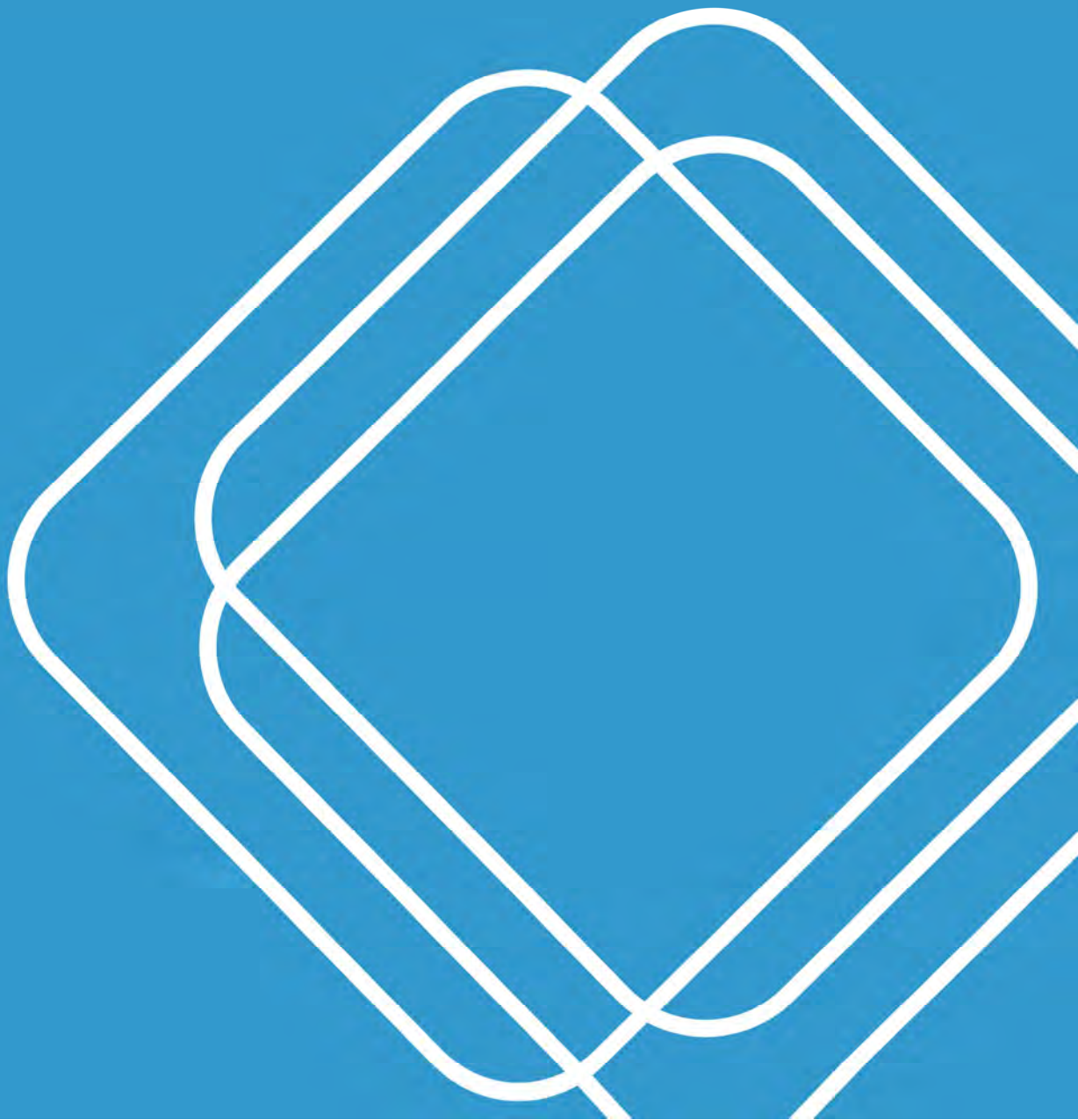
APPENDIX K

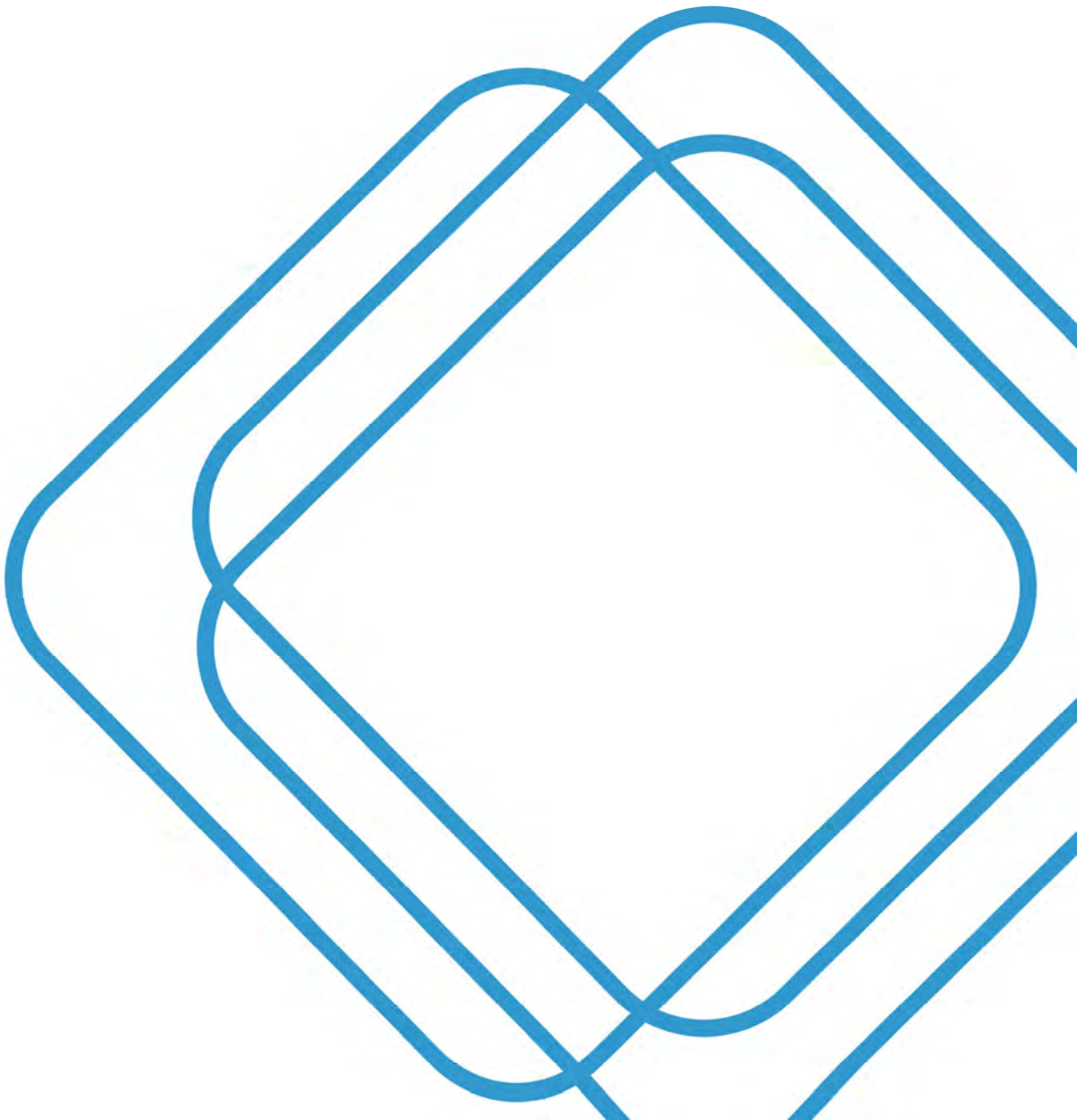
REVISED TRAFFIC AND TRANSPORT ASSESSMENT

SCT Consulting

SNOWY 2.0 MAIN WORKS TRAFFIC AND TRANSPORT ASSESSMENT

25 FEBRUARY 2020





Quality Assurance

Project:	Snowy 2.0 Main Works Traffic and Transport Assessment		
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1.0 Introduction

1.1 The project

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

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

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

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

This Traffic and Transport Assessment has been prepared to accompany an application and supporting EIS for the second phase of Snowy 2.0, which is to be known as the Snowy 2.0 Main Works. As the title suggests, this phase of the project covers the major construction elements of Snowy 2.0, including permanent infrastructure (such as the underground power station, power waterways, access tunnels, chambers and shafts), temporary construction infrastructure (such as construction adits, construction compounds and accommodation), management and storage of extracted rock material and supporting infrastructure (such as road upgrades and extensions, water and sewage treatment infrastructure and the provision of construction power). Snowy 2.0 Main Works also includes the operation of Snowy 2.0.

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

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

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

On 5 December 2018, Snowy 2.0 Main Works were deemed a controlled action by the Commonwealth Department of Environment and Energy (DEE). It was also determined that potential impacts of the project will be assessed by accredited assessment under Division 5.2 of the EP&A Act. This accredited process will enable DPIE to manage the assessment of Snowy 2.0 Main Works, including the issuing of the assessment requirements for the EIS.

1.2 Project location

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

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

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

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

– **Tantangara Reservoir** - at a full supply level (FSL) of about 1,229 metres (m) to Australian Height Datum (AHD), Tantangara Reservoir will be the upper reservoir for the pumped hydro project and include the headrace tunnel and intake structure. The site will also be used for a temporary construction compound, accommodation camp and other temporary ancillary activities;

– **Marica** - this site will be used primarily during construction (including construction of vertical shafts to the underground power station (ventilation shaft) and headrace tunnel (surge shaft), and be the location of a temporary accommodation camp);

– **Lobs Hole** - this site will be used primarily during construction but will also become the main entrance to the power station during operation. Lobs Hole will provide access to the Exploratory Works tunnel, which will be refitted to become the main access tunnel (MAT), as well as the location of the emergency egress, cable and ventilation tunnel (ECVT), portal and associated services; and

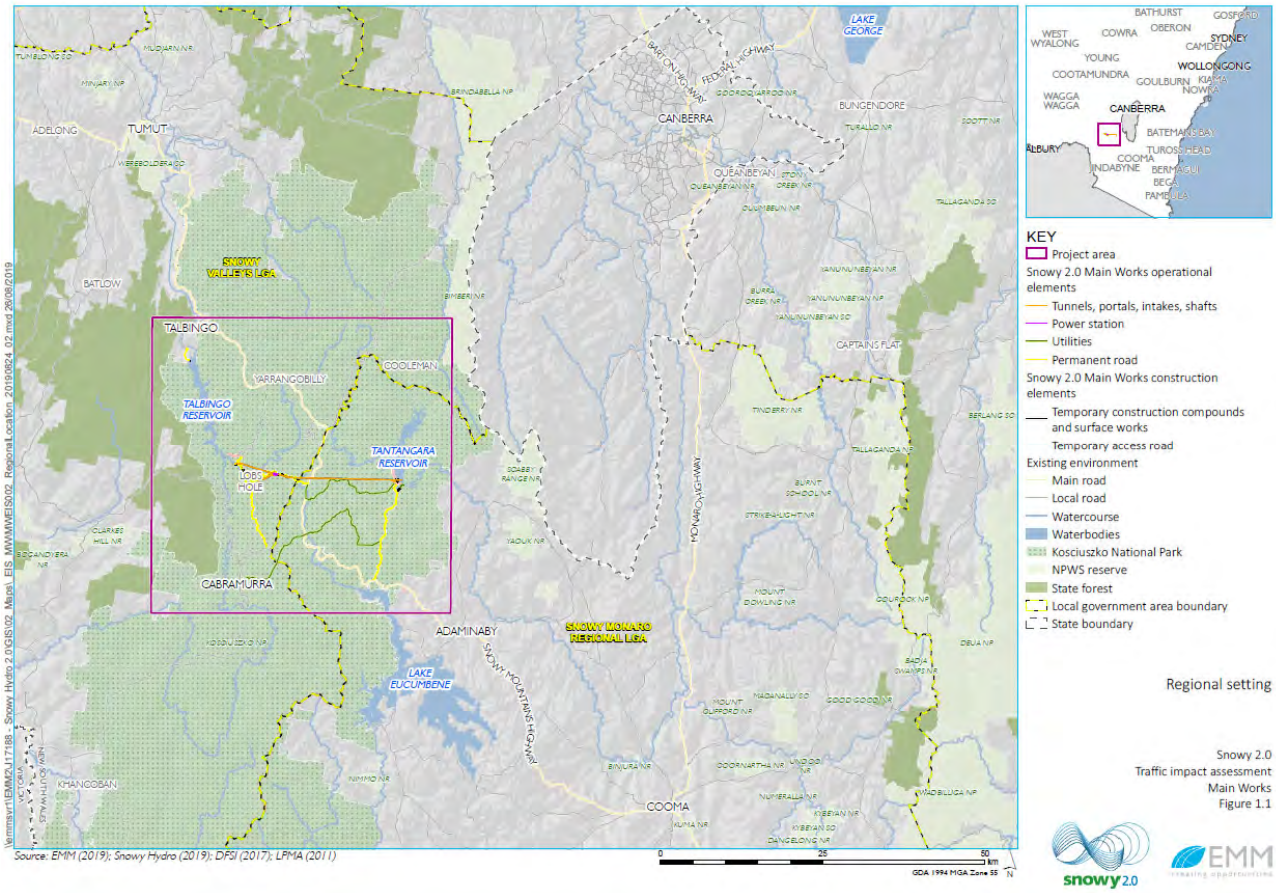
– **Talbingo Reservoir** - at a FSL of about 546 m AHD, Talbingo Reservoir provides the lower reservoir for the pumped hydro-electric project and will include the tailrace tunnel and water intake structure. The site will also be used for temporary construction compounds and other temporary ancillary activities.

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

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

The project is described in more detail in Chapter 2.

Figure 1.1 Snowy 2.0 regional overview



Source: EMM Consulting, June 2019

1.2.1 Project area

A project area for Snowy 2.0 Main Works has been identified that includes the construction and operational elements of the project. The project area is shown on **Figure 1.1** and includes:

– the water bodies of Tantangara and Talbingo reservoirs, covering areas of 19.4 square kilometres (km^2) and 21.2 km^2 respectively. The reservoirs provide the water to be utilised in the pumped hydro-electric scheme;

– major watercourses including the Yarrangobilly, Eucumbene and Murrumbidgee rivers and some of their tributaries;

– KNP, within which the majority of the project area is located. Within the project area, KNP is characterised by two key zones: upper slopes and inverted treelines in the west of the project area (referred to as the 'ravine') and associated subalpine treeless flats and valleys in the east of the project area (referred to as the 'plateau'); and

– farmland southeast of KNP at Rock Forest.

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

1.2.2 Study area

The study area of Snowy 2.0, for the purposes of this Traffic and Transport Assessment, lies within the Snowy Monaro Regional and Snowy Valleys LGAs. The proposed project underground and surface construction areas and their associated access roads and worksite areas extend over 27 km, from the lower intake/outlet at Talbingo Reservoir to the upper intake/outlet at Tantangara Reservoir.

The nearest regional service towns to the project area are at Tumut, approximately 80 km to the north-west and Cooma, 100 km to the south-east. Snowy Mountains Highway providing connection to these two service towns over approximately 180 km. The smaller local township of Adaminaby is located approximately 50 km south east of the main project route area and is also approximately 50 km by road from Cooma. Similarly, the smaller local township of Talbingo is located approximately 40 km north west of the main project route area and is also approximately 40 km by road from Tumut. Both Adaminaby and Talbingo provide a range of local facilities and services including fuel, shops, restaurants and accommodation.

The study area contains many of the highest mountains in Australia, which during the snow season attracts an influx of visitors resulting in increased in traffic volumes. Outside of the snow season, recreational visitors access the study area to visit the National Park facilities, but the traffic volumes generated during these periods is nominal and mostly limited to school holiday periods.

Outside of the KNP, the largest community within the study area is Cooma, which is served by Snowy Mountains and Monaro highways, that function as the main roads through the town centre to provide access to a large collection of commercial and retail developments within Cooma. Adjoining Cooma to the east lies Polo Flat which comprises mostly industrial developments generating a large portion of the heavy vehicles within the region.

1.3 Proponent

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

1.4 Purpose of this report

This Traffic and Transport Assessment supports the EIS for the Snowy 2.0 Main Works. It documents the traffic and transport assessment methods and results, the initiatives built into the project design to avoid and minimise associated impacts to traffic and transport and the mitigation and management measures proposed to address any residual impacts not able to be avoided.

The specific objectives of this assessment are to:

– describe the existing traffic and transport environment including baseline performance of the network;

– describe the approach undertaken for the traffic assessment;

– describe the initiatives built into the project design to avoid and minimise associated traffic and transport impacts;

– describe the proposed construction and operational activities and the forecast performance of the network as a result of the proposed construction and operational activities; and

– identify any mitigation and management measures proposed to address any residual impacts not able to be avoided.

1.4.1 Assessment guidelines and requirements

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

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

Table 1-1 Relevant matters raised in SEARs

Requirement	Section addressed
Assessment of the impacts of the project on the:	
- capacity, condition, safety and efficiency of the local, national park and State road network, including a road safety audit of the proposed haulage route	Section 3 and 4
- use of navigable waters in the Tantangara and Talbingo Reservoirs	Section 4
- public access to recreational facilities in the Kosciuszko National Park	Section 4
A strategy to enable regular and emergency management activities to be carried out on site within the Kosciuszko National Park during the project;	Section 4
A strategy to rationalise the road network within the Kosciuszko National Park following the construction of the project;	Rehabilitation Strategy as identified in Snowy 2.0 Main Works Appendix F of the EIS

To inform preparation of the SEARs, the Department of Planning, Industry and Environment (DPIE) invited relevant government agencies to advise on matters to be addressed in the EIS. These matters were taken into account by the Secretary for DPIE when preparing the SEARs.

1.5 Related projects

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

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

While these projects form part of the CSSI declaration for Snowy 2.0, they do not form part of Snowy Hydro's application for Snowy 2.0 Main Works. These related projects are subject to separate application and approval processes. A staged submission and separate approvals are appropriate for a project of this magnitude, due to its complexity and funding and procurement processes. However, cumulative impacts have been considered in this report where relevant.

1.6 Other relevant reports

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

- Aboriginal cultural heritage assessment (NSW Archaeology 2019) – Appended to the EIS;
- Air quality and greenhouse gas impact assessment (EMM 2019) – Appended to the EIS;
- Aquatic ecology assessment (Cardno 2019) – Appended to the EIS;
- Biodiversity development assessment (EMM 2019) – Appended to the EIS;
- Bushfire risk and hazard assessment (EcoLogical 2019) – Appended to the EIS;
- Cenozoic geodiversity report (Troedson 2019 – Appended to the EIS;
- Contamination assessment (EMM 2019) – Appended to the EIS;
- Economic assessment (Gillespie 2019) – Appended to the EIS;
- Groundwater assessment (EMM 2019) – Appended to the EIS;
- Hazard and risk assessment (Sherpa 2019) – Appended to the EIS;
- Heritage assessment and statement of heritage impact (NSW Archaeology 2019) – Appended to the EIS;
- Navigation assessment (RHDHV 2019) – Appended to the EIS;

- Noise and vibration impact assessment (EMM 2019) – Appended to the EIS;
- Paleozoic geodiversity report (Percival 2019) – Appended to the EIS;
- Recreational users study (TRC 2019) – Appended to the EIS;
- Reservoir assessment overview (RHDHV 2019) – Appended to the EIS;
- Social impact assessment – (Elton Consulting 2019) – Appended to the EIS;
- Soils and land assessment (EMM 2019) – Appended to the EIS;
- Surface water assessment (EMM 2019) – Appended to the EIS;
- Traffic and transport assessment (SCT 2019) – Appended to the EIS; and
- Water assessment (EMM 2019) – Appended to the EIS.

2.0 Project Description

2.1 Overview of Snowy 2.0

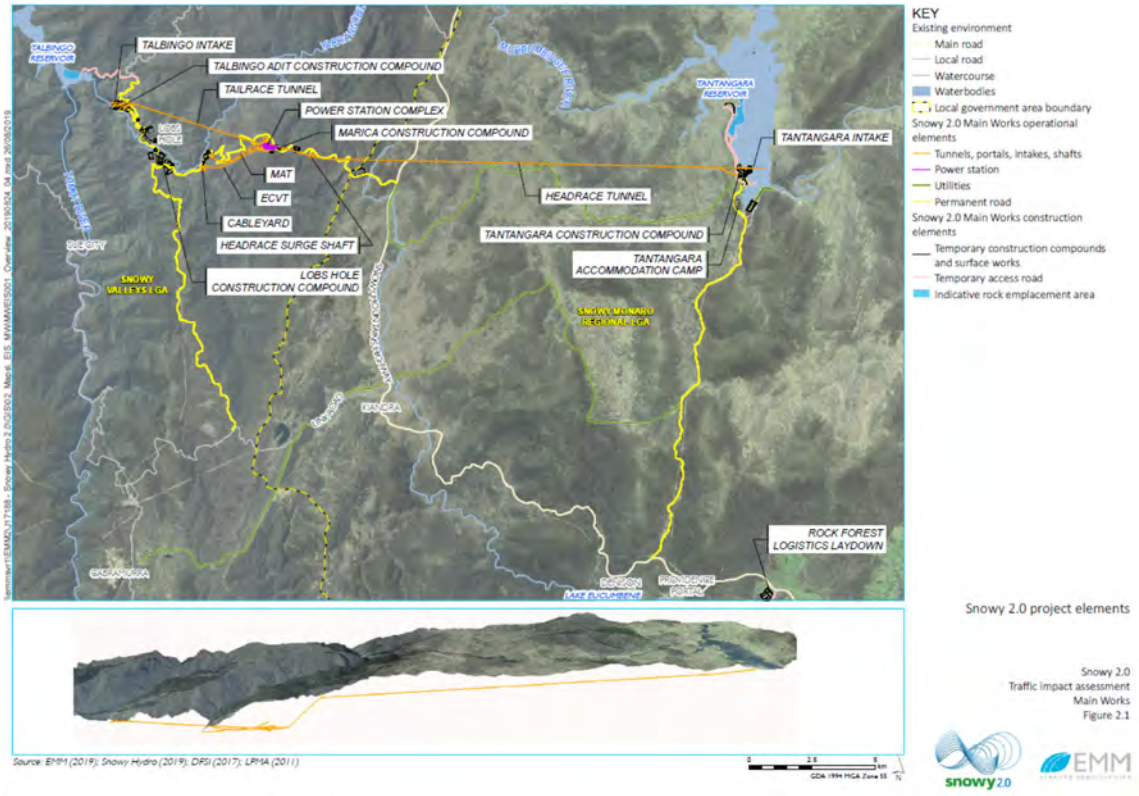
Snowy 2.0 will link the existing Tantangara and Talbingo reservoirs within the Snowy Scheme through a series of underground tunnels and a new hydro-electric power station will be built underground. An overview of Snowy 2.0 is shown on **Figure 2.1**, and the key project elements of Snowy 2.0 are summarised in **Table 2-2**.

Table 2-1 Overview of Snowy 2.0 Main Works

Project element	Summary of the project
Project area	The project area is the broader region within which Snowy 2.0 will be built and operated, and the extent within which direct impacts from Snowy 2.0 Main Works are anticipated.
Permanent infrastructure	Snowy 2.0 infrastructure to be built and operated for the life of the assets include the: – intake and gate structures and surface buildings at Tantangara and Talbingo reservoirs; – power waterway tunnels primarily comprising the headrace tunnel, headrace surge structure, inclined pressure tunnel, pressure pipelines, tailrace surge tank and tailrace tunnel; – underground power station complex comprising the machine hall, transformer hall, ventilation shaft and minor connecting tunnels; – access tunnels (and tunnel portals) to the underground power station comprising the main access tunnel (MAT) and emergency egress, communication and ventilation tunnel (ECVT); – establishment of a portal building and helipad at the MAT portal; – communication, water and power supply including the continued use of the Lobs Hole substation; – a cable yard adjacent to the ECVT portal to facilitate the connection of Snowy 2.0 to the NEM; – access roads, permanent bridge structures and barge launch ramps needed for the operation and maintenance of Snowy 2.0 infrastructure; and – fish control structures on Tantangara Creek and near Tantangara Reservoir wall.
Temporary infrastructure	Temporary infrastructure required during the construction phase of Snowy 2.0 Main Works are: – construction compounds, laydown, ancillary facilities and helipads; – accommodation camps for construction workforce; – construction portals and adits to facilitate tunnelling activities; – barge launch ramps; – water and wastewater management infrastructure (treatment plants and pipelines); – communication and power supply; and – temporary access roads.
Disturbance area	The disturbance area is the extent of construction works required to build Snowy 2.0. The maximum disturbance area is about 1,680 hectares (ha), less than 0.25% of the total area of KNP. Parts of the disturbance area will be rehabilitated and landformed and other parts will be retained permanently for operation (operational footprint).
Operational footprint	The operational footprint is the area required for permanent infrastructure to operate Snowy 2.0. The maximum operational footprint is about 99 ha. This is 0.01% of the total area of KNP.
Tunnelling and excavation method	The primary tunnelling method for the power waterway is by tunnel boring machine (TBM), with portals and adits using drill and blast methods. Excavation for other underground caverns, chambers and shafts will be via combinations of drill and blast, blind sink and/or raise bore techniques.
Excavated rock management	Excavated rock will be generated as a result of tunnelling activities and earthworks. The material produced through these activities will be stockpiled and either reused by the contractor (or NPWS), placed permanently within Tantangara or Talbingo reservoirs, used in final land forming and rehabilitation of construction pads in Lobs Hole or transported offsite.

Project element	Summary of the project
Construction water and wastewater management	Water supply for construction will be from Talbingo and Tantangara reservoirs and reticulated via buried pipelines (along access roads). Raw water will be treated as necessary wherever potable water is required (e.g. at accommodation camps). Water to be discharged (comprising process water, wastewater and stormwater) will be treated before discharge to Talbingo and Tantangara reservoirs as follows: – treated process water will be reused onsite where possible to reduce the amount of discharge to reservoirs, however excess treated water will be discharged to the reservoirs; – collected sewage will be treated at sewage treatment plants to meet the specified discharge limits before discharge and/or disposal; and – stormwater will be captured and reused as much as possible.
Rehabilitation	Rehabilitation of areas disturbed during construction including reshaping to natural appearing landforms or returning to pre-disturbance condition, as agreed with NPWS and determined by the rehabilitation strategy. This includes construction areas at Lobs Hole which comprise surplus cut materials that are required for the construction. Areas to be used by Snowy Hydro in the long-term may be re-shaped and rehabilitated to maintain access and operational capabilities (e.g. intakes and portal entrances).
Construction workforce	The construction workforce for the project is expected to peak at around 2,000 personnel
Operational life	The operational life of the project is estimated to be 100 years
Operational workforce	The operational workforce is expected to be 8-16 staff, with fluctuations of additional workforce required during major maintenance activities
Hours of operation	Construction of Snowy 2.0 will be 24/7 and 365 days per year Operation of Snowy 2.0 will be 24/7 and 365 days per year
Capital investment value	Estimated to be $4.6 billion

Figure 2.1 Snowy 2.0 project overview



Source: EMM Consulting, June 2019

2.2 Construction of Snowy 2.0

Construction activities will be carried out concurrently and across different sites. Specific details on these activities as well as an indicative schedule of construction activities is provided in Chapter 2 (Project description) of the EIS. This section summarises the key construction elements of the project. **Table 2-2** provides an overview of the construction elements, their purpose and location within the project area.

Table 2-2 Snowy 2.0 construction elements

Construction element	Purpose	Location
Construction sites	Due to the remoteness of Snowy 2.0, construction sites are generally needed to: – provide ancillary facilities such as concrete batching plants, mixing plants and on-site manufacturing; – store machinery, equipment and materials to be used in construction; – provide access to underground construction sites; and – provide onsite accommodation for the construction workforce.	Each construction site needed for Snowy 2.0 is shown on figures 2.2 to 2.6.
Substations and power connection	One substation is required to provide permanent power to Snowy 2.0, at Lobs Hole. This substation is proposed as part of a modification to the Exploratory Works with a capacity of 80 Mega Volt Amp (MVA). It will continue to be used for the Main Works, however the substation requires the establishment of further power supply cables to provide power to the work sites and the TBMs via the MAT, ECVT, Talbingo and Tantangara portals.	The supporting high voltage cable route mostly follows access roads to each of the work sites, using a combination of aerial and underground arrangements.

Construction element	Purpose	Location
Communications system	Communications infrastructure will connect infrastructure at Tantangara and Talbingo reservoirs to the existing communications system at the Tumut 3 power station (via the submarine communications cable in Talbingo Reservoir established during Exploratory Works) and to Snowy Hydro's existing communications infrastructure at Cabramurra.	The cable will be trenched and buried in conduits within access roads. Crossing of watercourses and other environmentally sensitive areas will be carried out in a manner that minimises environmental impacts where possible, such as bridging or underboring.
Water and waste water servicing	Drinking water will be provided via water treatment plants located at accommodation camps. Water for treatment will be sourced from the nearest reservoir. There are three main wastewater streams that require some form of treatment before discharging to the environment, comprising: – tunnel seepage and construction wastewater (process water); – domestic sewer (wastewater); and – construction site stormwater (stormwater).	Utility pipelines generally follow access roads. Water treatment plants (drinking water) will be needed for the accommodation camps and will be located in proximity. Wastewater treatment plants will similarly be located near accommodation camps. Process water treatment plants will be at construction compounds and adits where needed to manage tunnel seepage and water during construction.
Temporary and permanent access roads	Access road works are required to: – provide for the transport of excavated material between the tunnel portals 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 into and out of construction sites. The access road upgrades and establishment requirements are shown on figures 2.2 to 2.6. These roads will be used throughout construction including use of deliveries to and from site and the external road network. Some additional temporary roads will also be required within the footprint to reach excavation fronts such as various elevations of the intakes, requiring excavation or higher benches along the permanent roads.	The access road upgrades and establishment requirements are shown across the project area. Main access and haulage to site will be via Snowy Mountains Highway, Link Road and Lobs Hole Ravine Road (for access to Lobs Hole), and via Snowy Mountains Highway and Tantangara Road (for access to Tantangara Reservoir) (see Figure 2.1).
Excavated rock management	Approximately 9 million m^3 (unbulked) of excavated material will be generated by construction and require management. The strategy for management of excavated rock is to maximise the beneficial reuse of materials for construction activities. Beneficial re-use of excavated material may include use for road base, construction pad establishment, selected fill and tunnel backfill and rock armour as part of site establishment for construction. Excess excavated material that cannot be re-used during construction will be disposed of within Talbingo and Tantangara reservoirs, used in permanent rehabilitation of construction pads to be left in situ in Lobs Hole, or transported for on-land disposal if required.	Placement areas are shown on figures 2.2 to 2.6.

Construction element	Purpose	Location
Barge launch facilities	Barge launch facilities on Talbingo Reservoir will have already been established during Exploratory Works for the placement of the submarine communications cable and will continued to be used for Main Works for construction works associated with the Talbingo intake structure. The Main Works will require the establishment of barge launch facilities on Tantangara Reservoir to enable these similar works (removal of the intake plug).	Barge launch sites are shown on figures 2.2 to 2.6.
Construction workforce	The construction workforce will be accommodated entirely on site, typically with a FIFO/DIDO roster. Private vehicles will generally not be permitted and the workforce bused to and from site.	Access to site will be via Snowy Mountains Highway

The key areas of construction are shown on **Figure 2.2** to **Figure 2.6** and can be described across the following locations:

– Talbingo Reservoir – Talbingo Reservoir provides the lower reservoir for the pumped hydro-electric project and will include the tailrace tunnel and water intake structure. The site will also be used for temporary construction compounds and other temporary ancillary activities;

– Lobs Hole – this site will be used primarily for construction (including construction of the MAT and ECVT portals and tunnels to the underground power station and the headrace tunnel (and headrace tunnel surge shaft), and a temporary accommodation camp);

– Marica – the site will be used primarily for construction to excavate the ventilation shaft to the underground power station as well as for the excavation and construction of the headrace surge shaft;

– Plateau – the land area between Snowy Mountains Highway and Tantangara Reservoir is referred to as the Plateau. The Plateau will be used to access and construct a utility corridor, upgrade access tracks and construct a fish weir on Tantangara Creek;

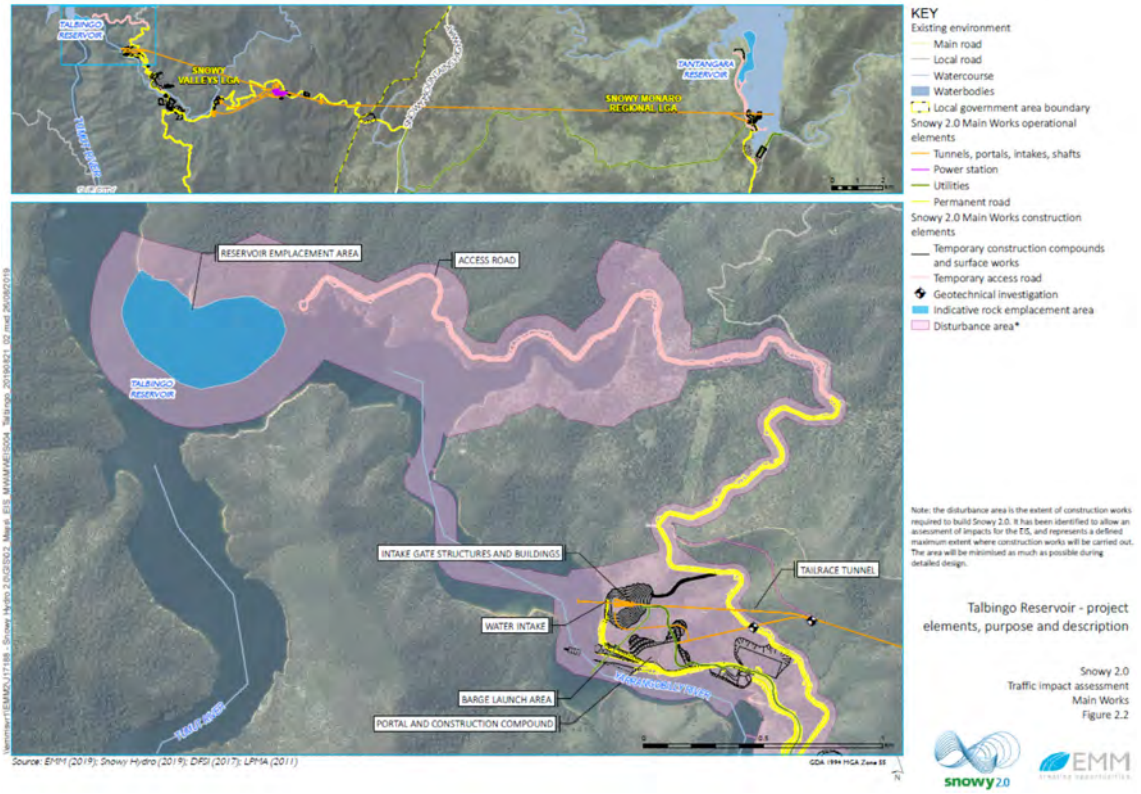
– Tantangara Reservoir – this will be the upper reservoir for the pumped hydro project and include the headrace tunnel and intake structure. The site will also be used for a temporary construction compound, accommodation camp and other temporary ancillary activities; and

– Rock Forest – a site to be used temporarily for logistics and staging during construction. It is located beyond the KNP along the Snowy Mountains Highway about 3 km east of Providence Portal.

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

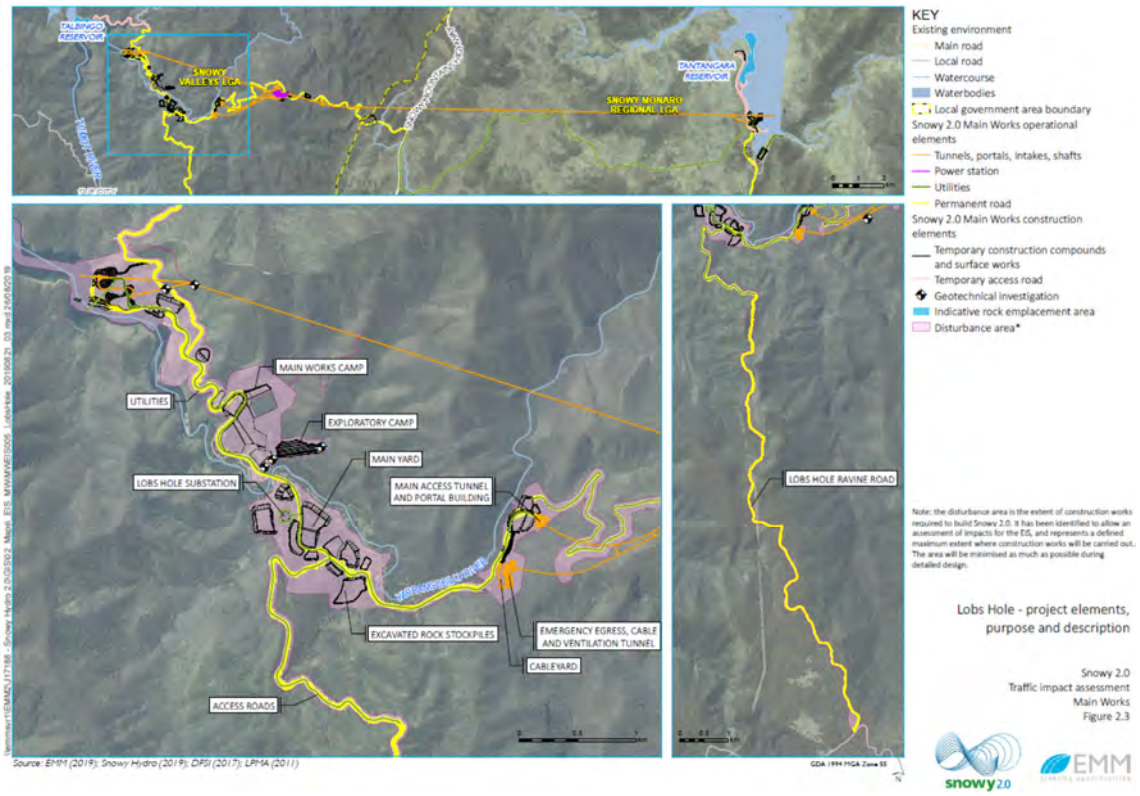
A key construction element for the project is the excavation and tunnelling for underground infrastructure including the power station, power waterway (headrace and tailrace tunnels) and associated shafts. The primary methods of excavation are shown in **Figure 2.7** with further detail on construction methods provided at Appendix D of the EIS.

