Mount Piper to Wallerawang Transmission Line Upgrade

Technical Report 8 – Traffic and Transport Assessment

Transgrid

August 2025

→ The Power of Commitment

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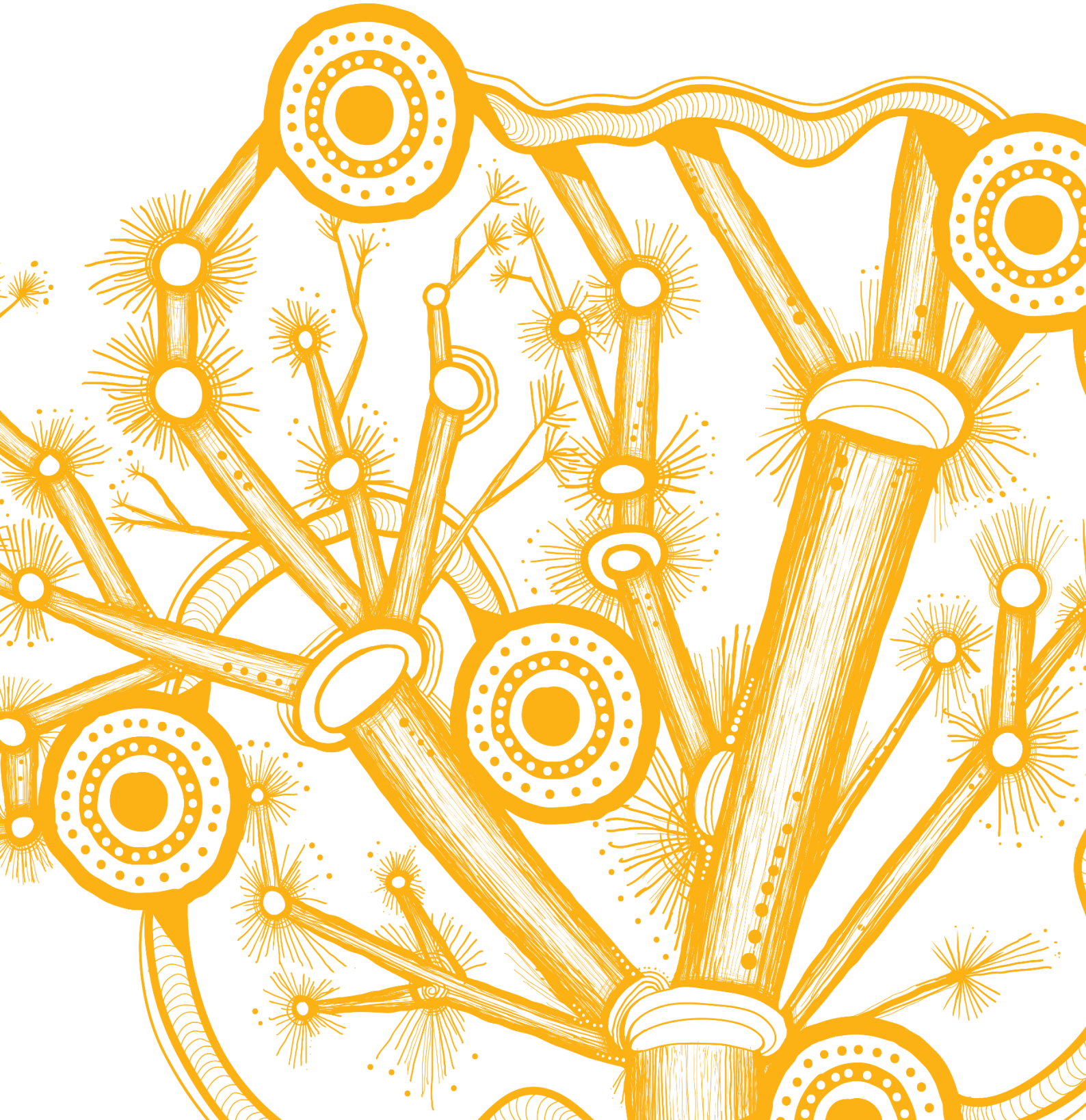
Acknowledgement of Country

Transgrid and GHD acknowledge Aboriginal and Torres Strait Islander peoples as the Traditional Custodians of the land, water and sky throughout Australia on which we do business. We recognise their strength, diversity, resilience and deep connections to Country. We pay our respects to Elders of the past, present and future, as they hold the memories, knowledges and spirit of Australia. Transgrid and GHD are committed to learning from Aboriginal and Torres Strait Islander peoples in the work we do.



Executive summary

The project

Transgrid proposes to deliver approximately eight kilometres (km) of new 330 kilovolt (kV) transmission line and double circuit transmission structures located between the Mount Piper and Wallerawang 330 kV substations (the project). The project would incorporate sections of an existing, single-circuit 132 kV transmission line, where the two transmission lines would share a widened easement and transmission structures. The project is located within the Central West region of NSW within the Lithgow Local Government Area (Lithgow LGA).

The project is identified in the NSW Network Infrastructure Strategy (EnergyCo, 2023) and also supports the key tenets of the NSW Electricity Infrastructure Roadmap (Roadmap) (DPIE, 2020). The Roadmap identifies that the expansion of renewable generation must be accompanied by increased transmission capacity to transfer power from Renewable Energy Zones (REZ) in inland NSW to key demand centres. The Mount Piper to Wallerawang Transmission Line Upgrade Project would provide the additional capacity required to reliably transmit power from the Central West Orana REZ to the Greater Sydney region.

Purpose of this report

This traffic and transport assessment has been prepared as part of the Environmental Impact Statement (EIS) to assess potential traffic and transport impacts from the construction and operation of the project. The assessment has been undertaken in accordance with the environmental assessment requirements of the Planning Secretary of the Department of Planning, housing and Infrastructure (the SEARs).

Existing environment

The existing road network environment within the study area was assessed through a desktop review of current facilities including active and public transport services, road characteristics and approved freight routes. The current performance of the network was also assessed through a mid-block capacity assessment at key intersections and access points.

The assessment of existing conditions identified that the road network in the study area is currently operating at an acceptable level with approved heavy vehicle routes along the state road network. The road network is a combination of state, regional and local roads. The key roads that provide access to the site include the Castlereagh Highway, Great Western Highway, Boulder Road, Frankfort Road, Brays Lane, Karawatha Drive, Main Street, Barton Avenue, Cripps Avenue and Heel Street in Wallerawang. The study area has limited public transport services with little active transport infrastructure provided. A review of historical recorded crashes has not identified any significant safety issues with a low number of recorded crashes.

Impacts from the project during construction

The impacts from the project were assessed for the horizon year of 2027 (the assumed final year of construction) through a mid-block, intersection turn warrants and safe intersection sight distance assessment. A total of 13 access points and eight intersections were assessed. The analysis assumed a worst-case peak hour flow of traffic generated to the project footprint of 30 light vehicles and 20 heavy vehicles. Based on these traffic volumes, the project is not expected to cause the road network to operate below an acceptable level. Existing intersection turn treatments at the key intersections are expected to be suitable for the proposed traffic flows. However, management of the project's traffic demand is required to minimise the potential impact on the operation of the traffic network, including the intersection of Brays Lane / Castlereagh Highway.

Some works and traffic management are required to ensure the sight distances at key intersections and access points meet the required safe distances. The works and traffic management that have been identified and discussed in engagement with Lithgow City Council and Transport for NSW, include:

– trimming of vegetation at the intersection of Boulder Road / Mount Piper Power Station Access Road (Access Point 1) by, or in consultation with Lithgow City Council, as the relevant road authority
– temporary traffic control at the intersection of Frankfort Road/ Boulder Road (alternative Access Point 1a)

– a left-in/left-out access arrangement at the intersection of Karawatha Drive / Castlereagh Highway (Access Point 3)
– potential passing bay on the southern road shoulder of Brays Lane for heavy vehicle passing.

To facilitate the Left-in/Left-out arrangement at Karawatha Drive, project vehicles seeking to travel south along the Castlereagh Highway would instead travel north to Access Point 2 at the Centennial Coal Springvale Coal Services facility and turn around within the site. Use of this area for vehicle turnaround has been agreed with Centennial Coal. The Left-in/Left-out arrangement would be managed via the Traffic and Transport Management Plan (TTMP), which will be developed prior to the commencement of construction.

The assessment has also identified an opportunity to improve safety on the Castlereagh Highway. This would involve changing the existing road sign to provide advanced warning on the southern approach to the intersection with Boulder Road. Consultation with Transport for NSW is ongoing in relation to this proposed change.

OSOM movements would be required for the mobilisation and demobilisation of the piling rigs (for foundations) and mobile cranes to each transmission structure location. No more than two OSOM vehicles per day, resulting in up to four one-way OSOM movements per day would occur. No OSOM high risk vehicles would be required. OSOM deliveries would utilise the NSW state road network in accordance with the Heavy Vehicle National Law and Regulations.

No road widening or intersection upgrades are required for OSOM or heavy vehicle movements. A heavy vehicle passing bay on the southern shoulder of Brays Lane may be required, however this would be confirmed by the construction contractor during detailed design and construction planning and in consultation with Lithgow City Council.

Stringing the transmission lines across Brays Lane and Main Street would require traffic control, or short-term road closures of about 30 to 60 minutes. These would be managed as part of the TTMP. If short-term closures are required, traffic would be diverted, adding up to two to seven minutes of travel time. The diversion routes would have minor impacts and would only be needed for short periods. Due to the short duration of closures and current low traffic volumes, the surrounding roads would likely accommodate the traffic diversions.

Impacts from the project during operation

Given the low intensity of maintenance activities and small number of personnel associated with the operational stage, the traffic impacts associated with the operation and maintenance of the project are expected to be negligible.

Stakeholder engagement

Engagement has been undertaken with both Transport for NSW and Lithgow City Council throughout the development of the traffic assessment. Engagement with stakeholders has been undertaken and will be ongoing to identify potential issues or impacts on the surrounding road network and confirm appropriate access, traffic management and works on the state and local road networks. This included a review of requirements for intersection treatments and sight distance at each of the key intersections. Transgrid's consultation with Transport for NSW and Lithgow City Council outlined that no intersection upgrades would be required for the project.

Cumulative impacts

The potential for cumulative traffic and transport impacts on the surrounding road network was considered in the intersection warrants and mid-block capacity assessment. This included traffic generation of other projects, based on suitable publicly available information. The cumulative impact assessment indicates that the surrounding road network is expected to continue to operate satisfactorily, with the proposed mitigation measures in place.

Recommended mitigation measures

Mitigation and management measures are proposed to avoid and minimise potential traffic and transport impacts. This will include implementing a TTMP (including a drivers' code of conduct) as part of the construction environmental management plan. Additionally, management of the traffic demand generated by construction activities will be undertaken to minimise the number of light vehicle trips during road network AM and PM peak hour periods. This will involve measures such as car-pooling, using mini buses and staggering arrival times of vehicles outside of the peak hour period to negate the requirement for an intersection upgrade at Brays Lane / Castlereagh Highway intersection.

Conclusion

This traffic and transport assessment has concluded that the performance of the road network is expected to operate at an acceptable level during and following implementation of the project. Some potential safety issues have been identified with regards to sight distances, however with the implementation of mitigation and management measures the potential impacts are considered to be manageable.

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Key terms, acronyms and abbreviations

Abbreviation/term	Definition
AUL	Auxiliary Left
AS	Australian Standard
BAL	Basic Left
BAR	Basic Right
CEMP	Construction environmental management plan
CHR	Channelised Right
CWO REZ	Central-West Orana Renewable Energy Zone
DPIE	Department of Planning, Industry and Environment
Easement	A legal property right attached to a parcel of land that enables the use of an identified part of the land by a third party other than the owner. For transmission lines, an easement defines the corridor area where the lines are located and that allows access, construction and maintenance work to take place. The easements for the 330 kV transmission lines would typically be 60 metres wide. The easement grants a right of access and for construction, maintenance and operation of the transmission line and other operational assets. For the project, some easements may overlap with existing easements such that the final easement width for the new easement would be narrower than 60 metres (e.g. where paralleling the existing transmission line north of the Wallerawang 330 kV substation) and in other areas it may be wider to accommodate diverging transmission lines (eg in the area south of the Mount Piper 330 kV substation).
EIS	Environmental impact statement
EnergyCo	Energy Corporation
EP&A Act	*Environmental Planning and Assessment Act 1979* (NSW)
GML	Gross Mass Limit
h	hour
Hazard tree	A hazard tree is defined as a tree or part of tree that if it were to fall would infringe on the vegetation clearance requirements at maximum conductor sag of the transmission lines.
km	kilometre
km/h	Kilometre per hour
kV	kilovolt
LGA	Local Government Area
m	metre
MVA	Megavolt ampere, a unit of power representing maximum rated capacity
NEM	National Electricity Market
NHVR	National Heavy Vehicle Regulator
NSW	New South Wales
OSOM	Oversize and overmass
PCE	Per car equivalent
PCU	Passenger car unit
Project	The CSSI project “Mount Piper to Wallerawang Transmission Line Upgrade Project”, which is the subject of this Environmental Impact Statement. The project involves the construction and operation of high voltage transmission lines between the Mount Piper and Wallerawang 330 kV substations.
Project footprint	Area that is to be directly affected by the construction and operation of the project.
REZ	Renewable Energy Zone
TTMP	Traffic and Transport Management Plan

Abbreviation/term	Definition
RUM	Road User Movement
SCA	State Conservation Area
SEARs	Secretary's environmental assessment requirements
SISD	Safe Intersection Sight Distance
Study area	For the purpose of the traffic and transport assessment, the study area comprises of the road network surrounding the project footprint as well as any key roads that form part of proposed site access routes.
TTA	Traffic and Transport Assessment
VCR	Volume to capacity ratio

1. Introduction

1.1 Background

The Commonwealth and NSW governments have both established targets to achieve net-zero emissions by 2050. Achieving these targets requires low emissions technologies to be deployed at scale across all sectors of the economy, including the electricity generation sector, currently Australia's largest source of greenhouse gas emissions.

The NSW Transmission Infrastructure Strategy (DPE, 2018) aims to engage the private sector to invest in priority energy infrastructure projects, which can deliver low-cost, clean and reliable energy to consumers

As part of the Transmission Infrastructure Strategy, the NSW Government has developed a plan to establish five Renewable Energy Zones (REZs) to increase renewable energy generation, reduce carbon emissions, and help deliver lower wholesale electricity costs to consumers. The Central-West Orana REZ (CWO REZ), being the first REZ established, is planned to generate at least 4.5 gigawatt by the late-2020s.

The NSW Government's Electricity Infrastructure Roadmap (DPIE, 2020) identifies that the expansion of renewable generation must be accompanied by increased transmission capacity to transfer power from REZs in inland NSW to key demand centres. Interest in new energy generation projects in the CWO REZ is forecasted to exceed the existing transmission network capacity in several locations. The existing infrastructure located between the Mount Piper 550/330 kilovolt (kV) substation (Mount Piper 330 kV substation) and the Wallerawang 330/132 kV substation (Wallerawang 330 kV substation) has been identified in the NSW Network Infrastructure Strategy (EnergyCo, 2023) as requiring upgrades. The Mount Piper to Wallerawang Transmission Line Upgrade Project (the project) would provide the additional capacity required to reliably transmit power from the CWO REZ to the Greater Sydney region.

1.2 Location

The project is located within the Central West region of NSW within the Lithgow City Council Local Government Area (LGA). It is located approximately 14 kilometres (km) north-west of Lithgow situated on the western fringes of the Blue Mountains (Figure 1.1).

The area that is to be directly affected by the construction and operation of the project, is referred to as the project footprint and is shown in Figure 1.1. The project footprint is approximately 86.5 hectares in size and is generally bounded by the following:

– Castlereagh Highway to the north
– Former Wallerawang Power Station site to the east
– Gardens of Stone State Conservation Area (SCA) to the south
– Mount Piper Power Station to the north-west.

Land uses within and adjacent to the project footprint include:

– electricity generation at Mount Piper Power Station
– electricity transmission, including the Mount Piper and Wallerawang 330 kV substations, and associated transmission lines
– mining activities, with several Centennial Coal operations including the former Ivanhoe Coal Mine and Springvale Coal Services overlapping the project footprint
– agriculture, primarily livestock grazing
– conservation, notably the Gardens of Stone SCA
– state and local road reserves including the Castlereagh Highway, Boulder Road and Brays Lane
– rail corridors including the Main Western Rail Line and a disused railway line near Brays Lane.

Mixed land uses are proposed at the former Wallerawang Power Station site. This may include commercial and industrial land use. Development of a Battery Energy Storage System is also proposed by others at the site.

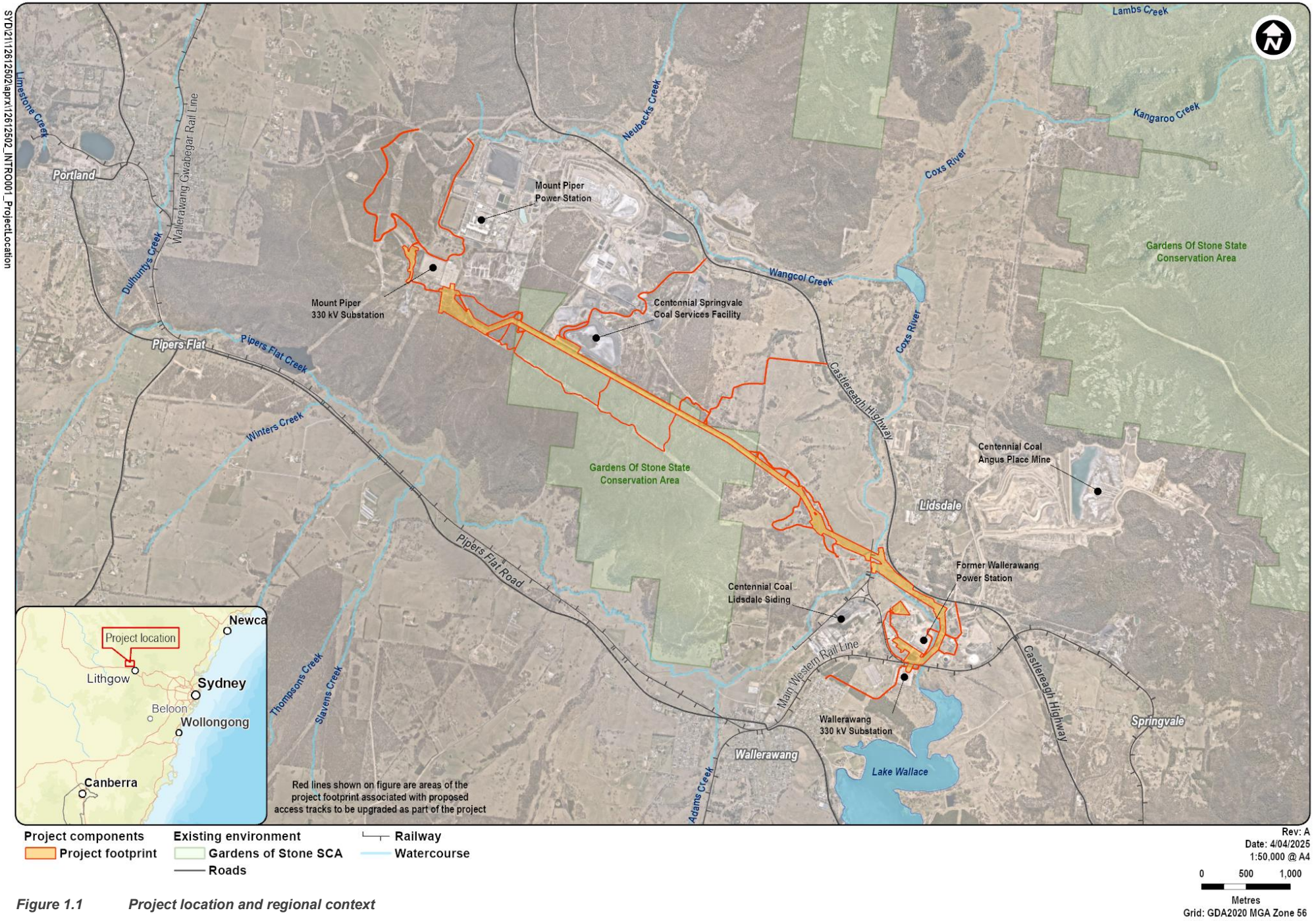


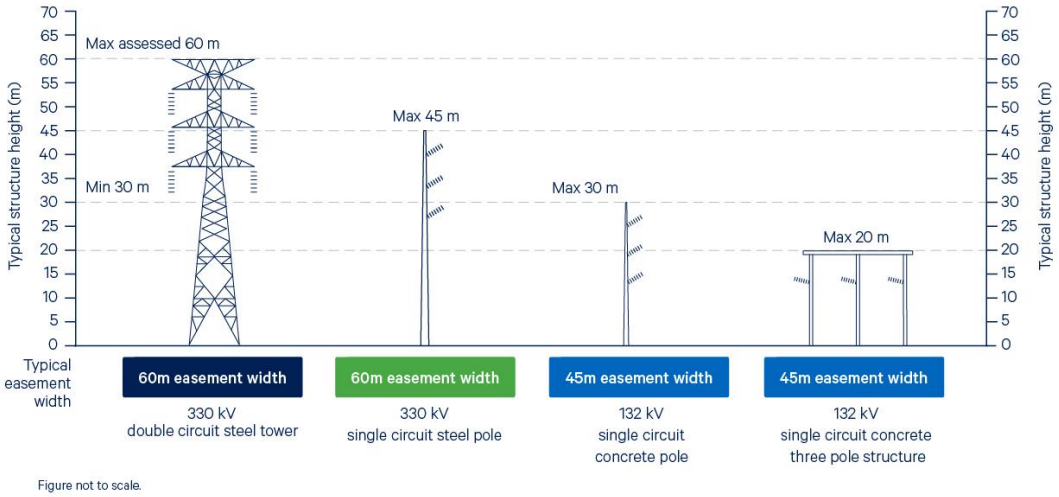
Figure 1.1 Project location and regional context

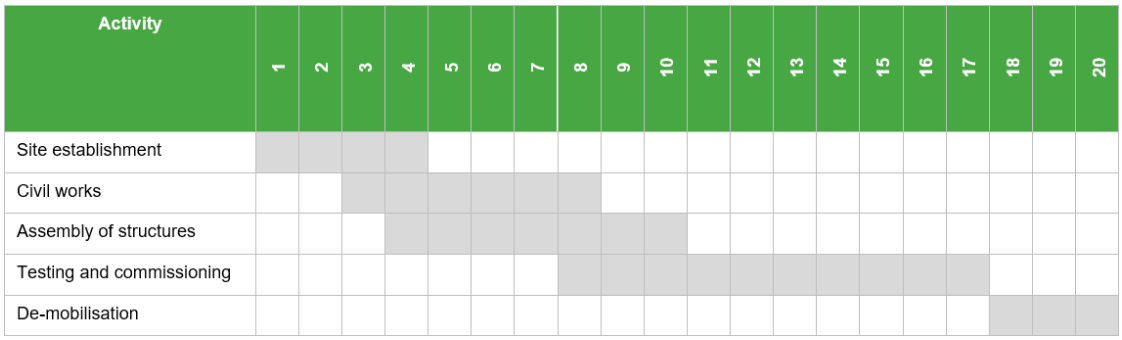
1.3 The project

The project would involve construction and operation of approximately 8 km of new 330 kV transmission line between the Mount Piper and Wallerawang 330 kV substations as shown in Figure 1.2. The project would also include the replacement of transmission structures, partial adjustment of existing transmission lines, permanent and temporary access tracks, construction compounds and laydown areas.

Table 1.1 outlines the key features of the project. The description of the project in Figure 1.2 is based on the current concept design. Further detail is provided in Chapter 3 of the Environmental Impact Statement (EIS). The project will continue to be refined as part of detailed design.

Table 1.1 The project

Feature	Description
Design	
Transmission line and easement	Approximately 8 km of new 330 kV transmission line between the existing Mount Piper 330 kV and Wallerawang 330 kV substations that would include (from west to east): – widening of approximately 0.5 km of existing easements in the vicinity of the Mount Piper 330 kV substation by up to 40 metres (m) to accommodate the new 330 kV transmission line and adjustments to existing 132 kV and 330 kV transmission lines – widening of the existing 132 kV easement from 45 m to 60 m for 4.8 km to accommodate double circuit transmission structures for the existing 132 kV transmission line and the new 330 kV transmission line – installation of two 132 kV pole structures where the existing 132 kV transmission line is restrung onto the new double circuit transmission structures – construction of 1.2 km of new 330 kV transmission line from the existing 132 kV transmission line south-east to the intersection of Main Street and the Castlereagh Highway on a 60 m easement – construction of 1.5 km of new 330 kV transmission line on a 40 m easement running parallel to existing 330 kV transmission lines for approximately 1.1 km and then diverging and widening to 60 m for the remaining 0.4 km to the Wallerawang 330 kV substation. The standard easement widths for 132 kV and 330 kV transmission lines are 45 m and 60 m respectively. However, easements may vary in width where multiple transmission lines converge/ diverge or where they overlap with an existing easement.
Transmission structures	Transmission structures for the project include approximately 28 new steel lattice towers and four steel and/or concrete pole structures. Transmission structures would range in height from approximately 14 to up to 60 m, however these heights would be subject to detailed design. The image below presents an indicative illustration of the types of structures proposed for the project and their maximum heights.  Figure not to scale. The steel transmission structures would generally be spaced between 100 m to 550 m apart and the pole structures about 30 m to 50 m apart. New conductors, earth wires and optical ground wire (OPGW) would be installed on the new transmission structures for the new 330 kV and existing 132 kV lines.

Feature	Description
	Local adjustment of existing transmission structures would be required in the vicinity of the Mount Piper 330 kV substation to minimise crossover of transmission lines. Redundant transmission structures, including the gantry immediately north of the Main Western Rail Line, would be removed and recycled, where possible.
Construction	
Program	Construction of the project would commence once all necessary approvals are obtained. It is anticipated that construction would commence in late 2026. Construction would be undertaken in stages over a period of approximately 20 months. The key activities and their indicative durations shown in the below table. 
Construction methodology	Construction of the project would include: – site establishment including vegetation removal, construction compound establishment, access track construction and upgrade – removal of existing transmission structures where required – civil works involving earthworks and establishment of construction benches for each transmission structure, and establishment of brake and winch sites – construction of footings and foundation work for the new transmission structures – assembly and erection of new transmission structures – stringing of conductors.
Construction hours	The proposed construction working hours for the project are 7 am to 7 pm Monday to Sunday. Out-of-hours construction work will likely be required between 7 pm to 7 am Monday to Sunday and public holidays, to align with scheduled outages. Justification for the out-of-hours works includes: – proximity to live transmission lines requiring the work to be completed under a scheduled outage for network and personnel and contractor safety – the need to complete works within a limited time window to meet a timeframe to re-energise the transmission line to avoid disruption to customers – minimising disruptions to the use of the Main Western Rail Line during stringing.
Construction workforce	Expected to peak at about 150 personnel and contractor, with an average workforce of about 60 personnel and contractor.
Construction compounds and laydown areas	A total of three construction compounds would support the construction of the project. One would be located at the western end of the project near the Mount Piper 330 kV substation and two located at the eastern end of the project within the former Wallerawang Power Station site. The locations of these compounds are shown in Figure 1.2. Laydown of materials (e.g. poles, cable drums, other large equipment, etc.) would also occur at specified locations along the easement within the project footprint, particularly at transmission structure locations.
Access	To facilitate efficient construction access, the following is required: – upgrading and widening of approximately 25 km of existing access tracks to at least 6 m, with some sections widened up to 10 m due to local topography – construction of approximately 2 km of new 6 m wide access tracks. In addition to those tracks, approximately 4 km of existing track would be used only by light vehicles. The light vehicle tracks may require minor repairs (for example, filling potholes), but would not be graded or widened. The project footprint would be accessed from public roads at 13 access points, with the majority of these being existing property access points.

Feature	Description
	Existing access tracks would be used in preference to new tracks wherever possible. Access track upgrades and widening would include required drainage. Access points and access tracks established for the construction of the project that are not required for future operation and maintenance activities would be returned to pre-project conditions, subject to agreement with landowners.
Utility adjustments and infrastructure crossings	The new transmission line would need to cross the following utilities and infrastructure: – water pipeline operated by WaterNSW – distribution lines operated by Endeavour Energy – rail signal power supply – council drainage and other assets – public roads at Brays Lane and Main Street – rail lines at the Main Western Rail Line and the disused rail line travelling north of Brays Lane. It is not currently anticipated that the project would require the adjustment of any nearby utilities. Further investigations and consultation with asset owners would be undertaken during detailed design.
Vegetation clearing	The project would require the clearance of vegetation for a number of activities including but not limited to building new access tracks and widening existing ones, establishment of construction compounds, laydown areas, and brake and winch sites, construction of the transmission structures, and establishing and maintaining the vegetation clearance requirement for the transmission lines. Vegetation clearing would be undertaken either with the use of machinery or manually, where it is unsafe to operate machinery, or when access is limited. Root balls would be retained where possible. Clearing methods would be determined with consideration to vegetation type or structure, slope and terrain, and environmental and ecological constraints. Removed vegetation, which is weed free, would be mulched for beneficial reuse, where appropriate. Areas cleared for construction, that are not needed for operation of the project, would be rehabilitated to a stable and weed free condition.
Testing and commissioning	Testing and structure checks would form part of the final construction and installation work. These activities would ensure the project has been installed in accordance with the design and statutory standards and is safe to proceed to commissioning which would include, but not be limited to: – transmission line cut-in and connection to the electrical network – protection, control and metering checks – high voltage equipment operation and energisation – post commissioning testing and verification.
Demobilisation and rehabilitation	Upon completion of the construction works, all construction equipment, temporary fencing and waste would be removed. All disturbed areas would be rehabilitated to a stable, weed-free condition, unless designated as a permanent access track. This would include spreading topsoil, cleared and stockpiled at the beginning of construction, across the disturbed area to stabilise it to a state where natural regrowth can occur.
Operation	
Design life	About 50 years.
Maintenance	All project infrastructure would require regular maintenance to maintain serviceability and maximise its operational life. Maintenance activities would include: – transmission structure monitoring – annual aerial inspection – routine vegetation management on the easement and in the hazard tree zone – access tracks would be maintained in a trafficable condition. Should any irregularities be identified following routine inspections, a work crew would be dispatched from existing Transgrid maintenance depots to rectify any defects found. Periodic inspection and maintenance work would be managed by Transgrid as part of existing operations, with no additional personnel requirements.

