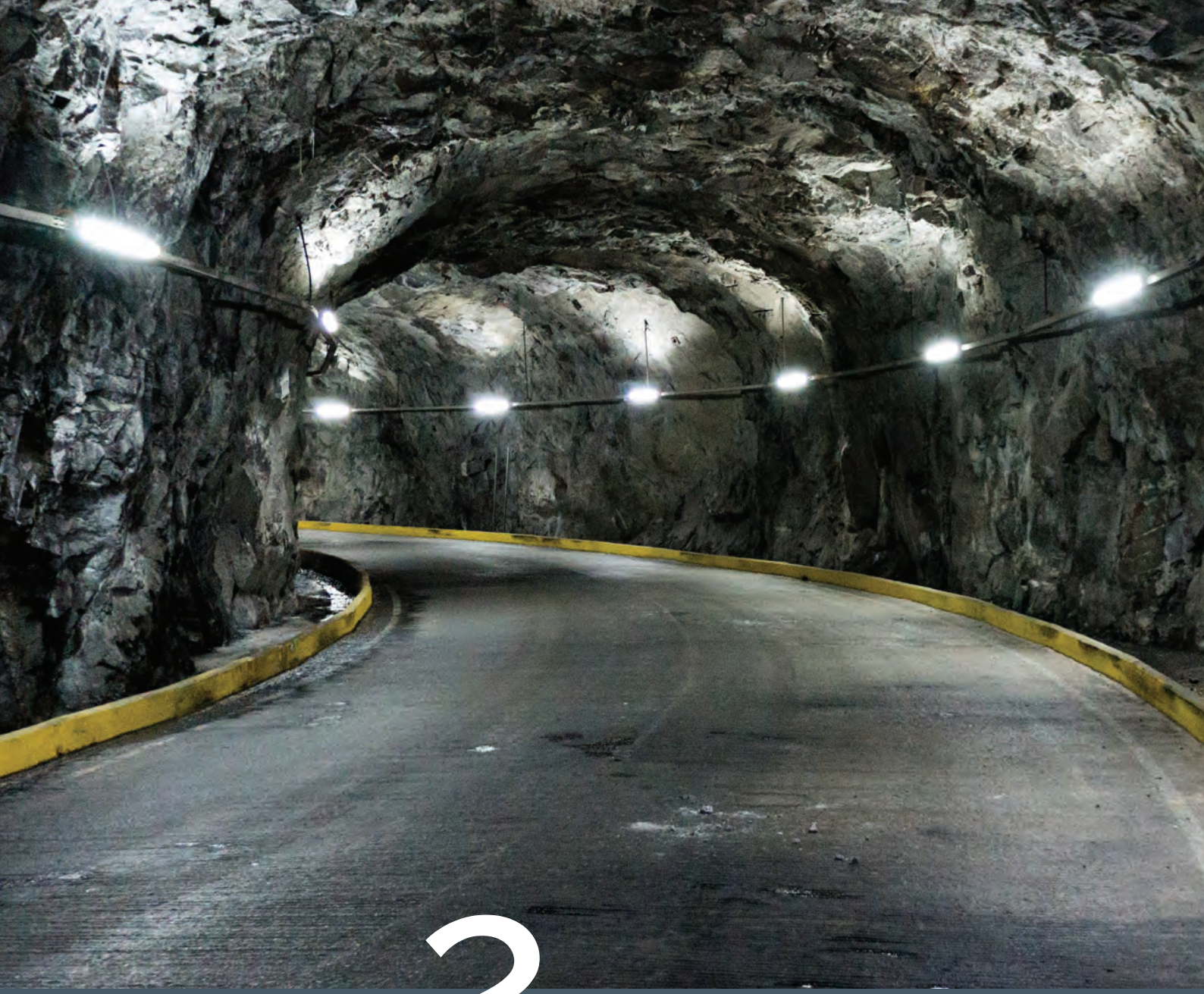


CHAPTER 2

PROPOSED EXPLORATORY WORKS

2 Proposed exploratory works

This chapter describes the elements, construction activities and method for Exploratory Works. The works described in this chapter form the basis of the environmental impact assessment undertaken.

2.1 Exploratory Works elements

2.1.1 Overview

Exploratory Works will involve construction of an exploratory tunnel to enable exploratory drilling and provide a greater understanding of the underground conditions at the Snowy 2.0 power station cavern. Several supporting elements will be required to facilitate the construction of the exploratory tunnel, and these are summarised in Table 2.1 and shown in Figure 2.1.

An avoidance footprint has been defined for Exploratory Works and is shown in Figure 2.1 and several other figures throughout this section. The avoidance footprint is defined as all areas excluded from clearing and ground disturbance due to sensitive environmental and heritage constraints.

A disturbance footprint has been defined for Exploratory Works and is shown in Figure 2.1 and several other figures throughout this section. The Exploratory Works disturbance footprint is defined as all areas subject to clearing and ground disturbance.

Table 2.1 Summary of Exploratory Works elements

Project element	Overview
Exploratory tunnel	An exploratory tunnel approximately 3.1 km long
Horizontal and test drilling	Horizontal and other test drilling, investigations and analysis at the proposed cavern location and associated areas, and around the portal construction pad, access roads and excavated rock emplacement areas all within the disturbance footprint
Portal construction pad	An entrance structure at the western end of the exploratory tunnel, and an area for infrastructure, equipment and activities required for the construction of the exploratory tunnel
Accommodation camp	A fully serviced accommodation camp catering for a construction workforce of up to 152 personnel
Access roads	26 km of road upgrades and approximately 2 km of new roads to facilitate access to the project area
Barge access	The construction and use of two new barge ramps on Talbingo Reservoir at the existing Talbingo Spillway and Middle Bay
Supporting infrastructure	Provision of power, communications, water and waste infrastructure and services to the construction sites
Excavated rock management	Up to 750,000 m^3 of bulked excavated rock to be placed within temporary emplacement areas within Lobs Hole and/or subaqueous placement within Talbingo Reservoir subject to management and monitoring
Revegetation and rehabilitation	Post-construction revegetation and rehabilitation of areas disturbed by construction elements and activities, including removal and decommissioning of construction facilities (should Snowy 2.0 not proceed).

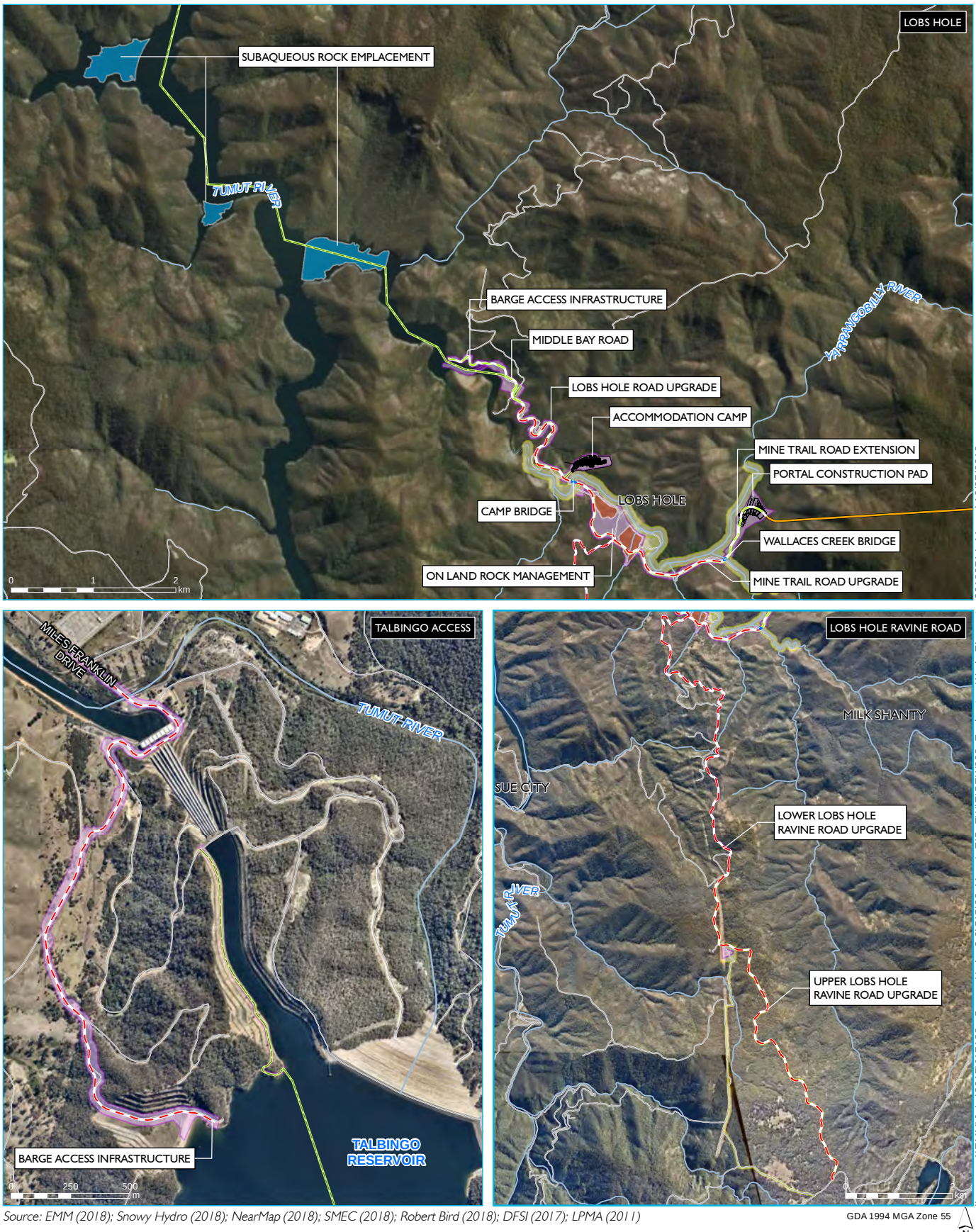
As mentioned in Chapter 1, Exploratory Works is a separate application to the construction and operation of Snowy 2.0. Therefore, decisions regarding whether Snowy 2.0 proceeds are separate to Exploratory Works. Should Snowy 2.0 not proceed, constructed elements of Exploratory Works would be decommissioned and rehabilitated in consultation with NPWS, ensuring the values of KNP are maintained.

2.1.2 Guiding design principles and approach

Given the complexities of Exploratory Works, its scale and schedule, an iterative and risk-based design and assessment process was adopted in identifying and assessing potential environmental impacts. This iterative process to develop the design and construction methods for Exploratory Works was undertaken with the guiding principles of avoiding and minimising environmental impacts where possible. This EIS has been prepared with consideration of impacts commensurate with the levels of risk identified through the iterative design and assessment process.

The challenges for the design team included the need to develop solutions that balance the need for ensuring a safe working environment for the construction of Exploratory Works, including the safe movement of plant, equipment, materials and workforce across the site, with the need to preserve and protect the values of the KNP and the environmental constraints of the location. Throughout the design process, the objective was to identify and avoid sensitive locations, to minimise the construction footprint and maintain as much of the existing natural environment as is feasible. For this reason, Lobs Hole was selected as a works area because it has historically been subject to disturbance associated with the former town, grazing, cultivation and mining.

This means that the facilities and infrastructure proposed in this EIS are sufficient for Exploratory Works only, but if the main Snowy 2.0 project is approved to proceed, they may need to be augmented to accommodate further development for this purpose. For example the accommodation camp has been designed to accommodate the Exploratory Works workforce only and has been sited in a cleared area with low value vegetation.



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Source: EMM (2018); Snowy Hydro (2018); NearMap (2018); SMEC (2018); Robert Bird (2018); DFSI (2017); LPMA (2011)

GDA 1994 MGA Zone 55

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KEY

- Exploratory tunnel
- Access road upgrade
- Access road extension
- Permanent bridge
- Portal construction pad and accommodation camp conceptual layout
- Communications cable
- Local road or track
- Watercourse
- On land rock management
- Subaqueous excavated rock placement
- Disturbance footprint
- Avoidance footprint

Exploratory Works elements

Snowy 2.0
Environmental Impact Statement
Exploratory Works
Figure 2.1

2.2 Exploratory tunnel

2.2.1 Purpose and location

The purpose of the exploratory tunnel is to optimise the location, design and construction method of the power station cavern. An exploratory tunnel of approximately 3.1 km is proposed to provide access to the location of the largest cavern (the cavern for the machine hall) for the underground power station. This will enable horizontal drilling at the cavern location and help gain a greater understanding of underground conditions at the cavern location which, in turn, is required to finalise the design of Snowy 2.0. A minor variation of an additional approximately 500 m may be required if the exploratory drilling indicates poor ground conditions in the nominated cavern location.

The exploratory tunnel is proposed in the north-east section of Lobs Hole and will extend in an east-west direction with the portal and portal construction pad to be outside the western end of the tunnel at a site east of the Yarrangobilly River and is shown on Figure 2.1.

2.2.2 Infrastructure and design

The exploratory tunnel will have a finished clearance of approximately 8 m by 8 m with a D-shaped cross section. The proposed tunnel cross-section is provided in Figure 2.2. The cross-section shape and dimensions are designed to allow two-lane traffic for the removal of excavated material along with ventilation and drainage of groundwater. Minor expansions (niches) within the tunnel will be required to allow for material crushing and turning bays during construction.

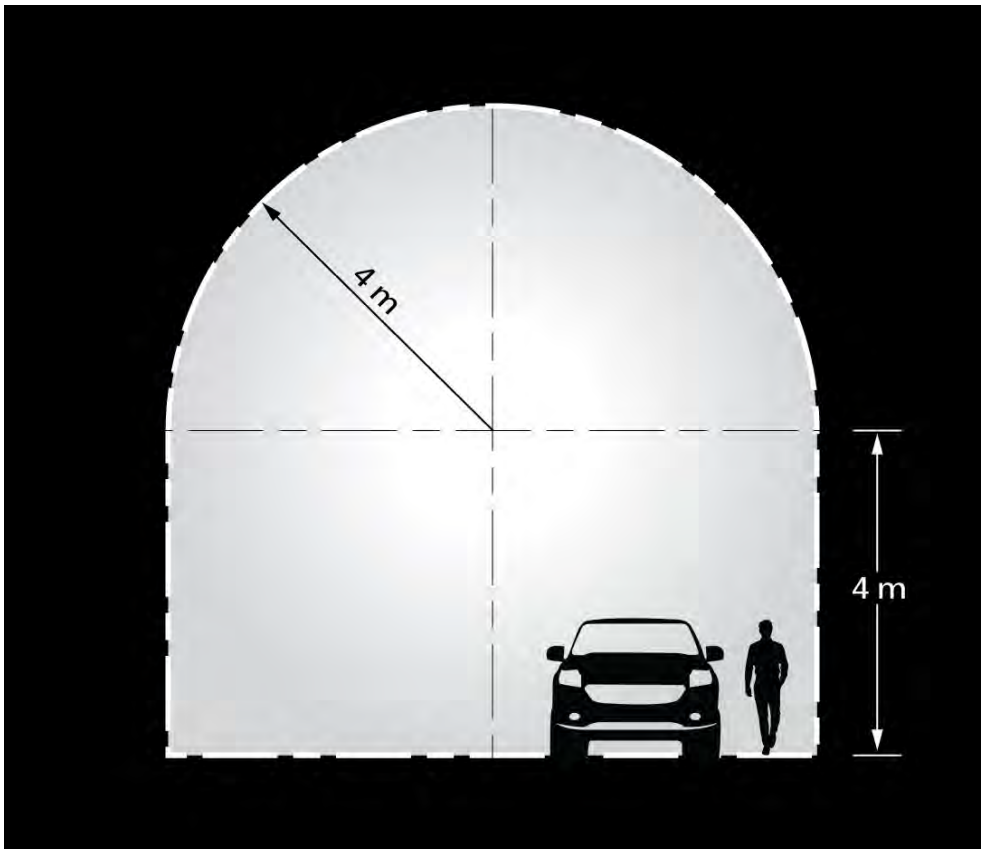


Figure 2.2 Exploratory tunnel cross section

The exploratory tunnel will have the following functions:

- plant, equipment and personnel access and egress to the cavern location to conduct geological testing;
- spoil removal;
- ventilation;
- routing of services; and
- dewatering.

Subject to obtaining the necessary approvals if Snowy 2.0 proceeds, the exploratory tunnel could be utilised to form the main access tunnel (MAT) to the underground power station for Snowy 2.0.

i Tunnel lining

The exploratory tunnel will be shotcrete-lined with permanent anchor support, and incorporate a groundwater management system.

ii Lighting and ventilation

The exploratory tunnel will have adequate lighting installed to enable workers to carry out work safely and effectively. Lighting will be designed in accordance with relevant tunnelling and construction standards. All underground work fronts will be ventilated. Ventilation will be designed in accordance with relevant design principles for underground ventilation systems.

iii Dewatering, treatment and disposal

Groundwater intersected during tunnelling will be contained and transferred to the portal for treatment and management. Construction pits with submersible pumps will be provided with interconnected hoses that discharge to the tunnelling affected water sedimentation pond at the tunnel portal. Areas identified during forward probing with the potential for high groundwater flows may require management through a detailed grouting program or similar.

iv Tunnel portal

The portal will provide a safe and stable entrance to the exploratory tunnel. The location of the tunnel portal is shown on Figure 2.3. The tunnel portal will be established at the western end of the exploratory tunnel and provide access and utilities to the exploratory tunnel during construction and operations. The portal will house diesel-generated power, communications, ventilation and water infrastructure. An example of a finished portal structure is shown in Photograph 2.1.