Figure 2.2 Snowy 2.0 locational areas – Talbingo Reservoir



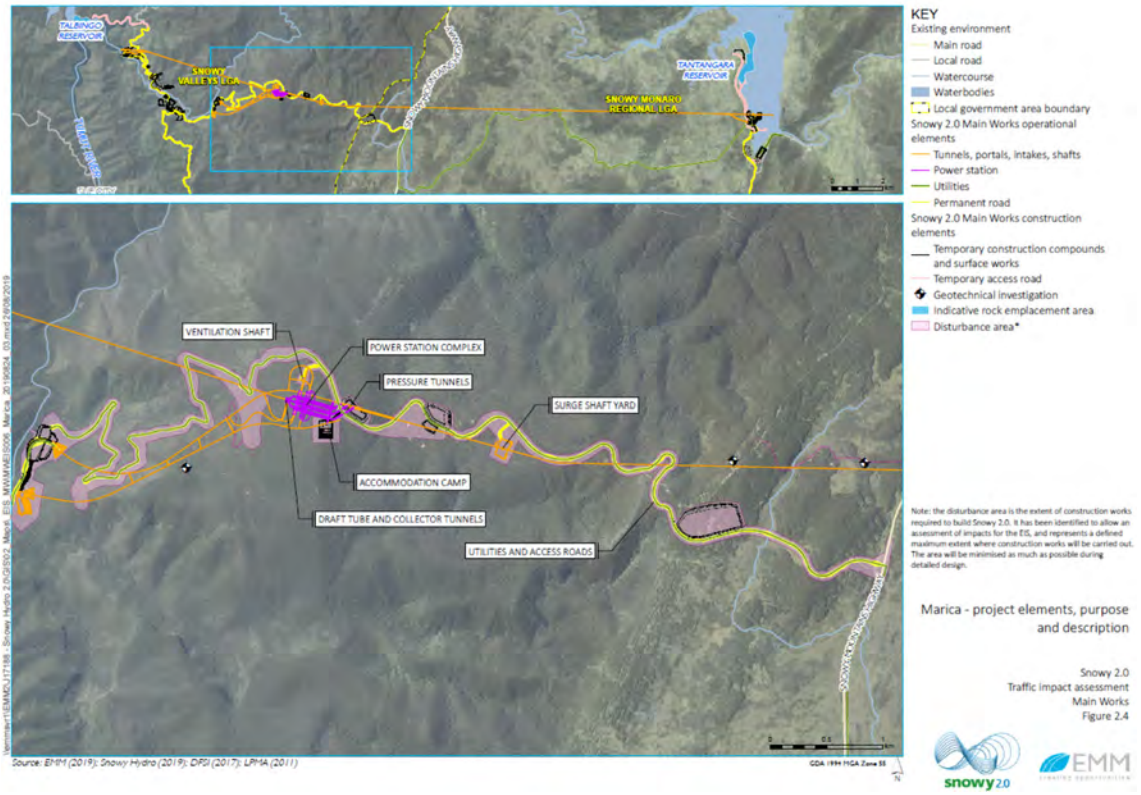
Source: EMM Consulting, June 2019

Figure 2.3 Snowy 2.0 locational areas – Lobs Hole



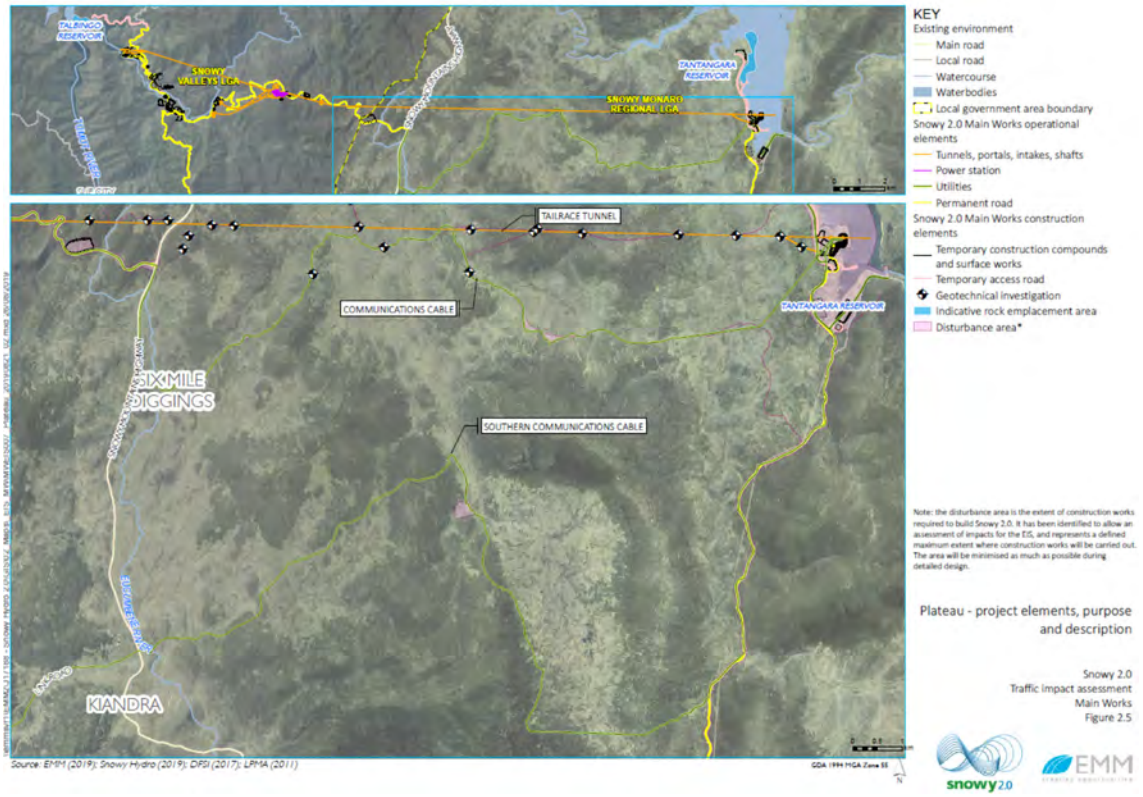
Source: EMM Consulting, June 2019

Figure 2.4 Snowy 2.0 locational areas – Marica



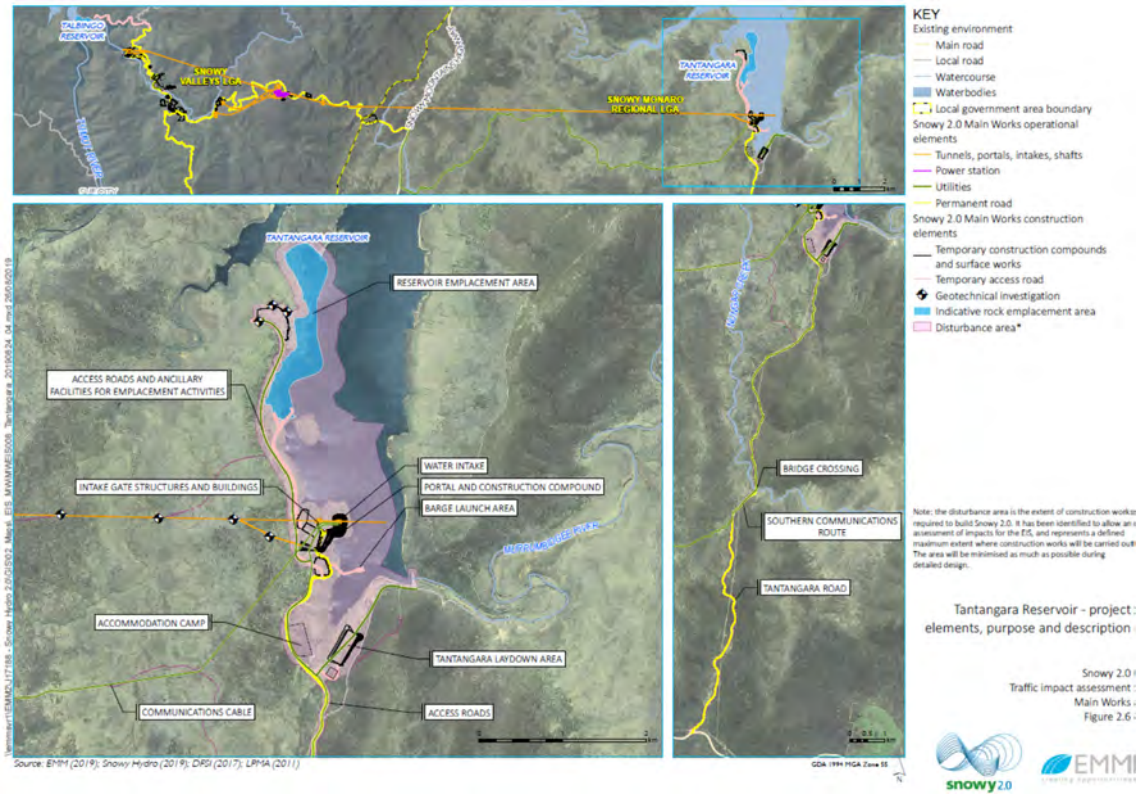
Source: EMM Consulting, June 2019

Figure 2.5 Snowy 2.0 locational areas – Plateau



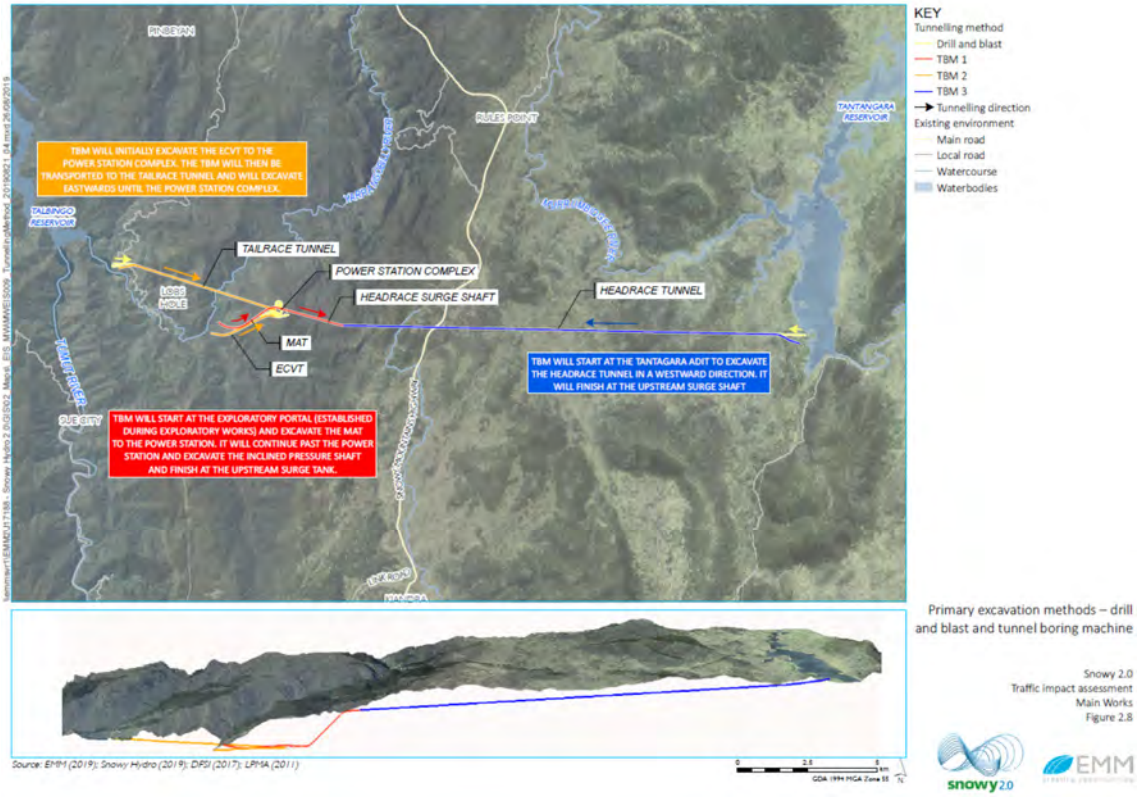
Source: EMM Consulting, June 2019

Figure 2.6 Snowy 2.0 locational areas – Tantangara and Rock Forest



Source: EMM Consulting, June 2019

Figure 2.7 Snowy 2.0 excavation and tunnelling methods



Source: EMM Consulting, June 2019

2.3 Operation of Snowy 2.0

2.3.1 Scheme operation and reservoir management

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

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

– collects releases from the Murrumbidgee River and the Goodradigbee River Aqueduct;

– provides a means for storage and diversion of water to Lake Eucumbene via the Murrumbidgee-Eucumbene Tunnel; and

– provides environmental releases through the Tantangara Reservoir river outlet gates to the Murrumbidgee River.

Talbingo Reservoir currently has the following operational functions:

– collects releases from Tumut 2 power station;

– collects releases from the Yarrangobilly and Tumut rivers;

– acts as head storage for water pumped up from Jounama Pondage; and

– acts as head storage for generation at Tumut 3 power station.

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

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

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

2.3.2 Permanent access

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

2.3.3 Maintenance requirements

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

– maintenance of equipment and systems within the power station complex, intake structures, gates and control buildings;

– maintenance of access roads (vegetation clearing, pavement works, snow clearing);

– dewatering of the tailrace and headrace tunnel (estimated at once every 15 to 50 years, or as required); and

– maintenance of electricity infrastructure (cables, cable yard, cable tunnel).

2.4 Rehabilitation and final land use

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

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

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

3.0 Existing traffic and transport environment

3.1 Study area

The Snowy 2.0 study area is located within the Snowy Monaro Regional and Snowy Valleys LGAs in an area that contains many of the highest mountains in Australia. During the snow season the area attracts an influx of visitors resulting in increased traffic volumes on the major road network. Outside of the snow season, recreational visitors access the study area to visit the National Park facilities, but the traffic volumes generated during these periods is low and mostly limited to school holiday periods.

The central point of the Snowy 2.0 study area is approximately 200 km by road from either Canberra, to the north-east, or Wagga Wagga, to the north west, as shown in **Figure 1.1**.

The nearest regional service towns to Snowy 2.0 are Tumut, approximately 80 km to the north-west and Cooma, 100 km to the south-east. The distance between these two service towns is approximately 180 km. Both towns are located on the Snowy Mountains Highway. Other communities within or close to the project area include Adaminaby, located approximately 50 km south east of the main project area and approximately 50 km by road from Cooma, and Talbingo, located approximately 40 km north west of the main project area and approximately 40 km by road from Tumut. Both Adaminaby and Talbingo provide a range of local facilities and services including fuel, shops, restaurants and accommodation.

The largest community within the study area is Cooma, which is served by Snowy Mountains and Monaro highways, that function as the main roads through the town centre to provide access to commercial and retail developments within Cooma. At the eastern fringe of Cooma lies Polo Flat which comprises mostly industrial developments generating a large portion of heavy vehicles within the region.

The proposed underground and surface construction areas associated with Snowy 2.0 extend over a distance of 25 km, from the lower intake/outlet at Talbingo Reservoir to the upper intake/outlet at Tantangara Reservoir and is located on either side of the Snowy Mountains Highway. The project area is serviced by a network of local roads, many of which are located within the KNP.

3.2 Existing transport context

3.2.1 Modes of travel

Based on the 2016 Australia Bureau of Statistics (ABS) Census data for the Snowy Monaro Regional and Snowy Valleys LGA, approximately 68% and 73% of the LGA populations respectively, travel to work by car as a driver or passenger. This represents 6,686 and 4,341 people respectively, totalling 11,027 people across the two LGAs. The percentage of people travelling to work by car as a driver or passenger is higher than the NSW and Australia averages of 65% and 68% respectively. A very low level (approximately 2% and 0.4%) of the population respectively in both these LGAs travel to work by public transport, due in part to the limited availability of public transport options in the area.

3.2.2 Public transport

3.2.2.1 Southern NSW train services

There are no train services in the study area. The nearest train stations are at Canberra, which has connecting train services to Goulburn, the Southern Highlands townships and Sydney three times a day, and at Wagga Wagga, which has services connecting to Melbourne and Sydney twice daily with interchange stops for coach services in Albury, Wagga Wagga, Griffith, Cootamundra, Canberra, Moss Vale and Bowral. Both rail stations are over 140 km away from the project area via road.

3.2.2.2 Southern NSW coach services

A Southern NSW road coach service operates between Wagga Wagga train station interchange and Tumut on Monday, Wednesday and Friday, and from Cootamundra train station interchange to Tumut every Tuesday, Thursday and Sunday.

Coach services also operate daily between Canberra interchange and Eden, stopping at Cooma, and a Canberra interchange to Bombala service that stops at Cooma every Monday, Wednesday and Friday.

There is only one designated coach stop in the township at Tumut and Cooma with both stops located in the centre of town.

3.2.2.3 Council supported bus services

Public transport provided by Snowy Valleys Council and private coach/bus services are available to people living in the Snowy Valleys LGA. Community transport provided by Council is for those in the Commonwealth Home Support Program (CHSP) group, people with disabilities and disadvantaged because of isolation and lack of transport. These services require booking in advance. Other private coach/bus services include school buses that service the local schools in the Snowy Valleys LGA.

There is also a bus service operated by Cooma Coaches which travels around Cooma on weekdays providing limited services during the morning and afternoon peaks.

Community transport is also provided by Snowy Monaro Regional Council, servicing people living in Cooma, Berridale and Bombala to and from Canberra and Bega for medical and social appointments, and to other regional towns for shopping on a fortnightly and monthly basis. People eligible for the Council's community transport are those of age 65 (Aboriginal people age 50) and above with disability, and persons disadvantaged because of their isolation and remoteness. Bus services from Cooma also operate more frequently during the winter season to ski resorts.

3.2.3 Walking and cycling

The study area contains significant hiking and mountain biking trails throughout the KNP. The locations, uses and potential project impacts on these facilities are detailed at Appendix X.2. Many of these trails lead to camp sites within the KNP that are not accessible by motor vehicle.

The local councils have also facilitated the location and construction of walking and cycling trails in the study area. Over the years, Councils have constructed shared trails (for walking and mountain bikes), as the Snowy Mountain is fast becoming a popular mountain biking destination. Some trails are opened during the weekend and some are open during mountain biking season from November.

Snowy Monaro Regional Council took the opportunity of constructing cycle ways in Cooma using the Federal Government's New Work Opportunity program during 1996. This included a cycleway beside Cooma Creek starting at the Rotary Oval end of Murray Street and continuing through to the Nijong Ovals (to the north of the Cooma township) and from Barrack Street over the footbridge and beside Vulcan Street to Lambie Street. This north-south off-road cycle path now extends further south from Rotary Oval to Church Road along Cooma Creek.

There is also a cycle route along Smith Street and Mittagang Road corridor that starts from Massie Street (to the north of Cooma township) as an on-road cycle route and off-road cycleway between Bowi Street and the northern end of Yallakool Road (RMS' Cycle Finder website).

3.2.4 Road network

The Snowy Mountains and Monaro highways will be the main transport routes that will be assessed by project generated traffic during both the construction and operational phases of the Snowy 2.0 project. The connecting local road network which will be used to access individual worksites, will also be assessed to determine the capacity of individual local roads to accommodate both the current baseline traffic and the future project generated traffic.

3.2.4.1 Snowy Mountains Highway

The Snowy Mountains Highway is a 333 km long state highway which connects from the Princes Highway north of Bega, via Bemboka to the Monaro Highway south of Nimmitabel, then from the Monaro Highway at Cooma via Adaminaby, Kiandra, Tumut and Adelong to the Hume Highway near Hillas Creek.

Within the KNP area, the Snowy Mountains Highway has a two-lane two-way sealed carriageway, generally varying between 6 to 8 m wide. The speed limit generally is 100 km/h on the rural sections, 60 km/h when approaching the townships of Cooma and Tumut, and 80 km/h when approaching Adaminaby.

When approaching the Snowy Mountains Highway/Miles Franklin Drive intersection near Talbingo in the downhill direction, the speed limit reduces to 60 km/h for light vehicle and 40 km/h for trucks and buses. At several sections of the highway where the road alignment involves sharp right or left turns, the speed limit may vary and is subject to advisory road signs. In the higher altitude regions, above 1,000 m altitude, where the highway is subject to snow and ice cover over the winter months, distinctive yellow line marking and tall red reflector posts are used for better visibility of the road and vehicles can be required to use snow chains when travelling on these higher sections of the highway, with speed reductions to 80 km/hr.

The road is an approved B-Double route for 25/26 m long B-Double vehicles to Talbingo from the north and to Adaminaby from the south and is approved throughout its length within the KNP for 19 m long vehicles.

The Snowy Mountains Highway intersects with Link Road, Miles Franklin Drive and other local roads nearer to the project worksite areas, which will be used for vehicle access to project worksites. In addition, the route via Elliott Way (Goat Ridge Road), from near Cabramurra to the areas around Tumbarumba may also be used by some of the project related traffic if construction materials and other locally based supplies are sourced from these areas, including areas in the vicinity of the NSW/Victoria border.

The Snowy Mountains Highway from Cooma to Adaminaby is outside the KNP area and is approximately 50 km long. It runs west from Cooma, then north-west after the intersection with Kosciuszko Road 6 km west of Cooma. It is a two-lane two-way highway with a road width varying from 6.6 to 7.2 m. The speed limit is generally 100 km/h, but it is reduced to 80 km/h when approaching Adaminaby.

Within the township of Cooma, there is a higher concentration of residential developments, and as such, the road environment is representative of an urban local road network, with a lower speed environment ranging between 50-60km/hr with roundabouts controlling the major intersections. The physical traits of the road reserve also differ with Cooma, with widened road reserves catering for on-street parking, kerb and guttering, footpaths and street lighting installed at short intervals.

During the winter snow season, traffic volumes along Snowy Mountains Highway increases with visitors destined for the ski fields within KNP. With Cooma serving as the main rest stop for visitors during the snow season, drivers can experience congestion along the main road of Sharp Street (an extension of Snowy Mountains Highway and Monaro Highway), especially with the increased turnovers of the on-street parking adjacent to the roundabout controlled intersections.

The Snowy Mountains Highway from Hume Highway (south) to Tumut is also outside the KNP area. It is approximately 43 km running southeast from Hume Highway, passing Adelong and turning north-east after the intersection with Batlow Road for approximately 5 km to reach Tumut. The two-lane two-way highway has a road width varying from 6.3 to 7.8 m. The speed limit is generally 100 km/h and reduces to 50 km/h near the town entrance and 35 km/h where it joins the Tumut Street in Adelong. An advisory speed limit of 75 km/h is posted at sharp bends on the highway. The speed limit also reduces to 80 km/hr in some sections in winter.

The Snowy Mountains Highway from Tumut to Talbingo provides entry to the KNP from the north. This 37 km long section connects Tumut to the north and Talbingo, via Miles Franklin Drive, to the south. The two-lane two-way highway has a road width of approximately 6.8 to 7.2 m and a general speed limit of 100 km/h.

3.2.4.2 Monaro Highway

The Monaro Highway is a 285 km long north-south highway connecting Canberra and Cooma where it joins the Snowy Mountains Highway at the intersection of Monaro Highway (Snowy Mountains Highway) / Bombala Street in Cooma. It continues further south, cross the Victoria border and eventually joins the Princes Highway, near Cann River. The Monaro Highway is the major access for most traffic to and from Canberra.

Within the study area, Monaro Highway is a two-lane two-way highway with road width varying from 7.4 to 10.3 m. The speed limit is generally between 80 km/h and 100 km/h in the rural area, reducing to 60 km/h on the approaches to Cooma. When entering school zones, speed limit reduces to 40 km/h between 8:00 and 9:30 am and between 2:30 and 4:00 pm.

Within the study area, Monaro Highway is generally an approved 25/26 m B-Double route apart from a section of road between Murray Street and Snowy Mountains Highway which is not permitted to carry B-Double vehicles.

3.2.4.3 Link Road

Link Road is a two-way rural road varying from 5.3 to 6.6 m wide between Elliott Way to the west and Snowy Mountains Highway to the east. This road provides connection between the Snowy Mountains Highway and Cabramurra (Snowy Hydro's town), which is accessible via the Link Road and Goat Ridge Road. It also provides access to the Selwyn Snow Resort during the winter season, which is accessible via Snowy Mountains Highway, the Link Road and Kings Cross Road. The road is approximately 15 km long and is fully sealed. Link Road is an undulating road with numerous bends with lower advisory speed limit signs on approaches. The sign-posted speed limit is 80 km/h, except in the vicinity of the NPWS ticket booth which is normally 60 km/hr, but 40 km/hr in ski season.

All intersections on Link Road are basic T-intersections, except for its intersection with Snowy Mountains Highway where an auxiliary right turn (AUR) and auxiliary left turn (AUL) is provided on the major road to allow left and right turning movements to access Link Road. Link Road is not an approved B-Double route.

3.2.4.4 Kings Cross Road (also known as Mount Selwyn Road)

This road, although mostly unsealed, provides a shorter connection between Link Road, near the Selwyn Snow Resort and Cabramurra village, compared to the fully sealed route via Link Road and Goat Ridge Road.

Kings Cross Road is sealed for the initial 3 km of its length between Link Road and the Mount Selwyn Resort. The last 1 km at the western end near Cabramurra is unsealed, but generally straight and level. It is a two-lane two-way road with a general speed limit of 100 km/h, although lower speed limits apply in the vicinity of the Selwyn Snow Resort. The centre line of the road is not marked. Sealed sections have a width between 5 and 6 m, while the unsealed section has a width of approximately 7 m. All intersections are of a basic T-form. Kings Cross Road is not an approved B-Double route.

3.2.4.5 Lobs Hole Ravine Road

The northern section (which will be used for at least emergency use) is 23 km long, single lane and gravel. The southern section of Lobs Hole Ravine Road is approximately 14 km of narrow, single lane, unsealed road linking between Link Road to the future project worksite within the Lobs Hole-Ravine Reserve. The road has narrow sections along cliff edges and the road width varies from 3.0 to 4.6 m.

The existing road alignment will be substantially widened to dual lane in each direction and reconstructed for use by the project construction traffic. All internal intersections are proposed to be of a basic T-junction. Lobs Hole Ravine Road is not an approved B-Double route.

3.2.4.6 Marica Track

Marica Track is an ‘off-road’ 4WD access only fire trail which commences approximately 2.7 km south of Snowy Mountains Highway, along Wallaces Creek Trail. Marica Track is not an approved B-Double route.

A new access road will be built to support transport of construction equipment and personnel over the general route traversed by the existing Marica Track alignment. The new access road will require a new access intersection to be constructed at the Snowy Mountains Highway, approximately 2 km south of the existing Coppermine Trail access intersection.

3.2.4.7 Tantangara Road

Tantangara Road is a local road running in a north-south direction from the Snowy Mountains Highway to Tantangara Reservoir. It is a two-lane two-way road with a speed limit of 100 km/h generally as there is no speed limit posted. Some bends have lower advisory speed limit warning signs. It is an unsealed road with a general trafficable width of at least 6 m on most sections. Some sections of the road surface have frequent corrugations and loose gravel. Large potholes which retain water are also present on many sections. All intersections are of a basic T-junction and lack additional turning lanes and other traffic capacity or safety improvements.

Tantangara Road is currently not an approved B-Double route.

3.2.4.8 Polo Flat Road

Polo Flat Road is a 4 km long fully sealed road, connecting Monaro Highway to the north and the Snowy Mountain Highway to the south. It runs through the middle of the Polo Flat industrial area. The road width varies from 6.0 to 8.6 m with speed limit capped at 80 km/h within the industrial area. The centre line of the road is marked.

There is a non-operational railway level crossing approximately 645 m south of Monaro Highway to the north. The railway level crossing is controlled by give way signs. The railway is currently operated by a local historic railway group, however it is not running trains at present due to the need to upgrade railway infrastructure.

There is a railway bridge on Polo Flat Road near its intersection with Baron Street, with low clearance of 4.1 m. Polo Flat Road is an approved 25/26 m B-Double route.

3.2.4.9 Saleyards Road

Saleyards Road is a 209 m long fully sealed road, connecting Snowy Mountains Highway to the south and Polo Flat Road to the north. It is a two-lane two-way local road with a road width varying from 10 to 13 m. It provides a bypass route from Monaro Highway to Polo Flat Road for heavy vehicles more than 4.1 m in height.

Saleyards Road is an approved 25/26 m B-Double route.

3.2.4.10 Yareen Road

Yareen Road is a 1.6 km long fully sealed local road, connecting Monaro Highway to the west and Polo Flat Road to the east. There are residential dwellings on both sides of the road. The road width varies from 7.3 to 8.8 m with a speed limit of 60 km/h. The centre line is marked.

There is a non-operational railway level crossing approximately 93 m west of Monaro Highway, which was controlled by flashing lights and stop signs. The railway is currently operated by a local historic railway group, however it is not running trains at present due to the need to upgrade railway infrastructure. Yareen Road is an approved 19 m B-Double route with travel conditions: no travel is permitted between 7:00 am to 9:00 am and 3:00 pm to 5:00 pm on school days.

3.2.5 Key intersections

3.2.5.1 Link Road / Lobs Hole Ravine Road

The current configuration of Link Road/Lobs Hole Ravine Road intersection is a T-junction. The minor road has an unsealed surface up to the edge of the though traffic lane on the major road.

Figure 3.1 Intersection of Link Road / Lobs Hole Ravine Road, facing west

Source: EMM Consulting

3.2.5.2 Snowy Mountains Highway / Link Road

The current configuration of the Snowy Mountains Highway/Link Road intersection is a T-junction with an auxiliary left-turn (AUL) and a channelised right-turn (CHR) on the major road of Snowy Mountains Highway to allow left and right turning movements to access Link Road.

Figure 3.2 Intersection of Snowy Mountains Highway / Link Road, facing north

Source: EMM Consulting

3.2.5.3 Snowy Mountains Highway / Tantangara Road

The current configuration of the Snowy Mountains Highway/Tantangara Road intersection is a basic T-junction. Tantangara Road has widened road shoulders to allow for turning vehicles. In addition, there is wide sealed shoulder on the inside radius of the Snowy Mountains Highway.

Figure 3.3 Intersection of Snowy Mountains Highway / Tantangara Road, facing west

Source: EMM Consulting

3.2.5.4 Snowy Mountains Highway / Kosciuszko Road

The current configuration of the Snowy Mountains Highway/ Kosciuszko Road intersection is a T-junction with both rural auxiliary left-turn (AUL) and right-turn (AUR) treatments provided along the major road to allow left and right turning movements for cars and trucks to access the minor arm of Snowy Mountains Highway.

Figure 3.4 Intersection of Snowy Mountains Highway / Kosciuszko Road, facing south

Source: Google map

3.2.5.5 Snowy Mountains Highway / Vale Street

The current configuration of the Snowy Mountains Highway/Vale Street intersection is a single lane roundabout with 13 m diameter island. All approaches to the intersection are two-lane two-way roads including Snowy Mountains Highway that runs in an east-west direction as a B-Double route. The intersection is located in the Cooma township with large number of angled on-street parking provided on Vale Street and Snowy Mountains Highway to service the local centre.

Figure 3.5 Intersection of Snowy Mountains Highway / Vale Street, facing north

Source: Google map

3.2.5.6 Monaro Highway (Snowy Mountains Highway) / Bombala Street

The current configuration of Monaro Highway (Snowy Mountains Highway) /Bombala Street intersection is a single lane roundabout with 13 m diameter island. All approaches to the intersection are two-lane two-way roads including Snowy Mountains Highway and Monaro Highway that runs in an east-west direction as a B-Double route. The intersection is located in the Cooma township with large number of angled on-street parking provided on all approaches to service the local centre.

Figure 3.6 Intersection of Monaro Highway (Snowy Mountains Highway) / Bombala Street, facing north

Source: Google map

3.2.5.7 Monaro Highway / Yallakool Road

The current configuration of Monaro Highway/ Yallakool Road intersection is a basic T-junction. This intersection is located within 100 m of the Polo Flat Road intersection along Monaro Highway.

Figure 3.7 Intersection of Monaro Highway / Yallakool Road, facing north

Source: Google map

3.2.5.8 Monaro Highway / Polo Flat Road (north end)

The current configuration of the Monaro Highway/Polo Flat Road (north end) intersection is a basic T-junction with a rural auxiliary left-turn treatment (AUL) on the major road to allow left turning movements for cars and trucks to access the minor road.

Figure 3.8 Aerial layout of Monaro Highway/Polo Flat Road (north end) intersection

Source: EMM Consulting

3.2.5.9 Monaro Highway / Saleyards Road (south of Polo Flat Road)

The current configuration of the Monaro Highway/Saleyards Road intersection is a basic T-junction with a rural basic BAR/BAL treatment (i.e. parallel widened shoulder) to allow turning movements for cars and trucks.

Figure 3.9 Aerial layout of Monaro Highway / Saleyards Road intersection, facing south east

Source: EMM Consulting

3.3 Existing traffic volumes

3.3.1 Overview

Existing TfNSW daily traffic counts (AADT) have been supplemented with more recent intersection and tube counts undertaken specifically for this project.

Tube counts were undertaken at 16 locations during investigations for the Exploratory Works EIS (not shown) and at ten further locations (one week) for the Main Works EIS (as shown at **Annexure A**). These one-week tube counts are taken to be representative of typical 24-hour volumes for each of the defined roads.

Intersection counts were undertaken (also shown at **Annexure A**) at thirteen locations for the Main Works EIS which cover the morning and afternoon peaks providing information on peak hourly intersection turning movements and heavy vehicle traffic proportions.

Intersection counts for same locations were also undertaken on weekdays and weekends in June, July and August 2019 during the start of the ski season as well as winter school holidays.

It should be noted that:

– project specific counts have been taken both outside the main winter school holiday periods and during winter school holiday periods to capture seasonal peaks associated with winter holiday recreational traffic in the KNP resort area (i.e. Mount Selwyn);

– intersection traffic counts were taken during the week and for limited duration (generally one day); and

– tube counts were undertaken for much longer periods (up to four months in the KNP area).

3.3.2 Daily traffic volumes

Historic daily traffic volumes for the main project access routes have been determined from published TfNSW daily traffic surveys for the years where the data is available (which is generally between 2010 and 2018) and are summarised in **Table 3-1**. To establish base 2018 daily traffic volumes if TfNSW statistics are not available, it is standard practice in most rural areas of NSW to add +1% annual (linear) traffic growth to the most recent annual survey.

Table 3-1 Historic daily traffic volumes

Station ID	Road	2010	2011	2015	2017	2018	Average % of heavy vehicle
95108	Snowy Mountains Highway (5 km west of Tumut)	2,555	2,683	-	-	2,871[1]	21%[2]
95104	Snowy Mountains Highway (270 m south of Tumut)	1,208	1,295	-	-	1,386[1]	8%[2]
08158	Snowy Mountains Highway (400 m east of Adaminaby)	797	798	776	-	799[1]	-
08080	Snowy Mountains Highway (100 m east of Pine Valley)	3,454	3,637	-	4,065	3,976	-
6113	Monaro Highway (400 m east of Cooma)	-	-	5,140	5,367	5,525	12%[2]
08082	Monaro Highway (1.54 km north of Bunyan)	4,301	4,344	4,370	4,685	4,773	-
6114	Monaro Highway (1.94 km south of Bredbo)	-	-	4,778	5,180	5,148	12%[2]

Note: 1. +1% annual (linear) traffic growth has been adopted, which gives a growth factor x 1.01 from the 2017 volumes; x 1.03 from the 2015 volumes; x 1.07 from the 2011 volumes; and x 1.08 from the 2010 volumes.
2. Average proportion of heavy vehicles on the Snowy Mountains Highway are assumed based on 2010 and 2011 statistics; results on the Monaro Highway are assumed based on 2015, 2017 and 2018 statistics.

Source: RMS Traffic Volume Viewer (TfNSW 2018)

Baseline daily (two-way) traffic volumes for the main project access routes have also been determined from tube counts undertaken in 2018 and 2019 and are summarised in **Table 3-2**.

Table 3-2 Baseline daily total traffic volumes

Road	Location	Non-winter period[1]			Winter holiday period[2]		
		Light vehicles	Heavy vehicles	% Heavy vehicles	Light vehicles	Heavy vehicles	% Heavy vehicles
Link Road	West of Lobs Hole-Ravine Road	206	22	10%	Not available		
Link Road	Between Kings Cross Road and Snowy Mountains Highway	316	44	12%	1,382 (Sunday of Queen's Birthday Weekend 2019)		
Snowy Mountains Highway	North of Link Road (Garden Gully Creek)	436	79	15%	Not available		
Snowy Mountains Highway	North of Yarrangobilly Caves intersection	385	70	15%	Not available		
Snowy Mountains Highway	West of Cooma	3,499	477	12%	9,311 (Sunday of Queen's Birthday Weekend 2019)		
Snowy Mountains Highway	SMEC Offices	4,261	586	12%	Not available		
Monaro Highway	Cooma (west of Polo Flat Road)	4,888	1,509	24%	Not available		
Monaro Highway	South of Cooma	1,524	971	39%	Not available		
Monaro Highway	East of Polo Flat	4,198	683	14%	10,953 (Friday of Queen's Birthday Weekend 2019)		
Polo Flat Road	Polo Flat North	1,036	806	44%	Not available		
Polo Flat Road	Polo Flat South	1,102	1,067	49%	Not available		

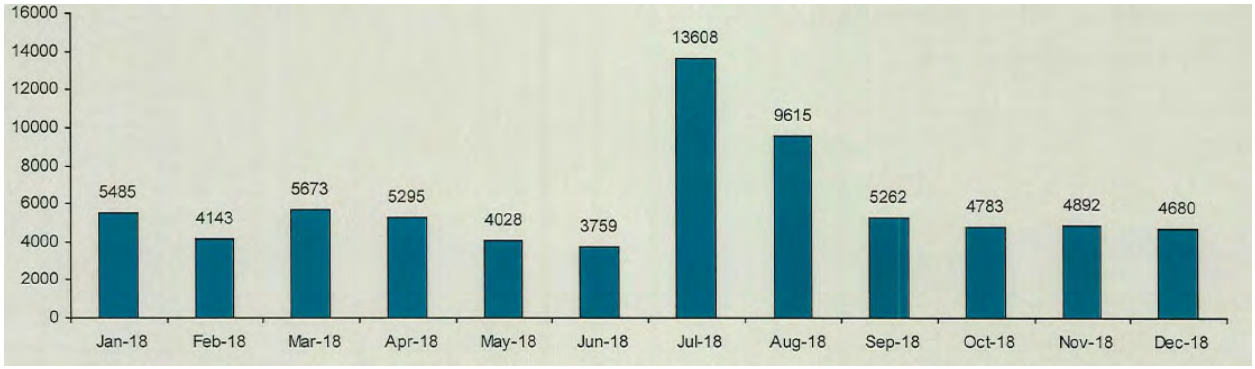
Note: 1. Non-winter holiday period data were collected in March / April of 2019.
2. Winter holiday period data were collected in June / July / August of 2019.

Source: EMM Consulting

3.3.3 Seasonal traffic variation

Given the location of the ski fields and resorts in the Snowy Mountains, it is expected there are significant seasonal variations in visitors and associated traffic in the road network within the study area. As shown in **Figure 3.10**, traffic recorded on Link Road by National Parks and Wildlife Service shows that traffic peak occurred in the month of July, i.e. 13,608 vehicles, which is more than double the average monthly traffic volume (5,935 vehicles) across the year.

Figure 3.10 Traffic count on Link Road by month in 2018



Source: NSW National Parks and Wildlife Service

The main roads through the Cooma area including the Snowy Mountains Highway and Kosciuszko Road routes towards the Adaminaby/Kiandra and Jindabyne/Thredbo areas, have significantly higher daily and peak hourly traffic volumes during the winter peak snow season periods, especially on weekends and during public holiday or school holiday periods, in particular when there are heavy snowfalls and good skiing conditions.

There were heavy snowfalls and good skiing conditions in all the NSW ski resorts during the June 2019 Queen's Birthday long weekend, from Friday to Monday and the daily traffic volumes on all the key approach routes to four

intersections in the Cooma and Kiandra areas were recorded by 24-hour camera intersection traffic surveys at the following locations:

– intersection of Monaro Highway / Polo Flat Road (north end) – East of Cooma;

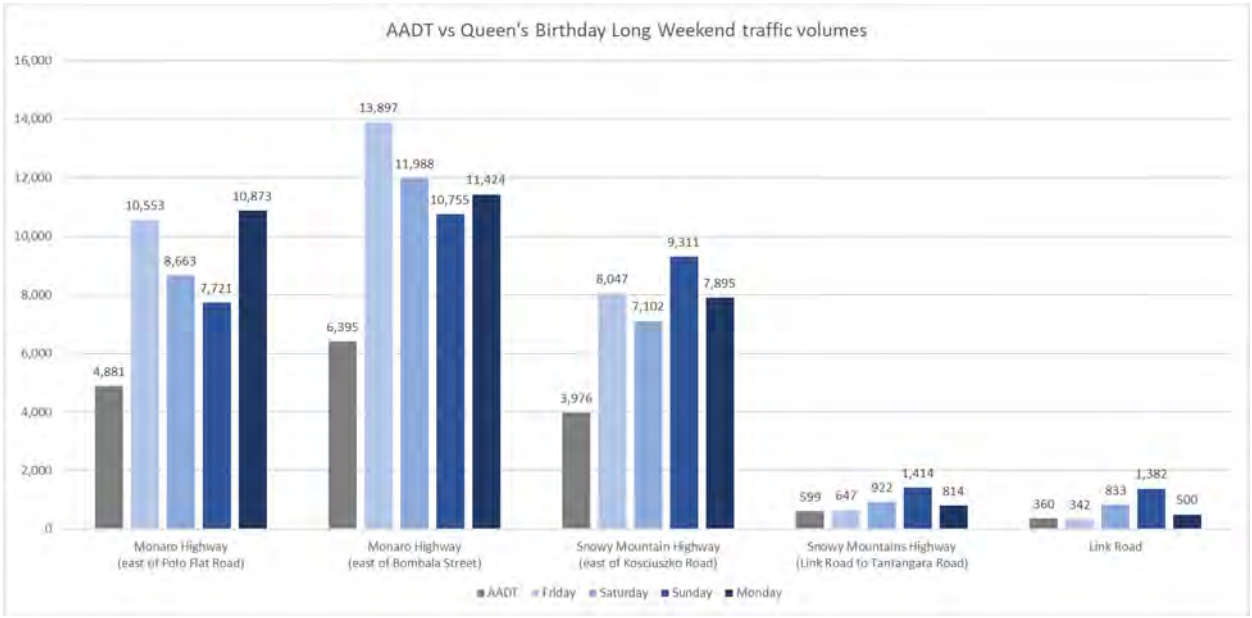
– intersection of Monaro Highway (Snowy Mountains Highway) / Bombala Street – Centre of Cooma;

– intersection of Snowy Mountains Highway / Kosciuszko Road – West of Cooma; and

– intersection of Snowy Mountains Highway / Link Road – at Kiandra.

From these intersection camera surveys, the 24-hour daily traffic volumes were determined for the key approach routes and these winter peak daily traffic volumes were compared with the average year baseline daily traffic volumes for the relevant road in **Figure 3.11**.

Figure 3.11 AADT vs Queen's Birthday long weekend traffic volumes



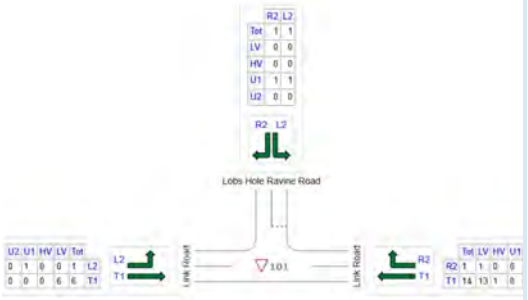
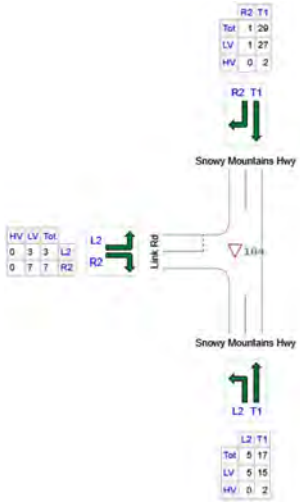
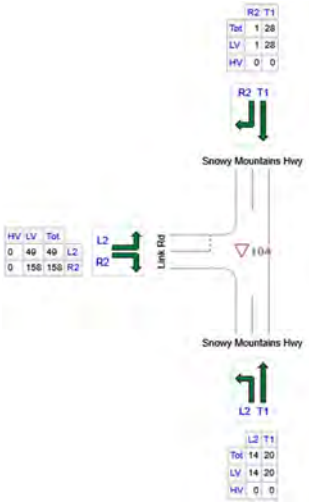
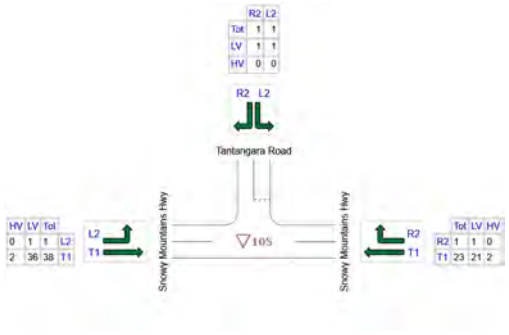
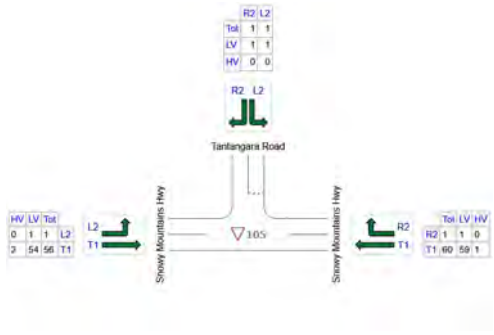
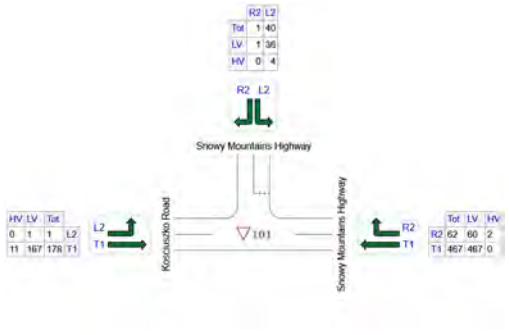
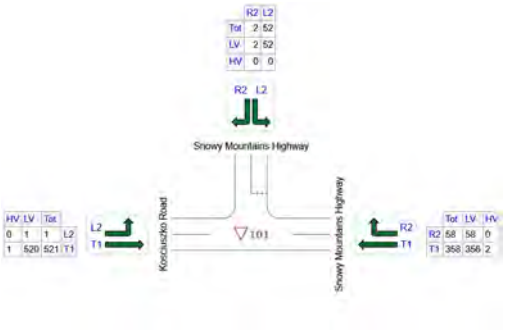
Source: EMM Consulting, June 2019

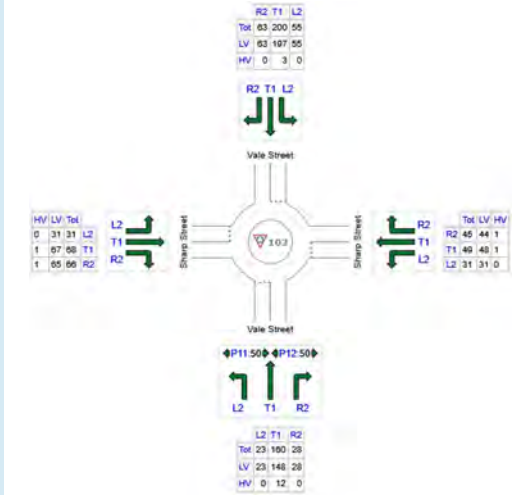
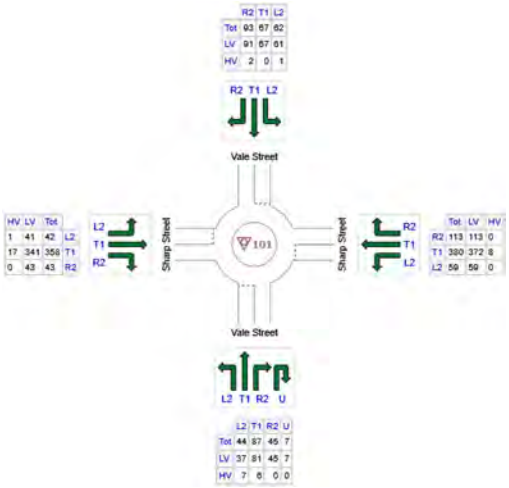
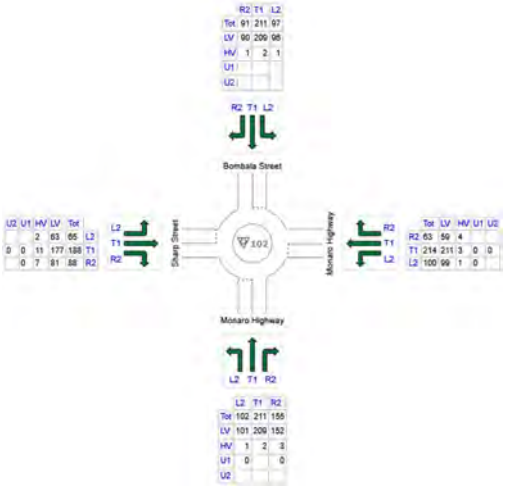
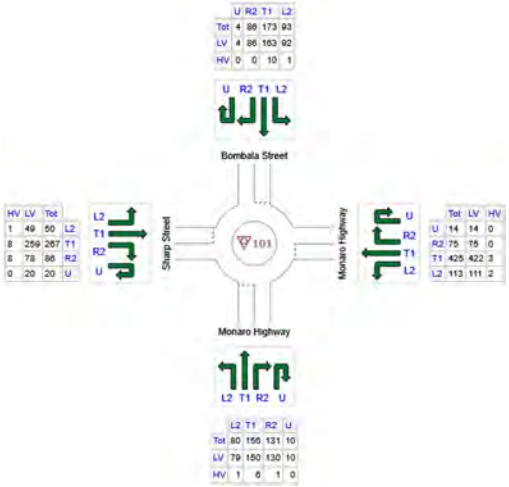
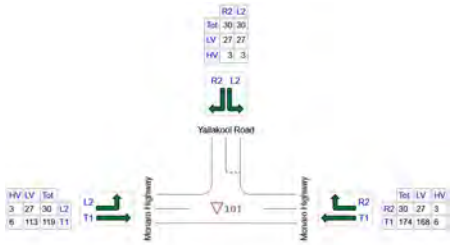
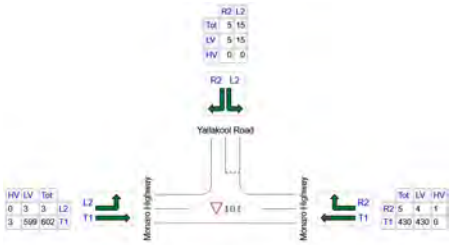
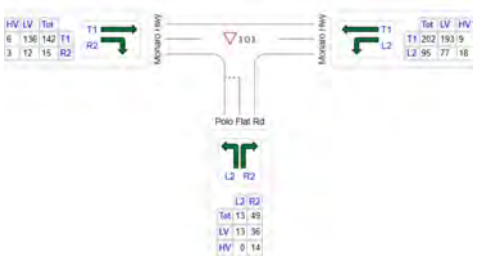
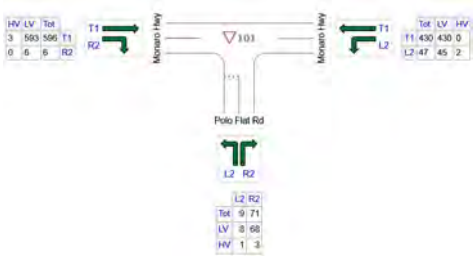
The main roads within Cooma and the major corridors of Snowy Mountains Highway and Kosciuszko Road towards the Adaminaby / Kiandra and Jindabyne / Thredbo areas, experience significantly increased daily and peak hourly traffic volumes during the winter peak snow season periods, as well as on weekends, public holiday and school holiday periods.

