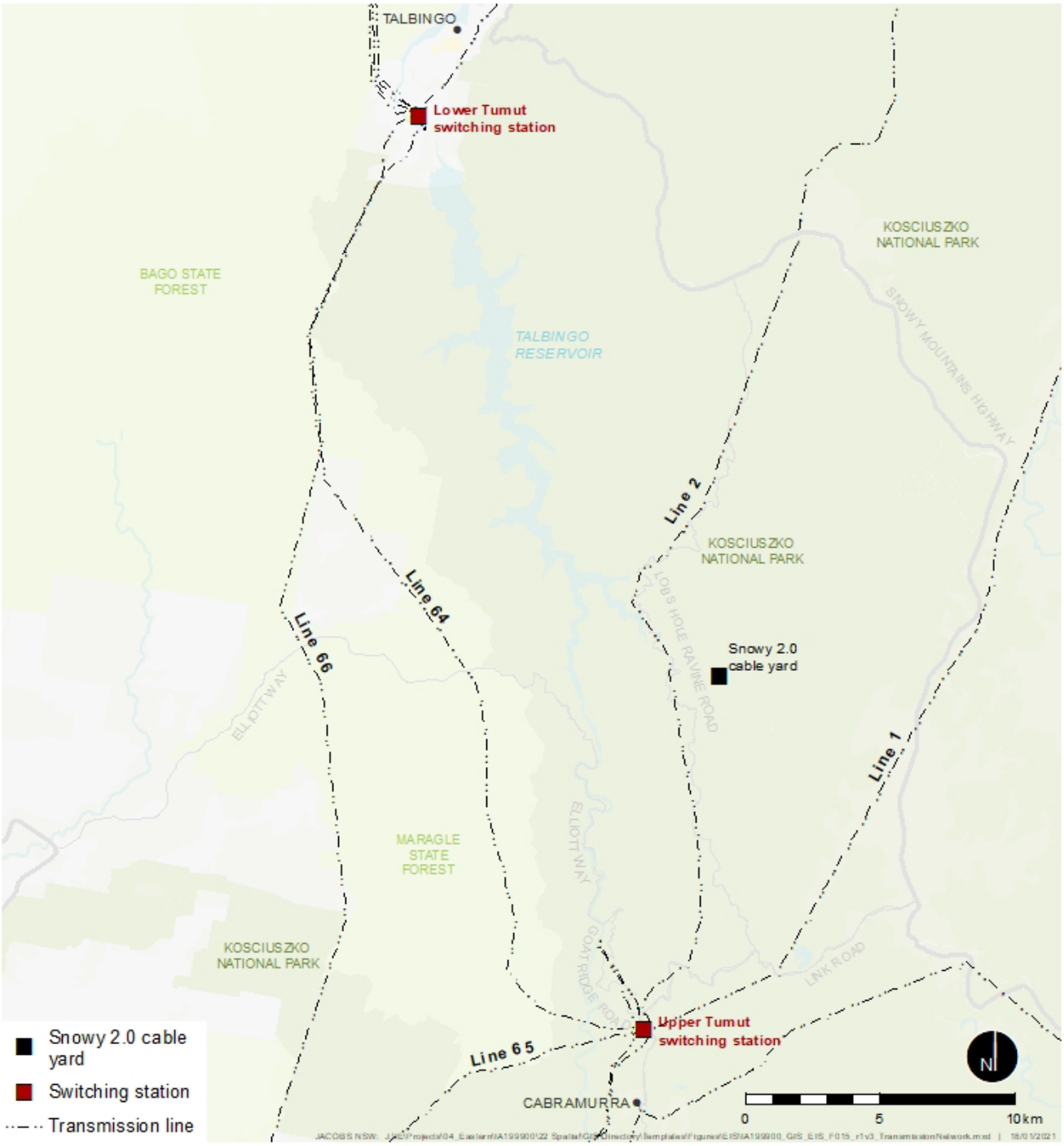


Figure 3-1 Surrounding transmission network

3.2.1.1 Options Considered

Transmission Line 2

TransGrid's Line 2 presents the closest connection into the existing transmission network being approximately 1.7 kilometres west of the Snowy 2.0 cable yard, refer to **Figure 3-2.** Line 2 runs generally north-south to the east of Talbingo Reservoir, providing a single 330 kV connection between Upper Tumut 330 kV switching station and Yass 330 kV substation.

While the operating capacity of Line 2 is not sufficient to transmit the full 2,000 MW capacity of Snowy 2.0, it could provide the initial 330 kV connection point and the location of the ultimate 500 kV connection into HumeLink. The HumeLink project would be required to bring 500 kV lines from the west of Talbingo Reservoir to the connection point at Line 2.

Snowy Hydro Limited have approval for a temporary substation (Ravine 330kV) cutting into Line 2, to provide construction load supply. This substation has already been constructed.

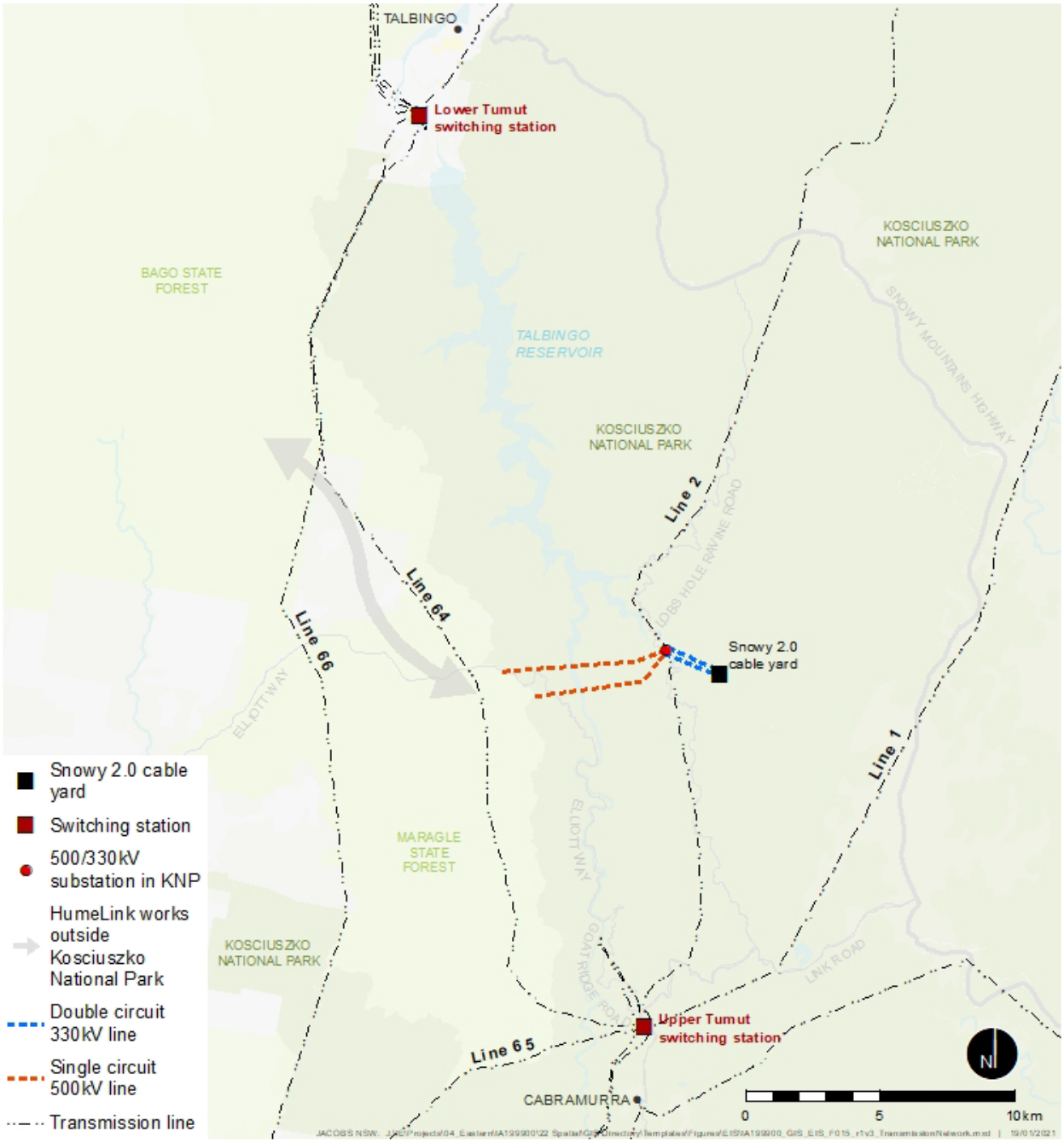


Figure 3-2 Conceptual connection to Line 2

A solution utilising Line 2 is assumed to require the following elements within KNP:

- Two double circuit 330 kV transmission lines (each line being approximately two kilometres in length) running parallel, occupying a total easement width of 120 metres from the Snowy 2.0 cable yard to Line 2
- The permanent expansion or replacement of the existing temporary Ravine 330 kV substation, to a 500/330 kV substation located at the Line 2 cut-in occupying a footprint of approximately 600 metres x 300 metres based on outdoor switchgear or approximately 360 metres x 200 metres for an indoor gas insulated switchgear
- Two single circuit 500 kV transmission lines each being approximately six kilometres in length, running separately (two easements with each being 80 metres wide) from the edge of KNP at Bago State Forest to Line 2, plus approximately eight kilometres of new access tracks outside of the new transmission easements.

While this provides the shortest connection option for Snowy 2.0, this option would involve extensive permanent impacts within KNP and the recreational area of Lobs Hole Ravine. In particular, the substation would require bulk earthworks and vegetation clearance, would install large transformers which would result in adverse noise amenity, and the intensity of infrastructure could result in visual amenity impacts.

This option would also require the later HumeLink project to complete works to bring two separate large 500 kV transmission lines into KNP, which would have impacts on biodiversity, heritage values and visual amenity and extend the overall period of construction activities and visitor impacts within KNP.

Early consultation carried out with NPWS regarding the construction and operation of a new large scale substation in this area of KNP determined its impact on the future recreational use of the area and impacts on biodiversity and heritage values would far exceed the benefit of a shorter transmission connection.

Transmission Line 1

TransGrid's Line 1 is the next closest existing transmission line located approximately eight kilometres east of the Snowy 2.0 cable yard, near Snowy Mountains Highway within KNP, refer to **Figure 3-3**. Line 1 runs generally north-south, providing a single 330 kV connection between Upper Tumut 330 kV switching station and Canberra 330 kV substation.

While the operating capacity of Line 1 is not sufficient to transmit the full 2,000 MW capacity of Snowy 2.0, it could provide the initial 330 kV connection point and the location of the ultimate 500 kV connection with HumeLink. The HumeLink project would bring two separate 500 kV lines from the west of Talbingo Reservoir, past the Snowy 2.0 cable yard, and on to the connection point at Line 1.

A solution using Line 1 was assumed to require the following elements within KNP:

- About eight kilometres each for two double circuit 330 kV transmission lines, running parallel (total easement width of 120 metres) from the Snowy 2.0 cable yard to Line 1, plus about four kilometres of new access tracks outside of the easement
- A new 500/330 kV substation located at the Line 1 cut-in occupying a footprint of approximately 600 metres x 300 metres based on outdoor switchgear or approximately 360 metres x 200 metres for an indoor gas insulated switchgear
- About 16 kilometres each for two single circuit 500 kV transmission lines, running separately (two easements with each being 80 metres wide) from the edge of KNP at Bago State Forest to Line 1, plus about 10 to 20 kilometres of new access track outside of the easements.

Similar to the Line 2 option, this option would involve extensive permanent impacts within KNP and would be highly visible to visitors using Snowy Mountains Highway, particularly with four new transmission lines approaching the new substation from the west. The substation would require bulk earthworks and vegetation clearance, would install large transformers which would result in adverse noise amenity, and the intensity of infrastructure could result in visual amenity impacts.

This option would also require the later HumeLink project to complete extensive works within KNP, which would extend the overall period of construction activities and visitor impacts within the park.

This option requires taking all transmission lines (Snowy Connection and HumeLink) about eight kilometres east of the Snowy 2.0 cable yard and in the opposite direction to the incoming approach of the HumeLink transmission lines. This would add unnecessary capital costs and environmental impacts to both the Snowy connection and the HumeLink projects.

This option does not present any benefits over the other options and therefore was not further progressed.

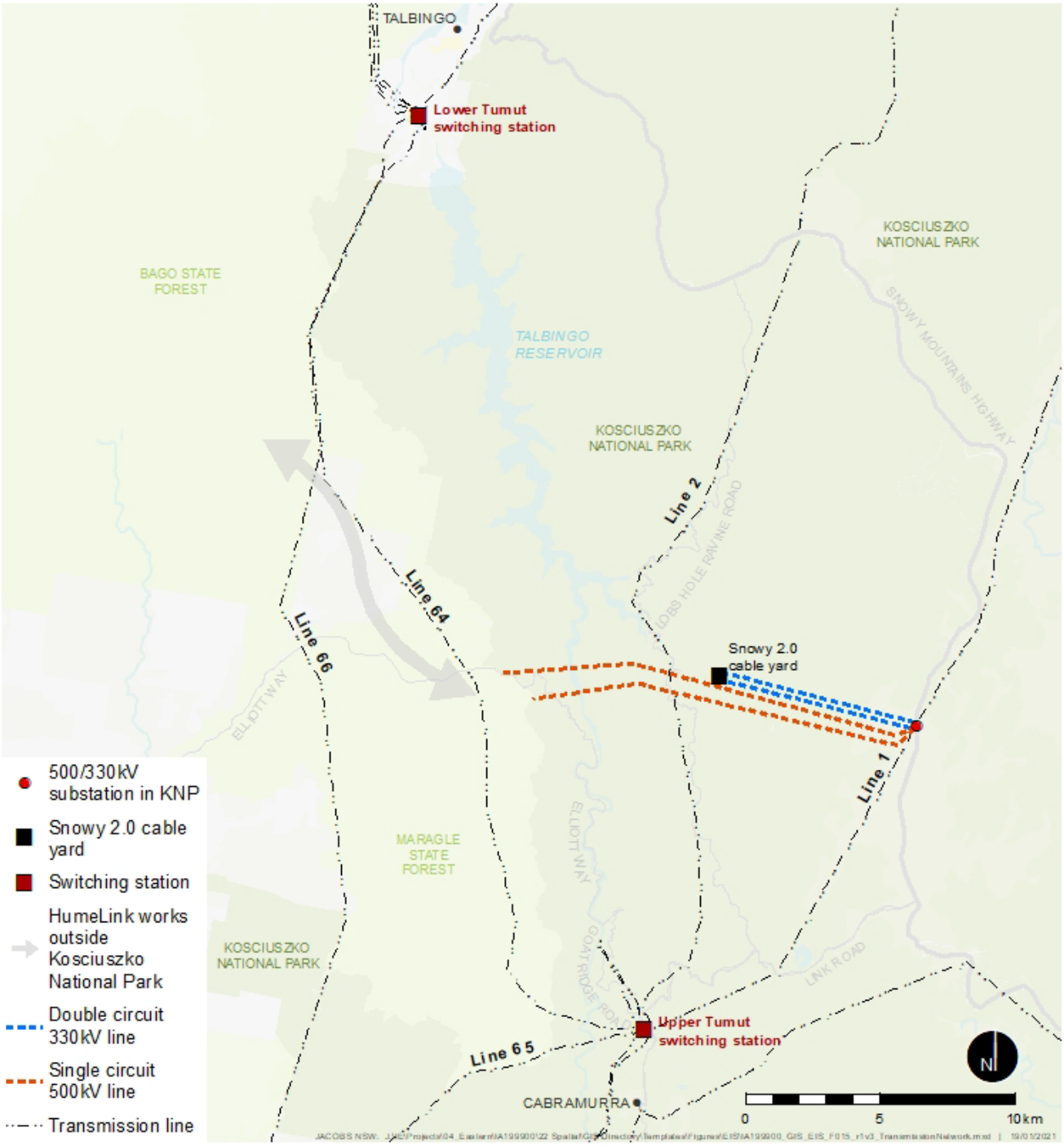


Figure 3-3 Conceptual connection to Line 1

Transmission Line 64

TransGrid's existing Line 64 is located approximately nine kilometres directly west of the Snowy 2.0 cable yard, within Bago State Forest. Line 64, runs generally north-south, providing a single 330 kV connection between the Upper and Lower Tumut 330kV switching stations, refer to **Figure 3-4**.

While the operating capacity of Line 64 is not sufficient to transmit the full 2,000 MW capacity of Snowy 2.0, it could provide the initial 330 kV connection point and the location of the ultimate 500 kV connection with HumeLink. The HumeLink project would bring 500 kV lines to the connection point at Line 64.

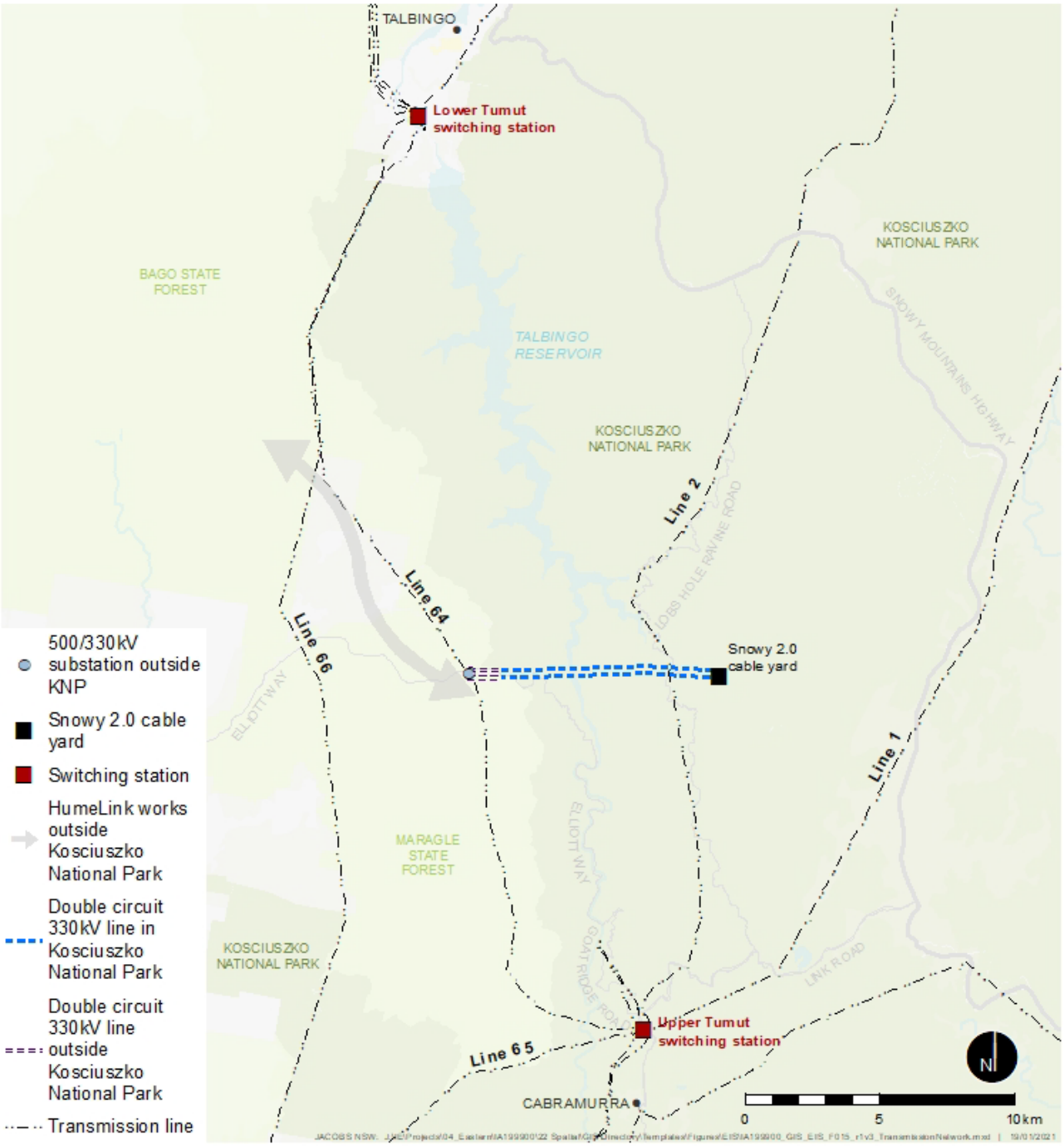


Figure 3-4 Conceptual connection to Line 64

A solution using Line 64 was assumed to require the following elements within KNP:

> About eight kilometres each for two double circuit 330kV transmission lines, running parallel (total permanent easement width ranging between approximately 120 to 140 metres wide) from the Snowy 2.0 cable yard to the edge of KNP at Bago State Forest, plus approximately 4.2 kilometres of new access track outside of the easements

The following elements would occur outside KNP:

> About 1.3 kilometres each for two double circuit 330 kV transmission lines, running parallel (total permanent easement width ranging between approximately 120 to 140 metres wide) within Bago State Forest

- A new 500/330 kV substation located at the Line 64 cut-in occupying a footprint of approximately 600 metres x 300 metres.
- All aspects of the 500 kV transmission lines for the future HumeLink project.

Adjacent to Line 64, at its closest point to the Snowy 2.0 cable yard, there is a suitable area to accommodate a 500/330 kV substation. From a construction and access perspective, the potential site is located on relatively level terrain, therefore reducing cut and fill requirements. Additionally, the site is serviced by Elliott Way (a sealed road) and an existing unsealed access road, therefore avoiding the need for extensive access road construction and further vegetation clearing. Forestry Corporation of NSW (FCNSW) were consulted due to its location in Bago State Forest and advised TransGrid that it was located within an area that is not actively forested due to the limited commercial value of timber in that area. FCNSW demonstrated a willingness to negotiate with TransGrid regarding the potential site and also the future HumeLink transmission lines.

Under early consultation with NPWS, they were supportive of this connection location as the new substation would be located outside of KNP and the future HumeLink transmission line works would avoid the national park.

Lower Tumut switching station

TransGrid has given high level consideration to connecting Snowy 2.0 to the existing Lower Tumut 330 kV switching station. The switching station is located at the northern end of Talbingo Reservoir outside of KNP and is an existing hub for eight 330 kV transmission lines.

This option was assumed to involve undergrounding the connection from the Snowy 2.0 cable yard to Talbingo Reservoir where the connection would then transition to submarine cables laid on the bed of Talbingo Reservoir, running north and then connecting to the switching station, refer to **Figure 3-5**. The connection would require four 330 kV circuits comprising twelve individual cables, as each of the three phases of the four circuits would be a separate cable.

A solution using Lower Tumut switching station was assumed to require the following elements within KNP:

- Twelve cables laid in an approximate 20 metre wide trench from the Snowy 2.0 cable yard to Talbingo Reservoir
- Twelve submarine cables laid side-by-side on the bed of Talbingo Reservoir for approximately 22 kilometres to the northern end of the Talbingo Reservoir.

It was not considered feasible to install submarine cables on the bed of the Yarrangobilly River to access Talbingo Reservoir due to risks of damage to the riverbed caused from the large cables and necessary cable protection. Additionally, it is unlikely the Yarrangobilly River could actually accommodate 12 submarine cables and the required joint pits.

The following elements would occur outside KNP:

- An underground connection (either trenched or laid using the horizontal directional drilling (HDD) approach) comprising 12 cables between the exit point of the reservoir and the new substation
- Expansion of the switching station to a new 500/330 kV substation with an additional footprint of approximately 600 metres x 300 metres
- All aspects of the 500 kV transmission lines for the future HumeLink project.

Use of submarine cables would minimise the amount of permanent impact to surface vegetation and visual amenity within KNP. However, an assessment of a submarine connection within Talbingo Reservoir determined that:

- Laying submarine cables on the bed of Talbingo Reservoir is not practical given the presence of debris including large boulders, dead trees and other major impediments. Clearing a cable route along the bed would be extremely challenging and subject to a marine survey, which would require extensive submarine dredging and rock clearing operations along the entire length of the submarine route. Without a clear cable lay route, the submarine cables would not be able to be maintained in the event of a cable or joint failure

- Each cable drum would carry approximately two kilometres of cable with a weight in excess of 120 tonnes. Transporting cable drums of this size and weight is not considered feasible from a road safety perspective and lack of suitable road infrastructure in this area
- Based on the estimated submarine cable run length of 22 kilometres and each cable length being two kilometres an estimated 160 submarine rated joint pits would be required. Given the high number of cable joints, the probability of cable joint failure is increased. Additionally, the joining of the cables would need to take place on the surface and would require a significant amount of slack to allow it to be placed back on the reservoir floor. During this operation, there is a significant opportunity for the cable and the joints to be damaged
- The cables would be laid by vessel, which may require additional facilities in Talbingo Reservoir to be constructed for cable spooling and cable jointing
- The submarine cable may be exposed to damage by boat anchor. As such, suitable cable protection would need to be installed to ensure damage is prevented
- A permanent wharf, barge and cable storage facilities would need to be established at Talbingo Reservoir and would require ongoing maintenance and operational crews.

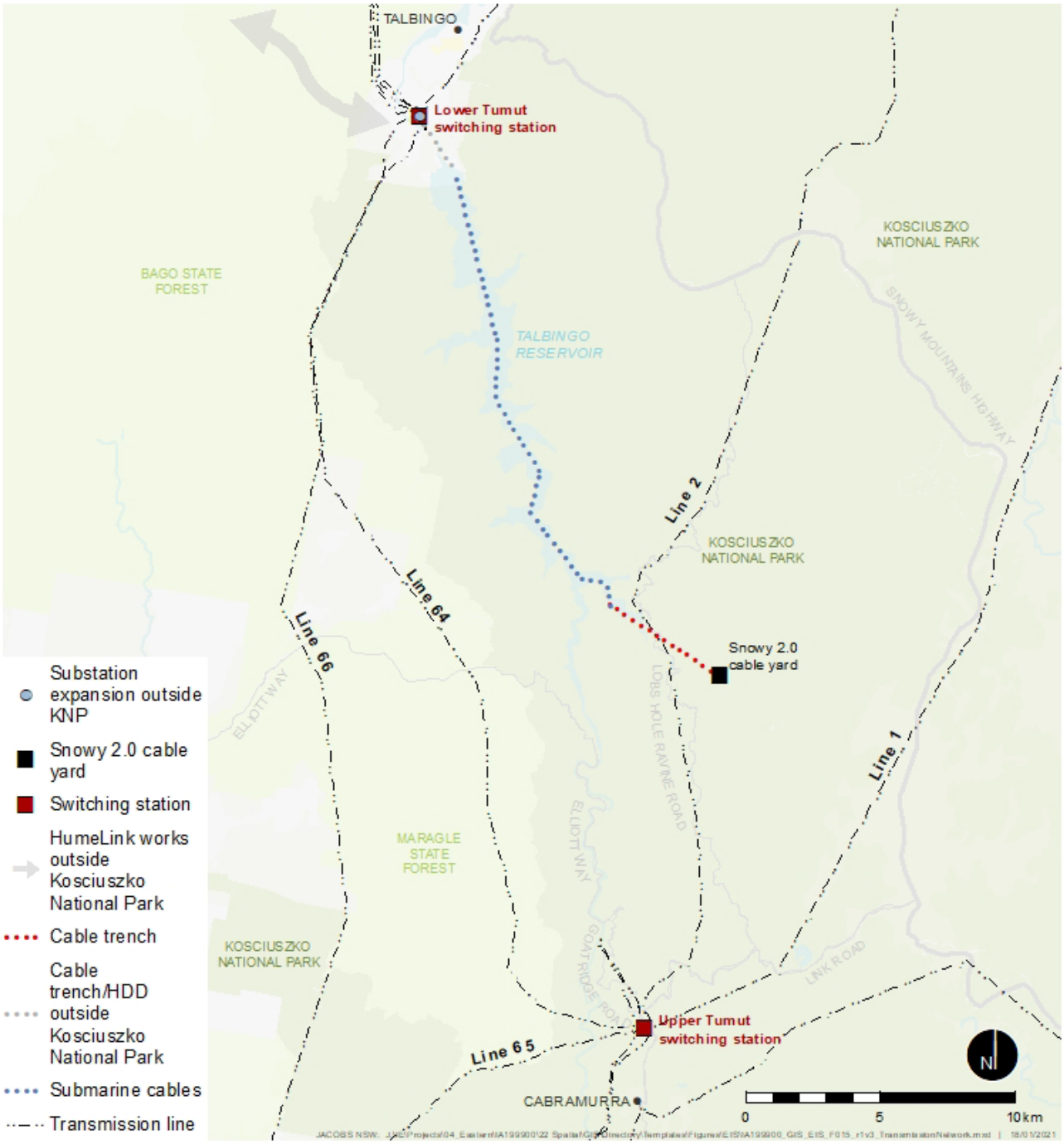


Figure 3-5 conceptual connection to Lower Tumut switching station

Whilst this option may present minimal surface impacts within KNP, there are considerable constraints to the constructability of the submarine cable as outlined above. Furthermore, whilst an expansion of the switching station is feasible, this option does not present a suitable point of connection for HumeLink.

Lower Tumut is an existing convergence point for multiple critical transmission assets. As the NSW jurisdictional network planner, TransGrid has identified Lower Tumut, and the immediate area of existing multiple paralleling transmission lines, as a critical network location. This locality presents a significant risk to the security of the NSW transmission supply (and the wider NEM) in the event of simultaneous outages across multiple adjacent lines (such as bushfire, lightning strike, structure failure). The development of additional 500 kV transmission lines converging into Lower Tumut has been deemed an unacceptable risk.

Due to the significant network security concerns related to connecting HumeLink into a substation at Lower Tumut, this option was not considered suitable and therefore was not further considered as a feasible option.

Upper Tumut switching station

TransGrid has also given high level consideration to connecting Snowy 2.0 to the existing Upper Tumut 330kV switching station. The switching station is located south of Talbingo Reservoir, near Cabramurra within KNP and is an existing hub for eight 330kV transmission lines.

A solution using Upper Tumut switching station was assumed to require the following elements within KNP:

- About 14 kilometres each for two double circuit 330 kV transmission lines, running parallel (total easement width of 120 metres) from the Snowy 2.0 cable yard to Upper Tumut, plus an allowance for about 5 kilometres of new access track outside of the easement
- Expansion of the switching station to a new 500/330 kV substation with an additional footprint of approximately 600 metres x 300 metres.
- About five kilometres each for two single circuit 500 kV transmission lines, running separately (two easements each 80 metres wide) from the edge of KNP at Maragle State Forest to Upper Tumut, and assuming all tracks are contained within the easements

The majority of the 500 kV transmission lines for the future HumeLink project would occur outside KNP.

This option requires taking all transmission lines (Snowy Connection and HumeLink) about 14 kilometres south of the Snowy 2.0 cable yard and in the opposite direction to the incoming approach of the HumeLink transmission lines. This would add unnecessary capital costs and environmental impacts to both the Snowy connection and the HumeLink projects.

This option does not present any benefits over the other options and therefore was not considered further as an option.

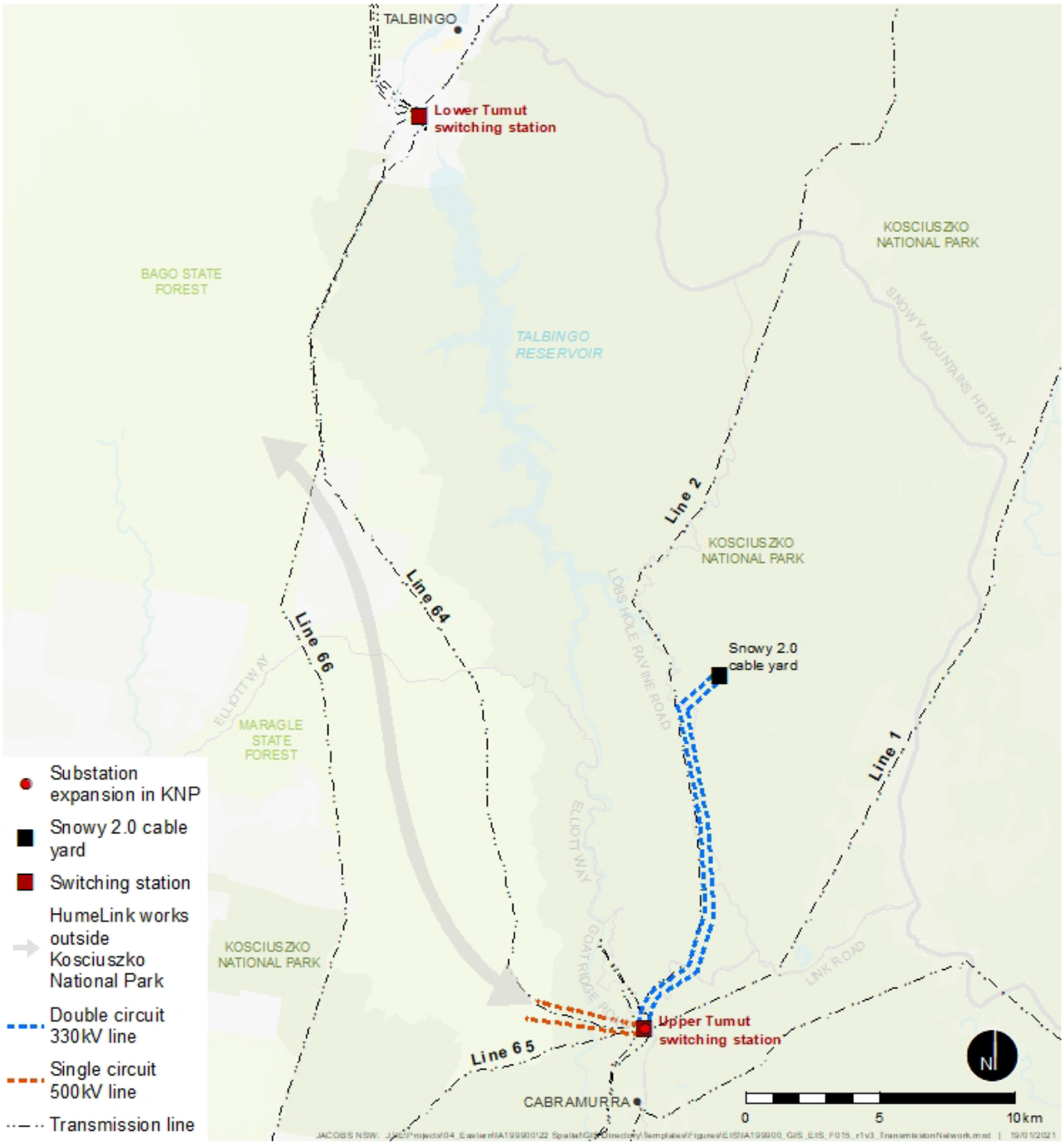


Figure 3-6 Conceptual connection to Upper Tumut switching station

3.2.1.2 Summary and Evaluation

Of the feasible options, connection to Line 2 and Line 64 have the shortest length of new transmission assets within KNP and represent options with lower overall environmental impact.

Line 64 has the following advantages over Line 2:

> Within KNP the new transmission connection would be located within a single corridor
> The new substation would be located outside of KNP
> The HumeLink 500 kV transmission lines would be located outside of KNP in their entirety.

Developing the initial and ultimate connection point at Line 64 is the preferred option as it presents the least potential impact to KNP.

An evaluation of the substation location and connection points identified and assessed is provided in **Table 3-1**.

Table 3-1 Evaluation of the substation location and connection points

Location of substation and initial connection	Feasible	New assets within KNP	TransGrid preferred
Line 2	Yes	> New substation occupying a footprint of approximately 600 metres x 300 metres > Approximately 16 kilometres of lines in three transmission corridors, including: - Four kilometres of double circuit 330kV lines - Twelve kilometres of 500 kV lines > Approximately eight kilometres of access tracks.	No
Line 1	Yes	> New substation occupying a footprint of approximately 600 metres x 300 metres > Approximately 48 kilometres of lines in three transmission corridors, including: - Sixteen kilometres of double circuit 330 kV lines - Thirty two kilometres of 500 kV lines. > Up to 24 kilometres of access tracks.	No
Line 64	Yes	> 16 kilometres of lines sited in one transmission corridor, including: - Sixteen kilometres of double circuit 330 kV lines > Approximately 4.2 kilometres of access tracks located outside the transmission line corridor.	Yes
Lower Tumut	No	-	-
Upper Tumut	Yes	> New substation occupying a footprint of approximately 600 metres x 300 metres > Approximately 38 kilometres of lines located in three transmission corridors, including: - Twenty eight kilometres of double circuit 330 kV lines - Ten kilometres of 500 kV lines > Approximately five kilometres of access tracks.	No

3.2.2 Type of connection

The next phase of the options assessment focused on an assessment of the types of transmission options that are available for the connection between Snowy 2.0 cable yard and Line 64, with particular consideration to:

> Constructability and feasibility
> Construction and operational safety
> The extent of vegetation clearance and ground disturbance that would be required.

Four technical options were considered, including:

> Underground trenched cable
> Micro-tunnelling and horizontal directional drilling

- Deep cable tunnel
- Overhead transmission.

The technical aspects of each option are described and consideration given to option scenarios.

3.2.2.1 Options considered

Underground trenched cable

An underground trenching solution would involve the excavation of long trenches, the laying of cables, backfilling and site remediation. Approximately every one kilometre along the alignment there would be a joint bay. Joint bays would occupy a disturbance area of approximately 300 square metres for each three-phase cable set.

The construction methodology requires vegetation clearing and ground disturbance to provide for the trench and access roads for the movement of construction vehicles. Access roads would need to be sized for the trenching equipment and the safe transport of the large cable drums (approximately five metres in diameter) during construction. Given the large diameter of the cable drum, the access road width would need to be considerably wider than typical existing transmission line access tracks in KNP, which are about five metres in width.

The construction of the trenches also involves infilling using backfill material that meets certain standards for dissipating heat. This fill would need to be trucked to site and non-suitable spoil removed from site.

An example of the trenching approach is shown in **Photo 3-1**, noting that the image shows only two circuits, whereas four circuits, comprising 12 individual cables would be required.

During operation, permanent access roads would need to be maintained to provide access to each of the joint bays along the alignment for routine maintenance activities, and also to enable emergency access for cable fault repairs.

Photo 3-1 Example of a trenched double circuit underground transmission connection

The steep terrain between the Snowy 2.0 cable yard and Line 64 poses significant challenges to implementing this option. The trench would need to traverse hard rock and high gradient sections along the route, including Sheep Station Ridge and up the escarpment on the western side of Talbingo Reservoir. Given the steepness of the gradients, the construction method required for this option, the requirement for permanent safe access

for each joint bay, and ensuring worker safety in hazardous terrain, this solution would not be feasible on either side of Sheep Station Ridge or for the slope up to the substation site on the western side of the Talbingo Reservoir.

However, an assumed scenario for a high level consideration of this option, would involve at least 10 kilometres of trenched cable corridor, potentially using Elliott Way on the western side, with an overhead solution spanning the Talbingo Reservoir. The trench would be approximately 20 to 30 metres wide and require significant additional width for cut and fill on cross slopes to create flat areas for the cable trenches and the laying of 12 individual cables (to comprise the four 330 kV circuits). For the proposed 5 metre wide access tracks for the overhead line option the impact width of the tracks is generally between 10 to 20 metres depending on the levels and cross falls required. The wider level width for the cable trenches is estimated to likely need a similar ratio of disturbance e.g. a 40 to 100 metre disturbance width depending on the terrain.

At the top of Sheep Station Ridge, the cables would transition to an overhead transmission connection solution to span across Talbingo Reservoir. This would require the additional development of transition sites (from cable to overhead conductor technology) within KNP. Each double circuit transition site would occupy a disturbance area of approximately 70 metres x 25 metres or alternatively a single transition site occupying a larger overall footprint. In addition an APZ of approximately 50 metres wide would be required around each site to provide the necessary bushfire protection. Up to four transition sites would be required should the remainder of the transmission connection on the western side of Talbingo Reservoir to the substation site transition back to an underground connection. The overhead transmission easement across the reservoir would require minimal vegetation clearance.

This solution would require full and permanent impacts to vegetation and potential heritage along the length and width of the trench. The extensive earthworks would result in a large volume of rock and dirt spoil, including potential Naturally Occurring Asbestos, and significant truck movements to remove spoil and bring in appropriate fill. Overall, the steep terrain and need for extensive excavation work means that this option is not suitable from an engineering or safety perspective and would create an area where only grass would be allowed to revegetate the area to prevent damage to the cables and thermal backfill

Micro-tunnelling and horizontal directional drilling

Micro-tunnelling and HDD of cables would involve the drilling of 12 individual micro tunnels side-by-side for each phase of the circuit, noting there a three phases per circuit and four circuits required to facilitate the connection. Micro-tunnelling is limited to shallow depths of overburden and is not feasible for deep sections.

Both micro-tunnelling and HDD would require cable launch sites/joint bays to be established about every one kilometre along the alignment. A micro-tunnelling launch site requires a footprint of at least 60 metres x 60 metres and a HDD launch site requiring a footprint of approximately 30 metres x 30 metres.

Suitable access would also need to be constructed to each launch site for vehicular access. Access roads would need to be sized appropriately to transport large cable drums to the launch sites and would need to remain permanently to facilitate inspection and maintenance activities at the joint locations.

An easement (at least 30 metres wide) would be required along the full length of the cable corridor. Vegetation maintenance activities would be carried out during operation.

An assumed scenario for a high level consideration of this option, would involve about nine kilometres of cable corridor. Both HDD and micro-tunnelling are not considered safe or feasible on the steep sloping inclines on either side of Sheep Station Ridge or the slope up to the substation site on the western side of the Talbingo Reservoir. Therefore, once at the top of the Sheep Station Ridge, the cables would need to transition to an overhead transmission connection across Talbingo Reservoir. This would require the additional development of transition sites (from cable to overhead conductor technology) as described previously for the trenched connection approach. The overhead transmission easement across the reservoir would require minimal vegetation clearance.

Vegetation would be fully removed and benching activities would occur at approximately nine cable launch sites along the corridor, the transition sites and at the overhead structure locations.

Whilst HDD is typically the least invasive in terms of launch site development (approximately 30 metres x 30 metres for a single cable duct), this connection would require a total 12 ducts to be drilled. Consequently, multiple launch sites would need to be established, extending side-by-side to accommodate each new cable drift. This represents a potential impact area of up to 30 metres x 60 metres every one kilometre along the cable corridor.

Consultation carried out by Snowy Hydro with micro-tunnelling equipment manufacturers determined that micro-tunnelling posed significant engineering challenges due to the expected underlying geology and the moderate to high strength rock conditions within the corridor.

Due to the presence of hard rock and heterogeneous ground conditions along the corridor, there is also considerable risk that control of the HDD alignment for 12 individual cables would not be maintained to the required accuracy. Hence, the cable drift could extend beyond the intended easement corridor of approximately 30 metres wide.

There is also a high risk that the required cable circuit ratings would not be achievable with this configuration and available cable sizes. This option would then need either two cables per phase (24 cables in total) or at least another circuit and the additional width that goes with these solutions.

Deep cable tunnel

A deep cable tunnel solution would require development of a tunnel approximately six metres in diameter, constructed using a specialised tunnel boring machine (TBM).

A tunnel would also require:

- Deep vertical shafts beneath the substation site at the western end, if an inclined tunnel is not suitable
- A low point sump for collection, treatment and discharge of water at the eastern end. This would require the construction and operation of an additional new substation and water treatment plant
- Ventilation points and permanent access roads to these components
- To ensure safety of personnel entering the tunnel for maintenance and emergency conditions, multiple intermediate access/egress points (tunnels/shafts) along the tunnel route and associated permanent surface access track would also be required.

An assumed scenario for a high level consideration of this option, would involve a nine kilometre long deep tunnel, that would pass beneath Talbingo Reservoir. The cable tunnel would be capable of housing 12 cables, comprising the four 330 kV circuits, and would also accessible 24/7 for maintenance and emergency activities.

The transmission connection alignment would create challenging tunnelling conditions given the depth and the steep gradient to enable passing beneath the Talbingo Reservoir. Given the challenging conditions specialised tunnelling plant, equipment and methods would be required. A purpose built and designed TBM would be required to navigate the corridor and its specific conditions. Snowy Hydro has advised that the Snowy 2.0 TBM's were not designed for the conditions of the connection alignment and would not be suitable. Further, the Snowy 2.0 TBM's would not be available for several years, which would impact the construction program for the project and significantly impact the operational timing for the Snowy 2.0 project.

Based on the depth required to pass beneath Talbingo Reservoir and the elevation of the connection point at Line 64, a deep vertical shaft would be needed within Bago State Forest at the western extent of the tunnel. The shaft would be approximately 600 metres in vertical height. At this stage a feasible option for cables of a suitable capacity and weight to negotiate a 600 metre deep vertical shaft to the substation has not been found.

The surface works to establish the shaft would require a large cleared level construction pad, new access roads and a spoil disposal site. To excavate the vertical shaft, an additional temporary substation for construction power separate to the proposed substation proposed would be required.

Waste rock from the tunnel and shafts may require the establishment of a new waste rock storage location (in addition to that approved for the Snowy 2.0 Main Works). This may require additional roads and clearing for the storage, transportation and disposal of waste rock.

During construction and operation, water ingress would present a significant risk. All water inflow would need to be collected, treated and discharged into Talbingo Reservoir. This would require the construction and operation of an additional new substation and water treatment plant at an appropriate low point. These works would require an additional levelled and cleared area within KNP.

At some locations the tunnel would be greater than 600 metres below the surface. To develop the necessary emergency access/egress points along the tunnel route, additional shafts/tunnels would be required plus electrical infrastructure may be required to provide lifts or winders for emergency evacuation, pumping and atmosphere control. These components impose significant feasibility constraints.

Hazards arising for workers entering a deep tunnel were assessed as being greater than those for the Snowy 2.0 Main Access Tunnel (MAT) and the Emergency Cable and Ventilation Tunnel (ECVT) due to the increased cable tunnel length, steep gradients (western section), potential for water ingress and flooding, fire hazards, and toxic atmosphere risks. The MAT and ECVT tunnels share safety and isolation zones and crossovers which facilitate emergency exit routes. This is not possible with a single large cable tunnel proposed in this solution option, and therefore results in a serious level of risk to human safety during inspection and maintenance.

The logistical requirements of constructing a cable tunnel would be significantly more than for an overhead transmission connection. Compared to the overhead connection, a cable tunnel would require production of concrete segments and their transport, significantly more personnel for construction and larger volumes of water and power (power through construction of additional feeders, substation or diesel power station). Although the extent of vegetation clearing in KNP would likely be less than an overhead transmission connection, there would still be significant vegetation clearing and ground disturbance at the main portals, along access tracks, including any access tunnel/shafts required along the alignment.

Given the engineering and safety challenges with a major underground cable tunnel, coupled with the requirement for additional power supply during construction and operation and a waste rock storage location, this option was not progressed.

Overhead transmission connection

Overhead transmission lines involve construction of steel lattice transmission structures which are used to support conductors at a safe height. Each structure can support up to two transmission circuits. Structures are typically 400 to 500 metres apart in flat terrain, but can be further apart depending on the terrain below the conductors.

Earthworks are required for the development of the structures, for establishing a safe work bench around each structure and for foundation excavations. Access tracks would need to be established to each structure location to facilitate construction, ongoing maintenance and emergency access.

An easement would be required along the full length of the transmission line, within which any vegetation of a growth height with the potential to come in close proximity of the conductors, would need to be removed. However, groundcover and the understory vegetation, such as small shrubs could remain in situ. Vegetation maintenance activities would be carried out during operation.

This option has given consideration to the development of two overhead double circuit 330 kV transmission lines from the Snowy 2.0 cable yard to Line 64. The transmission lines would be located side-by-side and would carry two 330 kV circuits each, to meet the full requirements of Snowy 2.0.

Each transmission line from the Snowy 2.0 cable yard to the substation would require about 21 structures. A work site about 40 metres x 60 metres would be established at each structure location. Access tracks would need to be established to each structure location to facilitate construction and ongoing maintenance, however the majority would be contained within the disturbed easement area. Only about 4.2 kilometres of new access track would need to be constructed outside of the easement corridor.

This option would be able to navigate the challenging and steep terrain by positioning the structures atop the steep ridges where the conductors could span across the gullies and Talbingo Reservoir. The final surveyed easement would be about 120 to 140 metres wide, but this option has the benefit of being able to retain

vegetation within gully areas, as the clearance of the conductors above the tree canopy would be sufficient to address the risk of fire and trees growing into the conductor space.

The overhead transmission connection approach is a proven method in the steep alpine terrain characteristic of the project area. Whilst vegetation clearing along the transmission corridor would be required to ensure safe operational clearances can be maintained, areas of remnant alpine forest can be retained within the gully areas.

3.2.2.2 Summary and evaluation

The underground trenched cable, and deep cable tunnel options, are both considered unsuitable solutions. The micro-tunnelling or HDD option, while it may be potentially suitable is not the preferred solution, particularly as it would require the development of up to four transition sites on prominent ridge points within KNP, for the transition between cable and overhead solution.

Compared to the other options, the overhead transmission solution would involve considerably less excavation works and spoil generation. Additionally, the overhead transmission connection approach would allow for much safer worksites to be established, which would generally be confined to structure locations and along access tracks which have been selected with due consideration to favourable terrain.

Based on the reasons described above, the overhead transmission line approach is the optimal and preferred type of connection as shown in **Table 3-2**. This preferred option is the project as described in more detail in **Chapter 5**.

Table 3-2 Evaluation of the types of transmission connections

Connection option	Potentially suitable	Comparison of surface impacts	Key environmental issues	TransGrid preferred
Underground trenched cables, with overhead crossing of reservoir	No	> Approximately nine kilometres x 30 metres of cable trench, which would be fully cleared of vegetation as part of construction > Approximately nine joint bays > Approximately two kilometres of access tracks outside the trench or the overhead transmission line easement > Up to four cable-overhead transition sites each occupying an area of approximately (70 metres x 35 metres plus an APZ) > Approximately two kilometres of overhead transmission lines with limited clearing	> Management of NOA spoil > Destruction of sub-surface indigenous heritage > Biodiversity impacts > Visual impacts > Permanently cleared easement for the cables with only grass allowed	No
Deep cable tunnel	No	> Shafts for emergency access, including access tracks to these points > Construction site for excavation of deep shaft > Two additional substations and associated access roads > A dedicated spoil disposal area(s)	> Rock spoil > Water management > Visual impacts	No

Connection option	Potentially suitable	Comparison of surface impacts	Key environmental issues	TransGrid preferred
Micro-tunnelling / HDD, with overhead crossing of reservoir	Yes	> Approximately nine kilometres x 30 metres of cable corridor cleared of trees > Approximately two kilometres of overhead transmission lines with limited clearing > Up to four cable-overhead transition sites each occupying an area of approximately (70 metres x 35 metres plus an APZ) > Approximately nine locations hosting 12 launch sites (each location about 30 metres x 60 metres) fully cleared of vegetation > Approximately two kilometres of access tracks outside the cable corridor or the overhead transmission line easement	> Management of NOA spoil > Destruction of sub-surface indigenous heritage > Biodiversity impacts > Visual impacts	No
Overhead transmission lines	Yes	> Approximately nine kilometres of overhead transmission located in a single transmission line corridor with a permanent easement width of approximately 120 to140 metres > Limited or no clearing in gullies > 42 structure sites comprising an areas of approximately 40 metres x 60 metres per structure, fully cleared of vegetation > Approximately 4.2 km of access tracks outside the cleared transmission connection corridor.	> Biodiversity impacts > Visual impacts	Yes

3.2.3 Route selection

The next phase of the options assessment process involved the identification and evaluation of three potential overhead transmission line routes linking the Snowy 2.0 cable yard to the substation site at Line 64. The key factors for the identification and evaluation of potential routes included:

> Identification of feasible transmission structure locations, which could use the mountain peaks and ridgetops for constructability purposes and minimisation of biodiversity impacts through spanning over vegetation
> Minimising the length of the corridor to reduce vegetation clearing and ground disturbance
> The length and constructability of the access tracks along the route.

Three transmission line route options were identified with consideration to the above and are shown in **Figure 3-7**.

Option 1 had the following advantages:

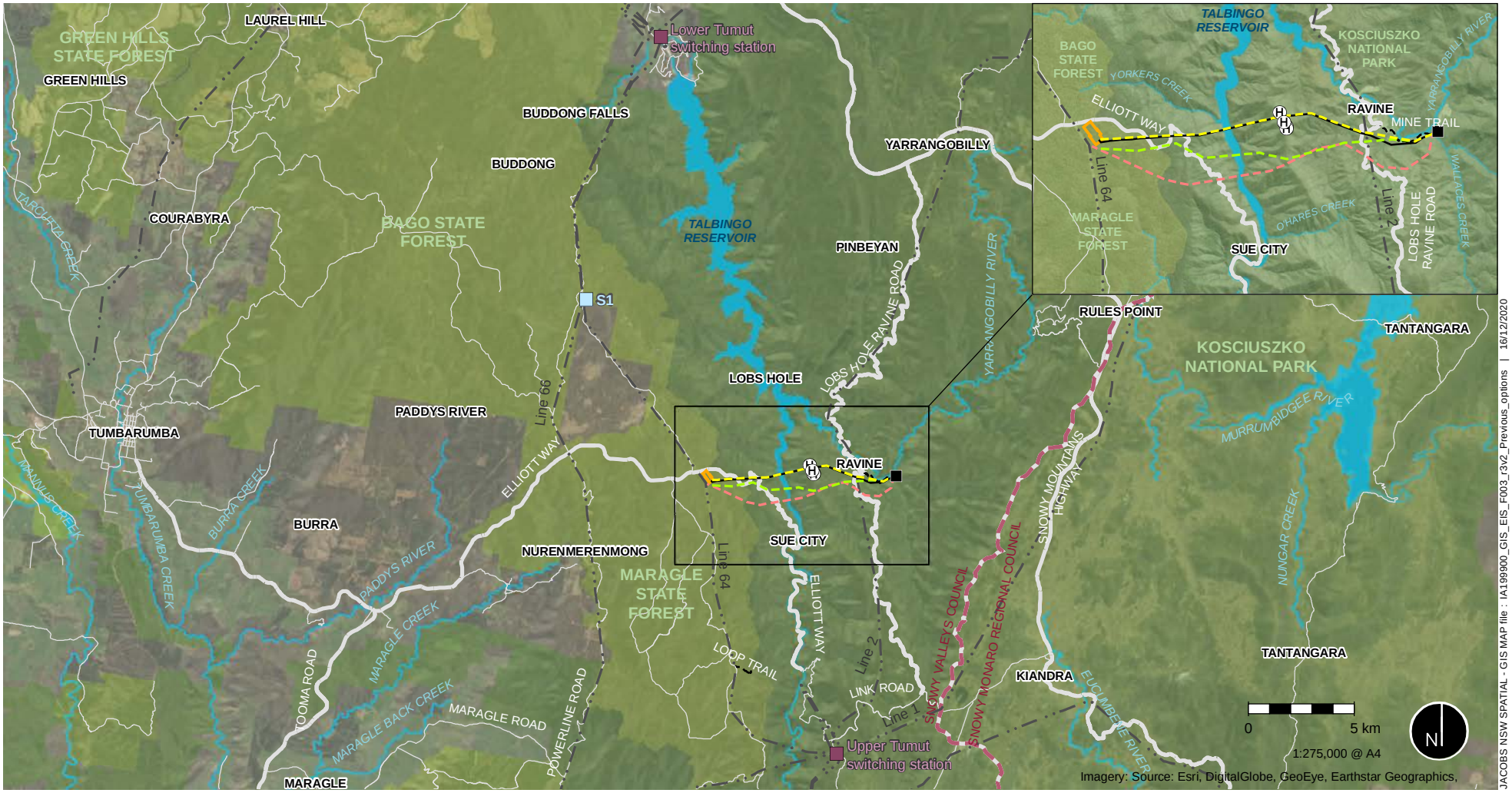
Option 1 had the following advantages:

- A feasible access track route where tracks could be safely designed and constructed along the ridgelines on the steeper slopes with particular consideration to Sheep Station Ridge
- The largest area to safely erect structures on both sides of the Talbingo Reservoir crossing
- The shortest feasible route (approximately nine kilometres) from the Snowy 2.0 cable yard to Line 64, therefore minimising vegetation clearing.

Option 2 was found to be highly constrained with difficult access and therefore was not considered further.

Option 3 was discussed with NPWS representatives, who confirmed their agreement for the preferred route (Option 1) due to the following considerations:

- The preferred route travels through lower terrain, reducing visual impact, especially where taller vegetation would provide greater visual screening from surrounding vantage points such as the Wallaces Creek Lookout
- The preferred route 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.



Current option:
- Proposed 500kV substation
- Potential helipad location
- Proposed transmission line
- Snowy 2.0 cable yard
- Transgrid switching station

Previous options:
- Previous indicative substation location (option S1)
- Option 1 (preferred)
- Option 2
- Option 3

- Electricity transmission line
- Minor road
- Major road
- Trail
- Water body
- State forest
- NPWS estate
- Local Government boundary

Figure 3-7 | Transmission line route options considered

Data source:
Jacobs 2020, TransGrid, EMM 2020,

3.2.4 Overhead transmission connection concept design

The height of overhead conductors above the underlying tree canopy has a direct correlation to the extent of vegetation clearing along the transmission connection corridor to ensure safe clearances are achieved. Ensuring a safe clearance above the canopy is achieved is critical in reducing the risk of bushfire ignition.

Two concept designs importing different structure heights were identified and assessed as outlined in **Table 3-3**. The base case design with a structure height of about 75 metres has been identified as the preferred option.

Table 3-3 Concept design

Concept option	Description and assessment	TransGrid preferred
Base Case: structure height of 75 metres	This option would involve transmission structures up to 75 metres in height. Under this option the transmission line design maintains minimum safe electrical clearances from the tree canopy to the overhead high voltage conductors and reduces vegetation clearing requirements by optimising structure locations. Where feasible, the structure locations were positioned on elevated terrain to utilise gully areas where conductor clearances are sufficient to avoid clearing. Light Detection and Ranging (LiDAR) analysis of the preferred corridor was used to determine the areas where the mature height of the underlying vegetation would potentially encroach the safe clearance area beneath the overhead conductors and would need to be cleared. Conversely, the analysis supported identifying areas where vegetation could be retained. The required clearing is included in the disturbance area as showing in **Figure 1-2**.	Yes
Over Canopy Design: structure height of 94 metres	This option would involve building the transmission connection at a height above the tree canopy, which satisfies the required safe electrical clearances, where no vegetation clearing would be required (aside from at the structure locations and along access tracks). LiDAR analysis of the preferred corridor determined that structures would need to be up to 94 metres in height to ensure safe clearance above the canopy. The taller height structures (nearly 20 metres higher than the base case) would require larger footing foundations, and increase the distance at which the structures are visible. From an engineering perspective, the construction of the transmission connection above the tree canopy is feasible, however there would be significant constraints associated with: Asset and bushfire risk: As the amount of vegetation (fuel load) under the transmission lines increases, the risk of a bushfire causing a catastrophic failure of the four 330 kV circuits increases. The ability for TransGrid to respond to a catastrophic failure would also become more difficult as the vegetation under the transmission lines increases due to the inability to traverse the transmission corridor if required for urgent repairs. Therefore, it is beneficial to have a cleared corridor for responding to a catastrophic failure of the transmission lines. NEM Risks: As the amount of vegetation under the transmission lines increases, the risk of a bushfire causing a trip of the transmission connection circuits increases. Should this occur, there is potential for the full loss of generation from Snowy 2.0, which could lead to voltage collapse and widespread consequences including load shedding across the NEM, which would likely require several hours to restore.	No

3.2.4.1 Access

The project identifies the need for access tracks to be established to support the construction of the transmission connection. Approximately 4.2 kilometres of new access track are required to be constructed outside of the proposed cleared areas of the transmission connection corridor. Access tracks allow for bulky construction equipment, large volumes of materials and workers to be safely transported to and from each of the structure work sites.

These tracks once built are proposed to be retained for use during operation. They would continue to provide 24/7 safe access for workers to each structure site for routine maintenance and emergency repair works. These tracks would also provide safe access for vegetation maintenance activities.

While the access tracks could be decommissioned and rehabilitated following construction and permanent helipads established to facilitate maintenance and inspection activities, this would require permanent helipads at each structure location to be established at a safe distance from live conductors. Without suitable ground access, some maintenance and repair works, particularly conductor and earth wire repair may need to be carried out from a helicopter, which presents significant safety risks. Furthermore, emergency access would be limited to daylight hours and constrained during inclement weather conditions such as heavy rain, snow and strong winds without ground based access.

Worker safety is the number one priority at TransGrid. TransGrid has previously made a decision to restrict use of helicopters for conductor and earthwire stringing due to critical safety risks. As such, a ground based access along the transmission connection corridor is considered the preferred approach.

4. Statutory framework

This section describes the environmental impact assessment and approval process for the project as well as other relevant environmental planning and statutory approvals. It addresses the SEARs including the relevant statutory context for the project having regard to:

- The assessment pathway for the project under the *Environmental Planning and Assessment Act 1979*;
- The approvals required before the project may be carried out, including any approvals under the Commonwealth *Environment Protection & Biodiversity Conservation Act 1999*;
- The likely interactions between these approvals (if granted) and any obligations or rights under the *National Parks and Wildlife Act 1974*; and
- Any relevant matters for consideration;

4.1 Approval framework

The planning approval process for the project comprises a mix of both NSW and Commonwealth requirements as the project has been deemed a controlled action under the EPBC Act. The project would be assessed under the Bilateral Agreement process between the Commonwealth and NSW Governments. The assessment and approval process is described in the sections below.

4.1.1 Environmental Planning and Assessment Act 1979

On 7 March 2018 the then NSW Minister for Planning (now the Minister for Planning and Public Spaces) declared Snowy 2.0 and the Transmission Project to be CSSI as it is considered to be essential for the State for economic, environmental or social reasons. As the project is State Significant infrastructure (SSI) under Section 5.12 of the EP&A Act it does not require consent under Part 4 of the EP&A Act. The project is also declared to be CSSI under Section 5.13 of the EP&A Act, by virtue of clause 16 and Schedule 5, clause 9(4)(a) of SRD SEPP. The project would therefore be assessed and determined as CSSI by the Minister for Planning and Public Spaces under Part 5, Division 5.2 of the EP&A Act.

