Transport for NSW

Bells Line of Road Slope Stabilisation

Review of Environmental Factors

February 2023

NSW GOVERNMENT

transport.nsw.gov.au

Acknowledgement of Country

Transport for NSW acknowledges the traditional custodians of the land on which the project is proposed.

We pay our respects to Elders past and present and celebrate the diversity of Aboriginal people and their ongoing cultures and connections to the lands and waters of NSW.

Many of the transport routes we use today – from rail lines, to roads, to water crossings – follow the traditional Songlines, trade routes and ceremonial paths in Country that our nation's First Peoples followed for tens of thousands of years.

Transport for NSW is committed to honouring Aboriginal peoples' cultural and spiritual connections to the land, waters and seas and their rich contribution to society.

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1. Introduction

This section introduces the proposal and provides context for the environmental assessment. In introducing the proposal, the objectives and proposal development history are detailed and the purpose of the report provided.

1.1 Proposal identification

Transport for NSW (Transport) propose to remediate Slope 33459 (-33.536756, 150.420932), Slope 93282 (-33.542548, 150.423865) and Slope 96403 (-33.540781, 150.421356) on Bells Line of Road at Mount Tomah (the proposal) within the Blue Mountains local government area.

Bells Line of Road provides a vital link between Central West NSW and the Sydney road network. While the Great Western Highway remains the primary route across the Blue Mountains, Bells Line of Road performs as an important secondary route for cross-mountain traffic, as well as functioning as a local access road.

Following the extreme weather event of March 2021, Bells Line of Road has experienced slope failures along the road affecting the safety and usability of the road. Lane and road closures implemented have resulted in significant detours and increased travel times for road users. Stabilisation of these slopes would restore usability of Bells Line of Road as a safe and efficient road corridor.

Key details of each slope are described in Table 1-1.

Table 1-1: Key details of the Slope 33459, 96403, 93282

Location Details			
Title	Slope 33459	Slope 93282	Slope 96403
Road	Bells Line of Road: A two lane road, with one lane in each direction		
Co-ordinates	-33.536756, 150.420932	-33.542548,150.423865	-33.540781, 150.421356
Suburb	Mount Tomah		
Local Government Area	Blue Mountains City		
Slope Length	30 metres (slope) 70 metres (drainage)	50 metres	210 metres
Chainage of Works	Works are proposed at various locations along the slope, refer to Figure 3-1, Figure 3-2 and Figure 3-3		
Existing Environment	A steep, exposed slope up from Bells Line of Road vegetated with undergrowth and moderate tree cover. Blue Mountain Botanic Gardens adjacent to the south-east	A steep, exposed basalt slope up from Bells Line of Road vegetated with undergrowth and moderate tree cover.	A steep, sheltered basalt slope down from Bells Line of Road vegetated with undergrowth and higher tree cover.

The location of the proposal is shown in Figure 1-1 and an overview of the proposal is provided in Figure 1-2. Further details of the works proposed at each slope is provided in Section 3.2.3.

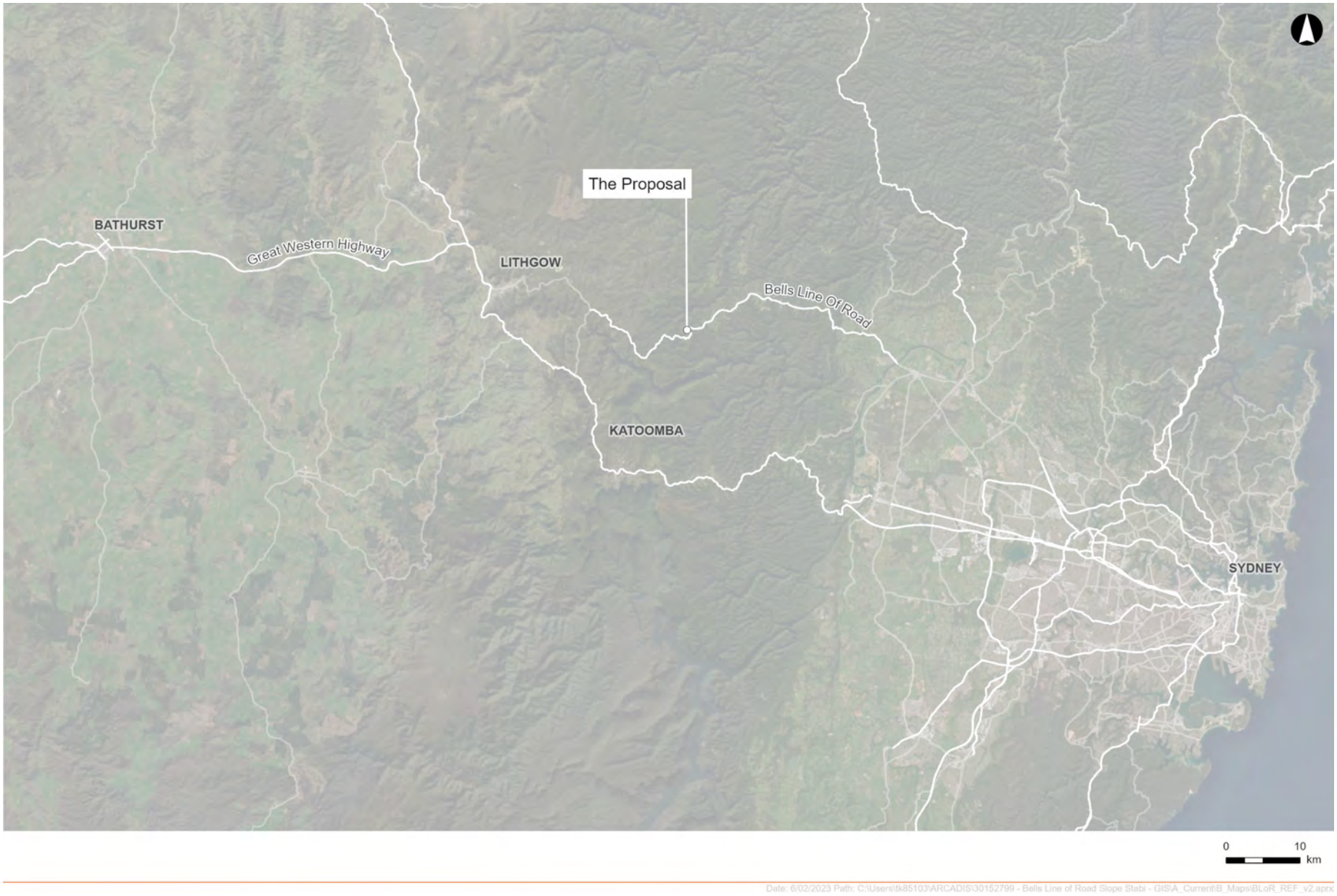


Figure 1-1: Location of the proposal

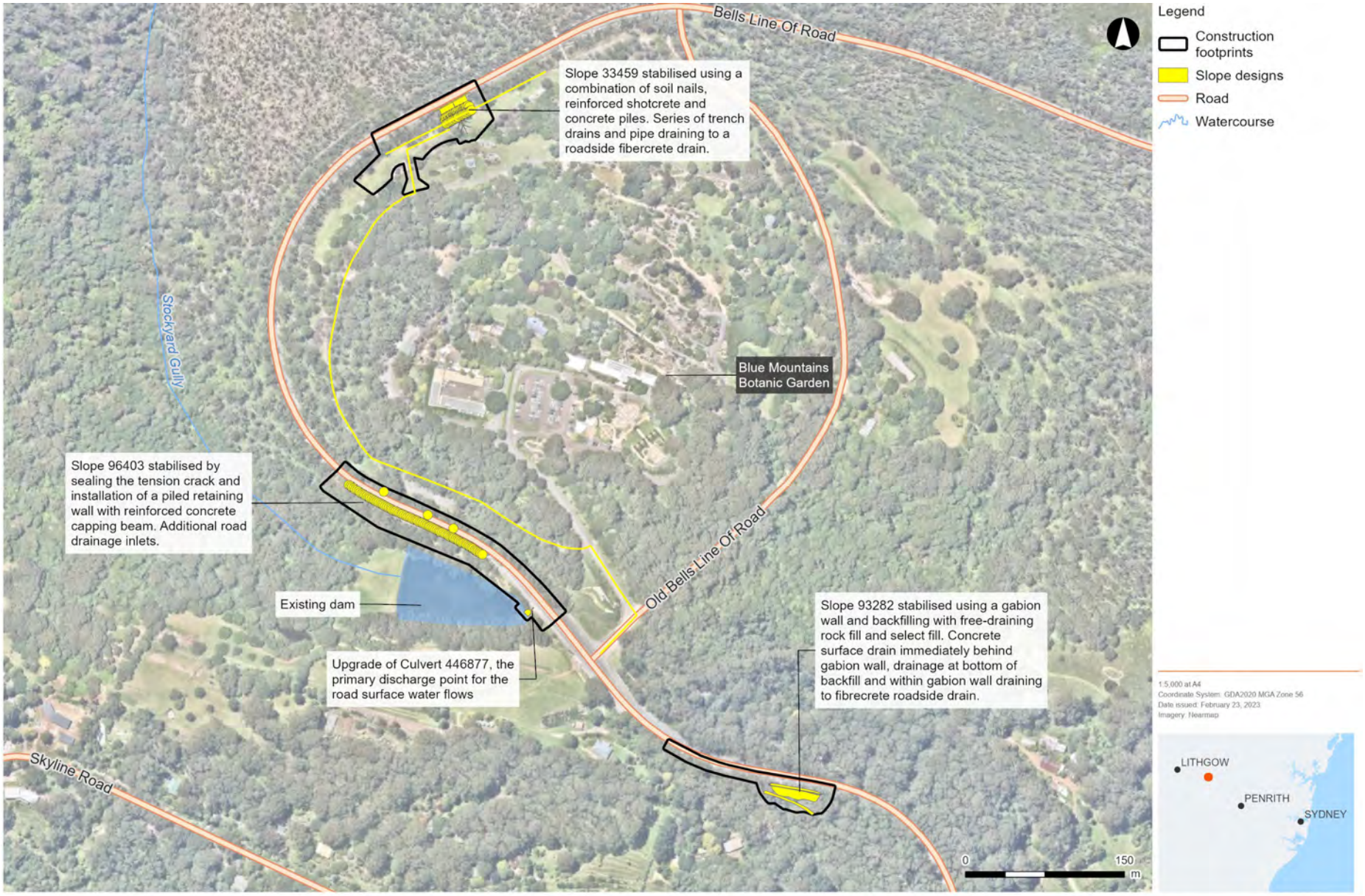


Figure 1-2: Overview of the proposal

1.2 Purpose of the report

This review of environmental factors (REF) has been prepared by Arcadis Australia Pacific Pty Ltd (Arcadis) on behalf of Transport. For the purposes of these works, Transport is the proponent and determining authority under Division 5.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

The purpose of the REF is to describe the proposal, to document the likely impacts of the proposal on the environment, and to detail mitigation and management measures to be implemented.

The description of the proposed work and assessment of associated environmental impacts has been carried out in the context of Section 171 of the Environmental Planning and Assessment Regulation 2021, the factors in *Guidelines for Division 5.1 assessments*, (DPE 2022), *Roads and Related Facilities EIS Guideline* (DUAP 1996), the *Biodiversity Conservation Act, 2016* (BC Act), the *Fisheries Management Act 1994* (FM Act) and the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

In doing so, the REF helps to fulfil the requirements of Section 5.5 of the EP&A Act including that Transport examine and take into account, to the fullest extent possible, all matters affecting or likely to affect the environment by reason of the activity.

The findings of the REF would be considered when assessing:

- Whether the proposal is likely to have a significant impact on the environment and therefore the necessity for an environmental impact statement to be prepared and approval sought from the Minister for Planning under Division 5.2 of the EP&A Act.
- The significance of any impact on threatened species as defined by the BC Act and/or FM Act, in section 1.7 of the EP&A Act and therefore the requirement for a Species Impact Statement or a Biodiversity Development Assessment Report
- The significance of any impact on nationally-listed biodiversity matters under the EPBC Act, including whether there is a real possibility that the activity may threaten long-term survival of these matters, and if offsets are required and able to be secured.

The potential for the proposal to significantly impact any other matters of national environmental significance or Commonwealth land and the need, subject to the EPBC Act strategic assessment approval, to make a referral to the Australian Department of Climate Change, Energy, the Environment and Water for a decision by the Commonwealth Minister for the Environment on whether assessment and approval is required under the EPBC Act.

2. Need and options considered

This section describes the need for the proposal in terms of its strategic setting and operational need. It identifies the various options considered and the selection of the preferred option for the proposal.

2.1 Strategic need for the proposal

Bells Line of Road forms one of two major routes which link the Sydney urban area with Lithgow and the NSW Central West region, through the Blue Mountains. The Great Western Highway is the other major route which links the Sydney urban area to the Central West of NSW.

Extreme weather events occurring in March 2021 resulted in the deterioration of several slopes along Bells Line of Road. This included the development of tension cracks and overall slope instability, further discussed in Section 2.2. In response to this lane and road closures have been enforced to maintain the safety of road, resulting in significantly increased travel times.

The proposal is required to improve slope stability, minimise the risk of slope failure, preserve the life of existing infrastructure and improve road safety.

2.1.1 NSW State Infrastructure Strategy 2022-2042

The State Infrastructure Strategy 2022-2042 (the State Infrastructure Strategy) (Infrastructure NSW, 2022) sets the strategic vision for infrastructure across NSW over 20 years and combined with the Future Transport Strategy 2056 and the Regional Development Framework (NSW Government, 2018), brings together infrastructure investment and land-use planning for cities and regions within NSW.

The State Infrastructure Strategy outlines Infrastructure NSW's recommendations for priority transport infrastructure projects and initiatives for NSW to 2042, to ensure the transport system creates opportunities for people and businesses to access the services and support they need.

The proposal aligns with the State Infrastructure Strategy by ensuring infrastructure is well maintained, leading to reliable service and a resilient asset while preserving the Bells Line of Road corridor for the future.

2.1.2 Future Transport Strategy 2056

The Future Transport Strategy 2056 (NSW Government, 2018a) outlines a 40-year vision to create and maintain a world class, safe, efficient and reliable transport system across NSW. There are a series of infrastructure and services plans that underpin the delivery of the strategic directions and customer outcomes. The proposal is consistent with the key objective to prioritise the maintenance of the critical transport infrastructure asset that is Bells Line of Road.

2.1.3 Regional NSW Services and Infrastructure Plan

For Regional NSW, the Future Transport Strategy 2056 is supplemented by the Regional NSW Services and Infrastructure Plan (NSW Government, 2018b) which identifies initiatives required in the short, medium and long term to meet customer needs now and into the future.

The Bells Line of Road is noted as a key inland connection between Central West NSW and Greater Sydney, highlighting the importance of ongoing maintenance and improvements.

2.1.4 Bells Line of Road Long Term Strategic Corridor Plan

In 2012, the Australian and NSW governments completed a Long Term Strategic Corridor Plan for Bells Line of Road to identify improvement works and set priorities for the next 20 years and beyond.

The Plan identified some locations where the existing horizontal and vertical road geometry falls below current road standards and guidelines. Identified in the short and medium term improvements to the existing corridor was the risk of steep embankments that are prone to land slips. The plan noted the ongoing program of slope evaluation and stabilisation carried out by the former Roads and Maritime Services (now Transport for NSW).

2.1.5 Beyond the Pavement

Beyond the Pavement (Transport, 2020) is the overarching Transport policy guiding urban design on all of its projects. One of the four physical design objectives adopted to achieve Transport's commitment is that the project should fit sensitively into the existing environment of the site. The proposal is consistent with this objective by utilising stabilisation techniques that are commonly used throughout the Transport road network, including gabion walls and shotcrete.

2.2 Limitations of existing infrastructure

Bells Line of Road is a 59-kilometre major road that provides an alternate crossing of the Blue Mountains to the Great Western Highway. Following the extreme weather events of March 2021, several slopes along Bells Line of Road have seen severe condition deterioration. The high levels of rainfall experienced during this event has led to disturbances in the soils that allows rain to build up in tension cracks along the affected slopes. This caused the ground to become highly unstable on both sides of the road and Bells Line of Road experienced slope failures, which affects the safety and usability of the road. Figure 2-1 provides a cross-sectional view of the current condition of the affected slopes along Bells Line of Road as well as the increased potential for slope failure following heavy rainfall.

Current efforts to maintain a high level of safety for road users has involved lane and road closures, resulting in significant detours and increased travel times for road users.

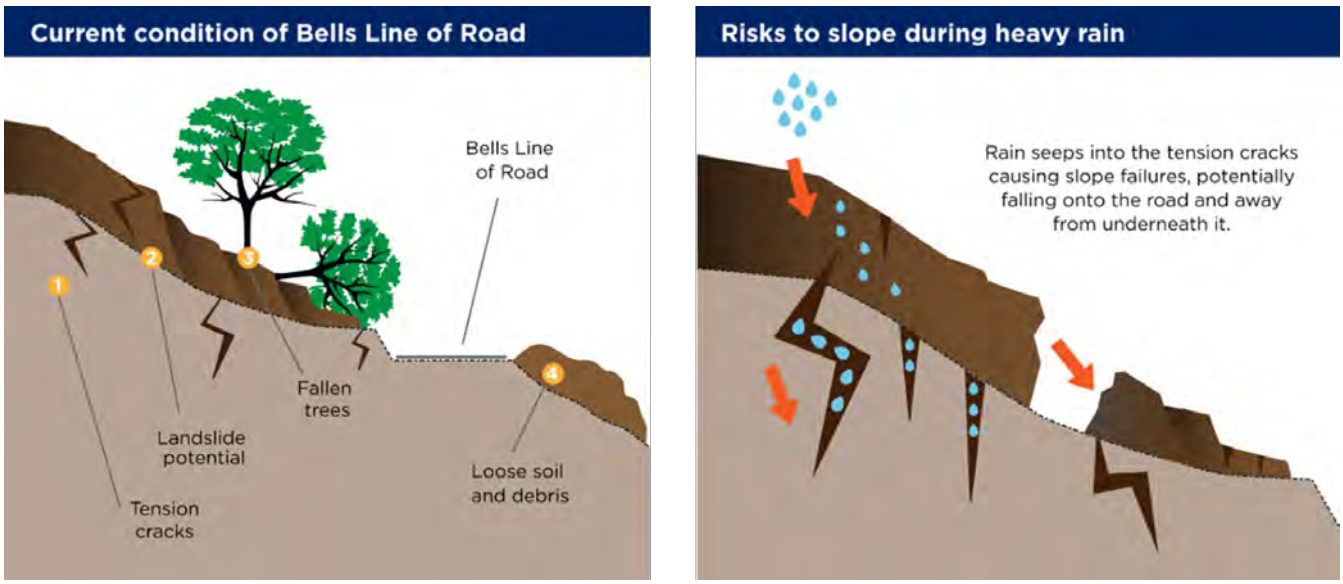


Figure 2-1: Current condition of affected slopes and potential safety risks (Source: https://roads-waterways.transport.nsw.gov.au/projects/west-region-projects/bells-line-road/index.html)

2.3 Proposal objectives

The objectives of the proposal are to:

- Improve the slope stability and minimise the risk of slope failure, reducing the risk to at least Assessed Risk Level 3 (ARL 3) in accordance with *Guide to Slope Risk Analysis* (Roads and Maritime Services, 2014)
- Preserve the life of existing infrastructure
- Improve road user safety.

2.4 Alternatives and options considered

2.4.1 Methodology for selection of the preferred option

The options considered for the proposal were assessed against the proposal objectives outlined in Section 2.3.

2.4.2 Identified options

Two options were considered during development of the proposal:

- Option 1 "do nothing" – No slope stabilisation works would be undertaken. The unstable and/or failed slopes would remain in their existing condition and continue affecting the safety and usability of the road. To maintain a high level of safety, current lane and road closures would remain in place.
- Option 2 "slope stabilisation" – carry out stabilisation of the three failed slopes (the proposal) restoring road and shoulder availability for traffic function. Partial road closures would be required during construction to facilitate the works.

2.4.3 Analysis of options

An assessment of options against the proposal objectives is provided in Table 2-1.

Table 2-1: Assessment of options against the proposal objectives

		Option 1	Option 2
Proposal objectives	**Improve the slope stability and minimise the risk of slope failure, reducing the risk to at least Assessed Risk Level 3 (ARL 3) in accordance with *Guide to Slope Risk Analysis* (Roads and Maritime Services, 2014)**	This option would not improve the stability of the slopes and would not minimise the risk of slope failure. **Does not meet criteria** ☒	The proposed works would stabilise the slopes and reduce the risk of slope failure to ARL 3 at each slope. **Does meet criteria** ☑
	Preserve the life of existing infrastructure	Without stabilisation, the slopes may continue to fail, further threatening the integrity of the adjacent road and road infrastructure. **Does not meet criteria** ☒	The slope stabilisation designs including pile reinforcement, soil nails and gabion wall are designed for a 100-year design life. Stabilisation works would preserve the longevity of the road by increasing stability and reducing risk of future failures at these locations. **Does meet criteria** ☑
	Improve road use safety	Without stabilisation, the slopes may continue to fail, posing a continued safety risk to road users. **Does not meet criteria** ☒	Stabilising the slopes would repair the road and reduce the risk of continued failure at these locations, thereby improving safety of Bells Line of Road for road users. **Does meet criteria** ☑

3. Description of the proposal

This section describes the proposal and provides descriptions of existing conditions, the design parameters including major design features, the construction method and associated infrastructure and activities.

3.1 The proposal

In response to slope failures caused by the extreme weather events of March 2021, Transport proposes to stabilise Slope 33459, Slope 96403 and Slope 93282 on Bells Line of Road at Mount Tomah, located about 25 kilometres east of Lithgow in the Blue Mountains local government area.