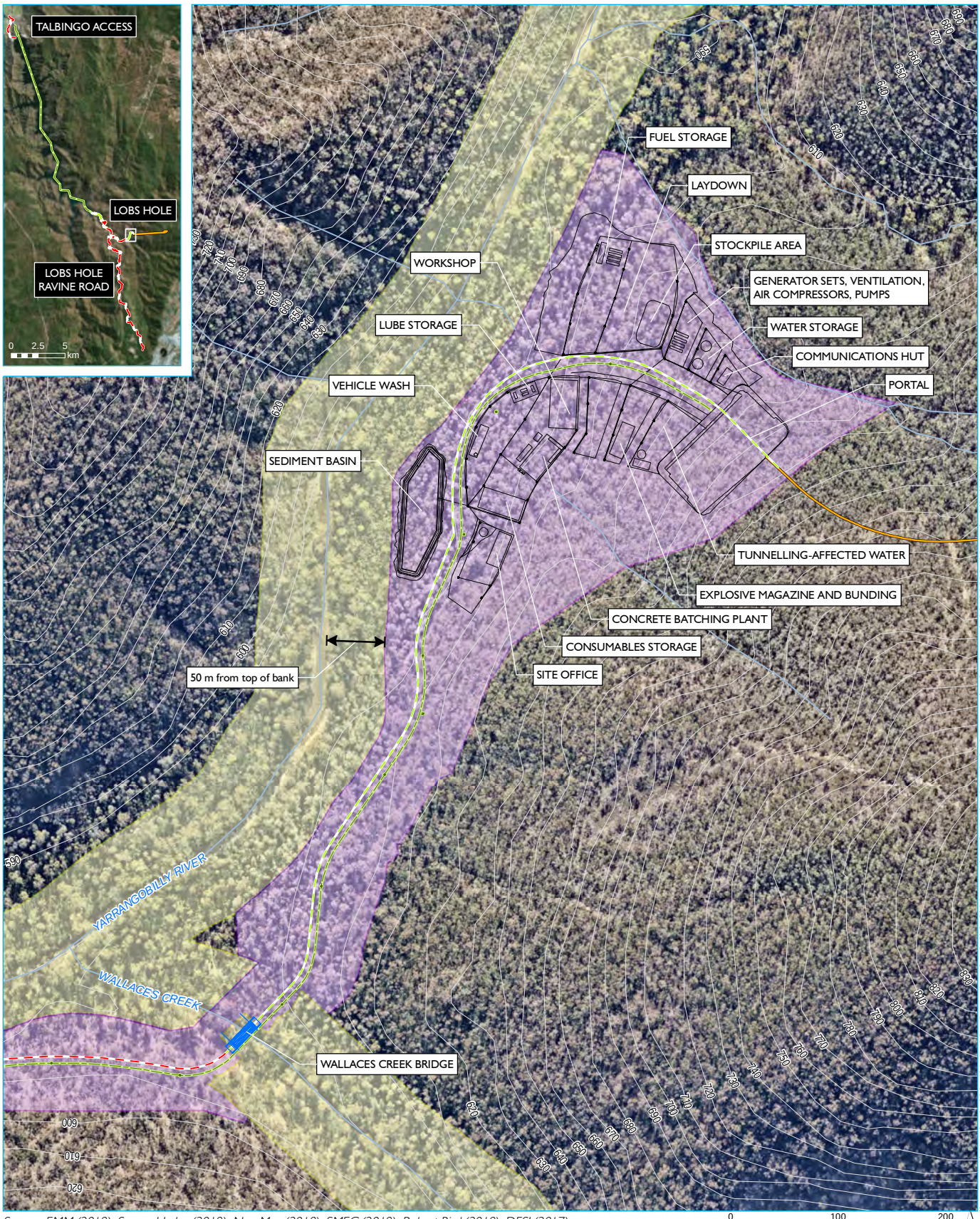
Photograph 2.1 Finished Tumut 2 power station tunnel portal

2.3 Portal construction pad

2.3.1 Purpose and location

A portal construction pad for the exploratory tunnel will provide a secure area for construction activities. Infrastructure at the portal construction pad will primarily support tunnelling activities and include a concrete batching plant (CBP) and associated stockpiles, site offices, maintenance workshops, construction support infrastructure, car parking and equipment laydown areas. A temporary excavated rock stockpile area is also required to stockpile material excavated during tunnel construction before its transfer to the larger excavated material management areas at Lobs Hole.

The portal construction pad will be excavated to provide a level construction area with a near vertical face for the construction of the portal and tunnelling. The layout of the portal construction pad is shown in Figure 2.3. The portal construction pad will be adjacent to the tunnel portal at the western end of the exploratory tunnel. The area required for the portal construction pad is approximately 100,000 m^2. A description of the key facilities and equipment to be sited at the portal construction pad is provided in this section.



Source: EMM (2018); Snowy Hydro (2018); NearMap (2018); SMEC (2018); Robert Bird (2018); DFSI (2017)

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KEY

- Access road upgrade
- Access road extension
- Permanent bridge
- Portal construction pad conceptual layout
- Exploratory tunnel
- Communications cable
- Watercourse
- Contour (10m)
- Disturbance footprint
- Avoidance footprint

Conceptual layout – portal construction pad

Snowy 2.0
Environmental Impact Statement
Exploratory Works
Figure 2.3

2.3.2 Infrastructure and design

i Site offices and workshops

A site office will provide the primary base for personnel and contractors working during construction. A dedicated workshop is also required for the servicing of heavy plant and equipment as well as pre-fabrication. The workshop will comprise a covered area of approximately 1,125 m^2. The indicative site office and workshop locations are shown in Figure 2.3.

ii Concrete batching plant

A CBP will be required to support the tunnel construction, tunnel shotcreting, portal construction and construction of footings, base slabs for structures and other applications that require pre-cast concrete segments or concrete cast in-situ. Stockpiles providing around two to three months of CBP feedstock (aggregate and sand) are expected to be needed, and will be stored within the portal construction pad footprint.

A CBP design capacity of 50 cubic metres (m^3) per day is expected to be sufficient to service the Exploratory Works construction schedule. There is also sufficient space to enable an increase in capacity of the CBP if required within the assessed footprint of the portal construction pad. The predicted total concrete production required for Exploratory Works is approximately 50,000 m^3.

iii Fuel storage facility

The main fuel storage facility for Exploratory Works will be north-west of the tunnel portal as shown in Figure 2.3. The fuel storage facility will have capacity to store approximately 275,000 litres (L) of fuel and have an area of around 122 m^2. Fuel storage facilities will also be provided at ancillary construction areas as described in Section 2.10.6.

Environmental controls will include:

- an asset protection zone (APZ) to minimise bushfire risks; and
- fully bunded enclosure to minimise the risks of spills and loss of containment.

iv Vehicle and equipment storage and maintenance

A laydown area for vehicle, equipment and materials storage will be established at the portal construction pad near the temporary excavated material stockpile. The laydown area will have an area of approximately 9,000 m^2. Engineering and manufacturing plant and materials will also be stored in the workshop which will be near the CBP. A vehicle and equipment wash down facility will also be established on the west side of the portal construction pad.

A dedicated covered area of approximately 800 m^2 is proposed for storage of consumables associated with the tunnelling and activities at the portal construction pad. The vehicle and equipment storage locations are provided in Figure 2.3.

Vehicle and equipment storage and maintenance will also be provided at ancillary construction areas as described in Section 2.10.6.

v Magazine (explosives)

To facilitate the drill and blast method for tunnel construction, an explosives magazine will be required, and will be near the tunnel portal at the portal construction pad. The location of the explosives magazine is provided in Figure 2.3. The magazine will be designed in accordance with relevant legislation, standards and codes of practice for the storage and handling of explosives in NSW. This will include the implementation of all required emergency, security and safety plans required by SafeWork NSW and under relevant legislation. To minimise hazards associated with the storage of explosives the magazine has a minimum setback distance of 18.11 m to nearby structures and vegetation.

vi Materials stockpiles

Materials stockpiles are required at the portal construction pad for temporary storage of building materials and excavated rock. These materials will be stockpiled at the CBP. A temporary excavated rock stockpile area is also required for material excavated during tunnel construction before its transfer to the larger excavated material management areas. The excavated rock will be transported by truck from the portal construction pad to the emplacement areas by road. Building materials may also be stored in this area as required.

2.3.3 Impact avoidance and minimisation

Key considerations of environmental impacts during the design of the portal construction pad included establishing a 50 m setback from the Yarrangobilly River to avoid impacts to riparian habitat from vegetation clearance and stormwater runoff. The arrangement of the portal construction area was designed to incorporate sufficient APZs without impacting the 50 m Yarrangobilly buffer.

2.4 Accommodation camp

2.4.1 Purpose and location

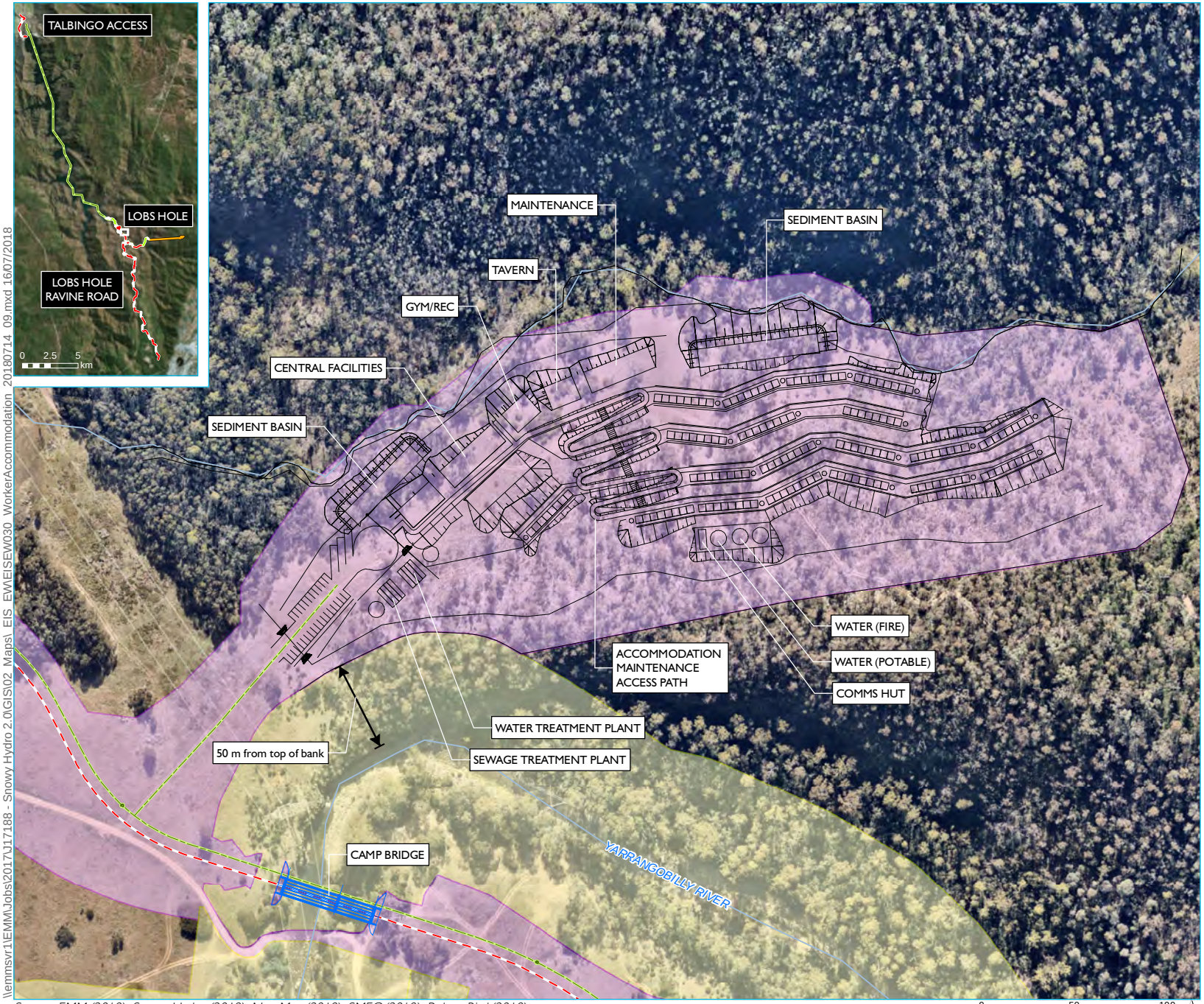
An accommodation camp will provide accommodation and supporting services for workers near the exploratory tunnel.

2.4.2 Infrastructure and design

The accommodation camp will comprise up to 152 single rooms with private ensuites. The accommodation camp layout includes ensuite rooms surrounding central facilities including a kitchen, gym, administration office, laundry, maintenance building, sewage and water treatment plants and parking that will service the Exploratory Works workforce. The conceptual layout of the accommodation camp is shown on Figure 2.4.

The accommodation camp will provide food and beverage services to the Exploratory Works workforce in the dedicated kitchen. Laundry facilities will be provided in the central facilities building. A gym and recreation facility will be provided for use by the workforce during stays at the accommodation camp.

Access to the accommodation camp will be via an access road connecting to the north side of Lobs Hole Road at Lobs Hole. Car and bus parking facilities will be provided for the workforce.



KEY

- Exploratory tunnel
- Access road upgrade
- Access road extension
- Permanent bridge
- Accommodation camp conceptual layout
- Communications cable
- Watercourse
- Disturbance footprint
- Avoidance footprint

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Source: EMM (2018); Snowy Hydro (2018); NearMap (2018); SMEC (2018); Robert Bird (2018)

Conceptual layout – accommodation camp

Snowy 2.0
Environmental Impact Statement
Exploratory Works
Figure 2.4

2.4.3 Impact avoidance and minimisation

Key considerations of environmental impacts during the design of the accommodation camp are listed below:

- siting the camp in an area largely devoid of vegetation with only small areas of low value vegetation remaining;
- establishing a 50 m setback from the Yarrangobilly River to avoid impacts to riparian habitat from vegetation clearance and stormwater runoff; and
- arranging the site layout so that adequate bushfire APZs can be established without impacting the 50 m Yarrangobilly River buffer.

2.5 Excavated rock management

2.5.1 Purpose and location

It is estimated that up to 750,000 m^3 of bulked materials will be excavated, mostly from the exploratory tunnel and portal construction pad with additional quantities from road upgrade works. Initial information suggests a small volume of tunnel rock may be potentially acid forming (PAF), requiring suitable management and design techniques for emplacement and disposal. Subject to geochemical testing of the rock material, excavated rock will either be re-used, placed on land or placed subaqueously within Talbingo Reservoir. The proposed on land and subaqueous placement areas are described further in this section.

A flow chart showing the proposed process for excavated rock management is provided in Figure 2.5. As shown in this figure excavated material will be managed for either re-use, on land or subaqueous placement.

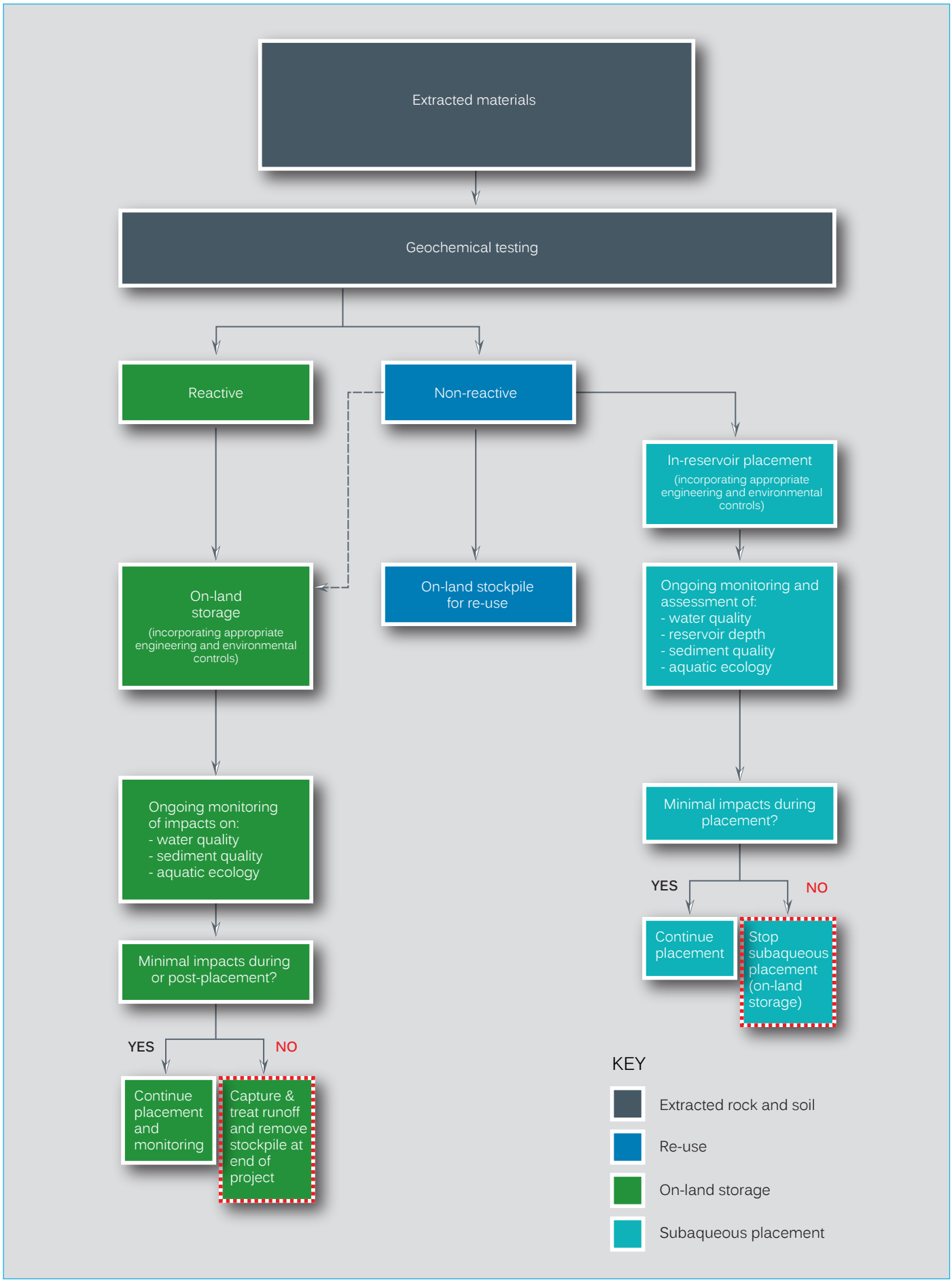
2.5.2 Re-use of materials

i Management

Excavated material identified as suitable for re-use will be re-used within the construction of Exploratory Works or made available to NPWS for road-base materials within KNP. Excavated material will be identified as suitable for re-use based on geochemical testing and particle size. It is expected that up to 40,000 m^3 of suitable excavated material will be made available to NPWS for use in road maintenance and upgrades. Transportation and re-use of materials by NPWS will be subject to a separate approvals process. Material identified as reactive and unsuitable for re-use will be managed as per the on land rock placement detailed in Section 2.5.3.

ii Storage

Excavated material identified as suitable for re-use will be placed in the western emplacement area. The western emplacement area is shown on Figure 2.6. All remaining material placed in this emplacement area will be removed following the completion of Exploratory Works.



snowy 2.0

EMM creating opportunities

Excavated rock management flow chart

Snowy 2.0
Environmental Impact Statement
Exploratory Works
Figure 2.5

2.5.3 On land rock placement

i Management

Excavated materials for on land placement will be placed in one of two rock emplacement areas at Lobs Hole as described in Figure 2.5 and shown on Figure 2.6, the eastern and western emplacement areas. On land placement of excavated rock will involve a mix of the following options:

- Permanent landform – excavated material will be placed within the eastern emplacement area to create (subject to agreement with NPWS) a permanent landform suitable for future recreational uses in the long term following completion of the main Snowy 2.0 project construction, should it proceed.

