



A P P E N D I X

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# BUSH FIRE RISK AND HAZARD ASSESSMENT







# Snowy 2.0 Bushfire Risk and Hazard Assessment - Main Works EIS

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**EMM**

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## DOCUMENT TRACKING

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<b>Project Number</b>	18SYD_11712
<b>Project Manager</b>	Dominic Adshead
<b>Prepared by</b>	Letara Judd
<b>Reviewed by</b>	Dominic Adshead
<b>Approved by</b>	Nathan Kearnes
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Template 2.8.1



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## Abbreviations

Abbreviation	Description
APZ	Asset Protection Zone
AS 3959	Australian Standard 3959 2018 Construction of buildings in bushfire prone areas)
asl	Above sea level
BAL	Bushfire Attack Level
BCA	Building Code of Australia
BFMC	Bush Fire Management Committee
BOM	Bureau of Meteorology
BPM	Bush Fire Protection Measures
BRMP	Bush Fire Risk Management Plan
CSSI	Critical State Significant Infrastructure
DECC	Department of Environment and Climate Change
DEM	Digital Elevation Model
ELA	Eco Logical Australia
EP&A Act	<i>Environmental Planning and Assessment Act 1979</i>
FDI	Fire Danger Index
KNP	Kosciuszko National Park
NCC	National Construction Code
NPWS	NSW National Parks and Wildlife Service (part of the NSW Office of Environment and Heritage)
NSP	Neighbourhood Safer Place
NSW	New South Wales
OEH	NSW Office of Environment and Heritage
PBP	Planning for Bush Fire Protection
PoM	Plan of Management
NSWRFS	NSW Rural Fire Service
RF Act	<i>Rural Fires Act 1997</i>
SFAZ	Strategic Fire Advantage Zone
SFPP	Special Fire Protection Purpose
TBM	Tunnel Boring Machine
t/ha	Tonnes per hectare

# 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 which would increase hydro-electric capacity within the existing Snowy Mountains Hydro-electric Scheme (Snowy Scheme). Snowy 2.0 is the largest committed renewable energy project in Australia and is critical to underpinning system security and reliability as Australia transitions to a decarbonised economy. Snowy 2.0 will link the existing Tantangara and Talbingo reservoirs within the Snowy Scheme through a series of underground tunnels and a new hydro-electric power station will be built underground.

Snowy 2.0 has been declared to be State significant infrastructure (SSI) and critical State significant infrastructure (CSSI) by the former NSW Minister for Planning under Part 5 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) and is defined as CSSI in clause 9 of Schedule 5 of the *State Environmental Planning Policy (State and Regional Development) 2011* (SRD SEPP). CSSI is infrastructure that is deemed by the NSW Minister to be essential for the State for economic, environmental or social reasons. An application for CSSI must be accompanied by an environmental impact statement (EIS).

Separate applications are being submitted by Snowy Hydro for different stages of Snowy 2.0 under Part 5, Division 5.2 of the EP&A Act. This includes the preceding first stage of Snowy 2.0, Exploratory Works for Snowy 2.0 (the Exploratory Works) and the stage subject of this current application, Snowy 2.0 Main Works (the Main Works). In addition, an application under Part 5, Division 5.2 of the EP&A Act is also being submitted by Snowy Hydro for a segment factory that will make tunnel segments for both the Exploratory Works and Main Works stages of Snowy 2.0.

The first stage of Snowy 2.0, the Exploratory Works, includes an exploratory tunnel and portal and other exploratory and construction activities primarily in the Lobs Hole area of the Kosciuszko National Park (KNP). The Exploratory Works were approved by the former NSW Minister for Planning on 7 February 2019 as a separate project application to DPIE (SSI 9208).

This Bushfire Risk and Hazard Assessment has been prepared to accompany an application and supporting EIS for the **Snowy 2.0 Main Works**. As the title suggests, this stage of the project covers the major construction elements of Snowy 2.0, including permanent infrastructure (such as the underground power station, power waterways, access tunnels, chambers and shafts), temporary construction infrastructure (such as construction adits, construction compounds and accommodation), management and storage of excavated rock material and establishing supporting infrastructure (such as road upgrades and extensions, water and sewage treatment infrastructure, and the provision of construction power). Snowy 2.0 Main Works also includes the operation of Snowy 2.0.

Snowy 2.0 Main Works is shown in **Figure 1.1** and **Figure 1.2**. If approved, the Snowy 2.0 Main Works would commence before completion of Exploratory Works.



The Snowy 2.0 Main Works do not include the transmission works proposed by TransGrid (TransGrid 2018) that provide connection between the cableyard and the NEM. These transmission works will provide the ability for Snowy 2.0 (and other generators) to efficiently and reliably transmit additional renewable energy to major load centres during periods of peak demand, as well as enable a supply of renewable energy to pump water from Talbingo Reservoir to Tantangara Reservoir during periods of low demand. While the upgrade works to the wider transmission network and connection between the cableyard and the network form part of the CSSI declaration for Snowy 2.0 and Transmission Project, they do not form part of this application and will be subject to separate application and approval processes, managed by TransGrid. This project is known as the HumeLink and is part of AEMO's Integrated System Plan.

With respect to the provisions of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), on 30 October 2018 Snowy Hydro referred the Snowy 2.0 Main Works to the Commonwealth Department of the Environment and Energy (DoEE) and, on a precautionary basis, nominated that Snowy 2.0 Main Works has potential to have a significant impact on MNES and the environment generally.

On 5 December 2018, Snowy 2.0 Main Works were deemed a controlled action by the Assistant Secretary of the DoEE. It was also determined that potential impacts of the project will be assessed by accredited assessment under Part 5, Division 5.2 of the EP&A Act. This accredited process will enable the NSW Department of Planning, Industry and Environment (DPIE) to manage the assessment of Snowy 2.0 Main Works, including the issuing of the assessment requirements for the EIS. Once the assessment has been completed, the Commonwealth Minister for the Environment will make a determination under the EPBC Act.

## 1.2 Project Location

Snowy 2.0 Main Works are within the Australian Alps, in southern NSW, about mid-way between Canberra and Albury. Snowy 2.0 Main Works is within both the Snowy Valleys and Snowy Monaro Regional local government areas (LGAs).

The nearest large towns to Snowy 2.0 Main Works are Cooma and Tumut. Cooma is located about 50 kilometres (km) south east of the project area (or 70 km by road from Providence Portal at the southern edge of the project area), and Tumut is located about 35 km north west of the project areas (or 45 km by road from Tumut 3 power station at the northern edge of the project area). Other townships near the project area include Talbingo, Cabramurra, Adaminaby and Tumbarumba. Talbingo and Cabramurra were built for the original Snowy Scheme workers and their families, while Adaminaby was relocated in 1957 to make way for the establishment of Lake Eucumbene.

The location of Snowy 2.0 Main Works with respect to the region is shown in **Figure 1.1** and **Figure 1.2**.

The pumped hydro-electric scheme elements of Snowy 2.0 Main Works are mostly underground between the southern ends of Tantangara and Talbingo reservoirs, a straight-line distance of 27 km. Surface works will also occur at locations on and between the two reservoirs. Key locations for surface works include:

- **Tantangara Reservoir** - at a full supply level (FSL) of about 1,229 metres (m) to Australian Height Datum (AHD), Tantangara Reservoir will be the upper reservoir for Snowy 2.0 and include the

headrace tunnel and intake structure. The site will also be used for a temporary construction compound, accommodation camp and other temporary ancillary activities;

- **Marica** - this site will be used primarily for construction including construction of vertical shafts to the underground power station (ventilation shaft) and headrace tunnel (surge shaft), and a temporary accommodation camp;
- **Lobs Hole** - the site will be used primarily for construction but will also become the main entrance to the power station during operation. Lobs Hole will provide access to the Exploratory Works tunnel, which will be refitted to become the main access tunnel (MAT), as well as the location of the emergency egress, cable and ventilation tunnel (ECVT), portal, associated services and accommodation camp; and
- **Talbingo Reservoir** - at a FSL of about 546 m AHD, Talbingo Reservoir will be the lower reservoir for Snowy 2.0 and will include the tailrace tunnel and water intake structure. The site will also be used for temporary construction compounds and other temporary ancillary activities.

Works will also be required within the two reservoirs for the placement of excavated rock and surplus cut material. Supporting infrastructure will include establishing or upgrading access tracks and roads and electricity connections to construction sites.

Most of the proposed pumped hydro-electric and temporary construction elements and most of the supporting infrastructure for Snowy 2.0 Main Works are located within the boundaries of KNP, although the disturbance footprint for the project during construction is less than 0.25% of the total KNP area. Some of the supporting infrastructure and construction sites and activities (including sections of road upgrade, power and communications infrastructure) extends beyond the national park boundaries. These sections of infrastructure are primarily located to the east and south of Tantangara Reservoir. One temporary construction site is located beyond the national park along the Snowy Mountains Highway about 3 km east of Providence Portal (referred to as Rock Forest).

The project is described in more detail in Chapter 2.

### 1.3 Project Area

The project area for Snowy 2.0 Main Works has been identified and includes all the elements of the project, including all construction and operational elements. The project area is shown on **Figure 1.1** and **Figure 1.2**. Key features of the project area are:

- the water bodies of Tantangara and Talbingo reservoirs, covering areas of 19.4 square kilometres (km<sup>2</sup>) and 21.2 km<sup>2</sup> respectively. The reservoirs provide the water to be utilised in Snowy 2.0;
- major watercourses including the Yarrangobilly, Eucumbene and Murrumbidgee rivers and some of their tributaries;
- KNP, within which the majority of the project area is located. Within the project area, KNP is characterised by two key zones: upper slopes and inverted treelines in the west of the project area (referred to as the 'ravine') and associated subalpine treeless flats and valleys in the east of the project area (referred to as the 'plateau'); and
- farm land southeast of KNP at Rock Forest.



The project area is interspersed with built infrastructure including recreational sites and facilities, main roads as well as unsealed access tracks, hiking trails, farmland, electricity infrastructure, and infrastructure associated with the Snowy Scheme.

## 1.4 Proponent

Snowy Hydro is the proponent for the Snowy 2.0 Main 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.

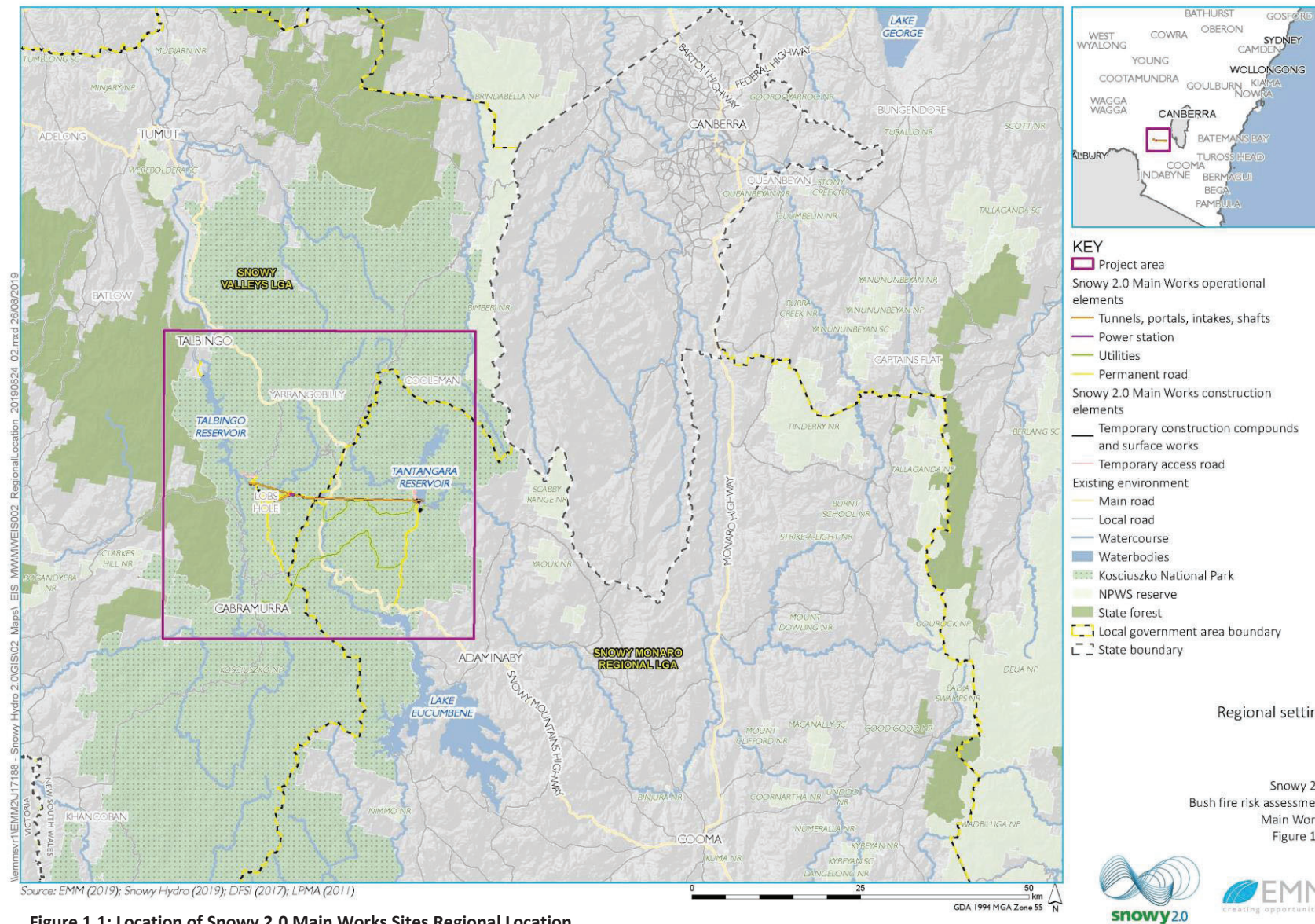


Figure 1.1: Location of Snowy 2.0 Main Works Sites Regional Location



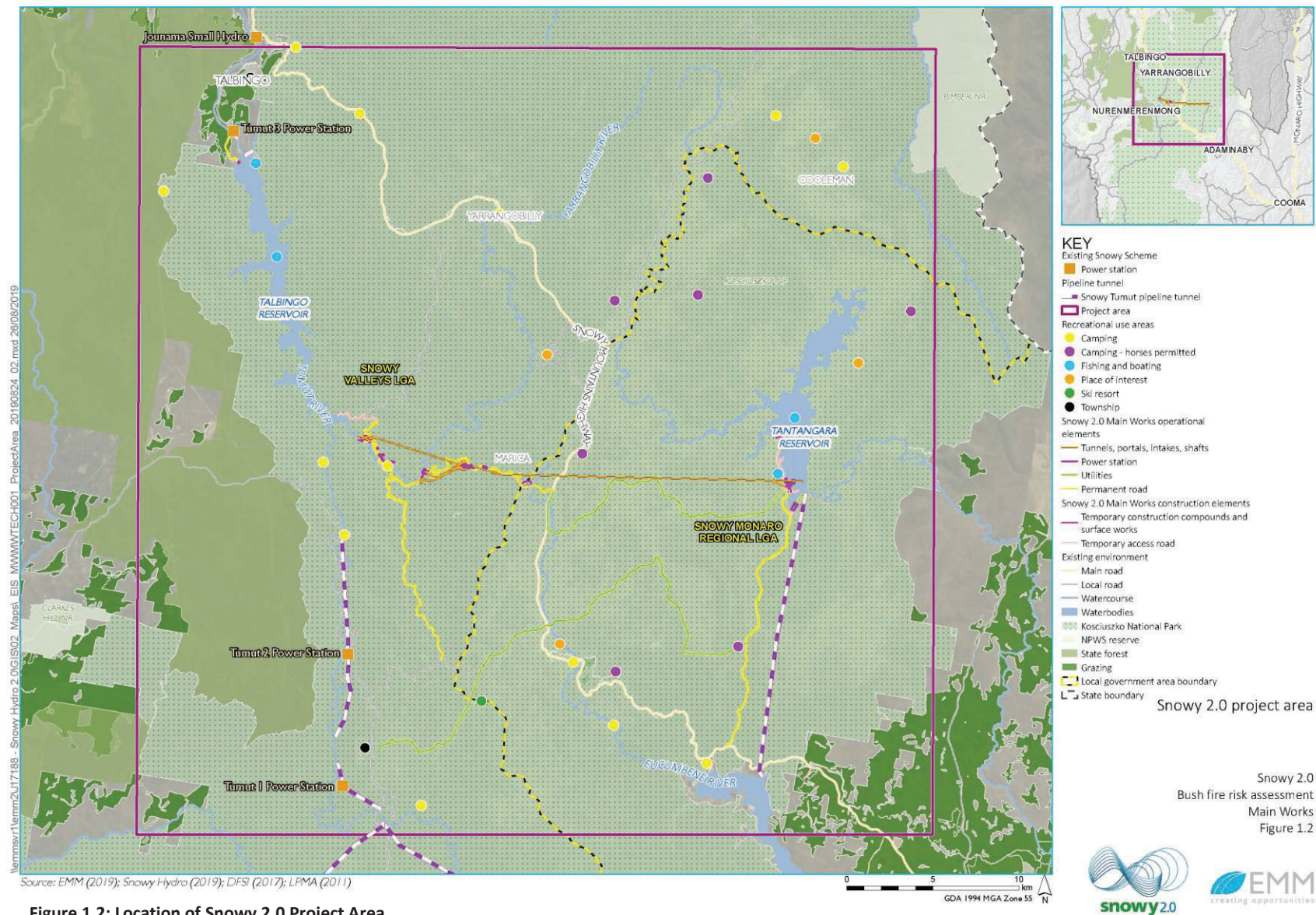


Figure 1.2: Location of Snowy 2.0 Project Area



## 1.5 Purpose of this report

This Bushfire Risk and Hazard Assessment supports the Snowy 2.0 Main Works EIS. It documents the bushfire protection measures associated with the proposed Main Works, provides the methods and results, the initiatives built into the project design to avoid and minimise bushfire impacts, and the mitigation and management required to address residual impacts not able to be avoided.

The specific objectives of this assessment are to:

- identify the bushfire hazard surrounding the proposed Main Works;
- minimise the potential impact of radiant heat and direct flame contact by separating development from bushfire hazards as well as minimising the vulnerability of buildings to ignition and fire spread from flames, radiation and embers through identification of appropriate APZs;
- qualify appropriate access and egress for workers, contractors, the public and firefighters;
- provide adequate water supplies for bushfire suppression; and
- determine emergency planning and maintenance requirements of APZs, fire trails, access for firefighting and on-site equipment for fire suppression.

This Bushfire Risk and Hazard Assessment has been prepared in accordance legislation and regulations provided in **Section 1.6**.

## 1.6 Assessment Guidelines and Requirements

### 1.6.1 Secretary's Environmental Assessment Requirements

This Bushfire Risk and Hazard Assessment has been prepared in accordance with the Secretary's Environmental Assessment Requirements (SEARs) for Snowy 2.0 Main Works, issued on 31 July 2019, as well as relevant government assessment requirements, guidelines and policies, and in consultation with the relevant government agencies.

The SEARs must be addressed in the EIS. Table 1 lists the matters relevant to this assessment and where they are addressed in this report.

**Table 1: Relevant matters raised in SEARs**

Reference	Requirement	Section Addressed
Public Safety	including an assessment of the risks to public safety, paying particular attention to bushfire risks, emergency egress and evacuation, and the handling and use of any dangerous goods	Bushfire Risks & Emergency Egress and Evacuation (Section 6)

### 1.6.2 National Parks and Wildlife Act 1974

Whilst the Snowy 2.0 works will operate under the Snowy Park Lease issued under section 37B of the *National Parks and Wildlife Act 1974* (NP&W Act 1974), the zones under that Act are still relevant to a bushfire and hazard assessment of the Main Works. The proposed works will be located within the E1 National Park and Nature Reserves Zone. The main objectives of this zone are:

- to enable the management and appropriate use of land that is reserved under the NP&W Act 1974 or that is acquired under Part 11 of NP&W Act 1974;

- to enable uses authorised under the NP&W Act 1974; and
- to identify land that is to be reserved under the NP&W Act 1974 and to protect the environmental significance of that land.

Management principles apply to the reserved land ‘to identify, protect and conserve areas containing outstanding or representative ecosystems, natural or cultural features or landscapes or phenomena that provide opportunities for public appreciation and inspiration and sustainable visitor or tourist use and enjoyment’. Under Section 30E of the NP&W Act 1974 the management principles that apply to national parks include:

- the conservation of biodiversity, the maintenance of ecosystem function, the protection of geological and geomorphological features and natural phenomena and the maintenance of natural landscapes;
- the conservation of places, objects, features and landscapes of cultural value;
- the protection of the ecological integrity of one or more ecosystems for present and future generations;
- the promotion of public appreciation and understanding of the national park’s natural and cultural values;
- provision for sustainable visitor or tourist use and enjoyment that is compatible with the conservation of the national park’s natural and cultural values;
- provision for the sustainable use (including adaptive reuse) of any buildings or structures or modified natural areas having regard to the conservation of the national park’s natural and cultural values;
- provision for the carrying out of development in any part of a special area (within the meaning of the *Hunter Water Act 1991*) in the national park that is permitted under section 185A having regard to the conservation of the national park’s natural and cultural values; and
- provision for appropriate research and monitoring.

The *Kosciuszko National Park Plan of Management (DEC 2006)* (KNP PoM), which includes the Snowy Management Plan details the long-term management guidelines to maintain the values of the national park. The KNP PoM specifies the fire management strategies to be:

- based upon the imperatives of firefighter safety and the protection of life and property;
- consistent with the protection of natural and cultural values;
- broadly based and integrate fire prevention, preparedness, response and recovery strategies;
- practical, achievable and cost-effective;
- based upon a strategic analysis of risks to assets;
- focused on the protection of significant values and assets;
- based upon sound science;
- informed by the known and likely implications of climate change;
- based upon a landscape-wide approach; and
- supported by the community.

The *Kosciuszko National Park Fire Management Strategy 2008-2013* (DECC 2008) outlines the National Parks and Wildlife Service (NPWS) procedures on Asset Protection Zones. This document was prepared

in accordance with the policies and procedures which were detailed in the *NPWS Fire Management Manual* (NPWS 2006) and the KNP PoM. This strategy has identified existing Asset Protection Zones (APZs) for assets of significance within the KNP which include assets of Snowy Hydro Limited. It also identifies an assessment of APZs within KNP are carried out to provide compliance with performance criteria or acceptable solutions with *Planning for Bush Fire Protection* (NSWRFS 2006) and AS 3959 (*Construction of buildings in bush fire-prone areas*). Consultation with the NSW RFS will be undertaken where compliance is constrained.

### 1.6.3 Environmental Planning and Assessment Act 1979

The NSW EP&A Act and NSW *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) form the statutory framework for planning approval and environmental assessment in NSW. This legislation is supported by environmental planning instruments (EPIs) including State environmental planning policies (SEPPs) and local environmental plans (LEPs).

A bush fire safety authority under section 100B of the *Rural Fires Act 1997* (RF Act), is not required under section 5.23 of the EP&A Act for state significant infrastructure.

### 1.6.4 Rural Fires Act 1997

Bush fire suppression and management is regulated by the RF Act. The objects of this Act are to provide for the:

- prevention, mitigation and suppression of bush and other fires in local government areas (or parts of areas) and other parts of the State constituted as rural fire districts;
- co-ordination of bush firefighting and bush fire prevention throughout the State;
- protection of persons from injury or death, and property from damage, arising from fires; and
- protection of the environment by requiring certain activities referred to above to be carried out having regard to the principles of ecologically sustainable development described in section 6 (2) of the *Protection of the Environment Administration Act 1991*.

Under section 63 of the RF Act it states that it is the duty of a public authority to take the notified steps and any other practicable steps to prevent the occurrence of bush fires on, and to minimise the danger of the spread of a bush fire on or from any land vested in or under its control or management.

For bush fire hazard reduction works under the RF Act, approval, consent or other authorisation is not required under *National Parks and Wildlife Act 1974* if:

- the work is carried out in accordance with a bush fire risk management plan that applies to the land; and
- there is a bush fire hazard reduction certificate in force in respect of the work and the work is carried out in accordance with any conditions specified in the certificate; and
- the work is carried out in accordance with the provisions of any bush fire code applying to the land specified in the certificate.

Furthermore, emergency firefighting does not apply to any stop work order or interim protection orders under Part 6A, or harm to fauna for the purposes of section 45, 70, 98, 99 or 100 of the *National Parks and Wildlife Act 1974*.

### 1.6.5 Planning for Bush Fire Protection – Final Draft 2018

*Planning for Bush Fire Protection 2006* is currently under review by the NSW RFS with a pre-release draft issued in 2018 and a final gazetted version and amended legislation expected in late 2019. The objectives of the *Planning for Bush Fire Protection (PBP) 2018* are to:

- afford buildings and their occupants protection from exposure to a bush fire;
- provide for a defensible space to be located around buildings;
- provide appropriate separation between a hazard and buildings which, in combination with other measures, minimises material ignition;
- ensure that appropriate operational access and egress for emergency service personnel and residents is available;
- provide for ongoing management and maintenance of bush fire protection measures; and
- ensure that utility services are adequate to meet the needs of firefighters.

### 1.6.6 National Construction Code

The Building Code of Australia (BCA) is adopted in NSW through the EP&A Act. The National Construction Code (NCC) is a performance-based code for the construction of buildings which contains all the Performance Requirements comprising BCA as Volumes 1 and 2 and the Plumbing Code of Australia as Volume 3. Construction of buildings in bush fire prone areas for performance requirements and Deemed-to-Satisfy provisions relating are covered in the NCC. Provisions apply to buildings of Class 1, Class 2, Class 3, Class 4, Class 10 and buildings considered Special Fire Protection Purpose. The Deemed-to-Satisfy solution in the NCC for buildings in designated bush fire prone areas is the *Australia Standard 3959 Construction of buildings in bush fire prone areas* and the *NASH Standard: Steel Framed Construction in Bushfire Areas 2014*.

### 1.6.7 Australian Standard AS3959

The Australian Standard AS3959-2018 *Construction of buildings in bushfire-prone areas* (Standards Australia 2018) (AS 3959) is applied throughout Australia to the construction of buildings on bush fire prone lands. Its objectives are to prescribe particular construction details for buildings to reduce the risk of ignition from a bushfire while the fire front passes.

### 1.6.8 Bush fire prone lands

The subject land is mapped as bush fire prone land on the Snowy Valleys LGA and Snowy Monaro Regional LGA Bush fire Prone Land map.

## 1.7 Related projects

There are three other projects related to Snowy 2.0 Main Works, they are:

- Snowy 2.0 Exploratory Works (SSI-9208) – a Snowy Hydro project with Minister’s approval;
- Snowy 2.0 Transmission Connect Project (SSI-9717) – a project proposed by TransGrid; and
- Snowy 2.0 – Segment Factory (SSI-10034) – a project proposed by Snowy Hydro.

While these projects form part of the CSSI declaration for Snowy 2.0 and Transmission Project, they do not form part of Snowy Hydro’s application for Snowy 2.0 Main Works. These related projects are subject to separate application and approval processes. Staged submission and separate approval is appropriate



for a project of this magnitude, due to its complexity and funding and procurement processes. However, cumulative impacts have been considered in this report where relevant.

## 1.8 Other relevant reports

This Bushfire Risk and Hazard Assessment has been prepared with reference to other technical reports that were prepared as part of the Snowy 2.0 Main Works EIS. The other relevant reports referenced in this Bushfire Risk and Hazard Assessment are listed below.

- Aboriginal cultural heritage assessment (NSW Archaeology 2019) – Appended to the EIS;
- Air quality and greenhouse gas impact assessment (EMM 2019) – Appended to the EIS;
- Aquatic ecology assessment (Cardno 2019) – Appended to the EIS;
- Biodiversity development assessment (EMM 2019) – Appended to the EIS;
- Bushfire risk and hazard assessment (EcoLogical 2019) – Appended to the EIS;
- Cenozoic geodiversity report (Troedson 2019 – Appended to the EIS;
- Contamination assessment (EMM 2019) – Appended to the EIS;
- Economic assessment (Gillespie 2019) – Appended to the EIS;
- Groundwater assessment (EMM 2019) – Appended to the EIS;
- Hazard and risk assessment (Sherpa 2019) – Appended to the EIS;
- Heritage assessment and statement of heritage impact (NSW Archaeology 2019) – Appended to the EIS;
- Navigation assessment (RHDHV 2019) – Appended to the EIS;
- Noise and vibration impact assessment (EMM 2019) – Appended to the EIS;
- Paleozoic geodiversity report (Percival 2019) – Appended to the EIS;
- Recreational users study (TRC 2019) – Appended to the EIS;
- Reservoir assessment overview (RHDHV 2019) – Appended to the EIS;
- Social impact assessment – (Elton Consulting 2019) – Appended to the EIS;
- Soils and land assessment (EMM 2019) – Appended to the EIS;
- Surface water assessment (EMM 2019) – Appended to the EIS;
- Traffic and Transport Assessment Report (SCT 2019) – Appended to the EIS; and
- Water assessment (EMM 2019) – Appended to the EIS.