Key features of the proposal have been detailed in Table 3-1 and is shown in Figure 3-1, Figure 3-2 and Figure 3-3.

Table 3-1: Key features and existing environment of Slope 33456, Slope 93282 and Slope 96403

Slope	Existing Environment	Key Features
33459	The slope is a cutting approximately 30 metres long and sits on interlaminated siltstone (80%) and sandstone (20%) above Bells Line of Road. Existing trees are bushfire affected and the Blue Mountains Botanic Garden is intending to remove them. Upon consultation, the Garden stated they would remove the tree prior to these proposed works commencing. Geology Interlaminated siltstone, fine grained, pale grained, pale grey stained orange-brown topped with high plasticity clays, orange-brown and grey clays, trace gravels, stiff to very stiff	Slope stabilisation – A combination of three rows of three metre deep soil nails, reinforced shotcrete and concrete piles Drainage – Trench drains made up of a one metre wide central trench with five 600mm wide limb trenches adjoining – Trench drain leads to a 900 x 900 x 1350mm drainage pit – 225mm drainage pipe recessed into the slope prior to shotcrete which drains to a roadside fibrecrete Roadside Furniture – Chain mesh fence marking the boundary between the road reserve and the Blue Mountains Botanic Gardens
93282	The slope is a cutting approximately 50 metres long and sits on siltstone above Bells Line of Road, Geology Siltstone, pale grey, laminated (siltstone and fine-grained sandstone), medium to slightly weathered. Topped with clayey sandy silt, high plasticity, dark brown	Slope Stabilisation – Rock-filled gabion wall ranging from one to four metres in height to be installed on a reinforced concrete base layer – Shotcrete on bottom row of gabion baskets – Backfill slope behind wall with free-draining rock fill and compacted select fill and covered with topsoil and jute Drainage – Concrete surface drain installed behind the top of the gabion wall – Corrugated perforated drainage pipe installed under free-draining rock – Pipe installed at the base of each gabion basket – Fibrecrete drain installed along the edge of Bells Line of Road adjacent to the gabion basket Roadside Furniture – Linemarking will be repainted

Slope	Existing Environment	Key Features
96403	The slope is a cutting approximately 210 metres long and sits on a subsurface of interlaminated siltstone (80%) and sandstone (20%) above Bells Line of Road. Geology Interlaminated siltstone, fine grained, pale grained, pale grey stained orange-brown topped with high plasticity clays, orange-brown and grey clays, trace gravels, stiff to very stiff	Slope stabilisation – Tension crack to be sealed with bentonite and road pavement materials – Installation of a piled retaining wall consisting of 80 bore piles, each measuring 900mm in diameter and 11.4 to 13.5m deep with a reinforced concrete capping beam linking the piles – Repair of pavement impacted by retaining wall construction including reconstruction of surface and subsurface pavement Drainage – Installation of three additional inlet pits – Upgrade of culvert outlet point which involves restoring broken lintel, reshaping outlet channel, installing a trench drain outlet and installing a rock mattress Roadside Furniture – Guardrail on the westbound kerb will be reinstated and line marking will be repainted

Key features of the proposal are discussed further in Section 3.2.3.

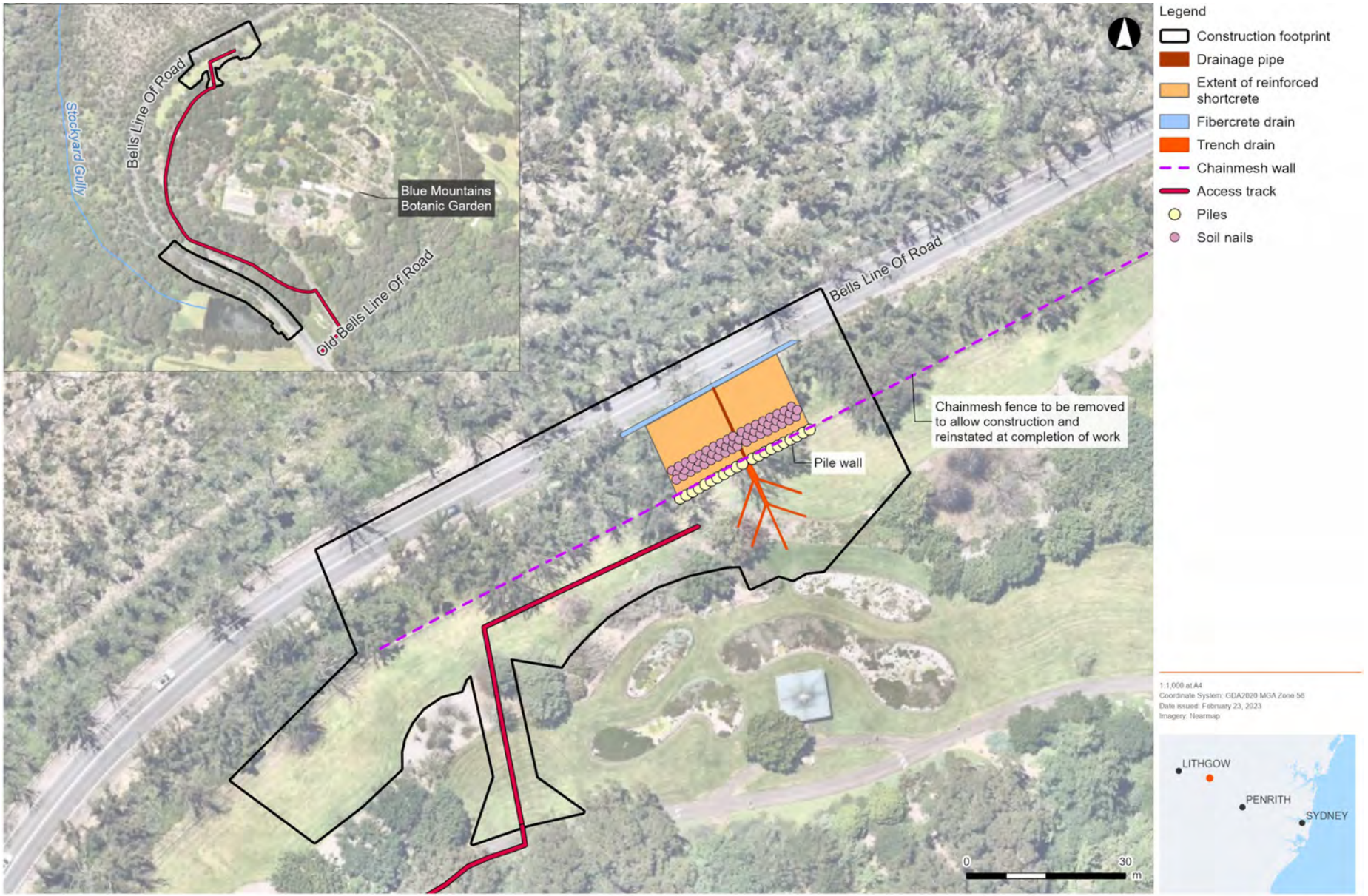


Figure 3-1: Key features of the proposal – Slope 33459

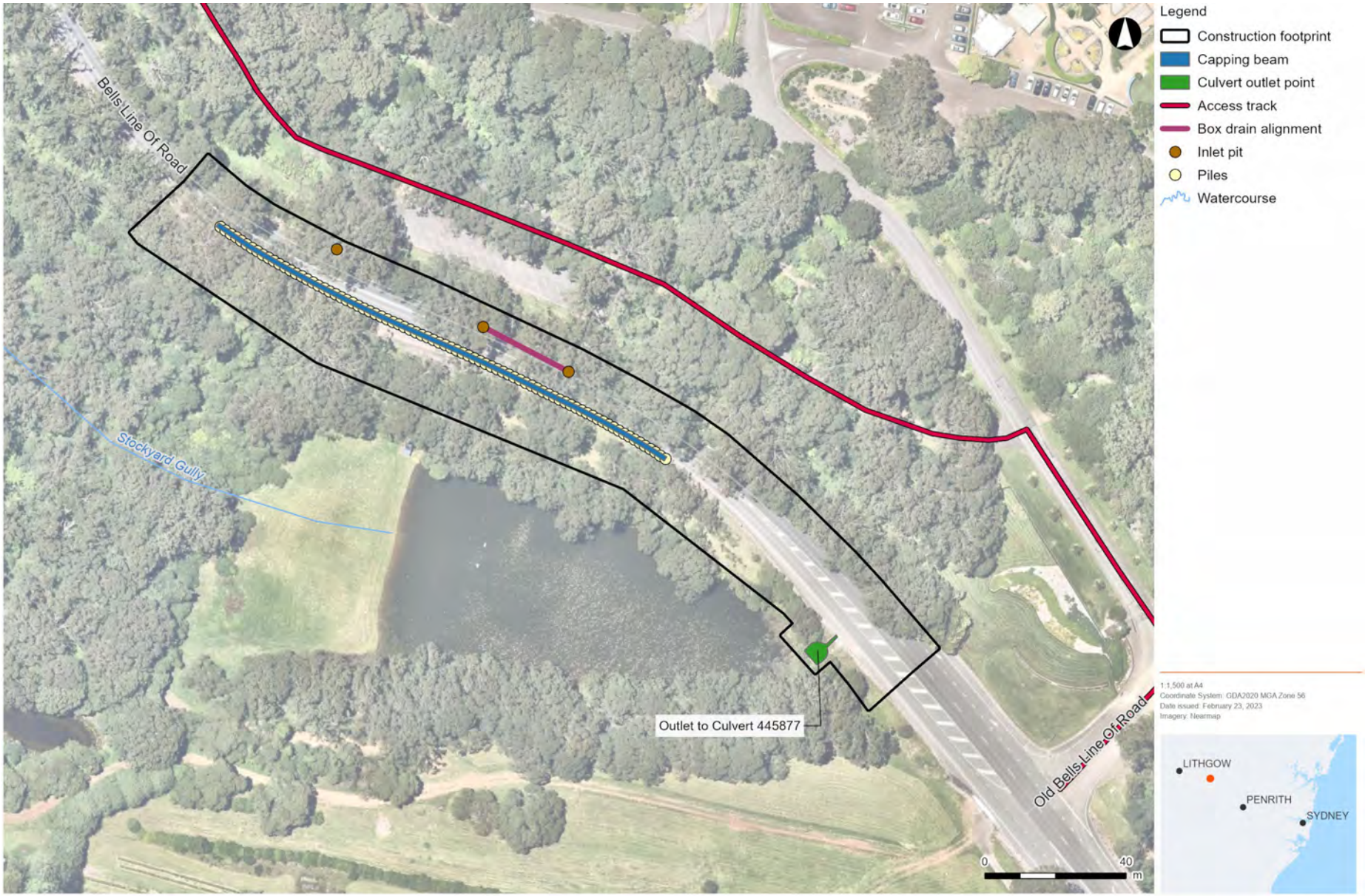


Figure 3-2: Key features of the proposal - Slope 96403

Figure 3-3: Key features of the proposal – Slope 93282

3.2 Design

The method of stabilisation at each slope has been prepared in accordance with Transport for NSW project specifications, design standards and guidelines as follows:

- Materials Specifications:
  - 3071 – Selected Material for Formation Layers
  - 3211 – Cements, Binders and Fillers
  - 3400 – Manufacture and Delivery of Road Signs
  - 3411 – Supply of Guide Posts
  - 3356 – Waterborne Road Marking Paint
  - 3552 – Subsurface Drainage Pipe
  - 3553 – Seamless Tubular Filter Fabric
  - 3557 – Flexible Strip Filter Drains
  - 3580 – Aggregate Filter Materials for Subsurface Drainage
- Australian and International Standards:
  - AS 1289 Methods of testing soils for engineering purposes – Soil compaction and density tests – Determination of the dry density/moisture content relation of a soil using standard compactive effort
  - AS 1726 Geotechnical site investigations
  - AS 2159 Piling design and installation
  - AS 5100.2 Bridge design – Design loads
  - AS 5100.3 Bridge design – Foundations and soil-supporting structures
  - ASTM.A975.97 Standard Specification for Double-Twisted Hexagonal Mesh Gabions and Revet Mattresses (Metallic-Coated Steel Wire or Metallic-Coated Steel Wire With Poly(Vinyl Chloride) (PVC) Coating)
  - AustRoads guides and Transport supplements.

3.2.1 Design criteria

Table 3-2 presents key design criteria for the proposal. This information represents the standard to which the proposal would be designed and constructed.

Table 3-2: Design criteria

Design Element	Slope 33459	Slope 93282	Slope 96404
Design life of slopes	100 years		
Slope Risk Level	ARL 3 in accordance with *Guide to Slope Risk Analysis* (Roads and Maritime Service, 2014)		
Design loadings	Structural dead load 10kPa maintenance load Construction load	Structural dead load 20kPa design surcharge 150kN barrier impact load Construction load (40T piling rig)	20kPa design surcharge
Stability – minimum factor of safety	Construction (short term) – 1.2 Operations (long term) – 1.5	Construction (short term) – 1.2 Operations (long term) – 1.3	Construction (short term) – 1.25 Operations (long term) – 1.4

Design Element	Slope 33459	Slope 93282	Slope 96404
Pile Capacity	As per design standard		

3.2.2 Engineering constraints

Engineering constraints considered in the design of the proposal include site accessiblity and safety, construction staging and availability of construction ancillary facility sites, as discussed below.

Surface water management

Surface water saturation factored into the instability and subsequent failure of Slopes 33459 and 96403. As such, management of surface water and drainage solutions needed to be included in the design.

Surface water from the Blue Mountains Botanic Garden has created an unstable plane of rock at the top of Slope 33459 which the proposed trench drain design would stabilise.

The two existing inlet drainage pits across Bells Line of Road from Slope 96403 are frequently blocked by leaf litter, causing overflow of the existing drain leading to water draining onto the slope. This water saturation destabilises the ground surface and increases the risk of slope failure.

Site accessibility and safety

Given the topography of the area, steep roadside cuts and active use of Bells Line of Road, safe access to the three slopes during construction is difficult. Slope 33459 would be accessed via the Blue Mountains Botanic Garden and Bells Line of Road. Slope 96403 would be accessed via Bells Line of Road and an access track parallel to and south of Bells Line of Road that is owned and maintained by the Blue Mountains Botanic Garden. Slope 93282 would be accessed via Bells Line of Road and an unnamed access track off Skyline Road. To ensure the safety of construction personnel and road users, traffic management measures that include partial road closures would be required. Closures are discussed further in Section 3.3.7.

Traffic management and construction staging

The proposal construction staging strategy needs to be structured to be feasible and meet proposal needs, with particular consideration given to managing traffic flows in both directions through portable traffic signals. This would be done in a way that ensures minimal impact of lane closures affecting the usability of Bells Line of Road.

Availability of construction ancillary facility sites

Cleared and level land available for ancillary facilities near the proposal is limited. Section 3.4 describes the ancillary facilities that would be required for construction of the proposal.

3.2.3 Major design features

The major design features of the proposal are described below and shown in Figures 3-1 to 3-8.

Slope 33459

Stabilisation

Slope 33459 would be stabilised by cutting and trimming the slope face to design level and using a combination of soil nails, reinforced shotcrete and concrete piles. Three rows of three-metre soil nails would be installed on the slope. Reinforcements, dowels and strip drain with weepholes would be installed, followed by the slope being sprayed with shotcrete. A wall of 21 piles would be installed near the crest of the slope, with each pile measuring 450 millimetres in diameter and a minimum of seven metres deep with one metre rock sockets. The piled wall would extend five metres beyond the slide tension crack at each side.

Drainage

A series of trench drains would be installed on the grassy area above Slope 33459. There would be a one-metre-wide central trench, with five 600-milimetre-wide limb trenches adjoining. These drains would lead to a 900 by 900 by 1350-milimetre drainage pit near the crest of the slope. A 225-milimetre diameter drainage pipe would be recessed into the slope prior to shotcrete placement and would drain to a roadside fibrecrete drain. Excavation trenches for the trench drains would be up to three metres in depth.

Property access

As shown in Figure 3-1, primary access to Slope 33459 would be via existing sealed internal roads inside the Blue Mountains Botanic Garden. A temporary three-metre-wide access track would be constructed from the existing road to the construction works area. The construction works area would allow adequate space for vehicles to turn around and egress via the same track. Slope 33459 would also be accessed via the westbound lane of Bells Line of Road which would be closed for the duration of construction.

Roadside furniture

At the completion of construction, the chain mesh fence marking the property boundary between the Blue Mountains Botanic Garden and the road reserve would be reinstated. Line marking on Bells Line of Road would be repainted, as required.

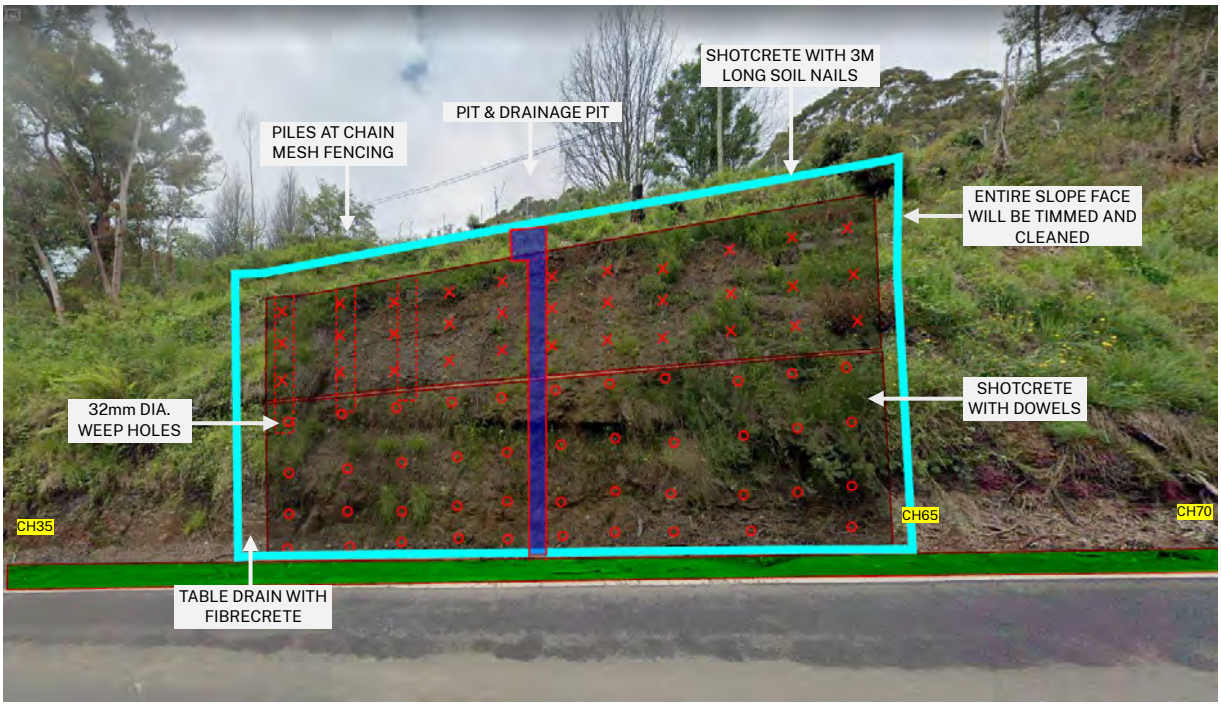


Figure 3-4 Existing site features and key features of Slope 33459 - View from bottom of slope

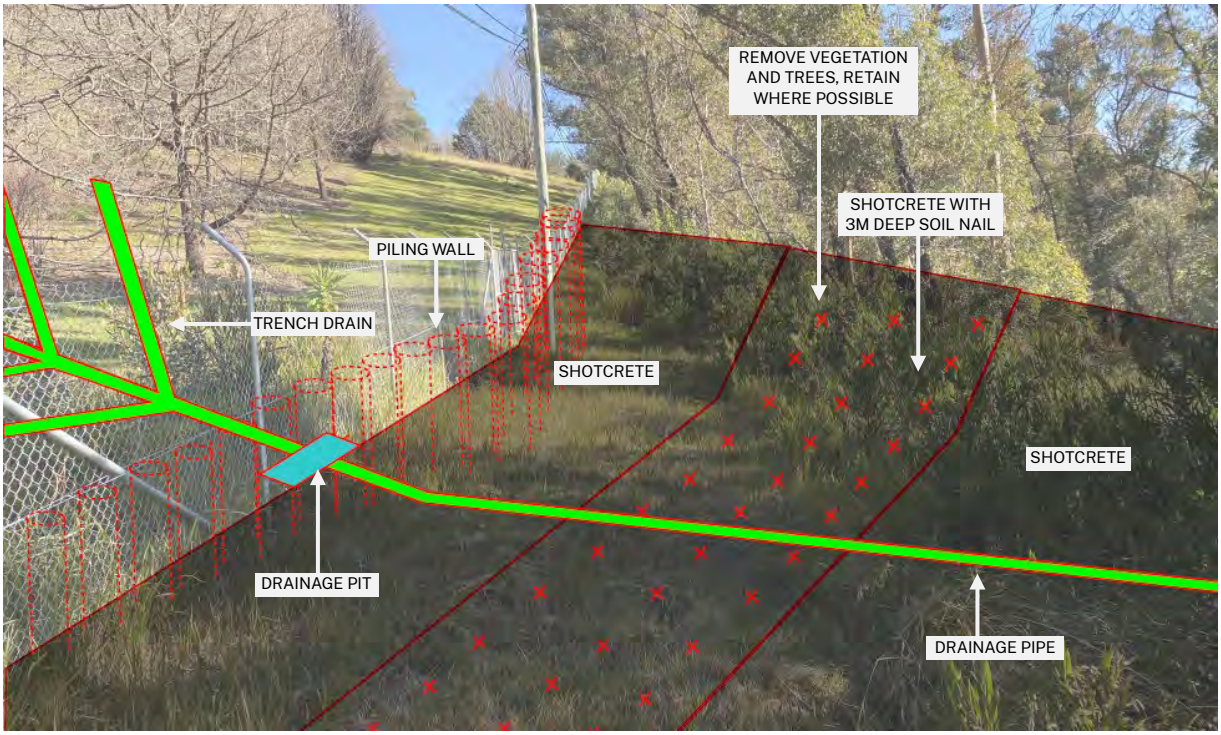


Figure 3-5 Existing site features and key features of Slope 33459 – View from top of slope

Slope 96403

Stabilisation

Slope 96403 would be stabilised by sealing the tension crack with bentonite and road pavement materials and the installation of a piled retaining wall. The piled retaining wall would consist of 80 bore piles with each pile measuring 900 millimetres in diameter and 11.4 to 13.5 metres deep, and a reinforced concrete capping beam on top linking the piles.