- Disposal outside the KNP – if the main Snowy 2.0 project does not proceed, any excavated material not incorporated in the eastern emplacement permanent area will be disposed of to a suitable location outside the KNP subject to consultation with NPWS and further assessment and approvals.

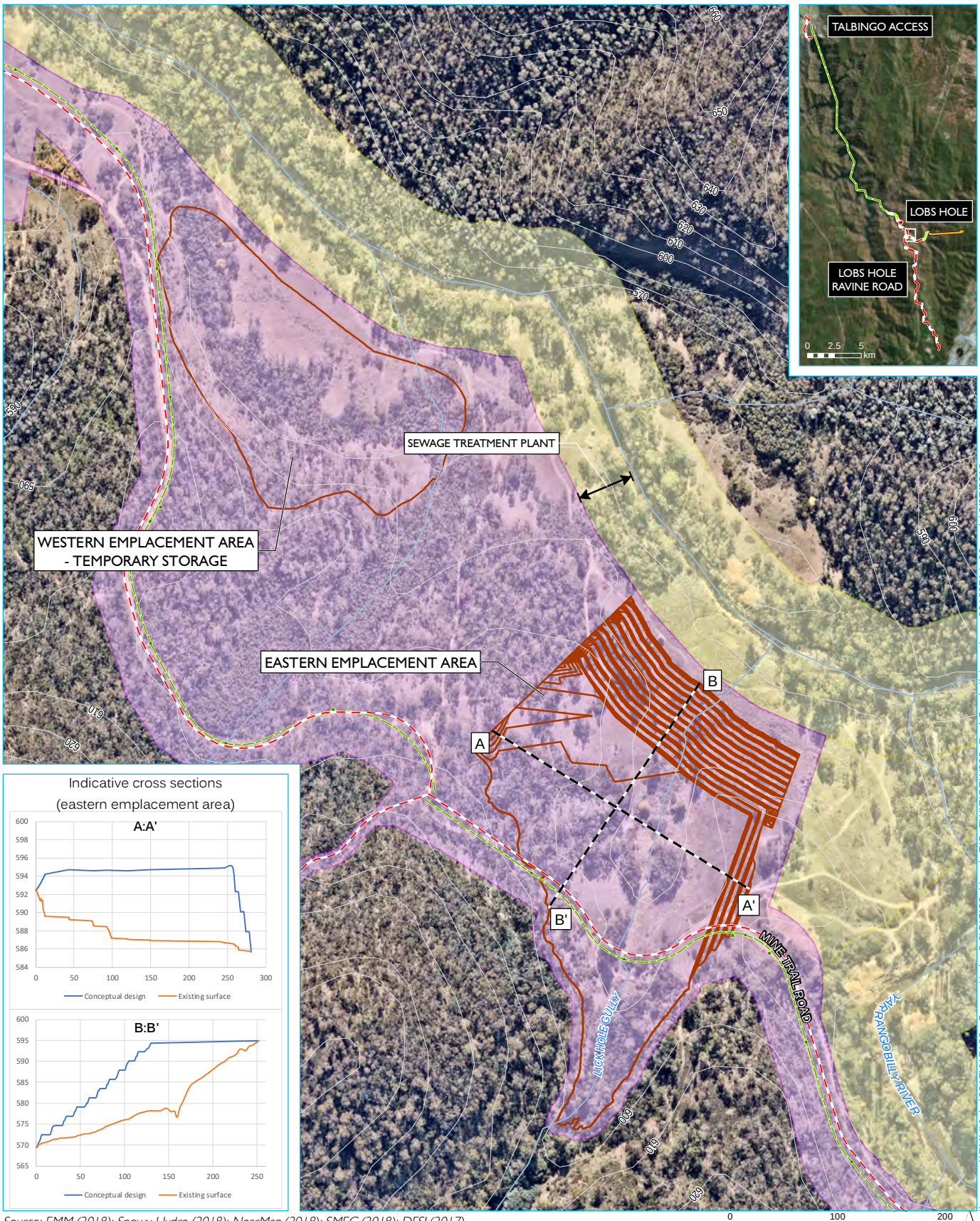
ii Eastern emplacement area

The eastern emplacement area is within Lick Hole Gully at Lobs Hole and is shown in Figure 2.6. Consultation with NPWS throughout the design process has identified an opportunity for the eastern emplacement area to form a permanent landform that enables greater recreational use of Lobs Hole following the completion of Snowy 2.0's construction, should it proceed. It is envisaged that the excavated material emplacement area will provide a relatively flat landform suitable for camping and basic recreational facilities to be confirmed in consultation with NPWS.

The emplacement area has a capacity of up to 600,000 m^3 of material. It will be approximately 25 m maximum depth and be benched down to the northern edge of the emplacement which is setback more than 50 m from the Yarrangobilly River.

The eastern emplacement area will be built from the bottom-up and maintain a 50 m buffer to the Yarrangobilly River. The design target permeability of the eastern emplacement area will approach the natural rate of groundwater recharge, that is, 1.10^{-5} metres per second (m/s). This will be achieved by trafficking of each layer during its construction.

The eastern emplacement area will be built in eleven 2 m lifts, with each lift built in two 1 m layers. Each lift will be separated from the lift above by a 4 m bench. The crest of each bench will be bunded so that runoff from the batter slope above the bench is captured and then slowly infiltrates the landform.



Indicative cross sections
(eastern emplacement area)

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

KEY

- Cross-section
- Exploratory tunnel
- Access road upgrade
- Access road extension
- Communications cable
- On land rock management
- Watercourse
- Contour (10m)
- Disturbance footprint
- Avoidance footprint

Conceptual layout – excavated material emplacement areas

Snowy 2.0
Environmental Impact Statement
Exploratory Works
Figure 2.6

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a. Design and management

The design and management of the eastern emplacement area will incorporate systems for avoidance, minimisation and management of environmental impacts to the surrounding local environment.

Key matters been considered in the design of the emplacement area include:

- the potential presence of PAF material in the exploratory tunnel excavated rock; and
- impacts on surface water quality and discharges to the Yarrangobilly River.

The guiding principles for the design, siting, construction method and long-term management of the emplacement area undertaken for Exploratory Works are listed below:

- reducing potential for seepage entering the Yarrangobilly River or forming groundwater recharge;
- avoidance of known environmental constraints. This includes a 50 m setback from the Yarrangobilly River, avoiding disturbance to the former Lobs Hole mine area and avoidance of heritage items such as the Washington Hotel; and
- management of existing surface water flows from Lick Hole Gully.

Environmental management measures that will be implemented for the emplacement area include:

- an acid consuming (AC) pad will be built beneath the eastern emplacement area to separate PAF material from water flows through Lick Hole Gully;
- AC limestone layers will be incorporated into the eastern emplacement area for passive treatment of PAF material;
- an operational testing method will be developed prior to construction to ensure adequate AC limestone is included in the emplacement areas to neutralise potential acidity;
- the emplacement areas will be constructed in a manner that maximises trafficking, thereby reducing the hydraulic conductivity of the emplacement area and reducing the potential for groundwater recharge and/or discharge to the Yarrangobilly River;
- the emplacement area construction method will include a method to stabilise the emplacement areas using stockpiled soil and vegetation; and
- drains, diversions and other water management infrastructure will be installed.

Should monitoring identify unacceptable impacts from this emplacement area, it will be removed and Lick Hole Gully rehabilitated in consultation with NPWS.

iii Western emplacement area

The western emplacement area will be used to store excavated materials suitable for re-use as described in Section 2.5.2. All remaining material placed in this emplacement area will be removed following the completion of Exploratory Works.

2.5.4 Subaqueous rock placement

Suitable excavated material will be placed within Talbingo Reservoir as part of Exploratory Works. An initial program of up to 50,000 m^3 will be carried out. The program will be implemented in a section of Talbingo Reservoir in accordance with a detailed management plan based on an engineering method informed through the materials' geochemistry and reservoir's characteristics. The purpose of the program is to confirm the suitability of the emplacement method for future excavated rock material from the construction of Snowy 2.0, should it proceed.

Should the initial phase show that there are minimal impacts to the reservoir from the subaqueous rock placement, the subaqueous rock placement program may be continued to include subaqueous placement of a greater proportion of excavated rock (ie up to 750,000 m^3) subject to further consultation with relevant authorities.

The rock for subaqueous placement will be taken from the excavated rock emplacement areas as described above. Testing of the excavated material would be conducted during excavation to assess geochemical properties. Any rock assessed as unsuitable for subaqueous placement based on the prior geochemical and leachability testing would be separately emplaced on-land and not used in the program (refer to Figure 2.5). Suitable (ie non-reactive material) would be stored at the on-land rock emplacement areas and then transported and loaded to a barge, for subaqueous placement.

All placement within the reservoir would occur within silt curtains and be subject to a detailed monitoring regime before, during, and after placement. Suitable placement areas have been identified for Exploratory Works and are described in the section below. Further detailed information is also provided in Appendix L.

i Subaqueous rock placement areas

The selection of subaqueous rock placement locations considered several criteria including aquatic ecology, environmental and social considerations, available water depth, potential for resuspension, distance from load-out point in Middle Bay, Snowy Hydro operations and ability to implement environmental controls during placement. The following three potential locations for subaqueous rock placement have been identified:

- Plain Creek Bay;
- Cascade Bay; and
- Ravine Bay.

The indicative subaqueous rock placement areas are provided in Figure 2.7.

The initial phase will place up to 50,000 m^3 of excavated material within the Plain Creek Bay subaqueous rock placement area. Should the trial show that there are minimal impacts to the reservoir from the subaqueous rock placement at Plain Creek Bay, the subaqueous rock placement program may be expanded to include subaqueous placement at Cascade Bay and/or Ravine Bay.

ii Management and monitoring

A specific water quality monitoring program would be developed for subaqueous placement together with a management action plan. The following will be carefully monitored and assessed during the program:

- water quality monitoring to establish the effectiveness of control measures during subaqueous placement;
- physical and chemical testing of excavated material every 5,000 m^3 before placement to assess the potential for geochemical reactivity; and
- the bathymetry of the subaqueous placement areas before and after placement.

The management, mitigation and monitoring measures would be refined following ongoing investigations. Mitigation measures to be implemented during the program are detailed in Chapter 6 and Appendix L.

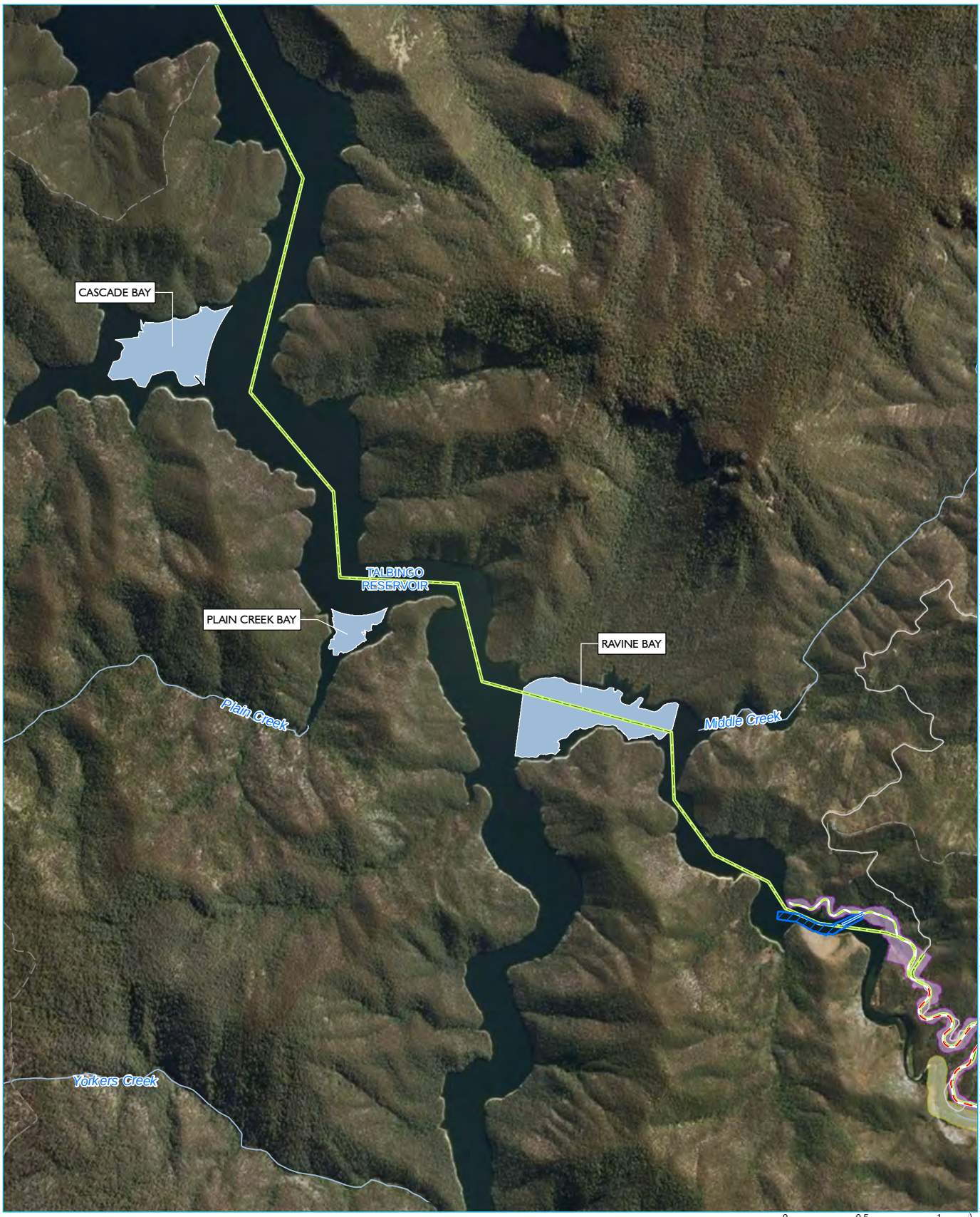
iii Management response

In the event that monitoring of the subaqueous rock placement identifies likely unacceptable environmental impacts, management responses will be executed. The management responses would include:

- investigate the issue;
- modify work practices if required; and
- stop placement if required.

iv Continuation of subaqueous rock placement

Should the initial phase show that there are minimal impacts to the reservoir from the subaqueous rock placement, the subaqueous rock placement program may be continued to include subaqueous placement of a greater proportion of suitable excavated material (ie over 50,000 m^3) subject to further consultation with relevant authorities.



Source: EMM (2018); Snowy Hydro (2018); ESRI (2018); SMEC (2018); DFSI (2018); GA (2017); LPMA (2011)

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GDA 1994 MGA Zone 55

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KEY

- Access road upgrade
- Access road extension
- Communications cable
- Subaqueous rock placement area
- Major watercourse
- Local road
- Track
- Middle Bay barge access
- Disturbance area - barge infrastructure
- Disturbance footprint
- Avoidance footprint

Subaqueous excavated rock placement

Snowy 2.0
Environmental Impact Statement
Exploratory Works
Figure 2.7

snowy 2.0 EMM creating opportunities

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2.6 Road access and transport

2.6.1 Purpose and location

Access and transport works are required to:

- provide for the transport of excavated material between the exploratory tunnel and the excavated rock emplacement areas;
- accommodate the transport of oversized loads as required; and
- facilitate the safe movement of plant, equipment, materials and construction workers onto and across the construction sites.

The access roads will be upgraded or established to provide access for a truck and dog trailer. The access road upgrades and establishment are provided in Figure 2.8.

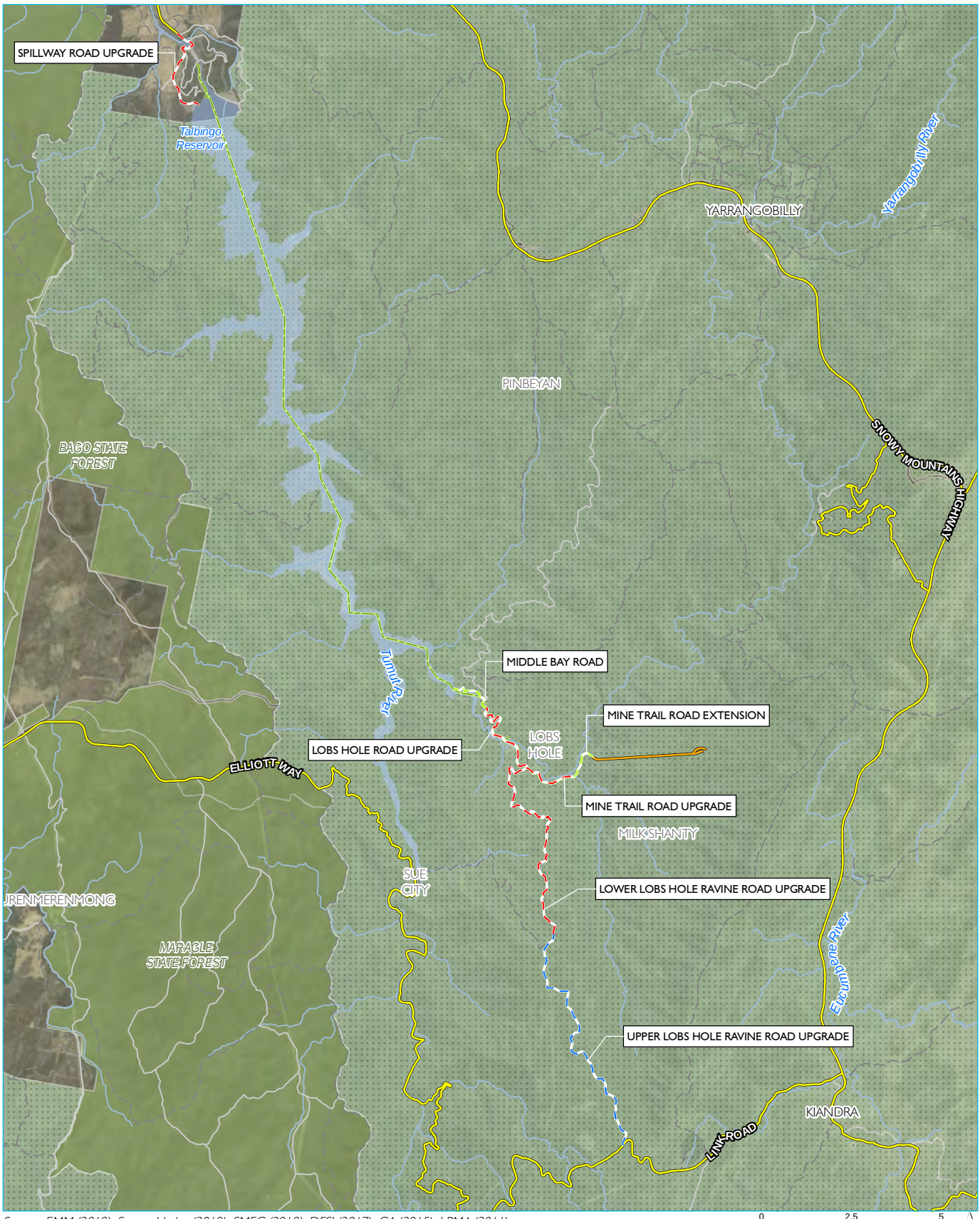
Barge access to the project area is also proposed and is detailed in Section 2.7. Barge access will be provided for roll-on roll-off barges via barge ramps near the Talbingo Spillway (at the northern end of Talbingo Reservoir) and Middle Bay (at the southern end of the reservoir).