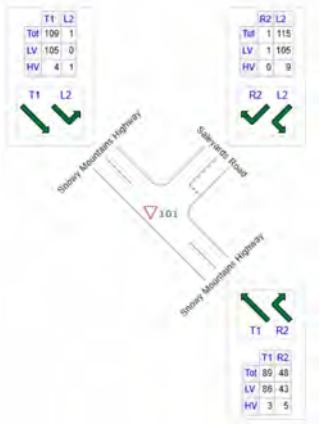
3.3.4 Intersection traffic volumes

Weekday peak hour traffic volumes during non-winter period as well as weekend peak hour traffic volumes during winter holiday period for a number of critical intersections along the main project access routes have been determined from intersection traffic counts undertaken in 2019 and are summarised in **Table 3-3**. It is noted that the peak hour of the weekday during the non-winter periods (namely weekday PM peak) as well as the peak hour during the winter peak (typically Friday PM peak) were selected to assess the worst hourly conditions for the intersections.

Table 3-3 Weekday peak hour intersection traffic volumes

Intersection	Non-winter period[1]	Winter holiday period[2]
Link Road / Lobs Hole Ravine Road		Not available
Snowy Mountains Highway / Link Road		
Snowy Mountains Highway / Tantangara Road		
Snowy Mountains Highway / Kosciuszko Road		

Intersection	Non-winter period[1]	Winter holiday period[2]
Snowy Mountains Highway / Vale Street		
Monaro Highway (Snowy Mountains Highway) / Bombala Street		
Monaro Highway / Yallakool Road		
Monaro Highway / Polo Flat Road (north end)		

Intersection	Non-winter period[1]	Winter holiday period[2]
Monaro Highway / Saleyards Road (south of Polo Flat Road)		Not available

Note: T1=through movement, L2=left turn movement, R2=right turn movement, LV=light vehicles, HV=heavy vehicles
1. Non-winter holiday period data were collected in March / April of 2019.
2. Winter holiday period data were collected in June / July / August of 2019.

Source: SCT Consulting

3.4 Network assessment criteria

The three key traffic assessments undertaken for the purpose of this study are crash data review, road conditions and safety implications and intersection capacity assessment, which are summarised in **Table 3-4**.

Table 3-4 Assessment and criteria

Assessment	Criteria
Crash Review	Crash data analysis (Section 3.5)
Road Conditions / Safety Assessment	Safe intersection sight distance (sections 3.6 and 4.4) Road width (sections 3.6 and 4.4)
Intersection Capacity Assessment – Critical Intersections	Austroads intersection warrants (sections 3.7 and 4.5) Level of Service (sections 3.7 and 4.5) Degree of Saturation (sections 3.7 and 4.5)

Based on these parameters, the performance of the existing road network can be established to quantify and benchmark any potential impacts caused as a result of traffic generated by the project.

3.4.1 Safe Intersection Sight Distance

Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections identifies that a Safe Intersection Sight Distance (SISD) should be provided along a major road at any intersection, this is to ensure that a vehicle entering the road has sufficient sight distances of oncoming vehicles. As such, SISD is dependent on the travel speed of oncoming vehicles on the main road, road alignment and types of vehicles.

Austroads provides the following formula to determine the SISD:

$$SISD = \frac{D_T \times V}{3.6} + \frac{V^2}{254 \times (d + 0.01 \times a)}$$

Whereby,

SISD = Safe Intersection Sight Distance

D_T = decision time (sec) = observation time (3 sec) + reaction time (sec)

V = operating (85th percentile) speed (km/h)

d = coefficient of deceleration

a = longitudinal grade in %

3.4.2 Intersection Level of Service

Operational performance is typically measured through an assessment of the throughput of vehicles across a traffic network, with average delay per vehicle used to assess the performance of an individual intersection. The average delay per vehicle measure is linked to a Level of Service (LOS) index which characterises the intersection's operational performance. **Table 3-5** provides a summary of the LOS performance bands of intersections.

Table 3-5 Level of Service definition

Level of Service	Average Delay (seconds per vehicle)	Roundabout	Give Way / Stop Signs
A	Less than 14.5	Good operation	Good operation
B	14.5 to 28.4	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	28.5 to 42.4	Satisfactory	Satisfactory, but accident study required
D	42.5 to 56.4	Operating near capacity	Near capacity and accident study required
E	56.5 to 70.4	At capacity. Roundabouts require other control methods	At capacity, requires other control method
F	>70.5		

Source: Roads and Maritime Guide to Traffic Generating Developments (2002)

Degree of saturation (DoS) is used as a measure of the capacity of the intersection. This is determined by the ratio of the volume of vehicles that can pass through the intersection against the capacity provided by the green time, if applicable, and number of available traffic lanes, i.e. vehicle / capacity = DoS.

3.4.3 Austroads intersection warrants

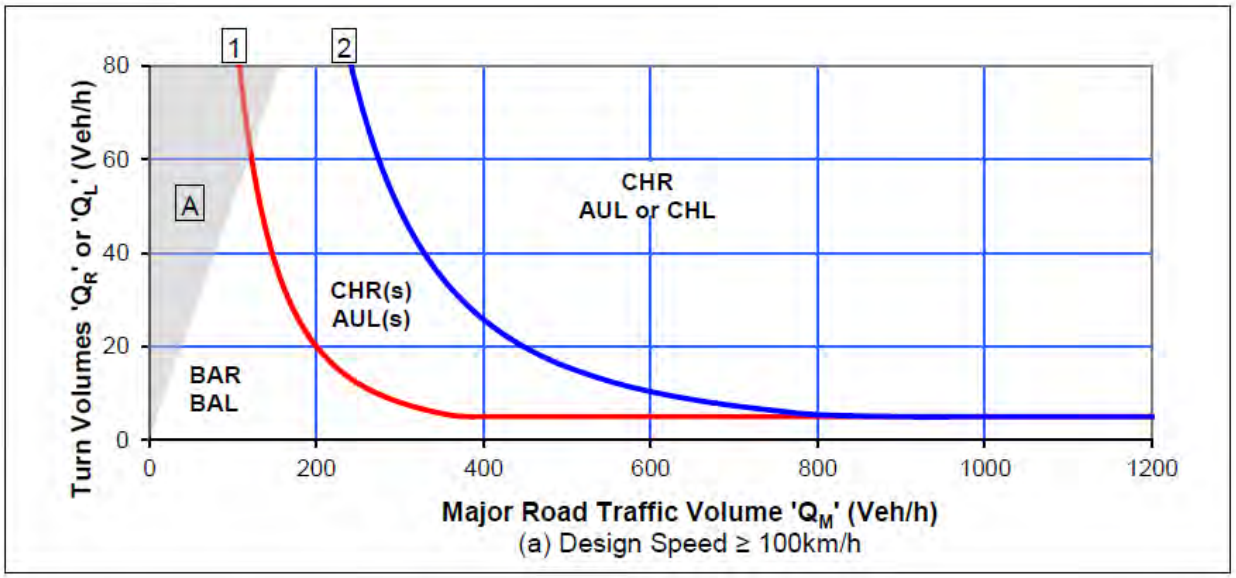
Rural intersection operations are assessed from the combination of the peak hourly through and turning traffic movements that are occurring at each intersection. This determines the need for additional intersection turning lanes in accordance with the current Austroads (2017) Part 4 intersection design standards and the Austroads (2017) warrant design charts shown in **Figure 3.12**.

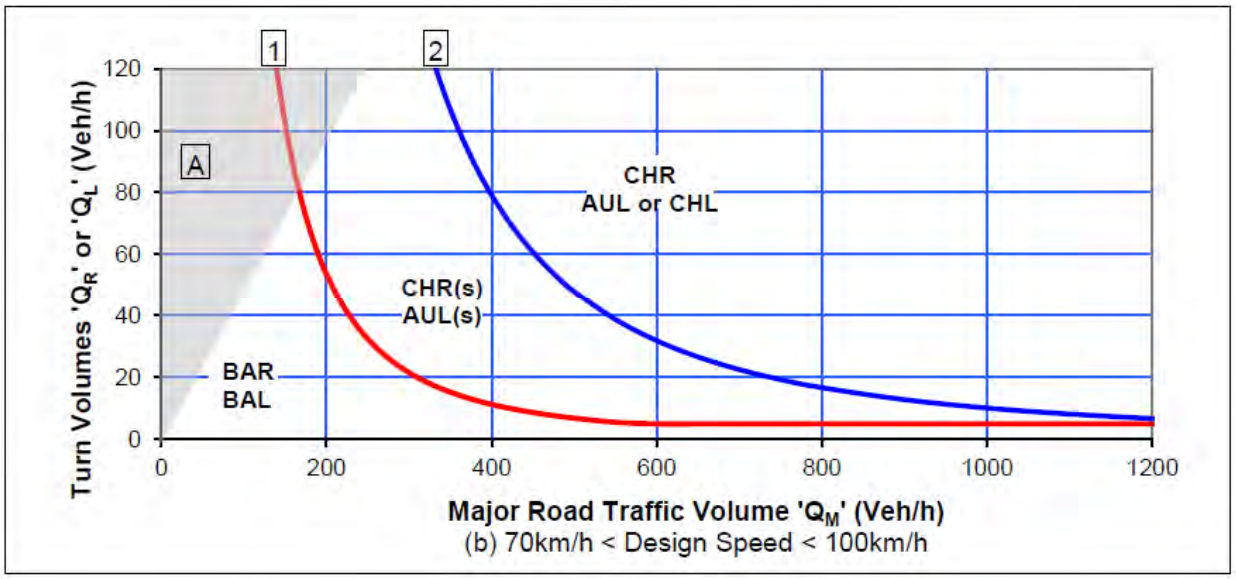
There are separate design charts for roads with design speeds either 100 km/h and greater, or lower than 100 km/h. For design speeds of 100 km/h or greater, additional left or right turn traffic lanes are only required where the major road peak hourly traffic volume exceeds 120 vehicles per hour and the minor road traffic also exceeds the level shown in the top warrant chart in **Figure 3.12**.

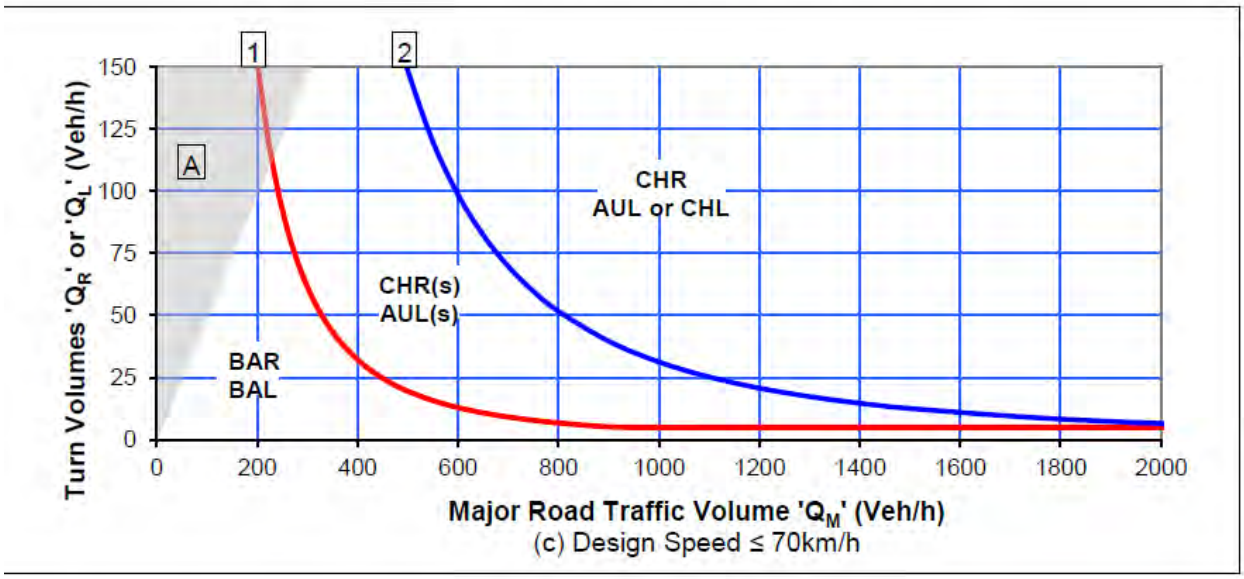
For design speeds lower than 100 km/h, additional left or right turn traffic lanes are only required where the major road peak hourly traffic volume exceeds 170 vehicles per hour and the minor road traffic also exceeds the level shown in the lower warrant chart in **Figure 3.12**.

Junctions on major roads are classified as either Basic Treatments (BA), which are basic road connections without any additional capacity to cater for turning movements, Auxiliary Treatments (AU), whereby short auxiliary lanes are provided to improve safety or Channelised Treatments, whereby conflicted movements are separated by raised or painted medians and/or islands. Based on these classifications, the guideline offers the warrants for intersection improvements based on the traffic volumes.

Figure 3.12 AUSTROADS warrants for turn treatments on major roads at unsignalised intersections







Source AUSTROADS Guide to Traffic Management Part 6 – Intersections, Interchanges and Crossings, Figure 2.25

3.5 Crash review

The general traffic safety conditions on four segments of the Snowy Mountains Highway and the townships of Cooma and Tumut have been reviewed for the most recent five-year accident history (years 2013 to 2017 inclusive) using the TfNSW interactive accident history database (TfNSW 2018). Only reported accidents are recorded within the TfNSW interactive accident history database. The categorised accident history is provided in **Table 3-6** and illustrated in **Annexure B**.

Most reported accidents occur at off-road left and right bends on the Snowy Mountains Highway. There are also several accidents caused by struck animals on the highway. Rear-end collisions and cross traffic accidents become more frequent in the townships of Cooma and Tumut. Accidents reported during daytime are slightly more than those at night.

Table 3-6 Summary of accident history on the Snowy Mountains Highway and Cooma township from 2013 to 2017

Location	Degree of crash	Total number of crashes	Total injury crashes
Monaro Highway East of Bombala Street to Polo Flat Road (north)	Minor	2	10
	Moderate	6	
	Serious	2	
	Fatal	0	
Monaro Highway South of Polo Flat Road (south)	Minor	1	4
	Moderate	3	
	Serious	0	
	Fatal	0	
Polo Flat Road	Minor	2	4
	Moderate	2	
	Serious	0	
	Fatal	0	
Saleyards Road	Minor	0	0
	Moderate	0	
	Serious	0	
	Fatal	0	
Snowy Mountains Highway West of Bombala Street to Chapman Street	Minor	1	7
	Moderate	3	
	Serious	2	
	Fatal	1	
Township of Cooma	Minor	9	55
	Moderate	32	
	Serious	13	
	Fatal	1	
Snowy Mountains Highway from Cooma to Adaminaby	Minor	4	16
	Moderate	6	
	Serious	5	
	Fatal	1	
	Minor	8	30
	Moderate	14	

Location	Degree of crash	Total number of crashes	Total injury crashes
Snowy Mountains Highway from Adaminaby to Snowy Monaro LGA boundary	Serious	7	
	Fatal	1	
Snowy Mountains Highway from Snowy Monaro LGA boundary to Talbingo	Minor	2	10
	Moderate	4	
	Serious	4	
	Fatal	0	
Snowy Mountains Highway from Talbingo to Tumut	Minor	1	4
	Moderate	0	
	Serious	3	
	Fatal	0	
Township of Tumut	Minor	8	45
	Moderate	23	
	Serious	13	
	Fatal	1	

Source: TfNSW Centre for Road Safety – Interactive crash statistics – LGA view

The Snowy Mountains Highway is divided into 4 segments from Cooma to Tumut and the average number of crashes per kilometre from 2013 to 2017 is calculated for each segment. The results are summarised in **Table 3-7**. The results suggest that traffic crashes are most frequent on the highway segment from Adaminaby to the LGA boundary.

Table 3-7 Average accident per kilometre on the Snowy Mountains Highway from 2013 to 2017

Location	Approximate length (km)	Crashes per kilometre
The Snowy Mountains Highway from Cooma to Adaminaby	50	0.32
The Snowy Mountains Highway from Adaminaby to LGA boundary	56	0.54
The Snowy Mountains Highway from LGA boundary to Talbingo	34	0.29
The Snowy Mountains Highway from Talbingo to Tumut	36	0.11

Source: TfNSW Centre for Road Safety – Interactive crash statistics – LGA view

The number of reported crashes on the local roads and other minor roads connected to the Snowy Mountains Highway is too low to present statistically significant data. The total numbers of reported accidents on these roads from 2013 to 2017 are summarised in **Table 3-8**.

Table 3-8 Total number of crashes on local roads from 2013 to 2017

Location	Number of reported crashes
Tantangara Road	0
Link Road	1
Kings Cross Road	1
Lobs Hole Ravine Road	0
Miles Franklin Drive	1

Source: TfNSW Centre for Road Safety – Interactive crash statistics – LGA view

3.6 Road conditions / safety assessment

A preliminary assessment has been undertaken to determine the suitability of existing road width against the baseline traffic, on roads where construction traffic is expected. In summary the review has identified:

– The external road sections that were identified as non-compliant against Austroads (2016) design standards, such as Polo Flat Road and Monaro Highway, are either current approved B-Double routes or are currently used by large volumes of heavy vehicles and possess significant spare capacity under current conditions. The expected increase of project traffic on these road sections will be relatively minor compared to their spare capacities. Hence, it is not expected these road sections will require any upgrades.

– The only exception is Link Road for the following reasons:

  - part of Link Road is less than 6.0 m wide with no centreline;
  - Link Road provides access to the Selwyn Snow Resort which experiences significant traffic queuing during peak snow season weekends specifically and during the winter holiday period more generally (between June and September); and
  - a relatively large number of additional project vehicles will be using Link Road.

– A review of available accident data has identified a section of the Snowy Mountains Highway between Link Road and Tantangara Road where there is a cluster of accidents associated with the corresponding section having reduced pavement width in comparison with other sections of the Snowy Mountains Highway.

Hence a more detailed safety review (a road safety audit) has been undertaken by Safe Systems Solutions for the proposed haulage route that is to be used for the transport of precast concrete segments that will be manufactured at the Polo Flat site and used to line the various tunnels that make up Snowy 2.0 Main Works. The haulage route commences at the point of vehicular access/egress at the segment factory at Polo Flat and ends at the perimeter of the Snowy 2.0 Main Works construction site within KNP at Link Road, through Monaro Highway, Sharp Street and Snowy Mountains Highway. The key findings of the road safety audit (safety items identified with medium or higher level of risks only) are summarised in **Table 3-9**.

The full road safety audit is included in **Annexure C**.

Table 3-9 Summary of issues identified from road safety audit

Item #	Location	Key audit findings	Risk assessment		
			Frequency	Severity	Level of risk
a ii	Polo Flat Rd – Rail bridge	Along Polo Flats Road, near the Baron Street intersection, there is an existing timber rail bridge. There is a low clearance for the bridge structure of 4.1 m. Also, the timber piers are unprotected. A Heavy Vehicle (HV) colliding with either the top of the rail bridge or one of the timber piers could potentially collapse the structure. It is assumed that this is a non-active rail bridge.	Improbable	Serious	Medium
b ii	Sharp Street (Cooma Town Centre) - Pedestrians	The strip shopping centre environment increases the likelihood of pedestrian jay-walking. A crash involving a pedestrian and fully-laden Heavy Vehicle has the potential to result in serious/fatal outcomes – even in a low speed environment.	Improbable	Serious	Medium
b iii	Sharp Street (Cooma Town Centre) - Cooma Creek Bridge	The Cooma Creek Bridge has non-standard features including: a. The vertical face of the concrete barrier. This is a rigid, fixed object. Should an errant vehicle collide with this vertical edge, there would be rapid deceleration increasing the impact force on the occupants. b. The concrete barrier tapers from kerb height (approx. 100 mm) to approx. 500 mm. Should a vehicle leaving Cooma mount the barrier on the bridge, then travel along the concrete barrier system (one side of the vehicle on the barrier and the other on the road pavement) this could potentially lead to a roll-over crash. c. The existing bridge containment appears to be a pedestrian parapet and would be unlikely to contain an errant Heavy Vehicle. A HV that loses control at this site, could drive through the containment system and fall into the creek below.	Improbable	Serious	Medium
c i	Intersection of Snowy Mountains Hwy / Kosciuszko Rd	The Snowy Mountains Highway continues straight onto Kosciusko Road. To continue on the Snowy Mountains Highway, a vehicle needs to turn right using the Channelised Right Turn facility. This right turn has restricted sight lines due to the crest of the road. This restricted sight line increases the likelihood of HVs not seeing an oncoming vehicle and therefore the likelihood of cross-traffic type crashes. In addition, the Channelised Right Turn facility appears to have a short deceleration lane with inadequate space for additional storage. As HV will be turning right here as part of the haul route, inadequate deceleration lanes and lack of storage could lead to rear-end type crashes.	Improbable	Serious	Medium
c ii	Intersection of Snowy Mountains Hwy / Tantangara Rd	At the Tantangara Road intersection, the sight lines are restricted due to the horizontal and vertical geometry along Snowy Mountains Highway. This may mean a HV exiting the minor road may not be able to see a vehicle travelling on the Snowy Mountains Highway and the vehicle would need to brake to let the HV in or manoeuvre around the HV. This could lead to a collision with the HV or with oncoming traffic. Also, a HV turning right into Tantangara Road needs to hold up the through-traffic lane. This increases the risk of a rear-end crash.	Improbable	Serious	Medium
e i	Link Road	There is an absence of line-marking on Link Road – due to the reduced carriageway width. Line-marking plays a key role in delineating a road environment, particularly highlighting where the edge of the road ends and where opposing traffic lanes are separated. A lack of delineation increases the risk of run-off road crashes and head-on crashes.	Improbable	Serious	Medium

Item #	Location	Key audit findings	Risk assessment		
			Frequency	Severity	Level of risk
f i	General – steep drop offs	Along the haul route there are a several examples where steep drop-offs are unshielded. An errant vehicle travelling at these locations may leave the carriageway and descend down steep batters and potentially rolling-over or colliding with fixed hazards (trees).	Improbable	Serious	Medium
f ii	General – road geometry	Along the haul route, substandard horizontal and vertical geometry exists. While there are several examples of “Curve Warning” with advisory speed signs along the route, there is further improvement potential along the route where these warning signs could be implemented. The winding nature of this route means there is horizontal and vertical geometry that restricts sights lines. Warning signs inform drivers of the upcoming restricted sight line environment and enables them to adjust their driving to suit conditions. Without these signs, there is an increased potential for run-off road crashes to occur.	Improbable	Serious	Medium
f iii	General – road pavement	With the introduction of more HVs, the condition of the road pavement would be expected to deteriorate more rapidly. Roads in poor condition can lead to potholes, reduced grip and traction and an increased risk for vehicle loss of stability. The road pavement condition impacts the likelihood of a crash occurring.	Improbable	Serious	Medium
f iv	General – barrier systems	There are a variety of containment systems implemented along the haul route. It is unclear from the site inspection whether the containment systems are graded to be able to contain HV in the highspeed environment. If the containment system fails, an errant HV could break through the barrier and be exposed to significant roadside hazards (large drop offs, bodies of water, fixed objects etc.).	Improbable	Serious	Medium
f v	General – overtaking opportunities	There is an approximately 75 km length along Snowy Mountains Highway where there are no dedicated overtaking lanes. This significant length increases the likelihood of vehicles overtaking by using the oncoming traffic lane. Overtaking in this manner increases the likelihood of head-on collisions.	Improbable	Serious	Medium
f vi	General – wildlife	During the site inspection, high levels of dead wildlife were observed lying on the shoulders / adjacent the live carriageway. Colliding with animals in high-speed environments can lead to further collisions with run-off road crash types typically occurring. If an animal is left on the live carriageway, HVs may run over the animal causing instability or choose to swerve to avoid the animal potentially leading to head-on crashes.	Improbable	Serious	Medium

Source: Safe Systems Solutions, September 2019

3.6.1 Safe intersection sight distance review

A safe intersection sight distance review was undertaken for the key intersections listed below in accordance with the Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections.

Table 3-10 Summary of issues identified from SISD review

Intersections	SISD review (requirements)	SISD issues
Link Road / Lobs Hole Ravine Road	The existing sight distance of westbound traffic along Link Road is deemed to satisfy the requirements for minimum distances.	Reducing the speed limit on Link Road may be explored to improve driver awareness of the increased traffic movements adjacent to this intersection.
Snowy Mountains Highway / Link Road	Minimum sight distance of heavy vehicles with 100 km/hr design speed with 5% downhill grade is over 300 m.	Sight distance of southbound traffic along Snowy Mountains Highway from Link Road is only approximately 190 m. Reducing the speed limit on Snowy Mountains Highway to 80 km/hr requires 180 m sight distance. Existing curves would limit drivers to this speed.
Snowy Mountains Highway / Tantangara Road	Minimum sight distance of heavy vehicles with 100 km/hr design speed on a flat grade is 290 m.	Sight distance of eastbound and westbound traffic along Snowy Mountains Highway from Tantangara Road is approximately 80 m and 170 m respectively. Reducing the speed limit to 60 km/h may be explored to improve driver awareness of the increased traffic movements adjacent to this intersection.
Snowy Mountains Highway / Kosciuszko Road	Although this intersection does not satisfy the required sight distances, there are auxiliary lanes provided on the departures of the left and right-tuning vehicles exiting onto Snowy Mountains Highway and Kosciuszko Road from the minor arm.	N/A
Monaro Highway / Yallakool Road	This intersection would satisfy the required sight distances for vehicles exiting from Polo Flat Road.	N/A
Monaro Highway / Polo Flat Road (north end)	This intersection satisfies the required sight distances for vehicles exiting from Polo Flat Road.	N/A
Monaro Highway / Polo Flat Road (Saleyards Road)	This intersection satisfies the required sight distances for vehicles exiting from Polo Flat Road.	N/A

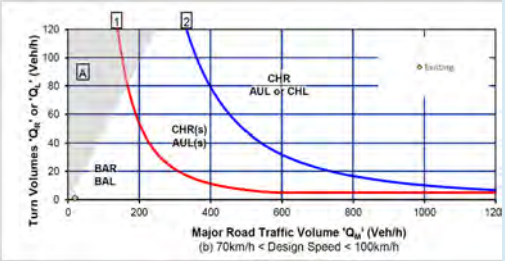
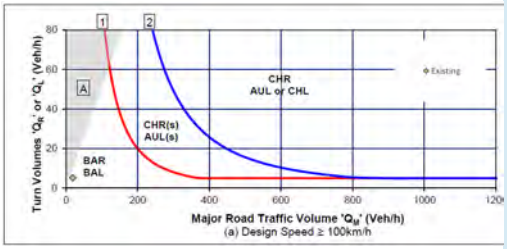
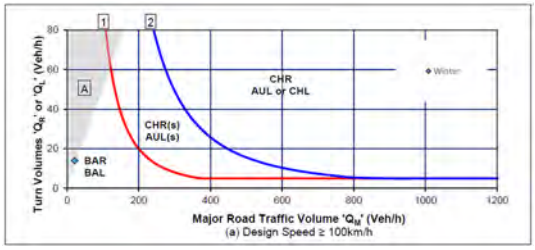
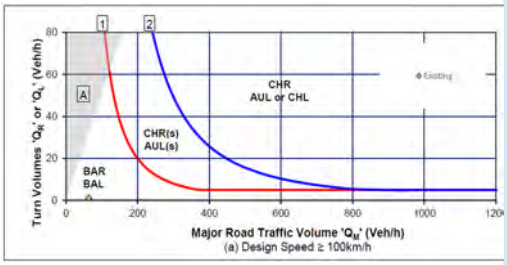
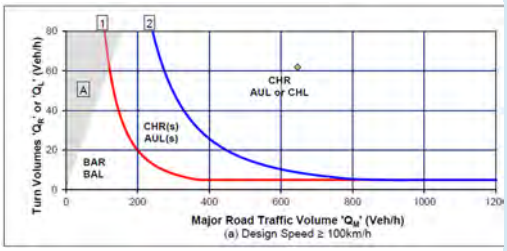
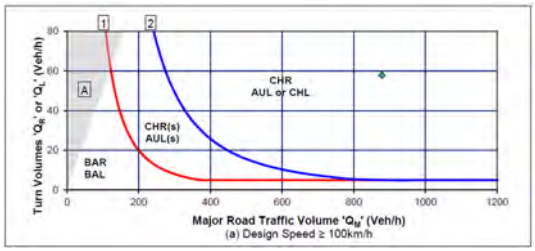
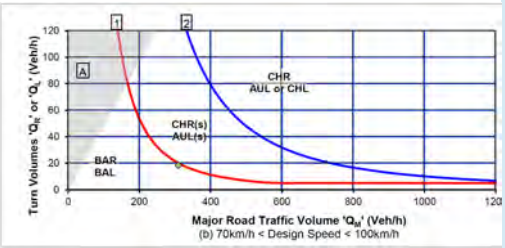
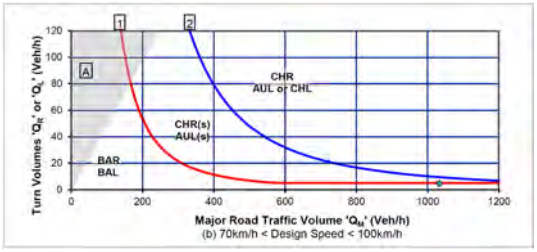
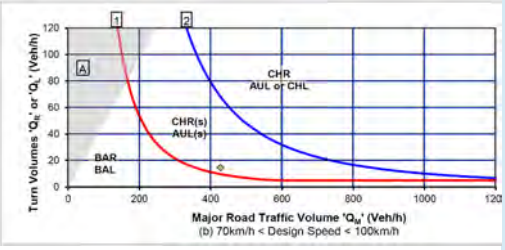
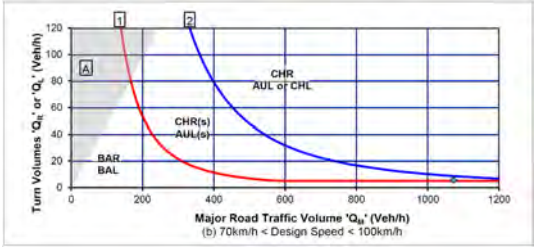
Source: SCT Consulting

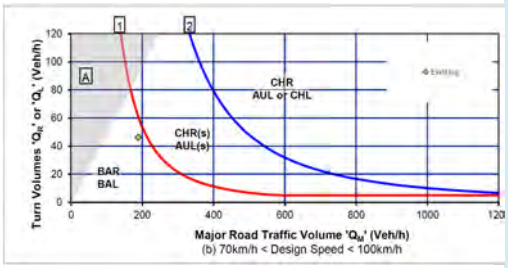
3.7 Existing intersection capacity assessment

3.7.1 Austroads intersection warrants

Intersection warrants review according to Austroads (2017) Part 4 intersection design standards and the Austroads (2017) warrant design charts was undertaken for critical priority intersections within the study area under existing traffic conditions, as summarised in **Table 3-11**. Existing turning traffic volumes on the major road at each intersection are represented by the green diamond for non-winter traffic volumes and blue diamond for winter peak traffic volumes.

Table 3-11 Critical intersection warrants

Intersection	Non-winter period[1]	Winter holiday period[2]
Link Road / Lobs Hole Ravine Road		N/A
Snowy Mountains Highway / Link Road		
Snowy Mountains Highway / Tantangara Road		N/A
Snowy Mountains Highway / Kosciuszko Road		
Monaro Highway / Yallakool Road		
Monaro Highway / Polo Flat Road (north end)		

Intersection	Non-winter period[1]	Winter holiday period[2]
Monaro Highway / Saleyards Road		N/A

Note: 1. Non-winter holiday period data were collected in March / April of 2019.
2. Winter holiday period data were collected in June / July / August of 2019.

Source: SCT Consulting

Based on the Austroads warrants for turn treatments on major roads at unsignalised intersections under existing traffic conditions, only two intersections should require channelised right turning lane or auxiliary left turning lanes:

– Monaro Highway / Polo Flat Road (north end); and

– Monaro Highway / Yallakool Road.

3.7.2 SIDRA intersection modelling

Intersection capacity assessment using SIDRA has been undertaken for critical intersections across the study area.

Critical intersections that have been assessed in KNP and surrounds are:

– Link Road / Lobs Hole Ravine Road;

– Snowy Mountains Highway / Link Road;

– Snowy Mountains Highway / Tantangara Road; and

– Snowy Mountains Highway / Kosciuszko Road.

Critical intersections that have been assessed in Cooma and Polo Flat are:

– Snowy Mountains Highway / Vale Street;

– Monaro Highway (Snowy Mountains Highway) / Bombala Street;

– Monaro Highway / Yallakool Road;

– Monaro Highway / Polo Flat Road (north end); and

– Monaro Highway / Saleyards Road.

3.7.2.1 Calibration and validation

Default SIDRA model parameters, namely ‘Gap Acceptance’ and ‘Follow-up headway’ factors, were adjusted, as per *Roads and Maritime Traffic Modelling Guidelines 2003*, in order to match the SIDRA outputs with the queue lengths surveyed during the winter peak hours for the critical intersections. These factors were then retained for the assessment of the construction traffic scenarios during the non-winter peak period. This approach was agreed with the (then) Department of Roads and Maritime Services.

For all the intersections within the KNP, vehicles turning into and out of the side streets were able to manoeuvre with minimal delays, mainly due to the low volume of traffic that is typically present within the national park. Even during the peak snow periods, the intersection of Link Road and Snowy Mountains Highway was observed to operate with minimal delays, with most vehicles approaching Snowy Mountains Highway from Link Road able to enter the highway without halting to a stationary stop at the intersection. There was however one instance where a motorist remained stationary at the intersection for a short period, even though there were no oncoming vehicles on Snowy Mountains Highway, which resulted in three vehicles queueing behind the stationery vehicle. However, this queue soon dissipated with minimal delay.

Queuing at the intersection of Snowy Mountains Highway and Kosciuszko Road was observed to be minimal, with most vehicles utilising the auxiliary exit lane when turning left onto Snowy Mountains Highway.

Intersections within Cooma town centre, namely Sharp Street / Bombala Street and Sharp Street / Vale Street displayed steady queuing along Sharp Street during the winter peak period, which were mainly due to the delays caused by on-street parking manoeuvres along both the approach and exit lanes of the intersections. During instances where there were no parking manoeuvres, there were minimal queues observed along Sharp Street approaches of the intersections.

Video surveys of the closely spaced intersections of Yallakool Road and Polo Flats Road showed three manoeuvres during the peak hour whereby vehicles would exit onto Monaro Highway from either Yallakool Road or Polo Flats Road to enter either of the minor roads. Although it was observed that these vehicles did not experience any extensive delays, the potential for extensive delays if these manoeuvres are increased were noticed.

3.7.2.2 Queue calibration

To ensure the models are representative of the existing queues during the winter peak seasons, the 95th percentile queue output from SIDRA were compared against the surveyed maximum queue for the corresponding peak hours as shown in **Table 3-12**.

Table 3-12 Baseline intersection queueing calibration

Intersection	Approach	Surveyed	SIDRA	Difference
Snowy Mountains Highway / Link Road	West	3	1.1	- 1.9
	South	0	0	0
	East	-	-	-
	North	0	0	0
Snowy Mountains Highway / Kosciuszko Road	West	0	0	0
	South	-	-	-
	East	1	0.3	- 0.7
	North	1	0.0	- 1.0
Snowy Mountains Highway / Vale Street	West	9	7.2	- 1.8
	South	5	4.1	- 0.9
	East	11	8.7	- 1.3
	North	6	5.1	- 0.9
Snowy Mountains Highway / Bombala Street	West	11	10.9	- 0.1
	South	12	11.3	- 0.7
	East	20	18.7	- 1.3
	North	7	6.9	- 0.1
Monaro Highway / Yallakool Road	West	0	0	0
	South	-	-	-
	East	1	0.1	- 0.9
	North	1	0.2	- 0.8
Monaro Highway / Polo Flats Road	West	1	0.1	- 0.9
	South	3	4.3	+ 1.3
	East	0	0	0
	North	-	-	-

Source: SCT Consulting

For the remainder of the intersections not listed in **Table 3-12**, there were no persistent queues observed at the sites with most vehicles able to undertake their manoeuvres with little to no delays.

3.7.2.3 Critical intersection performance

SIDRA modelling was undertaken using the calibrated parameters and the peak hour intersection performance for winter and non-winter periods are summarised in **Table 3-13**.

Table 3-13 Baseline intersection performance summary

Intersection	Non-winter period[1]			Winter holiday period[2]		
	Delays (s)[3]	Degree of Saturation	Level of Service	Delays (s)[3]	Degree of Saturation	Level of Service
Link Road / Lobs Hole Ravine Road	6.8	0.008	A	-	-	-
Snowy Mountains Highway / Link Road	7.8	0.017	A	7.8	0.237	A
Snowy Mountains Highway / Tantangara Road	7.8	0.022	A	-	-	-
Snowy Mountains Highway / Kosciuszko Road	14.9	0.254	B	19.9	0.282	B
Snowy Mountains Highway / Vale Street	13.4	0.607	A	24.0	0.728	B
Monaro Highway (Snowy Mountains Highway) / Bombala Street	17.9	0.653	B	33.4	0.882	C
Monaro Highway / Yallakool Road	8.2	0.111	A	21.6	0.328	B
Monaro Highway / Polo Flat Road (north end)	13.2	0.167	A	95.1	0.862	F
Monaro Highway / Saleyards Road	4.1	0.114	A	-	-	-

Note: 1. Non-winter holiday period data were collected in March / April of 2019.
2. Winter holiday period data were collected in June / July / August of 2019.
3. Delays of the worst movement reported.

Source: SCT Consulting

Table 3-13 shows that during the weekday peak hours, the intersections operate at Level of Service B or better with spare capacity, as evidenced by the Degree of Saturation.

All the intersections perform with lesser spare capacity, with increased traffic flows during the winter holiday peak hour, but still operate at Level of Service C or better.

However, the intersection of Monaro Highway and Polo Flat Road is operating at Level of Service F, during the winter peak periods under existing conditions. Despite operating at Level of Service C during the winter peak periods under existing conditions, the intersection of Monaro Highway (Snowy Mountains Highway) / Bombala Street in Cooma is also considered to be failing by TfNSW as the degree of saturation exceeds 0.85.

4.0 Potential impacts of construction traffic

4.1 Construction overview

4.1.1 Construction activities and staging

The construction of the Snowy 2.0 Main Works would be undertaken in multiple stages over an estimated period of 5 to 6 years. During this period, light and heavy vehicles will access the site from the adjoining public road network as well as circulating within the site boundary. The peak traffic for the project is expected to occur in 2022 after which time the numbers of vehicles ramp down as the civil construction progresses.

Throughout the construction period there will be several traffic generating activities, including:

– deliveries of materials, plant and equipment to and from site, including materials such as aggregate and cement as well as delivery of pre-cast concrete segments required for the tunnel construction;

– transport of personnel to and from designated airports;

– busing of personnel to and from shifts on site;

– servicing of accommodation camps (e.g. waste collection, food delivery, etc); and

– haulage of excavated rock and materials from surface works and tunnelling activities.

The regular types and volumes of vehicles estimated over the life of the construction works will range from semitrailers delivering concrete and segments for the tunnels, truck and dogs bringing in road-base and other construction materials, agitators for the concrete pours to smaller vehicles such as mini-buses and coaches for the workforce and light vehicles for internal movements by personnel. These movements will occur on both the external and internal site road network.

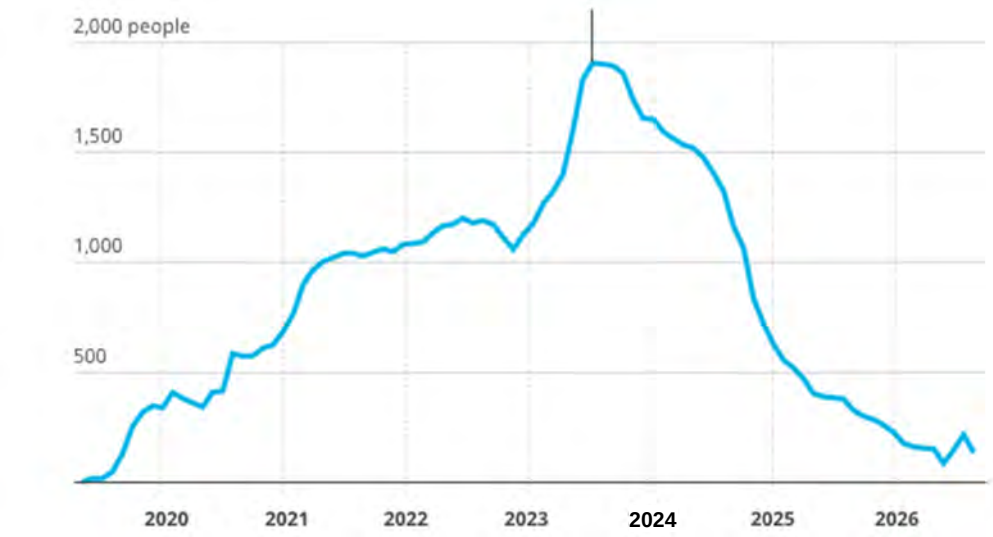
In June 2019, Snowy Hydro lodged an application seeking planning approval from the NSW Minister for Planning and Public Spaces for an ancillary facility to Snowy 2.0, being a segment factory, proposed for a site at Polo Flat (SSI-10034). Should the factory be approved and constructed, pre-cast concrete segments would be manufactured at the Polo Flat factory and delivered to the Snowy 2.0 site.