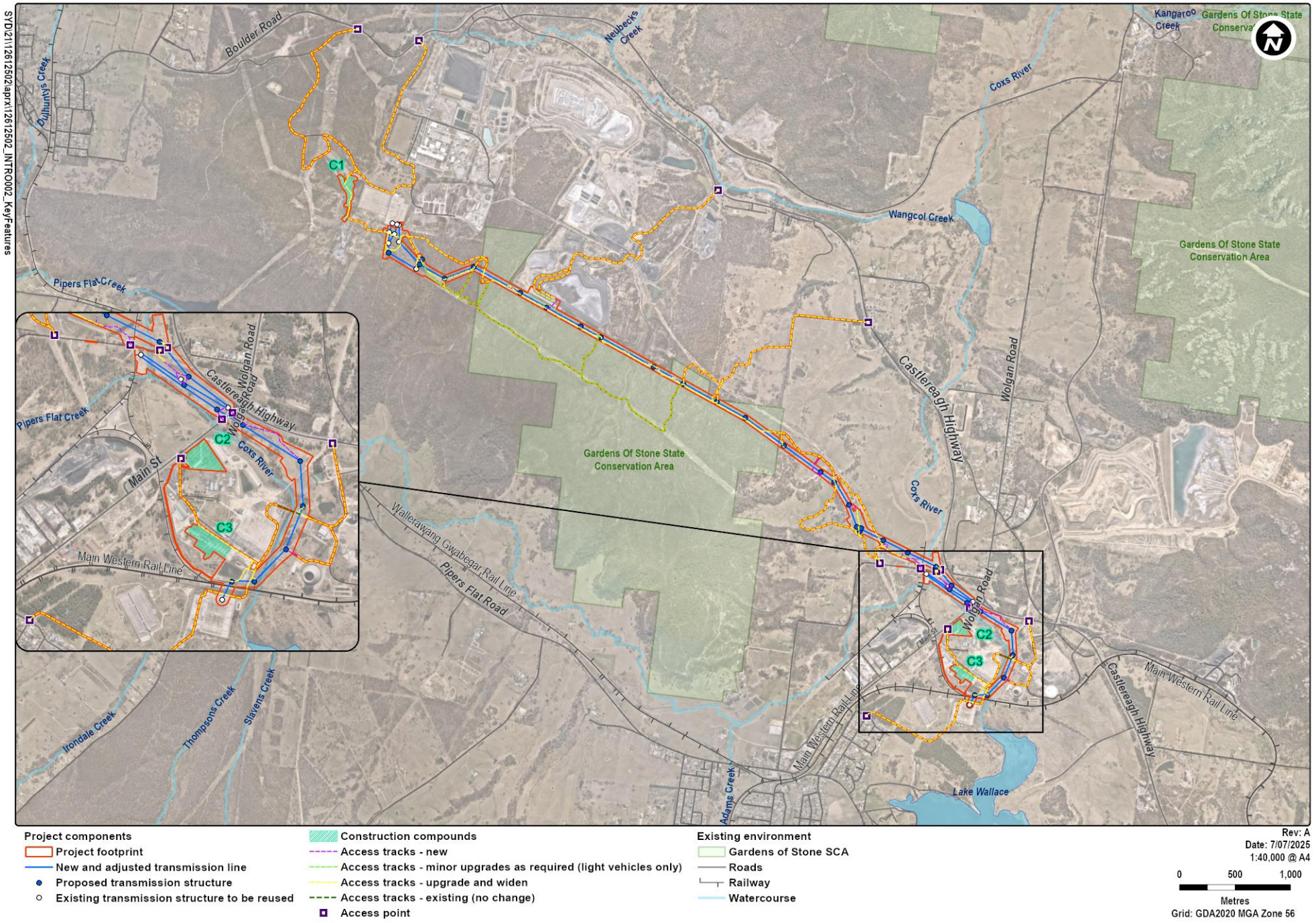


Figure 1.2 Key features of the project

1.4 Secretary's Environmental assessment requirements

This traffic and transport impact assessment has been prepared to address the Secretary's Environmental Assessment Requirements (SEARs), issued on 22 May 2025. Table 1.2 outlines the requirements relevant to this assessment.

Table 1.2 Relevant SEARs

Requirements	Where addressed in this report
Traffic and transport	
An assessment of the peak and average traffic generation, including light vehicles, shuttle buses, heavy vehicles and high risk heavy vehicles requiring escort and construction worker transportation;	Section 4
An assessment of the likely transport impacts to the site access route(s), including the above listed vehicles, site access point(s), any Crown land, particularly in relation to the capacity and condition of the roads, road safety and intersection performance;	Sections 4 and 5 No traffic impacts on Crown Roads Impacts on other Crown Land considered in Technical Paper 4 Land Use and Agriculture Assessment
Details of the ongoing maintenance works required to service assets, outlining the measures to maintain the road;	Section 7
A cumulative impact assessment of traffic from nearby developments (including mining operations); and	Section 6
Provide details of measures to mitigate and / or manage potential impacts (developed in consultation with the relevant road/rail authorities) including: – a schedule of all required road upgrades (including resulting from heavy vehicle and over mass / over dimensional traffic haulage routes), – clear figures of proposed road upgrades (including the site access point); and – road maintenance contributions, and any other traffic control measures.	Section 4.2.1.2 – intersection warrants assessment Section 4.1.3 and Table 4.1 – schedule of required road work No road upgrades are proposed. Section 4.2.2.4 and Figure 4.23 – potential passing bay on Brays Lane Sections 4.7, 5.8, 7 – road condition impacts and mitigation

1.5 Purpose and structure of this report

This report has been prepared by GHD Pty Ltd (GHD) as part of the Environmental Impact Statement (EIS) for the project.

The purpose of this report is to assess potential traffic and transport issues from the construction and operation of the project and, where required, identify feasible and reasonable mitigation and management measures. The report aims to:

– describe the existing traffic and transport environment around the project footprint
– review the existing conditions, traffic volumes and crash data for the public road network used to access the project footprint
– review the construction works and access arrangements of the project
– assess the potential impacts of the construction works of the project on the performance of key intersections during construction
– determine suitable mitigation measures to minimise the impacts where required.

The report is structured as follows:

– **Section 1** – provides an introduction to the project and the purpose of this report.
– **Section 2** – outlines the process by which the Traffic and Transport Assessment (TTA) was undertaken, including defining the study area, existing data collection, and traffic modelling and forecasting.
– **Section 3** – describes the existing transport environment and traffic conditions currently experienced by road users.

- **Section 4** – provides a summary of potential construction traffic impacts, including traffic generation, traffic performance and potential impacts on road users.
- **Section 5** – provides a summary of potential operational traffic and transport impacts related to the project.
- **Section 6** – provides an assessment of the cumulative traffic and transport impacts with other committed developments in the study area.
- **Section 7** – recommends management measures to avoid or minimise the potential impacts identified.
- **Section 8** – summarises the findings of the TTA.
- **Section 9** – lists the documents that have been referred to, or have informed, this study.

2. Methodology

This section outlines the process by which the TTA was undertaken, including defining the existing data collection and the approach to the traffic and transport assessment.

2.1 Study area

The study area for the TTA includes roads and key intersections leading to and from the project footprint that have the potential to be directly or indirectly affected by the construction and operation of the project. This is limited to roads in the public road network, including the following roads:

– Castlereagh Highway (between Boulder Road and the Great Western Highway)
– Great Western Highway (between Lithgow and Barton Avenue)
– Boulder Road (between Frankfort Road and the Castlereagh Highway)
– Frankfort Road
– Karawatha Drive
– Brays Lane
– Main Street
– Barton Avenue, Cripps Avenue and Heel Street in Wallerawang.

The key roads and intersections in the study area, as well as the project footprint, are shown in Figure 2.1. Figure 4.1 and Figure 4. provide a more detailed view of the roads and project elements shown on Figure 2.1.

2.2 Legislative and policy context to the assessment

This section summarises the legislation, guidelines and/or policies driving the approach to the assessment.

The SEARs relevant to traffic and transport impacts and where these have been addressed in this report, are discussed in section 1.4.

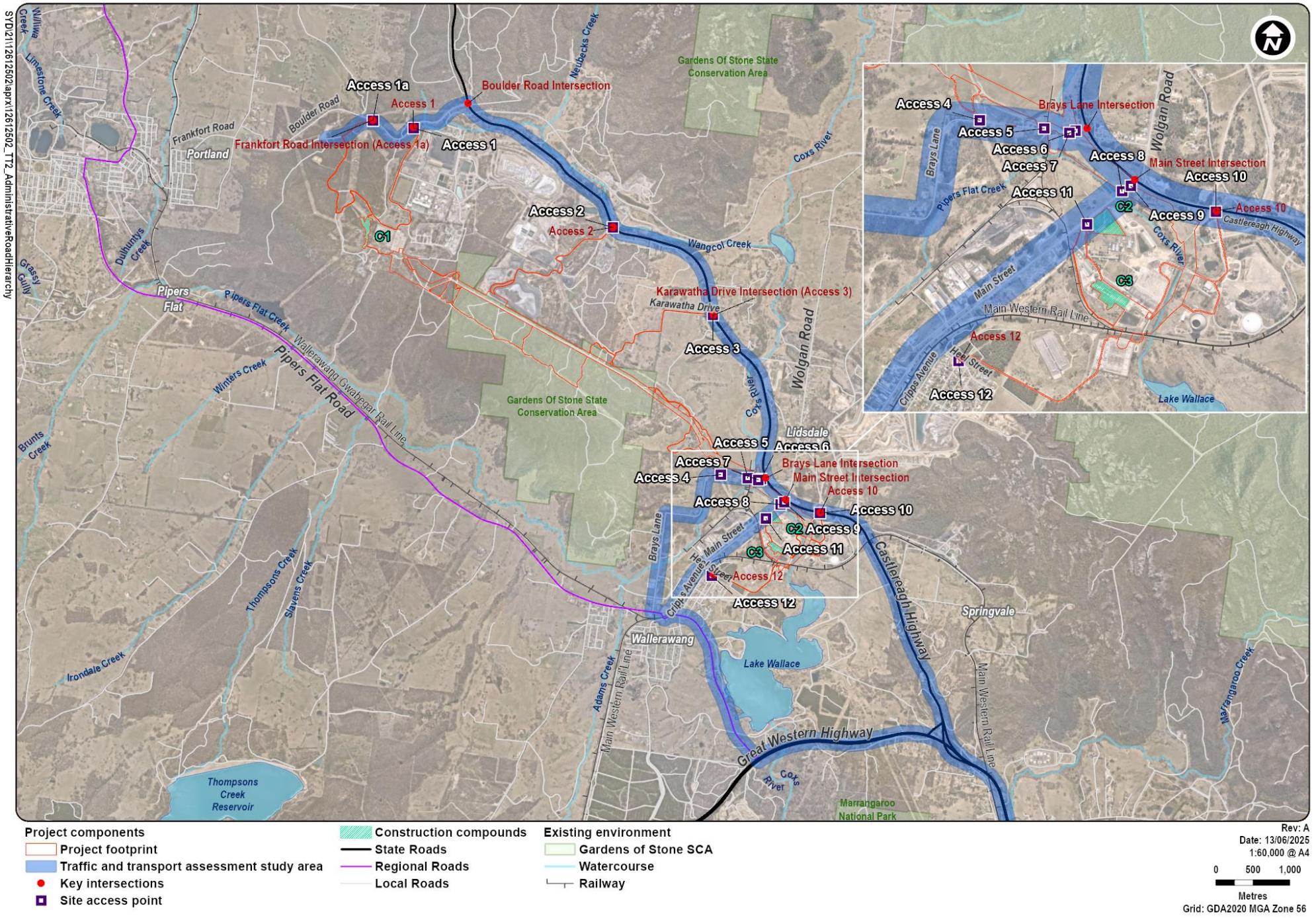


Figure 2.1 Key roads, intersections and access points

2.3 Assessment approach

This TTA report was undertaken with reference to the *Guide to Transport Impact Assessment* (Transport for NSW, 2024) and *Guide to Traffic Management Part 12 Integrated Transport Assessments for Development* (Austroads, 2020). The following tasks were undertaken:

- research the characteristics of the existing environment, including desktop inspection of aerial imagery, traffic surveys (counts) and stakeholder feedback provided
- review the proposed construction activities with respect to proposed workforce resources, construction site access routes and site accesses
- identify the potential impacts of the project during construction based on expected peak activities, including impacts on traffic volumes in the road network
- review conditions expected during operation (including maintenance)
- an assessment of the existing road performance using a mid-block assessment per the *Austroads Guide to Traffic Management Part 3 – Traffic Study and Analysis Methods* (Austroads, 2020)
- investigation of warrants for required intersection treatments that provide vehicular access to construction areas and easements
- assess the potential for cumulative impacts with other existing and proposed developments
- recommend measures that could avoid, reduce and/or mitigate the likelihood, extent and/or duration of the impacts identified.

2.3.1 Desktop review of existing conditions

A desktop review was undertaken to understand the general characteristics of the study area and supplement site observations. The desktop review utilised publicly available information, including:

- aerial imagery, including Nearmaps and Google Maps
- street view images from Google Maps
- public transport routes and schedules from Transport for NSW Trip Planner (**transportnsw.info/routes/bus**)
- freight rail schedules published by Australian Rail Track Corporation
- road crash data published by the Transport for NSW Centre for Road Safety (**transport.nsw.gov.au/roadsafety**)
- publicly available traffic count data from the Transport for NSW Traffic Volume Viewer Website (**Traffic Volume Viewer**)
- National Heavy Vehicle Regulator (NHVR) maps of heavy vehicle routes published by Transport for NSW (**maps.transport.nsw.gov.au/egeomaps/restricted-access-vehicles-map/index**)
- bicycle routes published by Transport for NSW (**Cycleway Finder**)
- National Heavy Vehicle Regulator (NHVR) maps of heavy vehicle routes (data provided by Transport for NSW).

2.3.2 Data collection

GHD commissioned traffic surveys, which were conducted on 30 October 2024, at the following intersections:

- Boulder Road / Castlereagh Highway
- Karawatha Drive / Castlereagh Highway
- Brays Lane / Castlereagh Highway
- Main Street / Castlereagh Highway.

The surveys collected turning movement counts categorised into the following vehicle classes:

- Light vehicles (Austroads class 1-2)
- Trucks (Austroads class 3-5)
- Heavy trucks (Austroads class 6-12).

Surveys were conducted during a weekday, with data collected at 15-minute intervals for the following periods:

– AM survey period (6am to 9am)
– PM survey period (3.30pm to 6.30pm).

The locations of the traffic surveys, as outlined above, are shown in Figure 2.1.

The traffic survey data provides a current estimate of the number of vehicles using the Castlereagh Highway, including separate counts of light and heavy vehicles. These were used to determine the existing 'baseline' traffic conditions for 2024 (refer to section 3.6); these volumes are also used in assessing the impacts of additional vehicles resulting from the project on the road network in future years.

2.3.3 Background traffic growth

Historical Transport for NSW traffic counting stations were identified along roads within or close to the study area, as identified on the Transport for NSW **Traffic Volume Viewer** website. The most recent count data available from Transport for NSW is located on the Castlereagh Highway to the north of the intersection with the Great Western Highway, which was from 2012. While this is within the study area, the data is not considered to be recent enough for the purpose of this study.

A background traffic growth of two per cent per annum was applied to the study area to account for the background growth of vehicle trips between 2024 and the expected construction period in 2028. This growth rate was discussed and agreed with a representative of Transport for NSW on 19 December 2024.

2.4 Assessment criteria

2.4.1 Mid-block assessment

Mid-block analysis provides a quantitative measure of the ability of a network to move traffic and is a function of vehicle demand and lane capacity.

2.4.1.1 Vehicle demand

Vehicle demand is a measure of the volumes of activity a road experiences. To account for the different impacts of light and heavy vehicles in the traffic mix, traffic volumes have been converted from 'vehicle units' to 'passenger car units' (PCU) using multipliers called passenger car equivalent (PCE) factors. This allows for the assessment of traffic volumes using one homogenised unit for all vehicle types.

To assess the project's impacts on heavy vehicles, a PCE factor of two has been adopted, which is consistent with transport planning principles and the criteria included in the *Traffic Modelling Guidelines* (Roads and Maritime Services, 2013).

2.4.1.2 Lane capacity

Lane capacity is a measure of a road's ability to accommodate the volumes of vehicles that traverse it during peak periods of road network activity.

A road in which fixed elements influence traffic flow conditions (e.g. traffic signals, stop signs, give-way signs, roundabouts or other controls) that cause traffic to stop periodically is referred to as an interrupted flow facility. The lane capacity of a road with interrupted flow varies depending on the type of lane (Austroads, 2020a). The typical mid-block capacity for roads with interrupted flow, stipulated by Austroads, is provided in Table 2.1.

Table 2.1 Typical mid-block lane capacities for urban roads with interrupted flows

Type of lane	One-way mid-block capacity (PCU/hr)
Median or inner lane	
Divided road	1,000
Undivided road	900
Middle lane (of a three-lane carriageway)	
Divided road	900

Type of lane	One-way mid-block capacity (PCU/hr)
Undivided road	1,000
Kerb lane	
Adjacent to parking lane	900
Occasional parked vehicles	600
Clearway conditions	900

Source: Austroads Guide to Traffic Management Part 3 (2020)

It is noted that:

– The Austroads Guide specifies that peak period mid-block volumes could increase to 1,200 to 1,400 PCU/hr per lane for roads with uninterrupted flows.
– To support a highly conservative analysis, 900 PCU per hour per lane capacity was used to calculate the Volume to Capacity Ratio (VCR) for the Castlereagh Highway as an undivided road with clearway conditions (i.e. no parking within the road shoulders).

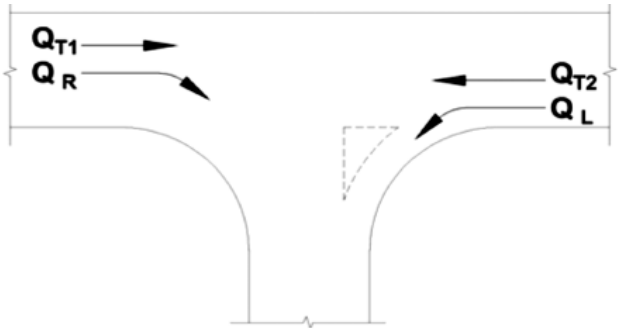
2.4.1.3 Volume to capacity ratio

The VCR is the ratio of the volume of vehicles relative to the capacity of the road. The ratio gives an indication of the road's degree of saturation and its ability to accommodate additional traffic. A lower VCR indicates low traffic volumes and typically translates to a better quality of service for road users. A ratio greater than one suggests that the road is oversaturated with users, leading to congestion, queueing and possible accidents.

Austroads suggests a practical degree of saturation of 0.90 is adopted.

2.4.2 Intersection warrants assessment

An assessment of whether any design treatments are required to cater for turning movements at intersections along the Castlereagh Highway to maintain acceptable levels of safety for vehicles has been undertaken. The intersection warrants assessment utilises guidance sourced from the *Austroads Guide to Traffic Management – Part 6: Interchanges, Intersections and Crossing Management (Austroads, 2020)*. This guidance accounts for the hourly traffic flows along the major road and turning movement flows calculated using the Austroads guide, as shown in Figure 2.2.



Road type	Turn type	Splitter island	Q_M (veh/h)
Two-lane two-way	Right	No	= $Q_{T1} + Q_{T2} + Q_L$
		Yes	= $Q_{T1} + Q_{T2}$
	Left	Yes or no	= Q_{T2}
Four-lane two-way	Right	No	= 50% x $Q_{T1} + Q_{T2} + Q_L$
		Yes	= 50% x $Q_{T1} + Q_{T2}$
	Left	Yes or no	= 50% x Q_{T2}
Six-lane two-way	Right	No	= 33% x $Q_{T1} + Q_{T2} + Q_L$
		Yes	= 33% x $Q_{T1} + Q_{T2}$
	Left	Yes or no	= 33% x Q_{T2}

Source: Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management (Figure 3.26)

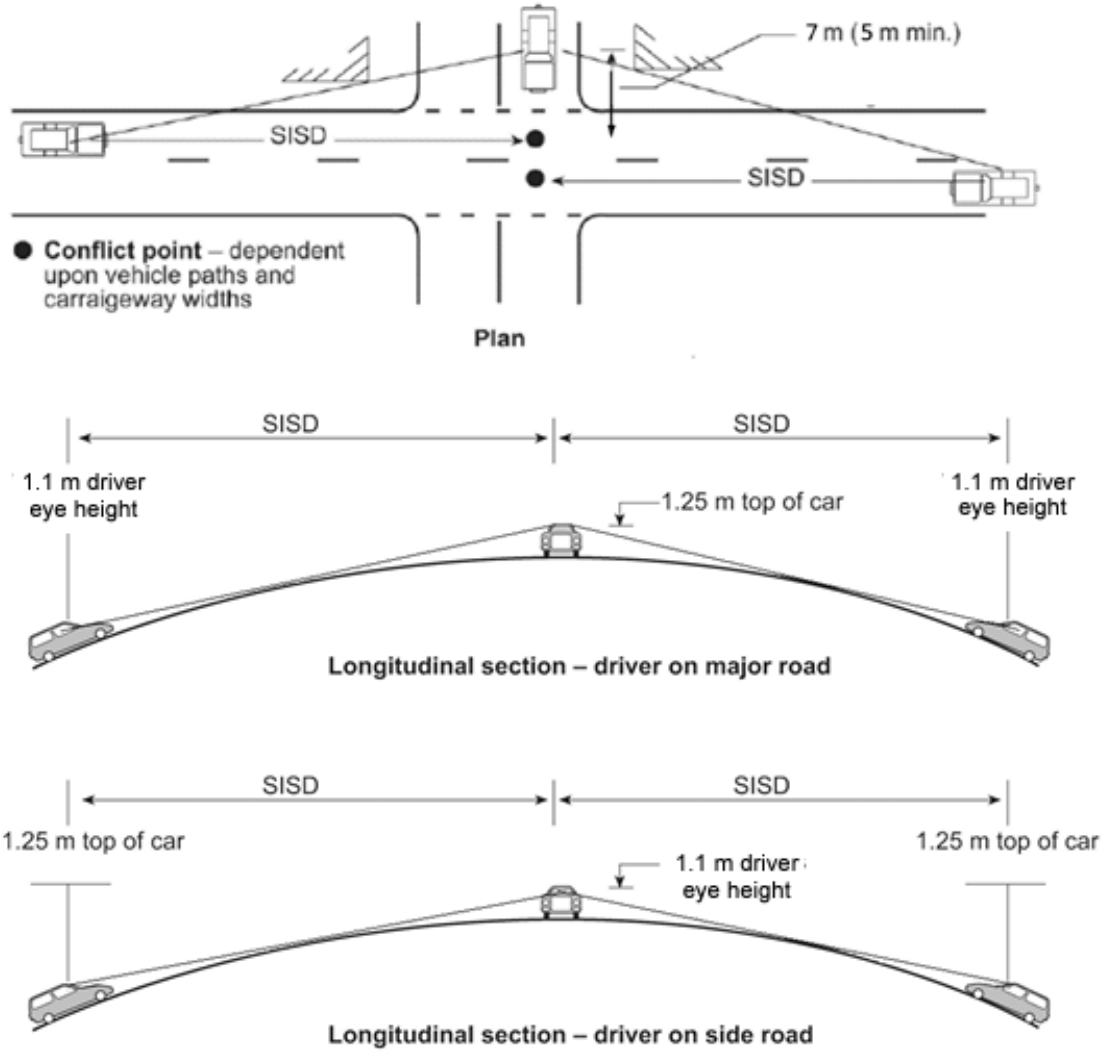
Figure 2.2 Calculation of the major road traffic volume guide

2.4.3 Intersection sight distance review

Sight distance at the intersections at access points along the Castlereagh Highway and Boulder Road to the project footprint was reviewed to determine whether there is adequate longitudinal sight distance at the proposed intersections to allow drivers to safely navigate into and out of the area.

The required sight distances were derived from the *Austroads Guide to Road Design (AGRD) Part 4A: Unsignalised and Signalised Intersections* (Austroads, 2021). The assessment assumed the design speed was an additional 10 (km/h) over the posted speed limit.

Safe Intersection Sight Distance (SISD) provides sufficient sight distance for a driver of a vehicle on the major road to observe approaching vehicles from the minor road and to stop before a potential collision. Safe intersection sight distance is measured from the driver's eye height (1.1 m for cars, and 2.4 m for trucks) to the top of a car (1.25 m), as shown in Figure 2.3.



Source: Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections (Figure 3.2)

Figure 2.3 Safe intersection sight distance (SISD) – Cars

This assessment was conducted based on a desktop review, utilising Google Maps, Nearmap, Google Street View, and site photos to evaluate the potential available sight distance at the intersection access points. It should be noted that:

– The actual sight distances observed by road users on site may differ from those depicted in Google images due to potential changes in vegetation or the road environment.

– The height of the Google camera above the road surface may vary from the actual driver's eye level. Nonetheless, imagery from these sources is considered to provide a reasonably accurate representation of the site conditions and has been used for this assessment.

2.5 Stakeholder engagement

Engagement with Transport for NSW and Lithgow City Council has been undertaken throughout the preparation of this TTA. Table 2.2 provides a summary of the stakeholder engagement undertaken for this TTA, including key issues discussed and the report sections where these issues have been addressed.

Table 2.2 Summary of stakeholder engagement

Stakeholder	Date of consultation	Key discussion items	Key issues raised	TTA report section
Transport for NSW	19 December 2024	Presentation of proposed access points interacting with Transport for NSW roads	See below with regards to issues raise on specific access points or intersections.	-
		Traffic assessment methodology	Agreement on 2% annual growth rate for background traffic.	Section 2.3.3
			Agreement on Austroads intersection warrants assessment (no modelling).	Section 4.2.1.2
			No high risk OSOM vehicles are expected, therefore, no detailed OSOM route analysis is required for the assessment.	Section 4.1.5
		Pre-construction site establishment	Transgrid to provide pre-construction site establishment information to Transport for NSW.	Transgrid would provide information through ongoing consultation
		The preliminary intersection warrants assessment results for the Brays Lane intersection indicates that this intersection may require a turning lane upgrade for the left turn into Brays Lane	It was discussed and confirmed that there is no requirement to upgrade the intersection, however, it is recommended that traffic demand management, such as car-pooling and staggered start times, are implemented in order to reduce the impact on the intersection performance.	Section 4.2.1.2
		Projects included in cumulative impact assessment	Mount Piper Battery Energy Storage System (BESS) is approved noting access issues for large vehicles at the Boulder Road intersection. Wallerawang BESS also to utilise Access Point 2. Great Western BESS to be included in the assessment. No other additional items or road works were raised by Transport for NSW.	Section 6
		Safe sight distance assessment	Reaction times used in the assessment were confirmed to be appropriate.	Section 4.2.1.3

Stakeholder	Date of consultation	Key discussion items	Key issues raised	TTA report section
		Access point[1] for the project off the Castlereagh Highway	Temporary traffic control is only allowed for works within the road reserve. Proposed access would require ministerial sign-off (controlled access road). Ongoing consultation on the use of Access Point 10 is to be undertaken.	Previously identified Access Point has been removed with access to the transmission line to occur via Access Point 9. Note that access points have been renumbered accordingly. This former access point has not been assessed further in this report.
	13 June 2025	Recommended signage change on Castlereagh Highway south of Boulder Road to improve safety	Transport for NSW advised they will review this as part of the EIS exhibition.	Section 4.1.3 for identification of potential signage change
Lithgow City Council	1 April 2025	Stringing of transmission lines over council roads	Potential impact on access to council roads during stringing works, including temporary road closures. Transgrid to obtain a road occupancy licence and implement traffic control during stringing works over Brays Lane and Main Street.	Section 4.2.2.3 for the description of potential impacts from proposed stringing work.
		Potential upgrade of Brays Lane to provide a passing bay	Indicative design drawings of passing bay to be provided.	The indicative location of the potential passing bay has been identified in section 4.2.2.4. Adequate space has been allocated for the facility in line with the Austroads Guide to Road Design. The need for the passing bay will be determined as part of detailed design and construction planning. Design details including design drawings would be provided to Lithgow City Council as part of ongoing consultation.

[1] At the time of consultation, an Access Point off the Castlereagh Highway was considered an option. Subsequent to stakeholder consultation, this Access Point has been removed from the project.

Stakeholder	Date of consultation	Key discussion items	Key issues raised	TTA report section
		Available sight distances not met at Access Points 1 and 1A along Boulder Road	Council raised no concerns on proposed vegetation trimming at the Boulder Road / Mount Piper Power Station Access Road (Access Point 1) and Boulder Road / Frankfort Road (Access Point 1A) intersections to improve available sight distances. Council also raised no concerns on the proposed implementation of traffic control at the intersection of Frankfort Road and Boulder Road during construction.	Section 7 Vegetation trimming to improve the sight distance at Mount Piper Power Station Access Road would be undertaken by (or on behalf of) Council as part of regular maintenance. As such vegetation management is normally undertaken as part of regular maintenance. Therefore, it is not included in the project scope. Note: With the implementation of traffic control at Frankfort Road and Boulder Road, vegetation trimming would not be required.
		Safe sight distance review for access points on Brays Lane and Main Street	Sight distances for all access points off Brays Lane and Main Street were confirmed to be acceptable, with no concerns raised, noting the close proximity of some intersections to the Castlereagh Highway.	Section 4.2.1.3

3. Existing environment

This section describes the existing transport environment and traffic conditions currently experienced by road users.