Drainage

The existing drainage system in the vicinity of Slope 96403 has been reviewed and is at capacity. The primary catchment contributing to the existing drainage system is from the Blue Mountains Botanic Garden. Additional inlet pits would be installed on the westbound curb kerb to assist in reducing peak surface flows to Bells Line of Road drainage systems and improve the road drainage system to manage road reserve catchment flows. Stormwater running on the eastbound kerb of Bells Line of Road would run along the surface against the kerb. This would discharge via a dedicated outlet at the existing culvert at the eastern edge extent of the works (Culvert 446877).

The culvert outlet, which drains into manmade dam southwest of Bells Line of Road on Blue Mountains Botanic Garden land, would be upgraded. This would involve restoring the broken lintel, reshaping the outlet channel, installing a trench drain outlet and installing a rock mattress.

Property access

As shown in Figure 3-2, access to Slope 96403 would be via the Bells Line of Road. The eastbound lane and the eastbound lane would be closed for the duration of construction. The lane closures may occur simultaneously. The Blue Mountains Botanic Garden access track would also be used for visual inspection and assessment of the eastern side of the road. No plant or equipment would be permitted without prior approval from Blue Mountains Botanic Garden.

A temporary access track would be constructed within the road reserve from Bells Line of Road to Culvert 446877 to enable safe access down the slope for a mini excavator and construction personnel.

Roadside furniture

At the completion of construction, the guard rail on the eastbound kerb would be reinstated and the line marking on Bells Line of Road would be repainted, as required.

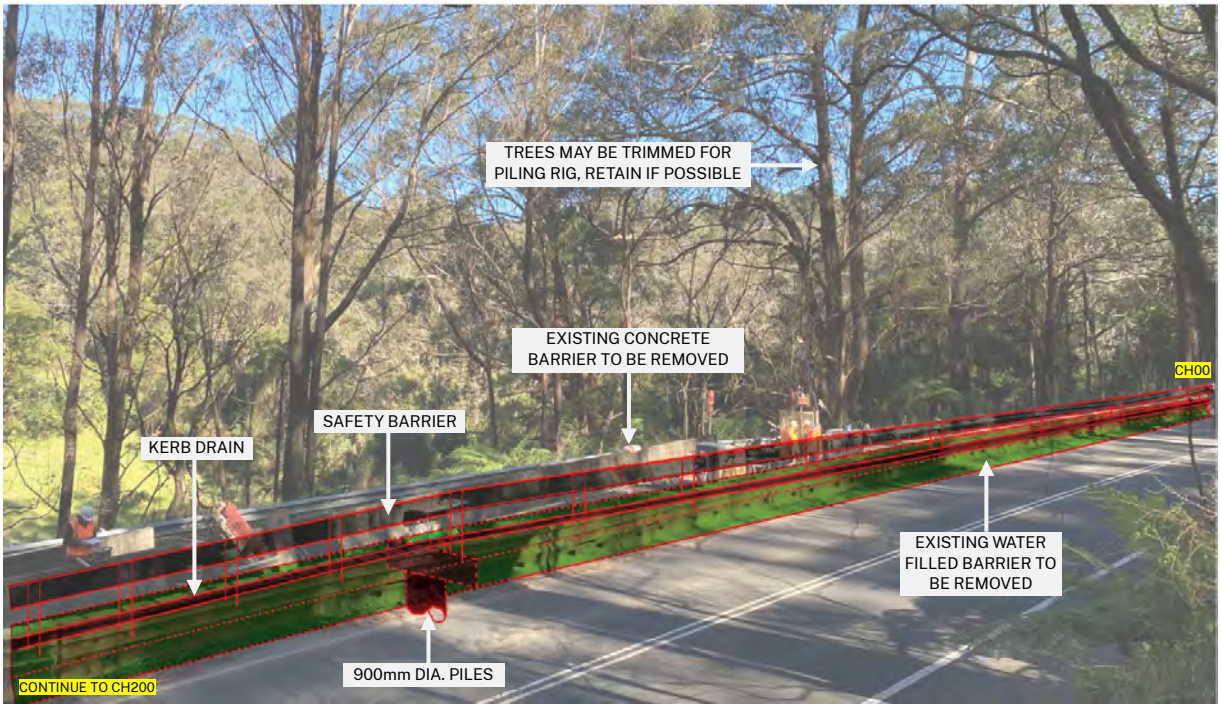


Figure 3-6 Existing site features and key features of Slope 96403 looking south at works along the westbound lane

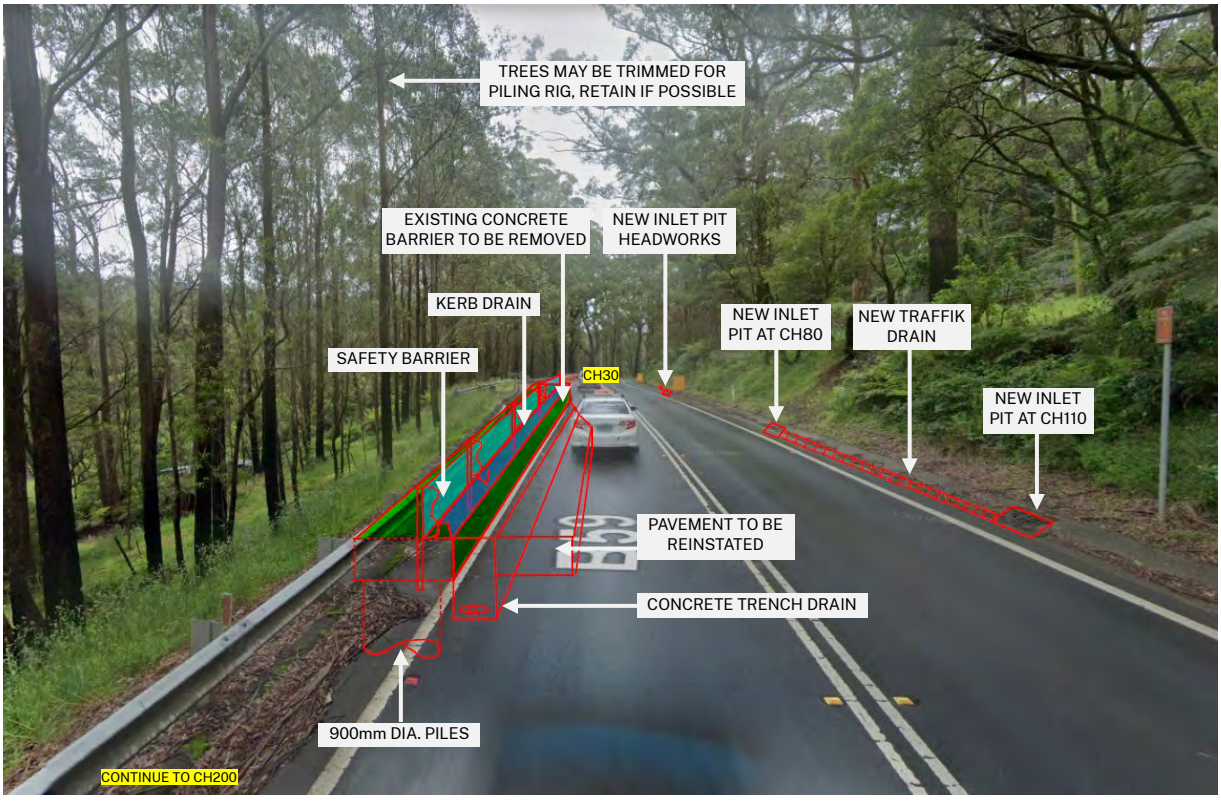


Figure 3-7 Existing site features and key features of Slope 96403

Slope 93282

Stabilisation

Slope 93282 would be stabilised by removing trees, cutting and trimming the slope face and installation of a gabion wall. Rock-filled gabions would be installed on top of a reinforced concrete base layer. The wall would range from one to four metres in height depending on the height of the slope. The bottom layer of gabion baskets would be sprayed with shotcrete. The slope behind the wall would be backfilled with a layer of free-draining rock fill and compacted select fill and covered with topsoil and jute.

Drainage

A concrete surface drain would be installed immediately behind the top of the gabion wall to capture runoff from the above slope. Behind the base of the gabion wall, a corrugated perforated drainage pipe would be installed under the free-draining rock fill to capture any flow that permeates through and avoid water building up behind the gabion wall. As the bottom layer of gabion baskets would be sprayed with shotcrete, a pipe would be installed at the base of each basket to allow water to drain out. A fibrecrete drain would be installed along the edge of Bells Line of Road adjacent to the gabion wall.

Property access

Access to Slope 93282 would be via the Bells Line of Road or via an existing access track from Skyline Road (shown in Figure 3-3).. The eastbound lane would be closed for the duration of construction.

Roadside furniture

At the completion of construction, line marking on Bells Line of Road would be repainted. The existing type of concrete barrier will be removed and disposed of.

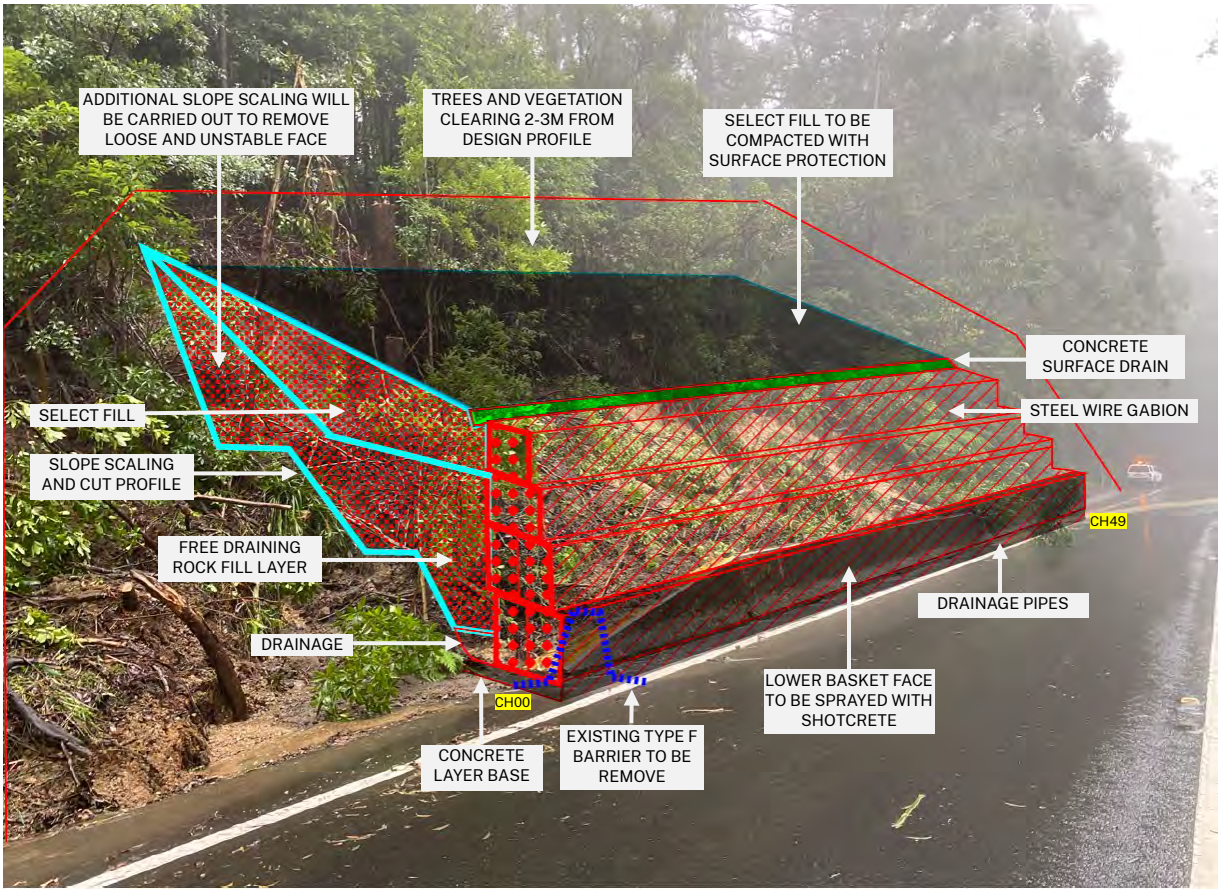


Figure 3-8: Existing site features and key features of Slope 93282

3.3 Construction activities

This section provides a summary of the likely methodology, staging, work hours, plant and equipment, and associated activities that would be used to complete the proposal. An indicative construction methodology has been provided for this REF and may need to be modified following the appointment of a construction contractor.

A construction environmental management plan (CEMP) would be developed for the proposal. The methods used would be consistent with statutory requirements, including any work, health and safety regulations and conditions of approval issued following determination of the proposal. Environmental mitigation and management measures specific to this proposal are included in Section 7. The CEMP would be consistent with these measures.

3.3.1 Work methodology

The indicative construction work methodology associated with each slope is described in Table 3-3.

Table 3-3: Indicative construction activities

Component	Typical activities

Pre-construction and site establishment	– Finalise site surveys, geotechnical and other investigations
	– Demarcation of the proposal construction footprint and installation of temporary safety barriers and fencing
	– Installation of erosion and sediment controls
	– Set up of temporary traffic arrangements (as described in Section 3.3.7)
	– Pre-clearance biodiversity surveys for vegetation clearing
	– Mobilisation and establishment of ancillary facilities (as described in Section 3.4)
	– Construct a temporary three metre access track to Slope 33459 from the Blue Mountains Botanic Garden
	  – Lay geofabric along the footprint of the track
	  – Lay and compact hardstand material on top of the geofabric to create a firm base for the hardstand.

Vegetation removal	– Trees would be removed through the use of chainsaws, elevated work platforms (EWPs), crane or rope access – Removed trees would be mulched or chipped onsite, if time allows, before transportation offsite in trucks. Any vegetation not mulched or chipped during shift would be temporarily stored at ancillary facilities to be later taken off site for mulching and disposal.

Slope stabilisation	**Slope 33459**
	– Seal tension crack with bentonite and road pavement materials
	– Install trench drains and pit
	  – Excavate one-metre-wide longitudinal ‘spine’ trench drain first up to three metres in depth, then install geotextile, 100-milimetre bedding layer of rock filter material
	  – Lower the pipe into the trench, then cover with rock backfill and compact
	  – Following completion of the main trench, excavate each 600-millimetre-wide limb trench from downslope to upslope up to three metres in depth
	  – Shoring boxes would be used to avoid trench side wall collapse due to the poor stability of the ground
	  – If large basalt boulders are encountered, a rock breaker may be required
	  – If significant infiltration is experienced, a sump would be used to pump water out of trench
	  – Each trench would be fully completed prior to progressing to the next trench
	– Slope stabilisation
	  – Slope scaling
	  – Slope face cutting and trimming

Component	Typical activities
	– Install soil nails, reinforcement, anchors and shotcrete – Cut slot and install one 225-millimetre down pipe flush with existing cut profile – Install soil nails in rows from top to bottom – Install reinforcement, anchors and strip drain with weepholes – Spray shotcrete – Install fibrecrete drain – Mark out, bore and pour concrete piles – Level ground by filling, laying hard stand and installing metal plates along the pile rig movement area. – Mark out and bore piles. If basalt boulders are encountered in the upper colluvium layer, a hydraulic rock breaker may be required – Clean, install cages and pour concrete. **Slope 96403** Seal tension crack with bentonite and road pavement materials – Mark out, bore and pour concrete piles – Level the ground by filling, make it hard stand & install metal plates along the pile rig movement area. – Mark out and bore piles. If basalt boulders are encountered in the upper colluvium layer, a hydraulic rock breaker may be required – Clean, install cages and pour concrete. – Install concrete capping beam on top of pile caps – Repair the pavement where impacted by retaining wall construction including reconstruction of surface and subsurface drainage – Drainage improvement works to occur at any time – Install new safety barrier and kerb – At Culvert 445877 outlet, restore broken lintel, reshape outlet channel by cut and fill, install drain outlet and install rock protection / rock mattress **Slope 93282** – Loose rock would be lightly scaled and removed using an excavator – Trim slope to remove excess loose material and achieve design profile – Excavate to gabion wall foundation level and pour concrete base – Place lower level of gabions and rock fill

Component	Typical activities
	– Install geotextile and drainage layer behind gabion wall, place backfill and compact – Progressively install gabion levels and backfill as described above in six-metre sections – Install concrete drain and fibrecrete drain
Finishing work	– Remove excess material due to works by hand or with mechanical aid such as excavator, bobcat or roadsweeper – Clean drains with or adjacent to work areas of any fallen rocks and debris – Rehabilitation of disturbed areas – Installation of safety barrier (at Slope 96403) and line marking – Removal of temporary access track (at Slope 33459) and rehabilitate grassed areas to their previous condition – Decommission and rehabilitation of ancillary facilities.

3.3.2 Construction workforce

The indicative construction workforce required for each slope is described provided in Table 3-4.

Table 3-4: Indicative construction workforce

	Slope 33459	Slope 96403	Slope 93282
Indicative workforce (full time equivalents)	31	48	25

3.3.3 Construction hours and duration

Subject to planning approval, the proposal is expected to commence in early 2023. The commencement and duration of each slope stabilisation work is as follows:

- Slope 33459: 12 to 14 weeks
- Slope 96403: 16 to 18 weeks
- Slope 93282: 10 to 12 weeks.

The delivery of Slopes 33459 and 93282 would occur concurrently. The duration of work may be extended in the event of poor weather conditions. The sequencing of work would be confirmed upon engagement of a construction contractor.

Construction would be carried out within the standard construction hours as defined in the Interim Construction Noise Guideline (DECCW, 2009):

- 7 am to 6 pm Monday to Friday
- 8 am to 1 pm Saturday
- No work on Sunday or public holidays.

Some works would be conducted outside standard construction hours, for the safety of workers and to minimise traffic disruption. Any work outside of standard construction hours would be carried out in accordance with the *Construction Noise and Vibration Guidelines* (Roads and Maritime, 2016), any road occupancy licence requirements and the environmental management measures listed in Section 7.

Potential construction work that would be carried out outside of standard construction hours is described in Table 3-5.

Table 3-5: Potential work outside of standard construction hours

Activity	Justification
Slope 33459 soil nailing and shotcrete works	Additional road space may be required to safely position soil nail drilling machine and concrete trucks. This would require closure of one lane of Bells Line of Road. Works may be carried out at night over about two weeks to minimise traffic impacts on road users as a result of partial road closure.
Slope 96403 southern section piling works	Pending confirmation of the construction contractors equipment availability, additional road space may be required to safely position the piling rig to bore the 900 millimetre piles. This will require closure of one lane of Bells Line of Road. Works may be carried out at night over four to six weeks to minimise traffic impacts on road users as a result of partial road closure.

3.3.4 Plant and equipment

Indicative plant and equipment required during slope stabilisation works would include, but not be limited to:

- Large excavator
- Piling rig
- Auger
- Long reach excavator
- Soil nail drill
- Rock breaker
- Backhoe loader
- Excavator operated crane
- Concrete truck
- Concrete pump
- Elevated working platform
- Forklift
- Loader
- Water carting truck
- Fuel tanker
- Light and heavy vehicles
- Compactor
- Compressor
- Water pump
- Generator
- Welding and steel cutting equipment.

The final list of plant and equipment required would be determined upon finalisation of the construction methodology by the construction contractor.

3.3.5 Earthworks

The proposal would require various earthwork activities, including:

- Trimming of affected slopes and removal of loose material
- Excavation of drainage trenches at Slope 33459
- Levelling ground to ensure safe and correct use of machinery, such as the pile auger
- Pile boring at Slopes 33459 and 96403
- Excavation for gabion wall foundation at Slope 93282
- Backfilling behind the gabion wall foundation at Slope 93282
- Topsoiling and re-vegetation of disturbed areas.

About 500 cubic metres of excavated material would be generated at Slope 93282. This material is proposed to be spread and compacted at Ancillary Facility 6, as described in Section 3.4. All other excavated material would be disposed of appropriately at a licensed facility as per this REF and the future construction contractor's CEMP.

3.3.6 Source and quantity of materials

Construction would require various resources and materials. Typical materials that would be used for the proposal and estimated quantities are presented in Table 3-6. Construction materials would generally be sourced from offsite suppliers. Locally sourced materials would be used where possible to minimise haulage distances and support the local economy. Material source would comply with relevant Transport material quality specifications.

