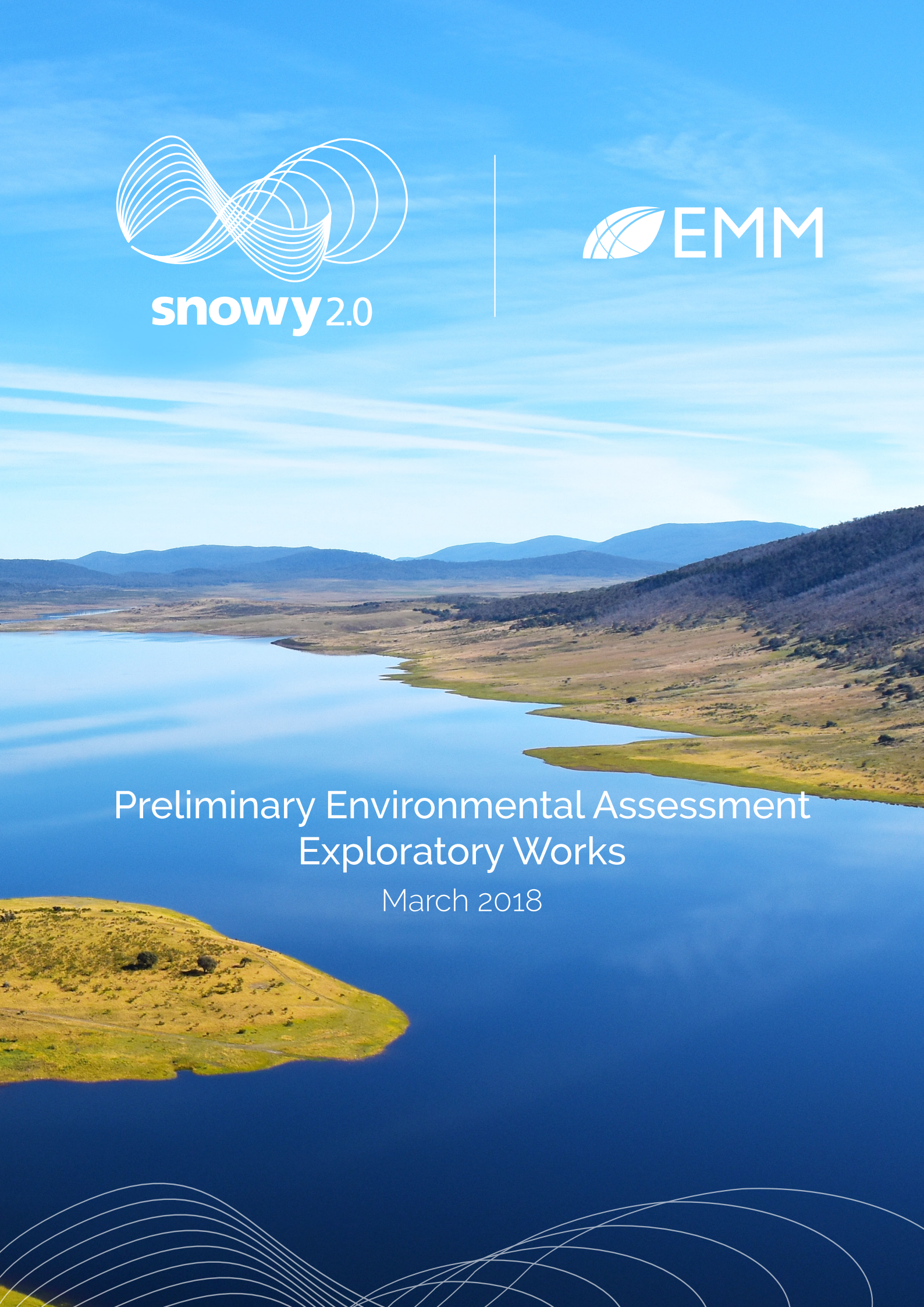


snowy 2.0

EMM

Preliminary Environmental Assessment Exploratory Works

March 2018

Snowy 2.0

Preliminary Environmental Assessment | Exploratory Works

Prepared for Snowy Hydro Limited | 15 March 2018

Ground Floor, Suite 01, 20 Chandos Street
St Leonards, NSW, 2065

T +61 2 9493 9500
F +61 2 9493 9599
E info@emmconsulting.com.au

www.emmconsulting.com.au

Snowy 2.0

Final

Report J17188RP1 | Prepared for Snowy Hydro Limited | 15 March 2018

Prepared by	**Lawrence Wallis**	**Emily McIntosh**	Approved by	**Brett McLennan**	**Duncan Peake**
Position	Environmental Scientist	Senior Environmental Scientist	Position	Director	Director
Signature			Signature		
Date	15 March 2018	15 March 2018	Date	15 March 2018	15 March 2018

Document Control

Version	Date	Prepared by	Reviewed by
FINAL	15 March 2018	Emily McIntosh Lawrence Wallis	Duncan Peake Brett McLennan

T +61 (0)2 9493 9500 | F +61 (0)2 9493 9599

Ground Floor | Suite 01 | 20 Chandos Street | St Leonards | New South Wales | 2065 | Australia

www.emmconsulting.com.au

Table of contents

Table of contents *(Cont'd)*

Tables

Figures

Photographs

1 Introduction

1.1 The project

Snowy Hydro Limited (Snowy Hydro) proposes to develop Snowy 2.0, a large scale pumped hydro-electric storage and generation project. Snowy 2.0 would increase pumped hydro-electric capacity within the existing Snowy Mountains Hydro-electric Scheme (Snowy Scheme). This would be achieved by establishing a new underground hydro-electric power station that will increase the generation capacity of the Snowy Scheme by almost 50%, providing an additional 2,000 megawatts (MW) generating capacity, and providing approximately 350 gigawatt hours (GWh) of storage available to the National Electricity Market (NEM) at any one time, which is critical to ensuring system security as Australia transitions to a decarbonised NEM. Snowy 2.0 would link the existing Tantangara and Talbingo reservoirs within the Snowy Scheme through a series of underground tunnels and hydro-electric power station.

Snowy 2.0 is expected to have a number of benefits including:

- providing an additional 2,000 MW generating capacity, directly contributing to the State's renewable energy targets under the *NSW Climate Change Policy Framework* (NSW CCPF) (NSW Government 2016) and the objectives of the *NSW Renewable Energy Action Plan* (NSW REAP) (NSW Government 2013);
- providing up to 350 GWh of additional energy storage capacity;
- ensuring system security and reliability as Australia transitions to a decarbonised NEM dominated by intermittent renewable generation;
- creation of direct and indirect employment opportunities during construction and operation; and
- direct and indirect benefits to the local, State and national economies during the life of the project.

The development of the design and construction methods for the Exploratory Works would be underpinned by the guiding principles of avoiding and minimising environmental impacts where possible. Snowy Hydro remains committed to continuing to engage with stakeholders, including the local community, and will implement a program for stakeholder consultation during the preparation of the environmental impact statement (EIS) for the Exploratory Works.

On 7 March 2018 the New South Wales (NSW) Minister for Planning declared Snowy 2.0 to be Critical State Significant Infrastructure (CSSI) under the provisions of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) on the basis that it is critical to the State for environmental, economic and social reasons. This Declaration came into effect on 9 March 2018 and is included in clause 9 of Schedule 5 of the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP). As Snowy 2.0 is declared CSSI, applications for the different phases of the project are required to be submitted under Part 5, Division 5.2 of the EP&A Act. The NSW Minister for Planning is the consent authority for applications for CSSI. Each application will be subject to the provisions and requirements of a rigorous and robust planning process under the EP&A Act.

It is likely that Snowy 2.0 would be constructed in two phases.

The first phase is known as Exploratory Works and includes the construction of an exploratory tunnel and portal, the establishment of a construction compound and supporting infrastructure, excavated rock stockpile and the construction and upgrade of new and existing access infrastructure.

The primary purpose of the Exploratory Works is to gain a greater understanding of the underground conditions at the proposed location of the power station cavern. The design and construction of the power station cavern is largely informed through analysis of the rock properties and structural geology obtained through exploration tunnelling and drilling at depth. The Exploratory Works seek to achieve this key objective.

The second phase includes the main construction works and operation of Snowy 2.0, including construction of all tunnels connecting Tantangara and Talbingo reservoirs, the construction of the underground hydro-electric power station, and construction of connection works to link Snowy 2.0 with the national electricity transmission system. The construction infrastructure established during the Exploratory Works would be utilised during the main construction works of Snowy 2.0.

This preliminary environmental assessment (PEA) has been prepared for an application for the Exploratory Works for Snowy 2.0. The main works and operation of Snowy 2.0 will be subject to a separate application and detailed in a corresponding PEA.

1.2 Site and surrounds

Snowy 2.0 would be in both the Snowy Valleys and Snowy Monaro Regional local government areas (LGAs), predominantly between Tantangara Reservoir in the east and Talbingo Reservoir in the west. The middle of Tantangara Reservoir is approximately 27 kilometres (km) north-north-west of the township of Adaminaby. The middle of Talbingo Reservoir is approximately 50 km north-west of Adaminaby and approximately 30 km east-north-east of the township of Tumbarumba. As previously mentioned, Tantangara and Talbingo reservoirs are existing reservoirs that form part of the Snowy Scheme.

The nearest large towns to Snowy 2.0 are Cooma and Tumut. Cooma is approximately 65 km south-east of the middle of Tantangara Reservoir. Tumut is approximately 45 km north of the middle of Talbingo Reservoir.

Snowy 2.0 would mostly be within the Kosciuszko National Park (KNP). The KNP encompasses 6,735 square kilometres (km^2) and is the largest national park in NSW. The park is approximately 150 km in length, running from the Victorian border to the west of the Australian Capital Territory's (ACT) Namadgi National Park. The Exploratory Works would predominantly be in the Ravine region of the KNP. This region is between Talbingo Reservoir to the north-west and the Snowy Mountains Highway to the east which connects Adaminaby and Cooma in the south-east to Talbingo and Tumut to the north-west of the KNP. Talbingo and Adaminaby also provide a base for users of the Selwyn Snow Resort in winter.

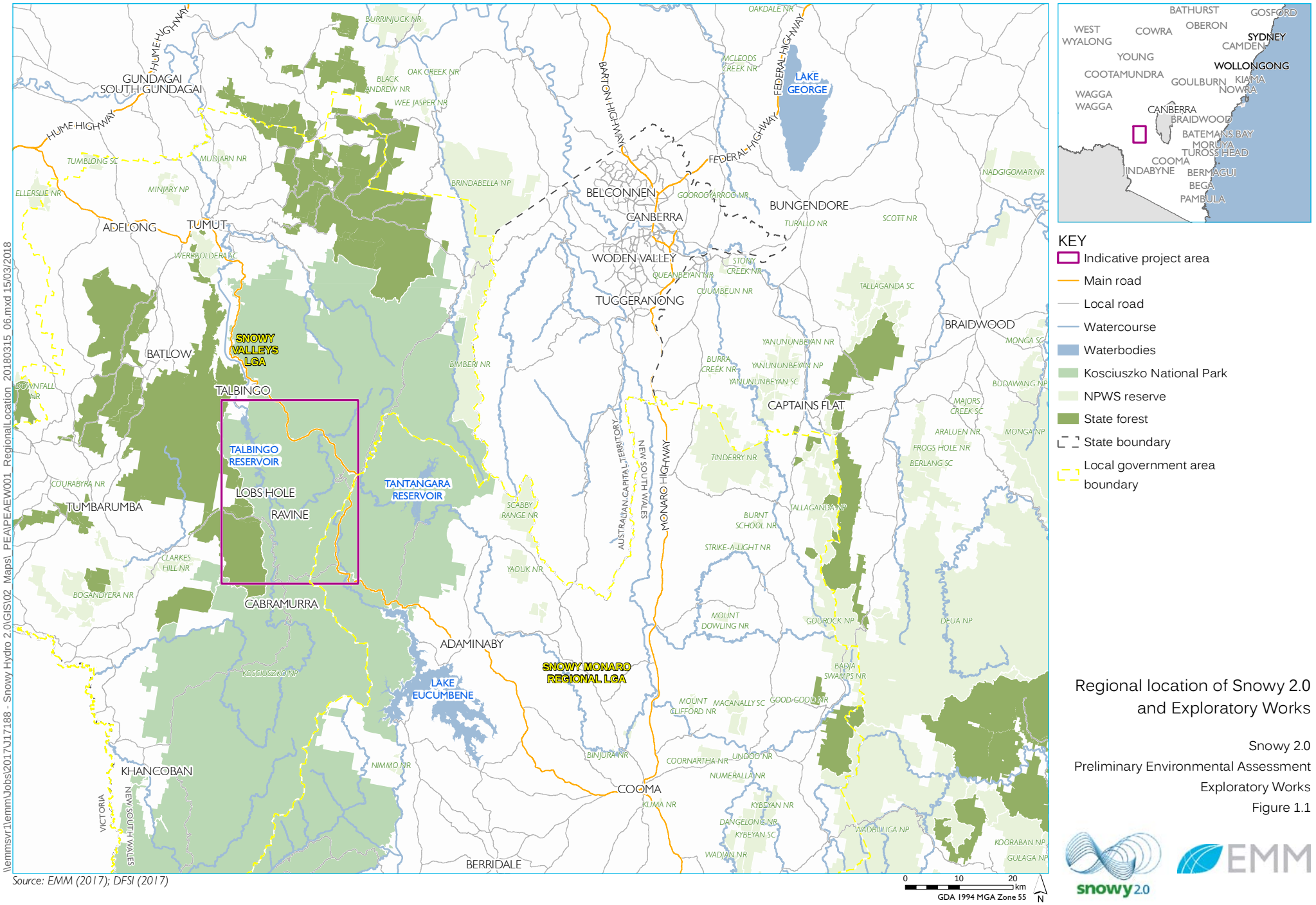
Within this PEA, the area in which the Exploratory Works would be undertaken is described as the Exploratory Works project area. The Exploratory Works project area can be seen in Figure 1.1.

There are several communities and townships near the Exploratory Works project area including Talbingo, Cabramurra and Adaminaby. Talbingo and Cabramurra were originally built for the original Snowy Scheme workers and their families. Talbingo town has developed into a popular place for holiday makers as the town has a lot of outdoor activities such as water skiing, fishing and walking. Cabramurra town was modernised and rebuilt in the early 1970s and is owned and operated by Snowy Hydro. It is still used to accommodate Snowy Scheme employees and contractors. Adaminaby was relocated from its original location (now known as Old Adaminaby) in 1957 due to the construction of Lake Eucumbene.

The Exploratory Works would be undertaken adjacent to Talbingo Reservoir. The reservoir is used for fishing, water skiing and canoeing.

Other attractions and places of interest within the area proximate to the Exploratory Works project area include Selwyn Snow Resort, the Yarrangobilly Caves complex and Kiandra. Kiandra has special significance as the first place in Australia where recreational skiing was undertaken and is also an old gold rush town.

The regional location of Snowy 2.0 and the Exploratory Works is shown in Figure 1.1.



KEY

- Indicative project area
- Main road
- Local road
- Watercourse
- Waterbodies
- Kosciuszko National Park
- NPWS reserve
- State forest
- State boundary
- Local government area boundary

Regional location of Snowy 2.0 and Exploratory Works

Snowy 2.0
Preliminary Environmental Assessment
Exploratory Works
Figure 1.1

snowy 2.0

EMM

Source: EMM (2017); DFSI (2017)

\\emmsvr1\emm\Jobs\2017\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ PEA\PEAEW001 RegionalLocation 20180315 06.mxd 15/03/2018

1.3 The Snowy Scheme

The Snowy Scheme is the largest engineering project ever undertaken in Australia. It is also one of the largest and most complex hydro-electric schemes in the world. Its construction is seen by many as a defining point in Australia's history, and an important symbol of Australia's identity as an independent, multicultural and resourceful country (Australian Government 2015).

The Snowy Scheme was designed to collect and store water, divert it through trans-mountain tunnels and power stations and then release it west of the Snowy Mountains into the catchments of the Murray and Murrumbidgee rivers. This long-term water regulation was designed to counteract the effects of severe drought sequences and increase agricultural productivity in the Murray Darling Basin (Snowy Hydro 2017).

While the diversion of water for irrigation was always part of the original vision of the Snowy Scheme, the engineers were well aware of the potential for the generation of hydro-electricity. The Australian Government has paid for the Snowy Scheme through the sale of the electricity generated by the scheme.

The Snowy Scheme consists of:

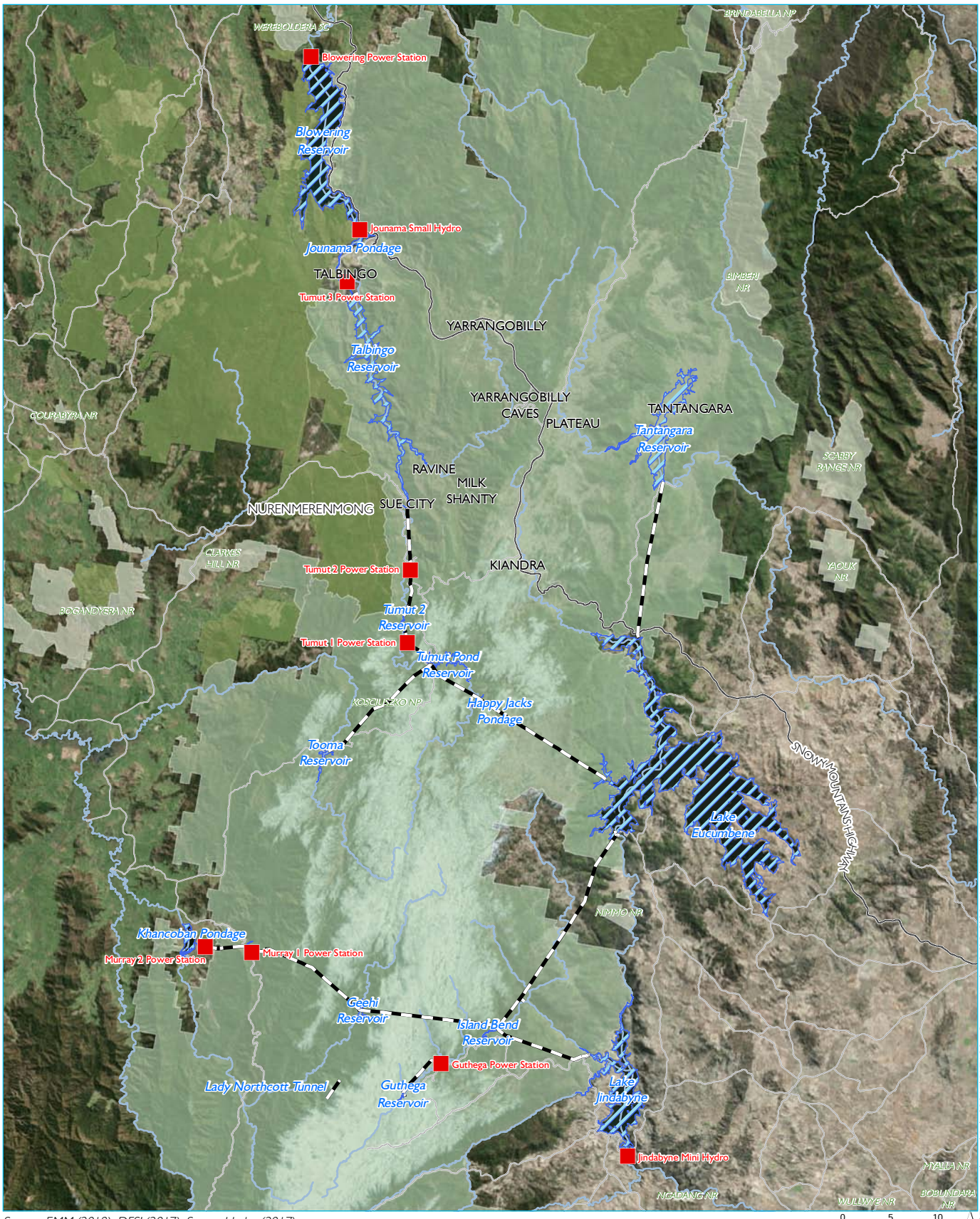
- sixteen major dams with a total active storage capacity of 5,300 gigalitres (GL);
- nine power stations;
- one pumping station and one pump storage capability at Tumut 3 Power Station; and
- 145 km of tunnels and pipelines and 80 km of aqueducts.

The Snowy Scheme has 4,100 MW of existing hydro-electric generating capacity and produces 4,000 GWh on average each year for the NEM.

The location of Snowy Scheme infrastructure is shown in Figure 1.2.

The Snowy Scheme operates predominantly within the KNP under a lease from the NSW Minister for the Environment.

Snowy Hydro operates the Snowy Scheme under a water licence administered by the NSW Department of Industry - Water (DI - Water) that allows for water collection, storage, diversion and release in order to generate electricity.



\\Emmsvr1\emmJobs\2017\J17188 - Snowy Hydro 2.0\GIS\02_Maps_PEA\PEAEW002_TheScheme_20180313_03.mxd 13/03/2018

Source: EMM (2018); DFSI (2017); Snowy Hydro (2017)

0 5 10 km
GDA 1994 MGA Zone 55

N

KEY

- Power station
- Pipeline tunnel
- Scheme storage
- Main road
- Local road or track
- Watercourse
- Kosciuszko National Park
- Other NPWS reserve
- State forest

Existing Snowy Scheme infrastructure

Snowy 2.0
Preliminary Environmental Assessment
Exploratory Works
Figure 1.2

1.4 Proponent

Snowy Hydro is the proponent for Snowy 2.0 and as such, the proponent for the Exploratory Works. Snowy Hydro is an integrated energy business – generating energy, providing price risk management products for wholesale customers and delivering energy to homes and businesses. Snowy Hydro is the fourth largest energy retailer in the NEM and is Australia's leading provider of peak, renewable energy.

In addition to the Snowy Scheme, Snowy Hydro owns, operates and maintains a number of gas and diesel peak electricity generating plants, including:

- 300 MW Valley Power gas-fired power station near Traralgon in Victoria;
- 320 MW Laverton North gas-fired power station in Melbourne;
- 667 MW gas-fired power station at Colongra in NSW; and
- 136 MW of diesel peaking generation across three sites in South Australia (SA).

By combining the power of the Snowy Scheme with gas and diesel peak electricity generating plants, Snowy Hydro delivers a flexible and reliable mix of energy to customers every day. Key to Snowy Hydro's success is the ability to utilise the Snowy Scheme's large, reliable and fast start capabilities, whether it's through spot generation, risk management for wholesale customers, ancillary services, futures contracts or electricity and gas supply to households, commercial and industrial customers.

Snowy Hydro is currently owned by the NSW (58%), Victorian (29%) and Commonwealth (13%) governments. The Commonwealth Government is in the process of acquiring the States' shares in the Snowy Hydro so that it will be fully owned by the Commonwealth. It is a Corporations Law company with an independent board of directors.

1.5 Strategic justification

1.5.1 Strategic justification for Snowy 2.0

The NSW energy system (and broader NEM) is facing major and unprecedented challenges through rising energy costs, deterioration in energy system security and reliability, and a transition in the generation mix away from coal-fired, dispatchable, baseload power to renewable wind and solar power characterised by intermittency.

The principal drivers of these challenges are:

- a requirement for replacement capacity due to the retirement of baseload coal-fired power stations (eg the proposed retirement of Liddell Power Station in 2022);
- reducing costs of intermittent renewable generation; and
- carbon emission reduction policies, including the NSW CCPF and NSW REAP.

The growth of renewable generation from wind and solar across the NEM has displaced some traditional coal-fired generating capacity, leading to reduced capacity to respond to network disturbances. This means the power system is less secure during some operating conditions, which has led to system blackouts (the most recent example being that which occurred in South Australia in September 2016). In this regard, the *Independent Review into the Future Security of the National Electricity Market - Blueprint for the Future* (Finkel et al, 2017) (also known as the Finkel review) concluded that 'a secure power system is a necessary condition for a reliable supply of electricity to consumers' and recommended options for improving security, including large scale pumped hydro storage.

Snowy 2.0 will be able to dispatch significant quantities (ie up to 2,000 MW) of electricity to major load centres at any time on demand. This would be a more effective means of meeting peak demand and be demonstrably cheaper than the most common alternative solutions – gas-fired and diesel peak electricity generating plants, which take a lot longer to start up and are less flexible in meeting rapid changes in load. Snowy 2.0 would also increase generation competition in the NEM at the peak times, and thus exert downward pressure on peak energy prices. With the planned retirement of generation powered by fossil fuels, the reserve generation capacity available in the NEM and in NSW is rapidly declining (AEMO 2017a), making the electricity supply less reliable.

Snowy 2.0 would perform the same function as batteries but on a very large scale, storing energy when surplus electricity is available (likely to be from solar and wind) and discharging when there is a deficiency of electricity. Snowy 2.0 would have around 350 GWh available in storage capacity, which is equivalent to about 21 million Tesla Powerwall 2.0 electricity storage batteries, or 2,800 Tesla grid-connected batteries similar to those recently connected in SA.

Pumped hydro-electric storage also has high full cycle energy efficiency of about 75%. While this is less efficient than lithium-ion storage batteries, at about 90%, lithium-ion batteries currently only have a life span of around 10 years, whereas the life span of a pumped hydro-electric scheme is over 50 years for the electrical plant and 100 years for the civil infrastructure. The full life cycle cost of pumped hydro-electric storage is likely to be an order of magnitude less than the full life cost of lithium-ion battery storage at present. Although the full life cycle cost of lithium-ion storage is expected to fall in the future, it is unlikely to reach the low cost of pumped hydro-electric storage.

The large scale pumped hydro-electric storage and generation proposed under Snowy 2.0 would future-proof and play a major role in responding to the challenges faced by the NEM, at the least possible cost, against the intermittency of the primary renewable technologies (wind and solar) that are expected to supply a large portion of the NEM's energy needs.