Helicopter access to the project area will also be provided by an existing helipad at Lobs Hole near the eastern rock emplacement area.

2.6.2 Access roads

The access road works are summarised into the following categories:

- upgrades to existing roads that do not require widening (eg surface works);
- access road upgrades including track widening;
- construction of new roads; and
- watercourse crossings.



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

0 2.5 5 km

GDA 1994 MGA Zone 55

N

KEY

- Access road upgrade - without widening
- Access road upgrade - with widening
- Access road extension
- Exploratory tunnel
- Communications cable
- Main road
- Local road
- Vehicular track
- Perennial watercourse
- Scheme storage
- Kosciuszko National Park
- State forest

Access road upgrades and establishment

Snowy 2.0
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Figure 2.8

In total, 18.5 km of road widening, 7.5 km of road upgrades that do not include widening, 2 km of new roads and two watercourse crossings are proposed for Exploratory Works. A summary of the access road works required is provided in Table 2.2 below and further described in this section.

Table 2.2 Access road works summary

Roadwork area	Overview
Road upgrades without widening	
Upper Lobs Hole Ravine Road	Minor upgrades to 7.5 km section of existing road. Generally only single lane access will be provided. No cut and fill earthworks or vegetation clearing will be undertaken
Road upgrades with widening	
Lower Lobs Hole Ravine Road	Upgrades to 6 km section of existing road involving cut and fill earthworks in some sections, with two-way access provided
Lobs Hole Road	Upgrade to 7.3 km section of existing road providing two-way access
Mine Trail Road	Upgrade to 2.2 km section of existing track to two-way access
Spillway Road	Upgrade of a 3 km section of existing road to provide two-way access to the proposed Talbingo barge ramp
New roads	
Mine Trail Road extension	Establishment of a new two-way road providing access to the exploratory tunnel portal
Middle Bay Road	Establishment of a new two-way road to the proposed Middle Bay barge ramp
Watercourse crossings	
Wallaces Creek Bridge	Establishment of a new bridge at Wallaces Creek as part of the Mine Trail Road extension
Camp Bridge	Establishment of a new bridge across Yarrangobilly River as part of Lobs Hole Road upgrade

For public safety reasons, public access to Lobs Hole Ravine Road will be restricted from both the Snowy Mountains Highway (in the north) and Link Road (in the south) for the duration of Exploratory Works.

i Road upgrades without widening

The upper section of Lobs Hole Ravine Road requires minor upgrades to a 7.5 km section of existing flat to undulating track referred to as Upper Lobs Hole Ravine Road. Due to identified sensitive biodiversity values within the surrounding vegetation, only minor upgrades are proposed to provide for generally one-way traffic. This section of Ravine Road will have maintenance activities to rehabilitate gravel pavement to 4 m lane width, maintain drainage paths, installation of guideposts and snow poles above the snow line. The existing roadway provides adequate space for passing bays in several sections and no vegetation clearing will be required. The Upper Lobs Hole Ravine Road upgrade is provided in Figure 2.9 with inset photos showing the condition of the existing road.

ii Road upgrades with widening

Several access roads will be upgraded and widened to provide two lane access. These road upgrades include upgrades to Lower Lobs Hole Ravine Road, Lobs Hole Road, Mine Trail Road and Spillway Road. These road works will include culvert and drainage, road widening, retaining walls, gravel pavement overlay, installation of guideposts, guard fences and snow poles above the snow line. The Lower Lobs Hole Ravine Road upgrade is provided in Figure 2.9 with inset photos showing the condition of the existing road. Mine Trail Road, Lobs Hole Road and Middle Bay Road are provided in Figure 2.10 with inset photos showing the condition of the existing roads.

iii New roads

Two new roads will be established at Middle Bay Road and an extension to Mine Trail Road and are shown in Figure 2.10. New road establishment works will include clearing and grubbing, installation of several culverts, drainage channels and outlet protection works, road construction, gravel pavement, installation of guideposts and guard fence.

iv Temporary construction access road works

A temporary construction road is required between Wallaces Creek and the exploratory tunnel portal until Mine Trail Road extension is complete and is shown in Figure 2.11. This temporary road will enable haulage of excavated material from the exploratory tunnel, portal and portal construction pad during the initial stages of Exploratory Works, while the permanent access road works are constructed.

2.6.3 Watercourse crossings

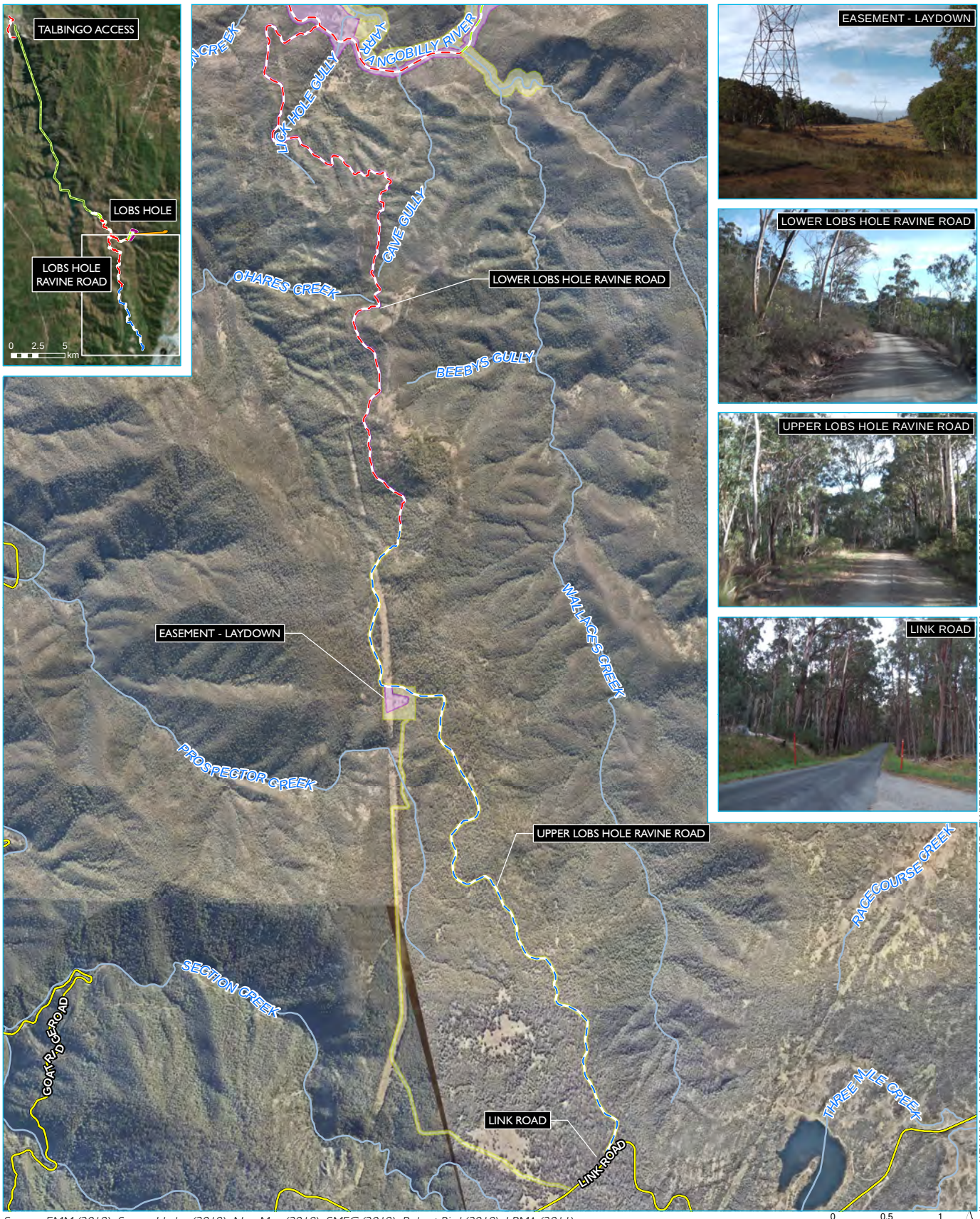
Bridge construction works will be required at two locations for Exploratory Works as described in Table 2.3. The locations of bridge works are shown in Figure 2.11.

Table 2.3 Watercourse crossing summary

Bridge works area	Overview
Camp Bridge	An existing crossing on Yarrangobilly River will be used as a temporary crossing while a new permanent bridge is built as part of Lobs Hole Road upgrade. The existing crossing will require the crossing level to be raised with rocks to facilitate vehicle passage. The rocks used to raise the crossing level will be removed and the crossing no longer used once the permanent bridge has been constructed. The new bridge (Camp Bridge) will be a permanent crossing and used for both Exploratory Works and Snowy 2.0 main works (if it proceeds).
Wallaces Creek Bridge	Establishment of a new permanent bridge at Wallaces Creek as part of the Mine Trail Road extension. Establishment of this bridge will require an initial temporary pre-fabricated 'Bailey bridge' to be constructed, which will be removed before the end of Exploratory Works.

The design for permanent bridges at both crossings will consist of steel girders with a composite deck. This is the most common type of permanent bridge constructed in and around the existing Snowy Scheme.

The construction works for the temporary and permanent watercourse crossings will be undertaken incorporating controls to minimise mobilisation of sediments into the Yarrangobilly River. In addition, the design of both the temporary and permanent structures has incorporated appropriate aquatic ecology controls to allow for fish passage.



Source: EMM (2018); Snowy Hydro (2018); NearMap (2018); SMEC (2018); Robert Bird (2018); LPMA (2011)

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KEY

- Access road upgrade - without widening
- Access road upgrade - with widening
- Access road extension
- Main road
- Watercourse
- Disturbance footprint
- Avoidance footprint

Lobs Hole Ravine Road upgrades

Snowy 2.0
Environmental Impact Statement
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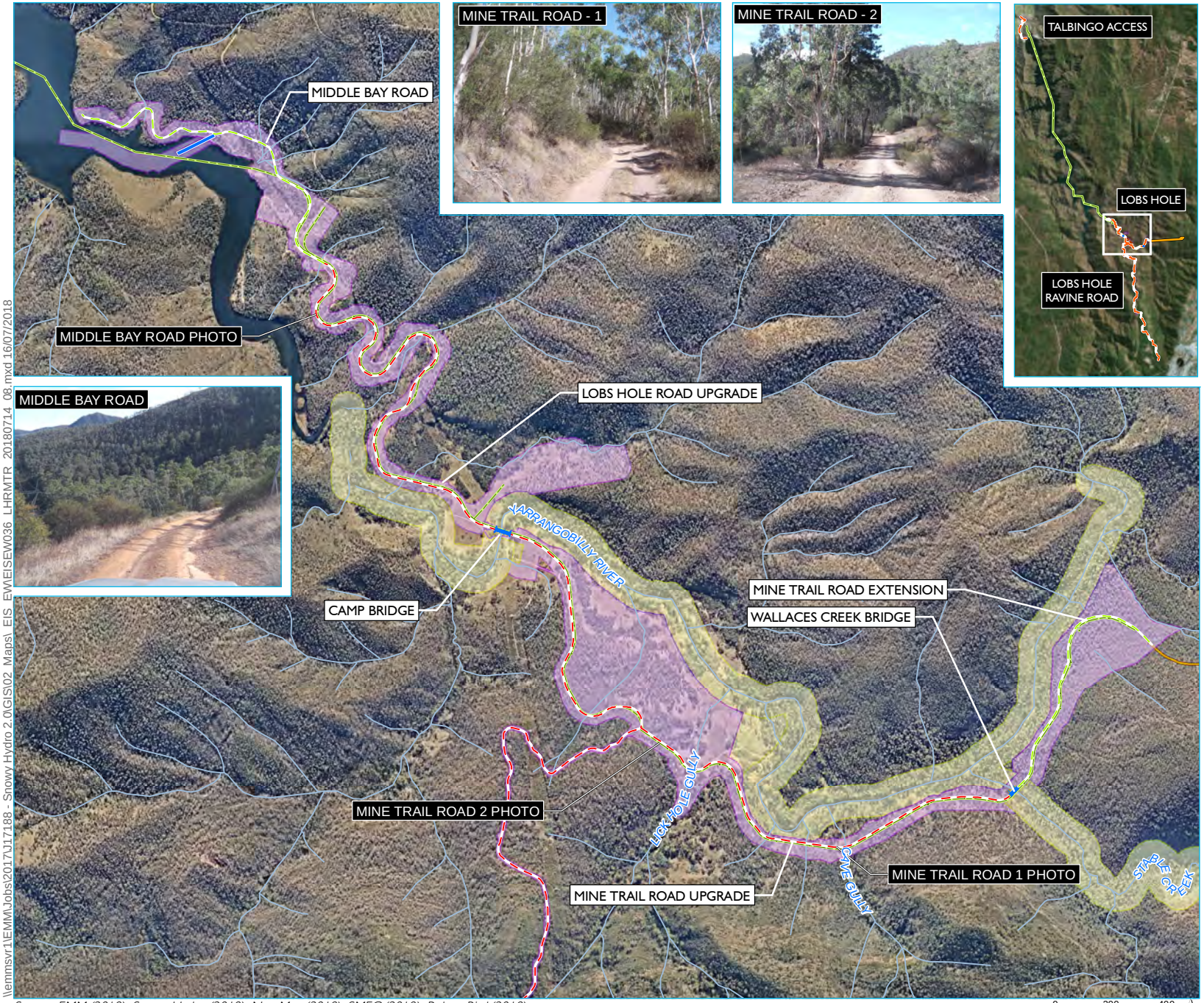
Figure 2.9



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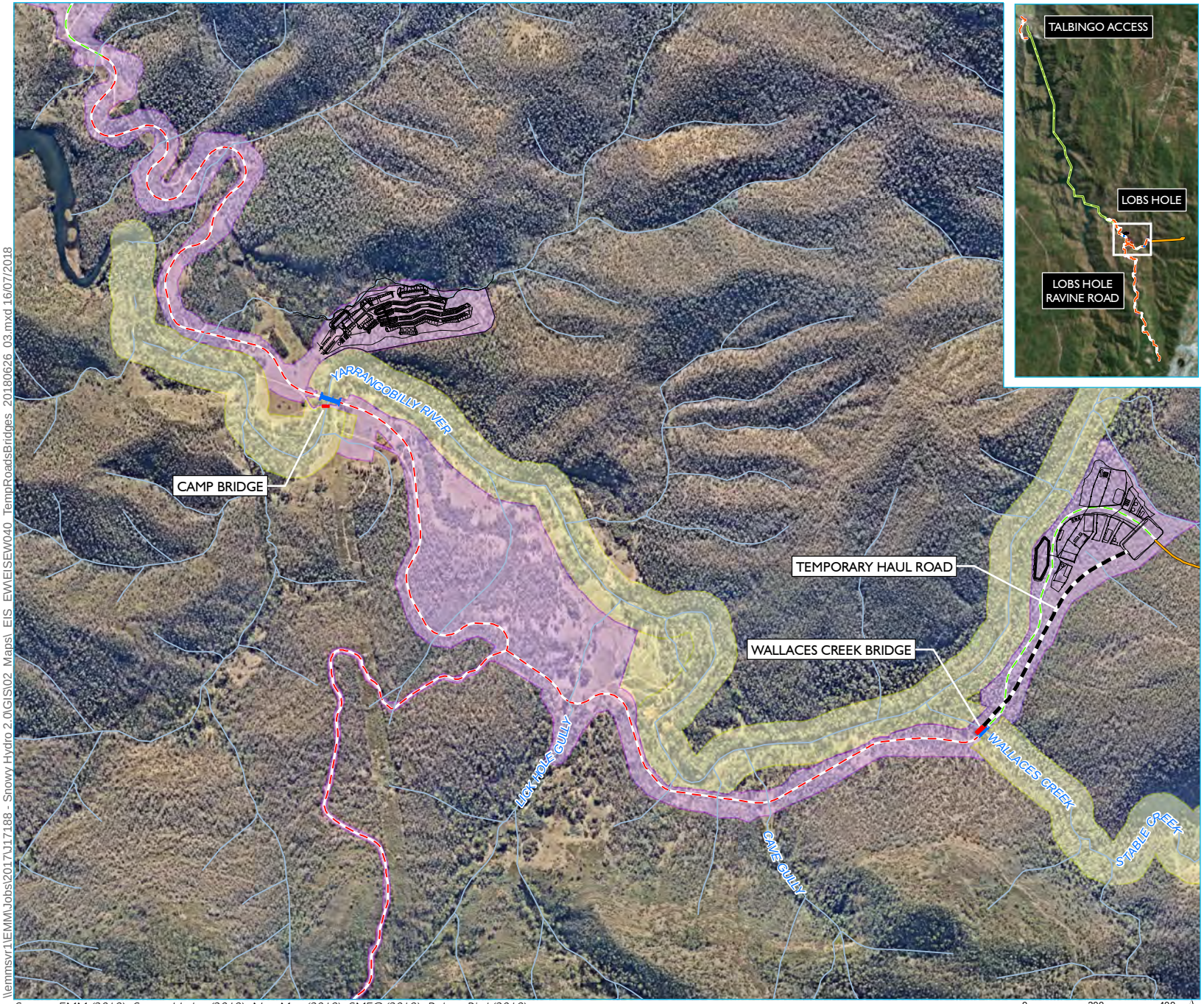
Source: EMM (2018); Snowy Hydro (2018); NearMap (2018); SMEC (2018); Robert Bird (2018)

Lobs Hole Road and Mine Trail Road upgrades and extension

Snowy 2.0
Environmental Impact Statement
Exploratory Works
Figure 2.10



KEY

- Temporary haul road
- Temporary bridge
- Permanent bridge
- Portal construction pad and accommodation camp conceptual layout
- Exploratory tunnel
- Access road upgrade
- Access road extension
- Watercourse
- Disturbance footprint
- Avoidance footprint

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Source: EMM (2018); Snowy Hydro (2018); NearMap (2018); SMEC (2018); Robert Bird (2018)

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N

Temporary roads and bridges

Snowy 2.0
Environmental Impact Statement
Exploratory Works
Figure 2.11

2.6.4 Impact avoidance and minimisation

Key considerations of environmental impacts during the design of the access and transport infrastructure are listed below:

- establishing a 50 m setback from the Yarrangobilly River to avoid impacts to riparian habitat;
- establishing an avoidance area and minimising upgrade works along the upper section of Lobs Hole Ravine Road to avoid impacts to identified habitat for Smoky Mouse;
- investigating use of the existing transmission line easement as an alternative access route to the Upper Lobs Hole Ravine Road, however further biodiversity surveys identified Smoky Mouse habitat within vegetation along the edges of the easement and this alternative was discounted;
- establishing an alternative access option via barge to minimise upgrades to Lobs Hole Ravine Road and avoid impacts to Smoky Mouse;
- avoiding heritage items including the Washington Hotel;
- avoiding disturbance to known contaminated areas including the former Lobs Hole mine;
- using of existing roads and cleared areas at Lobs Hole; and
- minimising disturbance of potential aquatic habitat and fish passage through design of temporary bridge crossings.