This EIS has been prepared in accordance with the SEARs and Part 3 of Schedule 2 of the EP&A Regulation. This includes a description of the project, alternative options, likely environmental impacts and mitigation measures, and relevant environmental planning approvals and permits associated with the project. A copy of the SEARs and an indication of where each requirement is addressed in the EIS is provided in **Appendix A**. **Appendix A** also outlines where each relevant environmental element listed in the EP&A Regulation is addressed within the EIS.

This EIS will be placed on public exhibition for six weeks. During the exhibition period, government agencies, project stakeholders and the community will be able to review the EIS and have an opportunity to make a written submission to DPIE for consideration in its assessment of the project. At the completion of the public exhibition period, DPIE will collate and provide TransGrid with a copy of all submissions received during the exhibition period. The responses to submissions will be documented in a submissions report. If changes are proposed to the project a preferred infrastructure report or amendment report will be prepared.

The approval process under Part 5, Division 5.2 of the EP&A Act is shown on **Figure 4-1**. Further information on the assessment process is available on the DPIE website (https://www.planning.nsw.gov.au/Assess-and-Regulate/Development-Assessment/Planning-Approval-Pathways/State-Significant-Infrastructure).

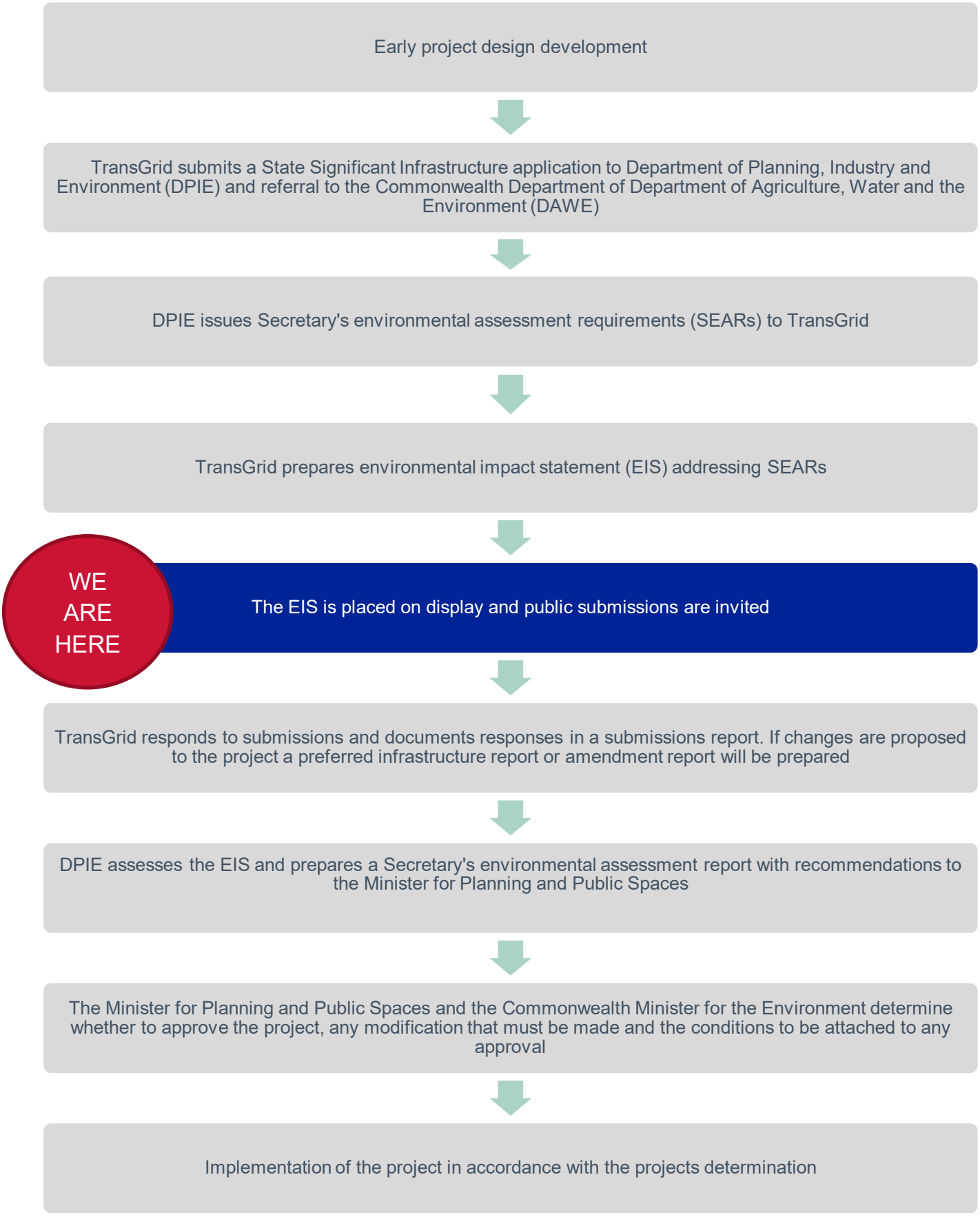


Figure 4-1 The assessment and approval process for the project

4.1.2 Other legislative approval requirements

Under section 5.23 of the EP&A Act, certain separate environmental approvals would not be required for the project. Approvals not required for the project under section 5.23 of the EP&A Act include:

- A permit under section 201, 205 or 219 of the *Fisheries Management Act 1994* (FM Act) to carry out dredging and reclamation works, to harm marine vegetation in a protected area or to block fish passage
- Approvals under Part 4 to disturb or excavate a place, building, work, relic, moveable object, precinct or land to which an interim heritage order or listing on the State Heritage Register (SHR) applies and an excavation permit under section 139 of the *Heritage Act 1977* (Heritage Act)
- An Aboriginal heritage impact permit to harm an Aboriginal object or place under section 90 of the NPW Act
- A water use approval under section 89, a water management work approval under section 90 or an activity approval (other than an aquifer interference approval) under section 91 of the *Water Management Act 2000* (WM Act).

Other NSW legislation that may trigger the need for additional approvals prior to commencing works are summarised **Table 4-1**.

Table 4-1 NSW legislation with potential additional approval requirements

Legislation	Requirement for approval
Biosecurity Act 2015	Under this Act, all plants are regulated with a general biosecurity duty to prevent, eliminate or minimise any biosecurity risk they may pose. Section 22 requires that any person who deals with any plant, who knows (or ought to know) of any biosecurity risk, has a duty to ensure the risk is prevented, eliminated or minimised so far as is reasonably practicable. The biodiversity management plan to be prepared and implemented will include measures to minimise the potential for biosecurity risks during construction in accordance with the *Biosecurity Act 2015.*
Biodiversity Conservation Act 2016 (BC Act)	The BC Act identifies threatened species, ecological communities and key threatening processes and establishes a framework to avoid, minimise and offset the impacts of proposed development and land use change on biodiversity. Under section 7.9 of the BC Act, any SSI application is to be accompanied by a Biodiversity Development Assessment Report (BDAR), unless it is determined that the proposed development is not likely to have any significant impact on biodiversity values. A BDAR has been prepared and is provided in **Appendix B** and summarised in **Section 7.1**.
Electricity Supply Act 1995	TransGrid is considered a network operator under the *Electricity Supply Act 1995*. Clauses 45(1) and (2) state that a network operator may erect, install, or extend electricity works on public land (including a public road, public reserve, Crown land, State Forest or land under the control and management of a public or local authority) and is exempt from the requirement for any approval under the *Local Government Act 1993*, except in relation to buildings. Although approval is not required from local council, under clause 45(4), the local council must be notified of works and given reasonable opportunity (being not less than 40 days from the date on which the notice was given) to make submissions in relation to the proposed works. The network operator must then give due consideration to any submissions made. Snowy Valleys Council would be notified when the project is on public exhibition and would be invited to provide a submission.

Legislation	Requirement for approval
NPW Act	The NPW Act aims to conserve nature including habitats, biological diversity, and significant landforms, landscapes and natural features. The KNP is reserved as a national park under Part 4, Division 3 of the NPW Act. All activities within KNP must be consistent with the KNP PoM in accordance with Part 5 of the NPW Act. As discussed in **Section 2.4.4**, the project does not currently comply with one of the stated policies for electricity transmission infrastructure in KNP, that being the requirement for all additional telecommunication and transmission lines to be located underground. Due to the constraints surrounding the project, other types of connection were explored. However the optimal and feasible connection approach was identified as an overhead transmission connection as discussed in **Section 3.2.2**. However, the project has sought to meet the general principles of the KNP PoM, particularly with regard to minimising the visual and biodiversity impacts of the project. As a transitional measure ahead of amendments to the KNP POM, clause 7 of Schedule 4 to the SHC Act provides that for a period of three years from the first Snowy 2.0 approval (7 February 2019), section 81(4) does not operate to prohibit operations being undertaken in relation to the Snowy 2.0 project (which includes transmission) that are not in accordance with the KNP PoM. Under Section 153 of the NPW Act, the Minister "*may upon such terms and conditions as the Minister thinks fit for grant of joint or several use easements or rights of way through, upon or in a national park… for the purpose of providing access to any area included in any lease or licence within the park, site, area or reserve, …. Or for the erection of standards, posts, wires and appliances for the conveyance or transmission of electricity, or for any other purpose deemed necessary*". TransGrid would seek the granting of an easement for the proposed transmission corridor in accordance with Section 153. TransGrid have a Memorandum of Understanding (MOU) with NPWS on land reserved and acquired under the NPW Act for the ongoing operation and maintenance of its transmission assets. The project would be conducted and operated in accordance with the requirements set out in the MOU.
Forestry Act 2012	This Act provides for the dedication, management and use of State forests and other Crown-timber land for forestry and other purposes. TransGrid will acquire the necessary access and property rights (from FCNSW) to construct, operate and maintain the transmission connection assets in perpetuity.
Roads Act 1993	Section 138 of the Roads Act requires that a person obtain the consent of the appropriate roads authority for the erection of a structure, or the carrying out of work in, on or over a public road, or the digging up or disturbance of the surface of a public road. The project would require works (stringing of conductors and earthwires between structures) in and above the road reserve of Elliott Way, which is an unclassified regional road. In the case of unclassified roads, consent from the road authority (local council) is not required, as under Clause 5, Part 2 of Schedule 2, TransGrid is an ANO under the *Electricity Supply Act 1995* and

Legislation	Requirement for approval
	can therefore carry out works as part of network operator functions, in, on or over an unclassified road. As such, a permit from Snowy Valleys Council would not be required. The project areas do not traverse any classified roads or crown roads. Consultation would be required with the relevant road authorities to confirm any road upgrades requirements as identified in the road safety audit, refer to **Section 7.6.3.1**.
Protection of the Environment Operations Act 1997 (POEO Act)	The POEO Act provides for the issue of an Environment Protection Licence (EPL) for premises-based scheduled activities pursuant to section 48 of the POEO Act, and non-premises based scheduled activities pursuant to section 49 of the POEO Act. Activities requiring an EPL are listed in Schedule 1 of the POEO Act. The project would not involve any scheduled activities and therefore would not require an EPL. Construction activities must comply with the requirements for the POEO Act, including by not limited to the following sections: > Section 115 and 1165 (regarding disposal of waste, leaks, spillages and other escapes) > Section 120 (regarding pollution of waters) > Section 124 and 126 (regarding operations that result in air pollution > Section 139 regarding noise pollution > Section 167 (regarding the appropriate maintenance and operation of plant and equipment) Appropriate management and mitigation have been identified in relation to these aspects in **Section 8**.
Water Management Act 2000	The project may require temporary dewatering during construction. Licensing of groundwater extraction in accordance with the *NSW Aquifer Interference Policy* (Department of Primary Industries (DPI) Water, 2012) would be required if the extracted groundwater exceeds three megalitres/year. If dewatering is required, the amount of water extracted is expected to be less than three megalitres/year. Therefore a water access licence will not be required.
Heritage Act 1977	Section 146 of the *Heritage Act* requires that the Heritage Council be notified if a relic is uncovered during construction and if it is reasonable to believe that the Heritage Council is unaware of the location of the relic. This provision has been incorporated into mitigation measures for the project, summarised in **Section 7.2**.

Legislation	Requirement for approval
Waste Avoidance and Resource Recovery Act 2001 (WARR Act)	The WARR Act encourages the most efficient use of resources in order to reduce environmental harm in accordance with the principles of ESD. Resource management for the project has applied the resource management hierarchy specified in the WARR Act, being: > Avoidance of unnecessary resource consumption > Resource recovery, including reuse, reprocessing, recycling and energy recovery > Disposal. Waste management is discussed in **Section 7.12**.

4.1.3 Commonwealth government requirements

4.1.3.1 Environmental Protection and Biodiversity Conservation Act 1999

The EPBC Act is the Commonwealth Government's central piece of environmental legislation. Under Part 3 of the EPBC Act, approval from the Commonwealth Minister for the Environment is required for an action that:

> Has, will have, or is likely to have a significant impact on a matter of national environmental significance (MNES)
> Is undertaken on Commonwealth land and has, will have, or is likely to have a significant impact on the environment
> Is undertaken outside Commonwealth land and has, will have or is likely to have a significant impact on the environment of Commonwealth land
> Is undertaken by the Commonwealth and has, will have or is likely to have a significant impact on the environment.

Under the EPBC Act proposed 'actions' that have the potential to impact on MNES or the environment of Commonwealth land, or are being carried out by a Commonwealth agency, must be referred to the Commonwealth Government. If the Commonwealth Minister for the Environment determines that a referred project is a 'controlled action', the approval of that Minister is required for the project in addition to the approval from the NSW Minister for Planning and Public Spaces.

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

> Listed threatened species and communities (section 18 & section 18A) (refer to **Section 7.1** and **Appendix B**)
> Listed migratory species (section 20 & section 20A) (refer to **Section 7.1** and **Appendix B**)
> The heritage values of a National Heritage place (section 15B & section 15C) (refer to **Section 7.3**).

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 Part 5, Division 5.2 of the EP&A Act. As the project is a controlled action, the Commonwealth Minister for the Environment would need to issue a separate approval for the project to DPIE.

Further information on the assessment process is available on the DAWE website (https://www.environment.gov.au/epbc).

An approval under the EPBC Act would be required prior to commencement of construction.

5. Project description

This chapter provides a detailed description of the project features including infrastructure components, land acquisition requirements, proposed construction methodology and operational aspects based on current available design information.

This chapter also addresses the actions proposed for any uncertainties associated with the assessment.

5.1 Project overview

The project would connect Snowy 2.0 to the NEM as described in **Section 1.1**.

The key elements of the project are shown on **Figure 1-2** and include:

- A new 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 would occupy a footprint of about 300 metres wide by 600 metres long inclusive of an approximate 25 metre to 45 metre wide cleared APZ surrounding the switchyard
- Upgrade and widening of an existing access road off Elliott Way to the substation including the construction of new driveways into the 330 kV and 500 kV switchyards
- Two new 330 kV overhead double-circuit transmission lines from the Snowy 2.0 cable yard to the new substation:
  - Total length of each line is approximately nine kilometres
  - Located in a transmission corridor ranging in width from approximately 120 metres to 200 metres
  - Each line would comprise approximately 21 steel lattice structures up to 75 metres in height
- Short overhead 330 kV transmission line connection (approximately 300 metres in length) comprising both steel lattice structures and pole structures as required between the substation and Line 64
- Construction of up to 10 kilometres of new access tracks (Option A) or eight kilometres (Option B) to the transmission structures, and upgrade to existing access tracks where required. Option A minimises disturbance within a mapped high risk 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 metres wide by 30 metres long) to support the transmission line construction activities carried out at higher elevations
- Ancillary construction activities, including the establishment of tensioning and pulling sites for conductor and earth wire stringing, crane pads, site compounds and equipment laydown areas, and the transport and haulage of equipment and waste to and from the project area
- The accommodation of up to 20 construction workers at the Snowy 2.0 works accommodation at Lobs Hole with the remainder of the construction workforce being accommodated as required in the nearby townships of Tumbarumba, Talbingo, Tumut, Adaminaby, Providence Portal and Cooma.

5.2 Project elements

5.2.1 Substation

The land where the substation is located would be acquired from FCNSW by freehold acquisition.

The substation is expected to occupy an area of about 300 metres wide by 600 metres long inclusive of an APZ and laydown areas for materials and equipment during construction.

The substation would generally be orientated in a north-south direction and would be set back approximately 70 metres from Elliott Way. The boundary of the APZ would extend to the road corridor of Elliott Way on the north east side.

The substation switchyard would comprise a level benched area on which all high voltage and ancillary substation equipment and buildings would be located. This would generally include (but not be limited to):

- Up to three 500/3300 kV three-phase or up to nine single-phase transformers to convert the voltage from 330 kV to 550 kV to support future 500 kV transmission line augmentations to TransGrid's network
- Approximately three ancillary transformers to provide low voltage supplies
- Two 500 kV reactors
- 330 kV and 500 kV switchbays
- Onsite buildings to house substation controls, secondary systems equipment and amenities
- Oil containment and stormwater system (including bunding and containment tank(s) or a dam)
- Lightning masts
- Steel gantries
- Security fencing.

The indicative substation layout is shown on **Figure 5-1**.

The transmission connection would connect to Line 64 via the 330 kV switchyard. Whilst not required for the grid connection of Snowy 2.0, the 500 kV yard (as shown in **Figure 5-1**), which includes the transformers and other equipment, is required to provide the connection point of the southern network reinforcement project (HumeLink). In readiness to support the connection of HumeLink, the 500 kV component of the substation has been included in this CSSI application.

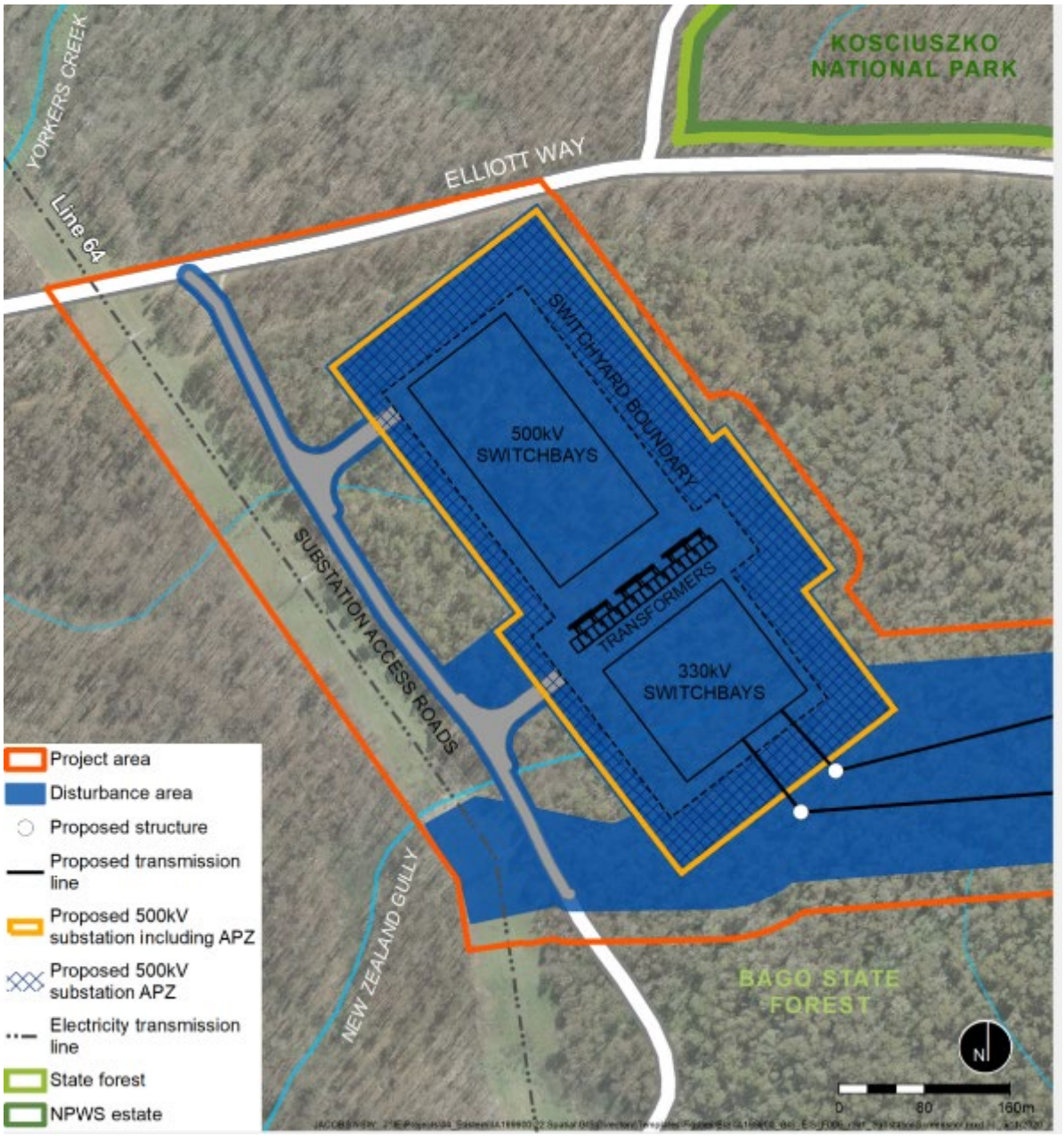


Figure 5-1 Indicative substation layout

5.2.1.1 Safety and security

Security fencing compliant with current TransGrid standards for substation fencing would be installed. This would include generally three metre high palisade security fencing on all sides of the substation. The security fence would be comprised of a galvanised steel (or similar) material and topped with barbed or razor wire.

To comply with TransGrid's safety requirements, additional security measures at the substation would include:

- Security cameras within the switchyard
- Safety and public information signage on both the substation and surrounding transmission line structures
- APZ extending between approximately 25 metres and 45 metres from the substation boundary, which would be cleared of vegetation and maintained to address bushfire risk.

5.2.1.2 Lighting

Interior and exterior lighting would be installed at the substation. The external lighting would be installed in a manner that aims to minimise light spill to areas beyond the substation boundary fence.

The onsite buildings would be fitted with lighting, general power outlets, exit signs and smoke detectors.

5.2.1.3 Access and parking

A permanent access driveway would be established to the substation off Elliott Way, refer to **Figure 5-1**. The access driveway would be designed to allow passenger vehicle access for employees undertaking maintenance operations, and would also be suitable to allow larger vehicles access as required (such as for equipment replacement).

Given the limited operational requirements for the substation, it is unlikely that any formal or dedicated parking facilities would be provided within the substation. However, sufficient cleared hardstand areas within the site, would be available for any vehicles that visit the substation during operation (such as for routine maintenance or inspections).

5.2.1.4 Stormwater and drainage

An impervious surface and an oil containment system would be installed as part of the substation. The on-site stormwater drainage system would allow stormwater flows from the site to be diverted appropriately away from the switchyard. The stormwater and drainage system would be developed during detailed design, however is expected to include a series of surface drains which would connect with a grid of stormwater pits within the substation site.

5.2.1.5 Landscaping

Landscaping of the substation site would be undertaken in consultation with FCNSW, however is expected to involve the planting of groundcover species to stabilise disturbed areas within the cleared APZ. Existing trees along Elliott Way would be retained to screen views of the substation from the road.

5.2.1.6 Utility connections

Given the remoteness of the substation site, it is expected that existing water supplies and sewage connections are not available to service the on-site buildings. As such, it is expected that a rainwater tank would be installed at the substation for the provision of freshwater and a wastewater septic system with pump out sewer would be incorporated into the amenities design.

Low voltage electricity supplies to the on-site buildings (for elements such as lighting and control room operations) would be provided via the auxiliary transformers at a lower voltage.

5.2.2 Transmission line connection

5.2.2.1 Transmission line structures

Two 330 kV double-circuit transmission lines would be constructed from the Snowy 2.0 cable yard to the substation and would be located side-by-side. The cable yard is the distribution and transition point from where electricity generated from the Snowy 2.0 underground power station complex would transition from underground to overhead.

Each transmission line would comprise approximately 21 steel lattice structures (approximately 42 in total combined). Each structure would be up to 75 metres in height supporting two circuits comprising up to twelve conductors and a two overhead earth wires and/or optical ground wires. The transmission structures supporting each double-circuit transmission line would generally be located adjacent to each other and supported at ground level on a combination of concrete pile, rock anchor and mass concrete style foundations.

Geotechnical investigation works would be carried out at each structure location to verify the type of foundation that would be required. From the last structures at the western extent, the overhead conductors would enter the substation and connect to the substation gantry, which would then connect into the relevant 330 kV switchbays.

From the substation, an approximate 300 metre long 330 kV double circuit overhead connection would be constructed to cut into Line 64. This short connection would comprise both steel lattice structures and concrete or steel pole structures as required.

Due to the location of the transmission lines in an alpine area, the structures would be designed to handle ice and snow loads in addition to conventional structure loading requirements. The distance between structures would be designed to manage the sag and swing movement of suspended conductors.

A concept image of a steel lattice structure is shown on **Figure 5-2**.

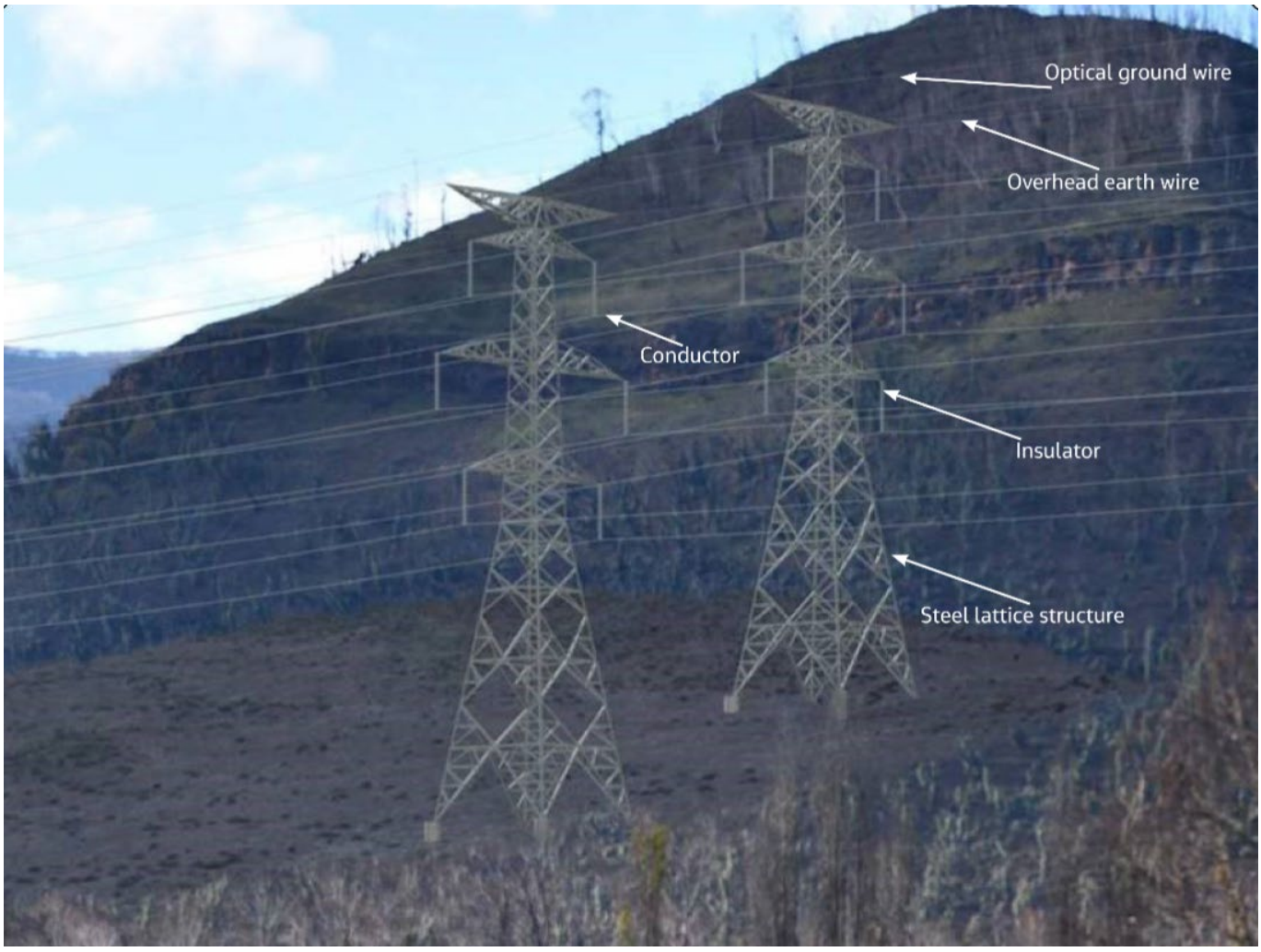


Figure 5-2 Indicative concept design for the transmission structures

To protect the transmission lines in the event of a lightning strike, adequate earthing controls would be installed as outlined in **Table 5-1**.

Table 5-1 Transmission line earthing

Earthing Component	Description
Earthing	Each structure would require earthing connections to 'ground' the structure in the event of a lightning strike. The fixtures would consist of earthing strips and earthing stakes consisting of galvanized steel or copper depending on the soil conditions. The earthing strips would be buried horizontally, just below the ground surface while earthing stakes would extend down vertically into the soil. Each structure would have one earthing fixture per leg (four in total).
Overhead earth wires	Each transmission line would have two earth wires strung along the top of each structure to provide protection to the conductors in the event of a lightning strike. The earth wires would consist of one standard ground wire and one OPGW. The OPGW would serve the dual purpose of protecting the line in the event of a lightning strike, whilst also providing a communications link between the Snowy 2.0 cable yard and the substation to aid in the monitoring and protection of the line. The earth wires would consist of an aluminium conductor steel reinforced line with a diameter of about 16 to 18 millimetres.

5.2.2.2 Construction corridor and easement

The transmission lines would be located within an easement which would provide a right of access for TransGrid to construct, operate and maintain the transmission lines. The terms of the easements would be negotiated with NPWS and FCNSW as part of the property acquisition process as discussed in **Section 5.4.1.1**. The final easement would be surveyed following the completion of construction and is expected to be about 120 to 140 metres wide.

Easements are sized to ensure standard safety clearances under high wind conditions, provide an area where vegetation heights can be controlled and provide ease of access for ongoing maintenance and repairs.

Vegetation with a potential mature height that could infringe upon the safe clearance distances below the height of the lowest conductor and vegetation within the blowout zone would need to be cleared. Any trees adjoining the transmission corridor which have the potential to strike the conductor in the event of failure (referred to as hazard trees), would also need to be cleared.

With consideration to the transmission connection concept design, LiDAR analysis was performed to determine the zones of vegetation clearance encompassing vegetation along the transmission corridor, vegetation within the conductor blowout zone and hazard trees. This determined a worst case variable transmission corridor width ranging from approximately 120 metres to 200 metres. The vegetation clearing zones are captured in the project disturbance area as shown on **Figure 1-2**.

Further refinement of the transmission corridor within the project area, including final structure locations and vegetation clearing locations, would occur during detailed design, which would further guide the permanent easement width along the extent of the transmission connection. Once established and with consideration to the conductor blowout, transmission structure spacing and removal of hazard trees, the permanent managed easement along the extent of the transmission connection is expected to be in the order of approximately 120 to 140 metres.

Ensuring the clearances are achieved is critical in managing the risk of bushfire, ensuring public safety and maintaining system reliability.

5.2.3 Access tracks and roads

Project area east would be accessed via Lobs Hole Ravine Road and Mine Trail Road. These roads have been upgraded as part of Snowy 2.0 and do not form part of this project.

Elliott Way, which is a sealed road would provide the primary transport route to the western extent of the project area including the substation. A new access road would be established from Elliott Way to the substation to facilitate construction and would remain in place throughout its operation.

New access roads and tracks would be required to allow for vehicles, plant, machinery and equipment to be transported to the work locations, including all transmission structures and the helipad during the construction phase. The access tracks would be approximately five metres wide and would be retained to facilitate ongoing maintenance activities of the transmission lines and provide access during emergency events such as bushfire.

The new access tracks and roads would be of suitable grade to allow deliveries of large equipment and plant (such as transmission structures, transformers, concrete trucks, cranes, elevated work platforms etc) and allow for the turning radius of the vehicles. Where required adequate sediment retention basins would be included in the access track design to manage erosion sedimentation and associated impacts on receiving waters.

The indicative layout of the access tracks to be established including the existing road network to be used is shown on **Figure 1-2**. Given the complex terrain and steep gradients, the establishment of linear access tracks was not feasible at some locations. Consequently, their design and location were primarily driven by the existing terrain. The final layout of access tracks would be established as part of the detailed design process.

A new waterway crossing would be required at Sheep Station Creek for the access track in this location. This crossing is expected to be either a small bridge or a large culvert.

5.2.4 Helicopter landing pad

To facilitate construction of the project, helicopters may be used to deliver materials and equipment, particularly atop Sheep Station Ridge. To enable helicopters to operate safely and allow easy access to the site, a helicopter landing pad would be required. The preferred location for the helicopter landing pad is at the top of Sheep Station Ridge, refer to **Figure 1-2**. The helicopter landing pad is expected to occupy an area of approximately 30 metres by 30 metres.

5.3 Project staging and timing

Construction of the project is anticipated to commence in early 2022 and take approximately 39 months to complete. Estimated timing and staging of the main project activities is set out in **Figure 5-3**.

	2022				2023				2024				2025
Activity	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
330 kV switchyard													
Site mobilisation													
Site access road													
Site establishment clearing and earthworks													
Construction													
Commissioning													
Rehabilitation and demobilisation													
500 kV substation													
Site mobilisation													
Site access road													

Activity	2022				2023				2024				2025
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1
Site establishment, clearing and earthworks													
Construction													
Rehabilitation and demobilisation													
Transmission line connection and cut-in													
Site mobilisation													
Access track construction													
Vegetation clearing along the corridor													
Construction													
Commissioning													
Rehabilitation and demobilisation													

Figure 5-3 Indicative timing for the construction of key project elements

With reference to **Figure 5-3**, the commissioning of the 500 kV component of the substation has not been included as its commissioning timeframe is dependent on the future completion of HumeLink.

The construction program is indicative only and may change based on potential factors including but not limited to:

- Additional works carried out as part of detailed design which may delay construction commencement
- Unseasonal weather conditions delaying construction works
- Unexpected discovery of threatened biodiversity or cultural heritage items resulting in works ceasing in a given location until the matter is investigated and rectified
- Completion of equipment installation at the substation may be affected by operational timing changes of Snowy 2.0.

5.4 Construction activities

The construction methodology outlined in the subsequent sections would be subject to confirmation by the construction contractor.

Approved construction works would commence firstly with the construction of the access tracks to the substation and transmission structure locations. Construction of the helipad (if required) is also expected to commence in the initial stages. Once suitable access has been established, construction of the substation and transmission lines would commence and occur concurrently as detailed in **Section 5.3**.

5.4.1 Site Preparation and pre-construction activities

Pre-construction activities would typically include:

- Site mobilisation once relevant approvals have been granted, property access arrangements are in place between FCNSW and NPWS, and agreements with construction contractors has been achieved
- Surveying and clearly marking out the approved disturbance footprint and any environmental avoidance areas

- Installation of appropriate stormwater and diversion drainage and erosion and sedimentation control works prior to ground disturbance and vegetation clearing
- Informing 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
- Establishment of the construction compound and equipment laydown areas at the substation site and at Lobs Hole. The compound at Lobs Hole would be located within the approved disturbance footprint of Snowy 2.0.

5.4.1.1 Property acquisitions

The project would not require the acquisition of privately owned land, however would involve the acquisition of land from FCNSW and NPWS. The substation site is expected to be acquired from FCNSW as freehold land while the land subject to transmission connection corridor would be acquired in the form of easements with NPWS and FCNSW. The easements would provide TransGrid the necessary access rights to operate and maintain the transmission lines and to ensure that the necessary development setbacks are in place. The acquisition of land associated with the project:

- Is not expected to affect forestry operations carried out by FCNSW as the area is not actively forested given its low commercial value
- Would not restrict pedestrian access by recreational users of KNP and Bago State Forest, however would restrict future developments along the transmission corridor. This includes any development associated with potential future recreational activities such as future camping provisions at Lobs Hole, which may encroach on the easement.

5.4.2 Substation construction methodology

5.4.2.1 Site establishment and vegetation clearance

The main site establishment activities at the substation would include:

- Vegetation clearing across the substation site and APZ. This would also involve the stripping and stockpiling of topsoil for later use. Vegetation clearing is expected to be carried out utilising a bulldozer equipped with a tree pusher, however would be confirmed in consultation with FCNSW
- Establishment of a site compound and laydown area within the disturbance areas associated with the substation and APZ. The site compound would be in place 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, first aid rooms, chemical/fuel stores and stockpile areas
- 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.

5.4.2.2 Earthworks

Excavation works would be carried out 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. Bulk earthworks would also be required to establish the level surface for the substation bench.

Based on the substation design it is estimated that 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 FCNSW.

Where excavated spoil is not appropriate for reuse on site, it may be necessary to import additional spoil 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).

5.4.2.3 Civil and building works

Civil works would generally involve the establishment of concrete foundations for the high voltage equipment and buildings within the switchyard, construction of stormwater drainage and oil containment infrastructure and establishment of cable trenches and installation of subsurface cables. Installation of electrical equipment for the substation would be undertaken using cranes to lift in the required equipment.

Following establishment of the foundations, onsite buildings would be constructed and services installed including general lighting, power and ventilation.

Additional elements such as security fencing would also be installed.

5.4.3 Transmission line construction methodology

5.4.3.1 Site establishment

A suitable construction compound and laydown area (approximately 100 metres by 100 metres) would be established within a cleared area at Lobs Hole provided by Snowy Hydro outside the project area. It is expected that this area would be located within the Snowy 2.0 disturbance footprint. A second site compound would be established within the disturbance area reserved for the substation to service construction activities in project area west.

The site compounds would be in place throughout the construction period and are expected to contain demountable offices, equipment laydown areas, vehicle and equipment storage, maintenance sheds, chemical/fuel stores and stockpile areas.

5.4.3.2 Access track construction and upgrades

To facilitate the construction of each transmission structure and the helipad, access tracks would be established as shown on **Figure 1-2**. Access track construction works would utilise a minimum disturbance approach and would be unsealed. Access track construction works would include the following key activities:

- Erosion hazard assessment and the implementation of necessary erosion and sediment controls (including sediment retention basins as required) prior to or immediately after vegetation clearing and before ground disturbing works commence.
- Vegetation clearing within the approved corridor using a clearing method agreed with NPWS and FCNSW. This is expected to be carried out both manually in the areas of steeper slopes and machine clearing where access can be safely achieved
- Grubbing and bulk earthworks (cut and fill) using an excavator
- Stockpiling topsoil and subsoil resources for re-use in rehabilitation
- Laying and compaction of a suitable rock aggregate/road base
- Placing material at the approaches, and on the bed and banks of the waterway to be crossed to enable access of heavy vehicles hauling plant and equipment between the structures
- Grading and/or reshaping of existing tracks where required, within the existing access track width (no road widening)
- Minor excavations followed by laying and compaction of crushed rock or gravel, to improve the existing track surface and drainage.

Construction in project area east would utilise Lobs Hole Ravine Road and Mine Trail Road which has been upgraded and extended as part of Snowy 2.0. Depending on the conditions of these roads prior to the commencement of construction, some upgrades may be required. The repair and upgrade to existing access tracks would involve:

- Grading and/or reshaping of existing tracks, within the existing access track width (no road widening)

- Minor excavations followed by laying and compaction of crushed rock or gravel, to improve the track surface and drainage.

5.4.3.3 Clearing

Prior to clearing occurring, vegetation clearance zones would be marked-out (using high visibility taping or similar) within the defined surveyed easement corridor.

The method of tree clearing along the transmission corridor is expected to be carried out manually using chainsaws in manner that preserves the root balls to reduce impact on soil stability. In areas of flatter terrain, clearing may be carried out using a bulldozer equipped with a tree pusher or an excavator as agreed to with NPWS and FCNSW. On completion of vegetation clearing and grubbing, topsoils assessed as suitable for recovery and rehabilitation would be stripped and stockpiled within the disturbance area. Following the clearing of defined sections, the ground would be re-shaped to the previous contour, then compacted followed by the spreading of the stockpiled topsoil over the disturbed areas. Where cleared vegetation can be mulched on-site, it would be spread out over exposed surfaces to stabilise the area and minimise erosion and sedimentation.

5.4.3.4 Helipad

Once access to the helipad site has been established, the site would be cleared of vegetation then levelled using an excavator. Suitable rock aggregate/road based would then be placed over the disturbed area and compacted. The helipad would be remediated after construction.

5.4.3.5 Transmission structures

Establishment of works sites

Complete vegetation clearing of an area of approximately 40 metres by 60 metres would be required around each transmission structure to allow for the laydown of materials and equipment and facilitate access for vehicles, plant and machinery during structure construction. Where the transmission line structures of the two double-circuit 330 kV lines are located directly side-by-side, the 40 metres by 60 metres cleared areas around the structure sites would overlap.

Given the steep terrain traversed by the transmission connection, level construction benches would be established within the 40 metre x 60 metre worksite at the majority of the transmission structure locations to allow for the safe operation of plant and equipment (namely elevated work platforms and cranes) during structure construction.

The actual size and number of benches required at each structure location would be determined during detailed design, however it is expected that up to two level benches would be required at the base of each structure with each bench being up to 20 metres x 20 metres in size. Construction benches would be constructed using an excavator utilising a cut-and-fill approach to establish the levelled area. The amount of bulk earthworks required to form the level bench would be dependent on the slope of the terrain at the bench location.

Structure foundations

Geotechnical investigation works using a mobile drill rig would be carried out at each structure location once the access tracks have been established. This would be required to determine the most appropriate foundation design for each structure including the required depth of excavation required for each foundation.

It is expected that a combination of concrete pile, rock anchor and mass concrete style foundations would be used at structure locations along the transmission connection corridor. Given the uncertainty surrounding geological conditions at the structure sites, it is anticipated that the depth of the foundation may be in the order of approximately 10 to 20 metres below the ground surface (mbgs) in good material. Foundation depths at some structure locations may exceed this should they occur in unstable soil. Mass concrete type foundations would generally involve establishing an open excavation, followed by the installation of steel framework and backfilling with concrete, whilst pile type foundations would involve boring four boreholes at each structure leg location, followed by backfilling with concrete. Rock anchors are high tensile steel rods which would be grouted into pre-

drilled holes at each structure leg location to provide the anchor point for each leg. Blasting may be required should rock be encountered.

Structure assembly

The steel lattice structures would be transported to each structure location via heavy vehicle in parts and assembled on-site. Mobile cranes would be used to move steel members and structure sections around the worksite and position the structure section to allow work crews to manually bolt the sections together. The base of each structure would be secured to the foundations via holding down bolts at each structure leg. The general method of structure assembly is shown on **Photo 5-1**.

Photo 5-1 Structure assembly using cranes

5.4.3.6 Stringing of conductors and earth wire

A process called ‘tension stringing’ would be used to string the conductors and overhead earthwires between the transmission line structures using hydraulic tensioning and pulling equipment. This process would ensure that the conductors and earthwires would remain above the ground during the stringing of each section.

Tensioning and pulling sites would be set up within the 40 metre x 60 metre area around the structure or at a suitable location within the disturbance area of the transmission corridor. The extent of earthworks carried out at these sites would be determined by the terrain.

Sheaves (or pulleys) would be attached to the top of the structures in readiness for stringing work using an elevated work platform. The stringing process would commence with the pulling out of a light weight draw wire or rope across the extent of the transmission line section being strung. This draw wire or rope would either be pulled and dropped into the sheaves using a drone or pulled out across the transmission corridor by a vehicle or machine (such as a dozer) then lifted by winch or crane and manually placed in sheaves by work crews climbing the structure or via an elevated work platform.

The draw wire or rope would then be attached to the earth wire or conductor drum (depending on which is being strung) and would be pulled through the sheaves under tension using specialised tensioning and pulling equipment. Once the intended section has been strung and the correct tension has been established, the conductor/earth wire would be terminated at each end, clipped into position and the sheaves removed.

The conductor and earth wire stringing process are shown on **Figure 5-4**.

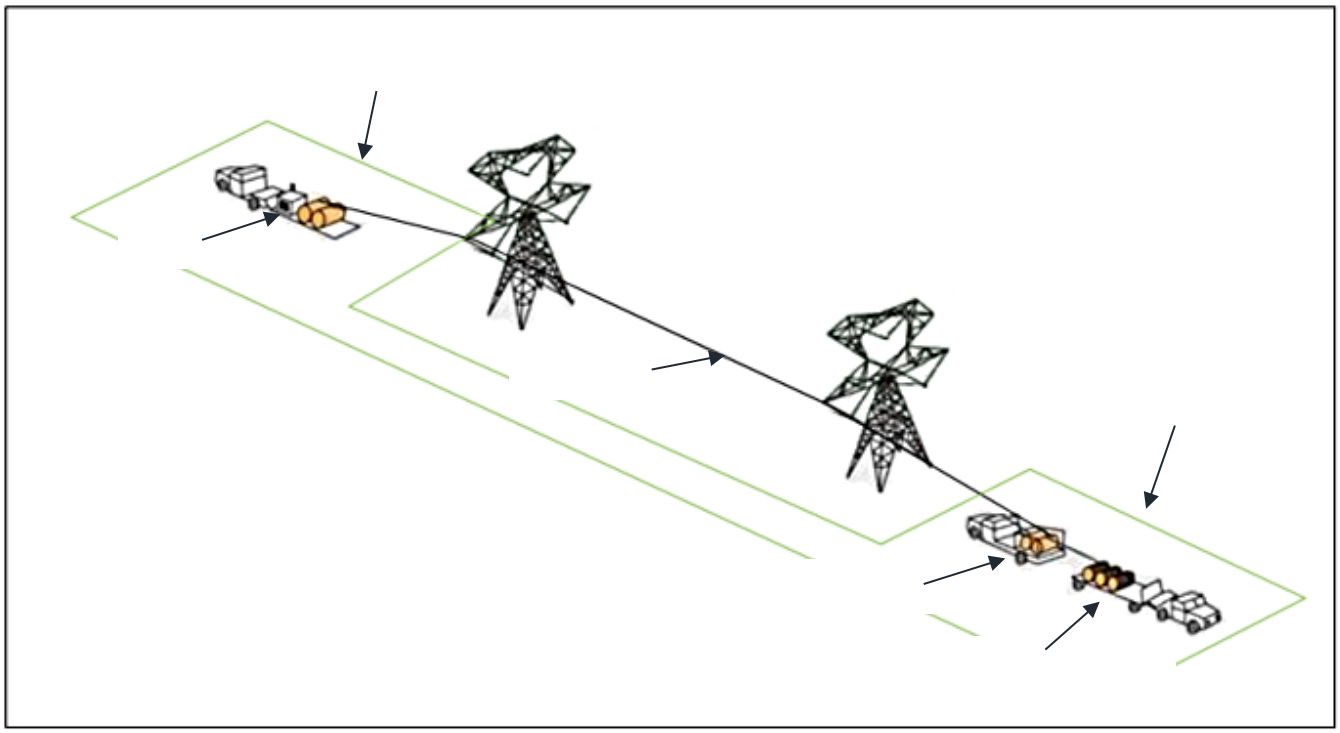


Figure 5-4 Conductor and earth wire stringing process

5.4.4 Commissioning

Following construction of the 330 kV switchyard component of the substation and the transmission connection, commissioning works would be carried out which would generally include testing of all high voltage equipment and ensuring all protection, control and metering equipment is operating correctly. Additionally, all necessary cut-in works to Line 64 would be completed and relevant testing undertaken.

The new transmission lines and substation would then be placed into standby in readiness for Snowy 2.0 to be completed. Once Snowy 2.0 becomes operational, the high voltage equipment would be energised and the project placed into service.

5.4.5 Plant and equipment

The indicative plant and equipment used for the key elements during construction is outlined in **Table 5-2**.

Table 5-2 Indicative equipment

Works element	Type of equipment
Substation	Excavator, dump truck, bulldozer, tree pusher, roller, grader, truck and dog, drilling rigs, concrete truck and pump, backhoe, semi-trailers, trencher, water truck, light vehicles, compressor, generator, drills, mobile cranes, whacker rammers, bobcat, elevated work platforms, flatbed hiab truck, tilt tray truck, drill rig and hand tools.
Access tracks and roads	Excavator, dump truck, bulldozer, grader, truck and dog, water cart, light vehicle, compressor, piling rig, agitator truck, concrete truck, semi-trailer and roller.

Works element	Type of equipment
Transmission line construction and stringing	Bulldozer, tree pusher, mulcher, excavator, roller, chainsaws, piling rig, drill rig, truck and dog, concrete truck and pumps, semi-trailers, mobile cranes, bobcat, tensioning and winch equipment, elevated work platform, helicopter and drone.

5.4.6 Construction resources

5.4.6.1 Materials

Indicative construction materials would include fuel, pre-fabricated transmission structure sections, transmission structure fittings, overhead earthwire, electrical conductor, timber, scaffolding, explosives (potentially), steel, concrete, electrical equipment, geotextiles, aggregate/road base and cement. The sources of construction materials are yet to be determined. It is expected that construction materials would be sourced from several different locations including nearby towns such as Tumbarumba and Tumut with some items and specialised equipment being sourced from major cities such as Canberra, Sydney and Melbourne.

5.4.6.2 Water

Approximately 60,000 kilolitres of water is expected to be required over the duration of construction works. It is expected that water would be required for:

- Amenities at the substation site
- Dust suppression during excavation works and for stockpiles
- Concrete production
- Access track construction
- Testing of the spill oil containment system following construction of the substation.

It is expected that the water would be sourced from nearby towns such as Tumbarumba and Tumut and trucked in for works occurring in project area west. All water to be used during construction in project area east would be supplied by Snowy Hydro from their Snowy 2.0 operations at Lobs Hole and would be sourced from Talbingo Reservoir.

5.4.6.3 Energy use

Power to support construction equipment is expected to be sourced from mobile diesel generators.

5.4.6.4 Waste

The management of waste would be detailed in a construction waste management plan (CWMP) and a spoil management strategy which would be developed during detailed design and construction planning.

Excavated material

Large volumes of excess excavated material would be generated as part of bulk earthworks during the construction of the substation, access tracks and the transmission structures. The excavated material is expected to contain a mixture of rock of varying diameter and finer grade soil. The management of excavated material and spoil would be defined by the spoil management strategy and is expected to be managed as outlined in **Section 5.4.7**.

An estimated breakdown of excess excavated material (material which cannot be reused as fill material) anticipated during bulk earthworks is provided in **Table 5-3**.

Table 5-3 Estimated spoil volumes

Component	Project area west (cubic metres)	Project area east (cubic metres)
Substation and access road	11,300	-
Access tracks	19,500	120,000
Structure foundations and benches	7, 000	207,000
Total	37,800	327,000

*The spoil volumes are estimates only and may be subject to change upon completion of detailed design

Vegetation

The management and disposal of timber and vegetation debris would be developed in consultation with NPWS and FCNSW and documented in the CWMP. Vegetation wastes is expected to be managed by a combination of:

- Processing timber through a timber chipper followed by distributing the chips across exposed areas of the transmission corridor to assist in the prevention of erosion
- Relocation of felled timber containing hollows that could provide fauna habitat into the adjoining forested areas
- Removal of timber off-site and stockpiling at a suitable location for potential re-use as building material or firewood.

General construction waste

Construction waste such as used materials and packaging would be placed in dedicated waste containers at the work sites and the construction compounds at Lobs Hole and the substation site. Construction waste would be removed from the project area by truck and disposed of at a suitably licensed facility. Waste facilities that would likely be used would include Tumut waste and recycling centre, Talbingo waste depot and Tumbarumba landfill. Waste generated during construction in project area east may also utilise Cooma landfill and Adaminaby waste transfer station.

5.4.7 Management of excavated material

The strategy for the management of excavated material would aim to maximise the beneficial re-use of materials for construction activities, which may include the reuse of road base, construction benches at the transmission structure sites, landscaping or other uses as part of the substation build, with the excess spoil to be suitably managed and disposed of. The strategy for the management and disposal of excavated material in project area west and project area east would be documented in the spoil management strategy and is expected to be managed as outlined below.

5.4.7.1 Project area west

Excess spoil generated in project area west (approximately 38,000 cubic metres), which cannot be reused is expected to be disposed of via the following methods:

- Temporary or permanent land based disposal off-site
- Spreading out smaller volumes waste spoil within the transmission corridor in a manner under consultation with NPWS and FCNSW.

Landfill facilities capable of accepting the type and volumes of the spoil are currently being identified and would continue to be identified during detailed design and prior to construction.

5.4.7.2 Project area east

Excess spoil generated in project area east (approximately 327,000 cubic metres) would be transported by truck from the work locations via Lobs Hole to the Ravine Bay emplacement area,(refer to **Figure 1-2**) where it would be managed and disposed of in accordance with the Snowy 2.0 Main Works approval. The haulage of this material would be confined to the newly formed access tracks and the established access tracks at Lobs Hole formed as part of Snowy 2.0. These areas would be closed to the public for the duration of construction.

The extent of the emplacement area and total approved volume of spoil to be disposed is 4,500,000 cubic metres, of which 2,800,000 cubic metres is expected to be used for Snowy 2.0. There is sufficient volume for all of the project's excavated material to be placed in the Ravine Bay emplacement area. Additionally, no modifications to the access road between Lobs Hole and the Ravine Bay emplacement area would be required.

At Ravine Bay, material generated during drilling and blasting carried out as part of Snowy 2.0 would be placed within Talbingo Reservoir up to the full supply level (FSL) to establish the pad extending out into the bay, material would then be placed above FSL on-land in a new constructed landform. Excess excavated material generated in project area east would then be combined with the Snowy 2.0 Main Works material at this site. The material would be placed on the pad and the existing landform would be sculpted to establish a natural landform consistent with the surrounding environment and future recreational plan for the area under consultation with NPWS. The final agreed landform and its rehabilitation is documented in the Snowy 2.0 Main Works Detailed Rehabilitation Plan prepared by Snowy Hydro. An indicative artist impression of the Ravine Bay emplacement area following its rehabilitation is shown on **Figure 5-5**.

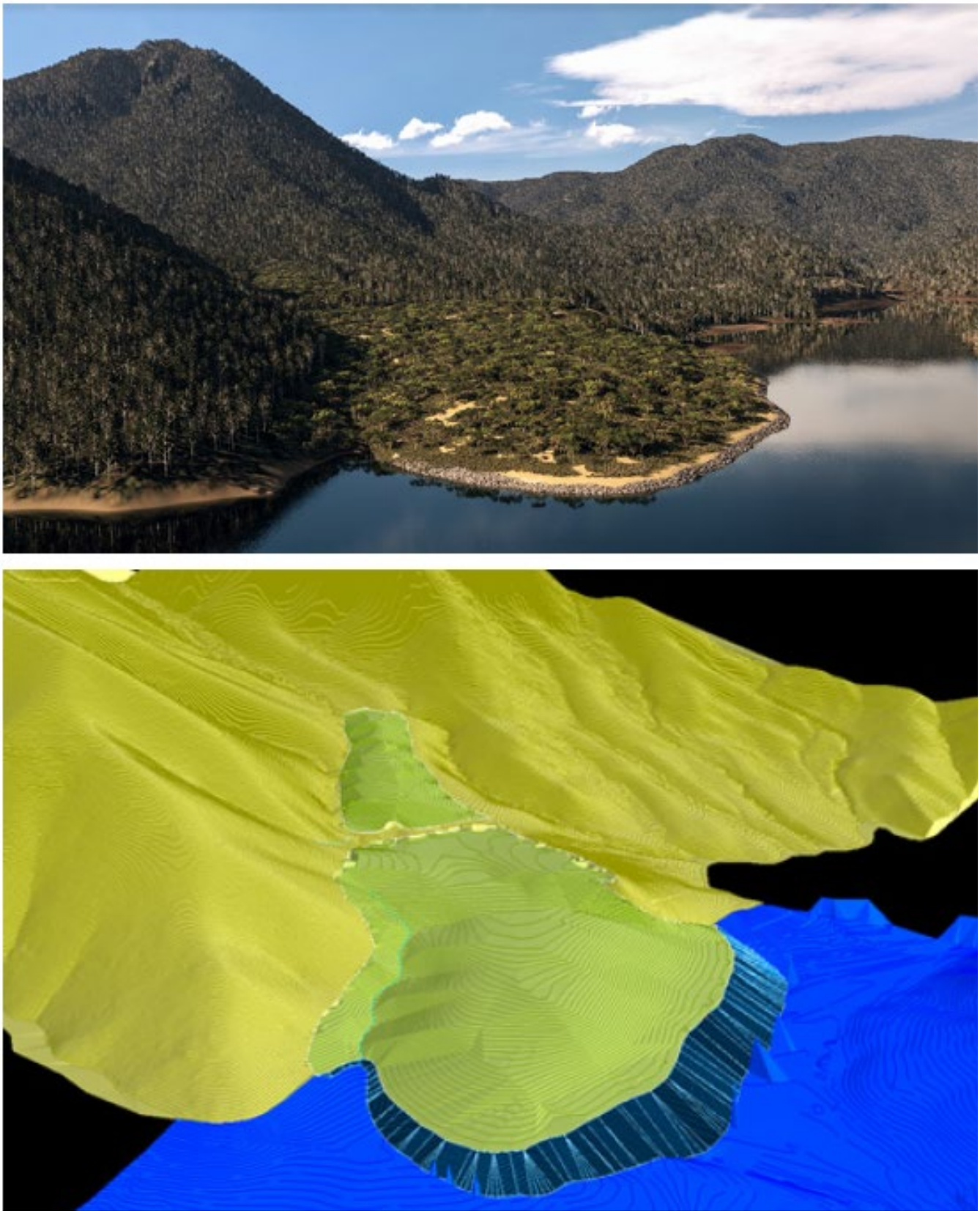


Figure 5-5 Ravine Bay emplacement area visualisation

(Source: Snowy 2.0 Main Works Preferred Infrastructure Report and Response to Submissions, EMM 2020)

5.4.7.3 Naturally occurring asbestos

The project traverses areas in the central portion of the project area which are mapped as ranging from low to high risk of containing NOA. These areas were visually investigated and re-classified as having very low potential to contain NOA. Notwithstanding this, further geotechnical investigations would be carried out once access is established to these locations to verify presence or absence of NOA within the areas of vegetation clearing and ground disturbance. If NOA is determined to be present, it would be managed and disposed of at a suitably licenced facility and in accordance with a dedicated NOA management plan. No NOA material if encountered would be disposed of at the Ravine Bay emplacement area. The implications and management of NOA are discussed further in **Section 7.5.3.1**.

Geotechnical investigations would assist in closing out uncertainties associated with NOA in this assessment.

5.4.8 Construction workforce and working hours

5.4.8.1 Workforce

The construction workforce would vary depending on the stage of construction and associated activities. During peak construction activities, the project would employ up to 140 workers, with an average workforce anticipated to be around 75 workers (depending on the stage of construction works). During peak construction about 50 workers would be within the project area east and about 90 workers would be within project area west.

5.4.8.2 Construction Working hours

Given the isolated location of the project with no residential dwellings potentially affected by noise generating works 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. Traffic movements to and from the project area would occur approximately one hour either side of the construction working hours and would continue throughout the hours of construction (i.e. traffic movements would occur between the hours of 5 am to 7 pm).

Out of hours works

A series of works outside the proposed construction hours are anticipated including (but not limited to) the following:

- Cut-over and commissioning of the transmission connection
- The delivery of equipment or materials as requested by police or other authorities for safety reasons
- Substation assembly (such as the oil filling of substation equipment)
- Emergency work to avoid the loss of lives and/or property and/or to prevent environmental harm
- Work timed to correlate with system planning outages.

5.4.8.3 Workforce accommodation

By motor vehicle, the travel distance between the substation site and the eastern extent of the project area at Lobs Hole is approximately 50 kilometres with a travel time of approximately one hour. To avoid excessive travel time and manage worker safety (particularly fatigue), about 20 construction personnel working in project area east are expected to be housed in Snowy 2.0 works accommodation. These workers are expected to be transported to the accommodation by bus at the commencement of their working roster. The balance of construction staff (approximately 30) during the peak periods of construction are anticipated to access the project area each day from surrounding townships of Talbingo, Tumut, Adaminaby, Providence Portal and Cooma.

Construction personnel working in project area west are expected to be accommodated in Tumbarumba, which is located approximately 40 kilometres (approximately 30 minutes' drive) from the substation site. Consultation undertaken with Snowy Valleys Council has confirmed that Tumbarumba has sufficient capacity to support the workforce in project area west.

5.4.9 Traffic movements

Construction vehicle movements would comprise vehicles transporting equipment, waste, materials and spoil, as well as vehicles driven by the construction workforce accessing the project area.

Estimated light and heavy vehicle movements on a typical day and during the peak construction period is outlined in **Table 5-4**.

Table 5-4 Estimated vehicle movements

Vehicles	Movement type	Estimated movements
Substation		
Light vehicles	Indicative daily movements (typical day)	50
	Maximum daily movements (peak construction period)	80
Heavy vehicles	Indicative daily movements (typical day)	30
	Maximum daily movements (peak construction period)	75
Transmission lines and access tracks		
Light vehicles	Indicative daily movements (typical day)	40
	Maximum daily movements (peak construction period)	70
Heavy vehicles	Indicative daily movements (typical day)	50
	Maximum daily movements (peak construction period)	75

* Indicative daily movements are based on current program of work and may change as a result of detailed construction planning
*One vehicle movement refers to one inbound and outbound trip.

It is anticipated that the maximum predicted daily heavy vehicle movements would occur during:

- Bulk earthworks and civil works during the substation construction
- Bulk earthworks and civil works during access track construction and establishment of the transmission structure foundation
- Transmission connection corridor vegetation clearing works.

The high volume of heavy vehicle movements during the above activities is attributed to heavy vehicles transporting large volumes of spoil, vegetative matter and debris from the project area.

Light personnel vehicle movements would be generally attributed to the construction workforce accessing the project area for work each day and accessing the work locations along the transmission connection corridor.

Under the single-phase transformer option, each of the nine single-phase transformers would be transported separately to the substation site on an oversize overmass (OSOM) vehicle. Other OSOM vehicles may also be required for the delivery of equipment but the total number of OSOM movements is expected to be low. These OSOM vehicles are anticipated to travel from Port Kembla to the substation in project area west.

5.4.9.1 Parking

Construction vehicles in the project area east are expected to consist of light utility and heavy vehicles required to facilitate construction (no personal vehicles). It is anticipated that these vehicles, when not in use, would be parked within the designated site compound area at Lobs Hole or at other designated areas as agreed with Snowy Hydro and NPWS.