## 2. Project description

This chapter provides a summary of the Snowy 2.0 Main Works project. It outlines the functional infrastructure required to operate Snowy 2.0, as well as the key construction elements and activities required to build it. A more comprehensive detailed description of the project is provided in Chapter 2 (Project description) of the EIS, which has been relied upon for the basis of this technical assessment.

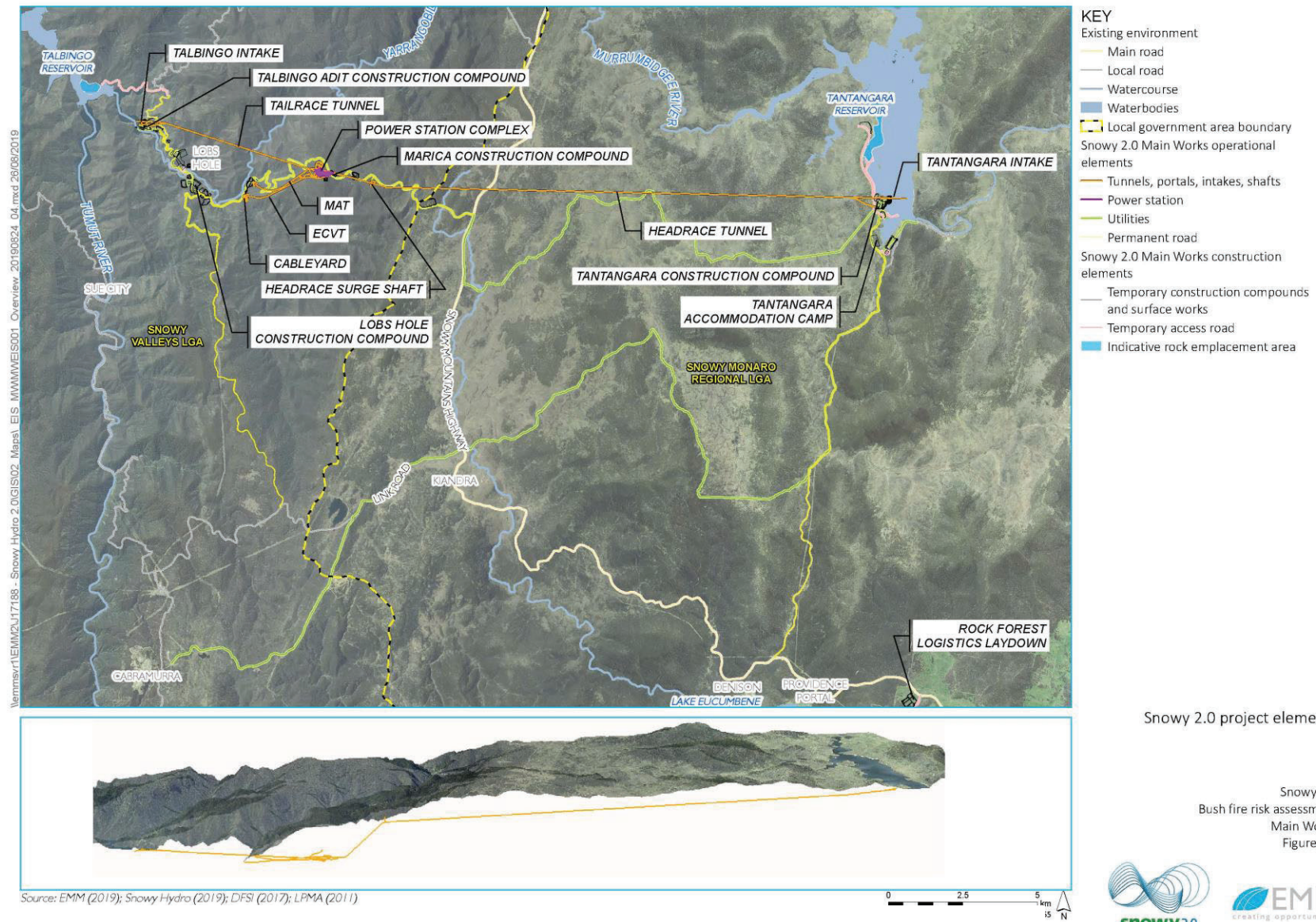
### 2.1 Overview of Snowy 2.0

Snowy 2.0 will link the existing Tantangara and Talbingo reservoirs within the Snowy Scheme through a series of underground tunnels and a new hydro-electric power station will be built underground. An overview of Snowy 2.0 is shown on **Figure 1.1** and **Figure 1.2**, and the key project elements of Snowy 2.0 are summarised in **Table 2**.

**Table 2: Overview of Snowy 2.0 Main Works**

Project element	Summary of the project
Project area	The project area is the broader region within which Snowy 2.0 will be built and operated, and the extent within which direct impacts from Snowy 2.0 Main Works are anticipated.
Permanent infrastructure	<p>Snowy 2.0 infrastructure to be built and operated for the life of the assets include the:</p> <ul style="list-style-type: none"> <li>• intake and gate structures and surface buildings at Tantangara and Talbingo reservoirs;</li> <li>• power waterway tunnels primarily comprising the headrace tunnel, headrace surge structure, inclined pressure tunnel, pressure pipelines, tailrace surge tank and tailrace tunnel;</li> <li>• underground power station complex comprising the machine hall, transformer hall, ventilation shaft and minor connecting tunnels;</li> <li>• access tunnels (and tunnel portals) to the underground power station comprising the main access tunnel (MAT) and emergency egress, communication, and ventilation tunnel (ECVT);</li> <li>• establishment of a portal building and helipad at the MAT portal;</li> <li>• communication, water and power supply including the continued use of the Lobs Hole substation;</li> <li>• cable yard adjacent to the ECVT portal to facilitate the connection of Snowy 2.0 to the NEM;</li> <li>• access roads and permanent bridge structures needed for the operation and maintenance of Snowy 2.0 infrastructure; and</li> </ul> <p>fish control structures on Tantangara Creek and near Tantangara Reservoir wall.</p>
Temporary infrastructure	<p>Temporary infrastructure required during the construction phase of Snowy 2.0 Main Works are:</p> <ul style="list-style-type: none"> <li>• construction compounds, laydown, ancillary facilities and helipads;</li> <li>• accommodation camps for construction workforce;</li> <li>• construction portals and adits to facilitate tunnelling activities;</li> <li>• barge launch ramps;</li> <li>• water and wastewater management infrastructure (treatment plants and pipelines);</li> <li>• communication and power supply; and</li> <li>• temporary access roads.</li> </ul>

Project element	Summary of the project
Disturbance area	The disturbance area is the extent of construction works required to build Snowy 2.0. The maximum disturbance area is about 1,680 hectares (ha), less than 0.25% of the total area of KNP. Parts of the disturbance area will be rehabilitated and landformed and other parts will be retained permanently for operation (operational footprint).
Operational footprint	The operational footprint is the area required for permanent infrastructure to operate Snowy 2.0. The maximum operational footprint is about 99 ha. This is 0.01% of the total area of KNP.
Tunnelling method	The primary tunnelling method for the power waterway is by tunnel boring machine (TBM), with portals and adits using drill and blast methods. Excavation for other underground caverns, chambers and shafts will be via combinations of drill and blast, blind sink, and/or raise bore techniques.
Excavated rock management	Excavated rock will be generated as a result of tunnelling activities and earthworks. The material produced through these activities will be stockpiled and either reused by the contractor (or NPWS), placed permanently within Tantangara or Talbingo reservoirs, used in final land forming and rehabilitation of construction pads in Lobs Hole, or transported offsite.
Construction water and wastewater management	<p>Water supply for construction will be from the two existing reservoirs (Talbingo and Tantangara) and reticulated via buried pipelines (along access roads). Raw water will be treated as necessary wherever potable water is required (eg at accommodation camps).</p> <p>Water to be discharged (comprising process water, wastewater and stormwater) will be treated before discharge to the two existing reservoirs (Talbingo and Tantangara) as follows:</p> <ul style="list-style-type: none"> <li>• treated process water will be reused onsite where possible to reduce the amount of discharge to reservoirs, however excess treated water will be discharged to the reservoirs;</li> <li>• collected sewage will be treated at sewage treatment plants to meet the specified discharge limits before discharge and/or disposal; and</li> <li>• stormwater will be captured and reused as much as possible.</li> </ul>
Rehabilitation	Rehabilitation of areas disturbed during construction including reshaping to natural appearing landforms or returning to pre-disturbance condition, as agreed with NPWS and determined by the rehabilitation strategy. This includes construction areas at Lobs Hole which comprise surplus cut materials that are required for the construction. Areas to be used by Snowy Hydro in the long-term may be re-shaped and rehabilitated to maintain access and operational capabilities (eg intakes and portal entrances).
Construction workforce	The construction workforce for the project is expected to peak at around 2,000 personnel.
Operational life	The operational life of the project is estimated to be 100 years.
Operational workforce	The operational workforce is expected to be 8-16 staff, with fluctuations of additional workforce required during major maintenance activities.
Hours of operation	<p>Construction of Snowy 2.0 will be 24/7 and 365 days per year.</p> <p>Operation of Snowy 2.0 will be 24/7 and 365 days per year.</p>
Capital investment value	Estimated to be \$4.6 billion.





## 2.2 Construction of Snowy 2.0

A number of construction activities will be carried out concurrently, and across a number of different sites. Specific details on these activities as well as an indicative schedule of construction activities is provided in Chapter 2 (Project description) of the EIS. This section summarises the key construction elements of the project.

**Table 3** provides an overview of the construction elements, their purpose and location within the project area.

**Table 3: Snowy 2.0 Construction elements**

Construction element	Purpose	Location
Construction sites	<p>Due to the remoteness of Snowy 2.0, construction sites are generally needed to:</p> <ul style="list-style-type: none"> <li>• Provide ancillary facilities such as concrete batching plants, mixing plants and on-site manufacturing;</li> <li>• Store machinery, equipment and materials to be used in construction;</li> <li>• Provide access to underground construction sites; and</li> <li>• Provide onsite accommodation for the construction workforce.</li> </ul>	Each construction site needed for Snowy 2.0 is shown on <b>Figure 2.2</b> to <b>Figure 2.7</b> .
Substations and power connection	One substation is required to provide permanent power to Snowy 2.0, at Lobs Hole. This substation is proposed as part of a modification to the Exploratory Works with a capacity of 80 mega volt amp (MVA). It will continue to be used for Main Works, however requires the establishment of further power supply cables to provide power to the work sites and TBM at Tantangara, as well as Talbingo, in particular to power the TBMs via the MAT, ECVT, Talbingo and Tantangara portals.	The supporting high voltage cable route mostly follows access roads to each of the work sites, using a combination of aerial and buried arrangements.
Communications system	Communications infrastructure will connect infrastructure at Tantangara and Talbingo reservoirs to the existing communications system at the Tumut 3 power station (via the submarine communications cable in Talbingo Reservoir established during Exploratory Works) and to Snowy Hydro's existing communications infrastructure at Cabramurra.	The cable will be trenched and buried in conduits within access roads. Crossing of watercourses and other environmentally sensitive areas will be carried out in a manner that minimises environmental impacts where possible, such as bridging or underboring.
Water and waste water servicing	<p>Drinking water will be provided via water treatment plants located at accommodation camps. Water for treatment will be sourced from the nearest reservoir.</p> <p>There are three main wastewater streams that require some form of treatment before discharging to the environment, including:</p> <ul style="list-style-type: none"> <li>• Tunnel seepage and construction wastewater (process water);</li> <li>• Domestic sewer (wastewater); and</li> </ul> <p>Construction site stormwater (stormwater).</p>	<p>Utility pipelines generally follow access roads.</p> <p>Water treatment plants (drinking water) will be needed for the accommodation camps and will be located in proximity.</p> <p>Waste water treatment plants will similarly be located near accommodation camps.</p> <p>Process water treatment plants will be at construction compounds and adits where needed to manage</p>

Construction element	Purpose	Location
		tunnel seepage and water during construction.
Temporary and permanent access roads	<p>Access road works are required to:</p> <ul style="list-style-type: none"> <li>provide for the transport of excavated material between the tunnel portals and the excavated rock emplacement areas;</li> <li>accommodate the transport of oversized loads as required; and</li> <li>facilitate the safe movement of plant, equipment, materials and construction workers into and out of construction sites.</li> </ul> <p>The access road upgrades and establishment requirements are shown on <b>Figure 2.2</b> to <b>Figure 2.7</b>. These roads will be used throughout construction including use of deliveries to and from site and the external road network. Some additional temporary roads will also be required within the footprint to reach excavation fronts such as various elevations of the intakes excavation or higher benches along the permanent roads.</p>	<p>The access road upgrades and establishment requirements are shown across the project area. Main access and haulage to site will be via Snowy Mountains Highway, Link Road and Lobs Hole Ravine Road (for access to Lobs Hole), and via Snowy Mountains Highway and Tantangara Road (for access to Tantangara Reservoir) (see <b>Figure 2.1</b>).</p>
Excavated rock management	<p>Approximately 9 million m<sup>3</sup> (unbulked) of excavated material will be generated by construction and require management.</p> <p>The <b>strategy</b> for management of excavated rock will aim to maximise beneficial reuse of materials for construction activities. Beneficial re-use of excavated material may include use for road base, construction pad establishment, selected fill and tunnel backfill and rock armour as part of site establishment for construction.</p> <p>Excess excavated material that cannot be re-used during construction will be disposed of within Talbingo and Tantangara reservoirs, used in permanent rehabilitation of construction pads to be left in situ in Lobs Hole, or transported for on-land disposal if required.</p>	Placement areas are shown on <b>Figure 2.2</b> and <b>Figure 2.7</b> .
Barge launch facilities	Barge launch facilities on Talbingo Reservoir will have already been established during Exploratory Works for the placement of the submarine communications cable, and will continued to be used for Main Works for construction works associated with the Talbingo intake structure. The Main Works will require the establishment of barge launch facilities on Tantangara Reservoir to enable these similar works (removal of the intake plug).	Barge launch sites are shown on <b>Figure 2.2</b> and <b>Figure 2.7</b> .
Construction workforce	The construction workforce will be accommodated entirely on site, typically with a FIFO/DIDO roster. Private vehicles will generally not be permitted and the workforce bused to and from site.	Access to site will be via Snowy Mountains Highway

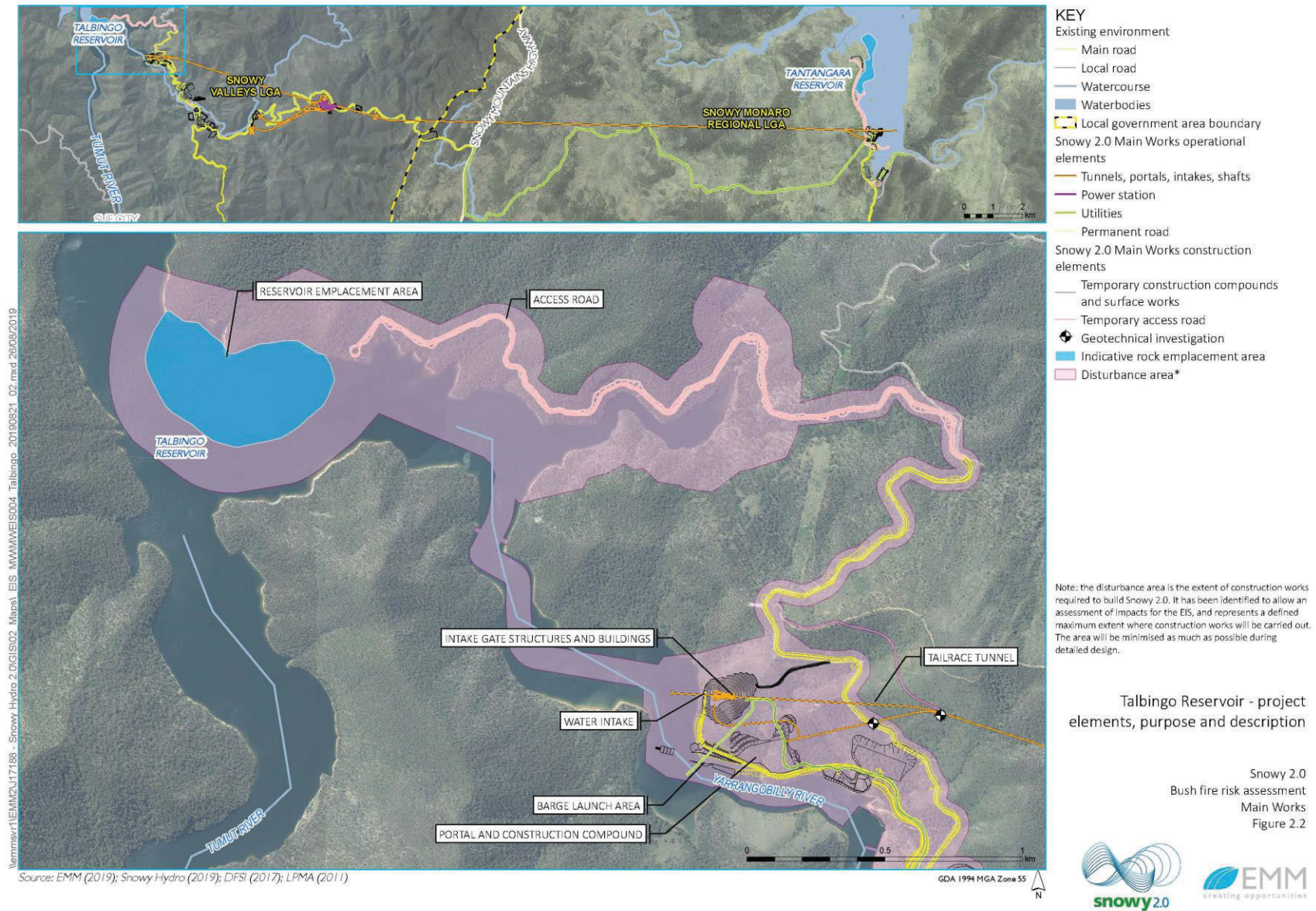
The key areas of construction are shown on **Figure 2.2** to **Figure 2.7** and can be described across the following locations:

- Talbingo Reservoir – Talbingo Reservoir provides the lower reservoir for the pumped hydro-electric project and will include the tailrace tunnel and water intake structure. The site will also be used for temporary construction compounds and other temporary ancillary activities;
- Lobs Hole – this site will be used primarily for construction (including construction of the MAT and ECVT portals and tunnels to the underground power station and the headrace tunnel (and headrace tunnel surge shaft), underground tailrace surge shaft and a temporary accommodation camp);
- Marica – the site will be used primarily for construction to excavate the ventilation shaft to the underground power station as well as for the excavation and construction of the headrace surge shaft;
- Plateau – the land area between Snowy Mountains Highway and Tantangara Reservoir is referred to as the Plateau. The Plateau will be used to access and construct a utility corridor and construct a fish weir on Tantangara Creek;
- Tantangara Reservoir – Tantangara Reservoir will be the upper reservoir for the pumped hydro project and include the headrace tunnel and intake structure. The site will also be used for a temporary construction compound, accommodation camp and other temporary ancillary activities; and
- Rock Forest – a site to be used temporarily for logistics and staging during construction. It is located beyond the KNP along the Snowy Mountains Highway about 3 km east of Providence Portal.

During the construction phase, all work sites will be restricted access and closed to the public. This includes existing road access to Lobs Hole via Lobs Hole Ravine Road. Restrictions to water-based access and activities will also be implemented for public safety and to allow safe construction of the intakes within the reservoirs. Access to Tantangara Reservoir via Tantangara Road will be strictly subject to compliance with the safety requirements established by the contractor.

A key construction element for the project is the excavation and tunnelling for underground infrastructure including the power station, power waterway (headrace and tailrace tunnels) and associated shafts. The primary methods of excavation are shown in **Figure 2.8** with further detail on construction methods provided at Appendix D of the EIS.