Snowy 2.0 would increase the security and reliability of the NSW energy system and the broader NEM by providing 2,000 MW of energy generation capacity and 350 GWh of energy storage capacity. The development of Snowy 2.0 would play a key role in addressing the challenges currently faced by the NEM. Snowy 2.0 would help NSW and Australia achieve energy system reliability and security, at least cost and with very low emissions.

1.5.2 Strategic justification for Exploratory Works

The purpose of the Exploratory Works for Snowy 2.0 is to gain a greater understanding of the underground conditions at the proposed location of the power station cavern locations. An exploratory tunnel would be extracted to the top of the Machine Hall cavern to enable numerous horizontal investigation probes to be drilled to allow for further investigation of the rock conditions, ground temperature and stress conditions to confirm the suitability of the site for the underground power station.

The underground power station for Snowy 2.0 consists of multiple large caverns, approximately 850 metres (m) below ground level. The Machine Hall, the largest component of the underground power station, is likely to be contained in a cavern about 190 m long, over 30 m wide and approximately 55 m high. This would be one of the largest underground caverns for a hydro-electric power project in the world.

The underground power station is one of, if not the most, challenging areas for the design of Snowy 2.0. Design and construction of excavations of this size and complexity are highly dependent on the rock properties and structural geology at the potential locations. The existing geotechnical investigation program is largely a surface-based program that utilises deep drill holes to access the depths of the proposed underground caverns.

This approach is appropriate for determining preliminary subsurface geological information on a broad scale for feasibility studies, but has limitations for detailed design of large underground caverns. For Snowy 2.0, the required target depths for the boreholes are up to over 1,000 m depth, which results in a prolonged drilling process and presents challenges maintaining the verticality of the boreholes as the drilling progresses. Subsequently, undertaking in-situ geotechnical testing in the boreholes is challenging and sometimes not possible due to the varying verticality and depth. This testing can be readily undertaken within the proposed exploration tunnel along with detailed geological mapping at the proposed cavern location which allows the power station location to be confirmed.

The Ravine Beds geological unit is to be intersected in a large portion of the excavations for Snowy 2.0. Should Snowy 2.0 be approved, approximately 25 km of tunnels and the underground caverns will be situated in the Ravine Beds geological unit.

No tunnel or excavation for the Snowy Scheme intersected the Ravine Beds geological unit. For Snowy 2.0, excavation conditions, water seepage, rock bedding and faulting conditions are extremely important, particularly in the area of the Machine Hall.

While several boreholes are proposed from the surface in this area, these boreholes are only 100 millimetres (mm) or less in diameter and only provide an insight into the conditions. It is common practice internationally for hydropower projects, particularly with large caverns, to conduct an exploratory tunnel to the top of the power station cavern and drill numerous horizontal investigation probes. The associated testing includes in-situ stress testing to confirm that the precise power station complex location and orientation is suitable for the stress conditions at depth.

Snowy Hydro (previously the Snowy Mountains Hydro-Electric Authority) designed and constructed both Tumut 1 and Tumut 2 power station complexes. For both Tumut 1 and Tumut 2, exploratory tunnel programs were completed prior to the finalisation of the design and the start of construction. It is important to note that the depths of Tumut 1 and Tumut 2 power stations are approximately one third the depth of the Snowy 2.0 power station. In addition, the previous largest excavations for existing power station complexes in the Snowy Scheme were approximately half the size of those proposed for Snowy 2.0.

An added advantage of excavating an exploratory tunnel to reach the underground power station is the significant amount of detailed excavation conditions that will be documented during the excavation of the tunnel itself which will inform design and contracting for the main construction works.

1.6 Purpose of report

The purpose of this report is to request and inform the content of the Secretary's Environmental Assessment Requirements (SEARs) for the Exploratory Works of Snowy 2.0. The SEARs will specify the requirements for the EIS that will be prepared for the Exploratory Works.

This report has been prepared by EMM Consulting Pty Limited (EMM) on behalf of Snowy Hydro.

2 Statutory approval framework

2.1 Commonwealth legislation

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) aims to protect matters of national environmental significance (MNES) including:

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

If an action will, or is likely to, have a significant impact on any MNES, it is deemed to be a 'controlled action' and requires approval from the Commonwealth Minister for the Environment or the Minister's delegate. To determine whether a proposed action will or is likely to be a controlled action, a Referral of Proposed Action is submitted to the Commonwealth Department of the Environment and Energy (DEE) for assessment.

The Exploratory Works will mostly be undertaken within the KNP. Both the KNP and Snowy Scheme are listed on the National Heritage List, and as such, are defined as national heritage places under the EPBC Act.

Preliminary and detailed ecological surveys have been undertaken within the Exploratory Works project area, including detailed plant community type mapping targeted flora and fauna surveys. These surveys have identified the presence of Alpine Sphagnum Bogs and Associated Fens, listed as an endangered ecological community under the EPBC Act.

Several threatened fauna species listed under the EPBC Act have also been identified in the Exploratory Works project area, including the Smoky Mouse (*Pseudomys fumeus*), Eastern Pygmy-possum (C*ercartetus nanus*), Broad-toothed Rat (*Mastacomus fuscus*), Boorolong Frog (Litoria booroolongensis) and Alpine She-oak Skink (*Cyclodomorphus praealtus*). No threatened flora species have been recorded within the Exploratory Works project area.

The likely impact of the Exploratory Works on these MNES has yet to be finalised. However, at the time of the preparation of this PEA, preliminary assessments have determined that the Exploratory Works are unlikely to have a significant impact on MNES. Ecology and heritage assessments will be undertaken to determine the likely impacts of the Exploratory Works on threatened species and ecological communities, and the heritage significance of the KNP and Snowy Scheme. The results of these assessments will be documented in a Referral of Proposed Action which will be submitted to DEE.

2.2 NSW legislation

2.2.1 EP&A Act and its Regulation

The EP&A Act and the NSW *Environmental Planning and Assessment Regulation* 2000 (EP&A Regulation) are the primary pieces of legislation regulating environmental planning and assessment in NSW. The legislation is supported by a range of environmental planning instruments (EPIs) including State environmental planning policies (SEPPs) and local environmental plans (LEPs).

Part 5 of the EP&A Act establishes the assessment and approval regime for State significant infrastructure (SSI) and CSSI.

The EP&A Act and EP&A Regulation is principally administered by the NSW Department of Planning and Environment (DPE) and local councils. The parts of the EP&A Act and EP&A Regulation that relate to SSI and CSSI are administered by DPE.

2.2.2 Critical State significant infrastructure

Sections 5.12 and 5.13 of Part 5 of the EP&A Act provide for the declaration of SSI and CSSI.

Section 5.12(4) of the EP&A Act enables a SEPP or an order of the NSW Minister for Planning (published on the NSW legislation website) to declare development to be SSI. Section 5.13 enables the Minister to declare SSI to be CSSI if '"it is of a category that, in the opinion of the Minister, is essential for the State for economic, environmental or social reasons'.

On 26 October 2017 Snowy Hydro requested that the NSW Minister for Planning declare Snowy 2.0 to be CSSI.

On 7 March 2018 the NSW Minister for Planning declared Snowy 2.0 to be CSSI. This Declaration came into effect on 9 March 2018 and is included in clause 9 of Schedule 5 of the SRP SEPP.

2.2.3 SRD SEPP

The SRD SEPP identifies development that is State significant development, SSI, CSSI or regionally significant development.

Clause 16 of the SRD SEPP states that development specified in Schedule 5 of the SEPP:

(a) may be carried out without development consent under Part 4 of the Act, and

(b) is declared to be State significant infrastructure for the purposes of the Act if it is not otherwise so declared, and

(c) is declared to be critical State significant infrastructure for the purposes of the Act.

Clause 9 of Schedule 5 of the SRD SEPP states:

9 Snowy 2.0 and Transmission Project

(1) The Snowy 2.0 and Transmission Project is a proposed program of works for the expansion of the generating capacity of the Snowy Mountains Hydroelectric Scheme and for associated upgrades and additions to the electricity transmission network. The object of this clause is to declare development for the purposes of the Snowy 2.0 and Transmission Project that is set out in this clause to be State significant infrastructure and critical State significant infrastructure.

(2) This clause applies to development on land in any of the following local government areas:

(a) Cootamundra-Gundagai Regional,

(b) Goulburn Mulwaree,

(c) Snowy Monaro Regional,

(d) Snowy Valleys,

(e) Upper Lachlan Shire,

(f) Yass Valley.

(3) **Snowy 2.0**

Development for the purpose of pumped hydro and generation works to be known as Snowy 2.0 on land between Tantangara Reservoir and Talbingo Reservoir that involves:

(a) the carrying out of exploratory geotechnical works or engineering investigations, and

(b) the construction and operation of an underground hydroelectric power and pump station capable of supplying approximately 2,000 megawatts of hydroelectric power, and

(c) the construction of water and access tunnels, surge tank and intake and outlet structures at and between the two reservoirs.

(4) **Transmission works**

Development that involves:

(a) 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, and

...

(5) The development referred to in this clause does not include:

(a) the carrying out of surveys, sampling, environmental investigations, geotechnical borehole drilling, test drilling, test excavations, or other tests or investigations, for the purposes of feasibility assessment and the preliminary design of the Snowy 2.0 and Transmission Project, or

(b) the carrying out of works to upgrade or modify electricity transmission lines, works within existing switchyards, and the installation of communications infrastructure.

(6) **Ancillary development**

Development that is ancillary to any other development in this clause, including the carrying out of works to upgrade or construct access roads, utilities infrastructure, construction accommodation, construction compounds and construction power supply.

2.3 Statutory approval pathway

Two main approvals may be required for the Exploratory Works component of Snowy 2.0. One approval is under the NSW EP&A Act. The other is under the EPBC Act, should the Exploratory Works be determined to be a controlled action as a result of potential impacts on MNES. Notwithstanding this, as stated above, at the time of preparing this PEA, preliminary assessments have determined that the Exploratory Works are unlikely to have a significant impact on MNES.

The statutory approval pathway is shown in Figure 2.1 and detailed further in this section. This assumes that an approval under the EPBC Act is not required for the Exploratory Works.

2.3.1 Pathway under Part 5 of the EP&A Act

As noted in Section 2.2.2, the assessment and approval process for a CSSI project is established under Part 5 of the EP&A Act.

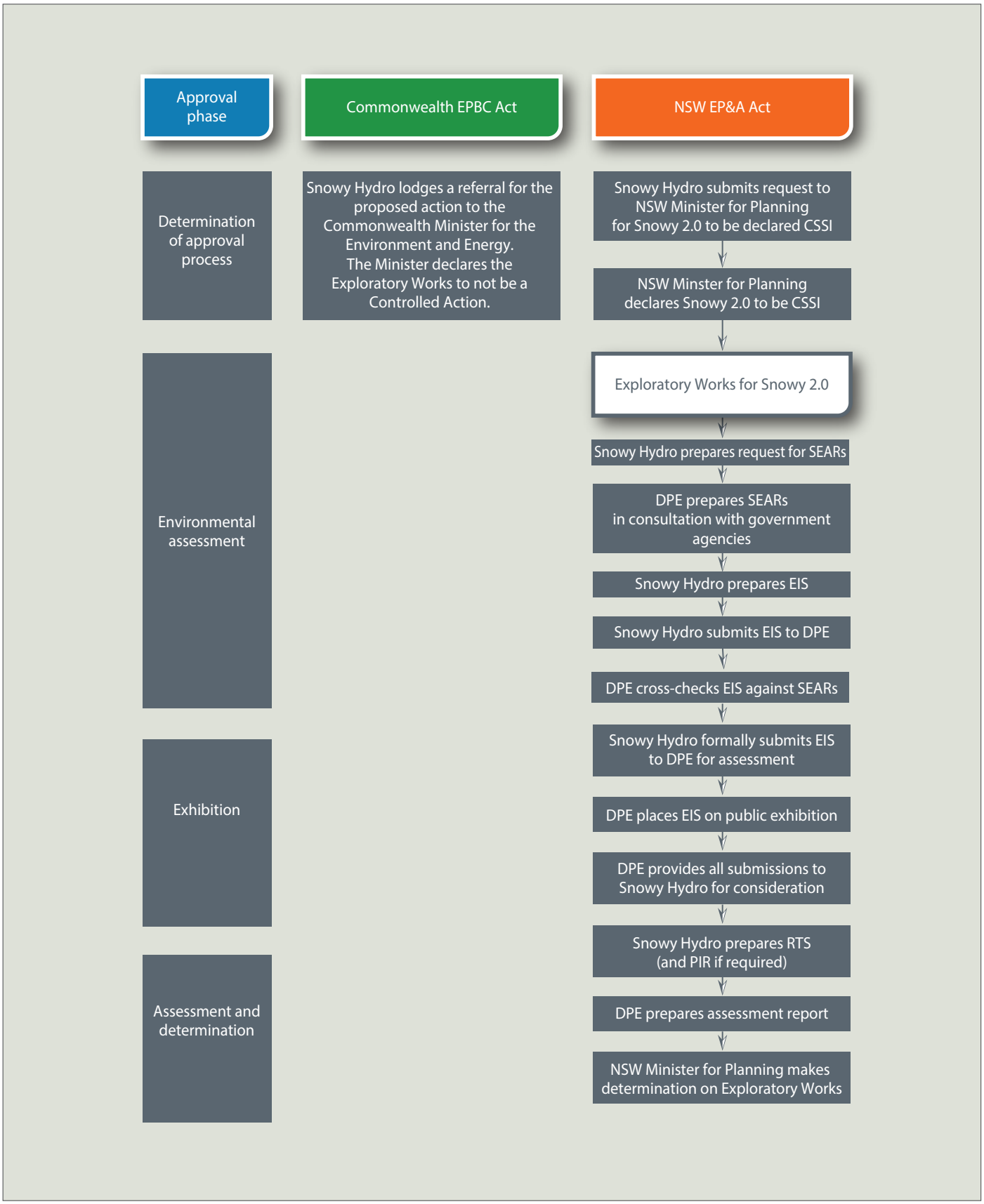
This PEA seeks the SEARs for works associated with the Exploratory Works component of Snowy 2.0 which includes the excavation of an exploratory tunnel, the establishment of a construction compound and construction of an excavated rock stockpile, and the construction and upgrade of new and existing access infrastructure, as defined in Chapter 3.

Figure 2.1 shows the approval process for the Exploratory Works (this PEA) with the key steps described below. As previously stated, a separate PEA will be submitted for the main works for Snowy 2.0:

- An EIS will be prepared in accordance with the SEARs and Part 3 of Schedule 2 of the EP&A Regulation (as per Section 5.16 of the EP&A Act). The DPE will place the EIS on public exhibition for a minimum of 28 days (as per Section 2.21(2)(d), and 2.22(1), with Schedule 1, Part 1, Division 2, Item 12 of the EP&A Act). During the exhibition period, government agencies and the community have the opportunity to review the EIS and make a written submission to the DPE for consideration in its assessment of the Exploratory Works.

- At the completion of the public exhibition period, DPE will collate and provide Snowy Hydro with a copy of all submissions received during the exhibition period. After reviewing the submissions, Snowy Hydro will prepare a submissions report that responds to the relevant issues raised. If changes are required to the Exploratory Works as a result of the issues raised or to minimise environmental impact, a preferred infrastructure report (PIR) may also be required.

- If this is required, Snowy Hydro would prepare the PIR to address the changes to the design to minimise impacts and submit this for review to the DPE. The PIR would be made available to the public. Approval from the NSW Minister for Planning is required before Snowy Hydro can proceed with the project (as per Section 5.19 of the EP&A Act).



Planning approval pathway

Snowy 2.0
Preliminary Environmental Assessment
Exploratory works
Figure 2.1

There are a number of authorisations, approvals and licences under other NSW legislation that may apply to the SSI, including CSSI, under sections 5.24 and 5.23 of the EP&A Act. Table 2.1 provides a summary of the different NSW legislation and lists the approvals, licences, orders and permits that are applicable for CSSI projects.

Table 2.1 Permits and approvals required for CSSI and SSI projects

Legislation	Details of the approval/permit/order	Required for SSI or CSSI
NSW *Fisheries Management Act 1994* (FM Act)	An aquaculture permit under section 144 of the Act	Yes
	A permit under section 201, 205 or 219 of the Act	No
	A stop-work order under Division 7, of Part 7A of the Act	No
NSW *Protection of the Environment Operations Act 1997* (POEO Act)	An environment protection licence (EPL) under Chapter 3 of the Act	Yes
	An environment protection notice under Chapter 4 of the Act	No
NSW *Roads Act 1993*	Consent under section 138 of the Act	Yes
NSW *Pipelines Act 1967*	A licence	Yes
NSW *Coastal Protection Act 1979*	Concurrence under Part 3 of the Act.	No
NSW *Heritage Act 1977*	An approval under Part 4, or an excavation permit under section 139 of the Act	No
NSW *National Parks and Wildlife Act* (NPW Act)	An Aboriginal heritage impact permit under section 90 of the Act	No
	An interim protection order	No
	A stop-work order under Division 1, of Part 6A of the Act	No
	A remediation direction under Division 3 of Part 6A of the Act	No
NSW *Rural Fires Act 1997 (RF Act)*	A bushfire safety authority under section 100B of the Act	No
NSW Water Management Act 2000 (WM 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 Act	No
NSW *Biodiversity Conservation Act 2016* (BC Act)	A regulatory compliance order or direction under Part 11 of the Act	No
NSW *Local Government Act 1993*	An order under section 124 of the Act	No

2.3.2 Pathway under the EPBC Act

As previously stated, while preliminary assessments have determined that the Exploratory Works are unlikely to have a significant impact on MNES, detailed assessments have yet to be undertaken. Ecology and heritage assessments will be undertaken to determine likely impacts of the Exploratory Works on threatened species and ecological communities, and the heritage significance of the KNP and Snowy Scheme. The results of these assessments will be documented in a Referral of Proposed Action and submitted to DEE, as shown in Figure 2.1.

Should the assessments indicate that the Exploratory Works are not likely to have a significant impact on MNES, Snowy Hydro will seek a declaration from the Commonwealth Minister for the Environment that the project is not a controlled action. Should this declaration be made, approval under the EPBC Act is not required for the Exploratory Works.

However, should the assessments indicate that the Exploratory Works are likely to have a significant impact on MNES, Snowy Hydro will seek a declaration from the Commonwealth Minister for the Environment that the project is a controlled action. Where an action is declared to be a controlled action, DEE decides on the approach to be used for assessing the relevant impacts from five different pathways. One of the assessment pathways is by an assessment process established under NSW law and administered by the NSW Government which is accredited by a bilateral assessment agreement under the EPBC Act between the Commonwealth and NSW governments.

The ecology assessment for the Exploratory Works is currently, and will be, undertaken in accordance with the BC Act together with its supporting *Biodiversity Assessment Method* (BAM) (OEH 2017). To date, the BAM is not formally recognised as a current bilateral agreement pathway, however this pathway is expected to be formalised before an EIS for Exploratory Works would be submitted. If the Exploratory Works is deemed to be a controlled action and approval is required under the EPBC Act, confirmation that a bilateral agreement pathway has been established with the BAM will be required so the action can be assessed under the approved bilateral agreement and coordinated by DPE.

If a bilateral agreement is used, a copy of DPE's assessment report would be forwarded to DEE on completion of the State process. After the NSW Minister for Planning makes a determination on the Exploratory Works, the Commonwealth Minister for the Environment must then make a decision on whether to approve the taking of the action within 30 business days of NSW Minister for Planning's determination.

In the event no bilateral assessment agreement process is available for the Exploratory Works, separate assessments and approvals would be required according to the applicable assessment methods determined for each jurisdiction.

2.4 Other NSW legislation

2.4.1 Snowy Hydro Corporatisation Act 1997

The NSW *Snowy Hydro Corporatisation Act 1997* (SHC Act) came into force on 28 June 2002. It enabled the corporatisation of the former Commonwealth Snowy Mountains Hydro-electric Authority to Snowy Hydro Limited, and entitled Snowy Hydro to a number of key operating instruments to enable the continued operation of the existing Snowy Scheme. Concurrent corporatisation legislation was also passed in each of the Commonwealth and Victorian parliaments.

The SHC Act has eight parts. Part 3 relates to transfers, including the transfer of electricity generating assets from the Snowy Mountains Hydro-electric Authority and the State of NSW to Snowy Hydro, and the transfer of electricity transmission assets to TransGrid.

Parts 4 and 5 of the SHC Act relates to water. Part 4 sets out the terms and timing for the Snowy Water Inquiry which was to examine environmental issues arising in rivers and streams from the operations of the Snowy Scheme. Part 5 establishes the entitlement of Snowy Hydro to the Snowy Water Licence and prescribes the basic rights and obligations that are to be contained in the licence.

Part 6 relates to leases (known as the Snowy Park Lease) under the NPW Act to allow for the operation of the Snowy Scheme and the Snowy Water Licence.

Part 7 relates to the application of certain NSW legislation, including application of the EP&A Act.

Further details on the Snowy Water Licence, the Snowy Park Lease, and the application of the EP&A are provided below.

i Snowy Water Licence

The Snowy Water Licence is a statutory instrument issued under Part 5 of the SHC Act. It embodies the operating and accounting principles of the Snowy Scheme. The Snowy Water Licence confers the following rights on Snowy Hydro:

- to collect all water from the rivers, streams and lakes within the Snowy Water Catchment;
- to divert that water;
- to store that water;
- to use that water to generate electricity and for purposes that are incidental or related to the generation of electricity; and
- to release that water from storage.

Snowy Hydro's rights are subject to the rights of certain other occupiers to take and use water (eg local councils). In addition to these rights, the Snowy Water Licence also sets out Snowy Hydro's water related obligations, in particular, release obligations.

The Exploratory Works, main construction works and operation of Snowy 2.0, would have no impact on downstream water users. Minor amendments to the Snowy Water Licence may be required for the operation of Snowy 2.0 such as the net Jounama release calculation to reflect the addition of pumped hydro capability between Tantangara and Talbingo reservoirs. No amendments to the Snowy Water Licence will be required for the Exploratory Works.

ii Snowy Park lease

Part 6 of the SHC Act entitles Snowy Hydro to the grant of a lease, licence, easement or right of way over KNP, for the purposes of the existing Snowy Scheme development. This lease, known as the Snowy Park Lease, was granted to Snowy Hydro by the NSW Minister for Environment in 2002 and has a term of 75 years.

The Exploratory Works (and main construction works for Snowy 2.0) would be mostly inside KNP, but outside Snowy Hydro's existing Snowy Park Lease area. As such, minor amendments will be required to the SHC Act to enable an amendment of the Snowy Park Lease to include the areas that will be accessed and occupied by Snowy Hydro during the Exploratory Works and main construction works (see also discussion below at section 2.4.2).

iii Application of EP&A Act

Part 7 of the SHC Act approved the Snowy Scheme as at the date of corporatisation (28 June 2002) under former Parts 4 and 5 of the EP&A Act. Section 41(2) of the SHC Act states:

> A determining authority is not required to comply with Part 5 of the EPA Act for the purposes of granting an initial approval. However, the determining authority is, for the purposes of any Act or law, taken to have complied with Part 5 of the EPA Act in granting the initial approval (but only to the extent that the determining authority would but for this Act have been required to comply with that Part).

Section 41(3) of the SHC Act states:

> For the purposes of the application of any Act or law to an activity that is part of the existing Scheme development but that is not the subject of an approval granted by a determining authority or of a development consent, the activity is taken to have been commenced and previously carried out in accordance with Part 5 of the EPA Act.

The Exploratory Works are a major augmentation to the Snowy Scheme, beyond the scope of Snowy Hydro operations currently authorised by the SHC Act. Assessment and approval under the EP&A Act is therefore required prior to commencing the Exploratory Works.

2.4.2 National Parks and Wildlife Act 1974

The NPW Act aims to conserve nature and objects, places or features of cultural value within the landscape and contain specific provisions protecting Aboriginal objects and Aboriginal places. It is administered by the NSW Office of Environment and Heritage (OEH), including the NSW National Parks and Wildlife Service (NPWS) which is part of OEH.

As previously stated, there are a number of approvals, directions, orders or notices under the NPW Act that do not apply to approved SSI and CSSI. These include:

- Aboriginal heritage impact permits (AHIPs);
- interim protection orders;
- stop work orders; and
- remediation directions.

Notwithstanding the above, minor amendments to provisions of the SHC Act would be required to authorise the expansion of the existing Snowy Park Lease within KNP to permit the Exploratory Works associated with Snowy 2.0 to be authorised under the NPW Act and the Plan of Management (PoM) for KNP.

2.4.3 Biodiversity Conservation Act 2016

On 25 August 2017 the new BC Act commenced operation. It is administered by OEH.

Under the BC Act, impacts to biodiversity are assessed and offset in accordance with the BAM (OEH 2017) where they exceed certain thresholds. For SSI and CSSI, use of the BAM is mandatory where clearing thresholds are exceeded, or where projects are deemed to result in a significant impact to threatened species, populations or communities listed under the BC Act. The biodiversity assessment undertaken for the Exploratory Works will be in accordance with the requirements of the BAM.

As previously stated, an order or direction under Part 11 (regulatory compliance mechanisms) of the BC Act cannot be issued for approved CSSI.

2.4.4 Protection of the Environment Operations Act 1997

The POEO Act is the principal NSW environmental protection legislation and is administered by the NSW Environment Protection Authority (EPA). Section 48 of the POEO Act requires an EPL to undertake scheduled activities.

During the construction for Exploratory Works, there is potential that an EPL may be required for extractive activities, helicopter related activities and waste disposal associated with tunnelling activities and the excavation of rock material. Scheduled activities are defined in Schedule 1 of the POEO Act and the scheduled activities that may be applicable for the construction of the Exploratory Works are outlined in Table 2.2.