Construction personnel working in project area west are expected to park within a designated construction workforce parking area, which would be established within the site compound area at the substation site. The

compound would also have sufficient capacity to support the parking of utility and heavy vehicles required to facilitate construction in the western portion of the project area.

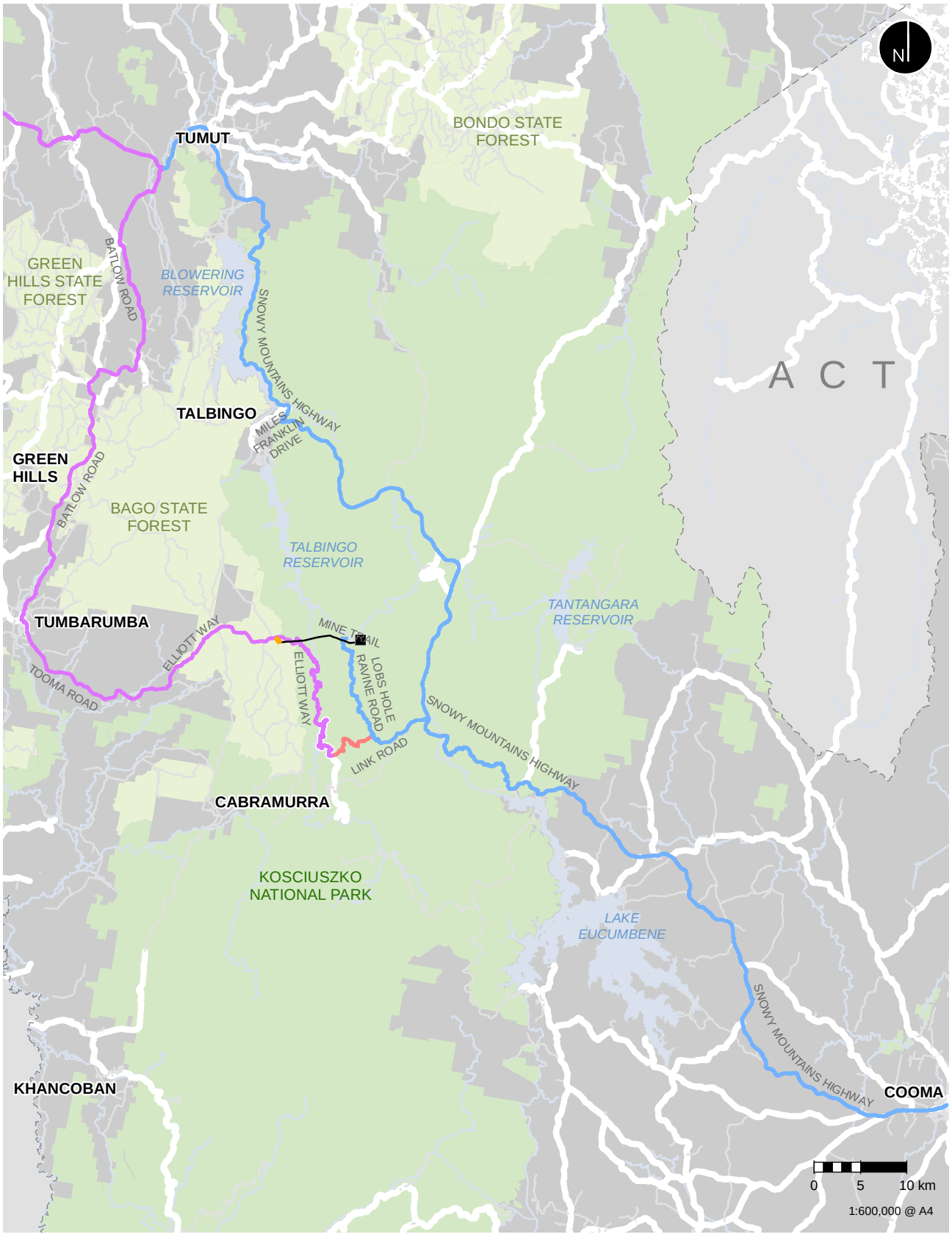
5.4.9.2 Primary transport routes

The anticipated haulage routes for heavy vehicles carrying materials and equipment to and from the project area are outlined below.

- Project area west: It is expected that majority of materials and equipment would travel along Hume Highway, Snowy Mountains Highway, Batlow Road, Tooma Road and Elliott Way
- Project area east: It is expected that the majority of materials and equipment would travel along Snowy Mountains Highway (via both from Cooma and Tumut), Link Road and Lobs Hole Ravine Road.

Once repairs to Link Road and Goat Ridge Road are complete following the damage from the Dunns Road bushfire, some traffic movements would occur along these roads for access to project area east and project area west.

It is expected that all heavy transport on the surrounding road network would occur between 5am to 7pm to limit noise impacts. The transport routes are shown on **Figure 5-6**.



Proposed transmission line
Proposed 500kV substation
Snowy 2.0 cable yard

Haulage routes
Project area east
Project area west
Access to east and west

Major road
Minor road
Waterway
Water body
State forest
NPWS estate

Figure 5-6 | Primary transport routes

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

5.4.10 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 5-5**. 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 the transmission lines) is not required. The rehabilitation plan would be developed in consultation with NPWS and FCNSW prior to construction and would be consistent where relevant with the approved Snowy 2.0 Rehabilitation Management Plan.

All rehabilitation activities would be accordance with the rehabilitation plan for the project.

Table 5-5 Rehabilitation strategy

Rehabilitation phases	Rehabilitation activities
Site preparation	During the preparation of the worksites including the substation, access tracks, helipad and transmission structure sites, the following activities would be carried out: 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: > Stabilisation of exposed areas and slopes and prepare the sites for revegetation > Installation of erosion and sediment controls at the work sites to manage impacts both during and post construction > Seeding soil slopes to assist in stabilisation > Planting vegetation on any higher risk slopes > Mulching of stabilised and revegetated areas where required.
Maintenance and monitoring	Ongoing maintenance and monitoring of rehabilitation works would include: > Monitoring of stabilised slopes and revegetated areas > Monitoring on the performance of erosion and sediment controls > Weed control and monitoring > Maintaining any fencing placed around rehabilitation areas > 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: > Removal of any temporary fencing around the works sites and site compound areas > Disassembling and removal on any temporary on-site infrastructure including site offices, amenities, equipment storage, and maintenance sheds within the site compound areas > Removal of all construction equipment and machinery from the site compound areas and work sites > Removal and disposal of any remaining stockpiles and other waste materials from the site compounds and other laydown areas > Removal of any temporary environmental controls (e.g. erosion and sediment controls) which are no longer required. The rehabilitation phases described above would coincide with the work site demobilisation activities.

Rehabilitation phases	Rehabilitation activities
Project decommissioning	> Removal all project infrastructure > Rehabilitating and revegetating of the project site.

5.5 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 foundation 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, foundation, 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 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.

5.6 Project decommissioning

The project would remain in service for the operational life-span of Snowy 2.0, which is anticipated to be 100 years. Prior to carrying out any decommissioning activities, a decommissioning plan would be prepared in consultation with NPWS and FCNSW. The decommissioning works are expected to involve:

- Removal of the overhead conductors and earth wires
- Dismantling of the transmission structures and earthing strips
- Decommissioning of the Snowy 2.0 switchbays and the substation
- Rehabilitating and revegetating the transmission corridor.

Access tracks may be left in-situ for future use by NPWS and FCNSW. This would be confirmed in consultation with NPWS and FCNSW during the preparation of the decommissioning plan.

Depending on the presence of future transmission lines connecting to the substation and electricity demand and grid requirements at the time of decommissioning, the substation may continue to remain in operation. If the substation would no longer be required, decommissioning would generally involve the following:

- Removal and disposal of all electrical infrastructure with considerations for potential re-use at other substation sites
- Removal of all structural supports and perimeter fencing
- Demolition of onsite buildings
- Rehabilitating and revegetating the substation site.

5.7 Ongoing design process

Full details of the design for the project are yet to be completed. The EIS is based on a current design status for each project element which may be refined through the detailed design process.

Further geotechnical investigations are required to finalise the detailed design and help address uncertainties associated with this assessment. Due to the inaccessible terrain geotechnical investigations would be carried out as access tracks are constructed for the project. As such detailed design would progress in parallel with initial construction activities. The design would continue to seek to minimise the final permanent disturbance area as much as possible.

Construction methods and how the project would be constructed may also vary subject to design refinements and the selection of the construction contractor. These details would be resolved as the design of the project progresses. As a result, the final design may vary from the design described in this EIS.

The assessment of the project within the EIS is based on consideration of reasonable worse case environmental impacts to allow flexibility in the design and construction methodology. The ongoing design of project elements would adopt the identified performance outcomes for the project as identified in the EIS.

The disturbance area is as small as possible to minimise environment impacts as far as practical. The alignment of the transmission line follows the shortest practical route linking Snowy 2.0 with the nearest existing transmission line outside of KNP. Similarly, the placement of access tracks has focused on selecting the shortest possible routes (based on topography) and avoiding sensitive areas where possible. The project's design consequently minimises, as far as practical, the overall area being impacted.

Any proposed variations that fall outside the disturbance area would be reviewed for consistency with the assessment contained in this EIS, including relevant mitigation measures and any future conditions of approval. If any proposed variations are not consistent with the approvals, appropriate modifications to the project approval would be sought in accordance with the requirements of the EP&A Act.

5.8 Interactions with Snowy 2.0

As detailed in this chapter, where the project interacts with aspects of Snowy 2.0, TransGrid is seeking consent for the following:

- The establishment and operation of a site compound, occupying an area of approximately 100 metres x 100 metres within the approved Snowy 2.0 disturbance area. This location will be agreed to with Snowy Hydro and would avoid further vegetation clearance and ground disturbance under this project
- Use of water supplied by Snowy 2.0 operations at Lobs Hole for dust suppression and other construction activities in project area east
- Use of concrete supplied by Snowy 2.0 batching facilities for the construction of the transmission connection and ancillary infrastructure as required in project area east
- Disposal of approximately 327,000 cubic metres of excess spoil at the Ravine Bay emplacement where It would be managed in accordance with the Snowy 2.0 Main Works approval
- Use of up to 20 beds at the Snowy 2.0 works accommodation by the construction workforce working in project area east.

6. Engagement

Stakeholder and community engagement has played an integral role in informing the design of the project and in scoping the content of the EIS. This chapter describes the consultation and engagement carried out to date, consultation proposed during the exhibition of the EIS, and future consultation. This chapter also addresses the following SEARs:

- A description of the engagement that was carried out during the preparation of the EIS, the key issues raised during this engagement and the proposed engagement strategy for the project if it is approved;
- During the preparation of the EIS, you should consult with the relevant local, State or Commonwealth Government authorities, service providers, community groups and affected landowners.

6.1 Engagement strategy

6.1.1 Engagement approach

TransGrid is committed to an engagement process that is proactive, transparent and represents a genuine desire to work with our stakeholders. Throughout the development of the project, TransGrid has and will continue to engage with affected and interested parties so that project planning is informed by input from stakeholders and communities in line with both regulatory requirements and TransGrid internal policies and standards.

A Community and Stakeholder Engagement Plan (CSEP) was developed for the project and outlines TransGrid's approach to community and stakeholder engagement.

The CSEP is based on TransGrid's overarching framework for community and stakeholder engagement which extends from the initial inception of the project, throughout the environmental assessment and exhibition phase and following approval of the project.

TransGrid has adopted the general principles of the International Association for Public Participation (IAP2) *Quality Assurance Standard* (IAP2, 2015) which is recognised as an industry standard.

6.1.2 Engagement objectives

TransGrid's community and stakeholder engagement objectives are to:

- Inform people about the project and seek their early input to identify issues and address them where possible
- Develop and maintain working relationships with stakeholders
- Demonstrate how issues and feedback are considered in the EIS, project design and delivery methodology
- Prepare meaningful and accessible communication materials for those impacted and interested in the project.

The engagement objectives of the EIS process are outlined in **Table 6-1**. To achieve these objectives, TransGrid aims to identify issues that may affect project outcomes and timeframes through ongoing two-way communication and open, honest and inclusive feedback and to integrate people's interests and feedback in project considerations.

This approach has and will continue to be followed through the three stages of the EIS process – preparation, exhibition and post-exhibition.

Table 6-1 Engagement objectives during EIS process

Stage 1: During the early stages of EIS preparation	Stage 2: During public EIS exhibition	Stage 3: Post -exhibition
Objective: Focus on early consultation, identification and consideration of issues with potential influence on project outcome and timeframe.	**Objective:** Focus on how issues have been addressed and how environmental and social impacts will be managed, and provide confidence in the management of impacts during construction and operation.	**Objective**: Focus on analysis of and response to issues raised in submissions and provide confidence that all issues have been considered and impacts are appropriately managed.

6.1.3 Stakeholder identification

Table 6-2 provides a list of key stakeholder groups that have been consulted as part of the project.

Table 6-2 Key stakeholder groups for the project

Stakeholder Group	Stakeholders
Government Ministers	> NSW Minister for Energy and Environment > Federal Minister for Energy and Emissions Reduction > Minister for Planning and Public Spaces > Commonwealth Minister for the Environment
Federal Member	Member for Eden-Monaro
State Member	Member for Monaro
Local government	> Snowy Valleys Council > Snowy Monaro Regional Council
Government	> DPIE > Environment, Energy and Science group of the DPIE (EESG) including the Biodiversity and Conservation Division (BCD) > NPWS (NPWS is both a government entity and an affected landowner) > FCNSW (FCNSW Is both government entity and an affected landowner) > Heritage NSW > DAWE > NPWS Southern Ranges Regional Advisory Committee > NSW Environmental Protection Authority (EPA) > DPI-Fisheries > NSW Department of Industry-Land and Water > Snowy Advisory Committee > Transport for NSW > Destination NSW

Stakeholder Group	Stakeholders
Local business	> Snowy Hydro > Tumut Regional Chamber of Commerce > Tumbarumba Chamber of Commerce > Batlow Fruit Co-Op > Berry Growers Association > Costa Group Berry Farmers > Tumut Bowling and Recreation Club > Tumut Bike Hire
Local tourism	> Tumut Visitor Information Centre > Tumbarumba Visitor Information Centre
Community groups	> Country Women's Association - Tumbarumba > Country Women's Association - Tumut > Do It For Batlow > Ground Up Tumut > Men's Sheds at Tumut and District, Talbingo and Tumbarumba > Softwoods Working Party > Tumbafest Committee > Tumbarumba Lions Cub > Tumbarumba Rotary Club > Tumbarumba Vignerons Association > Tumut Foundation > Tumut Historical Society > Tumut Show Society
Environmental groups	> National Parks Association of NSW > Nature Conservation Council > NSW Landcare > Total Environment Centre > Colong Foundation
Aboriginal Stakeholders	Consultation effort was generally focussed with members of the Ngarigo and Wiradjuri clans who were identified as holding specific cultural knowledge with regards to the project area. An overview of the full consultation with Aboriginal Stakeholders is provided in Section 4 of the Aboriginal cultural heritage assessment report (ACHAR) (**Appendix C**)
General Public	General members of the public who may take an interest in the project

6.2 Engagement undertaken prior to and during the preparation of the EIS

A wide-ranging engagement program was developed prior to and during preparation of the EIS to consider the range of stakeholders who may be potentially impacted by or interested in the project. This included providing opportunities for general stakeholder participation as well as more targeted engagement with government agencies and Aboriginal group representatives.

6.2.1 Community and stakeholder engagement

Specific engagement activities were carried out with the community to support the preparation of the EIS, including those specified in the SEARs. Engagement activities focused on providing the local community with information about the project and an opportunity to provide feedback on key issues and concerns.

The methods and timing of key engagement are outlined in **Table 6-3** and shown on **Figure 6-1**.

Table 6-3 Community engagement activities

Timing	Description
Ongoing since June 2018	**Community contact points** > Community Information Line - 1800 222 537 > Community email address - community@transgrid.com.au
	Website > Provides a central hub for up-to-date project information, including key milestones and consultation https://www.transgrid.com.au/Snowy2
	Feedback portal – Social Pinpoint > Allows all stakeholders to have their say on how the project might impact them and their community https://transgrid.mysocialpinpoint.com.au/snowy-20-transmission-connect
June 2018	**Project factsheet** > Initial project overview and introduction to the upcoming EIS. Issued via the Tumbarumba and Tumut Visitor Information Centres and available on the TransGrid website
November 2018	**Project factsheet** > Update on project overview and introduction to the upcoming EIS
	Social media campaign > Provided a project update and an invitation to the three community information sessions held in conjunction with Snowy Hydro
	Community information sessions > Held in conjunction with Snowy Hydro at The Parade, Tumbarumba; Nest Café, Tumbarumba; Wynyard Street, Tumut; Tumut Golf Club
June 2019	**Project factsheet** > Invitation to provide initial feedback via our Feedback portal. Issued via the Tumbarumba and Tumut Visitor Information Centres and available on the TransGrid website
	Social media campaign > Provided a project update and an invitation to the three community information sessions held in conjunction with Snowy Hydro
	Community information sessions > Held in conjunction with Snowy Hydro at Tumut Bowling Club (67 attendees), Talbingo shops (14 attendees), Nest Café Tumbarumba (53 attendees)

Timing	Description
	Phone briefings > Local associations and community groups briefed by phone and provided with fact sheets to distribute to their members
November 2019	**Project factsheet** > Update and reminder to provide initial feedback via the Feedback portal. Issued and available on the TransGrid website
February 2020	**Community information stall at Tumbafest with the Humelink project team** > 2-day stall including maps and factsheets. Estimated 100-plus community, council and business visitors
September 2020	**Phone interviews** > Conducted with local associations and community groups. > Factsheets issued via email to be distributed to their members
	Project presentation > A presentation of the project was provided to National Parks Association (NPA) and Snowy Valleys Council at separate meetings. The presentation provided an overview of the project and provided a summary of potential and anticipated impacts. The presentation also provided the opportunity for members of the NPA to provide feedback on the project
	Project factsheet > Update and reminder to provide initial feedback via the Feedback portal. Issued to local associations and community groups, local libraries, via the Tumbarumba and Tumut Visitor Information Centres and available on the TransGrid website

Specific targeted engagement activities were carried out with stakeholders to support the preparation of the EIS. The activities focused on providing stakeholders with information about the project and an opportunity to provide feedback on key issues and concerns.

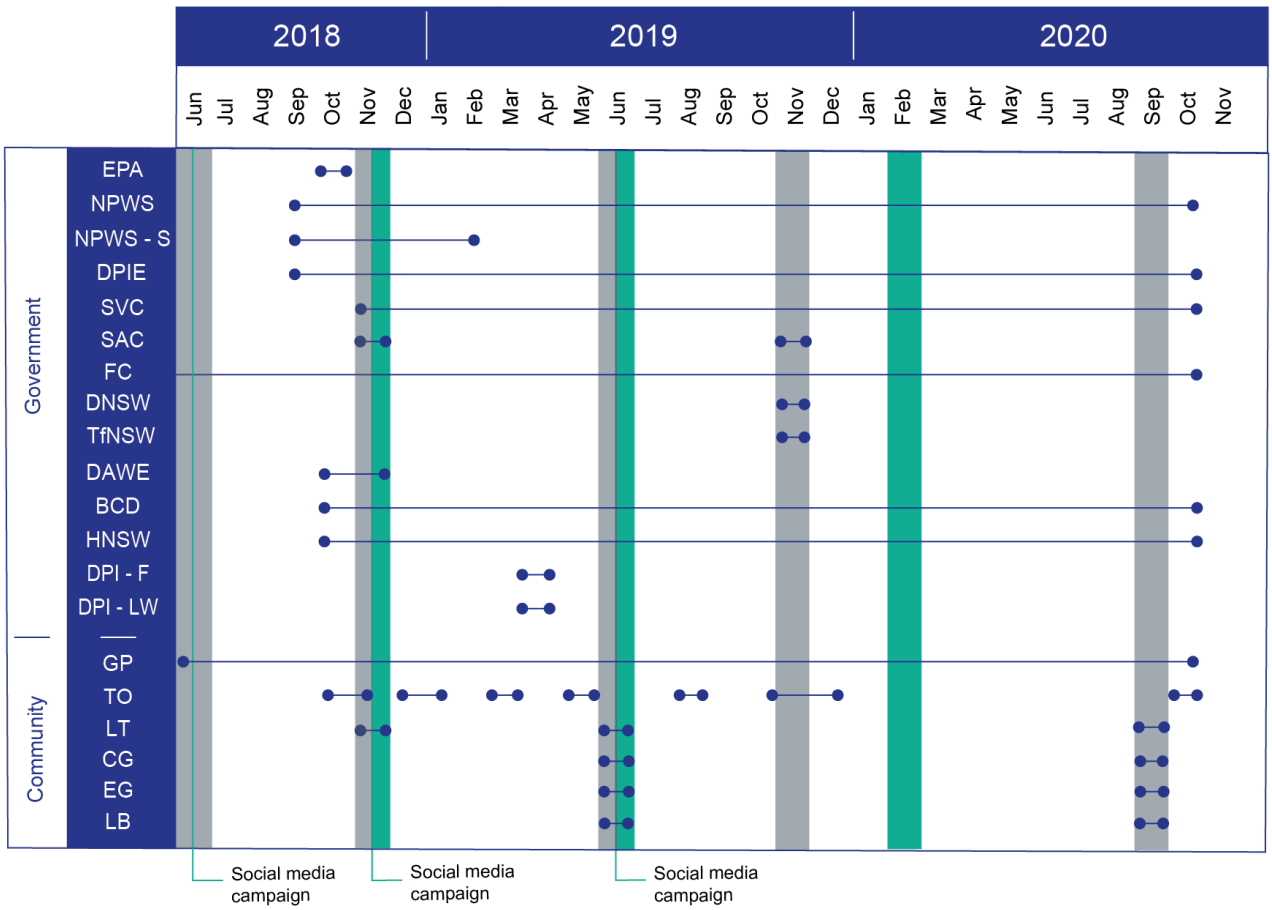
Key stakeholders were notified, offered engagement and/or briefed on an ongoing basis via meeting, phone calls and emails. The briefings were designed to ensure stakeholders were adequately informed of the project to ensure issues and concerns were understood, captured and addressed in the planning process and to receive feedback.

Engagement with Snowy Valleys Council, FCNSW and NPWS has been ongoing through the development of the EIS, including briefings, face-to-face and online meetings.

Engagement with non-government organisations, and environment and industry groups was undertaken in face-to-face and online meetings, letters, presentations and printed communications material.

Engagement with local communities was undertaken early through joint engagement sessions with Snowy Hydro, providing opportunity for community members to raise issues or concerns with both organisations, and with TransGrid directly specific to the project.

Consultation will also be carried out with service providers including accommodation providers and the relevant road authorities to confirm any road upgrades requirement as identified in the road safety audit, refer to **Section 7.6.3.1**.



Key

Government agency / department

EPA	Environment Protection Authority
NPWS	National Parks and Wildlife Services
NPWS - S	NPWS - Southern Ranges Regional Advisory Committee
DPIE	Department of Planning, Industry and Environment
SVC	Snowy Valleys Council
SAC	Snowy Advisory Committee
FCNSW	Forestry Corporation of NSW
DNSW	Destination NSW
TfNSW	Transport for NSW, Roads & Maritime Services
DAWE	Department of Agriculture Water and the Environment
BCD	Biodiversity Conservation Division of the DPIE
HNSW	Heritage NSW
DPI - F	Department of Primary Industries - Fisheries
DPI - LW	Department of Primary Industries - Land and Water

Community / interest group

GP	General Public
TO	Traditional Owners
LT	Local Tourism
CG	Community Groups
EG	Environmental Groups
LB	Local Business

Community Information Session

Project fact sheet published / distributed

Targeted engagement (e.g. meeting, briefing, routine correspodence)

Figure 6-1 Engagement undertaken prior to and during the preparation of the EIS

6.2.2 Engagement with Aboriginal Groups

Consultation with Aboriginal groups was carried out in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (ACHCRP). During the consultation process, which commenced in October 2018, a total of 20 groups/individuals registered their interest in the project. Whilst all 20 Registered Aboriginal Parties (RAPs) were routinely consulted throughout the project, including prior to and during the preparation of the ACHAR and as part of the site surveys and excavation works carried out, members of the Ngarigo and Wiradjuri clans were identified as holding specific cultural knowledge with regards to the project area. Consequently, consultation was more focussed with the Ngarigo and Wiradjuri people, who participated in the fieldwork carried out for the project.

The complete summary of the consultation carried out with the Aboriginal groups for the project is outlined in Chapter 4 of the ACHAR provided in **Appendix C**.

6.3 Stakeholder and community feedback

Many community concerns and issues that arose during the consultation activities carried out were specific to Snowy 2.0 and not directly associated with this project. This is likely attributed to the community and key stakeholders understanding that the need for the project is directly driven by the requirement to connect Snowy 2.0 the NEM.

The key issues that were raised specific to the project are outlined in **Table 6-4**.

Table 6-4 Summary of issues raised relevant to the EIS

Theme	Feedback received	Issued raised by	Where addressed in the EIS
Biodiversity	Impacts on threatened species and communities. Particular species of concern included Booroolong Frog, Smoky Mouse and various threatened orchid species	> Government > Community	**Section 7.1.3**
	Biodiversity offsets and the offsets strategy	> Government	**Section 7.1.5**
Visual amenity	Impacts on the natural beauty of KNP and surrounding alpine area due to the introduction of the new transmission lines into the landscape and associated vegetation clearing resulting in a 'scarring' on the landscape	> Government > Community > Environmental Groups	**Section 7.7.3**
Aboriginal heritage	Impacts on known and potentially unknown Aboriginal heritage, particularly in project area east, in proximity to Wallaces Creek and Yarrangobilly River	> Government > Environmental Groups	**Section 7.2.3**
Consultation	Importance of community consultation, particularly in the smaller regional towns of Tumbarumba, Adelong and Batlow, which would be subject to heavy vehicle movements during construction	> Council	**Chapter 6**
Rehabilitation	Land rehabilitation during and following construction	> Government	**Section 5.4.10**
Assessment of alternatives	Concerns were raised whether TransGrid had assessed the potential undergrounding of the transmission connection to minimise impacts on biodiversity and visual amenity, particularly in KNP	> Environmental Groups	**Chapter 3**

Theme	Feedback received	Issued raised by	Where addressed in the EIS
Socio-economic	Local employment opportunities and increased demand for local goods and services during construction	> Council > Community	**Section 7.11.3**
	Availability of accommodation to support the construction workforce	> Council	
	Impacts on the fruit picking seasonal workforce particularly regarding potential shortages of accommodation during construction	> Council > Community	
Traffic and transport	Increased traffic congestion, road safety and amenity impacts in the small townships situated along the haulage route	> Council > Community	**Section 7.6.3**
	Damage to local roads caused by heavy vehicle movements along the haulage route	> Council	
	Upgrades to local roads to facilitate the movement of heavy vehicles servicing the project	> Council	
Tourism and recreation	Impacts on recreational use of KNP and Bago State Forest including recreational fishing and boating on Talbingo Reservoir	> Community > Council	**Section 7.11.3**
	Impacts on recreational hunting in Bago State Forest	> Government	
Surface water quality	Impacts on surface water quality due to increased run-off, erosion and sedimentation during construction in project area east	> Government > Environmental Groups	**Section 7.4.3**
Land Acquisition	Methods of land acquisition to support the construction and operation of the project	> Government	**Section 5.4.1.1**

6.4 Public exhibition of the EIS

During the public exhibition period, the community and other stakeholders will be able to review the EIS and make a written submission to the DPIE for consideration in its assessment of the project.

During this time, TransGrid would undertake further consultation with the community and stakeholders using several of the consultation methods implemented prior to and during preparation of the EIS, including those summarised in the sections below. This would allow the community and other stakeholders to be informed about the project and the opportunity to provide a submission.

6.4.1 Display of the EIS

The EIS will be available for review by the community and stakeholders on:

> DPIE Major Projects website www.planningportal.nsw.gov.au/major-projects
> TransGrid's website www.transgrid.com.au

6.4.2 Project notifications and updates

During the EIS exhibition, TransGrid will continue to inform stakeholders through a variety of engagement tools, either in person or via digital platforms, including:

- Stakeholder briefings
- Project webpage
- Traditional media and advertisements
- Social media.

6.4.3 Consideration of community feedback

Engagement carried out after exhibition of the EIS will focus on responding to issues raised in submissions and preparing a submissions report. Any proposed changes to the project would be included in either a preferred infrastructure report or an amendment report. These reports would be available to the public via the DPIE Major Projects website https://www.planningportal.nsw.gov.au/major-projects.

6.5 Engagement during delivery of the project

Engagement with the community and key stakeholders would be ongoing in the lead up to and during construction of the project. The engagement activities would aim to provide:

- The community and stakeholders with a high level of awareness of all processes and activities associated with construction
- Accurate and accessible information and a timely response to issues and concerns raised by the community
- Opportunities for feedback and input.

The TransGrid community information line and community email address would continue to be available during construction. Targeted consultation methods, such as letters, notifications, signage and face-to-face meetings, would also continue to occur. The TransGrid website and social media platforms would also include updates on the progress of the project.

7. Environmental impact assessment

This chapter provides an assessment of the predicted and potential impacts associated with the project. For each key issue the assessment methodology is detailed, existing environment is described, potential impacts (both direct and indirect) of the project during construction and operation are assessed, and the proposed management measures are described. The proposed management measures in this chapter are summarised in **Chapter 8**.

The assessment of key issues is supported by detailed investigations that are documented in the specialist assessment reports in **Appendix B** to **Appendix J**.

7.1 Biodiversity

This section summarises the findings of the BDAR provided in **Appendix B**. The BDAR addresses the following SEARs:

Biodiversity:

- 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;
- A strategy to offset any residual impacts of the project focusing on enhancing the biodiversity values of the Kosciuszko National Park in the medium to long term.

7.1.1 Assessment methodology

The method for the biodiversity assessment included:

- Desktop review of available databases, regional mapping, assessment reports and other relevant environmental and strategic planning documents, to identify threatened species requiring further assessment and consideration
- A habitat and likelihood of occurrence assessment to determine the likelihood of a particular species occurring within the study area. A likelihood ranking was assigned to each species, including 'recorded', 'high', 'moderate', 'low' and 'none'. The likelihood of occurrence assessment was used to guide and inform the field surveys carried out for the project
- Field surveys to identify the biodiversity values within the study area including:
  - Identification and mapping of plant community types (PCT) and stratification of native vegetation into survey units (vegetation zones) A plot-based full floristic survey and vegetation integrity assessment
  - Targeted survey for threatened flora species using parallel transects undertaken across suitable habitats within required survey periods (seasons). Targeted surveys for orchids were conducted during October, November, December 2018 and January, February, October, November and December 2019. A large portion of the study area was also resurveyed in later October 2020 for the newly identified *Caladenia montana* habitat.
  - A mixture of targeted fauna survey techniques including live trapping, baited remote sensor camera traps, call broadcasting, ultrasonic call recording (bats), spotlighting and timed area searches. Surveys were conducted over 14 days between November 2018 and February 2019
- Identification and assessment of potential impacts on biodiversity arising from the project
- Mitigation measures for avoiding, managing or reducing impacts on biodiversity values during detailed design, construction and operation
- Identification of any residual impacts that cannot be avoided, minimised or mitigated which must be offset.

The BDAR has been undertaken in accordance with Stage 1 and Stage 2 of the *Biodiversity Assessment Method* (OEH, 2017) (BAM). The BDAR addresses potential impacts to biodiversity listed under the BC Act, FM Act and MNES identified in the EPBC Act.

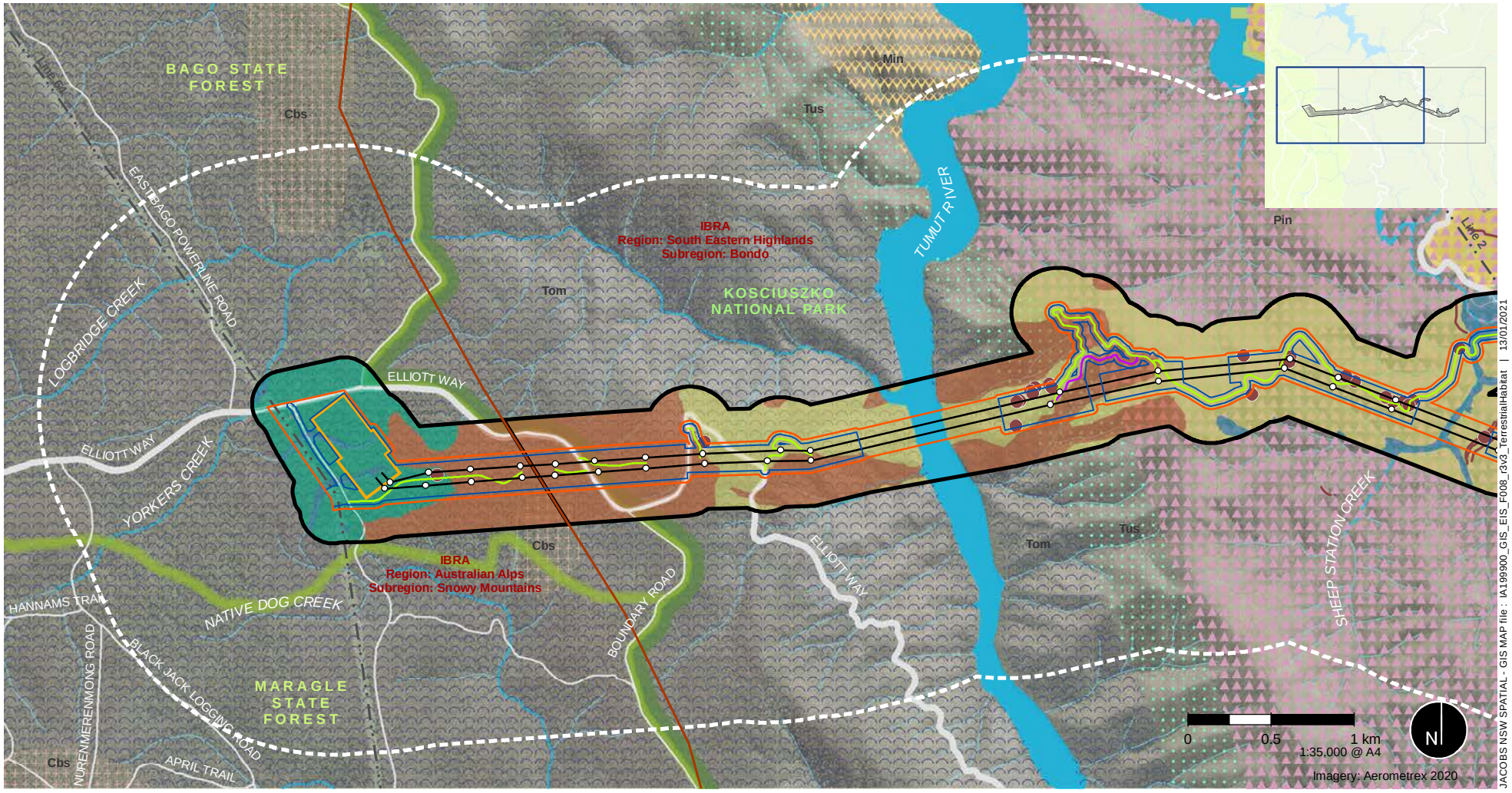
The NSW government developed the *Guideline for applying the Biodiversity Assessment Method at severely burnt sites* (DPIE, 2020) following the 2019-2020 bushfires. As majority of the fieldwork undertaken for this BDAR was completed prior to the 2019-2020 fires, the guideline largely does not apply to this assessment.

Further detail about the assessment methodology, including field surveys undertaken is provided in the BDAR (**Appendix B**).

7.1.1.1 Study area

The biodiversity study area included a 50 metre buffer from the edge of the disturbance area. To assess the current extent of native vegetation with the broader landscape, a 1,500 metre buffer was also placed around the disturbance area in accordance with the *Biodiversity Assessment Method* (OEH, 2017) (BAM). The biodiversity study area and 1,500 metre landscape buffer are shown on **Figure 7-1**.

Database searches and desktop assessment was undertaken within 10 kilometres from the project area and is defined as the locality (refer to **Section 1.3.1**). This broader study area is used for the purposes of reviewing regional vegetation mapping and searches for previously recorded threatened species.



- Project area
- Disturbance area
- BDAR study area
- Proposed structure
- Proposed transmission line
- Proposed access track - Option A
- Proposed access track - Option B
- Proposed 500kV substation
- Snowy 2.0 disturbance footprint (05.02.2020)
- IBRA
- Landscape buffer (1500m)

Habitat type

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

Mitchell landscapes

- Cbs: Cabramurra - Kiandra Basalt Caps and Sands
- Tus: Cootamundra - Tumut Serpentinite and Ultramafics
- Min: Minjary Hills and Ranges
- Pin: Pinbeyan - Ravine Ranges
- Tom: Tooma Granite Ranges
- Water

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

Figure 7-1 | Biodiversity study area and habitat

Data source:
Jacobs 2020, TransGrid 2020, EMM 2020, DPE 2018,

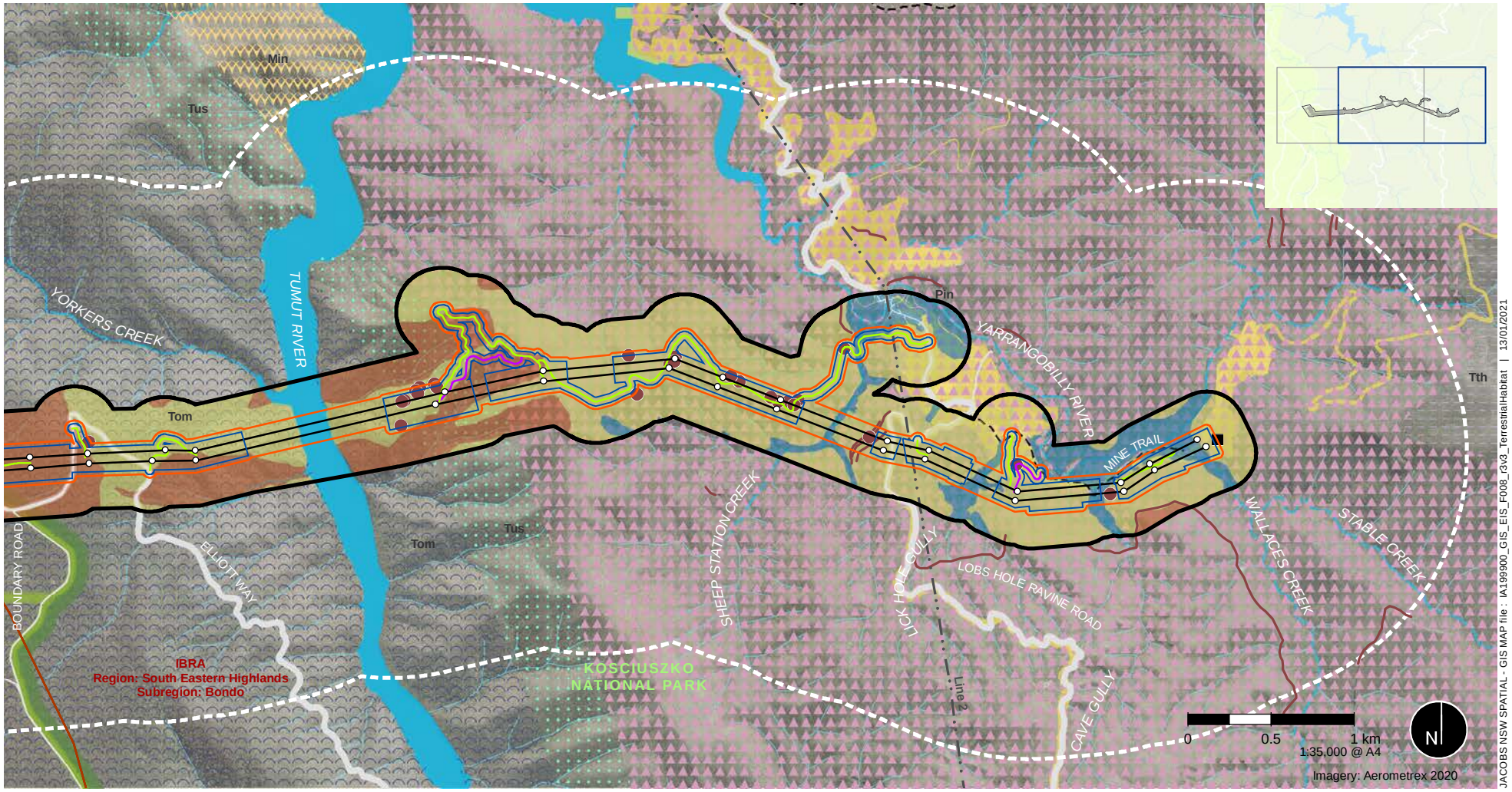


Figure 7-1 | Biodiversity study area and habitat

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

7.1.2 Existing environment

7.1.2.1 Landscape features

The landscape features of the study area were determined in accordance with the requirements of the BAM. **Table 7-1** summarises the biodiversity landscape features of the study area. Many of these landscape features are shown on **Figure 7-1**.

Table 7-1 Biodiversity landscape features of the study area

Landscape feature	Description
Interim Biogeographic Rationalisation for Australia (IBRA) (Thackway and Cresswell, 1995).	The project is located across two bioregions: > South Eastern Highlands Bioregion and the Snowy Mountains sub-region > Australian Alps Bioregion, and the Bondo sub-region.
NSW Landscape Regions (Mitchell landscapes)	The project crosses a variety of landscapes as mapped by the NPWS (2002) and described by DECC (2002) as follows from east to west: > Pinbeyan – Ravine Ranges > Cootamundra – Tumut Serpentinite and Ultramafics > Tooma Granite Ranges The broader study area, outside of the disturbance area, also includes a small area of the Cabramurra – Kiandra Basalt Caps and Sands.
Rivers and streams	The project is located within the Murrumbidgee catchment. The broader study area contains the second order (Strahler) 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). To the south of the substation, New Zealand Gully flows into Native Dog Creek which flows south and becomes 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.
Wetlands	There are no naturally occurring wetlands in the project area. However Talbingo Reservoir does offer wetland habitat features within the project area.
Connectivity of habitat	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 of the project, there is habitat connectivity into Victoria through 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 project area within the Snowy Mountains to 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 project area.

Landscape feature	Description
Areas of geological significance	Areas of geological significance generally include karst, caves, crevices, cliffs, rocky outcrops. Areas of rocky outcrops and cliffs are present within the project area and surrounds. The karst areas, tufa deposits and fossil sequence at Ravine are recognised in the KNP PoM as a significant natural feature. There are two tufa deposits about 1 kilometre south of the project. The geodiversity features around the project are discussed further in **Section 7.5.2.4**.
Areas of outstanding biodiversity value	The project area does not contain any areas of outstanding biodiversity value listed on the DPIE register of declared areas of outstanding biodiversity value.
Native vegetation extent	The current percentage of native vegetation cover was calculated in the BDAR from regional vegetation mapping within the 1,500 metre landscape buffer. The current percent native vegetation cover in the landscape buffer is 97%.
Dunns Road bushfire	The Dunns Road bushfire 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) and impacted the entire project area and much of the study area.
Patch size	The main barrier that breaks apart vegetation within the project area is the Talbingo Reservoir which is approximately 190 metres wide within the project area. The Talbingo Reservoir divides the vegetation into two patches that are each more than 100 ha in size. 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.

7.1.2.2 Native vegetation

Plant community types

Following desktop review and ground truthing, seven PCTs were identified within the disturbance area as shown on **Figure 7-2**. These PCT are:

- 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 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
- PCT 729: Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion
- PCT 999: Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion
- PCT 1196: Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion.

PCTs were also split up into vegetation zones based on broad condition classes. None of this vegetation corresponds with a threatened ecological community listed under the BC Act or EPBC Act. A detailed description of each PCT, vegetation zone and corresponding vegetation integrity score is provided in the BDAR (**Appendix B**) and the amount of each PCT in the disturbance area is provided in **Table 7-5**.

Groundwater dependent ecosystems

There are a number of high and moderate potential aquatic and terrestrial Groundwater Dependent Ecosystems (GDEs) that were identified within the broader study area by the *Atlas of Groundwater Dependent Ecosystems* (Bureau of Meteorology, 2017) and the *Risk Assessment Guidelines for Groundwater Dependant Ecosystems* (Serov et al., 2012).

There are four moderate to high potential terrestrial GDEs in the project area including PCT 285, PCT 296, PCT 300 and PCT 302, these are shown on **Figure 7-3**.

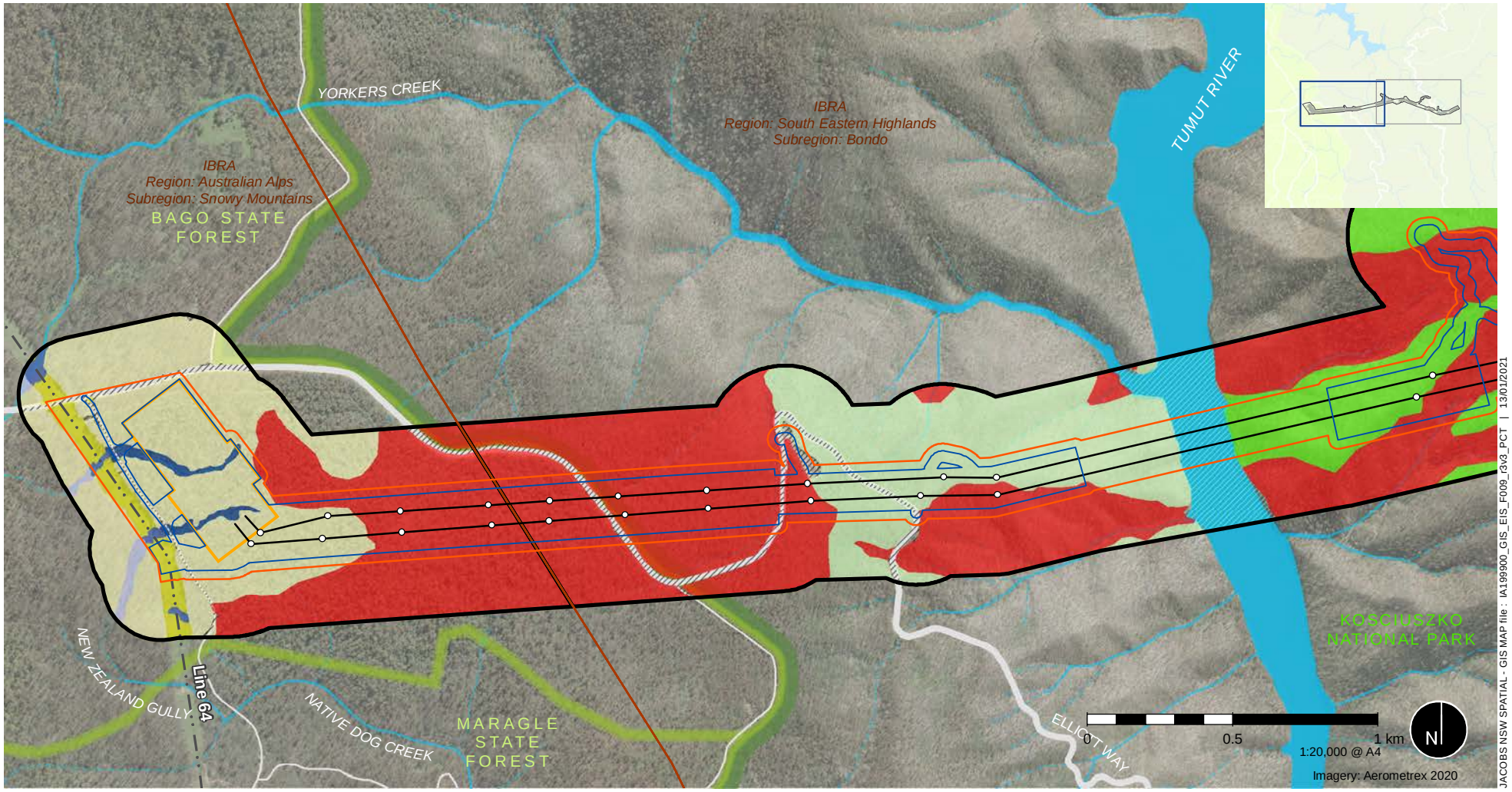
None of the PCTs are likely to have a total reliance on groundwater, though PCT 285, PCT 296, PCT 300 and PCT 302 are likely to be facultative GDEs that is they are partially dependent on groundwater. Within the study area, PCT 285 and PCT 302 are likely to have the highest groundwater dependency as they are located on alluvial and colluvial soils along waterways.

7.1.2.3 Habitat suitability for threatened species

The PCTs listed in **Section 7.1.2.2** correspond with four broad habitat types, including:

- Upper Riverina Dry Sclerophyll Forests (PCT 285 and 302
- Southern Tableland Dry Sclerophyll Forests (PCT 729, 296 and 999
- Southern Tableland Wet Sclerophyll Forests (PCT 300)
- Subalpine Woodlands (PCT 1196).

These habitat types are shown on **Figure 7-1**.



- Project area
- Disturbance area
- BDAR study area
- Proposed 500kV substation
- Proposed structure
- Proposed transmission line
- Electricity transmission line
- Minor road
- Major road
- Waterway
- NPWS estate
- State Forest
- IBRA

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

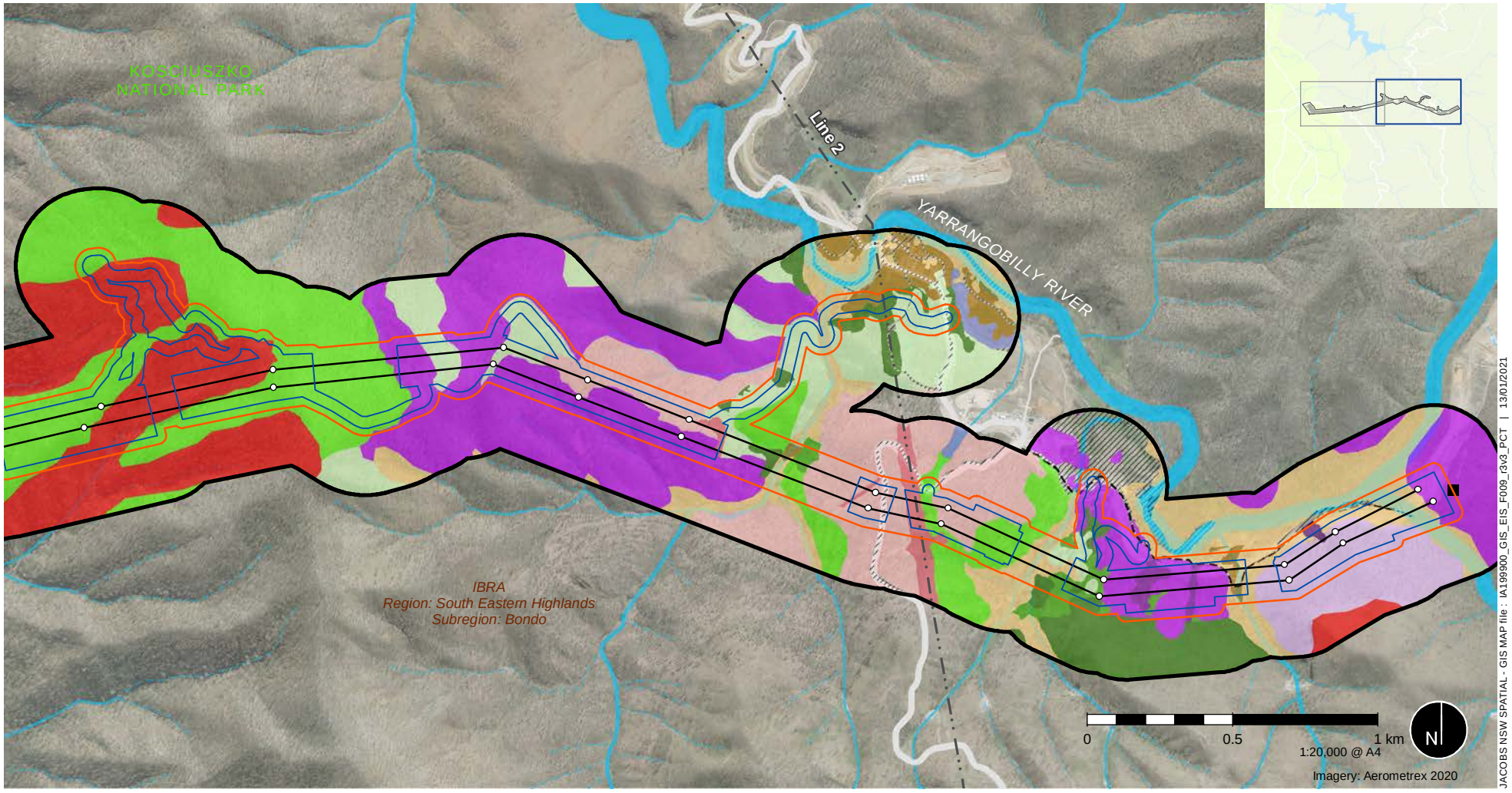
PCT 300: Ribbon Gum - Narrow-leaved (Robertsons) Peppermint montane fern - grass tall open forest
- Good

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

Other
- Water
- Cleared

Data sources:
Jacobs 2020,
DPE 2018,

Figure 7-2 | Plant community type and condition



Data sources:
Jacobs 2020,
DPE 2018,
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Figure 7-2 | Plant community type and condition

7.1.2.4 Threatened species

Threatened flora

Due to the large extent, variability and generally high quality of the habitats present across the broader KNP and Bago State Forest, many listed threatened plant species are known to occur in the locality. The threatened flora species considered likely to occur in the project area and targeted during surveys are summarised in **Table 7-2**. This list was primarily determined by the Biodiversity Assessment Method Calculator (BAM-C) based on the habitats present within the disturbance area, however additional species were added based on a review of databases, recent relevant surveys and advice from BCD. No threatened plant species were recorded during the initial field surveys.

Targeted surveys undertaken for *Caladenia montana* in October 2020 preliminarily identified plants that match the morphological description for this species. Samples have been sent to the Australian Royal Botanical Gardens for identification and are undergoing genetic analysis to confirm the identification of the plants identified. The results are still pending. Therefore, the calculation of impacts on *Caladenia montana* has been delayed until the final determination from the genetic analysis is received.

Table 7-2 Threatened flora likely to occur in the project area

Species name	Common name	EPBC Act	BC Act
Caladenia montana	-	-	V
Calotis glandulosa	Mauve Burr-daisy	V	V
Pomaderris cotoneaster	Cotoneaster Pomaderris	E	E
Pterostylis alpina	Alpine Greenhood	-	V
Pterostylis foliata	Slender Greenhood	-	V
Pterostylis oreophila	Blue-tongued Greenhood	CE	CE
Thelymitra alpicola	Alpine Sun Orchid	-	V
Thelymitra atronitida	Black-hooded Sun Orchid	-	CE
Thesium australe	Austral Toadflax	V	V

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

Threatened fauna

The threatened fauna species likely to occur in the project area and targeted during surveys are summarised in **Table 7-3**. The 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 (refer to **Photo 7-1** and **Photo 7-2**).

The Masked Owl, Powerful Owl and Booroolong Frog were assumed to occur in the project area.

Table 7-3 Threatened fauna likely to occur in the project area and targeted during surveys

Common name	Species name	EPBC Act	BC Act
Birds			
Pink Robin	*Petroica rodinogaster*	-	V
Painted Honeyeater	*Grantiella picta*	V	V
Gang-gang Cockatoo	*Callocephalon fimbriatum*	-	V
Little Eagle	*Hieraaetus morphnoides*	-	V
Square-tailed Kite	*Lophoictinia isura*	-	V
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	M	V
Barking Owl	*Ninox connivens*	-	V
Powerful Owl	*Ninox strenua*	-	V
Masked Owl	*Tyto novaehollandiae*	-	V
Mammals			
Eastern Pygmy-possum	*Cercartetus nanus*	-	V
Smoky Mouse	*Pseudomys fumeus*	E	CE
Spotted-tailed Quoll	*Dasyurus maculatus*	E	V
Yellow-bellied Glider	*Petaurus australis*	-	V, EP
Greater Glider	*Petauroides volans*	V	-
Squirrel Glider	*Petaurus norfolcensis*	-	V
Brush-tailed Phascogale	*Phascogale tapoatafa*	-	V
Koala	*Phascolarctos cinereus*	V	V
Bats			
Large Bent-winged Bat	*Miniopterus orianae oceanensis*	-	V
Southern Myotis	*Myotis macropus*	-	V
Amphibians			
Alpine Tree Frog	*Litoria verreauxii alpina*	V	E

Key: E = endangered, EP = endangered population. CE = critically endangered, V = vulnerable

Photo 7-1 The Eastern Pygmy-possum was recorded during the survey on a camera trap

Photo 7-2 The Eastern Pygmy-possum was recorded during spotlighting

Threatened fish

No targeted fish surveys have been undertaken. Based on the assessment and review of the work undertaken for the *Snowy 2.0 Exploratory Works EIS* (EMM, 2018) and *Snowy 2.0 Main Works EIS* (EMM, 2019), only the Murray Crayfish and the Macquarie Perch are likely to occur in the project area in the Tumut River / Talbingo Reservoir, Yarrangobilly River and Wallaces Creek. It is noted that the Trout Cod have also been stocked in the Talbingo Reservoir as recently as 2016 (Cardno, 2018).

Migratory species

Six EPBC Act listed migratory species may occur in the locality (refer to **Table 7-4**). While some migratory species of bird are likely to use the study area and locality, the study area would not be classed as an 'important habitat' as defined by the *Significant Impact Guidelines 1.1 - Matters of National Environmental Significance* (Department of the Environment, 2013). A nationally significant proportion of a population would not be supported by the project area. The Satin Flycatcher was the only migratory species observed during the field surveys.

Table 7-4 EPBC Act listed migratory species that are considered likely to occur

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

7.1.2.5 Aquatic habitat

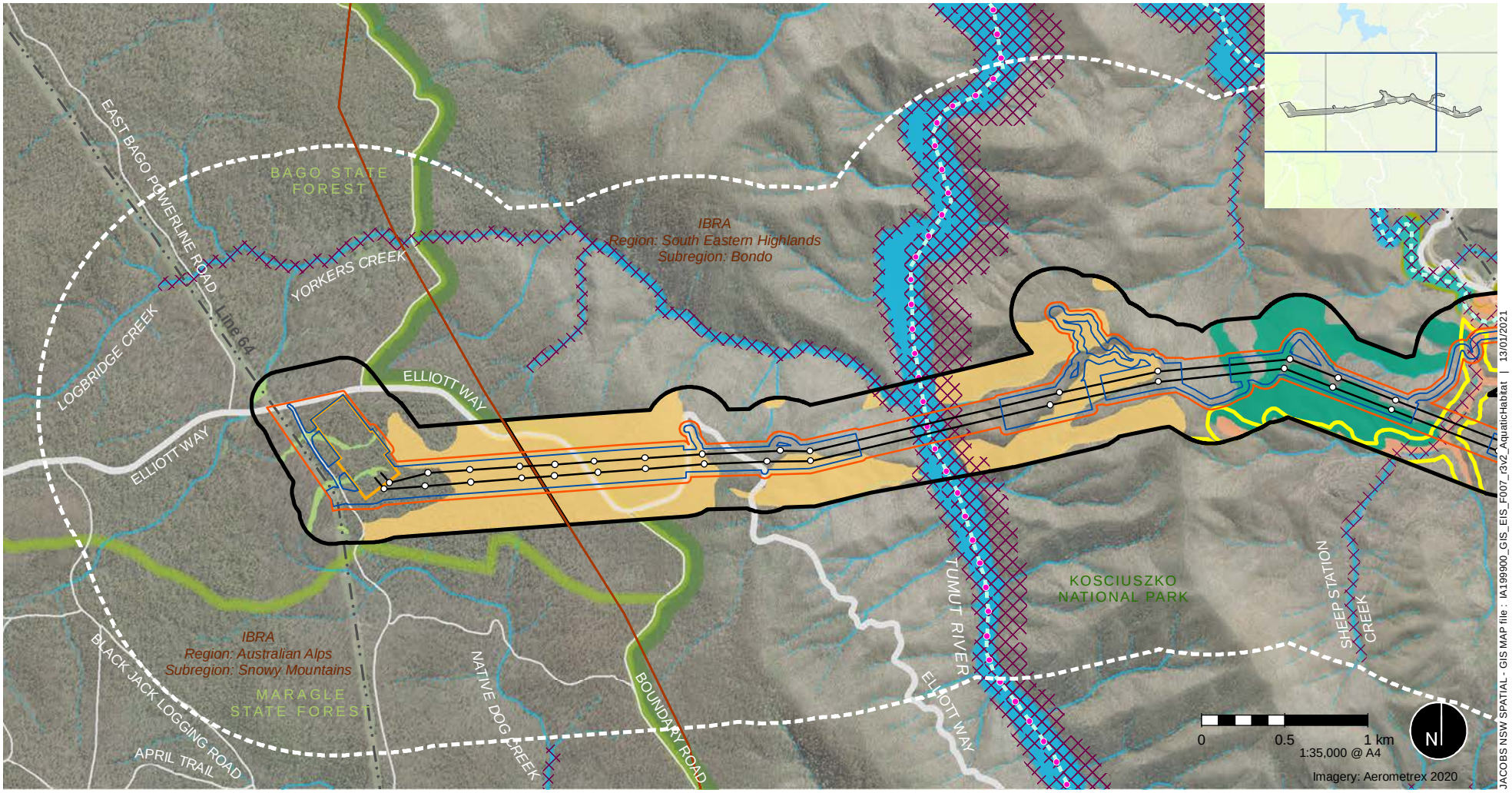
Twenty nine waterways traverse the project area, including several named waterways and unnamed drainage lines. Six of these waterways are stream order three or greater. Wallaces Creek, Tumut River and Yarrangobilly River are major waterways. These waterways have also been mapped as key fish habitat (KFH) (DPI, 2013) 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.

These aquatic habitats listed above are sensitive receiving environments and 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.

Thirteen generally unnamed gullies/drainage lines also occur within the project area, these gullies are first order, ephemeral and most have little to no channel definition.

A map of aquatic habitats including KFH is provided in **Figure 7-3**.