3.1 Road network

Roads within NSW are categorised in the following two ways:

– by legal classification (ownership)
– by the function that they perform (administrative classification).

Legal classification

Roads, as defined by the *Roads Act 1993*, are classified based on their importance to the movement of people and goods within NSW (as a primary means of communication). The legal classification of a road allows Transport for NSW to exercise authority of all or part of the road and to provide financial assistance to councils.

Road classifications are instituted by order of the Minister as published in the NSW Government Gazette and can fall under any of these categories: main roads, highways, freeways, controlled access roads, secondary roads, tourist roads, tollways, transitways, and state works.

Administrative classification

Management responsibility and funding allocation for roads are based on a different system called administrative classification. These classes are:

– **State roads** are major arterial links through NSW and within major urban areas. They are the principal traffic-carrying roads and fully controlled and maintained by Transport for NSW. State roads include all tollways, freeways and transitways; and all or part of a main road, tourist road or state highway.
– **Regional roads** are roads of secondary importance between state roads and local roads. Along with state roads, regional roads provide the main connections to and between smaller towns and perform a sub-arterial function in major urban areas. Regional roads are typically the responsibility of councils for maintenance funding. Traffic management on regional roads is controlled under the delegations to local government from Transport for NSW. Regional roads may form all or part of a main road, secondary road, tourist road, or other roads as determined by Transport for NSW.
– **Local roads** form the remainder of the council-controlled roads. Local roads are the responsibility of councils for maintenance funding, although Transport for NSW may fund some maintenance and improvements based on specific programs (e.g. urban bus routes, road safety programs). Traffic management on local roads is controlled under the delegations to local government from Transport for NSW.

Functional hierarchy

Functional road classification involves the relative balance of the mobility and access functions. Transport for NSW defines four levels in a typical functional road hierarchy, ranking from high mobility and low accessibility to high accessibility and low mobility. These road classes are:

– **Arterial roads** – generally controlled by Transport for NSW, they typically have no limit in flow and are designed to carry vehicles long distance between regional centres.
– **Sub-arterial roads** – can be managed by either Transport for NSW or local council. Typically, their operating capacity ranges between 10,000 and 20,000 vehicles per day, and their aim is to carry through traffic between specific areas in a sub region or provide connectivity from arterial road routes (regional links).
– **Collector roads** – provide connectivity between local roads and the arterial road network and typically carry between 2000 and 10,000 vehicles per day. These roads are typically managed by local councils.
– **Local roads** – provide direct access to properties and the collector road system and typically carry between 500 and 4,000 vehicles per day. These roads are typically managed by local councils.

The administrative classification of roads in the study area is shown in Figure 2.1.

3.2 Road characteristics

An outline of the characteristics of the key roads within the study area is presented in sections 3.2.1 to 3.2.4. The locations of all key roads are shown in Figure 2.1. The roads providing access during construction and operation comprise state roads and regional roads connected with a network of sealed local roads and unsealed access tracks.

3.2.1 Castlereagh Highway

The Castlereagh Highway (B55) is a state road (arterial road) which provides a north-south connection between the Golden Highway near Dunedoo in the north, with The Great Western Highway near Marrangaroo in the south.

The key characteristics of the Castlereagh Highway are outlined in Table 3.1 and shown at Figure 3.1.

Table 3.1 Castlereagh Highway key characteristics

Feature	Description
Carriageway	Generally one traffic lane provided in each direction, which widens to two lanes in some locations. The carriageway has a travel width of around 7 m (3.5 m-wide traffic lanes each lane), with 2 m wide road shoulders on each side of the road.
Speed limit	100 km/h to the north of Brays Lane and typically 80 km/h to the south.
Parking	No parking is permitted within the study area.
Pedestrian facilities	No pedestrian facilities are provided within the study area.
Bicycle facilities	No bicycle facilities are provided within the study area.
Public transport	No bus services run along Castlereagh Highway.

Image source: Google Street View (2022 imagery)

Figure 3.1 Castlereagh Highway

3.2.2 Great Western Highway

The Great Western Highway (A32) is a state road (arterial road), providing a key road connection between Bathurst and Sydney. Great Western Highway forms a grade separated interchange with the Castlereagh Highway to the south of the project. The key characteristics of the Great Western Highway are outlined in Table 3.2.

Table 3.2 Great Western Highway key characteristics

Feature	Description
Carriageway	Two traffic lanes provided in each direction. The carriageway has a travel width of around 7 m in each direction, with a wide central median.
Speed limit	Typically 110 km/h to the west of the Castlereagh Highway interchange and 100 km/h to the east of the Castlereagh Highway interchange.
Parking	No parking is allowed along the highway near the study area.
Pedestrian facilities	No pedestrian facilities are provided along the highway near the study area.
Bicycle facilities	No bicycle facilities are provided along the highway near the study area.
Public transport	Bus services run along the Great Western Highway, including the 600 and 636 bus routes.

3.2.3 Regional roads

The following regional roads are located within the study area:

– Pipers Flat Road is a single-carriageway road that connects Portland and Wallerawang. It runs in an approximate north-south direction.
– Barton Avenue is a single-carriage road starting at Pipers Flat Road and Great Western Highway. It runs in an approximate north-south direction.

These roads typically provide one travel lane in each direction, separated by double solid white lines. Road characteristics of the two roads are summarised in Table 3.3.

Table 3.3 Road characteristics – regional roads

Road name	Carriageway	Travel width (m)	Posted speed limit (km/h)
Pipers Flat Road	Two lanes with two-way traffic	7.5	60
Barton Avenue	Two lanes with two-way traffic	7.5	60

3.2.4 Local roads

All other roads within the study area are classified as local roads and typically have two-lane carriageways catering to two-way traffic (one lane per direction) and are all sealed roads.

Road characteristics of the sections of the roads relevant to the TTA are summarised in Table 3.4.

Table 3.4 Road characteristics – local roads

Road name	Carriageway	Travel width (m)	Posted speed limit (km/h)
Main Street	Two lanes with two-way traffic	12.0	50
Brays Lane	Two lanes with two-way traffic	5.3	50
Karawatha Drive	Two lanes with two-way traffic	5.8	50
Boulder Road	Three lanes with two-way traffic, short lanes for turning movements provided	10.7	60 (at Frankfort Road and to the east) 80 (to the west of Frankfort Road)
Frankfort Road	Two lanes with two-way traffic	5.1	50
Cripps Avenue	Two lanes with two-way traffic	6.6	50
Heel Street	Two lanes with two-way traffic	7.8	50
Barton Avenue	Two lanes with two-way traffic	7.8	80 (south of Wallerawang Public School) 50 (within Wallerawang)[1]

Note: 1. School zone operations near Wallerawang Public School between 8-9.30 am and 2.30-4 pm on school days

3.3 Transport network

3.3.1 Heavy vehicle routes

The National Heavy Vehicle Regulator is responsible for administering the Heavy Vehicle National Law across Australia. The Heavy Vehicle National Law regulates the use of heavy vehicles on roads to ensure that roads remain safe for all road users, protect road infrastructure, and ensure that goods and passengers are transported efficiently. To do this, heavy vehicles are classified depending on their mass, size, configuration, or a combination of these.

A Restricted Access Vehicle (RAV) is defined as any single motor vehicle or combination with a combined load that exceeds the general access overall dimensions as defined in the Heavy Vehicle National Regulation. This includes articulated vehicles longer than 19 m.

Oversize and/or overmass (OSOM) vehicles are defined by Transport for NSW as a heavy vehicle or combination that alone or together with its load, exceeds prescribed mass or dimension requirements. All OSOM vehicles need to be escorted.

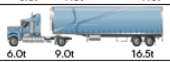
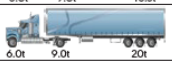
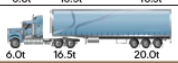
Vehicle classifications that meet the limits described in Table 3.5 and Table 3.6, including Gross Mass Limit (GML), are classified as general access vehicles. Under the national mass and loading arrangements, these are vehicles with unrestricted access to the road system, except where a road or bridge is signposted otherwise. This is subject to the vehicles possessing a current registration appropriate to the vehicle configuration and no specific access restrictions or additional permits being required.

Table 3.5 General access vehicles – prescribed dimension limits

Vehicle type	Dimension limits (m)		
	Length	Height	Width
Truck	12.5	4.3	2.5
Bus	12.5		
Truck and trailer	19.0		
Articulated vehicle	19.0		

Source: General access heavy vehicles, Transport for NSW website (information current as of September 2023)

Table 3.6 General access vehicles – prescribed mass limits

	Description	Maximum Length (metres)	Maximum Regulatory Mass under GML (tonnes)
1. COMMON RIGID TRUCKS - GENERAL ACCESS			
(a)	 2 Axle Rigid Truck	≤ 12.5	15.0
(b)	 3 Axle Rigid Truck	≤ 12.5	22.5
(c)	 4 Axle Rigid Truck	≤ 12.5	26.0
(d)	 4 Axle Twinsteer Rigid Truck	≤ 12.5	26.5
(e)	 5 Axle Twinsteer Rigid Truck	≤ 12.5	30.0
2. COMMON SEMITRAILER COMBINATIONS - GENERAL ACCESS			
(a)	 3 Axle Semitrailer	≤ 19.0	24.0
(b)	 4 Axle Semitrailer	≤ 19.0	31.5
(c)	 5 Axle Semitrailer	≤ 19.0	35.0
(d)	 5 Axle Semitrailer	≤ 19.0	39.0
(e)	 6 Axle Semitrailer	≤ 19.0	42.5
3. COMMON RIGID TRUCK AND TRAILER COMBINATIONS (General access when complying with prescribed mass and dimension requirements)			
(a)	 2 Axle Truck and 2 Axle Dog Trailer	≤ 19.0	30.0
(b)	 2 Axle Truck and 2 Axle Pig Trailer	≤ 19.0	30.0
(c)	 3 Axle Truck and 2 Axle Dog Trailer	≤ 19.0	40.5
(d)	 3 Axle Truck and 2 Axle Pig Trailer	≤ 19.0	37.5
(e)	 3 Axle Truck and 3 Axle Dog Trailer	≤ 19.0	42.5
(f)	 3 Axle Truck and 3 Axle Pig Trailer	≤ 19.0	40.5
(g)	 3 Axle Truck and 4 Axle Dog Trailer	≤ 19.0	42.5
(h)	 4 Axle Truck and 3 Axle Dog Trailer	≤ 19.0	42.5
(i)	 4 Axle Truck and 4 Axle Dog Trailer	≤ 19.0	42.5

Note: Gross Mass Limit (GML)

Source: Excerpt from the NHVR **Common Heavy Freight Vehicle Configurations Chart (NHVR, 2017)**

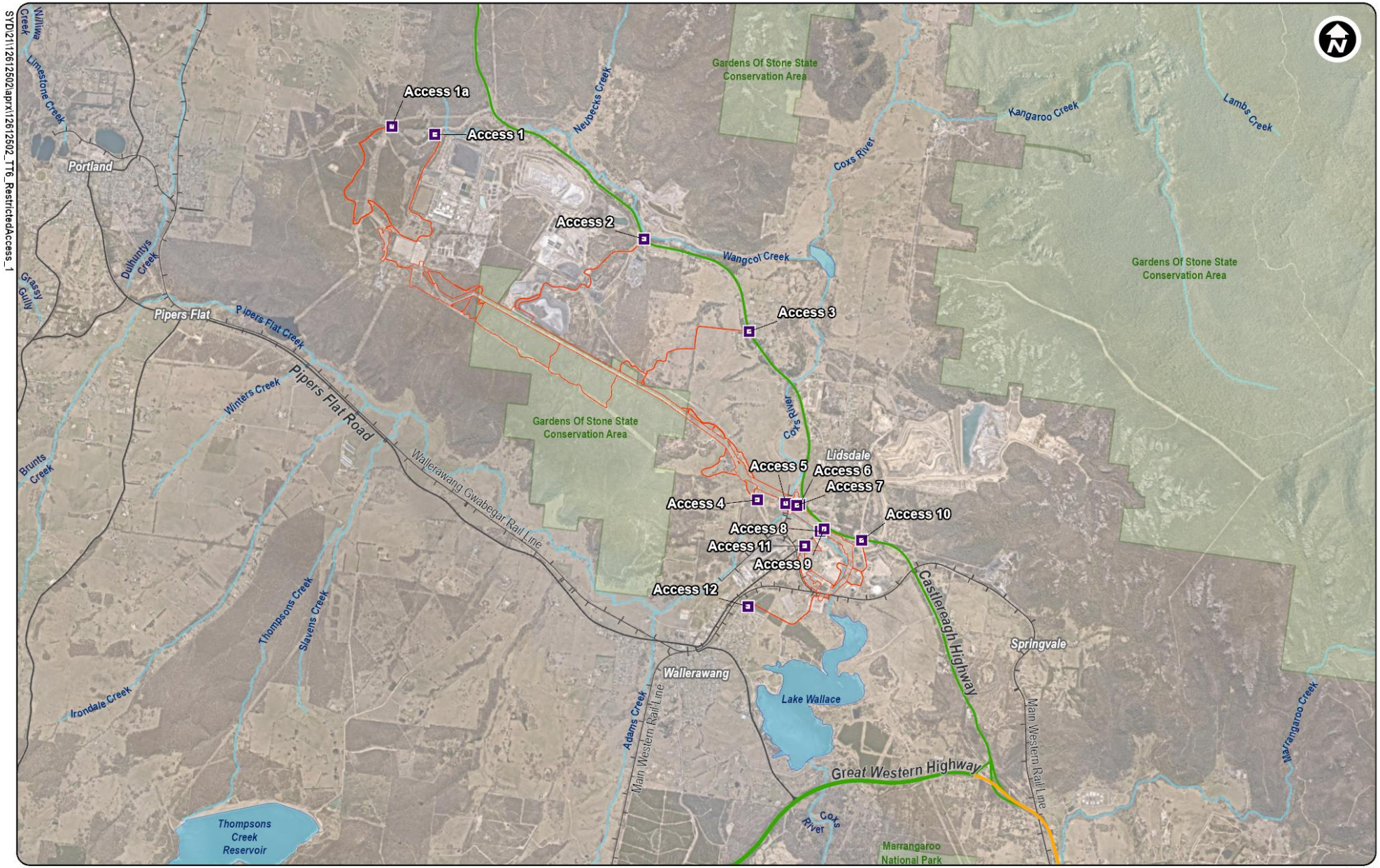
3.3.1.1 Approved heavy vehicle routes

The Transport for NSW Interactive Restricted Access Vehicle Map identifies the network of routes that are approved to be used by heavy vehicles of various sizes, including vehicles up to the size of a 26 m B-double.

The Transport for NSW Oversize Overmass Load Carrying Vehicles Network Map (**maps.nhvr.gov.au**) identifies the network of routes that are approved to be used by OSOM vehicles of various sizes, as shown in Figure 3.2. The approved OSOM routes include Castlereagh Highway and Great Western Highway.

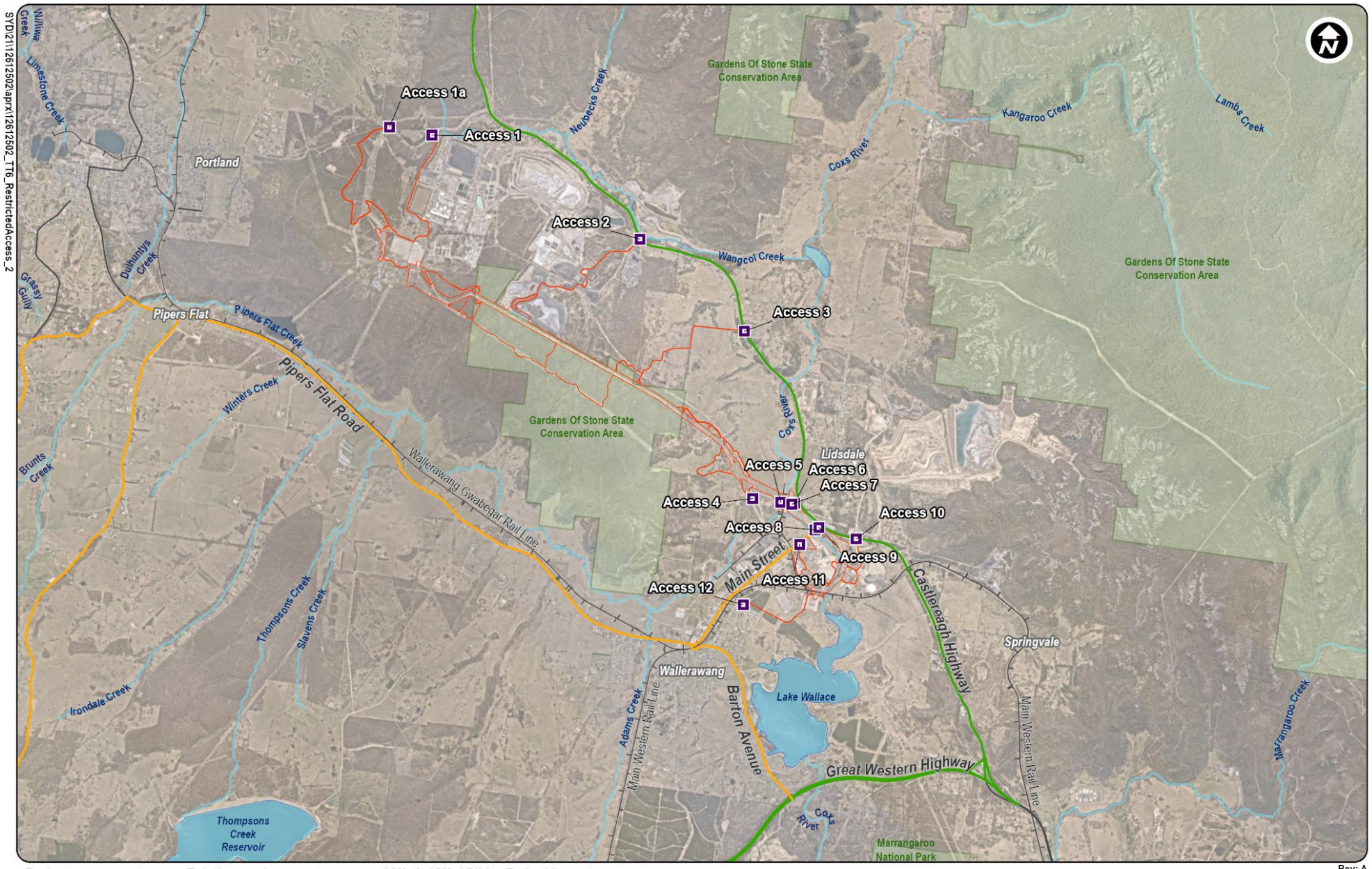
Castlereagh Highway, Great Western Highway and Forest Ridge Drive are approved freight routes for RAVs, as shown in Figure 3.3. These routes are approved to carry vehicles up to 26-m B-doubles and 4.6-m high vehicles.

It is assumed that the required heavy vehicle movements would originate from Sydney or Newcastle, with some movements potentially required from Orange/Bathurst. Proposed heavy vehicle access routes are described in section 4.1.4. All planned heavy vehicle routes will be in accordance with NHVR conditions for relevant roads along heavy vehicle access routes as outlined in section 4.1.4.



Source: **National Network Map | NHVR**

Figure 3.2 Restricted Access Vehicle Map – OSOM routes



Source: **National Network Map | NHVR**

Figure 3.3 Restricted Access Vehicle Map – 26 m B-double routes (Source: Transport for NSW, modified by GHD)

3.3.2 Public transport

3.3.2.1 Bus network

A desktop review identified that two bus routes, route 600 and route 636, operate within the study area, with bus stops provided in Wallerawang along Main Street, Pipers Flat Road and Barton Avenue (shown in Figure 3.4). These bus routes also operate along the Great Western Highway. No public bus services operate along Castlereagh Highway.

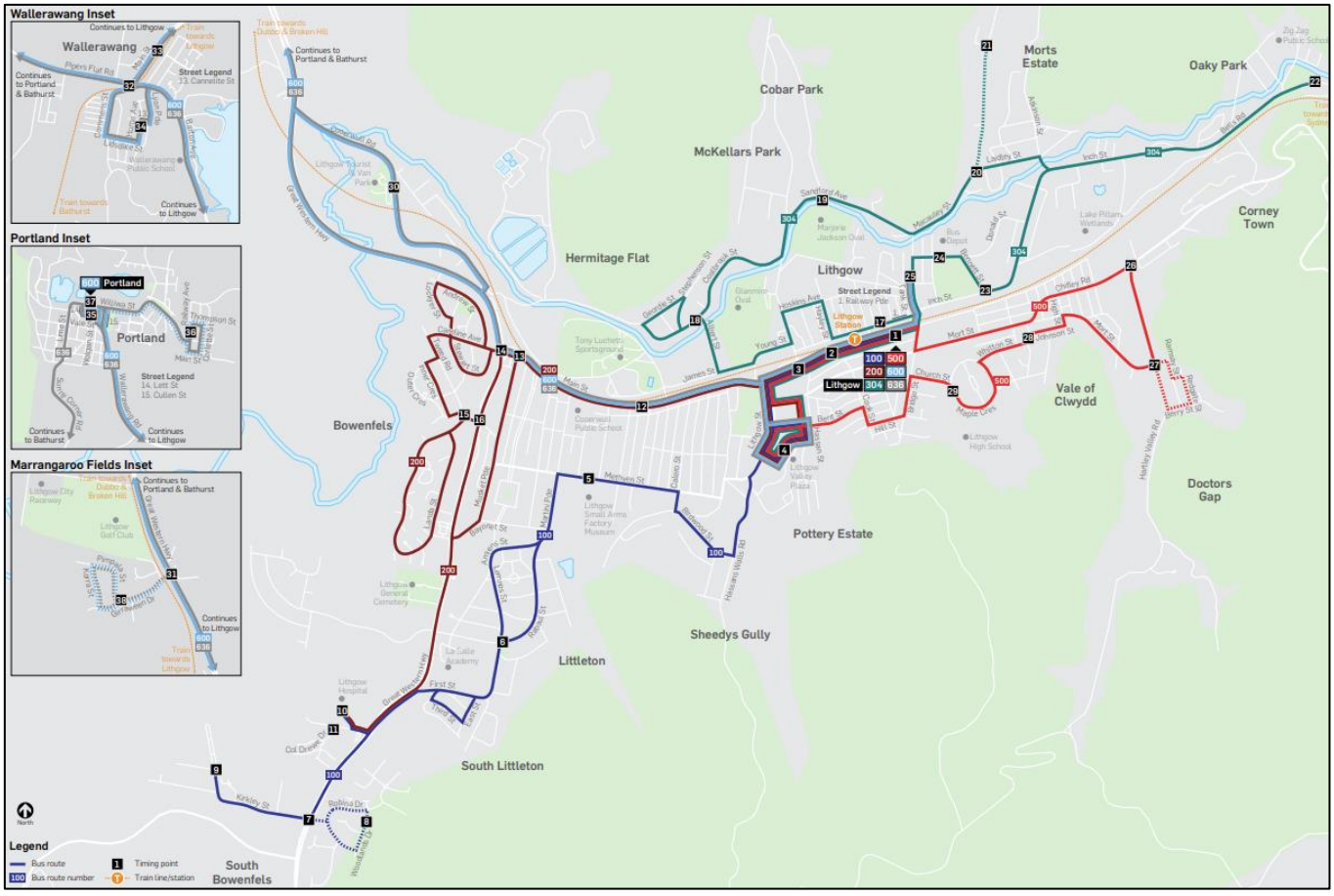
School bus routes are discussed in section 3.3.2.2.

The daily schedule of bus services varies from day to day, with the maximum number of bus services outlined in Table 3.7.

Table 3.7 Bus services

Route Number	Route	Operation	AM frequency (7-10 am)	PM frequency (3-6 pm)	Weekend
600	Portland to Lithgow via Wallerawang (and return)	Operates Monday to Friday except public holidays from 7.10am to 3.45pm	1 service	No service	No service
636	Lithgow to Bathurst via Meadow Flats, Portland and Wallerawang	Operates Monday to Saturday except public holidays from 7.10am to 3.45pm	1 service	1 service	Single service on a Saturday

Source: Lithgow Buslines



Source: Lithgow Buslines

Figure 3.4 Existing public transport routes and stops

3.3.2.2 School bus services

There are a number of school bus services in the study area that are operated by Lithgow Buslines. These include bus routes along the following roads within the study area:

– Bus 2 to Wallerawang Public School – Boulder Road and Castlereagh Highway.
– Bus 3 to St Patricks Primary School (Lithgow) – Special to East Portland Via Castlereagh Highway and Boulder Road.
– Bus 9 to St Patricks Primary School (Lithgow) – Castlereagh Highway.
– Bus 2 to Portland Central School – Great Western Hwy, Castlereagh Highway and Main Street.

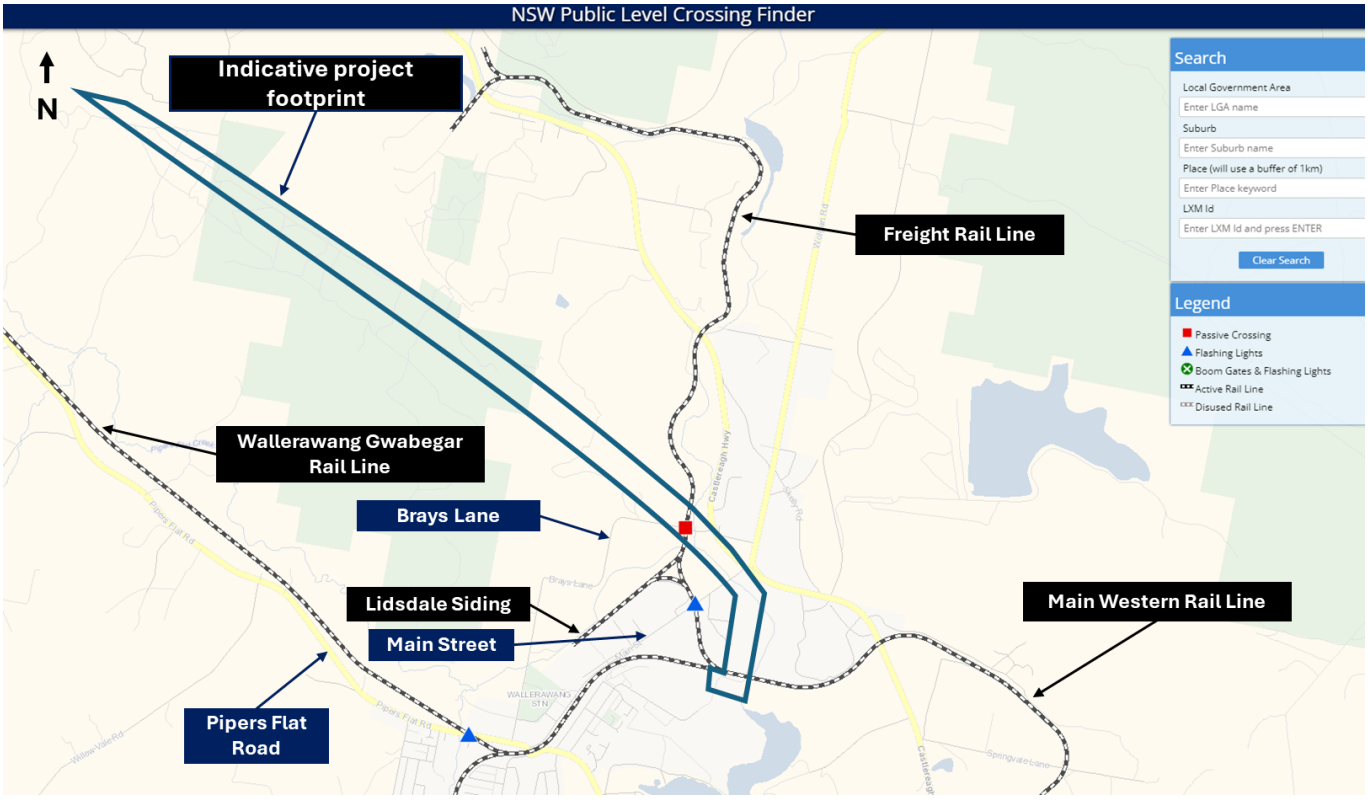
3.3.2.3 Passenger rail

There are no train stations within the study area, with the nearest station being Lithgow Station. However, the Main Western Rail Line passes through the study area at Wallerawang, which provides rail services between Sydney, the Blue Mountains, Lithgow and Bathurst. The locations of rail lines in the vicinity to the project footprint area shown in Figure 1.1.

3.3.3 Rail freight

There are two freight rail lines within the study area, including the Main Western rail line and the Wallerawang Gwabegar Rail Line. The Main Western rail line has a shared passenger rail to the south of the project footprint, which also operates as a connection for freight in the region. The line provides a rail freight connection between regional areas of NSW and Port Botany in Sydney.

Brays Lane (passive crossing) and Main Street and Pipers Flat Road (flashing lights) also forms a level crossing with an active freight rail line, as shown in Figure 3.5. Freight rail services are infrequent along these connections.