2.7 Barge access and transport

2.7.1 Purpose and location

Given the avoidance measures implemented on Lobs Hole Ravine Road to maintain Smoky Mouse habitat, an alternative to road access through use of barge access to the project area, is proposed. The barge access infrastructure will enable transport of bulky and heavy equipment and provide alternative access in case of emergency. Heavy equipment for barge transport may include drilling jumbos, haul trucks and large excavators for portal construction and establishment of work sites. Materials including cement, aggregates, sand and steel could also be delivered by barge. The barge access infrastructure includes:

- a new barge ramp near the Talbingo Spillway (Talbingo barge ramp);
- a new barge ramp at Middle Bay (Middle Bay barge ramp);
- occasional use of the existing Talbingo Reservoir boat ramp near the dam wall; and
- dredging to facilitate ramp construction and barge navigation.

A barge access infrastructure report was prepared by Royal HaskoningDHV which provides details of the conceptual design and construction methods for the barge access infrastructure and is provided in Appendix L. This section provides a summary of construction and operation of the barge infrastructure.

2.7.2 Infrastructure and design

i Talbingo and Middle Bay barge ramps

The Talbingo barge ramp is on Snowy Hydro owned land at the north end of Talbingo near the existing Talbingo Spillway and will comprise a barge ramp and adjacent laydown area. The Talbingo barge ramp will be a concrete ramp at a grade of 1:10 (vertical:horizontal) approximately 10 m wide. The reservoir bed 20 m either side of the centreline of the barge ramp will be no higher than the barge ramp surface. The infrastructure for the Talbingo barge ramp is provided in Figure 2.12.

The Middle Bay barge ramp and access makes use of existing access and previously disturbed areas near the existing Middle Bay unformed boat launching area. The Middle Bay barge ramp will take the form of a concrete ramp at a grade of 1:10 (vertical:horizontal) and be approximately 15 m wide. The infrastructure proposed for Middle Bay barge ramp is provided in Figure 2.13.

The barge ramps will be constructed from cast in-situ concrete above the reservoir FSL and pre-cast concrete planks or slabs below FSL. The pre-cast planks will be laid on a pre-prepared flexible foundation comprising bedding material screed and compacted at the desired grade. The planks will be connected with stainless steel straps and pins. The barge's bow ramp will be lowered onto the concrete barge ramp to enable vehicles, plant and equipment to roll-on and roll-off the barges. The barges will be positioned using tugs and held against the concrete ramp by mooring lines attached to bollards near the crest of the ramp. The mooring lines will be tensioned using a winch to ensure the barges are held securely in place.

ii Middle Bay navigation channel

Dredging is required to establish a navigation channel on the approach to the Middle Bay barge ramp. The concept layout of the navigation channel is provided in Figure 2.13. The minimum channel depth would be 534.7m Australian Height Datum (AHD) for Exploratory Works.

Channel batters formed by dredging would be approximately 1:2 (vertical:horizontal). Acceptable dredge batters would be confirmed following review of the geotechnical investigation (refer to Section 2.10.2). The minimum width of the navigation channel would be 50 m. Turning basins would be 100 m. The width of the navigation channel may increase in the vicinity of bends in the channel to accommodate navigation.

The navigation channel alignment will also provide space for a pump intake, on the inside bend of the channel, approximately 80 m downstream from the toe of the ramp. The pump intake is proposed as part of Exploratory Works water services pipeline which is detailed further in Section 2.8.1.

2.7.3 Barge transport

During Exploratory Works, barges will be loaded at the Talbingo barge ramp, travel about 18 km along Talbingo Reservoir and be unloaded at the Middle Bay barge ramp before returning to the north. A round trip from Talbingo barge ramp to Middle Bay barge ramp and return would take approximately four hours. Some loads may also be transported in the reverse direction, for example when equipment is no longer required. Barges may be towed by a tug or self-propelled. There may also be the need for smaller, faster maintenance boats. There are expected to be up to 24 barge movements per day transporting equipment and materials between Talbingo barge ramp and Middle Bay barge ramp.

Barges at Middle Bay will also be used for transport and placement of excavated material as part of the sub-aqueous rock placement program (See Section 2.5.4).

Barging may occur 24 hours a day but is likely to be used predominantly during daylight hours.

Source: EMM (2018); Snowy Hydro (2018); NearMap (2018); SMEC (2018); PS (2018); DFSI (2017)

KEY

- Access road upgrade
- Access road extension
- Exploratory tunnel
- Communications cable
- Main road
- Local road or track
- Talbingo barge access
- Disturbance area - barge infrastructure
- Disturbance footprint

Talbingo barge access

Snowy 2.0
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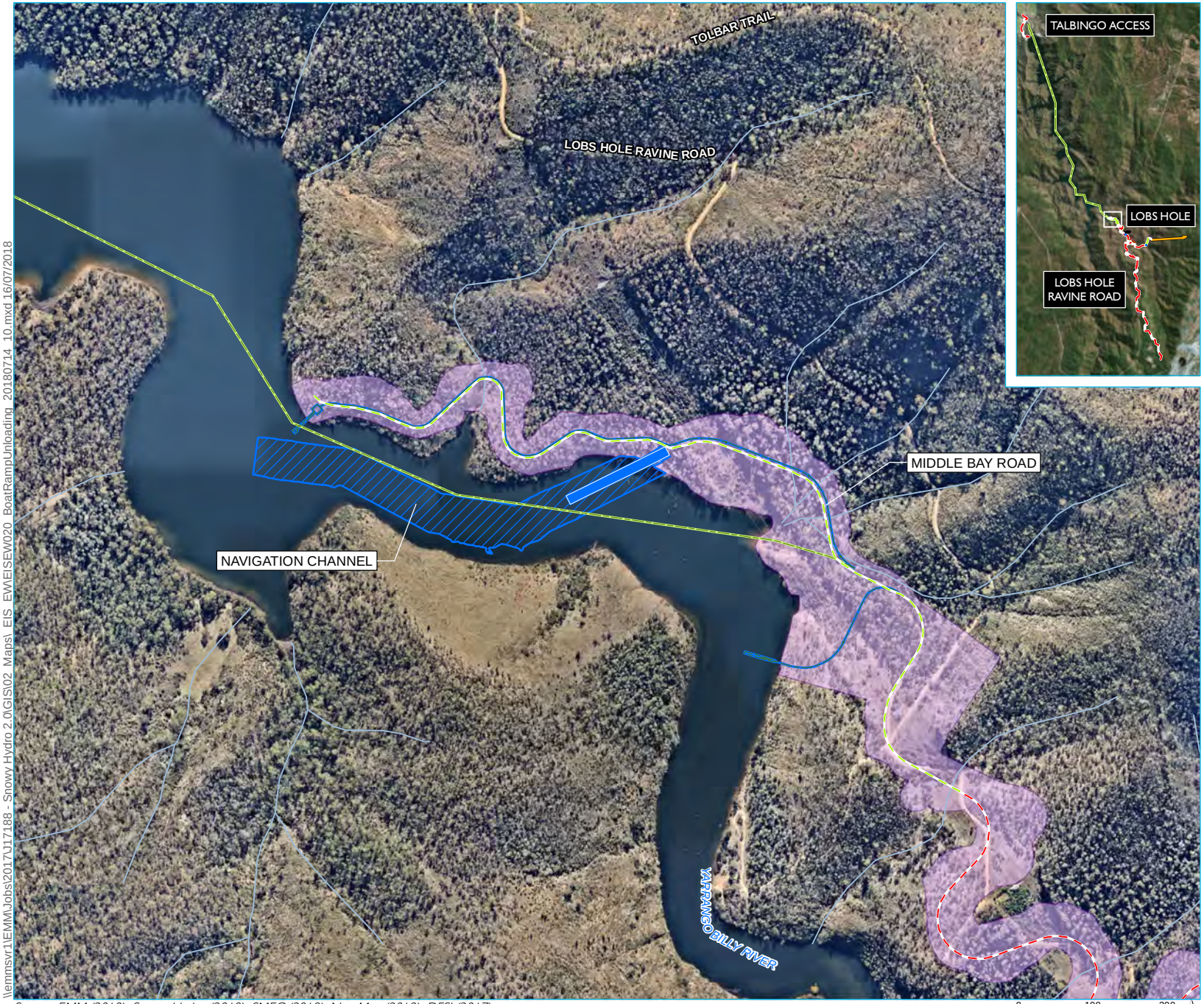
Exploratory Works
Figure 2.12

snowy 2.0

EMM creating opportunities



KEY

- Communications cable
- Water services pipeline
- Access road upgrade
- Access road extension
- Watercourse
- Middle Bay barge access infrastructure/ramp
- Disturbance area - barge access
- Disturbance footprint

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

0 100 200 m

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Middle Bay barge access

Snowy 2.0
Environmental Impact Statement
Exploratory Works
Figure 2.13

2.7.4 Impact avoidance and minimisation

Key considerations of environmental impacts during the design of barge access infrastructure included:

- use of existing disturbed areas at the Talbingo Spillway and the Middle Bay unformed boat launching area;
- submerged timber (dead trees and wood debris) removed during construction will be replaced at a similar depth within the reservoir to minimise impacts to potential habitat for fish and other aquatic biota; and
- minimisation of impacts to recreational users of Talbingo Reservoir through avoidance of restricting access to Talbingo boat ramp during peak use times.

2.8 Supporting infrastructure

2.8.1 Water

i Water services pipeline

A services pipeline for the supply and discharge of water for Exploratory Works will pump water between Talbingo Reservoir and the exploratory tunnel portal and accommodation camp. The layout of the water services pipeline and associated water infrastructure is provided in Figure 2.14.

The services pipeline intake structure will be sited near the Middle Bay barge ramp. The intake structure will be in the form of a submersible pump station. An electrical control cabinet will be on the reservoir banks above the flood level. The discharge from the pump station will be via 300 mm high density polythene (HDPE) pipe and the pipeline will follow the alignment of the Middle Bay Road.

ii Water supply and use

The portal construction pad water supply will be pumped via a water services pipeline from Talbingo Reservoir near the Middle Bay barge ramp. Water will be pumped to the portal construction pad which is east of Middle Bay. The pipeline will be terminated at a storage tank at the portal construction pad. The raw water will be used for non-potable purposes such as dust suppression and for tunnel construction and concrete batching purposes. The water services pipeline will be sized to cater for all non-potable purposes and the demand will reduce overtime once the tunnel seepage water can be re-used on site.

A package water treatment plant is proposed at the accommodation camp to provide potable water to the accommodation camp and portal construction pad facilities and will be treated to a standard that complies with the *Australian Drinking Water Guidelines* (NHMRC 2011). The 100 kL potable water tank will provide a minimum of 24 hours storage. The potable water will be carted by truck from the accommodation camp to tanks at the portal construction pad facilities.

A dedicated 200 kL fire water supply tank will also be maintained at the portal construction pad. For fire fighting services at the portal construction pad a minimum storage based on 15 L/s for two hours will be provided.

The accommodation camp water supply will be pumped via the water services pipeline from Talbingo Reservoir at Middle Bay. Potable and non-potable water storage tanks will be at the accommodation camp. For fire services at the camp a minimum non-potable storage of 15 litres per second (L/s) for two hours will be provided. The potable water tank will provide a minimum of 24 hours storage.

iii Sewage and water treatment facilities

A sewage treatment plant (STP) is proposed at the accommodation camp to treat waste water. The STP will treat all waste water from the accommodation camp. The STP will produce effluent quality comparable to standard inland treatment facilities in the region (eg Cabramurra STP, or Thredbo STP). Following treatment waste water will be discharged to Talbingo Reservoir via the water services pipeline connecting the accommodation camp to Middle Bay.

An emergency waste water storage tank with 25,000 L capacity will be provided at the accommodation camp based on 12 hours storage at daily sewage load.

The domestic sewage volume at the portal construction pad is not expected to be significant and hence it will be tanked from the portal construction pad to accommodation camp facilities for treatment in the STP.

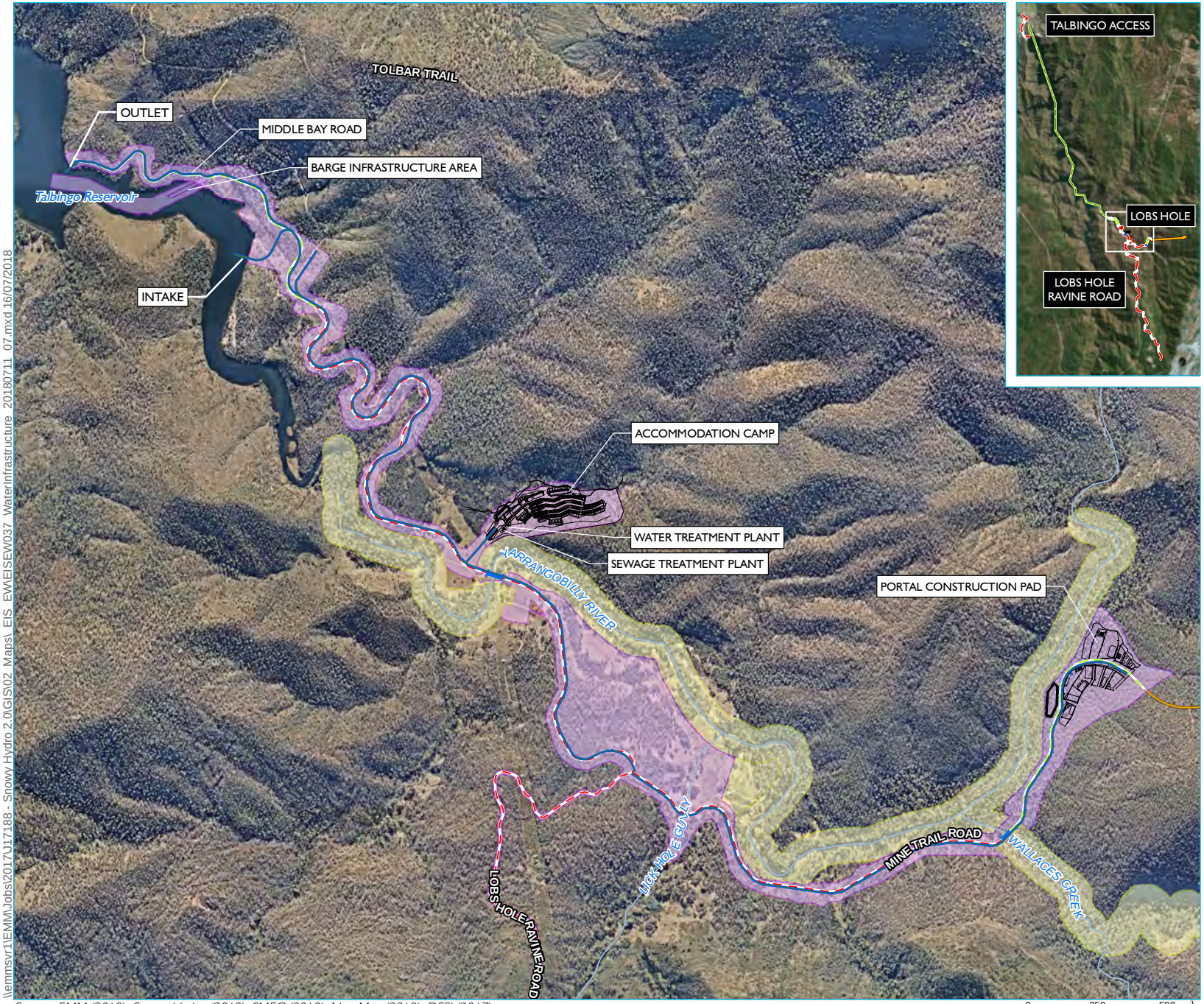
During Exploratory Works tunnel seepage water will be pumped to a sediment basin near the tunnel portal as shown in Figure 2.3. The tunnel seepage water will undergo preliminary treatment at the portal construction pad before it is reused for non-potable purposes at the construction site. Any excess treated water will be conveyed to Talbingo Reservoir through the water services pipeline.

2.8.2 Power

Power supply for Exploratory Works will be required at the accommodation camp, the portal construction pad and the Middle Bay barge ramp. Power requirements at these sites will be provided by diesel generator sets at the portal construction pad as shown in Figure 2.3. A temporary high voltage/low voltage reticulation network will connect the diesel generators to facilities throughout the project area via buried conduit within the Exploratory Works disturbance footprint. Diesel storage tanks will be at the portal construction pad. By using diesel-generated power instead of new or augmented transmission supply connections, the extent of ground disturbance and vegetation clearing needed to establish construction power has been significantly reduced.