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

Likely facultative GDEs

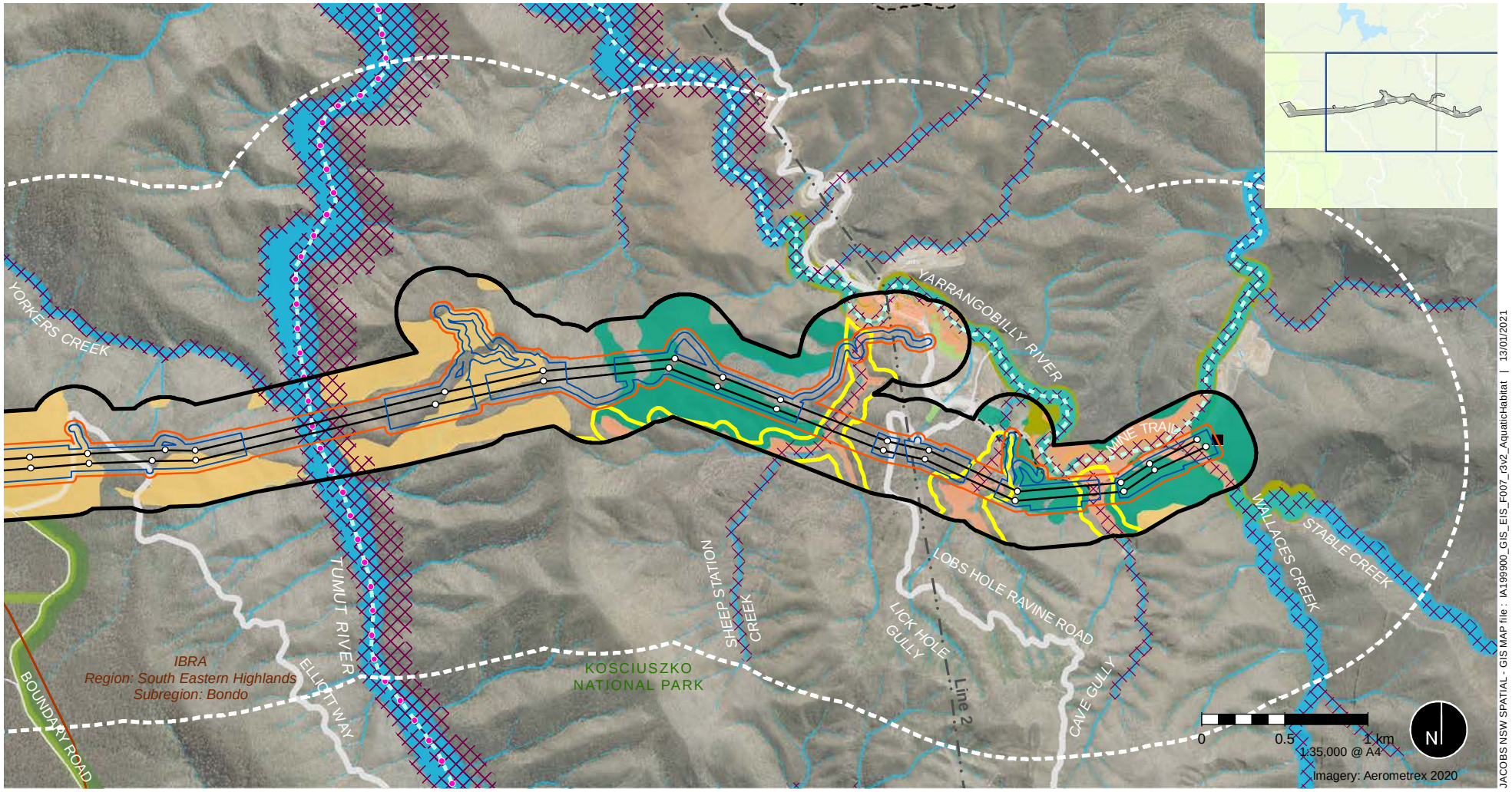
- PCT 296: Brittle Gum - peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion
- PCT 285: Broad-leaved Sally grass - sedge woodland on valley flats and swamps in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion
- PCT 300: Ribbon 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

- Murray Crayfish (Tumut River)
- Macquarie Perch (Tumut River and Yarrangobilly River)
- Key Fish Habitat
- Booroolong Frog habitat buffer
- Snowy 2.0 Booralong Frog exclusion area

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

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

Figure 7-3 | Aquatic habitats



Project area
Disturbance area
BDAR study area
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

Murray Crayfish (Tumut River)
Macquarie Perch (Tumut River and Yarrangobilly River)
Key Fish Habitat
Booroolong Frog habitat buffer
Snowy 2.0 Booralong Frog exclusion area

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

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

Figure 7-3 | Aquatic habitats

7.1.3 Assessment of potential impacts

7.1.3.1 Construction

Impacts on native vegetation and habitat

Direct impacts have been calculated using the disturbance area which includes access track option A and does not account for areas within the approved disturbance area of Snowy 2.0 as there is some overlap with the project.

The project would result in the direct removal of about 135.6 hectares of native vegetation as summarised in **Table 7-5**. There would be no direct impacts to any threatened ecological communities (TECs). The removal of this vegetation would also have direct impacts on threatened species habitat as outlined in **Table 7-6**.

Table 7-5 Summary of direct impacts to vegetation within the disturbance area

PCT	PCT name	Impacted area (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
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	43.28
1196	Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	23.95
296	Brittle Gum - peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion	21.15
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	3.12
729	Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion	34.72
999	Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion	7.61
Total		**135.6**

Table 7-6 Summary of direct impacts on threatened species habitat (species credit species)

Species name	Common name	EPBC Act	BC & FM Act	Impacted habitat (ha)
Birds				
Callocephalon fimbriatum	Gang-gang Cockatoo (breeding)	-	V	69.60
Ninox strenua	Powerful Owl (breeding)	-	V	43.28
Tyto novaehollandiae	Masked Owl (breeding)	-	V	3.12
Frogs				
Litoria booroolongensis	Booroolong Frog	E	E	3.12
Mammals				
Cercartetus nanus	Eastern Pygmy-possum	-	V	133.06
Petaurus australis - endangered population	Yellow-bellied Glider Population on the Bago Plateau	-	EP	61.22
Petaurus norfolcensis	Squirrel Glider	-	V	68.13

Key: E = endangered, EP = endangered population, V = vulnerable

Indirect impacts to vegetation and habitat retained adjacent to the cleared transmission corridor could be associated with the creation of new edges in previously intact vegetation. Indirect impacts are changes to the structure and function of retained vegetation in association with factors such as increased light intensity and duration, increased exposure to wind and weed and pathogen invasion resulting from the creation of a new edge (i.e. edge effects). These edge effects would equate to an area of approximately 39.23 hectares and can have a negative impact on flora and fauna species. The primary expected indirect impact from this project is an increase in exotic plant cover along new edges, particularly in areas already containing any cover of weeds. The largest impacts would be from species such as Blackberry (*Rubus fruticosus* species agg.), which would cause a flow-on effect of a reduction in native groundcover over time. Indirect impacts to vegetation are expected to impact the quality of habitat for all threatened species in the long-term. As such the indirect impacts have been included in the calculation of ecosystem and species credits, refer to **Section 7.1.5**.

Other impacts on biodiversity that are in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat are further discussed below.

Groundwater dependent ecosystems

The project is not likely to interrupt the hydrological connection between a GDE and the aquifer it depends on, nor is it likely to impact groundwater quality or recharge. This is because the project would have a limited interaction with groundwater, as discussed in **Section 7.4.3**. There would however require the removal of facultative GDEs during construction (PCT 285, PCT 296, PCT 300 and PCT 302).

Aquatic biodiversity

The project has the potential to impact 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 threatened fish.

Sheep Station Creek would be directly impacted by a new waterway crossing along the new access track, while New Zealand Gully and an unnamed tributary of Yorkers would be directly impacted during the construction of the substation. Other waterways within the disturbance area have the potential to be indirectly impacted by erosion and contamination. These impacts are discussed further in **Section 7.4.3**.

The Booroolong Frog is heavily reliant on the presence of permanent water and movements are generally local and small scale. 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 waterway crossing over Sheep Station Creek would be designed to avoid blocking streamflow. As such, impacts to the movement of the Booroolong Frog would be relatively minor and current movement patterns are expected to remain unaltered.

Prescribed biodiversity impacts

Prescribed biodiversity impacts (as defined by the BAM) are in addition to, or instead of, impacts from clearing vegetation and/or loss of habitat. The project does have the 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 fences) and impacts on water quality for aquatic species and the Booroolong Frog. These are discussed below. Habitat connectivity is discussed as an operational impact in **Section 7.1.3.2**.

Rocky outcrops

The disturbance area does have some occurrences of rock outcropping of sedimentary rocks on the ridge tops and upper slopes. Threatened species such as Dusky Woodswallow, Spotted-tailed Quoll, Little Eagle, Booroolong Frog, Large Bent-winged Bat, Southern Myotis and Masked Owl are known to be associated with rocks.

The rocky outcrops and scattered rocks within the disturbance area are likely to be within the home range of the Little Eagle and would likely be used as refuge and foraging habitat by the Spotted-tailed Quoll.

There are no major open cliff faces with crevices or caves that may be suitable as shelter or roosting sites for the Dusky Woodswallow, Large Bent-winged Bat, Southern Myotis, or Masked Owl within the disturbance area. The Booroolong Frog habitat is restricted to the rocky drainage lines and not the ridges where rock outcrops occur.

The majority of rocky outcrops are unlikely to be removed by the project as the structures would be built on the ridges and the transmission lines would span across the outcrops. However two of the access roads are positioned over rocky outcrops as shown on **Figure 7-1**. While it is assumed that final placement of access tracks would aim to avoid these rocky outcrops, they may still be impacted. These are unlikely to present important habitat for any threatened species and a large number of rocky outcrops that would remain in and around the project area the disturbance area, the project would not have a significant impact on rocky habitats or the species that depend on these habitats.

Impact on water quality

There would be potential for indirect impacts to surrounding aquatic habitats from erosion and sedimentation and contaminated run-off (e.g. hydraulic fluids, oils, drilling fluids, etc) from construction which 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 any species of threatened fish. The impacts to water quality are discussed further in **Section 7.4.3**.

The greatest potential for a detrimental impact to the aquatic habitat of the Booroolong Frog would be caused by the 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 corridor where drainage leads into the Talbingo Reservoir.

Controlling impacts to water flow, water quality, and sedimentation associated with run-off from vegetation clearing, newly constructed access tracks, and structures would be key in mitigating the impacts on water quality, water bodies and hydrological processes that sustain threatened species.

Vehicle strikes

There would be a chance of fauna injury and mortality during the construction and operation of the project through vehicle collision. Threatened species most at risk of vehicle strike include the Eastern Pygmy-possum and Gang-gang Cockatoo. The Eastern Pygmy-possum would likely move across the access tracks to reach newly fragmented habitats, while the Gang-gang Cockatoos would frequently forage on or next to the road. If the Smoky Mouse is present then it may also be at risk. The Squirrel Glider, Yellow-bellied Glider and Greater Glider are unlikely be affected by vehicle strike due to their arboreal habits. Although the likelihood would be considered low due to low population densities, Koalas and Spotted-tailed Quolls could be also be at risk of vehicle strike when dispersing and moving through the disturbance area.

Noise, vibration and dust, light and contaminants

Construction activities would likely result in a small increase in ambient noise levels as well as potentially loud noises and vibration for short periods associated with construction. Noise and vibration from construction activities would potentially disturb fauna and may disrupt foraging, reproductive, or movement behaviours. Impacts from noise emissions would likely be temporary and localised to where construction is being undertaken at the time. These noise emissions are not considered likely to have a significant long-term impact on wildlife populations outside the disturbance area. Habitats near to the disturbance area would likely include some sensitive species (e.g. woodland birds) that may seek to avoid the noise, and some more tolerant species, including small mammals, which would likely become accustomed to the noise. over the long-term.

Elevated levels of dust may be deposited onto the foliage of vegetation adjacent to the disturbance area during construction. 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. While some level of dust would likely be generated during construction, the deposition of dust on foliage would likely be highly localised and intermittent and is therefore not considered likely to be a major impact of the project.

During winter and out of hours work, lighting may potentially be required in the early mornings and late afternoons. This could potentially affect nocturnal fauna.

During construction 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 would be the localised contamination of soil, waterways, and potential direct physical trauma to flora and fauna that come into contact with contaminants.

7.1.3.2 Operation

Habitat connectivity

The creation of open and shrubby corridors within areas of intact forest would be the key impact to habitat connectivity from the project. The predicted canopy gap caused by the transmission corridor may fragment and restrict normal movement patterns for non-flying species such as the Squirrel Glider, Eastern Pygmy-possum, Yellow-bellied Glider and Greater Glider. However, the project would not completely stop movement across the cleared corridors, as there would be no physical barrier, only a reduction in large trees. Additionally, it is expected that some level of groundcover and shrub regrowth would occur which may facilitate movement. As such, there would likely be a level of impact to habitat connectivity, but functional connectivity for most species is unlikely to be significantly impacted.

Fencing associated with the substation site may affect the ability of threatened non-flying species to move through the area. The substation security fencing installed around the substation would be about three metres high topped with barbed/razor wire. Barbed/razor wire fencing is a hazard to wildlife, particularly gliding mammals such as Yellow-bellied Glider and Squirrel Glider who may collide with fencing while gliding or climbing. The potential for entanglement in barbed wire would likely be greatest within 100 metres of the substation fence corners where animals are within gliding distance of other trees.

The transmission corridor and access tracks may function as a wildlife corridor connecting areas of habitat, for the movement of introduced pests including foxes and dogs. Rabbits, deer and horses were observed using the existing access tracks and transmission easements in the locality. This indicates that the establishment of a cleared transmission corridor and access tracks through currently densely forested areas would likely create further grazing habitat for rabbits, deer and horses and may open up areas of habitat that currently have lower pest species densities.

Another unintended consequence of the cleared transmission corridor and access tracks is the opening up of areas of habitat into previously inaccessible areas which could provide an opportunity for illegal hunting, poaching and illegal plant extraction (although the likelihood of this occurring is low).

Transmission lines and structures could also be used as a resource by fauna, for perching, nesting and roosting.

Mitigation measures to reduce the impact of habitat connectivity are provided in **Section 7.1.4** and would include improving the visibility of fencing and restriction of unauthorised use of access tracks.

Collisions of fauna with transmission lines

The project would increase the risk of collisions of birds and bats with the transmission lines and structures. This may lead to the abandonment of territories caused by a potential increase in scavenger activity due to the availability of additional carcasses from collision.

Substation lighting

During operation, the substation would be lit by security lighting at all hours of the night. While the external lighting would be installed in a manner that aims to minimise light spill to areas beyond the substation boundary fence, there is likely to be some small amount of light pollution into the surrounding vegetation. 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 transmission easements.

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, which are expected to remain around the substation. It is likely that any nocturnal animals present would become used to the additional lighting 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 would be unlikely to significantly affect any nocturnal species in the area.

7.1.3.3 Matters of National Environmental Significance

For threatened biodiversity listed under the EPBC Act identified in habitats within the study area or considered as moderately likely to occur, significance assessments have been completed in accordance with the *EPBC Significant Impact Guidelines 1.1 – Matters of National Environmental Significance* (Department of Environment, 2013). The EPBC Act listed species subject to this assessment included:

- Spotted-tailed Quoll (*Dasyurus maculatus*)
- Greater Glider (*Petauroides volans*)
- Koala (*Phascolarctos cinereus*)
- Booroolong Frog *(Litoria booroolongensis*)
- Macquarie Perch (*Macquaria australasica*).

The significance assessment found that the project is unlikely to result in a significant impact to these threatened species. Nor would the project substantially modify, destroy or isolate an area of important habitat for migratory species, and it would not seriously disrupt the lifecycle of an ecologically significant proportion of a population of migratory birds.

7.1.4 Mitigation measures

Mitigation measures for biodiversity are presented in **Table 7-7**. Mitigation measures for erosion and sediment control and water quality are provided in **Section 7.4**.

Table 7-7 Mitigation measures for biodiversity impacts

Ref	Impacts	Mitigation measures
Pre construction		
B1	Impacts to biodiversity	A biodiversity management plan will be prepared and implemented prior to construction. It will include the following measures: > The boundary of the clearing limits for the transmission 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 > Where possible, within areas of retained vegetation that are not impacted by Snowy 2.0, a 50 metre exclusion zone (buffer) around Booroolong Frog habitat will be clearly demarcated by fencing and signage and identified on maps for construction personnel. 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 will serve to identify the ecological sensitivity of the land and only approved works with adequate controls in place will be permitted to be undertaken > Where works will be undertaken within the 50 metre riparian buffer zone for the Booroolong Frog, an ecologist will inspect all vegetation, rocks, logs and other shelter sites to locate any frogs. Frogs will be relocated to the designated relocation site. 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) > 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 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 Offset Strategy and offset requirements for the project. This process involves the preparation of a pre-clearing report > 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 NPWS and FCNSW > Cleared native vegetation will be mulched and stockpiled for use during rehabilitation. > Hollows logs and limbs will be retained for placement within retained vegetation and reuse during rehabilitation.

Ref	Impacts	Mitigation measures
Construction		
B2	Sediment control	> Erosion and sedimentation will be managed through implementation of effective sediment control measures as outlined in the soil and water management plan (SWMP) which will be prepared > Revegetation of slopes will be undertaken as soon as possible in line with the Rehabilitation Plan.
B3	Impacts 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.
B4	Fauna vehicle strike	Vehicle movements on newly formed access tracks will be limited to a 20 km/h speed limit implemented to reduce the risk of vehicle strike to fauna.
B5	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. > During the clearing works, weeds will be disposed and managed appropriately to stop the spread of existing weed species > 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 > 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. > Waste will be stored appropriately in inaccessible bins and disposed off-site. The details of the monitoring program will be determined during the preparation of the Biodiversity Management Plan.
B6	Light and noise pollution	Artificial lighting required during construction in the early morning and late afternoon in winter will be limited to within approved construction hours.
Operation		
B7	Impacts to threatened species	Monitoring of threatened species to ensure impacts arising from the project are within predicted levels. The details of the monitoring program will be determined during the preparation of the Biodiversity Management Plan.
B8	Light and noise pollution	Directional lighting will be used for any permanent lighting required (i.e. substation) to minimise light spill as much as possible.

7.1.5 Biodiversity offset

The Biodiversity Offsets Scheme applies to SSI projects unless the Secretary of DPIE and the Chief Executive of EESG determine that the project is not likely to have a significant impact.

Offsets would be required for the direct and indirect impacts to native vegetation and threatened species habitats. A framework for the project's Biodiversity Offset Strategy has been completed (refer to Section 15 of the BDAR). The Biodiversity Offset Strategy would be further developed through consultation with key stakeholders including Snowy Hydro, DPIE, NPWS, BCD and DAWE, and detailed in a separate document to the EIS.

The offset credit requirement has been calculated using the BAM-C based on the concept design. This involved dividing the project impacts by bioregion, as the project is located across the South Eastern Highlands Bioregion and Australian Alps Bioregion. The bioregion boundaries align closely with the KNP and Bago State Forest boundary. The credit requirement generated by the BAM-C for the disturbance area 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, 2019).

TransGrid proposes to use the same framework which has been developed for the *Snowy 2.0 Main Works Biodiversity Offset Strategy* (EMM, 2020) and included in the Snowy 2.0 Main Works Infrastructure Approval; 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 Snowy 2.0 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 (DPIE, 2020a).

The Biodiversity Offset Strategy including a breakdown of the ecosystem and species credit requirements generated by each of the impacts is discussed further in the BDAR provided in **Appendix B**.

7.2 Aboriginal heritage

This section summarises the findings of the ACHAR provided in **Appendix C**. The ACHAR addresses the following SEARs:

Heritage:

- An assessment of the cultural and heritage impacts of the project, including impacts on:
  - The cultural values of the Kosciuszko National Park;
  - Aboriginal and historic heritage items.

7.2.1 Assessment methodology

The method for the Aboriginal cultural heritage assessment included:

- A desktop assessment of the project area to develop a predictive model. This involved undertaking database searches including the Aboriginal Heritage Information Management System (AHIMS) and review of previous archaeological investigations specific to the project
- Predictive modelling to determine the archaeological sensitivity of particular landforms, and ultimately the location, extent and sampling strategy for the test excavation methodology and program
- Field surveys of the project area were carried out on the 21-22 March 2018, 16-19 April 2018 and 24 September 2019 by Jacobs archaeologists. A further archaeological survey was also carried out on the 19-25 May 2019 with nominated site officers from Brungle-Tumut Local Aboriginal Land Council (BTLALC).
- An archaeological survey and program of test excavation was carried out from 21 to 25 October 2019 with RAPs and LALC representatives. The purpose of this visit was to investigate the potential for subsurface Aboriginal objects in two areas identified during the survey as a potential archaeological deposit (PAD): the substation site and an area within the transmission corridor in the project area west referred to as Substation PAD and PAD_03. A further site survey was carried on the 12 November 2020 with the intent to survey the top of Sheep Station Ridge and access tracks in this location. Due to the steep terrain, safety concerns and adverse weather the top of this ridge was not reached. This area would be surveyed at a later date once suitable access to the area has been established. This survey would be post approval (if granted)
- Consultation with the Aboriginal community representatives
- Assessment to determine the cultural significance of identified items
- Assessment of impacts on Aboriginal items/sites identified in the desktop assessment and verified through surveys and test excavations, and identification of management measures to minimise impacts on Aboriginal heritage.

The ACHAR was prepared in accordance with

- *Aboriginal Cultural Heritage Consultation Requirements for Proponents* (DECCW, 2010)
- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011)
- *Cultural Landscape Management: Guidelines for Identifying, Assessing, and Managing Cultural Landscapes in the Australian Alps National Parks* (Lennon and Matthews, 1996)
- *The Australia ICOMOS Burra Charter* (Australia ICOMOS, 2013) (Burra Charter).

7.2.1.1 Consultation

Engagement with Aboriginal stakeholders was carried out to provide an opportunity for Aboriginal people to be involved in the project and allow TransGrid to gain an understanding of the cultural environment in which the project is located. The consultation activities carried out in accordance with ACHCRP are summarised in **Section 6** and discussed in detail in Section 4 of the ACHAR (**Appendix C**).

7.2.2 Existing environment

7.2.2.1 Environmental and cultural context

The project area is within the country of the Walgal people (also spelled Walgalu, Wolgal), whose lands occupied the northern part of the Australian Alps, near Kiandra, now referred to as KNP.

Aboriginal occupation of the Australian Alps is represented in the region's archaeological record, and in the cultural knowledge of the Aboriginal population. These provide information on a network of pathways, ceremonial practices and sites, and the practice of moth hunting, which together make up a unique cultural complex. The landscape, and places within it, are connected with this cultural complex and consequently with its heritage value.

An examination of environmental factors, and of cultural and spiritual practices associated with the project area reinforces the importance of the Snowy Mountains to local Aboriginal groups, and demonstrates the presence of varying amounts of Aboriginal archaeological material. The archaeological record within the region includes a variety of site types such as occupation sites in the open and in rock shelters, as well as culturally modified trees, quarries, ceremonial places and burials.

7.2.2.2 Identified cultural heritage values relevant to project area

Apart from archaeological sites, there are no places where specific Aboriginal cultural values have been identified during consultation and from the cultural heritage reports, either within or in the immediate vicinity of the project area.

During consultation, it was repeatedly expressed by the RAPs that the area was a meaningful place to the local Aboriginal communities, that there was a feeling of custodianship of the sites and objects within the project area and that the land holds specific social, spiritual and cultural values. It was expressed by representatives of the Snowy Mountains Indigenous Elders Group and the BTLALC that people had lived in the area for thousands of years, and that the high ridges, rock shelters, confluence of creeks, rivers and permanent water sources are highly significant parts of the Aboriginal landscape.

7.2.2.3 Desktop assessment and previous archaeological investigations

Registered AHIMS sites

An extensive search of the AHIMS database maintained by Heritage NSW was undertaken on 21 September 2020. The AHIMS search returned 101 previously recorded sites within and near the project area. Of these, five registered sites are within the project area. All five of these sites are also within the disturbance area. Four of these AHIMS sites are within a PAD (ST PAD 01). These sites are surface scatters of stone artefacts are described in **Table 7-8** and shown on **Figure 7-4**. Another site (AHIMS # 56-6-0041) is located about 27 metres from the disturbance area.

Table 7-8 Summary of AHIMS sites within the disturbance area

AHIMS ID	Site name	Site features	Site type	Distance from disturbance area
56-6-0009	Ravine; Lobs Hole; KNP91-59	Artefact	Open Camp Site	Within disturbance area and PAD (ST PAD 01)
56-6-0477	Ravine SU17/L1	Artefact	Artefact Scatter	Within disturbance area
56-6-0495	Ravine SU3/L1	Artefact	Artefact Scatter	Within disturbance area and PAD (ST PAD 01)

AHIMS ID	Site name	Site features	Site type	Distance from disturbance area
56-6-0496	Ravine SU3/L2	Artefact	Artefact Scatter	Within disturbance area and PAD (ST PAD 01)
56-6-0497	Ravine SU3/L3	Artefact	Artefact Scatter	Within disturbance area PAD (ST PAD 01)

Previous archaeological studies

There have been a number of archaeological projects and heritage assessments carried out in the Australian Alps. However, the most relevant archaeological assessments to the project area are the investigations associated with Snowy 2.0, being the *Snowy 2.0 Exploratory Works Aboriginal Cultural Heritage Assessment Report* (NSW Archaeology Pty Ltd, 2018) and *Snowy 2.0 Main Works: Aboriginal Cultural Heritage Assessment Report (*NSW Archaeology Pty Ltd, 2019). These assessments examined Lobs Hole Ravine, Talbingo Reservoir and the Mine Trail Road. These survey areas overlap with the project and provide the location of Aboriginal sites and artefacts.

The review of past archaeological studies has supported the development of a predictive model for the project area. Based on this model, the following predictions for Aboriginal sites to be present within the project area were made:

- Stone artefact occurrences (isolated or in clusters) were likely to be the most common site types
- Scarred trees and ceremonial structures were less likely to be present due to European land-use practices
- Rock shelters and art sites were unlikely to be present due to the surrounding geology not being conducive to shelter formation
- Stone artefacts were predicted to be present on the surface and under the ground. Artefact density and site complexity is expected to be greater near reliable water, areas of low gradient and the confluence of a number of different resource zones
- Both low density surface and subsurface artefacts may occur across the entire project area.

7.2.2.4 Archaeological survey findings

As outlined in **Section 7.2.1**, three surveys of the project area were carried out. During the survey in May 2019, ten surface artefacts were identified. All of these artefacts were within the area of the previously recorded site cluster consisting of AHIMS# 56-6-0009, AHIMS# 56-6-0495, AHIMS# 56-6-0496, and AHIMS# 56-6-0497 as shown on **Figure 7-4**. Therefore, it has been assumed that the artefacts found during the survey relate to one or more of these previously recorded sites, which are located within 70 metres of one another.

The survey also identified four areas of PAD as shown on **Figure 7-4**. These PADs included:

- ST PAD 01 and ST PAD 02, located in project area east
- Substation PAD located at the substation site in project area west
- ST PAD 03 located in transmission corridor in project area west.

ST PAD 01 incorporates AHIMS# 56-6-0009, AHIMS# 56-6-0495, AHIMS# 56-6-0496, and AHIMS# 56-6-0497.

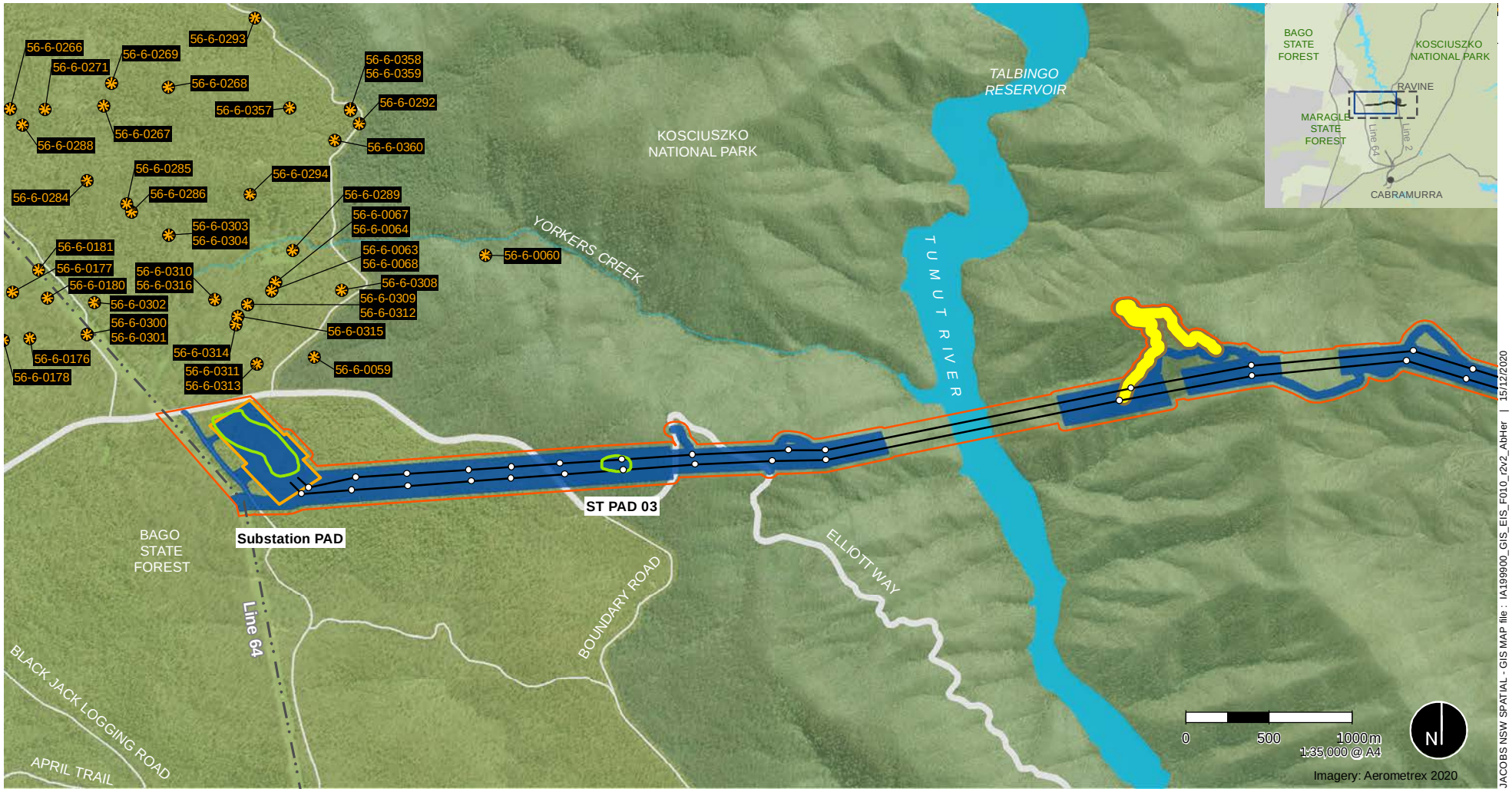


Figure 7-4 | Aboriginal heritage

Data source:
Jacobs 2020, OEH 2019,
© Department Finance, Services and Innovation 2018

Project area
Disturbance area
Proposed structure
Proposed transmission line
Snowy 2.0 cable yard
Snowy 2.0 Disturbance footprint
AHIMS
AHIMS search extent (see inset map)
Future survey area
PAD boundary
Electricity transmission line
Minor road
Major road
Trail
Waterway
Water body
NPWS estate

Figure 7-4 | Aboriginal heritage

Data source:
Jacobs 2020, OEH 2019,

7.2.2.5 Test excavation findings

An archaeological survey and program of test excavation was carried out in October 2019. The purpose of this visit was to investigate the potential for subsurface Aboriginal objects located in the Substation PAD and ST PAD 03.

Two of the areas of PAD (ST PAD 01 and ST PAD 02) have not been subject to archaeological excavations for the project as both these areas are within the Snowy 2.0 disturbance footprint which has been the subject of a separate archaeological assessment. Therefore it was decided to leave the sub-surface testing of these PADs as part of the Snowy 2.0 archaeological assessment in order to avoid duplicating assessment requirements. The results of the Snowy 2.0 archaeological assessment were used to inform the recommendations for these two areas of PAD (ST PAD 01 and ST PAD 02) in the overlap area of the project and Snowy 2.0.

The Substation PAD is located on a relatively level section of ground on the top of a north-south oriented ridgeline. To the east, the terrain falls steeply away to the top of Talbingo Reservoir. The excavations at this PAD found no artefacts, from a total of 28 excavated pits. As Aboriginal artefacts have not been identified within this PAD, during both the surveys and test excavation it was concluded that the Substation PAD is not an archaeological site.

ST PAD 03 is located on a relatively level section of ground that contrasts with the moderate to steeply sloped terrain. The excavations at this PAD found nine artefacts, of which two were recovered from subsurface deposits in excavated pits. The remaining artefacts were found on the ground surface. All of these surface artefacts are made from quartz as shown in **Photo 7-3**. These results show that ST PAD 03 contains an assemblage of stone artefacts (cores and unretouched flakes) located on the current ground surface and subsurface deposits. These items appear to be representative of Aboriginal sites in the Australian Alps, and it is likely that similar sites occur within KNP and Bago State Forest.

Photo 7-3 Sample of quartz flakes artefacts at ST PAD 03

7.2.2.6 Significance assessment

Significance assessments generally use a series of standard criteria to define why a site is important. The criteria used for the significance assessment are described in the Burra Charter. These criteria include assessing for:

- Social value
- Historical value
- Scientific value
- Aesthetic value.

An overall significance rating (low, medium or high) was assigned to each site within the project area based on an average across the criteria.

For the two areas of PAD (ST PAD 01 and ST PAD 02) the archaeological significance is assessed through extrapolation from similar areas of the landscape that have been subject to excavation. Results of excavations carried out for Snowy 2.0 were used to assess the likely significance of ST PAD 01 and ST PAD 02, given that these two areas of PAD are located in low-elevation areas near Yarrangobilly River, which are similar to the landforms assessed by Snowy 2.0.

The significance of all items in the project area is summarised in **Table 7-9**.

Table 7-9 Assessment of site significance

Site name	Assessed significance and additional detail
ST PAD 01 (incorporating previously recorded sites AHIMS# 56-6-0009, AHIMS# 56-6-0495, AHIMS# 56-6-0496, and AHIMS# 56-6-0497)	**Moderate.** Assessed as being of Moderate significance having regard to the surface artefact assemblage. The Archaeological significance of subsurface deposits is unknown. Potential to have moderate significance, based on results of Snowy 2.0 excavations nearby. This PAD encompasses several previously recorded surface artefact scatters. These consist of a medium density assemblage of tuff and quartz cobbles and cores and unretouched flakes on the ground surface.
ST PAD 02	**Moderate** Archaeological significance of subsurface deposits unknown. Potential to have moderate significance, based on results of Snowy 2.0 excavations nearby.
AHIMS# 56-6-0477	**Low** Site could not be re-found during the archaeological survey. Significance assessment follows *Snowy 2.0 Exploratory Works Aboriginal Cultural Heritage Assessment Report* (NSW Archaeology Pty Ltd, 2018).
ST PAD 03	**Low** Low density assemblage of quartz cores and unretouched flakes, on ground surface and subsurface deposits.
Substation PAD	**Nil** No artefacts found. This area of PAD was assessed as not being an Aboriginal site.

7.2.3 Assessment of potential impacts

7.2.3.1 Construction

There are three PADs (ST PAD 01, ST PAD 02, ST PAD 03) and one site (AHIMS# 56-6-0477) within the disturbance area which would be directly impacted by the construction of the project. All of these are expected to be harmed in their entirety.

One site (AHIMS # 56-6-0041) is potentially at risk of indirect impacts during construction of the project due to it being located close to the disturbance area (refer to **Figure 7-4**). This site would be protected during construction to avoid inadvertent damage.

Due to its positioning atop the steep and heavily vegetated Sheep Station Ridge, an approximate 1.6 kilometre section of access track under Option A was not surveyed due to the unlikely nature that it would contain Aboriginal Heritage. Notwithstanding, under consultation with Heritage NSW, it was agreed that this section of track would be surveyed prior to construction commencing to confirm the presence or absence of Aboriginal heritage within that portion of the disturbance area.

7.2.3.2 Operation

No adverse impacts on Aboriginal cultural heritage (either direct or indirect) are anticipated during operation of the project.

7.2.4 Mitigation measures

Mitigation measures for impact on Aboriginal heritage are presented in **Table 7-10**. No operational mitigation measures are required.

Table 7-10 Mitigation measures for Aboriginal heritage impacts

Ref	Impacts	Mitigation measures
Pre construction		
AH1	Changes to the disturbance area	During detailed design, if the disturbance area changes but is still within the project area, a consistency assessment will be prepared to confirm if impacts are consistent with the EIS.
AH2	Sheep station ridge access track	The area of access track atop Sheep Station Ridge which has not been surveyed will be surveyed in consultation with the RAPs once suitable access to the area has been established. Any areas or items of Aboriginal cultural heritage significance identified as part of this additional investigation will be managed in accordance with measures developed in consultation with RAPs. These measures will be included in the CHMP prepared for the project.
AH3	Impacts on Aboriginal heritage during construction	A CHMP will be prepared, to guard against inadvertent impacts to Aboriginal objects during construction. The CHMP will specify that project works will be restricted to the disturbance area. It will include provisions to ensure workers are made aware of cultural heritage places and their value, for example through project inductions. The CHMP will include provisions to guard against indirect impact to AHIMS# 56-6-0041.
AH4	Salvage Excavation	A Salvage Excavation Method Document will be prepared prior to carrying out the salvage excavation works at the four impacted items (ST PAD 01, ST PAD 02, PAD 03 and AHIMS# 56-6-0477). This document will be provided to RAPs, who will be given a 28-day period to review the document and provide feedback. An indicative method to be followed during salvage excavations is provided in Section 12.1 of the ACHAR.
AH5	Impacts ST PAD 03, and AHIMS# 56-6-0477.	Salvage collection of surface artefacts will be carried out, prior to project construction at ST PAD 03 and AHIMS# 56-6-0477.

Ref	Impacts	Mitigation measures
AH6	Impacts to ST PAD 01 and ST PAD 02	Salvage collection of surface artefacts, and salvage excavations will be carried out, at ST PAD 01 and ST PAD 02. Collection of surface artefacts at ST PAD 01 will also salvage any artefacts from the previously recorded surface sites within this PAD's boundaries, these sites being AHIMS# 56-6-0009, AHIMS# 56-6-0495, AHIMS# 56-6-0496, and AHIMS# 56-6-0497. It is assumed that ST PAD 01, ST PAD 02, AHIMS# 56-6-0009, AHIMS# 56-6-0495, AHIMS# 56-6-0496, AHIMS# 56-6-0497 and AHIMS# 56-6-0477 are intact and have not been either destroyed through activities of Snowy 2.0 or salvaged by the Snowy 2.0 archaeological team. If these sites have been entirely salvaged or destroyed by the Snowy 2.0, then the mitigation measures relating to salvage collection and excavation at these sites will not apply.
Construction		
AH7	Unexpected finds	In the event that a site or artefact (as defined by the NPW Act or Heritage Act) is identified during construction works, works will cease at the location and no further harm to the object will occur. The find will be immediately reported to TransGrid, and the regulator in accordance with legislation. No work will commence in the vicinity of the find until any required approvals have been given by the regulator. In the event that skeletal remains are encountered during the activity, works must stop immediately, the area secured to prevent unauthorised access and TransGrid, NSW Police and Heritage NSW contacted.

7.3 Non-Aboriginal heritage

This section summarises the findings of the non-Aboriginal heritage assessment provided in **Appendix G**. The non-Aboriginal heritage assessment addresses the following SEARs:

Heritage:

- An assessment of the cultural and heritage impacts of the project, including impacts on:
  - The listed heritage values of the Australian Alps National Parks and Reserves National Heritage Place;
  - The listed heritage values of the Snowy Mountains Scheme National Heritage Place;
  - The cultural values of the Kosciuszko National Park.

7.3.1 Assessment methodology

The term 'heritage item' is used throughout this section to indicate any non-Aboriginal historical heritage place including buildings, structures, and archaeological remains.

The methodology for the non-Aboriginal heritage assessment included:

- Desktop assessment which involved a review of relevant heritage legislation, search of all available historical heritage registers for the study area and literature review
- Developing a predictive model for occurrence of historical site types in the landscape
- Carrying out field surveys of the identified priority areas to inspect known historical heritage items, identifying previously unidentified historical heritage items, assessing potential for historical archaeology and determine heritage curtilages. The field survey occurred over four days in May 2019
- Determine the potential impacts on the identified heritage items
- Preparation of an assessment of significance for heritage items within the project area
- Development of management measures to mitigate impacts on non-Aboriginal heritage.

The non-Aboriginal heritage assessment was prepared in accordance with the *Burra Charter* (Australia ICOMOS, 2013), *Assessing heritage significance - a NSW Manual update* (NSW Heritage Office, 2001) and the *Historical Archaeology Code of Practice* (Heritage Council of NSW, 2006).

7.3.2 Existing environment

7.3.2.1 Historical context

Much of the landscape contains limited human disturbance, however some development within and in proximity to the project includes an existing transmission line, minor access tracks, and infrastructure associated with the Talbingo Reservoir. European settlers have been living and working within the project area since the early 19th century. The historical record shows that there have been phases of land use, commencing with pastoralism and subsumed by mining, of both copper and gold.

Mining in the Australian Alps was primarily for alluvial gold mining, which brought large numbers of people to settle in the Australian Alps in towns like Kiandra, approximately 13 kilometres from the project. With the commencement of mining for copper in 1874 at Lobs Hole (also known as Ravine), a settlement began to support both the miners and the facilities required by them. By 1908, the village of Ravine contained a number of temporary buildings, a school, butcher's shop, blacksmiths' shop and a boarding house. At its height, 500 people lived at Lobs Hole.

From 1915, the village of Ravine began its decline due to falling copper prices and World War One leading to the abandonment of the Lobs Hole Central Mine.

Mining also occurred at the New Maragle goldfields which opened in 1874, however unlike Lobs Hole, no town was established.

The construction of the Snowy Scheme brought another wave of habitation into the area, although it is likely that it also destroyed much of the earlier heritage. The Snowy Scheme was completed in 1974, with a total of seven power stations, 16 dams and 225 kilometres of tunnels, pipelines and aqueducts.

The chronology of settlement in the locality is provided in **Table 7-11**.

Table 7-11 Chronology of non-Aboriginal heritage

Date	Event(s)
1820s	European exploration and sporadic settlement begins. Settlement at this time is outside the limits of the recognised "Colony" of NSW
1830s	Intensification of European settlement and grazing
1851	Gold is discovered in Kiandra
1874	Discovery of copper in Lobs Hole
1880s	Decline of Kiandra
1891	Construction of copper smelt at Ravine
1910	Proclamation of the village of Ravine (Lobs Hole)
1921	Abandonment of village of Ravine
1949-1974	Snowy Scheme constructed
1986	Ravine included in KNP

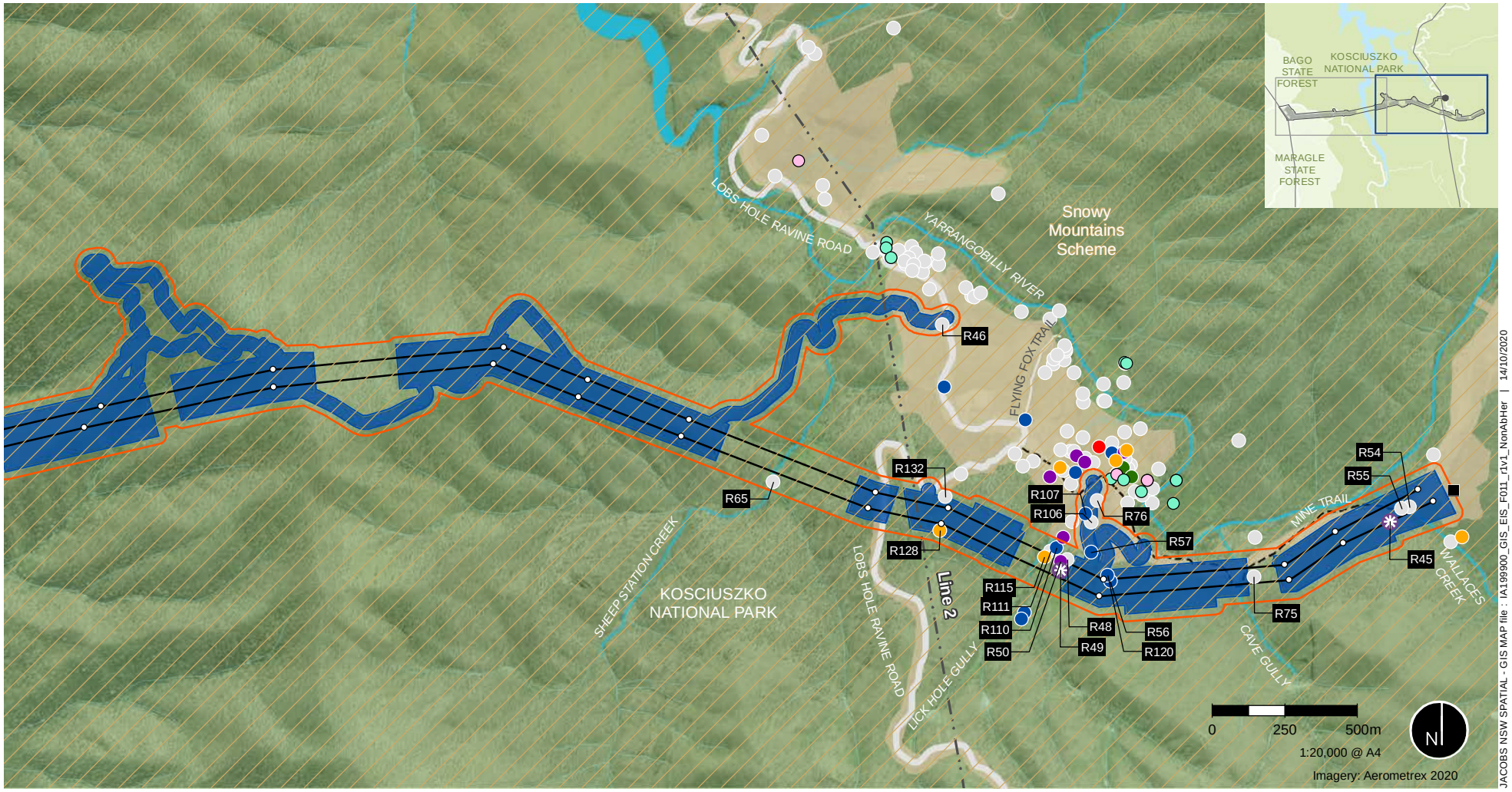
7.3.2.2 Heritage register and previous heritage assessments

Searches of State and Federal heritage databases were undertaken to establish known heritage items within the locality. The search identified ten items, as outlined in **Table 7-12**. As shown in this table and on **Figure 7-5**, the project is within the curtilage of two items on the National Heritage List (NHL), being the Australian Alps National Parks and Reserves and the Snowy Scheme. It is noted that the Register of the National Estate (RNE) is maintained on a non-statutory basis as a publicly available archive.

Table 7-12 Summary of heritage items identified on heritage registers in the locality

Item name	Listing	Significance	Within project area
Australian Alps National Parks and Reserves	NHL – listed place	National	Partially
Snowy Mountains Scheme	NHL – listed place / RNE	National	Partially
Four Mile Hut	RNE	National	No, over 10 kilometres south
KNP (1981 boundary)	RNE	National	Partially
Matthews Cottage	SHR / LEP	State / Local	No, about 10 kilometres east
Kiandra Courthouse/ Chalet	SHR / LEP	State / Local	No, about 10 kilometres east
Sue City	Historic Heritage Information Management System (HHIMS)	Local	No, about 2.5 kilometres south
Items relating to New Maragle goldfield	HHIMS	Local	No, over 1 kilometres south

Given the national heritage importance of the Australian Alps National Parks and Reserves and the Snowy Mountain Scheme, the project was deemed to be a 'controlled' action on the basis of potential impacts to the heritage values of a National Heritage place (section 15B & section 15C), refer to **Section 4.1.3**.



Project area
Disturbance area
Proposed structure
Proposed transmission line

Snowy 2.0 cable yard
Snowy 2.0 Disturbance footprint

Heritage
Potential heritage
Section 170 heritage
National Heritage List

Archaeological potential
Historic heritage - local significance (NSW Archaeology 2019)
High
Moderate
Low-Moderate
Low
Limited
Historic heritage (NSW Archaeology 2019)

Electricity transmission line
Waterway
Water body
NPWS estate

Figure 7-5 | Non-Aboriginal heritage

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

7.3.2.3 Previous heritage assessment

As part of the *Snowy 2.0 Main Works EIS* (EMM, 2019), 20 items of non-Aboriginal heritage were identified within the project area of this project, refer to **Table 7-13** and **Figure 7-5**. Ten of these items are located within the disturbance area and have been shaded grey in **Table 7-13**. Two of these items (R45: Lobs Hole Copper Mine Water Race and R49: Circular stone wall) are assessed as having heritage significance under the *Assessing Heritage Significance - A NSW Manual Update* (NSW Heritage Office, 2001).

Table 7-13 Heritage items within the project area and disturbance area

ID	Site Name	Details
R45	Lobs Hole Copper Mine Water Race	This water race is cut into the base of the hill slope on the southern side of the Yarrangobilly River. It extends from Wallaces Creek in the east to the Lobs Hole Copper Mine. It was constructed in 1907 and was originally described as measuring two miles in length, with a dam at its eastern end.
R46	Large excavation	This large excavation is located on the western side of Lobs Hole Ravine Road. It is heavily overgrown and its purpose is unknown.
R48	Excavation (possible shed)	This feature is an excavation which contains stacked piles of sheet tin, corrugated iron and other metal, including roof capping.
R49	Circular stone wall	Semicircular stone wall made with massive natural boulders. The stone forms a flat platform for a horse or other to walk around driving a shaft attached to a mechanical device such as a chaff cutter or wheat grinder.
R50	Shed with bullock wagon frame	Frame complete with thick wire rope for 'lowering' bullocks.
R54	Site of bridge	This was once the site of a bridge crossing of the Yarrangobilly River at the end of the mine trail.
R55	Brick hearth	This hearth is interpreted as belonging to a former picnic site.
R56	Excavated ditch	This feature appears as an old cut and benched road alignment in the Struggle Street area.
R57	Old road alignment	This road is fragmentary and appears as an extension of a road in the Struggle Street area.
R65	Thomas house	The John Thomas homestead on Sheep Station Creek.
R75	Mine shaft on main lode 31	Lobs Hole Copper Mine shaft on M.L. 31 at east end of main lode.
R76	Scatter of tin, glass and brick	Scatter of domestic debris.
R106	Old road	This road is fragmentary and appears as an extension of a road in the Struggle Street area.
R107	Building platform	This level platform and time scatter in the Struggle Street area. The platform is overgrown with regenerating bush and the ground’s surface is obscured by leaf litter, providing low visibility.
R110	Building platform	Building platform in the Struggle Street area and near the creek.

ID	Site Name	Details
R111	Path to creek	Struggle Street: path descends into creek channel.
R115	Stone-lined channel	Stone lined channel in Lick Hole Gully.
R120	Building platform	This platform on a prominent knoll at the top of Struggle Street. An alignment of stone two metres in length is noted along the northern edge.
R128	First school at Lobs Hole	The first school was described as being a single structure on the top of a steep hill. The school building was of wooden construction with a stone-lined wooden chimney and two windows. The first teacher was appointed in 1892. In 1908 the district inspector recommended that the school be decommissioned owing to its poor condition. A new school site was procured in the proposed village site and the new school opened in 1909.
R132	Old track	Old track and dumped sections of half pipes made from corrugated iron.

7.3.2.4 Archaeological items

There is only sporadic evidence of European settlers that have been living and working within the project area since the early 19th century. Although some non-Aboriginal heritage may exist throughout the project area, there are two main areas where the potential is higher. These are:

- Lobs Hole Ravine: The types of remains to be found in this area are associated with both the copper mine and the habitation sites in the township that grew up around it
- Bago State Forest: The New Maragle goldfields once covered the area to the west of the Tumut River, including parts of the Bago and Maragle State Forests. It is therefore possible that some evidence of items associated with the goldfields workings remains, particularly in more remote pockets of the area.

It is possible that some items relating to mining infrastructure and, less likely, pastoral activity in the form of huts/sheds and/or their sites, may remain within the project area. There is also a limited possibility that items relating to the construction of the Snowy Scheme in the 1950s remain in some areas within the project area.

7.3.2.5 Site survey

The site inspection carried out over four days in May 2019 noted that the only area within the project area with a high potential for non-Aboriginal heritage items was in the Lobs Hole Ravine (project area east). Although 10 of the heritage items previously identified by Snowy 2.0 are located in the disturbance area of project area east, only five were able to be ground-truthed.

No historic heritage items were identified in the project area in addition to those already recorded and assessed as part of Snowy 2.0.

7.3.2.6 Significance assessment

Significance assessments were carried out by using a system of assessment centred on the Burra Charter. In NSW, heritage is assessed against seven criteria. If an item meets one or more of the seven heritage criteria, and retains the integrity of its key attributes, it can be considered to have significance.

The Lobs Hole Copper Mine is an important component of the mining history at Lobs Hole. It has a strong association with Reeckmann and Forsstrom, who were important in developing mining at Lobs Hole and as central figures in the Lobs Hole Copper Mining Company. The Lobs Hole Copper Mine Water Race is assessed to be of local significance against criteria a (Historical significance) and b (Associative significance).

Three items within the disturbance area are considered to be of heritage significance and were considered further. These include:

- Australian Alps National Parks and Reserves (National)
- Snowy Scheme (National)
- Lobs Hole Copper Mine Water Race (R45) (Local).

7.3.3 Assessment of potential impacts

7.3.3.1 Construction

The project area is within the curtilage of two items on the NHL, being the Australian Alps National Parks and Reserves, and the Snowy Mountain Scheme which are MNES under the EPBC Act (refer to **Table 7-12**).

The Australian Alps National Parks and Reserves is made up of 11 national parks and covers approximately 1,653,180 hectares. The KNP is part of the Australian Alps National Parks and Reserves and covers an area of approximately 690,000 hectares. Approximately 195 hectares of the project area is in the KNP, representing 0.028 percent of the KNP. It was considered that the existing heritage values would not be adversely impacted by the project, given the project's relatively small disturbance area within the larger curtilage of the Australian Alps National Parks and Reserves.

The purpose of Snowy 2.0 and the project is to augment the existing hydro scheme, not to replace it. The project would not physically affect any existing components or heritage attributes of the existing Snowy Scheme.

Therefore, no significant impact is expected for either the Australian Alps National Parks and Reserves and the Snowy Mountain Scheme pursuant to section 15B of the EPBC Act.

Standard construction management measures, such as limiting vegetation clearing, and undertaking rehabilitation of disturbed areas are recommended in **Section 7.1.4** and would help to minimise potential impacts on the heritage values of these heritage places.

Ten items in the disturbance area would be directly impacted and includes R45, R46, R54, R55, R56, R57, R106, R107, R120 and R128. Of these ten items, one is of local heritage significance (R45) and five items have archaeological potential (R46, R56, R107, R120 and R128). Of the five items with archaeological potential, none of these have archaeological significance. The remaining items were assessed as have no archaeological potential or archaeological significance.

Mitigation measures have been provided for all the heritage items impacted by the project and are outlined in **Section 7.3.4**.

The ten items located within the project area, but outside the disturbance area, would not be impacted by the project. Management measures have been recommended to avoid inadvertent impacts to these items.

7.3.3.2 Operation

No operational impacts are expected on non-Aboriginal heritage.

7.3.4 Mitigation measures

Mitigation measures for non-Aboriginal impacts are presented in **Table 7-14**. No operational mitigation measures are required.

Table 7-14 Mitigation measures for non-Aboriginal heritage impacts

Ref	Impacts	Mitigation measures
Detailed design		
NH1	Changes to the disturbance area	During detailed design, if the disturbance area changes but is still within the project area, a consistency assessment will be prepared to confirm if impacts are consistent with the EIS.
NH2	Impacts to non-Aboriginal heritage impacts	A historic and natural heritage management plan will be prepared for the project, which clearly outlines the extent of impact to each recorded historic heritage item within the disturbance area and potential impacts to those sites located within the broader project area. The plan should clearly outline measures for their protection (where applicable) and details of further investigation and archaeological archival recording where appropriate.
NH3	Impacts to non-Aboriginal heritage impacts (R45, R46, R54, R55, R56, R57, R106, R107, R120 and R128)	All heritage items within the disturbance area that are to be impacted by the project will be subject to archival recording and archaeological excavations prior to the commencement of works. If these sites have been entirely destroyed by the Snowy 2.0, then the mitigation measures relating to archival recording and archaeological excavations will not apply.
Construction		
NH4	R45 (Lobs Hole Copper Mine Water Race)	If the construction of the project will destroy or directly impact the R45 (Lobs Hole Copper Mine Water Race), archival recording and archaeological excavation must occur prior to the commencement of construction. An archaeological research design and methodology must be produced in keeping with the *Historical Archaeology Code of Practice* (Heritage Council of NSW, 2006).
NH5	Unexpected finds	In the event that a site or artefact (as defined by the NPW Act or Heritage Act) is identified during construction works, works will cease at the location and no further harm to the object will occur. The find will be immediately reported to TransGrid, and the regulator in accordance with legislation. No work will commence in the vicinity of the find until any required approvals have been given by the regulator. In the event that skeletal remains are encountered during the activity, works must stop immediately, the area secured to prevent unauthorised access and TransGrid, NSW Police and DPIE contacted.

7.4 Water

This section summarises the findings of the hydrology assessment provided in **Appendix I**. The hydrology, assessment addresses the following SEARs:

Water:

- A site water balance for the project, including water supply and wastewater disposal arrangements;
- An assessment of the impacts of the project on:
  - The quantity of the region's surface and ground water resources, including Yarrangobilly River, Wallaces Creek, Talbingo Reservoir and the Tumut River;
  - Hydrological flows on site, including any potential flooding impacts.

7.4.1 Assessment methodology

The methodology for the hydrology assessment included:

- A review of existing background information relevant to the project area
- A desktop review of existing flood behaviour using flood mapping prepared for Snowy 2.0, and other publicly available information
- Assessment of the impact of construction and operation activities on water quality, hydrology and ground water
- Assessment of potential groundwater related impacts in accordance with the *NSW Aquifer Interference Policy* (DPI Water, 2012)
- Identification of appropriate measures to mitigate the potential impacts resulting from construction and operation of the project.

7.4.2 Existing environment

7.4.2.1 Catchments and waterways

The project is located at the headwaters of the Murrumbidgee catchment within the Snowy Mountains region. The catchment is characterised by 5,100 square kilometres of national parks and reserves including KNP.

The Tumut Reservoir crosses beneath the project, travelling for 182 kilometres before entering the lower Murray Darling Basin. The waterway is the largest tributary of the Murrumbidgee River and contains several water storage dams along its length including, Talbingo Reservoir and Blowering Dam. Talbingo Reservoir is a major rock fill dam forming part of the Snowy Scheme and is located approximately 2.5 kilometres downstream of the project area at the confluence of the Tumut River and Yarrangobilly River. Blowering Dam is an additional 22 kilometres downstream and is one of the largest dams in NSW (DPI Water, 2017).

In addition to Tumut River, the project area also contains five waterways or streams including Wallaces Creek, Yarrangobilly River, Sheep Station Creek, Cave Gully, and Lick Hole Gully. Thirteen unnamed gullies/drainage lines also occur within the project area, these gullies are ephemeral and have little to no channel definition, refer to **Figure 7-6**.

7.4.2.2 Hydrogeology

Geotechnical investigations have been undertaken at the substation site (SMEC, 2019a), including the drilling of 17 boreholes and seven test pits. From these geotechnical investigations and investigations as part of Snowy 2.0 (EMM, 2019d), groundwater occurrence is mostly anticipated to be associated with fractured or weathered basement lithologies. Some thin veneers of colluvium or residual soils are likely; however these are not expected to be saturated and would generally sit above the regional water table. Some alluvial deposits may be associated with the major drainages, such as Yarrangobilly River at the eastern end of the project, however, these would be within the narrow valley floors and typically away from the project. Alluvial deposits associated with Yarrangobilly River are estimated to be of the order of three to four metres thick.

There are no registered groundwater bores within five kilometres of the project.

There is potential for development of karst features within the limestones of the Byron Range Group as shown on **Figure 7-8**.

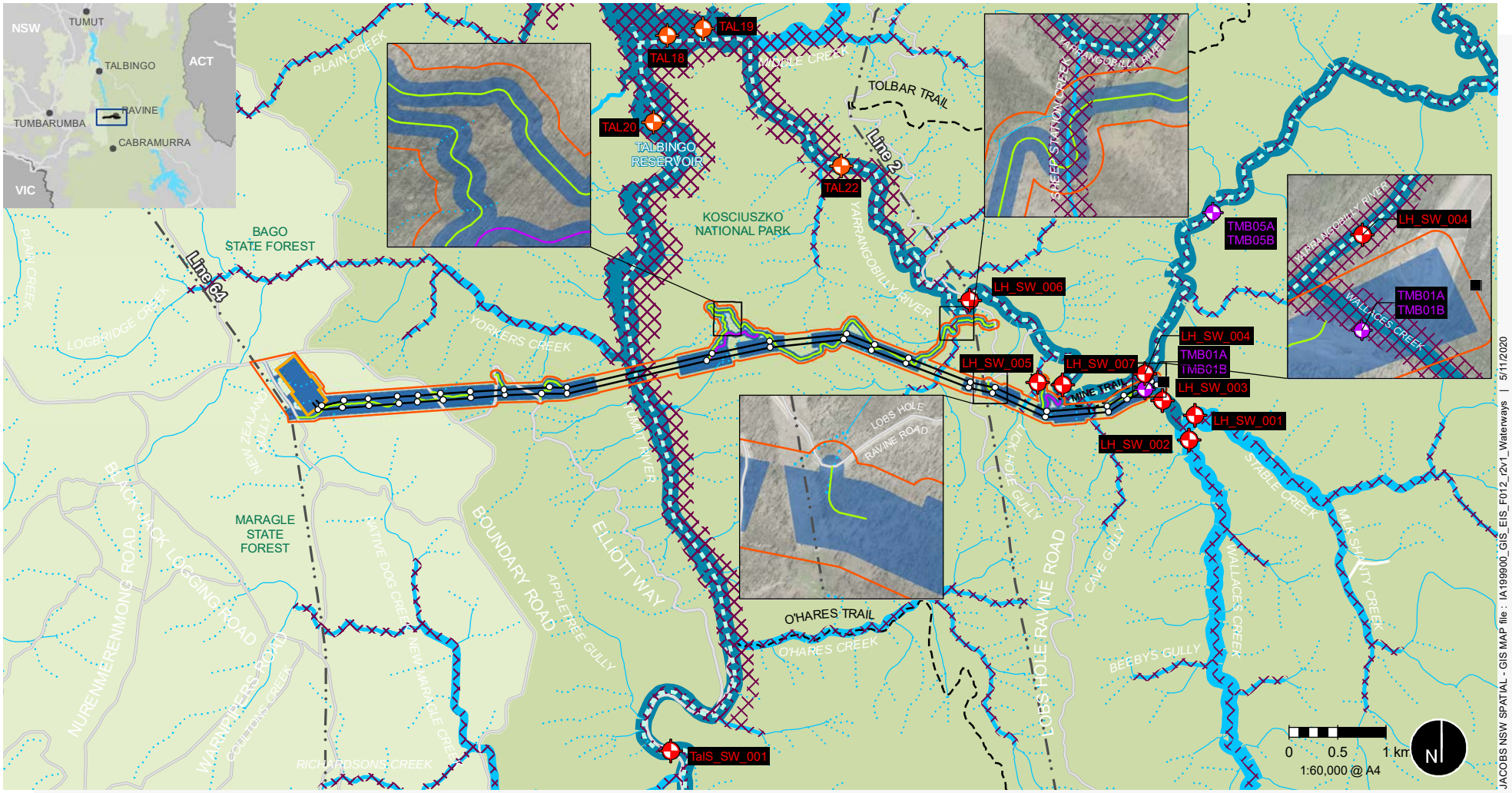
Depth to water

Geotechnical investigation at the substation site reported ground water levels ranging from 6.1 to 11.0 metres below ground level (mbgl).