Source: **NSW Public Level Crossing Finder** (2024) (modified by GHD)

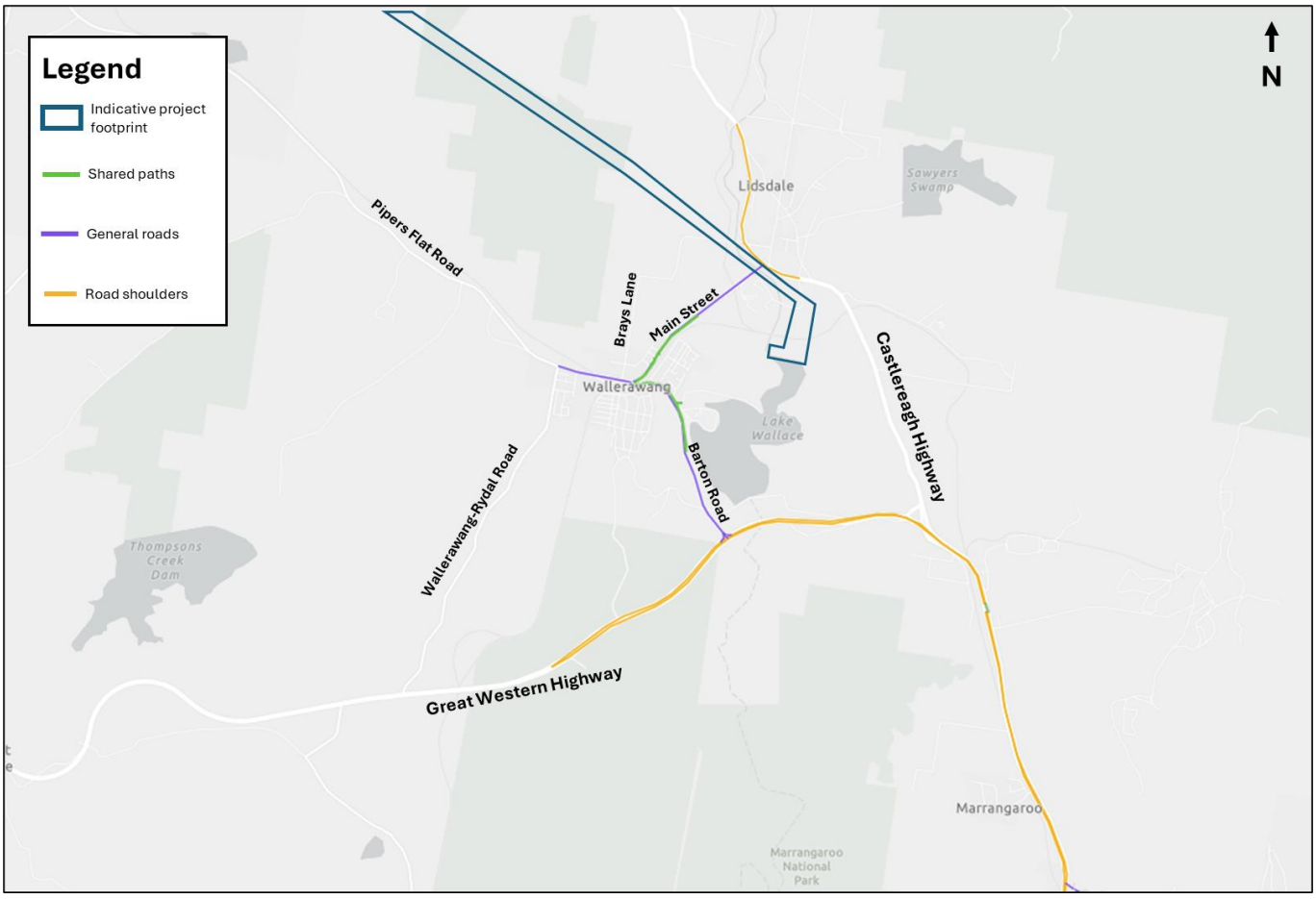
Figure 3.5 Level crossings at Brays Lane and Main Street

Lidsdale Siding is a privately-owned coal storage and rail loading facility, located outside of the project footprint (see Figure 3.5), on the northern edge of Wallerawang between Main Street and Pipers Flat Creek. The siding plays a critical role in the supply of coal to Mount Piper Power Station and for transport of coal from Centennial's western mining operations, including the Springvale underground mine, to domestic and export markets. The one-way siding is accessed via the freight rail line that departs the Main Western Rail Line just north of the Wallerawang 330 kV substation.

3.3.4 Active transport

Active transport facilities aid the movement of pedestrians and cyclists, such as cycleways and footpaths. A review of active transport facilities within the study area was conducted using the Transport for NSW cycleway finder and aerial imagery. The review identified several facilities (as shown Figure 3.6), including the following:

- Existing pedestrian and cycle facilities are generally limited within the study area due to the rural land uses, long travel distances between places of work and residential areas.
- Along the Castlereagh Highway, there is a short section of road shoulder for use by cyclists, although dedicated facilities are not provided along the remaining length of the road.
- General road cycling (where cyclists are in mixed traffic conditions) routes along Main Street, Barton Avenue and Pipers Flat Road (between Wallerawang-Rydal Road and Main Street).
- Shared paths (off-road paths for shared use by pedestrians and cyclists) are provided along a short section of Main Street and Barton Avenue within Wallerawang.
- Road shoulders are used for cycling along the Great Western Highway.
- Footpaths are generally not provided along most roads within the study area.



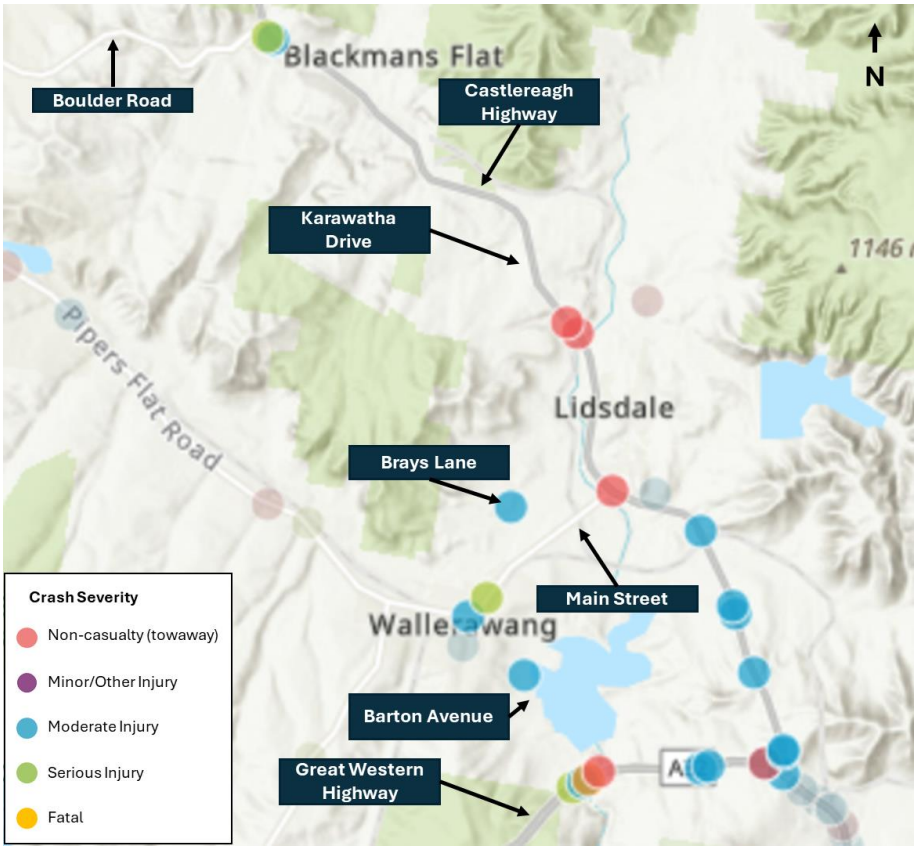
Source: Transport for NSW **Cycleway Finder** (2024, modified by GHD)

Figure 3.6 Existing walking and cycling network

3.4 Crash data analysis

An analysis of recorded crash data was undertaken using the available data published by the Transport for NSW Centre for Road Safety. The published crash data covers a five-year period between 2019 and 2023 and provides the details, including the location, severity, crash type, conditions and number of injuries for each recorded crash.

The location of these crashes with the corresponding severity is shown in Figure 3.7. A summary of the crashes by severity and year recorded is provided in Table 3.8. Analysis of the Road User Movement (RUM) code for the recorded crashes is provided in Table 3.9.



Source: Transport for NSW Centre for Road Safety (2024. modified by GHD)

Figure 3.7 Crashes within the study area (2019-2023)

Table 3.8 Road crash incidents on roads in the study area (2019-2023)

Year	Degree of crash					Total
	Non-casualty (towaway)	Minor/other injury	Moderate injury	Serious injury	Fatal	
2019	0	0	4	1	1	**6**
2020	2	0	1	0	0	**3**
2021	3	0	5	1	0	**9**
2022	0	0	1	1	0	**2**
2023	0	0	5	1	0	**6**
Total	**5**	**0**	**16**	**4**	**1**	**26**

Data source: NSW Road Crash Data 2019-2023

Table 3.9 Road crashes in the study area by RUM Code (2019-2023)

Rum Code	RUM Description	Number of crashes	% of all recorded crashes
13	Vehicles from adjacent direction (intersection only) – right near	1	4%
16	Vehicles from adjacent direction (intersection only) – left near	2	8%
21	Vehicles from opposing direction – right through	2	8%
30	Vehicles from the same direction – rear end	1	4%
33	Vehicles from the same direction – lane side swipe	1	4%
34	Vehicles from the same direction – lane change right (not overtaking)	2	8%
40	Manoeuvring – U turn	1	4%
41	Manoeuvring – U turn into fixed object	1	4%
71	Off path, on straight – left off carriageway into object	4	15%
72	Off path, on straight – off carriageway to right	1	4%
73	Off path, on straight – right off carriageway into object	3	12%
81	Off path, on curve or turning – off carriageway left on right bend into object	3	12%
82	Off path, on curve or turning – off carriageway right on right bend	1	4%
84	Off path, on curve or turning – off carriageway right on left bend	1	4%
85	Off path, on curve or turning – off carriageway right on left bend into object	1	4%
87	Off path, on curve or turning – off carriageway left on left bend into object	1	4%
Total		**26**	**-**

Analysis of the crash data for the five-year the period (2019–2023) indicates the following:

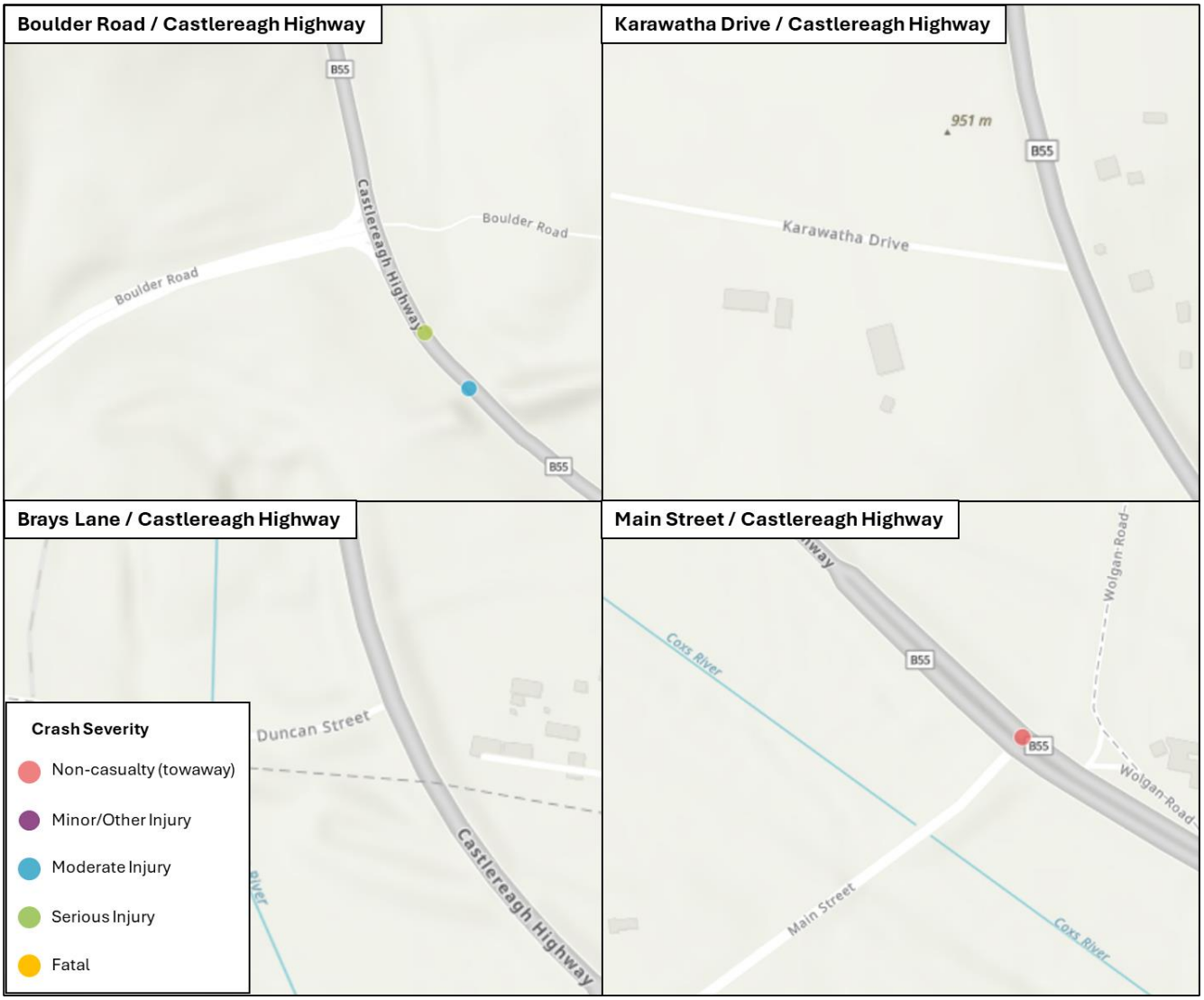
– 26 crashes were recorded within the study area.
– Over half of the recorded crashes reported a moderate injury (62 per cent) with the next highest being non-casualty (towaway) (19 per cent).
– There were four serious injury crashes and one fatal crash recorded (19 per cent of all crashes).
– The most common crash type was a RUM code 71, which involves the vehicle driving left off the carriageway on a straight into object (15 per cent of all crashes).

3.4.1 Key intersections

An analysis of recorded crashes at key intersections within the study area was conducted to identify any potential safety concerns. The key intersections which provide a primary connection to access points for the project are:

– Boulder Road / Castlereagh Highway
– Karawatha Drive / Castlereagh Highway
– Brays Lane (named as Duncan Street in Figure 3.8) / Castlereagh Highway
– Main Street / Castlereagh Highway.

The recorded crashes at each of the intersections outlined above are shown in Figure 3.8 with a summary of the crash data at the intersection shown in Table 3.10.



Source: Transport for NSW Centre for Road Safety (modified by GHD)

Figure 3.8 Recorded crashes at key intersections (2019-2023)

Table 3.10 Crash data at the main intersections (2019-2023)

Location	Crash ID	Reporting Year	Severity	RUM Code	Rum description
Boulder Road and Castlereagh Highway intersection	1201518	2019	Moderate Injury	82	Off carriageway right on right bend
Boulder Road and Castlereagh Highway intersection	1260156	2021	Serious Injury	87	Off carriage way left on left bend into object
Main Street and Castlereagh Highway intersection	1237380	2020	Non casualty (towaway)	16	Vehicles from adjacent direction (intersection only) – Left near

Analysis of the crashes at key site access intersections identified the following:

– No crashes were recorded at either the Brays Lane / Castlereagh Highway intersection or the Karawatha Drive / Castlereagh Highway intersection.

– Only one crash was recorded at Main Street / Castlereagh Highway intersection, as a non-casualty (towaway):
  - This crash was recorded as a RUM code 16 (vehicles from adjacent direction – left near), indicating vehicles exiting Main Street and along the Castlereagh Highway were involved.
  - This crash could indicate a potential safety concern with turns into/out of Main Street with either speed or sight distance.
– Two crashes were recorded at the intersection of Boulder Road / Castlereagh Highway:
  - One crash resulted in a moderate injury with a vehicle travelling off the carriageway to the right on a right bend. The vehicle was travelling northbound along the Castlereagh Highway towards Boulder Road.
  - The other crash resulted in a serious injury with the vehicle off the carriageway to the left on a left bend. The vehicle was travelling southbound along the Castlereagh Highway after the intersection with Boulder Road.
  - The two recorded incidents could indicate a potential speed issue at the bend in the Castlereagh Highway south of Boulder Road. It is noted that although the speed limited at this location is 100 km/h, there is advisory speed signs of 85 km/h in both directions along Castlereagh Highway through this intersection to advise motorists to slow down.

3.5 Existing traffic volumes

The traffic survey data (described in section 2.3.2) was supplemented by a desktop review of existing information to understand the existing traffic and transport conditions in the study area.

3.5.1 Traffic survey data

Classified intersection count data

The intersections surveyed include:

– Boulder Road / Castlereagh Highway
– Karawatha Drive / Castlereagh Highway
– Brays Lane / Castlereagh Highway
– Main Street / Castlereagh Highway.

The following peak hours were identified based on the collected intersection traffic count data:

– Weekday AM peak hour – 6am to 7am
– Weekday PM peak hour – 3.30pm to 4.30pm.

For the purposes of this study, the following conservative assumptions were made for the intersections along Boulder Road at the intersections with Frankfort Road and the Mount Piper Power Station Access Road:

– Eighty per cent of trips turning into / out of Boulder Road continue along Boulder Road past the intersection with Frankfort Road (towards Portland), with limited traffic turning onto / out of Frankfort Road (assumed one light vehicle).
– Twenty per cent of trips turning into / from Boulder Road accessing / exiting from the Mount Piper Power Station Access Road (Access Point 1).

The turning movement volumes at each of the intersections surveyed are shown in Figure 3.9 to Figure 3.11.

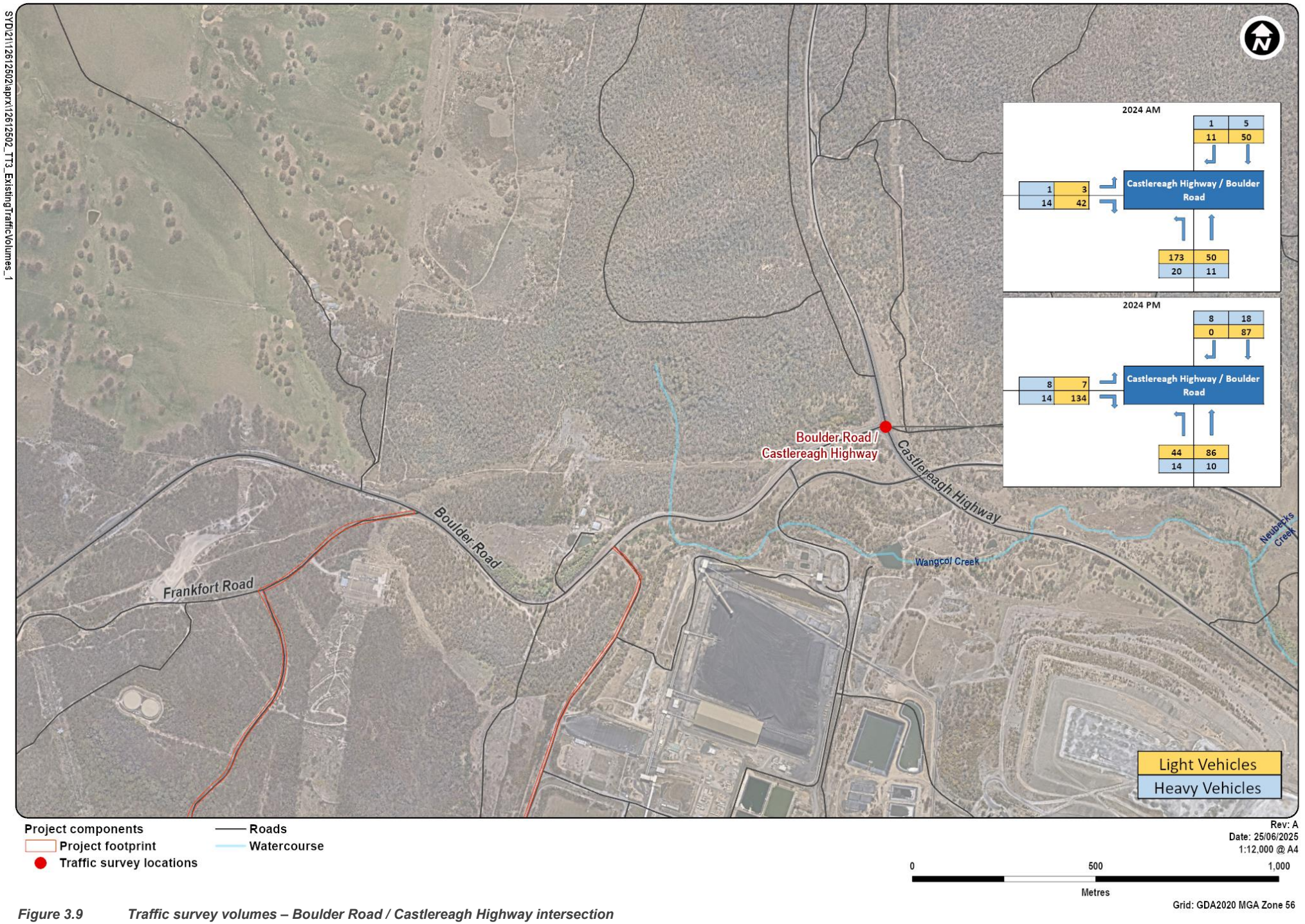


Figure 3.9 Traffic survey volumes – Boulder Road / Castlereagh Highway intersection

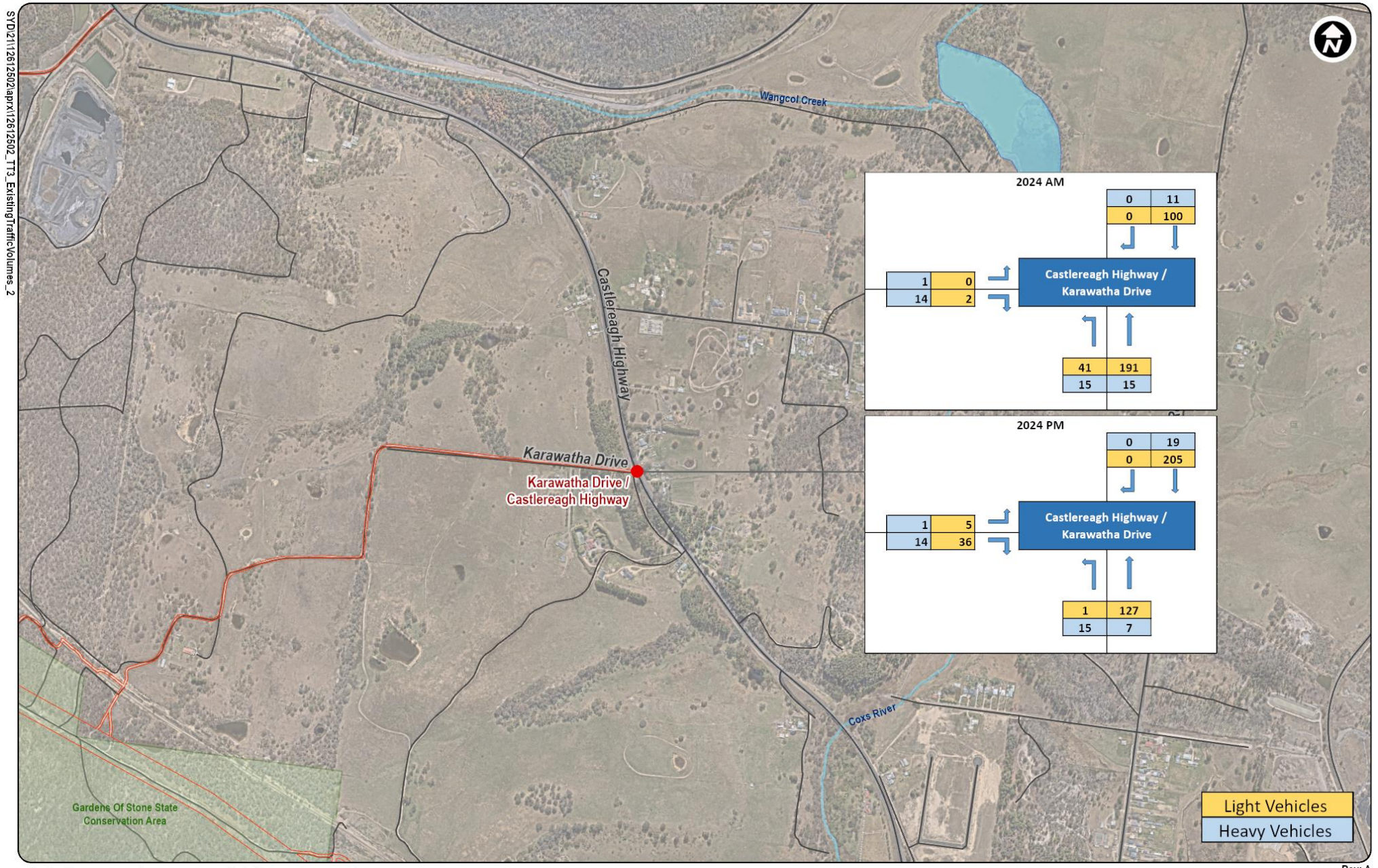


Figure 3.10 Traffic survey volumes – Karawatha Drive / Castlereagh Highway intersection

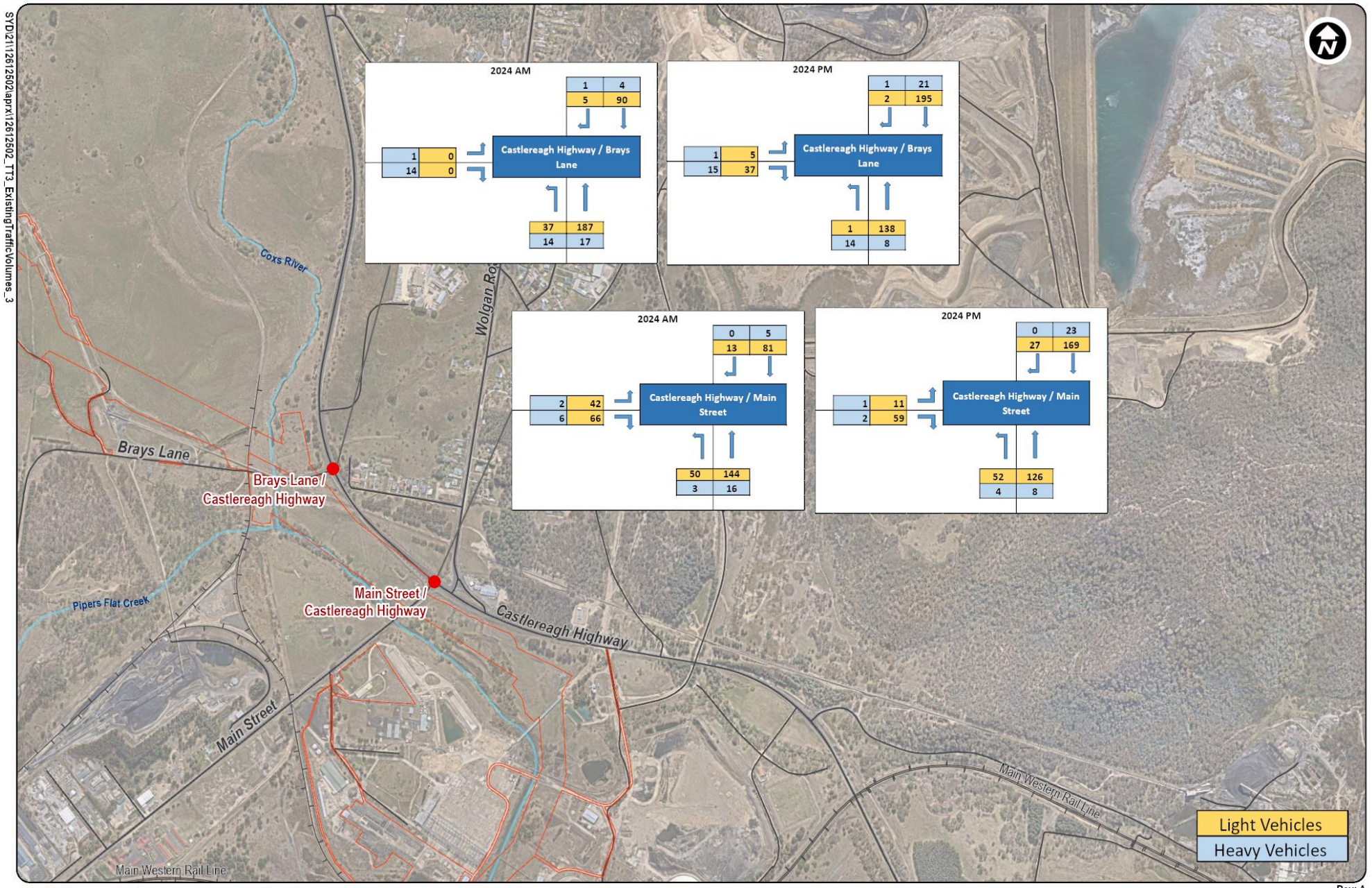


Figure 3.11 Traffic survey volumes – Brays Lane and Main Street / Castlereagh Highway

3.6 Mid-block capacity assessment

The existing road network performance was assessed using a mid-block assessment at key intersections and access points along the Castlereagh Highway and Boulder Road, using the traffic volumes gathered from the surveys (as described in section 3.5.1).

The locations assessed as part of the mid-block capacity analysis include either side (to the north and south or east and west) of:

– Frankfort Road / Boulder Road
– Access Point 1 (Mount Piper Power Station Access) / Boulder Road
– Boulder Road / Castlereagh Highway intersection
– Castlereagh Highway at site Access Point 2
– Castlereagh Highway / Karawatha Drive intersection
– Castlereagh Highway / Brays Lane intersection
– Castlereagh Highway / Main Street intersection
– Castlereagh Highway at site Access Point 10.