Table 3-6: Typical construction materials and approximate quantities

Material	Quantity		
	Slope 33459	Slope 96403	Slope 93282
Concrete	338 m^3	775 m^3	37 m^3
Steel	4 tonnes	93 tonnes	0.5 tonne
Bentonite / Cement mix	7 m^3	14 m^3	-
Gabion rocks	-	15 m^3	267 m^3
Import select fill	9 m^3	-	-
Aggregates	74 m^3	-	-

Material	Quantity		
	Slope 33459	Slope 96403	Slope 93282
Soil nails	58	-	-
Asphalt	-	32 m^3	-
Road base and sub-base	-	66 m^3	-

3.3.7 Traffic management and access

Temporary traffic management arrangements

Construction of the proposal would be subject to comprehensive traffic management measures to ensure the ongoing functionality of Bells Line of Road, and the safety of the public, motorists and construction personnel.

The proposed temporary management arrangements would involve the reduction of posted speed limit to 60 kilometres per hour, reduced to 40 kilometres per hour for certain high-risk deliveries and activities, and the installation of portable traffic signals to manage one-lane two-way traffic operation for the duration of construction at each slope. For Slope 33459 and 93282, sections of the westbound and eastbound lanes, respectively, would be closed at the same time. A section of the westbound lane would be closed for Slope 96403. Additionally, traffic controllers would be in place at the ancillary facilities located along Bells Line of Road to ensure safe egress where there may be poor line of sight.

These arrangements would be refined during further development of the construction methodology with consideration of the construction contractor's requirements.

Construction vehicle movements

It is estimated that the proposal would generate up to 15 heavy vehicle movements and 15 light vehicle movements per day per slope.

Haulage routes

Mass haulage of materials and transport between ancillary facilities and construction sites would be carried out using Bells Line of Road. Figure 3-9 shows the indicative location of construction access and egress to the ancillary facilities and construction sites.

Public and active transport arrangements

One existing bus stop, located at the proposed Ancillary Facility 4, would be impacted by construction of the proposal. The bus stop would continue to be used and there would be no disruption to services. Traffic controllers at the ancillary facility would ensure bus and construction vehicle movements are managed safely.

There are no formal pedestrian or cycling facilities within the proposal construction footprint. The construction traffic management plan would include measures to manage active transport movements throughout construction.

Property access arrangements

Access to residences, businesses and local roads would be maintained throughout construction.

3.4 Ancillary facilities

A number of ancillary facilities would be required to support delivery of the proposal. Six locations have been identified and assessed, outlined in Table 3-7 and shown in Figure 3-10. Ancillary Facility 1 is located within the Blue Mountains Botanic Garden, while Ancillary Facilities 2, 3, 4, 5 and 6 are located within the Bells Line of Road road reserve.

All ancillary facilities are located on relatively level land and would not require native vegetation clearing or impacts to heritage items. They are located on land adjacent to or nearby land where the proposal would be carried out, or with ready access to the road network to enable safe and efficient transport to and from site.

The potential environmental impacts associated with the ancillary facilities are assessed in Section 6.

Table 3-7: Proposed ancillary sites

Site	Location	Approximate size	Site description and proposed use

Ancillary Facility 1	-33.539839, 150.420596	830 m^2	– Existing sealed carpark within the Blue Mountains Botanic Garden
			– Over 200 metres to nearest sensitive receiver
			– Proposed use:
			  – Site office
			  – Amenities
			  – Temporary stockpiling
			  – Laydown
			  – Car park
			  – Storage areas

Ancillary Facility 2	-33.542432, 150.423349	760 m^2	– Sealed eastbound lane of Bells Line of Road
			– Adjacent to Slope 93282
			– About 40 metres to nearest sensitive receiver
			– Proposed use:
			  – Site office
			  – Amenities
			  – Temporary stockpiling

Ancillary Facility 3	-33.5380691, 150.4325938	350 m^2	– Existing unsealed pull off area on Bells Line of Road eastbound – About 1.2 kilometres along road to nearest construction site – Over 200 metres to nearest sensitive receiver – Proposed use: – Temporary stockpiling
Ancillary Facility 4	-33.5372757, 150.438604	700 m^2	– Existing unsealed pull off area on Bells Line of Road eastbound with tourist information sign and bus stop – About 1.8 kilometres along road to nearest construction site – About 30 metres north of the nearest residential receiver and about 50 metres west of the nearest commercial receiver – Proposed use: – Temporary stockpiling
Ancillary Facility 5	-33.548777, 150.396415	1090 m^2	– Existing unsealed pull off area on Bells Line of Road eastbound – About four kilometres along road to nearest construction site – No nearby sensitive receivers – Proposed use: – Temporary stockpiling

Site	Location	Approximate size	Site description and proposed use

Ancillary Facility 6	-33.546763, 150.391728	1300 m^2	– Existing unsealed pull off area on Bells Line of Road westbound
			– About 4.4 kilometres along road to nearest construction site
			– No nearby sensitive receivers
			– Proposed use:
			  – Temporary stockpiling
			  – Permanent deposit of about 500 cubic metres of excavated material from Slope 93282 (300-millimetre thickness, levelled and compacted)

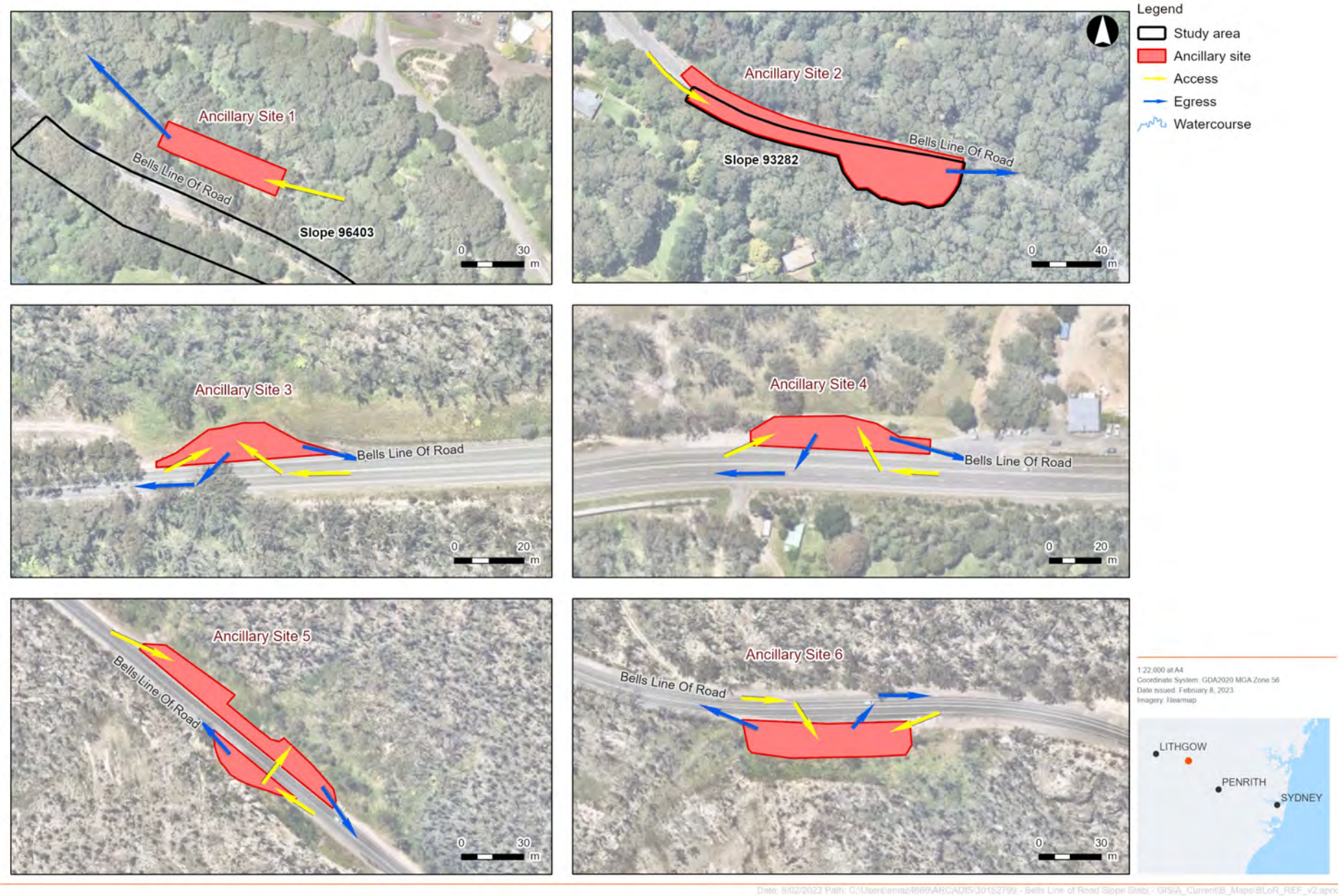


Figure 3-9: Indicative ancillary facility access

3.5 Public utility adjustment

No known utilities have been identified for adjustment or relocation as a result of the proposal. Known utilities that would be avoided during construction include:

- An overhead communications cable at Slope 33459 located above the existing chain mesh fence
- Any other water, sprinkler, fire abatement and other underground services present within the Blue Mountains Botanic Garden access and construction footprint
- Powerlines at the top on Slope 93282 on Skyline Road and at ancillary facilities
- Existing drainage infrastructure at Slope 96403, excluding that to be upgrade as part of the proposal.

All known above-and below-ground utilities, and any unexpected finds, would be protected as per Transport, Dial Before You Dig (DBYD) and utility provider specifications.

3.6 Property acquisition

The proposal would directly impact a state-owned property, the Blue Mountains Botanic Garden. Impacts to the property would be temporary only. All other works would be located within the existing road reserve. No property acquisition would be required as a result of the proposal.

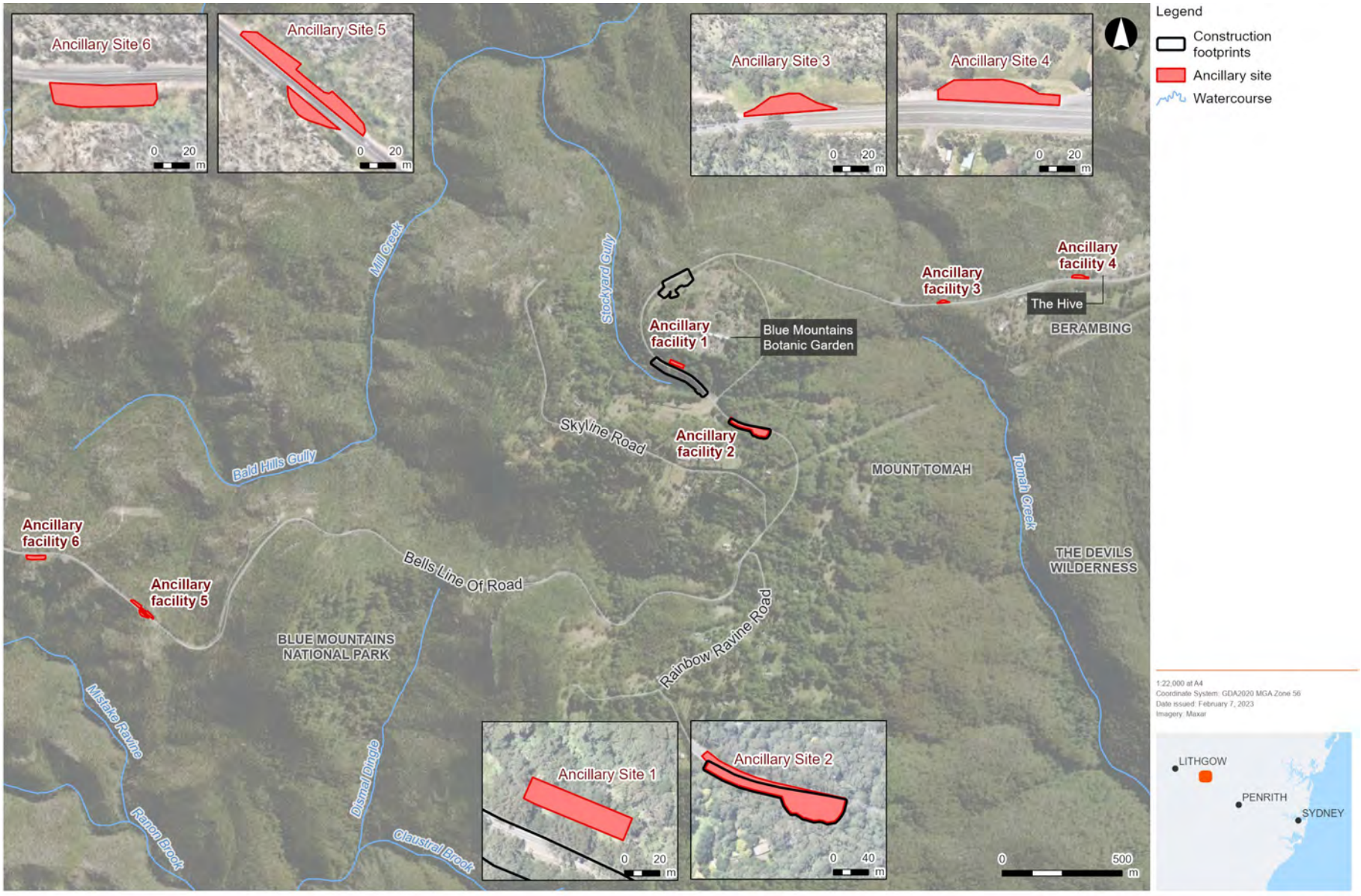


Figure 3-10: Location of proposed ancillary sites

4. Statutory and planning framework

This section provides the statutory and planning framework for the proposal and considers the provisions of relevant state environmental planning policies, local environmental plans and other legislation.

4.1 Environmental Planning and Assessment Act 1979

In accordance with Part 5, Subdivision 2, Section 5.5 of the EP&A Act, for the purpose of attaining the objects relating to the protection and enhancement of the environment, a determining authority (ie Transport) in its consideration of an activity (ie construction and operation of the proposal) shall, notwithstanding any other provisions of this Act or the provisions of any other Act or of any instrument made under this or any other Act, examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity.

4.2 State Environmental Planning Policies

State Environmental Planning Policy (Transport and Infrastructure) 2021 (SEPP (Transport and Infrastructure)) aims to facilitate the effective delivery of infrastructure across the State. Section 2.109 of SEPP (Transport and Infrastructure) permits development on any land for the purpose of a road or road infrastructure facilities to be carried out by or on behalf of a public authority without consent.

As the proposal is for a road and is to be carried out by or on behalf of Transport, it can be assessed under Division 5.1 of the EP&A Act. Development consent from council is not required.

The proposal is not located on land reserved under the *National Parks and Wildlife Act 1974* (NPW Act) and does not require development assessment, consent or approval under:

- *State Environmental Planning Policy (Biodiversity and Conservation) 2021*
- *State Environmental Planning Policy (Resilience and Hazards) 2021*
- *State Environmental Planning Policy (Planning Systems) 2021*
- *State Environmental Planning Policy (Precincts – Central River City) 2021*
- *State Environmental Planning Policy (Precincts – Eastern Harbour City) 2021*
- *State Environmental Planning Policy (Precincts – Western Parkland City) 2021*
- *State Environmental Planning Policy (Precincts – Regional) 2021.*

Section 2.10 to 2.15 of SEPP (Transport and Infrastructure) contains provisions for public authorities to consult with local councils and other public authorities prior to the commencement of certain types of development. Consultation, including consultation as required by SEPP (Transport and Infrastructure) (where applicable), is discussed in section 5 of this REF.

4.3 Blue Mountains Local Environmental Plan 2015

The proposal is located within the Blue Mountains Local Government Area (LGA) which is subject to the *Blue Mountains Local Environmental Plan 2015* (Blue Mountains LEP). Under this LEP, the land occupied by the proposal is zoned as (Figure 4-1):

- SP2 Infrastructure
- RU2 Rural Landscape.

As described above, section 2.109 of SEPP (Transport and Infrastructure) permits Transport to carry out development for the purpose of a road without consent. As a result, while development for roads would be permissible in all three land zones, consent from Blue Mountains City Council is not required for the proposal.

Notwithstanding this, the objectives of the land use zones and the proposal's consistency with these objectives is described in Table 4-1.

Table 4-1: *Blue Mountains Local Environmental Plan 2015* land use zone objectives and consistency with the proposal

Land use zone	Land use zone objectives	Consistency of proposal with land use zone objectives
SP2 Infrastructure	– To provide for infrastructure and related uses. – To prevent development that is not compatible with or that may detract from the provision of infrastructure.	The proposal consists of remediation works to existing road infrastructure.
RU2 Rural Landscape	– To encourage sustainable primary industry production by maintaining and enhancing the natural resource base. – To maintain the rural landscape character of the land. – To provide for a range of compatible land uses, including extensive agriculture.	Transport benefits associated with the remediation of Bells Line of Road would support local and regional primary industries by enhancing traffic efficiency and safety. The proposed work is consistent with the existing character of the land. The rural landscape would not be altered as a result of the proposal.

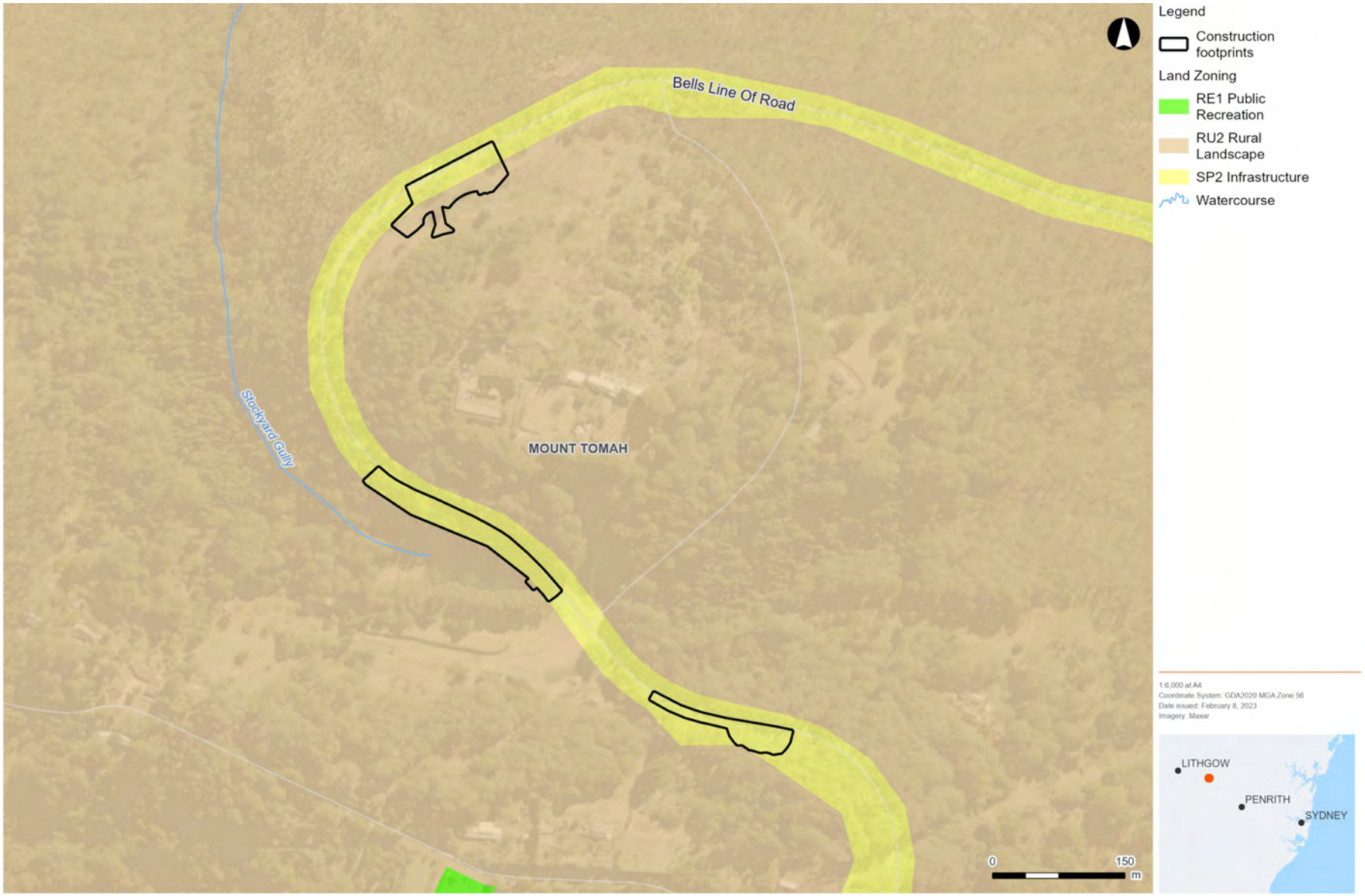


Figure 4-1: Land use zones as per *Blue Mountains Local Environmental Plan 2015*

4.4 Other relevant NSW legislation

4.4.1 Roads Act 1993

Part 2 of the *Roads Act 1993* sets out the provisions for the opening of public roads, including notification procedures. Part 4 of the Roads Act sets out the provisions for the closing of public roads, including notification procedures.

The proposal requires construction work on Bells Line of Road, which is a classified road within the Blue Mountains LGA, and temporary interruption to traffic along the proposal. A Road Occupancy Licence is required for any activity likely to impact on traffic flow, even if that activity takes place off-road. Transport is the proponent and the relevant roads authority for the proposal.

4.4.2 Protection of the Environment Operations Act 1997

The *Protection of the Environment Operations Act 1997* (POEO Act) provides the legal framework for the management of air, noise, water and waste pollution. Under Section 48 of the POEO Act, scheduled activities (as defined in Schedule 1 of the Act) require an environment protection licence (EPL).

Part 3.2 of the POEO Act requires an environment protection licence (EPL) for scheduled development work and the carrying out of scheduled activities (as set out in Schedule 1 of the POEO Act). As the proposal is considered to be maintenance of an existing road, in accordance with Clause 35 (2) of Schedule 1, an EPL is not required.