Table 2.2 Scheduled activities defined in Schedule 1 of the POEO Act that may be applicable to Exploratory Works

Schedule activity	Schedule definition
19 Extractive activities	(1) This clause applies to the following activities: land-based extractive activity, meaning the extraction, processing or storage of extractive materials, either for sale or re-use, by means of excavation, blasting, tunnelling, quarrying or other such land-based methods. water-based extractive activity, meaning the extraction of extractive materials, either for sale or re-use, by means of dredging or other such water-based methods. (2) In this clause, extractive materials means clay, sand, soil, stone, gravel, rock, sandstone or similar substances that are not minerals within the meaning of the Mining Act 1992.
20 Helicopter-related activities	(1) This clause applies to a helicopter-related activity, meaning the landing, taking-off or parking of helicopters (including the use of terminals and the use of buildings for the parking, servicing or maintenance of helicopters), being an activity: (a) that has an intended use of more than 30 flight movements per week (where take-off and landing are separate flight movements), and (b) that is conducted within 1 kilometre of a dwelling not associated with the landing, taking-off or parking of helicopters, but not including an activity that is carried out exclusively for the purposes of emergency aeromedical evacuation, retrieval or rescue. (2) The activity to which this clause applies is declared to be a scheduled activity.

Table 2.2 Scheduled activities defined in Schedule 1 of the POEO Act that may be applicable to Exploratory Works

Schedule activity	Schedule definition
39 Waste disposal (application to land)	(1) This clause applies to waste disposal by application to land, meaning the application to land of waste received from off site, including (but not limited to) application by any of the following methods: (a) spraying, spreading or depositing on the land, (b) ploughing, injecting or mixing into the land, (c) filling, raising, reclaiming or contouring the land. (2) However, this clause does not apply to an activity that involves any of the following: ... (e) sites where only virgin excavated natural material is received from off site and applied to land, (3) The activity to which this clause applies is declared to be a scheduled activity. (4) For the purposes of this clause, 1 litre of waste is taken to weigh 1 kilogram.

Source: Schedule 1 of Protection of the Environment Operations Act 1997 No 156.

Under section 5.24(1)(e) of the EP&A Act, an EPL cannot be refused if it is necessary for carrying out an approved CSSI development.

2.4.5 Water Management Act 2000

The WM Act regulates the use and interference with surface and groundwater in NSW where a water sharing plan (WSP) has been implemented. The WM Act is principally administered by the Department of Industry - Water (DI - Water). A number of WSPs apply to the region in which the site is located, including the:

- NSW Murray-Darling Basin Fractured Rock Groundwater;
- Murrumbidgee Regulated River; and
- Murrumbidgee Unregulated and Alluvial.

The application of these WSPs will be considered and discussed in the EIS for the Exploratory Works.

Under the WM Act, where a WSP is in place, unless an exemption is available, water can only be extracted and used in accordance with:

- a water access licence (WAL) which authorises the taking of a specific number of water units (share component);
- water supply work approval which authorises the construction and use of a device by which water is extracted such as a pump, bore or well;
- water use approval which authorises the use of the water for a specific purpose;
- an activity approval which authorises the carrying out of controlled activities; and
- an activity approval for aquifer interference.

If planning approval is granted for the Exploratory Works, any water supply work approvals, water use approvals and activity approvals for controlled activities will not be required pursuant to section 5.23 of the EP&A Act. The WAL and an aquifer interference approval will still be required to be obtained.

2.4.6 Roads Act 1993

The Roads Act is administered by either Roads and Maritime Services (RMS), local government or Department of Industry - Lands (DI - Lands). The RMS has jurisdiction over major roads, local government over minor roads and DPI-Lands over Crown roads. The Roads Act also allows for other public authorities to be the authority for certain public roads. The Roads Act sets out the rights of the public in regard to access to public roads.

Within and in proximity to the Exploratory Works project area, the RMS manages the Snowy Mountains Highway. The majority of other publicly accessible roads likely to be impacted by Exploratory Works are under the jurisdiction of NPWS. The proposed upgrades to existing access roads near Tumut 3 Power Station to enable barge access infrastructure are under the jurisdiction of Snowy Valleys Council.

Under section 138 or Part 9, Division 3 of the Roads Act, a person must not undertake any works that impact on a road, including connecting a road (whether public or private) to a classified road, without approval of the relevant authority, being either RMS or local council, depending upon classification of the road.

The interaction of Exploratory Works with the local and regional road network will be addressed in the EIS. Under the provisions of the EP&A Act, an approval under section 138 or Part 9, Division 3 of the Roads Act cannot be refused if it is necessary for carrying out a CSSI authorised by a development consent (see Section 2.3.1).

2.4.7 Rural Fires Act 1997

The RF Act aims to prevent, mitigate, and suppress bush and other fires in local government areas of the State. Section 63(2) of the RF Act requires the owners of land to prevent the ignition and spread of bushfires on their land. The RF Act is administered by the NSW Rural Fire Service (RFS) and NPWS.

In proximity to the Exploratory Works, NPWS is the local authority responsible for fire management in the KNP in accordance with the RF Act (DEC 2006). As the local authority under the RF Act the NPWS has certain rights and responsibilities to undertake appropriate measures to prevent fire from entering or leaving its estate. Further, the NPWS is required to implement the provisions of bushfire management plans (NPWS 2008).

Under Section 5.23(1) of the EP&A Act, a bush fire safety authority under Section 100B of the RF Act is not required for approved CSSI.

3 Project description

3.1 Overview

Snowy 2.0 is a large scale pumped hydro-electric storage and generation project. Snowy 2.0 would increase pumped hydro-electric capacity within the Snowy Scheme by establishing a new underground hydro-electric power station that will increase the generation capacity of the Snowy Scheme by up to 50%, making 2,000 MW of generation and 350 GWh of storage available to the NEM.

Snowy 2.0 would link Tantangara and Talbingo reservoirs within the existing Snowy Scheme and does not require any new dams or increased consumption or capture of water.

This PEA has been prepared for the Exploratory Works component of Snowy 2.0, associated with exploratory tunnelling and ancillary construction activities defined further in Section 3.2 below.

The full construction and the operation of Snowy 2.0 will be subject to a separate approval process.

3.2 Exploratory Works elements

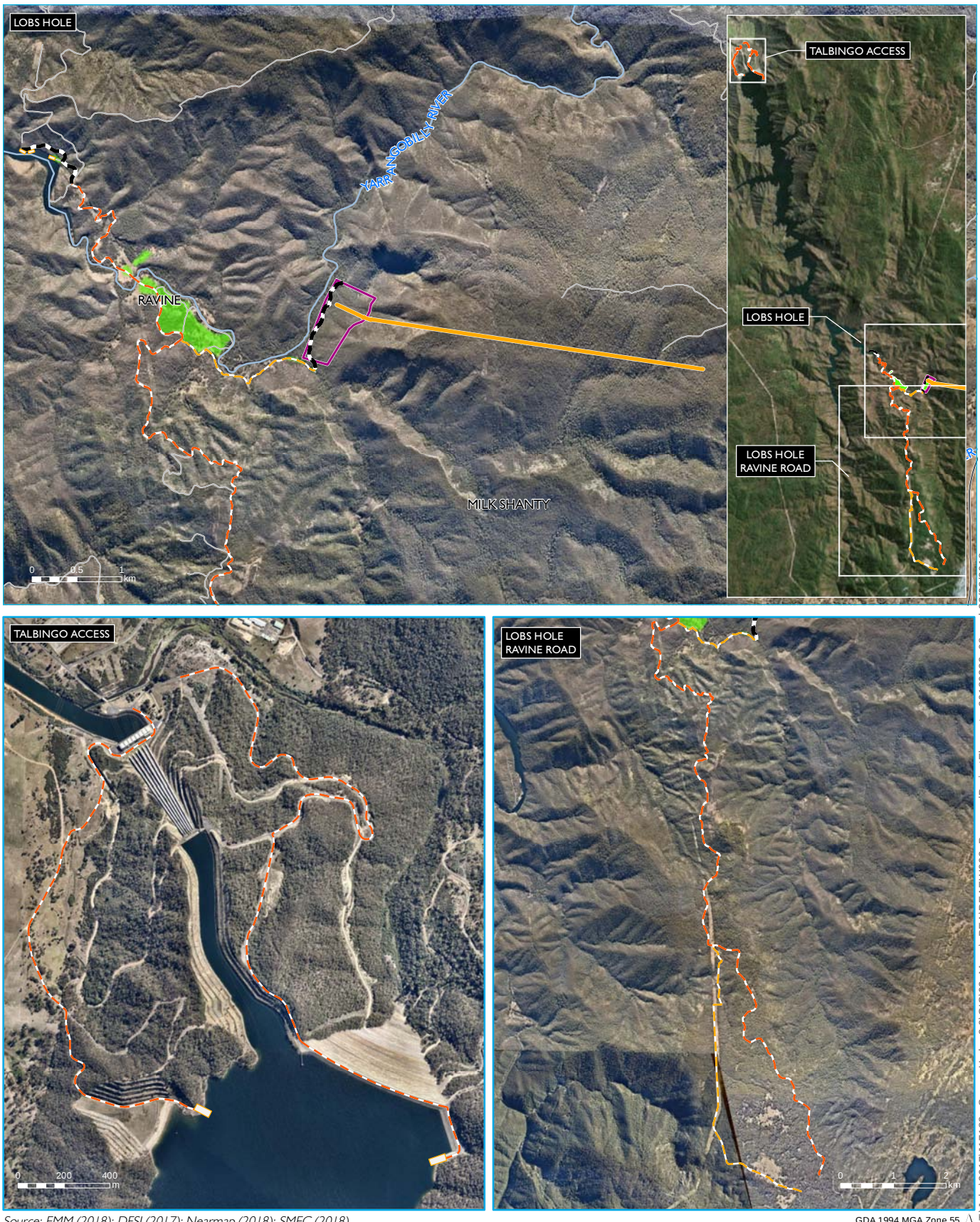
The Exploratory Works comprises construction works associated with geotechnical exploration for Snowy 2.0. As detailed in Section 1.5.2, investigations undertaken to date have identified exploratory tunnelling to the Machine Hall cavern of the underground hydro-electric power station as critical to the Snowy 2.0 project timing. The proposed Exploratory Works would involve:

- the establishment of an exploratory tunnel, construction pad and portal;
- the establishment of a construction compound and supporting infrastructure;
- road establishment and upgrades providing access to the proposed construction areas;
- establishment of barge access infrastructure on Talbingo reservoir; and
- excavated rock management.

The construction elements outlined above are detailed in Section 3.2.1 through to Section 3.2.12. A summary of the proposed construction areas is provided in Table 3.1. The locations for the proposed Exploratory Works elements are shown in Figure 3.1.

Table 3.1 Exploratory Works elements surface area

Site	Surface area (m^2)
Tunnel portal and construction pad	10,000 to 16,000
Construction compound	100,000 to 200,000
Excavated rock emplacement	100,000
Construction camp accommodation	15,000



Source: EMM (2018); DFSI (2017); Nearmap (2018); SMEC (2018)

GDA 1994 MGA Zone 55

T:\Jobs\2017\J17188 - Snowy Hydro 2.0\GIS\02_Maps_PEA\PEAEW003_ProposedProjectElements_20180323_08.mxd 23/03/2018

KEY

- Proposed road alignment
- Existing road (proposed upgrade)
- Existing track (proposed upgrade)
- Exploration tunnel and portal
- Exploration tunnel portal envelope
- Indicative wharf locations
- Indicative construction compound
- Main road
- Local road or track
- Watercourse

Exploratory works elements

Snowy 2.0
Preliminary Environmental Assessment
Exploratory Works
Figure 3.1

3.2.1 Exploratory tunnel

The exploratory tunnel would provide early access to the location of the Machine Hall cavern for the underground hydro-electric power station to enable exploratory drilling and accelerate the timeframe for construction of Snowy 2.0. These works are required to determine the optimal location of the cavern which, in turn, is required to finalise the design of Snowy 2.0.

The location of the proposed exploratory tunnel and portal is provided in Figure 3.2. The alignment and portal location presented in Figure 3.2 are indicative and may vary based on the results of further geotechnical investigations.

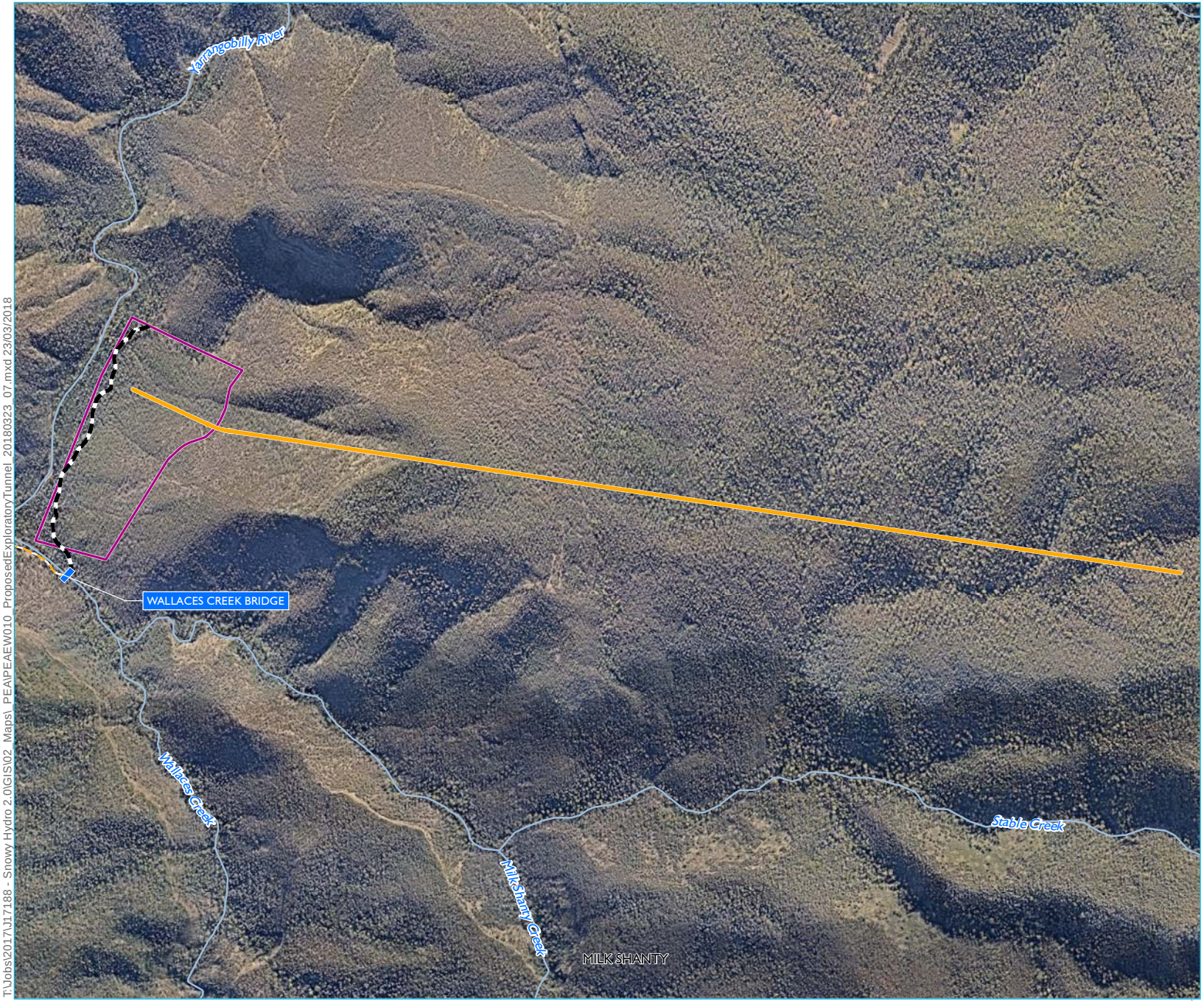
The exploratory tunnel would be excavated by drill and blast and have an 8 m by 8 m D-Shaped cross section. The exploratory tunnel would be shotcrete lined with permanent anchor support and will incorporate a groundwater management system.

The exploratory tunnel length would be between approximately 3 km and 4.4 km.

It is anticipated that the exploratory tunnel would also have multiple functions during construction of the main Snowy 2.0 project. During construction of Snowy 2.0 the exploratory tunnel would provide:

- plant, equipment and personnel access and egress;
- spoil removal;
- ventilation;
- routing of services; and
- dewatering.

The exploratory tunnel would also form the main access tunnel (MAT) to the underground hydro-electric power station during the operational phase of Snowy 2.0. It would also provide the ventilation exhaust pathway for the power station, and would be the primary access or egress in the event of an emergency.



KEY

- Exploration tunnel and portal
- Water crossing upgrade
- Indicative exploratory tunnel portal envelope

Project access routes

- Proposed road alignment
- Existing track (upgrade)

Existing environment

- Track-Vehicular
- Named watercourse

T:\Jobs\2017\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ PEA\PEAEW010 ProposedExploratoryTunnel 20180323 07.mxd 23/03/2018

Source: EMM (2018); DFSI (2017); GA (2015); LPMA (2011); Nearmap (2018)

0 0.5 1 km

GDA 1994 MGA Zone 55

N

Exploratory tunnel and indicative portal construction layout

Snowy 2.0

Preliminary Environmental Assessment

Exploratory Works

Figure 3.2

snowy2.0

EMM

3.2.2 Exploratory tunnel construction

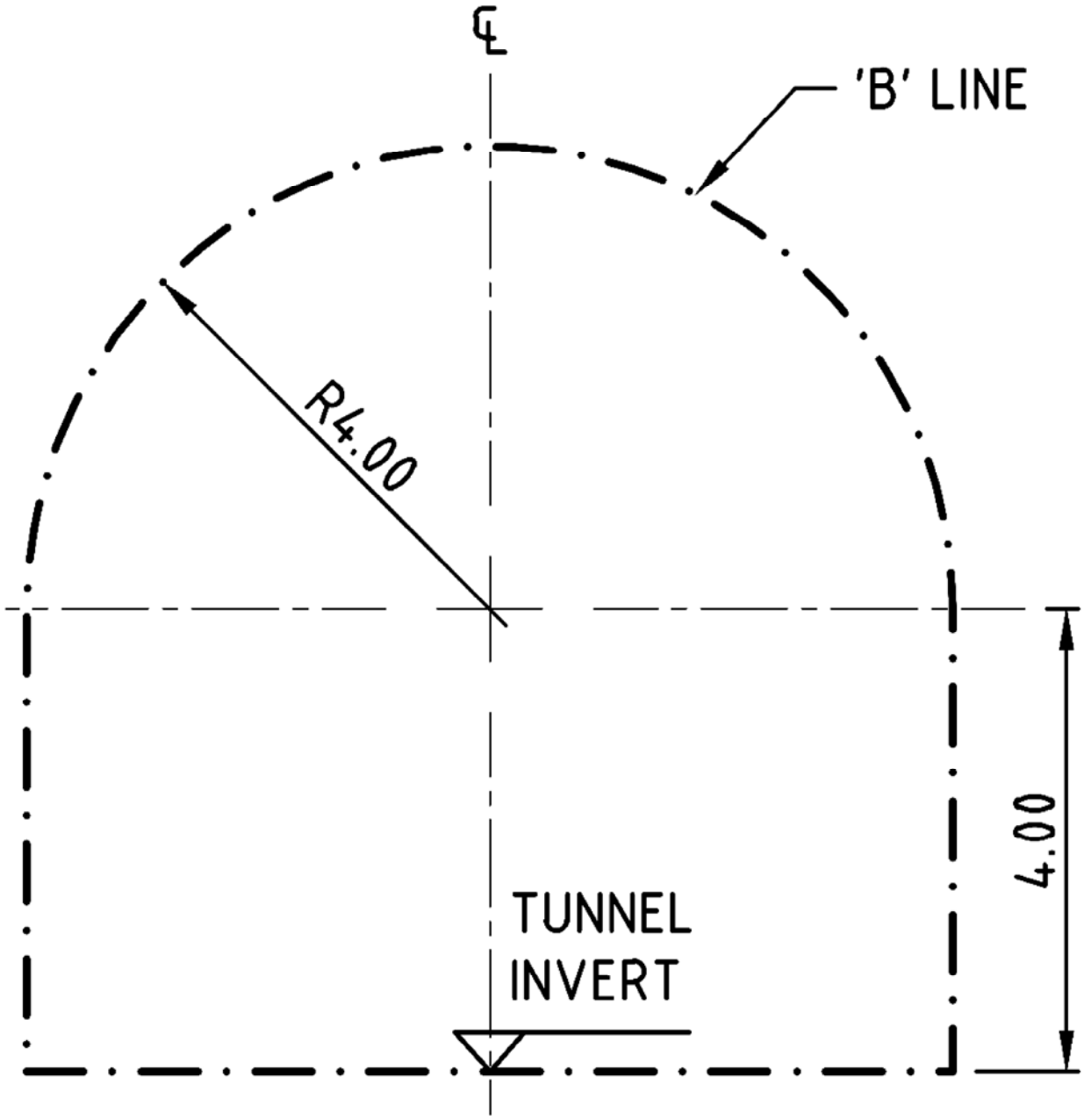
The proposed exploratory tunnel would be 'D' shaped with dimensions of 8 m x 8 m. The proposed tunnel cross-section is provided in Figure 3.3. The cross section shape and dimensions are designed to allow two-lane traffic for the removal of excavated material along with allowing space proofing for ventilation and drainage of groundwater.

The exploratory tunnel would be excavated using drill and blast methods. The drill and blast excavation process comprises the following tasks, which are repeated cyclically throughout the excavation works:

- drilling blast holes in a predetermined pattern in the working face of the tunnel;
- loading the blast holes with explosives, attachment of detonators and connection of the holes into a blast sequence;
- detonation of the blast;
- ventilation of the tunnel to remove blast fumes and dust;
- removal of blasted rock;
- scaling down of the tunnel roof and walls to remove loosened pieces of rock;
- geological mapping of the exposed rock faces and classification of the conditions to determine suitable ground support systems for installation;
- installation of ground support; and
- advancement of construction ventilation ducting and other utilities including power, water, compressed air and communications.

Groundwater intersected during tunnelling would be contained and fed to the portal for treatment and management. Areas identified during forward probing with potential high groundwater flows may require management through a detailed grouting program or similar.

The drill and blast tunnel excavation method described above is shown in Figure 3.4.



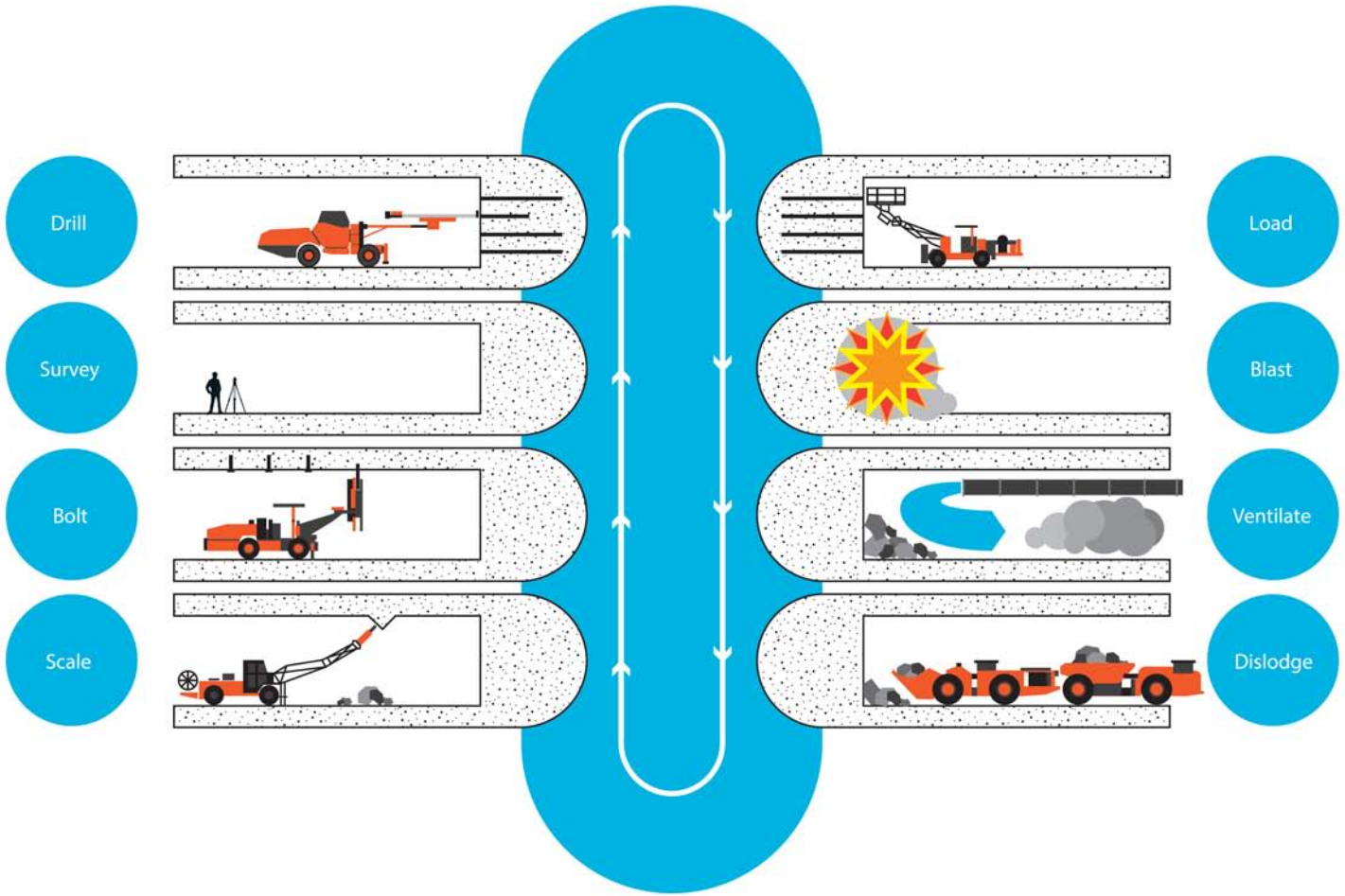
Geometric setout - drill and blast method

T:\Jobs\2017\U17188 - Snowy Hydro 2.0\GIS\02_Maps_PEA\PEAEW020_XSECT_20180314_02.mxd 14/03/2018

Source: SMEC (2018)

Exploratory tunnel cross-section

Snowy 2.0
Preliminary Environmental Assessment
Exploratory Works
Figure 3.3



Source: *http://www.railsystem.net/wp-content/uploads/2017/05/drill-and-blast-5.jpg*

Drill and blast excavation process

Snowy 2.0
Preliminary Environmental Assessment
Exploratory Works
Figure 3.4

3.2.3 Exploratory tunnel portal and construction pad

A construction pad for the exploratory tunnel would provide a secure area for construction activities. The construction pad would be excavated to provide a level construction area with a near vertical face for the construction of the portal and tunnelling. The area required is approximately 10,000 m^2 to 16,000 m^2. Within the construction pad area, the following equipment is likely to be established:

- ventilation system;
- diesel generator sets;
- air compressors;
- office huts;
- laydown area for equipment, materials and refuelling;
- workshop;
- temporary stockpile for excavated rock;
- water supply storage; and
- dirty water storage for treatment.