2.8.3 Communications

Communication infrastructure servicing Exploratory Works will be provided via fibre optic link. The fibre optic service has been designed to incorporate a submarine cable from Tumut 3 power station to Middle Bay in Talbingo Reservoir at the barge ramp and then via a buried conduit to the accommodation camp and the portal construction pad. The route for the submarine fibre optic cable is provided in Figure 2.15.



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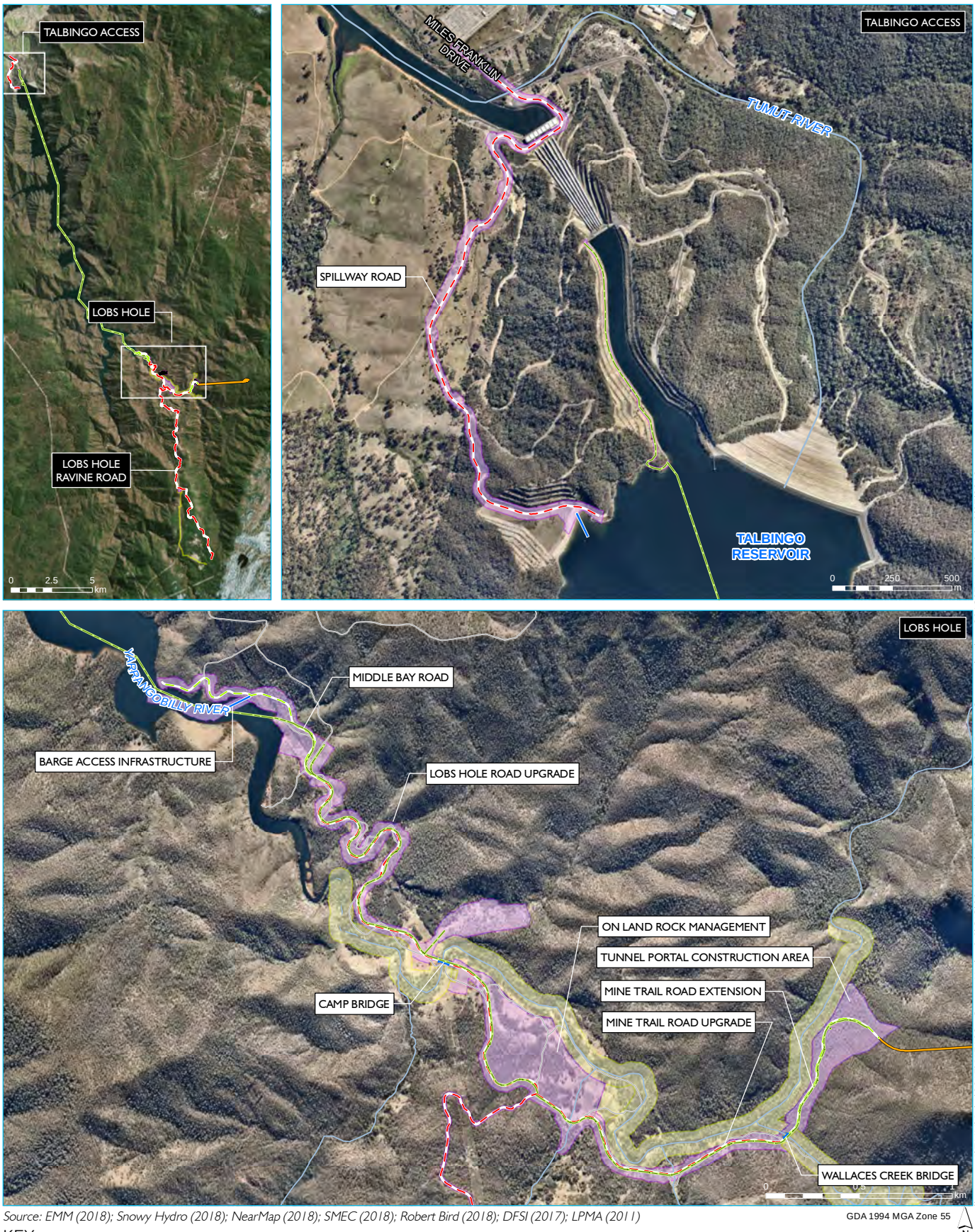
Source: EMM (2018); Snowy Hydro (2018); SMEC (2018); NearMap (2018); DFSI (2017)

Proposed water infrastructure

Snowy 2.0
Environmental Impact Statement
Exploratory Works
Figure 2.14



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Source: EMM (2018); Snowy Hydro (2018); NearMap (2018); SMEC (2018); Robert Bird (2018); DFSI (2017); LPMA (2011)

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N

KEY

- Communications cable
- Permanent bridge
- Portal construction pad and accommodation camp conceptual layout
- Exploratory tunnel
- Access road upgrade
- Access road extension
- Main road
- Local road or track
- Watercourse
- Barge access
- Disturbance footprint
- Avoidance footprint

Communications cable route

Snowy 2.0
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Figure 2.15

2.9 Construction staging and timing

2.9.1 Construction timing

Construction of the project is anticipated to commence at the end of 2018 with substantive works commencing in early 2019 and to continue for an estimated 34 months. Timing for the main construction activities for Exploratory Works is set out in Figure 2.16 below.

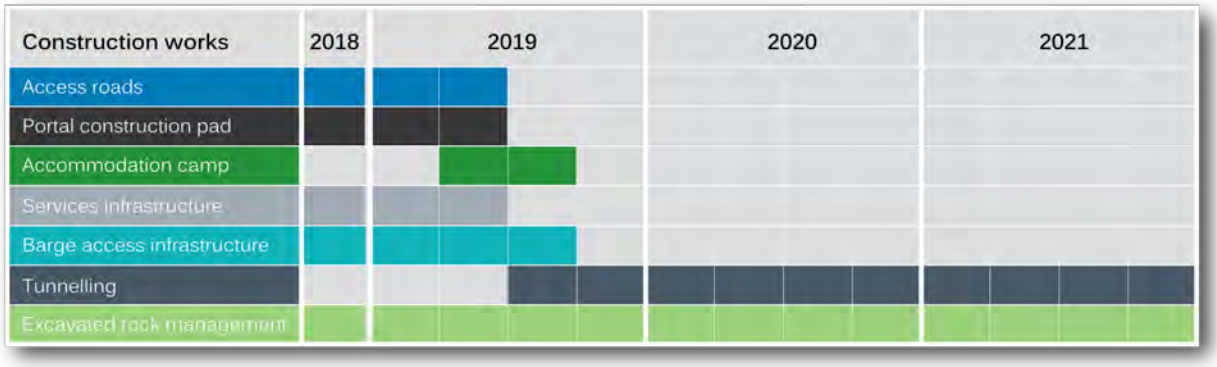


Figure 2.16 Indicative timing of Exploratory Works elements

This construction program should be treated as indicative only and may change based on:

- further work undertaken during the detailed design phase, and any further approvals for Snowy 2.0;
- unseasonal weather conditions; and
- field-based discovery, such as unexpected threatened biodiversity species or heritage items.

2.9.2 Construction staging

A detailed schedule will be prepared for the procurement, construction and commissioning of Exploratory Works. It is anticipated the schedule will include the following discrete but overlapping stages:

- **Geotechnical investigations and site establishment works**: To assist the detailed design of Exploratory Works further geotechnical investigations will be undertaken within the disturbance footprint. This will include a program of geophysical surveys, test pits, and borehole drilling. Site establishment works will be undertaken, such as preparation for road access.
- **Detailed design and permits**: Further input is required to the concept designs, as contained in this EIS, to produce detailed designs suitable for construction, followed by the preparation and lodgement of approval documentation required to allow surveyor activities, vegetation clearing, the construction of buildings and facilities and associated operational works.
- **Management plans**: a number of management plans will be prepared in line with the conditions of approval and submitted to the relevant authority.

- **Mobilisation**: Once initial approvals have been granted and agreement has been reached between Snowy Hydro and the successful contractor(s) the process of mobilising key design and construction staff and establishing a presence on-site can commence.

- **Construction works**: Once relevant designs are completed and approved construction works will commence including construction of road upgrades and extensions, the accommodation camp, the portal construction pad, barge facilities and the exploratory tunnel drill and blast program. The timing of the construction works is detailed further in Section 2.9.1.

- **Post-construction revegetation and rehabilitation, management and monitoring**: Following Exploratory Works the continued use of Exploratory Works infrastructure will be subject to whether Snowy 2.0 proceeds. Should Snowy 2.0 proceed the infrastructure established for Exploratory Works will be used as part of Snowy 2.0. Should Snowy 2.0 not proceed, all non-permanent infrastructure will be decommissioned and the disturbance area rehabilitated in accordance with an approved rehabilitation plan.

2.9.3 Changes to public access

i Duration of Exploratory Works

There will be public access restrictions imposed for the duration of Exploratory Works. Changes to public access include:

- the closure of public access to Lobs Hole Ravine Road from the intersection of Lobs Hole Ravine Road and Snowy Mountains Highway (in the north) and Link Road (in the south);

- the closure of public access to Lobs Hole Ravine Road from the intersection with Tolbar firetrail;

- the closure of public access to Ravine campground;

- the closure of public access to the Middle Bay hand-launching boat ramp; and

- restricted access to the northern part of the spillway area for the duration of Exploratory Works.

There will be occasional temporary restrictions to public access to the Talbingo Spillway boat ramp. The proposed restrictions to the spillway and occasional use of the Talbingo Reservoir public boat ramp near the dam wall is described further in Section 2.9.3 (ii) below.

ii Temporary/occasional

Talbingo Spillway will be temporarily closed to the public during the construction of the Talbingo barge ramp. As stated above, access to the northern part of the spillway (where the barge ramp is to be constructed) will be restricted to the public during Exploratory Works. If required, a road along the southern part of the spillway foreshore will be provided to maintain public use of the southern area.

The existing Talbingo Reservoir boat ramp will be used intermittently only, primarily at the start of Exploratory Works. During use for Exploratory Works, the boat ramp will be closed to the public. This will be for periods of typically one to two hours. The following peak visitor use periods will be avoided:

- for the duration of Exploratory Works 7am–9am on weekends and weekdays on school holidays between October and April; and
- all day during the Christmas and Easter holiday periods.

Any restrictions to the spillway and boat ramp access and the timetable for operation of the barge will be communicated to reservoir users by signage posted near Tumut 3 power station.

There will also be some restricted boat access to the Yarrangobilly Arm upstream of the low water barge turning basin to prevent interactions between the public and barge operations.

iii Following Exploratory Works

In the long term it is expected that Exploratory Works will improve public access to Lobs Hole. These improvements principally relate to access and internal roads around Lobs Hole and Ravine campground, which will contribute to the future public enjoyment and use of the KNP in the long term.

2.10 Construction method

2.10.1 Construction delivery

The current intended contract delivery method is to award two separate contracts to enable efficient construction of Exploratory Works following a competitive tender process. The initial Exploratory Works will be a construct-only contract comprising access roads and site establishment of the portal construction pad. A second contract requiring detailed design and construction for the remaining works will then be awarded.

The successful contractors will be contractually committed to delivering the defined Exploratory Works in compliance with the provisions of this EIS and the conditions of approval. Snowy Hydro, as principal, will be responsible for overseeing the construction of Exploratory Works. This will include periodic inspections, monitoring and auditing the work performed by the contractors.

2.10.2 Geotechnical investigation program

Further survey of ground conditions is required to inform detailed design for Exploratory Works. A program of geotechnical investigations including geophysical survey, construction of test pits, and borehole drilling, within the disturbance footprint will be undertaken.

The indicative geotechnical investigation sites are provided in Figure 2.17, and comprise a series of test pits, boreholes, geophysics surveys and horizontal drilling at the power station cavern on completion of the exploratory tunnel.

i Test pits

Test pits will be excavated to up to 3 m depth, unless prior refusal is reached. Bulk samples will be collected from the excavated material at various depths for laboratory soil testing. Dynamic cone penetrometers testing will also be carried out. At completion, test pits will be backfilled with the

excavated material and compacted. Where works are undertaken within existing roads, test pits will not be positioned in wheel paths.

ii Borehole drilling

Borehole drilling is required to facilitate the detailed design of cuttings, bridge foundations, retaining wall foundations, and drainage structures. Borehole drilling will be carried out using a variety of truck and track mounted drilling rigs. The sequence for borehole drilling is listed below:

- drill pad establishment – including vegetation clearing, establishing a drill pad with compacted aggregate, installation of erosion and sediment controls, site delineation and installation of plastic sheeting to control hydrocarbon spills;
- borehole drilling – by augers, washboring or diamond coring techniques; and
- in-situ testing, measurement and collection of samples – including photographs, point load testing, measurement of the water level and soil sampling.

Several boreholes will also require additional works including borehole wall imaging and installation of standpipe piezometers. Where no standpipes are required, boreholes will be backfilled with a lean mix cement grout mixture.

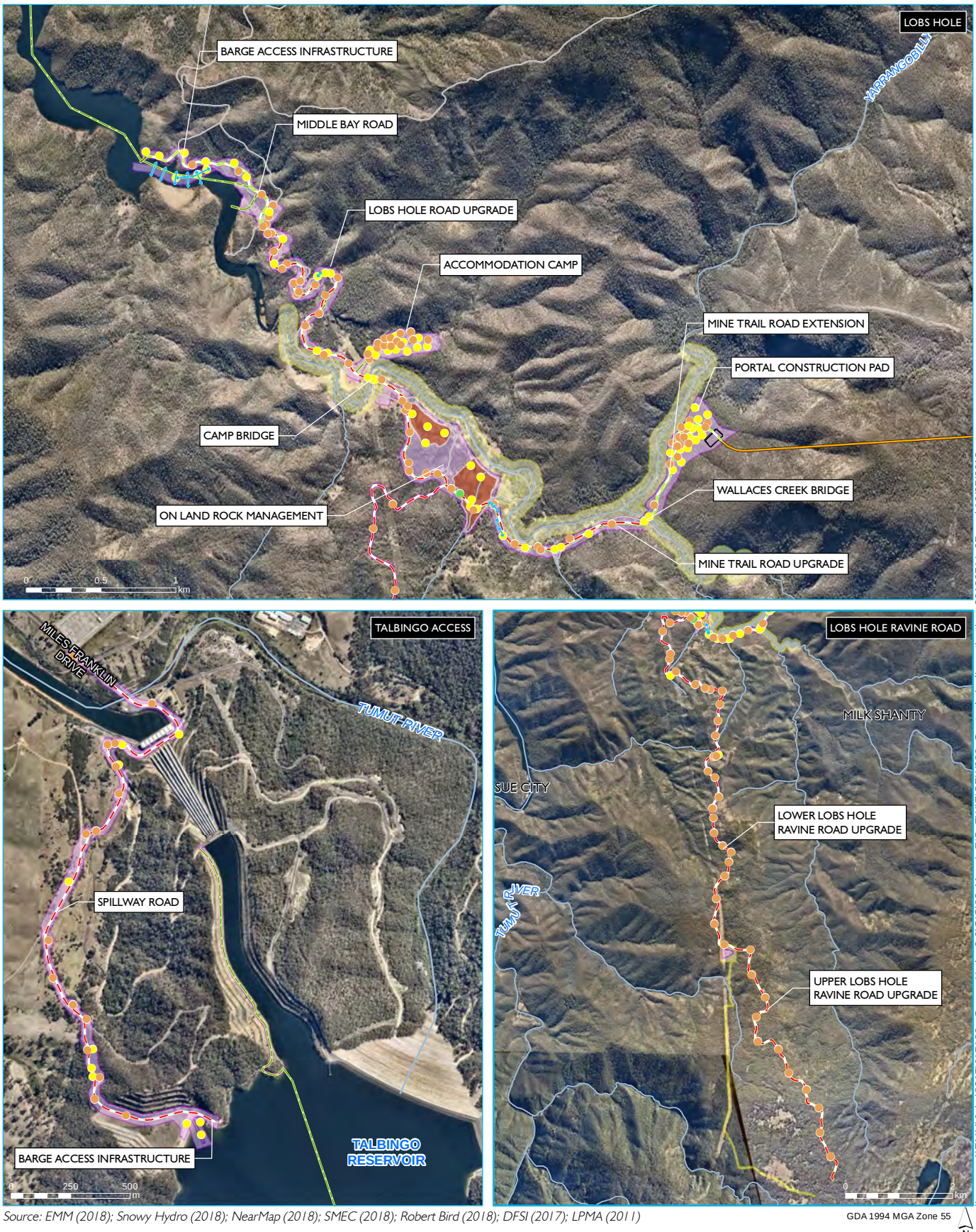
iii Borehole drilling in water

Several boreholes are proposed over water in Talbingo Reservoir to inform the detailed design of the barge ramps and navigation channel. Over water drilling activities are to include activities listed below:

- mobilise and secure floating barge to reservoir floor and shoreline using concrete anchors that will be removed at completion of work;
- drill boreholes using auger and rotary wash bore drilling techniques;
- rock core drilling using triple tube diamond coring techniques to the target depth; and
- in-situ testing and surveys including water pressure tests and acoustic surveys.

iv Installation of standpipe piezometers

Several boreholes will include the installation of standpipe piezometers which will be used for groundwater monitoring. All standpipe piezometers will be constructed in accordance with the *Minimum Construction Requirements for Water Bores in Australia* (NUCDL 2012).



Source: EMM (2018); Snowy Hydro (2018); NearMap (2018); SMEC (2018); Robert Bird (2018); DFSI (2017); LPMA (2011)

GDA 1994 MGA Zone 55

N

KEY

Geotechnical investigation sites

- Borehole
- Dynamic cone penetrometer
- Test pit
- Geophysical spread
- Access road upgrade
- Access road extension
- Exploratory tunnel
- Communications cable
- On land rock management
- Disturbance footprint
- Avoidance footprint

Geotechnical and geophysical investigation sites

Snowy 2.0
Environmental Impact Statement
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Figure 2.17

v Geophysics surveys

The geophysics surveys involve establishing temporary surface equipment that generates seismic energy and receives the resulting reflected/refracted seismic waves along an array of receivers. This seismic data involves establishing straight lines via a cable with geophones installed every 4–8 m and using small charges to generate seismic energy.

The geophysical survey activities will include the activities listed below:

- the geophone cable will be placed along the survey line with geophones spaced every 4 m;
- survey holes will be established along the survey line every 8 m using a post hole digger or auger;
- small charge of 100 gram (g) will be positioned at the bottom of the holes and then backfilled. A geophysicist will determine the amount of explosives to be used to ensure the minimum possible quantity is used; and
- the seismic shots will be executed one at a time. The shot holes will be inspected by the licensed shot-firer after each shot and filled if necessary.