**Figure 2.2: Talbingo Reservoir-project elements, purpose and description**



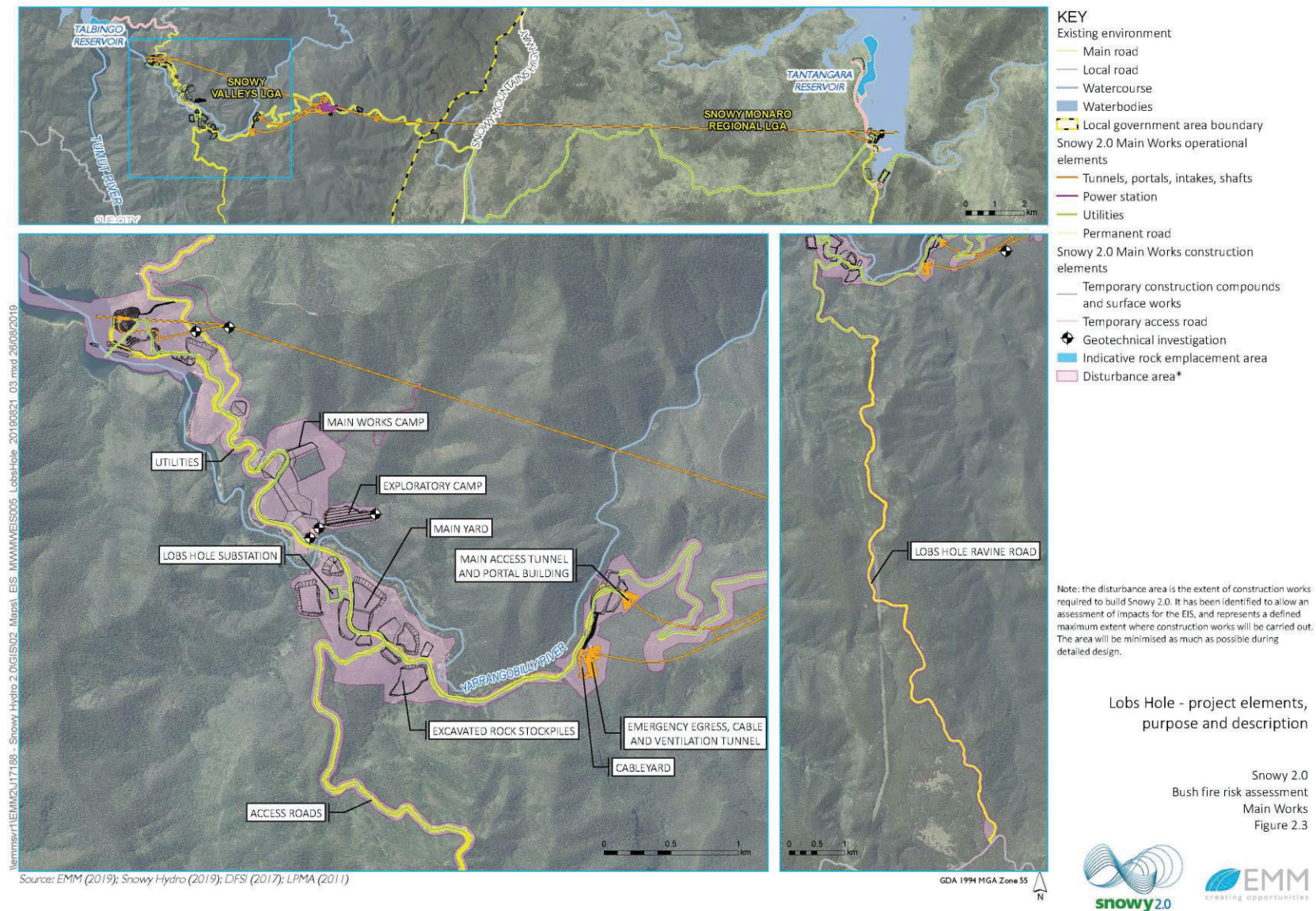


Figure 2.3: Lobs Hole - project elements, purpose and description



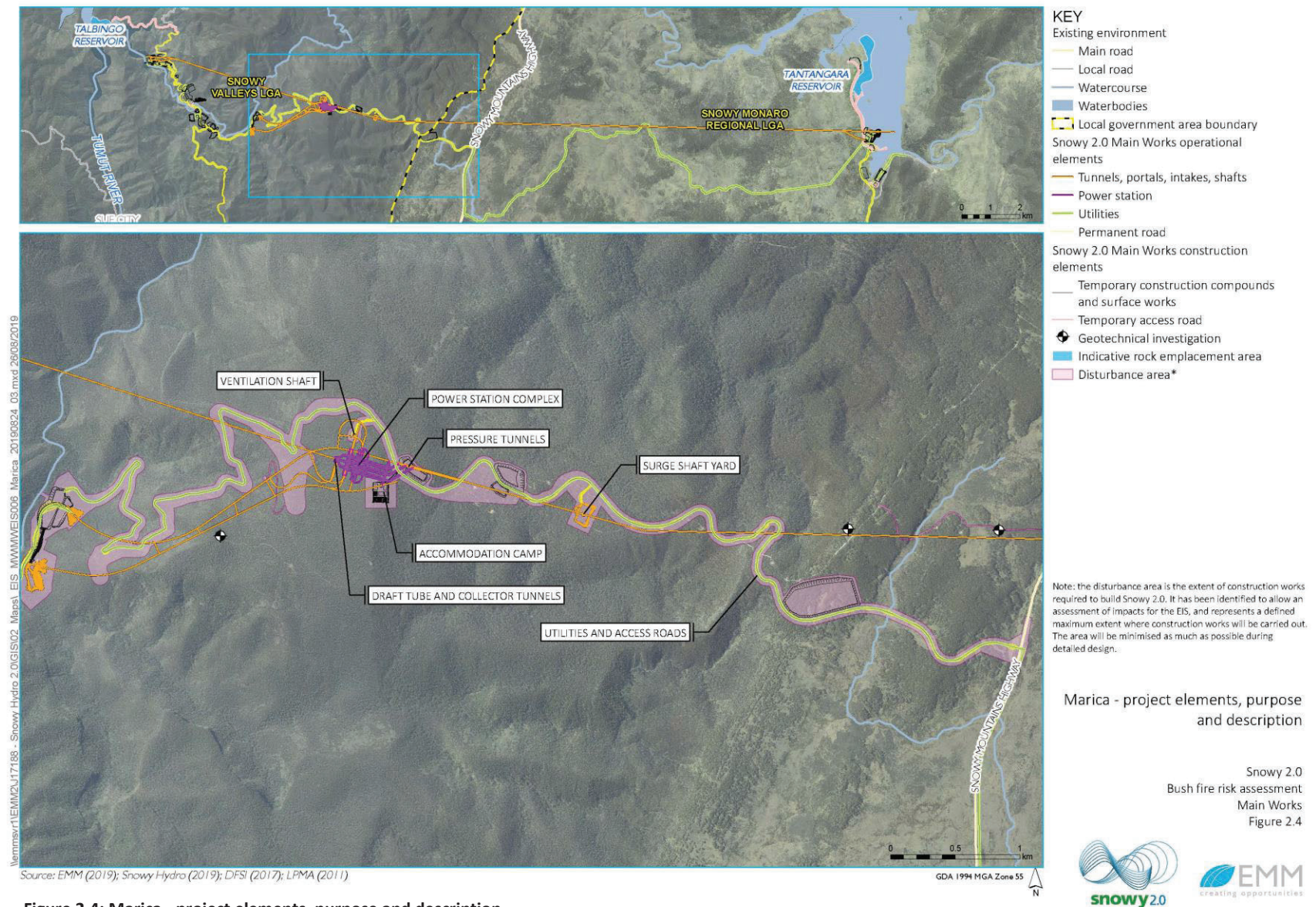


Figure 2.4: Marica - project elements, purpose and description



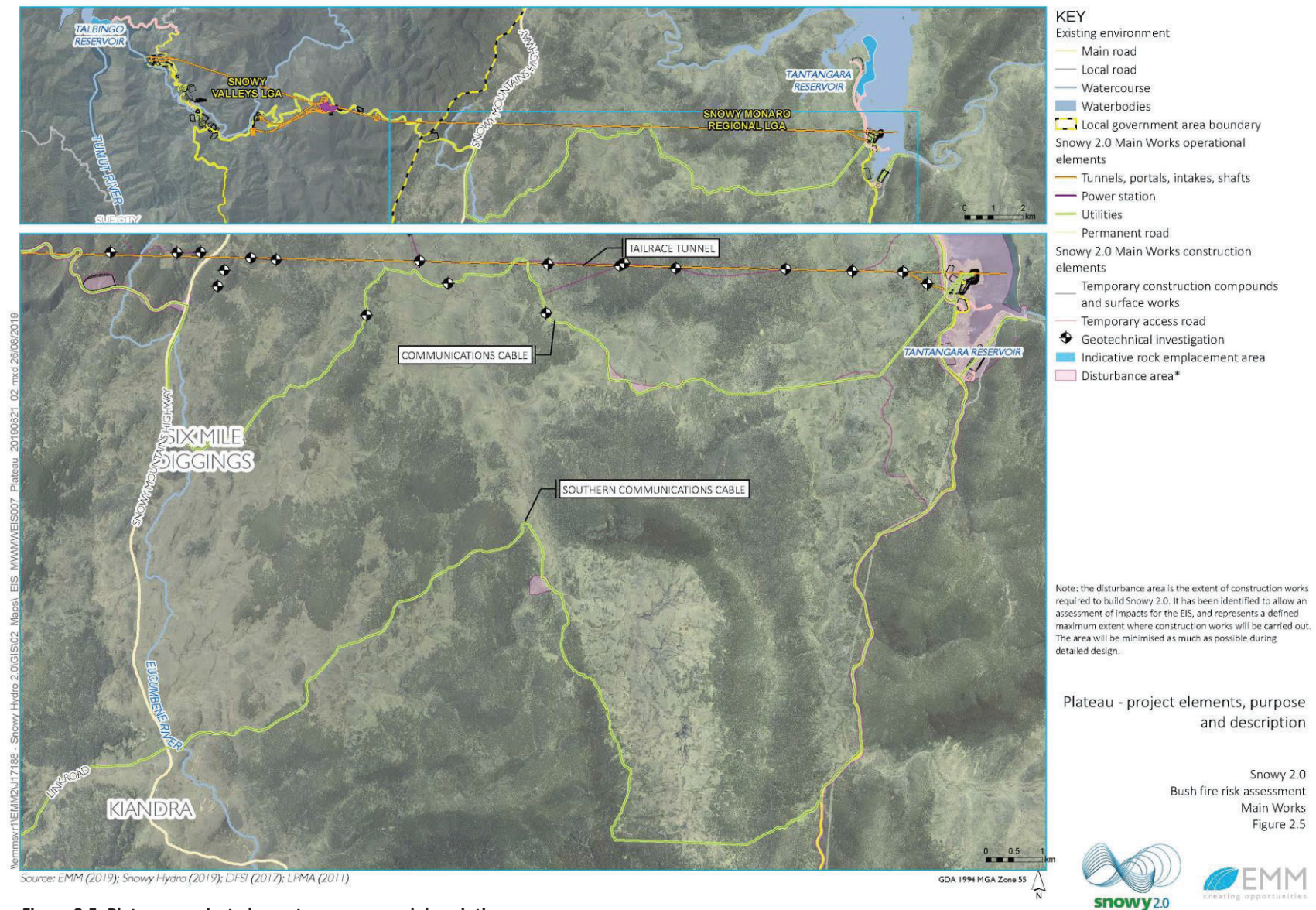
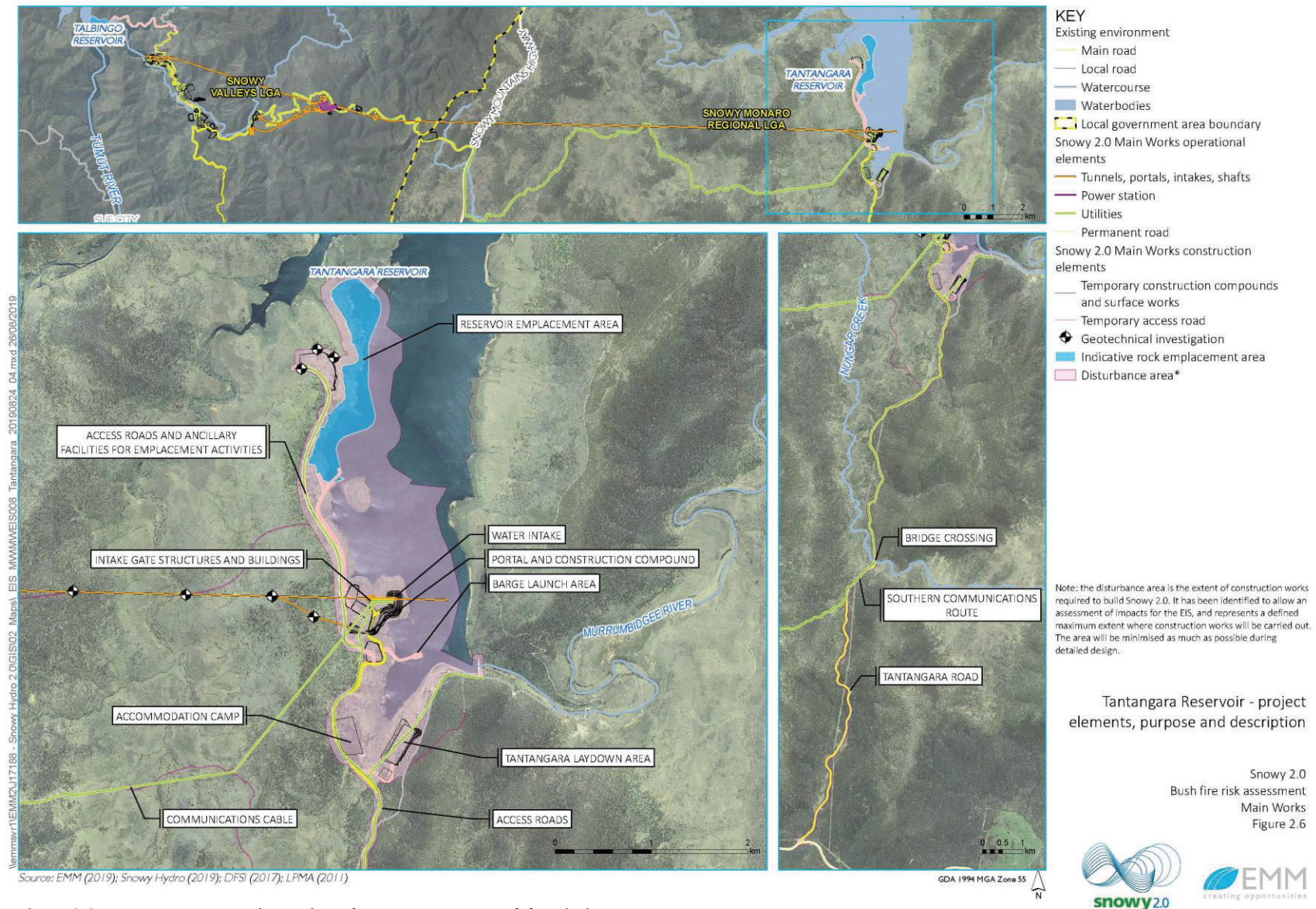


Figure 2.5: Plateau - project elements, purpose and description





**Figure 2.6: Tantangara Reservoir - project elements, purpose and description**



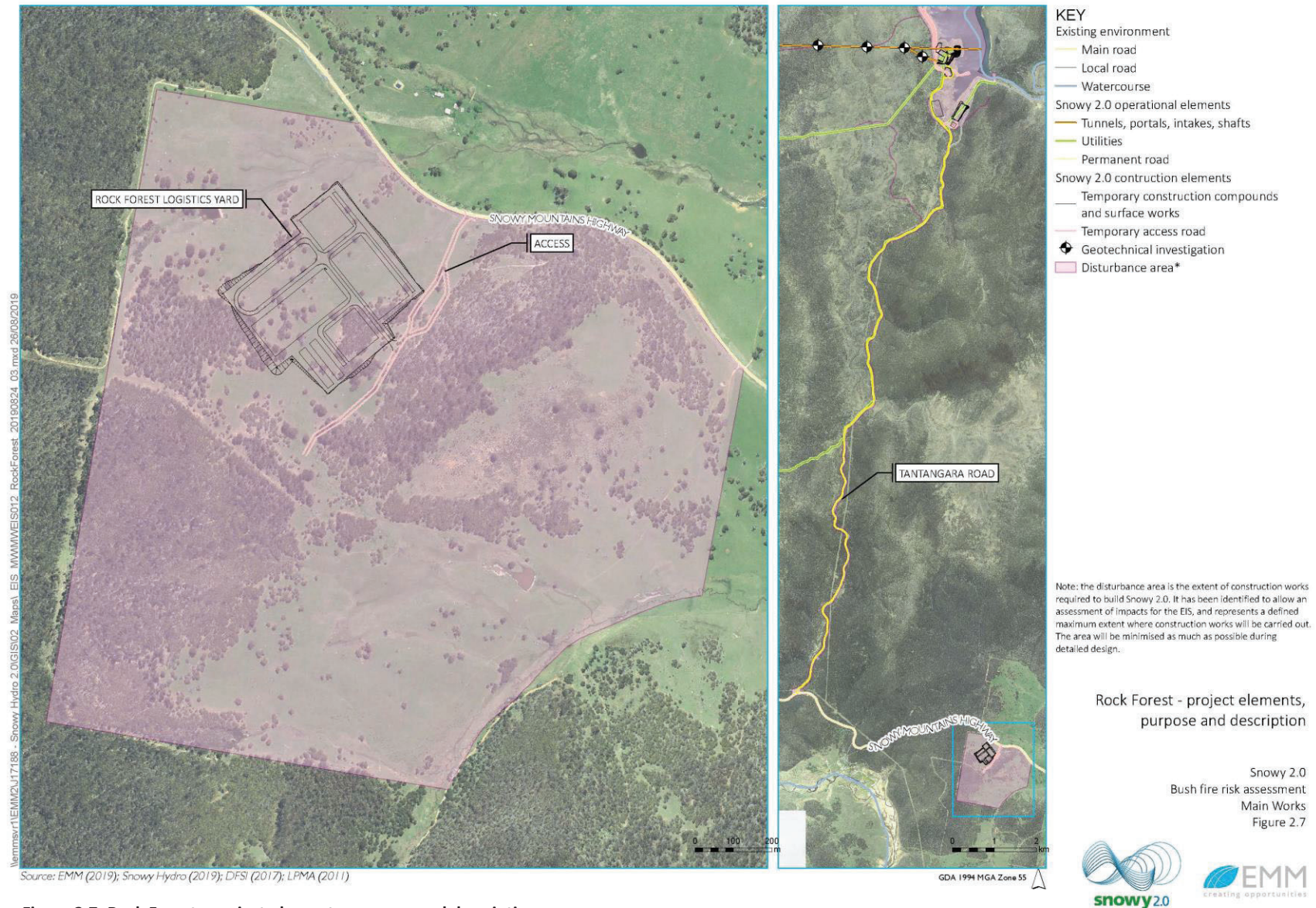
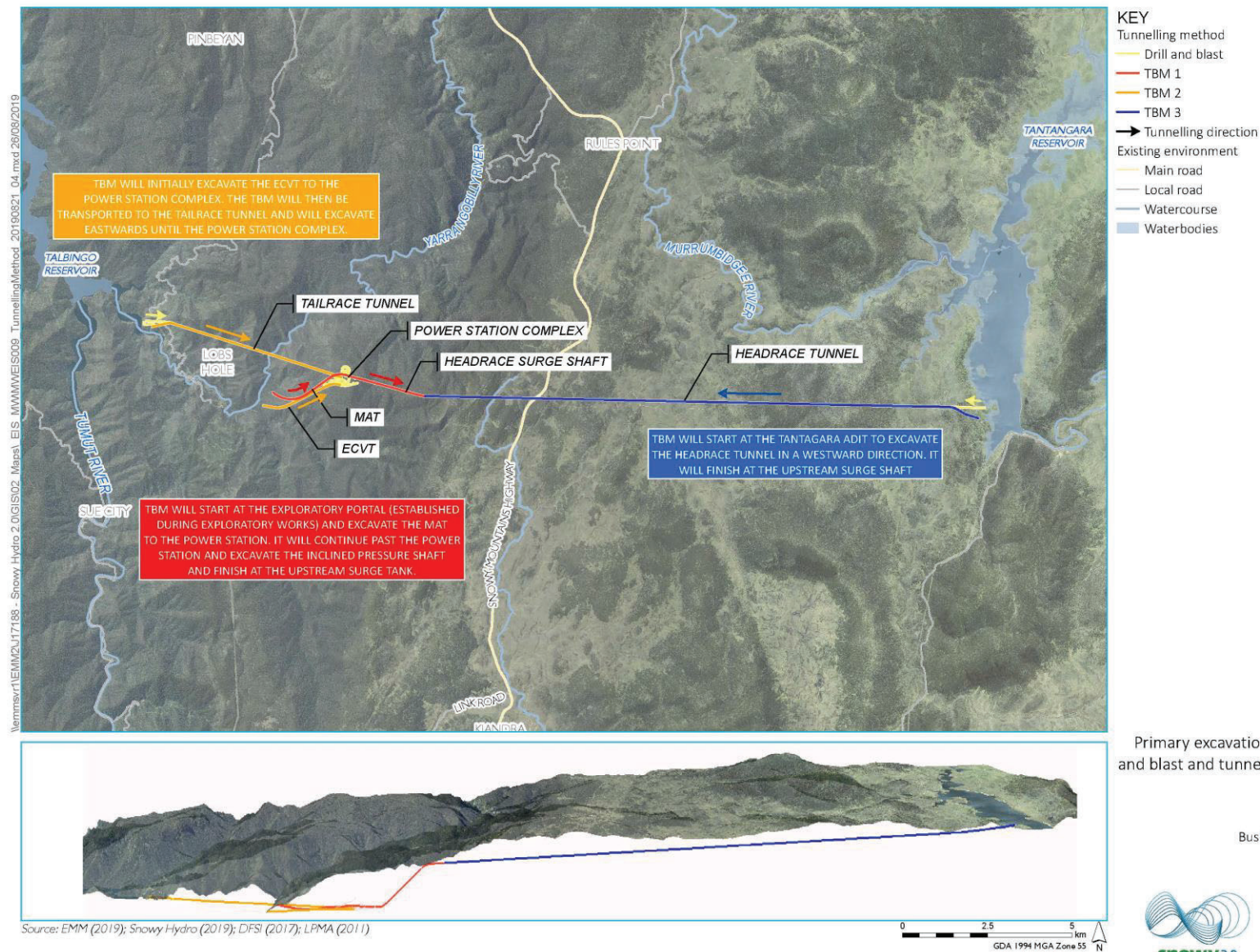


Figure 2.7: Rock Forest - project elements, purpose and description





Primary excavation methods – drill and blast and tunnel boring machine

Snowy 2.0  
Bush fire risk assessment  
Main Works  
Figure 2.8



Figure 2.8: Primary Excavation Methods - drill and blast and tunnel boring machine

## 2.3 Operation of Snowy 2.0

### 2.3.1 Scheme operation and reservoir management

Snowy 2.0 would operate within the northern Snowy-Tumut Development, connecting the existing Tantangara and Talbingo reservoirs.

Tantangara Reservoir currently has the following operational functions within the Snowy Scheme:

- collects releases from the Murrumbidgee River and the Goodradigbee River Aqueduct,
- provides a means for storage and diversion of water to Lake Eucumbene via the Murrumbidgee-Eucumbene Tunnel, and
- provides environmental releases through the Tantangara Reservoir river outlet gates to the Murrumbidgee River.

Talbingo Reservoir currently has the following operational functions:

- collects releases from Tumut 2 power station,
- collects releases from the Yarrangobilly and Tumut rivers,
- acts as head storage for water pumped up from Jounama Pondage, and
- acts as head storage for generation at Tumut 3 power station.

Due to its historic relationship to both the upstream Tumut 2 power station and downstream Tumut 3 power station, Talbingo Reservoir has had more operational functions than Tantangara Reservoir in the current Snowy Scheme.

Following the commencement of the operation of Snowy 2.0, both Tantangara and Talbingo reservoirs will have increased operational functions. Tantangara Reservoir will have the additional operational functions of acting as a head storage for generation from the Snowy 2.0 power station and also acting as a storage for water pumped up from Talbingo Reservoir. Talbingo Reservoir will have the additional operational function of acting as a tail storage from Snowy 2.0 generation.

As a result of the operation of Snowy 2.0, the water level in Tantangara Reservoir will be more variable than historically. Notwithstanding this, operations will not affect release obligations under the Snowy Water Licence nor will it involve any change to the currently imposed Full Supply Levels (FSLs). No additional land will be affected by virtue of the inundation of the reservoirs through Snowy 2.0 operations. Water storages will continue to be held wholly within the footprint of the existing FSLs.

### 2.3.2 Permanent access

Permanent access to Snowy 2.0 infrastructure is required. During operation, a number of service roads established during construction will be used to access surface infrastructure including the power station's ventilation shaft, water intake structures and gates, and the headrace tunnel surge shaft. Permanent access tunnels (the MAT and ECVT) will be used to enter and exit the power station. For some roads, permanent access by Snowy Hydro will require restricted public access arrangements.

### 2.3.3 Maintenance requirements

Maintenance activities required for Snowy 2.0 will be integrated with the maintenance of the existing Snowy Scheme. Maintenance activities that will be required include:

- maintenance of equipment and systems within the power station complex, intake structures, gates and control buildings;
- maintenance of access roads (vegetation clearing, pavement works, snow clearing);
- dewatering of the tailrace and headrace tunnel (estimated at once every 15 to 50 years, or as required); and
- maintenance of electricity infrastructure (cables, cable yard, cable tunnel).

## 2.4 Rehabilitation and final land use

A Rehabilitation Strategy has been prepared for Snowy 2.0 Main Works and appended to the EIS.

It is proposed that all areas not retained for permanent infrastructure will be revegetated and rehabilitated. At Lobs Hole, final landform design and planning has been undertaken to identify opportunities for the reuse of excavated material in rehabilitation to provide landforms which complement the surrounding topography in the KNP.

Given that most of Snowy 2.0 Main Works is within the boundaries of the KNP, Snowy Hydro will liaise closely with NPWS to determine the extent of decommissioning of temporary construction facilities and rehabilitation activities to be undertaken following the construction of Snowy 2.0 Main Works.

## 2.5 Environmental summary

The identification of significant environmental features, details of threatened species populations or ecological communities identified under the *Biodiversity Conservation Act 2016*, details and location of any Aboriginal object or Aboriginal place have been considered in the Main Works and provided by additional assessments as part of this EIS and are provided in Appendix Q.1, Q.2 and N.1.



### 3. Bushfire risk factors

The capacity for a fire to start and spread within the landscape can be assessed through consideration of regional fire weather, historic fire occurrence, potential ignition sources, vegetation, slope, access and construction standard of assets within this environment. These risk factors are detailed in the following sections.

#### 3.1 Regional fire weather

The climate experienced within KNP is strongly influenced by weather systems moving from west to east, with snow and rain on the western slopes brought by the moisture-laden western air stream moving across the north-south aligned mountain ranges. The pattern of prevailing wind conditions also varies from west to east, with the western slopes and higher altitude areas experiencing higher winds than the eastern slopes, potentially enabling vegetation to dry out quicker on western aspects under the drier westerly winds during the summer months.

Main Works sites experience a winter maximum and summer minimum rainfall pattern, with annual rainfall increasing with elevation. In higher elevation areas between three to five months of snowfall will contribute up to 60% of annual precipitation. The higher elevation Marica (1150-1290 asl.), Rock Forest (1160-1200m asl.) and Tantangara (1220-1270m asl) Main Works sites fall between the elevations of the Yarrangobilly (980m asl) and Cabramurra (1482m asl) Bureau of Meteorology (BOM) weather stations, which respectively have mean annual rainfall of 1178mm and 1169mm per annum (BOM 2018). The lower elevation Lobs Hole-Ravine Main Works sites receive the least rainfall of the project area sites. Located at approximately 550-650m asl., Lobs Hole-Ravine is slightly higher than the Talbingo BOM weather station (395m asl) which has mean annual rainfall 951mm (BOM 2018).

The majority of Main Works sites occur west of the Snowy Mountains Highway within the Southern Slopes Fire Weather Area and the Snowy Valleys Bush Fire Management Committee (BFMC) Area. The Snowy Valleys BFMC Bush Fire Risk Management Plan (Snowy Valleys BFMC 2017) identifies that within this region the:

- climate is cool temperate with winter rainfall maximum;
- bush fire season usually occurs from November to March;
- adverse fire weather is associated with north-westerly winds, high daytime temperature and low humidity; and
- dry lightning storms are common in the fire season.

The eastern sites of Tantangara and Rock Forest are within the western extent of the Monaro Alpine Fire Weather Area and the Snowy Monaro BFMC Area. The Snowy Monaro BFMC Bush Fire Risk Management Plan (Snowy Monaro BFMC 2009) identifies that within this region the:

- climate is cool temperate with winter and summer rainfall maximums;
- bush fire season usually occurs from October to March;
- adverse fire weather is associated with north-westerly to south-westerly winds, high daytime temperature and low humidity;
- dry lightning storms occur in the fire season; and
- fire danger periods have occurred in winter months.

The typical bushfire potential of vegetation within the KNP varies throughout the year, with these changes characterised by DECC (2008) as shown in **Table 4**. During an average bush fire season, the State Forests to the west of Lobs Hole/Ravine Main Works sites experience 31 Very High fire danger days and one Total Fire Ban (Severe fire danger or greater) day per annum (CSIRO 2018). This equates to on average more than two days each week during the summer in which *Very High* or greater fire danger occurs, and at least one Total Fire Ban Day (*Severe* or greater fire danger) each fire season.

In addition to these typical seasonal changes in bushfire risk, there are several climatic conditions identified (DECC 2008) which can further increase the potential for fires to start and spread over large areas:

- a wet spring and summer in the previous year (contributing to abundant grass fuels);
- a very dry winter and spring resulting in low soil and fuel moisture; and
- blocking high pressure systems develop in summer creating significant north-west wind flows.

Under these conditions, vegetation becomes dry enough for a bushfire to start and spread, and burn over large areas, at higher intensity, and producing embers and spotting ahead of the fire front. Such fires may impact each Main Works site from any direction, with sites most susceptible to bushfires burning from the west and north-west, south west under the influence of frontal systems, burning upslope and across slope under strong winds, or from winds funnelled from the direction of the Talbingo Reservoir.

**Table 4: Typical pattern of the yearly fire season in KNP**

Period	Unplanned fire risk	General Conditions
September to December	Moderate	<ul style="list-style-type: none"> <li>• Weeklong high-pressure synoptic patterns can bring cool dry and gusty northerly to westerly airstreams which are commonly followed by cooler south to south westerly winds in mid to late spring and occasionally in December</li> <li>• Extreme fire danger days occur when strong to gusty hot-north westerly winds precede cold fronts after prolonged spells of dry weather in November and December</li> <li>• Multiple ignitions can occur in remote areas of the Park with the passage of dry lightning storms during late spring and throughout the summer</li> <li>• Fires can occur in frost cured vegetation at higher elevations</li> </ul>
January to April	High	<ul style="list-style-type: none"> <li>• The summer period has warm to hot conditions at lower elevations and cooler conditions at higher elevations</li> <li>• Warm periods can be interspersed with south-easterly or easterly airstreams that bring drizzle or rain from the coast to the east side of the Park</li> <li>• Thunderstorms are frequent sometimes producing localised heavy rainfall and lightning strikes</li> <li>• Severe fires are likely to occur when January and February rains are below average and dry thunderstorms occur</li> <li>• Extreme fire danger days occur in December - February.</li> </ul>
May to June	Low	<ul style="list-style-type: none"> <li>• Moist mild weather occurs during this part of the year</li> <li>• Severe fires unlikely.</li> </ul>

Period	Unplanned fire risk	General Conditions
July to August	Low	<ul style="list-style-type: none"> <li>• A winter pattern of cool dry westerly airstreams dominate with occasional cold southerly fronts bringing snow about the ranges</li> <li>• Weekly passage of cold fronts produces rain and snow above 1200m</li> <li>• Frosts are common</li> <li>• Severe fires are unlikely</li> </ul>

Source: DECC 2008

### 3.2 Historic fire occurrence

Historically a diversity of clans and Aboriginal peoples lived permanently over a long period within the KNP (DECC 2008). Aboriginal people continuously used fire for a range of purposes, across the entire landscape at various times, with early European explorers identifying large areas had been subject to burning but were mild and resulted in little damage to vegetation (Jurskis *et al* 2006).

More recently an average of eleven bushfires per year are recorded within KNP (DECC 2008) with severe bushfires occurring approximately on a decadal basis (1899, 1926, 1939, 1952, 1965, 1968, 1978, 1983, 1988 and 2003 (Jurskis *et al* 2006, DECC 2008). The most recent severe fire in 2003 burnt approximately 478,000 hectares of KNP, including the project area (DECC 2008) and in February 2019 the Possum Point fire burnt for more than three weeks near the western boundary of KNP.

Fires in alpine regions of Australia are not common (historically occurring once or twice per century) usually developing from larger fires starting in the eucalypt dominated tableland foothills and montane slopes, and then usually develop into a large fire (Williams *et al* 2008). The project area is located entirely within tablelands and montane landscapes, in parts of KNP which have the some of the highest recorded frequencies of large fires (Snowy Monaro BFMC 2009, Snowy Valleys BFMC 2017), with up three large unplanned fires occurring adjacent to each Main Works sites since 1975 (DECC 2008). The KNP PoM (DECC 2008) identifies that unplanned fire events are likely every 5-11 years. Recent bushfires impacting on the Main Works sites include the Kosciuszko North Complex Fire of 2003 which burnt across all site areas for a total of 110,006 ha and the Long Plain Complex Fire of 2007 which burnt an area directly west of Tantangara sites.

### 3.3 Ignition sources

#### 3.3.1 Existing ignition sources

Within the KNP the main cause of fire ignitions is lighting, representing 37% of ignitions (**Figure 3.1**), although it is identified that a high proportion of unknown ignitions are also likely to be lightning (DECC 2008). Ignitions from dry lightning storms are most likely in those years when the landscape is extremely dry from below average rainfall. Ignitions from campfires/cooking are generally associated with holiday period at formal and informal camping spots on rivers and dams (Snowy Valleys BFMC 2017). Miscellaneous causes include discarded cigarette butts from smoking and motor vehicles.

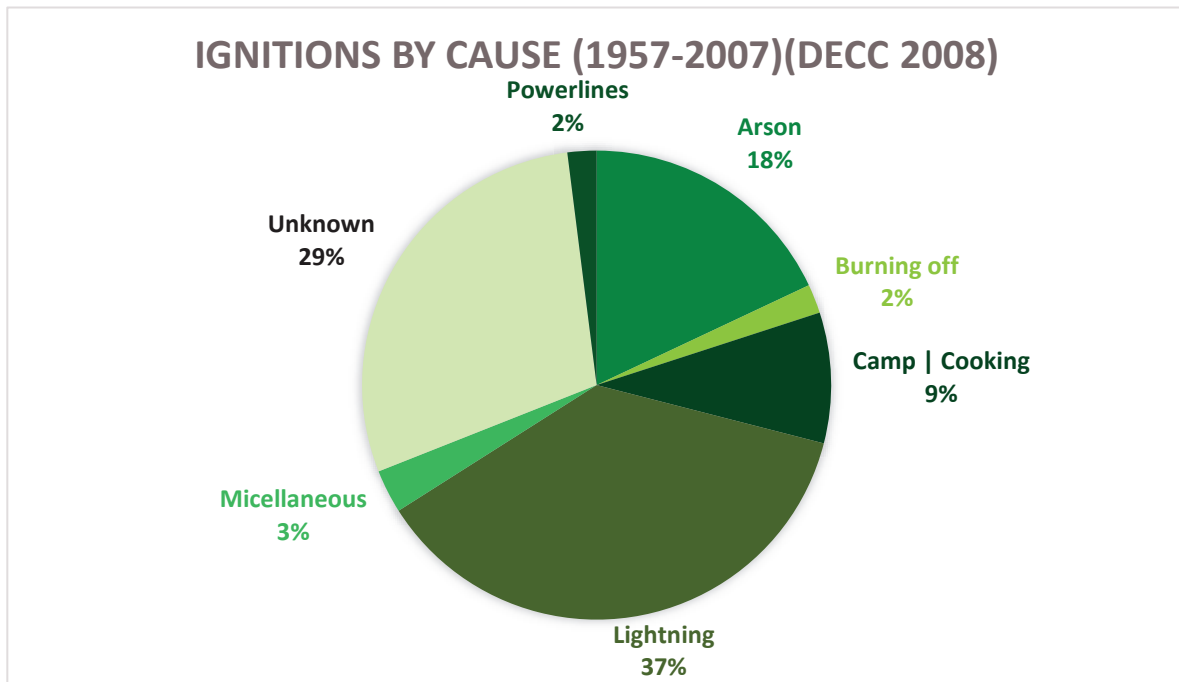


Figure 3.1: Ignitions by cause within KNP – 1957-2007

### 3.3.2 Project related ignition sources

There are a range of potential ignition sources from the construction and operation of the project area which will require the implementation of physical and procedural mitigation measures to reduce potential impacts. These may include:

- hot works;
- powerlines;
- equipment or services failure (such as pumps, cookers, generators);
- vehicles and plant operation (including clearing, earth moving and drilling machinery);
- accidental ignitions;
- smoking; or
- ignition of explosives or flammable materials (including mulch from clearing operations).

Unless mitigated these ignition sources have the potential to generate an ignition in adjoining vegetation or structures, and may represent a risk to personnel and assets within the project area, and life and property assets off site if a large bushfire develops.

## 3.4 Vegetation

Vegetation fuel is one of the key factors (with weather and topography) which influences how a fire behaves. Fuel attributes vary between different vegetation groups, by type, quantity, arrangement and moisture content. Based on these attributes fuels will also vary in how they ignite, spread and their intensity. Grouping vegetation types with similar fuel attributes together provides a means to generally characterise fire behaviour potential.