In response to key government agencies, (DPIE, EPA and NPWS), Snowy Hydro has revised the placement of excavated rock material from Marica to be permanently placed at a rehabilitated landform within the Rock Forest site. It is forecast that the total spoil to be transported from Marica to the Rock Forest site would be approximately 400,000 m^3, which based on previously assumed heavy vehicle type, represents 26,000 truck movements. With increased vehicle movements at the Marica and Rock Forest sites, as well as along Snowy Mountains Highway between these two sites, an addendum traffic assessment has been undertaken, as detailed in the following sections. Based on the assumptions adopted in the traffic assessment, 26,000 truck movements over a period of approximately 650 days would equate to approximately 40 heavy vehicle movements daily, which for the peak-hour equates to 4 heavy vehicles.

4.1.2 Construction staff

The workforce for the Snowy 2.0 Main Works is expected to reach about 2,000 workers at peak construction. The distribution of the workforce over the construction program is shown in **Figure 4.1**.

Figure 4.1 Construction staff profile



4.1.3 Construction and staff accommodation compounds

Personnel working on the project will generally not be permitted to drive to the camps, in order to reduce the volume of traffic on the roads, reduce travel time and improve safety outcomes for the workforce. This also has the benefit of reducing parking requirements at the accommodation camps. The construction workforce will be transported from designated towns and airports to the accommodation camps by project-supplied buses.

When on site, buses will collect workers and transport them between accommodation camps and various worksites before and after shifts. Bus pick-up and drop-off points will be marked at accommodation camps and at worksites, along with safe pedestrian routes. Sufficient buses will be allocated to each camp to ferry the workforce back and forth at the start and end of each shift. Exceptions will apply for superintendents and engineers or for personnel who require flexibility of movement as a result of the nature of their role.

The site roster for personnel will be developed by FGJV as contractor for the construction of the Snowy 2.0 project as part of their human resources and recruitment initiatives. However, it is expected the construction workforce will work a rostered 20 days on, 10 days off rotation, with two shifts of 12 hours each, or similar arrangement.

It is expected that the workforce will be transported to and from the accommodation compounds by way of the Snowy Mountains Highway and Link Road, Tantangara Road or the Marica Track. The use of Lobs Hole Ravine Road North for an alternative light vehicle access to Lobs Hole, which is currently part of a proposed modification to the Snowy 2.0 Exploratory Works approval, will be continued under Snowy 2.0 Main Works.

4.2 Assessment scenarios

For the purpose of the Traffic and Transport Assessment, six scenarios have been considered to understand the likely impacts of the project on the surrounding road network:

1. 2022 Baseline (No Project) under non-winter peak conditions;
2. 2022 Baseline (No Project) under winter peak conditions;
3. 2022 Main Works (With Project) under non-winter peak conditions;
4. 2022 Main Works (With Project) under winter peak conditions (for 4 intersections only);
5. 2022 Main Works and proposed segment factory works (cumulative impacts) under non-winter peak conditions; and
6. 2022 Main Works and proposed segment factory works (cumulative impacts) under winter peak conditions (for 4 intersections only).

In consultation with TfNSW, it was determined that, for the purpose of assessing the worst-case traffic and transport scenario, the baseline and estimated project traffic volumes for the years 2021-2022 are to be used for assessing the potential traffic and transport impacts of the Snowy 2.0 Main Works, while traffic volumes for the future year of 2022 are to be used for assessing potential impacts of the proposed segment factory.

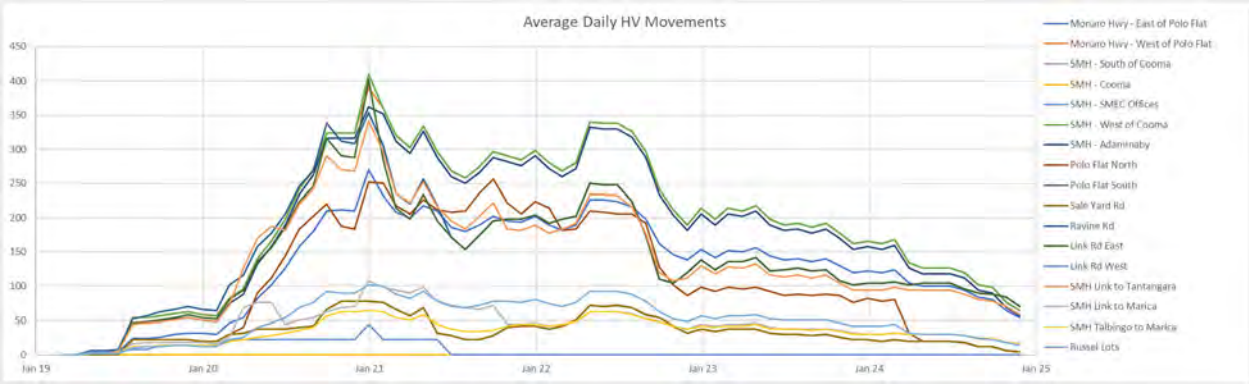
The baseline traffic volumes for 2022 were determined by applying a 1% per annum increase to the baseline traffic data collected in 2019, as agreed with TfNSW. For the 'With Project' scenario, the additional traffic generated during the construction stage of Main Works was assessed. This is considered the worst-case scenario as the amount of additional traffic to be generated during the operational stage would be less than the levels of traffic generated during the construction stage of the Main Works.

Four intersections have been assessed for winter peak conditions, as agreed with TfNSW. They are: Snowy Mountains Highway / Kosciuszko Road, Monaro Highway (Snowy Mountains Highway) / Bombala Street, Monaro Highway / Vale Street and Monaro Highway / Polo Flat Road (north end).

4.3 Construction traffic volumes

Construction vehicle movements will comprise construction worker's light vehicles and heavy vehicles transporting equipment, building and construction materials, waste and fill material if required. The forecast monthly construction vehicle volume profile for both Main Works and proposed segment factory works, expected on different parts of the external road network is presented in **Figure 4.2**.

Figure 4.2 Average daily heavy vehicle traffic movements



Source: FGJV, August 2019

4.3.1 Projected mid-block traffic volumes

Average and peak daily heavy and light traffic movements have been determined at critical locations of the study area road network as illustrated in **Annexure D**. A summary of estimated total two-way daily light and heavy traffic generation during the peak month in 2022 of Main Works and the proposed segment factory works is shown in **Table 4-1**.

Table 4-1 Daily total traffic volumes of Mains Works and proposed segment factory works

Road	Location	Main Works only		Main Works + proposed segment factory	
		Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles
Link Road	Between Kings Cross Road and Snowy Mountains Highway	150	224	150	402
Link Road	West of Lobs Hole-Ravine Road	48	44	48	44
Snowy Mountains Highway	North of Link Road (Garden Gully Creek)	42	146	42	148
Snowy Mountains Highway	North of Yarrangobilly Caves intersection	24	64	24	64

Road	Location	Main Works only		Main Works + proposed segment factory	
		Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles
Snowy Mountains Highway	West of Cooma	98	252	124	410
Snowy Mountains Highway	SMEC Offices	98	252	194	410
Monaro Highway	Cooma (west of Polo Flat Road)	94	252	264	390
Monaro Highway	South of Cooma	36	82	50	78
Monaro Highway	East of Polo Flat	48	176	74	270
Polo Flat Road	Polo Flat North	26	82	196	252
Polo Flat Road	Polo Flat South	42	82	308	78

Source: FGJV, June 2019 modified by SCT Consulting

4.3.2 Projected intersection traffic volumes

For the purpose of assessing the impacts of project traffic on the key intersections, the daily project traffic volumes were converted to peak hour traffic volumes:

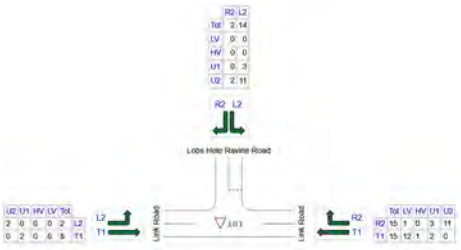
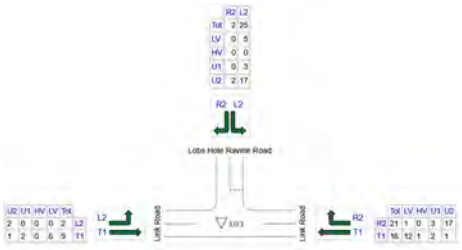
– by assuming that peak hour (1-hour) project traffic volumes are 10% of estimated daily project traffic volumes; and

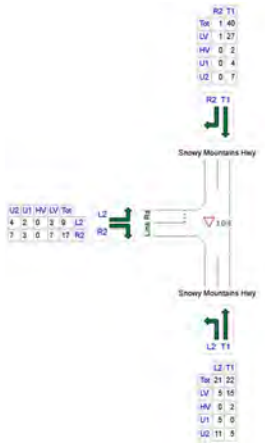
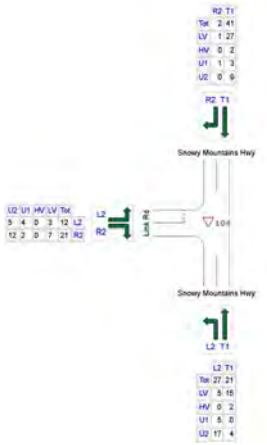
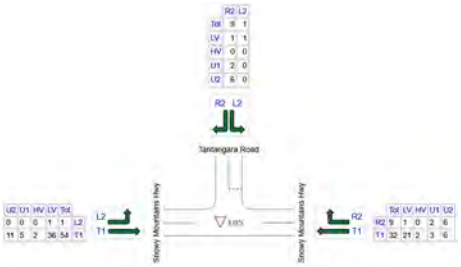
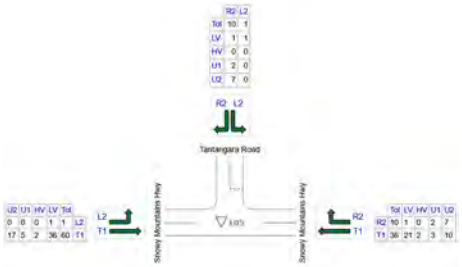
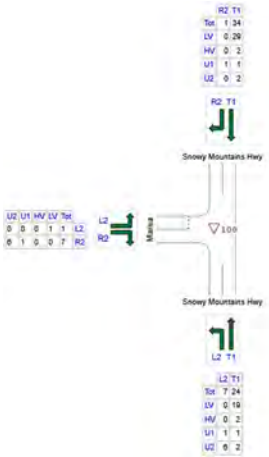
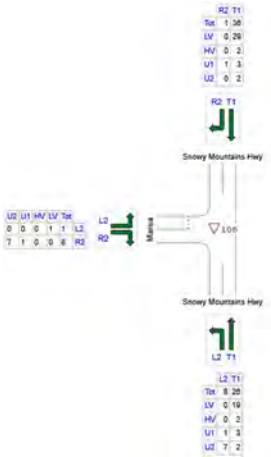
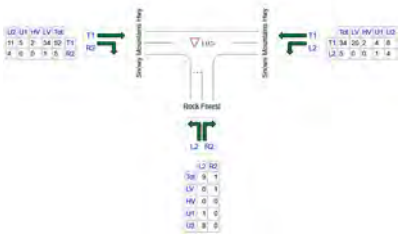
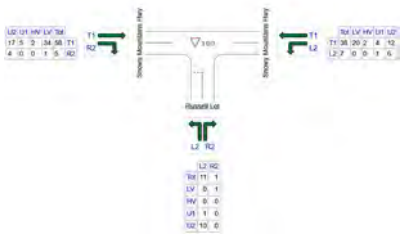
– by assuming that the mid-block project traffic flows were representative of two movements.

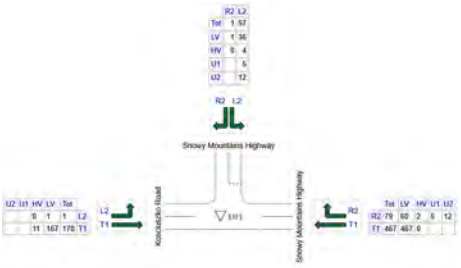
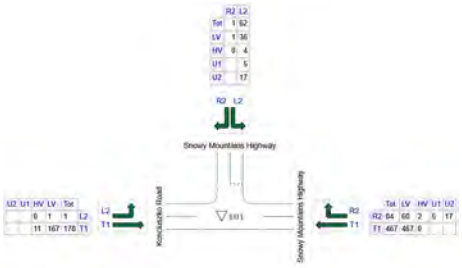
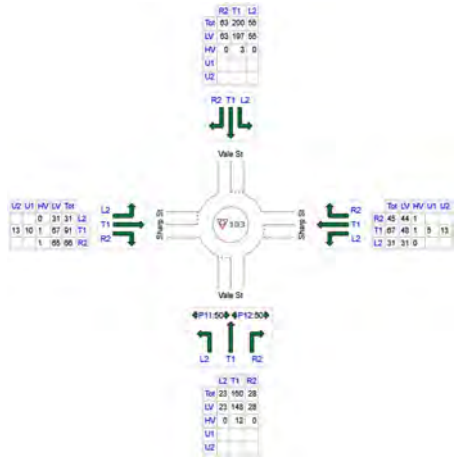
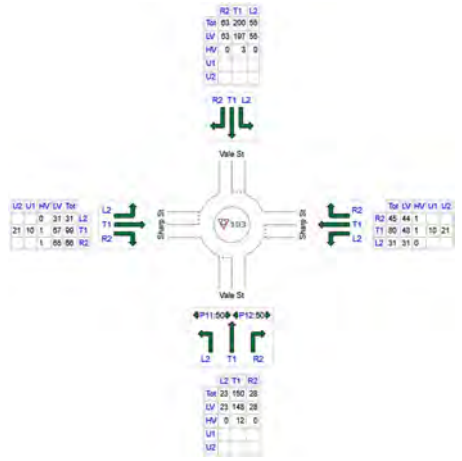
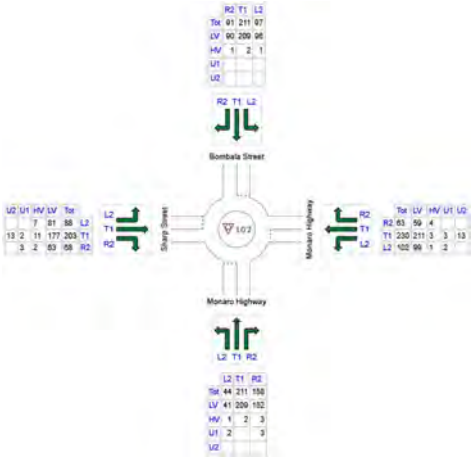
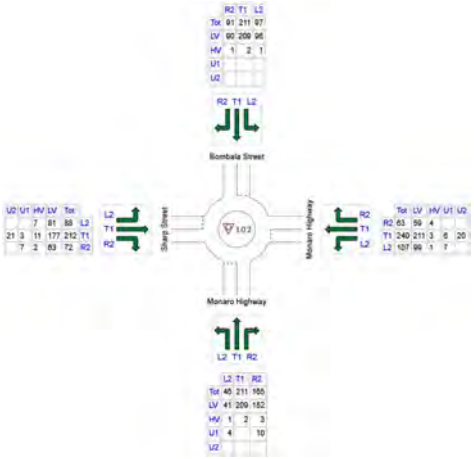
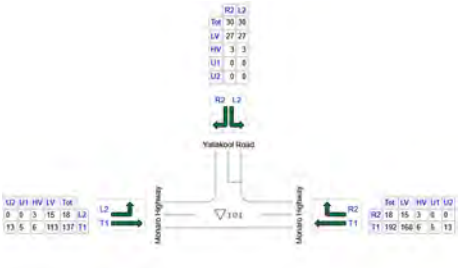
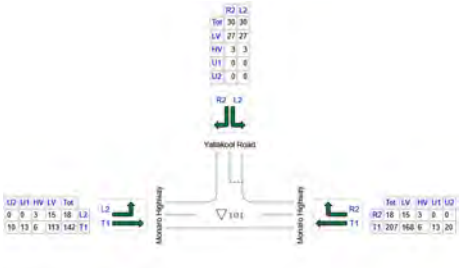
Estimated peak hour light and heavy traffic generation during the peak month in 2022 have been identified. A summary of the total (baseline and project) intersection turning volumes under non-winter peak period and winter peak period are summarised in

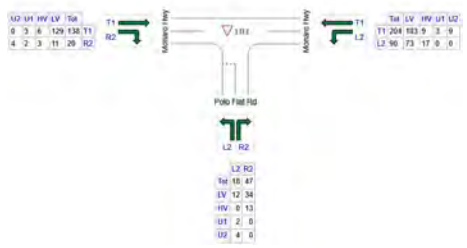
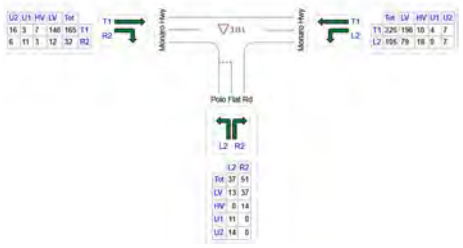
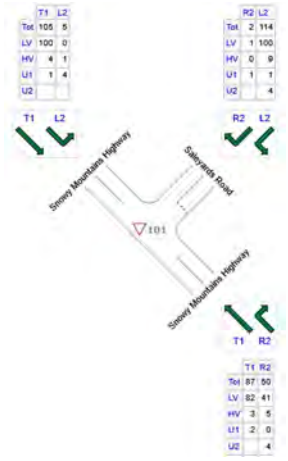
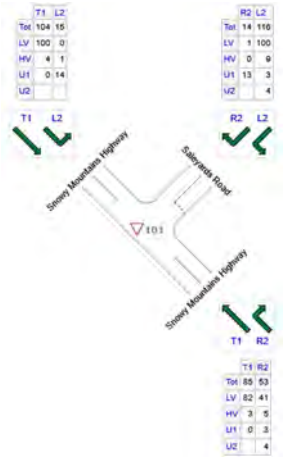
Table 4-2 and **Table 4-3** respectively.

Table 4-2 2022 peak hour projected total (baseline + project) intersection traffic volumes (non-winter period[1])

Inter-section	Main Works only	Main Works + proposed segment factory
Link Road / Lobs Hole Ravine Road		

Inter-section	Main Works only	Main Works + proposed segment factory
Snowy Mountains Highway / Link Road		
Snowy Mountains Highway / Tantangara Road		
Snowy Mountains Highway / Marica Access		
Snowy Mountains Highway / Rock Forest Access		

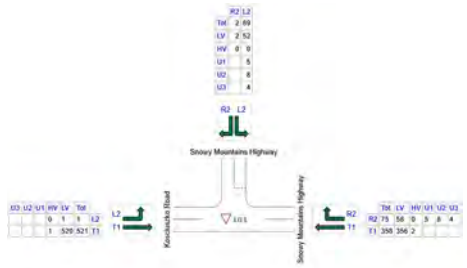
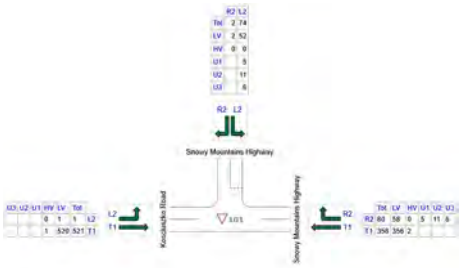
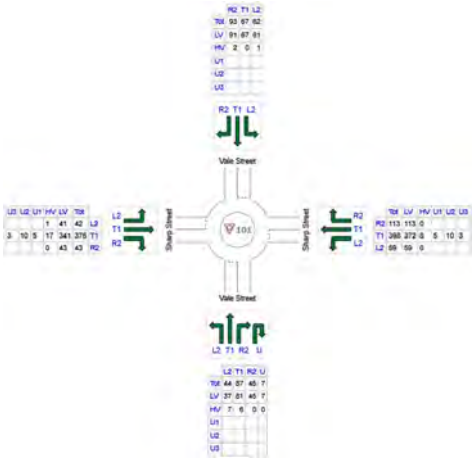
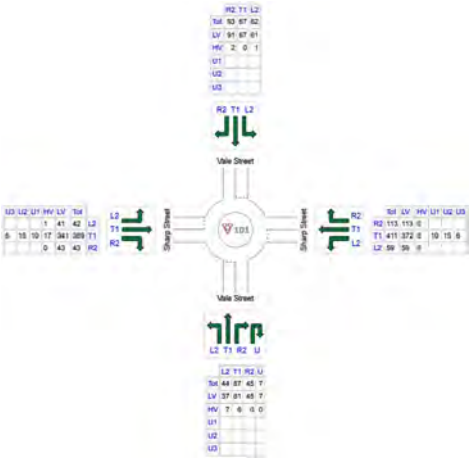
Inter-section	Main Works only	Main Works + proposed segment factory
Snowy Mountains Highway / Kosciuszko Road		
Snowy Mountains Highway / Vale Street		
Monaro Highway (Snowy Mountains Highway) / Bombala Street		
Monaro Highway / Yallakool Road		

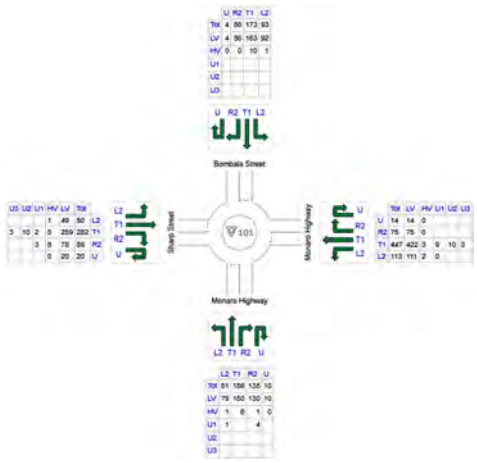
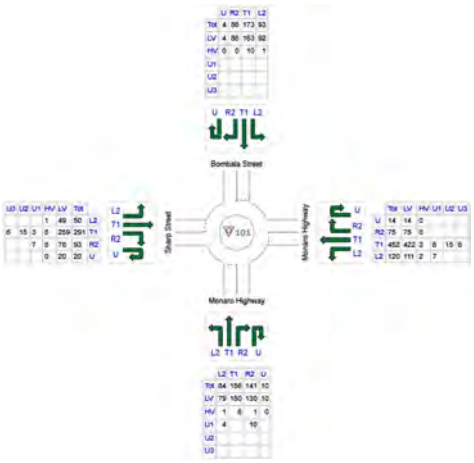
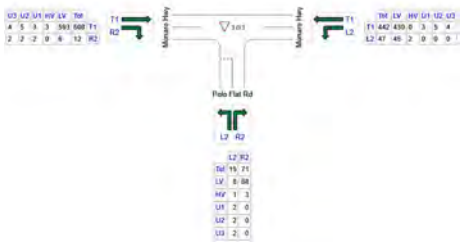
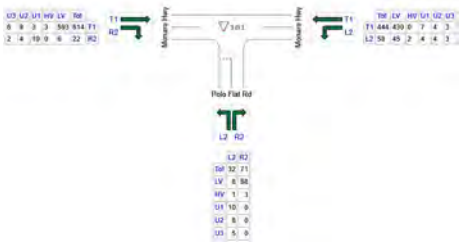
Inter-section	Main Works only	Main Works + proposed segment factory
Monaro Highway / Polo Flat Road (north end)		
Monaro Highway / Saleyards Road		

Note: T1=through movement, L2=left turn movement, R2=right turn movement, LV=light vehicles, HV=heavy vehicles
1. Non-winter holiday period baseline traffic was estimated based on data collected in March / April of 2019.

Source: SCT Consulting

Table 4-3 2022 peak hour projected total (baseline + project) intersection traffic volumes (winter peak period[1])

Inter-section	Main Works only	Main Works + proposed segment factory
Snowy Mountains Highway / Kosciuszko Road		
Snowy Mountains Highway / Vale Street		

Inter-section	Main Works only	Main Works + proposed segment factory
Monaro Highway (Snowy Mountains Highway) / Bombala Street		
Monaro Highway / Polo Flat Road (north end)		

Note: T1=through movement, L2=left turn movement, R2=right turn movement, LV=light vehicles, HV=heavy vehicles
1. Winter holiday period baseline traffic was estimated based on data were collected in June / July / August of 2019.

Source: SCT Consulting

4.4 Traffic impacts along key road network sections

As shown in **Table 4-1**, it is forecast that the largest number of heavy vehicles would be travelling on Link Road (between Kings Cross Road and Snowy Mountains Highway) and Snowy Mountains Highway (between Link Road and Cooma). During the peak month of project traffic, it is expected up to 410 heavy vehicles movements (total in both directions) per day in a 24-hour period could be travelling on these sections of Link Road and Snowy Mountains Highway, when Mains Works are assessed together with segment factory works proposed at Polo Flats cumulatively. Excluding the movements associated with the segment factory leaves up to 250 heavy vehicles movements per day (total in both directions) during the peak month of project traffic along Snowy Mountains Highway.

For the traffic associated with the Main Works, the largest increase of light vehicles is also expected on Link Road and Snowy Mountains Highway. A peak of 150 project related light vehicle movements (total in both directions) per day are anticipated on Link Road (between Kings Cross Road and Snowy Mountains Highway). However, during the proposed segment factory works, up to 308 daily light vehicle movements (total in both directions) are expected to be generated along Polo Flat Road between Cooma and the proposed segment factory.

As assessed in the Exploratory Works EIS, this level of daily increase of light and heavy vehicles as a result of Main Works and the segment factory – approximately 650 total vehicles (up to 1,400 Passenger Car Units (PCU) assuming a PCU factor of 2.9 for heavy vehicles) in a day will not have any significant impacts to the mid-block capacity of the study network given the network is currently operating at very low volume / capacity ratios with significant amount of spare capacity.

4.4.1 Link Road

As discussed above, Link Road is expected to see a large increase in both light and heavy vehicles during the construction phase of Snowy 2.0. During the peak month of project traffic this increase could be about 550 total vehicle movements per day. This level of increase on Link Road is less than the increase of traffic during peak winter days when a daily increase of approximately 1,000 vehicles could be experienced travelling in both directions, as shown in **Table 3.2**.

However, the cumulative increase of peak construction traffic as well as winter holidays traffic may cause localised congestion to occur, especially near the NPWS ticket booth.

Due to the increase of both light and heavy vehicle traffic along Link Road, the number of incidents could also increase, especially where Link Road is less than 6 m road width, where sightlines are limited and on sections of road with sharp curves. Safety risks could increase due to increased traffic and the high percentage of heavy vehicles. Mitigation measures will be required, such as increasing road width and implementation of a system to manage heavy vehicles movements.

4.4.2 Snowy Mountains Highway

Although the Snowy Mountains Highway is the main project traffic route, the traffic volume increase due to the project is less than the normal traffic variation during peak winter days when an increase of over 5,000 vehicles per day travelling in both directions could occur between Cooma and Kosciuszko Road.

Due to the increase of both light and heavy vehicle traffic along Snowy Mountains Highway, the number of incidents could also increase especially where road-widths may be considered inadequate, where sightlines are limited and on sections of road with sharp curves.

It should also be noted that the two roundabouts along Snowy Mountains Highway in Cooma at Vale Street and Bombala Street will require modifications to facilitate oversize vehicle movements through Cooma – refer to **Section 4.9** for a more detailed discussions of oversize vehicle movements.

Snowy Mountains Highway may be utilised for transport of spoil between worksites, especially between Marica Access and the Rock Forest site, which would increase the heavy vehicle through movements along Snowy Mountains Highway. However, as the analysis of the two intersections shows, the increased volume does not impede the performance of the intersections, due to the minimal hourly traffic volumes along the highway within Kosciuszko National Park.

4.4.3 Polo Flat Road

The combination of baseline traffic (less than 2,000 vehicles per day) and construction traffic (less than 500 vehicles per day) is not expected to cause any capacity issues on Polo Flat Road. Polo Flat Road is a local collector road serving the industrial area of Polo Flat and as such is unlikely to be materially impacted by increases in winter holiday traffic.

4.4.4 Construction site internal road network

The following internal construction site access roads are proposed to be restricted to construction vehicles only for the duration of the project:

– Lobs Hole Ravine Road;

– Marica Track access road;

– Rock Forest access road; and

– Tantangara Road (with some public access to be maintained in discussion with NPWS).

These roads are proposed to be upgraded to facilitate the movement of heavy vehicles required for Exploratory Works and Main Works. As part of the design, the internal road network will be designed to minimise any delays of construction vehicle operations. This will include upgrades to provide appropriate road widths to accommodate heavy vehicle movements.

Given the remoteness of these locations from the external public road network, it is unlikely that the operation of the internal road network would impact the performance of Link Road or Snowy Mountains Highway.

4.5 Construction traffic impacts at intersections

4.5.1 Austroads intersection warrants

An intersection warrants review was undertaken in accordance with Austroads (2017) Part 4 intersection design standards. The Austroads (2017) warrant design charts were applied to critical priority intersections within the study area under future traffic conditions (baseline traffic + background traffic growth + project traffic volumes) and the results are summarised in **Table 4-4** and **Table 4-5** respectively for non-winter period and winter peak period

respectively. Baseline and project traffic volumes at each of the critical priority intersections (roundabouts in Cooma excluded) are represented:

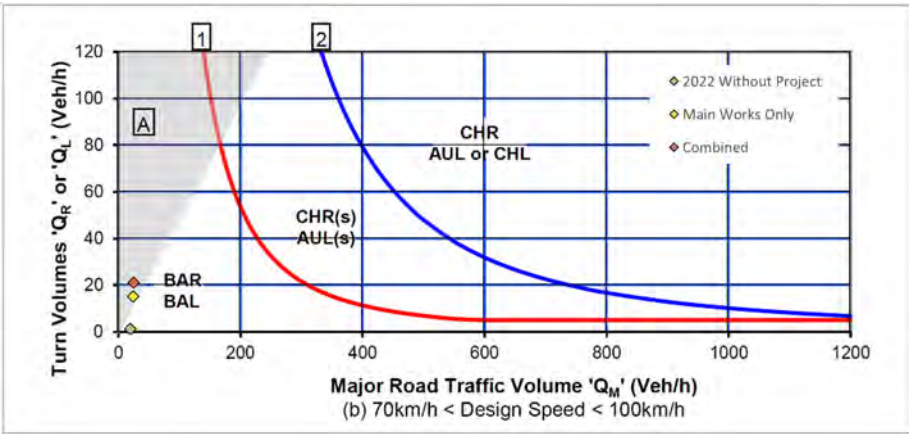
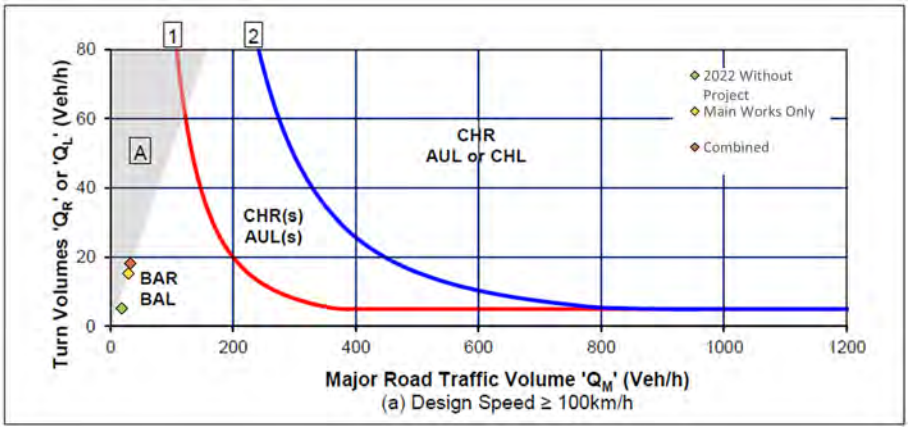
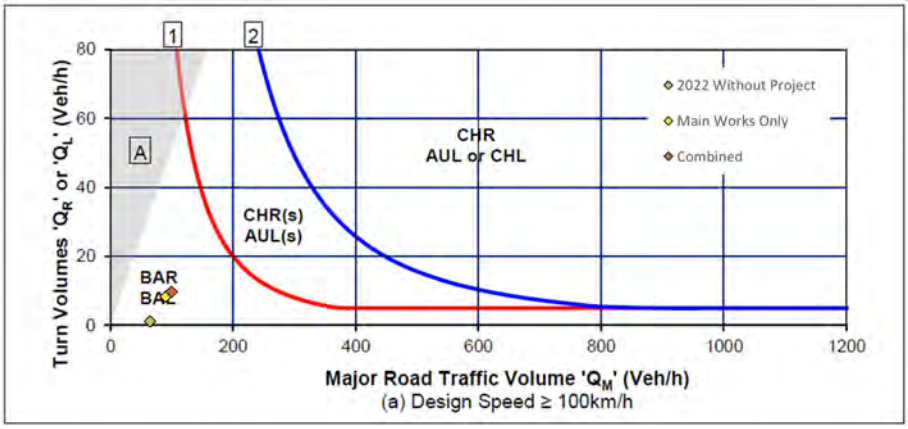
– Green diamond for 2022 baseline traffic volumes on the major road at each intersection;

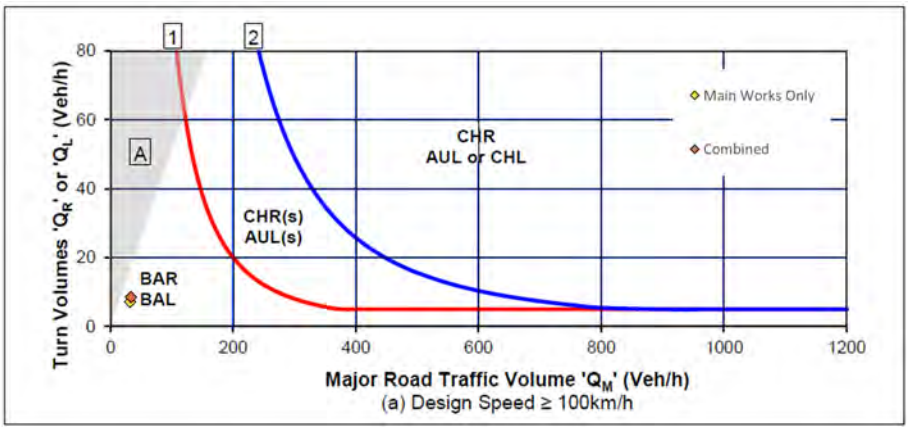
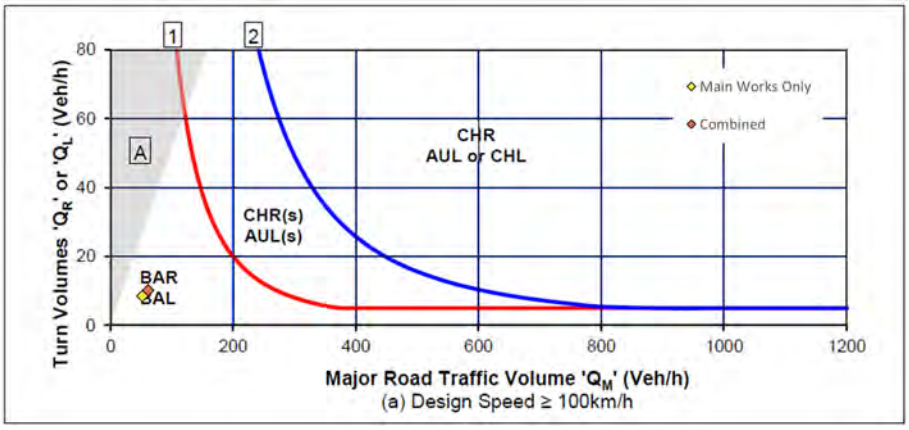
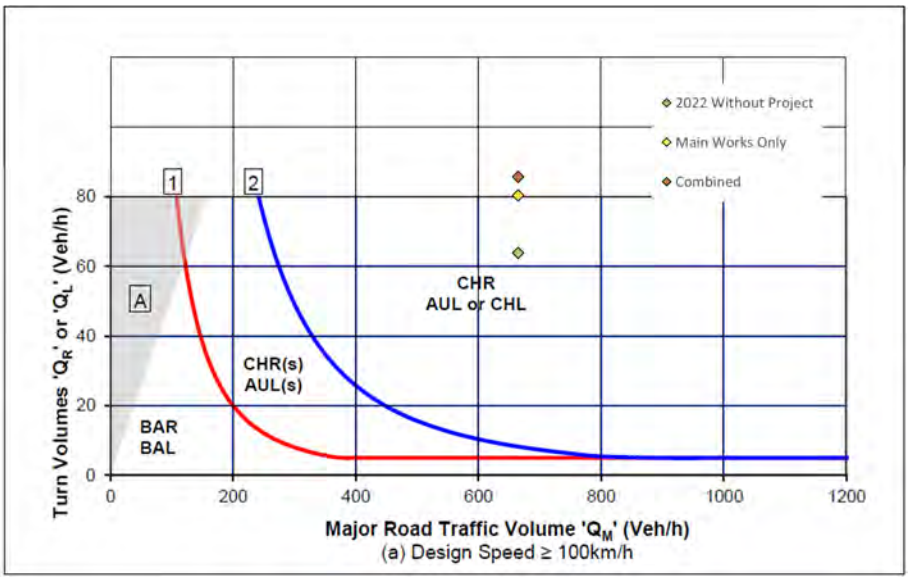
– Yellow diamond for combined baseline traffic volumes and construction (light and heavy) vehicles associated with Main Works only; and

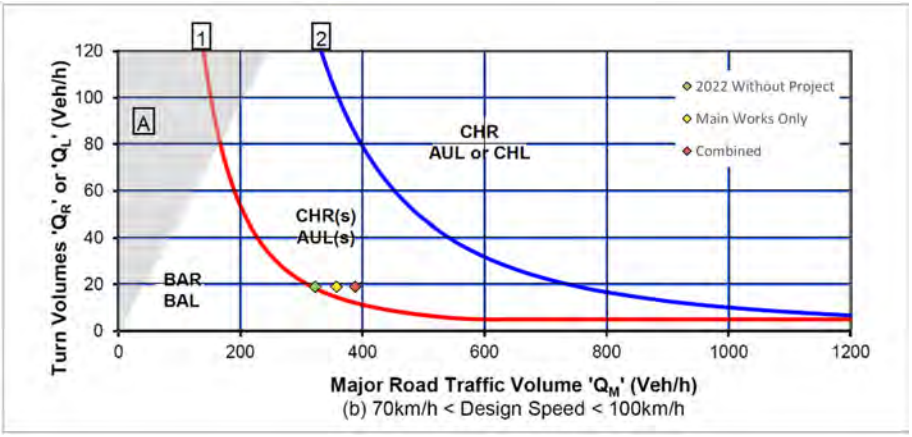
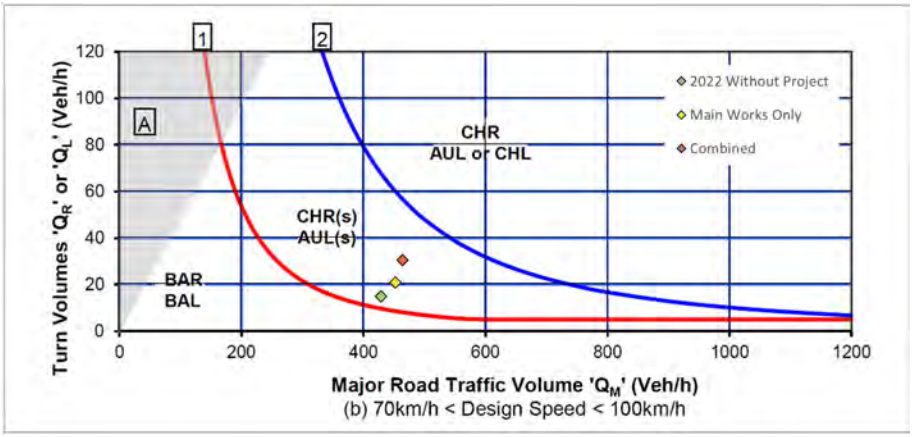
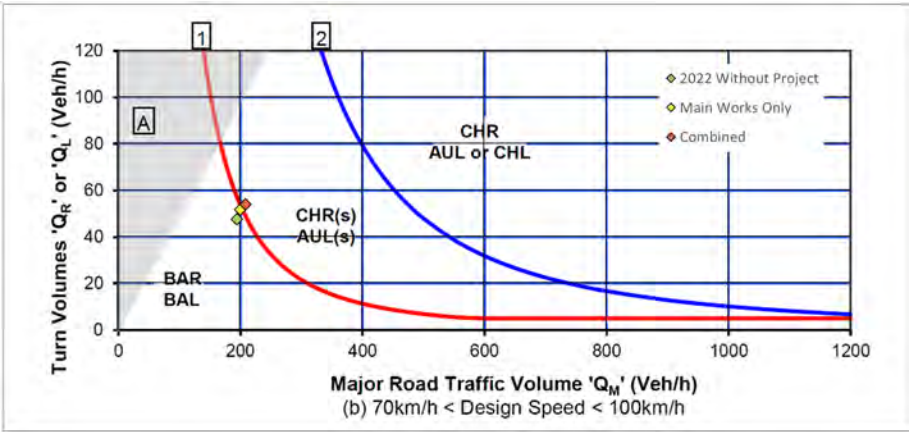
– Red diamond for combined baseline traffic volumes and construction (light and heavy) vehicles associated with Main Works + Polo Flat.

It should be noted that site accesses proposed at Marica Trail and the Rock Forest site from Snowy Mountains Highway will be new priority intersections.

Table 4-4 Critical intersection warrants (non-winter period[1])

Intersection	Intersection Warrant Chart
Link Road / Lobs Hole Ravine Road	
Snowy Mountains Highway / Link Road	
Snowy Mountains Highway / Tantangara Road	

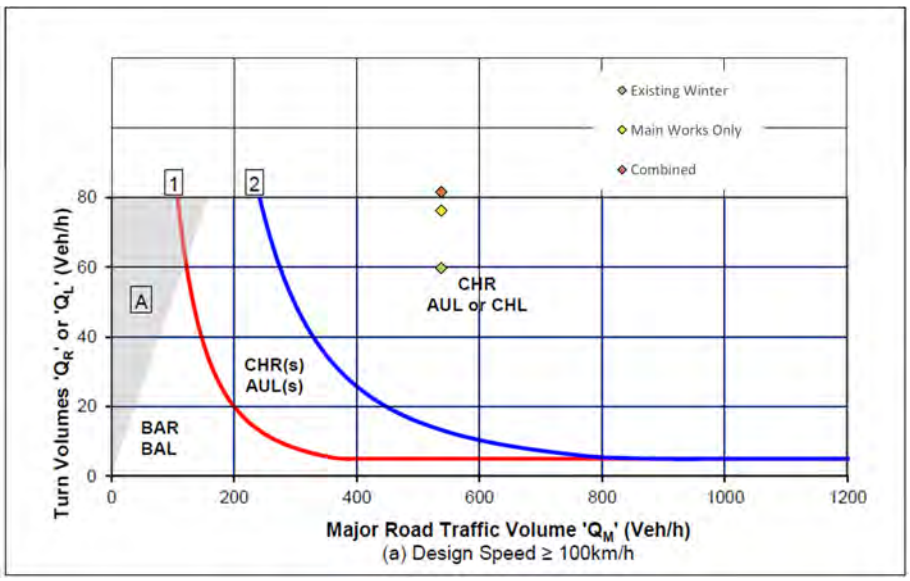
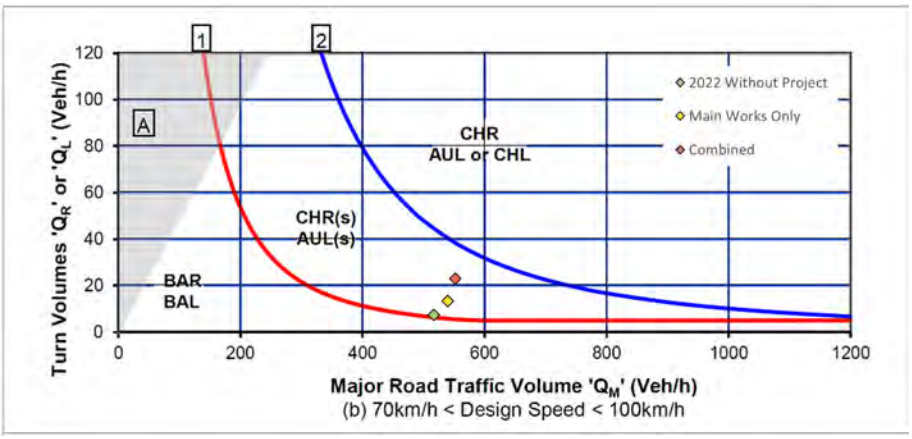
Intersection	Intersection Warrant Chart
Snowy Mountains Highway / Marica Access	
Snowy Mountains Highway / Rock Forest Access	
Snowy Mountains Highway / Kosciuszko Road	

Intersection	Intersection Warrant Chart
Monaro Highway / Yallakool Road	
Monaro Highway / Polo Flat Road (north end)	
Monaro Highway / Saleyards Road	

Note: 1. Non-winter holiday period baseline traffic was estimated based on data collected in March / April of 2019.