Marine geophysics surveys are required within Talbingo Reservoir to inform the design of Middle Bay barge ramp and navigation channel. Marine geophysics surveys will involve deploying a line of hydrophones along the reservoir floor and the generation of seismic energy by a small airgun. The airgun will be used to produce a controlled release of compressed gas at or near the reservoir floor, at approximately 8 m intervals along the geophysics line.

vi Horizontal drilling at power station cavern

The key aim for Exploratory Works is to acquire information about the underground conditions at the Machine Hall cavern for Snowy 2.0. To do this a program of horizontal investigation probes at depth is proposed. This program will be undertaken on the completion of the exploratory tunnel. The associated testing includes in-situ stress testing to confirm the precise underground power station complex location and suitable orientation for the stress conditions at depth.

2.10.3 Typical construction methods

i Pre-construction methods

Prior to the construction of any of the Exploratory Works elements, site-based pre-construction activities will be undertaken as outlined below.

- each of the Exploratory Works elements will be surveyed and the extent of the approved disturbance footprint clearly identified and marked;
- environmental avoidance areas will be identified and marked within the approved disturbance footprint;
- any ground disturbance or vegetation clearing associated with the pre-construction activities will require the installation of appropriate stormwater and diversion drainage and erosion and sedimentation control works prior to works;

- all project personnel, vehicles and project equipment will be required to stay within the confines of approved work areas and to gain access to and from work areas via approved access routes; and
- users of KNP and Talbingo Reservoir will be informed of the construction activities, the extent of work areas and the locations of environmental exclusion areas with project notifications, including warning signs of construction activities and notifications of access restrictions at road junctions and trail crossings.

ii Road work methods

a. Existing tracks for upgrade without widening

Where road upgrades are proposed without widening, no works will occur beyond their current boundary, which will be defined by the growth of established vegetation at the edge of the track. There will be no vegetation clearing to upgrade these tracks, however in some instances minor trimming of overhanging branches may be required.

Tracks which have erosion features and rutting that prevent safe passing will have all or some of the following improvement works: removal of high points, infill of scours, blade levelling and compaction of the surface by rolling.

b. Track widening and construction of new roads

Where track widening or new roads are established a minimal disturbance footprint approach will be adopted. Before any widening works start, the following sequence of events will be carried out:

- drainage will be constructed;
- clearing and grubbing works will be undertaken including the removal of high points;
- bulk earthworks (ie cut and fill) will be carried out;
- road pavement material will be placed on the roadway;
- road safety furniture and signage will be installed as required; and
- site stabilisation and rehabilitation to happen as soon as practical.

iii Bridge construction and creek diversions

With respect to creek crossings and potential impacts on the bed and banks of waterways, Exploratory Works will require:

- the installation of Wallaces Creek Bridge;
- the installation of Camp Bridge across Yarrangobilly River; and
- potential, temporary water diversions within the watercourse to allow access during road and bridge construction.

For Wallaces Creek Bridge and Camp Bridge, bridge foundations and substructures (including piles, abutments and piers) will be constructed using standard techniques and provide the base for a steel girder bridge with composite deck that is consistent with the type of permanent bridge used in and around the existing Snowy Scheme.

Temporary water diversions within the watercourse may be required to facilitate works. Construction methods will include:

- installing erosion and sedimentation controls including scour protection;
- constructing temporary local diversions within the watercourse;
- replicating natural bed and bank profiles and install jute matting, geofabric and rock armouring as required;
- revegetating with endemic native species; and
- removing diversions once bed and banks are sufficiently stabilised.

Once the temporary diversions are no longer required all structures and materials will be removed and the watercourse returned to its previous state.

iv Portal construction pad, accommodation camp and laydown areas

The methods for site preparation and establishment will be similar at the portal construction pad, accommodation camp and laydown areas.

The construction methods will involve the steps outlined below.

- delineating and marking vegetation to be cleared;
- clearing designated vegetation, removing topsoil and transporting to dedicated location to use in rehabilitation;
- levelling and profiling of the works area will be undertaken including surface finishing;
- installing site drainage, soil erosion and other permanent environmental controls;
- compacting works areas and grading and contouring internal roads;
- marking the location of facilities upon completion of the earthworks and, where required, establishing concrete bases;
- assembling pre-fabricated facilities and setting up water utilities ;
- levelling and preparing bases and pavements for other amenities; and
- establishing and connecting power and communication services to the facilities.

v Supporting infrastructure

Construction of supporting infrastructure will include:

- establishing water and waste water infrastructure;
- establishing power infrastructure; and
- establishing communications infrastructure.

The typical methods for supporting infrastructure construction are summarised in Table 2.4 below.

Table 2.4 Supporting infrastructure construction methods

Supporting infrastructure	Typical methods
Water and waste water	Construction of water infrastructure will involve establishment of a STP and water treatment plant at the accommodation camp. The water services pipeline will be established between Middle Bay, the accommodation camp and the portal construction pad. Construction of the water services pipeline will involve trenching within proposed road alignments, placement of the water services pipeline and backfilling with excavated material.
Power	Construction of power infrastructure will involve establishment of diesel generators at the portal construction pad. Following establishment of diesel generators power services will be connected to the required equipment, facilities and accommodation via buried conduit. Establishment of the buried conduit will involve trenching within the proposed road alignments, placement of the conduit and backfilling with excavated material.
Communications	The communications cable will be installed as a buried conduit and as a submarine cable in some sections. The sequencing for communications cable construction is outlined below. i) Establish a buried conduit between Tumut 3 power station and Talbingo Reservoir. ii) Lay a submarine cable from Tumut 3 power station to Middle Bay. iii) Establish a buried conduit from Lobs Hole to Middle Bay and exploratory tunnel. iv) Establishment of the buried conduit will involve trenching within proposed road alignments, placement of the conduit and backfilling with excavated material. v) The submarine section of the communications cable will be laid via boat or barge with the cable weighted and placed along the floor of the reservoir.

vi Barge access construction

Construction of the barge ramps will involve excavation, backfilling, dredging, installation of, cast-in-situ concrete planks and bollards.

The required excavation above FSL could be completed with a range of equipment including excavators and dozers. Excavation and dredging below FSL will be undertaken with a long reach excavator either positioned on the land or mounted on a barge, depending on the water level at the time of construction. Dredging will take place within a silt curtain.

Submerged timber (dead trees) would need to be removed to provide safe navigation and enable construction of the barge facilities. Submerged timber may also need to be removed from the proposed locations for subaqueous spoil placement to provide safe navigation and ensure the placed material is stable. Submerged tree trunks and branches would be cut and removed to 3 m below MOL throughout the reservoir where navigation is required, unless sediment or rock is encountered above this level. If sediment or rock is encountered, dredging would be required and the stump and root system of the submerged vegetation would be removed. Following removal, the submerged vegetation would be placed along the shoreline in up to 10 m water depth. The placement will provide habitat for fish and other aquatic biota.

Two options are under consideration for disposal of dredge material. These are:

- disposal on land; or
- disposal within Talbingo Reservoir.

Where dredge material is disposed on land the excavator will load heavy duty skips of 15–25 m^3 capacity, mounted on a separate transport barge. The barges will be towed to shore and the skips will be picked up off the barge using a truck for road transport to the excavated material emplacement area.

Dredging of sediment at the Middle Bay barge ramp location may occur before the ramp is fully constructed, in which case the barges will be transferred to the existing unformed boat launching area in Middle Bay until the ramp is completed.

Should dredge material be disposed of within Talbingo Reservoir, the transport barge will be fitted with water tight bulwarks for the temporary storage of dredge material. The transport barge will also be fitted with a centrally located elevated platform to support the required excavator.

The transport barge will be towed to the disposal area where a disposal barge will be anchored. The excavator will transfer the dredged material from the transport barge to the disposal barge for disposal below the water surface. The disposal barge or at least the fall pipe will be within a silt curtain. This method and environmental control will be the same for subaqueous placement of material in the reservoir.

vii Exploratory tunnel construction

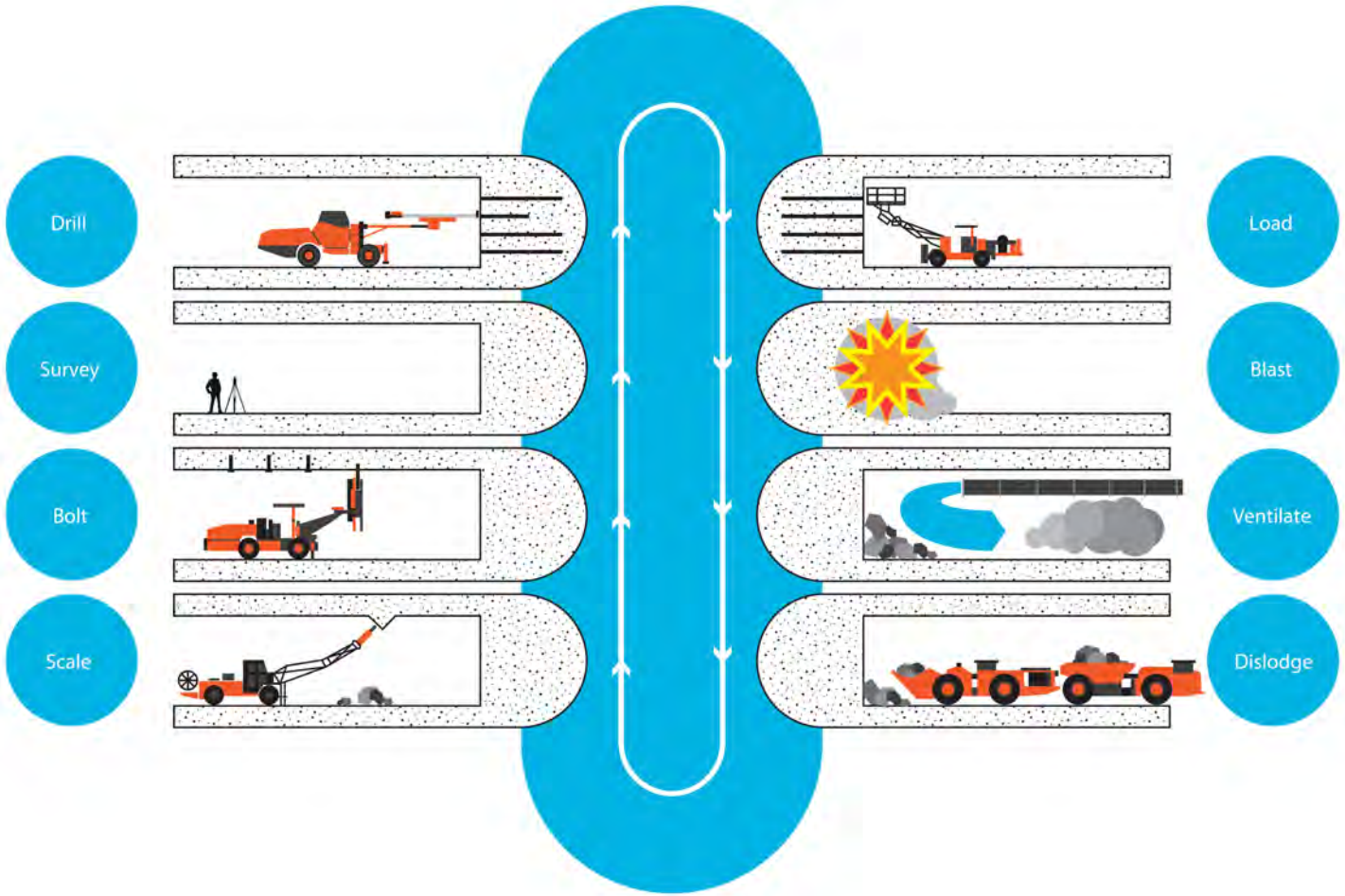
The major stage and primary activity of Exploratory Works is the extraction of rock to create the exploratory tunnel. Works will include the establishment of the portal and associated earthworks and batter protection, the drill and blast operation, rock coring, testing and cavern alignment confirmation to provide the completed exploratory tunnel. Tunnelling will be carried out via traditional methods, drill and blast being the most likely option. The exploratory tunnel will be shotcrete-lined. This method is summarised in Figure 2.18 and will involve the following steps:

- set out pre-support pattern and next advance blast pattern;
- install tunnel pre-support ahead of advancing tunnel face if required;
- drill next advance blast pattern;
- undertake charging and stemming of blast holes;
- conduct blasting;

- inspect blast area to ensure it is free of undetonated explosives;
- excavate blast spoil and scale the blasted zone;
- undertake geotechnical mapping of the tunnel face;
- set out rock bolt pattern and excavation performance monitoring locations where required;
- install tunnel support typically including rock bolts and steel fibre reinforced shotcrete and supplemented by steel ribs and lagging where required;
- install and monitor tunnel excavation performance monitoring instruments if required; and
- progressively repeat above sequence for the development of the exploratory tunnel.

The following supporting activities and methods will also be implemented during exploratory tunnel construction:

- forced ventilation of the tunnel excavation will commence once the tunnel has extended 20–30 m beyond the portal subject to the performance of the tunnel to self-ventilate;
- tunnel drainage systems will be progressively installed as tunnelling advances. This will typically consist of sumps constructed at 250–500 m intervals with the sumps connected to the tunnel portal and a sump at or near the tunnel face. The sump at the tunnel face will be equipped with a submersible pump and flexible discharge hose to feed tunnel water to the closest sump;
- bench excavation will follow as a complementary sequence 20–50 m behind heading construction following a similar drill and blast sequence;
- in-tunnel services such as water supply, power, lighting, air quality monitoring and communications will be progressively advanced around 20 m behind the tunnel face and away from blasting zone; and
- tunnel invert concreting will follow behind the bench development and may include under slab drainage system installation.



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

Drill and blast excavation process

Snowy 2.0
Environmental Impact Statement
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Figure 2.18

2.10.4 Plant and equipment

The indicative plant and equipment for each Exploratory Works element is provided in Table 2.5 below.

Table 2.5 Indicative plant and equipment

Exploratory Works element	Types of equipment
Exploratory tunnel	Excavator, dump truck, bulldozer, roller, grader, truck and dog, drilling rigs, grout pumps, agitator truck, shotcrete pump, semi trailer, water cart, light vehicles, compressor, generator, drills, jumbo, boomer, hydraulic breakers, air track, explosives transport vehicle, water bowser, 4WD telesco, stihl saw, forklift, light tower, compressor, gas monitor, rescue equipment, battery, ventilation fans, fuel truck, cement tanker, shotcrete robot, shotcrete pump, boom lift and water pump.
Portal construction pad	Excavator, dump truck, bulldozer, grader, truck and dog, crane, water cart, light vehicle, compressor, fuel vehicle, piling rig, agitator truck, concrete truck, semi trailer and roller.
Accommodation camp	Excavator, dump truck, bulldozer, grader, truck and dog, crane, water cart, light vehicle, compressor, fuel vehicle, piling rig, agitator truck, concrete truck, semi trailer and roller.
Access roads	Excavator, dump truck, bulldozer, grader, truck and dog, crane, water cart, light vehicle, compressor, fuel vehicle, piling rig, agitator truck, concrete truck, semi trailer and roller.
Barge access infrastructure	Bulldozer, excavator, roller, barge and skip truck.
Excavated rock management	Bulldozer, excavator, roller, barge and skip truck.

2.10.5 Traffic movements

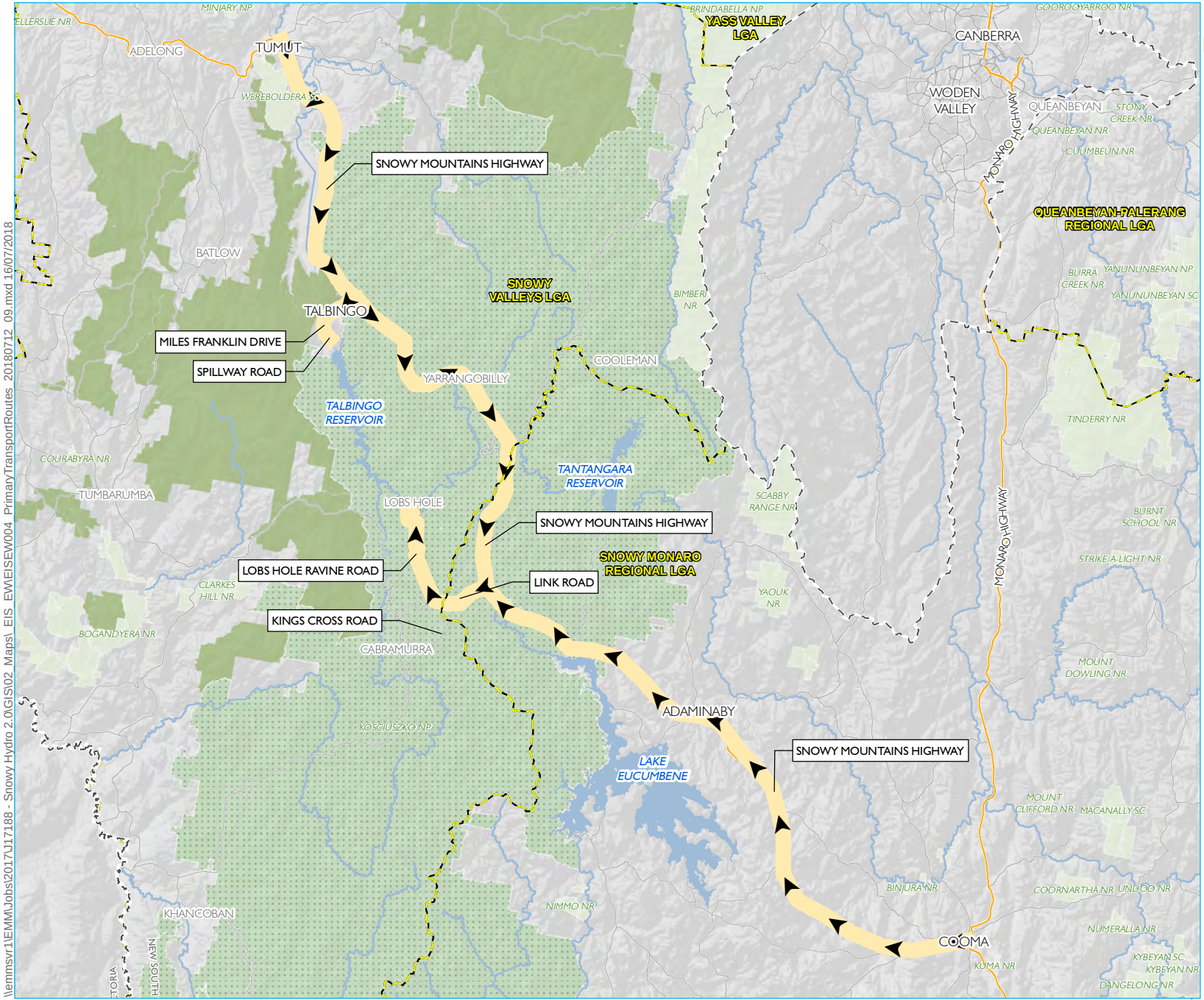
Through the duration of Exploratory Works, vehicle movements from the external road network will be required. The peak month for external traffic movements is predicted to occur in the sixth month of Exploratory Works with about 423 external traffic movements in this month. The peak hourly traffic generation has been estimated at 44 vehicle movements, which is expected to occur between 9–10am on a day during month six of Exploratory Works.

i Primary transport routes

It is expected that the majority of materials and equipment will travel along the Snowy Mountains Highway, Link Road and Lobs Hole Ravine Road, with some travelling via Talbingo to Talbingo Reservoir and transfer via a barge to site. It is expected that all heavy transport will be limited to daylight hours to limit noise impacts. The primary transport routes for construction material deliveries to site are provided in Figure 2.19.

ii Excavated rock haul route

Excavated material from the exploratory tunnel will be transported by truck from the portal construction pad to the excavated material emplacement area at Lobs Hole. The haul route for excavated material will use the Mine Trail Road extension and Mine Trail Road upgrade as shown in Figure 2.20. Excavated material haulage between the exploratory tunnel and the emplacement area will be undertaken 24 hours per day seven days per week.