AS 3959 (2018) and PBP (NSWRFS 2006 and NSWRFS 2018) use vegetation as key input to determine potential fire intensity exposure for construction, and the size of separation distances that are required between an asset and vegetation hazard. PBP 2018 groups vegetation into broad vegetation formations (Keith 2004) and AS3959 into a vegetation classification.

### 3.5 Slope

Like vegetation, slope is a key factor in influencing fire behaviour. Fires burning upslope will preheat and ignite fuels more easily, will have a higher rate of spread than on flat ground/downslope and therefore burn at greater intensity. Slope is the other key input in determining constructions standards and setbacks required under AS3959 and PBP (NSWRFS 2006 and NSWRFS 2018). The effective slope is the slope under the vegetation. Often a variety of slopes covering different distances within the vegetation occurs and the effective slope is based on the slope that will most significantly influence the bushfire behaviour for each aspect. The slopes factors that influence APZ are discussed in **Section 4.3**.

### 3.6 Access

Road access to Main Works sites is required to enable the construction and operation of the Snowy 2.0 project, including safe operational access to structures, access and egress for emergency services, and routes for safe evacuation if required. Within each Main Works site, perimeter and internal access is to enable emergency access and egress, and defensible spaces in which emergency services can undertake suppression operations along the full extent of the perimeter bush land interface.

The project area contains several existing access routes maintained for NPWS operational activities (including fire management) and for recreational uses, including routes being upgraded for the Snowy 2.0 Exploratory Works. A description of existing access routes within Project Area is provided in **Table 5**.

PBP 2018 identifies that fire fighting vehicles are to be provided with safe, all-weather access to structures and hazard vegetation, and where access/egress can only be achieved through forest, woodland or heath vegetation, secondary access shall be provided. For each Main Works site, a primary and secondary access through road will be provided, using the existing road network or new access routes, to:

- provide a through road to evacuate persons from a site. Dead end roads of more than 200 metres increase the chance of being isolated by the advancing fire and are therefore are not suitable as primary or secondary access;
- provide a route for responding firefighting resources to reach a site and assist with fire suppression and asset protection;
- provide a second access arrangement which can serve as alternative access in a different direction from the main primary access; and
- serve as a fuel reduced break or control line from which prescribed burning and backburning operations can be conducted from to reduce fuels between an asset and a potential fire run. Creating a fuel reduced area at strategic locations can enhance options for fire control and can reduce the potential for fires to grow to a large size if conditions allow.

Table 5: Description of each access route

Access Route	Distance	Type	Access Description
Lobs Hole Ravine Road (south from Talbingo Portal to Link Road)	21 kms	Natural surface and sealed	Exploratory Works upgrades to this route include 7.5km of unsealed road within the existing road footprint and 13.5 km of upgrading including widening and cut and fill works. This route is suitable as primary access and will be upgraded as part of Main Works to enhance access for the transformers.
Lobs Hole Ravine Road (north from Talbingo Portal to Snowy Mountains Highway)	20 kms	Natural surface	Natural surface and gravel road with extended sections of single lane with passing bays. Undulating with steep slopes. Route suitable as secondary access with control measures to meet the performance objective of PBP 2018.
Mine Trail Road	2 kms	Natural surface	Two way no through road being upgraded as part of Exploratory Works. The construction of Marica Trail West to join Mine Trail Road will provide primary/secondary access to Snowy Mountains Highway once established.
Marica Trail East	5.3 kms	Natural surface	The Marica Trail East is to be constructed as part of the Main Works Package and will link the Snowy Mountains Highway with Marica Trail West. It is to be constructed as a single lane primary/secondary access with passing bays and control measures to meet the performance objective of PBP 2018.
Marica Trail West	7.2kms	Natural surface	The Marica Trail West is to be constructed as part of the Main Works Package and will link the Marica Trail East and Snowy Mountains Highway with Mine Trail Road. It is to be constructed as a single lane primary/secondary access with passing bays and control measures to meet the performance objective of PBP 2018.
Tollbar Trail	11 kms	Natural surface	NPWS Management Track: Single lane fire trail with passing bays. Undulating with steep slopes. Not suitable for primary or secondary emergency access.
O'Hares Trail	6.2 km	Natural surface	NPWS Management Track: Single lane dead end fire trail with passing bays. Undulating with steep slopes. Not suitable for primary or secondary emergency access.
Dead Mans Trail	4 km	Natural surface	NPWS Management Track: Single lane dead end fire trail with passing bays. Undulating with steep slopes. Not suitable for primary or secondary emergency access.
(Powerline Trail)	7 km	Natural surface	Transmission line access track and not a formalised access road. Connects to Link Road to Lobs Hole Ravine South road
Tantangara Road (south)	16 kms	Natural surface	Two-way road from Quarry Road to Snowy Mountains Highway to provide primary access to Tantangara Main Works sites.
Quarry Trail	3 kms	Natural surface	Two-way road from Tantangara Road to Tantangara Main Works sites to be upgraded at the commencement of Main Works.
Tantangara Road (east)	1.3 km	Natural surface / sealed	Two-way road from Quarry Road to provide secondary access to Tantangara Dam wall. Multiple fire trails east to the Yaouk Valley provide informal secondary access.
Snowy Mountains Highway	220 km	Sealed	Two-way sealed road

All Main Works sites, to meet PBP 2018 requirements, are to have at least a primary and secondary access route for access/agress by fire fighting vehicles. , Some existing access routes are to be upgraded or new routes constructed in a staged approach with the development of other infrastructure. New access is proposed to be constructed in stages as follows:

- Lobs Hole Road is scheduled for completion Dec 2019
- ECVT Mine Trail is scheduled for completion Apr 2020;
- Marica Trail East is scheduled for completion Jul 2020;
- Marica Trail West is scheduled for completion Nov 2020;
- Tantangara Road is scheduled for completion Dec 2020;
- Quarry Trail is scheduled for completion Feb 2021.

A summary of primary and secondary access for each Main Works site is shown in **Table 6**.

**Table 6: Access associated with each site**

Main Works Site(s)	Primary and Secondary Emergency Access/Egress Description
Talbingo Intake, Talbingo Portal, Talbingo Construction Yard, Lobs Hole Accommodation Camp, Lobs Hole Main Yard, MAT Portal, ECVT Portal and Cable Yard	Primary: South on Lobs Hole Ravine Road to Link Road Secondary: North on Lobs Hole Ravine Road to Snowy Mountains Highway Secondary (once constructed): Mine Trail Road, Marica Trail West and Marica Trail East to Snowy Mountains Highway
Vent Shaft, Marica Camp, Surge Shaft	Primary: East on Marica Trail East to Snowy Mountains Highway Secondary: North on Lobs Hole Ravine Road to Snowy Mountains Highway Secondary (once constructed): West on Marica Trail West to Mine Trail Road, and south on Lobs Hole Ravine Road to Link Road
Tantangara Intake, Construction Compound, Camp, Substation	Primary: Quarry Road and south on Tantangara Road to Snowy Mountains Highway Secondary: East on Tantangara Road to Dam wall as an option for refuge. Numerous fire trails east to Yaouk Valley and west (including Port Phillip Trail) to Snowy Mountains Highway
Rock Forest Logistics Hub	Primary and secondary: East on Snowy Mountains Highway to Adaminaby, or west to Kiandra

### 3.7 Construction standard

A suite of bush fire protection measures can be applied in the design and construction of buildings to enhance their survivability from bushfires. These measures, which apply to development on bush fire prone land, includes:

- the planning requirements of PBP 2018;
- bush fire construction requirements required under the NCC (which contains the technical provisions for the design and construction of buildings); and
- construction requirements under BCA (which contains the performance requirements and deemed-to-satisfy provisions).

Under the Deemed to Satisfy provisions of the NCC, building work on bush fire prone land must comply with AS 3959 or the NASH Standard, or the specific conditions of the relevant development consent. This applies to buildings of:

- BCA Class 1, 2 and 3, Class 4 parts of a building and some Class 10 and SFPP buildings. The construction requirements of AS 3959 and the NASH Standard: Steel Framed Construction in Bushfire Areas 2014 are a Deemed-to-Satisfy solution in the NCC, as varied in NSW, for buildings in designated bush fire prone areas.
- BCA Class 5, 6, 7, 8 and 10 buildings (which include offices, factories, warehouses and other commercial or industrial facilities) do not have specific bush fire performance requirements under the BCA and as such building construction standards under AS 3959 do not apply as a set of deemed to satisfy provisions. The general fire safety constructions provisions within the BCA are taken as acceptable solutions, but the aim and objectives of PBP apply in relation to other matters such as access, water and services, emergency planning, and landscaping/vegetation management. The industrial nature of proposed buildings will achieve this in most instances.

The building construction standards for bush fire protection under AS 3959 is calculated to determine a Bushfire Attack Level (BAL) based on the Fire Danger Index (FDI), type of vegetation, the effective slope and the size of APZ required. There are six different BAL, each with a prescribed suite of design and construction specifications aimed at preventing ignition during the passing of a bushfire front. They are outlined as follows:

- BAL-LOW: The threat does not warrant application of construction standards. Developments with BAL-LOW are generally not within BFPL (greater than 100 m from bushland);
- BAL-12.5: Addresses background radiant heat at lower levels and ember attack;
- BAL-19: Addresses mid-range radiant heat and ember attack;
- BAL-29: Addresses high range radiant heat and ember attack;
- BAL-40: Addresses extreme range of radiant heat and potential flame contact and ember attack; and
- BAL-FZ: Addresses construction within the flame zone. New subdivided lots are not permitted within the flame zone in NSW.

The only exception where buildings will not be required to comply with the construction standard are those considered Class 10. This being a non-habitable building or structure, that is separated by more than 6 m from a building required to comply with the construction standard.



## 4. Bush fire hazard assessment

### 4.1 Vegetation Assessment

In accordance with PBP 2018 vegetation within 140m of each main works site is assessed to determine its formation and classification. The mapped plant community types (PCT (mapped by EMM (2019)) surrounding each main works site is shown in **Table 7**, with its corresponding Vegetation Formation (Keith 2004) and Vegetation Classification (as per AS 3959) shown in **Table 8**. The applicable FDI value is also shown, which is used in the calculation of APZ dimensions (see **Section 4.2**). The vegetation surrounding each main works site falls into three classifications as either Forest, Woodland or Grassland. These vegetation communities are shown in the map figures for each Main Works site provided in **Appendix A**.

**Table 7: Description of assessment inputs for each site**

Main Works Site	Description	Fire Danger Index (FDI)	Elevation	Plant Community Type (PCT) – see Table 7
Talbingo Intake	The portal provides a secure area for construction activities for the exploratory tunnel. The site includes a concrete batching plant, and associated stockpiles, site offices, maintenance workshops, construction support infrastructure, car parking, equipment laydown areas.	80	600 m	PCT 729, PCT 300, PCT 1191
Talbingo Construction Yard	Construction yards are likely to include offices, storage areas, associated infrastructure, laydown areas and operational areas.	80	600 m	PCT 729, PCT296, PCT 300, PCT 1191
Talbingo Portal	The portal provides a secure area for construction activities for the exploratory tunnel. The site includes a concrete batching plant, and associated stockpiles, site offices, maintenance workshops, construction support infrastructure, car parking, equipment laydown areas.	80	560 m	PCT 729, PCT296, PCT 300, PCT 1191
Lobs Hole Accommodation Camp	Accommodation for project workers. Facilities are likely to include ensuite rooms, kitchen, tavern, gym, offices, laundry and maintenance building and associated road network.	80	590 m	PCT 296, PCT 299, PCT 300, PCT302, PCT729
Lobs Hole Main Yard	Construction yards are likely to include offices, storage areas, associated infrastructure, laydown areas and operational areas.	80	590 m	PCT285, PCT 296, PCT 299, PCT 300, PCT302, PCT729, PCT999
ECVT Portal	Construction yards are likely to include offices, storage areas, associated infrastructure, laydown areas and operational areas.	80	630 m	PCT 296, PCT 300, PCT302, PCT 311, PCT729, PCT 999
MAT Portal	The portal provides a secure area for construction activities for the exploratory tunnel. The site includes a concrete batching plant, and associated stockpiles, site offices, maintenance workshops, construction support infrastructure, car parking, equipment	80	640 m	PCT 296, PCT 300, PCT302, PCT 311, PCT 999

Main Works Site	Description	Fire Danger Index (FDI)	Elevation	Plant Community Type (PCT) – see Table 7
	laydown areas. The site will include the storage of explosive magazines.			
Vent Shaft	The site is located on Marica Road north of Marica Accommodation. It is likely to have buildings with associated infrastructure and operational areas of the shaft.	80	1150 m	PCT 1196, PCT 729, PCT 953
Marica Accommodation	Accommodation for project workers. Facilities are likely to include ensuite rooms, kitchen, tavern, gym, offices, laundry and maintenance building and associated road network.	50	1200 m	PCT 1196, PCT 300, PCT 729, PCT 953
Surge Shaft	The site is located on Marica Road east of Marica Accommodation. It is likely to have buildings with associated infrastructure and operational areas of the shaft.	50	1290 m	PCT 1196
Tantangara Intake & Construction Compound	The portal provides a secure area for construction activities for the exploratory tunnel. The site includes a concrete batching plant, and associated stockpiles, site offices, maintenance workshops, construction support infrastructure, car parking, explosive storage, equipment laydown areas.	50	1250 m	PCT 1196, PCT 1224, PCT 1225, PCT 303
Tantangara Camp	Accommodation for project workers. Facilities are likely to include ensuite rooms, kitchen, tavern, gym, offices, laundry and maintenance building and associated road network.	50	1280 m	PCT 1196, PCT 1224, PCT 637, PCT 303
Rock Forest Logistics Hub	Logistics hub likely to include offices, storage areas, associated infrastructure, laydown areas and operational areas.	80	1190 m	PCT 1196, PCT 644, PCT 679, PCT 952

Table 8: Vegetation formations within 140 m of each site

Plant Community Type	Vegetation Formation (Keith 2004)	PBP 2018/ AS3959 Classification
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	Grassy Woodland	Woodland
PCT 296 – Brittle Gum - peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion	Dry Forests	Sclerophyll Forest
PCT 299 – Riparian Ribbon Gum- Robertson Peppermint- Apple Box riverine very tall open forest of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion	Wet Forest	Sclerophyll Forest
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	Wet Forest	Sclerophyll Forest

Plant Community Type	Vegetation Formation (Keith 2004)	(Keith)	PBP AS3959 Classification	2018/
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	Dry Forests	Sclerophyll	Forest	
PCT 303 – Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion and western South Eastern Highlands Bioregion	Grassy Woodland		Woodland	
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	Dry Forests	Sclerophyll	Forest	
PCT 637 – Alpine and sin-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion	Alpine Complex		Alpine Complex.0	
PCT 644 – Alpine Snow Gum – Snow Gum shrubby woodland at the intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion	Grassy Woodlands		Woodland	
PCT 639 – Alpine Ash - Snow Gum shrubby tall open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Wet Forest	Sclerophyll	Forest	
PCT 679 – Black Sallee – Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion	Grassy Woodlands		Woodland	
PCT 729 – Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion	Dry Forests	Sclerophyll	Forest	
PCT 952 – Mountain Gum – Narrow-leaved peppermint – Snow gum dry shrubby open forest on undulating tablelands, southern South Eastern Highlands Bioregion	Grassy Woodlands		Woodland	
PCT 953 – Mountain Gum – Snow Gum – Broad-leaved peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion	Dry Forests	Sclerophyll	Forest	
PCT 999 – Norton's Box- Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion	Dry Forests	Sclerophyll	Forest	
PCT 1191 – Snow Gum – Candle Bark woodland on the broad valley flats of the tablelands and slopes, South Eastern Highlands Bioregion	Grassy Woodland		Woodland	
PCT 1196 – Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion	Grassy Woodland		Woodland	
PCT 1224 – Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	Grasslands		Grassland	
PCT 1225 – Sub-alpine dry grassland and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion	Grasslands		Grassland	

## 4.2 Asset protection zone dimensions

An APZ is a buffer zone between a bush fire hazard and buildings that reduces the potential impact of direct flame contact, radiant heat and ember attack on an adjacent structure. The APZ is designed to minimise the presence of fine fuels involved in a fire and provide a defensible space for bushfire suppression. The APZ allows an area for suppression of fire, an area from which backburning or hazard

reduction can be conducted, an area which allows emergency services access and provides a relatively safe area for firefighters to defend buildings. APZs provided in this analysis are based on the requirements in PBP 2018, which are expected to be legislated late-2019.

For each Main Works site an APZ based on BAL-29 is nominated, which provides separation between each site and the hazard so that all buildings will be exposed to radiant heat levels exceeding  $29\text{kW/m}^2$  (based on a flame temperature of 1090 Kelvin (K)). For this BFHRA this includes all Main Works accommodation camps (Lobs Hole, Marica and Tantangara) which are considered long-term accommodation. Each camp will be used by workers who will have received a safety induction briefing about the formal emergency management procedures which apply to Project Area, and will be familiar with their surrounds, the safe refuge areas and primary and secondary evacuation routes. As such these sites are not considered Special Fire Protection Purpose developments and are treated as a standard residential development. This is consistent with the approach identified in Section 6.3.1 of PBP 2018, and these sites will meet radiant heat threshold of  $29\text{kW/m}^2$ .

The calculation of APZ dimensions is based on an input value of the FDI for the geographic region in which each Main Works site occurs (see **Table 7**), with the lower FDI areas requiring reduced APZ dimensions. The following FDIs and corresponding APZ Tables were used to calculate the APZ for each Main Works sites:

- Talbingo, Lobs Hole, Mat Portal, ECVT Portal and Vent Shaft sites are located within areas with an FDI 80 (LGA of Snowy Monaro Regional and Snowy Valleys) with APZs provided from Table 2.5 (AS3959 2018) and Table A1.11.5 (PBP2018).
- Surge Shaft and Tantangara sites are located in areas which meet the criteria for an 'Alpine' area - lands located above 1200m - and therefore are assessed under an FDI of 50 with APZs provided from Table 2.6 (AS3959 2018) and Table A1.11.6 (PBP2018).
- Marica Accommodation site and Rock Forest sites border on the 1200 m elevation mark and have conservatively provided APZs in accord with FDI 80 (LGA of Snowy Monaro Regional and Snowy Valleys) with APZs provided from Table 2.5 (AS3959 2018) and Table A1.11.5 (PBP2018).

### 4.3 Effective slope

The slope under vegetation that would most significantly influence fire behaviour is determined over a 100 m distance from each proposed development area (considering a worst-case scenario). In accordance with the requirements of PBP 2018 the effective slope in each direction is categorised into the following classes:

- All upslope vegetation (considered  $0^\circ$ )
- $> 0$  to  $5^\circ$  downslope vegetation
- $> 5^\circ$  to  $10^\circ$  downslope vegetation
- $> 10^\circ$  to  $15^\circ$  downslope vegetation
- $> 15^\circ$  to  $20^\circ$  downslope vegetation.

This assessment was made with 10 m contour data and confirmed by field assessment. The effective slope under vegetation within 100 m of the perimeter of each main works site, grouped into slope classes, is shown in **Table 9** and the map figures provided in **Appendix A**.



Table 9: Slope classes associated with each site

Main Works Site	Slope Description	all flat / upslope	>0-5 degrees	>5-10 degrees	>10-15 degrees	>15-20 degrees
Talbingo Intake	The site is located on a steep battered slope that falls to the river on the west.	✓				✓
Talbingo Portal	The site is located on a steep slope that falls to the river on the south.	✓	✓			
Talbingo Construction Yard	The site is located on a steep slope that falls to the river on the south	✓	✓			
Lobs Hole Accommodation Camp	The site is located on undulating slopes on the east of the river.	✓	✓	✓		
Lobs Hole Main Yard	The site is located on undulating steep slopes on the west of the river.	✓	✓	✓	✓	✓
MAT Portal	The site is located on a slope falling north west to the river.	✓	✓			
ECVT Portal and Cable Yard	The site is located on a slope falling west to the river.	✓	✓			
Vent Shaft	The site is located on a slope falling north west.	✓		✓		
Marica Camp	This site is located on a ridge top with slopes falling north, south and east.				✓	
Surge Shaft	The site is located on a slope falling west.	✓			✓	
Tantangara Intake	This site is located on a battered hilltop falling to the reservoir on the north, south and east.		✓			
Tantangara Construction Compound	The site is located on a slope that falls to the reservoir on the east.	✓	✓	✓		
Tantangara Camp	This site is located on a ridge top with slopes falling north, south and east.	✓		✓	✓	✓
Rock Forest Logistics Hub	The site is located on undulating slopes that falls to the north.	✓	✓	✓		

## 5. Application of bush fire protection measures

### 5.1 Asset protection zone requirements

APZ requirements are based on the adjacent vegetation and slope, with a BAL-29 APZ nominated for each Main Works site (see **Section 5**).

The APZ is located between the asset and the unmanaged vegetation and is generally provided for each elevation of the proposed development (north, south, east and west). An APZ can include land considered 'managed' such as maintained lawns, gardens, footpaths as well as access roads and roadside reserves.

For Forest vegetation the treatment of the APZ consists of two areas, the Inner Protection Area (IPA) and the Outer Protection Area (OPA) with the dimensions determined in accordance with Table A1.12.3 of PBP 2018. The descriptions and requirements for each are provided in **Table 10**. For all other vegetation classes present at Main Works sites (Grassland or Woodland) the APZ is treated to meet the IPA requirements across the full extent.

**Table 10: Inner and Outer Protection Zone specifications**

Protection area within APZ	Description	Requirements
Inner Protection Area (IPA)	<p>Located closest to the buildings providing a defensible space and managing heat intensities around building.</p> <p>Creates a fuel-managed area which can minimise the impact of direct flame contact and radiant heat on the development and be a defensible space. Vegetation within the IPA should be kept to a minimum level.</p>	<p>Litter fuels within the IPA should be kept below 1cm in height and be discontinuous. In practical terms the IPA is typically the curtilage around the dwelling, consisting of a mown lawn and well-maintained gardens</p> <p>Requirements for Trees, Shrubs and Grass management is described in <b>Section 5.2</b>.</p>
Outer Protection Area (OPA)	<p>Located closest to the bush fire hazard providing suppression of crown fires, filtering embers and reducing the potential length of flames by slowing the rate of spread.</p> <p>Located between the IPA and the unmanaged vegetation. Vegetation within the OPA can be managed to a more moderate level. The reduction of fuel in this area substantially decreases the intensity of an approaching fire and restricts the pathways to crown fuels; reducing the level of direct flame, radiant heat and ember attack on the IPA. Because of the nature of an OPA, they are only applicable in forest vegetation.</p>	<p>In practical terms the OPA is an area where there is maintenance of the understorey and some separation in the canopy.</p> <p>Requirements for Trees, Shrubs and Grass management is described in <b>Section 5.2</b>.</p>

The performance criteria and acceptable solutions required for APZs based on PBP 2018 and the capacity of each Main Works site to meet these requirements are identified in **Table 11**. As noted in the table challenges in APZ management occur on slopes over 18 degrees. Management practices may be difficult due to ground clearing and destabilisation of the slope resulting in landslip, slump, erosion or landslide. The bushfire management plan should identify appropriate management strategies for maintaining the

stability of areas over 18 degrees in slope that are used as an APZ, including how management actions will be implemented and maintained.

The APZ required for each Main Works site is described in **Table 12** to **Table 41**, and shown in the map figures in **Appendix A**.

**Table 11: Performance Criteria and Acceptable Solutions for APZs**

Performance Criteria <i>The intent may be achieved where:</i>	Acceptable Solution	Main Works Site	Site Compliance and Notes
Potential building footprints will not be exposed to radiant heat levels exceeding 29 kW/m <sup>2</sup> on each proposed lot	APZs are provided in accordance with Tables A1.12.6 and A1.12.7 based on the FDI	Talbingo Construction Yard Talbingo Intake Lobs Hole Accommodation Camp Main Construction Work Site ECVT Portal and Cable Yard MAT Portal Vent Shaft Marica Camp Surge Shaft Tantangara Intake Tantangara Camp Rock Forest Logistics Hub	Complies Complies Complies Complies Complies Complies Complies Complies Complies Complies Notes: Where Grassland APZs are required, BAL 12.5 APZs are provided.
APZs are managed and maintained to prevent the spread of a fire towards the building	APZs are managed in accordance with the requirements of 'Appendix 4	Talbingo Construction Yard Talbingo Intake Lobs Hole Accommodation Camp Main Construction Work Site ECVT Portal and Cable Yard MAT Portal Vent Shaft Marica Camp Surge Shaft Tantangara Intake Tantangara Camp Rock Forest Logistics Hub	Will comply Will comply Will comply Will comply Will comply Will comply Will comply Will comply Will comply Will comply Will comply Will comply
The APZ is provided in perpetuity	APZs are wholly within the boundaries of the development site	Talbingo Construction Yard Talbingo Intake Lobs Hole Accommodation Camp Main Construction Work Site ECVT Portal and Cable Yard MAT Portal Vent Shaft Marica Camp Surge Shaft Tantangara Intake	Will comply Will comply Will comply Will comply Will comply Will comply Will comply Will comply Will comply Will comply

Performance Criteria <i>The intent may be achieved where:</i>	Acceptable Solution	Main Works Site	Site Compliance and Notes
		Tantangara Camp	Will comply
		Rock Forest Camp	Will comply
		Rock Forest Logistics Hub	Will comply
APZ maintenance is practical, soil stability is not compromised and the potential for crown fires is minimised	APZs are located on lands with a slope less than 18 degrees	Talbingo Construction Yard	Complies
		Talbingo Intake	Will comply
		Lobs Hole Accommodation Camp	Complies
		Main Construction Work Site	Will comply
		ECVT Portal and Cable Yard	Complies
		MAT Portal	Complies
		Vent Shaft	Complies
		Marica Camp	Complies
		Surge Shaft	Complies
		Tantangara Intake	Complies
		Tantangara Camp	Will comply
		Rock Forest Logistics Hub	Complies
			Notes: Management plan to be provided for slopes over 18 degrees
Landscaping is managed to minimise flame contact, reduce radiant heat levels, minimise embers and reduce the effect of smoke on residents and firefighters	Landscaping is in accordance with Appendix 4	Talbingo Construction Yard	Will comply
		Talbingo Intake	Will comply
		Lobs Hole Accommodation Camp	Will comply
		Main Construction Work Site	Will comply
		ECVT Portal and Cable Yard	Will comply
		MAT Portal	Will comply
		Vent Shaft	Will comply
		Marica Camp	Will comply
		Surge Shaft	Will comply
		Tantangara Intake	Will comply
		Tantangara Camp	Will comply
		Rock Forest Logistics Hub	Will comply



**Table 12: Talbingo Intake: Bush fire hazard analysis and APZ requirements**

Lot #	OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North		All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
South		All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
East		All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
West		Downslope >15 to 20 degrees	Forest	52 m	48 m	28 m	48 m

**Table 13: Talbingo Portal: Bush fire hazard analysis and APZ requirements**

Lot #	OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North		All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
South		Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
East		All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
South West		Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m

**Table 14: Talbingo Construction Yard A: Bush fire hazard analysis and APZ requirements**

Lot # OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North East	All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
North West	Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
South East	All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
South West	Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m

**Table 15: Talbingo Construction Yard B: Bush fire hazard analysis and APZ requirements**

Lot # OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North	All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
South & West	Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
East	All upslopes and flat land	Forest	21 m	20 m	10 m	20 m

**Table 16: Lobs Hole Accommodation Camp A: Bush fire hazard analysis and APZ requirements**

Lot # OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North East	All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
North West	All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
South	All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
West	Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m

**Table 17: Lobs Hole Accommodation Camp B: Bush fire hazard analysis and APZ requirements**

Lot # OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North East	All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
North West	Downslope >5 to 10 degrees	Forest	33 m	31 m	16 m	31 m
South East	All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
South West	Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
South	Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m

**Table 18: Lobs Hole Accommodation Camp C: Bush fire hazard analysis and APZ requirements**

Lot #	OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North East		All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
North West		All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
South East		All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
South West		Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m

**Table 19: Lobs Hole Accommodation Camp D: Bush fire hazard analysis and APZ requirements**

Lot #	OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North West		Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
West		Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
South		All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
East		All upslopes and flat land	Forest	21 m	20 m	10 m	20 m



**Table 20: Lobs Hole Substation: Bush fire hazard analysis and APZ requirements**

Lot # OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North	Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
East	Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
South	All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
West	All upslopes and flat land	Forest	21 m	20 m	10 m	20 m

**Table 21: Lobs Hole Main Yard A: Bush fire hazard analysis and APZ requirements**

Lot # OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North East	Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
North West	Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
South	All upslopes and flat land	Forest	21 m	20 m	10 m	20 m

Table 22: Lobs Hole Main Yard B: Bush fire hazard analysis and APZ requirements

Lot # OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North	Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
South	Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
East	All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
West	Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m

Table 23: Lobs Hole Main Yard C: Bush fire hazard analysis and APZ requirements

Lot # OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North	Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
South	All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
East	Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
North West	Downslope >5 to 10 degrees	Forest	33 m	31 m	16 m	31 m
North East	Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m