4.4.3 Heritage Act 1977

Approval under Section 60 of the *Heritage Act 1977* is required for any action that would adversely affect an item that is subject to an Interim Heritage Order or a listing on the State Heritage Register. No State Heritage Register listed items are located within the construction footprint, therefore no s60 permit Is required.

4.4.4 National Parks and Wildlife Act 1979

The *National Parks and Wildlife Act 1974* (NPW Act) provides the basis for legal protection and management of National Parks estate and Aboriginal sites and objects in NSW. The NPW Act reserves land as historic sites to protect and conserve areas associated with a person, event or historical theme, or containing a building, place, feature or landscape of cultural significance.

The proposal is located adjacent to the Blue Mountains National Park. Work would not encroach onto national parks land. There are no registered Aboriginal heritage sites within the proposal construction footprint.

4.4.5 Biodiversity Conservation Act 2016

The purpose of the *Biodiversity Conservation Act 2016* (BC Act) is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development.

The NSW Biodiversity Offsets Scheme is established under Part 6 of the BC Act and the Biodiversity Assessment Method (BAM) is established under section 6.7 of the BC Act. The purpose of the BAM is to prescribe requirements for the assessment of certain impacts on listed threatened species, populations and ecological communities, areas of outstanding biodiversity value, and key threatening processes

Section 7.3 of the BC Act provides a test for determining whether proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats. Where a significant impact is likely, a Species Impact Statement must be prepared.

The significant impact test applied to threatened species and ecological communities relevant to the proposal is presented in Appendix D. The proposal is unlikely to have a significant impact on any BC Act listed species, populations or ecological communities.

4.5 Commonwealth legislation

4.5.1 Environment Protection and Biodiversity Conservation Act 1999

Under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act), a referral is required to the Australian Government for proposed actions that have the potential to significantly impact on matters of national environmental significance or the environment of Commonwealth land. These are considered in Appendix A and Section 6 of the REF.

A referral is not required for proposed road activities that may affect nationally-listed threatened species, endangered ecological communities and migratory species. This is because requirements for considering impacts to these biodiversity matters are the subject of a strategic assessment approval granted under the EPBC Act by the Australian Government in September 2015.

Findings – matters of national environmental significance

The assessment of the proposal's impact, on matters of national environmental significance and the environment of Commonwealth land, found that there is unlikely to be a significant impact on relevant matters of national environmental significance or on Commonwealth land. Accordingly, the proposal has not been referred to the Australian Government Department of Climate Change, Energy, the Environment and Water under the EPBC Act.

Findings – nationally-listed biodiversity matters (where the strategic assessment applies)

The assessment of the proposal's impact on nationally-listed threatened species, endangered ecological communities and migratory species found that there is unlikely to be a significant impact on relevant matters of national environmental significance. Chapter 6 of the REF describes the safeguards and management measures to be applied.

4.5.2 Native Title Act 1993

The *Native Title Act 1993* recognises and protects native title. The Act covers actions affecting native title and the processes for determining whether native title exists and compensation for actions affective native title. It establishes the Native Title Registrar, the National Native Title Tribunal, the Register of Native Title Claims and the Register of Indigenous Land Use Agreements, and the National Native Title Register. Under the Act, a future act includes proposed public infrastructure on land or waters that affects native title rights or interest.

A search of the Native Title Tribunal Native Title Vision website was carried out, with no Native Title holders/claimants identified.

4.6 Confirmation of statutory position

The proposal is categorised as development for the purpose of a road and is being carried out by or on behalf of a public authority. Under section 2.108 of SEPP (Transport and Infrastructure) the proposal is permissible without consent. The proposal is not State significant infrastructure or State significant development. The proposal can be assessed under Division 5.1 of the EP&A Act.

Transport for NSW is the determining authority for the proposal. This REF fulfils Transport's obligation under section 5.5 of the EP&A Act including to examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the activity.

5. Consultation

This section discusses the consultation carried out to date for the proposal and the consultation proposed for the future.

5.1 Community involvement

The construction footprint of Slope 33459 is partially within the Blue Mountains Botanic Garden and access will be required from within the garden in order to carry out the works. In addition, Ancillary Facility 1 utilises the existing sealed carpark within the Blue Mountains Botanic Gardens. Therefore, ongoing consultation has taken place between Transport for NSW and the Blue Mountains Botanic Gardens to discuss concerns and issues.

Key concerns and items discussed have been summarised in Table 5-1.

Table 5-1: Summary of key concerns and items discussed with the Blue Mountains Botanic Gardens

Date/Time	Method of Communication	Items discussed / Key concerns
16th Aug 2022 17th Aug 2022	Email Teams Meeting	Management plans discussed and provided to the Blue Mountains Botanic Gardens to review and comment. Plans include: - Traffic Management Plan within the Garden - Compound site use within the Garden - Dilapidation Reporting - Events - Review of Environmental Factors (REF)
13th Sept 2022	Email	Gardens sent through '*Prevention of Soil Diseases – Procedures for Contractors entering the site*' to be included as part of the delivery contract. Transport has confirmed this will be included
23rd Sept 2022	Site Visit In person meeting	- Discussed possible tree removal by the Gardens prior to Transport works. The removal will provide access to Transport organised Slope delivery contractors - Discussed possible eastern and western site accesses Finalised traffic plan to involve access from the western side, subject to the removal of three trees by the Gardens
27th Oct 2022	Teams Meeting	New item discussed – Slope 96403 requires access from within the Gardens on the western side of Bells Line of Road in order to carry out the culvery outlet treatment and slope delivery
10th Nov 2022	Email	Slope 33459 Rev D Design Plans issued to Gardens for review
16th Nov 2022	Email	Transport requestion any restriction dates from the Gardens due to peak periods and/or special events to be factored into delivery program
18th Nov 2022	Email	Gardens raised concerns about construction license request by Transport needing Ministerial approval. Transport has actioned and re-issued as License Agreement
5th Dec 2022	Email	Gardens Director George Salouros, Asset Management, Planning and Projects signed an agreement with Transport granting access to the Garden and carry out Slope 33459 works

5.2 SEPP (Transport and Infrastructure) consultation

In accordance with the Statutory Consultation checklist in Appendix B – Statutory consultation checklists, the proposed works do not trigger the requirement for SEPP (Transport and Infrastructure) consultation.

5.3 Government agency and stakeholder involvement

Various government agencies and stakeholders have been notified about the proposal, including:

- Blue Mountains Council
- Utility providers
- NSW State Emergency Services (SES)
- NSW Rural Fire Service (RFS)
- Emergency services
- Community groups.

Transport for NSW has not received any objections from the notified government agencies and stakeholders, nor were any issues raised.

5.4 Ongoing or future consultation

Prior to the start of construction, public notices and notification would be set up to notify the general public and relevant stakeholders of upcoming road works such as partial lane closures and any traffic disruptions.

Notification may include methods such as VMS boards, public notification posters in public venues near the slopes such as cafés, restaurants and reaching out to social clubs that use Bells Line of Road for recreational purposes, such as motorcycle and bike clubs.

6. Environmental assessment

This section of the review of environmental factors provides a detailed description of the potential environmental impacts associated with the construction and operation of the proposal.

All aspects of the environment potentially impacted upon by the proposal are considered. This includes consideration of:

- Potential impacts on matters of national environmental significance under the Environment Protection and Biodiversity Conservation Act 1999
- The factors specified in the guidelines Is an EIS required? (DUAP 1995/1996) as required under clause 228(1) of the Environmental Planning and Assessment Regulation 2000 and the Roads and Related Facilities EIS Guideline (DUAP 1996). The factors specified in clause 228(2) of the Environmental Planning and Assessment Regulation 2000 are also considered in Appendix A – Consideration of section 171 factors and matters of national environmental significance and Commonwealth land.

Site-specific safeguards and management measures are provided to mitigate the identified potential impacts.

6.1 Traffic and transport

This section provides an assessment of the potential traffic, access and transport impacts of the proposal on road users and identifies safeguards and management measures to avoid or minimise these impacts.

6.1.1 Methodology

The traffic and transport assessment involved the following:

- A review of existing conditions including the road network, safety concerns, public transport amenity and property access
- A review of the Traffic Management Plan (TMP) prepared for the proposed works (Mack Civil Engineering, 2022) (Appendix C – Traffic Management Plan)
- Assessment of the likely impacts during construction of the proposal and impacts on the local community and property access
- Identification of safeguards and management measures.

6.1.2 Existing environment

Bells Line of Road is a gazetted classified road (number 184) that runs from North Richmond in northwest Sydney to Bell in the western Blue Mountains. It has an existing speed limit of 80 kilometres per hour. Bells Line of Road provides alternative road access between the Greater Sydney Area and the Central West of NSW to the Great Western Highway, as well as providing road access to residents and businesses.

At each of the slope construction sites, the Bells Line of Road has the following configuration:

- Slope 33459: Two-way undivided carriageway with one lane in each direction
- Slope 96403: Two-way undivided carriageway with one lane in each direction, and a hard shoulder on the eastbound lane
- Slope 93282: Two-way undivided carriageway with one lane in each direction, and a passing lane in the westbound direction.

The Berambing Picnic Area bus stop (Stop ID 2758647) is located at the proposed location of Ancillary Facility 4. This bus stop is an unsealed pull off area on Bells Line of Road and services three weekday bus routes, as detailed in Table 6-1.

There is no existing active transport infrastructure, such as pedestrian and cycle paths, on this section of Bells Line of Road.

Table 6-1: Services utilising the Berambing Picnic Area bus stop

Route	Description	Number of services
682	Richmond to Kurrajong via Berambing (Loop Service)	Monday to Friday: one eastbound morning service, two eastbound afternoon services
5120	Berambing Picnic Area to Kuyper Christian School via Colo High School and Kurrajong Public School	Monday to Friday: one eastbound morning service, commencing in Berambing
5620	Colo High School to Berambing Crescent before Bells Line of Rd	Monday to Friday: one westbound afternoon service, terminating in Berambing

6.1.3 Potential impacts

Construction

Construction of the proposal would commence in early 2023 and would take about seven to eight months to complete, weather permitting. Potential construction impacts on traffic and transport would include:

- Construction vehicle movements
- Temporary increases to travel times due to speed limit restrictions

- Installation of temporary traffic signals
- Safety issues that may arise as a result of the temporary land closures at the Blue Mountains Botanic Garden, accommodating the ancillary facilities on the roadside pull-off areas, and partial road closures.

Construction of the proposal would be subject to comprehensive traffic management measures to ensure the ongoing functionality of Bells Line of Road, and the safety of the public, motorists and construction personnel. The TMP (Appendix C – Traffic Management Plan) details the traffic management measures to be implemented throughout construction.

Traffic

An estimated 15 light vehicle and 15 heavy vehicle movements would be anticipated at each construction site per day. Bells Line of Road has relatively low existing traffic volumes and would be able to accommodate these additional vehicle movements.

Road users would experience journey disruptions as a result of the sign posted speed limit to be reduced to 60 kilometres per hour at the construction sites and 40 kilometres per hour for certain high-risk deliveries and activities, as well as the temporary traffic signals to manage one-lane two-way traffic operation for the duration of construction at each slope. Slope 93282 and Slope 96403 would require closure of the eastbound lane, with Slope 33459 requiring closure of the west bound lane. Variable message signage would be installed throughout construction to advise road users of the duration of works, as shown in the TMP (Appendix C – Traffic Management Plan).

The pull off areas along Bells Line of Road to be used as ancillary facilities would be unavailable for use by the public during construction. Traffic controllers at the ancillary facilities would manage safe access and egress of construction vehicles onto Bells Line of Road. There is alternative pull off areas both eastbound and westbound that would remain available for use.

These arrangements would be short-term and temporary in nature, with only minor impact on road users expected.

Public transport

There would be no interruption in services at the Berambing Picnic Area bus stop as a result of construction activities. Traffic controllers at the ancillary facility would ensure bus and construction vehicle movements and pedestrians are managed safely.

Property access

Access to residences, businesses and local roads would be maintained throughout construction.

Access to certain areas of the Blue Mountains Botanic Garden would be restricted to the public throughout construction, including the construction site and Ancillary Facility 1. This temporary disruption is unlikely to impact garden users.

Operation

There would be no ongoing operational impacts as a result of the proposal. Full functionality of the road would be restored.

6.1.4 Safeguards and management measures

Table 6-2: Traffic and transport safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
TR01 Traffic management during construction	A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the Transport *Traffic Control at Work Sites Manual* (RTA, 2010) and *QA Specification G10 Control of Traffic* (Transport for NSW, 2008). The TMP includes:	Contractor	Pre-construction	

Impact	Environmental safeguards	Responsibility	Timing	Reference
	– confirmation of haulage routes – measures to maintain access to local roads and properties – site-specific traffic control measures (including signage) to manage and regulate traffic movement – requirements and methods to consult and inform the local community of impacts on the local road network – access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads – a response plan for any construction traffic incident – consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic – Details of ongoing consultation and plans in place with emergency services regarding road closures – monitoring, review and amendment mechanisms.			
TR02 Road closures	Night partial road closures will be scheduled to minimise traffic disruption and impact on businesses. The community and stakeholders will be notified prior to any closure.	Contractor	Construction	
TR03 Consultation	Consultation will be carried out with Blue Mountains Botanic Gardens regarding potential impacts to parking and grounds during the construction period.	Transport	Pre-construction Construction	
TR04 Traffic	Where possible, current traffic movements and property accesses are to be maintained	Contractor	Construction	

Impact	Environmental safeguards	Responsibility	Timing	Reference
Property access	during the works. Any disturbance is to be minimised to prevent unnecessary traffic delays. Landowners will be consulted should access to property be blocked at any time during construction.			

6.2 Noise and vibration

This section provides an assessment of the potential noise and vibration impacts of the proposal on surrounding receivers and identifies safeguards and management measures to avoid or minimise these impacts.

6.2.1 Methodology

The noise and vibration impact assessment included the following:

- Establishment of relevant construction noise and vibration criteria, based on the *Interim Construction Noise Guideline* (ICNG) (DECC, 2009) and Transport's *Construction Noise and Vibration Guideline* (CNVG) (Transport for NSW, 2016)
- Description of the existing noise environment including classification of the noise area category and determination of Rating Background Levels (RBL)
- Desktop analysis using Transport's *Construction and Maintenance Noise Estimator* (2022) basing affected distances on the noisiest plant for each slope (inputs used provided in Table 6-3)
- Assessment of the potential construction noise and vibration impacts, including consideration of:
  - Likely noise generating activities occurring during and outside standard construction hours and the associated impacts to nearby sensitive receivers
  - Potential sleep disturbances as a result of out of hours work
- Qualitative assessment of potential operational noise and vibration impacts
- Identification of feasible and reasonable construction and operational safeguards and management measures.

Table 6-3: Inputs used for the desktop assessment using Transport's *Construction and Maintenance Noise Estimator* (2022)

	Slope 33459	Slope 96403	Slope 93282	Ancillary facilities
Noise area category	R1			
Noisiest plant (Day)	Bored piling rig	Bobcat with planer	Excavator	Front loader
Noisiest plant (OOHW)	Air track drill	Bored piling rig	-	-
Is there line of sight to receiver?[1]	Yes	Yes	Yes	Yes

[1] As per *Construction and Maintenance Noise Estimator* (Transport for NSW, 2022), 'no' can only be selected if there is a solid barrier. Solid barriers can be in the form of road cutting, timber lapped and capped fence, shipping container, site office, etc. Substantial solid barriers are those greater than five metres in height or multiple rows of houses or a sound barrier specifically designed to mitigate construction noise. Blocked line of site due to vegetation or standard fencing does not count.

6.2.2 Construction noise and vibration assessment criteria

Construction hours

The ICNG defines working hours for which different construction noise assessment procedures apply. Standard working hours, during which the majority of construction work would occur, are:

- 7 am to 6 pm, Monday to Friday
- 8 am to 1 pm Saturday
- No work on Sundays or public holidays.

Any works outside of these hours would be classified as out of hours works.

The CNVG defines time periods when certain construction activity should be limited, where practicable, as described in Table 6-4.

Table 6-4: Recommended construction hours by activity

Activity	Working hours		
	Monday to Friday	**Saturday**	**Sunday and Public Holiday**
Standard construction	7 am to 6 pm	8 am to 1 pm	No work
Construction activities with impulsive or tonal noise emissions	8 am to 5 pm	9 am to 1 pm	No work

Construction noise management levels

The ICNG contains procedures for determining proposal specific Noise Management Levels (NML) for sensitive receivers based on the existing background noise surrounding the proposal site.

The NML for residential receivers set in accordance with the ICNG are outlined in Table 6-5. NMLs are set with reference to time of day and the background noise, known as the RBL. The RBL for the proposal was based on the noise area category selected from Transport's *Construction and Maintenance Noise Estimator*, shown in Table 6-12.

The NML for non-residential sensitive receivers are provided in Table 6-6. These levels only apply during hours when the non-residential premises are being used.

The difference between an internal noise level and the external noise level is 10 dB(A), which provides a conservative assumption that windows are open. Buildings where windows are fixed or cannot otherwise be opened may achieve a greater noise level performance.

Table 6-5: Noise management levels for residential land uses (ICNG)

Time of day	Noise management level, $L_{Aeq(15\text{-}minute)}$	How to apply
Standard hours: 7 am to 6 pm Monday to Friday 8 am to 1 pm, Saturday	**Noise affected** RBL + 10 dB(A)	The noise affected level represents the point above which there may be some community reaction to noise. Actions: Where the predicted or measured construction noise level exceeds the noise-affected level, all feasible and reasonable work practices should be applied to meet the noise affected level. All residents potentially impacted by the works should be informed of the nature of the works, the expected noise levels and duration, and provided with site contact details.
	Highly noise affected (HNA) >= 75 dB(A)	The HNA level represents the point above which there may be strong community reaction to noise. Actions: Where construction noise is predicted or measured to be above this level, the relevant authority may require respite periods that restrict the hours that the very noisy activities can occur. Respite activities would be determined taking into account times identified by the community when they are less sensitive to noise, and if the community is prepared to accept a longer period of construction to accommodate respite periods.
OOHW	**Noise affected** RBL + 5 dB(A)	A strong justification is typically required for these works. Actions: All feasible and reasonable work practices should be adopted. Where all feasible and reasonable work practices have been adopted and the noise level is more than five dB(A) above the NML, negotiation should be carried out with the community.

Table 6-6: Noise management levels for other sensitive land uses (DECC, 2009)

Land use	Noise management level, $L_{Aeq(15\text{-}minute)}$
Classrooms at schools and other educational institutions	Internal noise level – 45 dB(A)
Places of worship	Internal noise level – 45 dB(A)
Active recreation areas (characterised by sporting activities and activities that generate their own noise or focus for participants, making them less sensitive to external noise intrusion).	External noise level – 65 dB(A)
Passive recreation areas (characterised by contemplative activities that generate little noise and where benefits are compromised by external noise intrusion (i.e. reading and meditation).	External noise level – 60 dB(A)
Community centres	Dependent on the intended use. Refer to the recommended 'maximum' internal levels by AS/NZS 2107:2016 *Acoustics – Recommended design sound levels and reverberation times for building interiors*.

Note: 1. Applies when premises are in use

Sleep disturbance

The CNVG considers night works exceeding an external L_{Amax} sound pressure level at a receiver of 65 dB(A) to impact upon occupant sleep amenity.

Traffic noise

Construction traffic noise associated with the proposal were assessed in reference to the *NSW Road Noise Policy* (DECC, 2011). This policy requires any increase in the total traffic noise to be limited to two dB(A) above that of the existing road traffic noise.

As there would be no increase to operational road traffic volumes as a result of the proposal, therefore operational noise has not been considered further.

Proposal specific noise management levels

NMLs for the identified sensitive receivers were determined based on the measured RBL summarised in Table 6-12. The NMLs relevant to this assessment are presented in Table 6-7.

Table 6-7: NMLs for sensitive land uses

Land use	Noise management level, $L_{Aeq(15\text{-}minute)}$		
	Day (standard hours)	Evening	Night
Residential	50	40	35
Passive recreation	External noise level – 60 dB(A)		

Construction vibration criteria

Ground vibration generated by construction can have a range of effects on buildings and building occupants, with the main effects generally classified as:

- Human disturbance – disturbance to building occupants: vibration which inconveniences or interferes with the activities of the occupants or users of the building
- Effects on building structures – vibration that may compromise the condition of the building structure itself.

Construction vibration screening criteria have been adopted from the following sources:

- Cosmetic and structural damage to buildings: German Standard DIN 4150-3, 1999, *Structural Vibration – Part 3: Effects of vibration on structures*,
- British Standard BS 7385 Part 2-1993 Evaluation and Measurement for Vibration in Buildings

– Assessing Vibration: a technical guideline (DEC, 2006).

Human comfort

Table 6-8 presents the management levels for continuous and impulsive vibration at different land uses. The management levels specified are as overall unweighted root-mean-square (rms) vibration velocity levels (V_{rms}). The guideline *Assessing Vibration: a technical guideline* (DEC, 2006) specifies the management levels as suitable for vibration sources predominantly in the frequency range 8-80 Hz as would be expected for construction vibration.

Table 6-8: Daytime V_{rms} management levels for continuous and impulsive vibration

Receiver	Continuous vibration V_{rms}, mm/s		Impulsive vibration V_{rms}, mm/s	
	Preferred	Maximum	Preferred	Maximum
Residences – daytime	0.2	0.4	6	12
Residences – night-time	0.14	0.28	2	4

For intermittent vibration, the Vibration Dose Value (VDV) is used as the metric for assessment as it accounts for the duration of the source, which will occur intermittently over the assessment period. The VDV management levels at different land uses for intermittent vibration sources are presented in Table 6-9.