Two of the monitoring bores (TMB01A/B) installed as part of the Snowy 2.0 (EMM, 2018b) are located near the project as shown on **Figure 7-6**. Monitoring bores TMB01A/B indicate that the depth to ground water is about 5.1 to 6.1 mbgl on the Talbingo valley floor.

Indicative depths to water for the three main topographic/geomorphological environments, derived from the *Snowy 2.0 Exploratory Works Groundwater Assessment* (EMM, 2017a) are as follows:

- Elevated plateau areas: 4.6 to 48.8 mbgl (average 16.4 mbgl)
- Steeply incised valleys and ridges: 3.5 to 21.9 mbgl (average 11.21 mbgl)
- Valley floor/alluvial: 3.1 to 6.1 mbgl (average 4.4 mbgl).



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

Snowy 2.0 cable yard

Water bore
Water quality monitoring location
Macquarie Perch (Tumut River and Yarrangobilly River)
Key Fish Habitat

Strahler order
1
2
3
4
5
≥6

Major road
Road
State forest
NPWS estate

Figure 7-6 | Waterways and monitoring locations

Data source:
Jacobs 2020, TransGrid, EMM 2019,

Groundwater flow

Groundwater flow is driven by areas of groundwater recharge and groundwater discharge. Groundwater recharge occurs from the infiltration of rainfall and runoff over areas of outcropping and shallow sub-cropping formations. Groundwater flow in the vicinity of project area east would be from topographically elevated areas towards the Talbingo Reservoir and Yarrangobilly Creek. This pattern of groundwater flow for the project area east is expected to be similar in project area west.

The geology of the project area is likely to result in perched aquifers, which are aquifers that are above the regional water table. The deeper groundwater systems will be reliant on vertical infiltration from overlying perched aquifers for recharge.

Groundwater quality

Available groundwater quality data indicates that groundwater quality in the project area is typically of neutral to alkaline pH and relatively fresh.

7.4.2.3 Surface water quality

Surface water monitoring has been carried out at several monitoring sites on waterways within the project area for Snowy 2.0, as shown on **Figure 7-6**. Water quality data was not available for review for any major or minor waterways within project area west (i.e. Yorkers Creek or New Zealand Gully). Given the land use in the surrounding area, it is expected that the waterways in project area west would exhibit similar water quality as those waterways within project area east.

Water quality data available from Snowy 2.0 (EMM, 2018b, EMM, 2019d and Cardno, 2018) indicated that the water quality varied across the project area. Generally, the water quality at Wallaces Creek was good. Yarrangobilly River and Tumut River also had generally good water quality in summer and autumn. However, during winter and spring the water quality was marginally poorer. Talbingo Reservoir and Lick Hole Gully waterway exceeded many of limits in the *Guidelines for Fresh & Marine Water Quality* (Australian and New Zealand Governments,2018), indicating a poorer water quality at these locations. The Dunns Road bushfires may have affected surface water quality in the local waterways.

7.4.2.4 Flooding

Flood modelling of the Yarrangobilly River and its major tributaries was carried out for the *Snowy 2.0 Exploratory Works EIS* (EMM, 2018a) for a range of design flood events up to the Probable Maximum Flood (PMF) over the project area east, refer to **Figure 7-7**. The flood modelling results available covered a portion of project area east (refer to **Figure 7-7**). No existing flood modelling results were available for the remaining areas in project area west. The waterways in project area west are only minor and don't warrant flood modelling.

Within the project area:

- The Tumut River water levels are controlled by the Talbingo Reservoir operations
- New Zealand Gully and an unnamed tributary of Yorkers Creek at the substation site are ephemeral in nature and would experience short duration overland flooding during heavy rainfall events.
- Sheep Station Creek is affected by flooding, with the Snowy 2.0 modelling results indicating existing peak flood depths of up to 1.5 metres in the Annual Exceedance Probability (AEP) (1% AEP) event and up to eight metres in the PMF
- Yarrangobilly, Lickhole Gully, Cave Gully and Wallaces Creek are also subject flooding to in the 1% AEP.

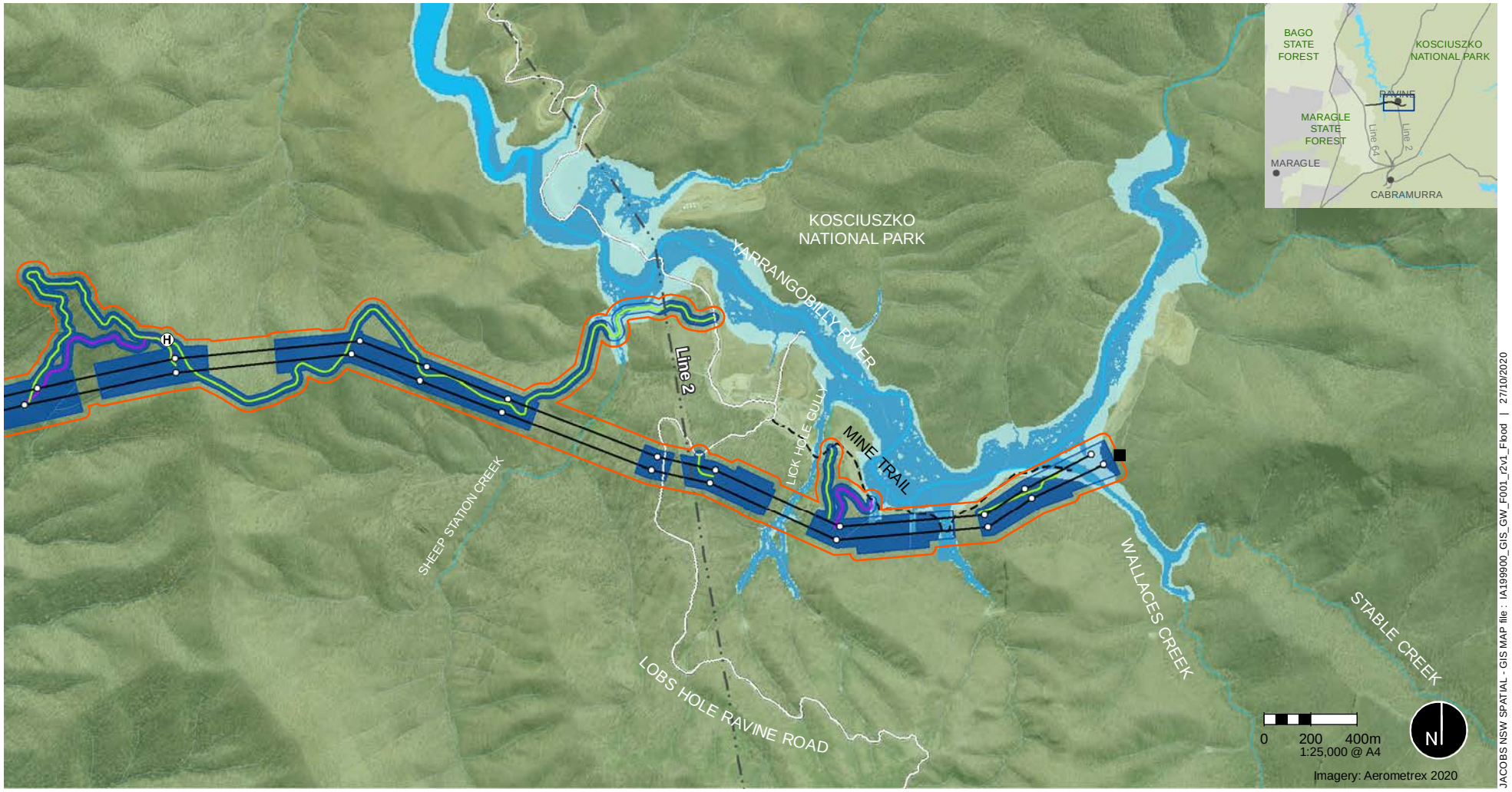


Figure 7-7 | Existing flood extents associated with the Yarrangobilly River

Data source:
Jacobs 2020, TransGrid, EMM 2019,
© Department Finance, Services and Innovation 2018

7.4.3 Assessment of potential impacts

7.4.3.1 Construction impacts

Hydrology and flooding

The far eastern extent of project area east has the potential to be impacted by flooding as shown on **Figure 7-7** during construction and would be subject to flooding in the PMF event.

The rest of the project area would be located away from major drainage lines and flood prone land and would be at low risk of flooding during construction. However, heavy rainfall during the construction period could result in local overland flows entering excavations or stockpiles of construction materials and spoil being washed away into nearby drainage lines and waterways.

Construction of the access tracks, structures and the substation have the potential to alter local flood behaviour due to the alteration or obstruction of existing overland flow paths (for example, due to stockpiling construction materials and spoil, establishment of crane pads and benching of the substation site), the establishment of erosion and sediment control measures, and the introduction of additional impervious surfaces. Any changes to overland flood behaviour would be localised and would not be expected to have any adverse effects on nearby properties or infrastructure (including any Snowy 2.0 infrastructure).

One of the new access tracks would require a waterway crossing at Sheep Station Creek, which is prone to flooding. To minimise the track closures during large flood events, the new waterway crossing (bridge/culvert) would be designed and constructed in a way that minimises flood risk. It is expected that the waterway crossing would be matched to the natural stream width to minimise adverse increase in flow velocities. This would minimise scour at waterway crossings. The waterway crossing would also be designed and constructed in accordance with design criteria for waterway crossings outlined in *Why do fish need to cross the road? Fish passage requirements for waterway crossings* (Fairfull and Witheridge, 2003).

Apart from the crossing of Sheep Station Creek, the other access tracks are predominantly positioned along ridge lines and hill sides and would not cross any other existing waterways. These access tracks would be affected by local catchment runoff during heavy rainfall but would not experience any significant flooding. To minimise the effects of overland stormwater runoff, an appropriate drainage system and erosion protection control would need to be provided.

Surface water quality

The construction of the project has the potential to impact the surface water quality of downstream waterways within and near the project area including Yarrangobilly River, Wallaces Creek, Sheep Station Creek, New Zealand Gully and an unnamed tributary of Yorkers Creek. Potential impacts to surface water quality include:

- Erosion of soils and sedimentation of waterways
- Tannin leachate from vegetation clearing during construction and operation
- Accidental leaks or spills of chemical and fuels from incidents and accidents during construction
- Dispersal of residual ash (that is present on the ground surface from bushfires) into waterways.

Sediment entering waterways can result in elevated turbidity, nutrients, and other contaminants which could result in a toxic environment for aquatic biota. In addition increased sedimentation can smother aquatic life affecting the ecosystems of downstream waterways and sensitive receiving environments (such as KFH).

Groundwater

Construction related impacts to groundwater are expected to be minimal as the local water table is anticipated to be below the depths of the majority of the excavations for foundations.

At the substation, the geology would be of low permeability. If groundwater is encountered in any excavations at the substation site, the potential inflows would be expected to be minimal and associated impacts negligible.

There is potential for shallower groundwater to be encountered within project area east in the vicinity of Yarrangobilly River and associated alluvial aquifers. Snowy 2.0 monitoring bores, TMB01A and TMB01B, show the depth to groundwater is expected to be in the order of five to six mbgl. The transmission structures, however, are located on the elevated flanks of the valley away from shallow alluvial aquifers and the depth to groundwater is likely to be below the base of any excavations. In the event that groundwater is encountered in any excavations at this location, potential inflows would be expected to be minimal due to the relatively low permeability of the geology with associated impacts assessed as negligible.

Boring for pile foundation may have potential to encounter groundwater, particularly in the lower lying far eastern portion of project area east. However, pile foundation would typically be driven or bored and therefore are not expected to require dewatering or have any significant impacts on groundwater.

Potential for leakage or spills impacting on groundwater are considered to pose the greatest risk to groundwater and would be managed through the implementation of adequate mitigation and management measures.

If dewatering is required, the amount of water extracted would be less than three megalitres/year, therefore a water access licence would not be required. Any required dewatering, including management and discharge for groundwater, would be managed under the SWMP.

Blasting

Blasting activities during construction can impact on groundwater through rock mass damage and contamination. Blasting requirements for the project would be limited. Where required they are expected to be of a shallow depth and not result in the interconnecting of previously isolated aquifers. Therefore, blasting would be unlikely to impact groundwater through rock mass damage or contamination.

NSW Aquifer Interference Policy

An assessment of the project against the minimal impact considerations of the *NSW Aquifer Interference Policy* (DPI Water, 2012) indicates that the project would have no more than a negligible interaction with groundwater and no further investigation or assessment are required under the *NSW Aquifer Interference Policy*.

Water balance

The project is not anticipated to have any significant take of surface or groundwater resulting from either construction or operation. The project would not have any discharge to the environment other than water applied for dust suppression, and the diversion of surface water runoff which will be appropriately managed with adequate erosion and sediment controls as required to manage potential impacts on receiving waters.

Approximately 60,000 kilolitres of water is expected to be required over the duration of construction works. It is expected that water would be required for:

- Amenities at the substation site
- Dust suppression during excavation works and for stockpiles
- Concrete production (it is expected that concrete would be sourced from offsite suppliers and from the Snowy 2.0 concrete batching facilities)
- Access track construction
- Testing of the oil spill containment system following construction of the substation.

It is expected that the water would be sourced, via tanker, from nearby towns such as Tumbarumba and Tumut for works occurring in project area west. It is expected that all water to be used during construction in project area east would be supplied by Snowy 2.0 Main Works operations at Lobs Hole and would be sourced from Talbingo Reservoir.

Water used for the testing of the spill oil containment system at the substation site would be captured and treated on site. While the wastewater from the amenities would be collected and disposed of off-site to an appropriately licenced facility as outlined in **Section 7.12.3**.

Construction of the project would have negligible impact on quantity of the region's surface and ground water resources, including Yarrangobilly River, Wallaces Creek, Talbingo Reservoir and the Tumut River.

7.4.3.2 Operational impacts

Surface water quality

Water quality risks during operation would be similar to those during construction and would include erosion of soils and sedimentation of waterways, tannin leachates and runoff of pollutants from accidental spills.

Flooding

During operation, the project would not be expected to cause any significant adverse impacts to flooding of any nearby properties or infrastructure (including Snowy 2.0). The new access tracks and associated drainage channels and waterway crossing (culvert/bridge) at Sheep Station Creek would cause minor interception and diversion of catchment runoff. This would not be expected to cause any significant changes in existing flow patterns or flooding conditions.

Tumut River water levels are controlled by the Talbingo Reservoir operation and the majority of structures nearest to the Tumut River would be located approximately 280 metres above the Talbingo Reservoir. Therefore, the majority of the structures would not be affected by elevated reservoir levels caused by flooding. However, the structures within the Snowy 2.0 cable yard would be located within the PMF flood extent and would be designed with an appropriate foundation to ensure stability. These structures and foundations would not represent a significant barrier to concentrate surface water flow.

It is expected that the substation site would potentially be subject to overland flooding as the site is located on two waterways (New Zealand Gully and an unnamed tributary of Yorkers Creek) which experience short duration overland flooding during heavy rainfall events. The substation would require a small section of New Zealand Gully to be filled and would include new drainage infrastructure to manage runoff through the substation site. The new impervious surfaces of the substation site may cause an increase in the peak flow rate and volume of runoff discharged from the substation site. There is an existing access track on the downstream side of the substation (about 120 metres to the north) where there is a potential for a minor increase in flood risk and erosion at two waterways crossings. This access track would be upgraded to provide access to the substation. Overland flooding impacts at the substation site and flood risk at the access road to the substation would be considered during detailed design, to ensure that the substation's drainage and stormwater system is adequate.

Groundwater

There would be no operational impacts on groundwater.

Water balance

The operation of the project would not impact on the quantity of the region's surface and ground water resources, including Yarrangobilly River, Wallaces Creek, Talbingo Reservoir and the Tumut River.

7.4.4 Mitigation measures

Environmental management measures relating to water are outlined in **Table 7-15**. Mitigating measures for soils and erosion are provided in **Section 7.5.4**.

Table 7-15 Mitigation measures for water impacts

Ref	Impacts	Mitigation measures
Detailed design		
W1	Waterway crossing	The waterway crossing over flood impacted waterways such as Sheep Station Creek will be designed and constructed in a way that minimises flood risk and minimise upstream and downstream impacts. The waterway crossing will be designed to ensure flow and drainage is maintained in waterways where construction works are taking place or where the permeant waterway crossing will be. The waterway crossing will be constructed in accordance with minimum design criteria for waterway crossings outlined in *Why do fish need to cross the road? Fish passage requirements for waterway crossings* (Fairfull and Witheridge, 2003).
W2	Flooding	> Flood modelling will be undertaken at the detailed design stage to define flood behaviour for the existing conditions due to mainstream and overland flooding. The flood models will be utilised to identify and address potential impacts of the proposed works for construction and operation of the project on flooding > Overland flooding impacts will be considered during detailed design, to ensure that the substation's drainage and stormwater system is adequate, and the substation's platforms are above the required flood immunity > Structures within the flood extent will be designed with appropriate foundation to ensure stability against hydrostatic pressure and debris load.
W3	Construction earthworks	A SWMP will be prepared and implemented prior to and during construction. The SWMP will include: > Erosion and sediment control plans for all stages of construction > Details on the construction and management of sediment basin if determined to be required > Protection of waterways such as scour protection, stabilisation and revegetation > Any imported fill will be certified at source locations as pathogen and weed free Excavated Natural Material or Virgin Excavated Natural Material) > Management of stockpiles and spoil > Tannin leachate management controls > Management of accidental spills, response and reporting > An induction protocol > Responsibilities for all management measures. 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, 2008b).

Ref	Impacts	Mitigation measures
Construction		
W4	Leakage or spills impacting soils, surface water or groundwater	> All chemicals or other hazardous substances will be stored in a bunded area and away from any drainage lines/pits. The capacity of the bunded area will be at least 130% of the largest chemical volume contained within the bunded area > No refuelling or bulk herbicide preparation will occur within 40 metres of natural drainage lines > Environmental spill kits containing spill response materials suitable for the works being undertaken will be kept on site at all times and be used in the event of a spill > Any spills will be contained, cleaned up promptly and immediately reported to the relevant site representative.
W5	Water quality impacts from stormwater runoff	> The SWMP will include arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather > Where required, adequate sediment controls (including the consideration of sediment basins) will be included in the access track design to manage erosion and sedimentation and associated impacts on receiving waters.
W6	Dewatering	Temporary dewatering for construction is not anticipated. In the event that dewatering is required then the following management measures will apply: > Confirmation of whether or not a licence under the WM Act as defined under the *NSW Aquifer Interference Policy* (DPI Water, 2012) is required prior to any dewatering activity commencing > If dewatering is required, the management of discharge water will be documented in the SWMP > Discharge water will be limited to vegetated, grassed areas, away from waterways, and within the construction footprint. If the discharge water is highly turbid, dewatering through a filter sock (or similar), or via transportable sedimentation tanks will be considered, where appropriate, to minimise sedimentation.
W7	Flooding impacts	A flood management plan (FMP) will be prepared for the project and will detail the processes for flood preparedness, materials management, weather monitoring, site management and flood incident management. The FMP will also address procedures and responsibilities for flood response (preparation of site upon receipt of flood warning, evacuation of site personnel) during and recovery following a flood event.
Operation		
W8	Waterway crossings	Waterway crossing and access tracks will be inspected as part of the maintenance inspections to ensure all crossings remain in good condition.

7.5 Land

This section provides an assessment of the potential impacts of the project on land, geology, soils and contamination and measures to mitigate them. This assessment addresses the following SEARs:

Land:

- Assessment of impacts of the project on:
  - The soils and land capability of the site, including the potential impacts associated with the use of hydrocarbons and chemicals, disturbing land associated with naturally occurring asbestos;
  - The geodiversity values of the site, including potential impacts on Karst systems, fossil beds and boulder streams;
  - A strategy to manage the progressive rehabilitation of the land disturbed by the project and enhance any new landforms created;

The rehabilitation strategy which is outlined in **Section 5.4.10**, would form the basis of the Rehabilitation Plan which would be prepared to guide the long term rehabilitation of the project area.

7.5.1 Assessment methodology

The methodology for the land assessment included:

- A desktop review using publicly available databases and previous investigations specific to the project to characterise the existing environment
- Identifying key land issues and impacts during construction and operation
- The identification of mitigation measures required to minimise these impacts.

7.5.2 Existing environment

7.5.2.1 Topography and landform

The project is located within the Australian Alps in southern NSW which is topographically highly variable within the project area. Landform features include elevated plateaus in project area west, to steeply incised valleys and ridges surrounding Talbingo Reservoir and Yarrangobilly River, and narrow alluvial terraces in the base of the Yarrangobilly River valley in project area east. Elevations across the project area range from 544 metres to 1,190 metres AHD.

The project lies about one kilometre north of what are considered the largest tufa banks (alluvial calcite deposits) in southern Australia, as shown on **Figure 7-8**.

7.5.2.2 Geology and soil landscapes

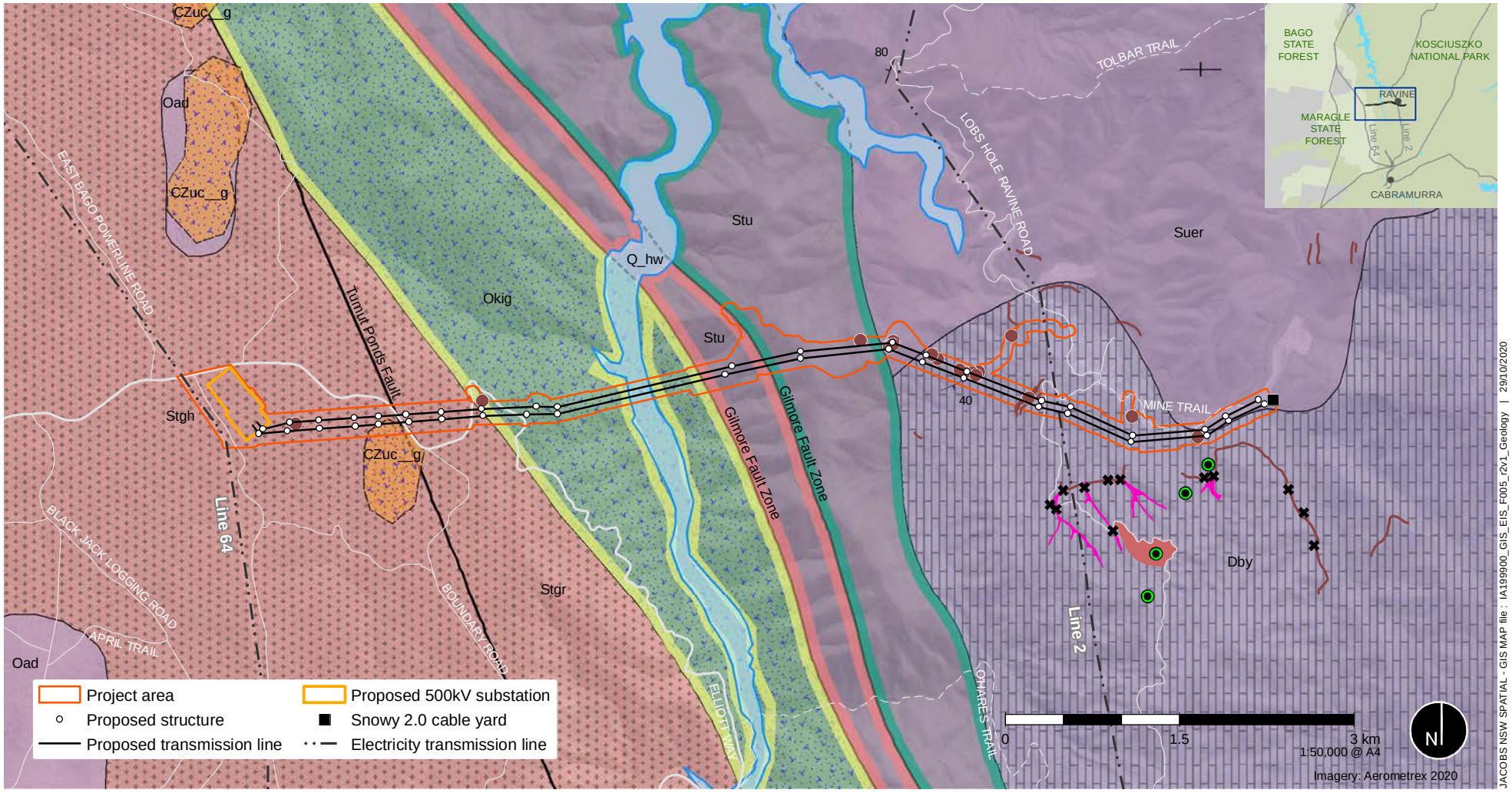
The geology of the project area is dominated by lithologies of the East Lachlan Orogen (Colquhoun, et al. 2020). In the west these include upper Silurian age plutonic intrusives, including the Greenhills Granodiorite and Rough Creek Tonalite. These lithologies are capped in places by Tertiary olivine basalts, however, the occurrence of tertiary basalt is limited with the project area. The plutonic lithologies are intruded against the meta-sediments and meta-volcanics of the East Lachlan Orogen. Locally this includes the Ordovician Gooandra Volcanics, lower Silurian Tumut Pond Group and Ravine Bers, and the lower Devonian Byron Range Group.

Substantial faulting, along the Tumut Ponds Fault and the Gilmore Fault Zone, occurs roughly perpendicular to the project through the steeply incised valley that holds the Talbingo Reservoir. The fault is a complex zone of strike slip and dip slip (reverse) movement. The fault zone hosts bodies of serpentinite that are known to contain occurrences of asbestiform minerals (chrysotile and tremolite) also so known as NOA (Marc Hendrickx and Associates Pty Ltd, 2020). NOA is discussed further below.

Geology encountered along the project area from west to east and the relevant project components within the units is shown on **Figure 7-8** and described as follows:

- Greenhills Granodiorite and Rough Creek Tonalite (substation, substation access road and 15 structure sites
- Gooandra Volcanics (basalt) (Access track and five structure sites)
- Tumut Pond Group (sandstone) (two access tracks, helipad and four structure sites)
- Ravine Beds (shale) (Access track and seven structure sites)
- Byron Range Group (Limestone) (Access track and 11 transmission structure sites).

As with the geology, the soils of the project area are varied and depend on landform. The soils are generally red and brown earths/structured red earths, with sandy loam and clay loan textures. Erosion was noted on poorly constructed or maintained forest tracks.



Cenozoic Sedimentary Province
- Lake edge
- Anthropogenic stored water, pondage, reservoirs, canals (Q_hw)

Cenozoic Igneous Province
- Geological boundary, position approximate
- Basalt
- Ungrouped Cenozoic igneous units - olivine basalt (CZuc_g)
- Rock outcrop
- Cliff

Geodiversity
- Tufa deposit
- Geodiversity site
- Tufa extent
- Fossil area

Lachlan Orogen
- Strike of strata, dip not determine
- Strike and dip of bedding
- Vertical bedding (strata)
- Geological boundary, position accurate
- Geological boundary, concealed
- Fault, position accurate
- Fault, concealed
- Basalt
- Granodiorite
- Limestone
- Quartzite
- Sandstone
- Tonalite
- Boraig Group (Dba)
- Byron Range Group (Dby)
- Tumut Pond Group (Stu)
- Ravine beds (Suer)
- Green Hills Granodiorite (Stgh)
- Rough Creek Tonalite (Stgr)
- Gooandra Volcanics (Okig)
- Adaminaby Group (Oad)

Potential for NOA
- High
- Medium
- Low

Figure 7-8 | Geology and geodiversity features

Data source:
Jacobs 2020, DIRE 2014, 2018, NPWS 2019,

7.5.2.3 Naturally occurring asbestos

NOA mapping for the region (NSW Trade & Investment, Division of Resources and Energy, 2015) indicates the there is a risk of encountering NOA around Sheep Station Ridge in geology associated with the Gilmore Fault Zone, Gooandra Volcanics and the Tumut Ponds Group, refer to **Figure 7-8**.

Marc Hendrickx and Associates Pty Ltd (2020) were engaged by TransGrid to assess the potential for NOA within the project area. On the basis of the assessment and observed geology of the project area these areas mapped on **Figure 7-8** as having a low to high risk of NOA have been re-classed with a very low potential to contain NOA.

7.5.2.4 Geodiversity

Karst formations occur at various places in KNP. Karst formations are landforms produced by the action of natural waters on soluble rocks (most commonly, limestone and dolomite), and are characterised by gorges, caves, dolines and irregular hydrological systems (DECC, 2006). The KNP PoM identifies geodiversity values including the eight karst areas in the park. The nearest karst areas are the Yarrangobilly Caves (approximately 14 kilometres to the north east of the project) and the Ravine areas (directly to the south of the project).

The Ravine Karst area is located around Lobs Hole Ravine Road. Recognised deposits associated with the Ravine Karst include Devonian fossiliferous rocks, periglacial block streams and tufa deposits near Lobs Hole (refer to **Figure 7-8**). There are two tufa deposits near the project these include the Cave Gully and The Lick Hole Gully deposit which are located approximately one kilometre south of the project. Devonian fossils are associated with the limestone of the Lick Hole Formation and the Periglacial block streams are located over 3.2 kilometres to the south of the project area, to the east of the Lobs Hole Ravine Road.

While there are no tufa sites within the project area, tufa is not restricted to the points mapped, and can extend along the associated gully floors for hundreds of metres (Troedson, 2019). It is possible that tufa sites may occur closer to the project than indicated by **Figure 7-8**.

7.5.2.5 Acid sulfate soils

No local scale acid sulfate soils mapping is available for the project area. A review of the national *Atlas of Australian Acid Sulfate Soils* (Fitzpatrick et al., 2011) on 26 October 2020 identified that Talbingo Reservoir is mapped as having a high probability of acid sulfate soils present. The areas of mapped acid sulfate soils are not within the disturbance area.

7.5.2.6 Contamination

A search of the NSW EPA contaminated sites register for the Snowy Valleys LGA in September 2020 identified that the closest contaminated sites to the project area included a landfill site, T3 spoil dump and adjoining river sediments, and former grit blasting site. None of these sites are within the project area. A search of the public contaminated land record of notices and EPL databases was also undertaken in September 2020. Two EPLs were identified, these were for electricity generation of the Snowy Scheme (EPL 10515) and the Snowy 2.0 Exploratory Works (EPL 21266).

Lobs Hole is the main area of potential contamination concern, due to its previous use as a copper mine and existing areas of identified metal contamination primarily associated with historical stockpiles. This site is of heritage value as described in **Section 7.3.2**.

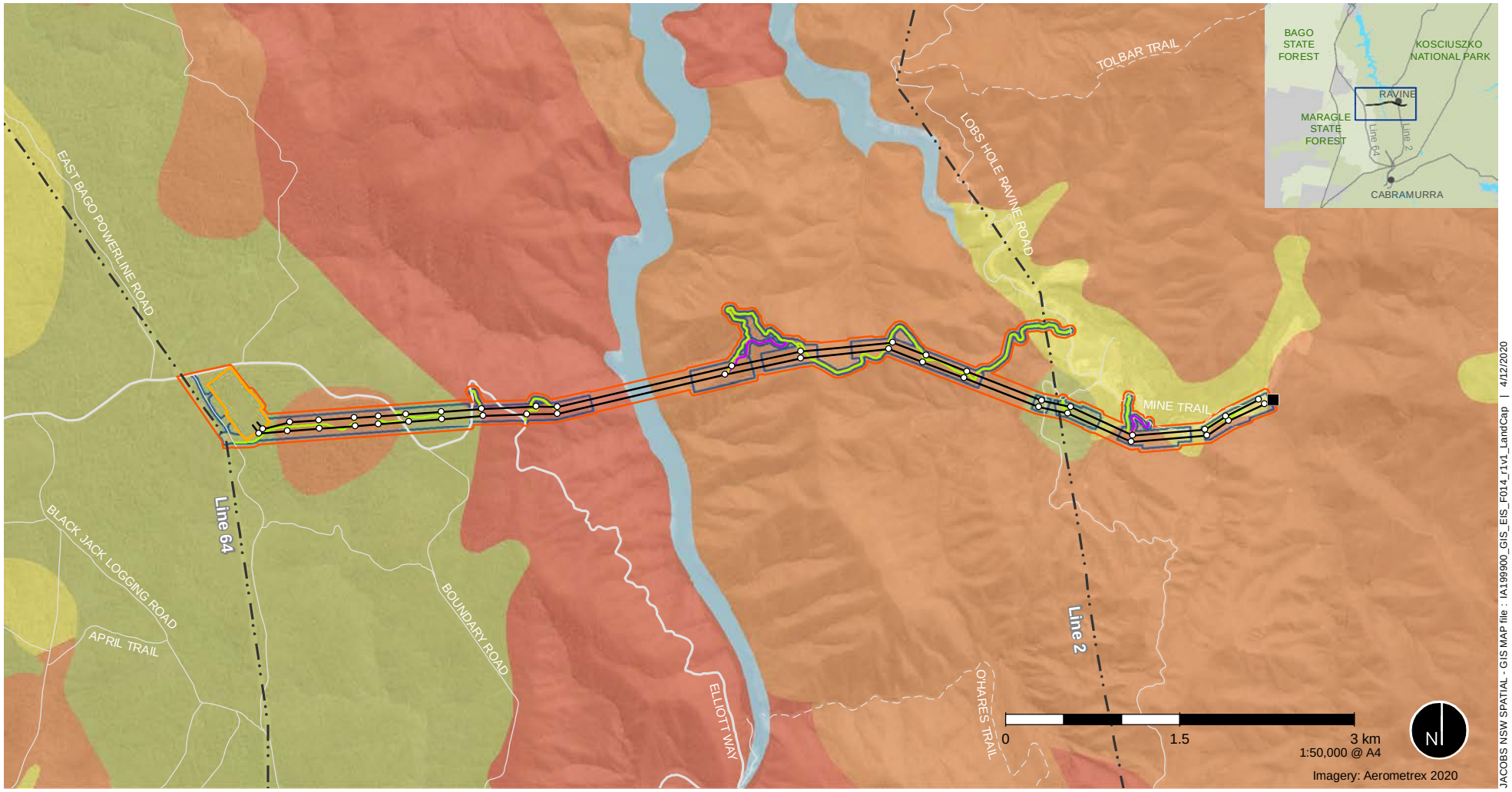
Other activities relating to vegetation clearing, forestry and historic settle could also have implications for potential site contamination within the project area.

7.5.2.7 Land and soil capability classes

Land in NSW is commonly classified according to the capability of land to remain stable under particular land uses. The *Land And Soil Capability Assessment Scheme* (OEH, 2012) classes land in terms of inherent physical characteristics or constraints, it considers the optimum use of land rather than the maximum use and in general would not change over time.

The majority of the project area within KNP is classified as land and soil capability (LSC) class 7 (Very low capability land) and 8 (Extreme limitations). While the majority of Bago State Forest within the project area is LSC class 4 (Moderate capability land), refer to **Figure 7-9**.

Soils with an LSC class of 7–8 are inherently poor and likely to have properties (ie shallow, pH extremes, etc) that may impede rehabilitation establishment and success.



Project area
Disturbance footprint
Proposed structure
Proposed transmission line
Proposed 500kV substation
Proposed access track - Option
Proposed access track - Option B

Snowy 2.0 cable yard

Land and soil capability classification
4 - Moderate to severe limitations
5 - Severe limitations
7 - Extremely severe limitations
8 - Extreme limitations
Water

Electricity transmission line
Track

Figure 7-9 | Land and soil capability classes

Data source:
Jacobs 2020, OEH 2012

7.5.3 Assessment of potential impacts

7.5.3.1 Construction

Topography and landform

The project would not significantly modify the existing landform or create new landforms. However the earth works associated with the structure sites, helipad, substation, and access tracks would create some localised landform changes within the disturbance area. These localised changes would be of a similar scale to other existing transmission infrastructure access tracks and structure sites in the area, therefore the landform changes are not considered to be substantial. Where possible the project has followed the existing landform to minimise earthworks.

As detailed in **Section 5.4.10**, progressive rehabilitation would be implemented as per the Rehabilitation Plan to be prepared for the project.

Geology and soil landscapes

Up to 365,000 cubic metres of soil would be excavated to allow for the construction of the substation, access tracks, helipad and foundation works for the transmission line structures. About 38,000 cubic metres would be generated from the project area west and about 327,000 cubic metres would be generated from project area east.

Vegetation clearing to establish the transmission corridor and access tracks can also disturb soil and in the long-term, can also increase soil erosion. Soil disturbance generates the potential for erosion and sediment transfer offsite, which may result in sedimentation of surrounding land and drainage lines. The risk of sediment transfer is higher where excavation or vegetation clearing is proposed in steep areas in close proximity to waterways, for instance at the Sheep Station Creek waterway crossing. Potential impacts to water quality from the project are discussed in **Section 7.4.3**.

The strategy for the management of excavated material is discussed in **Section 5.4.7**. The strategy aims to maximise the beneficial reuse of materials for construction activities, with the excess spoil to be suitably managed and disposed of. The management and disposal of excavated material would be as per the spoil management strategy as outlined in **Section 5.4.7**.

Potential spoil disposal impacts at the Ravine Bay emplacement area have been assessed as part of Snowy 2.0. The design of the Ravine Bay rock emplacement comprises an underwater pad constructed using excavated material from the reservoir bed up to FSL. The capacity of the underwater pad design would be approximately 1.8 million cubic metres of excavated material (EMM, 2020).

Naturally occurring asbestos

While the risk of encountering NOA has been determined to be very low by Marc Hendrickx and Associates Pty Ltd (2020), there is potential that NOA may be within the disturbance area at locations associated with the Gooandra Volcanics Tumut Ponds Group geological units (refer to **Figure 7-8**), and may present a risk to human health during construction.

Further assessment would be carried out during the geotechnical investigation for the project to verify the presence/absence of NOA within the NOA risk zones. Should NOA be detected, a NOA management plan would be prepared implemented to guide the handling, transport and disposal of the material.

Geodiversity

The project would not impact on the Yarrangobilly karst system, which is about 10 kilometres away. The project would not directly impact on the Ravine Kast area (including the Devonian fossiliferous rocks, periglacial block streams and tufa deposits). However, indirect impacts would potentially occur to the Ravine tufa deposits, as a result of erosion and sedimentation, vegetation changes, increased risk of close visitation and vibration. The risk of these impacts are considered to be minor.

While the tufa-lined gullies lie upstream of the project, airborne sedimentation may accumulation the deposits while impacting on vegetation development. Impacts from land clearing have already been observed in the Ravine area from weed infestations and alluvial deposits overlying tufa (SMEC, 2019b). Clearing and excavation activities have a minor potential to further exacerbate existing impacts, with vegetation changes impacting hydrology, native biota, soils and site microclimates near the deposits, and therefore indirectly impacting the deposits themselves (Troedson, 2019).

The project may have the potential to uncover or expose unknown geodiversity sites.

Acid sulfate soils

As there are no mapped acid sulfate soil areas within the disturbance area and no construction work would disturb sediments within Talbingo Reservoir, acid sulfate soil is not expected to be encountered.

Contamination

During construction there would be potential for construction activities to result in contamination of soil and/or water due to leaks and spills of potentially contaminating materials which would pollute the local environment including waterways and impact the land capability if not appropriately managed.

As described in **Section 7.5.2.6**, there is potential to encounter localised areas of contamination associated with historical land uses including the former Lobs Hole Copper Mine in project area east. Exposure to these contaminants may present a risk to human health during construction through inhalation and/or direct contact, or impacts to the environment due to contamination, if not managed appropriately.

Land and soil capability

Degradation of soil resources can reduce the capability of the affected land to support the intended vegetation and or land use. Soils can be degraded by the loss of organic matter and nutrient decline can occur through soil disturbance (resulting in increased breakdown rates of organic matter) and removal of vegetation as a source of new organic matter can reduce soil capability and rehabilitation outcomes. In addition volatilisation and leaching of nutrients can lead to a decline in nutrient levels. Loss of organic matter can also affect soil properties such as soil water storage, soil structure and cation exchange capacity.

Soils with an LSC class of 7–8 are already inherently poor and any further of loss of soil capability may result in limitations in establishing stabilising cover and rehabilitation, and in some cases the vegetation community originally on-site may not be able to be sustained following reinstatement. If not managed appropriately the project has the potential to further reduce the soil capability. The rehabilitation plan would consider the recover and re-use topsoils for rehabilitation and methods to maintain or improve their existing capability.

7.5.3.2 Operation

Potential impacts during operation would generally be associated with contaminated run-off, which may arise from normal vehicle operation (such as tyre wear, minor leaks of lubricants and fuels), maintenance practices or a spill or accident. The use of the access tracks and vegetation clearing during maintenance have the potential to exacerbate erosion if not appropriately managed.

The project would not directly impact the Cave Gully and Lick Hole Gully tufa deposits.

Operation of the project is not expected to significantly change the land use or the land capability of the project area, which is national park for the purpose of conservation and state forest that are not subject to active deforestation.

7.5.4 Mitigation measures

The mitigation measures to be implemented for impacts to land, geology, soils and contamination are presented in **Table 7-16**. Mitigation measures for potential impacts to water quality as a result of erosion and sedimentation are presented in **Section 7.4.3**. No operational mitigations measures are required.

Table 7-16 Mitigation measures for land impacts

Ref	Impacts	Mitigation measures
Pre construction		
L1	Encountering Contamination or NOA	Targeted geological investigations will be undertaken in areas of surface disturbance using a risk based approach. Results from these investigations will determine the level of management to be implemented for soils and contamination (including NOA).
L2	Contaminated land	A contaminated land management plan (CLMP) will be prepared prior to construction works commencing. It will include management measures to: > Manage areas of known or potential contamination that will be impacted during construction > Manage unexpected finds in the event that unexpected contamination sources are identified (including NOA). This will include guidance on identifying potential contaminated land characteristics (visual, odours, etc), steps to cease works in the affected area, further investigation to assess the extent, magnitude and type of contaminants and appropriate remedial actions.
L3	Exposure to NOA	> Further assessment will be carried out during the geotechnical investigation for the project to verify the presence/absence of NOA within the NOA risk zones. Should NOA be detected, a NOA management plan will be prepared and implemented to guide the handling, transport and disposal of the material > NOA awareness training will be provided to all staff and contractors working in areas with NOA risk > If asbestiform and/or indicator minerals and/or textures are encountered or suspected during excavation works, work is to stop in the area and management be alerted. The area will be isolated with a 10 metre exclusion zone and sign posted, access will be restricted and specialist geological and occupational hygiene advice will be sought prior to further progressing work in that area.
L4	Spoil management	A spoil management strategy will be prepared for the project. The spoil management plan will outline appropriate management procedures for the generation, management and importation (if required) of spoil. It will include, but not be limited to: > Confirming spoil quantities > Carrying out appropriate assessments, including geotechnical investigations > Procedures for classification of spoil > Identification of spoil reuse measures, including segregation of soils as subsoils and topsoils > Spoil stockpile management procedures > Spoil haulage routes > Spoil disposal and reuse locations > Imported spoil sources and volumes.

Ref	Impacts	Mitigation measures
Construction		
L5	Stockpiles	Management of topsoil stockpiles and other excavated material stockpiles to minimise dust and sediment in runoff will include: > Minimising the number of stockpiles, area and time they are exposed > Locating stockpiles away from drainage lines and natural waterways and from where they will be susceptible to erosion > Stockpiles will be bunded in accordance with the Blue Book (Landcom, 2004) *Managing Urban Stormwater – Soils and Construction*, Volume 1, 4th Edition) > Stabilise stockpiles, establish sediment controls and suppress dust as required.
L6	Excavated material management and transport	Excavated material will be managed in accordance with the spoil management strategy. > Where applicable, excess spoil will be re-used for other elements of the project such as access track construction. Where spoil cannot be reused it will be managed as per the SWMP. Alternatively, excess material will be disposed of at other suitable locations (including at Ravine Bay emplacement area) as agreed to with NPWS, FCNSW or at a suitable and licenced waste facility as documented in the spoil management strategy > Material which has been assessed as not suitable for reuse on land or for subaqueous disposal at the Ravine Bay emplacement area (as part of the Snowy 2.0 management procedure) or cannot be reused will be classified in accordance with the *Waste Classification Guidelines* (EPA, 2014). Excavated material will be transported to an appropriate excavated material disposal area. Approval will be obtained prior to transport and will require an estimate of the likely volume of excavated material to be disposed.
L7	Material for disposal in the Ravine Bay emplacement area	Excavated material to be disposed in the Ravine Bay emplacement area will be transported to the emplacement area by TransGrid and/or contractor and then managed by Snowy Hydro in accordance with the relevant approved Snowy 2.0 Rehabilitation Plan prepared by Snowy Hydro.
L8	Impacts to geodiversity	The CEMP will include measures to identify and report any newly identified geodiversity sites. It will also include measures to minimise impacts to known geodiversity sites.

Ref	Impacts	Mitigation measures
L9	Rehabilitation	A Rehabilitation Plan will be prepared in consultation with NPWS and FCNSW to guide the long term rehabilitation of the project. The rehabilitation plan will be based on the rehabilitation strategy outlined in **Section 5.4.10** and will: > Include a detailed plan for rehabilitation of the site > Characterise the soil types within the disturbance area > Include details of soil management measures, including: - Topsoil stripping and stockpiling procedure - Subsoil management measures - Soil reinstatement methodology which includes a topsoil application procedure > Include measures to minimise: - Loss of soil - Loss of organic matter, nutrient and soil decline - Compaction > Consideration of how rehabilitation will be carried out where soils are unable be recovered, or soils are poor/unfit for re-use > Include detailed performance and completion criteria for evaluating the performance of the rehabilitation of the sites, and triggering any remedial action (if necessary) > Describe the measures that would be implemented to: - Comply with the rehabilitation objectives and associated performance and completion criteria - Progressively rehabilitate the site > Include a program to monitor and report the effectiveness of these measures.

7.6 Transport

This section summarised the findings of the Traffic and transport impact assessment (TTIA) provided in **Appendix D**. The TTIA addresses the following SEARs:

Transport:

> An assessment of the transport impacts of the project on the capacity, condition, safety and efficiency of the local, national park and State road network, including a road safety audit of the proposed haulage route;

> A strategy to enable regular and emergency management activities to be carried out on site within the Kosciuszko National Park during the project;

> A strategy for managing these impacts having regard to existing road maintenance agreements (Original).

7.6.1 Assessment methodology

The methodology for the TTIA included:

> An assessment of the existing traffic and transport conditions in the project area including the local road network, traffic flows, public transport services, active transport and road safety using aerial photography, topographic information and other publicly available information and other available traffic studies

> Reviewing available traffic survey data

> Using traffic generation estimates for construction and operation of the project applied to existing traffic volumes to determine the proportional increase arising as a result of the project

- Analysis of existing traffic conditions and traffic generation during construction and operation of the project to determine impacts in terms of volume capacity ratio (V/C)
- An assessment of the project's impact on access (including regular and emergency management activities within KNP), pedestrians and cyclists
- A road safety audit of public roads on the proposed haulage routes was carried out in September 2020 to identify sections of the haulage route that were of poor road condition
- The identification of mitigation measures required to minimise these impacts.

The study area of the TTIA includes the road network that provides access to the substation (project area west) via Hume Highway, Snowy Mountains Highway, Batlow Road, Tooma Road and Elliott Way, and the connection point for the Snowy 2.0 cable yard (project area east) via Snowy Mountains Highway (from Tumut and Cooma), Link Road, Lobs Hole Ravine Road and Mine Trail.

7.6.2 Existing traffic and transport environment

7.6.2.1 Road network

The key roads in the study area are described in the TTIA and shown on **Figure 5-6**. These roads include:

- Hume Highway
- Snowy Mountains Highway
- Batlow Road
- Tooma Road
- Elliott Way
- Link Road
- Lobs Hole Ravine Road
- Mine Trail.

All roads are state roads with the exception of Lobs Hole Ravine Road and Mine Trail which are local roads within the KNP. Elliott Way, Lobs Hole Ravine Road and Mine Trail are within the project area and are described below:

- Elliott Way, is a regional road that links the township of Tumbarumba and the locality of Nurenmerenmong via Paddys River. The road connects Tooma Road with Goat Ridge Road through KNP and has one lane in each direction with a posted speed limit of 80 kilometres per hour (km/hr). This road was impacted by Dunns Road bushfire and is currently closed west of the Bago State Forest/KNP boundary. The road is an approved B-double route for 25/26-metre long B-double vehicles. However, B-double travel conditions exist, and travel is permitted outside of between 8am to 9am and 3:30pm to 4:30pm on school days and in dry weather only
- Lobs Hole Ravine Road is a regional two-way road with a single lane but allows two-way traffic. The road runs in a north-south direction, linking Bogong Peaks Wilderness, Pinbeyan and Cabramurra. The road connects the Snowy Mountains Highway with Link Road and has no line marking and no sign posted speed limit but is default to 100 km/hr under the Australian Road Rules. Based on the steep terrain, motorists driving to the conditions generally would not achieve speeds greater than 60 km/hr. Lobs Hole Ravine Road has been recently widened to dual lane in each direction with access restricted to Snowy 2.0 construction traffic only
- Mine Trail is a regional two-way road that runs east-west to link Cabramurra and Yarrangobilly. The road connects Lobs Hole Ravine Road and Wallaces Creek through KNP. As part of Snowy 2.0, Mine Trail was reconstructed for use by the project construction traffic and widened to one lane in each direction.

7.6.2.2 Public transport

Bus and coach services operate within the study area but not within the project area.

7.6.2.3 Active transport

There are limited off-road cycling facilities and shared paths within the study area, and there are none in the project area.

There are no formal walking trails in KNP in the project area. Management trails (which only allow vehicular access to KNP management and protection vehicles) are used by pedestrians and cyclists at the following locations:

- Mine Trail, which is wholly located within the project area
- Flying Fox Trail, which is intersected by the eastern side of the project area
- Maragle State Forest trails, including Hannams, March and April trails about one kilometre west of the project area
- Trails at Lobs Hole including O'Hares Trail south of the project area and Tolbar Trail north of the project area
- The existing transmission line easement (Line 64) to the west of project area.

The nearest formal walking trails are at Yarrangobilly Caves, approximately eight kilometres north-east of the project. A number of trails are also in the Maragle State Forest about one kilometre west of the project area including Hannams, March and April trails that are used for bushwalking and cycling.

7.6.2.4 Existing road safety

In the five-year period from July 2014 to June 2019, a total of 226 crashes were recorded in the study area. The majority of these crashes were on the Snowy Mountains Highway. In the five year period, six crashes were recorded on Elliott Way and Goat Ridge Road between Tooma Road and Link Road and one crash was recorded on Lobs Hole Ravine Road and Mine Trail north of Link Road.

7.6.2.5 Existing traffic volumes, patterns and operational performance

Existing traffic demand and operational performance

Snowy Mountains Highway, Link Road, Elliott Way, Lobs Hole Ravine Road, Batlow Road, Tooma Road and Mine Trail carry low amounts of traffic. These roads have capacity to accommodate additional traffic. Traffic volumes ranged up to 807 vehicles per hour on the Snowy Mountains Highway to as few as nine vehicles per day on Lobs Hole Ravine Road. Elliott Way has a peak hourly volume of up to 44 vehicles per hour. The road capacity ranges from 1,600 vehicles per hour on Elliott Way and Lobs Hole Ravine Road up to 2,600 vehicles per hour for the Snowy Mountains Highway.

Due to the proximity of the project to nearby ski fields and resorts in the Snowy Mountains, traffic on the surrounding road network is subject to seasonal variations. Roads in the surrounding road network, particularly Snowy Mountains Highway and Link Road, experience significantly increased daily and peak hour traffic volumes during the winter peak snow season periods due to increased travel to the Adaminaby and Kiandra areas and Selwyn Snow Resort. Depending on the location, the Snowy Mountains Highway increases in traffic by between 27 and 220 percent during the winter peak. The largest peak in traffic along the Snowy Mountains Highway is west of, and through Cooma. While Link Road has an increase in traffic of up to 304 percent during the winter period.

7.6.3 Assessment of potential impacts

7.6.3.1 Construction

Construction traffic distribution and generation

Light vehicle traffic movements in project area west would include personnel travelling between the construction site and their accommodation in the township of Tumbarumba via Elliott Way, as well as other light construction vehicles. Light vehicle movements in project area east would generally be concentrated to the existing access roads and newly formed access tracks associated with Snowy 2.0 and the project. There would not be a daily influx of light vehicle movements along Lobs Hole Ravine Road (down to the Lobs Hole Ravine area) associated with workers travelling to work as workers in project area east would be accommodated in the Snowy 2.0 works accommodation. Heavy vehicles would access the western extent of the project area via Elliott Way and the eastern extent of the project area via Snowy Mountains Highway, Link Road and Lobs Hole Ravine Road. There would also be some trips between project area east and west for works along the transmission line via Elliott Way, however the number of these trips would likely be low.

Based on the existing traffic volumes and forecast construction traffic volumes, the additional construction traffic movements would be unlikely to cause any operational or efficiency issues to the existing road network within the TTIA study area. The TTIA found that this increase in construction traffic would generally result in a small increase in V/C ratio to 0.6 or less on roads forming part of the proposed haulage route. The overall impact of construction would be minimal and these roads would continue to operate with spare capacity during the winter period.

Impacts of oversized vehicles

The substation would comprise up to three 500/330 kV three-phase or up to nine single-phase transformers to convert the voltage from 330 kV to 550 kV. Under the single-phase transformer option, each of the nine single-phase transformers would be transported separately to the substation site on an OSOM vehicle. These transformers are anticipated to be transported from Port Kembla to project area west. Other OSOM movements may also occur as part of the transport of other new high mass plant/equipment in the substation such as the reactors.

Due to the low number of transformer deliveries, combined with the fact that these oversized vehicles would travel outside of peak periods, the traffic impact of oversized vehicles on the existing network would be minimal.

To manage these oversized vehicles, an over dimensional permit would be sought from the National Heavy Vehicle Regulator (NVHR). This permit would undergo a separate approval process and a suitable contractor would be engaged for transportation. As part of the permit, the subcontractor would develop a construction traffic management plan (CTMP) and determine a suitable route and required road upgrades via a detailed route survey in consultation with TransGrid and the NVHR. These traffic movements would be undertaken at night under police escort and in accordance with any OSOM permit conditions.

Impacts on public roads during the stringing of the transmission lines

During the overhead stringing of conductors and earthwires on the new transmission lines, there may be temporary disruptions to traffic movements along Elliott Way. These disruptions would be managed in accordance with the CTMP and are expected to be minor and limited in duration and attributed to traffic controls (if required) put in place during the stringing above the road.

Impacts on public transport

Impacts to buses would be limited to a minor increase in travel time due to the addition of construction vehicles on the road network. Due to the availability of spare capacity on the surrounding road network, this impact is expected to be minimal. No impacts are anticipated on the operation of bus stops.

Impact on active transport

Impacts to active transport would be limited to minor amenity impacts at town centres due to the addition of construction vehicles on the road network. However, footpaths, pedestrian crossings and cycling facilities near construction vehicle routes would remain open during construction. Furthermore, as the project is not located near any formal walking or cycling tracks, no impacts on these active transport modes in the project area is expected.

Impacts on road safety

During construction, additional construction traffic has the potential to impact road safety on roads forming part of the proposed haulage route. This includes construction workers using Tooma Road and Elliott Way to commute between accommodation at Tumbarumba and worksites in project area west, and heavy vehicles transporting materials, equipment and spoil. To minimise the impacts of additional construction vehicles on road safety, appropriate driver induction, training, safety measures and protocols would be outlined in the CTMP and adhered to by the construction workforce.

The additional construction traffic using the road network has the potential to impact the road condition on roads forming part of the proposed haulage route. To minimise the risks associated with these impacts, routine defect identification and rectification of the access roads and tracks would be managed as part of the project maintenance procedure in accordance with existing road maintenance agreements (i.e. access tracks within KNP would be maintained in accordance with the MOU between TransGrid and NPWS for the Procedure for the Undertaking of Inspection, Maintenance and Emergency Works of TransGrid Network Assets and Associated Infrastructure). Furthermore, internal access roads and tracks would be designed in accordance with the relevant vehicle loading requirements. It is noted that Lobs Hole Ravine Road and Mine Trail were recently upgraded as part of Snowy 2.0 to increase road width and improve operating conditions for heavy vehicles.

A road safety audit of public roads on the proposed haulage routes was carried out in September 2020. The full road safety audit is included in Appendix A of the TTIA in **Appendix D**. The road safety audit identified the following key risks:

- Some sections of road were in poor condition including loose material and pavement damage such as potholes
- There were areas with sight distances that restrict visibility to upcoming horizontal curves or intersections or oncoming vehicles
- There were unprotected vertical drops and unprotected non-frangible hazards (such as fallen trees and rocks) located in the clearzone of the carriageway.
- There were areas of insufficient delineation, signage and lighting or barrier treatments
- Some areas were subject to water ponding
- The haulage route passes through areas where there is pedestrian activity such as through Cooma, Batlow, Tumbarumba and Tumut.

The road safety audit recommended that road improvements be considered at identified locations to improve safety outcomes for construction vehicles and local traffic. These recommendations would be reviewed by the construction contractor, and any road improvements identified would be discussed with the relevant road authority prior to construction. Notwithstanding any such road improvements are expected to be minor. These road improvements would not form part of this project and would be subject to separate approvals.

Impact on emergency vehicles

Access for management and emergency management activities would be unaffected as there are no plans to close any of the roads to management or emergency vehicles. During construction of the project, unhindered access would be available and maintained for management and emergency vehicles at all times. However, measures and strategies to maintain access at all times for management and emergency management activities may include consideration of the following and would be further developed as part of the CTMP:

- Provision of sufficient shoulder width or regular stopping bays to allow regular and emergency vehicles to pass or stop
- Staging of construction works to avoid the need for roads to be fully closed for any extended period of time
- Development of alternative access routes in consultation with NPWS and emergency services if any closures are required.

In addition, consultation with NPWS and emergency service providers would be required as part of the finalisation of the CTMP for the project. The CTMP would ensure that procedures are in place to maintain safe access for management vehicles through construction zones.

7.6.3.2 Operation

During operation, routine inspection and maintenance would generally involve light vehicles and small to medium plant accessing the project area. On occasion some heavy vehicles may be required. Routine inspection and maintenance is expected to occur periodically with only low numbers of light and heavy vehicle movements per day (approximately 10 movements in total) accessing the project area during the inspection and maintenance periods.

Due to the infrequent nature and low traffic volumes accessing the project during operation, impacts on the surrounding road network performance and road safety are assessed as minor. The operation of the project would not impact on traffic movements required for FCNSW and NPWS operations.

The new access tracks in the project area would potentially provide improved access for emergency vehicles responding to incidents within KNP and Bago State Forest.

7.6.4 Mitigation measures

Mitigation measures for transport impacts are presented in **Table 7-17**.

Table 7-17 Mitigation measures for transport impacts

Ref	Impacts	Mitigation measures
Construction		
T1	Traffic, access and transport	A CTMP will be prepared and implemented, and will include: - Confirmation of haulage routes - Measures to maintain access to local roads, and maintain the capacity of existing roads where possible - Site specific traffic control measures (including signage) to manage and regulate traffic movement - Requirements and methods to consult and inform the local community of impacts on the local road network due to the development-related activities - Consultation with TfNSW, and Snowy Valleys Council, NPWS, FCNSW and Snowy Hydro's contractors - Consultation with the emergency services to ensure that procedures are in place to maintain safe, priority access for emergency vehicles and emergency management activities - Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on Elliott Way - A response plan for any construction related traffic incident - Monitoring, review and amendment mechanisms - Individual traffic management requirements at each phase of construction - Measures to minimise the number of workers using private vehicles travelling to and from project area west

Ref	Impacts	Mitigation measures
		> Employment of standard traffic management measures to minimise short-term traffic impacts expected during construction > Management of oversized vehicles > Relevant traffic safety measures, including appropriate signage, driver conduct and safety protocols > Identify requirements for, and placement of, traffic barriers. The CTMP will also consider the following strategies to maintain access for regular and emergency management activities: > Staging of construction works to avoid the need for roads to be fully closed for any extended period of time > Development of alternative access routes in consultation with NPWS and emergency services if any closures are required > Provision of sufficient shoulder width or regular stopping bays to allow regular and emergency vehicles to pass or stop.
T2	Traffic control	If works will affect the free flow of traffic a Traffic Control Plan will be prepared, and a Road Occupancy Licence will be obtained from TfNSW.
T3	Impact to the local road network	Road maintenance will be managed through the following measures: > A Road Dilapidation Report will be prepared prior to and following construction of the project. Any impacts identified as caused by the project will be rectified as specified with any road maintenance agreements > Routine defect identification and rectification of the access roads and tracks will be managed as part of the project maintenance procedure > Access roads and tracks will be designed in accordance with the relevant vehicle loading requirements Consultation will be undertaken with the relevant road authorities to confirm any road upgrades requirements as identified in the road safety audit.
T4	Access	Affected communities, visitors, FCNSW, NPWS and emergency services will be notified in advance of any disruptions to traffic and restriction of access impacted by project activities.
Operation		
T5	Access and connectivity	Access protocols within KNP will be undertaken in accordance with the MOU between TransGrid and NPWS for the Procedure for the Undertaking of Inspection, Maintenance and Emergency Works of TransGrid Network Assets and Associated Infrastructure.