The locations of each key road intersection and access points to the project footprint are shown in Figure 2.1. The road capacities to the north and south of each intersection and access point is outlined in Table 3.11. It should be noted that the Castlereagh Highway generally has one traffic lane provided in each direction, although at some locations, the road widens to two lanes in a single direction in the form of an overtaking or turning lane.

Table 3.11 Assumed road capacity at key intersections and access points

Location	Road Capacity	
	Northbound	**Southbound**
Castlereagh Highway		
North of Boulder Road	1,800	900
South of Boulder Road	900	900
Boulder Road	1,800	900
North of Karawatha Drive	900	1,800
South of Karawatha Drive	1,800	900
Karawatha Drive	900	900
North of Brays Lane	900	900
South of Brays Lane	900	900
Brays Lane	900	900
North of Main Street	900	900
South of Main Street	900	900
Main Street	900	900
North of Access Point 2	900	900
South of Access Point 2	900	900
North of Access Point 10	900	900
South of Access Point 10	900	900
Boulder Road		
East of Mount Piper Power Station Access	1,800	900
West of Mount Piper Power Station Access	1,800	1,800
Mount Piper Power Station Access	1,800	1,800

Location	Road Capacity	
	Northbound	Southbound
East of Frankfort Road	900	1,800
West of Frankfort Road	900	900
Frankfort Road	300	300

The calculated PCU and VCR for each of the key intersections and access points are outlined in Table 3.12. The results of the mid-block capacity assessment indicate that all locations are currently operating well within capacity.

Table 3.12 Key intersections and access points – existing PCUs and VCR

Location		PCUs				VCR			
		AM peak hour		PM peak hour		AM peak hour		PM peak hour	
		Northbound/ Eastbound	Southbound/ Westbound	Northbound/ Eastbound	Southbound/ Westbound	Northbound/ Eastbound	Southbound/ Westbound	Northbound/ Eastbound	Southbound/ Westbound
Castlereagh Highway	North of Boulder Road	70	64	116	130	0.04	0.07	0.06	0.14
	South of Boulder Road	208	97	140	208	0.23	0.11	0.16	0.23
	Boulder Road	43	148	109	55	0.02	0.16	0.06	0.06
	North of Karawatha Drive	208	108	135	227	0.23	0.06	0.15	0.13
	South of Karawatha Drive	209	110	135	227	0.12	0.12	0.08	0.25
	Karawatha Drive	2	1	1	1	0.00	0.00	0.00	0.00
	North of Brays Lane	208	94	148	226	0.23	0.10	0.16	0.25
	South of Brays Lane	209	93	147	227	0.23	0.10	0.16	0.25
	Brays Lane	0	2	5	3	0.00	0.01	0.02	0.01
	North of Main Street	208	93	141	226	0.23	0.10	0.16	0.25
	South of Main Street	217	155	186	261	0.24	0.17	0.21	0.29
	Main Street	118	65	72	82	0.13	0.07	0.08	0.09
	North of Access Point 2	208	97	140	208	0.23	0.11	0.16	0.23
	South of Access Point 2	208	108	135	227	0.23	0.12	0.15	0.25
	North of Access Point 10	217	155	186	261	0.24	0.17	0.21	0.29
	South of Access Point 10	217	155	186	261	0.24	0.17	0.21	0.29
Boulder Road	East of Mount Piper Power Station Access	43	148	109	55	0.02	0.16	0.06	0.06
	Mount Piper Power Station Access	4	32	23.8	8	0.00	0.02	0.01	0.00
	East of Frankfort Road	43	120	89.2	51	0.05	0.07	0.10	0.03
	West of Frankfort Road	43	120	89.2	51	0.05	0.13	0.10	0.06
	Frankfort Road	2	2	2	2	0.01	0.01	0.01	0.01

4. Construction impacts

4.1 Project description – construction

This section provides a summary of the proposed construction traffic generation associated with the project.

4.1.1 Construction timing

Construction of the project is anticipated to commence in 2026. Construction would be undertaken in stages over a period of up to 20 months as per the proposed construction program shown in section 1.3.

4.1.2 Construction work hours

Due to the proximity to existing transmission lines, much of the construction work would need to be conducted under a scheduled outage. To complete the works within the scheduled outage period, the proposed project construction hours are 7am to 6pm Monday to Sunday plus extended compound operations from 6pm to 7pm Monday to Friday. The need for evening or night work would be driven by constraints such as outage recalls by the network operator, rail corridor shutdown periods scheduled by the rail operator, and road closure licence requirements from the local road authority.

4.1.3 Site access points

Access to each transmission structure and construction compound would be required during construction. Three construction compounds are proposed in the following locations:

– Compound 1 (C1) – adjacent to the Mount Piper 330 kV substation and accessible via Access Point 1 or alternative Access Point 1a
– Compound 2 (C2) – located east of Main Street adjacent to the entrance to the former Wallerawang Power Station site and accessible via Access Point 11
– Compound 3 (C3) – located within the former Wallerawang Power Station site on land previously used for a Transgrid substation and accessible via Access Point 12.

A total of 13 access points are proposed to be used during construction, with the location of these access points shown in Figure 4.1 (access points 1 to 3) and Figure 4. (access points 4 to 12). Most access points are existing points of entry that provide access to the project footprint. Access points 5 and 6 would be newly created for the project. Access to the project footprint would be via the following existing access points:

– Off Boulder Road: Access Point 1 and alternative Access Point 1a
– Off Castlereagh Highway: Access Points 2 and 10
– Off Karawatha Drive: Access Point 3
– Off Brays Lane: Access Points 4 to 7
– Off Main Street: Access Points 8, 9 and 11
– Off Heel Street: Access Point 12.

These access points will connect construction vehicles to the internal arrangement of access tracks within the project footprint. These access tracks are primarily existing tracks, with some to be widened, upgraded and some would be new. The location of the required access tracks for the project is shown on Figure 4.1 and Figure 4. Access tracks are described in detail in section 3.4 of the EIS.

Of the total 13 access points, nine access points (1, 4, 5, 6, 7, 8, 9, 10 and 12) would be used for future operation and maintenance. The other four access points are not required for future operation and maintenance.

The project would require some works at key intersections and each site access point (Figure 2.1). Consultation with Lithgow City Council and Transport for NSW in relation to these works has been undertaken, as outlined in Table 4.1.

No road widening upgrades or intersection upgrades are required for construction vehicles, including for OSOM movements, to gain access to the proposed access points.

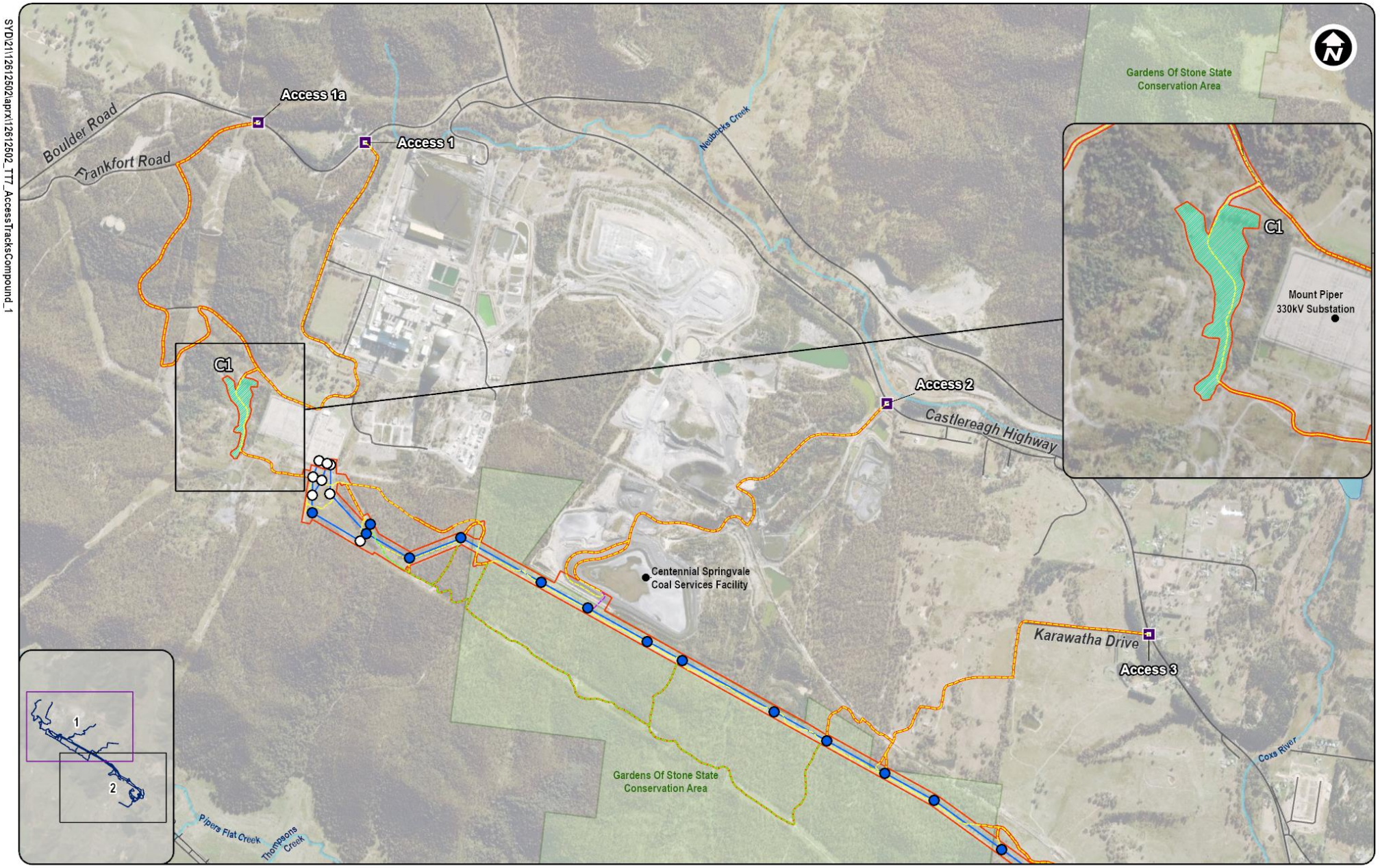


Figure 4.1 Construction access points 1 to 3

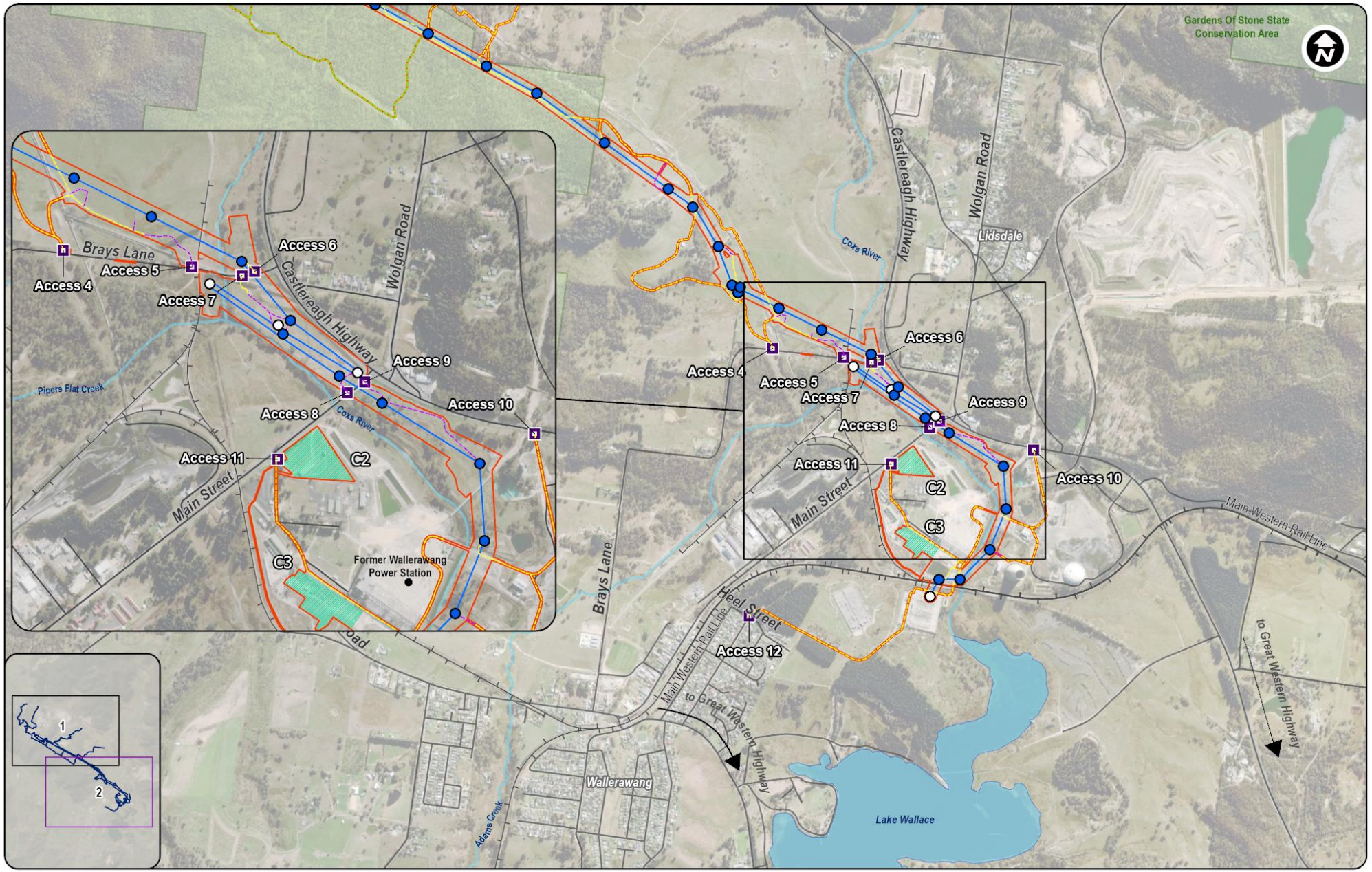


Figure 4.2 Construction access points 4 to 12

Table 4.1 Proposed site access points and road works required for the project

Access point (s)	Relevant roads	Identified constraints or safety risk	Description of proposed road works	Discussed and confirmed with Lithgow City Council	Discussed and confirmed with Transport for NSW
1	Boulder Road / Mount Piper Power Station Access Road	Inadequate sight distance to the north-east for vehicles turning right onto Boulder Road (see section 4.2.1.3)	No road upgrade works proposed. Vegetation trimming to meet the safe sight distance requirement. To be undertaken as required in consultation with Lithgow City Council.	Yes	N/A (all relevant roads are maintained by council)
Alternative 1a	Boulder Road / Frankfort Road	Inadequate sight distances from Frankfort Road to both the eastern and western approaches of Boulder Road (see section 4.2.1.3)	No road upgrade works proposed. The approach angle of Frankfort Road provides a constraint on the safe sight distance for vehicles for vehicles entering and exiting at the access point (see section 4.2.1.3). Traffic control will be adopted if access point 1a is used.	Yes	N/A (all relevant roads are maintained by council)
Boulder Road / Castlereagh Highway (to Access Points 1 and 1A)	Boulder Road / Castlereagh Highway	There is adequate safe intersection sight distance of the upcoming intersection from the Castlereagh Highway southern approach when travelling at the sign-posted advisory speed limit of 85 km/h. The sight distance is not adequate on approach when travelling at the road speed limit of 100 km/h (see section 4.2.1.3).	No road upgrade works proposed. An improvement for the existing road sign has been identified and could be undertaken by Transport for NSW. This would provide advance warning of the upcoming intersection. This recommendation has been made to Transport for NSW during consultation to improve safety.	N/A (update of sign is on a state road)	Yes (ongoing)
2	Centennial Coal Access Road	None identified	No road upgrade works proposed.	Yes	Yes
3	Karawatha Drive / Castlereagh Highway	Inadequate sight distance in the southeast direction if vehicles are exiting from the project footprint and turning right from Karawatha Drive onto the Castlereagh Highway (see section 4.2.1.3).	No road upgrade works proposed. The proposed Left-in/Left-out mitigation measure would address this issue (see section 4.2.1.3).	Yes	Yes

Access point (s)	Relevant roads	Identified constraints or safety risk	Description of proposed road works	Discussed and confirmed with Lithgow City Council	Discussed and confirmed with Transport for NSW
4, 5, 6 and 7	Brays Lane	Heavy vehicles travelling in opposite directions along Brays Lane are not currently able to pass each other safely within the road carriageway.	Potential passing bay, about 60 m by 4 m, may be provided on the southern shoulder of Brays Lane. The indicative location of the proposed passing bay is discussed further in section 4.2.2.4. The need for the passing bay would be confirmed by the construction contractor as part of detailed construction planning in consultation with Lithgow City Council.	Yes	N/A (impact on local road network only)
		Potential need for an upgrade to the turning lane treatments at the intersection of Brays Lane and Castlereagh Highway due to traffic generation during the construction of the project.	No road upgrade works proposed. Intersection warrants assessment identified the intersection of Brays Lane / Castlereagh Highway may need an upgraded turn treatment or mitigation measures (see section 4.2.1.2 for details). Mitigation measures such as carpooling or staggering vehicle access times would be implemented and would adequately manage the identified constraint.	N/A (issue relating to impact on state road network on the Castlereagh Highway)	Yes
		Impacts to traffic flow are expected during line stringing over Brays Lane, including short-term traffic management or road closures (see section 4.2.2.3).	No road upgrade works proposed.	Yes	N/A (impact on local road network only)
8, 9 and 11	Castlereagh Highway, Main Street	Impacts to traffic flow are expected during line stringing over Main Street, including short-term traffic management or road closures (see section 4.2.2.3).	No road upgrade works proposed.	Yes	N/A (relevant access points are on roads maintained by council)
10	Castlereagh Highway, Unnamed Access Road	None identified	No road upgrade works proposed.	N/A	N/A
12	Heel Street, Cripps Avenue, Barton Avenue	None identified	No road upgrade works proposed.	N/A	N/A

4.1.4 Site access routes

The primary travel routes to most access points, except Heel Street, are expected to be via the state road network from the Castlereagh Highway and the Great Western Highway. Travel routes to Heel Street are expected to be via the Great Western Highway, Barton Avenue and Cripps Avenue.

Site access routes are expected to originate primarily from Sydney and Newcastle, with some vehicles from Orange or Bathurst as required. All heavy vehicle access routes are to be along the NSW state road network and in accordance with NHVR law and regulations. The expected site access routes for the project, including OSOM movements, are as follows:

– To/from Sydney: along the Castlereagh Highway (B55) and Great Western Highway (A32) before connecting to the extensive approved/approved with conditions networks within the Sydney Basin to reach the port or commercial district where movements would originate or be travelling to.
– To/from Newcastle: along the Castlereagh Highway (B55), Golden Highway (B84) and New England Highway (A16) before connecting to the extensive approved/approved with conditions networks within the Newcastle Urban Area to reach the port or commercial district where movements would originate or be travelling to.
– To Orange/Bathurst: along the Great Western Highway (A32) and Mitchell Highway (A32), for Orange only.

All heavy vehicle access routes, including any OSOM routes, are to be planned in accordance with the NHVR conditions outlined in Table 4.2.

Table 4.2 NHVR road conditions along heavy vehicle access routes (25/26m B-Double and OSOM)

Road name	RAV conditions	OSOM conditions
Great Western Highway	Approved without conditions	Travel is restricted during peak periods on weekdays. Vehicles over 4.5 m wide are not permitted during daylight
Castlereagh Highway	Approved without conditions	Approved without conditions
New England Highway	Approved without conditions	Travel is restricted during peak periods on weekdays.
Golden Highway	Approved without conditions	Approved without conditions
Hunter Expressway	Approved without conditions	Travel is restricted during peak periods on weekdays.
Mitchell Highway	Approved without conditions	Approved without conditions

The proposed heavy vehicle access routes for each access, from the Castlereagh Highway or the Great Western Highway, are outlined in Table 4.3 and shown in Figure 4.3.

Table 4.3 Site access routes for each site access point

Site access point	Site access route
1 and 1a	Boulder Road to Castlereagh Highway (access 1 via the Mount Piper Power Station access and 1a via Frankfort Road).
2	Directly to Castlereagh Highway.
3	Karawatha Drive directly to Castlereagh Highway. Vehicles accessing the project footprint at Karawatha Drive would do so via a left-in / left-out only arrangement.
4	Brays Lane to Castlereagh Highway (note: this may not be suitable for larger vehicles (OSOM) due to the existing narrow bridge crossing the Coxs River). As part of the project, a vehicle passing bay is proposed along Brays Lane to assist with vehicle access along Brays Lane, which is a narrow rural road with no paved shoulders currently provided. The need for the passing bay would be confirmed by the construction contractor as part of detailed construction planning in consultation with Lithgow City Council.

Site access point	Site access route
	Alternate route, via Pipers Flat Road, due to the constraint of the narrow bridge for larger vehicles (OSOM), when required: – Brays Lane west to Pipers Flat Road, Barton Avenue to Great Western Highway (note: Pipers Flat Road, Barton Avenue are B-Double routes). This route includes constraints of two existing ford crossings, construction vehicles travelling through the Wallerawang urban area, and potential cumulative traffic impacts associated with the proposed BESS project on Brays Lane.
5	Brays Lane to Castlereagh Highway. The alternate route via Pipers Flat Road may also be relevant for Access Point 5, should the overland conveyor passing over Brays Lane be a height constraint and the narrow road bridge also be a constraint.
6	Brays Lane to Castlereagh Highway.
7	Brays Lane to Castlereagh Highway.
8	Main Street to Castlereagh Highway.
9	Main Street to Castlereagh Highway.
10	Directly to Castlereagh Highway.
11	Main Street to Castlereagh Highway.
12	Heel Street, Cripps Avenue, Barton Avenue to Great Western Highway[1]

Note: 1. Heavy vehicle movements to Access Point 12 are only to be utilised where other routes or access points cannot be used.

4.1.5 Construction traffic movements and access

OSOM movements would be required for the mobilisation of construction equipment and machinery to and from the project footprint. No OSOM high risk vehicles (as defined by Transport for NSW **OSOM 'Vehicles and Loads' webpage**) are expected to be used during the construction or operation phases of the project. OSOM movements, would only be for mobilisation and demobilisation of the piling rigs (for foundations) and mobile cranes to each transmission structure location. It is noted that no more than two OSOM vehicles (four one-way movements) would access the project footprint per day.

OSOM deliveries would arrive at the site via the NSW state road network and site access routes outlined in section 4.1.4. All OSOM vehicle movements would be in accordance with the Heavy Vehicle National Law and Regulations.

In addition, a small number of construction vehicles may be required to access the project footprint located to the south of the Main Western Rail Line (at the Wallerawang 330 kV Substation). The existing internal access roads within the former Wallerawang Power Station site, from Access Points 10 and 11, leads beneath a heritage listed rail bridge which has a height restriction. Only light vehicles can travel beneath the heritage rail bridge. As such, heavy vehicles travelling to and from the area to the south of the rail line would need to travel via Barton Avenue and Heel Street to gain access to the project footprint via Access Point 12. Access to Access Point 12 would not include any OSOM movements. A mitigation measure to restrict the use of the internal access road beneath the heritage rail bridge to light vehicles only has been included in Technical Report 5 – Aboriginal Cultural Heritage Assessment Report.

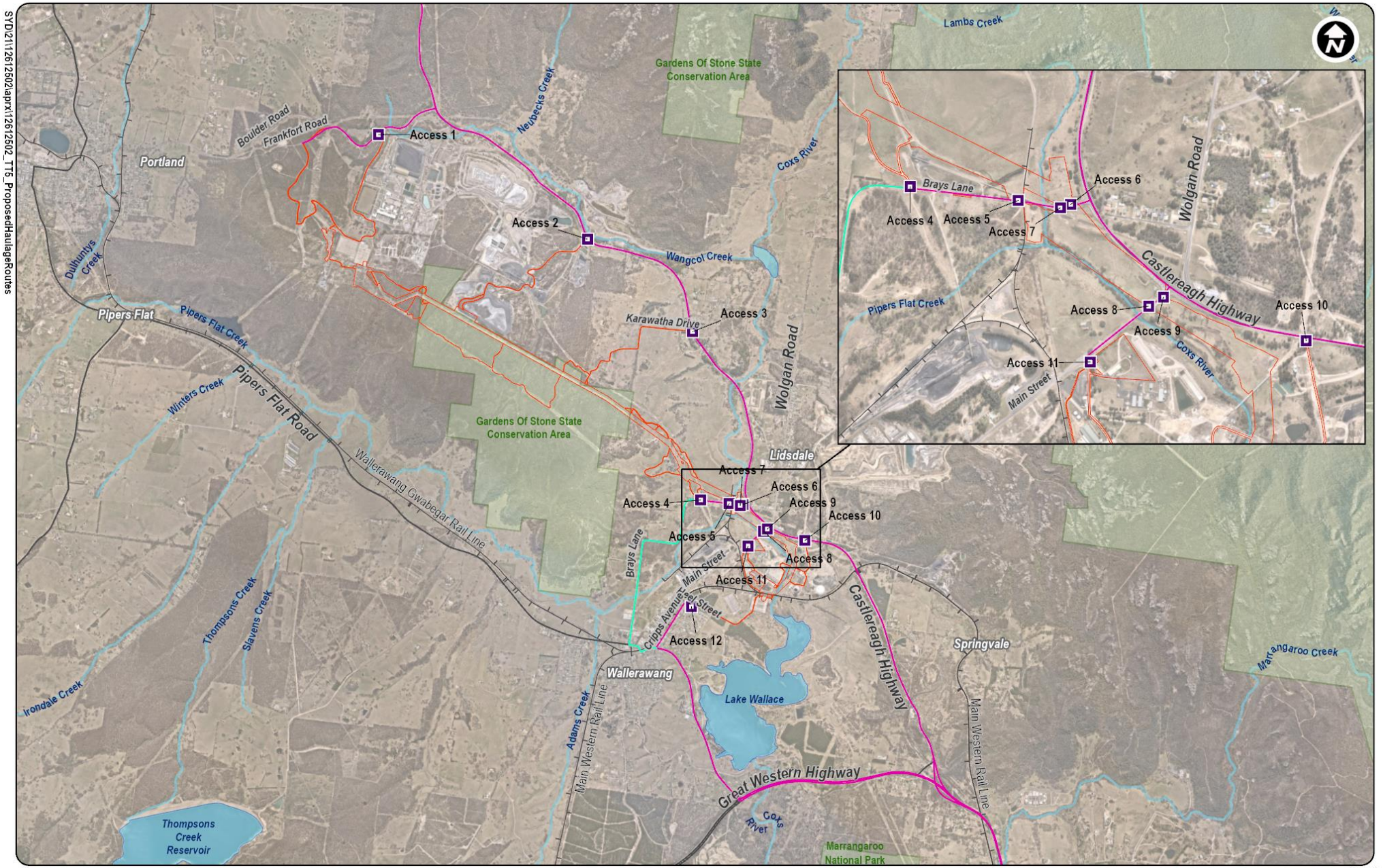


Figure 4.3 ***Proposed heavy vehicle access routes***

4.1.6 Construction traffic generation

Construction traffic would be required to transfer personnel and contractors to the work sites, deliver goods as well as move plant and equipment. The key aspects of construction traffic include:

– Construction traffic volumes will vary throughout the different stages of the project.
– Utilisation of access points would vary depending on the location of works being undertaken at the time.
– **Average construction traffic generation** would result in around:
  - 40 light vehicles accessing the project footprint in a day
  - 30 heavy vehicles accessing the project footprint in a day.
– **Peak construction traffic generation** is expected to generate up to:
  - 30 light vehicles accessing the project footprint in an hour
  - 20 heavy vehicles accessing the project footprint in an hour.

A summary of the estimated construction traffic movements is provided in Table 4.4 for each site access point, based on the works proposed at each access location. It is noted that this represents worst-case construction traffic generation at each location, as not all movements would be occurring simultaneously. These volumes are based upon the following assumptions:

– Vehicle movement signifies a one-way movement of a vehicle from one point to another (i.e. one round trip is equivalent to two vehicle movements).
– All contractors and personnel would travel to the site using a personal vehicle. The use of shuttle buses and/or carpooling for contractors and personnel have not been included to provide a worst case assessment.

Table 4.4 Indicative peak daily traffic movements at each access point

Access point	Maximum movements per day – heavy vehicles	Maximum movements per day – light vehicles	OSOM movements per day	Notes
Boulder Road				
1	60	60	4	Increased movements due to compound and number of structure locations
1a	60	60	4	As above. Access Point 1a is an alternative to Access Point 1
Castlereagh Highway north of Brays Lane				
2	30	30	4	Large number of structures assumed to be accessed from this location; assume only a few under construction at once
3	30	30	4	Large number of structures assumed to be accessed from this location; assume only a few under construction at once
Brays Lane				
4	40	40	4	Large number of structures assumed to be accessed from this location; assume only a few under construction at once. Assumed alternate route for Access Point 4 to only be used by up to 4 heavy vehicles (OSOM) per day that cannot use Brays Lane due to existing constraints (refer to Table 4.3)
5	16	16	2	Single structure only Assumed alternate route for Access Point 5 to only be used by up to 4 heavy vehicles (including OSOM) per day that cannot use Brays Lane due to existing constraints (refer to Table 4.3).

Access point	Maximum movements per day – heavy vehicles	Maximum movements per day – light vehicles	OSOM movements per day	Notes
6	16	16	2	Single structure only
7	16	16	2	Single structure only
Main Street				
8	16	16	2	Single structure only
9	16	16	2	Single structure only
11	40	40	4	Increased movements due to primary access to construction compounds
Castlereagh Highway (south of Main Street)				
10	16	16	2	Single structure only
Heel Street				
12	4	10	0	Access Point 12 would primarily be used by heavy vehicles that cannot use access points 10 and 11 (due to the height restriction of the heritage rail bridge from Access Points 10 and 11). No OSOM vehicles would be required to access this access point.