**Table 24: Lobs Hole Main Yard D: Bush fire hazard analysis and APZ requirements**

Lot # OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North	Downslope >15 to 20 degrees	Forest	52 m	48 m	28 m	48 m
South	All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
East	All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
West	Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m

**Table 25: Lobs Hole Main Yard E: Bush fire hazard analysis and APZ requirements**

Lot # OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North	Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
South	All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
East	Downslope >5 to 10 degrees	Forest	33 m	31 m	16 m	31 m
West	Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m

**Table 26: Lobs Hole Main Yard F: Bush fire hazard analysis and APZ requirements**

Lot #	OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North		Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
South		All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
East		All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
West		All upslopes and flat land	Forest	21 m	20 m	10 m	20 m

**Table 27: Lobs Hole Main Yard G: Bush fire hazard analysis and APZ requirements**

Lot #	OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North East		Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
North West		Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
South East		Downslope >5 to 10 degrees	Forest	33 m	31 m	16 m	31 m
South West		All upslopes and flat land	Forest	21 m	20 m	10 m	20 m



**Table 28: Lobs Hole Main Yard H: Bush fire hazard analysis and APZ requirements**

Lot # OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North East	Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
North West	All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
South East	All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
South West	All upslopes and flat land	Forest	21 m	20 m	10 m	20 m

**Table 29: Lobs Hole Main Yard I: Bush fire hazard analysis and APZ requirements**

Lot # OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North East	Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
North West	Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
South East	Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
South West	All upslopes and flat land	Forest	21 m	20 m	10 m	20 m

Table 30: Lobs Hole Main Yard J: Bush fire hazard analysis and APZ requirements

Lot #	OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
	North East	Downslope >5 to 10 degrees	Forest	33 m	31 m	16 m	31 m
	North West	Downslope >5 to 10 degrees	Forest	33 m	31 m	16 m	31 m
	South East	Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
	South West	All upslopes and flat land	Forest	21 m	20 m	10 m	20 m

Table 31: Lobs Hole Main Yard K: Bush fire hazard analysis and APZ requirements

Lot #	OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
	North	Downslope >5 to 10 degrees	Forest	33 m	31 m	16 m	31 m
	South	All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
	East	Downslope >10 to 15 degrees	Forest	42 m	39 m	19 m	39 m
	West	All upslopes and flat land	Forest	21 m	20 m	10 m	20 m

**Table 32: MAT Portal: Bush fire hazard analysis and APZ requirements**

Lot #	OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North		All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
South		All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
East		All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
West		Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m

**Table 33: ECVT Portal: Bush fire hazard analysis and APZ requirements**

Lot #	OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North		Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
South		Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m
East		All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
West		Downslope >0 to 5 degrees	Forest	27 m	25 m	15 m	25 m

**Table 34: Marica Vent Shaft: Bush fire hazard analysis and APZ requirements**

Lot #	OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North		Downslope >5 to 10 degrees	Forest	33 m	31 m	16 m	31 m
South		All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
East		All upslopes and flat land	Forest	21 m	20 m	10 m	20 m
West		Downslope >5 to 10 degrees	Forest	33 m	31 m	16 m	31 m

**Table 35: Marica Accommodation Camp: Bush fire hazard analysis and APZ requirements**

Lot #	OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North		Downslope >10 to 15 degrees	Forest	42 m	39 m	19 m	39 m
South		Downslope >10 to 15 degrees	Forest	42 m	39 m	19 m	39 m
East		Downslope >10 to 15 degrees	Forest	42 m	39 m	19 m	39 m
West		Downslope >10 to 15 degrees	Forest	42 m	39 m	19 m	39 m



Table 36: Surge Shaft: Bush fire hazard analysis and APZ requirements

Lot #	OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North East		All upslopes and flat land	Forest	16 m	14 m	4 m	14 m
North West		Downslope >10 to 15 degrees	Forest	30 m	27 m	10 m	30 m
South East		All upslopes and flat land	Forest	16 m	14 m	4 m	14 m
South West		All upslopes and flat land	Forest	16 m	14 m	4 m	14 m

Table 37: Tantangara Intake: Bush fire hazard analysis and APZ requirements

Lot #	OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North East		Downslope >0 to 5 degrees	Grassland	7 m	7 m	7 m	N/A
North West		Downslope >0 to 5 degrees	Grassland	7 m	7 m	7 m	N/A
South East		Downslope >0 to 5 degrees	Grassland	7 m	7 m	7 m	N/A
South West		Downslope >0 to 5 degrees	Grassland	7 m	7 m	7 m	N/A

**Table 38: Tantangara Construction Compound A: Bush fire hazard analysis and APZ requirements**

Lot #	OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North		Downslope >5 to 10 degrees	Grassland	8 m	7 m	7 m	N/A
South		Downslope >0 to 5 degrees	Grassland	7 m	7 m	7 m	N/A
East		Downslope >0 to 5 degrees	Grassland	7 m	7 m	7 m	N/A
West		Downslope >0 to 5 degrees	Grassland	7 m	7 m	7 m	N/A

**Table 39: Tantangara Construction Compound A: Bush fire hazard analysis and APZ requirements**

Lot #	OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North		Downslope >0 to 5 degrees	Grassland	7 m	7 m	7 m	N/A
South		All upslopes and flat land	Woodland	10 m	8 m	8 m	N/A
East		Downslope >0 to 5 degrees	Grassland	7 m	7 m	7 m	N/A
West		All upslopes and flat land	Woodland	10 m	8 m	8 m	N/A

**Table 40:Tantangara Accommodation: Bush fire hazard analysis and APZ requirements**

Lot #	OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North		Downslope >10 to 15 degrees	Woodland	19 m	15 m	15 m	N/A
South		Downslope >5 to 10 degrees	Woodland	15 m	12 m	12 m	N/A
East		Downslope >15 to 20 degrees	Woodland	25 m	19 m	19 m	N/A
West		All upslopes and flat land	Woodland	10 m	8 m	8 m	N/A

**Table 41:Rock Forest Logistics Hub: Bush fire hazard analysis and APZ requirements**

Lot #	OR direction from development boundary	Slope <sup>1</sup>	Vegetation <sup>2</sup>	BAL-29 required APZ (AS 3959-2018) <sup>3</sup>	PBP required APZ (PBP 2018) <sup>4</sup>	Inner Protection Area (IPA) <sup>5</sup>	Outer Protection Area (OPA) <sup>5</sup>
North East		Downslope >0 to 5 degrees	Woodland	17 m	13 m	13 m	N/A
North West		Downslope >5 to 10 degrees	Woodland	22 m	17 m	17 m	N/A
South East		All upslopes and flat land	Woodland	14 m	11 m	11 m	N/A
South West		All upslopes and flat land	Woodland	14 m	11 m	11 m	N/A

<sup>1</sup> Slope most significantly influencing the fire behaviour of the site having regard to vegetation found. Slope classes are according to PBP.<sup>2</sup> Predominant vegetation is identified, according to PBP and “Where a mix of vegetation types exist the type providing the greater hazard is said to be predominate”.<sup>3</sup> Analysis according to AS 3959-2018<sup>4</sup> Analysis according to PBP 2018<sup>5</sup> Analysis according to PBP 2018 Table A1.12.3

## 5.2 APZ maintenance requirements

The APZ is managed progressively to minimise fuel loads nearest an asset, and reduce potential radiant heat levels, flame, smoke and ember attack. The majority of vegetation surrounding Main Works sites is classified Forest, which is managed within the APZ as an IPA and OPA (as detailed in **Section 5.1**). All other vegetation types are either Grassland or Woodland, which are wholly managed as an IPA across the full extent of the APZ. Additional requirements identified by Snowy Hydro for APZ management must also be implemented in addition to these requirements.

**Table 42: APZ establishment and ongoing maintenance requirements**

APZ Area	Requirements in perpetuity
Inner Protection Area	<p>Trees:</p> <ul style="list-style-type: none"> <li>• canopy cover should be less than 15% (at maturity) trees (at maturity) should not touch or overhang the building;</li> <li>• lower limbs should be removed up to a height of 2m above ground;</li> <li>• canopies should be separated by 2 to 5m;</li> <li>• preference should be given to smooth barked and evergreen trees.</li> </ul> <p>Shrubs:</p> <ul style="list-style-type: none"> <li>• create large discontinuities or gaps in the vegetation to slow down or break the progress of fire towards buildings;</li> <li>• shrubs should not be located under trees;</li> <li>• shrubs should not form more than 10% ground cover;</li> <li>• clumps of shrubs should be separated from exposed windows and doors by a distance of at least twice the height of the vegetation.</li> </ul> <p>Grass:</p> <ul style="list-style-type: none"> <li>• should be kept mown (as a guide grass should be kept to no more than 100mm in height) leaves and vegetation debris should be removed.</li> </ul>
Outer Protection Area (applicable to Forest vegetation formation only)	<p>Trees:</p> <ul style="list-style-type: none"> <li>• tree canopy cover should be less than 30%;</li> <li>• trees should have canopy separation by 2 to 5m</li> </ul> <p>Shrubs:</p> <ul style="list-style-type: none"> <li>• shrubs should not form a continuous canopy;</li> <li>• shrubs should form no more than 20% of ground cover.</li> </ul> <p>Grass:</p> <ul style="list-style-type: none"> <li>• should be kept mown (as a guide grass should be kept to no more than 100mm in height) leaf and other debris should be mown, slashed or mulched.</li> </ul>



## 5.3 Construction standard and building requirements

### 5.3.1 General construction requirements

All buildings within each Main Works site are to be built to a BAL-29 construction standard as required by PBP 2018 and APZs are provided for BAL-29 class (as per Table A1.12.6 and Table A1.12.7 of PBP 2018).

The appropriate construction requirements for each Main Works site is applied from Section 3 'Construction General' and Section 7 'Construction for Bush fire Attack Level 29' of AS 3959 or the NASH Standard (1.17.14 updated) National Standard Steel Framed Construction in Bushfire Areas-2014 as appropriate. This includes:

- all accommodation camp buildings or parts of buildings that are classified as Class 1a, 1b, 2, 3, 4 or 9b under the provisions of Volume One of the National Construction Code are provided with a smoke alarm system or detection system.
- all buildings within each accommodation camp are served by a fire hose reel system to comply with the requirements of the NCC and AS 2441.
- all buildings are provided with portable fire extinguishers that are suitable for the fire hazard protected and in accordance with the requirements of AS2444.
- fire hydrants are provided in accordance with, with pressures and flows compliant with, AS2419.

### 5.3.2 Accommodation Camp On-site Refuge Requirements

On-site Refuges are required at Lobs Hole Accommodation Camp, Marica Accommodation Camp and Tantangara Accommodation Camp to provide an option for sheltering in place in the event of a bushfire. Each Refuge is to be located in the centre of the site to maximise the APZ distance, is to comply with a construction standard of BAL 29 and be of sufficient dimensions for the number of occupants. **Table 43** identifies compliance with the requirements for refuge buildings at each accommodation camp (PBP 2018).

APZs in line with BAL-29 construction standards are provided in perpetuity for the extent of each accommodation site. **Table 44** outlines how the proposed refuges aim to comply with the assessment criteria of *NSWRFS Neighbourhood Safer Places (2017)* guidelines, with **Table 45** providing detail on how the proposed refuges aim to NSW RFS recommendations in relation to the Exploratory Works EIS (NSWRFS letter reference D18/6454 dated 28 August 2018). All locations identified for places of refuge shall comply with the acceptable solutions or performance requirements for the site criteria as outlined in section 7 of the NSW Rural Fire Service (RFS) document *Guidelines for the Identification and Inspection of Neighbourhood Safer Places in NSW* dated April 2017. Consultation with the NSW RFS will be undertaken where compliance is constrained.

**Table 43: Description of On-Site Refuge Requirements for each site**

Main Works Site	Construction Standard & Location	Acceptable Solution	Complies
Lobs Hole Accommodation Camp	To be located in the centre of the site to maximise APZ area. To be built to BAL-29	<ul style="list-style-type: none"> <li>a refuge building is provided;</li> <li>the refuge building must provide the sufficient space for all occupants and comply with the occupancy levels permissible for that structure</li> </ul>	Will Comply Will Comply
Marica Accommodation Camp	To be located in the centre of the site to maximise APZ area. To be built to BAL-29	<ul style="list-style-type: none"> <li>a refuge building is provided;</li> <li>the refuge building must provide the sufficient space for all occupants and comply with the occupancy levels permissible for that structure</li> </ul>	Will Comply Will Comply
Tantangara Accommodation Camp	To be located in the centre of the site to maximise APZ area. To be built to BAL-29	<ul style="list-style-type: none"> <li>a refuge building is provided;</li> <li>the refuge building must provide the sufficient space for all occupants and comply with the occupancy levels permissible for that structure</li> </ul>	Will Comply Will Comply

**Table 44: Assessment Criteria for a Neighbourhood Safer Place**

	Performance Criteria	Acceptable Solution	Site Compliance
Radiant Heat	Building is located and constructed to enhance the chance of survival for humans in attendance from the radiant heat of a bush fire	Building is situated to prevent direct flame contact, material ignition and radiant heat levels of <10kW/m <sup>2</sup> OR; Provide 139 metres separation distance from a bush fire	Main Works for Snowy Hydro 2.0 is provided APZs for BAL-29 where buildings will not be exposed to radiant heat levels exceeding 29kW/m <sup>2</sup> (1090K). It is expected workers on site will be well-informed of the bush fire risk and appropriate emergency response procedures. The proposed On-site Safe Refuge is to be built within the centre of each main works accommodation camp to maximise APZs and is to be built to a construction standard of BAL-29.
Maintenance of the site and adjacent land	Area between the bush fire hazard and the site is maintained to a level that ensures the radiant heat levels at the building meet the performance criteria for radiant heat.	The site and the adjacent land to the site between the building and the bush fire hazard is managed or maintained in accordance with NSWRFs document Standards for Asset Protection Zones	Main Works for Snowy Hydro 2.0 is provided APZs for BAL-29. APZs to be managed as IPA and OPA where applicable, as outlined in Section 5.1, and in perpetuity in accordance with NSWRFs document Standards for Asset Protection Zones.

**Table 45: NSW Rural Fire Service Requirement for a Neighbourhood Safer Place**

NSW Rural Fire Service Requirement	Neighbourhood Safer Place Location	Site Compliance
Be clearly identified on the Bushfire Emergency Management and Evacuation Plan	Lobs Hole Accommodation Camp Marica Accommodation Camp Tantangara Accommodation Camp	Will Comply Will Comply Will Comply

NSW Rural Fire Service Requirement	Neighbourhood Safer Place Location	Site Compliance
Be clearly signposted as 'Bush fire Refuge'	Lobs Hole Accommodation Camp Marica Accommodation Camp Tantangara Accommodation Camp	Will Comply Will Comply Will Comply
Provide for the maximum capacity of the site (being the total number of all staff, contractors and visitors etc)	Lobs Hole Accommodation Camp Marica Accommodation Camp Tantangara Accommodation Camp	Will Comply Will Comply Will Comply
Buildings identified as a refuge shall comply with the occupancy levels permissible for a Class 9a Assembly Building ('Public Hall') and 'are per person' requirements (being 1 sq metre per person) as specified under the Building Code of Australia; and	Lobs Hole Accommodation Camp Marica Accommodation Camp Tantangara Accommodation Camp	Will Comply Will Comply Will Comply
Buildings identified as a refuge shall be constructed in accordance with Sections 3 and 5 (BAL 12.5) Australia Standard 3959-2018 Construction of buildings in bush fire prone areas of NASH Standard (1.7.14 updated) National Steel Framed Construction in Bushfire Areas- 2014 as appropriate and section A3.7 Addendum Appendix 3 of 'Planning for Bush fire Protection'	Lobs Hole Accommodation Camp Marica Accommodation Camp Tantangara Accommodation Camp	Based on the APZs provided, buildings identified as a refuge shall be constructed in accordance with Sections 3 and 7 (BAL 29) Australia Standard 3959-2018 Construction of buildings in bush fire prone areas of NASH Standard (1.7.14 updated) National Steel Framed Construction in Bushfire Areas- 2014 as appropriate and section A3.7 Addendum Appendix 3 of 'Planning for Bush fire Protection'

## 5.4 Access

### 5.4.1 Assess requirements

PBP 2018 requires an access design that enables safe evacuation away from an area whilst facilitating adequate emergency and operational response to the area requiring protection. Existing tracks within KNP and new or upgraded tracks provide primary and secondary access to Main Works sites (see **Section 3.6**).

All primary and secondary access roads will be required to meet the performance criteria and/or the acceptable solutions based on PBP 2018 and the *NSW Fire Trail Standards* (NSWRFS 2019) based on the relevant registered category of the fire trail. The aim of the upgrade to each fire trail is to meet the requirements of Category One. Where an acceptable solution is not able to be achieved, an alternative solution can be proposed providing it still meets the performance criteria. It is acknowledged that some sections of access road may be constrained due to steep slopes and unable to achieve dimensions identified in an acceptable solution, with an alternative solution required. This may include the use of hold points with radio call in procedures operating for long sections of single vehicle width with reduced passing opportunities (due to very steep side slopes which may require passing bays to be placed up opportunistically to make use of available safe and stable areas).

Compliance with the requirements for primary access routes is summarised in **Table 46**. For secondary access routes summarised from PBP 2018 in **Table 47** and *NSW Fire Trail Standards* (NSWRFS 2019) (for

a Category One Fire Tanker) in **Table 48**. A summary of primary and secondary access for each Main Works site was provided in **Table 6**.

#### 5.4.2 Primary and secondary access to Lobs Hole-Ravine

Access south on Lobs Hole Ravine Road (south of the Yarrangobilly River to Link Road) is the primary emergency access/egress route and Lobs Hole Ravine north to Snowy Mountains Highway (north of Yarrangobilly River) is identified as the alternative secondary access, until Marica Trail is constructed across its full extent. It is noted that acceptable solutions for fire trail width, turning area and passing bays (dimensions and frequency) cannot be practically achieved along the extent of Lobs Hole Ravine Road south of Blue Creek Trail due to very steep side slope and terrain. However, initial minor upgrades to the road and implementation of procedural controls can allow for the performance criteria to be met, with further upgrade works proposed under Modification 2 for the Exploratory Works EIS for completion prior to the commissioning of the Lobs Hole Main Works Accommodation Camp. . Tollbar Fire Trail is too steep in sections to provide a suitable alternative for secondary access to the Lobs Hole-Ravine Main Works sites.

#### 5.4.3 Maintenance and signage

Fire trails, trail signage, passing bays, turn-around points and fire breaks are to be made serviceable before the start of each fire season and during the season. Any maintenance required to meet NPWS fire trail requirements and the NSWRFs fire trail standard (NSWRFs 2019) is to be identified and implemented. Fire trail maintenance should be undertaken in accordance with the requirements identified in the *NSW Rural Fire Service – Fire Trail Design, Construction and Maintenance Manual* (NSW Soil Conservation Service 2017).



Table 46: Performance criteria and acceptable solutions for access for primary access

Performance Criteria <i>The intent will be achieved where:</i>	Acceptable Solutions	Primary Access	Site Compliance and Notes
Firefighting vehicles are provided with safe, all-weather access to structures and hazard vegetation	<ul style="list-style-type: none"> <li>internal camp access roads are two-wheel drive, all-weather roads; and</li> <li>perimeter roads are provided for residential subdivisions of three or more allotments; and</li> <li>traffic management devices are constructed to not prohibit access by emergency services vehicles; and</li> <li>maximum grades for sealed roads do not exceed 15 degrees and an average grade of not more than 10 degrees or other gradient specified by road design standards, whichever is the lesser gradient; and</li> <li>all roads are through roads. dead end roads are not recommended, but if unavoidable, dead ends are not more than 200 metres in length, incorporate a minimum 12 metres outer radius turning circle, and are clearly sign posted as a dead end; and</li> <li>where kerb and guttering is provided on perimeter roads, roll top kerbing should be used to the hazard side of the road; and</li> <li>where access/egress can only be achieved through forest, woodland or heath vegetation, secondary access shall be provided to an alternate point on the existing public road system.</li> </ul>	Tantangara Road	Will comply
		Lobs Hole Ravine Road (south to Link Road)	Will Comply
		Marica Trail (East)	Will Comply
		Snowy Mountains Highway	Complies
		Public roads within each site	Will Comply
The capacity of access roads is adequate for firefighting vehicles	<ul style="list-style-type: none"> <li>the capacity of perimeter and non-perimeter road surfaces and any bridges/causeways is sufficient to carry fully loaded firefighting vehicles (up to 23 tonnes); bridges/causeways are to clearly indicate load rating.</li> </ul>	Tantangara Road	Will comply
		Lobs Hole Ravine Road (south to Link Road)	Will Comply
		Marica Trail (East)	Will Comply
		Snowy Mountains Highway	Complies
		Public roads within each site	Will Comply
There is appropriate access to water supply	<ul style="list-style-type: none"> <li>hydrants are located outside of parking reserves and road carriageways to ensure accessibility to reticulated water for fire suppression;</li> <li>hydrants are provided in accordance with as 2419.1:2005;</li> <li>there is suitable access for a category 1 fire appliance to within 4m of the static water supply where no reticulated supply is available.</li> </ul>	Tantangara Road	Will comply
		Lobs Hole Ravine Road (south to Link Road)	Will Comply
		Marica Trail (East)	Will Comply
		Snowy Mountains Highway	Will Comply

Performance Criteria <i>The intent will be achieved where:</i>	Acceptable Solutions	Primary Access	Site Compliance and Notes
		Public roads within each site	
Access roads are designed to allow safe access and egress for medium rigid firefighting vehicles while residents are evacuating as well as providing a safe operational environment for emergency service personnel during firefighting and emergency management on the interface	<ul style="list-style-type: none"> <li>perimeter roads are two-way sealed roads; and</li> <li>8m carriageway width kerb to kerb; and</li> <li>parking is provided outside of the carriageway width; and</li> <li>hydrants are located clear of parking areas; and</li> <li>there are through roads, and these are linked to the internal road system at an interval of no greater than 500m; and</li> <li>curves of roads have a minimum inner radius of 6m; and</li> <li>the maximum grade road is 15° and average grade is 10°; and</li> <li>the road crossfall does not exceed 3°; and</li> <li>a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.</li> </ul>	Tantangara Road	Will comply
		Lobs Hole Ravine Road (south to Link Road)	Will Comply
		Marica Trail (East)	Will Comply
		Snowy Mountains Highway	Complies
		Public roads within each site	Will Comply
Access roads are designed to allow safe access and egress for medium rigid firefighting vehicles while residents are evacuating	<ul style="list-style-type: none"> <li>minimum 5.5m width kerb to kerb; and parking is provided outside of the carriageway width; and</li> <li>hydrants are located clear of parking areas; and roads are through roads, and these are linked to the internal road system at an interval of no greater than 500m; and</li> <li>curves of roads have a minimum inner radius of 6m; and</li> <li>the road crossfall does not exceed 3°; and a minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.</li> </ul>	Tantangara Road	Will comply
		Lobs Hole Ravine Road (south to Link Road)	Will Comply
		Marica Trail (East)	Will Comply
		Snowy Mountains Highway	Complies
		Public roads within each site	Will Comply

**Table 47: Relevant access requirements for secondary access from PBP (2018)**

Performance Criteria <i>The intent will be achieved where:</i>	Acceptable Solution	Performance criteria achieved?
Firefighting vehicles are provided with safe, all-weather access to structures and hazard vegetation	<ul style="list-style-type: none"> <li>where access/egress can only be achieved through forest, woodland or heath vegetation, secondary access shall be provided to an alternate point on the existing public road system.</li> </ul>	Secondary access provided by Lobs Hole Ravine Road (north), Marica Trail (west), Rock Forest secondary access

**Table 48: Fire trail standards – Category 1 (NSWRFS 2018)**

Performance Criteria	Acceptable Solution	Secondary Road	Performance criteria achieved?
Width: The width of the trail provides for safe and reliable unobstructed passage by a Category 1 firefighting vehicle within acceptable operational limits	<p>The trafficable surface has a width of 4 metres except for short constrictions to 3.5 metres for no more than 30 metres in length where an obstruction cannot be reasonably avoided or removed.</p> <p>Curves have a minimum inner radius of 6 metres. The minimum distance between inner and outer curves is 6 metres.</p>	<p>Lobe Hole Ravine Road (north)</p> <p>Marica Trail (west)</p> <p>Rock Forest Secondary Access</p>	<p>Acceptable solution can generally be achieved   Performance criteria can be achieved</p> <p>Performance criteria can be achieved</p> <p>Acceptable solution can generally be achieved</p>
Capacity: The construction and formation is trafficable under all weather conditions (other than due to flood, storm surge or snowfall) for a Category 1 firefighting vehicle.	Trail surfaces and crossing structures are capable of carrying vehicles with a gross vehicle mass of 15 tonnes and an axle load of 9 tonnes.	<p>Lobe Hole Ravine Road (north)</p> <p>Marica Trail (west)</p> <p>Rock Forest Secondary Access</p>	<p>Acceptable solution can be achieved</p> <p>Acceptable solution can be achieved</p> <p>Acceptable solution can be achieved</p>

Performance Criteria	Acceptable Solution	Secondary Road	Performance criteria achieved?
Grade and crossfall: The vertical profile of the trail provides for traction and safe working angle within the physical operational capability of a Category 1 firefighting vehicle.  <i>Note: This includes design that does not impede the undercarriage of a vehicle.</i>	<p>The maximum grade of a trail is not more than 15 degrees.</p> <p>The crossfall of the trail surface is not more than 6 degrees.</p> <p>Drainage structures, feature crossings, or other significant changes in the grade of the trail shall be in accordance with the NSWRFs Fire Trail Design, Construction and Maintenance Manual.</p>	<p>Lobe Hole Ravine Road (north)</p> <p>Marica Trail (west)</p> <p>Rock Forest Secondary Access</p>	<p>Acceptable solution can be achieved</p> <p>Acceptable solution can be achieved</p> <p>Acceptable solution can be achieved</p>
Clearance: A cleared corridor is provided around the trail which permits the unobstructed passage of a Category 1 firefighting vehicle and for a working corridor either side of the vehicle to enable firefighters to exit from, and access equipment in, the vehicle.	A minimum vertical clearance of 4 metres is provided above the surface of the trafficable surface clear of obstructions.	<p>Lobe Hole Ravine Road (north)</p> <p>Marica Trail (west)</p> <p>Rock Forest Secondary Access</p>	<p>Acceptable solution can be achieved</p> <p>Acceptable solution can be achieved</p> <p>Acceptable solution can be achieved</p>
Passing: The trail provides for two Category 1 firefighting vehicles to pass at appropriate intervals so as to avoid unacceptable delays in operations.	<p>Capacity for passing is provided every 250 metres comprising:</p> <ul style="list-style-type: none"> <li>a widened trafficable surface of at least 6 metres for a length of at least 20 metres; or</li> <li>a 6 metre wide and 8 metre long area clear of the trafficable surface with a minimum inner curve radius of 6 metres and minimum outer radius of 12 metres; or</li> <li>a turnaround as provided for in this table (below).</li> </ul>	<p>Tantangara Road</p> <p>Lobs Hole Ravine Road (south to Link Road)</p> <p>Marica Trail (East)</p> <p>Snowy Mountains Highway</p> <p>Public roads within each site</p> <p>Lobs Hole Ravine Road (north)</p> <p>Marica Trail (west)</p> <p>Rock Forest Secondary Access</p>	<p>To comply with access requirement of Condition 2 of NSWRFs letter reference D18/6454 dated 28 August 2018.</p> <p>North of Blue Creek Trail intersection to Snowy Mountains Highway there is sufficient opportunities for passing to meet the acceptable solutions.</p> <p>South of the Blue Creek Trail intersection the acceptable solution cannot be practically achieved due to very steep side slopes.</p> <p>Performance criteria can be achieved by:</p> <ul style="list-style-type: none"> <li>Identified (mapped and signed) passing bays which can be used as hold points with a call in/out procedures to manage</li> </ul>



Performance Criteria	Acceptable Solution	Secondary Road	Performance criteria achieved?
			<p>traffic flow in the event of an emergency; and</p> <ul style="list-style-type: none"> <li>UHF radio communication provides coverage between the Yarrangobilly River and the Blue Creek Trail intersection.</li> </ul>
<p>Turnarounds: The trail provides for a turning manoeuvre for a Category 1 firefighting vehicle to return in the direction from which it came at appropriate intervals and at the termination of a trail.</p>	<p>A turning area is provided at the termination of a trail and every 500 metres and is achieved by:</p> <ul style="list-style-type: none"> <li>an area clear of the trafficable surface 6 metres wide and 8 metres deep, with a minimum inner curve radius of 6 metres and outer minimum radius of 12 metres; or</li> <li>a turning circle of minimum 22 metre diameter.</li> <li>a T-junction with each terminating end of the junction being at least 10 metres in length from the intersection of the roads and the inner radius of that intersection being at least 6 metres</li> <li>a fire trail or road intersection.</li> </ul>	<p>Lobe Hole Ravine Road (north)</p> <p>Marica Trail (west)</p> <p>Rock Forest Secondary Access</p>	<p>Lobs Hole Ravine and Marica: acceptable solution cannot be practically achieved due to very steep side slopes.</p> <p>Performance criteria can be achieved by:</p> <ul style="list-style-type: none"> <li>Identified turn around points are mapped and include signage and distance).</li> </ul> <p>Rock Forest: Acceptable solution can be achieved</p>
<p>Drainage: The fire trail is drained effectively to manage rainfall runoff to prevent damage to the trafficable surface.</p>	<p>Drainage of the trail is designed and constructed in accordance with the NSWRFs Fire Trail Design, Construction and Maintenance Manual</p>	<p>Lobe Hole Ravine Road (north)</p> <p>Marica Trail (west)</p> <p>Rock Forest Secondary Access</p>	<p>Acceptable solution can be achieved</p> <p>Acceptable solution can be achieved</p> <p>Acceptable solution can be achieved</p>

## 5.5 Water supply and utilities

Provision of adequate water supply for bushfire and structural firefighting, and the appropriate location of utilities is essential to mitigate the bushfire and public safety risks associated with the development of the Major Works sites.