Table 6-9: Vibration dose value management levels for intermittent vibration

Receiver	VDV – Intermittent vibration, m/s1.75	
	Preferred	Maximum
Residences – daytime	0.2	0.4
Residences – night-time	0.13	0.26

Cosmetic and structural damage

Table 6-10 presents the German Standard DIN 4150-3 minimum safe levels of vibration at different frequencies for commercial and residential buildings, and Table 6-11 presents the BS 7385-2 guideline values relating to cosmetic damage from transient vibration.

DIN 4150-3 and BS 7385-2 state that exceedances of the guidance values do not necessarily mean that damage will occur, but that more detailed analysis may be required in order to quantify the site-specific relationship between vibration levels, strain and the potential for damage.

Table 6-10: DIN 4150-3 vibration cosmetic and structural damage criteria

Line	Structure type	Peak particle velocity (PPV) mm/s			
		Foundation of structure			Vibration at horizontal plane of highest floor at all frequencies
		<10 Hz	10-50 Hz	50-100 Hz	
1	Buildings used for commercial, industrial purposes, industrial buildings and buildings of similar design	20	20 – 40	40-50	40
2	Dwelling and buildings of similar design and/or use	5	5 – 15	15-20	15
3	Structures that, because of their particular sensitivity to vibration, do not correspond to those listed in rows 1 and 2, and are of great intrinsic	3	3 – 8	8 – 10	8

Line	Structure type	Peak particle velocity (PPV) mm/s			
		Foundation of structure			Vibration at horizontal plane of highest floor at all frequencies
		<10 Hz	10-50 Hz	50-100 Hz	
	value (e.g. heritage-listed buildings)				

Table 6-11: Transient vibration guide values for cosmetic damage (BS7385-2)

Line	Type of building	Peak component particle velocity in frequency range of predominant pulse	
		Frequency range	
		4-15 Hz	15 Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

Notes: 1. Values referred to are at the base of the building
2. For line 2, at frequencies below 4 Hz, a maximum displacement of 0.6, (zero to peak) should not be exceeded

6.2.3 Existing environment

Noise sensitive receivers

There are multiple noise sensitive residential receivers and two non-residential receivers in the vicinity of the proposal. The non-residential receivers include the Blue Mountains Botanic Garden and The Hive Berambing. Location of noise sensitive receivers is shown in Figure 6-1 to Figure 6-5.

Slope 33459 is located along Bells Line of Road, directly north-west of the Blue Mountains Botanic Garden. Rural residential dwellings are also located along Skyline Road, with the nearest affected receiver about 550 metres from works carried out.

Slopes 96403 is located to the south of the Blue Mountains Botanic Garden. Slope 96403 is about 100 metres away from the nearest building with the garden. The nearest noise sensitive receiver to Slope 96403 is a rural residential dwelling located on Bells Line of Road about 115 metres south-east.

Slope 93282 is located south-east of the Blue Mountains Botanic Garden, with its closest building about 450 metres from works to be carried out. The nearest residential noise sensitive receiver is a rural residential dwelling located about 80 metres south-west on Skyline Road. Additional rural residential dwellings are located along Skyline Road and Bells Line of Road.

The ancillary facilities are located at various point along Bells Line of Road with the exception of Ancillary Facility 1, located at a sealed carpark within the Blue Mountains Botanic Garden. Table 3-7 includes a site description and proposed use for each of the ancillary facilities.

The nearest non-residential receiver of Ancillary Facility 1 would be the Blue Mountains Botanic Garden. The nearest residential receiver is a rural dwelling located off Bells Line of Road, about 260 metres away.

Ancillary Facility 2, located adjacent to Slope 93282, is about 50 metres to the nearest residential sensitive receiver on Skyline Road.

Ancillary Facility 3 is located east-north-east of the garden on Bells Line of Road, with the nearest sensitive receiver being a rural dwelling about 250 metres southeast.

Ancillary 4 is located further east along Bells Line of Road. The nearest sensitive receiver is a rural dwelling located about 30 metres to the south of the site on the opposite side of Bells Line of Road. A commercial

building is also located about 60 metres to the east, with additional rural dwellings located further east along Bells Line of Road.

Ancillary Facility 5 and 6 are located to the south-west of the proposal. The Blue Mountains National Park surrounds the ancillary facilities, with no sensitive receivers located in the vicinity.

Existing noise environment

The proposal is located in the vicinity of rural residential properties and the Blue Mountains Botanic Garden. This is then surrounded by the Blue Mountains National Park. The existing ambient environment that surrounds the proposal is typically characterised by the road traffic noise generated from Bells Line of Road. Noise generating sources include:

- Engine noise and tyre noise from passing vehicle traffic
- Acceleration and deceleration at existing intersections.

Existing maximum noise levels

For the purpose of this REF, Transport's *Construction and Maintenance Noise Estimator* (2022) was used to determine the distance at which noise sensitive receivers would be impacted, as well as what extent they would be impacted. The assessment would be based on indicative individual plant detailed in Section 0.

The area surrounding the proposal was categorised as R1 as the area is predominantly bushland with scattered rural residences. Additionally, there are rural residential receivers located along Bells Line of Road and Skyline Road in proximity to the proposal. Table 6-12 identifies the RBLs corresponding with the noise area category.

Table 6-12: RBLs for noise area category R1

Noise area category		RBL or L_{A90} background level (dB(A))
R1: Rural residences located along Bells Line of Road, Old Bells Line of Road and Skyline Road	Day	40
	Evening	35
	Night	30

6.2.4 Potential impacts

Construction

The results are based on the noisiest plant active at that slope during daytime construction hours, as provided in Table 6-3. In reality, the noisiest plant would not necessarily be running continuously, therefore this is considered a conservative 'worst case' scenario.

Airborne noise – standard construction hours

During construction, exceedance at residences in close proximity to the proposal is predicted. Predicted RBL and NML exceedances during standard construction hours and the number of residential receivers potentially impacted at each slope is presented in Table 6-13. Figure 6-1, Figure 6-2 and Figure 6-3 shows the impact distances of each level of impact and residential receivers.

Impacts to residential sensitive receivers as a result of construction activities during standard construction hours would be temporary in nature and are expected to occur for a short duration only. A Noise and Vibration Management Plan would be prepared would detail measures to mitigate and minimise impacts to sensitive receivers.

The Blue Mountains Botanic Garden is classified as a passive recreation area with NML exceedance level shown in Table 6-7.

Table 6-7. NML exceedances are expected to occur at the north-west boundary of the garden, associated with construction activity on Slope 33459. Slope 96403 has the potential to impact the south-west property boundary, however no structures are located here. Slope 93282 is not expected to cause any NML exceedances at the garden.

Table 6-13: RBL and NML exceedances during standard construction hours

Site	$L_{Aeq(15minute)}$ noise level above background (RBL)	NML exceedance	Distance impacted (metres)	Number of receivers impacted
Slope 33459	Clearly audible (10 to 20 dB(A))	Up to 10 dB(A)	250	One non-residential (Blue Mountains Botanic Garden)
	Moderately intrusive (20 to 30 dB(A))	Up to 20 dB(A)	120	-
	Highly intrusive (>30 dB(A))	Above 20 dB(A)	45	-
Slope 96403	Clearly audible (10 to 20 dB(A))	Up to 10 dB(A)	185	One residential One non-residential (Blue Mountains Botanic Garden)
	Moderately intrusive (20 to 30 dB(A))	Up to 20 dB(A)	85	-
	Highly intrusive (>30 dB(A))	Above 20 dB(A)	30	-
Slope 93282	Clearly audible (10 to 20 dB(A))	Up to 10 dB(A)	120	Two residential
	Moderately intrusive (20 to 30 dB(A))	Up to 20 dB(A)	45	-
	Highly intrusive (>30 dB(A))	Above 20 dB(A)	20	-

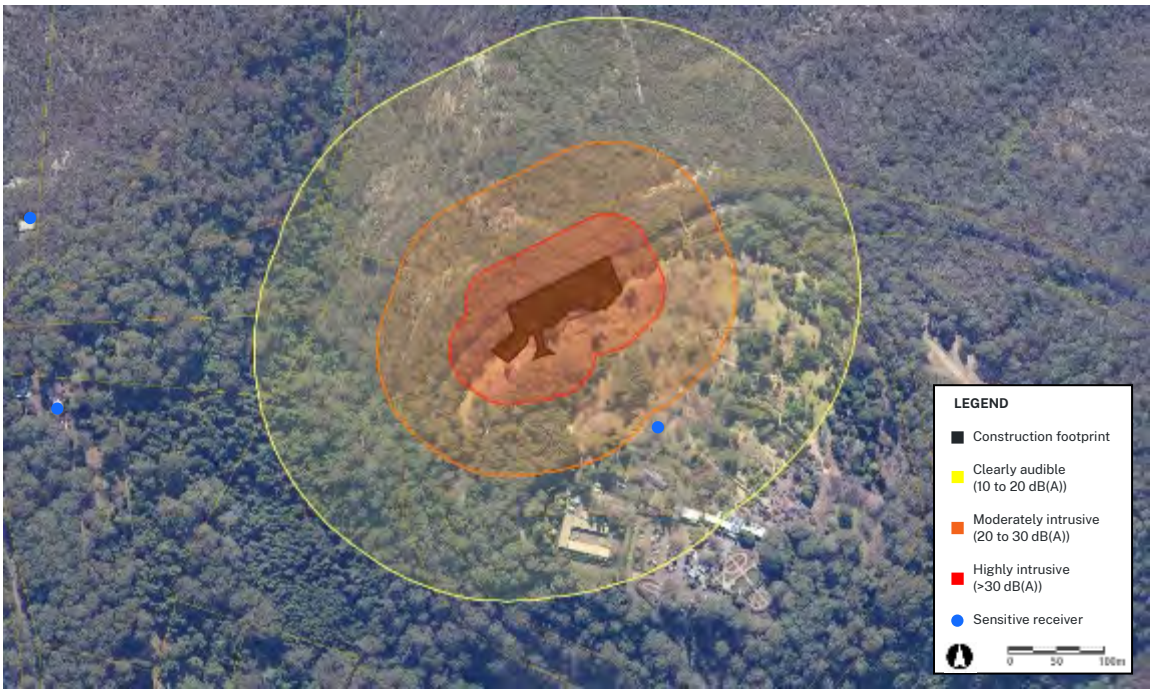


Figure 6-1: Potential daytime noise impacts - Slope 33459

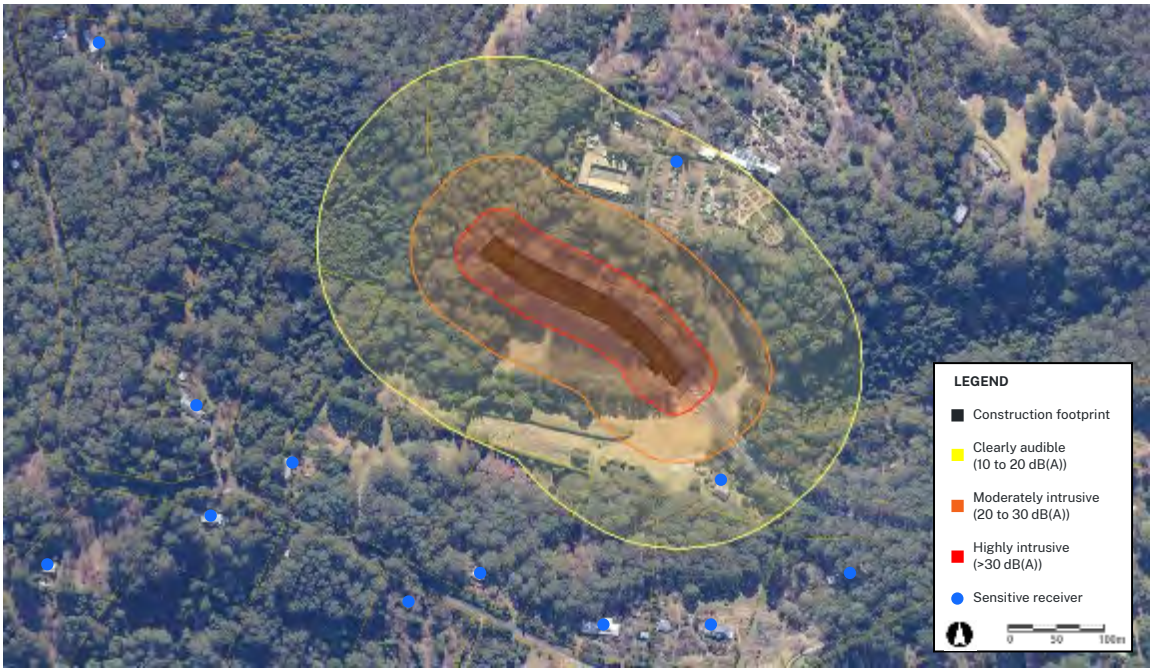


Figure 6-2:Potential daytime noise impacts - Slope 96403

Figure 6-3: Potential daytime noise impacts - Slope 93282

Airborne noise – out of hours work

Out of hours work would be required for certain activities to for worker safety and traffic flow on Bells Line of Road at Slopes 33459 and 96403. Slope 33459 would have about two weeks of night works, and Slope 96403 would have four to six weeks.

RBL and NML exceedances during out of hours works at multiple receivers are predicted, as presented in Table 6-14. Figure 6-4 and Figure 6-5 shows the impact distances of each level of impact and residential receivers.

Out of hours works would be avoided and minimised wherever possible, and would occur for a maximum of five consecutive days at a time, as required.

The following measures are recommended as per the *Construction and Maintenance Noise Estimator* (Transport for NSW, 2022):

- For all receivers, notification is to be given at least 7 days prior to the start of works
- For those where noise is clearly audible, in addition to initial notification, duration respite should be considered
- For those where noise is moderately intrusive, in addition to the above, phone calls and specific notification should be considered
- For those where noise is highly intrusive, in addition to the above, alternative accommodation should be offered.

A Noise and Vibration Management Plan would be prepared to detail measure to mitigate and minimise impacts to sensitive receivers.

Table 6-14: RBL and NML exceedances during out of hours works

Site	$L_{Aeq(15minute)}$ noise level above background (RBL)	NML exceedance	Distance impacted (metres)	Number of receivers impacted
Slope 33459	Noticeable (5 to 10 dB(A))	Up to 5 dB(A)	1750	10 residential
	Clearly audible (10 to 20 dB(A))	Up to 10 dB(A)	1250	11 residential
	Moderately intrusive (20 to 30 dB(A))	Up to 20 dB(A)	610	Nine residential
	Highly intrusive (>30 dB(A))	Above 20 dB(A)	290	One non-residential (Blue Mountains Botanic Garden)
Slope 96403	Noticeable (5 to 10 dB(A))	Up to 5 dB(A)	760	Nine residential
	Clearly audible (10 to 20 dB(A))	Up to 10 dB(A)	525	15 residential
	Moderately intrusive (20 to 30 dB(A))	Up to 20 dB(A)	250	One residential One non-residential (Blue Mountains Botanic Garden)
	Highly intrusive (>30 dB(A))	Above 20 dB(A)	120	-

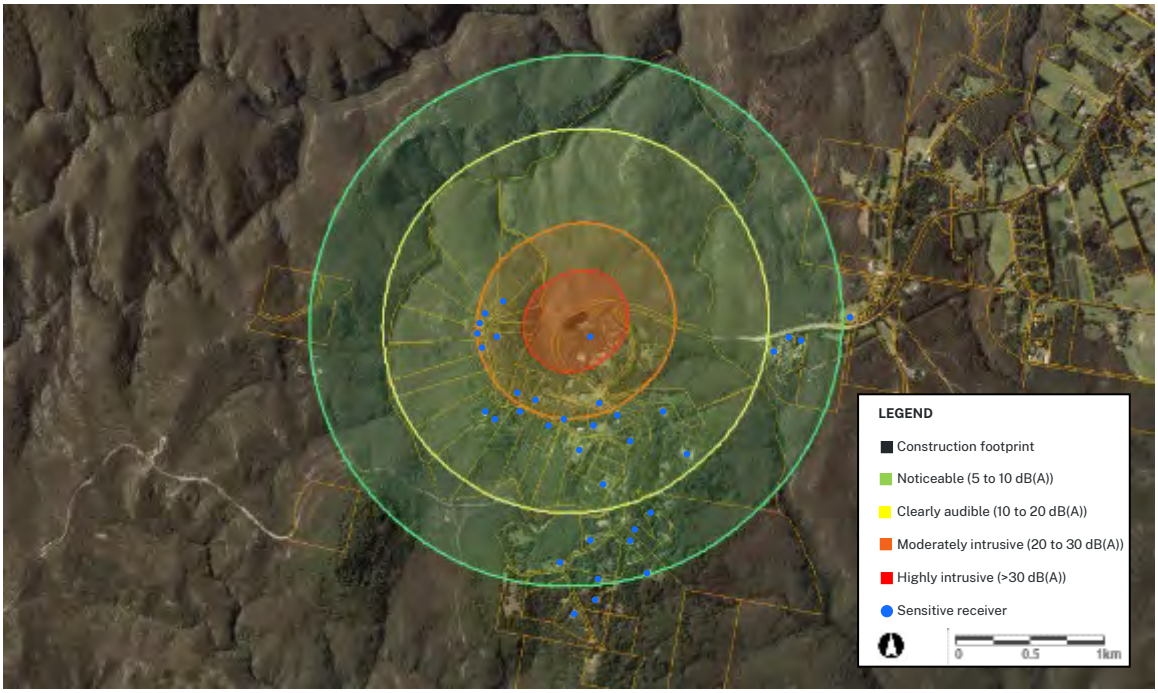


Figure 6-4: Potential out of hours noise impacts - Slope 33459

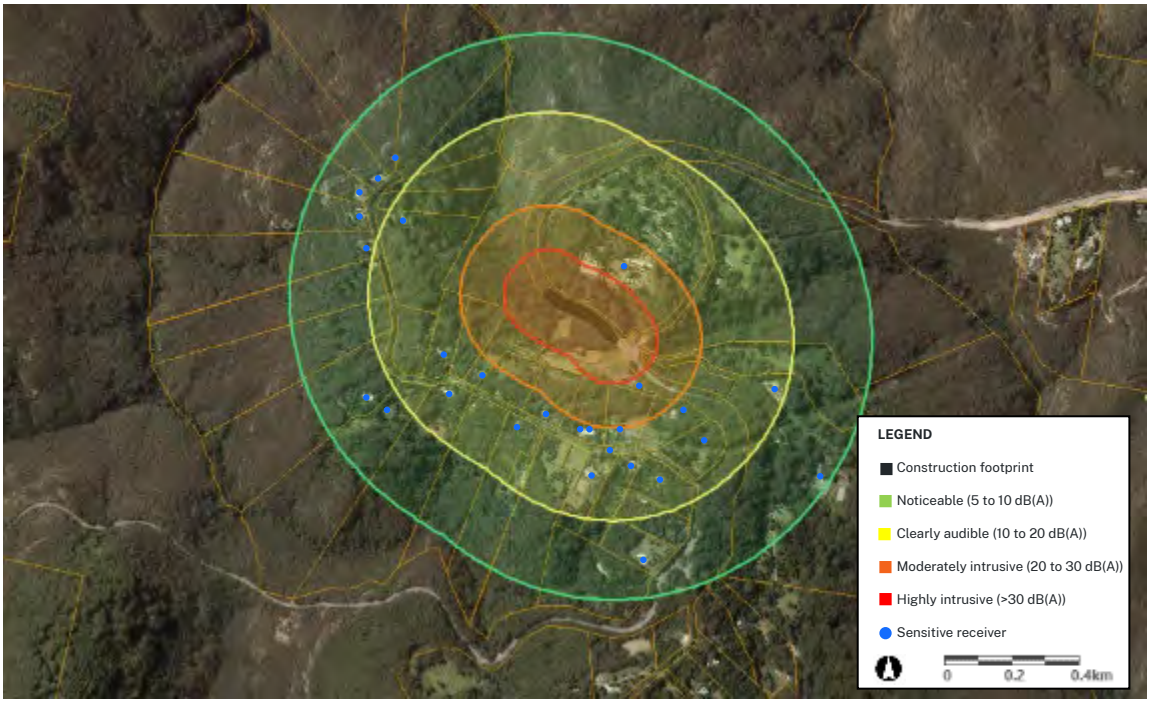


Figure 6-5: Potential out of hours noise impacts - Slope 96403

Sleep disturbances

Sleep disturbances could occur within 270 metres of Slope 33459, however there are no residential receivers within this area (Figure 6-6). For Slope 96403, the affected distance is 175 metres. Sleep disturbances associated with out of hours work may occur for one residential receiver (Figure 6-7).