7.7 Landscape character and visual impact

This section summarises the findings of the landscape character and visual impact assessment (LCVIA) provided in **Appendix H**. The LCVIA addresses the following SEARs:

Amenity:

> An assessment of the:
  – Visual impacts of the project, including lighting impacts and potential impacts on views of the project from key vantage points in the Kosciuszko National Park;

7.7.1 Assessment methodology

The methodology for the LCVIA included:

- Carrying out site visits to identify publicly accessible locations relevant to the project, reviewing relevant literature, and analysing aerial photographs and topographic maps to understand the project area. The site visits were conducted in May 2019 (pre Dunns Road bushfire) and May 2020 (post Dunns Road bushfire)
- Reviewing the proposed concept design and supporting material
- Defining landscape character through a contextual analysis
- Identifying the visual catchment of the project including determining the Zones of Visual Influence (ZVI) and theoretical visibility of the project infrastructure
- Identifying and describing landscape character zones and evaluating the likely impact on them
- Selecting viewpoints (VP) within the visual catchment representing a range of different land uses. NPWS were also consulted as part of the VP selection process
- Evaluating the visual impact of the project by comparing the sensitivity of viewpoints and the magnitude of the project's impact on them
- Producing photomontages for five VPs (VP 7, VP 9, VP 11, VP 12 and VP 13)
- Identifying landscape opportunities and methods to mitigate adverse visual impacts for consideration in the detailed design phase of the project.

7.7.1.1 Landscape character units and sensitivity

Landscape character units are derived from physical characteristics, visual features and land-use patterns within the defined project viewshed. The viewshed is the area that may be visually affected by the project. The viewshed is not the same as the extent of visibility, as it may be possible to see a transmission structure from areas outside the viewshed. Rather, the viewshed is the area from which there could be a visual impact.

The sensitivity of landscape character units to change is in part an assessment of the landscape character unit to accept or absorb further changes. Generally, the greater the extent of modification already made to a landscape, the lesser its sensitivity will be to further visual or landscape change.

7.7.1.2 Visual impact assessment

When assessing the visual impact of a project, the assessment is based on four criteria, namely visibility, distance, landscape character and viewer sensitivity and the number of viewers.

An assessment of the visual impact from indicative VPs within the public domain is partly based on photomontages that show views of the landscape and the possible alteration brought about by the project to these views and its associated infrastructure. No residences or private property would have views of the project. Photomontages assist in the qualitative analysis of the overall visual impact.

- **Visibility:** The visibility of project elements can be affected by intervening vegetation and topography
- **Distance:** Visibility decreases as distance from the project increases. Determining the ZVI provides an indication of the impact based solely on distance
- **Landscape character and viewer sensitivity:** Landscape character considers physical and natural attributes of an area such as topography, vegetation, natural water bodies and waterways and aspects such as land-use, modifications and classification or status within planning schemes or statutory documents. Sensitivity may be altered or be influenced by previous landscape modifications (e.g. cleared farmland has a lesser sensitivity to landscape change than a natural landscape such as a national park), as well as the land use type (e.g. residential sites will always be rated as 'high' sensitivity, whereas industrial areas may be rated as 'low' sensitivity)
- **Viewer numbers:** The overall level of visual impact will decrease where there are few people who may be present to view the project, or the level of visual impact may increase where there are a high number of people that can see the project.

Each of these criteria must be considered in the assessment of each VP. The ratings of each criterion are not numerically based and cannot be simply added together and averaged to arrive at an overall rating.

The resultant scale of effects ranges from Negligible to High, and also recognises whether a visual change has a positive or a nil impact. Further discussion on the scale of effects is provided in **Appendix H**.

Thirteen VPs were selected from locations that are accessible at times by the general public and from where the project is potentially visible from. The VPs encompass potential locations to view the project to the east and west of Talbingo Reservoir, and at a range of distances from the project. All of the VPs are within the LCVIA study area (refer to **Figure 7-10**), with the exception of VP 6, which is located outside the study area, but is the only formal vantage point (lookout) in proximity to the project.

The VPs were examined in a visibility matrix and then assessed using the scale of effects, resulting in a visual impact rating showing the scale of the impact. The location of the VPs are shown on **Figure 7-11** and **Table 7-19** provides a brief description and sensitivity of each VP.

7.7.1.3 LCVIA study area, viewshed and zones of visual impact

The view shed for the project is based on the distance at which the project takes up 0.5° (degrees) of the vertical field of view. The transmission structures are the largest project element and would be up to 75 metres in height. The LCVIA determined that the vertical field of view when viewed from 7.84 kilometres, assuming an average eye level of 1.6 metres in height.

ZVI provide a guide to the potential visual impact based solely on distance. ZVI can be determined based upon the distance of the viewer to a transmission structure. As a person moves toward or away from a structure, the visual impact would differ as the apparent height and scale of the structure would change.

The ZVI and LCVIA study area (which is determined by the outer 7.84 kilometre) are shown on **Figure 7-10**. The LCVIA study area includes the KNP, Bago and Maragle State forests, and the roads and trails within these areas.

7.7.2 Existing environment

As described in **Section 1.4**, the Dunns Road bushfire has affected the project area and beyond extensively. Visual changes to the landscape were observed upon revisiting the site about five months following the bushfire. Predominately change included a reduction in vegetation cover and a change in landscape colour as shown in **Photo 7-4**. Impact areas have received varying degrees of damage or destruction to vegetation, as well as damage to slopes and roads. During the May 2020 site visit it was noted that a few of the trees that had survived were producing new vegetative shoots from trunks or branches.

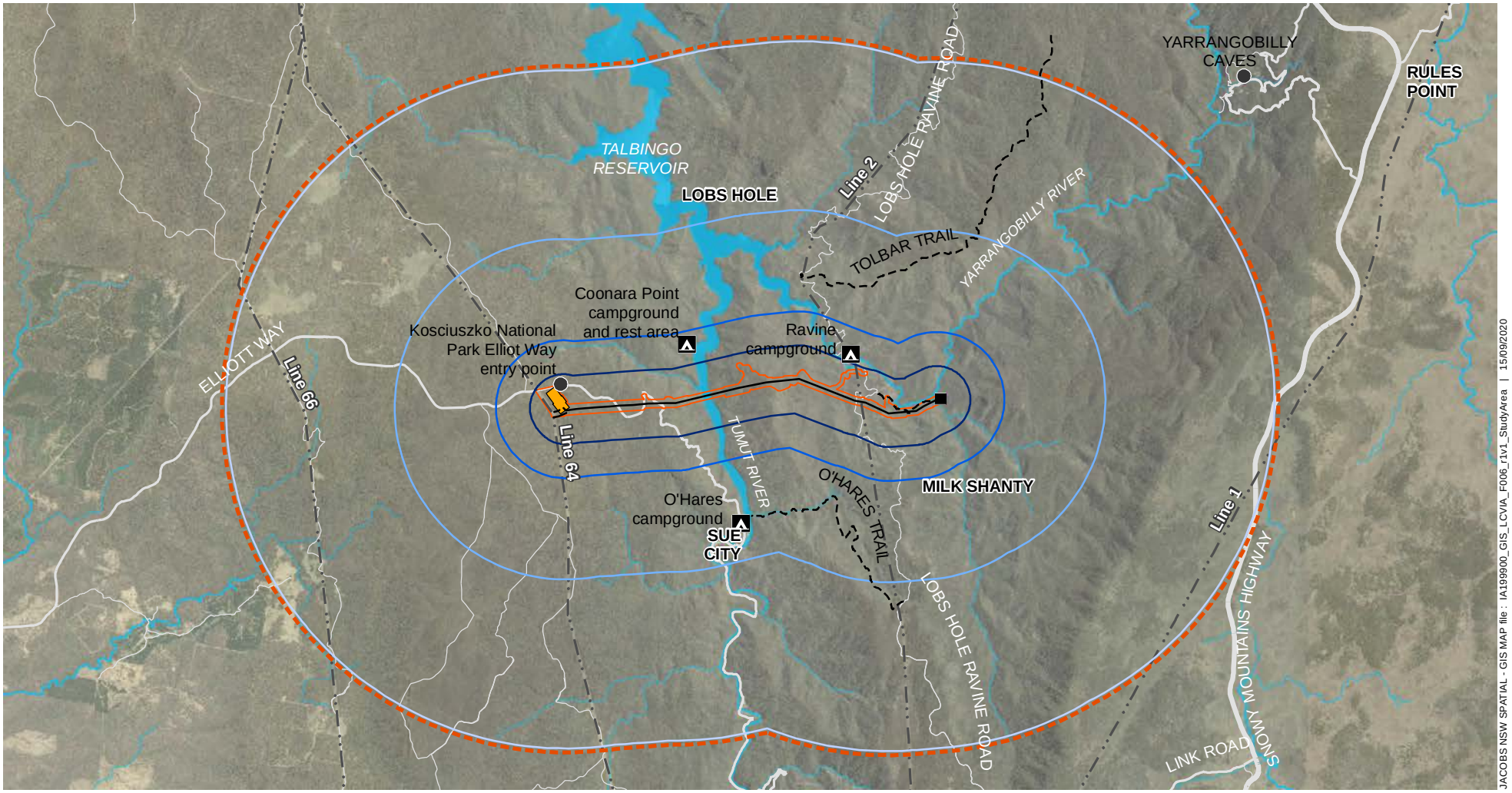
Photo 7-4 Bushfire impact to landscape character

With the exception of the Talbingo Reservoir, the majority of the project area was heavily vegetated prior to the Dunns Road bushfire. The project is within an area which is recognised as a sensitive area both visually and environmentally.

With respect to landscape character, the LCVIA study area (refer to **Figure 7-10**) includes an area with a variety of topographical features including the Tumut River/Talbingo Reservoir, and ridges, slopes and plateaus either side of the Yarrangobilly River valley.

Several roads are located in the LCVIA study area including Elliott Way, a sealed, two-lane road used to access the alpine region from the west. The KNP PoM recognises and zones Elliott Way as a major road corridor with a high scenic value. Unsealed roads associated with the Lobs Hole Ravine 4WD Trail, which experiences low and seasonal volumes of traffic, are also within the viewshed of the project.

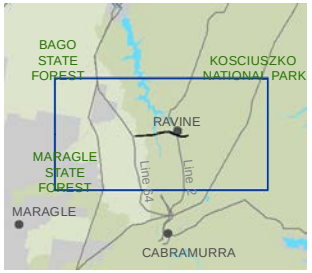
It is recognised that the KNP and surrounding area has been established in the context of the original Snowy Scheme. The KNP PoM also acknowledges that although the project is surrounded by a national park, that there would be impacts associated with the establishment, generation, and distribution of electricity in this area. There are also a number of existing transmission corridors that bisect areas of KNP. Visual sensitivity in proximity to these features is considered to be low.



Project area
Proposed transmission line
500kV substation
Snowy 2.0 cable yard
Visual study area
Zones of visual influence (ZVI)
782 m
782 m - 1.57 km
1.57 - 3.92 km
3.92 - 7.84 km
Point of interest
Campground
Electricity transmission line
Major road
Track
Waterway
Water body

0 1.5 3 km
1:135,000 @ A4

N



Data source:
Jacobs 2020, TransGrid,
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Figure 7-10 | LCVIA study area and zones of influence

7.7.2.1 Land use

The project is located within Bago State Forest and KNP. The predominant land uses in these areas include:

- State forest/national parks
- Recreational uses (particularly, boating, camping and four wheel trails)
- Water storage
- Electricity infrastructure (particularly, transmission corridors).

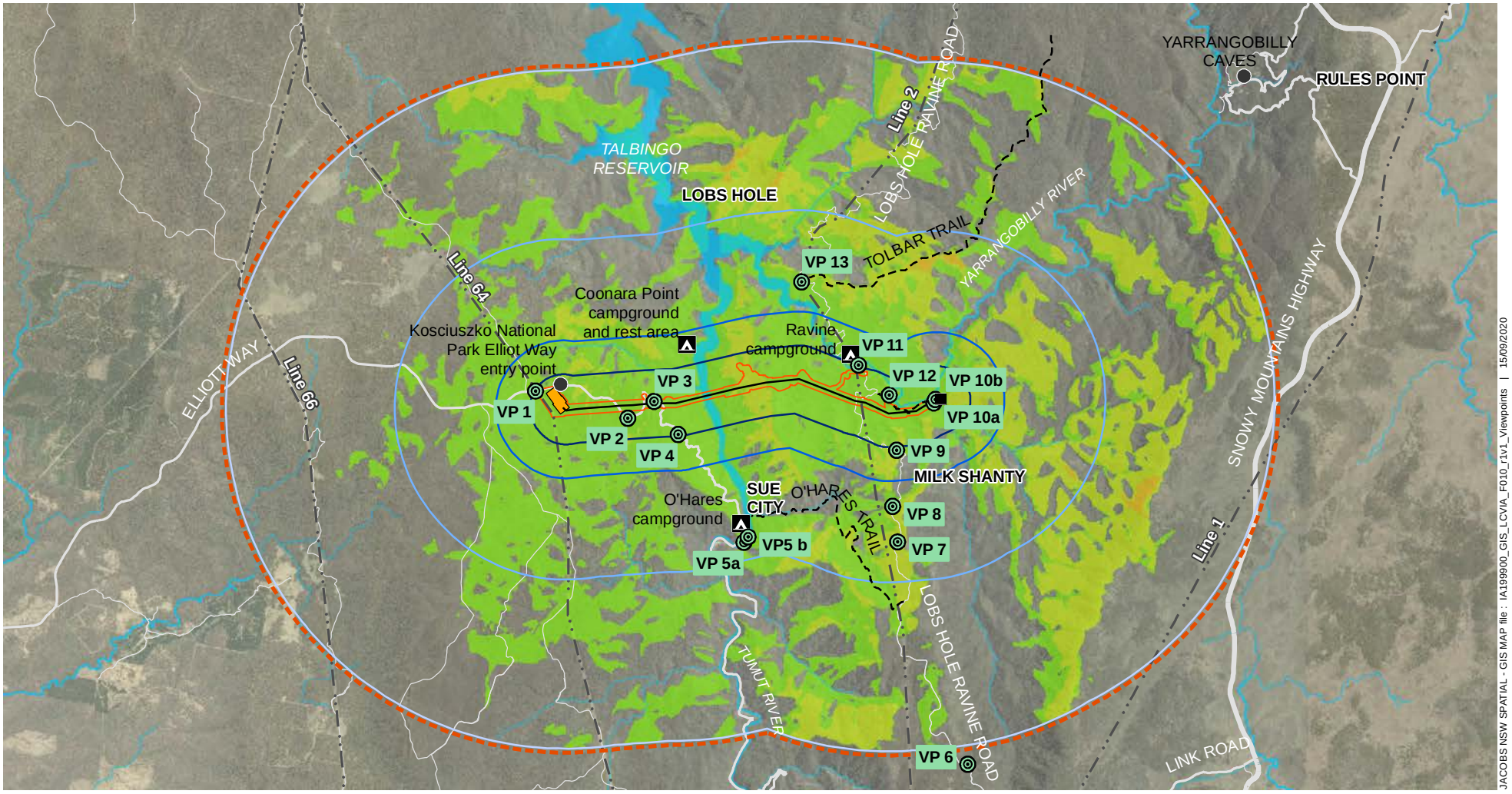
7.7.2.2 Landscape character

The landscape character of the LCVIA study area includes an area with a variety of topographical features including the valley holding the Tumut River/ Talbingo Reservoir, and ridges, slopes and plateaus either side of the Yarrangobilly River valley. There are five broad landscape character zones across the LCVIA study area based on landform. These landscape zones include river, valley, upper slope and plateau and transmission corridor.

7.7.2.3 Viewpoints

The VPs used in this assessment are shown on **Figure 7-11** and discussed further in **Table 7-18**. All of the VPs (with the exception of VP 1) considered to have a high sensitivity to change.

Due to the Dunns Road bushfire, the following assessed locations along Elliott Way, VP 3, VP 4 and VP 5 were inaccessible at the time of writing to capture views of the post bushfire landscape. At the time of writing, Elliott Way was closed to the public until further notice. VP 8 was also not accessible to be reassessed following the bushfire due to Snowy 2.0 construction activities.



Project area
Proposed transmission line
500kV substation

Snowy 2.0 cable yard

Visual study area
Viewpoint

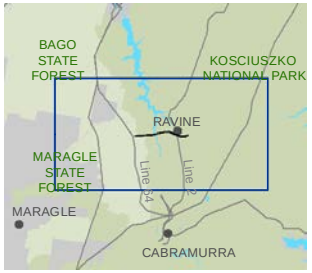
Zones of visual influence (ZVI)
782 m
782 m - 1.57 km
1.57 - 3.92 km
3.92 - 7.84 km

Visibility (tower height 75m)
0
1 - 20%
20 - 40%
40 - 60%

Point of interest
Campground
Electricity transmission line
Major road
Track
Waterway
Water body

0 1.5 3 km
1:135,000 @ A4

N



Data source:
Jacobs 2020, TransGrid,
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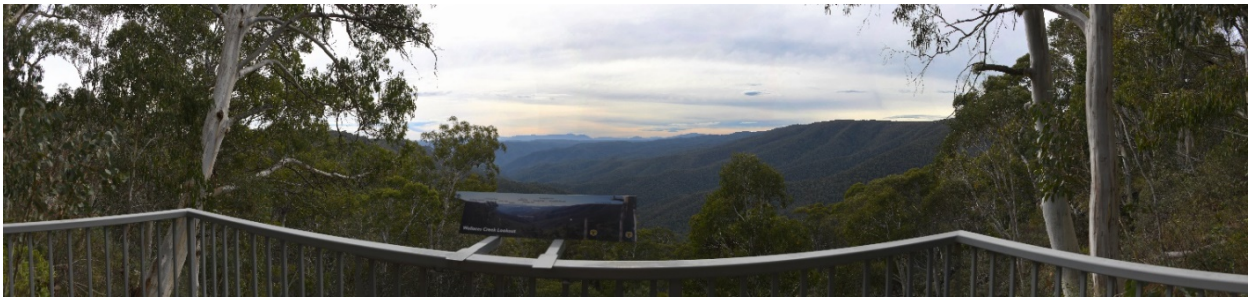
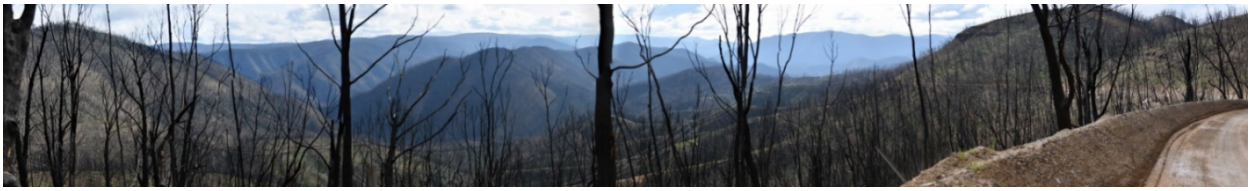
Figure 7-11 | Viewpoints

Table 7-18 Project view points

VP	Comments
1	**VP 1: Elliott Way Transmission corridor:** VP 1 is within the project area and located near Elliott Way at the crossing of the existing TransGrid Line 64. At this location, views are permitted to an existing transmission line along a transmission corridor, which travels north-south, perpendicular to Elliott Way. The photo below shows the view along Elliott Way five months after the Dunns Road bushfire. 
2	**VP 2 – Elliott Way / Boundary Road:** VP 2 is located at the intersection of Boundary Road and Elliott Way. Within this VP, views along Elliott Way are framed by the existing vegetation on either side of the road. The density of the remaining vegetation at this location allows filtered views through the trees. The photo below shows the view from this location five months after the Dunns Road bushfire. VP 2 is about 160 metres from where the project would cross Elliott Way near to this location. 
3	**VP 3 - Elliott Way:** VP 3 is within the project area and located at a small roadside clearing, in proximity to where the transmission lines would cross Elliott Way, refer to the photo below. VP3 is confined to the road due to existing vegetation which screens and filters views to the surrounding landscape, including the Talbingo Reservoir and ranges to the east. Following the Dunns Road bushfire, it is expected that these views have been temporarily opened up to reveal broader views across the reservoir and beyond. 

VP	Comments
4	**VP 4 – Elliott Way:** VP 4 is located in a clearing on the western road edge of Elliott Way as shown in the photo below. This VP was chosen as a potential point that road users may stop. Filtered views of the valley and surrounds are available at this location. VP 4 looks north towards the project at a distance of approximately 630 metres taking in views atop Sheep Station Ridge. 
5	**VP 5 (a and b) – O'Hare's Campground picnic area**: VP 5a is located near the entrance to O'Hare's Campground picnic area and VP 5b is located at the boat ramp adjacent to O'Hare's Campground, refer to the photo below. The views from these VPs are constrained by the topography. The project is approximately 3.5 kilometres north of this location. 
6	**VP 6 – Wallace's Creek Lookout:** VP 6 is located at the Wallace's Creek Lookout viewing platform, refer to the photo below. The project would be approximately eight kilometres to the north. Following the Dunns Road bushfire, this lookout was destroyed. It is unknown whether the lookout would be restored. 
7	**VP 7 – Lobs Hole Ravine Road:** VP 7 is located along Lobs Hole Ravine Road approximately three kilometres south of the project. The bushfires have resulted in an opening up of views along this section of road, including towards the project. The photo below shows the view from this location post Dunns Road bushfire. 

VP	Comments
8	**VP 8 – Lobs Hole Ravine Road:** VP 8 is located along Lobs Hole Ravine Road approximately two kilometres south of the project. From this VP, views along the valley to the north west are afforded. These views are filtered by the existing roadside vegetation on the lower slope to the road, refer to the photo below. The Dunns Road bushfire has opened up views from this location, similar to in VP 7. Filtered views are available of Line 2, which runs parallel to the general direction of Lobs Hole Ravine Road. 
9	**VP 9 – Lobs Hole Ravine Road:** VP 9 is located along Lobs Hole Ravine Road. This area is one of the few locations offering expansive vistas to the north. Views are available of Line 2 which generally runs north to south. While visible, the existing transmission lines are a relatively minor feature in the view. Prior to the Dunns Road bushfire, existing vegetation along the side of the road edge somewhat filtered views across the landscape from this location. Following the bushfire, vegetation at this location has been damaged to above-ground, as shown in the photo below. The project is about 800 metres away and would travel east to west across this view. 
10	**VP 10 – Mine Trail:** VP 10 is within the project area and located along Mine Trail, beyond the location of the former informal Mine Trail Campground. This VP was captured after the Dunns Road bushfire as the informal campground at Mine Trail no longer exists due to Snowy 2.0 construction works as shown in the photo below. This section of Mine Trail is newly formed for the construction of Snowy 2.0 and does not lead to publicly accessible locations beyond the former informal campground. For this reason, viewer numbers for this location are expected to be very low to none upon reopening of the Lobs Hole Ravine Road. 

VP	Comments
11	**VP 11 Lobs Hole-Powerline Road, Ravine Campground:** VP 11 is located along Lobs Hole-Powerline Road about 100 metres from the project. This view has the existing transmission lines in the immediate foreground, which pass over the road approximately 120 metres to the west. This location has been recently modified by construction of Snowy 2.0 and the Dunns Road bushfire as shown in the photo below. 
12	**VP 12 – Mine Trail clearing:** This VP is located at a clearing along Mine Trail where several local vehicular trails intersect next to the project. This clearing affords open views to the surrounding enclosing slopes that form the Lobs Hole Ravine. In the post bushfire landscape, vegetation along the slopes has been damaged, revealing the geological formations of the slopes. Construction works related to Snowy 2.0 are also visible in this view (as shown in the photo below), with these temporary elements to be removed prior to the reopening of the Lobs Hole Ravine Road to the public. 
13	**VP 13 – Lobs Hole-Powerline Road**: This VP is along Lobs Hole-Powerline Road, approximately three kilometres south of the project. Long range views are afforded down the ravine to the south, along the existing transmission corridor of Line 2. To the west, the southern reaches of Talbingo Reservoir can be seen. The VP has views of the existing transmission lines that generally travel parallel to the road toward the Ravine Campground to the south. The roadside vegetation in this area that formerly filtered views toward the project has been damaged by the Dunns Road bushfire as shown in the photo below. 

7.7.3 Assessment of potential impacts

7.7.3.1 Construction

Publicly accessible areas, where project area east may be viewed, would be closed to the public due to the construction of Snowy 2.0. For the project area west, it is assumed that bushfire related damage to Elliott Way would be repaired and accessible for the public during construction. As such, the construction works would be visible for roads users of Elliott Way (including the assessed VPs: VP 1, VP 2, VP 3 and VP 4) and to a lesser extent, recreational users of the surrounding area in project area west.

The construction elements and activities that would be visible from Elliott Way may include:

- Presence of heavy vehicles/construction vehicle traffic, including cranes and helicopters or drones
- Earth works vegetation clearing
- Traffic management signage and traffic stops
- Construction, stringing and tensioning of the transmission structures and transmission lines
- Removal of non-permanent elements following construction and rehabilitation works.

These elements and activities would be visible to the public from within a limited section of Elliott Way, where breaks in vegetation at transmission corridors and road crossings allow views through to the project area, and only visible during the construction period. The construction activity for the Talbingo Reservoir crossing may also be visible further south to road users travelling north. This visibility would be limited due to the winding nature of the road, topography and would be filtered through roadside vegetation. These views would contrast against the natural landscape, which is largely absent of development, affording to a moderate to high level of visual impact.

These visual impacts would be temporary in nature and would be expected to be remediated following the completion of the construction works. Due to the nature and scale of these works being out of the expected character within the Bago State Forest and KNP, park visitors and road users along this section of Elliott Way would experience a moderate-high level of visual impact, for a short section of a journey, when travelling through the project area.

No night works would be required during the construction of the project. However during winter lighting may potentially be required in the early mornings and late afternoons. The impacts of this lighting are considered negligible as the project is not in proximity to sensitive receivers.

7.7.3.2 Operation

Visual impact

The impacts on the VPs are summarised in **Table 7-19**. As described in **Table 7-19**, seven VPs would have nil to low impact, four would have a low to moderate impact, one would have a moderate-high (VP 3) and two would have a high impact (VP 10 and VP 12). Photomontages of VP 7, VP 9, VP 11, VP 12 and VP 13 are provided in the LCVIA provided in **Appendix H**. Representative photomontages for VP 7 and VP 9 are provided in **Photo 7-5** and **Photo 7-6**.

The LCVIA identified that areas potentially impacted by loss of landscape amenity or through views afforded to the project would largely be limited to short sections of Elliott Way to the west and south of the project, and along some sections of the Lobs Hole-Ravine 4WD trail and tracks that navigate the KNP. The impact to views and landscape areas from locations that look along sections of the cleared transmission corridor would experience a higher level of impact than views that are perpendicular or oblique to the project. The visual impacts would include the obviousness of the cleared vegetation as well as the addition of project elements into the landscape.

The impacts to Elliott Way are largely limited to a short section that would experience three new transmission corridor crossings. At VP 3, a substantial landscape change would occur, including the opening of views across the Talbingo Reservoir and a structure sited near the road.

Views toward the substation would be filtered through the existing stands of trees to the south of Elliott Way. Views of the substation lighting would be restricted to road users along Elliott Way travelling at night, and are considered negligible due to the substation being located behind existing vegetation, and not being in proximity to sensitive receivers.

Table 7-19 Visual impact summary

VP	Category of viewer	Approximate distance to project elements	Sensitivity	Overall visual impact	Comment
Project area west					
1	Vehicular traffic	300 metres – 500 KV substation	Low	Low	Due to the existing vegetation and low setting of the road in comparison to the road cutting and new transmission lines to the south, it would be unlikely that any elements of the project would be visible from this VP. Views toward the substation would be filtered through the existing stands of trees to the south of Elliott Way. The substation is the only element of the project that requires night lighting. Lighting impacts are expected to be negligible due to the substation being located behind existing vegetation and lack of sensitive receivers, particularly during night time hours.
2	Vehicular traffic	340 metres – Nearest transmission corridor edge	High	Low - Moderate	Existing vegetation would filter or screen the project for the majority of the time for road users on Elliott Way. Project elements would be visible at locations where the transmission corridor crosses Elliott Way. The change in views at these locations would include the new transmission lines, removal of vegetation and views along the transmission corridor perpendicular to the direction of travel. In proximity to this VP, the project would cross Elliott Way at three points. At these locations, the visual change may be likened to the two existing transmission corridors to the west.
3	Vehicular traffic	Within transmission corridor and about 140 metres to nearest structure	High	Moderate-High (potentially positive)	The change in this view would include the proposed transmission corridor and structures. The break in vegetation would enable long distance views along the valley which did not exist prior to the Dunns Road bushfire. The disturbance footprint of this vegetation clearing is likely to extend to approximately 260 metres along Elliott Way, extending south from this location. Although transmission corridor crossings are relatively common within the broader area, the positioning of a transmission structure relatively close in height and distance to the road is not common and would bring about an imposing change in this setting. In the context of a journey for road users, this would be a dramatic, yet short-lived change. This change in views, although modified, has the potential for a positive visual impact, as a new expansive vista would open up views across the Talbingo Reservoir and beyond. This positive outcome would be modified by the visibility of the proposed transmission lines, aircraft marker balls and structures.

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VP	Category of viewer	Approximate distance to project elements	Sensitivity	Overall visual impact	Comment
4	Park users, campers, vehicle rest area	760 metres – Nearest structure	High	Negligible	From this VP, views toward the project would be largely filtered by existing vegetation and topography along the east of Elliott Way. This vegetation would not be impacted by the project. The project elements potentially visible from this location would include the transmission lines suspended above the valley and structures to the north and north east. These project elements would be at such a distance that intervening vegetation in the foreground would largely screen views, rendering them an indiscernible element within the view.
5a	Campers, tourists, vehicular rest area	3.5 kilometres – Suspended transmission lines	High	Nil	Intervening topography and vegetation along ranges to the north would largely screen views of the project elements. As this VP is further than the three kilometre radius defined as the viewshed, project elements would be barely discernible in the context of the view.
5b	Boat users	3.4 kilometres – Suspended transmission lines	High	Nil	There is the potential for long range views to the transmission lines suspended above the valley from this VP. At a distance of 3.3 kilometres from the VP, it would be unlikely to expose any views of the project and would not constitute a discernible feature in the view.
Project area east					
6	Tourist stopping point	8.6 kilometres – Nearest structure	High	Nil	The combination of distance from the project, orientation of the viewing platform generally to the east and existing vegetation and topography intervening views toward the project results in no views of the project elements from this location. Following the Dunns Road bushfire, this lookout structure was destroyed, and unable to be visited to be reassessed. Vegetation in the area also thinned as a result of the fires. This assessment assumes that the lookout would be rebuilt, and that views may be through thinned vegetation. For these reasons, the visual impact is assessed as nil.

VP	Category of viewer	Approximate distance to project elements	Sensitivity	Overall visual impact	Comment
7	Vehicular traffic	2.9 kilometres – Nearest structure	High	Low - Negligible	The proposed structures would be visible within this view, but at such a distance that they would not be dominant elements within the landscape. As the vegetation regenerates from the Dunns Road bushfire it would filter or screen views to the project and obscure the bulk of the structures from being visible elements. A section of the photomontage looking north west is provided in **Photo 7-5**.
8	Vehicular traffic	2.1 kilometres - Nearest structure	High	Low	Due to existing transmission lines within the foreground of this view, and the degree of distance between the VP and potentially visible project elements, the visual impact at this location is assessed as low.
9	Vehicular traffic	840 metres – Nearest structure	High	Low-Moderate	The most prominent visual features of the project would likely be the descent of the transmission corridor down a ridge near the centre of this overall view, which would meet the existing Line 2 before heading further east, where topography would obscure views to structures located further east. The presence of existing transmission infrastructure within this view lessens the VP sensitivity to visual change. The overall visual impact at this location is assessed as low to moderate at such time as public visitation can recommence, and nil prior. A section of the photomontage looking north west is provided in **Photo 7-6**.
10	Camping users	Within transmission corridor	High	High	Within this view, the project would pass over the slope near the peak visible in the background of this view and head towards the VP. The visual impact at this location along Mine Trail would be low-moderate, depending on viewer numbers. The public may benefit from a new campground. This would be determined as part of the Rehabilitation Plan for the Lobs Hole Ravine area by Snowy Hydro under consultation with NPWS. The overall visual impact once visitation re-commences is assessed as high.

VP	Category of viewer	Approximate distance to project elements	Sensitivity	Overall visual impact	Comment
11	Vehicular traffic/ stopping location, camping	800 metres – Nearest structure	High	Moderate	The vegetation at this location is expected to regenerate over time to provide filtering or screening of views toward the project. As the structures will be elevated and traverse a ridgeline, they would still be somewhat visible above the vegetation. Although the landscape sensitivity is high, the prominence of existing transmission infrastructure within this view lessens the sensitivity to visual change. The moderate rating recognises that the existing transmission lines bisect the campsite, and the high rating recognises the recreational amenity for park visitors as a key site. The upgrade of Lobs Hole Ravine Road as part of Snowy 2.0 would allow for more vehicles including caravans and campers to access this area, as such the viewer numbers are expected to increase. A section of the photomontage looking south west to west is provided in **Photo 7-7**.
VP 12	Vehicular traffic/stopping location	400 metres – Nearest structure	High	High	Several structures would be within close enough distance to be considered dominant elements within this view. The new structures and vegetation clearing would be highly visible in front of exposed cliff-faces and a valley. Due to the proximity of these structures to the eastern point of termination (Snowy 2.0 cable yard) little opportunity exists to locate these structures elsewhere to mitigate the visual change. Due to the proximity of structures, their intervention in key views along ridgelines and to outstanding topographical features and the likelihood for park visitors to stop at this location, the visual impact at this location is determined to be high. A section of the photomontage looking east to south east is provided in **Photo 7-8**.
VP 13	Vehicular traffic	2.2 kilometres – Nearest structure	High	Low - Moderate	Four structures would likely be visible on the upper slopes to the south west of this VP. The presence of new infrastructure along the elevated ridgeline in middle-ground views would be a noticeable, but not a dominant visual change in views along Lobs Hole - Powerline Road. Although structures may be visible from this location, Lobs Hole-Powerline Road is characterised by the existing structures that generally travel parallel to the road toward the Ravine Campground to the south. A section of the photomontage looking north west is provided in **Photo 7-9**.

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In areas around Lobs Hole Ravine Road (VP 7 to VP 9) where project elements would be visible, views are often limited by intervening topography, existing vegetation or existing transmission infrastructure associated with Line 2 in the foreground. While the addition of new transmission infrastructure in this area would be visible, it would be similar to views afforded to existing infrastructure. Representative photomontages for VP 7 and VP 9 are provided in **Photo 7-5** and **Photo 7-6**.

Photo 7-5 VP 7 – Photomontage looking north west – post bush fire. The top image is pre project view.

Photo 7-6 VP 9 – Photomontage looking north west – post bush fire. The top image is pre project view.

Two viewpoints at Lobs Hole Ravine (VP 11 and VP 12) would experience a high visual impact that is unlikely to be mitigated by vegetation regeneration. These viewpoints would have clear views of sections of the project and are expected to experience increased visitor numbers in the future due to road upgrades. VP 10, located at the Mine Trail campground is also assessed as high, but would likely not be used as a campground post-construction due to the positioning of the transmission corridor at this location, and provision of upgraded amenities elsewhere at Lobs Hole as part of the Snowy 2.0 remediation works. Representative photomontages for VP 11, VP 12 and VP 13 are provided in **Photo 7-7** to **Photo 7-9**.

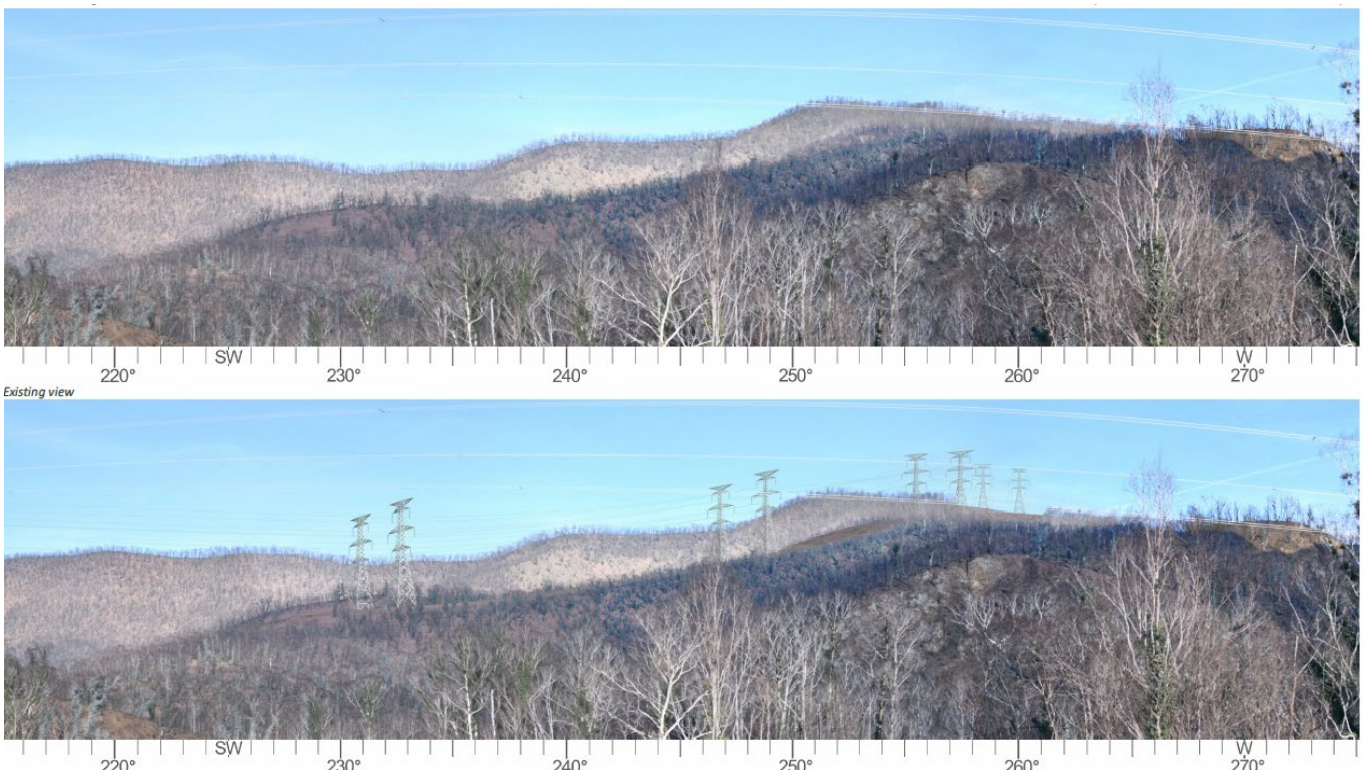


Photo 7-7 VP 11 Photomontage south west to west – post bush fire. The top image is pre project view.

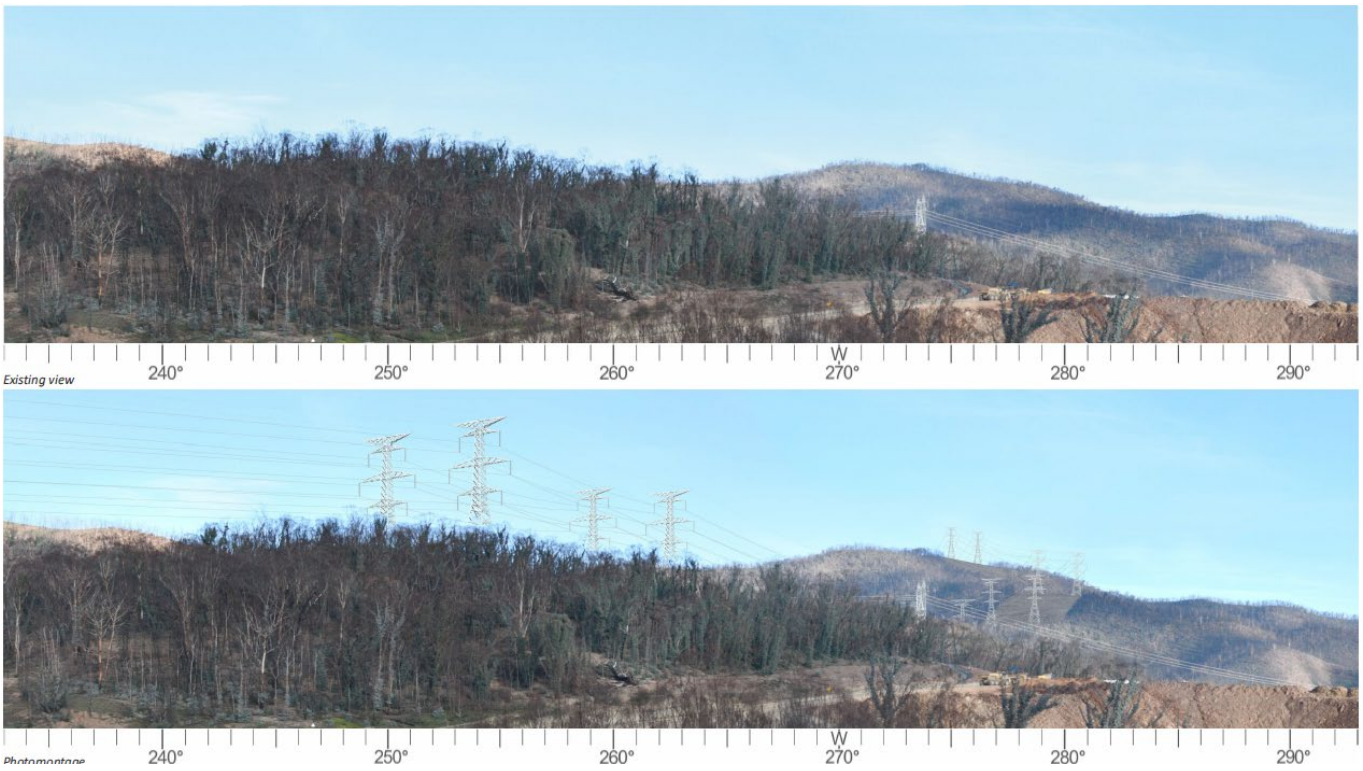


Photo 7-8 VP 12 – Photomontage looking south west to west – post bush fire. The top image is pre project view.

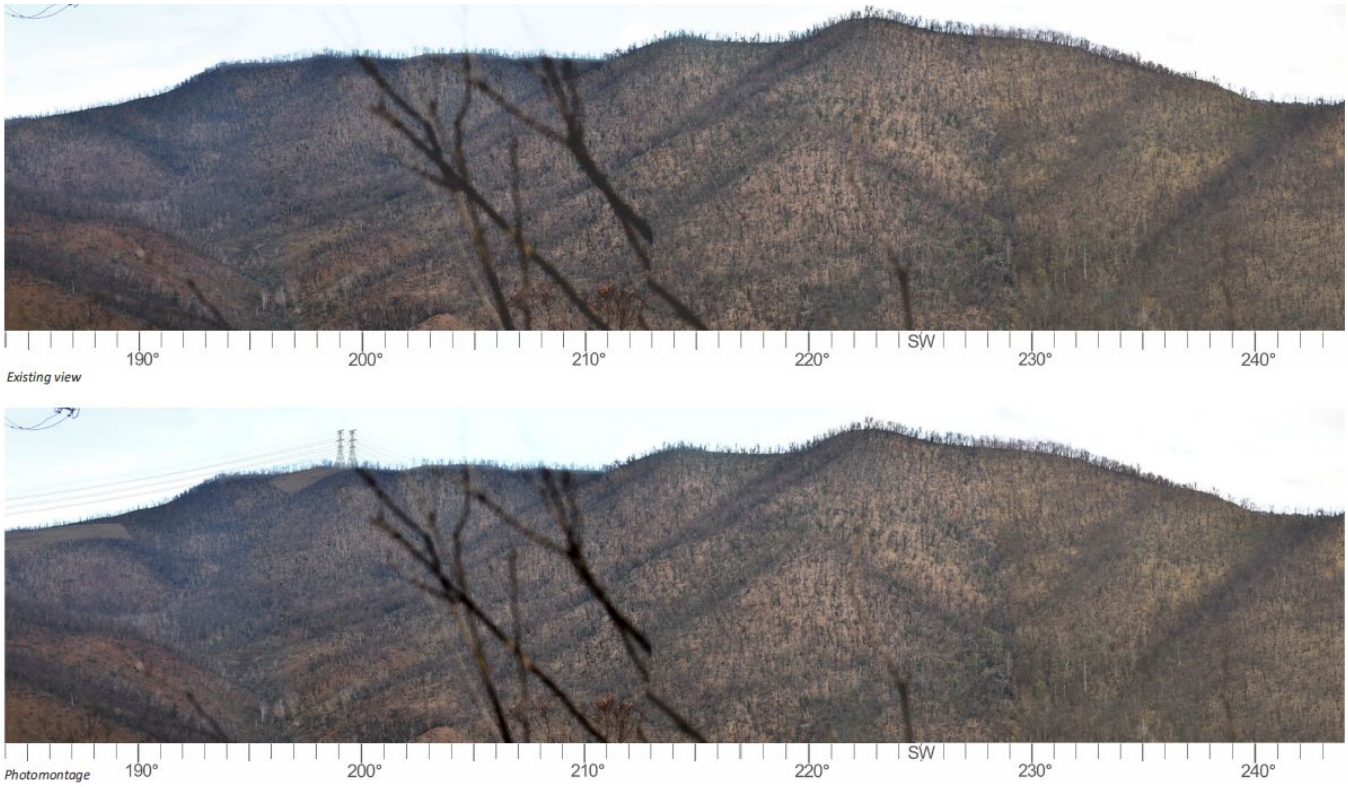


Photo 7-9 VP 13 – Photomontage looking south west to west – post bush fire. The top image is pre project view.

The full photomontages for the five VPs are provided in Appendix A of the LCVIA in **Appendix H**.

Vegetation in many areas is slowly regenerating and it is expected that over time the vegetation would be re-established to a point that provides for the screening or filtering of views to the majority of the project as expected prior to the Dunns Road bushfire.

The majority of the viewing locations are from tracks and trails that navigate the national park and would be provided with filtered or screened views toward the existing transmission lines and the project following regeneration of vegetation. The introduction of additional screening vegetation at the remaining viewpoints, would screen elements of the project, and would also remove views of other areas of KNP. For these reasons, it is considered that landscape mitigation of the transmission line is either not required or not suitable.

Landscape character

While landscape character sensitivity to change would be considered to be high, the obvious presence of a number of existing major transmission lines decrease this sensitivity when considering the project is of similar appearance. The addition of further transmission infrastructure would not be out of character within the area but would increase the industrialisation of the landscape character of KNP and Bago State Forest from a limited number of viewing locations.

7.7.4 Mitigation measures

Mitigation measures for landscape character and visual impacts are presented in **Table 7-20**. No operational mitigation measures are required.

Table 7-20 Mitigation measures for landscape character and visual impacts

Ref	Impacts	Mitigation measures
Detailed design		
VIA1	Visual impact from the substation	Detailed design will consider the retention of existing vegetation to the greatest extent practicable south of Elliott Way and around the substation to ensure that potential visual impacts from Elliott Way are minimised.
Construction		
VIA2	Visual impact	> All construction plant, equipment, waste and excess materials will be contained within the designated boundaries of the work site and will be removed from the site following the completion of construction > Stockpiles will be stabilised to prevent erosion by wind and water and avoid the development of dust plumes adversely impacting air and visual quality > On completion of the work disturbed areas will be stabilised and returned to as close to original condition.

7.8 Noise and Vibration

This section summarises the findings of the noise and vibration assessment (NVA) provided in **Appendix J**. The NVA addresses the following SEARs:

Amenity:

> An assessment of the:
  - Construction, operational and road noise impacts of the project.

7.8.1 Assessment methodology

The NVA assessment included:

> Identification of noise sensitive receivers and background noise levels
> A construction and operational noise assessment to predict noise levels that may be generated by the project; including airborne noise, construction traffic noise and vibration
> Assessment of noise and vibration impacts, summarising the assessment results at sensitive receivers
> The identification of mitigation measures required to minimise impacts.

The Construction Noise Estimator (CNE), (Roads and Maritime Services, 2017) was used to evaluate potential construction and operational noise impacts from each stage of construction and the operational substation. These predictions were evaluated by comparing the results against the construction Noise Management Levels (NMLs) and operational noise criteria established in **Section 7.8.3**.

7.8.2 Existing environment

7.8.2.1 Sensitive receivers

A noise sensitive receiver is considered to be any location where inhabitants or users may be impacted by noise generated by the project. The nearest sensitive receivers are shown on **Figure 7-12** and listed in **Table 7-21**. As shown in **Table 7-21**, there are two passive recreation areas within the vicinity of the project including the Coonara Point Campground and Rest Area and O'Hares Campground. There are also a number of residential properties along Bradley's Drive, Nurenmerenmong. All of these receivers are located over one kilometre from the project.

The Snowy 2.0 works accommodation is located near the project. Although this location would be sensitive to noise from project activities, it is not considered as a sensitive receiver owing to its affiliation with the project and also the broader Snowy 2.0 project.

There would also be sensitive receivers along routes and towns (such as Cooma, Batlow, Tumbarumba and Tumut) affected by haulage and daily construction traffic (ie traffic between accommodation locations and the construction sites).

Table 7-21 Nearby noise sensitive receivers

Receiver ID	Receiver details	Receiver type	Distance from the project
A3	Coonara Point Campground and Rest Area	Passive recreation area	One kilometre north
A5	O'Hares Campground	Passive recreation area	Three kilometres south
R20	Private properties at Nurenmerenmong	Residential	Four kilometres north west
A16	Snowy 2.0 works accommodation	n/a*	About 370 metres north

* Not applicable, the Snowy 2.0 works accommodation forms part of the overall Snowy 2.0 construction works.

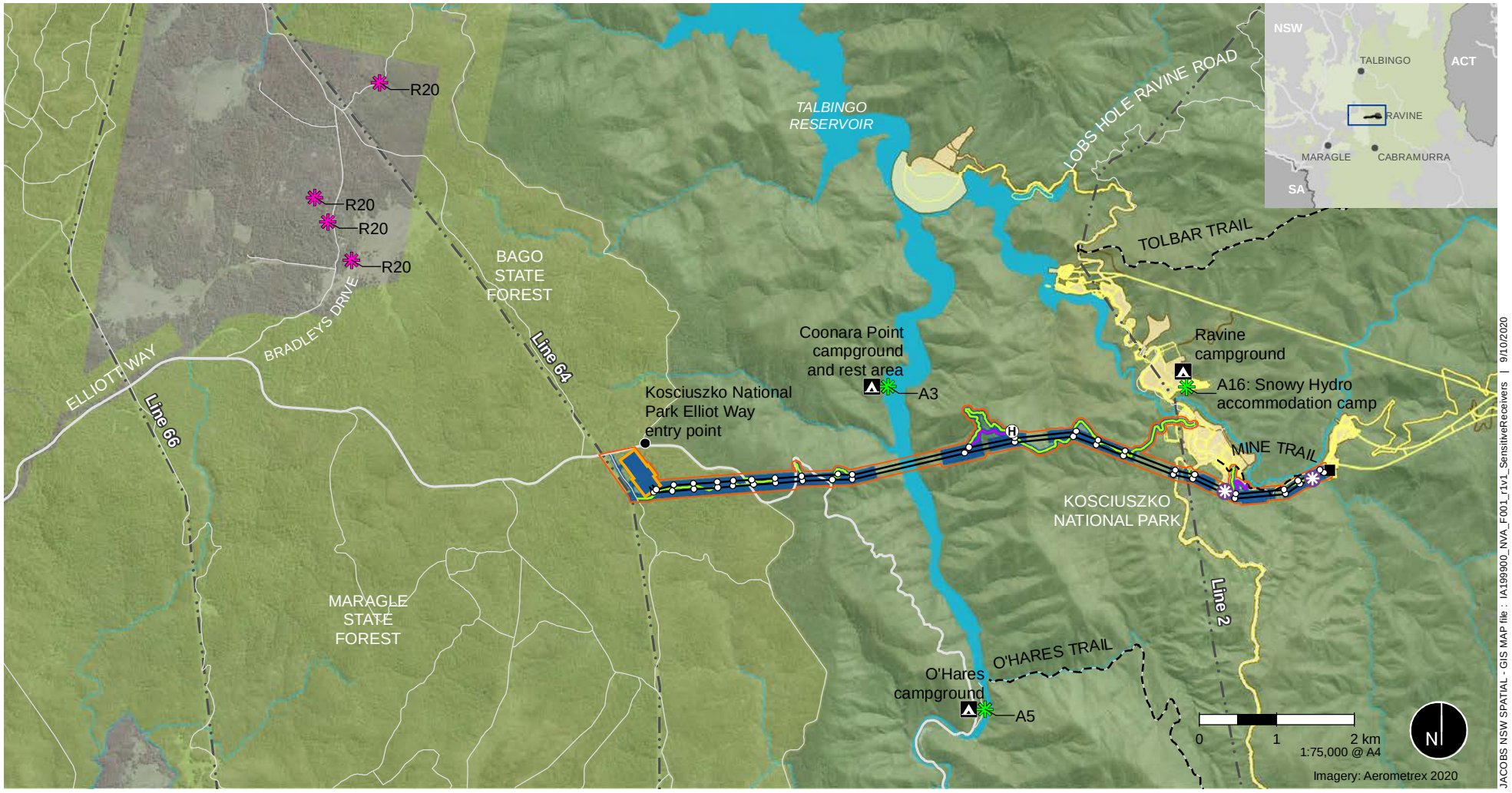
Two heritage structures, Lobs Hole Copper Mine Water Race (R45) and Circular stone wall (R49) are located within the project area as described in **Section 7.3.2**.The vibration impacts on these items are considered in **Section 7.8.4.1.**

7.8.2.2 Background levels

The project is located in a remote area with the background noise generally dominated by environmental noise sources such as wind blowing through vegetation, wildlife calls and the occasional vehicle travelling along Elliott Way. Owing to low background noise levels attributed to the remote location of the project, the background noise levels (RBLs) from the *Noise Policy for Industry* (NPI) (EPA, 2017) were adopted as listed in **Table 7-22**. These minimum recommended RBLs are consistent with those measured during monitoring, which was undertaken as part of the NVA for Snowy 2.0 (EMM, 2019c).

Table 7-22 Adopted background noise levels dB(A)

Day (7am to 6pm)	Evening (6pm to 10pm)	Night (10pm to 7am)
35	30	30



Project area
Disturbance area
Proposed 500kV substation
Potential helipad location
Proposed structure
Proposed transmission line
Proposed access track - Option A
Proposed access track - Option B

Sensitive receiver - accommodation
Sensitive receiver - private residence
Historic heritage - significant item (NSW Archaeology 2019)
Snowy 2.0 cable yard
Snowy 2.0 element
Snowy 2.0 Disturbance footprint

Kosciuszko National Park Elliottt Way entry point
Campground
Electricity transmission line
Track
Major road
Waterway
Water body
State forest
NPWS estate

Figure 7-12 | Noise and vibration study area and noise sensitive receivers

7.8.3 Criteria

7.8.3.1 Construction noise criteria

Construction noise criteria have been established for the project in accordance with the *Interim Construction Noise Guideline* (ICNG) (DECC, 2009), in the form of construction NMLs. Considering the adopted RBLs presented in **Table 7-22** and the guidance from the ICNG, the NMLs listed in **Table 7-23** were established to assess potential construction noise impacts at the identified residential receiver location (receiver R20 - Private properties at Nurenmerenmong).

Table 7-23 ICNG NMLs for residential receivers

Receiver type	Day (during standard hours)		Day (outside standard hours)		Evening		Night	
	L_{90} (RBL) dB (A)	NML L_{eq} 15 min dB(A)	L_{90} (RBL) dB (A)	NML L_{eq} 15 min dB(A)	L_{90} (RBL) dB (A)	NML L_{eq} 15 min dB(A)	L_{90} (RBL) dB (A)	NML L_{eq} 15 min dB(A)
Residential	35	45	35	40	30	35	30	35

For consistency with the ICNG, for non-residential land uses such as 'passive recreation areas' (receiver A3 - Coonara Point Campground and Rest Area and A5 - O'Hares Campground) a NML of 60 dB(A) was applied.

Construction traffic noise

In accordance with the *Road Noise Policy* (RNP) (Department of Environment, Climate Change and Water (DECCW), 2011), for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dB(A). In general terms, an increase of this magnitude would occur where traffic volumes increase by approximately 60 percent as a result of the development.

Blasting

Overpressure and vibration from blasting are assessed against the levels provided in the *Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration* (Australian and New Zealand Environment Council (ANZEC), 1990). Using a charge mass of between five and 45 kilograms, the estimated distance from the blast not to exceed air-blast overpressure and ground vibration levels are between 65 and 200 metres respectively.

7.8.3.2 Construction vibration criteria

Vibration arising from construction activities can result in impacts on human comfort or the damage of physical structures such as dwellings. These two outcomes have different criteria levels, with the effects of vibration on human comfort having a lower threshold.

The recommended safe working distances for the most vibration intensive plant and equipment are as follows:

- Cosmetic damage: 25 metres
- Human comfort: 100 metres
- Heritage structures: 50 metres.

These safe working distances are indicative only and would vary depending on the particular item of plant and local geotechnical conditions. This is discussed further in the NVA provided in **Appendix J**.

7.8.3.3 Operational noise criteria

The operational noise limits were derived in accordance with the INP and shown in **Table 7-24**.

Table 7-24 Project operational noise criteria

Receiver type	Time of day	Applicable NPI noise criteria ($L_{Aeq\ dB(A)}$)
Residential receivers	Day	40
	Evening	35
	Night	35
Areas specifically reserved for passive recreation (eg national park)	When in use	48

7.8.4 Assessment of potential impacts

7.8.4.1 Construction

As described in **Section 5.3**, it expected that the project would start in early 2022 and take about 39 months to complete. Construction would require the use of heavy machinery, which can generate high noise and vibration levels at nearby receivers. The potential impacts may vary greatly depending on the intensity and location of construction activities, the type of equipment used, existing background noise levels, intervening terrain, and prevailing weather conditions.

Potential noise and vibration sources during construction include:

- Operation of mobile and stationary construction plant and equipment
- Operation of construction compounds and other ancillary facilities (known as fixed sources)
- Construction vehicle movements.

In accordance with the assessment guidelines, potential noise impacts were predicted with a focus on those activities with the highest potential to cause noise impacts. As a result, the predictions identify worst-case construction noise levels, which may not be reached, or only reached infrequently.

The NVA assessment found that:

- Predicted worst-case noise levels during construction were predicted to remain below project noise management levels (NMLs) at the identified receiver locations. Levels up to 59 dB(A) were predicted at receiver A16 (Snowy 2.0 works accommodation) although this is not considered to be a sensitive receiver given its affiliation with the project. It is expected that the Snowy 2.0 works accommodation would meet relevant requirements to provide adequate levels of amenity
- Construction vehicle movements have the potential to generate temporary adverse noise impacts along on the local road network and haulage routes shown on **Figure 5-6**. The 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
- The major potential sources of vibration impact for the project would be the use of hydraulic rock breakers and vibratory rollers, as well as blasting activities. Due to the distance to sensitive receivers, building cosmetic damage and human comfort impacts would unlikely be impacted. However, care would need to be taken if works involving use of hydraulic rock breakers and vibratory rollers are required within 50 metres of heritage items R45 and R49
- Due to the distance from blasting locations to the nearest receivers, vibration impacts from blasting (including airblast overpressure) were not anticipated at sensitive receiver locations. Care would be required to avoid damage to heritage items R45 and R49 if blasting is required near these locations.

7.8.4.2 Operational impacts

Operation of the substation and transmission lines (including audible noise generated by corona discharge) would not result in unacceptable impacts at the identified sensitive receiver locations. Predicted noise levels at all sensitive receiver locations were well within the adopted noise management criteria.

The additional traffic movements from project operation activities are not expected to result in unacceptable changes in traffic noise levels at sensitive receivers along the local road network.

7.8.5 Mitigation measures

Mitigation measures for noise and vibration are presented in **Table 7-25**. No operational mitigation measures are required.

Table 7-25 Mitigation measures for noise and vibration impacts

Ref	Impacts	Mitigation measures
Construction		
NV1	Noise impacts	The standard techniques for controlling noise impacts during construction are presented in the ICNG. During construction relevant standard measures as outlined in Section 6 of the ICNG will be implemented.
NV2	Vibration from plant and equipment	Do not conduct vibration intensive works within the recommended safe setback distances. Avoid the use of vibration intensive plant within the nominated human comfort distances.
NV3	Heritage items	Care will be taken when carrying out vibration-intensive activities (e.g. use of hydraulic rock breakers and vibratory rollers, and blasting) within distances approaching the recommended safe setback distances around heritage items R45 and R49. Where maintaining these setback distances isn't possible a suitably qualified person will be present or monitoring will be undertaken during the works to suspend activities in the instance of any issues.
NV4	Blasting	A detailed blast plan will be prepared by the blasting contractor prior to each blast to mitigate the potential for the recommended safe setback distances being encroached.

7.9 Air quality

This section provides a qualitative assessment of the potential impacts of the project on air quality and measures to mitigate them. The assessment addresses the following SEARs:

Air:

> An assessment of the air quality impacts of the project.

7.9.1 Assessment methodology

Air quality

The methodology for the air quality assessment included:

> Characterising key features of the surrounding environment including the location of surrounding receivers and sensitive land use areas, prevailing climate and meteorological conditions and background air quality
> Identifying key air quality and impacts during construction and operation
> Identifying mitigation measures required to minimise impacts.

7.9.2 Existing environment

Sensitive receivers

The project is located within KNP with few nearby communities. The nearest sensitive receivers to the construction works are:

- Ravine Campground, located about one kilometre to the north of the project (currently closed for the construction of Snowy 2.0)
- Coonara Point Campground and Rest Area, location about one kilometre to the north of the project
- O'Hares Campground, located about three kilometres to the south of the project
- Snowy 2.0 works accommodation, located about 370 metres to the north of the project
- Private properties at Nurenmerenmong located about four kilometres to the north west.