For the purposes of this study, the construction traffic generation shown in Table 4.5 has been adopted to provide a conservative assessment of the potential increase in traffic associated with the project at each access intersection during peak construction periods.

Table 4.5 Daily and peak hour construction traffic generation per access point

Vehicle type	Daily vehicle movements	Peak hour vehicle movements
Heavy vehicles	60 (30 arrivals and 30 departures)	– AM peak hour: 20 (20 arrivals and 0 departures) – PM peak hour: 20 (0 arrivals and 20 departures)
Light vehicles	80 (40 arrivals and 40 departures)	– AM peak hour: 30 (30 arrivals and 0 departures) – PM peak hour: 30 (0 arrivals and 30 departures)

4.1.7 Construction traffic distribution

The distribution of construction traffic (both light and heavy vehicles) has been estimated based on the likely location/s of the source of materials and origins of personnel and contractors, as follows:

– 90 per cent to and from the south (Sydney, Lithgow and surrounds)
– 10 per cent to and from the north (Mudgee and surrounds).

The above distribution, in combination with the traffic generation estimates (section 4.1.6, have been used to estimate traffic volumes for the mid-block assessment (section 4.2.1.1) and the intersection warrants assessment (section 4.2.1.2).

4.1.8 Parking

Parking for the construction workforce would be mainly located within the construction compounds. Vehicles would park in designated areas within the transmission line easement that are outside of areas of active construction work. Given the limited amount of space available for parking along the easement, it is expected that personnel and contractors would generally carpool between the construction compounds and the work areas.

4.2 Traffic impacts

4.2.1 Road network performance and safety

4.2.1.1 Mid-block capacity assessment

A mid-block capacity assessment has been conducted with forecast traffic volumes for 2028 and traffic generated by the construction of the project. The results of the mid-block capacity assessment for the following two scenarios were compared to assess the impact of the project on the capacity of the road network:

– forecast 2028 base for AM and PM peak hour periods
– forecast 2028 base with traffic generated by the project for AM and PM peak hour periods.

Table 4.6 outlines the calculated 2028 base PCU values, the generated construction movements for each key intersection/access point, and the calculated VCR values for 2028, including traffic generated by the project.

Analysis of the results of the mid-block capacity assessment indicates that:

– All locations are expected to operate well within capacity in 2028 during the peak construction periods, with VCR values of less than 40 per cent.
– The increase in traffic associated with the project is low, with up to 55 additional vehicles in the peak hour during peak construction periods. Construction traffic would typically be lower during other periods.
– The peak construction traffic is expected to result in minimal impacts to the mid-block capacity of roads within the study area, which currently have low traffic volumes and operate well within capacity (as discussed in section 3.6). As such, it is expected that the average construction will result in lower impacts to the road network compared to peak construction traffic.

Table 4.6 Mid-block assessment results – 2028 base and with peak construction traffic (AM and PM peak hour)

Road / Location	Direction	2028 AM base (PCU)	2028 PM base (PCU)	Construction movements AM (vehicles)	Construction movements PM (vehicles)	2028 AM + construction (PCUs)	2028 PM + construction (PCUs)	2028 VCR AM + construction	2028 VCR PM+ construction
Castlereagh Highway (north of Boulder Road)	Northbound	76	126	0	5	76	133	0.04	0.07
	Southbound	69	141	5	0	76	141	0.08	0.16
Castlereagh Highway (south of Boulder Road)	Northbound	225	152	45	0	288	152	0.32	0.17
	Southbound	105	225	0	45	135	288	0.15	0.32
Boulder Road (west of Castlereagh Highway)	Eastbound	47	103	50	0	77	188	0.04	0.10
	Westbound	147	60	30	50	230	60	0.26	0.07
Castlereagh Highway (north of Karawatha Drive)	Northbound	225	146	0	50	225	216	0.25	0.24
	Southbound	102	246	0	0	117	246	0.06	0.14
Castlereagh Highway (south of Karawatha Drive)	Northbound	226	146	50	0	296	146	0.16	0.08
	Southbound	119	246	0	0	119	246	0.13	0.27
Karawatha Drive (west of Castlereagh Highway)	Eastbound	2	1	50	0	2	71	0.00	0.08
	Westbound	1	1	0	50	71	1	0.08	0.00
Castlereagh Highway (north of Brays Lane)	Northbound	225	160	0	5	225	166	0.25	0.18
	Southbound	102	245	5	0	109	245	0.12	0.27
Castlereagh Highway (south of Brays Lane)	Northbound	226	159	45	0	289	159	0.32	0.18
	Southbound	101	246	0	45	101	309	0.11	0.34
Castlereagh Highway (north of Main Street)	Northbound	225	153	0	5	255	160	0.28	0.18
	Southbound	101	245	5	0	108	245	0.12	0.27
Castlereagh Highway (south of Main Street)	Northbound	235	201	45	0	298	201	0.33	0.22
	Southbound	168	283	0	45	168	346	0.19	0.38
Main Street (west of Castlereagh Highway)	Eastbound	110	78	50	0	158	148	0.18	0.16
	Westbound	64	89	30	50	140	89	0.16	0.10
Castlereagh Highway (north of Access Point 2)	Northbound	225	152	0	5	225	153	0.25	0.17
	Southbound	105	225	5	0	112	225	0.12	0.25

Road / Location	Direction	2028 AM base (PCU)	2028 PM base (PCU)	Construction movements AM (vehicles)	Construction movements PM (vehicles)	2028 AM + construction (PCUs)	2028 PM + construction (PCUs)	2028 VCR AM + construction	2028 VCR PM+ construction
Castlereagh Highway (south of Access Point 2)	Northbound	225	146	45	0	288	146	0.32	0.16
	Southbound	117	246	0	45	105	288	0.12	0.32
Castlereagh Highway (north of Access Point 10)	Northbound	235	201	0	5	235	208	0.26	0.23
	Southbound	168	283	5	0	175	283	0.19	0.31
Castlereagh Highway (south of Access Point 10)	Northbound	235	201	45	0	298	201	0.33	0.22
	Southbound	168	283	0	45	168	346	0.19	0.38
Boulder Road (east of Access Point 1)	Eastbound	47	118	50	0	77	188	0.04	0.10
	Westbound	160	60	30	50	230	60	0.26	0.07
Mount Piper Power Station Access (Access Point 1)	Northbound	4	96	30	50	34	96	0.02	0.05
	Southbound	34	56	50	0	104	8	0.06	0.00
Boulder Road (east of Frankfort Road)	Eastbound	47	96	50	0	47	166	0.05	0.18
	Westbound	130	56	0	50	200	56	0.11	0.03
Boulder Road (west of Frankfort Road)	Eastbound	47	96	0	0	48	96	0.05	0.11
	Westbound	130	56	0	0	130	56	0.14	0.06

4.2.1.2 Intersection warrants assessment

The intersection warrants assessment identified that most proposed key intersections have turn treatments in line with the Austroads requirements for the forecast project traffic volumes. The assessment is highly conservative and based on the worst-case AM peak hour, with all personnel and contractors accessing the site by light vehicles in one hour.

The following sub-sections describe the assessment for each key intersection. For information on the methodology and major road volume calculations (Qm, Qr and Ql) refer to section 2.4.2 and Figure 2.2.

Overall, the assessment identified one key intersection requiring mitigation measures. The assessment for the left turn into Brays Lane from the Castlereagh Highway (Access Points 4 to 7) indicates that the forecast traffic volumes with construction traffic is close to the requirement of an auxiliary left turn lane. Mitigation measures should be considered, including carpooling for personnel and contractors and/or staggering work start times outside of the network peak hours.

Frankfort Road / Boulder Road

The intersection warrants assessment for the intersection of Frankfort Road and Boulder Road (shown in Figure 4.4) is outlined in Table 4.7 and Figure 4.5.

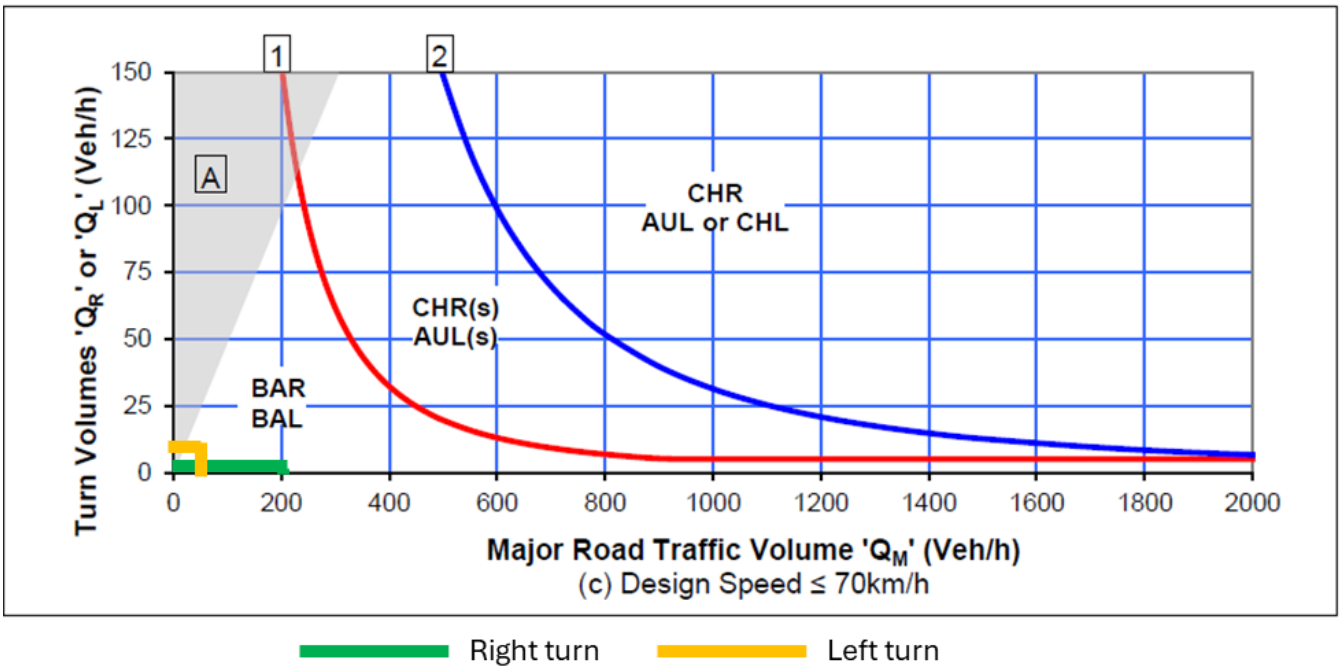
Table 4.7 Hourly traffic flows for warrants assessment – Frankfort Road / Boulder Road

Turning Movement	Peak period	Qm[1]	Qr or Ql*	Existing turn treatment	Required turn treatment
Right turn	AM Peak	198	1	CHR	BAR
	PM Peak	95	1	CHR	BAR
Left turn	AM Peak	62	16	AUL	BAL
	PM Peak	24	1	AUL	BAL

Note: 1. Refer to Figure 2.2 for reference to calculation methodology.

Source: NearMaps (modified by GHD)

Figure 4.4 Frankfort Road / Boulders Road intersection layout



Source: Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management (modified by GHD)

Figure 4.5 Turn treatment warrants assessment – Frankfort Road / Boulders Road

The assessment identified the following turn treatments would be required based on the worst-case turning movements:

– A basic right turn treatment would be required for the calculated major road and right-turn traffic flows. The existing channelised right treatment at this location is considered to be appropriate.
– A basic left-turn treatment would be required for the calculated major road and left-turn traffic flows. The existing treatment at this location is considered to be appropriate, which has an auxiliary left turn provided.

Mount Piper Power Station Access Road (Access Point 1) / Boulder Road

The turn treatment warrants assessment for the intersection of Boulder Road and the Mount Piper Power Station access road (Access Point 1), as shown in Figure 4.6, is outlined in Table 4.8 and Figure 4.7.

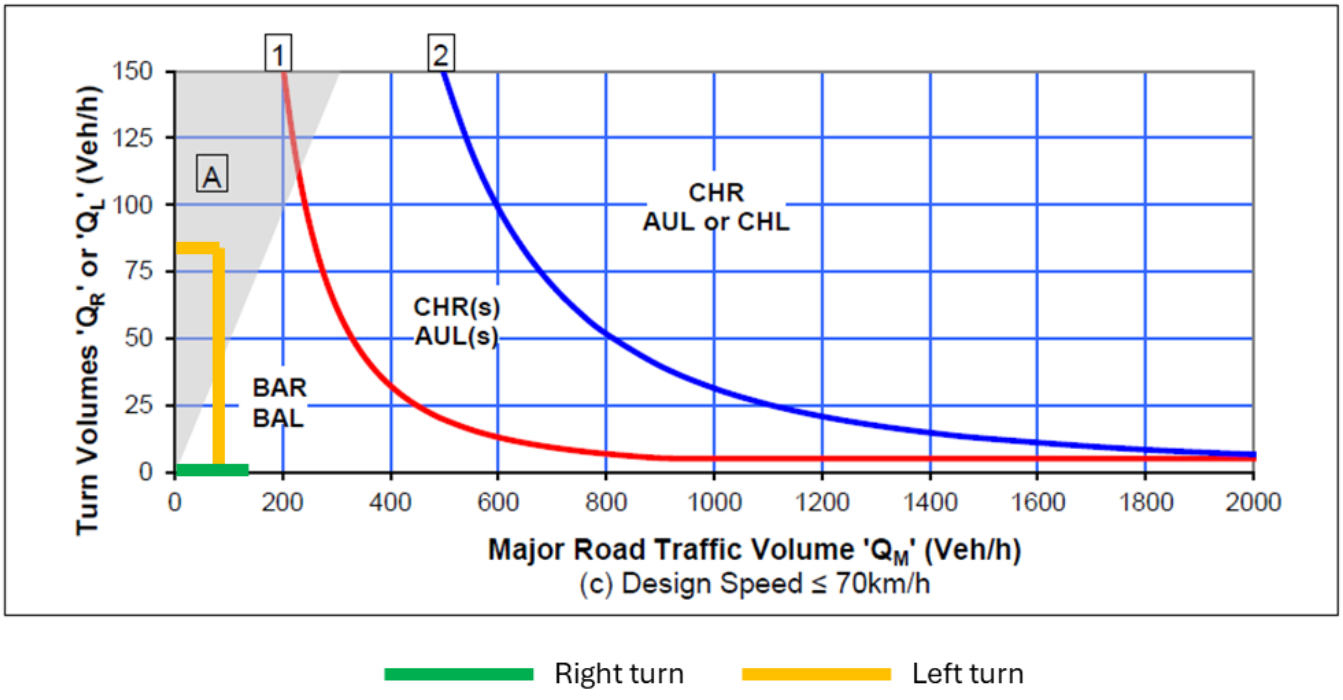
Table 4.8 Hourly traffic flows for warrants assessment – Mount Piper Power Station Access Road (Access Point 1) / Boulder Road

Turning Movement	Peak period	Qm*	Qr or Ql*	Existing turn treatment	Required turn treatment
Right turn	AM Peak	145	2	CHR	BAR
	PM Peak	92	2	CHR	BAR
Left turn	AM Peak	61	81	AUL	BAL
	PM Peak	24	4	AUL	BAL

Note: 1. Refer to Figure 2.2 for reference to calculation methodology

Source: NearMaps (modified by GHD)

Figure 4.6 Mount Piper Power Station Access Road / Boulder Road (Access Point 1) intersection layout



Source: Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management (modified by GHD)

Figure 4.7 Turn treatment warrants assessment – Mount Piper Power Station Access (Access Point 1) / Boulders Road

The warrants assessment identified the following turn treatments would be required based on the worst-case turning movements:

– A basic right turn treatment would be required for the calculated major road and right-turn traffic flows. A channelised right turn is already provided, which meets the requirements based on the expected traffic demand.
– A basic left-turn treatment would be required for the calculated major road and left-turn traffic flows. An auxiliary left turn is currently provided at this intersection, which meets the requirements based on the expected traffic demand.

Boulder Road / Castlereagh Highway

The turn treatment warrants assessment for the intersection of Boulder Road and the Castlereagh Highway (shown in Figure 4.8) is outlined in Table 4.9 and Figure 4.9.

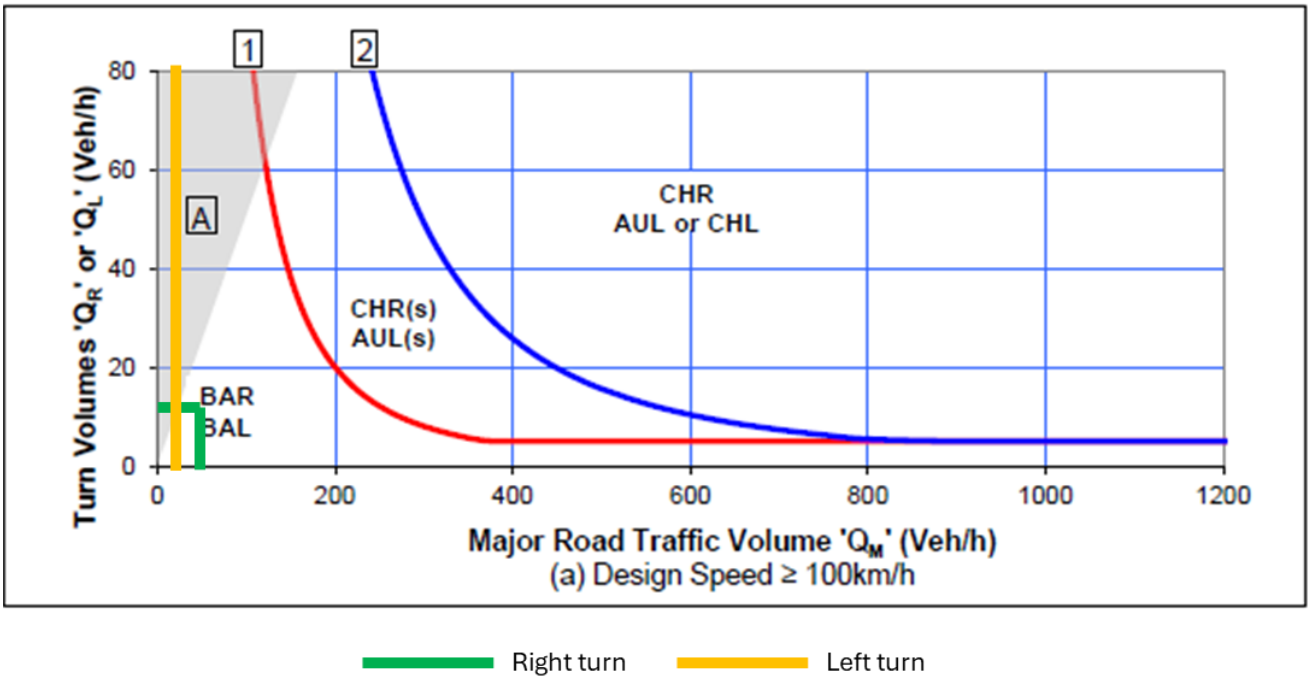
Table 4.9 Hourly traffic flows for warrants assessment – Boulder Road / Castlereagh Highway

Turning Movement	Peak period	Qm[1]	Qr or Ql*	Existing turn treatment	Required turn treatment
Right turn	AM Peak	90	13	CHR	BAR
	PM Peak	151	8	CHR	BAR
Left turn	AM Peak	31	191	CHL	CHL
	PM Peak	49	44	CHL	BAL

Note: 1. Refer to Figure 2.2 for reference to calculation methodology

Source: NearMaps (modified by GHD)

Figure 4.8 Boulder Road / Castlereagh Highway intersection layout



Source: Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management (modified by GHD)

Figure 4.9 Turn treatment warrants assessment – Boulders Road / Castlereagh Highway

The assessment identified the following turn treatments would be required based on the worst-case turning movements:

– A basic right-turn treatment would be required for the major road and right-turn traffic flows. The existing channelised right turn treatments are expected to be appropriate to accommodate the forecast traffic demands.
– An auxiliary left-turn treatment is required for the calculated major road and left-turn traffic flows, noting the high volume of traffic utilising the left turn. The existing auxiliary left turn is considered appropriate.

Access Point 2 / Castlereagh Highway

The turn treatment warrants assessment for the intersection of Access Point 2 and the Castlereagh Highway (shown in Figure 4.10) is outlined in Table 4.10 and Figure 4.11.

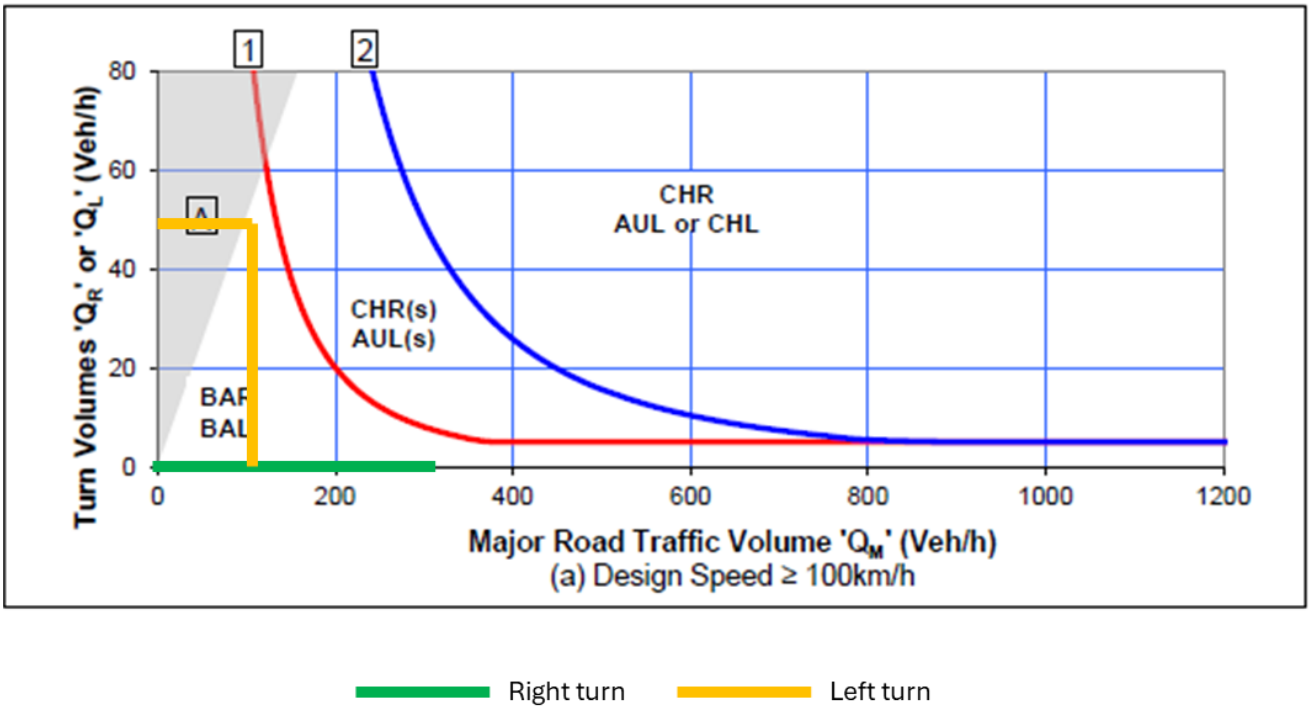
Table 4.10 Hourly traffic flows for warrants assessment – Access Point 2 / Castlereagh Highway

Turning Movement	Peak period	Qm[1]	Qr or Ql*	Existing turn treatment	Required turn treatment
Right turn	AM Peak	305	5	CHR	BAR
	PM Peak	242	0	CHR	BAR
Left turn	AM Peak	105	45	AUL	BAL
	PM Peak	69	0	AUL	BAL

Note: 1. Refer to Figure 2.2 for reference to calculation methodology

Source: NearMaps (modified by GHD)

Figure 4.10 Access Point 2 / Castlereagh Highway intersection



Source: Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management (modified by GHD)

Figure 4.11 Turn treatment warrants assessment – Access Point 2 / Castlereagh Highway

The assessment identified the following turn treatments would be required based on the worst-case turning movements:

– A basic right-turn treatment would be required for the major road and right-turn traffic flows. The existing treatment at this location is expected to be appropriate as this provides an additional lane to accommodate traffic turning right (which would be a low number of vehicles).
– A basic left-turn treatment would be required for the major road and left-turn traffic flows. The existing auxiliary left turn treatment is considered appropriate.

Karawatha Drive / Castlereagh Highway

The turn treatment warrants assessment for the intersection of Karawatha Drive and the Castlereagh Highway (shown in Figure 4.12) is outlined in Table 4.11 and Figure 4.13.

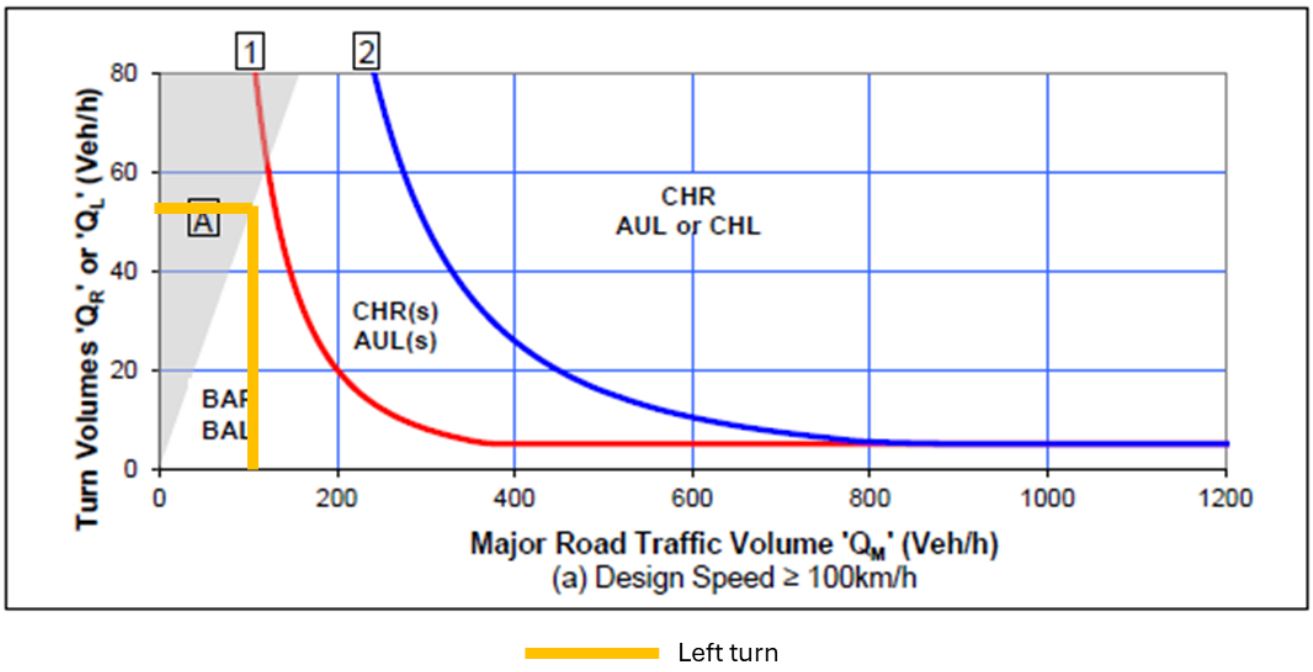
Table 4.11 Hourly traffic flows for warrants assessment – Karawatha Drive / Castlereagh Highway

Turning Movement	Peak period	Qm[1]	Qr or Ql*	Existing turn treatment	Required turn treatment
Left turn	AM Peak	105	51	BAL	BAL
	PM Peak	69	1	BAL	BAL

Note: 1. Refer to Figure 2.2 for reference to calculation methodology

Source: NearMaps (modified by GHD)

Figure 4.12 Karawatha Drive / Castlereagh Highway intersection layout



Source: Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management (modified by GHD)

Figure 4.13 Turn treatment warrants assessment – Karawatha Drive / Castlereagh Highway

The assessment identified the following:

– The right turn into Karawatha Drive is not permitted, and vehicles accessing the project are proposed to make a left in / left out only turn at this intersection. Vehicles leaving the construction footprint and wanting to head south along the Castlereagh Highway would turn left and then enter Access Point 2 and turnaround on the land owned by Centennial Coal. It is noted that there would only be about 7 vehicles throughout construction requiring this turnaround movement.
– A basic left-turn treatment would be required for the left-turn traffic flows. The existing left turn treatment at this intersection is considered appropriate.

Brays Lane / Castlereagh Highway

The turn treatment warrants assessment for the intersection of Brays Lane and the Castlereagh Highway (shown in Figure 4.14) is outlined in Table 4.12 and Figure 4.15.