Figure 6-6: Potential sleep disturbance L_{Amax} 65 dB(A) - Slope 33459

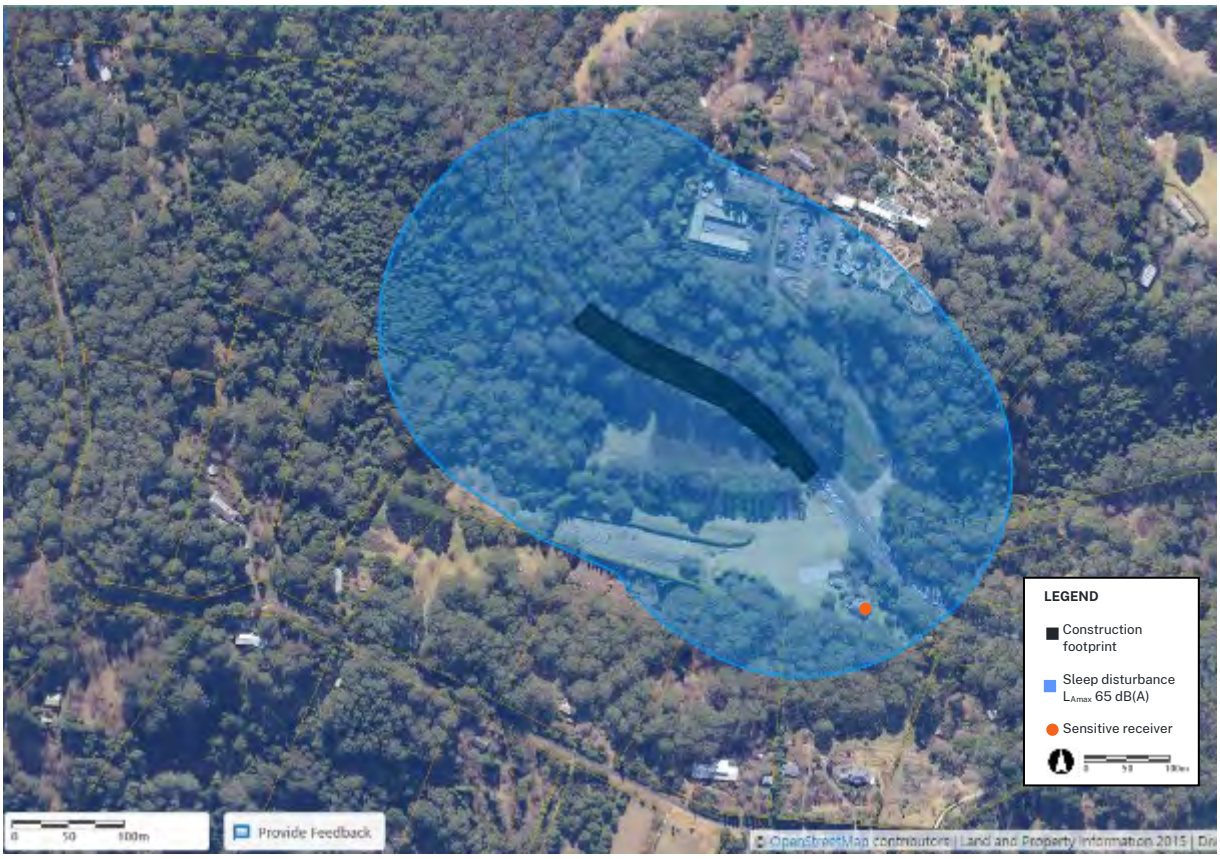


Figure 6-7: Potential sleep disturbance L_{Amax} 65 dB(A) - Slope 96403

Construction vibration impacts

Works would be occurring along the north-west boundary of the Local Heritage Listed Mount Tomah Botanic Garden, with the nearest building structure being the Northern Pavilion located about 40 metres south-east.

The vibration generated from construction works is unlikely to exceed the vibration criteria due to the distance between the works and nearby buildings.

Operation

There are no ongoing operational noise and vibration impacts as a result of the proposal. The noise environment would return to being characterised by road traffic noise from Bells Line of Road.

6.2.5 Safeguards and management measures

Table 6-15: Noise and vibration safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
NV01 Noise and vibration management	A Noise and Vibration Management Plan (NVMP) will be prepared and implemented as part of the CEMP. The NVMP will generally follow the approach in *the Interim Construction Noise Guideline (ICNG) (DECC, 2009*) and identify: – all potential significant noise and vibration generating activities associated with the activity – feasible and reasonable mitigation measures to be implemented – requirements for the development and implementation of an out of hours work protocol – a monitoring program to assess performance against relevant noise and vibration criteria – arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures – contingency measures to be implemented in the event of non-compliance with noise and vibration criteria.	Contractor	Pre-construction	Section 4.6 of QA *G36 Environment Protection*
NV02 Sensitive receiver notification	All sensitive receivers likely to be affected will be notified at least 5 working days prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of: – the proposal – the construction period and construction hours – contact information for project management staff – complaint and incident reporting – how to obtain further information.	Contractor	Construction	
NV03 Induction	All employees, contractors and subcontractors are to receive an	Contractor	Pre-construction	

Impact	Environmental safeguards	Responsibility	Timing	Reference
	environmental induction. The induction must at least include: – all proposal specific and relevant standard noise and vibration mitigation measures – relevant licence and approval conditions – permissible hours of work – any limitations on high noise generating activities – location of nearest sensitive receivers – construction employee parking areas – designated loading/unloading areas and procedures – site opening/closing times (including deliveries) – environmental incident procedures.			
NV04 Out of hours works	Where out of hours works are required, the following measures should be considered, as per the *Construction and Maintenance Noise Estimator* (Transport for NSW, 2022): – For those where noise is clearly audible, in addition to initial notification, duration respite should be considered – For those where noise is moderately intrusive, in addition to the above, phone calls and specific notification should be considered – For those where noise is highly intrusive, in addition to the above, alternative accommodation should be offered.	Contractor	Construction	
NV05 Highly intrusive activities	Noisy works (including rock breakers), will be completed by midnight.	Contractor	Construction	

6.3 Biodiversity

This section provides an assessment of the potential impacts of the proposal on biodiversity and identifies safeguards and management measures to avoid or minimise these impacts. A detailed assessment of biodiversity impacts is presented in Appendix D – Biodiversity Assessment Report.

6.3.1 Methodology

The methodology for the biodiversity assessment included a desktop assessment, habitat assessment, field surveys and assessment of potential impacts.

Desktop assessment

A desktop assessment was carried out in October and November 2022 which included a review of the following relevant databases, literature and guidelines:

- The NSW BioNet Wildlife Atlas and Threatened Biodiversity data collection (DPE, 2022a)
- The Protected Matters Search Tool (DCCEEW, 2022a)
- The NSW BioNet Vegetation Classification data collection (DPE, 2022b)
- The Fisheries NSW Spatial Data Portal (DPI, 2022)
- The register of declared Areas of Outstanding Biodiversity Value (AOBV) (DPE, 2022c)
- The Bureau of Meteorology Atlas of Groundwater Dependent Ecosystems (GDE) (BoM, 2022)
- National Flying-fox monitoring viewer (DCCEEW, 2022b)
- NSW WeedWise (DPE, 2022d)
- NSW State Vegetation Type Map (SVTM) (DPE, 2022d)
- Descriptions for NSW (Mitchell) Landscapes Version 2 (NPWS, 2002)
- The Biodiversity Assessment Method (DPIE, 2020a)
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities working draft (DEC, 2004)
- Threatened Species Assessment Guidelines: the assessment of significance (DECC, 2007)
- Matters of National Environmental Significance: Significant Impact Guidelines 1.1 (Commonwealth of Australia, 2013a)
- Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method (DPIE, 2020b)
- Survey guidelines for Australia's threatened mammals: guidelines for detecting mammals listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999 (CoA, 2011b)
- 'Species credit' threatened bats and their habitats: NSW survey guide for the Biodiversity Assessment Method (OEH, 2018a)
- Threatened reptiles Biodiversity Assessment Method survey guide (DPE, 2022e)
- Survey guidelines for Australia's threatened birds: guidelines for detecting birds listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999 (CoA, 2010a)
- Survey guidelines for Australia's threatened bats: guidelines for detecting bats listed as threatened under the Environment Protection and Biodiversity Conservation Act 1999 (CoA, 2010b).

Habitat assessment

A list of threatened flora, fauna and ecological communities known or considered likely to occur within the construction footprint was prepared and refined based on suitability of habitat features present, including associated plant community types, soil and geological preferences. A habitat assessment was then undertaken to determine the likelihood for each of these threatened entities to occur and, as such, to be potentially impacted by the proposal.

Field surveys

Flora and fauna field surveys were carried out on 3 November 2022 to target specific threatened species to validate the results of the desktop and habitat assessments. Survey effort is in accordance with the BAM.

Flora

Two plots were used to sample the vegetation of the construction footprint. Both plots sampled Blue Mountains Basalt Cap Forest (PCT 3209), with one plot (Q1) located on Slope 93282 and another plot (Q2) located on Slope 96403. It was not possible to sample the vegetation on Slope 33459 due to access being limited by a chain link fence and dangerously steep slope. The location of plots is shown in Figure 6-8 and Figure 6-9.

Targeted flora surveys were completed for two threatened species with a moderate or high likelihood of occurrence within the construction footprint:

- *Lastreopsis hispida* (Bristly Shield Fern) – listed as Endangered under the BC Act
- *Zieria murphyi* (Velvet Zieria) – listed as Vulnerable under the BC Act and EPBC Act.

All accessible areas were searched and the surveys were within the seasonal timeframes.

Fauna

Fauna habitat assessments were conducted across the construction footprint, including survey of:

- Vegetation type, structure and extent
- Forage trees including blossom and fruit trees for birds and Grey-headed Flying-fox (*Pteropus poliocephalus*) (listed as Vulnerable under the BC Act and EPBC Act) and feed trees for Koala (*Phascolarctos cinereus*) (listed as Endangered under the BC Act and EPBC Act)
- Terrestrial shelter habitat such as coarse woody debris, rocky outcrops and artificial shelter (ie corrugated iron sheets, building refuse, rubbish) for invertebrates, amphibians, reptiles and small terrestrial mammals.

Additionally, hollow-bearing trees were recorded and canopy searchers carried out opportunistically across the surveyed area, as well as incidental searches for indirect evidence of fauna, such as scats, nests, burrows, tracks, scratches, chewed cones and diggings.

Targeted fauna surveys were not undertaken for threatened fauna species given the seasonal constraints and access limitations as well as the small size of the subject land.

Impact assessment

Potential impacts to biodiversity as a result of the proposal were identified and assessed. This included an assessment of direct and indirect construction and operational impacts. Mitigation measures for avoiding, managing or reducing impacts on biodiversity values during detailed design, construction and operation were identified. Offsetting requirements for any residual impacts that cannot be avoided, minimised or mitigated were outlined and discussed.

Figure 6-8: Biodiversity BAM plot – Slope 96403

Figure 6-9 Biodiversity BAM plot - Slope 93282

6.3.2 Existing environment

Landscape features

The subject land consists of steep slopes adjoining Bells Line of Road in Mount Tomah. A summary of the landscape features in and surrounding the subject land is provided in Table 6-16.

Table 6-16: Landscape features of the subject land

Landscape feature	Subject land
IBRA bioregions and subregions	The proposal lies within the Sydney Basin bioregion and the Wollemi subregion.
NSW landscape regions (Mitchell landscapes)	The proposal lies within the Blue Mountains Plateau Mitchell Landscape, as mapped by Eco Logical Australia (2008). The Blue Mountains Plateau is described as an elevated, dissected plateau of Triassic quartz sandstones (Eco Logical Australia 2008).
Cleared areas	Of the 1.58 hectares of land in the proposal footprint, 1.01 hectares is cleared. Cleared land comprises mostly of the landscaped areas of the Blue Mountains Botanic Gardens and existing road areas and hardstand ancillary sites.
Rivers and streams	There are no rivers or streams crossing the proposal. The closest mapped stream is Stockyard Gully, located about 30 metres south of the subject land at Slope 96403.
Wetlands	There are no wetlands in the proposal. The closest wetland is an artificial dam to the south of the subject land at Slope 96403.
Connectivity features	The proposal adjoins and is surrounded by large areas of native vegetation in the Blue Mountains World Heritage Area.
Areas of Geological Significance and Soil Hazard Features	The proposal does not contain any karst, caves, crevices, cliffs or other areas of geological significance. It is located within the Blue Mountains, which contains substantial geological formations of exposed sandstone cliffs sitting above deep incised valleys. The soil landscape of the proposal is largely mapped as the Mount Tomah soil landscape; limitations of this soil landscape include localised steep slopes and localised mass movement hazard.

Plant community types and vegetation zones

The native vegetation within the construction footprint is consistent with one plant community type (PCT) – Blue Mountains Basalt Cap Forest (PCT 3209). This PCT is consistent with Threatened Ecological Communities (TECs) listed as Endangered under the BC and EPBC Act. This consisted of two vegetation zones (with different vegetation integrity scores), as summarised in Table 6-17 and shown in Figure 6-10 to Figure 6-12.

Table 6-17: Plant community types and vegetation zones

Veg. zone	Plant community type (PCT)	Associated threatened ecological communities	Area (ha) within footprint	VI score
Zone 1	PCT 3209: Blue Mountains Basalt Cap Forest (Moderate condition – Disturbed)	Blue Mountains Basalt Forest in the Sydney Basin Bioregion (Endangered, BC Act) Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion (Endangered, EPBC Act) (potential)	0.31	37.5
Zone 2	PCT 3209: Blue Mountains Basalt Cap Forest (Moderate condition)		0.26	48.4

PCT 3209: Blue Mountains Basalt Cap Forest

Blue Mountains Basalt Cap Forest (PCT 3209) is described in the BioNet Vegetation Classification Database as a tall to extremely tall sclerophyll open forest, commonly including a high cover of *Eucalyptus blaxlandii* and *Eucalyptus cypellocarpa*, occasionally *Eucalyptus radiata* or rarely, *Eucalyptus oreades* and other cool climate eucalypts. There is a sparse layered mid-stratum of one or more Acacia species, commonly including *Acacia melanoxylon* and occasionally *Acacia falciformis*. Occasionally there is also a sparse cover of the tree fern *Cyathea australis*. A sparse layer of lower shrubs very frequently includes *Indigofera australis* and commonly *Polyscias sambucifolia*. The ground layer is composed of a diverse range of ferns, forbs, climbers, grasses and graminoids. This PCT occurs in wet, cool environments on high elevation (above 800 metres asl) basalt and basalt enriched sandstones, and rarely shale in the Blue Mountains.

The identification of PCT 3209 in the construction footprint was based on:

- Existing regional mapping as an equivalent vegetation type
- Landscape position
- Soil landscape mapping
- Characteristic tree species present
- Structure and species composition consistent with descriptions in the BioNet Vegetation Classification Database.

The composition and structure of areas of PCT 3209 in the subject land varies between the different Slope sites, however all areas have greater floristic and landscape affinities to PCT 3209 than to other PCTs mapped nearby.

The vegetation was divided into two zones, based on the level of disturbance present. The vegetation on the two slopes that are located above the level of the road and that have steeper, more exposed slopes, lower tree cover and higher exotic cover (Slope 33459 and 93282) have been assigned to Zone 1 (Moderate condition – Disturbed), and the vegetation on the slope below the level of the road, which has higher tree cover and lower exotic cover (Slope 96403) has been assigned to Zone 2 (Moderate condition).

Threatened ecological communities

Blue Mountains Basalt Cap Forest (PCT 3209) is associated with the Blue Mountains Basalt Forest in the Sydney Basin Bioregion, listed as Endangered under the BC Act. Based on comparison of the vegetation recorded in the construction footprint with the Final Determination for Blue Mountains Basalt Forest in the Sydney Basin Bioregion (TSSC, 2011), all areas of native vegetation in the construction footprint are considered to be consistent with the TEC. This TEC occupies 0.57 hectares of the construction footprint (Figure 6-10 to Figure 6-12).

The areas of Blue Mountains Basalt Cap Forest in the subject land may also meet the criteria for Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion, listed as an Endangered under the EPBC Act. The TEC is broadly similar to Blue Mountains Basalt Forest in the Sydney Basin Bioregion, but only includes patches that meet certain size, condition and species composition thresholds. Based on comparison of the vegetation recorded in the construction footprint with the Commonwealth listing advice for Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion, only the vegetation in Zone 2 (Slope 96403) within the construction footprint is considered to be consistent with the TEC as defined under the EPBC Act. This TEC occupies 0.26 hectares of the construction footprint (Figure 6-13).

Groundwater dependent ecosystems

The Bureau of Meteorology's (BoM) GDEs Atlas (BoM, 2022) was reviewed in October 2022 to determine the occurrence of potential GDEs within the site investigation area and surrounding study area. No potential GDEs were identified in the subject land; the closest mapped GDEs are areas of Hinterland Sandstone Gully Forest located about 1.2 kilometres to the north.