KEY

- Primary construction material transport routes
- Main road
- Local road
- Watercourse
- Waterbodies
- Kosciuszko National Park
- NPWS reserve
- State forest
- Local government area boundary
- State boundary

\\emmsvr1\EMM\Jobs\2017\J17188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS EWEISEW004 PrimaryTransportRoutes 20180712 09.mxd 16/07/2018

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

Primary transport routes

Snowy 2.0
Environmental Impact Statement
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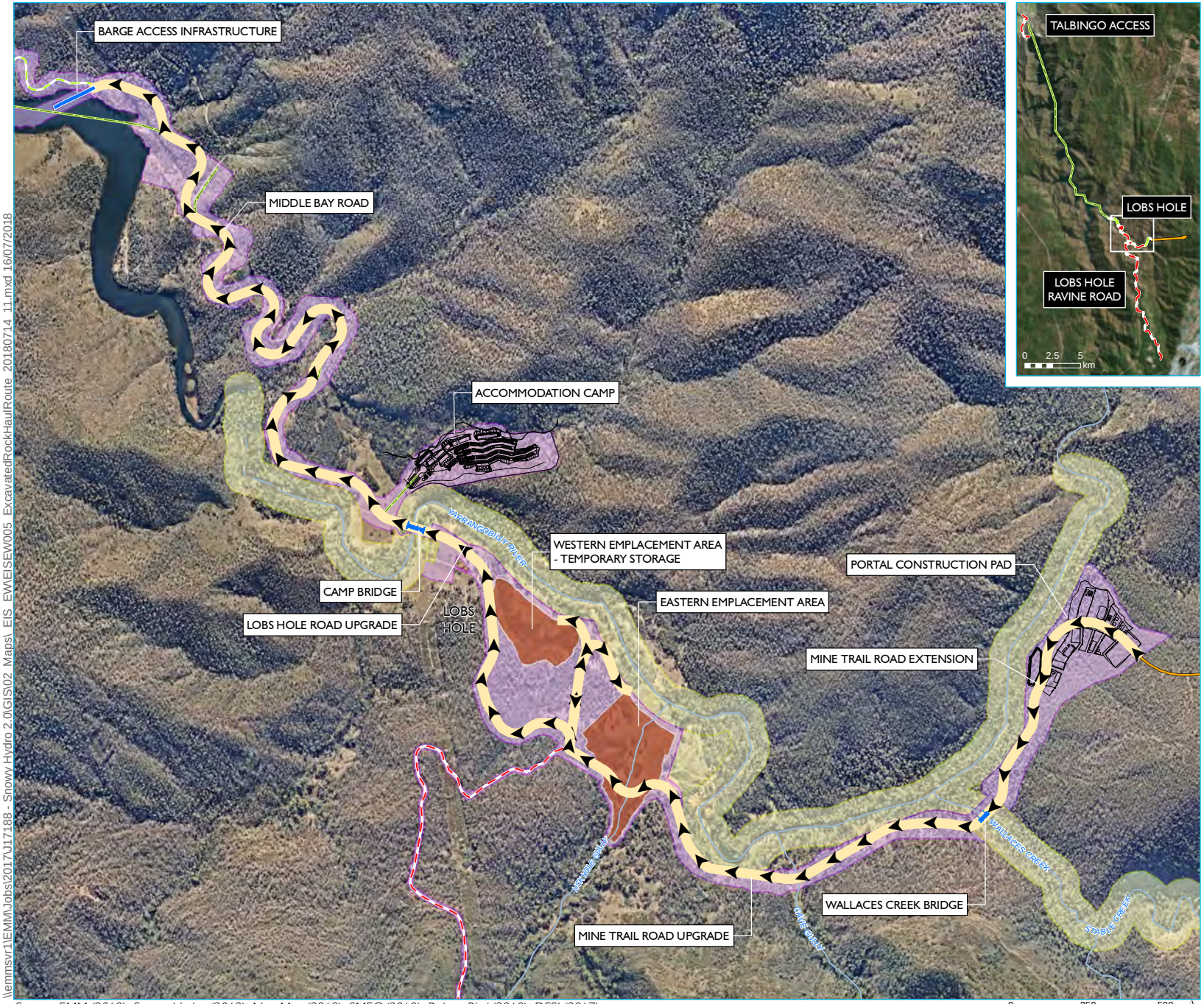
Figure 2.19



KEY

- Access road upgrade
- Access road extension
- Permanent bridge
- Exploratory tunnel
- Portal construction pad and accommodation camp conceptual layout
- Communications cable
- Excavated rock haul route
- Watercourse
- On land rock management
- Middle Bay barge access
- Disturbance footprint
- Avoidance footprint

\\emmsvr1\EMM\Jobs\2017\117188 - Snowy Hydro 2.0\GIS\02 Maps\ EIS EWEISEW005 ExcavatedRockHaulRoute 20180714 11.mxd 16/07/2018

Source: EMM (2018); Snowy Hydro (2018); NearMap (2018); SMEC (2018); Robert Bird (2018); DFSI (2017)

Excavated material haul route

Snowy 2.0
Environmental Impact Statement
Exploratory Works
Figure 2.20

2.10.6 Construction resources

i Material quantities and sources

Construction materials required for Exploratory Works will indicatively include fuel, wood, building materials, scaffolding, explosives, reinforcing steel, wire and cable, tunnelling equipment, rock bolts, pre-cast concrete, electrical equipment, geotextiles, aggregate, cement, coated stone, concrete and guard rails. The sources of construction materials are yet to be determined. It is expected that construction materials will be sourced from several different locations including nearby towns such as Cooma and Tumut with some items and equipment being sourced from nearby cities such as Canberra, Sydney and Melbourne.

ii Water use

Total water consumption is estimated to be approximately 226 megalitres (ML) annually for the duration of Exploratory Works with the main quantities being used in the accommodation camp, CBP and site dust suppression. Table 2.6 provides a summary of estimated water consumption.

Table 2.6 Water consumption estimates

		Predicted water use	
Water use	**Source**	**kL per day**	**ML per year**
Potable water	Talbingo Reservoir	48	17.5
Dust suppression	Process water system[2]	Variable	201[1]
Concrete production	Process water system[2]	12	4.4
Tunnel construction	Process water system[2]	10	3.7
Total	-	-	**226.6[1]**

Notes: 1. Median value provided for dust suppression.

2. The process water system will manage water produced by and used by construction activities. The process water system will preferentially source water from the portal sump, the portal construction pad water management basin then Talbingo Reservoir.

iii Energy use

As stated in Section 2.8.2, Exploratory Works power supply will be provided by diesel generators at the portal construction pad. The predicted fuel use for the duration of Exploratory Works is approximately 8,690,000 L of diesel fuel.

iv Waste management

The management and disposal of waste water and excavated rock are described in Sections 2.8.1 and Section 2.5 respectively.

Construction waste such as used materials and packaging will be placed in dedicated waste containers at the accommodation camp or portal construction pad. Construction waste will be removed from the project area by truck and disposed of to a licensed facility. Waste facilities that may be used during Exploratory Works include:

- Cooma landfill, approximately one hour and 45 minutes drive (100 km);
- Adaminaby waste transfer station, approximately one hour and 10 minutes drive (50 km);

- Tumut waste and recycling centre, approximately one hour and 45 minutes drive (100 km); and
- Talbingo waste depot, approximately one hour and 20 minutes drive (75 km).
- Tumbarumba landfill, approximately 45 minutes drive (45km)

Any hazardous materials will be disposed of to an appropriately licensed facility.

v Ancillary construction areas

Ancillary facilities and laydown areas have been identified within the conceptual layout for the portal construction pad and accommodation camp. A number of other indicative construction and laydown areas have also been identified to support Exploratory Works. A summary of these sites are:

- Upper Lobs Hole Ravine Road laydown area within the transmission line easement;
- rock emplacement area laydown, storage and ancillary uses;
- a laydown area approximately adjacent to Talbingo barge ramp;
- two laydown areas adjacent to the Middle Bay barge ramp; and
- other minor laydown areas as needed during site establishment of watercourse crossings.

Ancillary construction areas may also include temporary site offices and fuel storage areas. All ancillary construction areas are within the project area and clearance footprint identified for Exploratory Works.

In addition, an area near Camp Bridge has been identified to be used for a plant nursery and organic stockpile area. No clearing of vegetation is required in this area.

2.11 Workforce

Exploratory Works is likely to take 34 months from initial mobilisation to completion of the exploratory tunnel. The estimated time to complete construction of the accommodation camp is up to 10 months. Workers constructing the accommodation camp will be accommodated within Cabramurra (existing Snowy Hydro town) until the accommodation camp is constructed and operational Some workers may also be accommodated at Snowy Hydro owned units at Talbingo during construction of the Talbingo barge ramp.

It has been estimated that Exploratory Works will have a total workforce of up to 201 people, comprising 181 employed for actual Exploratory Works and 20 employed in the accommodation camp. It has been estimated that at any one point in time there will be up to 164 people working on Exploratory Works on-swing, with the remaining 37 people off-swing. All of the workforce will work on ‘swing’. This means that workers will likely work two weeks on and one week off.

Accommodation for 152 workers will be provided at the accommodation camp. Construction will be undertaken on a shift basis and accommodation will be shared between shifts. Once established, the accommodation camp is expected to provide sufficient accommodation for the duration of Exploratory Works.

It will take about 13 months to ramp up to 164 employees, and it is likely to remain reasonably constant at this level for the duration of Exploratory Works. The Exploratory Works employment curve is provided in Figure 2.21 below.

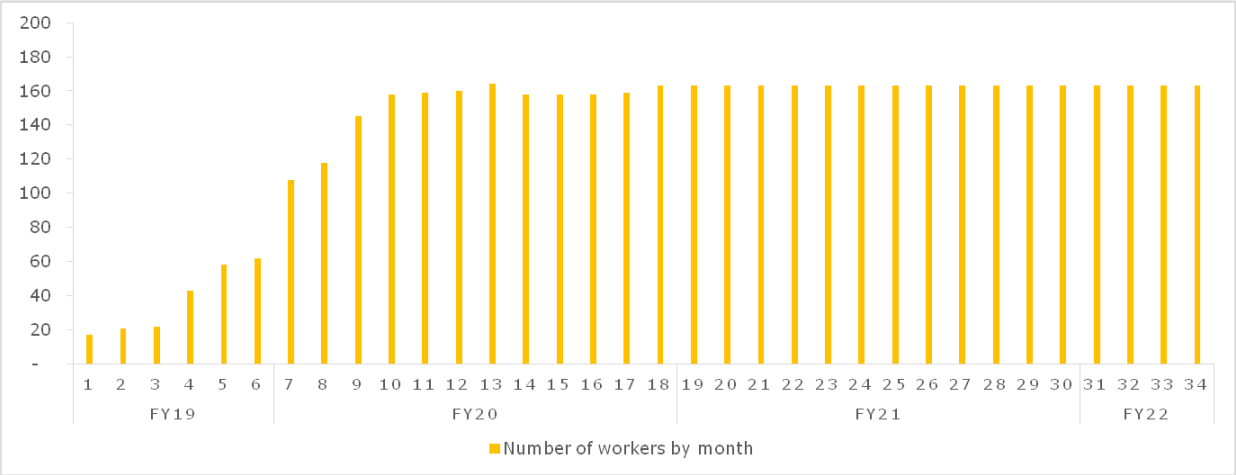


Figure 2.21 Exploratory Works employment curve

The average age of the workforce has been estimated to be 36 years. When on-swing, the workforce will work on shift. The shift times for the workforce are summarised in Table 2.7 below.

Table 2.7 Shift work summary

Work team	Shift summary
Tunnel	24 hours per day (2 shifts), 7 days per week
Roads	12 hours per day (1 shift), 5 days per week
Infrastructure	12 hours per day (1 shift), 5 days per week
Camp	16 hours per day (2 shifts), 7 days per week

The majority of the workforce will work on a fly-in fly-out (FIFO) and drive-in drive-out (DIDO) basis. Workforce access will be FIFO into Cooma or Canberra and then DIDO by bus to the project area. Access to the accommodation camp will be limited for workers on swing.

The approximate source geographies for the Exploratory Works construction workforce are provided in Table 2.8 below.

Table 2.8 Approximate construction workforce breakdown

Geography	Number	Percentage of workforce
Local area	23	11%
Local region	58	29%
Overseas	8	4%
Rest of Australia	112	56%

2.12 Rehabilitation and revegetation methods

The Exploratory Works rehabilitation strategy will consider the following phases:

- pre-development planning and design;
- site preparation;
- rehabilitation; and
- maintenance.

Rehabilitation will be considered during all phases of construction from design and site preparation, through to stabilisation and revegetation.

2.12.1 Pre-development planning and design

The core elements of the pre-development planning and design stage are:

- identify past, current and future land uses for the Exploratory Works project area;
- identify ecologically sensitive areas to protect (for example, the riparian zone of the Yarrangobilly River); and
- identify existing conditions and vegetation to preserve and specify for rehabilitation.

2.12.2 Site preparation

The rehabilitation activities to be undertaken during site preparation include:

- collection of indigenous/native seed and alpine sods for propagation;
- establishing an indigenous/native plant nursery within Lobs Hole to establish tube stock for revegetation;
- collecting and stockpiling organic matter from construction cuts and clearances, including topsoil, woodchip and organic matter for use in rehabilitation; and
- clearly define access routes for vehicles and machinery.

2.12.3 Stabilisation

Rehabilitation works to be undertaken alongside construction works include:

- rolling rehabilitation during construction to stabilise slopes and preparation of sites for revegetation including placement of organic matter and jute matting if required;
- mitigation of sediment runoff from rock emplacement areas and construction works including planting within swales and use of coir logs for sediment traps;
- hydroseeding soil slopes to assist stabilisation; and
- planting of higher risk slopes.

2.12.4 Maintenance and monitoring

Ongoing maintenance and monitoring of rehabilitation works will include:

- monitoring of slope stabilisation and revegetation;
- sedimentation ponds monitoring and maintenance;
- weed control;
- maintaining perimeter fencing to rehabilitation areas;
- replacement planting for seedlings that have not survived; and
- annual remulching of revegetation sites, until plants have sufficient mass to create their own biomass.

2.13 Decommissioning

Exploratory Works is construction works associated with further investigations to gather technical and environmental information for Snowy 2.0. Should Snowy 2.0 not proceed following the commencement or completion of Exploratory Works, elements constructed are able to be decommissioned and areas rehabilitated. Given works are within KNP, Snow Hydro will liaise closely with NPWS to determine the extent of decommissioning and types of rehabilitation to be undertaken. This approach will be taken to ensure that decommissioning allows for integration with future planned recreational use of these areas and to maintain the values of KNP.

These activities would be documented in a Decommissioning Plan, prepared in consultation with NPWS, and be implemented should Snowy 2.0 not proceed. Likely rehabilitation and decommissioning activities for Exploratory Works are shown in Table 2.9.

Table 2.9 Summary of likely decommissioning activities by site

Exploratory Works element	Rehabilitation and decommissioning activities
Accommodation camp	● removal of all accommodation facilities; ● some re-shaping of landform including fill to near pre-construction landform; ● rehabilitation of slopes through placement of organic matter and revegetation; and ● fencing and tree guards of revegetation areas to protect from grazing fauna.
Portal construction pad	● closure of exploratory tunnel entrance; ● removal of all construction infrastructure; ● re-shaping of batters by site-sourced fill material, with batters at 3H:1V with berms (4 m minimum), between each batter and to reshape to near pre-construction landform; ● rehabilitation of fill and cleared areas through addition of organic matter and revegetation; ● planted swales and sediment basins at the base of slope to assist in ongoing water quality treatment; and ● fencing and tree guards of revegetation areas to protect from grazing fauna.
Excavated rock emplacement areas	● removal of all construction infrastructure; ● final shaping of emplacement areas including finishing stockpiles surfaces; ● rehabilitation and revegetation or removal of emplacement areas in consultation with NPWS; ● fencing and tree guards of revegetation areas to protect from grazing fauna; and ● planted swales and sediment basins at the base of the stockpile to assist in ongoing water quality treatment.

During construction of Exploratory Works the maintenance and management of the project area will be the responsibility of the construction contractors. Throughout construction, the Exploratory Works will be carried out in accordance with a construction environmental management plan (CEMP).

Following the construction of Exploratory Works all ongoing maintenance and management of permanent infrastructure will be the responsibility of Snowy Hydro. The Snowy Management Plan Environmental Management Plan (SMP EMP) outlines Snowy Hydro's obligations with regard to the protection of the environment and public health and will be updated to include the ongoing management and maintenance of permanent infrastructure developed through Exploratory Works. The SMP EMP will also be updated to include any additional permits, approvals or plans required for Exploratory Works.