### 5.5.1 Water supply

Water supply for firefighting is to be sourced from the Talbingo and Tantangara Reservoirs pumped directly from each reservoir, with all sites on the east of Snowy Mountains Highway supplied by Tantangara Reservoir, and sites to the west supplied by Talbingo Reservoir.

Adequate water supply and pressure is to be designed, implemented and maintained during construction and occupation of each accommodation Camp for firefighting purposes, including:

- all buildings within each accommodation camp are served by a fire hose reel system to comply with the requirements of the NCC and AS 2441;
- fire hydrants are provided in accordance with, with pressures and flows compliant with, AS2419; and
- all buildings are provided with portable fire extinguishers that are suitable for the fire hazard protected and in accordance with the requirements of AS2444.

Where reticulated water supply is deemed inadequate, a non-reticulated water supply as an additional on-site stored supply of water for firefighting will be required, with an expected minimum of 20,000 L.

Each main works accommodation camp shall have an onsite emergency response team (ERT) which shall be fully trained and equipped to deal with potential bushfire and minor structural fire events.

All performance criteria and acceptable solutions (PBP 2018) for water supply are provided in **Table 49**.

### 5.5.2 Services

The Ravine substation located at Lobs Hole is a 80MVA substation which will provide permanent power to the Exploratory Works and Main Works construction and operations sites. This includes power supply for the TBMs via the MAT, ECVT, Talbingo and Tantangara portals. The substation will also provide permanent power to the power station and other operational facilities at Lobs Hole including the Talbingo intake control buildings and gates. The supporting high voltage cable route will follow access roads to these locations, with cables will be buried via trench in these access roads.

The Ravine substation will also provide power to Main Works sites at Marica using a 33kv underground power lines established within an easement directly adjacent to the Marica Road. This powerline will extend to the Snowy Mountains Highway, from which it will be trenched underground to provide power to the Tantangara Main Works sites. For the Rock Forest sites, electricity supply will be provided from the existing overhead power lines.

All performance criteria and acceptable solutions (PBP 2018) for utilities are provided in **Table 49**.

Table 49: Performance criteria and acceptable solutions for water, electricity and gas

Performance Criteria <i>The intent will be achieved where:</i>	Acceptable Solutions	Main Works Site	Site Compliance and Notes
A water supply is provided for firefighting purposes	<ul style="list-style-type: none"> <li>reticulated water is to be provided to the development, where available;</li> </ul>	Talbingo Construction Yard Talbingo Intake Lobs Hole Accommodation Camp Main Construction Work Site ECVT Portal and Cable Yard MAT Portal Headrace Guard Valve Portal (Marica) Surge Shaft Tantangara Intake Tantangara Camp Rock Forest Logistics Laydown	Will comply Will comply Will comply Will comply Will comply Will comply Will comply Will comply Will comply Will comply Will comply Note: Water supply from Talbingo and Tantangarra Reservoirs is considered reticulated
Water supplies are located at regular intervals The water supply is accessible and reliable for firefighting operations	<ul style="list-style-type: none"> <li>fire hydrant spacing, design and sizing comply with the Australian Standard as 2419.1:2005;</li> <li>hydrants are not located within any road carriageway;</li> <li>reticulated water supply uses a ring main system for areas with perimeter roads.</li> </ul>	Talbingo Construction Yard Talbingo Intake Lobs Hole Accommodation Camp Main Construction Work Site ECVT Portal and Cable Yard MAT Portal Headrace Guard Valve Portal (Marica) Surge Shaft Tantangara Intake Tantangara Camp Rock Forest Logistics Laydown	Will comply Will comply Will comply Will comply Will comply Will comply Will comply Will comply Will comply Will comply Will comply

Performance Criteria	Acceptable Solutions	Main Works Site	Site Compliance and Notes
<i>The intent will be achieved where:</i>			
Flows and pressure are appropriate	<ul style="list-style-type: none"> <li>fire hydrant flows and pressures comply with AS 2419.1:2005.</li> </ul>	Talbingo Construction Yard	Will comply
		Talbingo Intake	Will comply
		Lobs Hole Accommodation Camp	Will comply
		Main Construction Work Site	Will comply
		ECVT Portal and Cable Yard	
		MAT Portal	Will comply
		Headrace Guard Valve Portal (Marica)	Will comply
		Surge Shaft	Will comply
		Tantangara Intake	Will comply
		Tantangara Camp	Will comply
		Rock Forest Logistics Laydown	Will comply
			Will comply
The integrity of the water supply is maintained	<ul style="list-style-type: none"> <li>All above-ground water service pipes are metal, including and up to any taps.</li> </ul>	Talbingo Construction Yard	All sites shall comply with PBP acceptable solutions and AS3959 (2018) Section 7.8 WATER AND GAS SUPPLY: <i>'Above-ground, exposed water supply pipes shall be metal.'</i>  'Exposed' is defined as facades of buildings facing the bushfire hazard, and not shielded by any other part of the building or another building on the site.
		Talbingo Intake	
		Lobs Hole Accommodation Camp	
		Main Construction Work Site	
		ECVT Portal and Cable Yard	
		MAT Portal	
		Headrace Guard Valve Portal (Marica)	
		Surge Shaft	
		Tantangara Intake	
		Tantangara Camp	
		Rock Forest Logistics Laydown	

Performance Criteria	Acceptable Solutions	Main Works Site	Site Compliance and Notes
<i>The intent will be achieved where:</i>			
a static water supply is provided for firefighting purposes in areas where reticulated water is not available	<ul style="list-style-type: none"> <li>a connection for firefighting purposes is located within the IPA or non hazard side and away from the structure; a 65mm Storz outlet with a ball valve is fitted to the outlet, and</li> <li>ball valve and pipes are adequate for water flow and are metal, and</li> <li>supply pipes from tank to ball valve have the same bore size to ensure flow volume, and</li> <li>underground tanks have an access hole of 200mm to allow tankers to refill direct from the tank, and</li> </ul>	Talbingo Construction Yard	Will comply
		Talbingo Intake	Will comply
		Lobs Hole Accommodation Camp	Will comply
		Main Construction Work Site	Will comply
		ECVT Portal and Cable Yard	
		MAT Portal	Will comply
		Headrace Guard Valve Portal (Marica)	Will comply
		Surge Shaft	Will comply
		Tantangara Intake	Will comply
		Tantangara Camp	Will comply
a static water supply is provided for firefighting purposes in areas where reticulated water is not available	<ul style="list-style-type: none"> <li>a hardened ground surface for truck access is supplied within 4m of the access hole,</li> <li>above-ground tanks are manufactured from concrete or metal (or are appropriately shielded from direct flame contact), and</li> <li>raised tanks have their stands constructed from non-combustible material or bush fire-resisting timber (see Appendix F AS 3959), and</li> <li>unobstructed access can be provided at all times, and</li> <li>tanks on the hazard side of a building are provided with adequate shielding for the protection of firefighters, and</li> <li>underground tanks are clearly marked, and</li> </ul>	Rock Forest Logistics Laydown	Will comply
			Will comply
		Talbingo Construction Yard	Will comply
		Talbingo Intake	Will comply
		Lobs Hole Accommodation Camp	Will comply
		Main Construction Work Site	Will comply
		ECVT Portal and Cable Yard	
		MAT Portal	Will comply
		Headrace Guard Valve Portal (Marica)	Will comply
		Surge Shaft	Will comply
a static water supply is provided for firefighting purposes in areas where reticulated water is not available	<ul style="list-style-type: none"> <li>a hardened ground surface for truck access is supplied within 4m of the access hole,</li> <li>above-ground tanks are manufactured from concrete or metal (or are appropriately shielded from direct flame contact), and</li> <li>raised tanks have their stands constructed from non-combustible material or bush fire-resisting timber (see Appendix F AS 3959), and</li> <li>unobstructed access can be provided at all times, and</li> <li>tanks on the hazard side of a building are provided with adequate shielding for the protection of firefighters, and</li> <li>underground tanks are clearly marked, and</li> </ul>	Tantangara Intake	Will comply
		Tantangara Camp	Will comply
		Rock Forest Logistics Laydown	Will comply
			Will comply
			Will comply
			Will comply
			Will comply
			Will comply
			Will comply
			Will comply



[illegible]

Performance Criteria	Acceptable Solutions	Main Works Site	Site Compliance and Notes
<i>The intent will be achieved where:</i>			
Location and design of gas services will not lead to ignition of surrounding bushland or the fabric of buildings.	<ul style="list-style-type: none"> <li>reticulated or bottled gas is installed and maintained in accordance with AS/NZS 1596:2014 and the requirements of relevant authorities, and metal piping is used;</li> <li>all fixed gas cylinders are kept clear of all flammable materials to a distance of 10m and shielded on the hazard side;</li> <li>connections to and from gas cylinders are metal;</li> <li>polymer-sheathed flexible gas supply lines are not used;</li> <li>above-ground gas service pipes are metal, including and up to any outlets.</li> </ul>	Talbingo Construction Yard Talbingo Intake Lobs Hole Accommodation Camp Main Construction Work Site ECVT Portal and Cable Yard MAT Portal Headrace Guard Valve Portal (Marica) Surge Shaft Tantangara Intake Tantangara Camp Rock Forest Logistics Laydown	No gas supply is proposed at any site.

## 6. Preparedness and emergency response

The isolated nature of the Main Works sites makes them susceptible to potential bushfire risks and hazards associated with both project related and external fire sources. In the event of a bushfire, preparedness arrangements and pre-planned emergency response actions for the project area can potentially reduce the residual risk to site personnel, assets and operation, and life and property values off site.

All lease areas require fire protection strategies to be prepared by leaseholders in accordance with KNP Plan of Management (DEC 2006). This section identifies the bushfire risk mitigation measures that are to be developed by the proponent to reduce residual bushfire risk, maintain bushfire awareness, implement preparedness procedures, and document management actions and responsibilities for fire response, evacuation / shelter in place actions, monitoring and review.

### 6.1 Site mitigation measures

Bush fire mitigation measures are implemented at the commencement of works and maintained throughout the bushfire season. The measures, in combination, are critical in the prevention of building loss, assisting in the efforts of firefighting, and improving life safety. Mitigation measures to be implemented during the construction and operation of Main Works sites within the project area are shown in **Table 50**.

**Table 50: Site mitigation measures**

Requirement	Description
Maintenance of asset protection zones (APZ) including vegetation management	<p>From commencement of works and in place for the start of every declared bushfire season in perpetuity (commonly from 1 October annually) APZs are to be maintained in accordance with APZ dimensions and locations outlined in Section 5.</p> <p>Fuel levels within all APZs are to be maintained in accordance with Appendix 4 PBP 2018 for an IPA as follows:</p> <p><b>Trees:</b></p> <ul style="list-style-type: none"> <li>• canopy cover should be less than 15% (at maturity)</li> <li>• trees (at maturity) should not touch or overhang the building</li> <li>• lower limbs should be removed up to a height of 2m above ground</li> <li>• canopies should be separated by 2 to 5m</li> <li>• preference should be given to smooth barked and evergreen trees.</li> </ul> <p><b>Shrubs:</b></p> <ul style="list-style-type: none"> <li>• create large discontinuities or gaps in the vegetation to slow down or break the progress of fire towards buildings</li> <li>• shrubs should not be located under trees</li> <li>• shrubs should not form more than 10% ground cover</li> <li>• clumps of shrubs should be separated from exposed windows and doors by a distance of at least twice the height of the vegetation.</li> </ul> <p><b>Grass:</b></p> <ul style="list-style-type: none"> <li>• should be kept mown (as a guide grass should be kept to no more than 100mm in height)</li> <li>• leaves and vegetation debris should be removed.</li> </ul>

Requirement	Description
Building maintenance and preparedness	<p>Once constructed, buildings are to be well prepared prior to the start of the declared bushfire season (commonly from 1 October annually), and monthly within the bush fire period OR as per alarm, hose reels and extinguisher recommended intervals:</p> <ul style="list-style-type: none"> <li>• clear gutters, garden beds, roofs, external decks of all leaf litter and debris (&lt;6mm diameter).</li> <li>• to reduce ember attack potential, ensure external walls, eaves and roofs are sealed and painted, and any window fly wires, or screens are repaired.</li> <li>• fire extinguisher servicing, fire hose reels and alarm system testing to be completed where installed.</li> </ul>
New building establishment (occupied and fuels/explosive stores)	<ul style="list-style-type: none"> <li>• construction in accordance with the Building Code of Australia and AS3959:2018 (as updated) for all occupied buildings and all structures containing flammable materials or for storing explosives.</li> <li>• any above-ground building containing flammable liquids and explosive materials must be constructed to a minimum of BAL 29 construction standard (AS3959:2018) to provide for enhanced ember protection.</li> </ul>
Fire breaks and Trails	<p>Fire trails, trail signage, passing bays, turn-around points and fire breaks are serviceable before the start of each fire season and during the season. Identify and implement any maintenance required to meet NPWS fire trail requirements and the NSWRFs fire trail standard (NSWRFs 2019).</p> <p>All designated fire trails should be signposted in accordance with the NSWRFs Fire Trail Standard (2019) and NPWS requirements.</p>
Ensure an appropriate minimum level of fire and life safety is provided to occupants and workers	Buildings are constructed and maintained in accordance with the required construction standards (see Section 5.3).
Strategic Advantage Zone	Fire Consultation with the NPWS to consider the creation and maintenance of Strategic Fire Advantage Zones across the project should be undertaken.

## 6.2 Bush fire awareness measures

Workers, occupants and personnel on site during each bushfire season are required to establish and maintain bushfire awareness. Maintaining bushfire awareness includes observing emerging landscape and weather risks, looking signs of a bushfire ignition, monitoring communication sources and understanding the appropriate pre-planned responses to take. Bush fire awareness actions are shown in **Table 51** and must be incorporated into a Bushfire Emergency and Management Plan prepared for the project area.

Table 51: Bushfire awareness measures

Requirement	Responsibility	Description
Site induction and training requirements	Main Works Site Contractor	<p>The induction of new workers, contractors, visitors and site users is to include fire weather awareness and preparedness in response to Fire Danger Rating, fire reporting and response actions to a smoke sighting or fire starting, response to an emergency warning being issued by fire authorities, and site evacuation and shelter in place procedures including access and assembly refuge areas.</p> <p>Prior to starting activities on site, all personnel working during the bushfire season in areas within or directly adjoining vegetation hazard are required to complete bushfire awareness training.</p> <p>Appropriate competency-based training is also required for all personnel with responsibilities within the emergency control organisational structure (including fire response) or for the operation of emergency equipment.</p>
Weather and fire danger awareness	Main Works Site Contractor	Daily updates for all personnel within the season are provided including: Forecast FDR and FFDI, fire preparedness works preparedness code, significant weather changes forecast over the next four days and responses to an official emergency alert issued for each main works site.
Staff briefing and tool-box talks	Main Works Site Contractor	Briefings are to include site specific fire and emergency procedures, and hot works permit requirements. These are completed as part of a tool-box talks given to all workers and contractors at all inductions and the start of the bushfire season.
Liaison and pre-season drills with National Parks and Wildlife Service (NPWS) and local NSWRFs	Main Works Site Contractor	<p>Prior to the start of site operations and annually prior to the bushfire season, liaison with NSWRFs brigades and NPWS representatives is required to:</p> <ul style="list-style-type: none"> <li>confirm emergency procedures and operations;</li> <li>complete on-site familiarisation; and</li> <li>practice a bushfire response and evacuation drill.</li> </ul>
Fire and Incident Emergency Controller	Main Works Site Contractor	The person in charge (PIC) or their delegate is initially the Incident Controller (IC) until replaced by responding external Fire Authority IC
Refuge of last resort – Assembly Areas	Main Works Site Contractor	On-site Safe Refuges are provided at Lobs Hole Accommodation Camp, Marica Accommodation Camp and Tantangara Accommodation Camp. Each Refuge is to be located in the centre of the site to maximise APZ area and is to comply with a construction standard of BAL 29. APZs in line with BAL-29 construction standards are provided in perpetuity for the extent of each accommodation site.
Offsite Evacuation / Neighbourhood Safer Place	Main Works Site Contractor	<p>Offsite evacuations must only be undertaken at the direction of the PIC (or delegate) or IC as a coordinated action, in consultation with emergency agencies and must not be undertaken at the last minute (when it may be too late/dangerous to evacuate).</p> <p>The nearest designated Neighbourhood Safer Place are:</p> <ul style="list-style-type: none"> <li>1488 Bistro and Canteen located on Murrallin Road, Cabrumurra.</li> <li>Open Space located off Snowy Mountain Highway, Adaminaby</li> <li>Open Space located at the corner of Murray Jackson Drive and Bridle street, Talbingo</li> </ul>
Internal firefighting capacity	Main Works Site Contractor	Each main works accommodation camp shall have a full time, onsite emergency response team (ERT) which shall be appropriately trained and equipped to respond to potential bushfire events and initial structural firefighting within accommodation camps. All accommodation camps buildings shall be served by a



Requirement	Responsibility	Description
		fire hose reel system, plus have an appropriate firefighting tanker to enable bushfire and structural firefighting.
External firefighting resources	Main Works Site Contractor	The nearest fire resources are volunteer NSWRFs brigades at Adaminaby and Talbingo, more than one-hour response time away (if available). NPWS also maintains firefighting units based at Tumut and Jindabyne, and NSW Forestry Corporation manages fire units from Tumut.
Firefighting water supplies and equipment	Main Works Site Contractor	<p>To maximise the safety of the camps occupants, it is recommended that the facility's occupants and workers are comprehensively and regularly trained to undertake safe first attack firefighting operations. Training is recommended to specifically include the extent of first attack fire operations that can be undertaken without endangering the safety of persons engaged in fire-fighting activities. The requirement and extent of training is also recommended to be specifically addressed in the site's emergency response plan (ERP). Fire tanker resources with structural and bushfire fighting capacity must be established for each accommodation camp.</p> <p>It is recommended that all accommodation camp buildings meet the relevant BCA requirements, including smoke sensors and detectors, a fire hose reel system, portable fire extinguishers and hydrants compliant with the relevant standards.</p>
Debriefing after a fire event	Main Works Site Contractor	A debriefing and incident review shall be completed following each fire event.

### 6.3 Preparedness procedures

Pre-planned preparedness actions are required from the start of the bushfire season and in response to specific forecast fire danger indices. These preparedness procedures are to be documented in a Bushfire Emergency Management Plan for the project area (see **Section 6.5**), and include the following:

- minimum requirements for all work sites located within or adjoining vegetated areas (including grasslands) during the bushfire season;
- bush fire preparedness conditions and restrictions which apply based on forecast fire danger index.
- procedures for a coordinated managed evacuation. Options for offsite evacuation include primary and secondary access roads for each site (**Section 5.4**).
- procedures for shelter in place and stay and defending including preparation of a specific incident action plan that carefully considers the local risk factors associated with a bushfire in the vicinity. Assembly and refuge areas should be prepared and checked by the start of the fire season (annually before October) and during the fire season in accordance with the Mitigation Actions (**Section 6.1**).

### 6.4 Fire response

#### 6.4.1 Fire reporting and suppression

Fire reporting by the PIC (or delegate) will be undertaken when Emergency Alert warnings are provided.

While the NSW RFS is the principal response authority for all bushfire and structural events within the locality, and Fire and Rescue NSW for hazardous materials events, access constraints may inhibit effective response times. The nearest fire resources are volunteer NSW RFS brigades at Adaminaby and Talbingo, more than one-hour response time away (if available). NPWS also maintains firefighting units based at Tumut and Jindabyne, and NSW Forestry Corporation manages fire units from Tumut.

Fire response and suppression resources are required at each site to provide a first response in the event of a structural or bushfire emergency, which is likely include suppression of spot fires. Each main works accommodation camp shall have a full time, onsite Emergency Response Team (ERT), with an appropriate level of training and equipment to deal with potential bushfire and structural fire events. These operations are to only be undertaken by those with appropriate competencies for entering a fire ground and to undertake firefighting activities (both bushfire and structural as required). All buildings of the accommodation camps shall be served by a fire hose reel system, plus have an appropriate firefighting tanker capacity to enable bushfire and structural firefighting.

Bush fire reporting and suppression actions are to be documented in a Bushfire Emergency Management Plan, checked and updated prior to each bushfire season

#### 6.4.2 Formal emergency warnings

The bushfire actions in response to a formal emergency alert being issued by emergency services authorities or in response to a bushfire/smoke sighting is to be documented in the Bushfire Emergency Management Plan. This includes procedures for emergency evacuation.

#### 6.4.3 Emergency access, shelter-in-place and evacuation

All access roads which provide primary and secondary access and egress to the each site shall be upgraded to comply where possible with performance criteria and/or the acceptable solutions requirements specified in PBP 2018 and NSW RFS fire trail standards (NSW RFS 2019), as outlined in **Section 5.4** are met. Consultation with the NSW RFS will be undertaken where compliance is constrained. Access to Main Works sites is proposed to be upgraded in a staged approach, beginning at the commencement of Exploratory Works and to coincide with the development of Main Works infrastructure (see **Section 3.6**).

All vehicle access routes traverse bush fire prone vegetation which can support higher intensity bushfires. Attempting to evacuate at the last moment through these areas during a bushfire may be extremely dangerous with fatal consequences. All evacuations must be managed in accordance with the instructions of the Person in Charge (PIC), Incident Controller, fire warden or their delegate. Personnel may be directed to the On-site Refuges at Lobs Hole, Marica and Tantangara accommodation camps (see **5.3.2**) and shelter-in-place until a bushfire passes. Personnel must not 'self evacuate' in the event of receiving an Emergency Warning and must follow the direction of the PIC, in accordance with the procedures and actions identified in the Bushfire Emergency and Management Plan.

All permanent helipads established for emergency services activities should be designed and constructed with reference to the relevant standards, including consideration of the CASA Helicopter Landing Site Guidelines (CASA 2014).

## 6.5 Bush fire emergency management plan

A Bushfire Emergency Management Plan is required for the construction and operation of Main Works sites and should incorporate all relevant safety procedures and management recommendations detailed in the relevant Acts, Regulations and Australian Standards. The plan must consist of the following:

- identification and analysis of the bushfire risks of the Project Area and site-specific risks associated with each Main Works site;
- strategies and actions to maintain bushfire awareness before and during the bushfire season including climate and weather conditions, briefing of personnel contractors and visitors, training, hot works permits, emergency control structure and liaison with fire authorities.
- mitigation actions including the establishment and management of asset protection zones, access routes, and building maintenance requirements. These actions should be cross-referenced to a detailed map for each Main Works site;
- preparedness actions to implement from the start of the bushfire season and during the season based on forecast fire danger index;
- bushfire response actions including notification of ignitions and fires, fire response actions, emergency alert responses, emergency contact information, communication and assembly/evacuation/shelter in place arrangements;
- bushfire recovery actions to allow each site to be returned to normal operations, and enable the recovery of potentially impacted environmental and natural resource values; and
- monitoring and review requirements annually after the end of each bushfire season, and audit requirements to check mitigation and preparedness measures are in place prior to the start of each fire season.

This plan should be reviewed and updated after all major bushfire incidents, where significant changes to project layout or operation have occurred, or every five years during site operation. During initial construction as the site layout changes it may be necessary to update the plan annually. In those years in which the plan is not updated it should be checked annually to confirm the contents remain correct.

## 7. Summary of mitigation measures

This BFHRA identifies the bush fire protection measures applicable to design, construction, operation and ongoing management of the Main Works Package of the Snowy 2.0 Hydro Project. It has been prepared with reference to a range of relevant standards, requirements and guidelines including *Planning for Bush Fire Protection (2018)* and the Australian Standard AS 3959-2018 *Construction of Buildings in Bushfire-prone Areas*.

The table below provides a summary of recommendations to achieve compliance with the relevant requirements for bush fire protection for asset protection zones, construction standards, on-site refuges, access, water supply, provision of services, and emergency management and training.

**Table 52: Summary of recommended management measures**

Mitigation element	Protection Measure	BFHRA Report Reference
Asset Protection Zones	Asset protection zones are established for all Main Works sites to achieve BAL 29	<b>Section 5.10</b>
	Vegetation is managed within asset protection zones in perpetuity	<b>Section 5.2</b>
Construction Standards	All buildings proposed within each development site shall comply with BAL-29 construction standards of Australian Standard AS3959-2018 'Construction of buildings in bush fire-prone areas' or NASH Standard (1.7.14 updated) 'National Standard Steel Framed Construction in Bush fire Areas -2014' as appropriate	<b>Section 5.3.1</b>
On-site Refuge	All On-site Refuge buildings will be located within the centre of each Main Works Accommodation site, constructed to BAL-29 construction standard, be of appropriate capacity, signposted and mapped.	<b>Section 5.3.2</b>
Access	Primary and secondary access is maintained, upgraded and/or constructed to comply where possible with performance criteria and/or acceptable solution requirements of PBP 2018 and NSWRFs Fire Trail Standards (NSWRFs 2019). Consultation with the NSW RFS will be undertaken where compliance is constrained.	<b>Section 5.4</b>
Water supply	Water supply requirements for firefighting, including the provision of hydrants and hose reels, is designed, constructed in accordance with the relevant Standards and PBP 2018	<b>Section 5.5.1</b>
Electricity supply	Electricity supply and distribution is provided in accordance with the requirements of PBP 2018 and the relevant standards	<b>Section 5.5.2</b>
Emergency management and response	<p>A Bushfire Emergency Management Plan is prepared for the Project Area and includes responsibilities associated with and details of:</p> <ul style="list-style-type: none"> <li>• site specific hazards and risk at each main works site</li> <li>• procedures to maintain bushfire awareness</li> <li>• bushfire mitigation measures</li> <li>• fire preparedness actions</li> <li>• fire response actions including responses to emergency alerts issued by emergency services</li> <li>• bushfire recovery requirements</li> </ul>	<b>Section 6.5</b>
	Each main works accommodation camp shall have a full time, onsite Emergency Response Team (ERT), with an appropriate level of training and equipment to respond to potential bushfire and initial structural fire events.	<b>Section 6.4</b>

## 8. References

- Australasian Fire and Emergency Services Authorities Council (AFAC) (2008) *Common Hose Couplings for Australian AFAC Member Agencies*. Version 6 May 2008 AFAC, Melbourne
- Australian Building Codes Board (ABCB) (2019). *National Construction Code Volume One - Building Code of Australia*. ABCB
- Bureau of Meteorology (2018) *Climate Data Online*. Bureau of Meteorology Website accessed 29/11/18 15:29hrs <http://www.bom.gov.au/climate/data/index.shtml>
- Civil Aviation Safety Authority (CASA) (2014) *Guidelines for the establishment and operation of onshore Helicopter Landing Sites*. Civil Aviation Advisory Publication CAAP 92-2(2) February 2014
- CSIRO (2018) *Forest Climate Risk. Online data for Maragle State Forest*. Website: [www.forestclimaterisk.com.au/map/explorer/theme/heat-fire](http://www.forestclimaterisk.com.au/map/explorer/theme/heat-fire) accessed 29/11/18 15:45hrs
- Department of Environment and Climate Change (DECC) (2008) *Kosciuszko National Park Fire Management Strategy 2008–2013*. Prepared by the Parks and Wildlife Group, July 2008, Sydney
- Department of Environment and Conservation NSW (DEC) (2006) *Kosciuszko National Park Plan of Management*. As amended in 2010 and 2014
- EMM (2018) *Environmental Impact Statement - Exploratory Works for Snowy 2.0*. Prepared by EMM, St Leonards NSW
- EMM (2019) *Mapped Plant Community Type*. Fieldwork undertaken November 2018-March 2019
- Hines, F., Tolhurst, KG., Wilson, AAG, and McCarthy, GJ. (2010) *Overall fuel hazard assessment guide 4th edition July 2010*. Fire and adaptive management, report no. 82
- Industry Safety Steering Committee 3 (ISSC3) (2016) *ISSC3 Guide for the Management of Vegetation in the Vicinity of Electricity Assets*. November 2016. NSW.
- Jurskis, V., de Mar, P., and Aitchison, B. (2006) *Fire Management in the Alpine Region*. Paper presented at Life in a Fire-Prone Environment: Translating Science Into Practice Bush fire Conference 2006, Brisbane 6-9 June 2006
- Keith, D.A. (2004) *Ocean Shores to Desert Dunes: The Native Vegetation of New South Wales*. Department of Environment and Conservation, Sydney NSW
- NSW Soil Conservation Service (2017) *NSW Rural Fire Service – Fire Trail Design, Construction and Maintenance Manual*. Prepared by the Department of Industry, Soil Conservation Service for the NSW Rural Fire Service August 2017.
- NSWRFS (2006). *Planning for Bush Fire Protection: A Guide for Councils, Planners, Fire Authorities, Developers and Home Owners* including the 2010 Appendix 3 Addendum. Prepared by the NSW Rural Fire Service, Homebush NSW



NSWRFS (2017) *Neighbourhood Safer Places- Guidelines for the Identification and Inspection of Neighbourhood Safer Places in NSW* Prepared by the NSWRFs April 2017  
<https://www.rfs.nsw.gov.au/plan-and-prepare/neighbourhood-safer-places>

NSWRFS (2018) *Planning for Bush Fire Protection – A guide for councils, planners, fire authorities and developers. Pre-release issued August 2018.* Prepared by NSWRFs Homebush NSW

NSWRFS (2019) *Fire Trail Standards.* Prepared by the NSWRFs Homebush NSW, March 2019

Snowy Monaro BFMC (2009) *Bush Fire Risk Management Plan.* Plan prepared by Snowy Monaro BFMC and approved by the NSW Bush Fire Coordinating Committee 29 July 2009

Snowy Valleys BFMC (2017) *Bush Fire Risk Management Plan.* Plan prepared by Snowy Valleys BFMC 10 October 2017 and approved by the NSW Bush Fire Coordinating Committee 10 January 2018

Soil Conservation Service (2017) *NSW Rural Fire Service – Fire Trail Design, Construction and Maintenance Manual,* Prepared by the Department of Industry, Soil Conservation Service for the NSW Rural Fire Service August 2017.