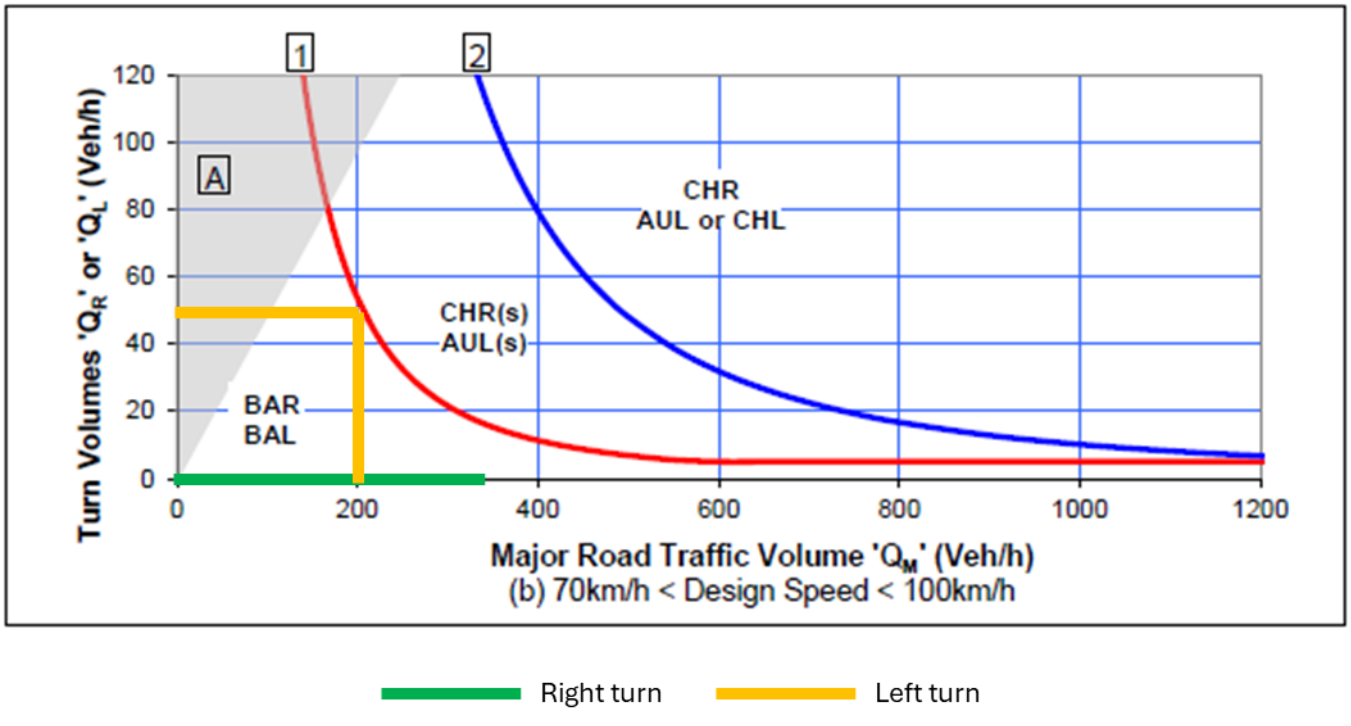
Table 4.12 Hourly traffic flows for warrants assessment – Brays Lane / Castlereagh Highway

Turning Movement	Peak period	Qm[1]	Qr or Ql*	Existing turn treatment	Required turn treatment
Right turn	AM Peak	302	6	CHR	BAR
	PM Peak	261	2	CHR	BAR
Left turn	AM Peak	208	51	BAL	BAL
	PM Peak	149	15	BAL	BAL

Note: 1. Refer to Figure 2.2 for reference to calculation methodology

Source: NearMaps (modified by GHD)

Figure 4.14 Brays Lane / Castlereagh Highway intersection layout



Source: Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management (modified by GHD)

Figure 4.15 Turn treatment warrants assessment – Brays Lane / Castlereagh Highway

The assessment identified the following:

– A basic right-turn treatment would be required. The existing right turn treatment at this location should be appropriate.
– The assessment of the left turn into Brays Lane indicates that the forecast traffic volumes with construction traffic is close to the requirement of an auxiliary left turn lane. Mitigation measures to minimise traffic generated should be considered, which could include carpooling for personnel and contractors and/or staggering work start times outside of the network peak hours. It should also be noted that the assessment is highly conservative and is based on the worst-case AM peak hour, with all personnel and contractors accessing the site by light vehicles in one hour.

Main Street / Castlereagh Highway

The turn treatment warrants assessment for the intersection of Main Street and the Castlereagh Highway (shown in Figure 4.16) is outlined in Table 4.13 and Figure 4.17.

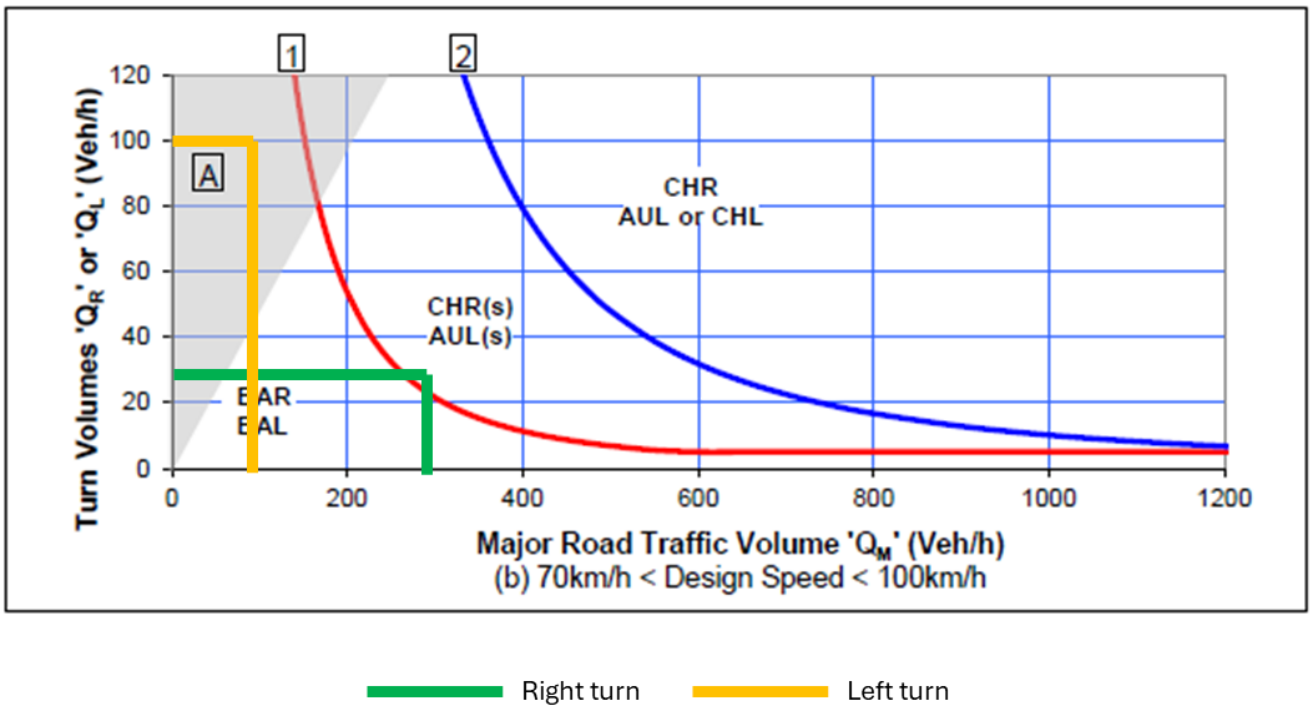
Table 4.13 Hourly traffic flows for warrants assessment – Main Street / Castlereagh Highway

Turning Movement	Peak period	Qm[1]	Qr or Ql*	Existing turn treatment	Required turn treatment
Right turn	AM Peak	303	18	CHR	CHR
	PM Peak	287	27	CHR	CHR
Left turn	AM Peak	81	99	AUL	BAL
	PM Peak	66	57	AUL	BAL

Note: 1. Refer to Figure 2.2 for reference to calculation methodology

Source: NearMaps (modified by GHD)

Figure 4.16 Main Street / Castlereagh Highway intersection layout



Source: Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management (modified by GHD)

Figure 4.17 Turn treatment warrants assessment – Main Street / Castlereagh Highway

The assessment identified the following:

– A channelised right-turn treatment would be required for the major road right-turn traffic flows. The existing channelised treatment at the location is therefore considered appropriate.
– A basic left-turn treatment would be required for the calculated major road and left-turn traffic flows. The existing treatment at this location is considered appropriate, with an auxiliary left turn currently provided.

Access Point 10 / Castlereagh Highway

The turn treatment warrants assessment for the intersection of Access Point 10 and the Castlereagh Highway (shown in Figure 4.18) is outlined in Table 4.14 and Figure 4.19.

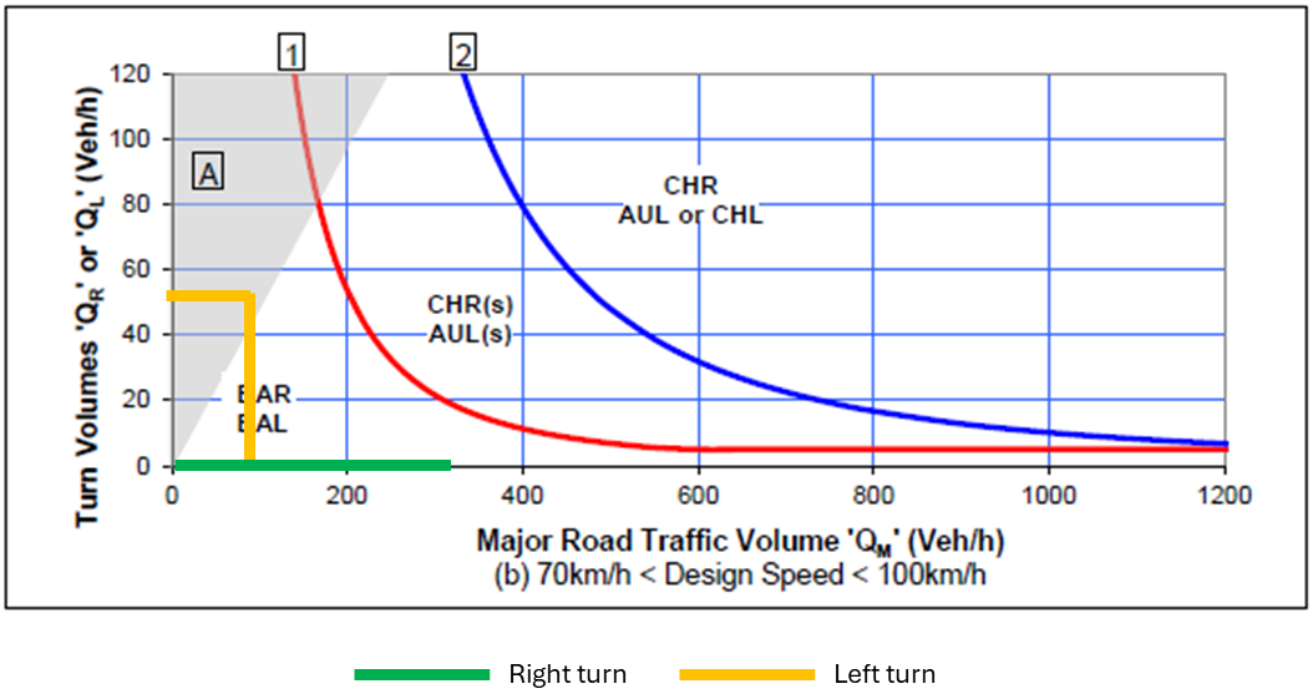
Table 4.14 Hourly traffic flows for warrants assessment – Access Point 10 / Castlereagh Highway

Turning Movement	Peak period	Qm[1]	Qr or Ql*	Existing turn treatment	Required turn treatment
Right turn	AM Peak	340	5	CHR	BAR
	PM Peak	318	0	CHR	BAR
Left turn	AM Peak	108	45	AUL	BAL
	PM Peak	95	0	AUL	BAL

Note: 1. Refer to Figure 2.2 for reference to calculation methodology

Source: NearMaps (modified by GHD)

Figure 4.18 Access Point 10 / Castlereagh Highway



Source: Austroads Guide to Traffic Management Part 6: Intersections, Interchanges and Crossings Management (modified by GHD)

Figure 4.19 Turn treatment warrants assessment – Brays Lane / Castlereagh Highway

The assessment identified the following:

– A channelised right-turn treatment would be required for the major road and right-turn traffic flows. The existing channelised treatment at this location is therefore considered appropriate.
– A basic left-turn treatment would be required for the calculated major road and left-turn traffic flows. The existing treatment at this location is considered to be appropriate, with an auxiliary left turn provided.

4.2.1.3 Intersection sight distance review

Table 4.15 summarises the sight distance requirements for intersections on the Castlereagh Highway and Boulder Road that provide access to the project footprint.

A sight distance review has been undertaken for access points off Brays Lane and Main Street for the purposes of consultation with the Lithgow City Council. All available sight distances at these access points were considered to meet requirements.

Table 4.15 Sight distance requirement for cars and trucks

Road	Intersection approach	Design Speed (km/h)	SISD (minimum requirement)		
			Required (m)		Approximate Measured (m)
			Cars	Trucks	
Frankfort Road/Boulder Road	Southeast	70	151	160	90
	Northwest	70	151	160	120
Mount Piper Power Station Access (Access Point 1) / Boulder Road	Southeast	70	151	160	200
	North-east	70	151	160	130
Boulder Road / Castlereagh Highway	North	110	285	300	330
	South	110	285	300	250
Access Point 2 / Castlereagh Highway	North	110	285	300	370
	South	110	285	300	330
Karawatha Drive / Castlereagh Highway	North	110	285	300	250
	South	110	285	300	300
Brays Lane / Castlereagh Highway	North	90	214	226	230
	South	90	214	226	230
Main Street / Castlereagh Highway	Northwest	90	214	226	290
	Southeast	90	214	226	370
Access Point 10 / Castlereagh Highway	East	90	214	226	300
	West	90	214	226	240

Requirements derived from Part 4a: Unsignalised and Signalised Intersections (2021)
Note: Assumptions

- Reaction time (Rt) = 2.0 seconds for cars travelling on all roads; 2.5 seconds for trucks on all roads
- Average level gradient over the braking distance

As identified in Table 4.15, the measured sight distances meet the minimum safe intersection sight distance (SISD) requirement at each location, with the exception of:

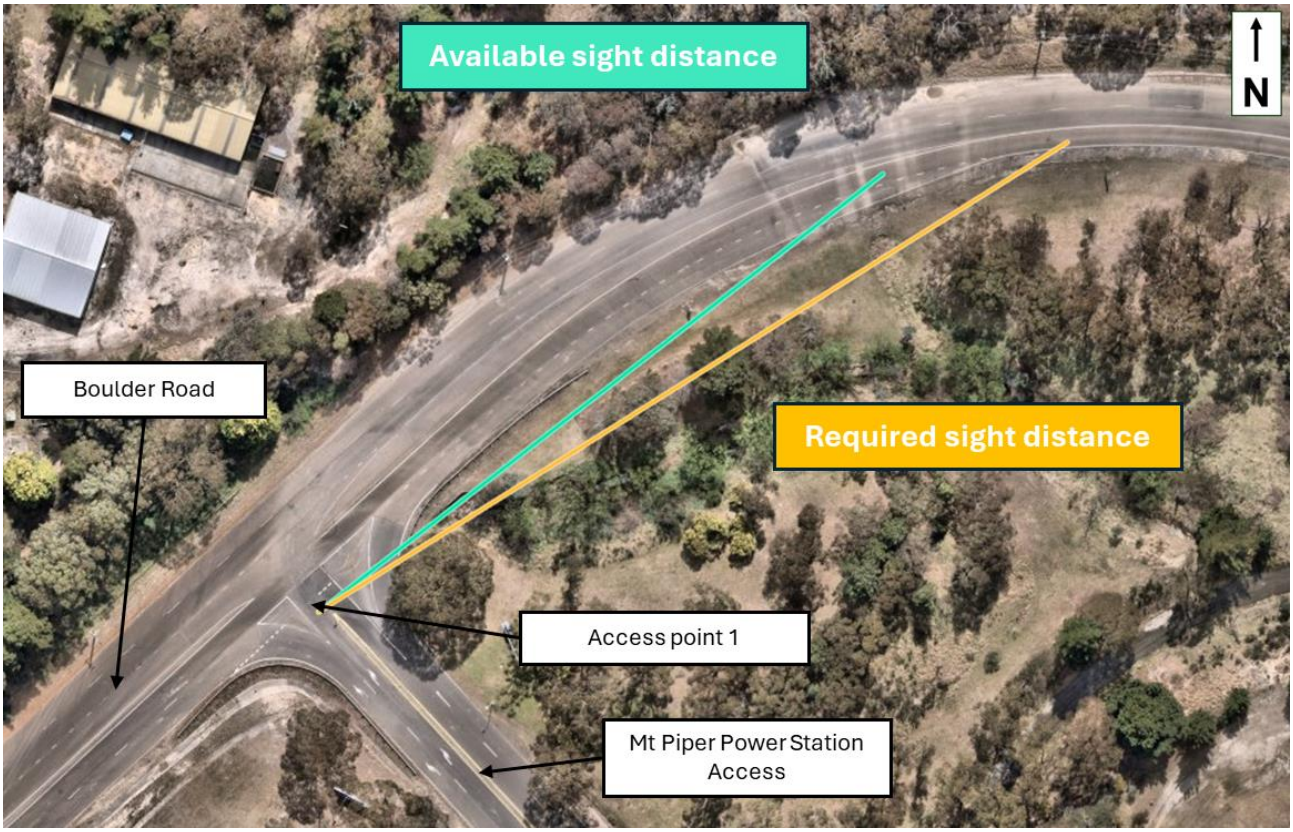
– **Frankfort Road/Boulder Road (Access Point 1a)**:

- This Access Point 1a is an alternative for Access Point 1. The existing road and intersection alignment (primarily in the horizontal and the vertical plane on the north-east approach) reduces the available sight distance from the intersection. Vegetation within the road verge reduces the available sight distance. Additionally, the approach angle of the Frankfort Road at this intersection is non-standard with a lower than a 70-degree approach angle. This tight approach angle makes it difficult for drivers egressing Frankfort Road to view vehicles approaching along Boulder Road from the west, which is a potential safety hazard. It is recommended that traffic control be implemented at this intersection during periods when construction vehicles are accessing or egressing from the project footprint at this location. This approach was discussed with Lithgow City Council, with no key concerns raised.

– **Mount Piper Power Station Access (Access Point 1) / Boulder Road (north-east approach):**
  - The existing road alignment (primarily in the horizontal plane on the north-east approach) reduces the available sight distance from the intersection (refer to Figure 4.21).
  - Trimming of vegetation within the verge may assist in improving sight distances at this intersection. Any vegetation trimming would be undertaken by or in consultation with Lithgow City Council as the road responsible authority.
– **Boulder Road / Castlereagh Highway (southern approach):**
  - The existing road alignment (primarily in the horizontal plane on the southern approach and the existing bridge abutment) reduces the available sight distance from the intersection. It should be noted that the intersection sight distance review was based on the posted speed limit (100 km/h) plus 10 km/h. However, the existing road environment has a lower advisory speed of 85 km/h, at which adequate safe intersection sight distance would be achieved.
  - To improve driver awareness of the upcoming intersection in a northbound direction, it is recommended that the existing Curve (right symbolic) sign (W1-3(R)) on the southern approach be changed to *Side Road Intersection on a Curve – Outside* (right symbolic) sign (W2-9(R)) to improve safety at the intersection. The recommended change is indicated at Figure 4.22.
  - Consultation with Transport for NSW is ongoing in relation to the proposed change to the sign.
– **Karawatha Drive / Castlereagh Highway (northern approach):**
  - The existing road alignment (primarily in the horizontal and the vertical plane on the northern approach) reduces the available sight distance from the intersection. Whilst there is an existing No Right Turn restriction southbound from Castlereagh Highway into Karawatha Drive, vehicles are permitted to turn right from Karawatha Drive onto Castlereagh Highway.
  - The proposed Left-in/Left-out access arrangement at this location has been recommended to address the identified sight distance issue and improve safety at the intersection. Project vehicles travelling south along the Castlereagh Highway would be required to first travel north along the Castlereagh Highway and turn around within the Centennial Coal Springvale Coal Services facility at Access Point 2, which has been agreed with Centennial Coal as part of consultation.

Source: Nearmap (modified by GHD)

Figure 4.20 Available and required sight distance at Frankfort Road / Boulder Roads



Source: Nearmap (modified by GHD)

Figure 4.21 Available and required sight distance at Boulder Road / Mount Piper Power Station Access

Source: Google Streetview (December 2023) – modified by GHD

Figure 4.22 Boulder Road / Castlereagh Highway (southern approach) proposed sign change

4.2.1.4 Impact on road safety

The project footprint can be accessed by the following heavy vehicle routes approved for use by vehicles up to 26 m B-double equivalent:

– Castlereagh Highway
– Great Western Highway.

It is likely that during construction, certain specialist plant, equipment or materials may require the use of OSOM vehicles. Where required, OSOM permits would be obtained from Transport for NSW and licensed haulage contractors engaged to manage OSOM movements.

Construction of the project is expected to generate a minimal increase in vehicle traffic compared to the existing traffic already in the road network. Additional traffic generated by the project is not expected to significantly change the vehicle composition in the road network and is not anticipated to cause changes to road safety risks in the study area.

A Traffic and Transport Management Plan (TTMP) will be implemented to maintain road safety and mitigate any potential impacts of the traffic generated by the project.

4.2.2 Road and site access impacts

4.2.2.1 Impact on local roads – Barton Avenue, Cripps Avenue and Heel Street in Wallerawang

The proposed site access point at Heel Street is expected to generate low volumes of traffic movements, which would typically be limited to around:

– ten light vehicles per day
– four heavy vehicles per day, as required where other accesses to the project footprint are not practicable

No OSOM movements would access the site via the Heel Street access (access point 12).

Barton Avenue, Cripps Avenue and Heel Street in Wallerawang function as local roads, which provide access to the Heel Street access point. Based on the low number of vehicles that would access the site at the Heel Street access point, the project is expected to have minimal impacts on the operation of these local roads.

All local roads are sealed and have sufficient carriageway width to accommodate two-way traffic. Access to these local roads is not expected to be impacted with the implementation of recommended mitigation measures.

The potential impact of the project's construction traffic on road condition is outlined in section 4.7.

4.2.2.2 Impact on property access

Access to private properties would be maintained throughout construction. Some properties may be affected by short-term restrictions on access in limited circumstances. Where short-term restrictions on access may be required, for example, during deliveries or line stringing, prior consultation will be undertaken with the affected parties. Potential impacts on property access is therefore expected to be minor.

Impacts on the use of land, including agricultural activities, due to any changes in access are discussed further in Technical Paper 4 – Land use and Agriculture.

4.2.2.3 Impacts from transmission line stringing across local roads

The project may require traffic management (such as a stop-go traffic control arrangement or short-term road closures of around 30 to 60 minutes) during the stringing of the transmission lines across Brays Lane and Main Street. The method of traffic management at these locations would be confirmed as part of the TTMP. The impacts of the two potential traffic management methods are discussed in the following sub-sections.

Stop-go traffic control

When traffic control is required to be implemented, traffic would be stopped for a brief period under a stop-go arrangement. Any impacts to traffic flows are expected to only occur for very short durations of no longer than about five minutes. The use of traffic management would enable access along the roads to be available, with traffic allowed to continue to flow in both directions.

The proposed traffic management for stringing activities would be undertaken in accordance with the TTMP and any Road Occupation Permit (or Road Occupancy Licence (if required for impacts on Castlereagh Highway)) requirements. This would include procedures to ensure that traffic does not queue back to the Castlereagh Highway.

The impact of stop-go traffic control on Brays Lane is expected to be minimal due to the existing low vehicle movements.. Although traffic volumes on Main Street are higher than on Brays Lane, impacts for stop-go traffic control on Main Street are considered to be manageable to ensure impacts on the road network are minor. Where feasible, stringing activities would be undertaken during off-peak traffic periods, when traffic numbers are lowers, to minimise any impacts to the road network.

Short-term closures

All short-term closures would be undertaken in accordance with the requirements of a Road Occupancy License (or equivalent for the council jurisdiction, such as a Road Occupation Permit). Where feasible, temporary lane closures are to be planned outside of peak traffic periods to minimise the impact on the road network.

Where short-term road closures are required, traffic diversion may be required. The diversion of traffic would likely occur along the following routes:

– Main Street closure: traffic would be required to be diverted from the intersections with Pipers Flat Road and the Castlereagh Highway. Vehicles would be required to use Brays Lane as an alternative to Main Street, which can be accessed via Pipers Flat Road and the Castlereagh Highway. This diversion would be around 2 km longer than the current route along Main Street (around two minutes additional travel time).

  This route may not be suitable for some heavy vehicles, which would be required to use Barton Avenue to access the Great Western Highway to connect onto the Castlereagh Highway. This route would be around 7 km longer than the current route along Main Street (around five minutes additional travel time).

– Brays Lane closure: traffic using Brays Lane would be required to be diverted from the intersections with Pipers Flat Road and the Castlereagh Highway. Diverted vehicles would be required to use Main Street as an alternative to Brays Lane, which can be accessed via Pipers Flat Road and the Castlereagh Highway. This would result in a maximum increase in travel time of around seven minutes to access the properties on Brays Lane to/from the Castlereagh Highway.

Where closures at both Brays Lane and Main Street are required simultaneously, vehicles would be required to utilise Barton Avenue, the Great Western Highway and the Castlereagh Highway as a diversion route.

The impacts of the diversion routes identified above are expected to be minor and for short periods only. With the short-term duration expected of any road closures, low current volumes and spare capacity of roads along diversion routes, it is expected that traffic diversions will be able to be accommodated within the surrounding road network. Alternative travel routes would be managed through the TTMP.

4.2.2.4 Heavy vehicle and OSOM access

Based on the intersection warrants assessment (refer to section 4.2.1.2), no road upgrades at key intersections and access points would be required. A passing bay along the southern shoulder of Brays Lane may be required to allow construction vehicles to pass each other safely and avoid potential queuing back to the Castlereagh Highway. The passing bay has been proposed based on a worst-case assessment of traffic movements and the requirement for a passing bay would be confirmed by the construction contractor as part of detailed construction planning in consultation with Lithgow City Council. If the passing bay is required, the design and construction of the passing bay will be undertaken in consultation with Lithgow City Council. If an alternate method of managing traffic impacts on Brays Lane is adopted, such as staggering of vehicle arrival and egress times, it would be documented as part of the TTMP.

An indicative footprint for the passing bay is shown in Figure 4.23, with a design of the passing bay to be prepared as part of the TTMP if it is confirmed to be required.

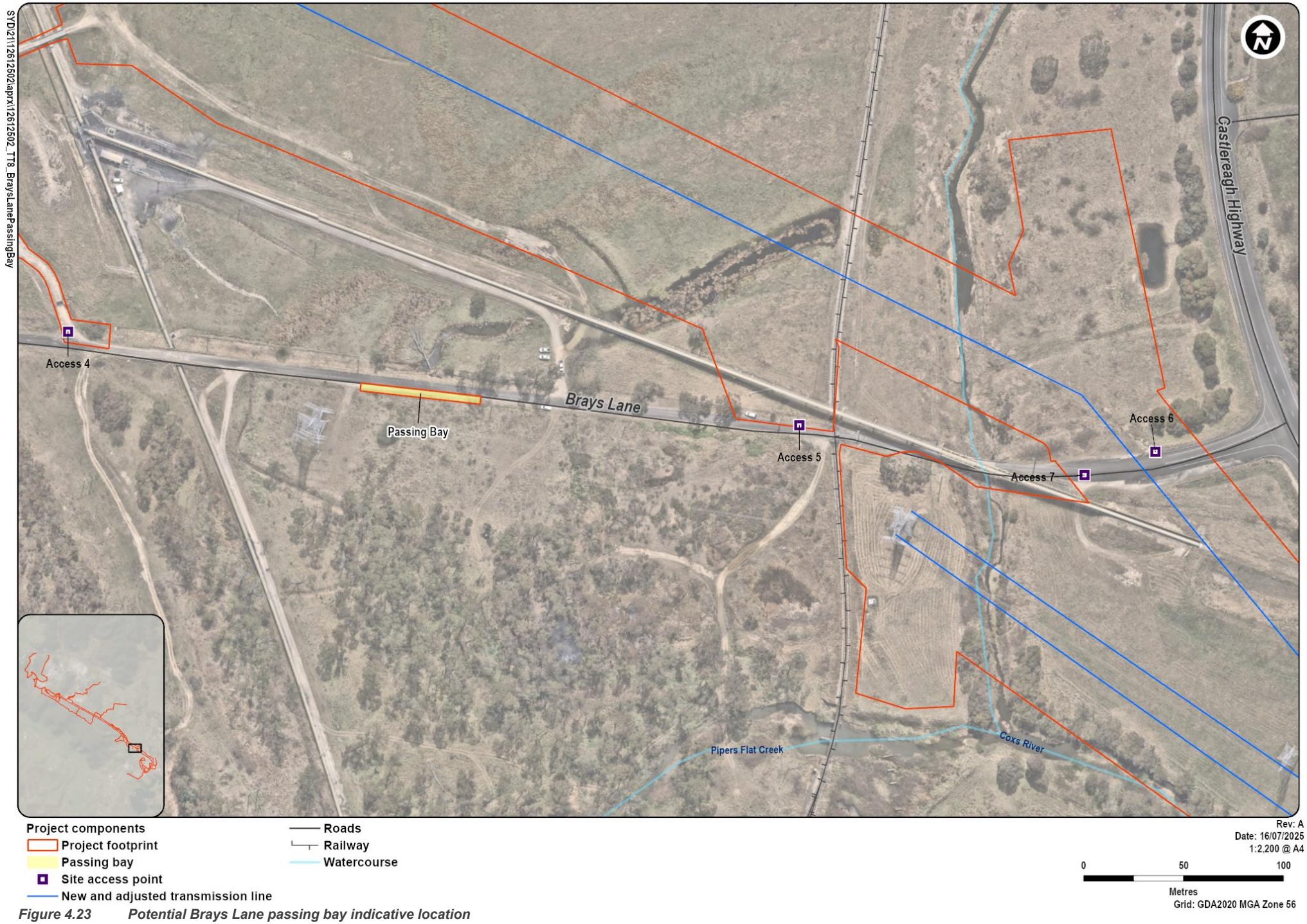


Figure 4.23 Potential Brays Lane passing bay indicative location

Designated access routes for construction vehicles have been planned to use the State arterial road network, wherever possible, and in accordance with NHVR approval conditions.

Heavy vehicle routes, including OSOM vehicle routes, are most likely to originate in Sydney or Newcastle, with some routes originating from Orange or Bathurst. These vehicle routes will mostly use the Castlereagh Highway, Great Western Highway and Main Street (approved with conditions) to access the project footprint, which are all approved routes.