Source: SCT Consulting

Table 4-5 Critical intersection warrants (winter peak period[1])

Intersection	Intersection Warrant Chart
Snowy Mountains Highway / Kosciuszko Road	
Monaro Highway / Polo Flat Road (north end)	

Note: 1. Winter holiday period baseline traffic was estimated based on data were collected in June / July / August of 2019.

Source: SCT Consulting

Based on the Austroads intersection warrants review for turn treatments on major roads at unsignalised intersections, the following intersection warrant upgrades are recommended due to increased traffic volumes at the intersections of:

– Monaro Highway / Yallakool Road;

– Monaro Highway / Polo Flat Road; and

– Monaro Highway / Saleyards Road.

It should be noted that the intersections of Monaro Highway / Yallakool Road and Monaro Highway / Polo Flat Road (north end) require upgrades even without the construction vehicles, based on the forecast growth of the corridor and that the haulage route along Monaro Highway between Polo Flat and Cooma does not add any turning movements by construction vehicles at the intersection with Yallakool Road.

4.5.2 SIDRA intersection modelling

Intersection capacity assessment using SIDRA has been undertaken for key intersections across the study area, with their performance summarised in **Table 4-6** for non-winter peak period and in **Table 4-7** for winter peak. It should be noted that site accesses proposed at Marica Trail and the Rock Forest site from Snowy Mountains Highway will be new priority intersections.

The following assumptions were also agreed with TfNSW in undertaking the future year SIDRA modelling:

– all modelling parameters used for base year calibration and validation remained the same; and

– construction heavy vehicles were assigned as 65% 'Heavy Vehicles' and 35% 'Large Trucks' as identified under SIDRA, to account for the larger construction vehicles.

Table 4-6 Future intersection performance summary (Non-winter peak)

Intersection	Scenarios	Performance		
		Delays (s)[1]	Degree of saturation	Level of service
Link Road / Lobs Hole Ravine Road	2022 No Project	6.9	0.008	A
	2022 Main Works only	8.0	0.026	A
	2022 Main Works + proposed segment factory works	8.3	0.034	A
Snowy Mountains Highway / Link Road	2022 No Project	7.8	0.017	A
	2022 Main Works only	9.2	0.037	A
	2022 Main Works + proposed segment factory works	9.5	0.049	A
Snowy Mountains Highway / Tantangara Road	2022 No Project	7.8	0.022	A
	2022 Main Works only	9.6	0.040	A
	2022 Main Works + proposed segment factory works	9.7	0.048	A
Snowy Mountains Highway / Marica Access	2022 No Project	-	-	-
	2022 Main Works only	10.1	0.025	A
	2022 Main Works + proposed segment factory works	10.1	0.028	A
Snowy Mountains Highway / Rock Forest Access	2022 No Project	-	-	-
	2022 Main Works only	9.9	0.045	A
	2022 Main Works + proposed segment factory works	10.1	0.053	A
Snowy Mountains Highway / Vale Street	2022 No Project	14.1	0.632	A
	2022 Main Works only	15.3	0.658	A
	2022 Main Works + proposed segment factory works	16.2	0.676	A
Monaro Highway (Snowy Mountains Highway) / Bombala Street	2022 No Project	19.6	0.693	B
	2022 Main Works only	20.9	0.714	B
	2022 Main Works + proposed segment factory works	24.2	0.760	B

Intersection	Scenarios	Performance		
		Delays (s)[1]	Degree of saturation	Level of service
Snowy Mountains Highway / Kosciuszko Road	2022 No Project	15.3	0.262	B
	2022 Main Works only	16.1	0.262	B
	2022 Main Works + proposed segment factory works	16.4	0.262	B
Monaro Highway / Yallakool Road	2022 No Project	8.3	0.114	A
	2022 Main Works only	9.0	0.134	A
	2022 Main Works + proposed segment factory works	9.5	0.148	A
Monaro Highway / Polo Flat Road (north end)	2022 No Project	13.6	0.176	A
	2022 Main Works only	15.3	0.205	B
	2022 Main Works + proposed segment factory works	16.7	0.241	B
Monaro Highway / Saleyards Road	2022 No Project	8.5	0.118	A
	2022 Main Works only	8.7	0.127	A
	2022 Main Works + proposed segment factory works	8.8	0.150	A

1. Delays of the worst movement reported.

Source: SCT Consulting

SIDRA modelling has confirmed that critical intersections within the study area will continue to operate satisfactorily with overall intersection LoS C or better, when considered under non-winter baseline traffic and all scenarios of construction (light and heavy) vehicles traffic.

Table 4-7 Future intersection performance summary (Winter peak)

Intersection	Scenarios	Performance		
		Delays (s)[1]	Degree of saturation	Level of service
Snowy Mountains Highway / Vale Street	2022 No Project	24.0	0.728	B
	2022 Main Works only	30.9	0.826	C
	2022 Main Works + proposed segment factory works	34.6	0.871	C
Monaro Highway (Snowy Mountains Highway) / Bombala Street	2022 No Project	43.3	0.936	D
	2022 Main Works only	75.3	1.010	E
	2022 Main Works + proposed segment factory works	108.1	1.063	F
Snowy Mountains Highway / Kosciuszko Road	2022 No Project	20.8	0.290	B
	2022 Main Works only	22.0	0.290	B
	2022 Main Works + proposed segment factory works	22.5	0.290	B
Monaro Highway / Polo Flat Road (north end)	2022 No Project	137.5	0.967	F
	2022 Main Works only	244.5	1.138	F
	2022 Main Works + proposed segment factory works	355.0	1.283	F

1. Delays of the worst movement reported.

Source: SCT Consulting

SIDRA modelling has confirmed that the following intersections are expected to operate unsatisfactorily (either Level of Service D or worse or Degree of Saturation 0.85 or over), when considered under winter baseline traffic and all scenarios of construction (light and heavy) vehicles traffic:

– Snowy Mountains Highway / Vale Street;

– Monaro Highway (Snowy Mountains Highway) / Bombala Street; and

– Monaro Highway / Polo Flat Road (north end).

4.5.3 Safe intersection sight distance review

As discussed in **Section 3.6.2**, the intersection of Snowy Mountains Highway with Tantangara Road and the Rock Forest site does not achieve minimum SISD requirements. Given the expected increase of construction traffic at these locations, mitigation measures such as localised speed reduction on the approaches to this intersection should be considered to mitigate the risks – refer to **Section 5.1**.

4.6 Public transport

As identified in **Section 3.2.2**, there are no regular mass transport systems currently in operation within the vicinity of Main Works. No impact will result from construction activities associated with Main Works.

4.7 Walking and cycling

Throughout the project, Lobs Hole Ravine Road will be closed to the public as will Lobs Hole itself. Access during the construction of the Main Works is the subject of ongoing consultation with NPWS. The closures will affect existing walking and mountain bike trails adjoining Lobs Hole Ravine Road. Although there is no alternative access proposed for the sites within the project area, there are numerous walking and cycle tracks within the KNP that visitors to the region may continue to access.

Outside of the KNP area, it is not expected that any walking and cycling access would be impacted by this project.

4.8 Tantangara and Talbingo Reservoirs Watercourse

The navigable waters within Tantangara and Talbingo reservoirs would remain open to the public throughout the project. However there will be restricted access to areas close to the construction sites for the period of works. All waterway users, including barges associated with the project, are to navigate the waterway in accordance with the provisions of *Marine Safety Regulation 2016*.

4.9 Over-Sized Over-Mass (OSOM) transportation

A review was undertaken by Rex J Andrews Engineered Transportation for SMEC to understand the potential implications of the transport of transformers (the largest OSOM vehicles) between Port Kembla and the Snowy Mountains Highway at Yarrangobilly.

The review was undertaken for the following details of truck size and transformer size:

– items to be transported: 6 x Transformers (11.35l x 3.70w x 4.20h x 207t);

– transport configuration: Prime mover with 14x8-14x8 beam set;

– overall dimensions: 140.0l x 6.5w x 4.9h x 582t;

– overall dimensions include the use of an additional 5 prime movers;

– escort requirement: 3 Police in NSW or 2 Police in ACT, 4 company escorts, and 2 support trucks; and

– most likely travel route: Port Kembla to Snowy Hydro (total of 463 km) via Tom Thumb Road, Springhill Road, Masters Road, Southern Freeway, Mt Ousley Road, Picton-Wilton Road, Hume Highway, Federal Highway, Majura Road, Monaro Highway, Sharp Street, Snowy Mountains Highway.

The review has identified the critical constraints on the network for the transportation of OSOM items to and from site. These critical constraints are highlighted in **Table 4-8**. The full Rex J Andrews report is included in **Annexure E**.

Table 4-8 Critical constraints of transporting OSOM items

Km index	Location	Section of road	Critical measurement	Procedure	Notes
6.5	Keiraville	Mount Ousley Road under the University Bridge	5.0 m clearance	Travel directly ahead	Loads that exceed 5.0 m will not be able to use this section of road. Detour for up to 5.3 m high via the Princes Highway.
7.5	Mount Ousley	Mount Ousley Road	8% gradient	Travel directly ahead up the range	Due to the gross weight of the beam set, it would be advisable to have 6 prime movers attached to the load for this section of road.
357.5	Cooma Option 1	Sharp Street through roundabout at Bombala Street	5.0 m into 5.0 m wide	Travel directly ahead	The beam set will need to travel over the left side of the roundabout. This will require the roundabout to have any vegetation removed and concreted in with a gentle slope, and the signs made removable.
357.9	Cooma Option 1	Sharp Street through roundabout at Vale Street	5.0 m into 5.0 m wide	Travel directly ahead	
358.3	Cooma Option 2	Massie Street onto Dawson Street	16.0 m into 10.0 m wide	Tight left hand turn	To enable the beam set to travel through this corner unrestricted, the telegraph pole on the inside of the turn would need to be relocated and it would be advisable to place no parking on all corners for a distance of at least 60 m from the corner.
358.5	Cooma Option 2	Dawson Street onto Snowy Mountains Highway	10.0 m into 17.0 m wide	Tight left hand turn	
410.0	Adaminaby through to site	Snowy Mountains Highway	6.0 m wide	Travel directly ahead	Generally, the highway from Adaminaby through to site is 6.0 m at the narrowest. There is approx. 600 mm overhang each side available on the shoulders. It is advisable that the entire road is blocked between checkpoints to allow the transporter-unrestricted access to this section of highway. There could be delays of 1-2 hours for each section. There will be no travel during the winter months or at any time that there is a possibility of ice or snow.
420.0	Providence Portal through to Kiandra	Snowy Mountains Highway	8% gradient	Travel directly ahead up the range	Due to the gross weight of the beam set, it would be advisable to have 6 prime movers attached to the load for this section of road.
439.0	Sawyers Hut	Snowy Mountains Highway	8.0 m wide	Multiple tight bends	The tightest section of Highway is between Sawyers Hut and Link Road. The beam set will tighten up on several corners; the tightest of these is the right-hand bend directly after Sawyers Hut. There are other corners that will also have some problems with swept path. The first right hand corner will require the embankment on the inside to be cut back by at least 2 m, the additional corners would only require some hardstand on the outside, and possible some realigning of some sections of guard rail.

Source: Rex J Andrews, 2017

4.10 Emergency vehicles

Access for emergency vehicles will be unaffected as there are no plans to close any of the roads to emergency vehicles. During upgrades of the internal roads, unhindered access will be available and maintained for emergency vehicles at all times. In addition, consultations with emergency service providers would be required as part of the finalisation of the Construction Traffic Management Plan of the project.

5.0 Mitigation Measures

5.1 Reduced speed areas

At locations where minimum sight distances cannot be achieved due to the existing road alignments, posted speed limits adjacent to the intersections will be reduced to satisfy the sight distance requirements and maintain safe maneuvering conditions for motorists. The locations of these intersections and the proposed speeds are summarised in **Table 5-1**.

Table 5-1 Proposed speed reduction locations

Location	Proposed Speed
Snowy Mountains Highway / Tantangara Road	60 km/hr
Snowy Mountains Highway / Rock Forest access	80 km/hr
Link Road / Lobs Hole Ravine Road	60 km/hr
Link Road / Snowy Mountains Highway	80 km/hr
Monaro Highway through Polo Flat Road and Yallakool Road intersections	60 km/hr

Source: SCT Consulting, August 2019

Advance warning signs would also be used as required to alert drivers and increase driver awareness of any sub-standard or changed traffic condition.

5.2 Intersection upgrades

Snowy Hydro is continuing to engage with roads authorities (SMRC and TfNSW) to determine the most appropriate measures to address traffic performance issues identified during the consideration of construction activities as well as intersection capacity assessment undertaken in **Section 4.0** of this report.

The intersections to be considered for upgrades include:

– the intersections of Monaro Highway / Yallakool Road and Monaro Highway / Polo Flat Road will require upgrades based on the forecast growth of the corridor specified by TfNSW, even without the consideration of construction vehicles during typical (non-winter) traffic conditions;

– some upgrades are required for the existing roundabout intersections of Monaro Highway (Snowy Mountains Highway) / Bombala Street and Snowy Mountains Highway / Vale Street in Cooma to provide adequate performance during winter peak conditions, when considered together with construction traffic. It should be noted this roundabout is expected to fail (i.e. perform poorly) under existing winter peak traffic conditions (during the peak hours on the weekends of the snow season) regardless of construction traffic;

– regardless of the winter peak traffic conditions, changes are required to the layout of both roundabout intersections of Monaro Highway (Snowy Mountains Highway) / Bombala Street and Snowy Mountains Highway / Vale Street in Cooma, to facilitate 250 t transformer movements;

– the intersections of Monaro Highway / Saleyards Road will require upgrades when considered with construction vehicles during typical (non-winter) traffic conditions;

– in addition to the external intersections to be considered for upgrades, three new (BAR / BAL) intersections will be created for access to the project worksites at the following locations:

  - Snowy Mountains Highway / Marica Access;
  - Snowy Mountains Highway / Rock Forest Access; and
  - Polo Flat Road / New Road to proposed segment factory.

5.3 OSOM

For any scheduled Over Size Over Mass (OSOM) movements and associated road closures, individual Transport Management Plans (TMP) and Traffic Control Plans (TCP) will be required. The TMP must detail the date, duration, load details, driver detail, proposed route, emergency contact details, communication protocols, route surveys that include road width dimensions (pinch points) and procedures to mitigate the pinch point locations.

To minimise impacts, transportation of OSOM movements would be limited to the conditions set out in OSOM traffic permits.

TMPs and TCPs must be prepared in consultation with TfNSW, submitted and approved by the DPIE, prior to the commencement of any deliveries in accordance with TfNSW 'high risk' OSOM movements. In addition, the TMPs must be prepared in consultation with relevant councils and emergency providers and include emergency contingency plans. The TMPs would include:

- alternate diversion routes for non-construction vehicles;
- potential lay-by areas for OSOM vehicles to allow vehicles to overtake at various locations along the corridor;
- details of road work / pavement modifications;
- vegetation management;
- temporary parking restriction requirements;
- earthwork and structural modifications; and
- intersection upgrades.

Separate Traffic Control Plans (TCP), as per TfNSW 'Traffic Control at Worksites Manual Version 5', may also be required to facilitate one-way movements on certain segments of the Snowy Mountains Highway.

5.4 Road maintenance

Prior to construction commencing, an independent and qualified expert will survey and prepare a Road Dilapidation Report for the main roads used during construction. Prior to operations commencing, a Road Dilapidation Report should be prepared for the main transport route. The report would assess the current condition of the road surfaces the construction vehicles would traverse, including the external road network, and describe mechanisms to restore any damage that may result due to its use by traffic and transport related to the project.

The Road Dilapidation Report will be submitted to the relevant road authority for review prior to the commencement of heavy vehicle movements.

Following completion of construction and operations, subsequent surveys and reports will be required to assess damage to the roads accessed by all heavy vehicles associated with the Snowy 2.0 project. At the completion of the construction phase, an assessment will be required that addresses damage caused during the Main Works phase by construction vehicles and sets out the repairs required to ensure network safety and efficiency.

In addition, routine defect identification and rectification of the newly constructed internal road network will be managed as part of the project maintenance procedure. Once appropriate vehicle type and size for construction are determined the internal access roads, will be designed in accordance with the relevant vehicle loading requirements to ensure maintenance in accordance with the requirements of the local road authority.

5.5 Traffic control

Any road works associated with pavement widening, such as those associated with intersection upgrades, that require temporary occupation of traffic lanes or working adjacent to the road, will require preparation and approval of Traffic Control Plans (TCP), identifying required traffic control measures as specified in AS1742-2002 (e.g. signage, traffic controllers and speed limits) and TfNSW 'Traffic Control at Worksites Manual Version 5' to ensure safety of all road users and to warn road users in advance of the change in traffic conditions.

5.6 Community consultation

All affected communities, visitors and emergency services will be notified in advance of any disruptions to traffic and restriction of access to areas of KNP impacted by project activities. The methods of notification would vary, but may include:

– driver warning signs;

– variable message signs;

– web notifications; and

– public notices in local publications.

Strategies will be established to ensure proper and adequate communication between the project and community. The communication strategy will be developed in conjunction with the Construction Traffic Management Plan to detail the methodology, frequency and response measures in relaying information to the community and ameliorating any community concerns.

5.7 Construction Traffic Management Plan

Traffic management would be detailed in the Environmental Management Plan (EMP). It would include the guidelines, general requirements and procedures to be used when construction and operational activities would have a potential impact on existing traffic arrangements. Implementation of the measures would ensure that delays and disruptions are managed with appropriate measures and identify / respond to any changes in road safety as a result of construction works.

The EMP would include:

– signage requirements (e.g. temporary speed restrictions, changes to the road environment, traffic management controls deployed);

– lane possession and approval process during periods of online construction (e.g. linemarking and temporary barriers); and

– a communications strategy which would include methods to provide advanced notice of any major or prolonged impacts (e.g. leaflets and local media), and real-time information regarding current impacts (e.g. variable message signs, radio traffic news).The strategy is to discuss the establishment of a project hotline where the community can query the project or report any traffic or safety concerns and discuss the methodologies of investigating and responding to the queries.

Some of the principles the EMP would encompass would include:

– minimisation of potential effects of any major sources of delay, any works which would significantly reduce the performance of the road network in the project area would be scheduled for periods of typically lower traffic volumes where possible e.g. avoid peak snow seasons; and

– the use of signage to clearly indicate the traffic controls in use. This could also include temporary speed restrictions and passing constraints if required to maintain road safety levels. In some instances, lane closures would be implemented to remove road traffic from construction zones altogether. Where practical, this would occur outside of peak periods to maintain peak period network capacity.

The EMP would be developed in consultation with the emergency services to ensure that procedures are in place to maintain safe, priority access for emergency vehicles through construction zones. Additionally, the EMP would be prepared in close consultation with emergency services with a view to planning and executing the works to minimise any impact of the works on their ability to respond to an incident, when possible.

Overall, the EMP would set out the strategy and procedures to minimise, mitigate and communicate the impacts of the construction of the project on the capacity, performance and safety of the local road network and traffic systems. The EMP would also address the management of impacts on all existing road users.

6.0 Conclusion

6.1 The project

Snowy 2.0 is a large-scale pumped hydro-electric storage and generation project which would increase hydro-electric capacity within the existing Snowy Scheme. The key construction element for the project is the excavation and tunneling for underground infrastructure including the power station, power waterway and its associated infrastructure.

6.2 Current traffic conditions

Under current conditions, SIDRA intersection assessment of the key locations along Snowy Mountains Highway and Monaro Highway shows that the intersections operate with spare capacity during the non-winter peak period. As such they do not require any intersection upgrades. However, with increased traffic flows during the winter holiday peak hour, all intersections perform with lesser spare capacity with the intersection of Monaro Highway / Polo Flat Road (north) operating at Level of Service F.

Based on the Austroads warrants for turn treatments on major roads at unsignalised intersections under existing traffic conditions, only two intersections should require channelised right turning lane or auxiliary left turning lanes:

– Monaro Highway / Polo Flat Road (north end); and

– Monaro Highway / Yallakool Road.

6.3 Future traffic conditions with background traffic growth and project traffic

With the 1% annual increase forecast for the background traffic growth up to 2022 (without the consideration of any project traffic), the closely spaced Monaro Highway intersections with Yallakool Road and Polo Flat Road were assessed to no longer satisfy the non-signalised basic turn arrangement of the intersection and that auxiliary turn lanes are warranted at the intersections.

Similarly, the combined growth of the background traffic and construction vehicles at the intersection of Snowy Mountains Highway and Saleyards Road, warrants an intersection upgrade with an auxiliary lane for the turning traffic right onto Saleyards Road from Snowy Mountains Highway.

SIDRA modelling has confirmed that critical intersections within the study area will continue to operate satisfactorily with overall intersection LoS C or better, when considered under non-winter baseline traffic and all scenarios of construction (light and heavy) vehicles traffic.

However, with the consideration of background traffic growth (under winter-peak traffic conditions) as well as project traffic, the following additional intersections are expected to operate unsatisfactorily (LoS F or DoS over 0.85):

– Snowy Mountains Highway / Vale Street;

– Monaro Highway (Snowy Mountains Highway) / Bombala Street; and

– Monaro Highway / Polo Flat Road (north end).

6.4 Intersection upgrades

Snowy Hydro is continuing to engage with roads authorities (SMRC and TfNSW) to determine the most appropriate measures to address traffic performance issues identified during the consideration of construction activities as well as intersection capacity assessment undertaken in **Section 4.0** of this report.

The intersections to be considered for upgrades include:

– the intersections of Monaro Highway / Yallakool Road and Monaro Highway / Polo Flat Road will require upgrades based on forecast growth of the corridor specified by TfNSW, even without the consideration of construction vehicles during typical (non-winter) traffic conditions;

– some upgrades are required for the existing roundabout intersections of Monaro Highway (Snowy Mountains Highway) / Bombala Street and Snowy Mountains Highway / Vale Street in Cooma to provide adequate performance during winter peak conditions, when considered together with construction traffic. It should be

noted this roundabout is expected to fail (i.e. performs poorly) under existing winter peak traffic conditions (during the peak hours on the weekends of the snow season) regardless of construction traffic;

– regardless of the winter peak traffic conditions, changes are required to the layout of both roundabout intersections of Monaro Highway (Snowy Mountains Highway) / Bombala Street and Snowy Mountains Highway / Vale Street in Cooma, to facilitate 250 t transformer movements;

– the intersections of Monaro Highway / Saleyards Road will require upgrades when considered with construction vehicles during typical (non-winter) traffic conditions;

– in addition to the external intersections to be considered for upgrades, three new (BAR / BAL) intersections will be created for access to the project worksites at the following locations:

  - Snowy Mountains Highway / Marica Access;
  - Snowy Mountains Highway / Rock Forest Access; and
  - Polo Flat Road / New Road to proposed segment factory.

6.5 Recommendations

Through this Traffic and Transport Assessment, recommendations have been made for:

– identified reduced speed areas where minimum sight distances cannot be achieved;

– intersection improvements and upgrades to accommodate the combined impact of assumed 2022 traffic volumes and estimated project traffic (including traffic volumes associated with winter peak traffic conditions);

– set out the requirements to address OSOM movements;

– addressed road maintenance and requirements for traffic controls and community consultation; and

– set out the requirements for traffic management plans.

It should be noted that not all proposed works identified above are triggered by any single application associated with the Snowy 2.0 project. As a result:

– changes to the Snowy Mountains Highway / Vale Street and Monaro Highway (Snowy Mountains Highway) / Bombala Street intersections are being assessed as part of the Modification 2 application to the previously approved Exploratory Works; and

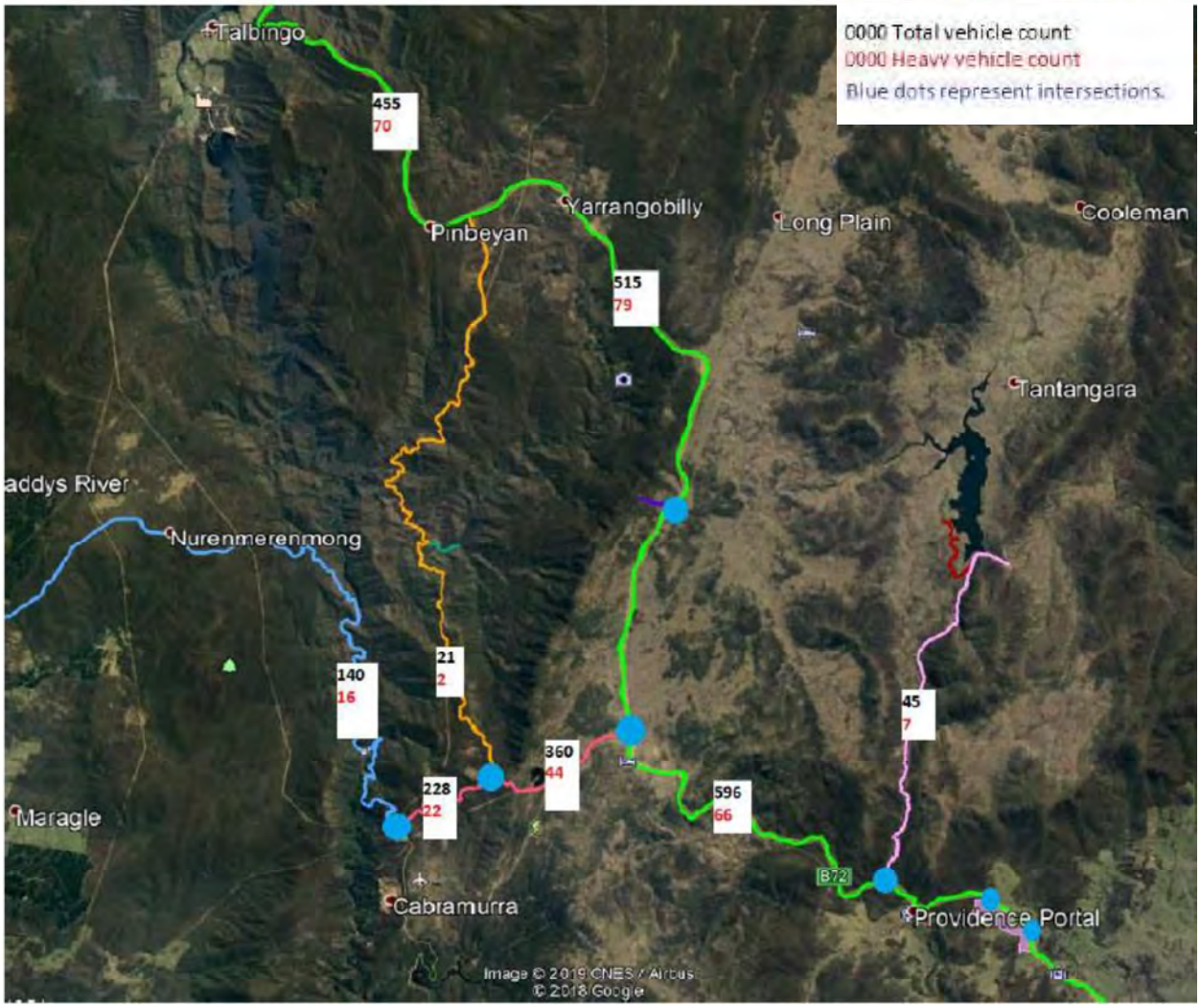
– intersection improvements and upgrades for the intersections in and around Cooma are being assessed through the application for the proposed segment factory.

Further, it should be noted that consultation between agencies, Snowy Hydro and FGJV, as contractor for the construction of the Snowy 2.0 project, are on-going. Further discussion on traffic and transport matters may result in the identification of additional issues and the need for additional works to those set out in this report.

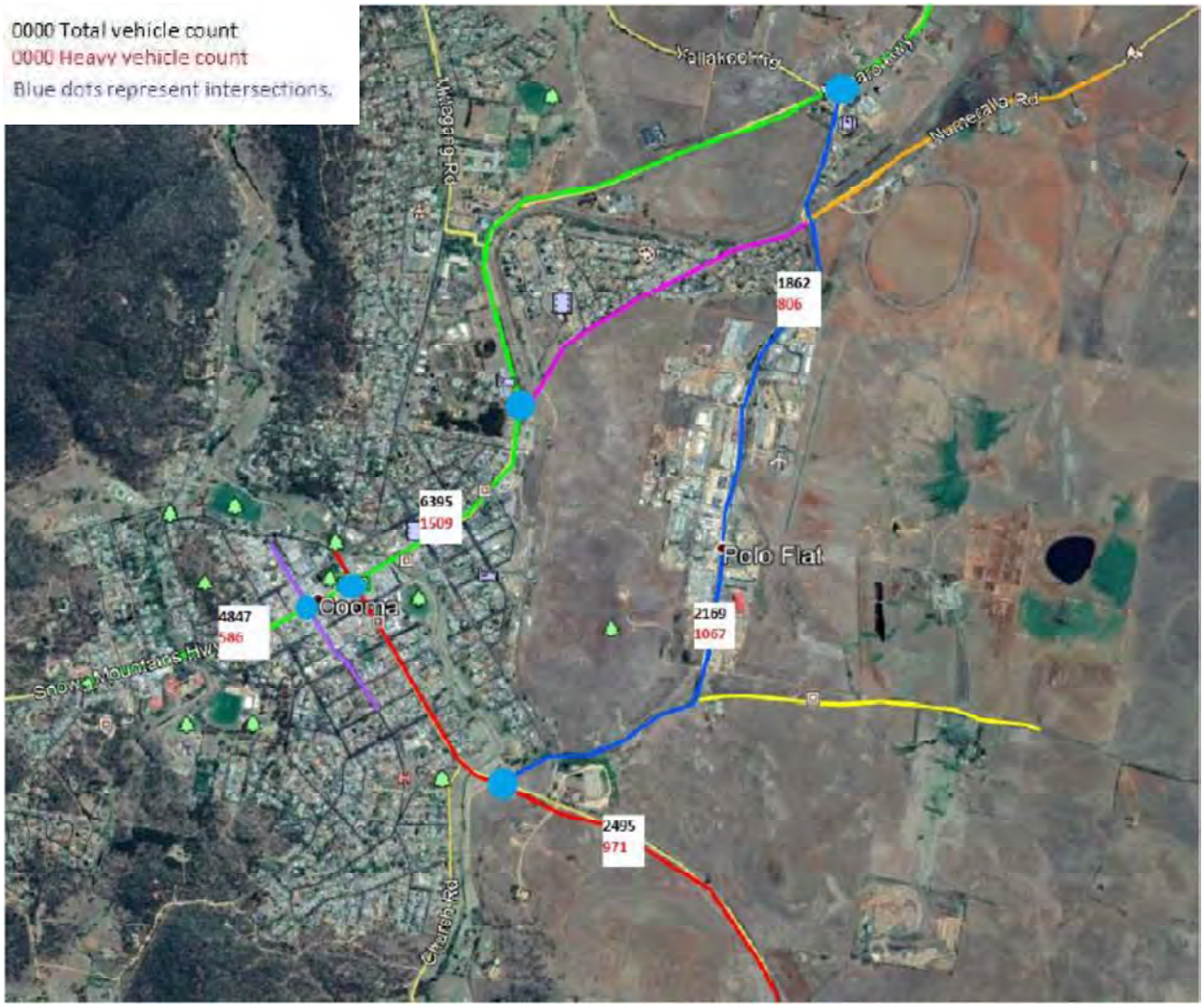
ANNEXURE A

Existing traffic data

Baseline average daily traffic numbers – KNP area



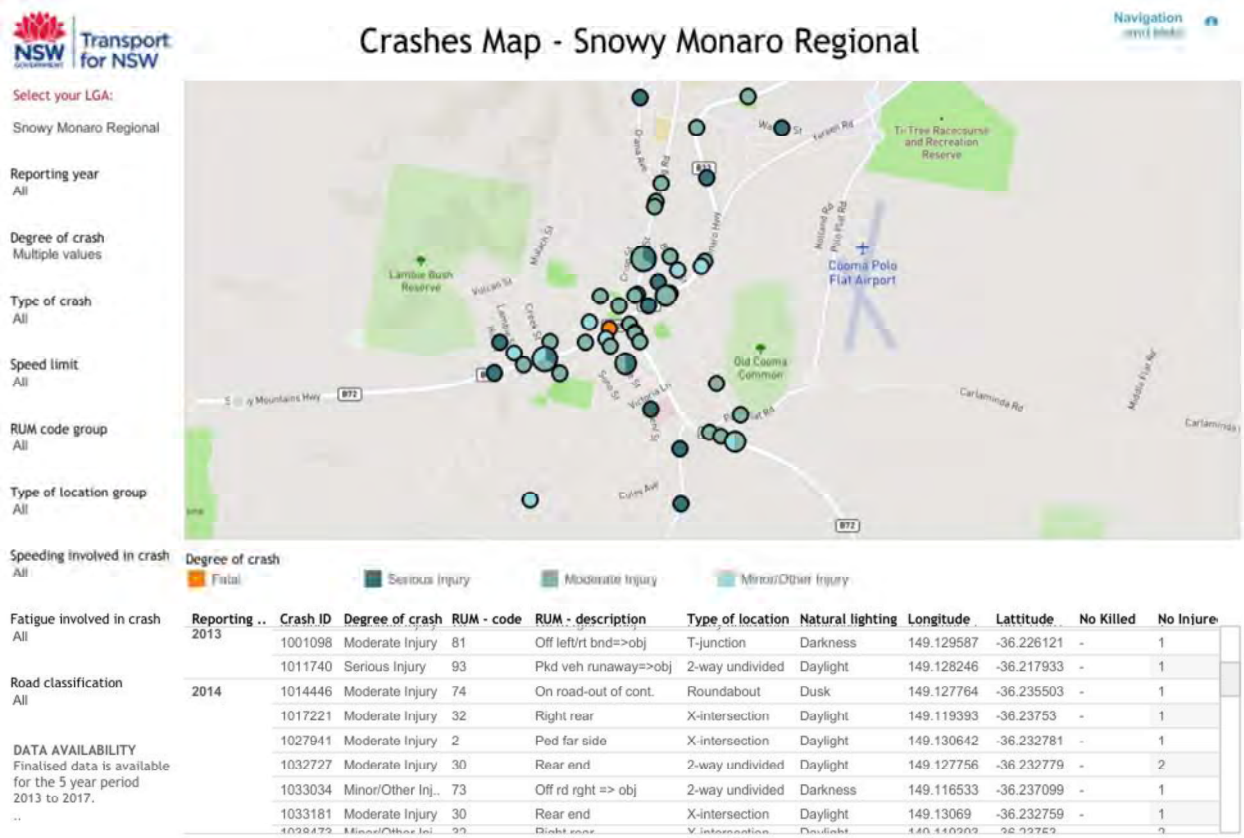
Baseline average daily traffic numbers – Cooma and Polo Flat



ANNEXURE B

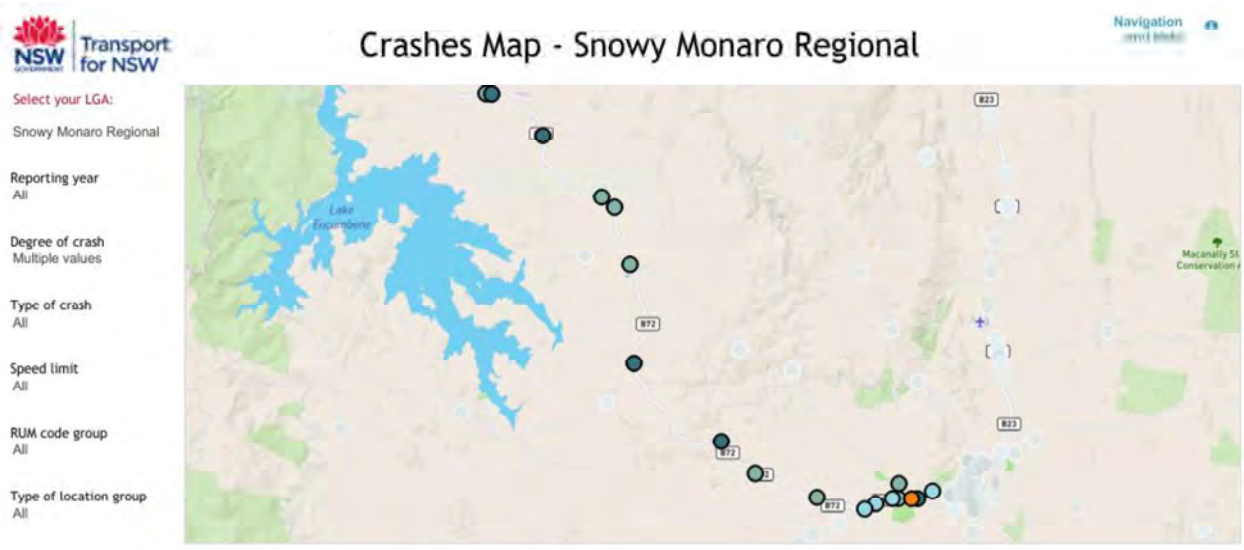
Accident history

Crash Map – Cooma township



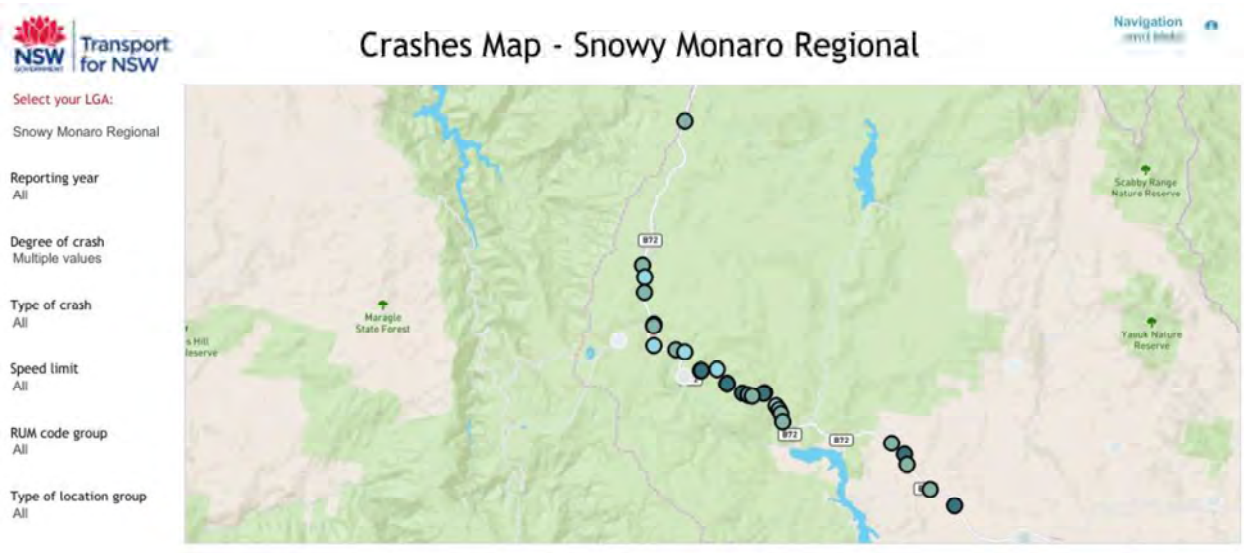
Reporting ..	Crash ID	Degree of crash	RUM - code	RUM - description	Type of location	Natural lighting	Longitude	Lattitude	No Killed	No Injure
2013	1001098	Moderate Injury	81	Off left/rt bnd=>obj	T-junction	Darkness	149.129587	-36.226121	-	1
	1011740	Serious Injury	93	Pkd veh runaway=>obj	2-way undivided	Daylight	149.128246	-36.217933	-	1
2014	1014446	Moderate Injury	74	On road-out of cont.	Roundabout	Dusk	149.127764	-36.235503	-	1
	1017221	Moderate Injury	32	Right rear	X-intersection	Daylight	149.119393	-36.23753	-	1
	1027941	Moderate Injury	2	Ped far side	X-intersection	Daylight	149.130642	-36.232781	-	1
	1032727	Moderate Injury	30	Rear end	2-way undivided	Daylight	149.127756	-36.232779	-	2
	1033034	Minor/Other Inj..	73	Off rd rght => obj	2-way undivided	Darkness	149.116533	-36.237099	-	1
	1033181	Moderate Injury	30	Rear end	X-intersection	Daylight	149.13069	-36.232759	-	1