The nearest sensitive receivers used to inform this assessment are shown on **Figure 7-13**.

Meteorological conditions

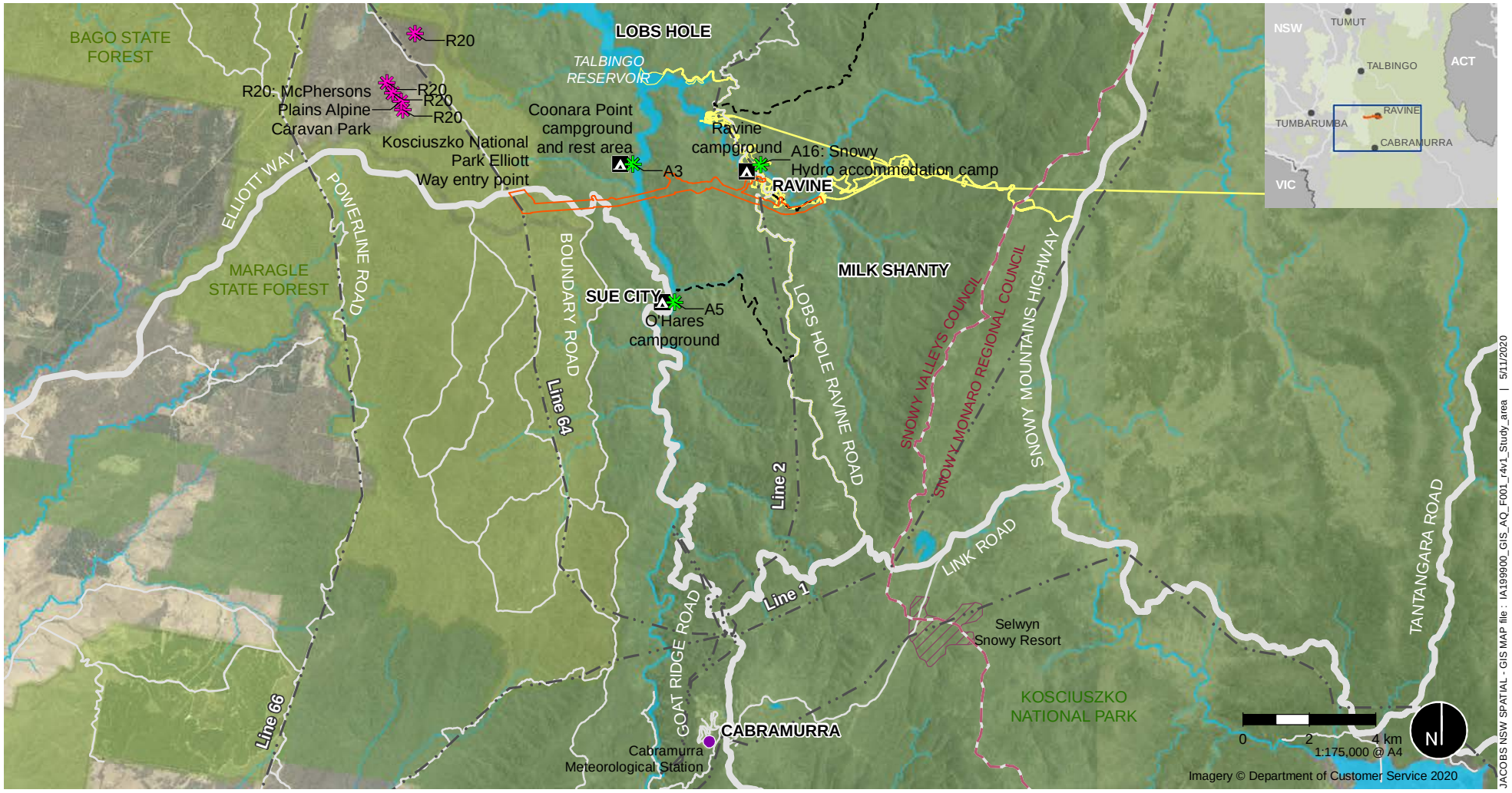
Meteorological conditions are important for determining the direction and rate at which emissions from a source would disperse. The nearest known meteorological station which collects data suitable for air quality purposes is located at Cabramurra, operated by the Bureau of Meteorology. This station (no. 72161) is located about 18 kilometres south of the project and records a variety of meteorological parameters on a 10 metre mast including temperature, wind speed, wind direction, rainfall and relative humidity (refer to **Figure 7-13**).

The annual data statistics for three representative years (2016-2018) have been examined for Cabramurra station to understand meteorological conditions near the project. Over these years, the mean wind speed has ranged from 4.9 to 5.1 metres per second (m/s), and the percentage of calms ranged from 4.1 to 6.3 percent. The annual prevailing winds are from the west-northwest. Conditions were consistent between years and as such it is expected that conditions would remain consistent in future years.

Existing air quality conditions

No air quality monitoring has been carried out for the project. The closest DPIE air quality monitoring stations are located over 100 kilometres from the project, and therefore were not deemed to be representative of the project area. There are no significant sources of air pollution in the region, nor are there any largely populated locations in the vicinity of the project.

Given the project location is located well removed from populated centres, industry and significant sources of air pollution, background air quality is likely to be well below the criteria outlined in the *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW* (NSW EPA, 2016), even with Snowy 2.0 in construction.



Project area
Bureau of Meteorology station (no. 72161)
Sensitive receiver - accommodation
Sensitive receiver - private residence
Snowy 2.0 element
Campground
Kosciuszko National Park Elliott Way entry point
Electricity transmission line
Major road
Minor road
Track
Waterway
Water body
State forest
NPWS estate

Figure 7-13 | Air quality monitoring

7.9.3 Assessment of potential impacts

7.9.3.1 Construction

Air quality impacts would likely be from the generation of dust during excavation and vegetation clearing works, vehicle movements along and wind erosion of unsealed surfaces, and emissions from equipment exhausts.

Emissions from these construction activities may generate some air quality impacts at the three identified campgrounds (Ravine and O'Hares Campgrounds, and the Coonara Point Campground and Rest Area) and the Snowy 2.0 worker accommodation due to their proximity to the project. Considering the prevailing wind conditions and location of sensitive receivers, temporary minor air quality impacts are more likely to occur at the Snowy 2.0 worker accommodation and at O'Hares Campground (to the south) instead of the other locations. Impacts could be in the form of nuisance dust or exposure to fine particles which could have a minor human health impact.

7.9.3.2 Operation

During operation, the transmission line and substation would have no significant impact on the air quality in the surrounding environment. The level of emissions and dust generated by maintenance vehicles would be comparable to that of other vehicles on the roads and access tracks in the area and would be considered to be negligible.

7.9.4 Mitigation measures

Construction mitigation measures for air quality are presented in **Table 7-26**. No operational mitigation measures are required.

Table 7-26 Mitigation measures for air quality

Ref	Impacts	Mitigation measures
Construction		
AQ1	Air quality	Air quality mitigation measures will include, but not be limited to: > Identifying potential sources of air pollution > Dust mitigation and suppression measures to be implemented > Plant and equipment will be switched off when not in use > Vehicles, plant and construction equipment will be appropriately sized for the task and properly maintained so as to achieve optimum fuel efficiency > Materials will be delivered with full loads and will come from local suppliers, where possible > Methods to manage work during strong winds or other adverse weather conditions > A progressive rehabilitation of disturbed areas.

7.10 Hazards and risks

This section provides an assessment of the potential hazards and risks generated by the project and measures to mitigate them. This assessment addresses the following SEARs:

Hazards:

- An assessment of:
- Any potentially hazardous impacts of the project, including electric magnetic fields (EMF) having regard to the latest advice of the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)
- Any public safety risks, including bushfire and flooding risks.

Flood risks are presented in **Section 7.4**. The remaining risks to public safety such as EMF, bushfire, and dangerous goods and hazardous substances are discussed in this section. The potential bushfire risks associated with the project has been informed by the bushfire assessment provided in **Appendix F**.

This hazards and risks assessment does not take into account potential health and safety risks to on-site workers associated with normal construction operations, as these are regulated by workplace health and safety legislation (including the *Work Health and Safety Act 2011* (WHS Act)) and are not relevant to approval of the project under Part 5, Division 5.2 of the EP&A Act.

7.10.1 Assessment methodology

7.10.1.1 Electric and magnetic fields

The EMF assessment included:

- A qualitative assessment of potential EMF exposure risk to the public and occupational exposure (during inspection and maintenance) for the operation of the substation with consideration to its remote location, site security and restriction of public access
- A quantitative assessment carried out by Aurecon (2020) to assess potential EMF risks to the public from the operation of the transmission lines using a specialised software package (CDEGS) to predict EMF levels at ground level along the transmission line. Predicted electric fields and magnetic fields were then compared to the adopted health guideline reference levels for the public outlined in **Table 7-27**.

The ARPANSA is a Commonwealth Government body whose responsibilities include protecting the health and safety of people, and the environment from EMF. ARPANSA has adopted the *International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines for limiting exposure to time varying Electric and Magnetic Fields (1Hz – 100kHz)* (ICNIRP, 2010). The ICNIRP Guidelines express limits in terms of 'Reference Levels' and 'Basic Restrictions' under general public and occupational exposure conditions. The general public reference levels for electric and magnetic fields are listed in **Table 7-27**. These limits apply independent of duration of exposure.

Table 7-27 Health guideline reference levels for the public and occupational exposure (ICNIRP, 2010)

Parameter	ICNIRP 2010 Reference Levels
Electric fields – general public	5,000 volts per metre (V/m)
Magnetic fields – general public	2,000 milligauss (mG)
Electric fields – occupational	10,000 V/m
Magnetic fields – occupational	10,0000 (mG)

7.10.1.2 Bushfire

The bushfire assessment included:

- Identifying bushfire risk factors
- Reviewing bushfire prone land maps
- Identifying bushfire protection measures
- Outlining bushfire emergency management during construction.

7.10.1.3 Dangerous goods and hazard substances

The dangerous goods and hazard substances assessment included:

- Considering the potential impacts associated with hazardous materials
- Identifying mitigation measures required to minimise the impacts from transporting, using and storing dangerous goods and hazard substances.

7.10.2 Existing environment

7.10.2.1 Electric and magnetic fields

EMF is part of the natural environment and electric fields are present in the atmosphere and static magnetic fields are created by the earth's core. EMF is also produced wherever electricity or electrical equipment is in use.

Electric fields are strongest closest to the wires and electrical equipment and their level reduces quickly with distance. The higher the voltage, the stronger the electric field. Most materials act as a shield or barrier to electric fields.

Magnetic fields are produced by the flow of an electric current through a wire. The higher the current, the greater the magnetic field. Like electric fields, magnetic fields are highest closest to the wire and their level reduces quickly with distance. Most materials would not act as a shield or barrier to magnetic fields.

The primary existing sources of EMF within the project area includes:

- Line 2 which forms a 330 kV connection between Upper Tumut switching station and Yass substation. The proposed project's transmission lines would pass over Line 2 in the Lobs Hole area
- Line 64, which forms a 330 kV connection between the Upper Tumut and Lower Tumut switching stations. Line 64 is located in the far west of the project area, adjacent to the substation and is the grid connection point for Snowy 2.0.

7.10.2.2 Bushfire

The bushfire season in the Snowy Mountains generally runs from October to March, although commencement can be declared as early as August. Days of elevated fire danger are relatively infrequent, but mostly occur during December to March. This coincides with the peak time for tourism in the area. Dry electrical storms and north-westerly winds are common during the bushfire season.

Risk ratings

The project is mapped (DECC, 2008) as having a high (moderate-high-extreme mosaic) bushfire behaviour potential due to:

- Hilly terrain
- North, west and south-west aspects
- Lower elevations
- Fuel groups that can support a high-intensity fire (such as woodland and dry forest).

The project area is currently managed as a Land Management Zone under the *Kosciuszko National Park Fire Management Strategy 2008-2013* (DECC, 2008a), as well as under the *Snowy Valleys Bush Fire Risk Management Plan* (Snowy Valleys Bush Fire Management Committee, 2018). Bushfire management in this zone focuses on maintaining ecologically-appropriate burn regimes and managing fuel loads.

The existing TransGrid transmission network is noted in the *Snowy Valleys Bush Fire Risk Management Plan* as a high risk asset (impact of fire is rated as unlikely, but would have catastrophic consequence). The main bushfire hazard reduction tactic is the management of easement clearances and the Plan notes that this is TransGrid's responsibility.

DECC (2008a) identifies that bushfire risk associated with existing public infrastructure in the region is influenced by:

- Single access roads
- Lack of water available for fire fighting
- Size and maintenance of APZs
- Remote locations, where protections would be difficult and/or dangerous for fire crews
- Proximity to areas with potential to support threatening fires.

Existing ignition sources

Sources of bushfire ignition include:

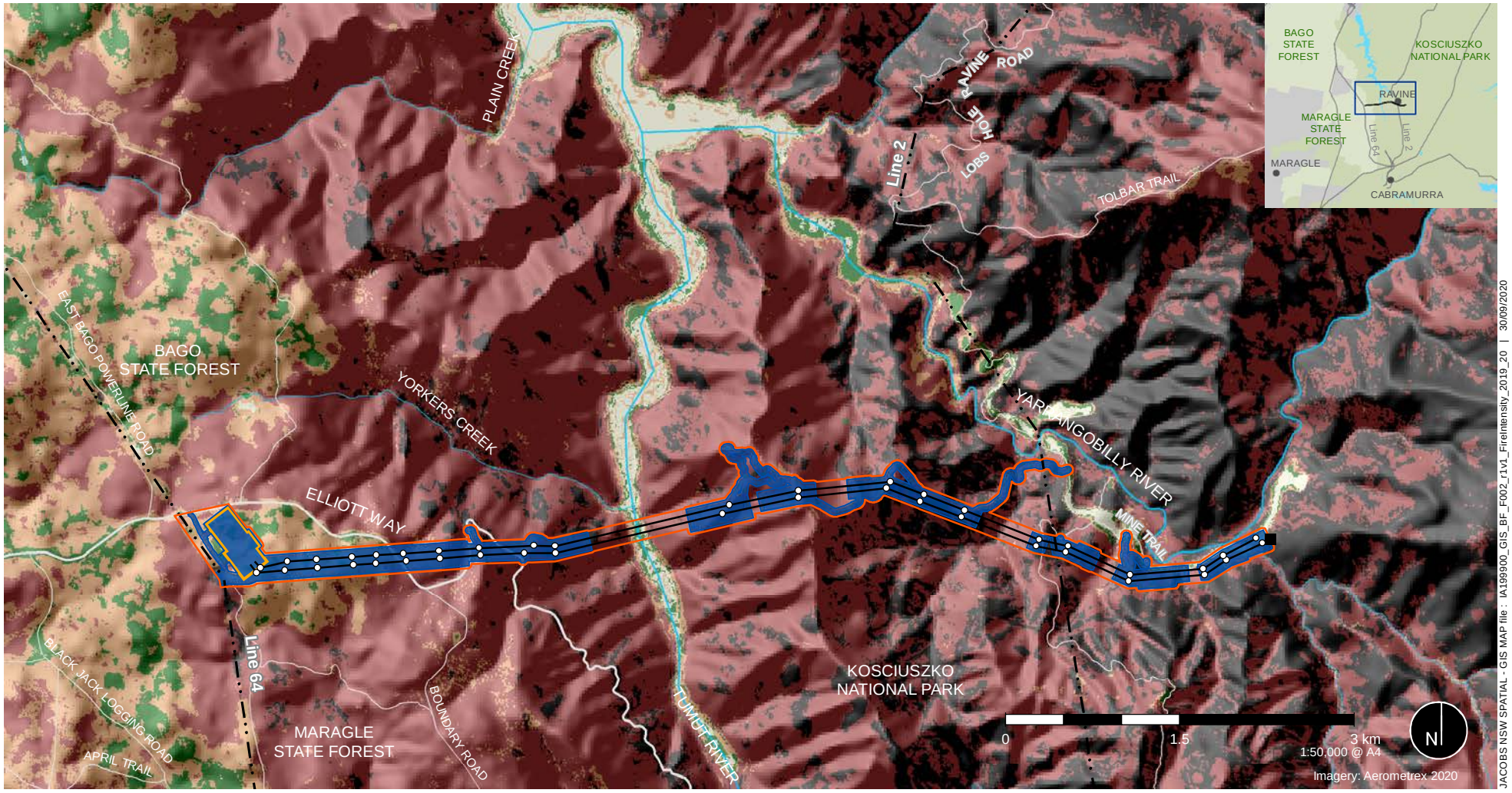
- Lightning strike – late spring and summer thunderstorms are common and are sometimes dry
- Arson – most common around townships, roads and trails; in grassy areas (which are more accessible than forests) and during school holidays
- Escaped tourists' campfires, especially during the summer holiday period
- Escaped planned burns
- Smoking
- Motor vehicles.

Fire history

Between 10 and 30 (average of 13.4) unplanned fires ignite in KNP each year (DECC, 2008a). The project area was last burnt in the 2019-20 Dunns Road bushfire. The severity of this fire across the project area is shown on **Figure 7-14**. Prior to this, KNP was burnt in the 2003 Australian Alps fires. During this event, a reported 140 individual fires were ignited in the Australian Alps by lightning on a single day. It was also burnt by bushfires in 1980, 1964 and 1938. Various portions of the project area were also subject to prescribed burns between 1970 and 1980. NPWS complete an average of five prescribed burns in KNP each year (DECC, 2008). These have generally been near the edges of the KNP, or in areas with higher ignition frequency.

7.10.2.3 Dangerous goods and hazardous substances

The dangerous goods and hazardous substances that are currently transported and stored in the project area east are associated with Snowy 2.0. TransGrid do not currently transport or store any dangerous goods in the project area.



Project area
Disturbance area
Proposed 500kV substation
Proposed structure
Proposed transmission line

Snowy 2.0 cable yard
Snowy 2.0 element

2019-20 Fire severity
Not mapped
Low - burnt understory with unburnt canopy
Medium -partial canopy scorch
High- full canopy scorch/partial consumption
Extreme - full canopy consumption

Electricity transmission line
Waterway

Figure 7-14 | Fire severity across the project area during the 2019-20 fire season

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

7.10.3 Assessment of potential impacts

7.10.3.1 Electric and magnetic fields

The project would introduce a new substation and new high voltage transmission lines into the project area. Consequently there would be additional localised increases to EMF. Operation of the project is not expected to pose a significant risk to the public, particularly the recreational users of KNP and Bago State Forest.

Given the remote location of the project area with no permanent nearby sensitive receivers, visited infrequently by the public and periodically for routine maintenance and inspection, the risk of chronic low level EMF exposure was assessed as low.

Substation

Potential EMF exposure risks to the public from the operation of the substation are expected to be negligible due to:

- Electrical equipment contained within the switchyard would be surrounded by a security fence to prevent public access therefore restricting exposure to high voltage electrical equipment at close distances (such as within five metres)
- The substation being located in a remote undeveloped area which:
  - Is generally only accessed periodically by the public, primarily by recreational users, such as for recreational hunting and bushwalking
  - The nearest residential properties are located approximately over one kilometre away.

Further to the above and to manage EMF exposure risks to onsite workers carrying out routine inspection and maintenance , the substation would be designed to ensure predicted EMF exposure limits would be within the EMF reference levels outlined in **Table 7-27**.

Transmission lines

EMF exposure to the public from operation of the conductors would potentially occur beneath the transmission lines and within the easement, and given the location of the project area, would most likely occur when members of the public engage in recreational activities. Such activities may include bushwalkers and recreational hunters passing through the transmission line corridor and recreational boating beneath the transmission lines on Talbingo Reservoir.

The predicted EMF levels for the project are as follows:

- The maximum magnetic field strength on the transmission corridor would be 192 mG which is under the general public reference level of 2000 mG
- The maximum electric field strength on the transmission corridor would be 2934 V/m which is under the general public reference level of 5000 V/m.

Based on the outcomes of the assessment, EMF exposure to the public from the operation of the transmission connection is expected to be well below the ARPANSA health guidelines.

7.10.3.2 Bushfire

Construction

Construction activities pose additional risks for on-site ignitions which may result in a fire escaping to the surrounding states forests or KNP. These mainly arise from generation of sparks through hot works such as welding hot work, vegetation clearing, and management and use of vehicles on site. Other potential ignition sources include uncontrolled discarding of cigarettes and domestic rubbish (such as glass bottles) by construction workers. Fuel leaks and spills from plant and machinery and the storage of flammable goods during construction could also provide a fuel source for bushfires if ignited.

Any fire that was unable to be contained quickly could result in significant areas of the landscape being impacted by fire due to the remote location and limited firefighting access in the area. A fire igniting in Bago State Forest or north-western areas of KNP, on a day of elevated fire danger, which burns under the influence of north-westerly winds towards/through the western or eastern side of the project may produce embers that could be carried across Talbingo Reservoir to ignite the western slopes and burn through project area east. The consequences of a fire could include:

- Direct threat to safety of project construction workers, visitors to KNP and the state forest, or others working in the area (e.g. Snowy 2.0 and NPWS personnel)
- Destruction of public and private property
- Destruction of Aboriginal and Non-Aboriginal heritage features
- Ecological degradation, if fire intensity or time between burns exceeds ecosystem fire tolerances, the post-fire climate may be unsuitable for regeneration or heavy rain could cause erosion of soil from areas where vegetation cover has been removed by fire
- Ash and sediment being washed into waterways and Talbingo Reservoir in rainfall events following a widespread fire.

Operation

Failures and other incidents of operating transmission lines and related infrastructure such as the substation that could lead to ignition include:

- Transmission line structure failure
- A transmission line conductor drop
- Contact with or flash-over to vegetation, e.g. due to vegetation growing into or near the transmission conductors, and falling trees contacting conductors
- Explosive failure of substation equipment
- Electrically induced fire (earthing system fault causes transfer of current or voltage to nearby metallic objects).

Operation of the project also has the potential to increase the bush fire risk through maintenance works such as hot works causing ignition within the project area potentially enabling fire to spread from the project area into Bago State Forest or KNP.

The project includes bushfire protection measures to protect the new infrastructure such from fires igniting in the landscape, these include:

- Routine condition monitoring and risk-based maintenance of project elements to minimise the incidence of Ignitions from asset failures
- Cleared and maintained APZ and transmission corridors to project the project elements
- Routine vegetation management of the APZ and transmission corridor including the removal of hazard trees
- Lighting protection measures on project elements
- Maintaining access tracks.

The mitigation measures described in **Section 7.10.4**, are expected to reduce, to an acceptable level, both the risk of bushfire ignition by construction and/or operation of the assets and the risk that bushfires in the landscape pose to the assets.

7.10.3.3 Dangerous goods and hazardous substances

Construction

The transport and storage of dangerous goods (which includes flammables, explosives, or other chemicals) could pose a significant risk to health and safety and surrounding environment if not appropriately managed.

The types of dangerous goods and hazardous substances that would be transported to the project area and used on site during construction may include, but are not limited to:

- Diesel fuels
- Oils, greases and lubricants
- Explosives (Class 1)
- Gases (oxy-Acetylene) (Class 2.1)
- Paints and epoxies (Class 3 PGII and Class 3 PGIII)
- Herbicides (class 6.1 PGII)
- Transformer insulation oils.

The storage, handling and use of dangerous goods and hazardous substances would be carried out in accordance with the WHS Act and associated regulations, the *Storage and Handling of Dangerous Goods Code of Practice* (WorkCover NSW, 2005) and relevant Australian Standards.

The types of dangerous goods and hazardous substances that would be stored and used during construction would be confirmed by the construction contractor and addressed in the CEMP for the project.

Operation

No dangerous goods and hazardous substances would be held or stored along the transmission line during operation, although small amounts may be transported, used on site.

The total required transformer and reactor insulator oil is estimated at 810 kilolitres. Although there would be a risk of spills and leaks (including insulation oil) at the substation site, the substation would incorporate an oil containment system comprising of an underground tank and/or containment dam. The capacity of the containment system would be designed in accordance with the relevant oil containments standards.

7.10.4 Mitigation measures

Mitigation measures to manage hazards and risks are presented in **Table 7-28**.

Table 7-28 Mitigation measures for hazard and risks

Ref	Impacts	Mitigation measures
Detailed design		
HAZ1	EMF exposure	All designs will be in accordance with the ICNIRP *Guidelines for limiting exposure to time varying Electric and Magnetic Fields (1Hz – 100Hz)* (ARPANSA, 2010) with consideration to the public and on-site workers.
HAZ2	Flashover resulting from lighting	The following lightning protection measures will be included in the detailed design: - Each structure will be equipped with earthing fixtures - Each transmission line will have two earthing lines at the top of each structure to provide protection to the conductors from lightning strike - Lightning masts will be installed at the substation.

Ref	Impacts	Mitigation measures
Construction		
HAZ3	Bushfire	A Prepare-Act-Survive bushfire response plan will be prepared for the project. The plan will be prepared according to *Planning for Bush Fire Protection* (RFS, 2019). The plan will include responsibilities associated with and details of: > Site specific hazards and risks for the project area > Procedures to maintain bushfire awareness > Bushfire mitigation measures > Fire preparedness actions including: - Evacuation triggers - Evacuation routes - Mustering points - Neighbourhood safer places and refuges of last resort - Instructions for sheltering in-vehicle if there are no other options.
HAZ4	Bushfire	> For the main construction compounds, a minimum of 40 metres clearance is required between fuel/chemical storage points and woody vegetation. The construction compound buildings will have at least 20 metres clearance to the vegetation > Firefighting equipment will be maintained at and/or accessible to all active construction sites during the declared bushfire danger season, and site personnel trained in its use. Equipment will be appropriate to the activities being conducted and the fire danger at the time of works, but as a minimum must include: - 4WD Striker with slip-on water unit, equipped with diesel pump and hoses - Extinguishers - Knap sacks - Hand tools (e.g. fire rakes). > Any vegetation cleared as part of these works will be removed from site (as much as reasonably practicable), or otherwise processed to avoid excessive bushfire fuel accumulation as agreed with FCNSW and NPWS.
HAZ5	Dangerous goods and hazardous substances	> All chemicals or other hazardous substances will be stored in a bunded area and away from any natural drainage lines. The capacity of the bunded area will be at least 130% of the largest chemical volume contained within the bunded area. The location of the bunded enclosure/s will be shown on Site Plans > The storage, handling and use of dangerous goods and hazardous substances will be carried out in accordance with the WHS Act and Regulations, the *Storage and Handling of Dangerous Goods Code of Practice* (WorkCover NSW, 2005) and relevant Australian Standards.

Ref	Impacts	Mitigation measures
Operation		
HAZ6	Bushfire	> Routine condition monitoring and risk-based maintenance of project elements to minimise the incidence of ignitions from asset failures > Ongoing vegetation management will be in accordance with TransGrid's operational vegetation monitoring and management procedures. This will include regular inspection and maintenance of trees and woody vegetation within the transmission corridor to provide safe clearance distance to the overhead conductors, and maintenance of the substation APZ > Ongoing risk management of trees located outside the easement that have potential to strike the conductor if they were to fall > Access tracks will be maintained to facilitate ongoing access to transmission structures for maintenance. It is recommended that these tracks are to be maintained to the standards of a Category 9 fire trail (RFS, 2016) to allow fire response in the area.
HAZ7	Bushfire	Hot work (activities involving high temperatures) and fire risk work (activities involving heat or with the potential to generate sparks) will be managed under TransGrid procedures, with measures including suspension of activities on days of elevated fire danger.

7.11 Social and economic

This section summarises the findings of the socio-economic impact assessment (SEIA) provided in **Appendix E**. The SEIA addresses the following SEARs:

Social:

> An assessment of the social impacts of the project on:
  – The demand for infrastructure and services in the Snowy Valleys local government area; and
  – Users of the Kosciuszko National Park, including recreational, fishing, bushwalking, camping and boating;

Economic:

> An assessment of the economic impacts of the project on the locality and NSW.

7.11.1 Assessment methodology

The methodology for the SEIA included:

> Identifying the potential socio-economic issues for the project and communities likely to be affected by the project's construction and operation
> Reviewing background information relevant to the project and socio-economic environment of the study area, and preparing a social baseline describing existing social characteristics, values and conditions within the study area
> Identifying and assessing potential socio-economic impacts of the project's construction and operation, including on local amenity, access and connectivity, social infrastructure and local community values
> Identifying mitigation measures to mitigate or manage the identified impacts.

The description of the existing socio-economic environment principally draws on data and information from the Australia Bureau of Statistics (ABS) 2016 Census of Population and Housing (ABS, 2016), supplemented by information and data from government agencies such as the DPIE, Snowy Valleys Council publications, reports, guidelines and websites and existing literature and project information including the *Snowy 2.0 Exploratory Works EIS* (EMM, 2018a), *Snowy 2.0 Main Works EIS* (EMM, 2019), and *Snowy 2.0 Main Works Recreational Users Study* (TRC Tourism, 2019).

A matrix was used to evaluate the potential significance of socio-economic impacts as outlined in the *Social Impact Assessment Guideline For State Significant Mining, Petroleum Production, And Extractive Industry Development* (Department of Planning and Environment, 2017) (refer to Figure 3.2 of **Appendix E**).

Study area

The primary study area for the assessment is shown on **Figure 7-15** and is based on those areas and communities that have the potential to experience changes to socio-economic conditions from the construction and operation of the project, including:

- Pinbeyan State Suburb Code (SSC) (SSC is an ABS approximation of suburbs), located at the project area east
- Cabramurra SSC, which is traversed by the central part of the project area
- Nurenmerenmong SSC, located at the project area west
- Talbingo SSC, located north-west of the project area, which is a popular location for tourists and provides access to Talbingo Reservoir for recreational users
- Tumbarumba SSC, located west of the project area, which is proposed to accommodate part of the construction workforce.

The primary study area incorporates a broader area than the project area identified for the EIS and recognises that potential socio-economic benefits and impacts due to such things as the influx of workers, construction haulage and local spending, would be experienced by communities beyond the project area to nearby towns and villages.

Socio-economic benefits and impacts of the project are also likely to be experienced by regional communities. As such, this assessment also considers potential impacts on a secondary study area comprising the wider Snowy Valleys LGA, which includes the main regional centre of Tumut located about 55 kilometres north-west of the project area (about 1.5 hours by car).

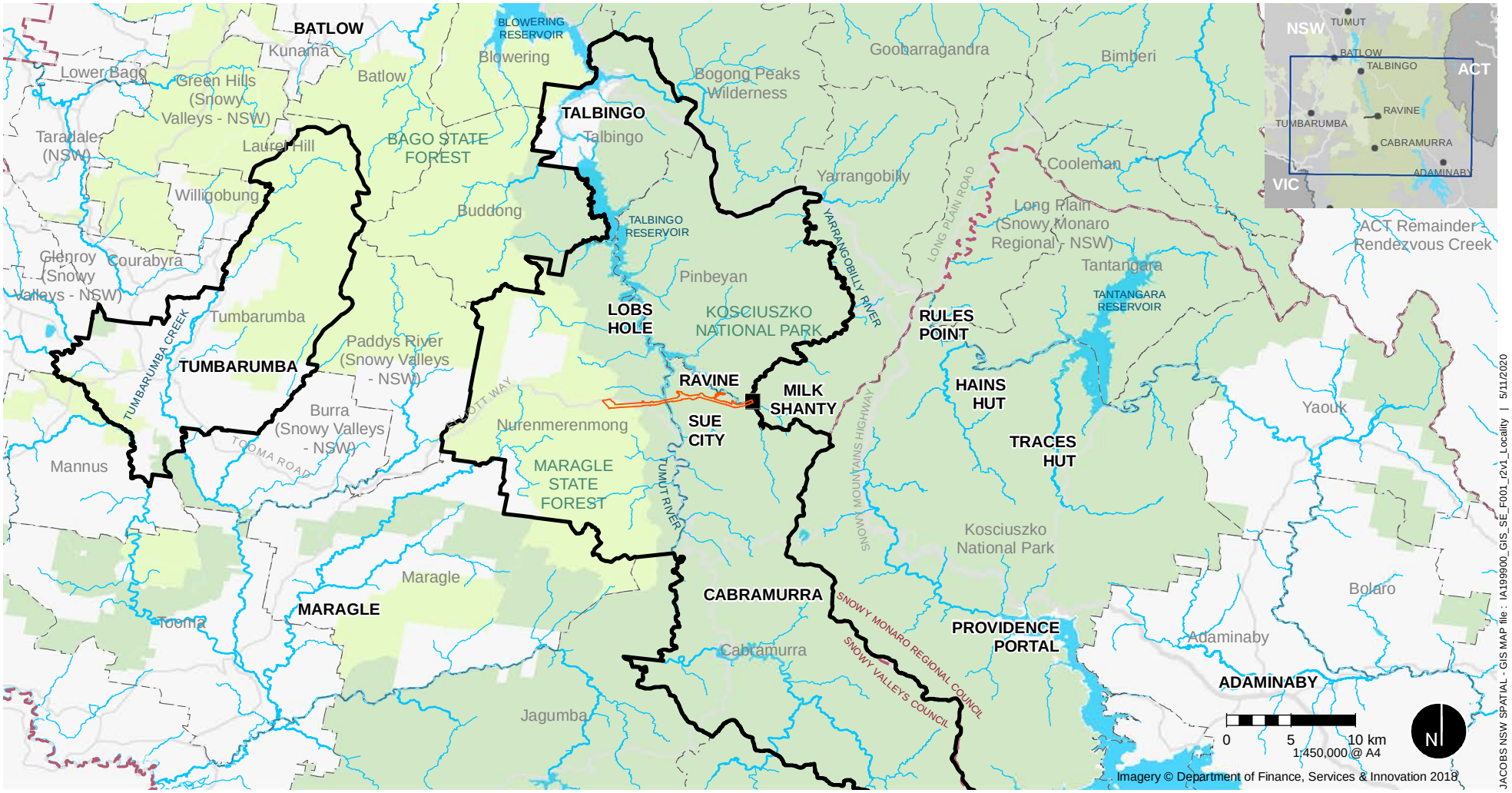


Figure 7-15 | Socio-economic impact assessment study area

7.11.2 Existing environment

The project is located in the Snowy Valleys LGA, within the Riverina Murray region of southern NSW. Local towns and villages near the project include Talbingo, Cabramurra and Tumbarumba in the Snowy Valleys LGA, and Providence Portal and Adaminaby in the adjoining Snowy Monaro Regional Council LGA. Talbingo and Cabramurra were originally established to house Snowy Scheme workers and their families (EMM, 2018a; Tumut Shire Council, 2019).

There are no local communities within the project area. The nearest community is the Snowy Hydro operational town Cabramurra, usually occupied by company workers and contractors, located about 15 kilometres south of the project. Cabramurra is currently closed to the public due to damage caused by the Dunns Road bushfires

The nearest towns offering day-to-day amenities are Talbingo and Tumbarumba, with Tumut being the largest town in the Snowy Valleys LGA. Cooma is located at the junction of the Monaro Highway and Snowy Mountains Highways about 80 kilometres south east of the project (approximately about two hours by road) and is one of three major towns in the adjoining Snowy Monaro LGA.

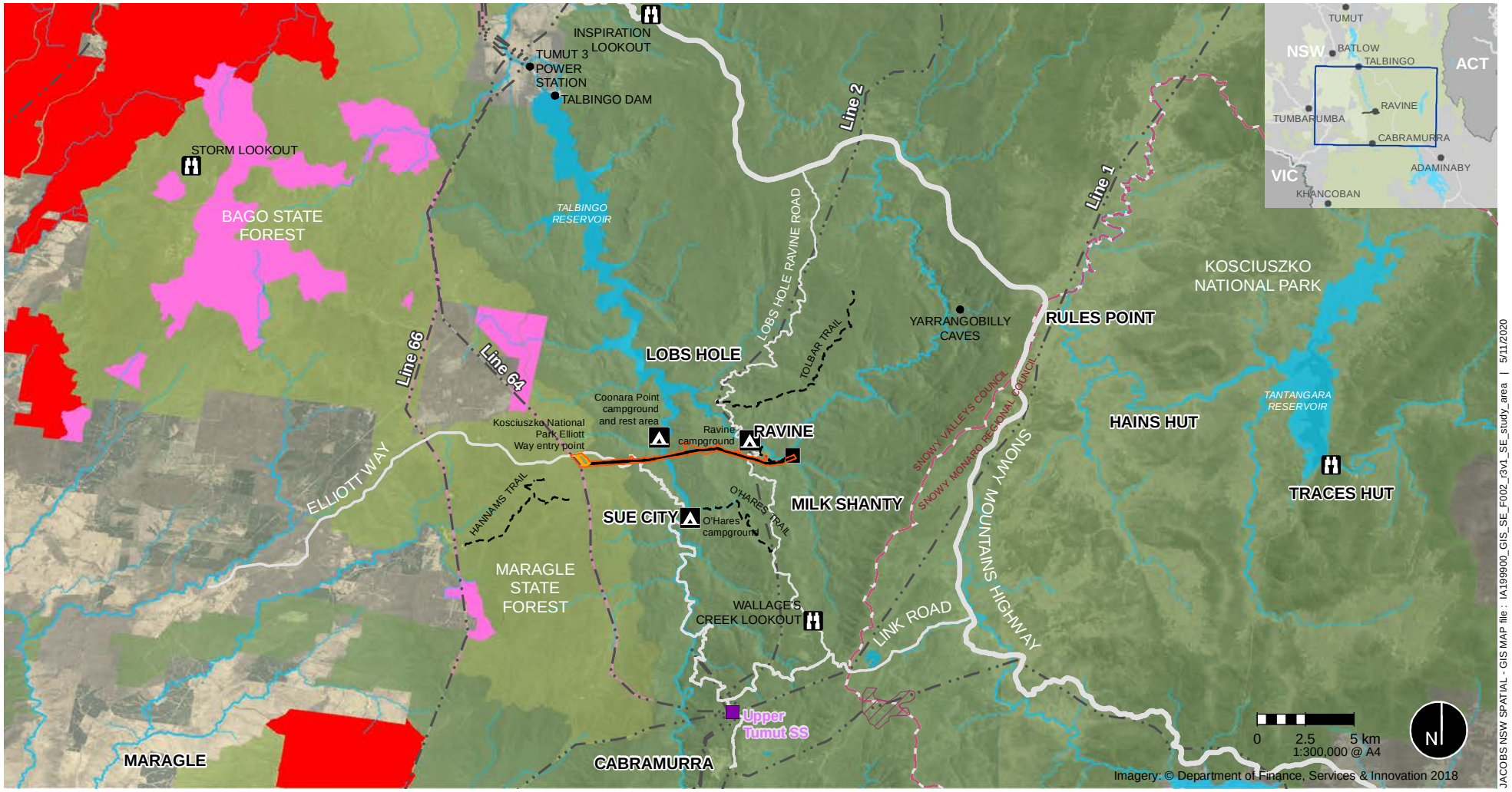
The Snowy Valleys LGA was affected by the Dunns Road bushfire. About 48 percent of the LGA, including land within and surrounding the project area, was directly impacted by bushfires resulting in extensive impact to property and industry within the LGA (Regional NSW, 2020).

7.11.2.1 Kosciuszko National Park

KNP is valued by communities for its scenic amenity, environmental and recreational values and is considered by many people as a special place that needs to be protected. KNP is also an important contributor to tourism and employment in local towns, with many visitors to KNP staying in nearby towns.

KNP is a well-known recreational destination attracting around 2.2 million visitors in 2016. Key recreational activities include vehicle-based sightseeing, bushwalking, fishing, canoeing, horse riding, cycling and caving; however, the seasonal presence of snow is the main drawcard for many visitors. Key tourist attractions near the project are shown on **Figure 7-16** and include Lobs Hole and Talbingo Reservoir. Lobs Hole Ravine is valued for its scenery, remoteness and unspoiled nature of the site, while Talbingo Reservoir is popular for fishing, swimming and water skiing.

As at November 2020, many visitor facilities and attractions within KNP are closed or have restricted access, including roads, campgrounds and accommodation, trails and attractions, to allow habitat to recover and/or repair park infrastructure from the Dunns Road bushfire.



Project area
Proposed 500kV substation
Proposed transmission line

Snowy 2.0 cable yard
Campground
Lookout
Point of interest
Existing TransGrid substation
Selwyn Snowy Resort
Local Government boundary

Track
Major road
Waterway
Water body
State forest
NPWS estate

FCNSW Hunting exclusions
Total hunting exclusion - no entry
Hunting exclusion (hazard reduction burn)

Figure 7-16 | Recreational key features

7.11.2.2 Business and industry

Businesses near the project area at Talbingo, Cabramurra and Adaminaby are predominantly directed to supporting the day-to-day needs of local communities and local tourism.

Other businesses near the project area, but outside of local towns, include:

- McPhersons Plains Alpine Caravan Park at Nurenmerenmong (currently closed until further notice), located north-west of the project area
- Selwyn Snow Resort, located south of the project area
- Yarrangobilly Caves facilities, located northeast of the project area.

The western extent of the project area is located within Bago State Forest. Consultation carried out with the FCNSW indicated that forestry activities are not currently carried out or anticipated to commence in the near future within those sections of the state forests located in the project area given its limited commercially viability compared to other sections of Bago State Forest.

Business and industry in the study area has been affected by events such as the Dunns Road bushfire and the COVID-19 pandemic. Effects of the bushfire on industry and business in the study area are expected to be experienced for many years. Rebuilding of affected infrastructure and attractions has commenced to allow business and industry to continue and recover. Restrictions on local businesses and travel associated with the COVID-19 pandemic are also likely to have impacted on tourism related businesses in the study area.

7.11.2.3 Social infrastructure

The study area and wider region accommodates a range of social infrastructure and community facilities that cater for the needs of both local and regional communities and includes educational facilities, medical facilities, emergency services and recreation and tourism.

Recreation and tourist activities within or near the project area are mainly nature based recreation activities at KNP, Bago and Maragle State Forests. These activities include camping, picnicking, bushwalking, fishing, canoeing, horse riding, cycling, caving, four-wheel driving and trail bike riding. Recreational hunting by eligible licence holders is also permitted in parts of the Bago and Maragle State Forests, including in the western end of the project area. Hunting is excluded within the easement for the existing 330 kV transmission line at the western end of the project area.

Recreation and tourism attractions and facilities located within or near to the project are shown on **Figure 7-16** and includes:

- Lob Hole Ravine 4WD trail (Lobs Hole Ravine Road), which is a 37 kilometres one-way trail that runs in north/south direction to the east of the Talbingo Reservoir
- Various management trails that are closed to motorists but are used or are likely to be used by walkers and cyclists, refer to **Section 7.6.2.3**
- Talbingo Reservoir, which is used for activities such as fishing, boating and water skiing and is partly within the project area
- O'Hares Campground, which is an unpowered campground and destination for boating, fishing and water skiing and includes picnic tables, barbecue facilities and a boat ramp
- Coonara Point Campground and Rest Area, located on the western side of the project
- Ravine campground, located on the eastern side of the project (currently closed for the construction of Snowy 2.0)
- Tumut 3 power station and Talbingo Reservoir, located near Talbingo
- Selwyn Snow Resort, located approximately 15 kilometres south of the project
- Yarrangobilly Caves located approximately 8 kilometres north-east of the project.

There are no formal walking trails in the project area, although existing management access tracks and trails are regularly used by walkers and cyclists within the KNP.

7.11.2.4 Community values

Community values are those things held as important to communities for quality of life and wellbeing. They include physical elements that contribute to such things as amenity and character, and intangible qualities such as sense of place and community cohesion.

The study area is valued for its scenic amenity, natural beauty, lifestyle, and mountain and dam access provided by the local area. The amenity and character of the study area is characterised by KNP, which is recognised for its 'pristine environment', and state forests, which provide a range of environmental, recreational, and scenic amenity values.

Supporting and growing local businesses and preserving and enjoying the local natural environment both for resident recreation as well as for tourism is important for local communities and is identified as a priority in the *Snowy Valleys 2028 Our Vision Our Future Community Strategic Plan 2028* (Snowy Valleys Council, 2018).

The survival of the Talbingo town, provision of children's and health services and improving roads for tourist access are also important local values for residents in Talbingo and Tumbarumba. The importance of maximising economic benefits for local communities, including opportunities for local employment, training and business, is likely to have increased importance given the effects of the bushfires and COVID-19 on businesses and communities in the study area.

As summarised in **Section 6.3,** consultation undertaken for the project and Snowy 2.0 identified a number of matters important to the local community including:

- Impact on biodiversity, visual amenity, water quality and Aboriginal heritage
- Potential to generate economic stimulus, including local employment and business opportunities
- Impacts on tourism and recreation
- Road safety and the condition and use of local roads, including heavy vehicle traffic through local townships
- Methods of land acquisition.

7.11.3 Assessment of potential impacts

7.11.3.1 Construction

Employment

The project would impact positively on employment through the creation of direct employment opportunities through the construction phase. The project would generate employment for an average of around 75 people over the 39 month construction program, with this growing to around 140 workers during peak periods. The creation of employment opportunities would benefit local and regional workers and have potential to support improved incomes for individuals.

The creation of employment opportunities, either directly or indirectly, would benefit local and regional workers and have potential to support improved social and economic outcomes through incomes for individuals and skills development.

Business and industry

During construction, positive economic impacts may occur for some businesses in the study area due to increased demand for goods and services, particularly in Tumbarumba. This includes:

- Local shops and food outlets at Tumbarumba that may benefit from increased business in response to day-to-day needs of construction workers and possible increased expenditure by residents employed on the project
- Accommodation providers in Tumbarumba and the local towns, due to increased demand for accommodation for construction workers

- Businesses and industries supplying goods and services to construction, which are likely to experience benefits from increased construction activities locally.
- Increased expenditure associated with purchases by construction workers is expected to have a positive impact on some local businesses, particularly in Tumbarumba and other towns that accommodate smaller numbers of workers servicing the eastern side of the project.

While specialist materials and equipment are expected to be sourced from outside of the local area, maximising the use of local suppliers in the provision of construction related goods and services, where possible, would have beneficial impacts for local businesses. These benefits would be particularly important in helping local businesses respond to economic impacts of the bushfires and COVID-19 pandemic.

It is proposed that about 20 construction personnel servicing project area east would use the Snowy 2.0 worker accommodation, while other construction personnel from outside of the study area are proposed to be accommodated in short-term accommodation at Tumbarumba, Talbingo, Tumut, Adaminaby, Providence Portal, and Cooma. Use of short-term accommodation by the construction workforce would increase demand for tourist accommodation such as hotel, motels, cabins or caravans.

Average occupancy rates of tourist accommodation suggests that there would be some capacity in the existing tourist accommodation to accommodate construction workers. The use of some available, under-utilised tourist accommodation for the construction workforce would provide economic benefits for accommodation owners, particularly during the off-peak tourist periods. During peak tourist periods, picking seasons and annual events, the demand for accommodation by construction workers has potential to impact on the availability of accommodation for tourists, visitors and seasonal workers. This may impact on the ability of the tourism sector to meet peak tourist demand and deter some visitors from visiting the area during the construction phase, potentially impacting some tourist related businesses. Reduced availability of short-term accommodation may also deter some seasonal workers from taking up employment with primary producers in the study area and surrounding region. This would particularly impact primary producers that are not able to provide on-site accommodation for seasonal workers and may affect their ability to harvest their produce if they are not able to source local workers.

A worker accommodation strategy would be prepared for the project to manage demand for tourist accommodation from the construction workforce during the construction phase and post-construction. This would include consultation with accommodation providers and tourist representatives to minimise impacts on tourism during construction and operation of the project. The preparation of a worker accommodation strategy for the project would be particularly important given potential effects of the bushfires on visitor accommodation in the study area, including through loss or damage to existing accommodation or increased demand by workers associated with the recovery and redevelopment.

Consultation with Snowy Hydro about the use of the Snowy 2.0 works accommodation is also ongoing, which would help to minimise impacts on tourist accommodation due to increased demand by construction workers. Maximising the number of workers employed on the project who currently live within the study area, would also help to reduce demand for short-term accommodation during the construction phase and subsequent impacts on other industries.

State forest land required for the substation in project area west would be cleared and no longer be available for use by the FCNSW. The project is not likely to impact on forestry operations, as consultation by TransGrid with FCNSW has indicated that commercial forestry activities are not currently undertaken, or anticipated to commence in the near future within the project area, given its limited commercial viability compared with other parts of Bago State Forest. Potential impacts on forestry operations during construction would be managed through discussions with the FCNSW.

Community values

Potential impacts on community values from the construction of the project would generally be associated with:

- Clearing of vegetation, impacting on community values relating to scenic and landscape amenity and the environment
- Increased noise, dust and construction traffic impacting on amenity close to the project for recreation users of KNP and state forests
- The influx of construction workers to local towns closest to the project, potentially impacting on community cohesion and sense of community.

The protection and management of KNP is important to local and regional communities and impact on flora and fauna from the construction of the project is likely to be a key concern for community members.

During construction, recreational users near the project may experience impacts on amenity due to noise from construction works, helicopter use and construction traffic. Changes to amenity have potential to impact on the use and enjoyment of these facilities by visitors and local communities or deter some people from using these facilities.

An influx of construction workers to towns in the study area has potential to impact on sense of community, particularly where towns have smaller population levels and where the increase in population affects access to services and facilities.

Social infrastructure

Where possible, construction infrastructure has generally been sited away from formal facilities such as campgrounds, helping to minimise impacts on recreational users.

During construction, the siting of construction facilities such as laydown areas, construction compounds and helicopter pad may temporarily disrupt access to and use of some recreational facilities and activities near the project. Temporary disruptions may occur in areas of Bago State Forest used for recreational hunting, areas of Talbingo Reservoir used for boating and fishing and management tracks within KNP used by walkers and cyclists.

A hunting exclusion area would be established near the project within the Bago State Forest. While this would impact on the use of this area for recreational hunting, other sections of Bago and Maragle State Forests would continue to be available for hunting.

A temporary exclusion area for aquatic activities would also be established during the overhead stringing of conductors and overhead earth wires across Talbingo Reservoir. These works are expected to occur over about a four to eight week period and has potential to temporarily impact on water based recreational activities in this area during this time. General access and use of other sections of Talbingo Reservoir would be maintained for recreational boating and fishing, including areas south of Coonara Point.

There are no active campgrounds located within the project area. The Ravine Campground located north of the project area at Lobs Hole is temporarily closed for Snowy 2.0 activities, and would be for the duration of the construction. The nearest publicly accessible campground to the project area during construction is O'Hares Campground located approximately three kilometres south of the project area. Construction of the project is not expected to impact on the use of this facility.

There would also be increased demand by construction workers of some community services and facilities, such as medical and emergency services. Increased demand by construction workers for medical and emergency services has potential to increase the pressure on these services potentially impacting on the ability of residents to access these services when required.

Evaluation of significance

The evaluation of significance of socio-economic impacts found that during construction negative impacts on community values from vegetation clearing and the presence of infrastructure assets had a high significance ranking. The evaluation also found a moderate significance ranking on social infrastructure including the disruption of some recreational facilities / activities and the demand for services such medical and emergency services. A low significance ranking was noted for access and connectivity.

The majority of the impacts on employment and industry were found to be positive with a significance ranking as high and extreme. A negative impact was identified for the reduced availability of tourist accommodation, this impact was evaluated as a moderate significance ranking.

7.11.3.2 Operation

Property acquisition

The project would not require the acquisition of privately owned land, however would involve the acquisition of land from FCNSW and NPWS, refer to **Section 5.4.1.1**. The substation site is expected to be acquired from FCNSW as freehold land while the land subject to the transmission connection corridor would be acquired in the form of easements with NPWS and FCNSW. The easements would provide TransGrid the necessary access rights to operate and maintain the transmission lines and to ensure that the necessary development setbacks are in place.

The acquisition of land associated with the project is not expected to affect forestry operations carried out by FCNSW and would not restrict pedestrian access by recreational users of KNP and Bago State Forest.

Business and industry

During operation, impacts on local businesses in the study area are expected to be minimal and would mainly be associated with the demand for goods and services by field staff carrying out routine maintenance work.

The project would provide a direct connection from Snowy 2.0 to the NSW transmission system. This would have significant economic benefits for business and industry across the Snowy Mountains region, NSW and other states by providing improved security and reliability of the NEM, and lower energy costs for customers, including businesses.

Community values

Potential impacts on community values during operation may be associated with:

- The presence of infrastructure assets in an environment that is considered to be pristine
- Changes to access during maintenance activities which may be temporarily required for short periods.

Whilst the study area currently accommodates a range of infrastructure assets, the addition of new elements has potential to impact on community values relating to landscape and scenic amenity and the environmental values of KNP and Bago State Forest.

Social infrastructure

Potential impacts on social infrastructure due to the operation of the infrastructure assets may be associated with:

- The presence of infrastructure assets, potential impacting on views and scenic amenity from some surrounding public roads and future recreational and camping facilities at Lobs Hole
- Access and use of recreational facilities in the vicinity of the infrastructure
- Recreational hunting exclusion zones in the vicinity of the project area.

This would likely have the greatest impact on users of recreational facilities closest to the project, including O'Hares Campground, the southern reach of the Talbingo Reservoir, Elliott Way and Lobs Hole Ravine Road.

During operation, a hunting exclusion zone would be established within the Bago State Forest in the vicinity of the project. This would impact on the use of this area for recreational hunting, although other sections of Bago and Maragle State Forests would continue to be available for hunting.

During the operation, light vehicles and small to medium plant would need to access the project area to undertake maintenance activities. These activities are not expected to impact on the uses of or access to recreational facilities near the project.

Evaluation of significance

The evaluation of significance of the socio-economic impacts found that during operation negative impacts on community values such as the presence of infrastructure assets had a high significance ranking. While the impacts on industry was found to be have an extreme positive significance ranking, as the project would improve security and reliability of the NEM and lower energy costs. Other operational impacts such as access and connectivity and property acquisitions were found to have a low significance ranking.

7.11.4 Mitigation measures

Recommended mitigation measures to manage social and economic impacts of the project's construction and operation are summarised in **Table 7-29**. Mitigation measures for biodiversity, transport, visual amenity, noise, and air quality are provided in **Section 7.1.4**, **Section 7.6.4**, **Section 7.7.4**, **Section 7.8.5** and **Section 7.9.3** respectively.

Table 7-29 Mitigation measures for social and economic impacts

Ref	Impacts	Mitigation measures
Construction		
SE1	General	A CSEP will be prepared and implemented to help provide timely and accurate information to the community during construction. The plan will include (as a minimum): > Mechanisms to provide details and timing of proposed activities to key stakeholders including residents, business owners, NPWS, FCNSW, emergency service, health and medical facilities, visitors, accommodation providers and annual event organisers, recreational users and motorists including changed traffic and access conditions and amenity impacts > Process for receiving and responding to queries and complaints regarding the project's construction.
SE2	Business and industry	> A worker accommodation strategy will be prepared for the project to manage demand for tourist accommodation from the construction workforce during the construction phase and post-construction > Maximise the use of the Snowy 2.0 works accommodation where possible to minimise demand for local accommodation > Consider local business opportunities in project procurement practices, including encouraging contractors to source local goods and services, where possible > Identify and communicate to local communities (prior to and during construction) opportunities and requirements for work on the project.
SE3	Social infrastructure	> Development, monitoring and review of project incident response plans, including ongoing consultation with emergency service providers about changes to local access and potential delays and disruptions > Preparation of a workforce health and safety plan that includes measures for responding to health, medical and safety incidents during construction.

Ref	Impacts	Mitigation measures
Operation		
SE4	General	> The operation and maintenance of the portion of the project in KNP will be carried out in accordance with any access and operational protocols established between TransGrid and NPWS.

7.12 Waste

This section provides an assessment of the potential impacts of the waste generated by project and measures to mitigate them.

7.12.1 Assessment methodology

The waste assessment included:

> Identifying potential waste generating activities and likely waste streams
> Identifying opportunities for the avoidance, minimisation, and reuse of waste
> Identifying the environmental impacts associated with the generation (and subsequent disposal) of residual waste materials.

Resource use and waste generation for the project has been identified and assessed based on proposed activities during construction and operation, the associated materials and resources required during each phase, their likely sources, and associated types of wastes that would be generated.

7.12.2 Existing environment

As the project is within the Bago State Forest and KNP, there is little waste currently generated in the project area. Waste sources are currently limited to roadside litter, green waste from the maintenance of roadside vegetation and from illegal dumping.

7.12.3 Assessment of potential impacts

7.12.3.1 Construction

The key waste generating activities would be from:

> Vegetation clearing
> Topsoil stripping
> Earthworks for the construction of access tracks, waterway crossings and project elements such as the substation and transmission structures.

As described in **Section 5.4.6.4**, an estimated 364,800 cubic metres (37,800 cubic metres in project area west and 327,000 cubic metres in project area east) of excess excavated material (spoil) would be generated as part of bulk earthworks which would require appropriate measures to manage potential impacts associated with its handling and reuse/disposal. Where suitable, excess spoil would be reused within the project area as part of access road construction, landscaping or other uses such as part of the substation build.

Excess spoil which cannot be reused in project area west is expected to be disposed of via the following methods:

> Temporary or permanent land based disposal off-site
> Spreading out smaller volumes of waste spoil within the transmission line easement in a manner agreed under consultation with NPWS and FCNSW.

Excess spoil generated in project area east is proposed to be transported by truck to Lobs Hole where it would be managed and disposed of by Snowy Hydro in accordance with the methods described in the *Snowy 2.0 Main Works EIS* (EMM, 2019) and any conditions of their approval. This would include:

- Reuse of construction material for Snowy 2.0 as aggregate, manufactured sand or construction pad establishment
- Placing suitable excavated material within the Ravine Bay emplacement area (refer to **Figure 1-2**), providing it meets the required geotechnical and leachability parameters
- Temporary or permanent land based disposal off-site outside of KNP.

As described in **Section 7.5.3.1**, a spoil management plan would be developed for project construction.

As discussed in **Section 7.5.2** there is potential to discover contaminated material or NOA during excavation works for the project. The management of contaminated spoil would be in accordance with the mitigation measures outlined in **Section 7.5.4**.

The potential impacts associated with excavating and disturbing soil may include sediment laden/contaminated runoff and leachate generation which could potentially impact on nearby receiving waterways. These impacts are considered in **Section 7.4.3** and **Section 7.5.3**.

The clearing of vegetation would generate green waste, including timber and leaves/grasses which would be stockpiled prior to reuse or disposal. Tannin rich leachate could occur as a result of raw mulch being stored on site. Mulch stockpiles would require appropriate management to prevent tannins from impacting the water quality of surrounding water resources. The water quality mitigation measures are provided in **Section 7.4.4**.

Other waste streams would include:

- Domestic waste generated by construction staff including food waste, paper, glass, cardboard, and containers, plastic and metal (including aluminium cans)
- Maintenance fluids generated during plant and equipment operation include paints, solvents, lubricants, and oils
- Packaging waste such as pallets, plastic film wraps, metal straps/bands, empty drum rolls (conductor, OPGW and overhead earth wire)
- Offcuts and surplus of general construction waste including piping and conduits, concrete (and concrete slurry), metal offcuts from transmission structures and substation components.
- Wastewater generated during construction may also include turbid water captured in excavations and sedimentation basins
- Grey water and sewage from site amenities
- Hydrocarbon and water mixtures from plant and equipment wash-down stations areas.

These waste streams including wastewater and sewage would be collected and disposed of off-site to an appropriately licenced facility. The waste volumes generated during construction would vary at different stages of construction depending on the type of construction activities being carried out.

If waste is not appropriately managed there would be the potential to pollute the local environment including waterways.

Operation

Waste generated by the operation of the project would be limited. Waste generated would be from maintenance activities (including vegetation removal and minor repair works) as well as general waste from maintenance personnel. Vegetation debris would be mulched on site and spread within the transmission corridor as agreed with FCNSW and NPWS. Other waste generated during operation would either be immediately removed from site and disposed of appropriately, or suitability stored at the substation for pick up by a licenced contractor as required.

A wastewater septic system with pump out sewer would be incorporated into the amenities design for the substation.

7.12.4 Mitigation measures

Mitigation measures for waste and resource use are presented in **Table 7-30**.

Table 7-30 Mitigation measures for waste impacts

Ref	Impacts	Mitigation measures
Detailed design		
WR1	Management of waste	Further consultation with local waste facilities will be carried out during detailed design to further determine potential disposal locations.
Construction		
WR2	Inappropriate handling and/or disposal of waste	A construction waste management plan (CWMP) will be prepared for the project and outline appropriate management procedures. It will include, but not be limited to: > Identification of the waste types and volumes that are likely to be generated by the project > Adherence to the waste minimisation hierarchy principles of avoid/reduce/reuse/recycle/dispose > Waste management procedures to manage the handling and disposal of waste, including vegetation, spoil, unsuitable material or unexpected waste volumes > Identification of reporting requirements and procedures for tracking of waste types and quantities > A resource management strategy detailing the process to identify reuse options for surplus materials.
WR3	Excess spoil with the project area east	Excess spoil generated in project area east will be transported by truck to Lobs Hole where it will be managed and disposed of by Snowy Hydro (in accordance with the methods described in the Snowy 2.0 Major Works EIS and any conditions of their approval).
WR4	Waste	All waste, including surplus soils, which cannot be reused will be classified in accordance with the *Waste Classification Guidelines* (EPA, 2014), removed from the site and disposed of at a facility that can lawfully accept the waste in accordance with the POEO Act and POEO Waste Regulation
Operation		
WR5	Waste	Operational waste will be managed in accordance with TransGrid Waste Management Procedures and associated Work Instructions.

7.13 Cumulative Impacts

This section provides an assessment of the potential cumulative impacts of the project when considered with other projects in the locality to address the following SEARs:

- An assessment of the likely economic, social and environmental impacts of the project having regard to the requirements in any relevant Government legislation, policies and guidelines, including:
  - The predicted impacts of the project, including any cumulative impacts;
- The relevant strategic context for the project having regard to:
  - Any other existing, approved or proposed projects that could result in cumulative impacts with the project;

7.13.1 Overview

Cumulative impacts are compounding environmental and community impacts caused by past, present or reasonably foreseeable future activities. Cumulative impacts may arise from the interaction of construction and operation activities of the project and other approved or proposed projects in the area. When considered in isolation, specific project impacts may be considered minor. However, these minor impacts may be more substantial when the impact of multiple projects on the same receivers is considered.

7.13.2 Assessment methodology

The assessment of cumulative impacts focused on the proposed activity's interaction with other projects in the vicinity of the project, and where construction and/or operational timeframes are likely to be concurrent.

Projects in the locality were identified based on a search of the following data sources in September 2020:

- The DPIE's online major projects database
- Local council websites/ development application tracking databases
- Proponent websites.