Indicative tunnel portal locations are presented in Figure 3.2 and may vary based on the results of further geotechnical investigations. The tunnel portal and construction pad will be sited within the portal envelope shown in Figure 3.2.

Establishment works for the construction pad and portal would consist of the activities listed below.

- Clearing of vegetation, typically using chainsaws, bulldozers and excavators.
- Levelling of a construction pad and stabilisation of areas of cut and fill, typically using bulldozers, graders, excavators and relevant support installation equipment. Drill and blast methods may be employed once excavation is beyond the weathered profile. Stabilisation systems typically comprise batters, shotcrete, soil nails, rock bolts or piling.
- Installation of tunnel headwall support including forward support systems for the first sections of tunnelling. These systems typically comprise shotcrete, rock bolts and canopy tubes.
- Excavation and support installation for the initial section of tunnel, which may comprise shallow cover and/or encounter weathered and weaker ground materials. Support systems in these areas often include steel ribs. Excavation may be undertaken by excavator, rock hammer or drill and blast.

Following excavation of the exploratory tunnel, a final portal entrance structure would be established. An example of an existing permanent portal within the Snowy scheme is shown in Photograph 3.1 below.

Photograph 3.1 Final portal entrance structure at Tumut 2 Power Station

3.2.4 Construction compound and support infrastructure

A construction compound is proposed at Lobs Hole that will provide supporting infrastructure to the exploratory tunnelling works. Areas of Lobs Hole can be seen in photographs 3.2, 3.3 and 3.4.

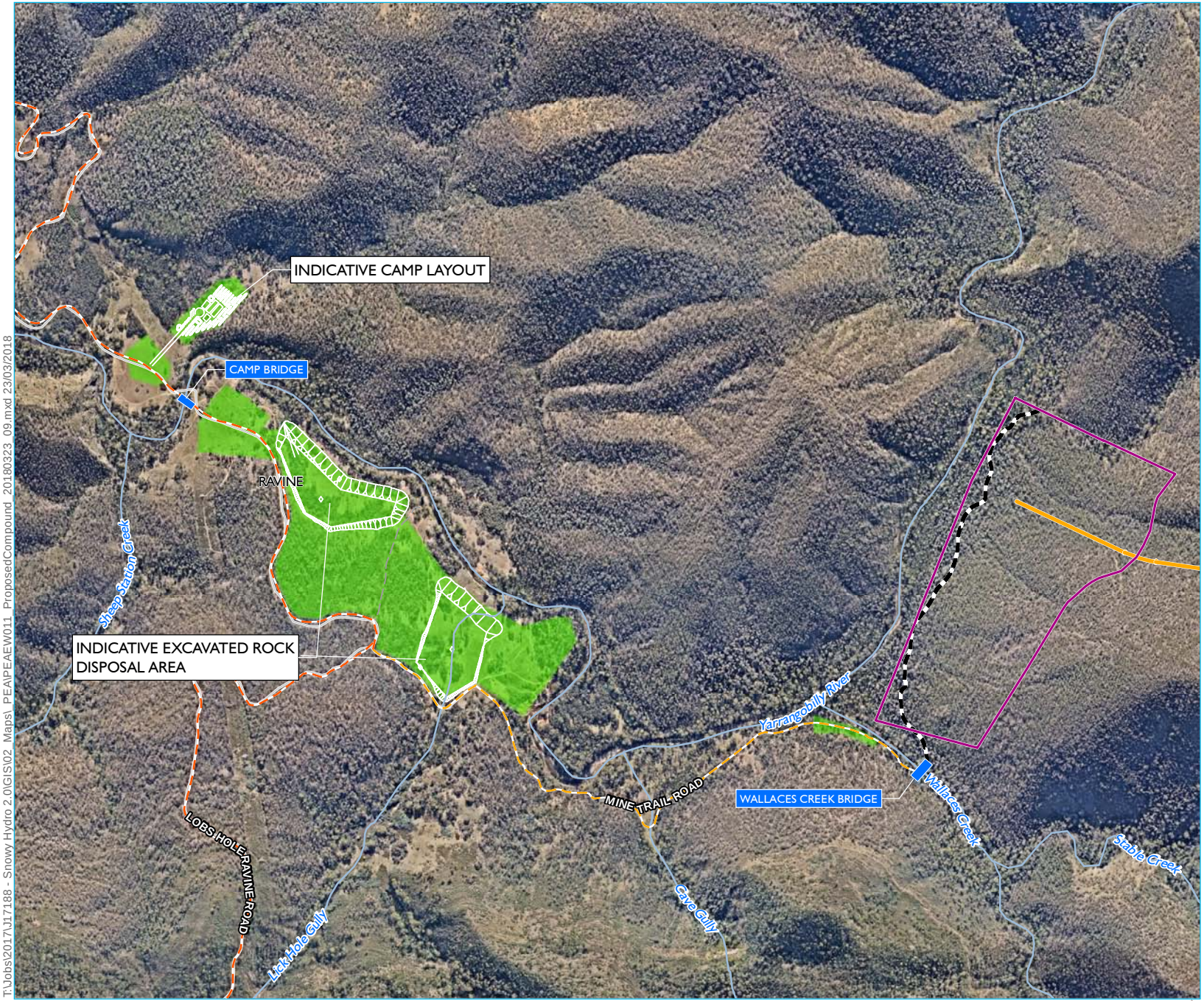
The construction compound would be up to approximately 1 km south-east of Talbingo reservoir with a footprint of approximately 300,000 m^2 inclusive of excavated rock stockpiles. An indicative footprint of the proposed construction compound is provided in Figure 3.5. Infrastructure to be established at the construction compound includes:

- accommodation camp;
- project office;
- laydown areas for equipment;
- excavated rock stockpile area;
- workshops;
- equipment including cranes, lifting equipment, forklifts and water carts;
- fuel farm and bowsers;
- magazine (explosives);
- water supply pipeline from Talbingo Reservoir;

- water discharge pipeline to Talbingo Reservoir;
- water treatment plant, or alternatively tanker unloading facility and water storage tanks;
- sewage treatment plant, or alternatively sewage storage tanks and tanker loading facility/point;
- diesel electricity generation;
- lighting;
- concrete batching plant and aggregate and sand stockpile area;
- materials testing laboratory;
- fire-fighting facility;
- first aid facilities;
- parking;
- helipad; and
- communications.

For safety reasons, public access to Lobs Hole via Lobs Hole Ravine Road would no longer be available during the Exploratory Works project.

Photograph 3.2 **Lobs Hole looking south west with Yarrangobilly River in bottom right and middle of photograph**



KEY

- Construction envelope
- Water crossing upgrades
- Exploration tunnel and portal
- Indicative exploratory tunnel portal envelope

Project access routes

- Proposed road alignment
- Existing road (proposed upgrade)
- Existing track (proposed upgrade)

Existing environment

- Local road
- Track-Vehicular
- Named watercourse

T:\Jobs\2017\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ PEA\PEAEW011 ProposedCompound 20180323 09.mxd 23/03/2018

Source: EMM (2018); DFSI (2017); GA (2015); LPMA (2011); Nearmap (2018)

0 0.5 1 km

GDA 1994 MGA Zone 55

N

Indicative construction compound footprint

Snowy 2.0
Preliminary Environmental Assessment
Exploratory Works
Figure 3.5

snowy2.0 EMM

Photograph 3.3 Lobs Hole looking south east with Yarrangobilly River in middle of photograph

Photograph 3.4 Site of former Lobs Hole Copper Mine

The approximate areas for the construction compound components are summarised in Table 3.2.

Table 3.2 Construction compound and support infrastructure approximate areas

Description	Size (m^2)
Concrete batching plant and aggregate and sand stockpile area	60,000
Excavated rock stockpile area	35,000
Laydown area, stockpile area, maintenance sheds, site offices	110,000
Excavated rock stockpile area	30,000
Office, laydown area, construction support infrastructure	25,000
Accommodation camp	10,000
Car parking for accommodation, equipment laydown	7,000

i Concrete batching plant

The concrete batching plant would be required for the exploratory tunnel lining and portal construction. It is anticipated that the stockpile area would allow for around two to three months supply of concrete aggregate and sand to the concrete batching plant to ensure that the construction schedule for the proposed access road works do not interfere with the exploratory tunnel excavation schedule.

Materials required for the concrete batching plant are likely to be sourced outside KNP and would be transported by truck. Notwithstanding this, rock excavated during the construction of the exploratory tunnel and portal would be utilised as aggregate for concrete batching if suitable.

The quantities and sources of materials and transport routes required for the concrete batching plant will be identified and assessed within the EIS.

ii Accommodation

Accommodation is required for workers within close proximity to the tunnel operations. An area of 100 m^2 per person for accommodation is planned. The proposed accommodation camp is likely to include:

- accommodation for about 50 to 100 workers;
- communal facilities (laundry, mess hall etc);
- sewage treatment plant or holding tanks (note only one sewage treatment and water treatment are expected between camp, offices and portal);
- water treatment plant, or trucking of water (note only one water treatment facility is expected between camp, offices and portal);
- first aid facilities; and
- parking facilities.

iii Site establishment

In general, once the proposed construction areas have been secured safely, the following activities would be undertaken for site establishment:

- identify and flag areas that are constrained and not to be disturbed during the Exploratory Works period;
- commence clearing of trees and vegetation in areas required as per layout;
- undertake any necessary earthworks to create a suitably flat area for the establishment of the construction compound. This will involve a 'cut and fill' approach to minimise the requirement for imported material; and
- surface finishing will be undertaken, compacting only existing material where possible, or importing additional material. Where suitable, this material would be sourced from other construction activities associated with the Exploratory Works (eg from upgrade works to Lobs Hole Ravine Road).

In areas that are closer to waterways or are at a heightened risk of flooding, imported material may be required to ensure there is a sufficient level so as to prevent inundation. This would be investigated and further details provided within the EIS.

3.2.5 Excavated rock management

It is estimated that approximately 500,000 m^3 to 750,000 m^3 of bulked rock and soil volume would be excavated during the Exploratory Works. Excavated rock from the tunnel excavation, and minor surplus rock from the road upgrades are expected to be temporarily stored in the construction compound area. Final excavated rock placement and management would be determined following the investigations being conducted for Snowy 2.0 (see below).

In the short-term, where suitable, excavated rock would be:

- stored on-site temporarily;
- re-used as construction material (ie aggregate);
- re-used by NPWS for roads; or
- placed within existing degraded areas and gullies within Lobs Hole.

Excavated rock would be compacted on placement and runoff and drainage controls installed. It is likely that placement would require stripping of topsoil (if any) and installation of a barrier such as a geofabric that will assist in the control of surface water runoff.

The locations for the temporary storage of excavated rock within the construction compound can be seen in Figure 3.5.

The long term options under consideration for rock excavated and temporarily stored as part of Exploratory Works include:

- sub-aqueous placement within Tantangara and Talbingo reservoirs;
- land-based disposal off-site outside of the KNP;
- use as construction material for the Snowy 2.0 main works (ie aggregate); and/or
- stockpiling for re-use by NPWS for road establishment and maintenance.

3.2.6 Site access

The access strategy for the Exploratory Works is to implement the minimum upgrades and improvements necessary to facilitate the safe movement of plant, equipment, materials and construction staff to the construction compound and exploratory tunnel. Road improvements and barge access infrastructure are required.

Currently the only suitable access to the construction compound and exploratory tunnel is via Lobs Hole Ravine Road and Mine Trail Road. These roads are single lane 4WD tracks with some steep gradients and varying widths between 3 m and 5 m. It is possible for vehicles to pass (with care) at most locations, however sight distance is limited and travel speeds are very slow. This presents a significant safety hazard for two way traffic and would be unacceptable for the movement of construction staff, equipment and materials required for construction purposes.

Road access is important for movement of construction personnel, light equipment and for emergency services, however may be restrictive for heavy equipment and access could be compromised in winter, in the case of an accident or if the road is blocked.

To provide an alternative to road access, a barge option is required, not only for bulky and heavy equipments but also in case of emergency. Access from Talbingo Reservoir via a wharf or ramp near the dam wall to Lobs Hole via a ramp or wharf at Middle Bay with roll on roll off barges is expected to be required.

Exploratory Works site access works would include:

- minor upgrades to Lobs Hole Ravine Road;
- potential upgrade of the intersection of Lobs Hole Ravine Road with Link Road;
- construct a new bridge across Wallaces Creek (Wallaces Creek Bridge);
- establish new road (Main Access Road) from Wallaces Creek Bridge to the exploratory tunnel;
- replacement bridge across Yarrangobilly River (Camp Bridge);
- upgrade to Mine Trail Road;
- construct new wharf at Middle Bay (Middle Bay Wharf);
- construct new wharf at Talbingo Reservoir near dam wall (Talbingo Dam Wall Wharf); and
- establish new road access to Middle Bay Wharf.

It should be noted that the maintenance and associated environmental control activities (ie weed control) for these site access establishment and upgrades would be the responsibility of Snowy Hydro.

3.2.7 Access road establishment and upgrades

The proposed access road upgrades and construction would be designed based on access for a truck and dog trailer. Road upgrades would be required for Lobs Hole Ravine Road and Mine Trail Road. A new road would be required from Lobs Hole Ravine Road to Middle Bay Wharf. The proposed road works can be split into the sections described below.

1. Upper Lobs Hole Ravine Road upgrade - Upgrade to an approximate 7.5 km section of existing flat to undulating track. Due to identified environmental constraints within the surrounding vegetation of this section of road, only minor upgrades are proposed. A laydown area at approximately 6.5 km may also be required. A separate access road avoiding these identified constraints is also proposed and is discussed further in Section 3.2.7 (i) below. The location of the upper Lobs Hole Ravine Road upgrade is provided in Figure 3.6.

2. Lower Lobs Hole Ravine Road upgrade - Upgrade to an approximate 6 km section of existing road. Due to the steep terrain in this section of the road, only minor corrections to the alignment would be possible without significant earthworks. Ideally this section of road would be upgraded for two way traffic, however due to the steep terrain and challenging geological features (basalt boulder fields in several locations) upgrading to two lanes will take an extended period of time, up to 18 months, and would delay access to the exploratory tunnel.

   As such, it is proposed that this section is upgraded to allow single lane access as a minimum for construction traffic only. Road works would include maintaining drainage lines, minor road widening, gravel pavement overlay, installation of guideposts and snow poles above the snow line. The location of the lower Lobs Hole Ravine Road upgrade is provided in Figure 3.6.

3. Lobs Hole Ravine Road upgrade at construction compound - Upgrade to an approximate 1.2 km section of existing road to the intersection with Mine Trail Road. This section of track could be upgraded to two way traffic and provide a storage area for vehicles waiting for the one way section of track to become available. Road works will include, culvert and drainage, road widening, retaining walls, gravel pavement overlay, installation of guideposts and guard fence. The location of the Lobs Hole Ravine upgrade at the construction compound is provided in Figure 3.6.

4. Mine Trail Road upgrade - Upgrade to an approximate 2.2 km section of existing single lane road. Road works would include a major culvert or bridge over Stable Creek, installation of several culverts, drainage channels and outlet protection works, road widening, gravel pavement, installation of guideposts and guard fence. The location of the Mine Trail Road upgrade is provided in Figure 3.6.

5. Mine Trail Road extension – Establishment of a new approximate 1 km road section to the exploratory tunnel and portal. Road works would include clearing and grubbing, installation of several culverts, drainage channels and outlet protection works, road construction, gravel pavement, installation of guideposts and guard fence. The location of the Mine Trail Road extension is provided in Figure 3.6.

6. Middle Bay Wharf access road – establishment of a new approximate 950 m road to the proposed Middle Bay Wharf. Road works would include clearing and grubbing, installation of several culverts, drainage channels and outlet protection works, road construction, gravel pavement, installation of guideposts and guard fence. Further details of the Middle Bay Wharf access are provided in Section 3.2.8.

7. Talbingo Reservoir access roads - Potential launch sites at the Talbingo Reservoir dam wall (ie Talbingo Dam Wall Wharf) are accessible via existing roads. To transport large equipment and plant to these launch sites, minor upgrade works may be required to the access roads south of Tumut 3 Power Station as shown on Figure 3.7. Further details regarding barge access are provided in Section 3.2.8.

i Upper Lobs Hole Ravine Road alternative alignment

The widening of the upper section of Lobs Hole Ravine Road is constrained due to the presence of threatened fauna species. While not preferred, a separate access road to avoid these environmental constraints is proposed and bypasses this upper section of Lobs Hole Ravine Road.

The road utilises an existing fire trail that connects Link Road to a transmission line running from the Upper Tumut Switchyard (near Cabramurra) north via Lobs Hole. The road would then run parallel along the transmission easement, before joining a short section of Dead Mans Fire Trail before connecting again to Lobs Hole Ravine Road. The location of the proposed alternative alignment is provided in Figure 3.6.

The total distance of this road alignment is approximately 7 km of which approximately half is along the existing transmission easement track.

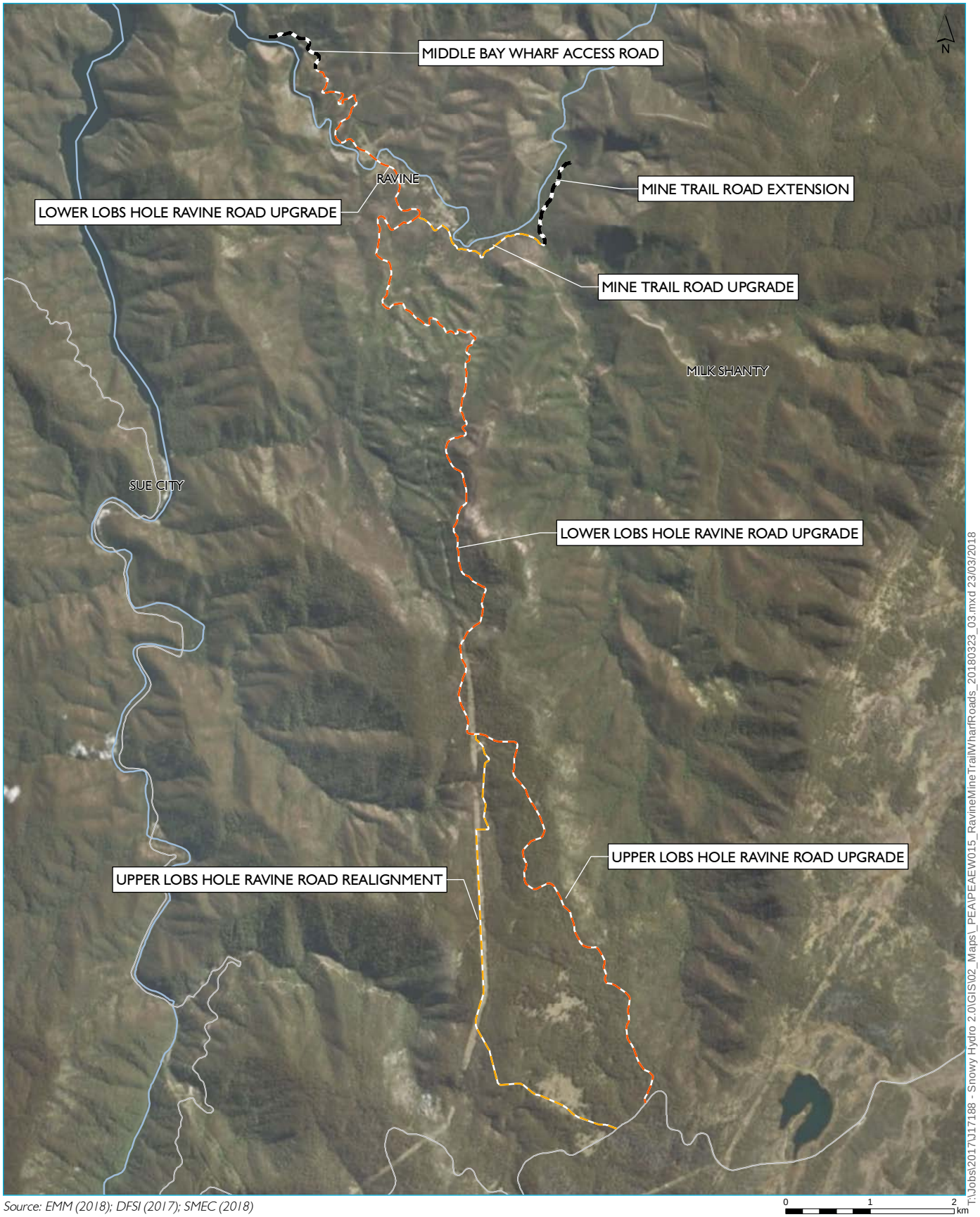
This road could also be used in conjunction with the existing Lobs Hole Ravine Road, providing one entry road and one exit road, therefore requiring only single lane traffic on each road to minimise earthworks and vegetation clearing required.

Road works would include clearing and grubbing, installation of drainage channels, road construction, gravel pavement and installation of guideposts. Snowy Hydro will engage with TransGrid regarding the feasibility of utilising the easement to facilitate access to Lobs Hole for Exploratory Works.

ii Bridge design

Bridge construction would be required at two locations for the Exploratory Works. One new bridge (Wallaces Creek Bridge) is proposed at Wallaces Creek as shown in Figure 3.7. One bridge upgrade (Camp Bridge) is proposed across the Yarrangobilly River at the construction compound as detailed in Figure 3.5.

The bridge design consists of steel girders with composite deck as this is the most common type of permanent bridge constructed in and around the existing Snowy Scheme. The use of lightweight steel girders would speed up construction, are easy to transport and would permit the use of smaller-scale lifting equipment at the construction site. The bridge design would seek to minimise ground disturbance as much as possible.



Source: EMM (2018); DFSI (2017); SMEC (2018)

0 1 2 km

GDA 1994 MGA Zone 55

T:\Jobs\2017\J17188 - Snowy Hydro 2.0\GIS\02_Maps_PEA\PEAEW015_RavineMineTrailWharfRoads_20180323_03.mxd 23/03/2018

KEY

- Proposed road alignment
- Existing road (proposed upgrade)
- Existing track (proposed upgrade)
- Local road or track
- Watercourse

Access road upgrades and Lobs Hole Ravine Road realignment option

Snowy 2.0
Preliminary Environmental Assessment
Exploratory Works
Figure 3.6

3.2.8 Barge access

The barging of plant and equipment on Talbingo Reservoir from the dam wall to Lobs Hole is also proposed. Barge access is required to provide a pathway to deliver major pieces of plant and equipment for construction and supplies to site.

Potential launch sites at the Talbingo Reservoir dam wall (ie Talbingo Dam Wall Wharf) include a wharf on the eastern side of the dam and the shoreline at the spillway on the western side of the reservoir. Both locations are accessible via existing roads. Further investigations need to be undertaken regarding dam safety and risk with respect to transporting large equipment and plant to determine a preferred option and any works required to upgrade or stabilise the access roads and loading areas. The proposed launch sites are shown in Figure 3.7.

The proposed unloading site at the southern end of Talbingo Reservoir would be a wharf at Middle Bay (ie Middle Bay Wharf), near Lobs Hole. The location of Middle Bay Wharf can be seen in photographs 3.5 and 3.6. The proposed location for the wharf and unloading site is provided in Figure 3.7. It is likely that public access to parts of Talbingo Reservoir would be restricted during barge activities associated with the Exploratory Works.