Standards Australia (2001) *AS 2444-2001 Portable fire extinguishers and fire blankets- Selection and location.* Sixth Edition 2001. Standards Australia, Sydney

Standards Australia (2005) *National Guidelines on Electrical Safety for Emergency Service Personnel* ENA Doc 008—2006, Standards Australia, Sydney

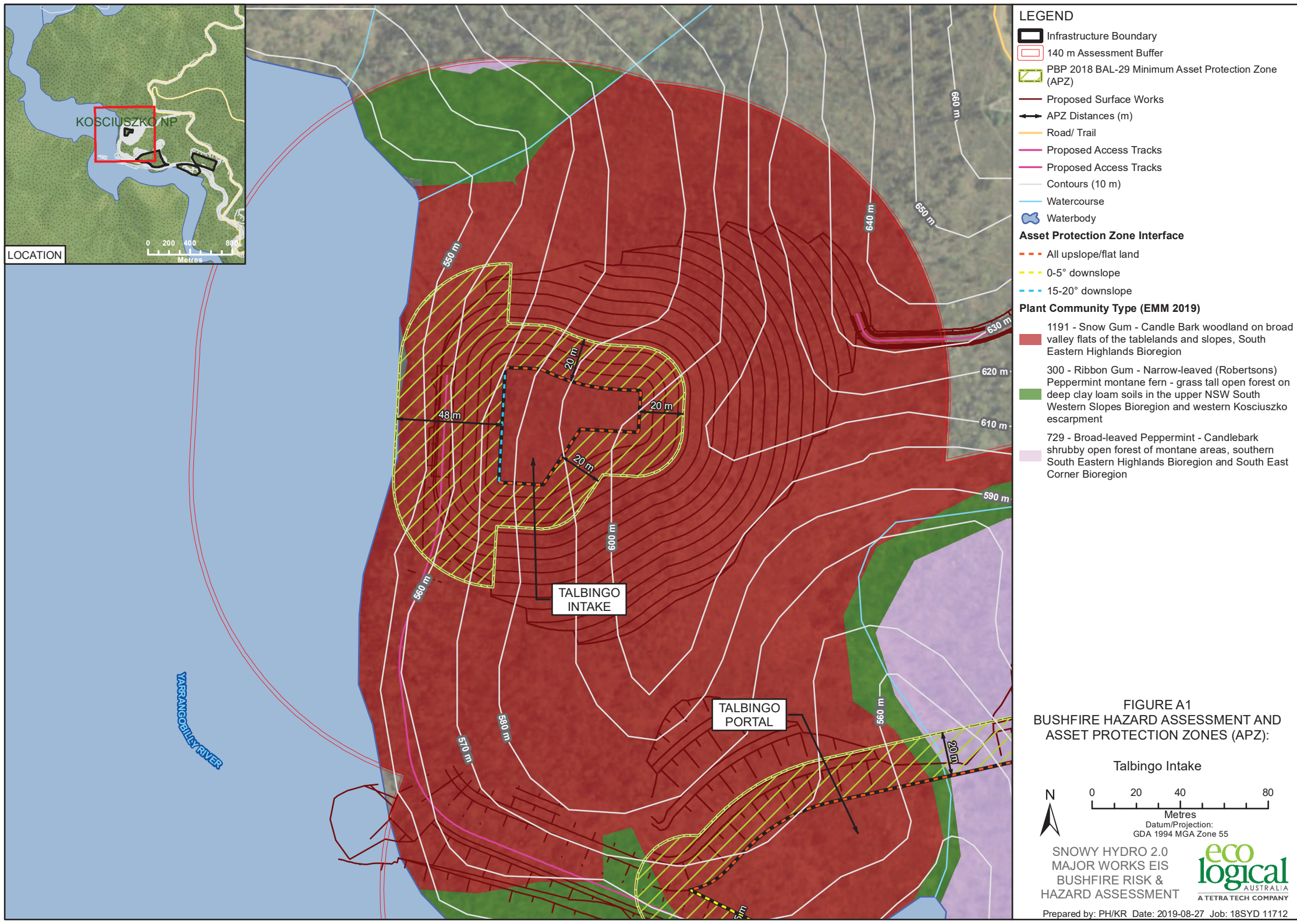
Standards Australia (2018) *AS 2441-2005 Installation of fire hose reels – incorporating amendment No. 1* Reconfirmed 2018. Standards Australia Sydney

Standards Australia (2018) *AS 3959:2018 Construction of buildings in bush fire prone areas.* (including amendments) Standards Australia, Sydney

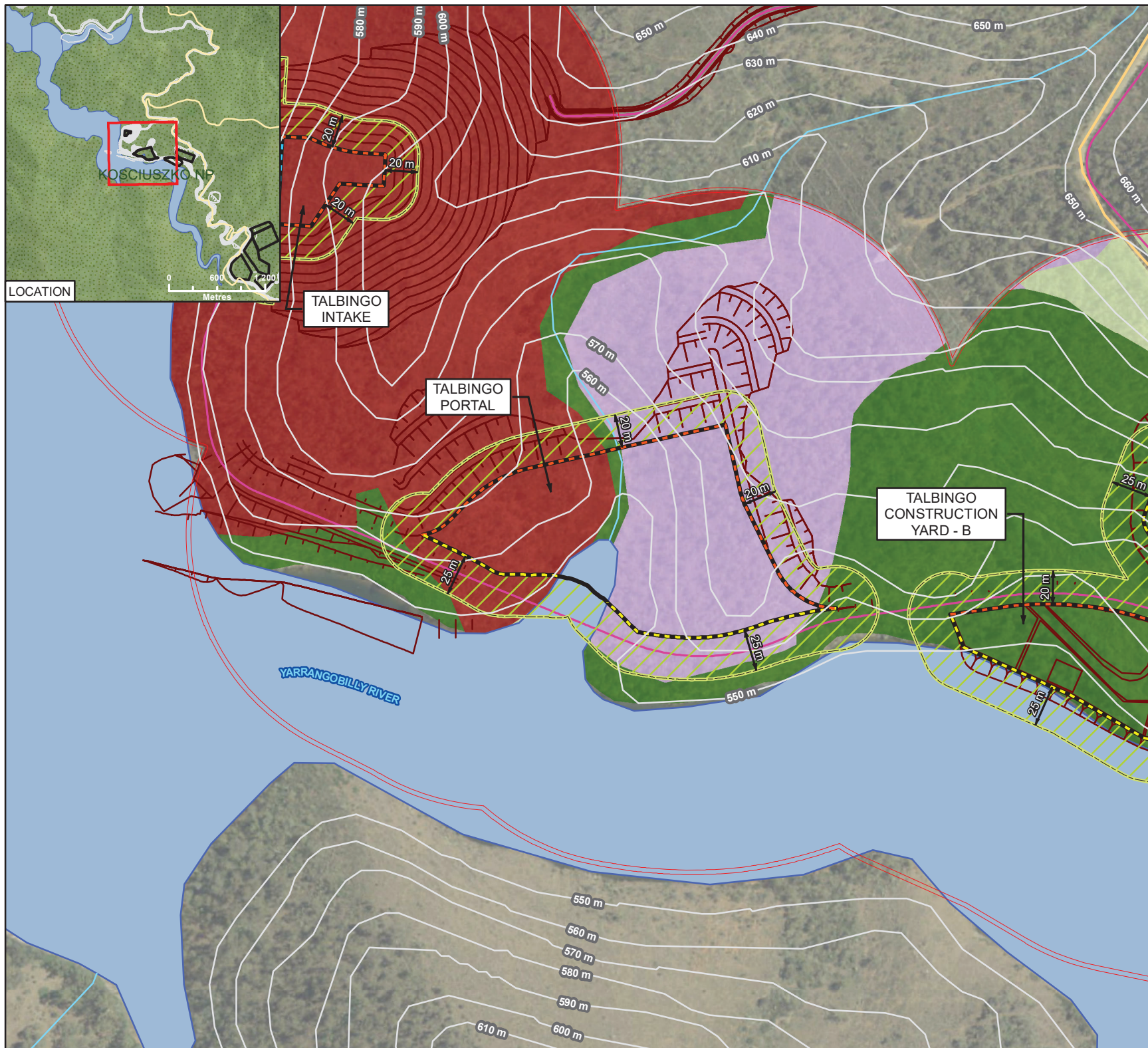
Standards Australia 2419.1:2017 *Fire hydrant installations. Part 1: System design, installation and commissioning.* Fifth Edition 2017. Standards Australia Sydney

Williams R. J., Wahren C. H., Tolsma A. D., Sanecki G. M., Papst W. A., Myers B. A., McDougall K. L., Heinze D. A. & Creen K. (2008) *Large fires in Australian alpine landscapes: their part in the historical fire regime and their impacts on alpine biodiversity.* International Journal of Wildland Fire 17, 793-808.

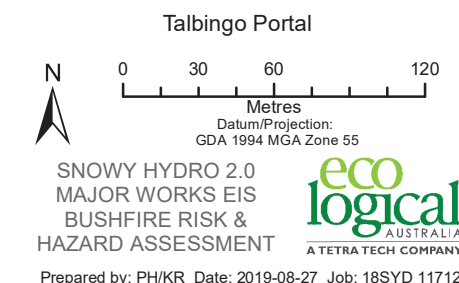
## Appendix A: Main Works Sites - Hazard Assessment and Asset Protection Zones



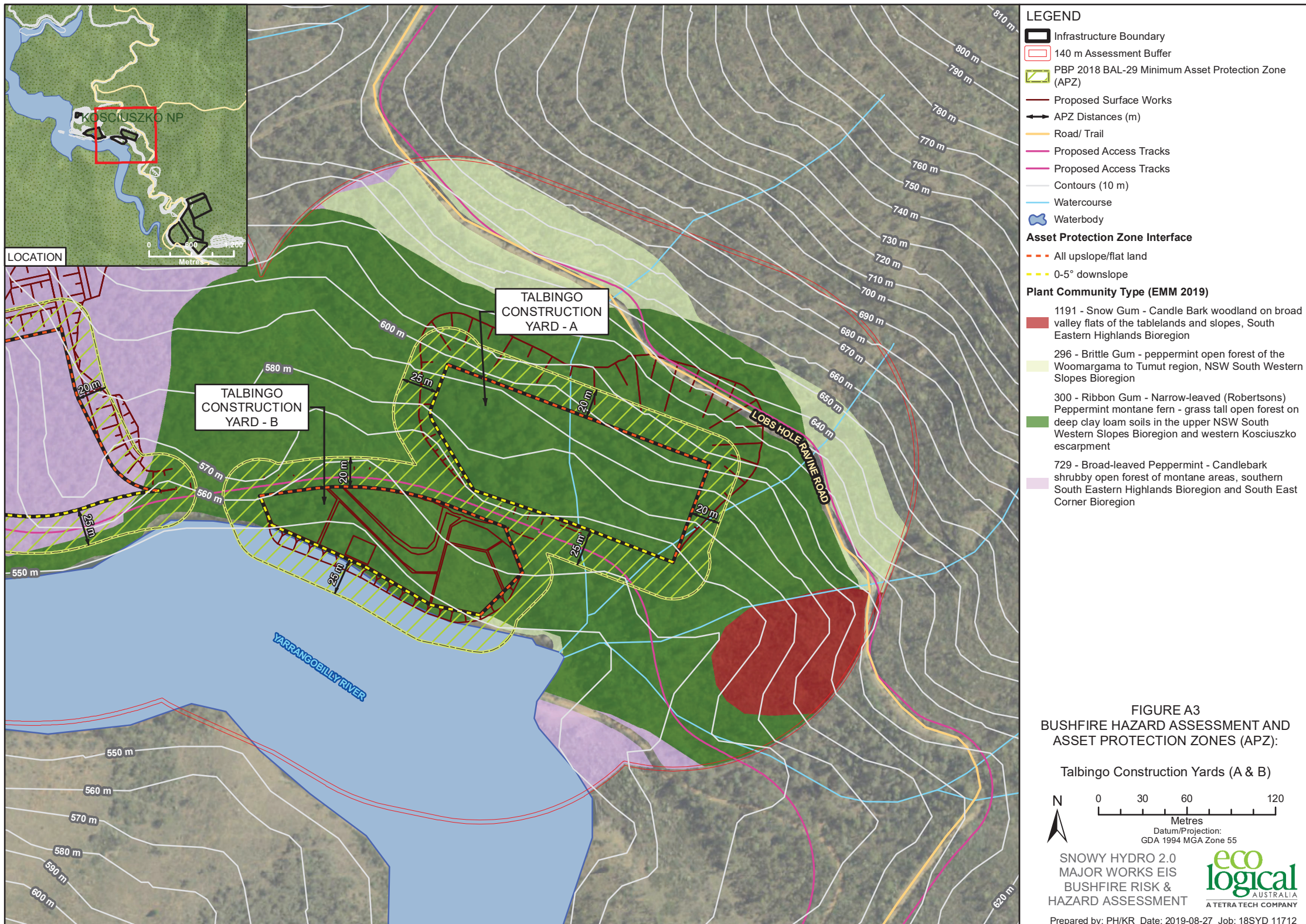




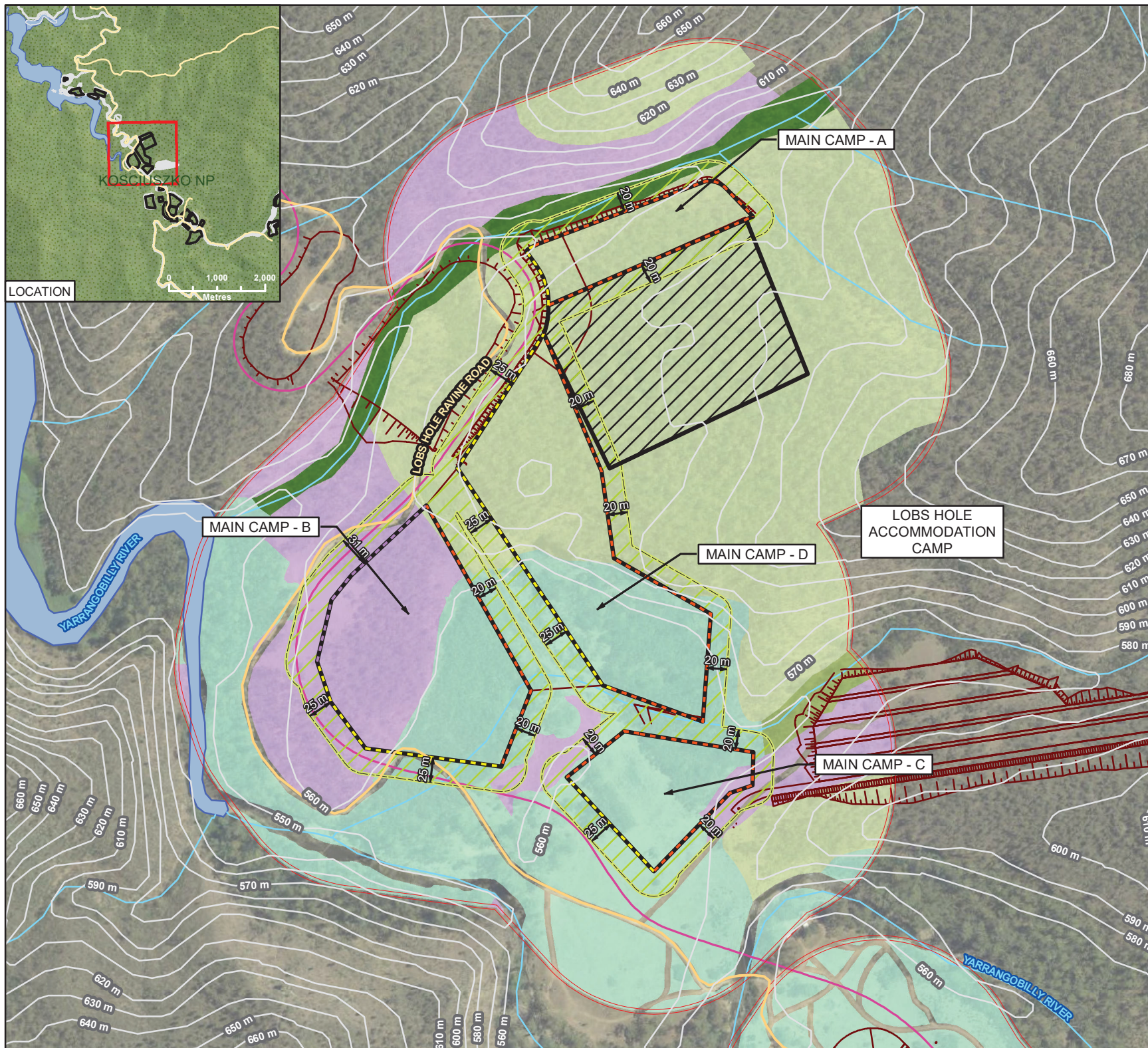
**FIGURE A2**  
**BUSHFIRE HAZARD ASSESSMENT AND**  
**ASSET PROTECTION ZONES (APZ):**











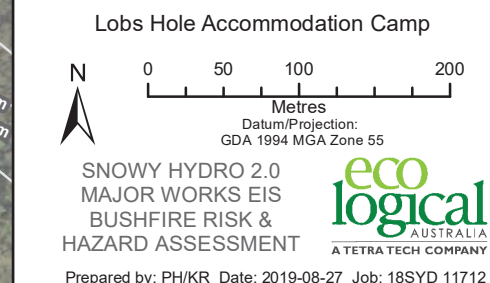
## LEGEND

- Infrastructure Boundary
- 140 m Assessment Buffer
- Avoidance Area
- PBP 2018 BAL-29 Minimum Asset Protection Zone (APZ)
- Proposed Surface Works
- APZ Distances (m)
- Road/ Trail
- Proposed Access Tracks
- Contours (10 m)
- Watercourse
- Waterbody
- Asset Protection Zone Interface**
  - All upslope/flat land
  - 0-5° downslope
  - 5-10° downslope

## Plant Community Type (EMM 2019)

- 296 - Brittle Gum - peppermint open forest of the Woomargama to Tumut region, NSW South Western Slopes Bioregion
- 299 - Riparian Ribbon Gum - Robertsons Peppermint - Apple Box riverine very tall open forest of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion
- 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
- 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
- 729 - Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion

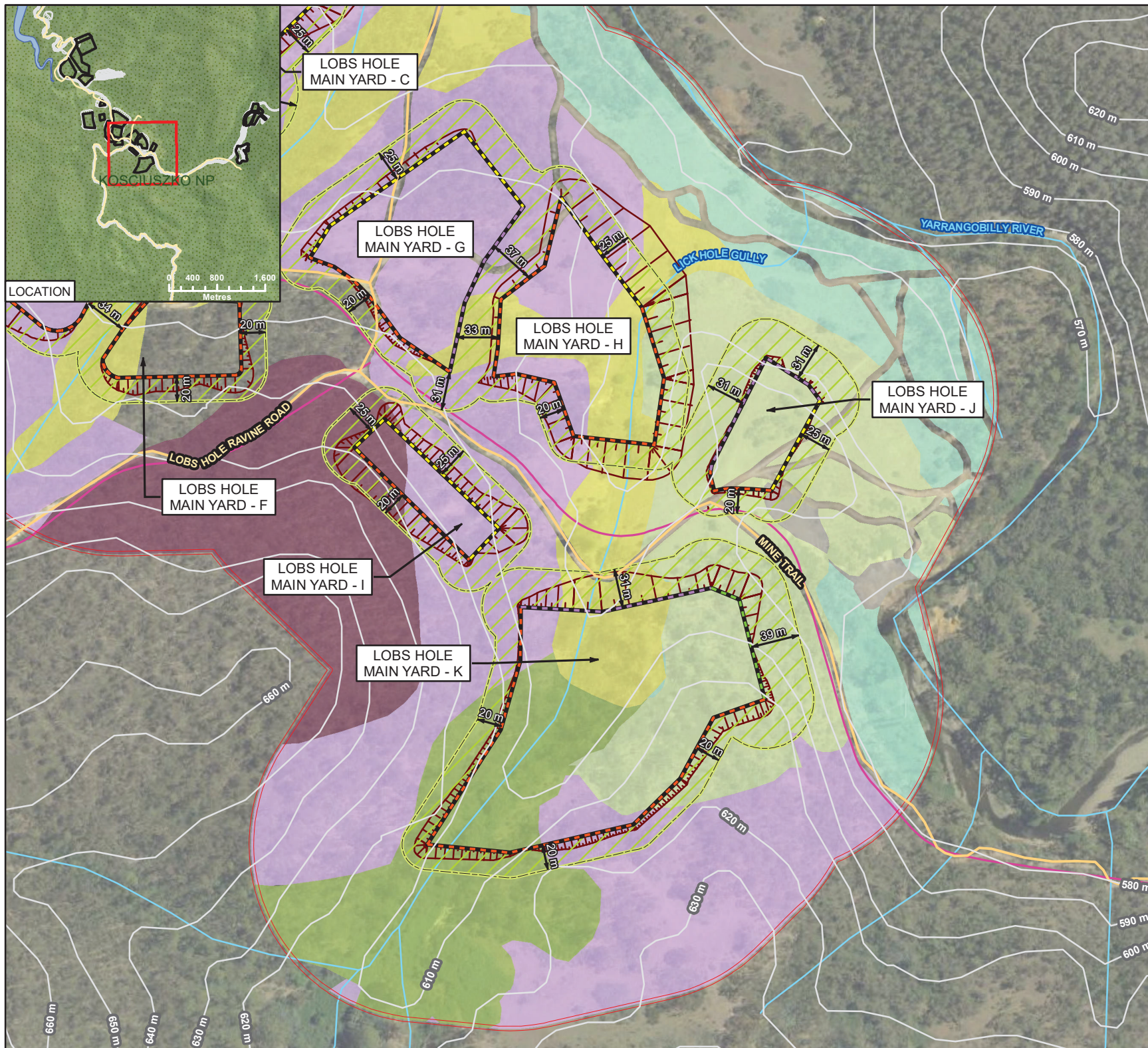
**FIGURE A4**  
**BUSHFIRE HAZARD ASSESSMENT AND**  
**ASSET PROTECTION ZONES (APZ):**











## LEGEND

- Infrastructure Boundary
- 140 m Assessment Buffer
- PBP 2018 BAL-29 Minimum Asset Protection Zone (APZ)
- Proposed Surface Works
- APZ Distances (m)
- Road/ Trail
- Proposed Access Tracks
- Contours (10 m)
- Watercourse

## Asset Protection Zone Interface

- All upslope/flat land
- 0-5° downslope
- 5-10° downslope
- 10-15° downslope
- 15-20° downslope

## Plant Community Type (EMM 2019)

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

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

299 - Riparian Ribbon Gum - Robertsons Peppermint - Apple Box riverine very tall open forest of the NSW South Western Slopes Bioregion and South Eastern Highlands Bioregion

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

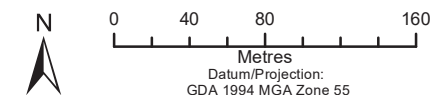
729 - Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion

999 - Norton's Box - Broad-leaved Peppermint open forest on footslopes, central and southern South Eastern Highlands Bioregion

Heavily disturbed land

**FIGURE A6**  
**BUSHFIRE HAZARD ASSESSMENT AND**  
**ASSET PROTECTION ZONES (APZ):**

Lobs Hole Main Yard - South

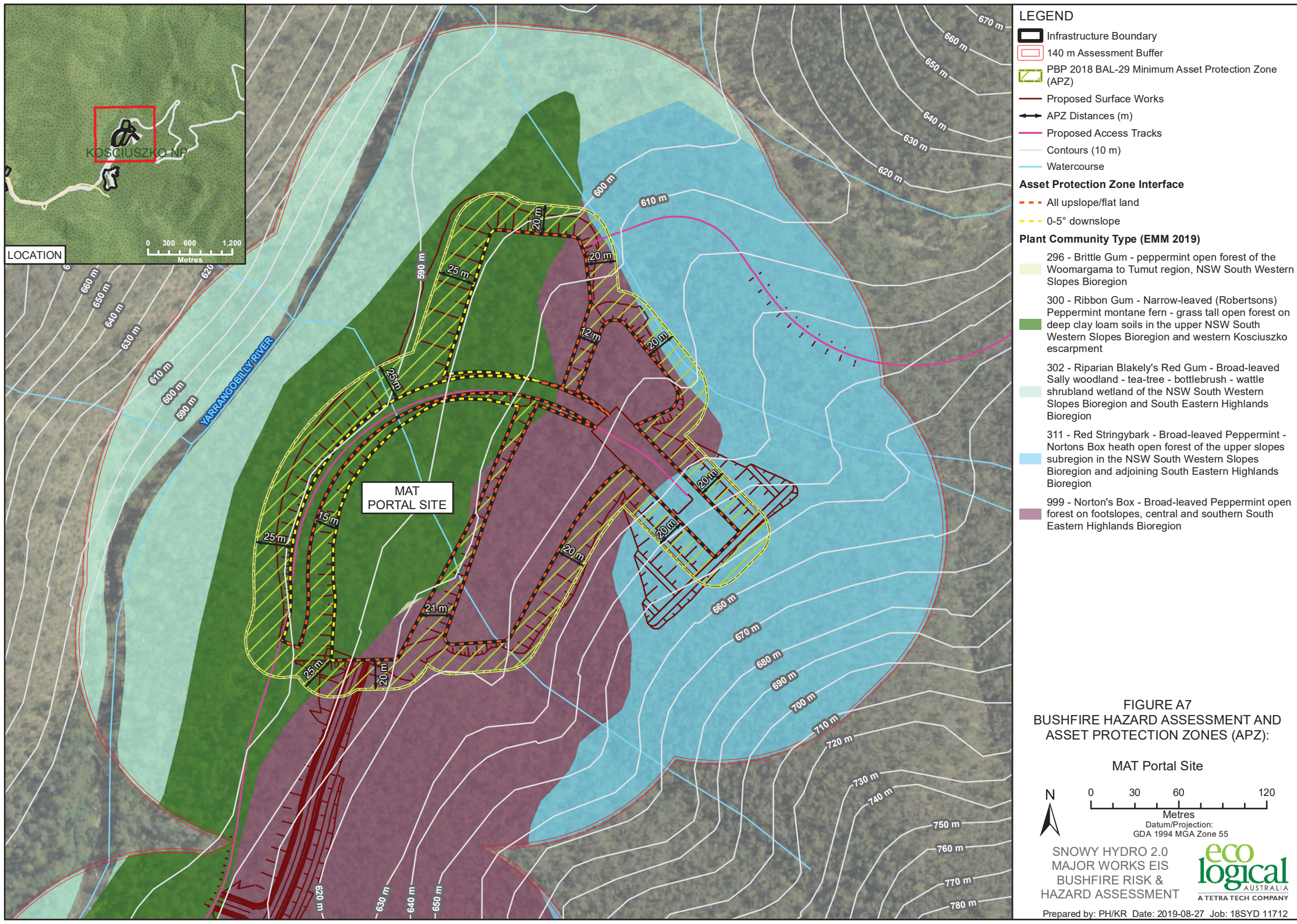


SNOWY HYDRO 2.0  
MAJOR WORKS EIS  
BUSHFIRE RISK &  
HAZARD ASSESSMENT

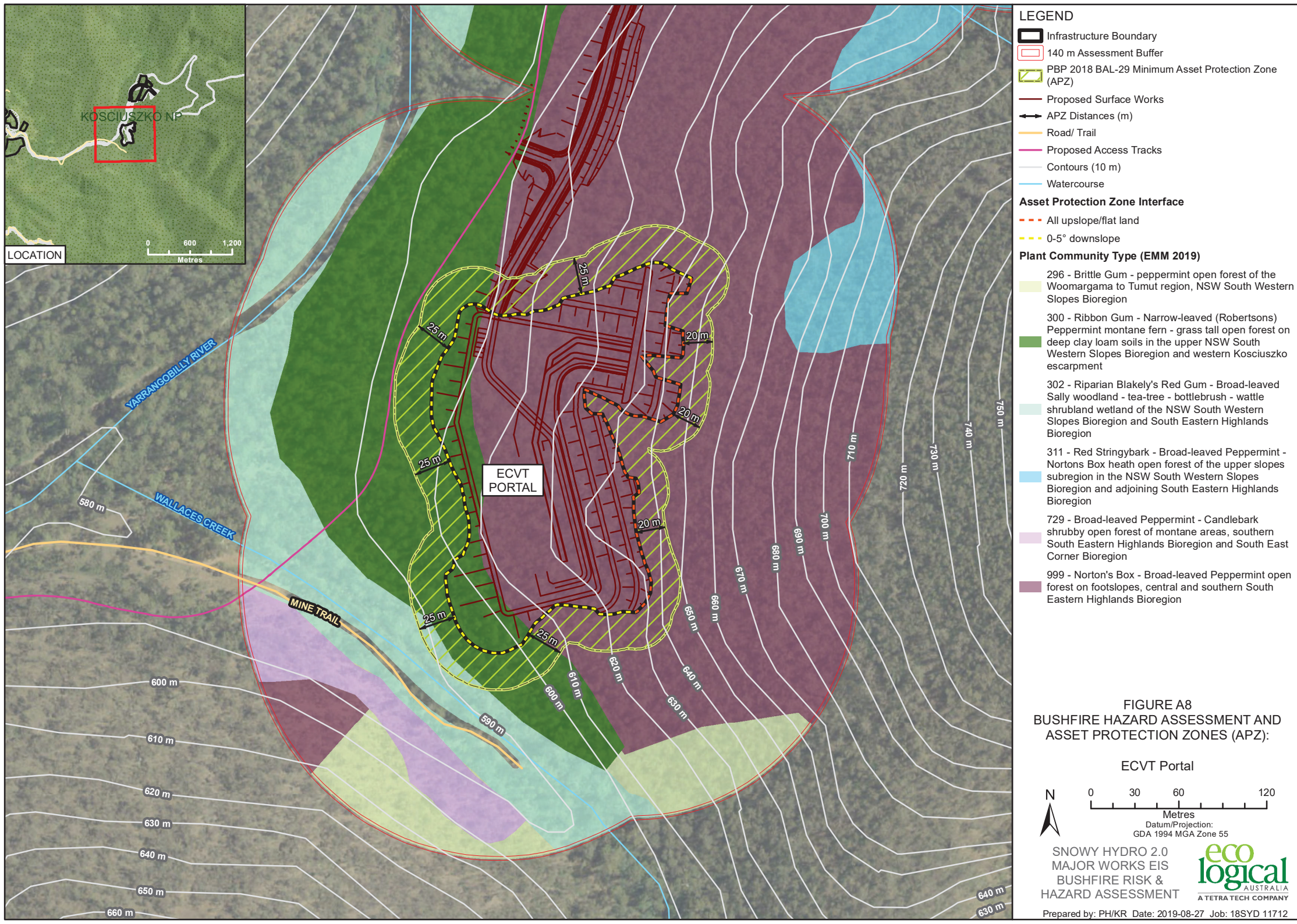
**eco**  
**logical**  
AUSTRALIA  
A TETRA TECH COMPANY