The projects identified were screened in relation to their potential for cumulative impacts with the project, based on their nature, size, and proximity to the project area.

The assessment of cumulative impacts has been limited to a desktop review of the predicted impacts of external projects and consideration of where these impacts would overlap with the project. These potential cumulative impacts have been described in general terms to identify the implications over and above those that would result if the project were to be constructed in isolation. The assessment draws on the findings of **Sections 7.1** to **Section 7.12**, and environmental impact assessments of other projects (where available).

7.13.3 Other projects in the study area

The projects in the locality that were considered to have the potential for cumulative impacts with the project are listed in **Table 7-31**.

Table 7-31 Existing and proposed projects

Project	Proponent	Description	Type	Status	Location in relation to the project	Construction timing
Snowy 2.0	Snowy Hydro	Tantangara and Talbingo reservoirs with tunnels feeding a new underground power station	Energy	Approved	Overlaps with project area	January 2020 to 2026
Snowy Mountains Highway	TfNSW	Various safety improvements and intersection upgrades along the Snowy Mountains Highway	Road	Approved	Snowy Mountains Highway is part of the haulage route. The upgrades would be about seven kilometres east of the project	Expected to be completed by October 2020
Bellettes Landfill Expansion	Snowy Valleys Council	Increase management and storage of general solid (non-putrescible) waste from 5,000 tonnes per annum to a limit of 40,000 tonnes per year	Landfill	Approved	one kilometre east of the project haulage route at Batlow Road/Snowy Mountains Highway intersection	Commenced construction in 2020 with ongoing works until 2032
Wondalga Road/Greenhills Road Intersection Upgrade	Snowy Valleys Council	Intersection upgrade	Road	Scoping	Batlow Road, south of Wondalga. Intersection is located 350 metres west of the project haulage route along Batlow Road	No set time for construction
HumeLink	TransGrid	The HumeLink project is proposed to reinforce the transmission network in southern NSW. The project would require new transmission connections between substations at Wagga Wagga, Bannaby and the new substation in Bago SF proposed under this project.	Energy	Scoping	Adjacent to the western end of the project	The construction start date is unknown at this stage, however it is expected that there would be overlap with the project

Project	Proponent	Description	Type	Status	Location in relation to the project	Construction timing
Line 64 upgrade	TransGrid	The project would replace a section the of existing earth wires on Line 64 and upgrade the necessary communication linkages along the line.	Energy	Scoping	Adjacent to the western end of the project	The project is expected to overlap

7.13.4 Cumulative impacts with other projects

Construction specific cumulative effects would most likely occur where construction works overlap in terms of timing and/or location with other local projects. Cumulative effects from construction activities usually relate to clearing of vegetation, noise and vibration, traffic and access, visual amenity and air quality impacts. The scale of the impacts largely depends on the type of work, its duration, and the sensitivity of surrounding land uses. Based on the findings of the specialist studies summarised in the preceding sections, the cumulative construction impacts for each aspect are discussed below.

The most immediate accumulation of impacts would be the impacts of the project in addition to those of the Snowy 2.0 as there is an overlap of project areas, and overlapping of project construction periods. There is also the potential for cumulative impacts from the HumeLink and Line 64 upgrade projects which overlap with the project construction period. This is particularly relevant for biodiversity, heritage and amenity (visual, air, noise and vibration) and water. The other projects in the locality may have a more regional impact on transport, socio-economic and waste.

The cumulative impacts of Snowy 2.0 and the project were also assessed as part of the *Snowy 2.0 Main Works EIS* (EMM, 2019).

7.13.4.1 Biodiversity

The cumulative impacts of the project and Snowy 2.0 would include the loss and fragmentation of vegetation and habitats, from the removal of about 454.56 hectares of native vegetation as outlined in **Table 7-32**. The cumulative direct impacts to threatened species from the project and Snowy 2.0 is outlined in **Table 7-33**.

Table 7-32 Cumulative impacts to native vegetation from the project and Snowy 2.0

PCT	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	1.77	5.54	6.85	14.16
296	21.15	48.37	25.60	95.12
300	43.28	10.52	34.74	88.54
302	3.12	12.00	2.83	17.95
729	34.72	24.1	21.40	80.22
999	7.61	1.28	12.40	21.29
1196	23.95	5.15	108.18	137.28
Total	**135.60**	**106.96**	**212.00**	**454.56**

* EMM Consulting 2017 and 2020a

Table 7-33 Cumulative impacts to threatened species habitat from the project and Snowy 2.0

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)	69.60	0.91	2.08	103.57
Ninox strenua	Powerful Owl (breeding)	43.28	-	-	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

7.13.4.2 Aboriginal heritage

The cumulative impacts of the project and Snowy 2.0 on Aboriginal heritage would be highest at Lobs Hole Ravine, where Aboriginal artefacts occur in higher densities. These long-term cumulative impacts would change the landscape and reduce the Aboriginal archaeological heritage resource in this area. However, the project's impacts to the archaeological resource at Lobs Hole are not expected to represent a significant additional impact. In addition, the project is largely linear in nature and therefore broad-scale impacts to any one area would be limited.

7.13.4.3 Non-Aboriginal heritage

The types of non-Aboriginal heritage items to be impacted by Snowy 2.0 are similar to those impacted by the project, i.e. the copper mine and the habitation sites. There would be cumulative impact at Lobs Hole that would involve broad-scale impacts across the historical features that make up the former village of Ravine and mining complexes at Lobs Hole. There are 10 heritage items that are affected by both project. In addition both projects occur within the Australian Alps National Parks and Reserves and Snowy Scheme curtilage.

Although Snowy 2.0 and the project span across an extensive geographical area, the existing historical heritage values on the Australian Alps National Parks and Reserves or the Snowy Scheme would not be impacted to a significant level because both projects are largely linear in nature, and the relatively small footprint within the curtilage of these two items. The broad-scale impacts to any one area would be limited. In addition the area is already used for hydro generation and the purpose of Snowy 2.0 and the project is to augment the existing hydro scheme, not to replace it.

7.13.4.4 Land and hydrology

There would be a risk of compounded erosion and sedimentation impacting waterways from Snowy 2.0 and the project. These cumulative risks to surface water quality are expected to be minor with implementation of mitigation measures during construction.

In addition, vegetation clearing and excavation activities from both Snowy 2.0 and the project have the potential to further exacerbate existing indirect impacts on the Ravine tufa deposits, with vegetation changes having the potential to impact hydrology, native biota, soils and site microclimates near the deposits, and therefore indirectly impacting the deposits themselves.

There are no anticipated cumulative flooding and groundwater, impacts associated with these projects during construction and operation. Nor are there anticipated cumulative water quality and hydrology impacts associated with these projects during operation.

7.13.4.5 Transport

Cumulative traffic impacts are expected due to additional traffic volumes that would be generated by the other projects in the locality which share the external road network, in particular Snowy Mountains Highway.

The various safety improvements and intersection upgrades along the Snowy Mountains Highway are expected to be completed by the end of 2020 and such, would not overlap with the construction schedule of the project. As a result of these upgrades, road safety is expected to improve along Snowy Mountains Highway.

Cumulative construction traffic with other projects would generally result in a slight increase in V/C ratio on roads forming part of the proposed haulage route. However, the overall impact would be minimal and roads would continue to operate with spare capacity during the winter peak period.

Cumulative impacts to buses would be limited to a potential minor increase in travel time due to the addition of construction vehicles on the road network. However, due to the availability of spare capacity on the surrounding road network, this impact is expected to be minimal. No impacts are anticipated on the operation of bus stops.

Cumulative impacts to pedestrians and cyclists are not expected particularly around Lobs Hole Ravine area, which is currently closed to the public due to the construction of Snowy 2.0. Although there is no alternative access proposed, these impacts are expected to be minimal as there are numerous walking and cycle tracks within the KNP and surrounding state forests that visitors to the region may continue to access.

No impacts to management and emergency vehicle access are expected as roads would remain open for these vehicles.

No cumulative transport operation impacts are expected.

7.13.4.6 Landscape character and visual

The key cumulative visual impacts would be where the project and Snowy 2.0 interact at the Lobs Hole Ravine area. Key Snowy 2.0 components include:

- Main access tunnel portal
- The emergency egress, cable and ventilation tunnel portal
- Snowy 2.0 cable yard and infrastructure
- Snowy 2.0 works accommodation and associated infrastructure
- Temporary construction and laydown areas
- Talbingo intake
- Light pollution from operational components.

The Snowy 2.0 cable yard marks the eastern end of the project, where the transmission infrastructure (this project) would connect to Snowy 2.0. The Snowy 2.0 cable yard is located in proximity to the Snowy 2.0 emergency egress, cable and ventilation tunnel portal. This infrastructure is located within a valley near Mine Trail, the assessed VP 10, refer to **Figure 7-11**. Due to the enclosed valley topography of this location, simultaneous views toward these elements from the public realm are limited to a short section of Mine Trail, which ends at the portal location. This road is not part of the nearby four wheel trails, and as such is not considered part of the broader scenic road network. The cumulative impacts of Snowy 2.0 and the project would result in a greater industrialisation of a restricted area, and would be experienced by low viewer numbers.

Elements of Snowy 2.0 in proximity to the Ravine campground would be visible from several assessed viewpoints, including VP 9, VP 11, VP 12 and VP 13 refer to **Figure 7-11**. These elements are related to the construction stage of Snowy 2.0, including the Snowy 2.0 works accommodation, access roads, construction and laydown areas, other associated infrastructure and vegetation clearing. By nature, these elements are temporary and would generally be present at times that the Ravine campground and the Lobs Hole Ravine 4WD trail are closed to the public, and therefore viewer numbers of these elements would be nil. Residual impacts, such as regenerating vegetation, permanently cleared areas or modified landscapes to allow construction access would likely be visible for several years as the landscape re-establishes. In this instance, cumulative impacts of Snowy 2.0 and the project are limited to the simultaneous views of cleared landscape and residual landscape modifications. These effects would be temporary but located in an area of heightened sensitivity due to the scenic road and campsite. The Lobs Hole Ravine area would be rehabilitated following construction of Snowy 2.0 and new campgrounds established.

Elements of Snowy 2.0 at Talbingo Reservoir include the Talbingo intake. Cumulative impacts of the project with these elements are restricted to road users of the four wheel trail, which at this location is along Lobs Hole-Powerline Road and includes the assessed VP 13. Views from the Ravine Campground toward the Talbingo Reservoir are screened by existing retained vegetation. Cumulative impacts of these elements are likely to be sequential, rather than simultaneous, due to the distance between these elements. At VP 13, the sensitivity of this area is lowered somewhat by the existing transmission lines (Line 2). However, these elements combined would contribute to an overall increase in the industrialisation of the character of this area.

7.13.4.7 Noise and vibration

At the nearest residential receiver R20 (Private properties at Nurenmerenmong), worst-case cumulative noise levels from construction activities associated with the project and Snowy 2.0 were predicted to remain below NMLs for all periods. At recreational receivers A3 (Coonara Point Campground and Rest Area) and A5 (O'Hares Campground), cumulative noise levels up to 39 dB(A) were predicted, well below the 60 dB(A) NML criteria. Levels up to 62 dB(A) were predicted at receiver A16 (Snowy 2.0 works accommodation), however this is not considered to be a sensitive receiver.

Considering these results, it was concluded that cumulative construction noise impacts from the project and Snowy 2.0 would not result in unacceptable noise levels at the nearest receivers. No cumulative vibration and impacts during are expected either during construction

No cumulative noise or vibration and impacts are expected during operation.

7.13.4.8 Air quality

The project and Snowy 2.0 would have timeframes and locations where construction activities are concurrent, resulting in potentially increased air quality impacts. The project and Snowy 2.0 would implement air quality mitigation measures, such as dust suppression controls. In addition, the nearest residential sensitive receivers are located over four kilometres away from the project. Due to these impacts being temporary, the distance from nearest residential sensitive receivers and them being localised to the Lobs Hole Ravine area, they would unlikely contribute to cumulative air quality impact in the broader region.

7.13.4.9 Hazards

The project and other projects in the locality may increase the risk of on-site ignitions which may result in a fire escaping into the surrounding state forest or KNP. Other fire risks would be associated with hot works, potential

for fuel spills providing a fuel source, and uncontrolled discarding of cigarettes and domestic rubbish by construction workers. A bushfire would provide a direct threat to the safety of project construction workers, visitors to KNP and the state forests, or others working in the area (e.g. Snowy 2.0 and NPWS personnel), and has the potential to impact public and private property, existing transmission assets in the area and heritage items, amongst other impacts detailed in **Section 7.10.2.2**.

The project and Snowy 2.0 will both implement fire risk mitigation measures. A Prepare-Act-Survive bushfire response plan will be prepared for the project construction.

No other cumulative hazards have been identified, as during construction, the project area would be unavailable to the public. No cumulative impacts are expected during operation.

7.13.4.10 Social economic

Potential cumulative socio-economic impacts include:

- Increased demand for local workers, directly on projects and in businesses that provide goods and services to various projects, increasing competition for local workers and potentially impacting the availability of local workers to support other industries such as tourism and agriculture
- Potential impacts from influx of construction workers from multiple projects, exacerbating potential impacts associated with increased demand for local health and emergency services and possible impacts on community values relating to poor worker behaviour (if relevant)
- Increased demand for accommodation by construction workers and workers involved in the bushfire recovery efforts, resulting in potential shortage of tourist accommodation for tourists, visitors and seasonal workers and potentially exacerbating impacts on tourism operators and primary producers
- Increased construction traffic using local roads, including heavy vehicles, exacerbating potential access and connectivity impacts relating to road disruptions, changes in road conditions, and community perceptions relating to road safety.

It is expected that these impacts would be effectively managed through implementation of mitigation measures for the respective projects along with regular consultation with nearby/adjoining projects and key stakeholders about the timing of activities that have potential to result in cumulative impacts and coordination with Snowy 2.0.

No cumulative operation socio-economic impacts are expected.

7.13.4.11 Waste

As described in **Section 5.4.7**, excess spoil from the project area west would be Ravine emplacement area, as such there would be a cumulative impact with Snowy 2.0 of additional vehicle movements to this area.

Many of the waste facilities in remote locations do not have large capacities and they may also have restrictions on throughput. Should closer (but generally smaller) local facilities be unable to accept the waste quantities from all projects, then there may be a requirement to truck the waste further distances to larger regional facilities. This may have the impact of longer and different waste haulage routes and additional traffic movements on the road network.

There are no anticipated cumulative waste impacts associated with the operation of the project and identified projects.

7.13.5 Mitigation measures

Mitigation measures for potential cumulative impacts are proved in **Table 7-34**.

Other mitigation measures that would address cumulative impacts are presented in **Section 7.6.4**, **Section 7.7.4**, **Section 7.8.5** and **Section 7.11.4**.

Table 7-34 Mitigation measures for cumulative impacts

Ref	Impacts	Mitigation measures
Detailed design		
CI1	Cumulative impacts	> Regular consultation will be carried out with nearby/adjoining projects and key stakeholders during the detailed design and construction phase to review potential cumulative impacts and timing of activities that have potential of cumulative impacts > As far as practical construction activities will be coordinated and staggered with Snowy Hydro to minimise cumulative impacts in the project area west > Engagement with Snowy Valleys Council and Snowy Monaro Regional Council will be ongoing regarding impacts on local infrastructure (including accommodation, services).

8. Summary of mitigation measures

This chapter collates the mitigation measures for the project that have been identified through the impact assessment process. This chapter also describes the proposed framework for managing the potential impact of this project through the creation of CEMPs and sub-plans which will set out specific impact mitigation and management measures.

8.1 Environmental management

8.1.1 Framework

TransGrid is committed to conducting its activities and services, including the current proposed activity, in a manner that minimises pollution, environmental impacts, and complies with relevant legislation, industry standards and codes of practice. To achieve this, TransGrid maintains an Environmental Management System (EMS) that is certified under the international standard ISO 14001. All activities undertaken for the project would be consistent with the EMS, and the construction contractor's EMS.

As a result of the detailed environmental assessment undertaken in this EIS, mitigation measures have been included in **Section 8.2**. The mitigation measures in **Section 8.2** form an integral part of the activity and have been taken into account in considering the likely significance of the project's impacts.

8.1.2 Construction environmental management

The management of environmental impacts during construction would be documented in the CEMP. The CEMP would provide a centralised mechanism through which all potential construction-related environmental impacts will be managed. It would also provide the overall framework for the system and procedures to ensure that environmental impacts are minimised, and that legislative and approval requirements are fulfilled.

The CEMP and environmental sub-plans would detail how specific environmental issues are to be managed during construction in accordance with the mitigation measures provided in the EIS and the conditions of approval. The specific mitigation associated with reducing the impact of the project as identified in this assessment are included in **Table 8-1**.

The CEMP would include:

- TransGrid's and the Contractor's environmental policy, objectives, and performance targets for construction
- Reference to all relevant statutory and other obligations, including consents, licenses and approvals
- Management policies, procedures, and review processes to assess the implementation of mitigation measures and the environmental performance of the project against the objective and targets
- Requirements and guidelines for management in accordance with:
  - The conditions of approval for the project
  - The mitigation measures specified in this EIS
- Requirements in relation to incorporating and implementing mitigation measures and emergency response procedures
- Roles and responsibilities of all personnel and contractors to be employed on site
- Incident and contingency management procedures
- Procedures for complaints handling and ongoing communication with the community
- Monitoring and auditing program, as defined by this EIS and the conditions of the approval.

The CEMP would comprise a main CEMP document, issue-specific sub-plans, activity-specific procedures and strategies, and site-based control maps as relevant. These include:

- Rehabilitation plan
- Spoil management plan
- Construction traffic management plan (CTMP)
- Biodiversity management plan
- Soil and water management plan (SWMP)
- Cultural heritage management plan (CHMP)
- Historic and natural heritage management plan
- Flood management plan (FMP)
- Contaminated land management plan (CLMP) and associated NOA management plan (if required)
- Prepare-Act-Survive bushfire response plan
- Construction waste management plan (CWMP)
- Worker accommodation strategy.

8.2 Summary of mitigation measures

A summary of the mitigation measures that would be implemented during the construction and operation of the project is presented in **Table 8-1**.

Table 8-1 Summary of mitigation measures

Mitigation Measures	
Biodiversity	
B1	A biodiversity management plan will be prepared and implemented during construction. It will include the following measures: - The boundary of the clearing limits for the transmission 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 - Where possible, within areas of retained vegetation that are not impacted by Snowy 2.0, a 50 metre exclusion zone (buffer) around Booroolong Frog habitat will be clearly demarcated by fencing and signage and identified on maps for construction personnel. 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 will serve to identify the ecological sensitivity of the land and only approved works with adequate controls in place will be permitted to be undertaken - Where works will be undertaken within the 50 metre riparian buffer zone for the Booroolong Frog, an ecologist will inspect all vegetation, rocks, logs and other shelter sites to locate any frogs. Frogs will be relocated to the designated relocation site. 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) - Pre-clearing surveys will be conducted prior to clearing, including translocation of fauna into areas of retained vegetation. Refinement of the clearing extent required for the transmission corridor will be undertaken as necessary. The final clearing extent will be documented. This

Mitigation Measures	
	information will be used to inform and refine the Biodiversity Offset Strategy and offset requirements for the project. This process involves the preparation of a pre-clearing report > 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 NPWS and FCNSW > Cleared native vegetation will be mulched and stockpiled for use during rehabilitation > Hollows logs and limbs will be retained for placement within retained vegetation and reuse during rehabilitation.
B2	> Erosion and sedimentation will be managed through implementation of effective sediment control measures as outlined in the soil and water management plan (SWMP) will be prepared > Revegetation of slopes will be undertaken as soon as possible in line with the Rehabilitation Plan.
B3	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.
B4	Vehicle movements on newly formed access tracks will be limited to a 20 km/h speed limit implemented to reduce the risk of vehicle strike to fauna.
B5	> 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. > During the clearing works, weeds will be disposed and managed appropriately to stop the spread of existing weed species > 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 > 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 > Waste will be stored appropriately in inaccessible bins and disposed off-site. The details of the monitoring program will be determined during the preparation of the Biodiversity Management Plan.
B6	Artificial lighting required during construction in the early morning and late afternoon in winter will be limited to within approved construction hours.
B7	Monitoring of threatened species to ensure impacts arising from the project are within predicted levels. The details of the monitoring program will be determined during the preparation of the Biodiversity Management Plan.
B8	Directional lighting will be used for any permanent lighting required (i.e. substation) to minimise light spill as much as possible.
Aboriginal heritage	
AH1	During detailed design, if the disturbance area changes but is still within the project area, a consistency assessment will be prepared to confirm if impacts are consistent with the EIS.

Mitigation Measures	
AH2	The area of access track atop Sheep Station Ridge which has not been surveyed will be surveyed in consultation with the RAPs once suitable access to the area has been established. Any areas or items of Aboriginal cultural heritage significance identified as part of this additional investigation will be managed in accordance with measures developed in consultation with RAPs. These measures will be included in the CHMP prepared for the project.
AH3	A CHMP will be prepared, to guard against inadvertent impacts to Aboriginal objects during construction. The CHMP will specify that project works will be restricted to the disturbance area. It will include provisions to ensure workers are made aware of cultural heritage places and their value, for example through project inductions. The CHMP will include provisions to guard against indirect impact to AHIMS# 56-6-0041.
AH4	A Salvage Excavation Method Document will be prepared prior to carrying out the salvage excavation works at the four impacted items (ST PAD 01, ST PAD 02, PAD 03 and AHIMS# 56-6-0477). This document will be provided to RAPs, who will be given a 28-day period to review the document and provide feedback. An indicative method to be followed during salvage excavations is provided in Section 12.1 of the ACHAR.
AH5	Salvage collection of surface artefacts will be carried out, prior to project construction, at ST PAD 03 and AHIMS# 56-6-0477.
AH7	Salvage collection of surface artefacts, and salvage excavations will be carried out, at ST PAD 01 and ST PAD 02. Collection of surface artefacts at ST PAD 01 will also salvage any artefacts from the previously recorded surface sites within this PAD's boundaries, these sites being AHIMS# 56-6-0009, AHIMS# 56-6-0495, AHIMS# 56-6-0496, and AHIMS# 56-6-0497. It is assumed that ST PAD 01, ST PAD 02, AHIMS# 56-6-0009, AHIMS# 56-6-0495, AHIMS# 56-6-0496, AHIMS# 56-6-0497 and AHIMS# 56-6-0477 are intact and have not been either destroyed through activities of Snowy 2.0 or salvaged by the Snowy 2.0 archaeological team. If these sites have been entirely salvaged or destroyed by the Snowy 2.0, then the mitigation measures relating to salvage collection and excavation at these sites will not apply.
AH7	In the event that a site or artefact (as defined by the NPW Act or Heritage Act) is identified during construction works, works will cease at the location and no further harm to the object will occur. The find will be immediately reported to TransGrid, and the regulator in accordance with legislation. No work will commence in the vicinity of the find until any required approvals have been given by the regulator. In the event that skeletal remains are encountered during the activity, works must stop immediately, the area secured to prevent unauthorised access and TransGrid, NSW Police and Heritage NSW contacted.
Non-Aboriginal heritage	
NH1	During detailed design, if the disturbance area changes but is still within the project area, a consistency assessment will be prepared to confirm if impacts are consistent with the EIS.
NH2	A historic and natural heritage management plan will be prepared for the project, which clearly outlines the extent of impact to each recorded historic heritage item within the disturbance area and potential impacts to those sites located within the broader project area. The plan should clearly outline measures for their protection (where applicable) and details of further investigation and archaeological archival recording where appropriate.

Mitigation Measures	
NH3	All heritage items within the disturbance area that are to be impacted by the project will be subject to archival recording and archaeological excavations prior to the commencement of works. If these sites have been entirely destroyed by the Snowy 2.0, then the mitigation measures relating to archival recording and archaeological excavations will not apply.
NH4	If the construction of the project will destroy or directly impact the R45 (Lobs Hole Copper Mine Water Race), archival recording and archaeological excavation must occur prior to the commencement of construction. An archaeological research design and methodology must be produced in keeping with the *Historical Archaeology Code of Practice* (Heritage Council of NSW, 2006).
NH5	In the event that a site or artefact (as defined by the NPW Act or Heritage Act) is identified during construction works, works will cease at the location and no further harm to the object will occur. The find will be immediately reported to TransGrid, and the regulator in accordance with legislation. No work will commence in the vicinity of the find until any required approvals have been given by the regulator. In the event that skeletal remains are encountered during the activity, works must stop immediately, the area secured to prevent unauthorised access and TransGrid, NSW Police and DPIE contacted.
Water	
W1	The waterway crossing over flood impacted waterways such as Sheep Station Creek will be designed and constructed in a way that minimises flood risk and minimise upstream and downstream impacts. The waterway crossing will be designed to ensure flow and drainage is maintained in waterways where construction works are taking place or where the permeant waterway crossing will be. The waterway crossing will be constructed in accordance with minimum design criteria for waterway crossings outlined in *Why do fish need to cross the road? Fish passage requirements for waterway crossings* (Fairfull and Witheridge, 2003).
W2	> Flood modelling will be undertaken at the detailed design stage to define flood behaviour for the existing conditions due to mainstream and overland flooding. The flood models will be utilised to identify and address potential impacts of the proposed works for construction and operation of the project on flooding > Overland flooding impacts will be considered during detailed design, to ensure that the substation's drainage and stormwater system is adequate, and the substation's platforms are above the required flood immunity > Structures within the flood extent will be designed with appropriate foundation to ensure stability against hydrostatic pressure and debris load.
W3	A SWMP will be prepared and implemented prior to and during construction. The SWMP will include: > Erosion and sediment control plans for all stages of construction > Details on the construction and management of sediment basin if determined to be required > Protection of waterways such as scour protection, stabilisation and revegetation > Any imported fill will be certified at source locations as pathogen and weed free Excavated Natural Material or Virgin Excavated Natural Material) > Management of stockpiles and spoil > Tannin leachate management controls > Management of accidental spills, response and reporting > An induction protocol > Responsibilities for all management measures.

Mitigation Measures	
	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).
W4	> All chemicals or other hazardous substances will be stored in a bunded area and away from any drainage lines/pits. The capacity of the bunded area will be at least 130% of the largest chemical volume contained within the bunded area > No refuelling or bulk herbicide preparation will occur within 40 metres of natural drainage lines > Environmental spill kits containing spill response materials suitable for the works being undertaken will be kept on site at all times and be used in the event of a spill > Any spills will be contained, cleaned up promptly and immediately reported to the relevant site representative.
W5	> The SWMP will include arrangements for managing wet weather events, including monitoring of potential high risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather > Where required, adequate sediment controls (including the consideration of sediment basins) will be included in the access track design to manage erosion and sedimentation and associated impacts on receiving waters.
W6	Temporary dewatering for construction is not anticipated. In the event that dewatering is required then the following management measures will apply: > Confirmation of whether or not a licence under the WM Act as defined under the *NSW Aquifer Interference Policy* (DPI Water, 2012) is required prior to any dewatering activity commencing > If dewatering is required, the management of discharge water will be documented in the SWMP Discharge water will be limited to vegetated, grassed areas, away from waterways, and within the construction footprint. If the discharge water is highly turbid, dewatering through a filter sock (or similar), or via transportable sedimentation tanks will be considered, where appropriate, to minimise sedimentation.
W7	A flood management plan (FMP) will be prepared for the project and will detail the processes for flood preparedness, materials management, weather monitoring, site management and flood incident management. The FMP will also address procedures and responsibilities for flood response (preparation of site upon receipt of flood warning, evacuation of site personnel) during and recovery following a flood event.
W8	Waterway crossing and access tracks will be inspected as part of the maintenance inspections to ensure all crossings remain in good condition.
Land	
L1	Targeted geological investigations will be undertaken in areas of surface disturbance using a risk based approach. Results from these investigations will determine the level of management to be implemented for soils and contamination (including NOA).

Mitigation Measures	
L2	A contaminated land management plan will be prepared prior to construction works commencing. It will include management measures to: > Manage areas of known or potential contamination that will be impacted during construction > Manage unexpected finds in the event that unexpected contamination sources are identified (including NOA). This will include guidance on identifying potential contaminated land characteristics (visual, odours, etc), steps to cease works in the affected area, further investigation to assess the extent, magnitude and type of contaminants and appropriate remedial actions.
L3	> Further assessment will be carried out during the geotechnical investigation for the project to verify the presence/absence of NOA within the NOA risk zones. Should NOA be detected, a NOA management plan will be prepared and implemented to guide the handling, transport and disposal of the material > NOA awareness training will be provided to all staff and contractors working in areas with NOA risk > If asbestiform and/or indicator minerals and/or textures are encountered or suspected during excavation works, work is to stop in the area and management be alerted. The area will be isolated with a 10 metre exclusion zone and sign posted, access will be restricted and specialist geological and occupational hygiene advice will be sought prior to further progressing work in that area.
L4	A spoil management strategy will be prepared for the project. The spoil management plan will outline appropriate management procedures for the generation, management and importation (if required) of spoil. It will include, but not be limited to: > Confirming spoil quantities > Carrying out appropriate assessments, including geotechnical investigations > Procedures for classification of spoil > Identification of spoil reuse measures, including segregation of soils as subsoils and topsoils > Spoil stockpile management procedures including minimising the number of stockpiles, area and time they are exposed, and locating stockpiles away from drainage likes and natural waterways and from where they will be susceptible to erosion > Spoil haulage routes > Spoil disposal and reuse locations > Imported spoil sources and volumes.
L5	Management of topsoil stockpiles and other excavated material stockpiles to minimise dust and sediment in runoff will include: > Minimising the number of stockpiles, area and time they are exposed > Locating stockpiles away from drainage lines and natural waterways and from where they will be susceptible to erosion > Stockpiles will be bunded in accordance with the Blue Book (Landcom, 2004) *Managing Urban Stormwater – Soils and Construction*, Volume 1, 4th Edition) Stabilise stockpiles, establish sediment controls and suppress dust as required.

Mitigation Measures	
L6	Excavated material will be managed in accordance with the spoil management strategy. > Where applicable, excess spoil will be re-used for other elements of the project such as access track construction. Where spoil cannot be reused it will be managed as per the SWMP. Alternatively, excess material will be disposed of at other suitable locations (including at Ravine Bay emplacement area) as agreed to with NPWS, FCNSW or at a suitable and licenced waste facility as documented in the spoil management strategy > Material which has been assessed as not suitable for reuse on land or for subaqueous disposal at the Ravine Bay emplacement area (as part of the Snowy 2.0 management procedure) or cannot be reused will be classified in accordance with the *Waste Classification Guidelines* (EPA, 2014). Excavated material will be transported to an appropriate excavated material disposal area. Approval will be obtained prior to transport and will require an estimate of the likely volume of excavated material to be disposed.
L7	Excavated material to be disposed in the Ravine Bay emplacement area will be transported to the emplacement area by TransGrid and/or contractor and then managed by Snowy Hydro in accordance with the relevant approved Snowy 2.0 Rehabilitation Plan prepared by Snowy Hydro.
L8	The CEMP will include measures to identify and report any newly identified geodiversity sites. It will also include measures to minimise impacts to known geodiversity sites.
L9	A Rehabilitation Plan will be prepared in consultation with NPWS and FCNSW to guide the long term rehabilitation of the project. The rehabilitation plan will be based on the rehabilitation strategy outlined in **Section 5.4.10** and will: > Include a detailed plan for rehabilitation of the site > Characterise the soil types within the disturbance area. > Include details of soil management measures, including: - Topsoil stripping and stockpiling procedure - Subsoil management measures - Soil reinstatement methodology which includes a topsoil application procedure > Include measures to minimise: - Loss of soil - Loss of organic matter, nutrient and soil decline - Compaction > Consideration of how rehabilitation will be carried out where soils are unable be recovered, or soils are poor/unfit for re-use > Include detailed performance and completion criteria for evaluating the performance of the rehabilitation of the sites, and triggering any remedial action (if necessary) > Describe the measures that would be implemented to: - Comply with the rehabilitation objectives and associated performance and completion criteria - Progressively rehabilitate the site > Include a program to monitor and report the effectiveness of these measures.

Mitigation Measures	
Transport	
T1	A CTMP will be prepared and implemented and will include: > Confirmation of haulage routes > Measures to maintain access to local roads, and maintain the capacity of existing roads where possible > Site specific traffic control measures (including signage) to manage and regulate traffic movement > Requirements and methods to consult and inform the local community of impacts on the local road network due to the development-related activities > Consultation with TfNSW, and Snowy Valleys Council, NPWS, FCNSW and Snowy Hydro's contractors > Consultation with the emergency services to ensure that procedures are in place to maintain safe, priority access for emergency vehicles and emergency management activities > Access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on Elliott Way > A response plan for any construction related traffic incident > Monitoring, review and amendment mechanisms > Individual traffic management requirements at each phase of construction > Measures to minimise the number of workers using private vehicles travelling to and from project area west > Employment of standard traffic management measures to minimise short-term traffic impacts expected during construction > Management of oversized vehicles > Relevant traffic safety measures, including appropriate signage, driver conduct and safety protocols > Identify requirements for, and placement of, traffic barriers. The CTMP will also consider the following strategies to maintain access for regular and emergency management activities: > Staging of construction works to avoid the need for roads to be fully closed for any extended period of time > Development of alternative access routes in consultation with NPWS and emergency services if any closures are required > Provision of sufficient shoulder width or regular stopping bays to allow regular and emergency vehicles to pass or stop.
T2	If works will affect the free flow of traffic a Traffic Control Plan will be prepared, and a Road Occupancy Licence will be obtained from TfNSW.
T3	Road maintenance will be managed through the following measures: > A Road Dilapidation Report will be prepared prior to and following construction of the project. Any impacts identified as caused by the project will be rectified as specified with any road maintenance agreements > Routine defect identification and rectification of the access roads and tracks will be managed as part of the project maintenance procedure > Access roads and tracks will be designed in accordance with the relevant vehicle loading requirements.

Mitigation Measures	
T4	Affected communities, visitors, FCNSW, NPWS and emergency services will be notified in advance of any disruptions to traffic and restriction of access impacted by project activities.
T5	Access protocols within KNP will be undertaken in accordance with the MOU between TransGrid and NPWS for the Procedure for the Undertaking of Inspection, Maintenance and Emergency Works of TransGrid Network Assets and Associated Infrastructure.
Landscape character and visual impact	
VIA1	Detailed design will consider the retention of existing vegetation to the greatest extent practicable south of Elliott Way and around the substation to ensure that potential visual impacts from Elliott Way are minimised.
VIA2	> All construction plant, equipment, waste and excess materials will be contained within the designated boundaries of the work site and will be removed from the site following the completion of construction > Stockpiles will be stabilised to prevent erosion by wind and water and avoid the development of dust plumes adversely impacting air and visual quality > On completion of the work disturbed areas will be stabilised and returned to as close to original condition.
Noise and vibration	
NV1	The standard techniques for controlling noise impacts during construction are presented in the ICNG. During construction relevant standard measures as outlined in Section 6 of the ICNG will be implemented.
NV2	Do not conduct vibration intensive works within the recommended safe setback distances. Avoid the use of vibration intensive plant within the nominated human comfort distances.
NV3	Care will be taken when carrying out vibration-intensive activities (e.g. use of hydraulic rock breakers and vibratory rollers, and blasting) within distances approaching the recommended safe setback distances around heritage items R45 and R49. Where maintaining of these setback distances isn't possible a suitably qualified person will be present or monitoring will be undertaken during the works to suspend activities in the instance of any issues.
NV4	A detailed blast plan will be prepared by the blasting contractor prior to each blast to mitigate the potential for the recommended safe setback distances being encroached.
Air quality	
AQ1	Air quality mitigation measures will include, but not be limited to: > Identifying potential sources of air pollution > Dust mitigation and suppression measures to be implemented > Plant and equipment will be switched off when not in use > Vehicles, plant and construction equipment will be appropriately sized for the task and properly maintained so as to achieve optimum fuel efficiency > Materials will be delivered with full loads and will come from local suppliers, where possible > Methods to manage work during strong winds or other adverse weather conditions > A progressive rehabilitation of disturbed areas.

Mitigation Measures	
Hazards and risks	
HAZ1	All designs will be in accordance with the ICNIRP *Guidelines for limiting exposure to time varying Electric and Magnetic Fields (1Hz – 100Hz)* (ARPANSA, 2010) with consideration to the public and on-site workers.
HAZ2	The following lightning protection measures will be included in the detailed design: > Each structure will be equipped with earthing fixtures > Each transmission line will have two earthing lines at the top of each structure to provide protection to the conductors from lightning strike > Lightning masts will be installed at the substation.
HAZ3	A Prepare-Act-Survive bushfire response plan will be prepared for the project. The plan will be prepared according to *Planning for Bush Fire Protection* (RFS, 2019). The plan will include responsibilities associated with and details of: > Site specific hazards and risks for the project area > Procedures to maintain bushfire awareness > Bushfire mitigation measures > Fire preparedness actions including: - Evacuation triggers - Evacuation routes - Mustering points - Neighbourhood safer places and refuges of last resort - Instructions for sheltering in-vehicle if there are no other options.
HAZ4	> For the main construction compounds, a minimum of 40 metres clearance is required between fuel/chemical storage points and woody vegetation. The construction compound buildings will have at least 20 metres clearance to the vegetation. > Firefighting equipment will be maintained at and/or accessible to all active construction sites during the declared bushfire danger season, and site personnel trained in its use. Equipment will be appropriate to the activities being conducted and the fire danger at the time of works, but as a minimum must include: - 4WD Striker with slip-on water unit, equipped with diesel pump and hoses - Extinguishers - Knap sacks - Hand tools (e.g. fire rakes). > Any vegetation cleared as part of these works will be removed from site (as much as reasonably practicable), or otherwise processed to avoid excessive bushfire fuel accumulation as agreed with FCNSW and NPWS.
HAZ5	> All chemicals or other hazardous substances will be stored in a bunded area and away from any natural drainage lines. The capacity of the bunded area will be at least 130% of the largest chemical volume contained within the bunded area. The location of the bunded enclosure/s will be shown on Site Plans. > The storage, handling and use of dangerous goods and hazardous substances will be carried out in accordance with the WHS Act and Regulations, the *Storage and Handling of Dangerous Goods Code of Practice* (WorkCover NSW, 2005) and relevant Australian Standards.

Mitigation Measures	
HAZ6	> Routine condition monitoring and risk-based maintenance of project elements to minimise the incidence of ignitions from asset failures > Ongoing vegetation management will be in accordance with TransGrid's operational vegetation monitoring and management procedures. This will include regular inspection and maintenance of trees and woody vegetation within the transmission corridor to provide safe clearance distance to the overhead conductors, and maintenance of the substation APZ > Ongoing risk management of trees located outside the easement that have potential to strike the conductor if they were to fall > Access tracks will be maintained to facilitate ongoing access to transmission structures for maintenance. It is recommended that these tracks are to be maintained to the standards of a Category 9 fire trail (RFS, 2016) to allow fire response in the area.
HAZ7	Hot work (activities involving high temperatures) and fire risk work (activities involving heat or with the potential to generate sparks) will be managed under TransGrid procedures, with measures including suspension of activities on days of elevated fire danger.
Social and Economic	
SE1	A CSEP will be prepared and implemented to help provide timely and accurate information to the community during construction. The plan will include (as a minimum): > Mechanisms to provide details and timing of proposed activities to key stakeholders including residents, business owners, NPWS, FCNSW, emergency service, health and medical facilities, visitors, accommodation providers and annual event organisers, recreational users and motorists including changed traffic and access conditions and amenity impacts > Process for receiving and responding to queries and complaints regarding the project's construction.
SE2	> A worker accommodation strategy will be prepared for the project to manage demand for tourist accommodation from the construction workforce during the construction phase and post-construction > Maximise the use of the Snowy 2.0 works accommodation where possible to minimise demand for local accommodation > Consider local business opportunities in project procurement practices, including encouraging contractors to source local goods and services, where possible > Identify and communicate to local communities (prior to and during construction) opportunities and requirements for work on the project.
SE3	> Development, monitoring and review of project incident response plans, including ongoing consultation with emergency service providers about changes to local access and potential delays and disruptions > Preparation of a workforce health and safety plan that includes measures for responding to health, medical and safety incidents during construction.
SE4	The operation and maintenance of the portion of the project in KNP will be carried out in accordance with any access and operational protocols established between TransGrid and NPWS.
Waste	
WR1	Further consultation with local waste facilities will be carried out during detailed design to further determine potential disposal locations.

Mitigation Measures	
WR2	A construction waste management plan (CWMP) will be prepared for the project and outline appropriate management procedures. It will include, but not be limited to: > Identification of the waste types and volumes that are likely to be generated by the project > Adherence to the waste minimisation hierarchy principles of avoid/reduce/reuse/recycle/dispose > Waste management procedures to manage the handling and disposal of waste, including vegetation, spoil, unsuitable material or unexpected waste volumes > Identification of reporting requirements and procedures for tracking of waste types and quantities A resource management strategy detailing the process to identify reuse options for surplus materials.
WR3	Excess spoil generated in project area east will be transported by truck to Lobs Hole where it will be managed and disposed of by Snowy Hydro (in accordance with the methods described in the Snowy 2.0 Major Works EIS and any conditions of their approval).
WR4	All waste, including surplus soils, which cannot be reused will be classified in accordance with the *Waste Classification Guidelines* (EPA, 2014), removed from the site and disposed of at a facility that can lawfully accept the waste in accordance with the POEO Act and POEO Waste Regulation.
WR56	Operational waste will be managed in accordance with TransGrid Waste Management Procedures and associated Work Instructions.
Cumulative impacts	
CI1	> Regular consultation will be carried out with nearby/adjoining projects and key stakeholders during the detailed design and construction phase to review potential cumulative impacts and timing of activities that have potential cumulative impacts > As far as practical construction activities will be coordinated and staggered with Snowy Hydro to minimise cumulative impacts in the project area west > Engagement with Snowy Valleys Council and Snowy Monaro Regional Council will be ongoing regarding impacts on local infrastructure (including accommodation, services).

9. Project justification and conclusion

This chapter provides the justification and merits for the project and a conclusion for the EIS.

9.1 Justification

Clause 7(1)(f) of Schedule 2 of the EP&A Regulation require an EIS to provide '*the reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development set out in subclause (4)*'. The principles of ecologically sustainable development (ESD) are discussed in **Section 9.1.1** and the biophysical, economic and social considerations are as follows:

- Biophysical costs and benefits: The project would clear about 135.6 hectares of vegetation. The project would introduce permanent infrastructure into KNP and Bago State Forest, and would change the existing natural landscape and its setting, affecting biodiversity and heritage. To offset the biodiversity impacts, a Biodiversity Offset Strategy has been prepared to deliver actions which provide for long-term improvements and conservation outcomes for KNP and Bago State Forest. As part of the Biodiversity Offset Strategy, management actions to offset impact within KNP would be designed in consultation with the relevant stakeholders. In relation to impacts on heritage values, it is considered that the existing heritage values of the Australian Alps National Parks and Reserves will not be adversely impacted by the project, given the project's relatively small disturbance area within the larger curtilage of this item and the proposed offset and mitigation measures that are to be implemented.
- Economic and social considerations: Most social impacts are localised and would be temporary during construction. These impacts include amenity (visual, noise and dust), temporary changes to the boating access on Talbingo Reservoir and community values relating to scenic and landscape amenity as a result of vegetation clearing. The project is expected to have a cumulative impact with Snowy 2.0 during construction on biodiversity, traffic and amenity (visual, noise and dust), water quality and bushfire risk. However, the majority of these impacts would be temporary and localised to the Lobs Hole Ravine area and would unlikely contribute to impacts in the broader region. Economic benefits are anticipated for local businesses during construction due to increased demand for goods and services. Impacts on accommodation availability for tourists and visitors during peak tourist periods and increased pressure on community services and facilities with an influx of construction workforce would also be likely during construction. During operation, the project would connect Snowy 2.0 to the transmission network, allowing Snowy 2.0 to operate within the NEM and provide reliable, dispatchable electricity. Therefore, the project supports the planned transition to a low carbon energy future.

The long term benefits of the project when taken together with Snowy 2.0 Main Works are considered to be in the public interest.

In addition, the project is consistent with the ISP, the NSW Transmission Infrastructure Strategy (DPE, 2018) and the Electricity Strategy.

9.1.1 Ecologically sustainable development

ESD is development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. The principles of ESD were an integral consideration throughout the development of the project.

ESD requires the effective integration of economic and environmental considerations in decision-making processes. The four main principles supporting the achievement of ESD and how the project responds to these principles are discussed below.

9.1.1.1 Precautionary principle

The precautionary principle deals with reconciling scientific uncertainty about environmental impacts with certainty in decision-making. It provides that where there is a threat of serious or irreversible environmental damage, the absence of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation.

This principle was considered during development of the project which included a detailed options analysis (refer to **Chapter 3**). The precautionary principle has guided the assessment of environmental impacts for this EIS and the development of mitigation measures.

This EIS assesses the environmental impacts associated with the project. The EIS was prepared adopting a conservative approach, which included assessing the worst case impacts and scenarios. Mitigation measures are proposed to address identified impacts. These mitigation measures would be implemented during the project. No mitigation measures have been postponed as a result of lack of scientific certainty. No threat of serious or irreversible damage is considered likely as a result of the project.

9.1.1.2 Inter-generational equity

Social equity is concerned with the distribution of economic, social and environmental costs and benefits. Inter-generational equity introduces a temporal element with a focus on minimising the distribution of costs to future generations. The principle states: “the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations”.

The project may impact on inter-generational equity through the consumption of resources during construction and operation, including fuel and raw materials. The project would result in the consumption of fuels, such as diesel, during construction and operation, the amounts of fuels that would be used are not expected to negatively impact future generations.

The project would be designed and implemented to achieve the most viable manner from an economic and social perspective. Further, the project is required to connect Snowy 2.0 to the NEM to provide reliable and renewable energy. Snowy 2.0 and the project facilitates the increasing generation and connection of renewable energy into the NEM and as such is considered a long term contributor to reduced reliance on low emission energy generation sources and benefitting both current and future generations.

9.1.1.3 Conservation of biological diversity and ecological integrity

Biodiversity values were considered in the development of the concept design of the project. Conservation of biological diversity and ecological integrity is a fundamental consideration of the project. The design and assessment of the project was carried out with the aim of identifying, avoiding, minimising and mitigating impacts.

The direct impact of the project would be the clearing of about 135.6 hectares of native vegetation, which provides important habitat for threatened species. Mitigation measures were identified to reduce the severity of direct and indirect impacts of the project on biodiversity. Where there are likely to be residual impacts associated with vegetation clearance, such impacts would be offset. A Biodiversity Offset Strategy has been prepared for the project such that long-term improvements and conservation outcomes for KNP and Bago State Forest would be achieved.

NPWS and FCNSW have been consulted throughout the development of the project design and will to be consulted as the design develops.

9.1.1.4 Improved valuation, pricing and incentive mechanisms

The principle of internalising environmental costs into decision making requires consideration of all environmental resources which may be affected by the carrying out of a project, including air, water, land and living things.

Environmental factors were considered throughout the development of the design and in planning for construction and operation of the project. As a consequence, environmental impacts were avoided or minimised where practical during the concept design development for the project.

Management measures outlined in this EIS will be implemented during construction and operation of the project. The cost of these management measures including offsetting payments are incorporated into the project cost, as well as the extent of environmental investigations carried out to inform this EIS.

9.1.2 Objects of the EP&A Act

The objects of the EP&A Act provide a framework within which the justification and merits of the project can be considered. A summary of this assessment is provided in **Table 9-1**.

Table 9-1 Consideration of objects of the EP&A Act

Object	Comment
(a). To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources.	Social and economic impacts would occur during the construction phase. The project would result in amenity (visual, noise and dust) impacts near the project, temporary changes to the boating access on Talbingo Reservoir and would impact community values relating to scenic and landscape amenity as a result of vegetation clearing. Economic benefits are anticipated for local businesses and accommodation owners due to increased demand for accommodation, goods and services. Community consultation would continue through the detailed design, construction and operational stages, should the project be approved. Details of community involvement are provided in **Chapter 6**. During operation, the project would support the efficient and reliable transmission of additional renewable energy from Snowy 2.0, and improved security and reliability of the NEM and lower energy costs for consumers. The socio-economic and community impacts are assessed in the SEIA in **Appendix E** and summarised in **Section 7.11.3**. The project was designed with the disturbance area as small as possible, to minimise environment impacts as far as practical, as discussed in **Chapter 3**. Some permanent impacts to biodiversity, visual amenity and heritage values would occur and have been minimised to the fullest extent possible. Mitigation measures have been proposed to manage project impacts where they cannot be avoided. The project is also essential to connect Snowy 2.0 to the transmission network to allow it to operate within the NEM to provide reliable, dispatchable electricity and support the planned transition to a low carbon energy future.
(b). To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	As described in **Section 9.1.1**, the project is consistent with the principles of ESD.

Object	Comment
(c). To promote the orderly and economic use and development of land.	The project would not require the acquisition of privately owned land. Acquisition of land from FCNSW and NPWS would be required for the project as outlined in **Section 5.4.1.1**. The acquisition of land associated with the project is not expected to affect forestry operations carried out by FCNSW and would not restrict pedestrian access by recreational users of KNP and Bago State Forest during operation. The project would promote the orderly and economic use and development of land within the project area by connecting Snowy 2.0 to the transmission network, allowing Snowy 2.0 to operate within the NEM.
(d). To promote the delivery and maintenance of affordable housing.	The project would not affect the delivery and maintenance of affordable housing.
(e). To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.	Biodiversity was considered in the development and selection of the preferred option, as discussed in **Chapter 3**. Biodiversity impacts are assessed in **Section 7.1**. No significant impacts to biodiversity are expected. Mitigation measures were identified to further reduce the severity of direct and indirect impacts on biodiversity. Where impacts on biodiversity cannot be avoided or minimised, appropriate offsets will be provided. A Biodiversity Offset Strategy has been prepared for the project as summarised in **Section 7.1.5** and provided in the BDAR in **Appendix B**.
(f). To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	There are four Aboriginal items and ten items of non-Aboriginal heritage identified within the disturbance area that would be impacted by the project. Although impacts to these sites and items are unavoidable, mitigation measures including salvage and archival recording are proposed to contribute further understanding of historical occupation and events. Refer **Section 7.2** and the ACHAR provided in **Appendix C**.
(g). To promote good design and amenity of the built environment.	Good design and amenity of the built environment were considered during project development. Consideration was given to the placement of project elements in the surrounding landscape to minimise operational visual amenity impacts, refer to **Section 7.7**. The project would be designed and operated in accordance with TransGrid's public safety and technical requirements.
(h). To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.	The design, construction and maintenance of the substation would be undertaken in accordance with applicable standards and TransGrid's existing management systems.

Object	Comment
(i). To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.	TransGrid is seeking approval for the project under Part 5, Division 5.2, of the EP&A Act. The project will be assessed under the Bilateral Agreement process between the Commonwealth and NSW Governments. Therefore, a single EIS has been prepared to address the requirements set out by the DPIE and DAWE. Consultation was carried out with Snowy Valleys Council and government agencies throughout development of the project and preparation of this EIS. Consultation carried out to date is described in **Chapter 6**.
(j). To provide increased opportunity for community participation in environmental planning and assessment.	The project development process involved consultation with relevant stakeholders. Consultation undertaken and proposed is outlined in **Chapter 6**. The EIS would be placed on public exhibition by DPIE, in which stakeholders and the community will be able to review the EIS and provide submissions on the project. Any submissions received would be responded to by TransGrid. This process provides further opportunity for community participation in the environmental planning and assessment process.

9.2 Conclusion

The project has been declared CSSI and is essential for the State. The project would connect Snowy 2.0 to the transmission network allowing it to operate within the NEM.

The merits of the project including the benefits of connecting Snowy 2.0 to the NEM are considered to outweigh any identified adverse impacts of this project. While some environmental impacts cannot be avoided, they would be minimised where possible through the implementation of mitigation measures and offsetting.

The Biodiversity Offset Strategy would be finalised once the detailed design is completed, and will be implemented to address the residual impacts of the project on biodiversity values.

The environmental performance of the project would be managed by the implementation of the CEMP. The CEMP would also ensure compliance with relevant legislation and any conditions of approval. With the implementation of the proposed mitigation and management measures, the potential environmental impacts of the project would be adequately managed.

This EIS considers the predicted impacts of the project to construct and operate a nine kilometre long overhead transmission connection and substation to connect Snowy 2.0 to the NEM (see **Chapter 7** for a comprehensive assessment). It has been prepared to support TransGrid's application for approval of the project in accordance with the requirements of Part 5, Division 5.2 of the EP&A Act, and as a controlled action under the EPBC Act. The EIS addresses the environmental assessment requirements of the SEARs, dated 1 November 2019.

On the basis of the findings detailed in the assessments within this EIS and with the implementation of the proposed management measures, the project could be carried out without any significant long term impacts on the local environment and as such is considered justified.

10. References

Aurecon (2020) EMF Risks Quantitative Assessment

Australian and New Zealand Environment Council ANZEC (1990) Technical Basis for Guidelines to Minimise Annoyance Due to Blasting Overpressure and Ground Vibration

Australian and New Zealand Governments (2018) Guidelines for Fresh & Marine Water Quality

Australian Bureau of Statistics (2016) 2016 Census QuickStats. Available at https://www.abs.gov.au/websitedbs/D3310114.nsf/Home/2016%20search%20by%20geography

Australian Energy Market Operator Limited (2020) 2020 Integrated System Plan

Australia ICOMOS (2013) The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance 2013.

Bureau of Meteorology (2017) Atlas of Ground Dependent Ecosystems

Cardno (2018) Aquatic Ecology Report – Appendix G of Snowy 2.0 Exploratory Works EIS

Colquhoun, G.P. et al. (2020) New South Wales seamless geology dataset, single layer, version 2.0 [digital dataset]. Maitland: Geological Survey of New South Wales, Department of Regional NSW.

Department of the Environment (2013) Significant Impact Guidelines 1.1 – Matters of National Environmental Significance. Available at https://www.environment.gov.au/system/files/resources/42f84df4-720b-4dcf-b262-48679a3aba58/files/nes-guidelines_1.pdf

Department of Environment and Climate Change (DECC) (2002) Descriptions for NSW (Mitchell) Landscapes Version 2

Department of Environment and Climate Change (DECC) (2008a) Kosciuszko National Park Fire Management Strategy 2008-2013. Prepared by the Parks and Wildlife Group, July 2008, Sydney

Department of Environment and Climate Change (DECC) (2008b) Managing Urban Stormwater: Soil and Construction Volume 2A – Installation of Services

Department of Environment and Climate Change (DECC) (2009) Interim Construction Noise Guideline (ICNG)

Department of Environment, Climate Change and Water (DECCW) (2008) Managing Urban Stormwater, Volume 2D – Main Road Construction

Department of Environment, Climate Change and Water (DECCW) (2010) Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010

Department of Environment, Climate Change and Water (DECCW) (2011) Road Noise Policy

Department of Environment and Conservation (2006) Kosciuszko National Park Plan of Management, NSW National Parks and Wildlife Services.

Department of Planning and Environment (2018) NSW Transmission Infrastructure Strategy

Department of Planning and Environment (2017) Social impact assessment guideline for State significant mining, petroleum production, and extractive industry development

Department of Planning, Industry and Environment (DPIE) (2019) NSW Electricity Strategy

Department of Planning, Industry and Environment (DPIE) (2020) Guideline for applying Biodiversity Assessment Method at severely burnt sites

Department of Planning, Industry and Environment (DPIE) (2020a) Snowy 2.0 Main Works Critical State Significant Infrastructure Assessment (SSI 9687). May 2020. https://majorprojects.planningportal.nsw.gov.au/prweb/PRRestService/mp/01/getContent?AttachRef=SSI-9687%2120200520T224223.775%20GMT.

Department of Primary Industries, Office of Water (DPI Water) (2012) NSW Aquifer Interference Policy

Department of Primary Industries, Office of Water (DPI Water) (2017) Murrumbidgee Water Resource Plan: Surface water resource description. First published April 2018

Elton Consulting (2019) Social Impact Assessment – Snowy 2.0 Main Works EIS. Prepared for EMM Consulting on behalf of Snowy Hydro Limited

EMM (2017a) Groundwater Assessment – Snowy 2.0 Exploratory Works EIS. Prepared for Snowy Hydro Limited

EMM (2017b) Phase 1 Contamination Assessment – Snowy 2.0 Exploratory Works EIS. Prepared for Snowy Hydro Limited

EMM (2017c) Social and Economic Assessment – Snowy 2.0 Exploratory Works EIS. Prepared for Snowy Hydro Limited

EMM (2018a) Environmental Impact Statement: Snowy 2.0 Exploratory Works

EMM (2018b) Groundwater Assessment – Snowy 2.0 Exploratory Works EIS. Prepared for Snowy Hydro Limited

EMM (2019) Environmental Impact Statement: Snowy 2.0 Main Works EIS. Prepared for Snowy Hydro Limited

EMM (2019a) Background Noise Monitoring Results Summary – Snowy 2.0 Main Works EIS. Prepared for Snowy Hydro Limited

EMM (2019b) Contamination Assessment – Snowy 2.0 Main Works EIS. Prepared for Snowy Hydro Limited

EMM (2019c) Noise and Vibration Impact Assessment – Snowy 2.0 Main Works EIS. Prepared for Snowy Hydro Limited

EMM (2019d) Water Assessment – Snowy 2.0 Main Works EIS. Prepared for Snowy Hydro Limited

EMM (2020) Snowy 2.0 Main Works Biodiversity Offset Strategy – Snowy 2.0 Main Works EIS. Prepared for Snowy Hydro Limited

Fairfull, S. & Witheridge, G. (2003) Why Do Fish Need to Cross the Road? Fish passage requirements for waterway crossings. NSW Fisheries Office of Conservation

Fitzpatrick, R., Powell, B. & Marvanek, S. (2011) Atlas of Australian Acid Sulphate Soils v2. CSIRO

Heritage Council of NSW (2006) Historical Archaeology Code of Practice

International Association for Public Participation (2015) Quality Assurance Standard

International Commission on Non-Ionizing Radiation Protection (ICNIRP) (2010) Guidelines for Limiting Exposure to Time-Varying Electric and Magnetic Fields (1 Hz – 100 kHz)

Jacobs (2019) Assessment of Potential for Naturally Occurring Asbestos at Proposed Archaeological Investigation Sites

Jacobs (2020) Non-Aboriginal Heritage Impact Assessment

Jacobs (2020) Traffic and Transport Impact Assessment

Jacobs (2020) Noise and Vibration Assessment

Landcom (2004) Managing Urban Stormwater – Soils and Construction, Volume 1, 4th Edition (known as the Blue Book Volume 1)

Lennon, J. & Mathews, S. (1996) Cultural landscape management: Guidelines for identifying, assessing and managing cultural landscapes in the Australian Alps national parks. Australian Alps Liaison Committee

Marc Hendrickx and Associates Pty Ltd (2020) Assessment of Potential NOA January 2020, TransGrid Talbingo Reservoir

National Parks and Wildlife Services (NPWS) (2002) Landscapes (Mitchell) of NSW. Hurstville NSW

National Parks and Wildlife Services (NPWS) (2020) NPWS Fire History – Wildfires and Prescribed Burn

NSW Archaeology Pty Ltd (2018) Snowy 2.0 Exploratory Works Aboriginal Cultural Heritage Assessment Report

NSW Archaeology Pty Ltd (2019) Snowy 2.0 Main Works Aboriginal Cultural Heritage Assessment Report

NSW EPA (2014) Waste Classification Guidelines

NSW EPA (2016) Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales

NSW EPA (2017) Noise Policy for Industry (NPI)

NSW Heritage Office (2001) Assessing Heritage Significance - A NSW Manual Update

NSW Rural Fire Service (2016) Fire Trail Standards 2016 Version 1.1

NSW RFS (2019) Planning for Bush Fire Protection: A guide for councils, planners, fire authorities and developers. Rural Fire Service, Government of New South Wales.

Office of Environment and Heritage (2011) Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales

Office of Environment and Heritage (2012) The Land and Soil Capability Assessment Scheme: Second approximation

Office of Environment and Heritage (2016) NSW Climate Change Policy Framework

Office of Environment and Heritage (2017) Biodiversity Assessment Method. Available at: https://www.environment.nsw.gov.au/-/media/OEH/Corporate-Site/Documents/Animals-and-plants/Biodiversity/biodiversity-assessment-method-170206.pdf

Regional NSW (2020) Snowy Valleys REDS Fire Impact Addendum

Roads and Maritime Services (2017) Construction Noise Estimator

Serov, P., Kuginis, L. & Williams, J.P. (2012) Risk Assessment Guidelines for Groundwater Dependent Ecosystems, Volume 1 The Conceptual Framework. NSW Department of Primary Industries, Office of Water

SLR (2019) Rehabilitation Strategy Appendix F Snowy 2.0 Main Works EIS

SMEC (2019a) Geotechnical Investigation Report – Maragle Substation, July 2019. Prepared for TransGrid

SMEC (2019b) Rapid Condition Assessment Tufa Deposits, Revision 1, June 2019. Prepared for EMM

Snowy Valleys Bush Fire Management Committee (2018) Bush Fire Risk Management Plan

Snowy Valleys Council (2018) Snowy Valleys 2028 Our Vision Our Future Community Strategic Plan 2028

Snowy Valleys (2020) Cabramurra. Available at https://visitsnowyvalleys.com.au/locations/cabramurra

Thackway, A. & Cresswell, I.D. (eds) (1995) An Interim Biogeographic Regionalisation for Australia: A Framework for Setting Priorities in the National Reserves System Cooperative Program

TransGrid (2018) Preliminary Environmental Assessment Snowy 2.0 Transmission Connection Project

TransGrid (2019) Maintenance Plan – Network Property

TransGrid (2020) Hot Work and Fire Risk Work Procedure

TRC Tourism (2019) Snowy 2.0 Main Works Recreational Users Study

Troedson, A. (2019) Cenozoic Geodiversity Assessment Report – Snowy 2.0 Main Works. Available at https://emmdigital.com.au/Snowy2.0MainWorksSummary/downloads/Appendix-O.2-Cenozoic-geodiversity-assessment.pdf

Tumut Shire Council (2019) About Cabramurra. Available at http://www.visittumut.com.au/towns-villages/cabramurra.aspx

URS (2015) Site Investigation and Remediation Assessment, Prepared for NSW Trade & Investment, Regional Infrastructure and Services, 20 February 2015

WorkCover NSW (2005) Storage and Handling of Dangerous Goods Code of Practice

TransGrid

Jacobs