Photograph 3.5 Middle Bay looking east with proposed wharf in middle and left of photograph

Photograph 3.6 Middle Bay looking west with proposed wharf in middle of photograph

i Wharf design

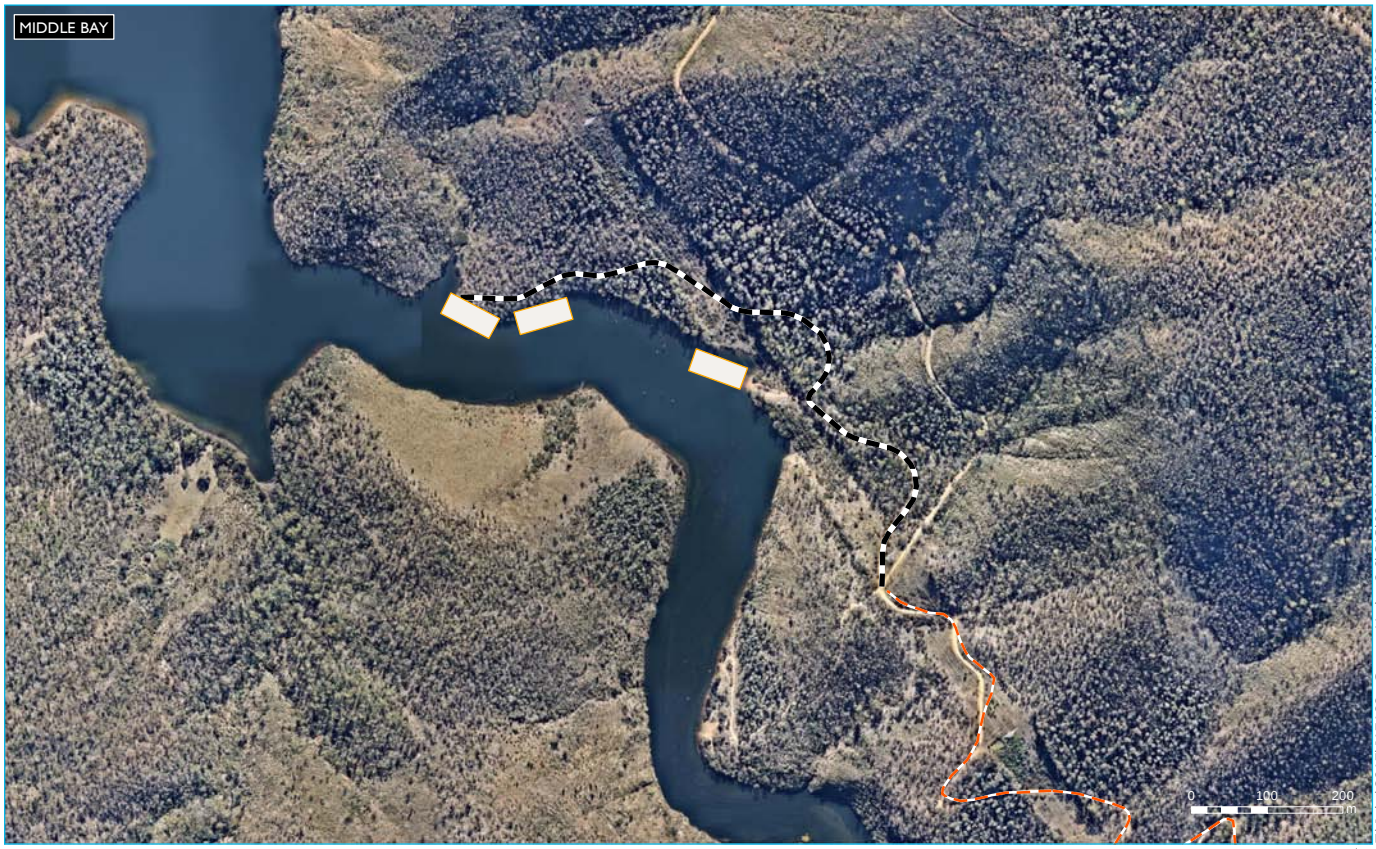
A new wharf (Middle Bay Wharf) is proposed at Middle Bay shown in Figure 3.7 due to the preference for a long term structure that would support full construction of Snowy 2.0. It is expected that the barge delivery would be most suited to the large pieces of equipment. These include several drilling jumbos, haul trucks (moxy) and large excavators for portal construction and establishment of work sites. Additionally, materials including cement, aggregates, sand and steel could be delivered by barge.

The challenge for the design of the Middle Bay Wharf is that the water level in Talbingo Reservoir can fluctuate 9 m between Minimum Operating Level (MOL) and Full Supply Level (FSL), to allow for the full range of operation out of Tumut 3 Power Station. This means that the wharf and barge would need to be designed to operate for the full 9 m level difference.

The wharf structure is likely to be constructed using piers, with the wharf floating depending on the level of the reservoir. It is possible that minor dredging works may be required to achieve an appropriate level for the barge to unload adjacent to the wharf.

3.2.9 Transport of equipment and materials to site

Due to the location, it is expected that the majority of materials and equipment would travel along the Snowy Mountains Highway and down Lobs Hole Ravine Road, with some required to travel via Talbingo to the Talbingo Dam Wall Wharf and be transferred via a barge to site.



Source: EMM (2018); DFSI (2017); Nearmap (2018); SMEC (2018)

GDA 1994 MGA Zone 55

N

T:\Jobs\2017\117188 - Snowy Hydro 2.0\GIS\02_Maps_PEA\PEAEW016_Barge_20180323_03.mxd 23/03/2018

KEY

- Indicative wharf locations
- Proposed road alignment
- Existing road (proposed upgrade)
- Watercourse

Barge access and wharf infrastructure

Snowy 2.0

Preliminary Environmental Assessment

Early Works

Figure 3.7

3.2.10 Communication infrastructure

Communication infrastructure servicing the Exploratory Works would be provided by fibre optic link. The fibre optic service would involve a submarine cable from Tumut 3 Power Station to Middle Bay in Talbingo Reservoir at the proposed wharf location and then via a buried conduit to Lobs Hole and the exploratory tunnel and portal.

3.2.11 Workforce details

It is currently expected that a workforce for the Exploratory Works would be approximately 50 to 100 people. These workers would be accommodated within the accommodation camp within the construction compound.

It is expected that the majority of workers would fly in and out of either Cooma Airport or Canberra Airport and then travel to site via either car or bus.

3.2.12 Construction schedule

Exploratory Works are expected to be completed within 18 to 30 months. Road and access works are expected to be completed within the first six months from commencement.

It is expected that construction would take place 24 hours a day, seven days a week for the tunnelling operations and 12 hours a day, seven days a week for access works.

3.2.13 Rehabilitation

All Exploratory Works align with components of the main works for Snowy 2.0. Should Snowy 2.0 not be approved or not progress, the Exploratory Works project area would need to be rehabilitated. Anticipated rehabilitation activities are summarised in Table 3.3.

Table 3.3 Planned rehabilitation activities

Exploratory Works element	Rehabilitation
Road access works	No remediation required as works are to be designed to be permanent.
Barge access infrastructure	No remediation works required as wharf and loading ramps are designed as permanent. Wharf can be removed if desired.
Construction camp	To be demobilised and all infrastructure removed. Site to be revegetated and returned to 'original state'.
Construction infrastructure	To be demobilised and all infrastructure removed. Site to be revegetated and returned to 'original state'.
Portal area	Permanent portal facade to be constructed, portal to be sealed from entry.
Exploratory tunnel	Tunnel to remain open, and allowed to flood in lower portion provided groundwater impacts are negated.

4 Stakeholder engagement and consultation

Snowy Hydro is committed to continuing to engage with stakeholders during the approval process for Snowy 2.0 including during the preparation of the EIS for the Exploratory Works. Stakeholder groups with an interest in the project include:

- nearby towns, townships and communities including Tumut, Adaminaby, Talbingo, Cabramurra and Cooma;
- NPWS as owners and managers of the KNP;
- State and Commonwealth government agencies, including DPE, DEE, OEH, DI - Water, RMS and EPA;
- local government including Snowy Monaro Regional Council and Snowy Valleys Council;
- Aboriginal groups;
- recreational park users;
- environmental groups;
- irrigators;
- chambers of commerce and community groups;
- tourism operators;
- the general public; and
- media.

Stakeholder engagement commenced with the introduction of Snowy 2.0 to all stakeholders in mid to late 2017 including provision of information on Snowy Hydro's website, publication of newsletters, a round of community drop-in sessions held in Adaminaby, Cooma, Talbingo and Tumut in November 2017, briefing sessions and meetings.

Stakeholder consultation will continue on both the Exploratory Works and Snowy 2.0 in general and a range of formal and informal stakeholder engagement tools will be used according to the particular needs of individual stakeholders. These will include phone calls, briefing sessions, meetings, community or drop-in sessions, newsletters and targeted stakeholder surveys. Information will continue to be made available on Snowy Hydro's website and will be regularly updated.

Outcomes of engagement activities will be addressed in the EIS for Exploratory Works.

5 Preliminary environmental impact assessment

5.1 Issues identification

The definition of environment within the EP&A Act was adopted for this chapter. The EP&A Act states that environment includes all aspects of the surroundings of humans, whether affecting any human as an individual or in his or her social groupings. This include natural environmental, cultural and socio-economic aspects.

Identification of environmental risks commenced in September 2017, with a preliminary environmental risk identification workshop held at Snowy Hydro's Cooma office on 12 September 2017, attended by representatives from Snowy Hydro and technical specialists. Following this initial workshop, detailed environmental investigations commenced for Snowy 2.0 and the Exploratory Works.

Further risk identification continued through a series of workshops held over the following months in parallel with the design process. The purpose of these workshops was to identify the potential environmental, social, economic and cultural risks and aspects associated with Snowy 2.0, including the Exploratory Works. Information collected from the investigations regarding social and environmental opportunities and constraints were incorporated into these workshops.

This iterative process to develop the design and construction methods for the Exploratory Works was undertaken with the underpinning principles of avoiding and minimising environmental impacts where possible. The potential environmental impacts identified during this process for the Exploratory Works are summarised in this section.

5.2 Natural environmental values

5.2.1 Terrestrial ecology

i Existing environment

The biodiversity values of the subalpine and montane areas in the Exploratory Works project area are unique, and support unique species and vegetation communities. The seasonal presence of snow sets the Australian Alps apart from most other places on mainland Australia. Beyond this, the Alps contain unusual assemblages of plants and animals, many of which are endemic to the Snowy mountains (DEC 2006).

The alpine and subalpine flora of the park is significant due to its diversity and uniqueness. The fauna of the KNP is also significant due to its diversity in relation to reptiles at high altitudes, and the number of cold-climate species of the alpine and subalpine areas. Other significant biodiversity features include the upper slope and inverted treelines and associated subalpine treeless flats and valleys, and changes in elevation resulting in different and unique flora and fauna assemblages across the project area.

Preliminary and detailed survey work has been undertaken, including detailed plant community type mapping targeted flora and fauna surveys. These surveys have identified the presence of one threatened ecological community within the broader project area; Montane Peatlands and Swamps of the New England Tableland, NSW North Coast, Sydney Basin, South East Corner, South Eastern Highlands and Australian Alps bioregions, listed as an endangered ecological community under the BC Act, and Alpine Sphagnum Bogs and Associated Fens, listed as an endangered ecological community under the EPBC Act. The results of the vegetation surveys undertaken to date are shown in Figure 5.1.

Several threatened fauna species listed under the BC Act and EPBC Act have also been identified in the Exploratory Works project area, including the Smoky Mouse (*Pseudomys fumeus*), Eastern Pygmy-possum (C*ercartetus nanus*), Broad-toothed Rat (*Mastacomus fuscus*), Boorolong Frog (*Litoria booroolongensis*) and Alpine She-oak Skink (*Cyclodomorphus praealtus*). No threatened flora species have been recorded within the Exploratory Works project area.

Known threatened fauna records in proximity to the Exploratory Works project area are shown in Figure 5.2.

ii Assessment approach

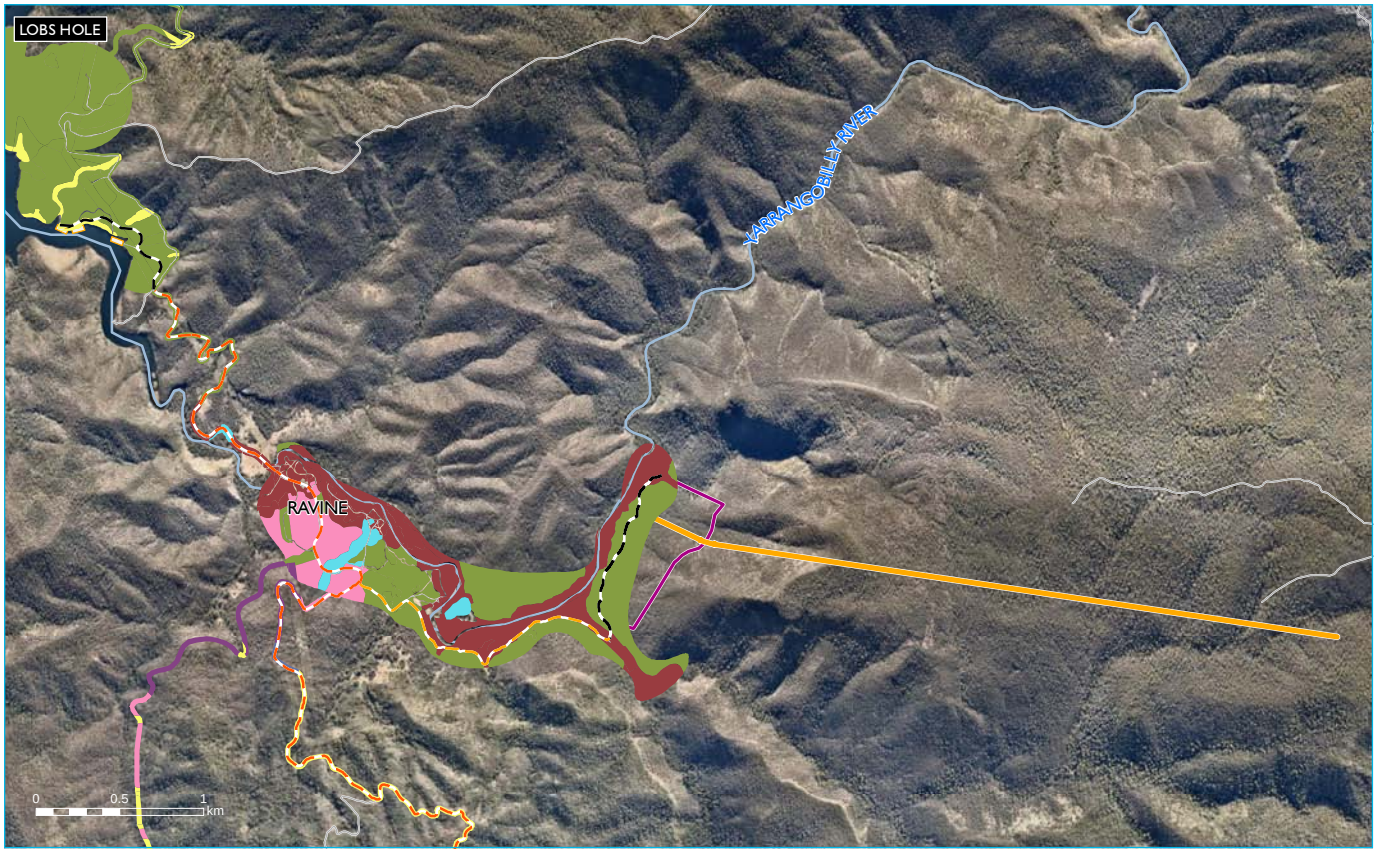
Preliminary desktop reviews identified that there is potential for activities associated with the Exploratory Works to impact on flora and fauna, including threatened species, populations and communities under both NSW and Commonwealth legislation. Vegetation clearance for the establishment of the exploratory tunnel construction pad, construction camp and supporting infrastructure may result in localised impacts and habitat loss.

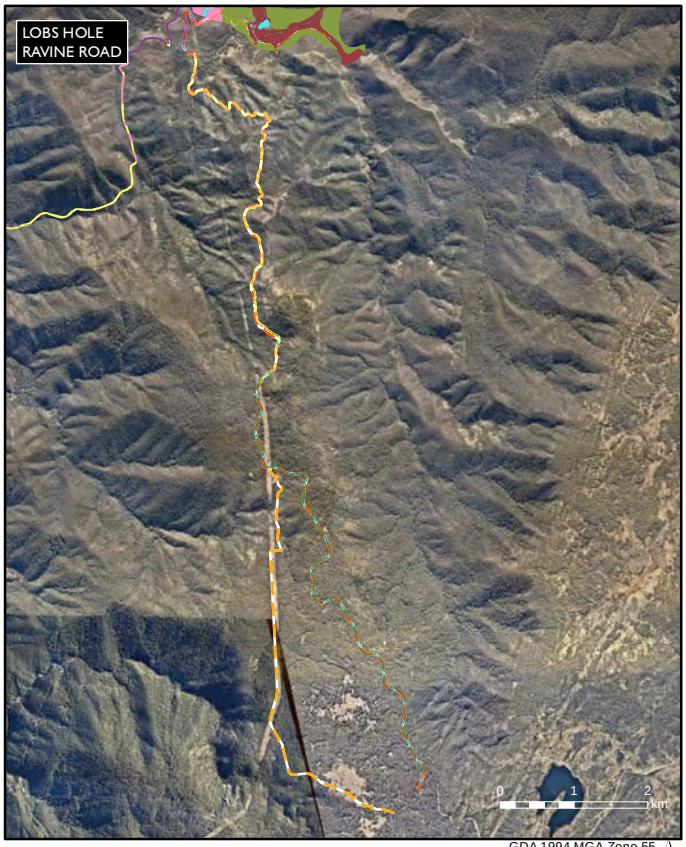
Additionally, the introduction and or spread of weeds and other invasive species into the existing environment, including the potential spread of weeds due to construction traffic along access tracks to the construction compound and exploratory tunnel and portal.

While there is scope to avoid impacts on NSW and Commonwealth listed species and communities as part of the design process and option evaluation process, ecological related impacts are considered a key matter for ongoing assessments, due to the location of the Exploratory Works largely within the KNP and its inherent conservation and ecological values.

Further assessments undertaken for the EIS will identify potential impacts that may occur during construction associated with Exploratory Works. Excavated rock emplacement and access road activities will be considered to ensure direct impacts on terrestrial ecology are mitigated as much as possible. Potential impacts to terrestrial ecology will be assessed according to the relevant NSW and Commonwealth legislation and guidelines, including:

- *Commonwealth EPBC 1.1 Significant Impact Guidelines – Matters of National Environmental Significance* (Commonwealth of Australia 2013);
- Commonwealth Department of the Environment – survey guidelines for nationally threatened species (various);
- BAM (OEH 2017);
- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC 2004);
- *Threatened species survey and assessment guidelines: field survey methods for fauna – Amphibians* (DECC 2009); and
- *NSW Guide to Surveying Threatened Plants* (OEH 2016).





T:\Jobs\2017\J17188 - Snowy Hydro 2.0\GIS\02_Maps_PEA\PEAEW018_Vegetation_20180323_04.mxd 23/03/2018

GDA 1994 MGA Zone 55

N

KEY

Vegetation survey (EMM, 2018)

- 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 999 - Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion
- PCT 302 - Riparian Blakely's Red Gum - Broad-leaved Sally woodland - tea-tree - bottlebrush - wattle shrubland wetland of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion
- PCT 311 - Red Stringybark - Broad-leaved Peppermint - Nortons Box heath open forest of the upper slopes subregion in the NSW South Western Slopes Bioregion and adjoining South Eastern Highlands Bioregion
- PCT 729 - Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion

- Proposed road alignment
- Existing road (proposed upgrade)
- Existing track (proposed upgrade)
- Exploration tunnel and portal
- Exploration tunnel portal envelope
- Indicative wharf locations
- Local road or track
- Watercourse

Biodiversity - vegetation survey

Snowy 2.0

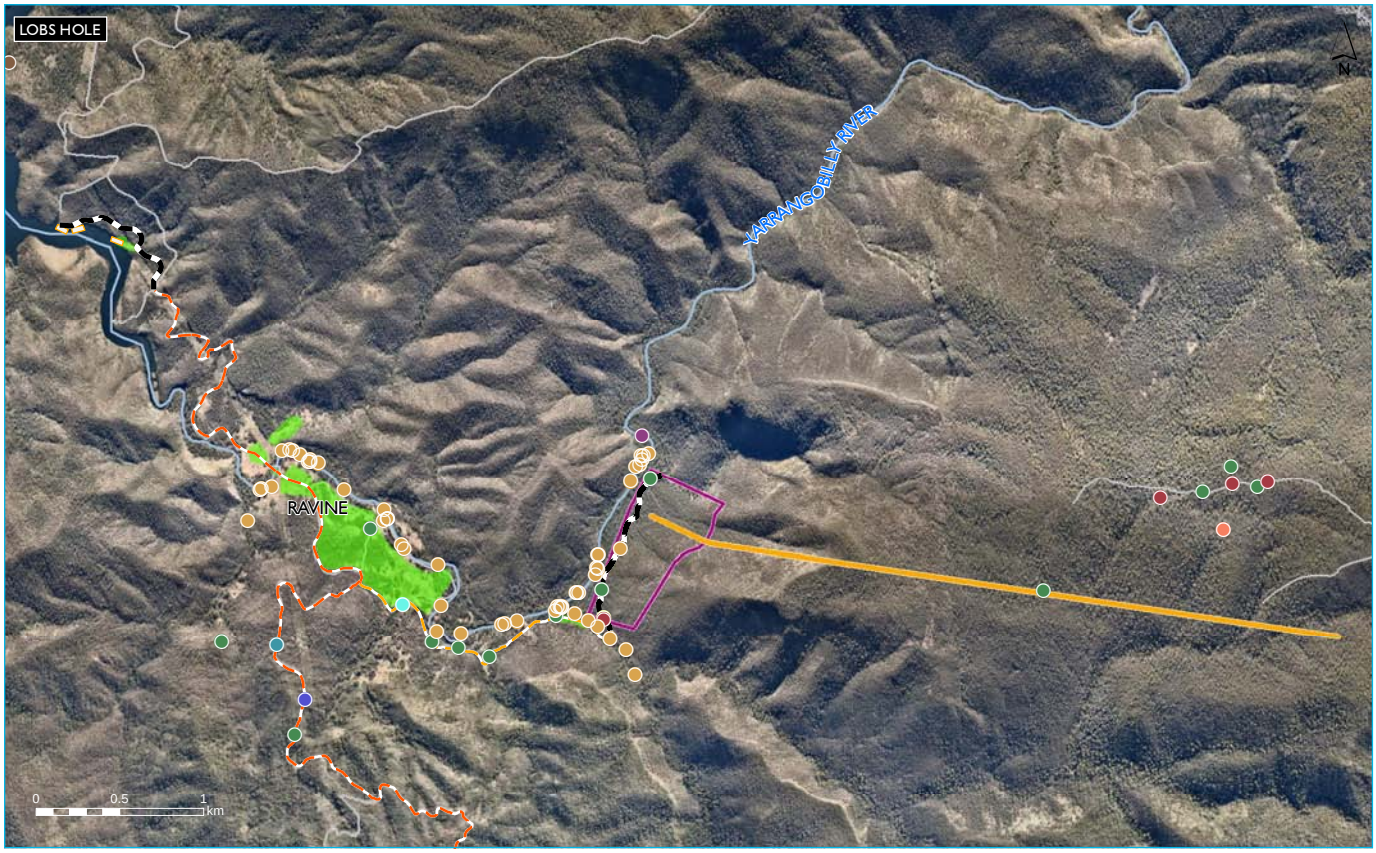
Preliminary Environmental Assessment

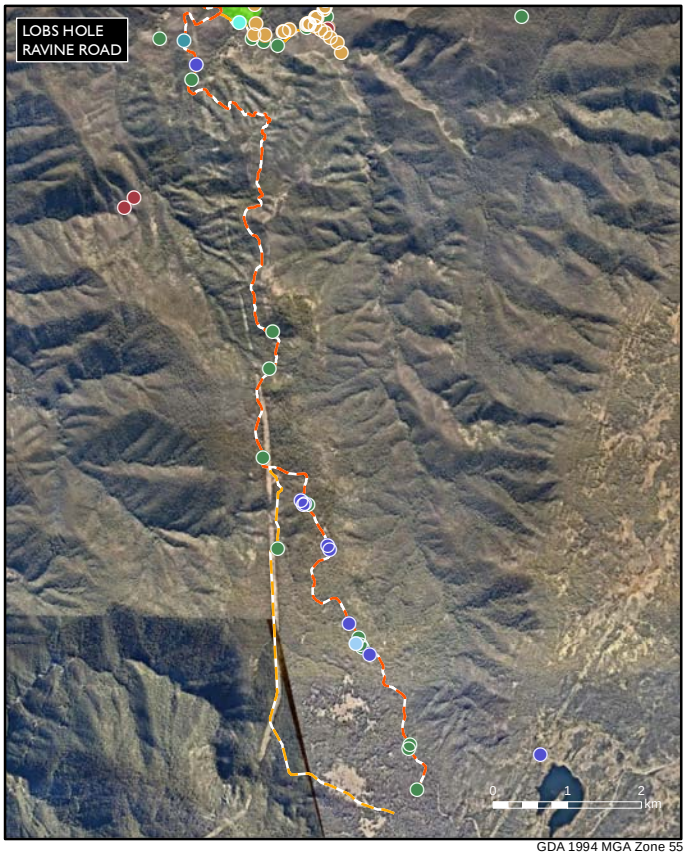
Exploratory Works

Figure 5.1

snowy 2.0

EMM





T:\Jobs\2017\J17188 - Snowy Hydro 2.0\GIS\02_Maps_PEA\PEAEW017_Fauna_20180325_04.mxd 23/03/2018

GDA 1994 MGA Zone 55

Source: EMM (2018); DFSI (2017); Nearmap (2018); SMEC (2018)

KEY

Threatened fauna (EMM, 2018)

- Booroolong Frog
- Diamond Firetail
- Eastern Pygmy-possum
- Flame Robin
- Gang-gang Cockatoo
- Murray Crayfish
- Rainbow Bee-eater
- Satin Flycatcher
- Scarlet Robin
- Smoky Mouse
- Varied Sittella

- Proposed road alignment
- Existing road (proposed upgrade)
- Existing track (proposed upgrade)
- Indicative wharf locations
- Exploration tunnel and portal
- Exploration tunnel portal envelope
- Indicative construction compound
- Local road or track
- Watercourse

Biodiversity - threatened fauna

Snowy 2.0
Preliminary Environmental Assessment
Exploratory Works
Figure 5.2

5.2.2 Aquatic ecology

i Existing environment

As previously discussed, the alpine areas and supporting species of the KNP are unique in mainland Australia. Similarly the alpine rivers of the KNP are significant as they form a very small percentage of all running waters in Australia.