It is noted that some heavy vehicle movements may utilise Barton Street (approved with conditions, see below), Cripps Avenue and Heel Street to reach Access Point 12. No OSOM movements would occur via this route. Barton Avenue is approved for B-doubles in emergency situations when directed by Transport for NSW. Traffic volumes for these movements are expected to be low, and approvals are to be obtained from Lithgow City Council and Transport for NSW, as part of the TTMP.

Details of all routes used for access and heavy vehicle movements during the construction are provided in section 4.1.4. These would be confirmed following construction planning and would be documented in the TTMP in consultation with Lithgow City Council and Transport for NSW.

4.3 Impact on walking and cycling

As outlined in section 3.3.4 there are limited active transport facilities near the site access points, with most facilities limited to Wallerawang. As a result, it is not expected that the construction of the project will impact active transport facilities.

Construction personnel and contractors and freight should be mindful of any active transport users when travelling to and from the project footprint, especially cyclists who are riding in mixed traffic conditions or road shoulders.

4.4 Impact on public transport

All bus services in the region are located in Wallerawang, with the exception of some school bus services, which also operate along the Castlereagh Highway. No changes to existing bus operations are required to facilitate the project's construction and operation. Impacts to bus services, due to increased traffic volumes associated with the project, are expected to be negligible given the low increase in traffic volumes associated with the project. At Brays Lane and Main Street there may be short-term road closures or traffic management associated with the stringing of the transmission line across these roads. Bus services on Main Street only operate in the AM and PM peak periods, with no bus services operating along Brays Lane.

If required, these traffic management activities at Main Street could result in potential impacts when they occur during the AM and PM peak periods when bus services operate along Main Street. Impacts on bus services would be consistent with those outlined in section 4.2.2.3, and would be limited to a very small number of services (about one or two services per peak) experiencing some increases in travel times as a result of short-term closures.

Stringing works over the Main Western Rail Line will be required during the construction phase, however, this is expected to be undertaken during a planned rail shutdown period and would be coordinated with rail operators.

The project's impact on public transport is therefore expected to be minimal.

4.5 Impact on rail freight

Brays Lane (passive crossing) and Main Street and Pipers Flat Road (flashing lights) form a level crossing with a freight rail line. The freight rail line is no longer in operation, with the tracks finishing just north of the crossing location. As outlined in section 4.4 stringing work over the Main Western Rail Line is expected to be undertaken during a rail shutdown.

All other locations where the rail line crosses the road network have existing bridges to separate road and rail traffic.

As such, the project is expected to have minimal impacts on rail services.

4.6 Impact on parking

It is expected that all traffic generated by the project will park within the project footprint boundary and will not impact parking supply in areas outside the project footprint.

4.7 Impact on road condition

Road condition generally deteriorates over time due to weather and vehicle use. This may lead to pavement cracking and rutting as well as the formation of potholes and corrugations. Unsealed roads are more susceptible to deterioration than sealed roads. In addition, heavy vehicles are more likely to cause road conditions to deteriorate than light vehicles. It is noted that all roads within the study area are sealed, as described in section 3.2.

With the minor increases in heavy vehicle traffic during construction (see section 4.1.6), the impact on the condition of the sealed roads within the traffic study area is expected to be minimal, depending on the existing pavement condition and applicable load restriction.

Potential impacts on road condition would be managed through road dilapidation surveys and rectification works, if required, through the implementation of mitigation measures detailed in section 7.

4.8 Summary of construction impact assessment

The assessment of potential impacts on the road network associated with the construction of the project identified the following:

- Considering traffic generation associated with the project, it is expected that all key roads within the study area will operate within capacity for forecast 2028 traffic volumes.
- An intersection warrants assessment found that all existing turn treatments at key intersections and access points are generally appropriate for the expected traffic flows. However, the construction traffic volumes for the left-turn movement into Brays Lane from Castlereagh Highway indicates the intersection would be close to the requirement of an auxiliary left turn lane. Traffic generation is to be minimised through measures such as carpooling or staggering of work start times outside of the peak hours.
- An SISD assessment was conducted on all key intersections and access points and identified potential sight distance deficiencies at the intersections of Frankfort Road / Boulder Road (alternative Access Point 1a) as well as Mount Piper Power Station Access Road / Boulder Road (Access Point 1). Traffic control would be required for Access Point 1a and vegetation trimming would be required for Access Point 1 to assist in increasing the available sight distance.
- Additionally, sight distance deficiencies have been identified for the Castlereagh Highway north of the intersection with Karawatha Drive. Vehicles associated with the project will be directed to utilise a Left-in/Left-out arrangement at this intersection to minimise the risk of potential right turn incidents.
- The approach angle of the Frankfort Road at the intersection of Boulder Road is non-standard, with a less than a 70-degree approach angle. Traffic control will be implemented at this intersection during periods when construction vehicles are accessing the project footprint at this location.
- A passing bay on the southern shoulder of Brays Lane is proposed based on worst case traffic volumes to accommodate heavy vehicle movements passing in each direction. The need for the passing bay will be confirmed as part of detailed construction planning in consultation with Lithgow City Council. Any alternate methods of managing traffic impacts on Brays Lane, such as staggering of vehicle arrival and egress times, are to be documented as part of the TTMP.
- A change in the sign on the southern approach to the Boulder Road / Castlereagh Highway intersection is recommended based on the existing road alignment which reduces the available sight distance to the upcoming intersection. It is recommended that the sign be updated to a *Side Road Intersection on a Curve - Outside (right symbolic)* sign to improve driver awareness of the upcoming intersection. Consultation with Transport for NSW is ongoing in relation to this recommended change.
- Negligible impacts are expected to active transport, public transport services or rail freight in the study area.
- Approved heavy vehicle routes on the state road network are expected to be used within the study area, with OSOM permits to be obtained as required. No high risk OSOM trips would be required as part of the project.
- No impacts on parking availability is expected within the study area.

5. Operational impacts

5.1 Project description – operation

This section provides a summary of the proposed operational traffic generation associated with the project.

5.1.1 Maintenance activities

The transmission line is expected to require regular and routine maintenance, which would involve the following activities:

– Periodic aerial inspections.
– Routine infrastructure inspections that would typically involve two or three maintenance personnel driving a light vehicle from public roads to the easement utilising access tracks and then along the easement inspecting each transmission structure. Routine maintenance would be carried out monthly for a period of two years following construction, after which ongoing maintenance would be undertaken infrequently.
– Reactive transmission line maintenance in response to unexpected issues identified during routine inspections. This would typically involve maintenance personnel and contractors using light vehicles, an elevated work platform and a medium-sized truck to rectify any defects found during routine inspections.
– Maintaining the Vegetation Clearance Requirements for the transmission line easement similar to existing maintenance activities for the existing easement.

5.1.2 Emergency response activities

Activities would be carried out to assess infrastructure conditions should an unplanned outage occur (e.g. through a weather event or other failure of infrastructure). The amount of maintenance and/or crew required to repair any damaged infrastructure would depend on the extent of the repairs required.

5.1.3 Operational traffic generation

During the operational phase of the project, access to the easement would be required monthly for one or two vehicles for a period of two years after commissioning. Following this, access to the easement would reduce to a level that represents similar access requirements to the existing 132 kV transmission line, that being one or two vehicles on an infrequent basis.

Of the total 13 access points required for construction, described in section 4.1.3, nine access points would be retained for future operation and maintenance:

– Main access point (1): Mount Piper Power Station entrance road off Boulder Road, Blackmans Flat
– Wallerawang access points (4) to (7): Brays Lane, Wallerawang
– Wallerawang access points (8) and (9): Main Street, Wallerawang
– Wallerawang access point (10): Castlereagh Highway, Wallerawang
– Wallerawang 330 kV substation access point (12): Heel Street, Wallerawang.

During operation, there may also be a temporary increase in vehicle movements in the event of an emergency or if maintenance works of a greater scale are required. This increase is not expected to differ from the current movements already required for the existing 132 kV transmission line in such situations.

Operational traffic has been assumed to be typically light vehicles, with heavy vehicles required for emergency repairs/maintenance. Any heavy vehicles required would be low in volume and would utilise the same routes used in the construction phase.

5.2 Impact on traffic

The traffic generation during operation is expected to be minor (see section 5.1.3) and are generally consistent with the movements required for the existing transmission line operations. As such, it is not expected that operational activities would significantly impact the traffic network's performance.

Heavy vehicles are expected to be used infrequently during the operation of the project. Where required, these vehicles would utilise the same heavy vehicle access routes identified for the construction stage (as outlined in section 3.3.1). No OSOM vehicles are expected to be required for general maintenance activities, with appropriate permits to be obtained if required.

5.3 Impact on walking and cycling

As outlined in section 3.3.4, there are limited active transport facilities within the study area, with most facilities limited to Wallerawang. It is not expected that the operation of the project would impact active transport facilities within the project footprint.

5.4 Impact on public transport

The project's operation is not expected to require alteration to any existing bus services. Additionally, negligible or no delays are expected to the services due to the operational traffic.

5.5 Impact on rail freight

Operational traffic is not expected to impact freight rail services. Maintenance vehicles using access tracks where level crossings are located will operate around services, which are expected to be infrequent.

5.6 Impact on parking

All traffic generated by the project's operation is expected to park within the project footprint boundary. There is no anticipated impact on parking outside the project footprint.

5.7 Impact on road safety

The operation of the project is projected to cause a negligible increase in vehicle traffic relative to the current levels in the road network. The additional traffic generated by the project is not expected to alter the vehicle composition within the road network and is not anticipated to affect road safety risks in the study area.

5.8 Impact on road condition

The very low volumes of light and heavy vehicles using the public road network for the operation and maintenance phase are anticipated to have a negligible impact on road condition during operation. It is noted that all roads within the study area are sealed, as described in section 3.2.

The number of vehicles associated with the operational phase is expected to be similar to existing operations and would therefore have negligible impacts to the condition of roads in the study area. As such, ongoing contributions to road maintenance would not be required.

6. Cumulative impacts

Section 21.2 of the EIS outlines the assessment methodology for cumulative impacts including the methods for identifying what projects have been considered as part of the issue-specific cumulative impact assessments for the project. The assessment has been undertaken in accordance with the Cumulative Impact Assessment Guidelines for State Significant Projects (DPIE 2022). Any traffic generated by existing operational projects, such as nearby mining operations has been captured within the existing traffic volumes and has already been considered in the assessment.

A total of 10 projects within 20 km of the project footprint were identified for consideration as part of the cumulative impact assessment and are shown in Figure 6.1. The following projects have been considered:

- Wallerawang Battery Energy Storage System
- Mount Piper Battery Energy Storage System
- Great Western Battery Energy Storage System
- Pinecrest Battery Energy Storage System
- Lake Lyell Pumped Hydro Energy Storage
- Ben Bullen Wind Farm
- Sunny Corner Wind Farm
- Wallerawang Power Station Ash Dam
- Wallerawang residential subdivision (DA226/22)
- Wallerawang Station upgrades.

Table 6.1 outlines the potential cumulative impacts for the above individual projects. It is not expected that more than one of the above projects will use a shared access point or intersection accessed by the project (as outlined in section 4.1.3). As such, these intersections are expected to be able to accommodate the cumulative increase in traffic as outlined in Table 6.1. Additionally, the Castlereagh Highway operates with ample spare mid-block capacity and would be able to accommodate the cumulative increase in traffic generated by the project and the above projects.

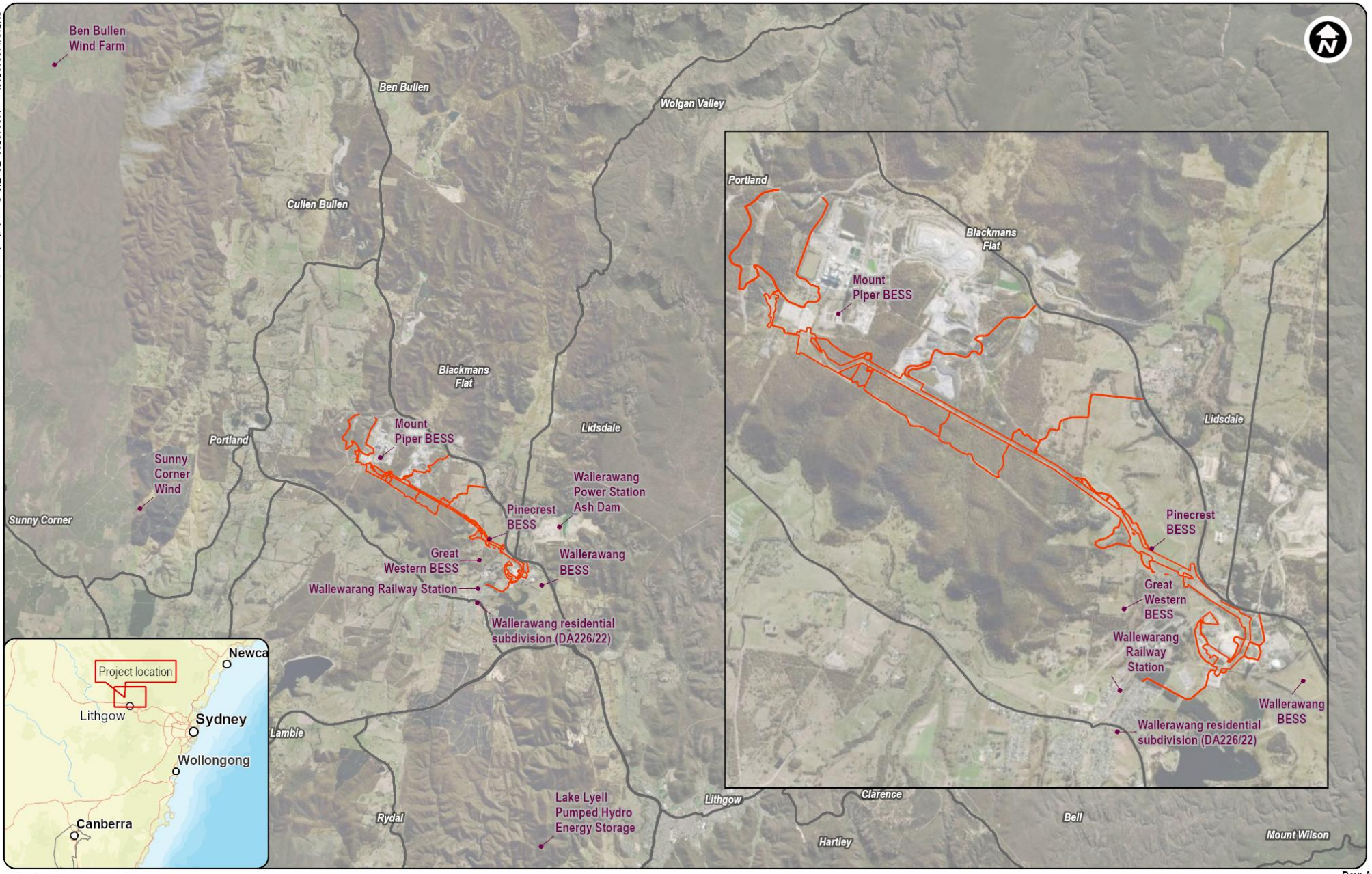


Figure 6.1 *Projects considered in cumulative assessment*

Table 6.1 Cumulative impact summary

Relevant future project	Scope	Approximate location	Status/timeframe/ operational period	Potential for cumulative impact
Wallerawang BESS	Design changes to optimise the layout of the approved Wallerawang BESS (500 MW and 1,000 MWh of battery storage capacity)	500 m east of the project footprint	Approved 4/8/2022. Current modification at response to submissions stage. Construction period of 1 to 2 years, expected to commence from 2025, construction does not appear to have commenced. Operational period unchanged.	Development of the Wallerawang BESS may generate additional traffic, including heavy vehicles along the Castlereagh Highway. Vehicles will use the unnamed access road from Castlereagh Highway, located to the south of Access Point 10. The construction volumes are expected to be up to 100 two-way light vehicle and 20 two-way heavy vehicle trips per day, and 36 OSOM movements over the course of the construction period. The Wallerawang BESS Traffic Impact Assessment report indicated that during the construction of the Wallerawang BESS, the road network will have a spare capacity of 70% to 80%. It is considered that the road network will comfortably accommodate the construction traffic generated from both projects in combination.
Mount Piper BESS	Development of a grid-scale BESS with a capacity of up to 500 MW	Immediately north of the project footprint	Approved 15/11/2024. Construction period of 18-24 months expected to commence from mid-2026 at the earliest. Potentially operational by 2027/2028 and would operate for about 20 years.	Vehicles generated from the Mount Piper BESS would be primarily using Boulder Road and an unnamed road as their main access point. This project would increase the turning movements and traffic volumes at Boulder Road and Castlereagh Highway. The expected peak traffic generation for the Mount Piper BESS is 170 light vehicles and 51 heavy vehicles, with all vehicles accessing the site from the south via the Castlereagh Highway. An updated intersection warrants assessment was conducted to include the expected traffic generation for the Mount Piper BESS at the intersection of Boulder Road and the Castlereagh Highway. This assessment indicated that the existing channelised left turn would be acceptable for the expected volumes. An updated mid-block assessment was also prepared with the results showing that with the additional traffic, both the Castlereagh Highway and Boulder Road would operate within capacity.

Relevant future project	Scope	Approximate location	Status/timeframe/ operational period	Potential for cumulative impact
Great Western BESS	Development of a 500 MW / 1,000 MWh BESS and associated infrastructure	300 m west of the project footprint	Approved 2/11/2023. Project has not yet commenced construction and construction start date is not known, however is expected to occur over 12-14 months. The BESS is intended to have an operational life of up to 20 years.	Traffic generated by the Great Western BESS will use Brays Lane (primary light vehicle access) from the Castlereagh Highway to access the site. Peak construction traffic volumes are expected to be 50 light vehicles and 20 heavy vehicle trips per day, with eight OSOM vehicles over the entire construction period. OSOM and primary heavy vehicles are planned to use Main Street. An updated intersection warrants assessment was conducted for both the Brays Lane and Main Street intersections including expected traffic from the Great Western BESS. The following was identified: – At Brays Lane, an auxiliary left turn treatment would be required. This assumes that all 50 light vehicles are using the Brays Lane access during the peak hour and approaching from the south. No upgrades to the intersection for an auxiliary turn treatment are expected to be required based on the assumed implementation of mitigation measures such as car-pooling / mini buses and staggering arrival times of vehicles outside of the peak hour period. – For the intersection of Main Street and Castlereagh Highway the existing auxiliary turn treatment is expected to be appropriate (basic left turn required). An updated mid-block assessment was also calculated and showed: – Castlereagh Highway and Brays Lane would continue to operate within capacity (at the intersection of Brays Lane). – Castlereagh Highway and Main Street would continue to operate within capacity (at the intersection of Main Street).
Pinecrest BESS	Development of 500 MW battery storage capacity and 1,000 MWh of storage with (2-hour duration) connecting to the grid via underground cabling	Layout shown in scoping report is located within project footprint, with Transgrid undertaking ongoing consultation with Banpu Energy regarding positioning of the site	Scoping report prepared with SEARs not yet issued. EIS is expected to be submitted in early 2026. Construction period of 18 months commencing in late 2026 if approved. Operations proposed to start in 2028.	Construction and operational phases of the projects have the potential to overlap with the project. Construction and operational traffic generated by the Pinecrest BESS may use Access Point 2 at Karawatha Drive to access the BESS site from the Castlereagh Highway. The expected traffic generation of the Pinecrest BESS is unknown as the project is only in early development phases (i.e. scoping report and EIS not developed). As a result, cumulative impacts are not known. The Pinecrest BESS project would be required to undertake a traffic and transport impact assessment, which would consider cumulative impacts from the Mount Piper to Wallerawang Transmission Line Upgrade project.

Relevant future project	Scope	Approximate location	Status/timeframe/ operational period	Potential for cumulative impact
Lake Lyell Pumped Hydro Energy Storage	Development of the Lake Lyell Pumped Hydro Energy Storage Scheme (that will provide between 300 to 350 MW of electricity generating capacity for up to 8 hours during peak demand	10 km south of the project footprint	EIS in preparation. Technical design expected to conclude in 2025. Construction expected to commence in late 2026 and to take four years with operation commencing in 2029.	Due to the distance between the project footprint and Lake Lyell Pumped Hydro Energy Storage site, it is not expected to affect the operation of key intersections near the project footprint. It is noted that construction of the project may contribute to traffic along the Great Western Highway in the Blue Mountains for any movements coming from Sydney. The number of vehicles for the Lake Lyell Pumped Hydro Energy Storage site project is currently unknown and therefore, cumulative impacts are not known.
Ben Bullen Wind Farm	Construction of approximately 64 wind turbine generators, a BESS and ancillary infrastructure	20 km north-west of the project footprint	EIS in preparation. Construction in 2028 for 18-24 months. Operational life of 35 years+.	Due to the distance between the project footprint and Ben Bullen Wind Farm site, no cumulative impacts are expected.
Sunny Corner Wind Farm	Construction of approximately 80 wind turbine generators, a BESS and ancillary infrastructure	6 km west of the project footprint	EIS in preparation. Construction in 2030 for 36 months. Operational life of 30 years.	The construction phase of the wind farm would not overlap with the project. The Mount Piper to Wallerawang Transmission Line Upgrade project would be in operation when the wind farm is expected to commence construction, therefore there any cumulative impacts would be minimal.
Wallerawang Power Station Ash Dam	Use of part of the lands lying north of the Castlereagh Highway that were once used by the former Wallerawang Power Station as coal ash dam repositories	Immediately north of the project footprint	Approved 13/10/2023. The modification proposes an additional ten years for the importation of capping material.	The Wallerawang Power Station Ash Dam is not expected to share access points with the project. Traffic generated by the existing Wallerawang Power Station is captured within the surveyed traffic volumes as it is currently operational. The Wallerawang Power Station Ash Dam project would not be expected to generate additional traffic as it is an extension of existing operations.
Wallerawang residential subdivision (DA226/22)	Torrens Subdivision – 1 Lot into 54 Residential Allotments, 4 New Roads, 2 lots for drainage and public reserve Allotment	19 Barton Avenue Wallerawang 2 km south-west of the project footprint	The DA was exhibited for comment closing on 13/06/25. Timing of construction is unknown.	No information is available to identify whether the construction of the subdivision would overlap with the project. Should there be an overlap of the construction phases, the new subdivision may introduce additional vehicles to the road network. The vehicle movements for the DA are not likely to interact with the study area road network, except for potential traffic generated by the subdivision interacting with project traffic along Barton Avenue to Access Point 12. The project would infrequently use Barton Avenue to gain access via Access Point 12. If the construction phases overlap, the cumulative traffic impacts on this local road are expected to be low.

Relevant future project	Scope	Approximate location	Status/timeframe/ operational period	Potential for cumulative impact
Wallerawang Station rail upgrades	Works to upgrade the existing station, closed in 1989, so that passenger services can be restated	850 m southwest of project footprint	Project has been announced on Transport for NSW website. Early enabling works will be carried out from March to August 2025. Once the design is finalised, construction will commence later in 2026.	The volumes of traffic associated with the construction and operation phases of the station upgrade are currently unknown. Early enabling works are underway and expected to be carried out until August 2025. Access to Wallerawang Station is via Main Street, Castlereagh Highway, and Barton Avenue which are public roads also to be utilised by the project. There are likely to be cumulative traffic impacts, if the construction phases for the projects overlap, along Main Street and Barton Avenue. Traffic volumes along Main Street are low, however no information is available for Barton Avenue, however they are similarly also expected to be low. The project's traffic generation for Main Street and Barton Avenue are very low, and as such, the project's contribution to cumulative impacts would be very low. Castlereagh Highway, as a major arterial and heavy vehicle route, would be expected to have sufficient capacity to accommodate increased traffic generation from the Station Upgrade works and this project. The potential for cumulative traffic impacts on the Castlereagh Highway is unlikely.

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7. Mitigation and management of impacts

Table 7.1 lists the mitigation and management measures that would be implemented to manage potential project impacts.

Table 7.1 Traffic mitigation and management measures

Impact	Mitigation measure	Timing
Traffic management and road network performance	A Traffic and Transport Management Plan (TTMP) will be developed and implemented as part of the CEMP, in consultation with relevant stakeholders. The plan will detail processes and responsibilities to minimise traffic disruptions and delays, to identify and to respond to changes to road access. The TTMP will include: – Consultation and approval of road designs from Lithgow City Council for any proposed minor road work, such as a passing bay on the shoulder of Brays Lane. The need for a passing bay will be determined in consultation with relevant road authorities. – Maps of designated and approved heavy vehicle routes for heavy vehicles and oversize and overmass movements. – Traffic and transport permitting requirements, including oversize and overmass movements permits and road occupancy licences. – Planning for heavy vehicle routes to Access Point 12 via Heel Street, as well as the alternate access routes for Access Points 4 and 5, which are to be confirmed through consultation with Lithgow City Council. – Transmission line stringing across the Main Western Rail Line to be undertaken within scheduled rail shutdown period (i.e. planned rail maintenance) or as agreed with the appropriate rail authority. – Road closures (partial or full) will be planned during the road network off-peak periods, where possible. – A drivers' code of conduct for haulage safety. – Requirements for drivers operating heavy vehicles on public roads. – Measures to ensure the efficient delivery of equipment and construction materials. – Traffic control measures at construction access points and intersections, including: • left-in/ left-out turn movements at the Karawatha Drive/ Castlereagh Highway intersection • traffic control at the Frankfort Road / Boulder Road intersection, including the requirements for obtaining a road occupancy licence • traffic management at Brays Lane and Main Street during stringing works, including the requirements for obtaining a road occupancy licence. – Measures to reduce traffic movements at Brays Lane / Castlereagh Highway. This will include reducing trips taken by personnel and contractors, such as carpooling and shuttle bus services. – Consultation with other relevant project proponents to consider cumulative traffic impacts and identify the need for project-specific mitigation measures.	Pre-construction Construction
Potential access impacts	Where temporary disruption to access cannot be avoided, consultation will be undertaken with the owners, occupants and managers of affected properties and road infrastructure to confirm their access requirements and determine any alternative arrangements required.	Construction
Impacts on local roads	Road dilapidation surveys will be undertaken of Brays Lane and Karawatha Drive, prior to and following the completion of construction, and provided to the relevant road authority. Condition monitoring will be carried out during construction. Rectification measures will be implemented to the satisfaction of the road owner, during and/or following completion of construction, to address any damage caused by the project.	Pre- and Post-Construction Construction

Impact	Mitigation measure	Timing
Intersection sight distance	Confirmation of safe sight distances for all proposed access points' will be undertaken when preparing the TTMP in consultation with the relevant road authority. Mitigation measures to meet safe sight distances at proposed access points and intersections will be adopted for: – intersection of Boulder Road / Frankfort Road requiring traffic control – intersection of Boulder Road / Mount Piper Power Station access road requiring vegetation trimming – intersection of Castlereagh Highway / Karawatha Drive requiring Left-in/Left-out access arrangement. All mitigation measures will be developed in consultation with the relevant road authority. Ongoing consultation will occur with Transport for NSW in relation to improving the existing road sign on the southern approach to the Boulder Road / Castlereagh Highway intersection.	Detailed Design Pre-construction

8. Conclusion

This Traffic and Transport Assessment (TTA) report has been prepared as part of the EIS for the proposed Mount Piper to Wallerawang Transmission Line Upgrade Project. The assessment included an analysis of existing conditions as well as the potential impacts of the project on the performance and safety of the road network in the study area.

Mid-block capacity assessment

Analysis of the results of the mid-block assessment indicates that all roads within the study area are expected to operate well within capacity in 2028 during the peak construction periods, with VCR values of less than 40 per cent.

Intersection treatment assessment

All existing turn treatments are expected to be appropriate for the forecast 2028 traffic and traffic generated by the project.

The forecast “with construction” traffic volumes for the left-turn movement into Brays Lane from the Castlereagh Highway indicate that the intersection would be close to the requirement of an auxiliary left turn lane. Mitigation measures are required for this intersection.

Intersection sight distance review

A high-level assessment of safe intersection sight distance (SISD) at the intersection access points to the project footprint was reviewed to determine whether there is adequate longitudinal sight distance at the proposed access points. The measured sight distances meet the minimum SISD requirement at each location, with the exception of:

– Frankfort Road/Boulder Road.
– Mount Piper Power Station Access (Access Point 1) / Boulder Road (north-east approach).
– Boulder Road / Castlereagh Highway (southern approach) if travelling 100 km/h. The SISD is met when the sign-posted advisory speed limit of 85 km/h is adopted.
– Karawatha Drive / Castlereagh Highway (northern approach).

Mitigation measures are proposed to address road safety at the intersections that do not meet the minimum SISD requirement.

Cumulative impacts

Several nearby projects were identified that may have potential impacts on the road network within the study area.

It is expected that traffic generated from the other projects may result in increased traffic volumes within the study area, in particular along the Castlereagh Highway or Great Western Highway. A review of the mid-block capacity with the cumulative traffic generation of these other projects indicates that the surrounding road network is expected to continue to operate satisfactorily with the expected increase in traffic volumes from the nearby projects identified.

A review of the intersection warrants assessment indicates that the Brays Lane / Castlereagh Highway intersection may require an auxiliary left turn treatment. Mitigation measures, such as car-pooling / mini buses and staggering arrival times of vehicles outside of the peak hour period, would assist in reducing the requirement for an intersection upgrade at this location.

The assessment is highly conservative and was undertaken assuming all personnel and contractors would arrive in a one hour period, and as such, it is expected that the average traffic generated by the project is expected to have minimal impacts on the road network.

Mitigation and management

A range of mitigation measures were identified to minimise the potential impacts of the project on the road network within the study area. These measures would be considered when preparing the TTMP, prior to construction and in consultation with the relevant road authority. The TTMP would detail the required traffic management processes, responsibilities, traffic control measures and approved site access routes to and from the site.

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