Crash Map – Cooma to Adminaby



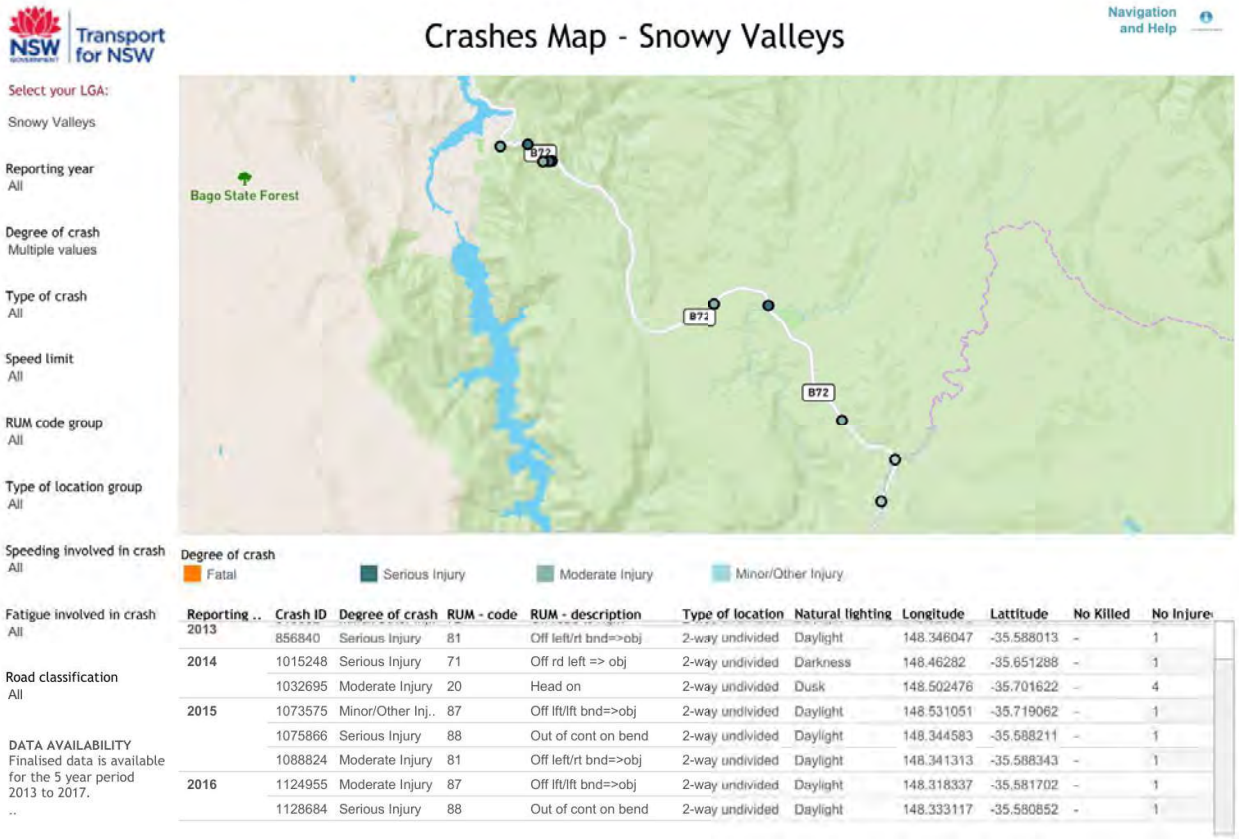
Reporting ..	Crash ID	Degree of crash	RUM - code	RUM - description	Type of location	Natural lighting	Longitude	Lattitude	No Killed	No Injure
2016	1106561	Minor/Other Inj..	67	Struck animal	2-way undivided	Darkness	149.072139	-36.240613	-	1
	1110498	Moderate Injury	21	Right through	T-junction	Daylight	149.076954	-36.231544	-	1
	1112851	Moderate Injury	30	Rear end	2-way undivided	Daylight	148.970253	-36.225485	-	1
	1126291	Moderate Injury	70	Off road to left	2-way undivided	Daylight	148.856075	-36.059531	-	1
2017	1129681	Fatal	70	Off road to left	2-way undivided	Darkness	149.08633	-36.240688	1	1
	1135338	Moderate Injury	85	Off rt/lft bnd=>obj	2-way undivided	Daylight	149.016109	-36.23992	-	1
	1139553	Moderate Injury	85	Off rt/lft bnd=>obj	2-way undivided	Daylight	148.865629	-36.065747	-	1
	1147508	Serious Injury	30	Rear end	T-junction	Darkness	149.090908	-36.240681	-	3

Crash Map –Adminaby to LGA Boundary



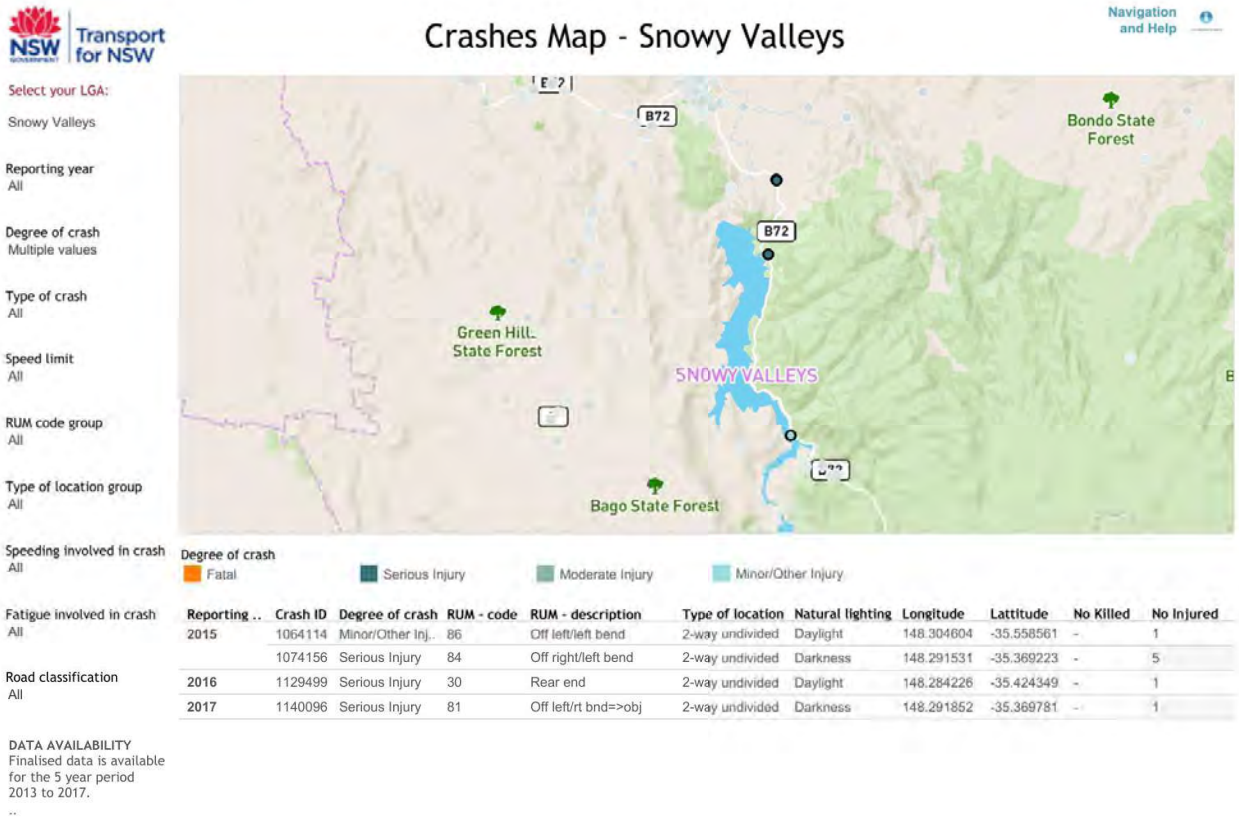
Reporting ..	Crash ID	Degree of crash	RUM - code	RUM - description	Type of location	Natural lighting	Longitude	Lattitude	No Killed	No Injure
2013	822263	Moderate Injury	80	Off left/right bend	2-way undivided	Daylight	148.592329	-35.922926	-	1
	831053	Serious Injury	84	Off right/left bend	2-way undivided	Daylight	148.721522	-35.978493	-	1
	836145	Moderate Injury	73	Off rd rght => obj	2-way undivided	Daylight	148.514293	-35.884566	-	1
	839144	Moderate Injury	20	Head on	2-way undivided	Daylight	148.703294	-35.9686	-	1
	839516	Moderate Injury	70	Off road to left	2-way undivided	Daylight	148.674706	-35.940815	-	1
	852924	Moderate Injury	66	Object on road	2-way undivided	Daylight	148.491027	-35.849935	-	1
	856368	Minor/Other Inj..	82	Off right/right bend	2-way undivided	Dawn	148.49127	-35.840905	-	1
	856764	Minor/Other Inj..	81	Off left/rt bnd=>obj	2-way undivided	Daylight	148.580291	-35.910387	-	1
	857279	Serious Injury	80	Off left/right bend	2-way undivided	Daylight	148.684275	-35.947498	-	1

Crash Map – LGA Boundary to Talbingo



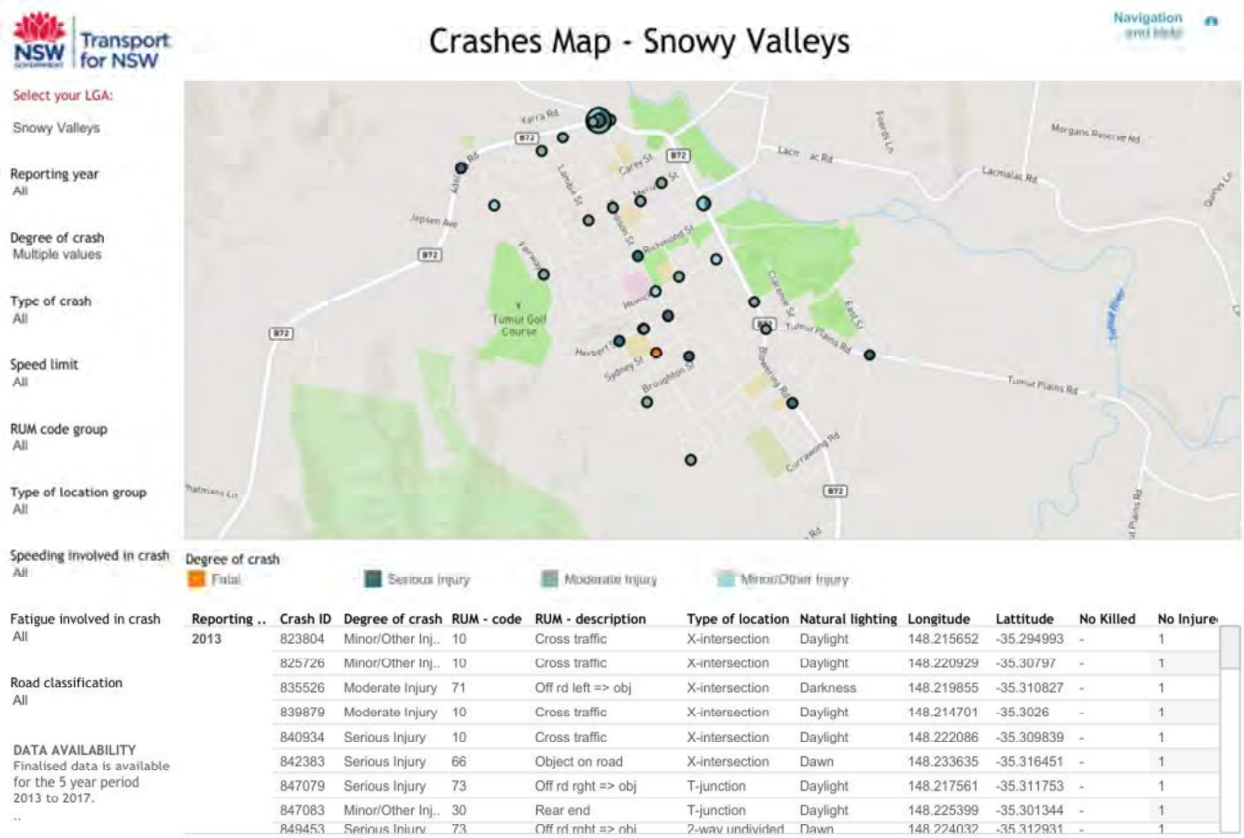
Reporting ..	Crash ID	Degree of crash	RUM - code	RUM - description	Type of location	Natural lighting	Longitude	Lattitude	No Killed	No Injure
2013	856840	Serious Injury	81	Off left/rt bnd=>obj	2-way undivided	Daylight	148.346047	-35.588013	-	1
2014	1015248	Serious Injury	71	Off rd left => obj	2-way undivided	Darkness	148.46282	-35.651288	-	1
	1032695	Moderate Injury	20	Head on	2-way undivided	Dusk	148.502476	-35.701622	-	4
2015	1073575	Minor/Other Inj..	87	Off lft/lft bnd=>obj	2-way undivided	Daylight	148.531051	-35.719062	-	1
	1075866	Serious Injury	88	Out of cont on bend	2-way undivided	Daylight	148.344583	-35.588211	-	1
	1088824	Moderate Injury	81	Off left/rt bnd=>obj	2-way undivided	Daylight	148.341313	-35.588343	-	1
2016	1124955	Moderate Injury	87	Off lft/lft bnd=>obj	2-way undivided	Daylight	148.318337	-35.581702	-	1
	1128684	Serious Injury	88	Out of cont on bend	2-way undivided	Daylight	148.333117	-35.580852	-	1

Crash Map – Talbingo to Tumut



Reporting ..	Crash ID	Degree of crash	RUM - code	RUM - description	Type of location	Natural lighting	Longitude	Lattitude	No Killed	No Injured
2015	1064114	Minor/Other Inj..	86	Off left/left bend	2-way undivided	Daylight	148.304604	-35.558561	-	1
	1074156	Serious Injury	84	Off right/left bend	2-way undivided	Darkness	148.291531	-35.369223	-	5
2016	1129499	Serious Injury	30	Rear end	2-way undivided	Daylight	148.284226	-35.424349	-	1
2017	1140096	Serious Injury	81	Off left/rt bnd=>obj	2-way undivided	Darkness	148.291852	-35.369781	-	1

Crash Map – Tumut Township



Reporting ..	Crash ID	Degree of crash	RUM - code	RUM - description	Type of location	Natural lighting	Longitude	Lattitude	No Killed	No Injure
2013	823804	Minor/Other Inj..	10	Cross traffic	X-intersection	Daylight	148.215652	-35.294993	-	1
	825726	Minor/Other Inj..	10	Cross traffic	X-intersection	Daylight	148.220929	-35.30797	-	1
	835526	Moderate Injury	71	Off rd left => obj	X-intersection	Darkness	148.219855	-35.310827	-	1
	839879	Moderate Injury	10	Cross traffic	X-intersection	Daylight	148.214701	-35.3026	-	1
	840934	Serious Injury	10	Cross traffic	X-intersection	Daylight	148.222086	-35.309839	-	1
	842383	Serious Injury	66	Object on road	X-intersection	Dawn	148.233635	-35.316451	-	1
	847079	Serious Injury	73	Off rd rght => obj	T-junction	Daylight	148.217561	-35.311753	-	1
	847083	Minor/Other Inj..	30	Rear end	T-junction	Daylight	148.225399	-35.301344	-	1
	849453	Serious Injury	73	Off rd rght => obj	2-way undivided	Dawn	148.224032	-35.312931	-	1

ANNEXURE C

Road safety audit

Snowy Mountains Highway Haul Route

Road Safety Audit

Audit Stage: Existing Conditions

Report for: Snowy Hydro Ltd

SAFE SYSTEM SOLUTIONS

ROAD SAFETY · AUDITING · ENGINEERING · PROJECT DEVELOPMENT

snowy hydro

snowy 2.0

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Information page

DATE: 10/9/2019

CLIENT: Snowy Hydro Ltd

PROJECT NUMBER: S20190286

FRONT
COVER

QUALITY RECORD:

Issue	*Date*	*Description*	*Prepared By*	*Reviewed By*	*Approved By*
1	9/9/2019	Draft RSA	Max McCardel Domenic Gangi	Kenn Beer	
2	10/9/2019	RSA	Max McCardel Domenic Gangi	Kenn Beer	

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ACN: 164 341 084 ABN: 98 164 341 084 Industry Code: 99994
Professional Indemnity Insurance Policy Number: 83CON1007716
Public Liability Insurance Policy Number: 15T2402729
Victorian WorkCover Policy Number: 14074213

1. Executive Summary

Safe System Solutions Pty Ltd has been engaged by Snowy Hydro Ltd to undertake an Existing Conditions Road Safety Audit (RSA) for Snowy Mountains Highway Haul Route.

The "Snowy 2.0" project will mean there will be additional Heavy Vehicles (HVs) operating on the road network to transport construction materials, precast elements and plant. 'Future Generation JV, the appointed Contractor for the project, have identified a haulage route to enable this transportation of goods.

This RSA exclusively focusses on the effects on road safety with increasing the volume of Heavy Vehicles for the transport of precast concrete segments along the proposed haulage route.

A number of issues have been identified associated with the following areas which require further investigation and consideration:

a) Redundant railway signage
b) Redundant infrastructure
c) Angled parking
d) Pedestrians
e) Cooma Creek Bridge
f) Roundabouts
g) Kosciusko intersection
h) Tantangara intersection
i) Road standard
j) Absence of linemarking
k) Steep drop-offs
l) Road geometry
m) Road pavement
n) Barrier systems
o) Overtaking opportunities
p) Wildlife

These are detailed in Table of the Road Safety Audit report.

2. Table of contents

3. List of Abbreviations

HV	Heavy Vehicle
RSA	Road Safety Audit
SMH	Snowy Mountains Highway

4. List of Tables

5. Background

a) Safety Audit Procedure

A road safety audit is a term used internationally to describe an independent review of a road project or existing road to identify any safety or performance concerns. The audit team considers the safety of all road users and qualitatively reports on road safety issues or opportunities for safety improvement. The team also considers other factors that are relevant to the existing site.

A road safety audit is therefore a formal examination of a road project, or any type of project which affects road users (including cyclists, pedestrians, mobility impaired etc.) or an existing road, carried out by an independent qualified team who identify and document road safety concerns. The objective of a Road Safety Audit is to provide reasonable (but not absolute) assurance that potential, foreseeable hazards for all road users when a road is operational which may result in injury (in particular fatal and serious injury) are identified.

A road safety audit is intended to help deliver a safe road system and is **not** a review of compliance with standards.

b) The Safe System

The Austroads Guide to Road Safety Part 6 (2019): Managing Road Safety Audits states that: *"for any project, there is a responsibility on the road authority to maximise alignment with Safe System principles".* The Guide continues to offer two methods for achieving this:

1. Undertake a Safe System Assessment in the early stages of the project.
2. Integrate Safe System principles into the Road Safety Audit process.

Table 1: Safe System Kinetic Energy

	Crash Type	Tolerable (10%) Speed (passenger vehicle)
	Head-On	~70km/h
	Side Impact (90°) Side Impact (45°)	~50km/h ~60km/h
	Side Impact into Point Source Hazard (eg. Tree, Power Pole)	30 – 40km/h
	Pedestrian, Cyclist, Motorcyclist	~30km/h

Source: Austroads (2018).

This RSA has been undertaken to conform with AGRS Part 6: Managing Road Safety Audits (2019). As such, an assessment has been undertaken for each RSA finding to determine if the kinetic energy associated with the possible crash is above tolerable levels (as set out above). Also, each recommendation has been categorised into one of the Austroads Safe System treatment categories described in Table 2 below.

Table 2: Safe System Treatment Categories

Primary	Road planning, design and management considerations that practically eliminate the potential of fatal and serious injuries occurring in association with the foreseeable crash types.
Supporting (step towards)	Road planning, design and management considerations that improve the overall level of safety associated with foreseeable crash types, but not expected to virtually eliminate the potential of fatal and serious injury occurring. Improves the ability for a Primary Treatment to be implemented in the future.
Supporting	Road planning, design and management considerations that improve the overall level of safety associated with foreseeable crash types, but not expected to virtually eliminate the potential of fatal and serious injury occurring. Does not change the ability for a Primary Treatment to be implemented in the future.
Non-Safe System Other Elements	Road planning, design and management considerations that are not expected to achieve an overall improvement in the level of safety associated with foreseeable crash types occurring. Reduces the ability for a primary treatment to be implemented in the future.

Source: Austroads (2018a).

c) The Safety Audit Team

Road Safety Audits are undertaken in teams of two or more, with at least one Senior Road Safety Auditor. The team consisted of:

Table 3: Road Safety Audit Team

Senior Road Safety Auditors	Road Safety Auditor
Domenic Gangi Safe System Solutions Pty Ltd **Kenn Beer** Safe System Solutions Pty Ltd Level 3	**Max McCardel** Safe System Solutions Pty Ltd

d) Site inspections and meetings

A list of site inspections and meetings associated with this Road Safety Audit is provided in the table below:

Table 4: Inspection and meetings

Activity	Location	Date	Time
PRE-AUDIT MEETING	Snowy Hydro Office, Cooma	05.09.209	1000
DAYTIME SITE INSPECTION	Snowy Mountains Highway Haul Route	05.09.209	1200
NIGHTTIME SITE INSPECTION	Snowy Mountains Highway Haul Route	05.09.209	1800

e) Audit process

This Road Safety Audit has been conducted in accordance with the procedures set out in the *Austroads Guide to Road Safety Part 6: Managing Road Safety Audits (2019)* and *Austroads Guide to Road Safety Part 6A: Implementing Road Safety Audits (2019)*. A review of the site has been completed to identify issues that affect road user safety and other relevant issues. The auditors cannot guarantee that every issue that affects road user safety has been identified. Although the adoption of the audit recommendations will improve the level of safety of the site it will not, however, eliminate all the road user safety risks.

Road Safety Audits are a formal process and the audit findings and recommendations should be documented by the client in writing. If recommendations are not accepted by the client then reasons should be included within the written response. A client is under no obligation to accept all the audit findings and recommendations and should consider these in conjunction with all other project considerations. It is not the role of the auditor to approve the client's response to an audit.

f) Risk assessment

The potential road safety problems identified have been ranked as follows:

A risk rating based on the **likelihood** of a crash occurring as a result of the deficiency together with the potential **consequence** of that crash.

The risk ratings adopted are:

- ⇒ **Intolerable**
- ⇒ **High**
- ⇒ **Medium**
- ⇒ **Low**

Tables 6 to 8 below show the risk rating process.

Table 5: Likelihood of a crash (Austroads, 2019)

Frequency	Description
Frequent	Once or more per week
Probable	Once or more per year (but less than once a week)
Occasional	Once every five to ten years
Improbable	Less often than once every ten years

Table 6: Likely severity of a crash (Austroads, 2019)

Severity	Description	Examples
Catastrophic	Likely multiple deaths	- High speed, multi-vehicle crash on a freeway - Car runs into crowded bus stop - Bus and petrol tanker collide - Collapse of a bridge or tunnel
Serious	Likely deaths or serious injury	- High or medium speed vehicle/vehicle collision - High or medium speed collision with a fixed roadside object - Pedestrian or cyclists struck by a car
Minor	Likely minor injury	- Some low speed vehicle collisions - Cyclist falls from bicycle at low speed - Left-turn rear-end crash in a slip lane
Limited	Likely trivial injury or property damage only	- Some low speed vehicle collisions - Pedestrian walks into object (no head injury) - Car reverses into post

Table 7: Resulting level of risk (Austroads, 2019)

	Frequent	Probable	Occasional	Improbable
Catastrophic	Intolerable	Intolerable	Intolerable	High
Serious	Intolerable	Intolerable	High	Medium
Minor	Intolerable	High	Medium	Low
Limited	High	Medium	Low	Low

6. Scope of Audit

This Road Safety Audit has been commissioned to independently examine the road safety issues for the proposed haulage route that is to be used for the transport of precast concrete segments to be manufactured at the Polo Flat Site and used to line the tunnels that make up Snowy 2.0 Main Works. The haulage route commences at the proposed vehicular ingress/egress at Polo Flat Road into the precast segment factory and ends at the Link Road intersection with Lobs Hole Ravine Road at the perimeter of the Snowy 2.0 Main works construction site within Kosciuszko National Park. Tatangara Road which intersects the Snowy Mountain Highway will also be used as a haulage route.

This road safety audit is a requirement of the Secretary's Environmental Assessment Requirements (SEARs) for separate Environmental Impact Assessments for the Snowy 2.0 Main Works project and an associated pre-cast concrete segment manufacturing factory proposed for a site off Polo Flat Road at Cooma. The roads that define the haul route inclusive of their posted speed are summarized in

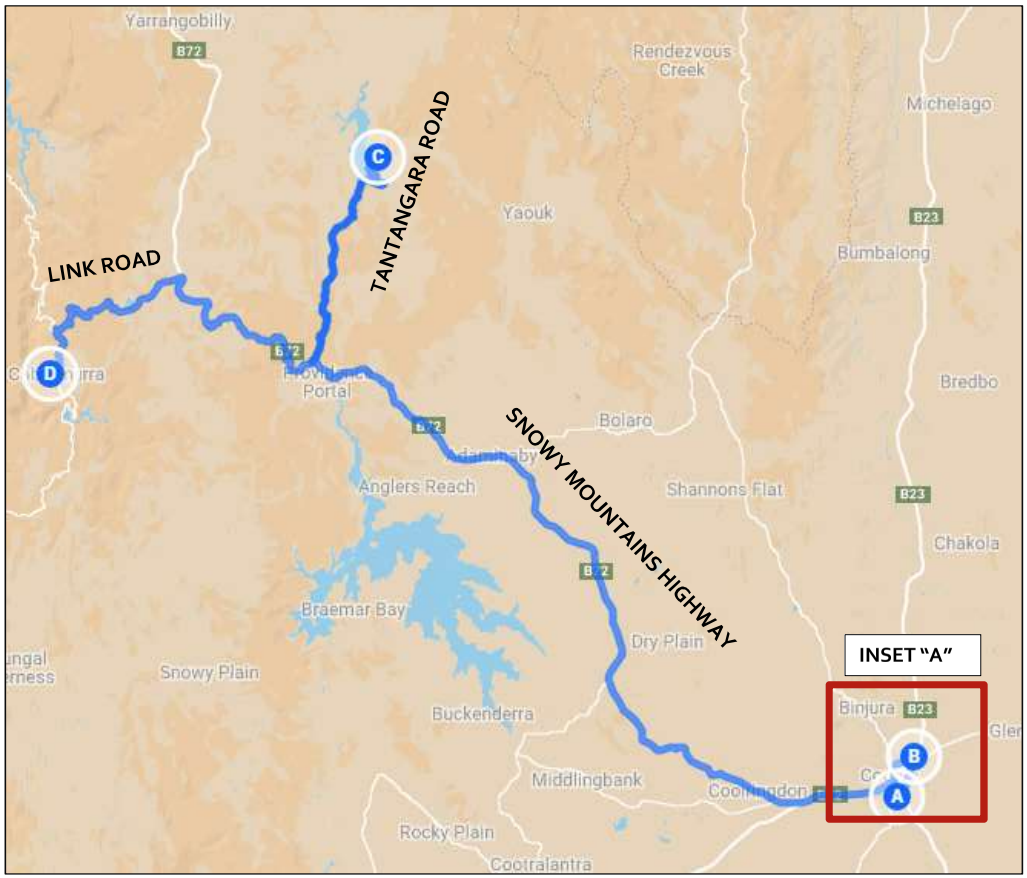
The Audit will consider the existing road geometry and cross section, intersections and property accesses, road signage, safety barriers, delineation and clear zones. The aim of the audit is to identify any potential road safety issues associated with hauling precast elements along the route. It will consider the route for haulage of precast elements and the implications that the haulage will have for other road users. It is not intended that the audit be a detailed review of all roads and intersections along the route and associated safety concerns for all road users under normal operation of the roads.

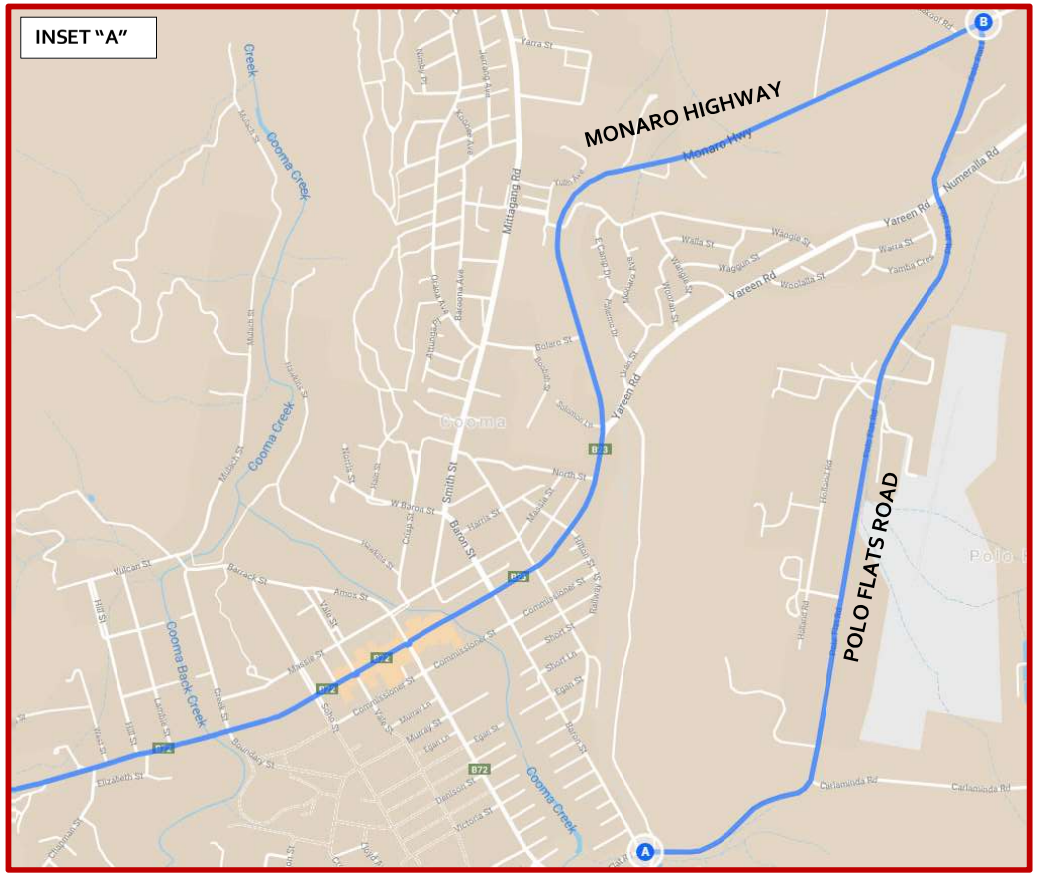
Table 9: Likely severity of a crash (Austroads, 2019)

Road Name	Posted speed	Segment Length
Polo Flat Rd	60-80 km/h	3km
Monaro Hwy	40-100 km/h	3km
Sharp St (Hilton St to Montague St)	60 km/h	2.5km
Snowy Mountains Hwy	80-100 km/h	88km
Link Rd	40-80 km/h	8km
Tantangara Rd	100 km/h*	16km

**default rural speed limit unposted*

Figure 1: Map of audit location (source: Google My Maps)





7. Audit Findings and Recommendations

The findings and recommendations of the Road Safety Audit can be found in Table 9 below.

Table 10: Audit Findings

Audit Findings	Level of Risk	Safe System Energy	Recommendations P – Primary ST – Step Towards S – Supporting N – Non-Safe System	Responsible Officer Accept Yes/No	Responsible Officer Comments
a) Polo Flats Road					
REDUNDANT RAILWAY SIGNAGE: i. Along Polo Flats Road there is a railway crossing that is no longer active. Yet at this location, the railway signage is still present including the "GIVE WAY" sign. Vehicles travelling along this road may slow at the railway crossing, expecting to give way, which could lead to potential rear-end type crashes.  **SOURCE:** S2-8700-REP-000001-A	Improbable Minor **Low**	Below tolerable	Consider removing redundant signage including (S): • Railway Crossing signs • Give Way Signs • "Reduce Speed Residential Area" – This appears to be a non-standard sign.		

Audit Findings	Level of Risk	Safe System Energy	Recommendations P – Primary ST – Step Towards S – Supporting N – Non-Safe System	Responsible Officer Accept Yes/No	Responsible Officer Comments
REDUNDANT INFRASTRUCTURE: ii. Along Polo Flats Road, near the Baron Street intersection, there is an existing timber rail bridge. There is a low clearance for the bridge structure of 4.1m. Also, the timber piers are unprotected. A Heavy Vehicle colliding with either the top of the rail bridge or one of the timber piers could potentially collapse the structure. It is assumed that this is a non-active rail bridge. 	Improbable Serious **Medium**	Below tolerable	A Construction Access Management Plan should be created to inform Heavy Vehicle drivers of the low clearance at this location (S) The rail bridge bridge piers should be shielded with approved road safety barriers and crash cushions on either end and installed to an approved design that includes specifications such as the number of barriers, deflection and the offset from kerb or pavement.		
b) Sharp Street (Cooma Town Centre)					
ANGLED PARKING: i. Along Sharp Street there is angled parking. This parking geometry means that vehicles exiting their park need to creep out to improve their sight distance. Whilst cars are reversing out of their spot, there is an opportunity for rear-end crashes to occur with the through traffic. 	Improbable Minor **Low**	Below tolerable	It is recommended to investigate whether the angled parking along Sharp Street can be remarked to parallel parking bays. This improves sight distances for vehicles exiting their parks. (S) If this can not be achieved, investigate a line marking scheme that encourages drivers to leave a buffer between the reverse parked vehicles. (S)		

Audit Findings	Level of Risk	Safe System Energy	Recommendations P – Primary ST – Step Towards S – Supporting N – Non-Safe System	Responsible Officer Accept Yes/No	Responsible Officer Comments
PEDESTRIANS: ii. The strip shopping centre environment increases the likelihood of pedestrian jay-walking. A crash involving a pedestrian and fully-laden Heavy Vehicle has the potential to result in serious/fatal outcomes – even in a low speed environment.  The below is an example of a crossing point and pedestrian refuge near Lambie Street: 	Improbable Serious **Medium**	Above tolerable	It is recommended to review all the formalised crossing points along Sharp Street and to improve their road safety performance. (S) A variety of Local Area Traffic Management devices could be employed to improve the road safety performance of these crossing points. A non-exhaustive list of treatments includes: • Narrowing the road environment (S) • Increasing sight line distances (S) • Zebra crossings or wombat (raised) crossings (S) • Kerb outstands (S) • Chevron pavement marking (S) • Pedestrian Fencing In addition to the above physical infrastructure treatments, consider reducing the speed throughout the town centre. (S)		

Audit Findings	Level of Risk	Safe System Energy	Recommendations P – Primary ST – Step Towards S – Supporting N – Non-Safe System	Responsible Officer Accept Yes/No	Responsible Officer Comments
COOMA CREEK BRIDGE: iii. The Cooma Creek Bridge has non-standard features including: a. The vertical face of the concrete barrier. This is a rigid, fixed object. Should an errant vehicle collide with this vertical edge, there would be rapid deceleration increasing the impact force on the occupants. b. The concrete barrier tapers from kerb height (approx. 100mm) to approx. 500mm. Should a vehicle leaving Cooma mount the barrier on the bridge, then travel along the concrete barrier system (one side of the vehicle on the barrier and the other on the road pavement) this could potentially lead to a roll-over crash. c. The existing bridge containment appears to be pedestrian parapet and would be unlikely to contain an errant Heavy Vehicle. A Heavy Vehicle that loses control at this site, could drive through the containment system and fall into the creek below.  **SOURCE:** S2-8700-REP-000001-A	Improbable Serious **Medium**	Below tolerable	Consider measures to improve the road safety of the structure and approach. This would require a detailed design and consideration of the best energy absorbing and redirecting barrier or other systems. (P or S)		

Audit Findings	Level of Risk	Safe System Energy	Recommendations P – Primary ST – Step Towards S – Supporting N – Non-Safe System	Responsible Officer Accept Yes/No	Responsible Officer Comments
c) Snowy Mountains Highway					
KOSCIUSKO INTERSECTION: i. The Snowy Mountain Highway continues straight onto Kosciusko Road. To continue on the SMH, a vehicle needs to turn right using the Channelised Right Turn facility. This right turn has restricted sight lines due to the crest of the road. This restricted sight line increases the likelihood of HVs not seeing an oncoming vehicle and therefore the likelihood of cross-traffic type crashes. In addition, the Channelised Right Turn facility appears to have a short deceleration lane with inadequate space for additional storage. As HV will be turning right here as part of the haul route, inadequate deceleration lanes and lack of storage could lead to rear-end type crashes. 	Improbable Serious **Medium**	Above tolerable	It is recommended to verify the sight lines currently being achieved at this intersection. Depending on how poor the sight lines are, various treatments could be adopted including: • Relocation of the existing 80km/h signage facing eastbound traffic further west • Reducing the speed (S) • Additional signage to advise of the approach to the intersection (S) • Regrading the road to remove this crest (P) It is recommended to review and redesign the Channelised Right Turn facility to increase the distance of the deceleration lane and provide additional storage. (S)		

Audit Findings	Level of Risk	Safe System Energy	Recommendations P – Primary ST – Step Towards S – Supporting N – Non-Safe System	Responsible Officer Accept Yes/No	Responsible Officer Comments
TANTANGARA INTERSECTION: ii. At the Tantangara Road intersection, the sight lines are restricted due to the horizontal and vertical geometry along Snowy Mountains Highway. This may mean a HV exiting the minor road may not be able to see a vehicle travelling on SMH and the vehicle would need to brake to let the HV in or manoeuvre around the HV. This could lead to a collision with the HV or with oncoming traffic. Also, a HV turning right into Tantangara Road needs to hold up the through-traffic lane. This increases the risk of a rear-end crash. 	Improbable Serious **Medium**	Below tolerable	As the HV traffic movements are anticipated to be high at this location, it is recommended to consider the installation of a Channelised Right Turn on SMH to enable vehicles to overtake the HVs turning right into Tantangara Road. (S) It is also recommended to consider implementing a reduced speed limit or warning for when HVs are exiting Tantangara Road. This could be achieved using a detector loop on the exit, and electronic speed limits that are only activated when the HV triggers the loop. Dropping the speeds will improve reaction times and inform drivers as they approach the intersection that something has changed in the road environment (a HV is entering SMH and still gaining speed). (S)		

Audit Findings	Level of Risk	Safe System Energy	Recommendations P – Primary ST – Step Towards S – Supporting N – Non-Safe System	Responsible Officer Accept Yes/No	Responsible Officer Comments
d) Tantangara Road					
ROAD STANDARD: i. Tantangara Road is currently an unsealed narrow road that has substandard horizontal and vertical curves as well as numerous locations where there are unshielded roadside hazards. Being unsealed leaves the road surface more prone to potholes and reduces the amount of grip / traction. All these factors lead to an increased likelihood for run-off road and head-on collisions. 	Improbable Minor **Low**	Below tolerable	It is recommended that the delineation of the route be improved through: • Curve warning signs with advisory speed (as required) (S) • Curve Alignment Markers (S) • Guide Posts (S) It is also recommended to install barrier systems where there are significant drop-offs or fixed hazards adjacent (or remove the hazard) (S) A swept path check along the route is also recommended to ensure that two semi-trailers will be able to pass one another. Alternatively, implement a process for construction drivers to advise one another via CB radio if they are about to enter a location that is too narrow for two semi-trailers and that a holding bay/area is in place to allow for passing. Signage on the road can be used to indicate areas where communication between drivers will be required.		

Audit Findings	Level of Risk	Safe System Energy	Recommendations P – Primary ST – Step Towards S – Supporting N – Non-Safe System	Responsible Officer Accept Yes/No	Responsible Officer Comments
e) Link Road					
ABSENCE OF LINEMARKING: i. There is an absence of linemarking on Link Road – due to the reduced carriageway width. Linemarking plays a key role in delineating a road environment, particularly highlighting where the edge of the road ends and where opposing traffic lanes are separated. Lack of delineation increases the risk of run-off road crashes and head-on crashes.  	Improbable Serious **Medium**	Below tolerable	Typically for road widths less than 5.5m the road centreline is not marked unless there is high HV traffic or frequent substandard curves. To improve delineation of the road environment, it is recommended: • Installing additional snow poles / guide posts – also taking note that around sharp curves the spacing of the posts should be adjusted (S) • Installing additional warning signs of upcoming curves combined with advisory speeds as required (S) • The centreline be marked where appropriate In addition to the above, it is recommended to implement a reduced speed limit (S) A swept path check of the radii should be undertaken at each small radius curve to ensure two semi-trailers will be able to pass one another. A preliminary check at one curve has shown that at 50km/h semi-trailers will be able to pass but may slightly encroach on the shoulder. Ensure that the shoulders are always maintained in a trafficable condition.		

Audit Findings	Level of Risk	Safe System Energy	Recommendations P – Primary ST – Step Towards S – Supporting N – Non-Safe System	Responsible Officer Accept Yes/No	Comments
f) General					
STEEP DROP-OFFS: i. Along the haul route there are a several examples where steep drop-offs are unshielded. An errant vehicle travelling at these locations may leave the carriageway and descend down steep batters and potentially rolling-over or colliding with fixed hazards (trees)  	Improbable Serious **Medium**	Above tolerable	Consider installing barrier systems at the highest risk locations to shield errant vehicles from the roadside hazards. (P)		

Audit Findings	Level of Risk	Safe System Energy	Recommendations P – Primary ST – Step Towards S – Supporting N – Non-Safe System	Responsible Officer Accept Yes/No	Responsible Officer Comments
ROAD GEOMETRY: *ii.* Along the haul route, substandard horizontal and vertical geometry exists. While there are several examples of "Curve Warning" with advisory speed signs along the route, there is further improvement potential along the route where these warning signs could be implemented. The winding nature of this route means there is horizontal and vertical geometry that restricts sights lines. Warning signs inform drivers of the upcoming restricted sight line environment and enables them to adjust their driving to suit conditions. Without these signs, there is an increased potential for run-off road crashes to occur.   	Improbable Serious **Medium**	Above tolerable	It is recommended to undertake a full review of the haulage route with respect to the road geometry and sight lines and swept paths around curves with a check against required curve widening. It would be expected that this review would recommend implementing new warning signs (curve warning signs, curve alignment markers, crest signs, curve widening etc.). (S)		

Audit Findings	Level of Risk	Safe System Energy	Recommendations P – Primary ST – Step Towards S – Supporting N – Non-Safe System	Responsible Officer Accept Yes/No	Responsible Officer Comments
ROAD PAVEMENT: iii. With the introduction of more HVs, the condition of the road pavement would be expected to deteriorate more rapidly. Roads in poor condition can lead to potholes, reduced grip and traction and an increased risk for vehicle loss of stability. The road pavement condition impacts on the likelihood of a crash occurring.	TO NOTE		It is recommended to implement a system to allow HV drivers (and other Snowy Hydro Ltd staff) to report any significant pavement defects. This would enable for patching works to be completed in a timely manner. (S) It is also recommended to conduct routine inspections of the haul route to identify weaknesses in the pavement and to remedy this before more significant defects occur. (S)		
BARRIER SYSTEMS: iv. There are a variety of containment systems implemented along the haul route. It is unclear from the site inspection whether the containment systems are graded to be able contain Heavy Vehicles in the high-speed environment. If the containment system fails, an errant HV could break through the barrier and be exposed to significant roadside hazards (large drop offs, bodies of water, fixed objects etc.)  	Improbable Serious **Medium**	Below tolerable	It is recommended to undertake a full review of the haulage route with respect to the existing containment systems. It would be expected that this review would recommend replacing lengths of barrier systems to shield errant Heavy Vehicles. (S)		

Audit Findings	Level of Risk	Safe System Energy	Recommendations P – Primary ST – Step Towards S – Supporting N – Non-Safe System	Responsible Officer Accept Yes/No	Responsible Officer Comments
					
OVERTAKING OPPORTUNITIES: v. There is an approximately 75km length along SMH where there are no dedicated overtaking lanes. This significant length increases the likelihood of vehicles overtaking by using the oncoming traffic lane. Overtaking in this manner increases the likelihood of head-on collisions.	Improbable Serious **Medium**	Above tolerable	It is recommended to investigate whether additional overtaking lanes can be constructed along SMH. (S) It is recommended to provide HV drivers a map of the pull-over areas / chain fitting bays to use and let traffic pass them. NOTE this recommendation is only appropriate if these areas have adequate deceleration / acceleration distances and sight lines for the HV to safely exit and re-enter the through lane. (S)		
WILDLIFE: vi. During the site inspection, high levels of dead wildlife was observed lying on the shoulders / adjacent the live carriageway. Colliding with animals in high-speed environments can lead to further collisions with run-off road crash types typically occurring. If an animal is left on the live carriageway, HVs may run over the animal causing instability or choose to swerve to avoid the animal potentially leading to head-on crashes.	Improbable Serious **Medium**	Above tolerable	It is recommended to implement a system to allow HV drivers (and other Snowy Hydro Ltd staff) to report dead wildlife on the road. This would enable for the removal of the animal in a timely manner. (S)		

8. Conclusion

This Road Safety Audit has been conducted in accordance with the procedures set out in the *Austroads Guide to Road Safety Part 6: Managing Road Safety Audits (2019)* and *Austroads Guide to Road Safety Part 6A: Implementing Road Safety Audits (2019)*. The site has been inspected and the supporting documentation has been examined. The findings, recommendations and Safe System elements are provided for consideration by the client and any other interested parties.