The Exploratory Works is within the catchment of the Murrumbidgee River and in proximity to Talbingo Reservoir, Yarrangobilly River, Stable Creek, Wallaces Creek, Cave Gully and two unnamed first order water courses.

The rivers and creeks in KNP support several native and non-native species of fish. Native species would include eels (*Anguilla* sp.) and species of galaxiids (Family Galaxiidae) and gudgeons (Family Eleotridae) and possibly also threatened fish species listed under State and Commonwealth legislation, such as Macquarie perch (*Macquaria australasic*a) and Murray cod (*Maccullochella peelii*). Several non-native species including species of trout (Family Salmonidae) and redfin perch (*Perca fluviatilis*) have been introduced to the rivers in the region (NPWS 1988).

Initial fish surveys have been undertaken in Talbingo Reservoir and in the Yarrangobilly River and Wallaces Creek. Exotic Brown trout (*Salmo trutta*) and Rainbow trout were found in the Yarrangobilly River and Wallaces Creek. Redfin perch (*Perca fluviatilis*), a non-native species, listed as noxious under the FM Act, was found throughout Talbingo Reservoir and in Wallaces Creek. The abundance of these species, which are known to predate on native species, suggests an overall poor condition of fish fauna in these watercourses. Eastern gambusia (*Gambusia holbrooki*), a non-native species known to predate on frog eggs and tadpoles, was also found in Talbingo Reservoir though in far lower abundance than redfin perch.

Juveniles from the *Galaxias olidus* complex of species were found in the Yarrangobilly River. Murray crayfish (*Euastacus armatus*), listed as vulnerable under the FM Act was found in Wallaces Creek and in the Yarrangobilly River just upstream of the Talbingo Reservoir full supply level.

ii Assessment approach

Construction activities in proximity to Talbingo Reservoir and watercourses have potential to impact on aquatic species, including threatened species.

At this stage the primary risk to aquatic ecology associated with Exploratory Works is the potential for impacts to water quality associated with construction activities, particularly construction/upgrade of roads, waterway crossings and the construction of wharves in Talbingo Reservoir, which may also require some limited dredging activities. While such activities may result in the mobilisation of sediments into watercourses and result in sedimentation and degradation of aquatic habitat, it is expected that the risk to aquatic ecology would be acceptable following implementation of standard control measures. The potential for loss of aquatic habitat is minimal and no re-alignment or displacement (except potentially a very small area beneath waterway crossings) of waterways is proposed. Crossings would also be designed and constructed to avoid any impacts on fish passage. Dredging and wharf construction also has the potential to displace some sensitive aquatic habitat (eg native aquatic plants) in Talbingo Reservoir.

The extent and intensity of all potential impacts will require further information regarding the construction methodology, location and layout of infrastructure and ancillary services and placement of excavated rock.

Further aquatic ecology surveys are currently underway along nearby watercourses to determine native fish species and aquatic vegetation to inform the assessment of potential impacts on the existing aquatic ecological environment. This will include mapping of aquatic habitat in Talbingo Reservoir that may be affected by wharf construction and any associated dredging activities. Potential impacts to aquatic ecology will be assessed according to the relevant NSW and Commonwealth legislation and guidelines, including:

- *Policy and guidelines for fish habitat conservation and management*. Update 2013 (NSW Department of Primary Industries 2013);
- Targeted searches for threatened species, populations and ecological communities under the BC Act and EPBC Act with the potential to occur in the project area;
- *Commonwealth EPBC 1.1 Significant Impact Guidelines – Matters of National Environmental Significance* (Commonwealth of Australia 2013);
- *Commonwealth EPBC 1.2 Significant Impact Guidelines – Actions on, or Impacting upon, Commonwealth Land and Actions by Commonwealth Agencies* (Commonwealth of Australia 2013);
- *Commonwealth Department of the Environment – Nationally Threatened Ecological Communities and Threatened Species Guidelines* (various);
- Commonwealth Department of the Environment – survey guidelines for nationally threatened species (various);
- BAM (OEH 2017);
- *Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities* (DEC 2004);
- NSW Biodiversity Offsets Policy for Major Projects (OEH 2014); and
- *Framework for Biodiversity Assessment* (OEH 2014).

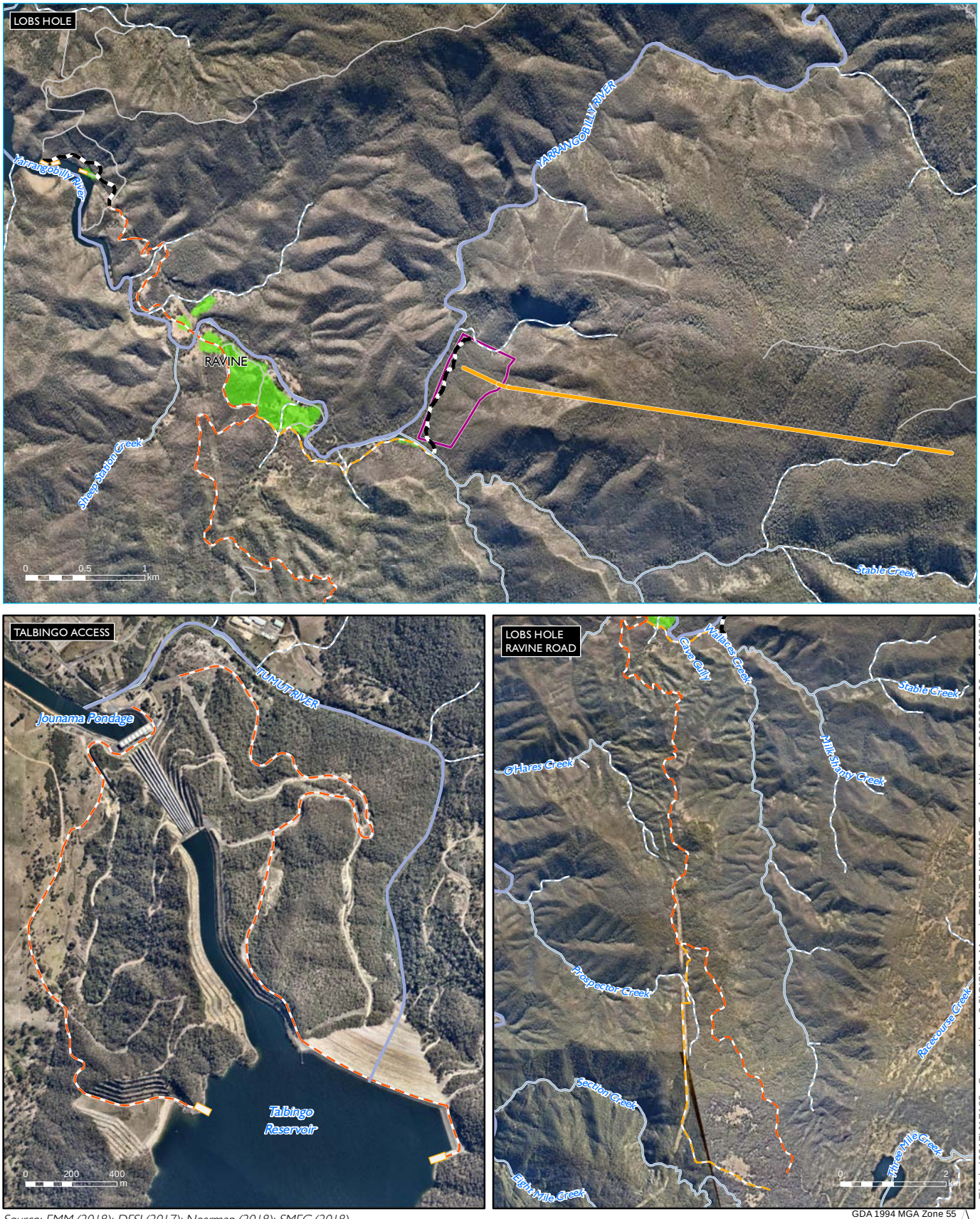
5.2.3 Surface water

i Existing environment

The Exploratory Works will be adjacent to the lower reach of the Yarrangobilly River within the catchment of the Murrumbidgee River. The Yarrangobilly River is a major watercourse that flows into the Talbingo Reservoir approximately 1.5 km downstream of the Exploratory Works project area. The Yarrangobilly River catchment is wholly within the KNP and is characterised by a range of subalpine grasslands and woodlands and montane dry sclerophyll forests. Elevations range from 550 m Australian Height Datum (AHD) (adjacent to the Exploratory Works project area) to more than 1,400 m AHD in the head water catchments.

Other watercourses within proximity to the Exploratory Works project area include Stable Creek, Wallaces Creek, Cave Gully and two unnamed first order water courses. All of these watercourses are tributaries to the Yarrangobilly River.

Existing surface water features in proximity to the Exploratory Works are shown in Figure 5.3.



T:\Jobs\2017\J17188 - Snowy Hydro 2.0\GIS\02_Maps_PEA\PEAEW005_SurfaceWater_20180323_06.mxd 23/03/2018

Source: EMM (2018); DFSI (2017); Nearmap (2018); SMEC (2018)

GDA 1994 MGA Zone 55

N

KEY

- Proposed road alignment
- Existing road (proposed upgrade)
- Existing track (proposed upgrade)
- Exploration tunnel and portal
- Exploration tunnel portal envelope
- Indicative wharf locations
- Indicative construction compound
- Local road or track
- Surface water feature
- Major waterway
- Perennial
- Ephemeral

Surface water - existing features

Snowy 2.0

Preliminary Environmental Assessment

Exploratory Works

Figure 5.3

Talbingo Reservoir forms part of the Snowy Scheme. Water is released from Talbingo Reservoir through the Tumut 3 Power Station into Jounama Pondage, which releases water into Blowering Reservoir. Blowering Reservoir is operated by Water NSW and releases water into the Tumut River to supply the Murrumbidgee Irrigation Scheme. The Tumut 3 Power Station also has the ability to pump water from Jounama Pondage up to Talbingo Reservoir.

ii Assessment approach

The development of the EIS will consider potential impacts to surface water associated with:

- the construction and upgrade of the access roads and bridges;
- the establishment of construction compound and exploratory tunnel;
- water management during construction, including management of wastewater from concrete batching plants, underground excavations (including tunnelling), water treatment plant and sewerage treatment plant;
- wharves and barge facilities; and
- works in proximity to the Yarrangobilly River and floodplain.

Potential impacts to water quality may include sediment laden runoff from disturbance areas, impacts of wastewater streams (eg from concrete batching, tunnelling activities and sewage) and impacts due to unintended leaks or spills during construction.

Potential impacts associated with works in proximity to the Yarrangobilly River and floodplain include the potential entrainment of excavated rock or other material in flood waters and increased risks of scour and erosion within the Yarrangobilly River channel and floodplain.

The following guidelines will be considered as relevant during the preparation of the EIS:

- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC / ARMCANZ 2000);
- *Managing Urban Stormwater: Soils and Construction Volume 1 (Landcom 2004) and Volume 2 (A. Installation of Services; B. Waste Landfills; C. Unsealed Roads; D. Main Roads; E. Mines and Quarries)* (DECC 2008); and
- *NSW Government's Floodplain Development Manual* (2005).

5.2.4 Groundwater

i Existing environment

The Exploratory Works is in the Australian Alps and South Eastern Highlands bioregions and the Murrumbidgee River catchment.

The geology of the alpine area comprises granites that have formed faulted, stepped ranges at the point where the South Eastern Highlands in NSW turn west into Victoria (NPWS 2003). More recent volcanic activity produced basalts and, in the Pleistocene, the cold climate superimposed glacial features on the landscape (NPWS 2003). The Australian Alps bioregion was the only part of the mainland to have been affected by Pleistocene glaciation and contains a variety of unique glacial and periglacial landforms above 1,100 m altitude (NPWS 2003).

The Exploratory Works is within the South Eastern Highlands which are part of the Lachlan fold belt that runs through the eastern states as a complex series of metamorphosed Ordovician to Devonian sandstones, shales and volcanic rocks intruded by numerous granite bodies and deformed by four episodes of folding, faulting and uplift. The general structural trend in this bioregion is north-south and the topography strongly reflects this (NPWS 2003).

Overlying the older Ordovician to Devonian units, a regionally extensive weathered zone is assumed to exist consisting of a mixture of colluviums, regolith and weathered basement rocks. Tertiary aged basalts also exist within this zone. Early field-based results suggest that shallow groundwater exists within this zone and a strong downward hydraulic gradient is apparent, supporting the conceptualisation of a rainfall recharge based system. Groundwater quality is very fresh with a pH generally ranging from near neutral to slightly alkaline.

More specific to the Exploratory Works exploratory tunnel excavation, the Late Silurian Ravine Beds geological unit is likely to be intersected which consists of limestone, sandstone, siltstone and shale. A key aspect of assessing the risk is to determine the hydraulic connection between the tunnel excavations, and the Yarrangobilly River, immediately west of the planned portals, which is also hosted within the Ravine Beds.

There are eight karst areas in the KNP, all of which are developed in Silurian, Devonian or Quaternary limestones (DEC 2006). These include Yarrangobilly Caves, a known groundwater dependent ecosystem (GDE) which are approximately 8 km north-east of the Exploratory Works project area.

The KNP contains other GDEs including Alpine Sphagnum Bogs and Associated Fens which are listed as endangered under the EPBC Act. These systems are thought to store rainfall, allowing slow release to creeks, rivers and springs. They also store shallow groundwater, which maintains wet soil conditions for most of the year.

ii Assessment approach

There is a limited amount of knowledge of groundwater systems around the Exploratory Works project area. The borehole and seismic data being collected in the coming months as part of the ground investigations associated with Snowy 2.0 will assist in the provision of baseline information for the preparation of the EIS. This will identify the ground conditions for earthworks and tunnelling and clarify and confirm potential impacts on the existing groundwater system and aquifers. Additionally, the establishment of a groundwater monitoring network and the development of conceptual and numerical hydrogeological models will provide a greater understanding of the groundwater systems for ongoing impact assessments.

A search of the *National Atlas of Groundwater Dependent Ecosystems* (Bureau of Meteorology 2015) identified there to be GDEs within the Exploratory Works project area, including Alpine Sphagnum Bogs and Associated Fens as mentioned previously. These GDEs will be surveyed and assessed within the EIS concurrently with aquatic ecology assessments. The Yarrangobilly Caves system will be considered an assumed GDE as a conservative approach and potential tunnel excavation impacts will be assessed as part of the groundwater study.

Consultation has already commenced with NPWS regarding collection of stygofauna data as part of the Feasibility Study drilling activities moving forward into the EIS.

The development of the EIS will consider potential impacts to groundwater associated with tunnelling activities. Potential impacts may include impacts on groundwater flows, quality and levels during tunnel construction and impacts on GDEs.

The key guidelines which will be considered as relevant during the preparation of the EIS include:

- *NSW Aquifer Interference Policy* (Department of Primary Industries 2012);
- *Australian Groundwater-Dependent Ecosystems Toolbox Part 1* (Richardson S et al 2011); and
- *Australian Groundwater Modelling Guidelines* (Barnett B et al 2012).

5.2.5 Contamination

i Existing environment

There are areas of known contamination and areas of potential contamination within the KNP associated with historical land uses. These areas are mostly associated with past or ongoing storage of hydrocarbons and with existing and former landfill sites that contain solid wastes (DEC 2006). These include putrescible and inert household and commercial waste, and builders' spoil and clean fill generated during construction activities (DEC 2006). In proximity to the Exploratory Works project area, there is also potential for contamination associated with historical mining at the former Lobs Hole Copper Mine.

A soil, sediment and surface water investigation was completed at the former Lobs Hole Copper Mine in 2014 (URS 2014). The results of the investigation found elevated concentrations of select metals (arsenic, copper and lead) near the former mine. Soils, with potential to be acid forming, were also present. The site of the former Lobs Hole Copper Mine can be seen in Photograph 3.4.

Sediments sampled from within the Yarrangobilly River had elevated levels of arsenic, lead, mercury, nickel and zinc above relevant ANZECC guidelines (ANZECC 2000); however, leachate tests suggested these metals were immobile due to the physio chemical status of the surface waters. Surface waters reported elevated levels of arsenic, copper, lead, nickel and zinc.

ii Assessment approach

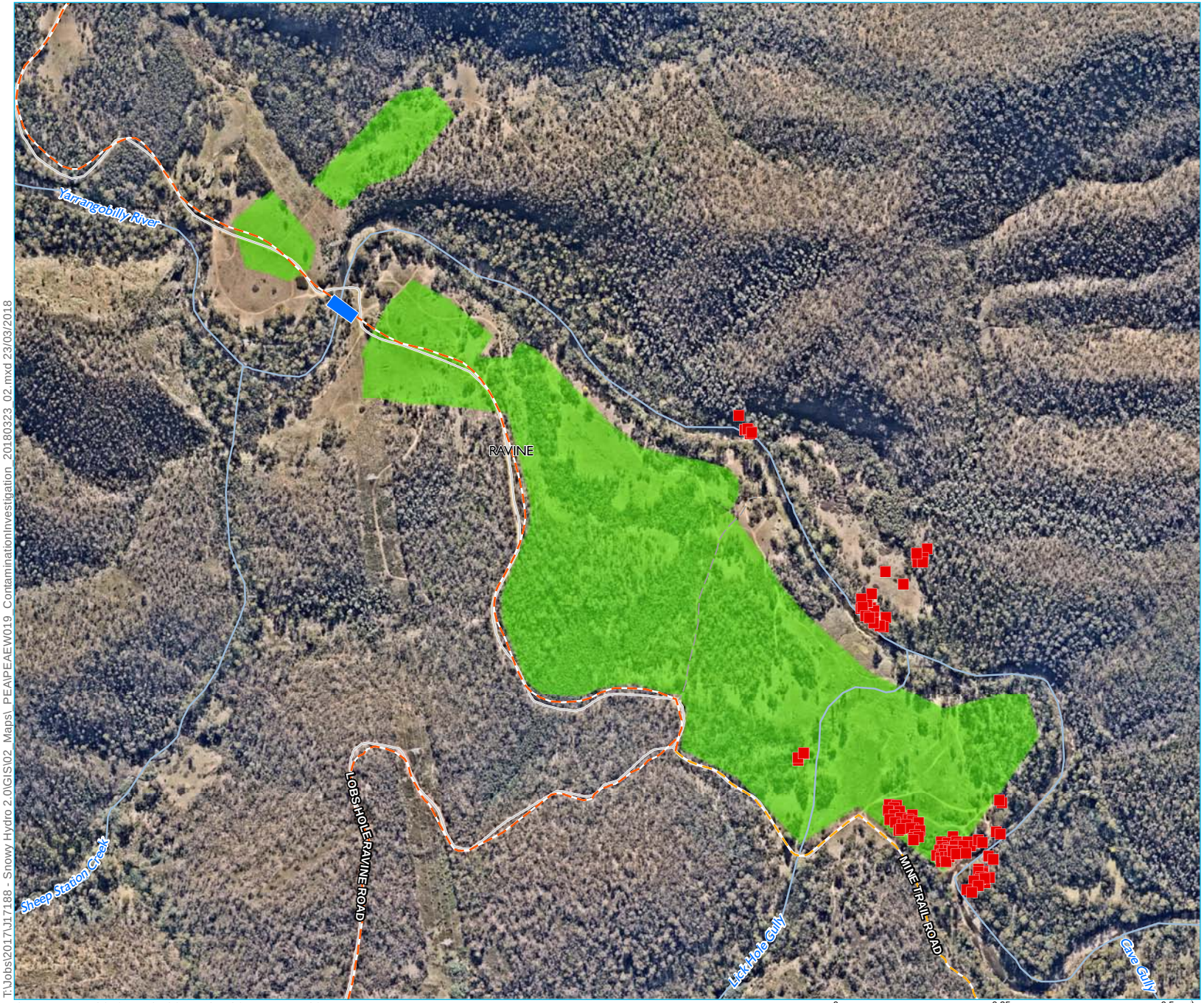
The Exploratory Works will expose the natural ground surface and sub-surface through the removal of vegetation and the excavation of soil for surface infrastructure works and the establishment of the construction compound and construction pads, auxiliary works, and equipment laydown areas. There is potential for disturbance of contaminated land and exposure to contaminated materials during construction.

A contamination assessment of the Exploratory Works project area will be completed as part of the EIS. This will include a review of the site history, identification of current or historical contaminating activities and the potential for site sampling to confirm contamination or risks to human health or the environment.

Recommended remediation and rehabilitation options will be reviewed to ensure that the land can be made suitable for the proposed use, should it be used for Exploratory Works, and that there are no risks to humans or the environment down gradient of the site.

The following government guidelines will be considered as relevant during the preparation of the EIS:

- *Managing Land Contamination: Planning Guidelines SEPP 55 – Remediation of Land* (Department of Urban Affairs and Planning and EPA 1998);
- *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom 2004);
- *Managing Urban Stormwater: Soils and Construction Volume 2* (DECC 2008);
- *Guidelines for Consultants Reporting on Contaminated Sites* (OEH 2000);
- *Guidelines on the Duty to Report Contamination under the Contaminated Land Management Act 1997* (Department of Environment and Climate Change 2009);
- *National Environment Protection (Assessment of Site Contamination) Measure 1999* (as amended in 2013)*;*
- *Approved Methods for the Sampling and Analysis of Water Pollutants in NSW* (DECC 2008);
- *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZECC / ARMCANZ 2000); and
- *Using the ANZECC Guidelines and Water Quality Objectives in NSW* (DEC 2006).



KEY

- Contaminated land sampling locations (URS, 2014)
- Water crossing upgrades
- Indicative construction compound

Project access routes

- Existing road (proposed upgrade)
- Existing track (proposed upgrade)

Existing environment

- Local road
- Track-Vehicular
- Named watercourse

T:\Jobs\2017\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ PEAIPEAEW019 ContaminationInvestigation 20180323 02.mxd 23/03/2018

Source: EMM (2018); DFSI (2017); GA (2015); LPMA (2011)

0 0.25 0.5 km

GDA 1994 MGA Zone 55

N

Previous contaminated site investigations – Lobs Hole Copper Mine

Snowy 2.0

Preliminary Environmental Assessment

Exploratory Works

Figure 5.4

snowy2.0

EMM

5.2.6 Soils

i Existing environment

The soils of the Australian Alps bioregion reflect the extreme climatic gradient across the ranges. The lowlands consist mainly of texture contrast soils, grading to uniform, organic soils and peats at the highest elevations (NPWS 2003). The soils of the South Eastern Highlands bioregion vary significantly across the bioregion in relation to altitude, temperature and rainfall.

ii Assessment approach

The Exploratory Works will expose the natural ground surface and sub-surface through the removal of vegetation and the excavation of soil for surface infrastructure works and the establishment of access tracks, construction compound and construction pads, auxiliary works, and equipment laydown areas. Potential soil capability impacts during construction may include erosion of soils, disturbance of acid sulfate soils and contamination of land due to spills and leaks from construction equipment and vehicles and the storage of fuel at construction camps.

A soils capability assessment will be undertaken as part of the EIS. The assessment will provide key measures for managing soils during construction, particularly soils required for rehabilitation post Exploratory Works. The following government guidelines will be considered as relevant during the preparation of the EIS:

- *Guidelines for surveying soil and land resources* (McKenzie et al 2008);
- *Acid Sulfate Soils Assessment Guidelines* (Department of Planning 2008);
- *Managing Urban Stormwater: Soils and Construction Volume 1* (Landcom 2004); and
- *Site Investigations for Urban Salinity (*Department of Land and Water Conservation 2002).

5.2.7 Subsidence

i Existing environment

The geology of the Exploratory Works project area was described in Section 5.2.4.

ii Assessment approach

As the Exploratory Works involves several tunnelling and excavation activities there is some potential for subsidence impacts where subterranean works lead to sinking of the earth surface.

It is considered there is low potential for subsidence impacts, as the dimensions of the tunnelling is limited and tunnelling will be predominantly at considerable depth. Notwithstanding this, an assessment of potential subsidence impacts will be undertaken and reported in the EIS.