Prepared by: PH/KR Date: 2019-08-27 Job: 18SYD 11712

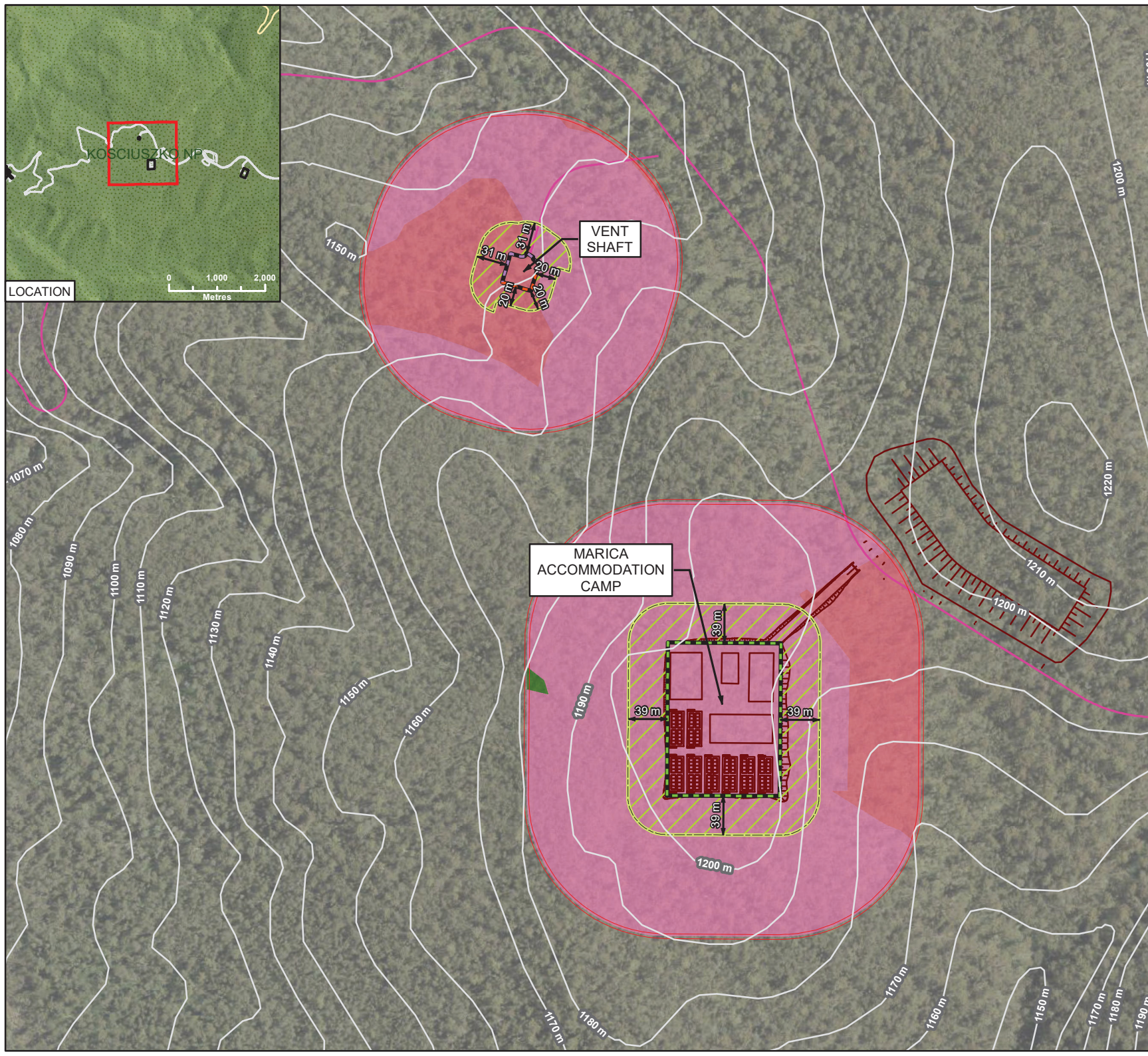












## LEGEND

- Infrastructure Boundary
- 140 m Assessment Buffer
- PBP 2018 BAL-29 Minimum Asset Protection Zone (APZ)
- Proposed Surface Works
- APZ Distances (m)
- Proposed Access Tracks
- Contours (10 m)

### Asset Protection Zone Interface

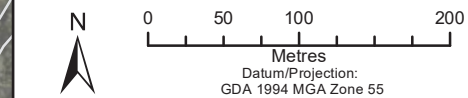
- All upslope/flat land
- 5-10° downslope
- 10-15° downslope

### Plant Community Type (EMM 2019)

- 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion
- 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
- 729 - Broad-leaved Peppermint - Candlebark shrubby open forest of montane areas, southern South Eastern Highlands Bioregion and South East Corner Bioregion
- 953 - Mountain Gum - Snow Gum - Broad-leaved Peppermint shrubby open forest of montane ranges, South Eastern Highlands Bioregion and Australian Alps Bioregion

FIGURE A9  
BUSHFIRE HAZARD ASSESSMENT AND  
ASSET PROTECTION ZONES (APZ);

Marica Accommodation Camp & Vent Shaft

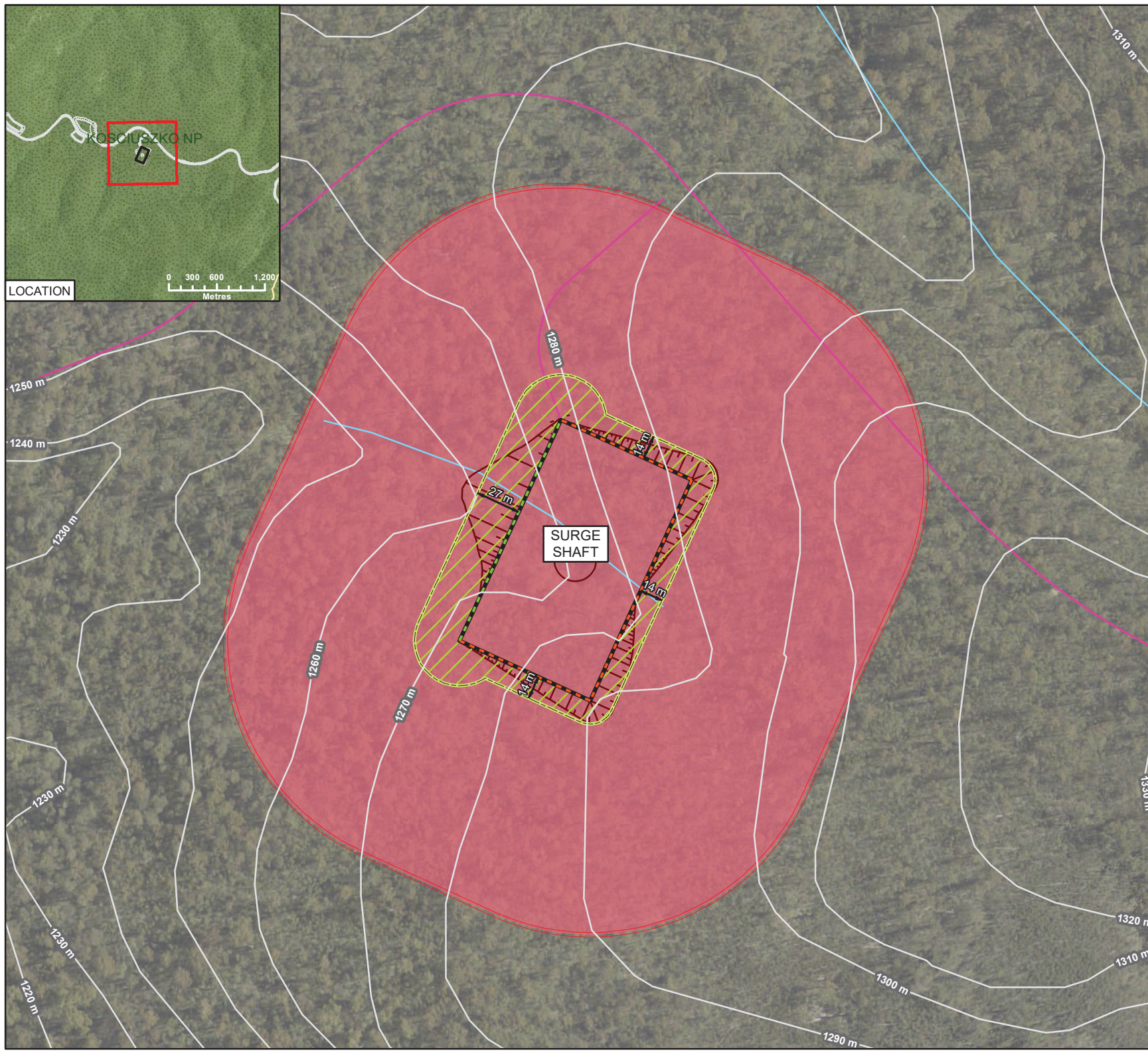


SNOWY HYDRO 2.0  
MAJOR WORKS EIS  
BUSHFIRE RISK &  
HAZARD ASSESSMENT

**eco**  
**logical**  
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- LEGEND**
- Infrastructure Boundary
  - 140 m Assessment Buffer
  - PBP 2018 BAL-29 Minimum Asset Protection Zone (APZ)
  - Proposed Surface Works
  - APZ Distances (m)
  - Proposed Access Tracks
  - Contours (10 m)
  - Watercourse
- Asset Protection Zone Interface**
- All upslope/flat land
  - 10-15° downslope
- Plant Community Type (EMM 2019)**
- 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion

FIGURE A10  
BUSHFIRE HAZARD ASSESSMENT AND  
ASSET PROTECTION ZONES (APZ):

Surge shaft

N

0 30 60 120  
Metres

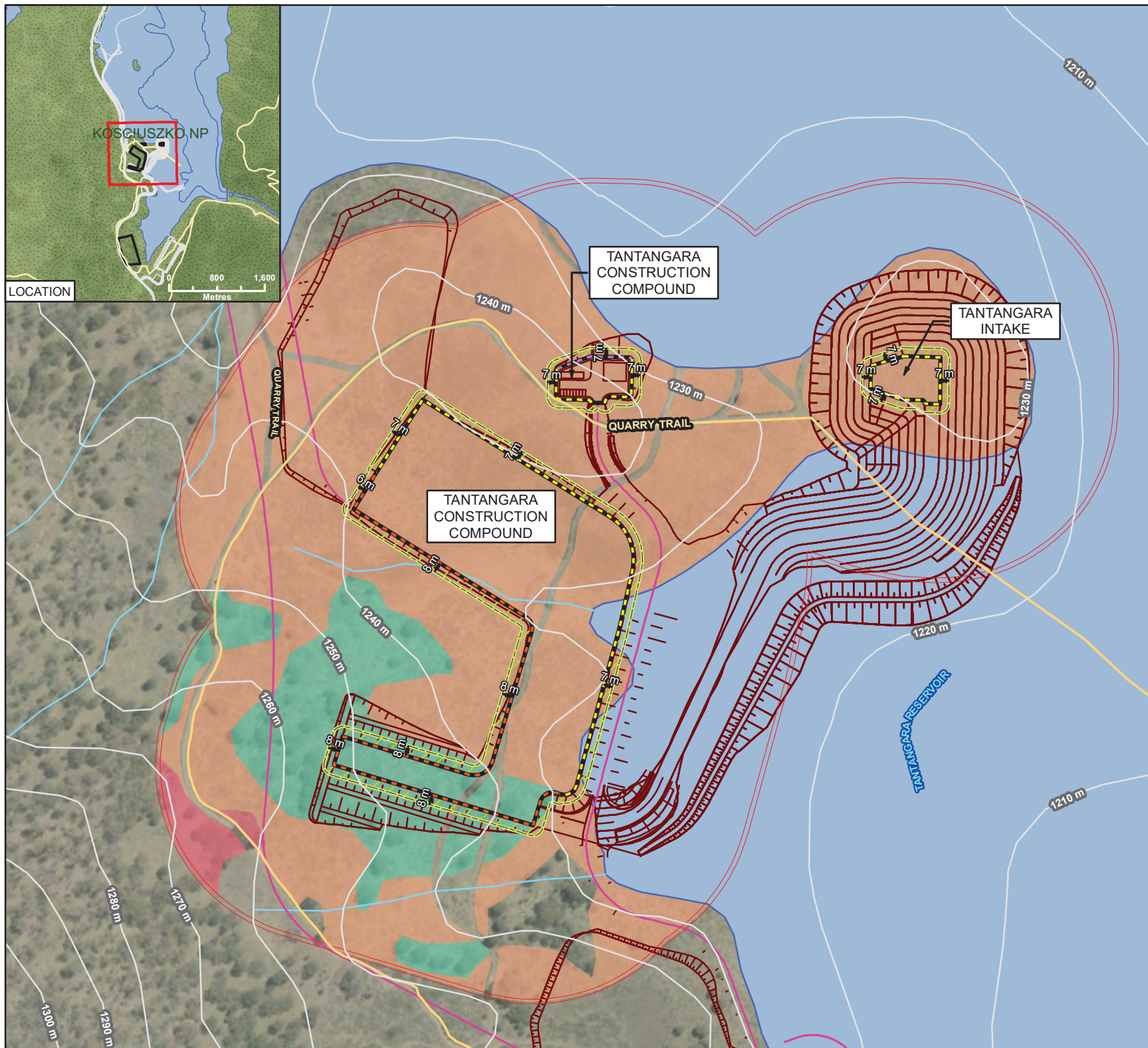
Datum/Projection:  
GDA 1994 MGA Zone 55

SNOWY HYDRO 2.0  
MAJOR WORKS EIS  
BUSHFIRE RISK &  
HAZARD ASSESSMENT

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## LEGEND

- Infrastructure Boundary
- 140 m Assessment Buffer
- PBP 2018 BAL-29 Minimum Asset Protection Zone (APZ)
- Proposed Surface Works
- APZ Distances (m)
- Road/ Trail
- Proposed Access Tracks
- Contours (10 m)
- Watercourse
- Waterbody

### Asset Protection Zone Interface

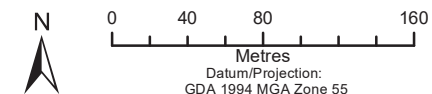
- All upslope/flat land
- 0-5° downslope
- 5-10° downslope

### Plant Community Type (EMM 2019)

- 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion
- 1224 - Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion
- 1225 - Sub-alpine grasslands of valley floors, southern South Eastern Highlands Bioregion and Australian Alps Bioregion
- 303 - Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion and western South Eastern Highlands Bioregion

FIGURE A11  
BUSHFIRE HAZARD ASSESSMENT AND  
ASSET PROTECTION ZONES (APZ):

Tantangara Intake and Construction Compound

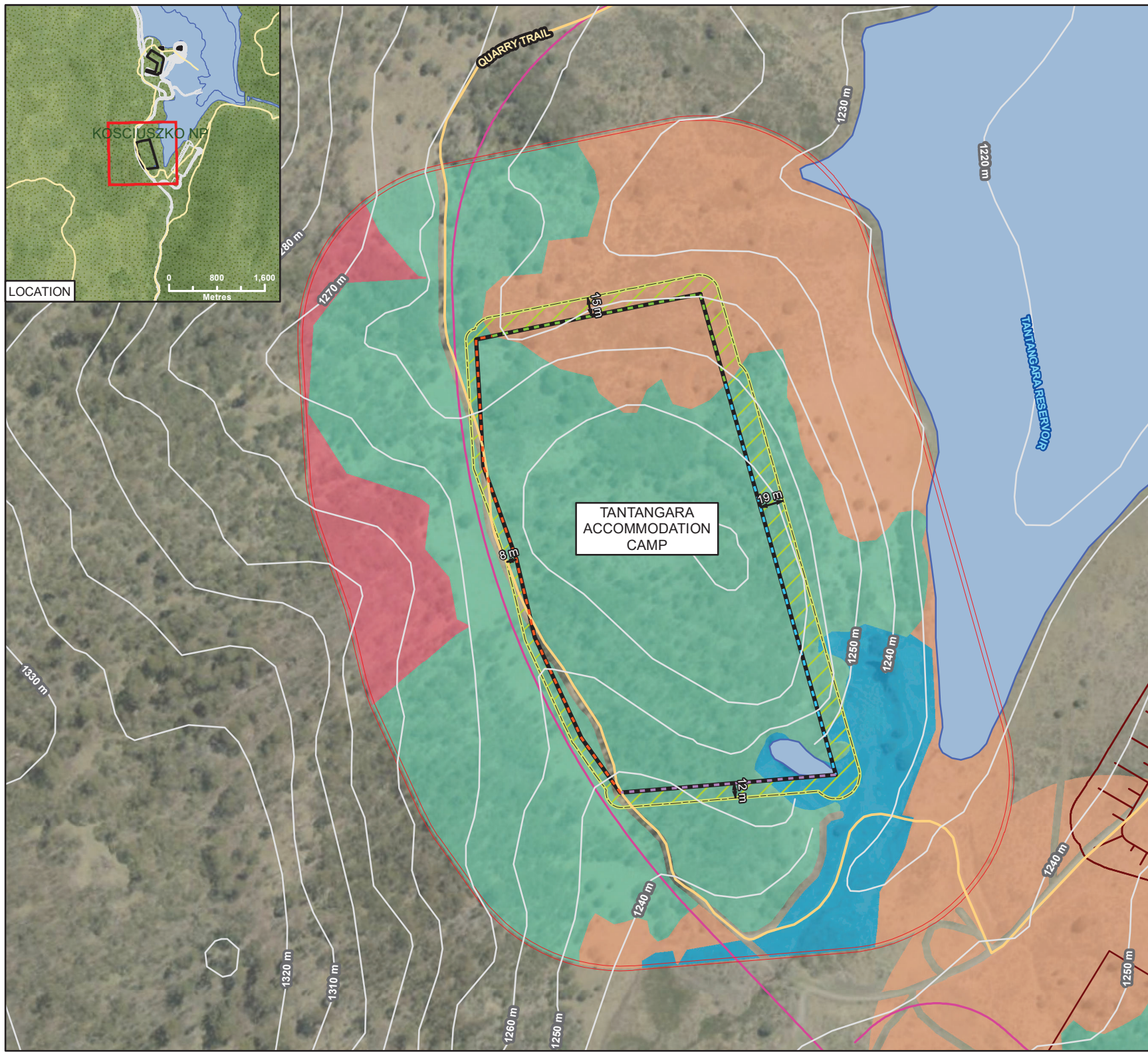


SNOWY HYDRO 2.0  
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HAZARD ASSESSMENT

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## LEGEND

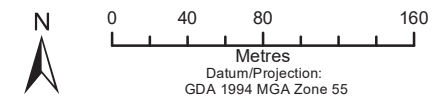
- Infrastructure Boundary
  - 140 m Assessment Buffer
  - PBP 2018 BAL-29 Minimum Asset Protection Zone (APZ)
  - Proposed Surface Works
  - APZ Distances (m)
  - Road/ Trail
  - Proposed Access Tracks
  - Contours (10 m)
  - Waterbody
- Asset Protection Zone Interface**
- All upslope/flat land
  - 5-10° downslope
  - 10-15° downslope
  - 15-20° downslope

## Plant Community Type (EMM 2019)

- 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion
- 1224 - Sub-alpine dry grasslands and heathlands of valley slopes, southern South Eastern Highlands Bioregion and Australian Alps Bioregion
- 303 - Black Sally grassy low woodland in valleys in the upper slopes sub-region of the NSW South Western Slopes Bioregion and western South Eastern Highlands Bioregion
- 637 - Alpine and sub-alpine peatlands, damp herbfields and fens, South Eastern Highlands Bioregion and Australian Alps Bioregion

FIGURE A12  
BUSHFIRE HAZARD ASSESSMENT AND  
ASSET PROTECTION ZONES (APZ):

Tantangara Accommodation Camp

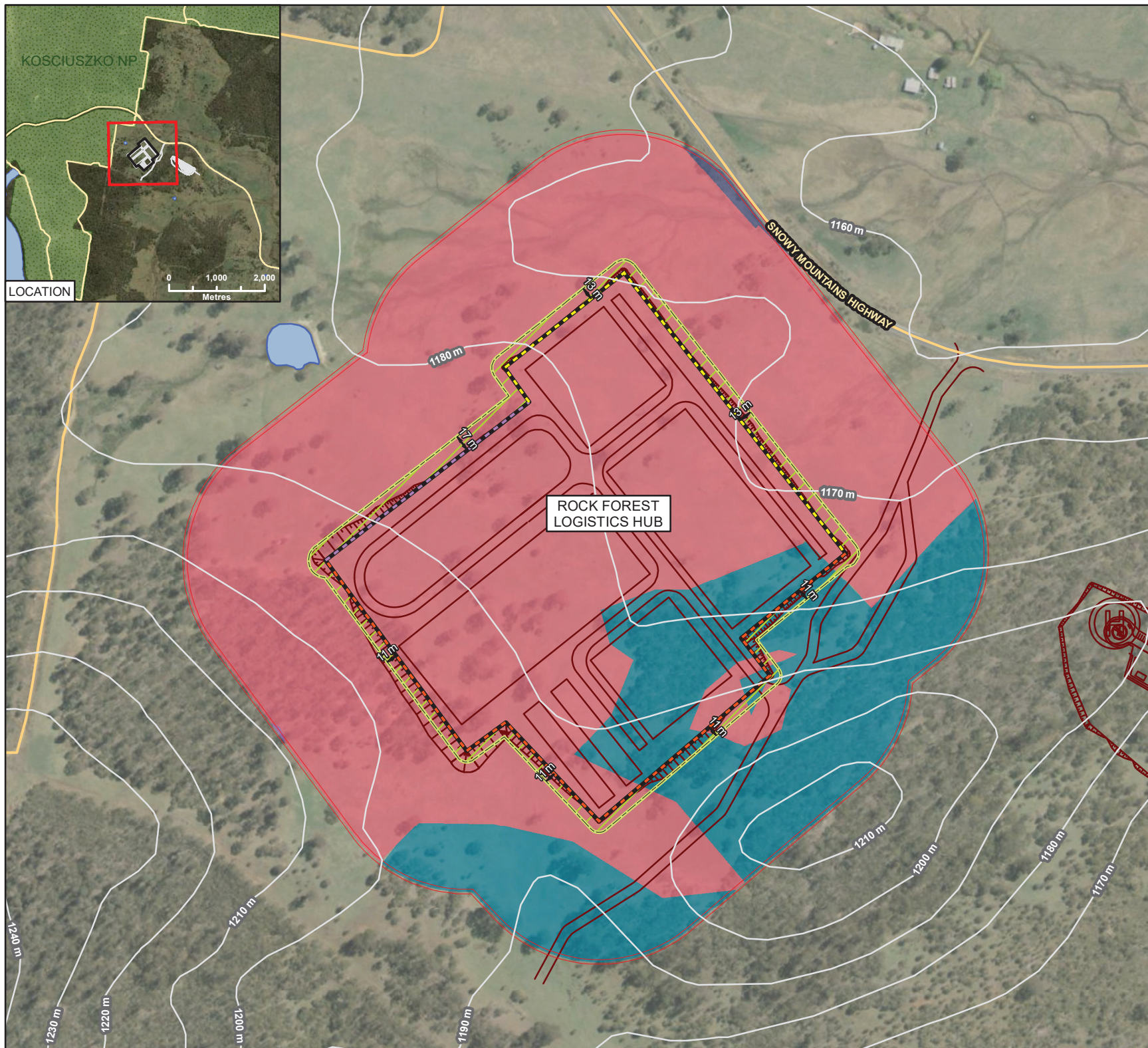


SNOWY HYDRO 2.0  
MAJOR WORKS EIS  
BUSHFIRE RISK &  
HAZARD ASSESSMENT

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**logical**  
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**LEGEND**

- Infrastructure Boundary
- 140 m Assessment Buffer
- PBP 2018 BAL-29 Minimum Asset Protection Zone (APZ)
- Proposed Surface Works
- APZ Distances (m)
- Road/ Trail
- Contours (10 m)
- Waterbody

**Asset Protection Zone Interface**

- All upslope/flat land
- 0-5° downslope
- 5-10° downslope

**Plant Community Type (EMM 2019)**

- 1196 - Snow Gum - Mountain Gum shrubby open forest of montane areas, South Eastern Highlands Bioregion and Australian Alps Bioregion
- 644 - Alpine Snow Gum - Snow Gum shrubby woodland at intermediate altitudes in northern Kosciuszko NP, South Eastern Highlands Bioregion and Australian Alps Bioregion
- 679 - Black Sallee - Snow Gum low woodland of montane valleys, South Eastern Highlands Bioregion and Australian Alps Bioregion
- 952 - Mountain Gum - Narrow-leaved Peppermint - Snow Gum dry shrubby open forest on undulating tablelands, southern South Eastern Highlands Bioregion

**FIGURE A13**  
**BUSHFIRE HAZARD ASSESSMENT AND**  
**ASSET PROTECTION ZONES (APZ):**

**Rock Forest Logistics Hub**

N

0 50 100 200  
Metres

Datum/Projection:  
GDA 1994 MGA Zone 55

SNOWY HYDRO 2.0  
MAJOR WORKS EIS  
BUSHFIRE RISK &  
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