Auditors:

..... 10.09.2019

Domenic Gangi BEng (Civil)
Senior Road Safety Auditor

..... 10.09.2019

Kenn Beer BEng (Hons), RPEng
Senior Road Safety Auditor (Level 3)

..... 10.09.2019

Max McCardel BEng (Hons)
Road Safety Auditor

Appendix A

Photos

Photo 1: Polo Flats Road, looking south

Photo 2: Sharp Street, looking west

Photo 3: Snowy Mountains Highway, northbound lane

Photo 4: Snowy Mountains Highway, northbound lane

Photo 5: Tantangara Road, looking east

Photo 6: Tantangara Road, looking east

Photo 7: Link Road, heading towards construction site

Photo 8: Link Road, approaching construction site

Photo 9: Link Road, (night)

Photo 10: Snowy Mountains Highway, (night)

ANNEXURE D

Construction traffic volumes

Avg - Total Project	LV	HV
Monaro Hwy - East of Polo Flat	50	142
Monaro Hwy - West of Polo Flat	200	208
SMH - South of Cooma	30	38
SMH - Cooma	220	0
SMH - SMEC Offices	140	208
SMH - West of Cooma	80	208
SMH - Adaminaby	80	200
Polo Flat North	154	122
Polo Flat South	240	38
Link Rd East	114	154
Link Rd West	32	8
SMH Link to Tantangara	66	150
SMH Link to Marica	26	48
SMH Talbingo to Marica	14	38
To Tumbarumba	26	10
Shannons Flat	0	0

0000 - Baseline LV movments
0000 - Baseline HV movements
0000 - Daily project LV movements
0000 - Daily project HV movements

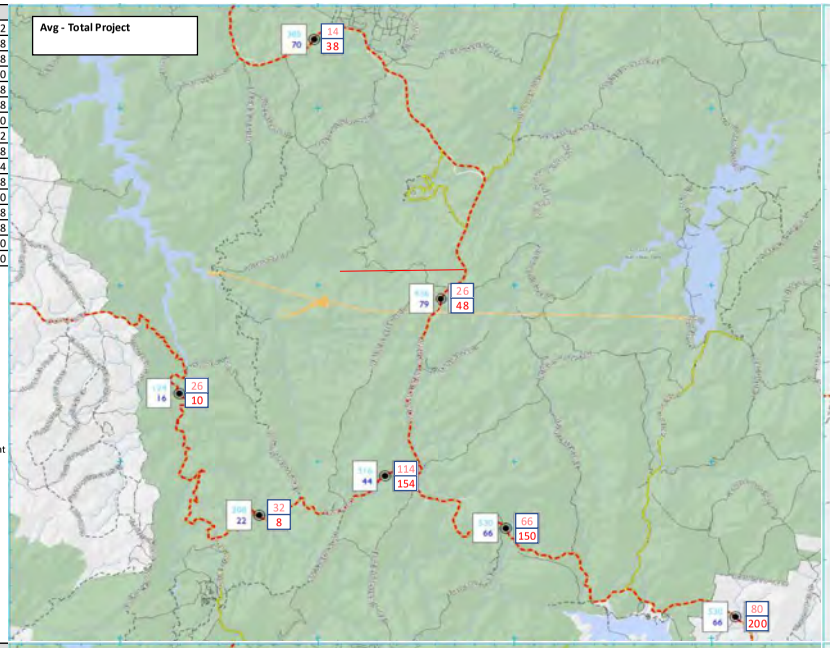
1. Movements shown are one-way only.

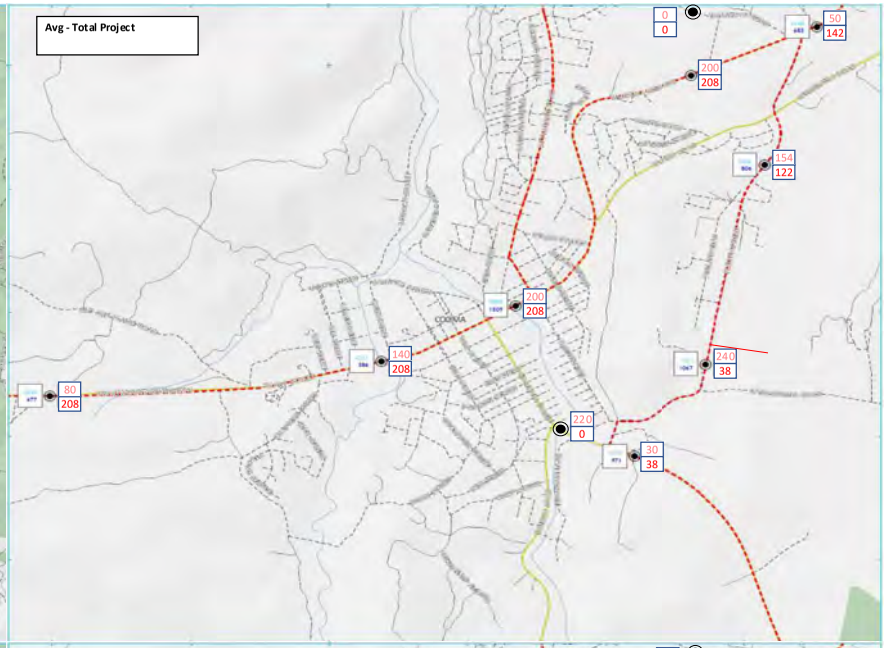
2. Movement numbers are shown only on main access routes. Local workers will use other local roads as appropriate, and project LVs will use local roads to access local business and council offices as required.

3. LV movements include private vehicles for workers at the Polo Flat facility.

4. Average numbers shows approximate average project traffic from Aug 19 to Dec 24. Peak numbers show projected peak movements in a day.

5. Map shows **higher** of FGJV and EMM number.





Peak - Total Project	LV	HV
Monaro Hwy - East of Polo Flat	74	270
Monaro Hwy - West of Polo Flat	264	390
SMH - South of Cooma	50	78
SMH - Cooma	280	0
SMH - SMEC Offices	194	410
SMH - West of Cooma	124	410
SMH - Adaminaby	124	362
Polo Flat North	196	252
Polo Flat South	308	78
Link Rd East	150	402
Link Rd West	48	44
SMH Link to Tantangara	92	342
SMH Link to Marica	42	108
SMH Talbingo to Marica	24	64
To Tumbarumba	40	44
Shannons Flat	0	0

0000 - Baseline LV movments
0000 - Baseline HV movements
0000 - Daily project LV movements
0000 - Daily project HV movements

1. Movements shown are one-way only.

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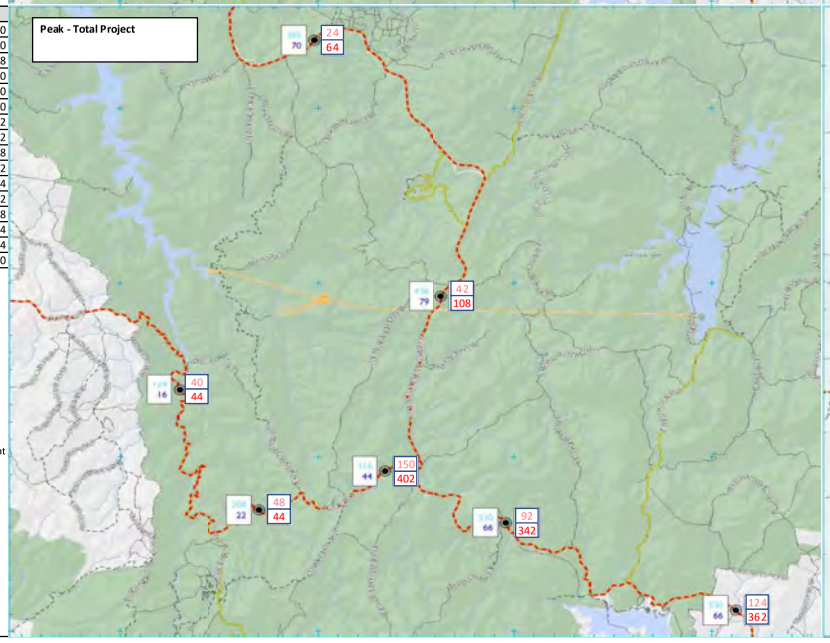
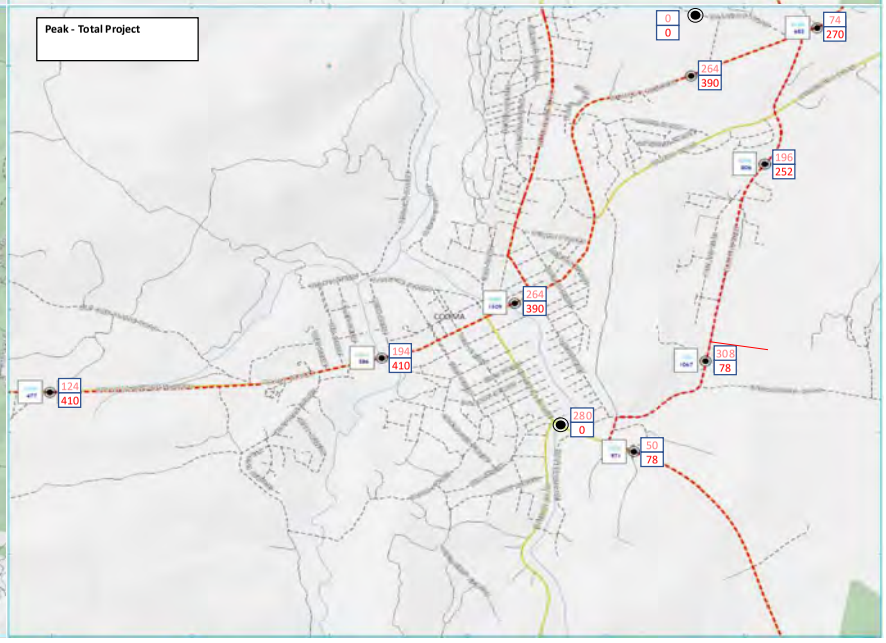




Traffic data on internal movements provided for information only
Based on Rev A data

Avg - Polo Flat Only	LV	HV
Monaro Hwy - East of Polo Flat	16	52
Monaro Hwy - West of Polo Flat	156	78
SMH - South of Cooma	16	0
SMH - Cooma	226	0
SMH - SMEC Offices	86	78
SMH - West of Cooma	16	78
SMH - Adaminaby	16	78
Polo Flat North	150	130
Polo Flat South	210	0
Link Rd East	10	36
Link Rd West	0	0
SMH Link to Tantangara	10	36
SMH Link to Marica	0	0
SMH Talbingo to Marica	0	0
To Tumbarumba	0	0
Shannons Flat	0	0

0000 - Baseline LV movments
0000 - Baseline HV movements
0000 - Daily project LV movements
0000 - Daily project HV movements

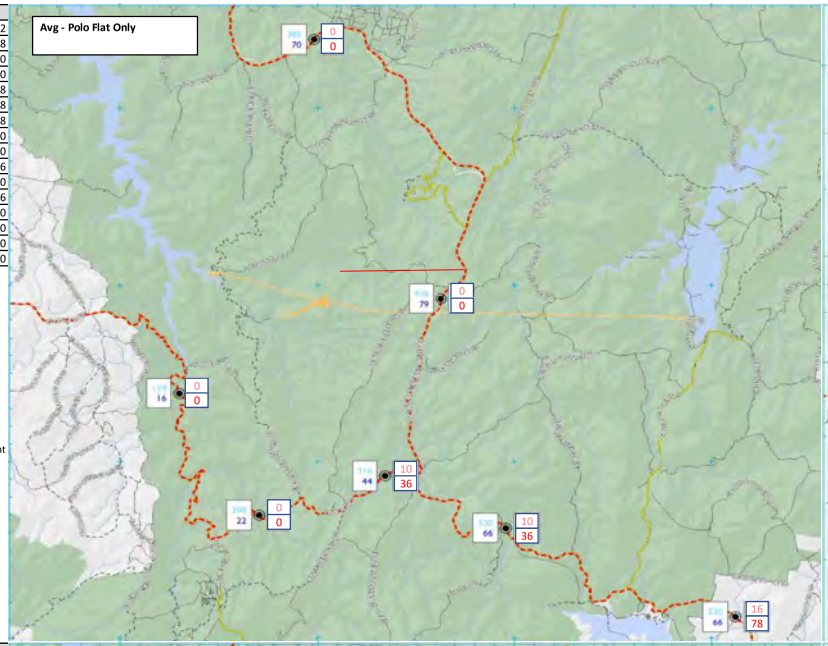
1. Movements shown are one-way only.

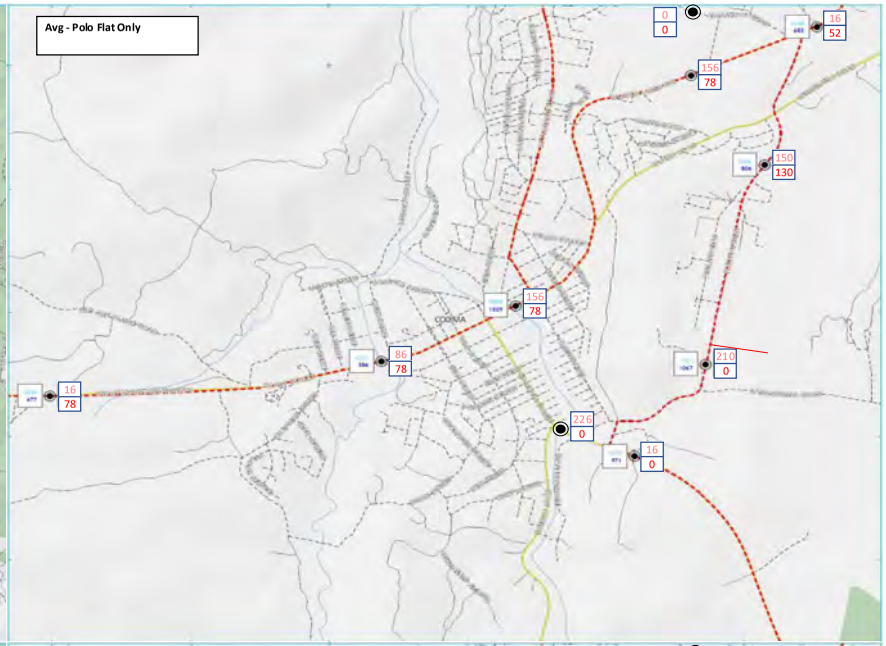
2. Movement numbers are shown only on main access routes. Local workers will use other local roads as appropriate, and project LVs will use local roads to access local business and council offices as required.

3. LV movements include private vehicles for workers at the Polo Flat facility.

4. Average numbers shows approximate average project traffic from Aug 19 to Dec 24. Peak numbers show projected peak movements in a day.

5. Map shows **higher** of FGJV and EMM number.





Peak - Polo Flat Only	LV	HV
Monaro Hwy - East of Polo Flat	26	84
Monaro Hwy - West of Polo Flat	196	132
SMH - South of Cooma	26	0
SMH - Cooma	260	0
SMH - SMEC Offices	110	132
SMH - West of Cooma	30	132
SMH - Adaminaby	30	110
Polo Flat North	194	216
Polo Flat South	266	0
Link Rd East	16	84
Link Rd West	0	0
SMH Link to Tantangara	16	84
SMH Link to Marica	0	0
SMH Talbingo to Marica	0	0
To Tumbarumba	0	0
Shannons Flat	0	0

0000 - Baseline LV movments
0000 - Baseline HV movements
0000 - Daily project LV movements
0000 - Daily project HV movements

1. Movements shown are one-way only.

2. Movement numbers are shown only on main access routes. Local workers will use other local roads as appropriate, and project LVs will use local roads to access local business and council offices as required.

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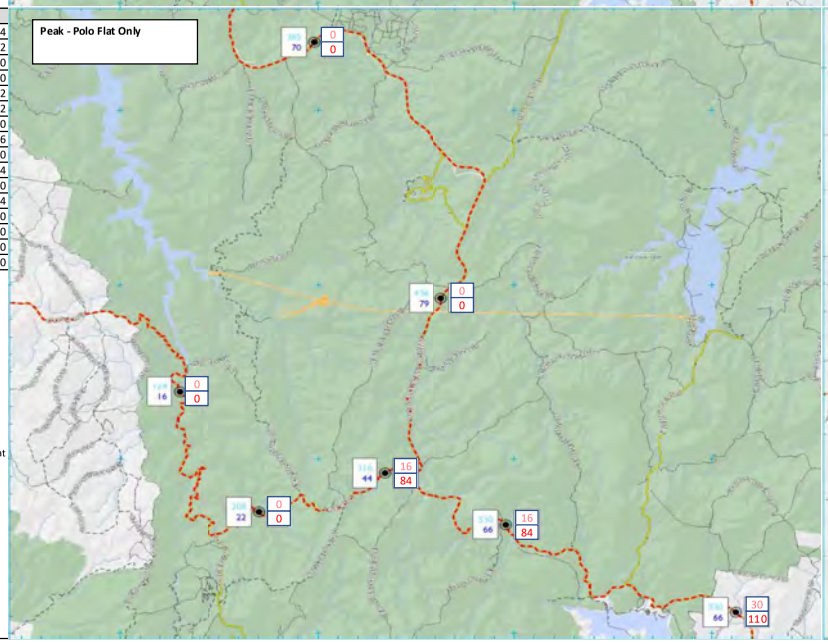
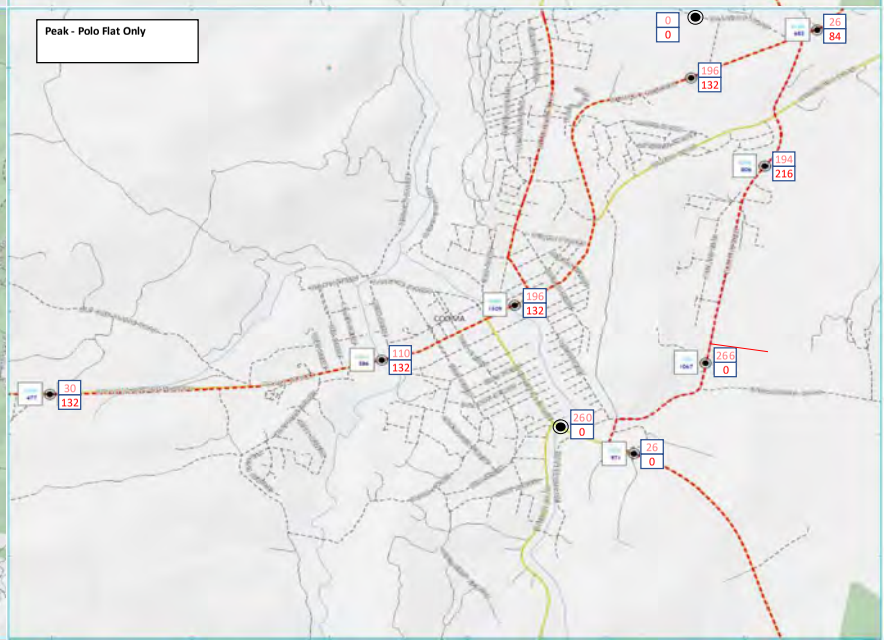




Traffic data on internal movements provided for information only
Based on Rev A data

Avg - Exduding Polo Flat	LV	HV
Monaro Hwy - East of Polo Flat	34	112
Monaro Hwy - West of Polo Flat	64	170
SMH - South of Cooma	14	36
SMH - Cooma	24	0
SMH - SMEC Offices	64	170
SMH - West of Cooma	64	170
SMH - Adaminaby	64	170
Polo Flat North	18	36
Polo Flat South	30	36
Link Rd East	114	128
Link Rd West	32	10
SMH Link to Tantangara	66	124
SMH Link to Marica	26	66
SMH Talbingo to Marica	14	38
To Tumbarumba	26	10
Shannons Flat	0	0

0000 - Baseline LV movments
0000 - Baseline HV movements
0000 - Daily project LV movements
0000 - Daily project HV movements

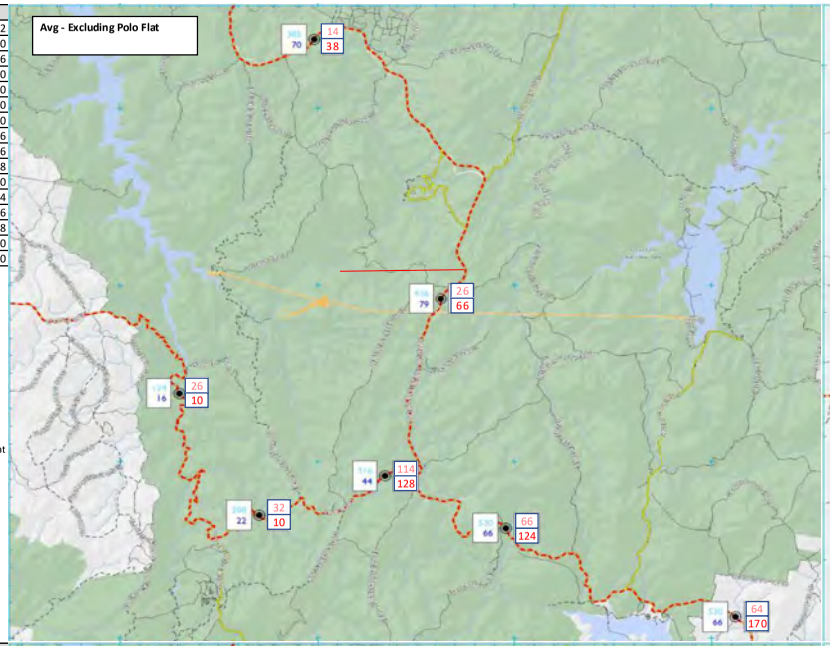
1. Movements shown are one-way only.

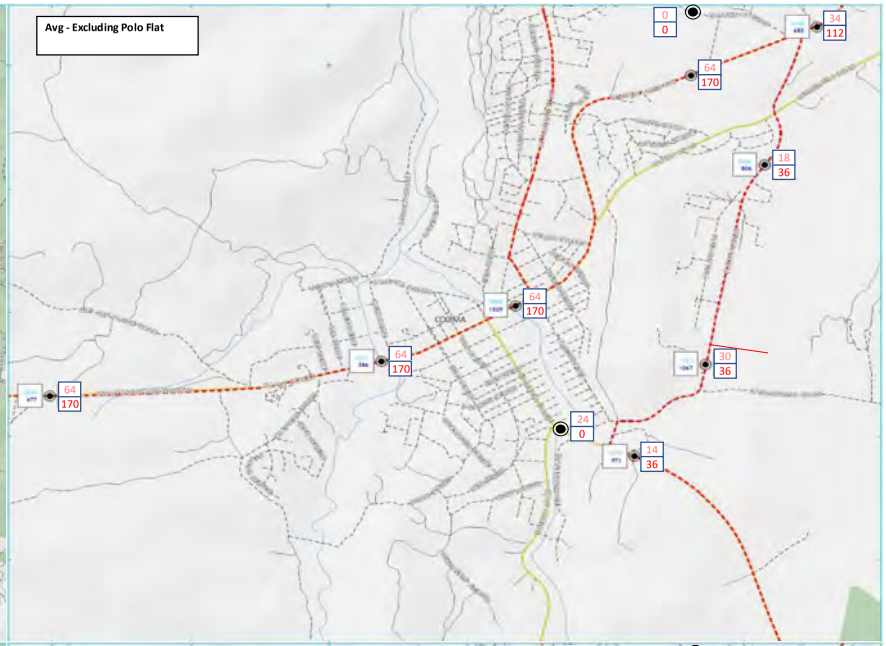
2. Movement numbers are shown only on main access routes. Local workers will use other local roads as appropriate, and project LVs will use local roads to access local business and council offices as required.

3. LV movements include private vehicles for workers at the Polo Flat facility.

4. Average numbers shows approximate average project traffic from Aug 19 to Dec 24. Peak numbers show projected peak movements in a day.

5. Map shows **higher** of FGJV and EMM number.





Peak - Exduding Polo Flat	LV	HV
Monaro Hwy - East of Polo Flat	48	176
Monaro Hwy - West of Polo Flat	94	252
SMH - South of Cooma	36	82
SMH - Cooma	56	0
SMH - SMEC Offices	98	252
SMH - West of Cooma	98	252
SMH - Adaminaby	98	252
Polo Flat North	26	82
Polo Flat South	42	82
Link Rd East	150	224
Link Rd West	48	44
SMH Link to Tantangara	92	236
SMH Link to Marica	42	106
SMH Talbingo to Marica	24	64
To Tumbarumba	40	44
Shannons Flat	0	0

0000 - Baseline LV movments
0000 - Baseline HV movements
0000 - Daily project LV movements
0000 - Daily project HV movements

1. Movements shown are one-way only.

2. Movement numbers are shown only on main access routes. Local workers will use other local roads as appropriate, and project LVs will use local roads to access local business and council offices as required.

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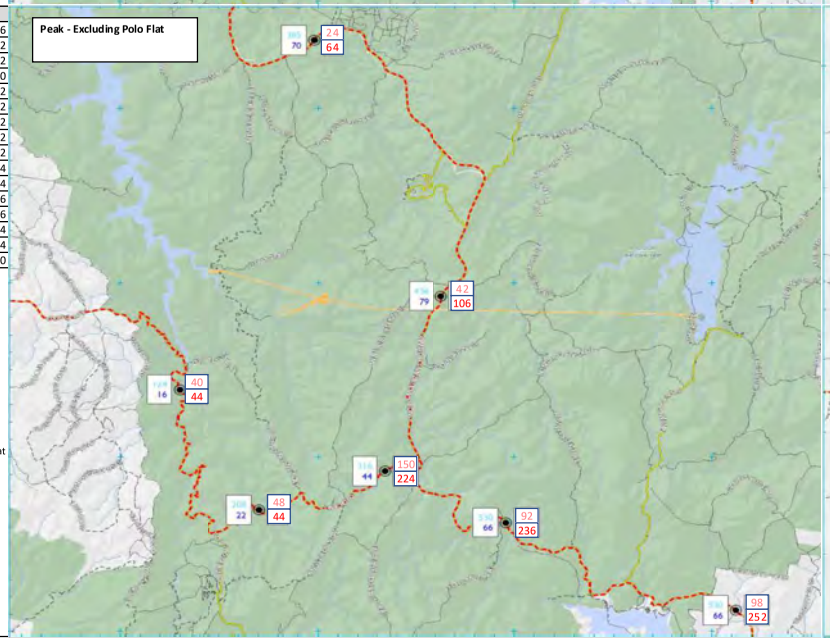
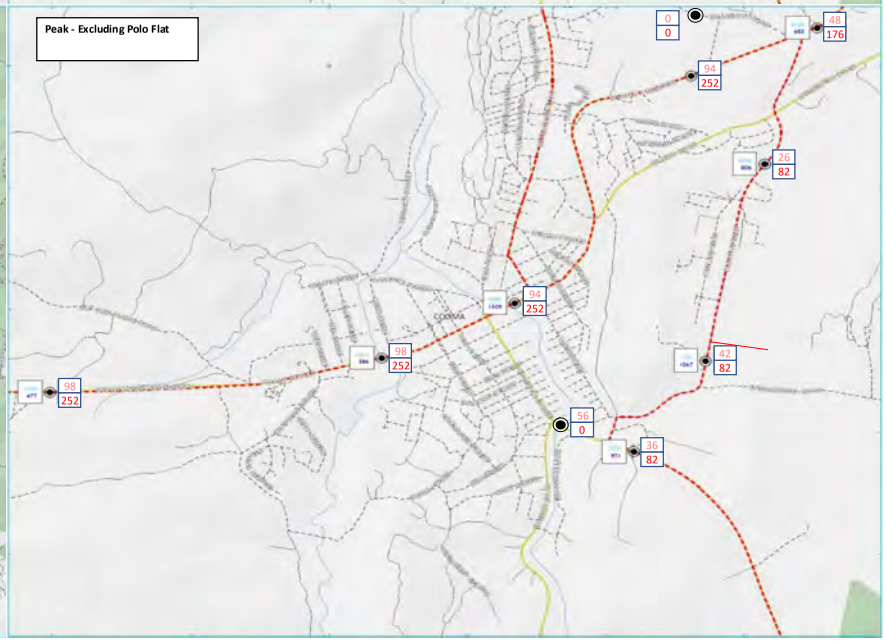




Traffic data on internal movements provided for information only
Based on Rev A data

ANNEXURE E

Rex J Andrews report

REX J ANDREWS
ENGINEERED TRANSPORTATION

ROUTE STUDY: SMEC
SNOWY HYDRO EXPANSION 2.0:
PORT KEMBLA TO SNOWY MOUNTAINS HIGHWAY.

25/09/2017 REV 01

Rev.	Date	Change	Responsible	Checked
00	12/09/17	Route Assessed	W Andrews	✓
00	14/09/17	Report compiled	W Andrews	✓
00	21/09/17	Report completed	W Andrews	✓
01	25/09/17	Road geometry added	W Andrews	✓

Index:

1.0 Introduction

This document describes observations and previous experience on sections of this route and explains the Transport of Transformers from Port Kembla to a general location on the Snowy Mountains Highway at Yarrangobilly.

This Route survey took place on 12-09-17.

2.0 Evaluation

1	No Cost
2	Some Work
3	Urgent Modification
4	Extreme Amount of Work

(Mark below boxes with an X)

		1	2	3	4
A	Harbour	X			
B	Road Modification			X	
C	Road Furnishings		X		
D	Trees		X		
E	Site Entrance			X	
F	Bridge Calculations			X	
G	Traffic Control	X			

3.0 Project data.

Date of latest Route Assessment: 04/08/2017

Survey undertaken by: (Rex J Andrews P/L)

Project name: Snowy Hydro Expansion 2.0

Location: Port Kembla (NSW) to Yarrangobilly (NSW)

Items to be transported: 6 x Transformers (11.35l x 3.70w x 4.20h x 207t)

Transport configuration: Prime mover with 14x8-14x8 Beamset.

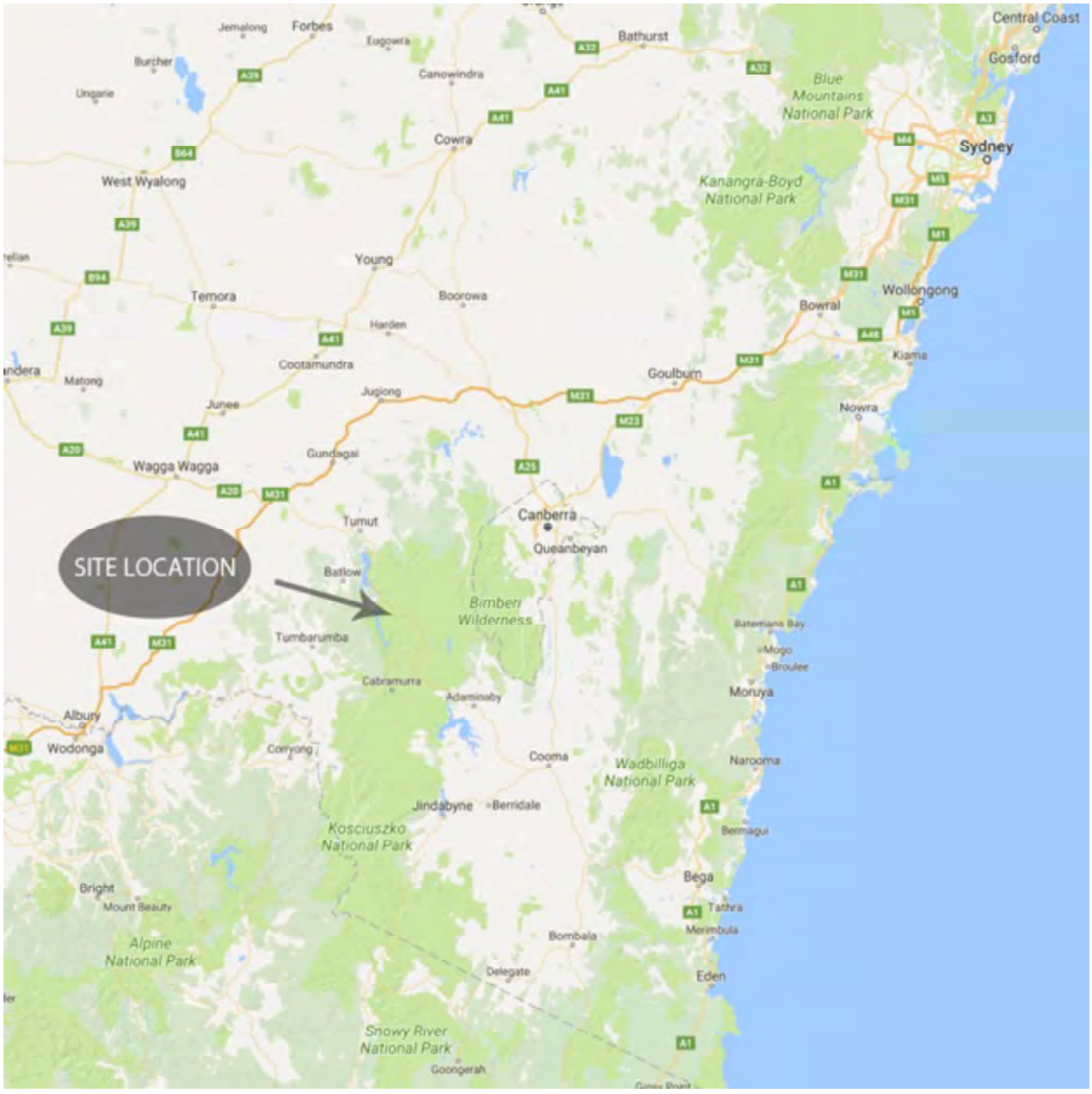
Overall dimensions: 140.0l x 6.5w x 4.9h x 582T.

(Overall dimensions include the use of an additional 5 prime movers).

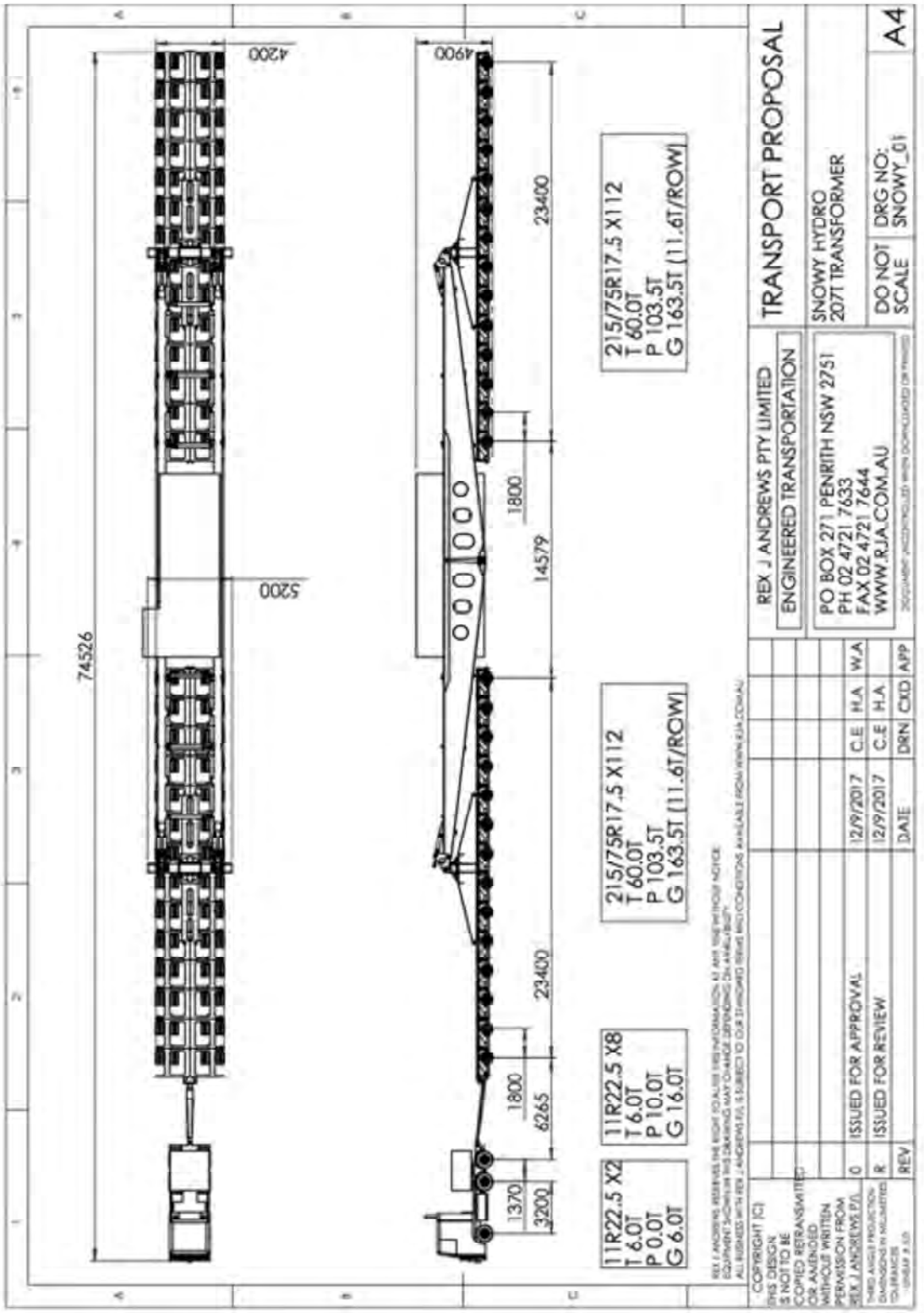
Escort requirement: 3 x NSW Police, 2 x ACT Police, 4 x Company escorts, and 2 support trucks.

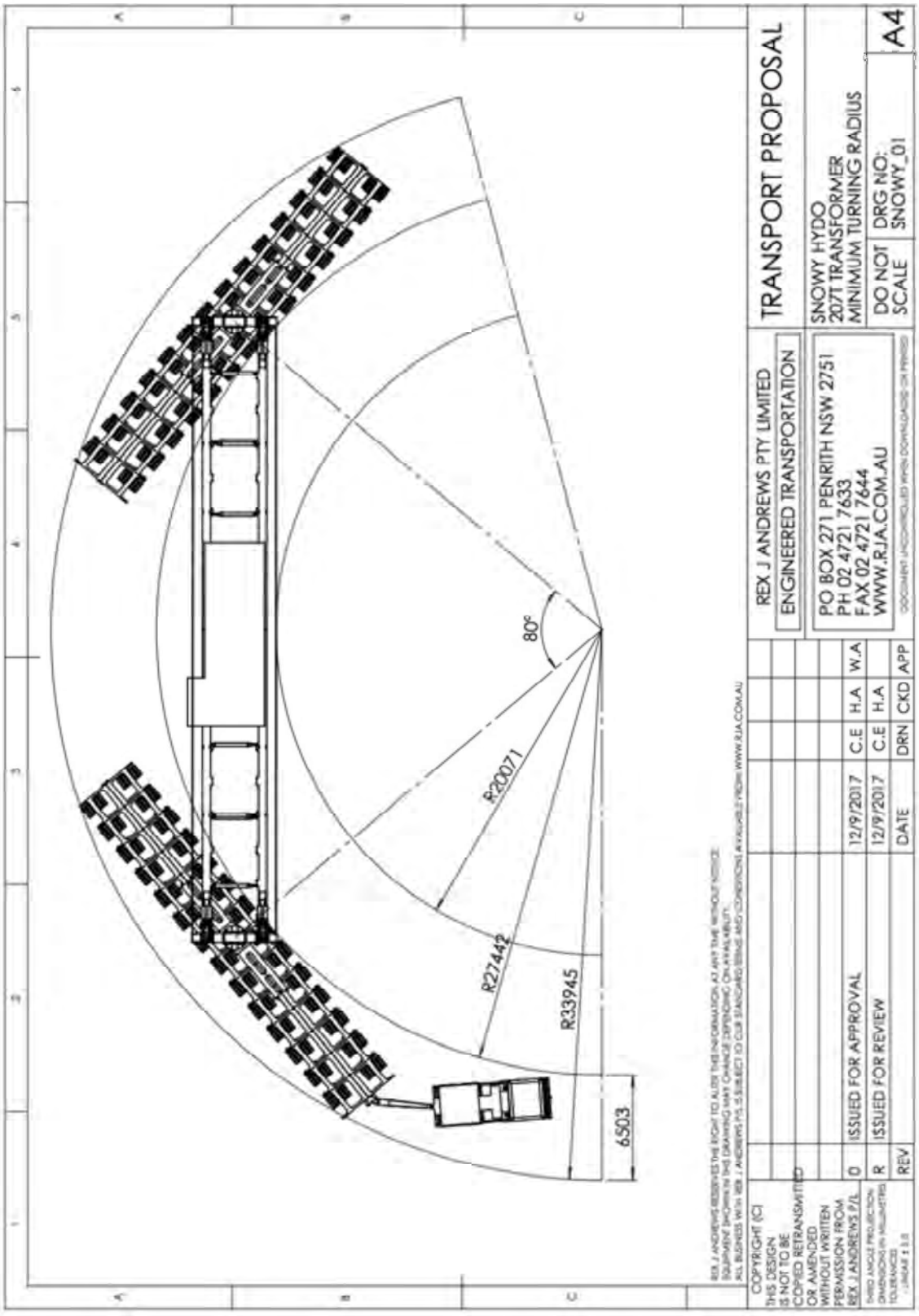
4.0 Site Location.

The Snowy Hydro expansion 2.0 is located between the Tantangara and Talbingo reservoirs. The likely access point will be off the Snowy Mountains Highway close to Yarrangobilly.



5.0 Transport drawings




80°
R20071
R27442
R33945
6503
TRANSPORT PROPOSAL
REX J ANDREWS PTY LIMITED
ENGINEERED TRANSPORTATION
PO BOX 271 PENRITH NSW 2751
PH 02 4721 7633
FAX 02 4721 7644
WWW.RJA.COM.AU
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A4
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0 ISSUED FOR APPROVAL 12/9/2017 C.E H.A W.A
R ISSUED FOR REVIEW 12/9/2017 C.E H.A
REV DATE DRN CKD APP

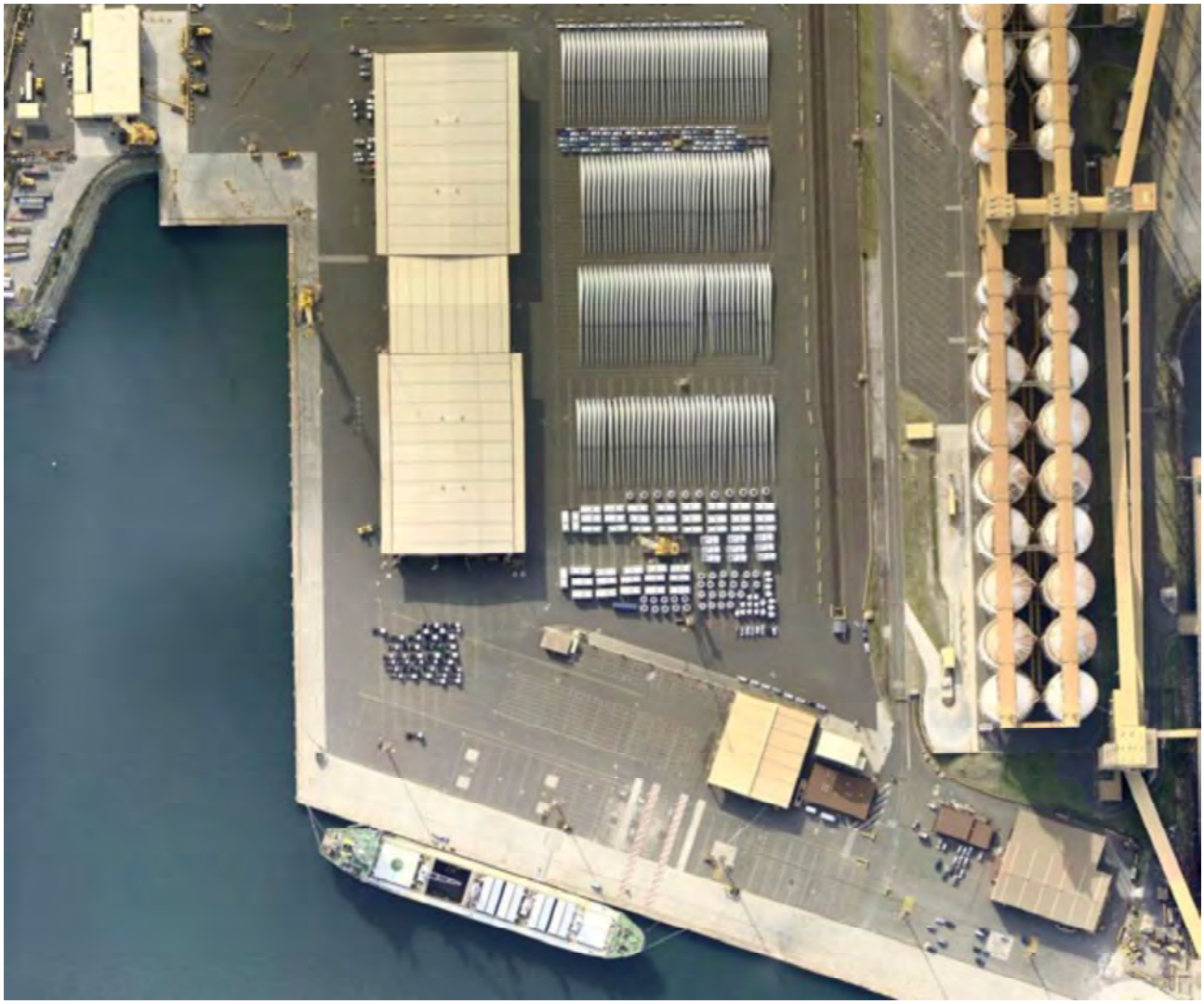
6.0 New Roads (Design Criteria)

The following is a guideline for the design criteria on new roads that will be required for the deliveries once they leave the Snowy Mountains Highway.