5.3 Cultural values

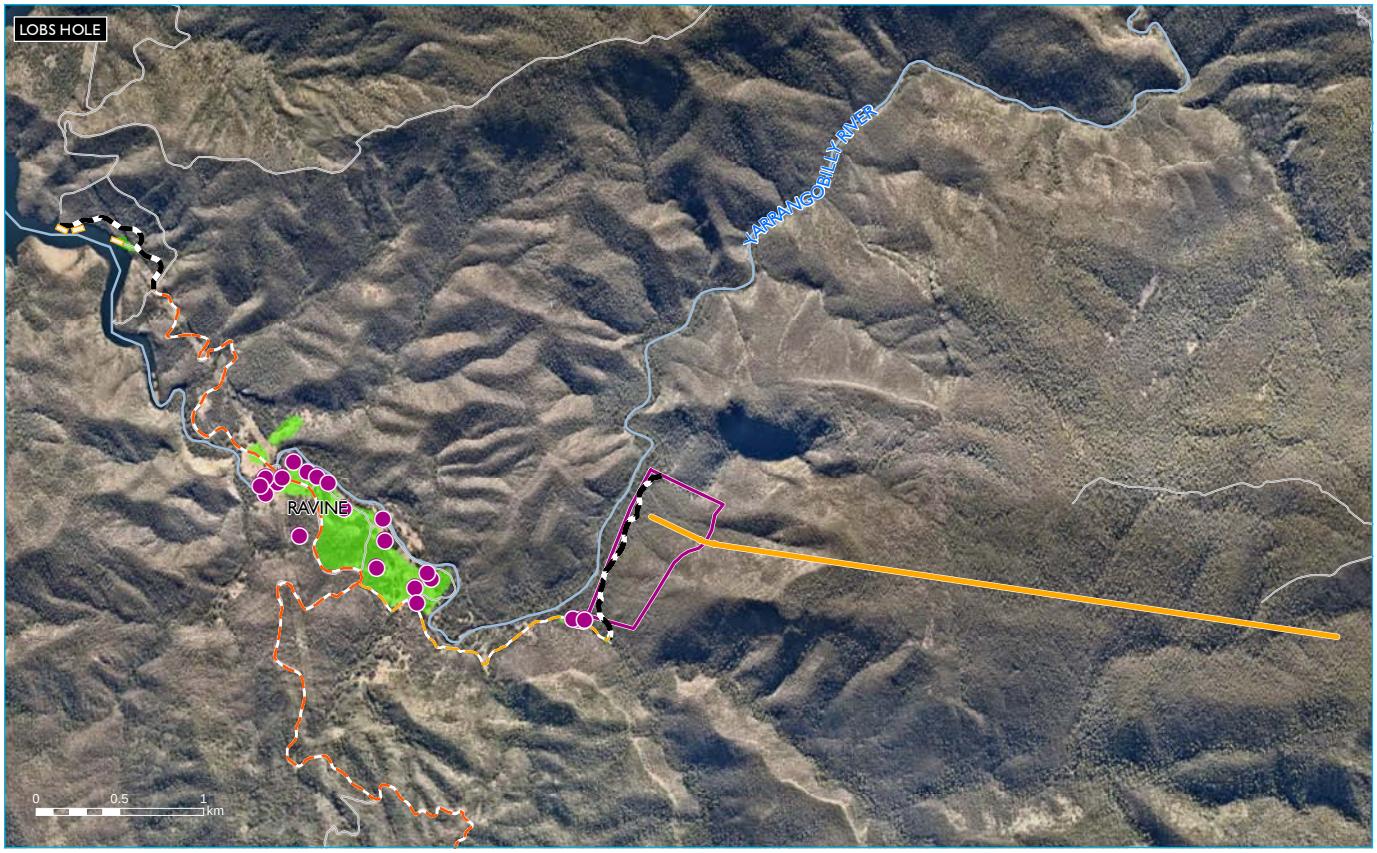
5.3.1 Aboriginal cultural heritage

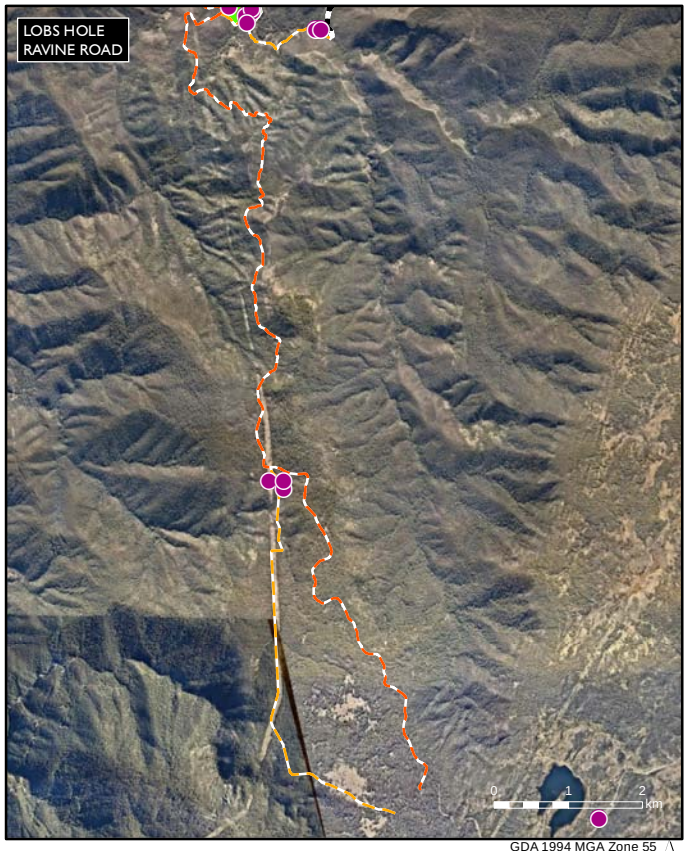
i Existing environment

Aboriginal people have lived in the Southern Highlands and its environs for at least 21,000 years, with occupation dated from the Late Pleistocene (DEC 2006). The Australian Alps bioregion was the traditional home of two Aboriginal groups; the Walgal people occupied the northern part of the bioregion near Kiandra in what is now the KNP, while the Ngarigo people lived in the region around the highlands (NPWS 2003). The major Aboriginal groups that traditionally occupied the South Eastern Highlands bioregion were the Walbanga in the centre, Ngarigo in the centre and southern parts of the bioregion, and Ngunawal and Gandangara in the north of the bioregion (NPWS 2003).

Surviving traces of Aboriginal occupation in the KNP include the remains of campsites, ceremonial grounds, stone arrangements, burial sites, rock art, scarred trees and grinding grooves (DEC 2006.) The region holds outstanding values due to the importance of Aboriginal social gatherings, based on Bogon moth feasting and ceremonial gatherings.

Known Aboriginal cultural heritage items in proximity to the project area are shown in Figure 5.5.





T:\Jobs\2017\J17188 - Snowy Hydro 2.0\GIS\02_Maps_PEA\PEAEW006_AHIMS_20180323_06.mxd 23/03/2018

Source: EMM (2018); DFSI (2017); Nearmap (2018); SMEC (2018)

GDA 1994 MGA Zone 55

N

KEY

- Aboriginal heritage site identified
- Proposed road alignment
- Existing road (proposed upgrade)
- Existing track (proposed upgrade)
- Exploration tunnel and portal
- Exploration tunnel portal envelope
- Indicative wharf locations
- Indicative construction compound
- Local road or track
- Watercourse

Identified Aboriginal heritage items

Snowy 2.0
Preliminary Environmental Assessment
Exploratory Works
Figure 5.5

ii Assessment approach

The Exploratory Works has potential to impact on known Aboriginal artefacts and places through land disturbance. The extent and intensity of potential impacts have yet to be determined. This will require further definition of construction methodology, location and layout of infrastructure and ancillary services and excavated rock placement. The mechanisms by which these impacts could occur include surface disturbance by surface infrastructure, the construction of access tracks and associated vehicle movements and earthworks.

Key matters identified as a priority for further Aboriginal cultural assessment are associated with the location of the construction compounds, exploratory tunnel and equipment laydown areas and road upgrade works.

Reviews of relevant registers and databases have been carried out. While they have indicated the presence of artefacts and scattered objects within Lobs Hole, no sites of significance to Aboriginal people are currently known. Further Aboriginal cultural heritage assessments including archaeological surveys will be undertaken as part of the EIS, to ensure that Aboriginal cultural heritage values are properly identified and considered.

There is scope to avoid identified known Aboriginal artefacts, sites and places through the design process and option evaluation process. Where this is not possible and these items may be harmed, approval of the project would allow these items to be removed as a permit under the NPW Act (this is not required for a CSSI project).

An Aboriginal cultural heritage assessment (ACHA) will be completed in accordance with conducted in accordance with the NSW OEH (2011) *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* and *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (NSW DECCW 2010a).

5.3.2 Historic heritage

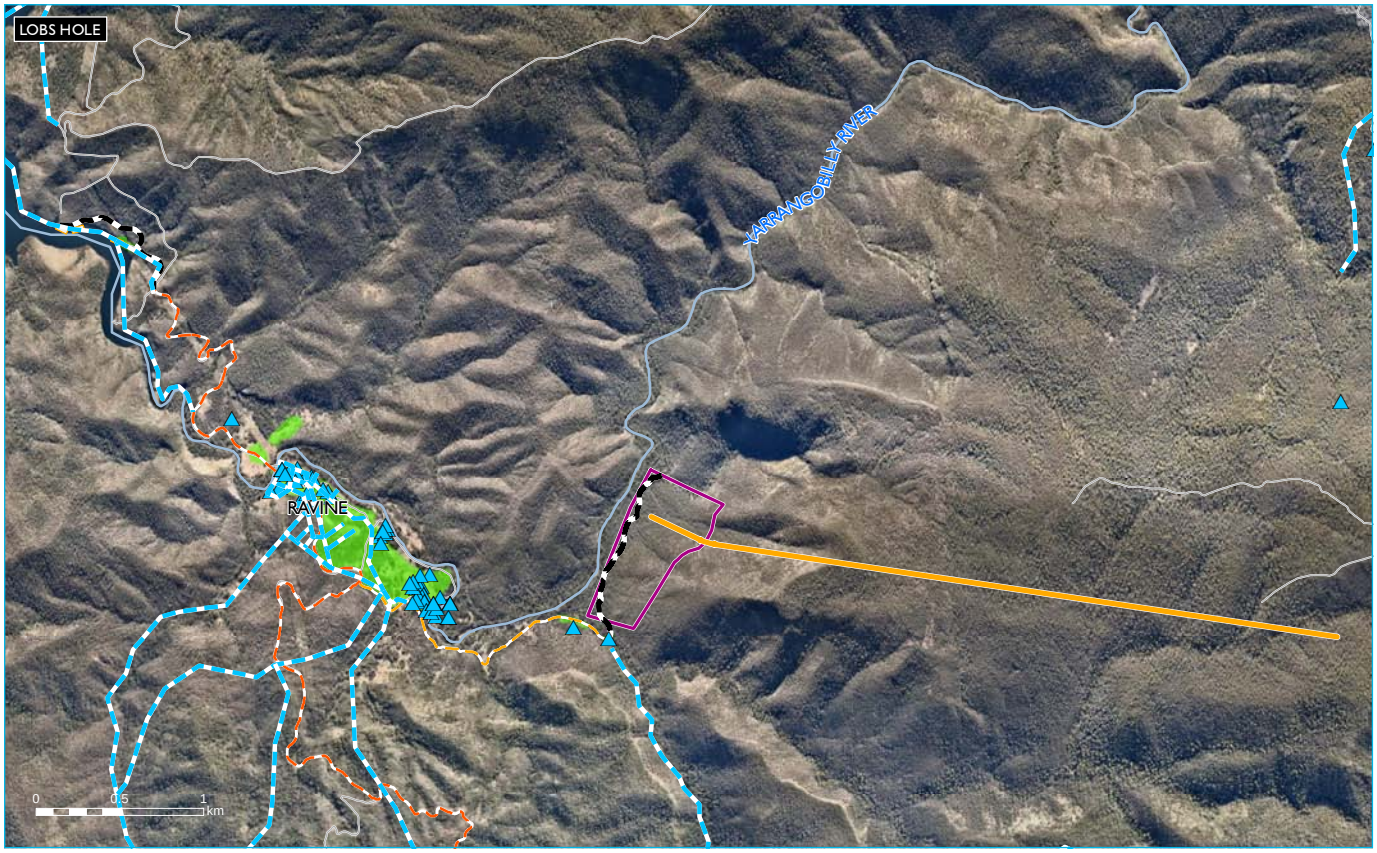
i Existing environment

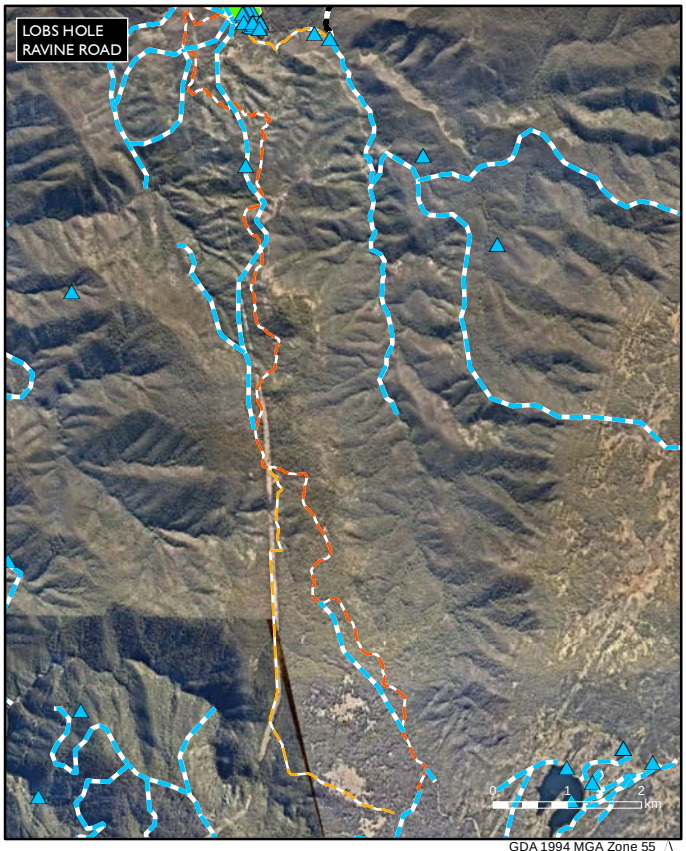
The alpine region and high country has a rich history extending from the early explorer-settlers in the 1820s, the establishment of pastoralism and transhumant grazing in the 1830s, the gold rush at Kiandra in 1859-60 and early scientific exploration. Throughout the twentieth century, the Snowy Scheme was built, scientific research developed further and tourism and recreation promoted. Other lesser known activities include timber harvesting and milling, and Eucalyptus oil distilling.

Additionally, the Snowy Scheme and KNP are listed as places on the National Heritage List under the EPBC Act. There are locally significant listed heritage items within the broader area including the Washington Hotel at Lobs Hole.

Mining and pastoral activities established at Lobs Hole in the 1870s. The former Lobs Hole Copper Mine was one of the most prominent copper mines in the Snowy Mountains between the 1890s and 1910s. During this period, an associated settlement developed, including the Washington Hotel, which comprised a population of up to 500 residents at its peak.

Known historic heritage items in proximity to the Exploratory Works are shown in Figure 5.6.





T:\Jobs\2017\J17188 - Snowy Hydro 2.0\GIS\02_Maps_PEA\PEAEW007_Historic_20180323_06.mxd 23/03/2018

GDA 1994 MGA Zone 55

N

Source: EMM (2018); DFSI (2017); Nearmap (2018); SMEC (2018)

KEY

- Historic heritage site identified
- Kosciuszko Huts Association (KHA) historic route
- Proposed road alignment
- Existing road (proposed upgrade)
- Existing track (proposed upgrade)
- Exploration tunnel and portal
- Exploration tunnel portal envelope
- Indicative wharf locations
- Indicative construction compound
- Local road or track
- Watercourse

Identified historic heritage items

Snowy 2.0
Preliminary Environmental Assessment
Exploratory Works
Figure 5.6

ii Assessment approach

Site establishment and surface infrastructure works have potential to directly impact on Snowy Scheme national heritage listed items and values and KNP national heritage listed items and landscape values.

Further assessment undertaken as part of the EIS will include the consideration of potential impacts on the values, settings and integrity of heritage areas and items and archaeological resources in proximity to the Exploratory Works.

Key matters identified as a priority for further historic heritage assessment are associated with works at Lobs Hole and mainly relate to historic mining activities. Additionally, KNP huts and memorial items within the general vicinity of the Exploratory Works may require further field surveys and research as part of the EIS assessment.

Historical heritage assessment to be undertaken as part of the EIS including archaeological surveys will be conducted in accordance with principles of *The Australian International Council on Monuments and Sites, Charter for Places of Cultural Significance* (also known as the *Burra Charter,* Australian ICOMOS 2013) and the NSW *Heritage Manual* (Heritage Office 1996 and 2006).

5.4 Socio-economic values

5.4.1 Social

i Existing environment

The Exploratory Works project area is in both the Snowy Valleys and Snowy Monaro Regional LGAs.

The nearest large towns to the project area are Cooma and Tumut. Cooma has a population of 6,379 people[1] and Tumut has a population of 6,154 people[2]. Cooma is approximately 65 km south-east of Tantangara Reservoir. Tumut is approximately 45 km north of the middle of Talbingo Reservoir. These towns provide higher level goods and services to the region such as health care, education, emergency services.

There are several communities and townships near the Exploratory Works project area including Talbingo (226 people), Cabramurra (37 people) and Adaminaby (210 people). Talbingo and Cabramurra were originally built for the original Snowy Scheme workers and their families. Talbingo town has developed into a popular place for holiday makers as the town has a lot of outdoor activities such as water skiing, fishing and walking. Cabramurra town was modernised and rebuilt in the early 1970s and is still used to accommodate Snowy Scheme employees and contractors. Adaminaby was relocated from its original location (now known as Old Adaminaby) in 1957 due to the construction of Lake Eucumbene.

The nationally significant tourism and recreational values of the KNP are based upon the diverse range of natural and cultural settings present within which to undertake recreational activities. These uses include (but are not limited to) boat users, camping, fishing, 4WDs, horse riding, downhill skiing and cross-country skiing.

---

[1] In the 2016 Census of Population and Housing (the Census), there were 6,379 people in Cooma (Urban Centres and Localities). Of these 50.1% were male and 49.9% were female.

[2] In the 2016 Census, there were 6,154 people in Tumut (Urban Centres and Localities). Of these 48.7% were male and 51.3% were female.

The Exploratory Works would be undertaken adjacent to Talbingo Reservoir. The reservoir is used for fishing, water skiing and canoeing.

Other attractions and places of interest within the area proximate to the Exploratory Works project area include Selwyn Snow Resort, the Yarrangobilly Caves complex and Kiandra. Kiandra has special significance as the first place in Australia where recreational skiing was undertaken and is also an old gold rush town.

The location and types of recreational uses in KNP near the Exploratory Works project area are shown in Figure 5.7.

ii Assessment approach

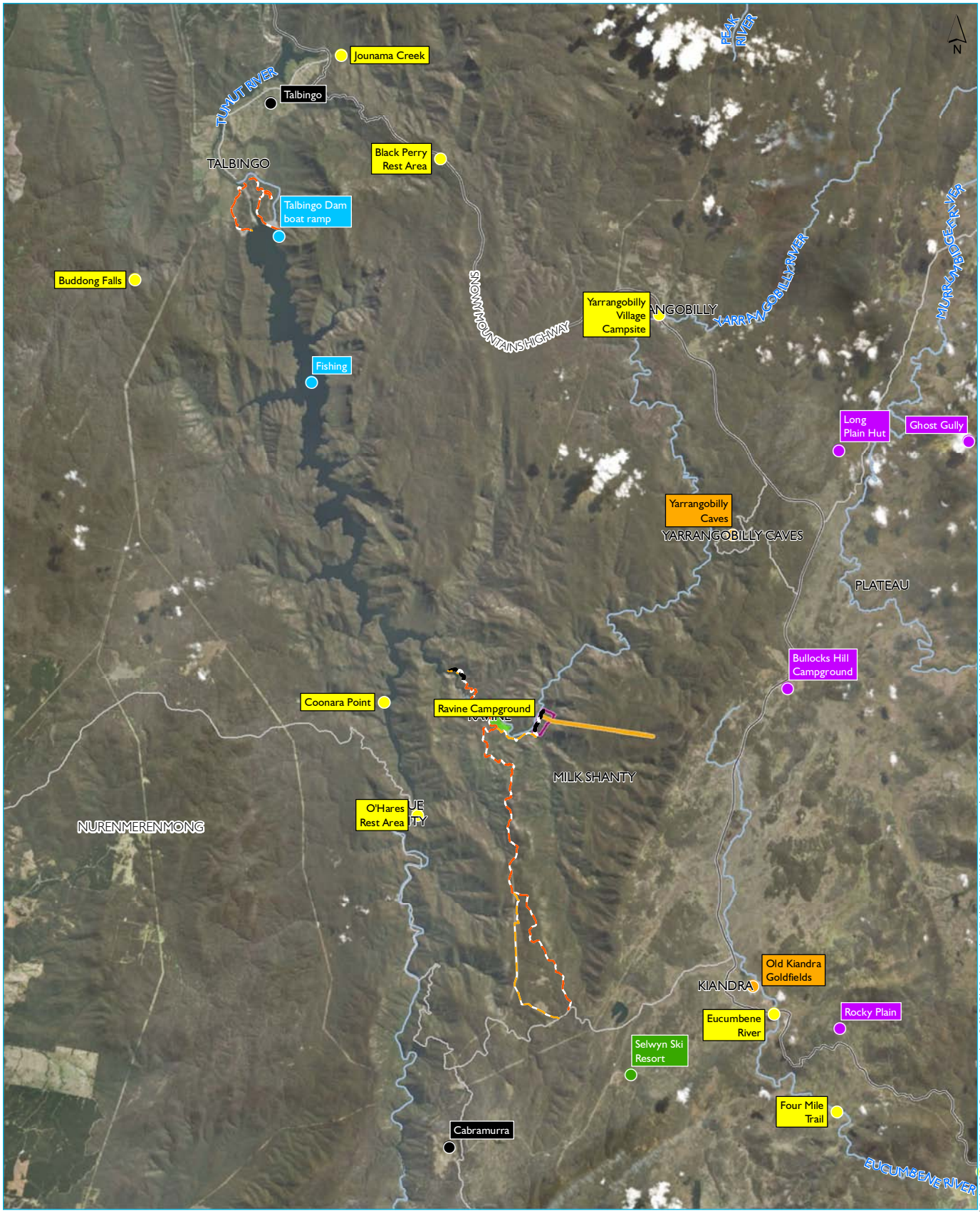
As discussed in Chapter 3 the Exploratory Works construction workforce will be predominantly accommodated in the accommodation camp for the duration of Exploratory Works. Workers will fly in and out of either Canberra or Cooma airports and then drive in and out of the Exploratory Works project area by bus or car. As such, no accommodation will be required in existing towns and townships for the Exploratory Works, except for the period of construction of the accommodation camp. During this time, it is likely that accommodation will be provided in Cabramurra, which is owned and operated by Snowy Hydro.

Notwithstanding the above, the Exploratory Works is likely to generate indirect impacts on nearby towns and townships. The local and regional economic benefits of the construction may create a short term population influx with subsequent increases in demand for housing, accommodation and social and community services.

The amenity values of the landscape are core to the recreational uses of the KNP. Some key areas used by the local community and visitors to the KNP are shown in Figure 5.7 and include Ravine Campground at Lobs Hole, O'Hares Rest Area, Coonara Point, Bullocks Hill Campground, Yarrangobilly Caves, and Long Plain Hut campsite. During the construction of the Exploratory Works, the amenity of the KNP is expected to be affected through increased traffic, noise and visual impacts from construction sites as well as restricted access due to construction related road closures. In particular, access to Lobs Hole and parts of Talbingo Reservoir would be restricted during the Exploratory Works. Users of the KNP likely to be impacted by the Exploratory Works include boat users, campers, 4WD enthusiasts, fishermen and bushwalkers.

A social impact assessment (SIA) will be undertaken during preparation of the EIS to assess social impacts of the Exploratory Works on the local and regional community and KNP users. The SIA will:

- include details of a program of community consultation undertaken to identify community values, opportunities, issues and concerns associated with the Exploratory Works;
- include an analysis of the workforce impacts of the Exploratory Works including impacts on access to and demand for local services and infrastructure;
- consider the outcomes and key findings of technical investigations for noise, air quality, surface water, traffic and economics and the associated social amenity impacts; and
- identify measures to avoid, reduce and mitigate predicted social impacts.



Source: EMM (2018); DFSI (2017); SMEC (2018)

0 2 4 km

GDA 1994 MGA Zone 55

T:\Jobs\2017\J17188 - Snowy Hydro 2.0\GIS\02_Maps_PEA\PEAEW008_Recreation_20180323_06.mxd 23/03/2018

KEY

Recreational use areas
- Camping
- Camping - horses permitted
- Fishing and boating
- Place of interest
- Ski resort
- Township

- Proposed road alignment
- Existing road (proposed upgrade)
- Existing track (proposed upgrade)
- Exploration tunnel and portal
- Exploration tunnel portal envelope
- Indicative wharf locations
- Indicative construction compound

- Main road
- Local road or track
- Watercourse

Recreational uses of the KNP

Snowy 2.0
Preliminary Environmental Assessment
Exploratory Works
Figure 5.7

Key matters identified for priority investigation of social impacts include the effects of the construction workforce on local and regional communities including impacts to housing and community services, if any.

The SIA will be undertaken with consideration to the *Social impact assessment guideline for State significant mining, petroleum production and extractive industry development* (Department of Planning 2017).

5.4.2 Economics

i Existing environment

The population of the Snowy Monaro Regional LGA in 2016 was 20,218, in the same year the population for the Snowy Valleys LGA was 14,395 (ABS 2016). The population of the towns of Cooma and Tumut were 6,379 and 6,154 respectively in 2016.The largest industry of employment in the Snowy Monaro Regional LGA is accommodation and food services followed by agriculture, forestry and fishing and retail trade (SMRC 2016). The largest industry of employment in the Snowy Valleys LGA is agriculture, forestry, retail trade and paper/cardboard manufacturing. The largest industries by employment reflect the region's economic strengths in tourism, agriculture including sheep and cattle farming, and forestry. The winter snow season is a major factor in the region's economy and tourism-focused businesses and infrastructure are common.

The unemployment rates for Snowy Monaro Regional and Snowy Valleys LGAs in 2016 were 3.3% and 5.4% respectively which was lower than the regional NSW unemployment rate (6.3%) at the time (ABS 2016). Median weekly household income in Snowy Monaro Regional and Snowy Valleys LGAs were $1,200 and $1,120 respectively and are both below the Australian and NSW median weekly household incomes (ABS 2016).

ii Assessment method

The normal scope of economic assessments is described below.

- Cost benefit analysis (CBA), which examines benefits and costs including environmental costs to producers and consumers in the Australian and/or NSW economy.
- Analysis of the economic activity that project expenditure and employment has on a regional, NSW or Australian economy - this can be undertaken qualitatively or quantitatively using input-output analysis and/or computable general equilibrium modelling.
- The effect on the locality which brings together components of the CBA and economic activity analysis but focused on the immediate locality where the development is located.

CBA can only be undertaken of a project in its entirety. It cannot be undertaken for subcomponents, such as the Exploratory Works. For these subcomponents there are economic costs but no economic benefits. The economic benefits of Snowy 2.0 relate to electricity generation which only arise from the main Snowy 2.0 project.

Notwithstanding, this phase will involve some direct costs and environmental impacts that are relevant to the CBA of Snowy 2.0. A broad CBA framework for Snowy 2.0 will be developed. The economic aspects of the Exploratory Works will be identified and valued using benefit transfer, and considered in the context of the broader CBA framework. The CBA framework and valuation of all impacts of the Snowy 2.0 will be further developed during the EIS of the main Snowy 2.0 project.

Economic activity analysis and effects on the locality can be undertaken for any activity that involves expenditure. It is proposed to assess the impacts of this expenditure on the NSW and Australian economy using computable general equilibrium modelling and impacts on the local economy using a combination of qualitative analysis and where appropriate input-output analysis.

5.4.3 Visual amenity

i Existing environment

As previously discussed the Exploratory Works will be undertaken in the KNP which is a part of the Australian Alps national heritage listing and contains landscapes with high scenic values. The Australian Alps landscape is characterised by peaked ranges, and broad, forested valleys, and is the only true alpine environment in NSW (NPWS 2003). Elevation across the project area is highest near Tantangara Reservoir at around 1,200 m and lowest near Talbingo Reservoir at around 550 m elevation.

ii Assessment method

The Exploratory Works will be undertaken in the KNP and sited in several areas currently accessible and visible to the public. It should be noted the public generally access these areas for the amenity values of the KNP. It is expected that the visual impacts of the Exploratory Works will be greatest during surface works and earthworks. Importantly the main Exploratory Works construction areas near Lobs Hole are approximately 15 km north of Cabramurra and 20 km south of Talbingo and would not be visible from any nearby residences. The proposed works are near and likely to be visible from a known recreational area, Ravine campground at Lobs Hole. Should Lobs Hole be unavailable to the public during the Exploratory Works, the nearest potential viewpoints may include Wallaces Creek Lookout near the intersection of Lobs Hole Ravine Road and Link Road and from boat users within Middle Bay of Talbingo Reservoir.

A visual impact assessment of the Exploratory Works will be conducted as part of the EIS and will consider the visual impacts of the project and the visual sensitivity of the surrounding environment.

There are no Commonwealth, NSW or local government planning policies, guidelines or standards applicable to visual impact assessment. The visual impact assessment will therefore be prepared with regard to industry standards included within the UK document *Guidelines for Landscape and Visual Impact Assessment (GLVIA) Third Edition* (2013), prepared by the Landscape Institute and Institute of Environmental Management and Assessment. The visual impact assessment will also be prepared with regard to the Standards Australia (AS4282) *Control of Obtrusive Effects of Outdoor Lighting*.

5.4.4 Traffic

i Existing environment

The primary transport routes proximate to Exploratory Works are the Snowy Mountains Highway, Long Plain Road, Port Phillip Trail, Tantangara Road, Link Road, Goat Ridge Road, Elliott Way, Snow Ridge Road and Tooma Road. RMS manages the Snowy Mountains Highway. The majority of other public roads likely to be impacted by Exploratory Works are under the jurisdiction of NPWS. Upgrades to roads near Tumut 3 Power Station are administered by Snowy Valleys Council.

The existing traffic network and major transport routes in the vicinity of the Exploratory Works project area are provided in Figure 5.8.

Snowy Mountains Highway is a state highway that begins in Bega at the intersection of Princes Highway and stretches 333 km north-west to an intersection with Hume Highway near Mount Adrah, passing through Cooma, Adaminaby and Tumut. The majority of the Snowy Mountains Highway is a sealed single carriageway. The Snowy Mountains Highway also connects with Monaro Highway in Cooma. The Snowy Mountains Highway will be the primary transport route to and from the project area heading both south towards Adaminaby and north towards Tumut.

Link Road intersects with Snowy Mountains Highway near Kiandra and heads west towards Cabramurra and Khancoban via Goat Ridge Road and Tumbarumba via Elliott Way. Link Road, Goat Ridge Road and Elliott Way are all sealed single carriageways.

As discussed in Chapter 3, currently the only suitable access to the construction compound and exploratory tunnel is via Lobs Hole Ravine Road and Mine Trail Road. These roads are single lane 4WD tracks with some steep gradients and varying widths between 3 m and 5 m. It is possible for vehicles to pass (with care) at most locations, however sight distance is limited and travel speeds are very slow.

ii Assessment approach

Key traffic impacts associated with the Exploratory Works are expected to occur due to increased traffic volumes on the local road network generated during the construction of the Exploratory Works. A traffic impact assessment will be conducted during preparation of the EIS in order to assess the impacts of the Exploratory Works on existing traffic and the local road network.

A traffic assessment will be undertaken to assess potential impacts associated with traffic generation from the construction of the Exploratory Works in accordance with the relevant guideline *Guide to Traffic Generating Developments* (RTA 2002). It will include:

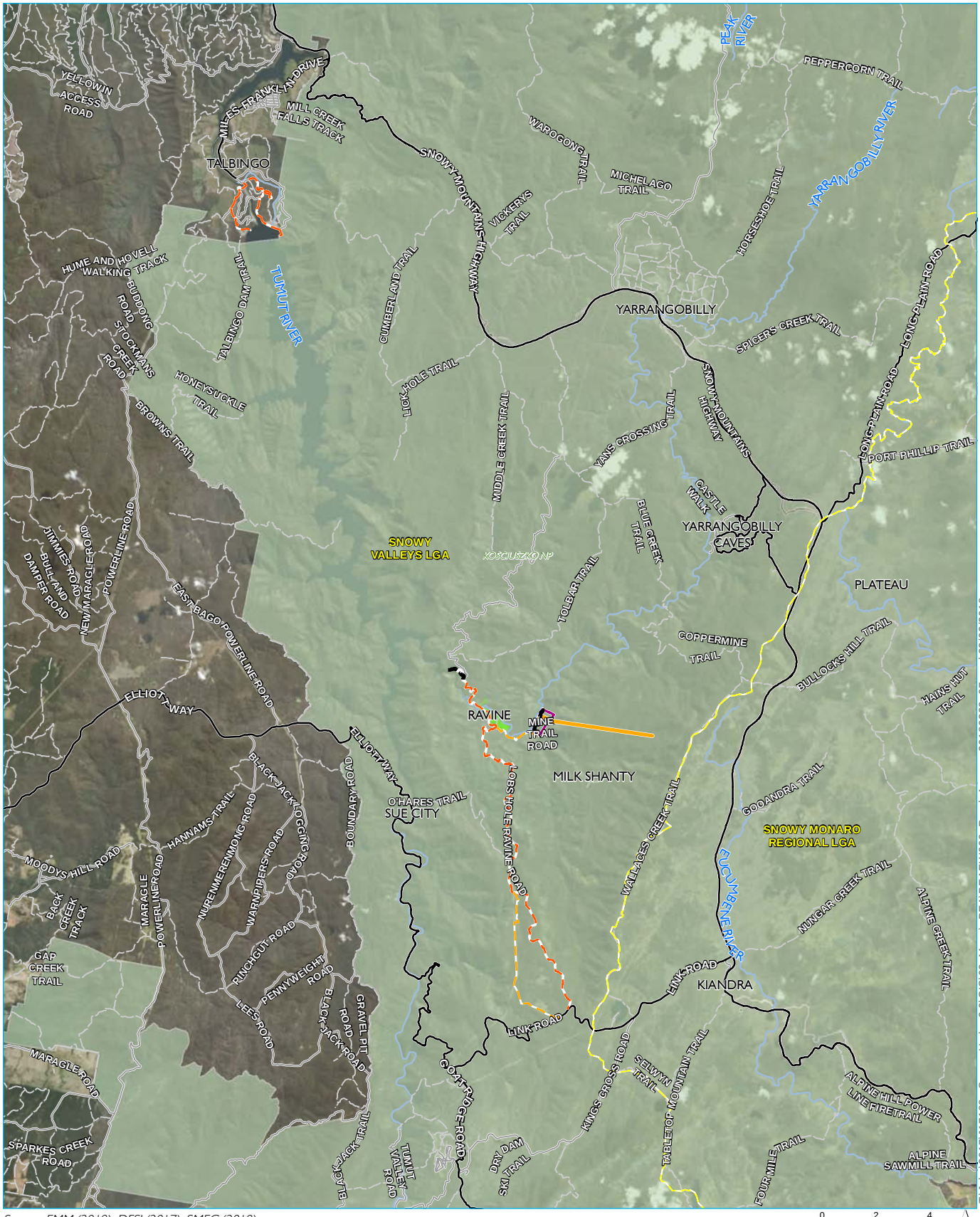
- existing traffic levels on transport routes and intersections likely to be used during the Exploratory Works;
- predicted traffic generation during construction;
- potential impacts to road and intersection capacity during construction; and
- potential road safety issues.

5.4.5 Waste

The Exploratory Works has potential to generate a variety of solid and liquid wastes during construction. Waste-generating activities may include pre-cast manufacturing (producing concrete slurry, concrete waste, timber formwork), dust suppression, wash down of plant and equipment (producing wastewater), staff amenities at construction compounds such as toilets (producing sewage and grey water), maintenance of construction plant and equipment (producing adhesives, lubricants, waste fuels and oils), and clearing of vegetation (producing green waste).

The quantity of waste likely to be generated by the Exploratory Works would be considered in the EIS. The following legislation and guidelines will be considered in the preparation of the waste assessment through the EIS:

- the waste hierarchy established under the *Waste Avoidance and Recovery Act 2001* (ie avoidance of waste, resource recovery, disposal of waste); and
- *Waste Classification Guidelines* (EPA 2014).



Source: EMM (2018); DFSI (2017); SMEC (2018)

0 2 4 km
GDA 1994 MGA Zone 55

N

T:\Jobs\2017\117188 - Snowy Hydro 2.0\GIS\02_Maps_PEA\PEAEW009_RoadsAccess_20180323_07.mxd 23/03/2018

KEY

Existing access
- Main road
- Local road
- Track

Project access routes
- Proposed road alignment
- Existing road (proposed upgrade)
- Existing track (proposed upgrade)
- Exploration tunnel and portal
- Exploration tunnel portal envelope
- Indicative construction compound
- Watercourse
- Kosciuszko National Park
- Local government area boundary

Existing traffic routes and access

Snowy 2.0
Preliminary Environmental Assessment
Exploratory Works
Figure 5.8

5.4.6 Hazards and risk

The Exploratory Works has potential to generate hazard and risk impacts during construction including through the use of fuel and other hazardous materials. Construction activities such as tunnelling, surface works and construction compound activities and operation of heavy equipment in public areas has the potential to result in safety risks to members of the public.

The potential hazard and risk impacts of the Exploratory Works will be investigated further through the EIS. Hazard and risk matters identified for priority consideration include impacts of the construction of the exploratory tunnel, construction compound and access roads. The following government guidelines will be considered during the preparation of the hazard and risk assessment:

- *Hazardous and Offensive Development Application Guidelines: Applying SEPP 33* (Department of Planning 2011);
- *International Standard (ISO / IEC 31010) Risk Management – Risk Assessment Technique*;
- *Australian Code for the Transport of Dangerous Goods by Road and Rail (7th edition)* (National Transport Commission 2007);
- *Storage and Handling of Dangerous Goods Code of Practice* (WorkCover 2005); and
- *Hazardous Industry Planning Advisory Paper No.4: Risk Criteria for Land Use Safety Planning* (DP&I 2011a).

5.4.7 Bushfire

i Existing environment

The landforms within the KNP contribute significantly to localised variations in weather conditions, wind patterns, vegetation, fuel loads and arrangements, and fuel moisture. Such topography and inherent variations are frequently a challenge in fire suppression operations (NPWS 2008).

The Exploratory Works area occurs within two Bush Fire Management Committee (BFMC) areas; Snowy Monaro and Riverina Highlands as specified under the RF Act with following characteristics:

- Snowy Monaro BFMC:
  - The typical/average climate is cool-temperate.
  - Winters are long and cold, with temperatures regularly falling below freezing and periodic snowfalls occurring through the region. The bush fire season generally runs from October to March.
  - In some years, good summer rains, drier than normal autumn conditions, severe winter frosts and gale force winds have created a further fire danger period throughout the winter months (Snowy Monaro BFMC 2009).

- Riverina Highlands BFMC:
    - The typical/average climate is cool-temperate.
    - Rainfall occurs predominantly in winter and the bushfire season runs from November to March.
    - Prevailing weather conditions associated with the bushfire season are generally north-westerly winds accompanied by high daytime temperatures and low relative humidity.
    - Frequent dry lightning storms occurring during the bushfire season are common on an annual basis.

The KNP is subject to a seasonal bushfire regime and the Exploratory Works project area was previously affected by bushfire in 2003. Notwithstanding this, large unplanned fires in the alpine and subalpine areas are relatively rare (NPWS 2008).

Fire history records for the KNP date back to the 1956-1957 season. By 2008, NPWS had compiled records of 556 unplanned fires, an average of about 11 fires per year, and 195 planned fires within KNP. Responsibility for fire management within the KNP was assumed by NPWS in 1986. Between 1986 and 2008, 113 prescribed burns were completed in the KNP covering a total area of 58,339 ha. This is an average of approximately five burns per year. Overall between 1957 and 2008, 11% of KNP had not burnt, 51% had burnt once and 30% had burnt twice. Over the same period more than 98% of the park had burnt at average inter-fire interval of more than 17 years and only 0.17% or 1140 ha had burnt, on average, at inter-fire intervals of less than 10 years.

ii Assessment approach

The Exploratory Works has potential to have bushfire impacts associated with the siting of construction activities and surface facilities. Potential bushfire risks include ignition risk from the activities and facilities as well as public safety of staff, fire fighters, emergency service workers and the general public. Bushfire impacts of the Exploratory Works will be further investigated through a bushfire hazard assessment in the preparation of the EIS.

The bushfire hazard assessment will be conducted in accordance with the guideline *Planning for Bush Fire Protection* 2006 (NSW Rural Fire Service (RFS) 2006) (PBP). The bushfire hazard assessment will be undertaken to demonstrate compliance with the aim and objectives of PBP and the specific objectives and performance criteria for the land use proposed. For the purposes of the assessment and in keeping with PBP guidelines, the proposed site will be considered 'other development' and no bushfire specific performance requirements are provided in the Building Code of Australia (BCA). Therefore, *Australian Standard 3959 -2009 Construction of Buildings in Bushfire-prone Areas* (AS3959-2009), does not apply as a set of 'deemed to satisfy' provisions.

General fire safety construction provisions are taken as acceptable solutions, but the aims and objectives of PBP apply in relation to other matters such as access, water and services, emergency planning and landscaping/vegetation management. Based on this, the bushfire hazard assessment will provide an appropriate combination of bushfire protection measures for the development. As the Exploratory Works includes a habitable work camp and other buildings, the bushfire hazard assessment (using slope and vegetation analysis) will ensure defendable space and/or APZ is provided for the size and scale of the Exploratory Works, to ensure that the proposed measures minimise radiant heat levels, and that access and services are adequate.

The bushfire hazard assessment will also consider the risks of ignition from the Exploratory Works and detail activities that are likely to cause naked flame, sparks or ignition sources. Risk treatments will be recommended in line with Snowy Hydro procedures, including Hot Work Procedure and job specific risk assessments (Work Method Statements) as well as maintenance schedules of site electrical equipment.

5.4.8 Noise and vibration

i Existing environment

Given the Exploratory Works project areas remote wilderness setting, background noise is likely to be low and characterised by recreational activities associated with park users. Background wildlife noise is also expected. Sensitive receivers are recreational users of the KNP including recreational users at Tantangara and Talbingo reservoirs, Currango Homestead, Bullocks Hill Campground and Ravine Campground at Lobs Hole.

Given the above and the lack of nearby 'residences' as defined in the EPA's *Noise Policy for Industry* (NPfI), there is no apparent or pressing need to conduct long term unattended noise sampling. If residences are identified, the EPA's minimum threshold background noise levels will be adopted where relevant given the expected acoustic climate.

The traffic route proposed for construction employees and deliveries will also be considered and baseline road traffic noise will be quantified through unattended monitoring over a period of at least seven days at representative locations on Snowy Mountains Highway from the north and south where residences are identified.

ii Assessment approach

The Exploratory Works would generate noise and vibration through the operation of heavy vehicles and equipment, carrying out construction activities including excavation and support of an exploratory tunnel, tunnel construction support infrastructure, drill and blast, portal establishment, excavation of construction pad/area, spoil management, accommodation camp construction, road upgrades, bridge construction and increased traffic volumes during construction, as well as possible wharf construction works.

Further investigation of noise and vibration impacts of the Exploratory Works will include a construction noise and vibration impact assessment (CNVIA) being prepared as part of the EIS. The CNVIA will be conducted in accordance with the NSW EPA *Interim Construction Noise Guideline* (DECC 2009) and the NPfI (EPA 2017) which requires proponents to characterise background noise levels for the project area and surrounds and assess the likely impact of the predicted or measured noise levels from the proposed development. The CNVIA will also assess noise from project vehicle movements on a public road, in accordance with the NSW *Road Noise Policy* (DECCW 2011) and noise generated by construction activities in accordance with the *Interim Construction Noise Guideline* (DECC 2009).

Construction vibration impacts will be assessed for the potential impacts on identified or known sensitive structures including for example Aboriginal rock structures or similar. Similarly, blast noise and vibration will be assessed using Australian and New Zealand Environment Conservation Council (ANZECC) guidelines.

Further, some elements of the Exploratory Works activities will be more akin to operational as opposed to construction projects (eg concrete batching plant) and span many months or even years. Hence, these elements may qualify as assessable against the EPA's NPfI as operational noise.

5.4.9 Air quality

i Existing environment

The Exploratory Works project area is a large distance from the nearest townships of Cabramurra and Talbingo, approximately 15 km north and 20 km south of the project area respectively. The Snowy Monaro Regional and Snowy Valleys LGAs both have high levels of agriculture which are likely to influence regional air quality. The area immediately surrounding the project area is very sparsely populated with recreational users of KNP being the nearest sensitive receivers. Consequently existing sources of air pollution in the area are limited and are primarily comprised of dust and vehicle exhaust emissions associated with recreational use of the KNP. Bushfires are also a source of seasonal particulate emissions.

ii Assessment approach

The potential air quality impacts of the Exploratory Works identified are considered to be limited and of relatively low risk. The primary air quality impacts expected during construction would be impacts on local air quality due to excavated rock management and placement, the use of construction plant and equipment, dust generating construction activities and increased vehicle movements. Of the air quality impacts identified, the impact of dust generation from the management and placement of excavated rock and the construction of access roads were identified as having priority for further investigation.

An air quality impact assessment will be undertaken as part of the preparation of the EIS and will assess the potential impacts of dust emissions from the Exploratory Works on sensitive receivers. The air quality assessment will be undertaken to review the potential air quality impacts associated with the project in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (DEC 2005b) which lists the statutory methods for modelling and assessing emissions of air pollutants from stationary sources in NSW.

6 Conclusion

Snowy Hydro proposes to develop Snowy 2.0, a large scale pumped hydro-electric storage and generation project largely within the KNP, and in the Snowy Monaro Regional and Snowy Valleys LGAs in NSW. Snowy 2.0 will have an energy generation capacity of up to 2,000 MW and an energy storage capacity of up to 350 GWh. The development of Snowy 2.0 is critical to ensuring system security as Australia transitions to a decarbonised NEM dominated by intermittent renewable generation. It would also result in the creation of direct and indirect employment opportunities during construction and operation and provide direct and indirect benefits to the local, State and national economies during the life of the project.

The NSW Minister for Planning has declared Snowy 2.0 to be CSSI under the provisions of the EP&A Act on the basis that it is critical to the State for environmental, economic and social reasons. Applications for the different phases of the project will be submitted under Part 5 of the EP&A Act, with the NSW Minister for Planning the consent authority. Each application will be subject to the provisions and requirements of a rigorous and robust planning process under the EP&A Act.

Snowy Hydro is committed to engaging with stakeholders, including the local community, and will implement a program for stakeholder consultation during the preparation of the EIS for the Exploratory Works.

Snowy 2.0 would be constructed in two phases. The first phase, which is known as Exploratory Works, includes the construction of an exploratory tunnel and ancillary construction activities which would be used to confirm the optimal location for the underground hydro-electric power station. The second phase includes the main construction works and operation of Snowy 2.0, including construction of all tunnels connecting Tantangara and Talbingo reservoirs, the construction of the underground hydro-electric power station, and construction of electricity transmission lines connecting Snowy 2.0 with the NSW electricity transmission system.

This PEA has been prepared for an application for the Exploratory Works for Snowy 2.0 and seeks the SEARs for works associated with an exploratory tunnel, construction pad and portal, a construction compound at Lobs Hole and ancillary activities such as access and communications infrastructure. A detailed analysis of environmental and socio-economic constraints and opportunities will be undertaken during the design phase and preparation of the EIS. The development of the design and construction methods for the Exploratory Works would be underpinned by the guiding principles of avoiding and minimising environmental impacts where possible.

Abbreviations

ABS	Australian Bureau of Statistics
APZ	Asset protection zone
BAM	Biodiversity Assessment Method
BC Act	NSW *Biodiversity Conservation Act 2016*
CBA	Cost Benefit Analysis
CSSI	Critical state significant infrastructure
DEC	Department of Environment and Conservation NSW
DEE	Commonwealth Department of the Environment and Energy
DI – Water	NSW Department of Industry – Water
DI - Lands	NSW Department of Industry – Lands
DPE	NSW Department of Planning and Environment
EIS	Environmental impact statement
EMM	EMM Consulting Pty Limited
EP&A Act	NSW *Environmental Planning and Assessment Act 1979*
EP&A Regulation	NSW Environmental Planning and Assessment Regulation 2000
EPA	NSW Environment Protection Authority
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EPL	Environment protection licence
FM Act	NSW *Fisheries Management Act 1994*
GWh	Gigawatt hour
ha	Hectares
km	Kilometre
KNP	Kosciuszko National Park
KSP Act	NSW *Kosciuszko State Park Act 1944*
LEP	Local environmental plans
LGA	Local government area
MNES	Matters of national environmental significance
MW	Megawatt
NEM	National electricity market
NPW Act	NSW *National Parks and Wildlife Act 1995*
NPWS	NSW National Parks and Wildlife Service
NSW LPI	NSW Land and Property Information
OEH	NSW Office of Environment and Heritage

PEA	Preliminary environmental assessment
POEO Act	NSW *Protection of the Environment Operations Act 1997*
PoM	Plan of management
REAP	Renewable Energy Action Plan
RF Act	NSW *Rural Fires Act 1997*
RMS	NSW Roads and Maritime Services
SEARs	Secretary's environmental assessment requirements
SHC Act	NSW *Snowy Hydro Corporatisation Act 1997*
SMRC	Snowy Monaro Regional Council
Snowy Hydro	Snowy Hydro Limited
SEPP	State Environmental Planning Policy
SRD SEPP	State Environmental Planning Policy (State and Regional Development) 2011
SSI	State significant infrastructure
TBM	Tunnel boring machine
TEC	Threatened ecological community
WAL	water access licence
WM Act	NSW *Water Management Act 2000*
WSP	water sharing plan

References

Australian Bureau of Statistics (ABS) 2016, Census Quick Stats: Snowy Monaro Regional LGA, viewed 16 October 2017, http://www.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/LGA17040?opendocument

2016, Census Quick Stats: Snowy Valleys LGA, viewed 16 October 2017, http://www.censusdata.abs.gov.au/census_services/getproduct/census/2016/quickstat/LGA17080?opendocument

Department of Environment and Conservation NSW (DEC) 2006, *Kosciusko National Park Plan of Management*.

Department of Environment and Climate Change (DECC) (2008) *Kosciusko National Park Fire Management Strategy 2008-2013.*

Finkel, A 2017, *Independent Review into the Future Security of the National Electricity Market*.

New South Wales Rural Fire Service (NSW RFS) (2006) *Planning for Bushfire Protection, A Guide for Councils, Planners, Fire Authorities and Developers***.**

NJ McKenzie, MJ Grundy, R Webster, AJ Ringrose-Voase, 2008 Guidelines for Surveying soil and land resources, CSIRO Publishing.

NSW National Parks and Wildlife Service (NPWS) 1988, *Kosciusko National Park plan of management*.

2003, *The Bioregions of New South Wales: their biodiversity, conservation and history*, Sydney.

2008, *Kosciuszko National Park Fire Management Strategy 2008–2013*, Hurstville.

OnSite Cultural Heritage Management (URS) 2015, *Preliminary Heritage Assessment Lobbs Hole Mine Site Investigation and Remediation Assessment Ravine NSW*, Narooma.

Riverina Highlands Bushfire Management Committee (2009) *Bushfire Risk Management Plan.*

Snowy Monaro Regional Council (SMRC) 2016, Snowy Monaro Regional Council Community and Economic Profile, viewed 16 October 2017, https://www.snowymonaro.nsw.gov.au/918/Community-and-Economic-Profile.

Snowy Monaro Bushfire Management Committee (2009) *Bushfire Risk Management Plan.*

OFFICE LOCATIONS

SYDNEY
Ground Floor, Suite 01, 20 Chandos Street
St Leonards NSW 2065
T 02 9493 9500
F 02 9493 9599

NEWCASTLE
Level 1, Suite 6, 146 Hunter Street
Newcastle NSW 2300
T 02 4907 4800
F 02 4907 4899

BRISBANE
Level 4, Suite 01, 87 Wickham Terrace
Spring Hill QLD 4000
T 07 3839 1800
F 07 3839 1866

ADELAIDE
Level 1, 70 Pirie Street
Adelaide SA 5000
T 08 8232 2253