ROAD GEOMETRY	
ROAD WIDTH	6.5 MINIMUM TRAFFICABLE WIDTH (INCREASING AT BENDS).
LONGITUDINAL SLOPE	MAXIMUM 10%, APPROVAL SHOULD BE SOUGHT FOR SLOPES EXCEEDING 10% OR ON ANY CORNER. CROSSFALL ON STEEP SECTIONS WILL ALSO NEED APPROVAL.
CROSSFALL (CROWNS BANKING)	2 % MAXIMUM.
BENDS	INSIDE RADIUS: MINIMUM 30 METRES OUTSIDE RADIUS: MINIMUM 38 METRES SWEPT PATH SHALL BE CONSIDERED FOR VEGETATION AND EMBANKMENTS TO ALLOW A SWEPT PATH FOR THE BEAMSET.
VERTICAL CURVE	500mm max.DEVIATION OVER 50m (DEPENDING ON DELIVERY METHODOLOGY).
INTERSECTIONS	OVERDIMENSIONAL LOADS SHALL BE ABLE TO TURN IN EITHER DIRECTION REGARDLESS OF THE APPROACH DIRECTION.

7.0 Port of Import.

The transformers will be imported from various countries, and will arrive on ships into Port Kembla. The ideal berth for these shipments is the AAT terminal. The facility has a hardstand storage area of roughly 40,000 s/q metres.

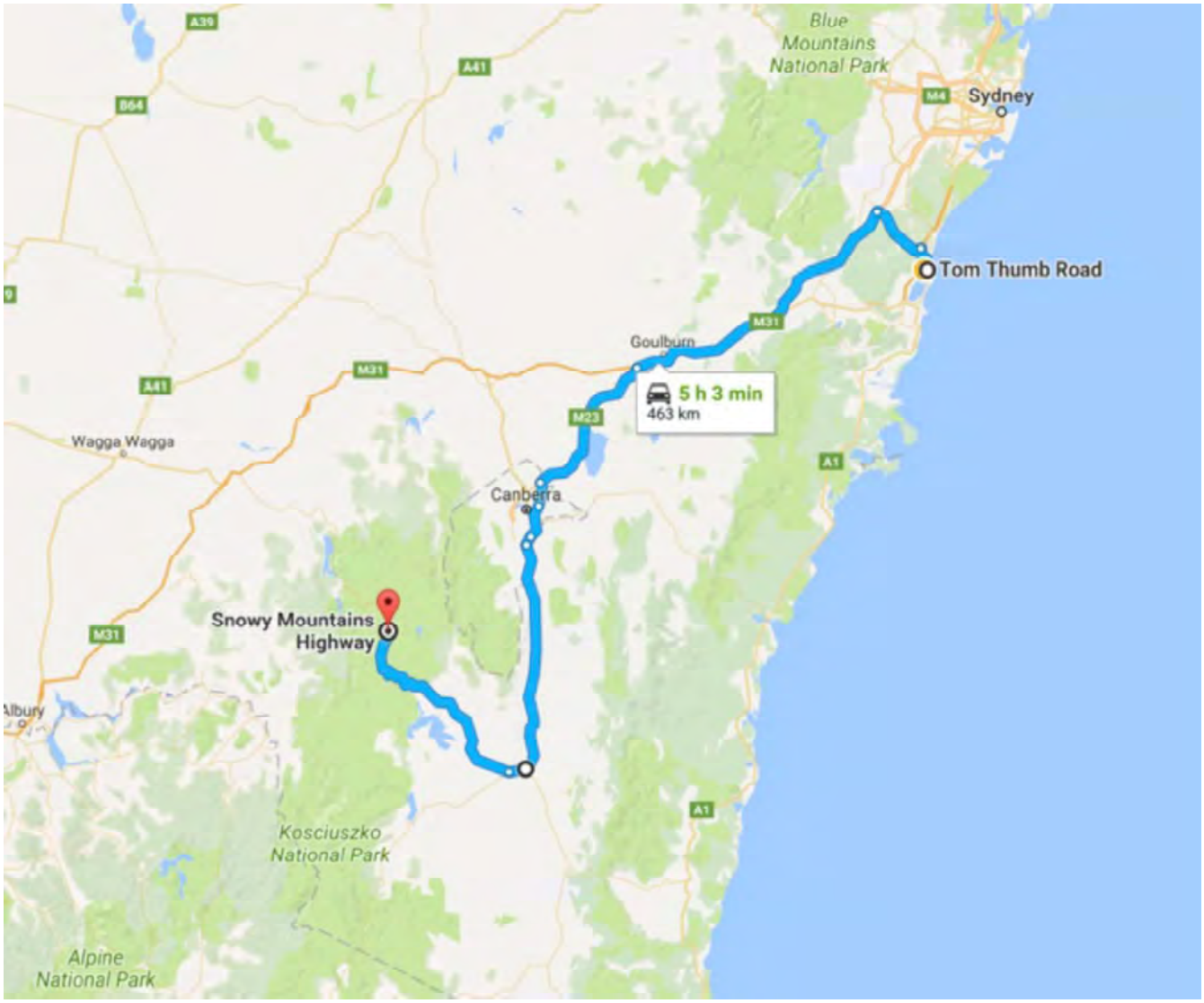


8.0 Route study: Port Kembla to Snowy Hydro.

We have based this study on the transformers entering Australia via the AAT terminal at Port Kembla. After accessing a number of options, the following was selected as the most likely route.

ROUTE: Port Kembla to Snowy Hydro 463.0 kilometres:

This route took us via Tom Thumb Road, Springhill Road, Masters Road, Southern Freeway, Mt Ousley Road, Picton-Wilton Road, Hume Highway, Federal Highway, Majura Road, Monaro Highway, Sharp Street, Snowy Mountains Highway.



Route Index

KEY	
CRITICAL	
CAUTION	
EMERGENCY PARKING	

KM index	Location	Section of road	Critical Measurement	Procedure	Notes
Route: Port Kembla to Snowy Hydro 2.0					
0.0	Port Kembla	Exit port onto Tom Thumb Road	5.5 Metres width	Travel directly ahead	Loads over 5.5 metres will require the boom gate to be removed. This is a standard procedure that happens a few time a month.
0.2	Port Kembla	Tom Thumb Road onto Springhill Road	16.0 metres into 11.0 metres wide	Left hand turn	The beamset will need to straddle the centre median strip while exiting Tom Thumb Road. The beamset will than travel onto the incorrect side of Springhill Road before returning to the correct side a further 100 metres to the west.
1.4	Port Kembla	Springhill Road onto Masters Road	15.0 metres into 10.0 metres wide	Right hand turn	No problems with this section of road.
2.6	Figtree	Masters Road onto Southern Freeway	8.0 metres wide throughout the turn	Right hand sweeping bend	No problems with this section of road
2.7	Figtree	Southern Freeway under The Avenue	5.4 Metres clearance	Travel directly ahead	Loads that exceed 5.3 metres will not be able to use this section of road.
6.4	Keiraville	Southern Freeway onto Mount Ousley Road	5.4 Metres clearance	Travel directly ahead	Loads that exceed 5.3 metres will not be able to use this section of road.
6.5	Keiraville	Mount Ousley Road under the University Bridge	5.0 Metres clearance	Travel directly ahead	Loads that exceed 5.0 metres will not be able to use this section of road. Detour for up to 5.3 metres high via the Princes Highway.
7.5	Mount Ousley	Mount Ousley Road	8% gradient	Travel directly ahead up the range	Due to the gross weight of the beamset, it would be advisable to have 6 prime movers attached to the load for this section of road.
13.0	Mount Ousley	Mount Ousley Road onto Picton-Wilton Road	15.0 metres into 10.0 metres wide	Tight left hand turn	Care to be taken with this procedure. The prime mover and front 14x8 platform module will need to travel over the median strip in the center of the corner. This will allow the beams to travel around the corner without travelling over the guard rail on the inside of the turn.
40.0	Wilton	Picton-Wilton Road onto the Hume Highway	7.0 metres wide throughout the turn	Large Sweeping left Hand Turn	No problems with this section of road

KM index	Location	Section of road	Critical Measurement	Procedure	Notes
104.0	Sutton Forest	Hume Highway	150.0m long x 10.0m wide	Merge to left	Large parking area
153.0	Goulburn	Hume Highway	180.0m long x 15.0m wide	Merge to left	Large parking area
168.0	Goulburn	Hume Highway onto Federal Highway	10.0 metres wide throughout the turn	Merge to the left	No problems with this section of road
224.0	Sutton	Federal Highway	130.0m long x 9.0m wide	Merge to left	Medium size parking area
235.0	Majura	Federal Highway onto Majura Road	7.0 metres wide throughout the turn	Large Sweeping left Hand Turn	No problems with this section of road
245.0	Pialligo	Majura Road onto the Monaro Highway	10.0 metres wide	Travel directly ahead	No problems with this section of road
353.0	Cooma	Monaro Highway	120.0m long x 10.0m wide	Merge to right	Medium size parking area
357.5	Cooma Option 1	Sharp Street through roundabout at Bombala Street	5.0 metres into 5.0 metres wide	Travel directly ahead	The beamset will need to travel over the left side of the roundabout. This will require the roundabout to have any vegetation removed and concreted in with a gentle slope, and the signs made removable.
357.9	Cooma Option 1	Sharp Street through roundabout at Vale Street	5.0 metres into 5.0 metres wide	Travel directly ahead	The beamset will need to travel over the left side of the roundabout. This will require the roundabout to have any vegetation removed and concreted in with a gentle slope, and the signs made removable.
357.0	Cooma Option 2	Sharp Street onto Baron Street	15.0 metres into 10.0 metres wide	Tight right hand turn	To enable the beam set to travel through this corner unrestricted, it would be advisable to place no parking on the side of the road while entering and exiting this corner on the left hand side.
357.2	Cooma Option 2	Baron Street onto Massie Street	17.0 metres into 16.0 metres wide	Moderate left hand turn	To enable the beam set to travel through this corner unrestricted, it would be advisable to place no parking on the side of the road while entering and exiting this corner on the right hand side.
358.0	Cooma Option 2	Massie Street roundabout at the intersection of Bombala Street	7.0 metres into 7.0 metres wide	Travel directly ahead	The signs on the center median will need to be removed, and the signs either side will also need to be made removable. Care to be taken as the beam set travels through the dip prior to the roundabout.

KM index	Location	Section of road	Critical Measurement	Procedure	Notes
358.3	Cooma Option 2	Massie Street onto Dawson Street	16.0 metres into 10.0 metres wide	Tight left hand turn	To enable the beam set to travel through this corner unrestricted, the telegraph pole on the inside of the turn would need to be relocated and it would be advisable to place no parking on all corners, and at least 60 metres from the corner.
358.5	Cooma Option 2	Dawson Street onto Snowy Mountains Highway	10.0 metres into 17.0 metres wide	Tight right hand turn	To enable the beam set to travel through this corner unrestricted, the telegraph pole on the inside of the turn would need to be relocated and it would be advisable to place no parking on all corners, and at least 60 metres from the corner.
365.0	Cooma	Snowy Mountains Highway intersection with Kosciuszko Road	13.0 metres into 7.0 metres wide	Large right hand turn	This is a large corner, however the beam set will need to straddle the center median strip.
409.0	Adaminaby	Snowy Mountains Highway	90.0m long x 6.0m wide	Merge to left	There are not many options for parking once the beam set leaves Cooma. It would be advisable to place traffic control at Adaminaby to allow the beam set to pull over to the side verge opposite the Ampol service station. From this point on parking will not be an option.
410.0	Adaminaby through to site	Snowy Mountains Highway	6.0 metres wide	Travel directly ahead	Generally the highway from Adaminaby through to site is 6.0 metres at the narrowest. There is approx. 600mm overhang each side available on the shoulders. It is advisable that the entire road is blocked between checkpoints to allow the transporter-unrestricted access to this section of highway. There could be delays of 1-2 hours for each section. There will be no travel during the winter months or at anytime that there is a possibility of ice or snow.
420.0	Providence Portal through to Kiandra	Snowy Mountains Highway	8% gradient	Travel directly ahead up the ranges	Due to the gross weight of the beamset, it would be advisable to have 6 prime movers attached to the load for this section of road.

KM index	Location	Section of road	Critical Measurement	Procedure	Notes
439.0	Sawyers Hut	Snowy Mountains Highway	6.0 metres wide	Multiple tight bends	The tightest section of Highway is between Sawyers Hut and Link Road. The beam set will tighten up on several corners the tightest of these is the right hand bend directly after Sawyers Hut. There are another couple of corners that will also have some problems with swept path. The first right hand corner will require the embankment on the inside to be cut back by at least 2 metres, the additional corners would only require some hardstand on the outside, and possible some realigning of some sections of guard rail.
448.0	Kiandra	Snowy Mountains Highway into Link Road	11.0 metres into 7.0 metres wide	Large left hand turn	No problems with this corner if required.
463.0	Yarrangobilly	Snowy Mountains Highway into site			There is no exsisting entrance into the site. The entrance will need to be made suitable for the sweptpath of the beam set.

0.0 Km's: Exiting Port Kembla.

PROCEDURE: Exit port heading north through the security gate.

COMMENTS: Loads over 5.5 metres will require the boom gate to be removed.

CONCLUSION: Contact port security 24 hours prior to departure, to allow them time to remove the boom gate.

ROAD MODIFICATIONS: Minor works required.

0.2 Km's: Left turn from Tom Thumb Road onto Springhill Road at Port Kembla.

PROCEDURE: Tight left hand turn from Tom Thumb Road onto Springhill Road.

COMMENTS: The beam set will need to cross from the incorrect side of Tom Thumb Road onto the incorrect side of Springhill Road, before returning to the correct side approx. 100 metres west of the intersection.

CONCLUSION: Police to control traffic flow on this intersection.

ROAD MODIFICATIONS: No works required.

1.4 Km's: Springhill Road onto Masters Road at Port Kembla.

PROCEDURE: Sweeping right hand corner.

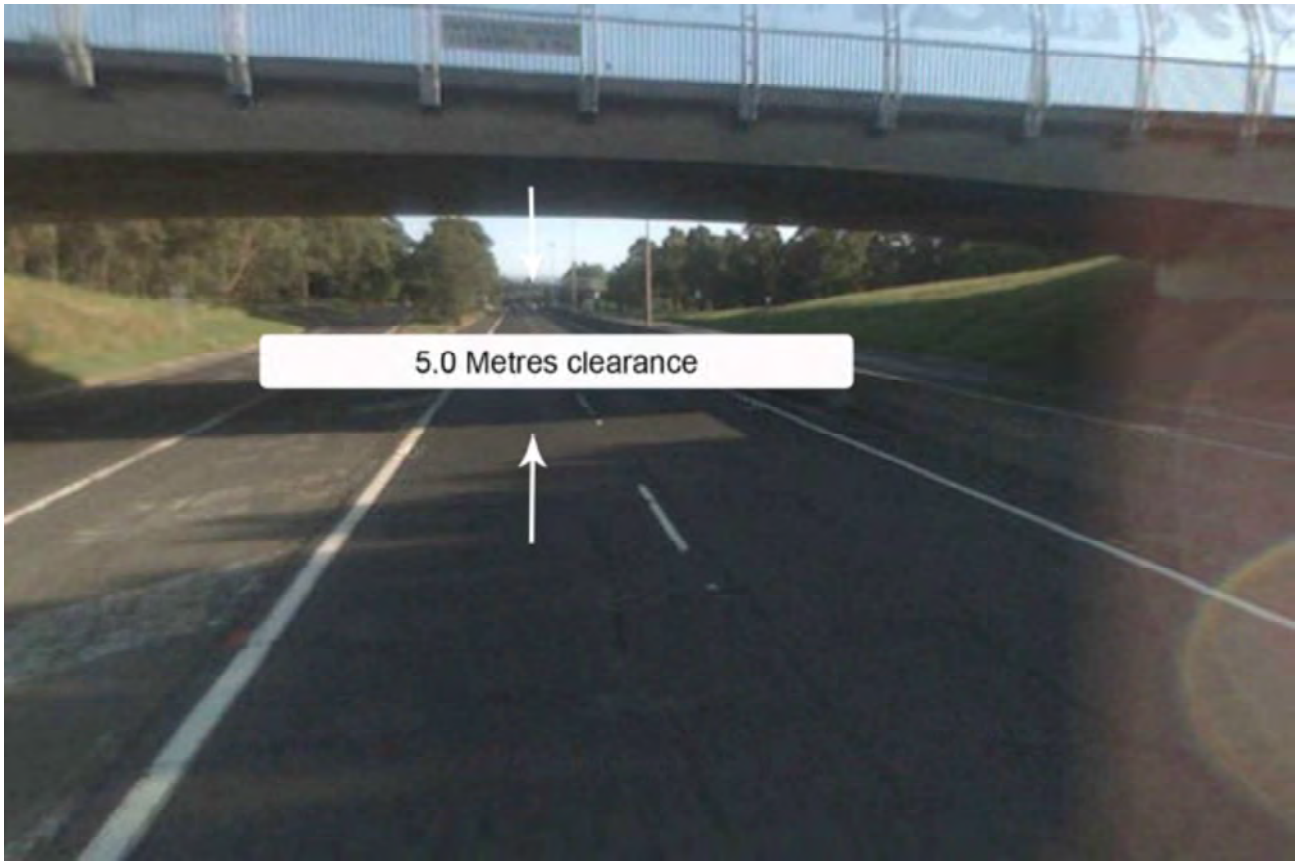
COMMENTS: The beam set will need to turn from the far left lane on Springhill Road before entering Masters Road.

CONCLUSION: Police to control traffic flow on this intersection.

ROAD MODIFICATIONS: No works required.

6.5 Km's: University Overbridge on the Southern Freeway at Keiraville.

Image 1:



PROCEDURE: Travel under bridge in the left hand lane.

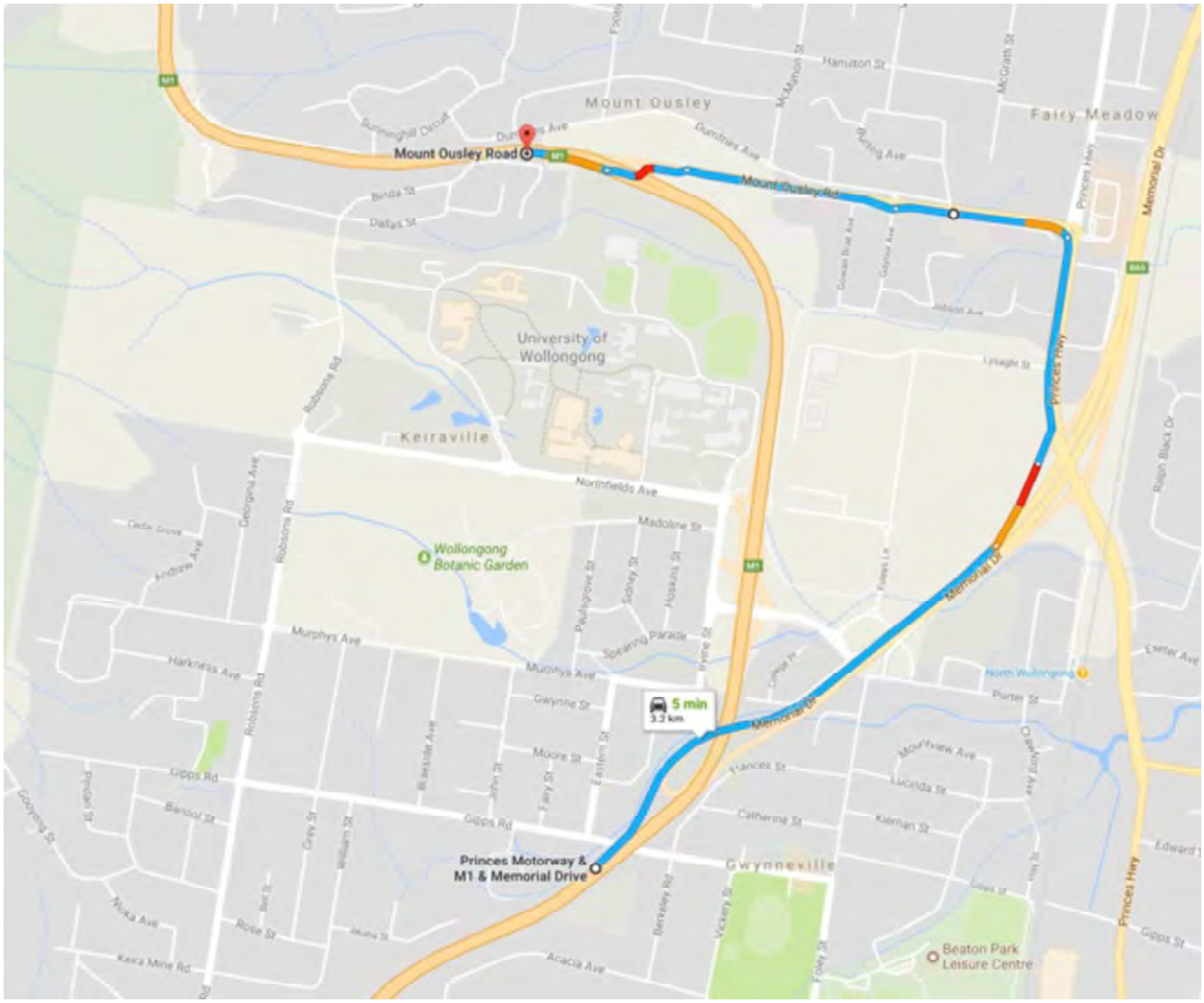
COMMENTS: No loads that exceed 5.0 metres to pass under this structure.

CONCLUSION: The beam set will be 4.9 metres at the highest point. However the load can be lowered to 4.7 metres high. If any load was over 4.9 metres they would be required to use the high load detour as per below.

ROAD MODIFICATIONS: No works required on this section of road.

Image 2: (High load detour)

VIA: Southern Freeway, Memorial Drive, Princes Highway, Mount Ousley Road.



13.1 Km's: Mt Ousley Road onto Picton-Wilton Road at Mt Ousley.

PROCEDURE: Tight left hand turn from Mt Ousley Road onto Picton-Wilton Road.

COMMENTS: The beam set will need to turn from the far right lane on Mt Ousley Road before entering the onramp. The front trailer will need to travel over the existing median strip while entering the corner.

CONCLUSION: The median strip will need to be checked to ensure it can handle the axle loadings of the trailer. Police to control traffic flow on this intersection.

ROAD MODIFICATIONS: No works required.

40.2 Km's: Picton-Wilton Road onto the Hume Highway at Wilton.

PROCEDURE: Sweeping left hand turn from Picton-Wilton Road onto Hume Highway onramp.

COMMENTS: The beam set will travel in the centre of the road while making this turn.

CONCLUSION: Police to control traffic flow at each end of the load.

ROAD MODIFICATIONS: No works required.

235.0 Km's: Federal Highway onto Majura Road at Majura.

PROCEDURE: Sweeping left hand turn from the Federal highway onto Majura Road.
COMMENTS: The beam set will travel in the centre of the road while making this turn.
CONCLUSION: Police to control traffic flow at each end of the load.
ROAD MODIFICATIONS: No works required.

COOMA OPTION 1: (SHARP STREET)

357.5 Km's: Sharp Street through roundabout at Bombala Street at Cooma.

Image 1:

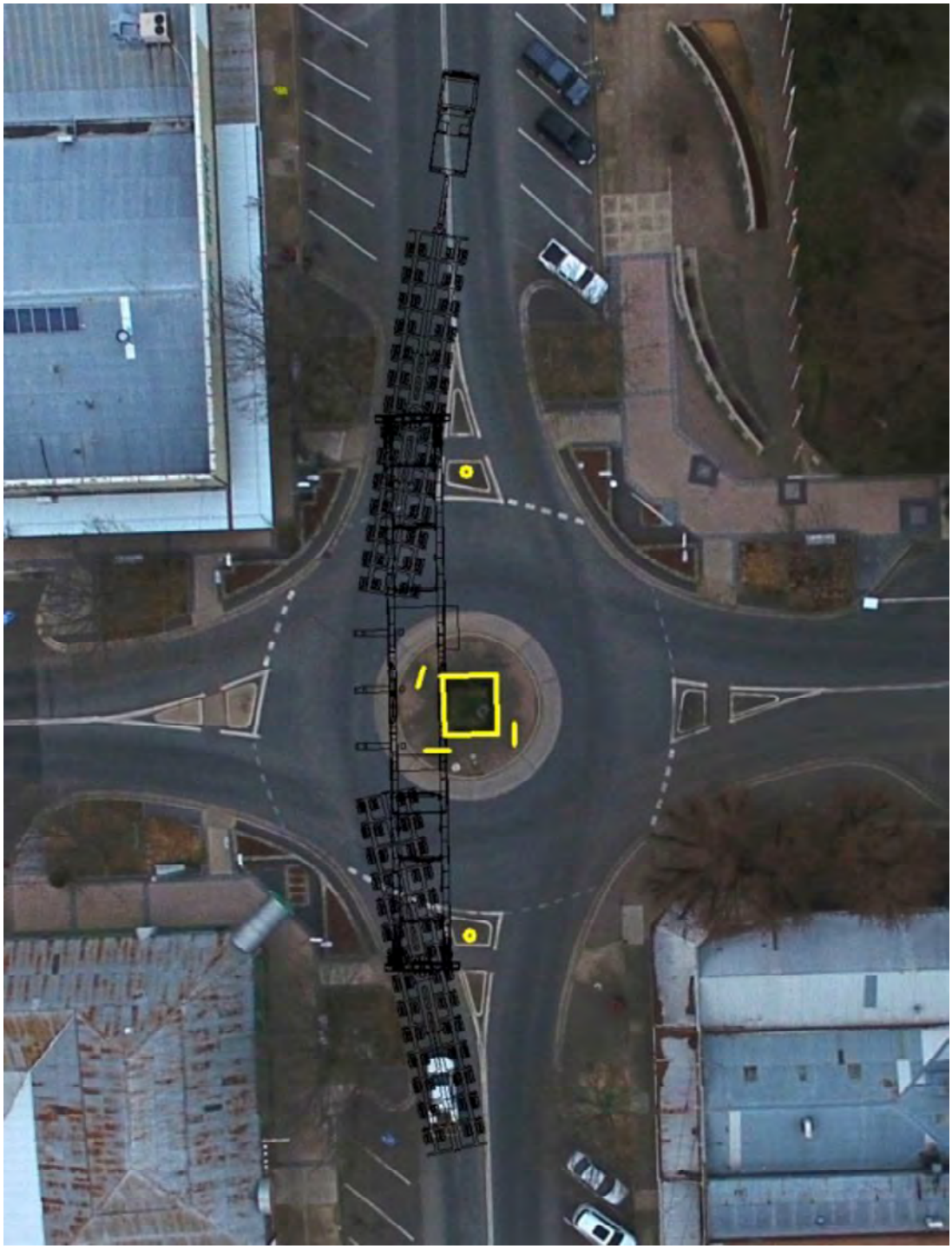


Image 2:

PROCEDURE: Travel directly ahead on Sharp Street at the roundabout through the Bombala Street intersection.

COMMENTS: The beam set will need to cross the left hand side of the roundabout.

CONCLUSION: The vegetation in the roundabout will need to be removed, and replaced with a concrete infill. A gentle slope from the centre of the roundabout to the outside edge needs to be maintained. Signs will need to be made removable on the roundabout.

ROAD MODIFICATIONS: Yes, a large amount of works is required.

357.5 Km's: Sharp Street through roundabout at Vale Street at Cooma.

Image 1:

Image 2:

PROCEDURE: Travel directly ahead on Sharp Street at the roundabout through the Vale Street intersection.

COMMENTS: The beam set will need to cross the left hand side of the roundabout.

CONCLUSION: The vegetation in the roundabout will need to be removed, and replaced with a concrete infill. A gentle slope from the centre of the roundabout to the outside edge needs to be maintained. Signs will need to be made removable on the roundabout.

ROAD MODIFICATIONS: Yes, a large amount of works is required.

COOMA OPTION 2: (BARON ST, MASSIE ST, DAWSON ST)

357.0 Km's: The Monaro Highway onto Baron Street at Cooma.

PROCEDURE: Tight right hand turn from the Monaro Highway onto Baron Street.

COMMENTS: The beam set will need to cross from the correct side of the Monaro Highway onto the correct side of Baron Street. The intersection will need to have all cars removed while entering and exiting the corner on the left hand side.

CONCLUSION: Traffic control to be put in place prior to the load arriving. Police to control traffic flow on this intersection.

ROAD MODIFICATIONS: No parking to be put in place for each movement.

357.2 Km's: Baron Street onto Massie Street at Cooma.

PROCEDURE: Moderate left hand turn from Baron Street onto Massie Street.

COMMENTS: The beam set will need to cross from the incorrect side of Baron Street onto the incorrect side of Massie Street. The intersection will need to have all cars removed while entering and exiting the corner on the right hand side.

CONCLUSION: Traffic control to be put in place prior to the load arriving. Police to control traffic flow on this intersection.

ROAD MODIFICATIONS: No parking to be put in place for each movement.

358.0 Km's: Massie Street through roundabout at Bombala Street at Cooma.

Image 1:

Image 2:

PROCEDURE: Travel directly ahead on Massie Street through the roundabout.

COMMENTS: The beam set will travel on the correct side of the roundabout. The beam set will travel over the centre of the roundabout.

CONCLUSION: Traffic control to be put in place prior to the load arriving, and signs to be made removable. Police to control traffic flow on this intersection.

ROAD MODIFICATIONS: No parking to be put in place on the south side of the roundabout for 60.0 metres.

358.3 Km's: Massie Street onto Dawson Street at Cooma.

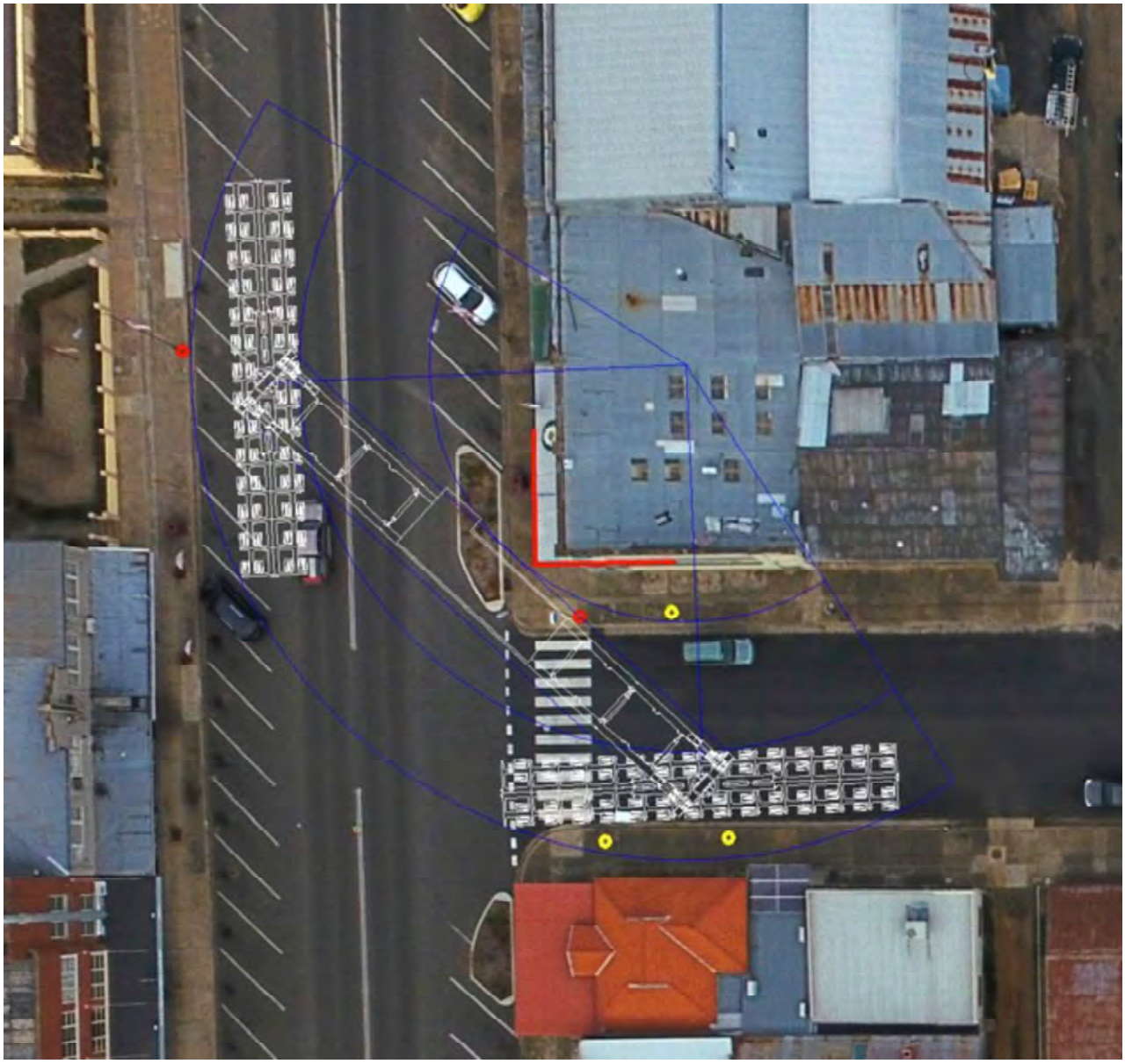
PROCEDURE: Tight left hand turn from Massie Street onto Dawson Street.

COMMENTS: The beam set will need to cross from the incorrect side of Massie Street onto the incorrect side of Dawson Street. The telegraph pole will need to be relocated on the inside of the turn, and the intersection will need to have all cars removed while entering and exiting the corner on all 4 corners.

CONCLUSION: Traffic control to be put in place prior to the load arriving. Police to control traffic flow on this intersection.

ROAD MODIFICATIONS: Yes, a large amount of works is required on this intersection.

358.5 Km's: Dawson Street onto the Snowy Mountains Highway at Cooma.



PROCEDURE: Tight right hand turn from Dawson Street onto the Snowy Mountains Highway.

COMMENTS: The beam set will need to cross from the correct side of Dawson Street onto the correct side of the Snowy Mountains Highway. The telegraph pole will need to be relocated on the inside of the turn, and the intersection will need to have all cars removed while entering and exiting the corner on all 4 corners.

CONCLUSION: Traffic control to be put in place prior to the load arriving. Police to control traffic flow on this intersection.

ROAD MODIFICATIONS: Yes, a large amount of works is required on this intersection.

365.0 Km's: Snowy Mountains Highway intersection with Kosciuszko Road at Cooma.

Image 1:

Image 2:

PROCEDURE: Sweeping right hand turn on the Snowy Mountains Highway.

COMMENTS: The beam set will need to cross from the correct side to the correct side of the Snowy Mountains Highway. The beams set will overhang the centre median strip.

CONCLUSION: Signs to be made removable on the centre median strip. Police to control traffic flow at the intersection.

ROAD MODIFICATIONS: A small amount of works are required.

409.0 Km's: Parking on the Snowy Mountains Highway at Adaminaby

PROCEDURE: Pull over to the left hand side of the highway.

COMMENTS: The load will need to park overnight at Adaminaby during the delivery.

CONCLUSION: It would be advisable to place traffic control at Adaminaby to allow the beam set to pull over to the side verge opposite the Ampol service station. From this point on parking will not be an option.

ROAD MODIFICATIONS: Traffic control required.

410.0 Km's: Snowy Mountains Highway between Adaminaby and site.

Image 1:

Image 2:

PROCEDURE: Travel directly ahead on the Snowy Mountains Highway.

COMMENTS: Once the beam set leaves Adminaby the road narrows to 6.0 metres wide with an additional 600mm of clearance for the load overhang on each side. This section of road also starts to have gradients up to 8% in places.

CONCLUSION: It is advisable that the entire road is blocked between checkpoints to allow the transporter-unrestricted access to this section of highway. There could be delays of 1-2 hours for each section. The load also requires 6 pull trucks fitted to the beam set for this section of road. There will be no travel during the winter months or at anytime which there is a possibility of ice or snow.

ROAD MODIFICATIONS: Traffic control and road blockages required.

439.0 Km's: Snowy Mountains Highway narrow section of Highway near Sawyers Hut.

Image 1:

Image 2:

Image 3:

PROCEDURE: Travel directly ahead through the narrow bends on the Snowy Mountains Highway.

COMMENTS: The tightest section of Highway is between Sawyers Hut and Link Road. The beam set will tighten up on several corners the tightest of these is the right hand bend directly after Sawyers Hut. There are another couple of corners that will also have some problems with swept path.

CONCLUSION: The first right hand corner will require the embankment on the inside to be cut back by at least 2 metres, the additional corners would only require some hardstand on the outside, and possible some realigning of some sections of guard rail.

ROAD MODIFICATIONS: Traffic control and road blockages required.

463.0 Km's: The Snowy Mountains Highway onto the site access Road at Yarrangobilly.

PROCEDURE: Turn off the Snowy Mountains Highway onto the site access Road.

COMMENTS: At this stage there is no existing access points.

CONCLUSION: A suitable site entrance would be required to accommodate the swept path of the beam set. The proposed location of this access points should be in a good position with flat ground and good line of site.

ROAD MODIFICATIONS: Large amounts of work are required on this section of road.

9.0 Conclusion:

After studying all options and undertaking a route survey, this route in its current condition will require a number of upgrades before it could be deemed suitable for transporting the transformers.

The following are the key points that need to be taken into consideration, if the project moves forward with this route.

BRIDGES:

- There are a number of bridges on route that will require bridge assessments. An RMS permit has been submitted for this combination for all state owned Roads. It is likely that bridge assessments will need to be undertaken in the near future on all Rail bridges on route.

OVERHEAD STRUCTURES: (5.3 Maximum loaded height)

- There are a large number of overhead structures between Port Kembla and the Snowy Mountains Highway. The lowest of these structures is the University Bridge at Keiraville. This bridge has a maximum safe clearance of 5.0 metres. All loads over 5.0 metres will need to take the high load detour via the Princes Highway. The high load detour will allow loads of up to 5.3 metres in height.

OVERHEAD UTILITIES:

- This route will need to be checked by an authorised scoping company. It is likely that the route has clearance for loads up to 5.2 metres in height.

OVERHEAD TREES:

- This route will need to be checked for a clear passage of at least 5.0 metres for overhead branches. Some trimming is likely on this route.

PAVEMENT:

- The route up until the Snowy Mountains Highway at Yarrangobilly is of Highway grade pavement and will be adequate for all loads. The pavement from the Snowy Mountains Highway through to the final place of rest should be made of a suitable material too take the axle loadings, and give adequate traction.

PORT KEMBLA:

- The Boom gate at the port will need removing. Otherwise there is no concern with the dimension of transporter on this section of route.

PORT KEMBLA THROUGH TO COOMA:

- The route is generally good. There are a couple of corners were the trailers will need to travel over a median strip and some signs made removable, but otherwise there is nothing that will stop the load making the turns.
- Due to the gradient up Mount Ousley, we would advise the use of at least 6-pull truck.
- There are several large parking bays that will need to be used on this section of road. They are listed in the above index.

COOMA:

- Option 1: The main street (Sharp Street) has 2 roundabouts that the beam set cannot travel over without removing the gardens and signs, and than concreting over. Discussions need to take place with the RMS and Monaro Shire council, to see if these works are possible. This would be the ideal option.
- Option 2: Is to detour this section of the main street via the following roads (Baron Street, Massie Street and Dawson Street). This route was checked but became problematic on the last 2 turns. It is not impossible but would require a large amount of works and would be a higher risk than option 1. Not recommended.
- We looked at a number of alternatives to pass through Cooma, but none of the other options were feasible.

COOMA TO ADAMINABY

- The road is generally good through to Adaminaby, however there are large sections of road that will require road closures of up to 30 minutes at a time.

ADAMINABY

- There is no parking area suitable to have the beam set completely off the highway. We would recommend having traffic control in place while the load is parked there, or alternatively build a parking area suitable for the loads.

ADAMINABY TO YARRANGOBILLY

- The road narrows to 6.0 metres with some extra area to overhang the load on the side verge. There are very few areas to allow oncoming traffic past the load on the majority of this section of road. We would recommend closing entire sections of the highway for up to two hours at several checkpoints i.e. chain down bay's. These checkpoints would need to be documented in a TMP and likely ROL's to be put in place, and approval from the RMS & NPWS.
- Due to the gradient on this section of road, we would advise the use of at least 6-pull truck.
- No travel whatsoever in wintertime, or at the chance of ice or snow.
- Several sections of road will require some widening, especially around Sawyers Hut.

ALTERNATIVE DELIVERY POINTS

- TUMUT # 3 POWER STATION. A route survey was undertaken from the Hume Highway through to the boat ramp on the Talbingo Reservoir above Tumut #3 power station. We believe the beam set could make it through to the boat ramp, but would require some works to take place on the access road from Murray Jackson Drive through to the boat ramp. As per the main option all bridges on route would need assessing.
- ELLIOT WAY. We did a desktop study on this route and soon realised that it was unfeasible. The mountain range has a large number of corners that would not accommodate a load of this size.

10.0 Trip times:

DAY 1: Port Kembla to Goulburn (10 hours)
DAY 2: Goulburn to ACT/NSW Border (8 Hours)
DAY 3: ACT/NSW border to Cooma (10 Hours)
DAY 4: Cooma to Adaminaby (10 Hours)
DAY 5: Adaminaby to Site entrance (10 Hours)
DAY 6: Site entrance to Power station (6 Hours)
DAY 7: Unloading at the Power station (12 Hours)

11.0 References:

Australian Load Restraint Guide
Rex J Andrews P/L Drawings
Rex J Andrews route survey # 202
Google Earth/Maps
Nearmaps
NHVR (OSOM)
NHVAS Maintenance Management (NHVAS21193)
NHVAS Basic Fatigue Management (NHVAS21193)