Figure 6-10: PCT, vegetation zones and BC Act TEC – Slope 33459

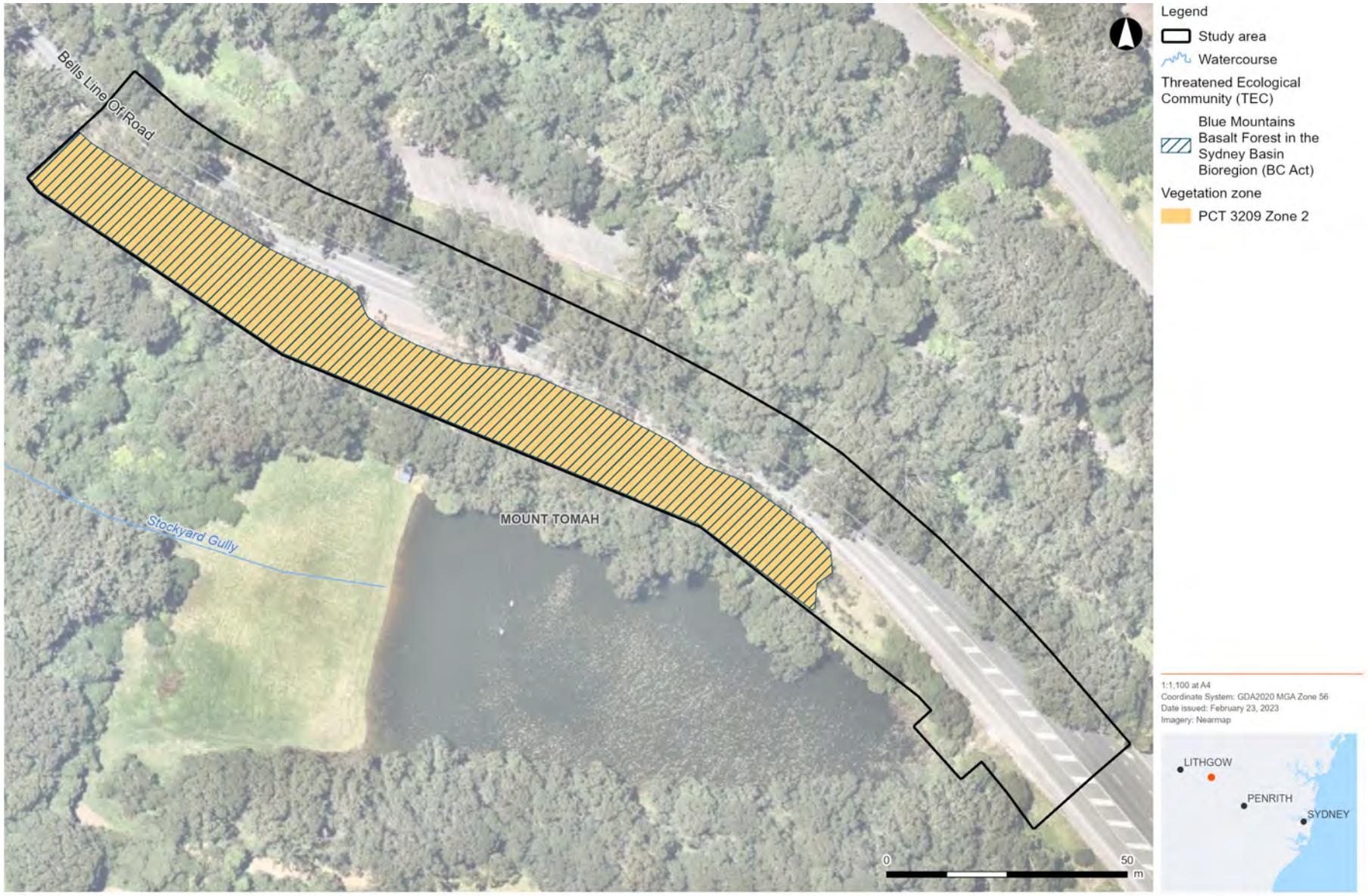


Figure 6-11 PCT, vegetation zones and BC Act TEC – Slope 96403

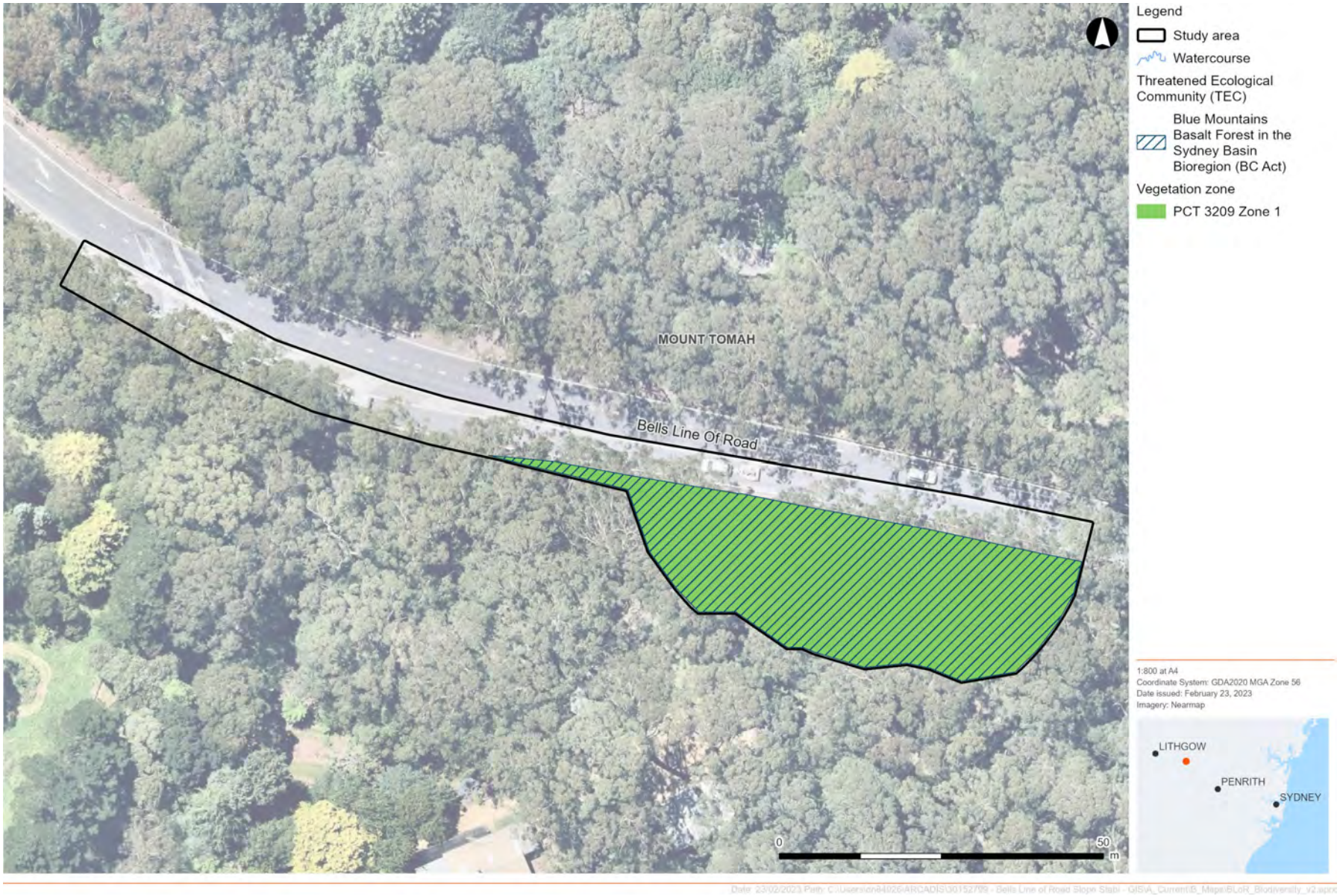


Figure 6-12 PCT, vegetation zones and BC Act TEC – Slope 93282

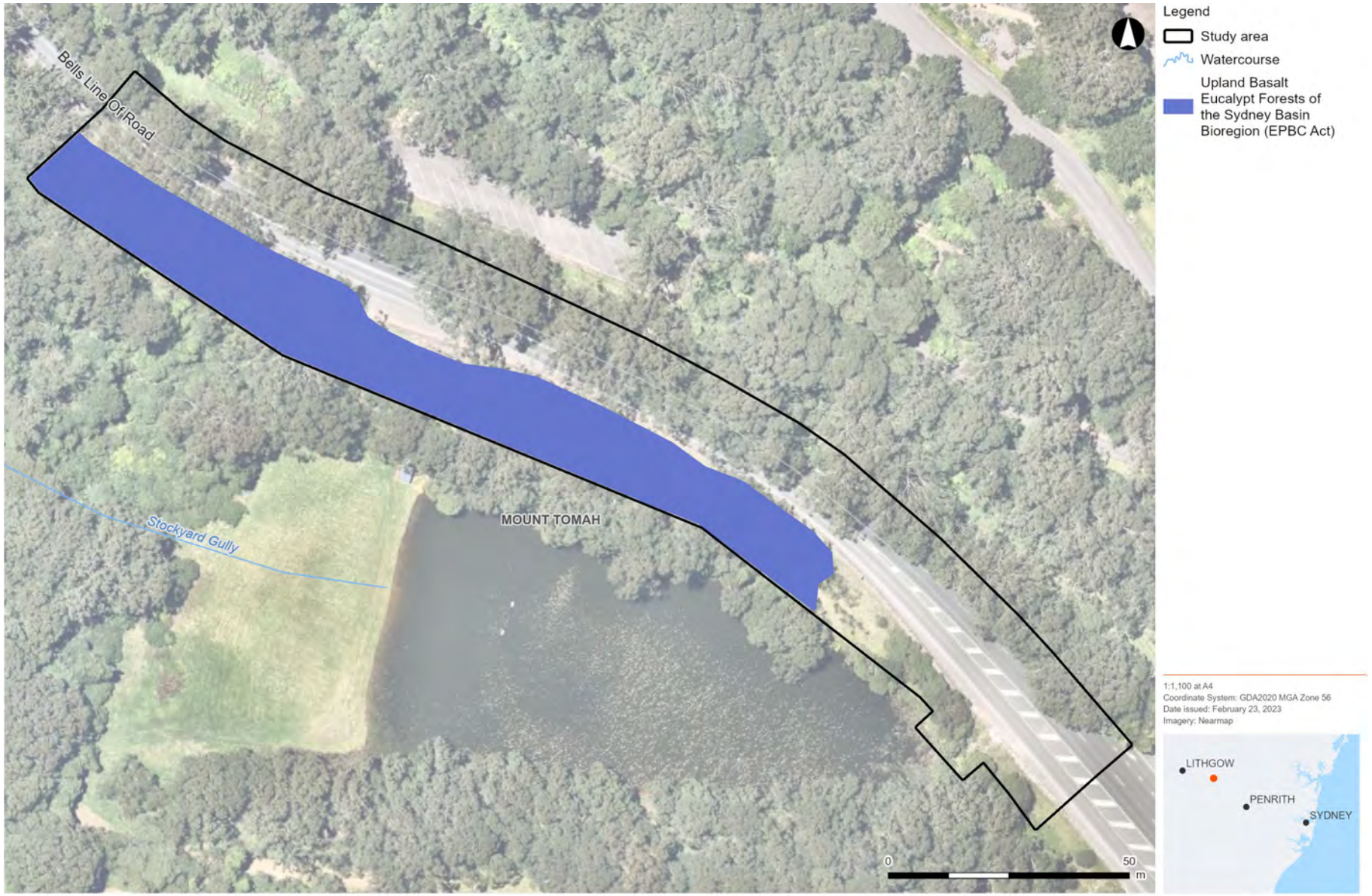


Figure 6-13: EPBC Act TEC – Slope 96403

Threatened species

The results of threatened species searches are provided in Table 6-18 for all species considered to have a moderate or high likelihood of occurrence.

Table 6-18: Threatened species surveys results

Species name	EPBC Act	BC Act	Identification method	Survey effort compliant?[1]	Notes
Lastreopsis hispida Bristly Shield Fern	-	E	Not recorded	Yes	Survey was within seasonal timeframes, however not all areas were accessible for survey
Zieria murphyi Velvet Zieria	V	V	Not recorded	Yes	Survey was within seasonal timeframes, however not all areas were accessible for survey
Callocephalon fimbriatum Gang-gang Cockatoo	E	V	Assumed present	No targeted survey conducted	Assumed present based on presence of associated PCT and potential breeding habitat (hollows with >9cm diameter).
Cercartetus nanus Eastern Pygmy-possum	-	V	Assumed present	No targeted survey conducted	Assumed present based on presence of associated PCT, although notable feed trees of the Banksia and Bottlebrush genera are absent on site.
Chalinolobus dwyeri Large-eared Pied Bat	V	V	Assumed present	No targeted survey conducted	Foraging habitat is assumed to be present based on presence of associated PCTs within 2km of rocky areas containing caves, escarpments, overhangs, outcrops, crevices.
Dasyurus maculatus Spotted-tail Quoll	E	V	Assumed present	No targeted survey conducted	Foraging and dispersal habitat is assumed to be present based on presence of associated PCTs.
Ninox strenua Powerful Owl	-	V	Assumed present	No targeted survey conducted	Assumed present based on presence of associated PCT and potential breeding habitat (hollows >20cm diameter, >4m above ground).
Petauroides volans Greater Glider	E	E	Assumed present	No targeted survey conducted	Assumed present based on presence of associated PCT and potential breeding habitat (hollows).
Phascolarctos cinereus Koala	E	E	Assumed present	No targeted survey conducted	Assumed present based on presence of associated PCT and Koala feed trees.

Of the species identified in the PMST, six threatened fauna species were considered to have a moderate or higher likelihood to occur in the subject land including:

- Broad-headed Snake (*Hoplocephalus bungaroides*), vulnerable under EPBC Act
- Gang-gang Cockatoo (*Callocephalon fimbriatum*), vulnerable under EPBC Act

- Greater Glider (*Petauroides volans*), vulnerable under EPBC Act
- Koala (*Phascolarctos cinereus*), endangered under EPBC Act
- Large-eared Pied Bat (*Chalinolobus dwyeri*), vulnerable under EPBC Act
- Spotted-tailed Quoll (*Dasyurus maculatus maculatus*), endangered under EPBC Act.

Fauna habitat assessment

Slope 33459

Terrestrial shelter habitat (i.e. coarse woody debris, rocky outcrops, bushrocks and leaflitter) was primarily absent on Slope 33459. The site predominantly consisted of a dense understorey of native vegetation regrowth, about 2.5 metres tall, that was used by small woodland bird species (i.e. Superb Fairywren) for foraging habitat. There were sections of dense, weedy grass that could provide suitable cover for reptile species, although this area is less likely to be used due to the absence of rocky outcrops and bushrocks. Two hollow-bearing trees (HBTs) were present and a total of two medium-sized hollows were identified. There were no signs of occupancy, and neither hollow was of sufficient size for owl breeding habitat. Furthermore, no indirect signs of fauna use (i.e. scats, nests, burrows, diggings or tracks) were identified on site.

Slope 96403

Similar to the previous slope, terrestrial shelter habitat features were primarily absent on Slope 96403. Fire damage was evident along the slope and the site was dominated by a weedy understorey, about 0.5 to one metre tall. The understorey was sparser and did not comprise optimal foraging habitat for small woodland bird species, although a select few individuals were observed gleaning. Two hollow-bearing trees were present in close proximity to the road, with 10 hollows in total. Three large hollows were of suitable size for owl species, with the remaining hollows being suitable for glider, possum and parrot species. However, there were no signs of occupancy. One small culvert (about 30 centimetres diameter) was present, although it would be unsuitable for microbat species. There were minimal indirect signs of fauna use, with only one potential burrow (about 5 centimetres diameter) located at the base of a Eucalyptus tree. Aquatic habitat in the form of a human-made dam is closely located to the site that could serve as potential suitable habitat for certain frog and waterbird species.

Slope 93282

Slope 93282 was dominated by a dense, weed understorey and some native vegetation regrowth. The trees on the slope had been previously cleared, and no hollow-bearing trees were identified on site. Fauna habitat features on site were minimal, as the understorey was too low (about 0.5 metres tall) to serve as foraging habitat for small woodland bird species, and no rocky outcrops, bushrocks or notable coarse woody debris were present. A Section along the top of the slope consisted of ample leaflitter (more than 5 centimetres depth), which could serve as suitable habitat for invertebrates and small reptile species. No indirect signs of fauna use were identified on site.

6.3.3 Potential impacts

Avoidance and minimisation

To achieve the proposal objectives, impacts on ecological values could not be completely avoided, however efforts to avoid and minimise these impacts have been taken.

Vegetation clearing would be minimised wherever possible. Ancillary facilities have also been located on existing cleared roadside and carpark areas to avoid native vegetation clearing. The proposal would not fragment surrounding native vegetation areas.

Protected areas within and/or adjacent to the construction footprint would be clearly demarcated prior to construction.

Construction direct impacts

Vegetation removal

Construction of the proposal would require the removal of up to 0.57 hectares of native vegetation. Vegetation removal is summarised in Table 6-19 and Figure 6-10 to Figure 6-12.

Fauna habitat removal

The removal of 0.57 hectares of native vegetation includes the removal of up to five hollow-bearing trees containing two medium sized hollows at Slope 33459 and three large hollows at Slope 96403. Removal of these trees could impact species credit species habitat including Eastern Pygmy-possum, Spot-tailed Quoll, Powerful Owl, Gang-gang Cockatoo and Greater Glider.

Hollow-bearing tree removal at Slope 33459 would be carried out outside the breeding period of Greater Glider (March to June) (NSW Threatened Species Scientific Committee, 2022) and Spot-tailed Quoll (July to August) (DCCEEW, 2022c) and therefore unlikely impact the breeding cycle of these species. Eastern Pygmy-possum breed opportunistically when foraging resources are available, and therefore could be impacted during breeding.

Hollow-bearing tree removal at Slope 96403 would be carried out outside the breeding period of Powerful Owl (May to August) (DPE, 2022d) and Gang-gang Cockatoo (October to January) (DPE, 2022d) and therefore unlikely impact the breeding cycle of these species.

Impacts to all threatened fauna species are limited to a very small area of vegetation (0.57 hectares) that is already edge-affected, adjacent to the road and suboptimal relative to the vast expanse of connected vegetation. It is unlikely that vegetation removal would impact any species significantly.

Table 6-19: Removal of vegetation within the construction footprint

Vegetation	PCT number	Condition	Status	Area to be impacted (ha)		
				Slope 33459	Slope 96403	Slope 93282
Blue Mountains Basalt Cap Forest	PCT 3209	Moderate condition – Disturbed (Zone 1)	Endangered, BC Act	0.18	-	0.13
Blue Mountains Basalt Cap Forest	PCT 3209	Moderate condition (Zone 2)	Endangered, BC Act and EPBC Act	-	0.26	-
Grass	-	-	-	0.27	-	-

Injury and mortality

The primary cause of increased fauna injury and mortality during construction would be as a result of vegetation clearing activities (particularly during the felling of hollow-bearing trees or trees containing arboreal mammals (e.g. possums, gliders), reptiles or active nests) or may result from collisions with work vehicles or plant, or accidental entrapment in plant, trenches or other works.

The removal of fauna habitat has inherent risks that can, in part, be mitigated through implementing appropriate clearing procedures. The majority of native and threatened fauna species that have habitat within the study area are highly mobile and typically vacate the vegetation in which they reside at the commencement of vegetation clearing. Other, typically ground dwelling, species are less mobile and at higher risk of construction phase mortality. Measures to reduce accidental injury or mortality to fauna are proposed in Section 6.3.4.

Assessments of significance

Assessments of significance were carried out for each threatened species and ecological community that has been recorded or with a moderate to high likelihood of occurrence in the construction footprint. Results of these assessments are presented in Appendix D – Biodiversity Assessment Report.

The assessments of significance concluded impacts to threatened entities on the BC and EPBC Act would not be significant.

Indirect and operational impacts

Indirect impacts occur when the proposal or activities relating to the construction, operation and general change in land-use patterns of the proposal affect native vegetation, threatened ecological communities, threatened species and their habitats beyond the direct impact area.

Edge effects, connectivity and habitat fragmentation

The native vegetation in the construction footprint is located in roadside areas and is currently subject to edge effects, including weed incursion at the road margin and adjoining cleared areas such as the Botanic Gardens boundary fence. The proposal is unlikely to result in additional edge effects through the creation of new edges.

The proposal would have negligible impacts to fauna connectivity as there would be minimal clearing over small areas. The clearing would results in a minor reduction of canopy cover at two slopes, increasing the crossing distance for fauna over Bells Line of Road. This is limited to two short stretches of road and is unlikely to impact any species life cycles, dispersal and migration patterns.

Invasion and spread of weeds

The invasion and spread of weeds pose a high risk to biodiversity and is a potential consequence of construction and operation activities when the appropriate management strategies are not implemented. Weeds present a high biodiversity risk as they compete with native vegetation and invade and transform ecosystems (Downey & Grice, 2008).

A total of 18 exotic species were recorded, of which three are identified as high threat weeds in the BAM-C: *Cenchrus clandestinus* (Kikuyu Grass), *Ehrharta erecta* (Pandic Veldtgrass) and *Ranunculus repens* (Creeping Buttrcup). High threat weeds are defined as plants that, if not controlled, will invade and outcompete native plant species (DPIE (EES), 2020a). One of the exotic plant species recorded in the subject land, *Rubus fruticosus* (Blackberry), is listed as a Priority Weed for the Greater Sydney region under the Biosecurity Act 2015; this species is also included on the Commonwealth list of 32 Weeds of National Significance (WoNS).

Specific measures for impacts relating to the invasion and spread of weeds are included in Section 6.3.4.

Noise, light, dust and vibration

Noise, light, dust and vibration can impact on surrounding biodiversity during the construction phase of the proposal. Dust as a result of the proposal is expected to be minimal and limited and would have a minor or negligible impact on ecological values in the vicinity of the subject land.

Some works will be undertaken at night, which could result in an increase in artificial lighting in the area and deter fauna from the area or disrupt activities. Impacts to fauna would be localised and restricted to small areas in direct vicinity of the proposal.

Activities such as vegetation clearing, habitat removal, increased human presence, plant and machinery during construction of the proposal have the potential to increase noise and vibration within the subject land and surrounding area. The proposal exists within a bushland area, where there is relatively low baseline of noise and vibration from existing roads and residential properties, with the exception of traffic noise along Bells Line of Road. Sudden additional noise and vibration has the potential to disrupt foraging, breeding and/or movement behaviour of both common and threatened fauna on the subject land and surrounds. Noise and vibration impacts are not considered likely to have a significant, long-term impact on fauna, including threatened fauna, as impacts are considered to be short-term and would be limited to the construction period and carried out in a very small area. Adjoining vegetation would provide refuges for fauna to retreat. Within the impact area, some sensitive species (e.g. woodland birds) may avoid the noise and vibrations, while some more tolerant species (e.g. small mammals) can habituate over the longer-term (Byrnes, et al., 2012). Given the subject land is directly adjacent to traffic noise, species inhabiting the subject land would have some tolerance to noise. Any breeding individuals could be disrupted, including threatened hollow-dependent fauna if they inhabit hollow-bearing trees at or within the vicinity of the subject land. Clearing would be scheduled for February to avoid breeding seasons of threatened fauna species, reducing the potential for indirect impacts.

Soil disease

Due to excavation activities required during construction of the proposal there is the potential for the transmission of soil diseases into the Blue Mountains Botanic Garden. As this is located in close proximity to the proposal care, is required that soil is not transmitted onto the site from vehicles, machinery, tools and boots. This would be managed in accordance with the Botanic Gardens *Prevention of Soil Diseases – Procedures for Contractors Entering the Site* (Royal Botanic Garden, 2009), as included in Section 6.3.4.

Conclusion on significance of impacts

The proposal is not likely to significantly impact threatened species or ecological communities or their habitats, within the meaning of the BC Act or the FM Act and therefore a Species Impact Statement or Biodiversity Development Assessment Report is not required.

The proposal is not likely to significantly impact threatened species, ecological communities or migratory species, within the meaning of the EPBC Act.

6.3.4 Safeguards and management measures

Table 6-20: Biodiversity safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
BI01 Biodiversity management	A Flora and Fauna Management Plan will be prepared in accordance with Transport for NSW's *Biodiversity Guidelines: Protecting and Managing Biodiversity on Projects* (RMS, 2011) and implemented as part of the CEMP. It will include, but not be limited to: – plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas – requirements set out in the *Landscape Guideline* (RMS, 2008) – pre-clearing survey requirements – procedures for unexpected threatened species finds and fauna handling – protocols to manage weeds and pathogens.	Contractor	Pre-construction	Section 4.8 of QA G36 Environment Protection
BI02 Pre-clearing surveys	Pre-clearing surveys will be undertaken in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	Pre-construction	
BI03 Removal of native vegetation and threatened fauna habitat	Vegetation and habitat removal will be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	Construction	
BI04 Exclusion zones	Exclusion zones will be set up at the limit of clearing in accordance *with Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	Pre-construction	
BI05 Unexpected species finds	The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened ecological communities or threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal site.	Contractor	Construction	

Impact	Environmental safeguards	Responsibility	Timing	Reference
BI06 Hollow-bearing trees	Hollow-bearing tree removal at Slope 33459 would not be undertaken between March and October to minimise potential to impact breeding fauna species	Contractor	Construction	
BI07 Hollow-bearing trees	Hollow-bearing tree removal at Slope 96403 would not be undertaken between May and January to minimise potential to impact breeding fauna species	Contractor	Construction	
BI08 Fauna management	Fauna will be managed in accordance with *Guide 9: Fauna handling* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	Construction	
BI09 Invasion and spread of weeds	Weed species will be managed in accordance *with Guide 6: Weed management* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	Construction	
BI10 Invasion and spread of pathogens and disease	Pathogens will be managed in accordance with *Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	Construction	
BI11 Noise, vibration and light	Works at Slope 96403 would be scheduled between February and April to avoid breeding seasons of these species, October to January (Gang-gang Cockatoo) and May to August (Powerful Owl) and indirect noise, vibration and light impacts.	Contractor	Construction	
BI12 Offsetting	Tree replacement would be undertaken in accordance with *Work Cover Amenity Code of Practice* (1998) and the *Work Safe Guide to Tree Trimming and Removal* (2006). Contractor would keep a register of the number of trees to be removed, the height of trees, and the diameter of trees. These trees would be either replanted in the close vicinity of removed trees or fund would be allocated as per the *Transport Biodiversity Policy* (2022) and *Tree and Hollow Replacement Guidelines* (2022).	Transport for NSW	Construction	

6.3.5 Biodiversity offsets

If impacts are unable to be avoided or safeguarded against, biodiversity offsets may be used to counterbalance the impact of development on biodiversity. Offsets for the proposal are determined with reference to the Transport *No Net Loss Guidelines* (Transport for NSW, 2022a) and supporting resources, and *Tree and Hollow Replacement Guidelines* (Transport for NSW, 2022b) and supporting resources.

Offsets are not required for ecosystem and species credits as offset thresholds are not triggered (refer to Section 7.1 of Appendix D – Biodiversity Assessment Report).

Tree and hollow replacements are required. A preliminary estimate of tree clearing is that between 10 and 30 trees would be removed. Tree replacement ratios range from 1:16 to 1:2, depending on size of the tree. A range

of size classes were recorded. Extrapolated out this would require approximately 140 replacement plantings. Tree data would be required to accurately counted upon vegetation clearing and offset ratios recounted.

Up to five hollows would be removed (two at Slope 33459, three at Slope 96403). The replacement requirement as per the *Tree and hollow replacement guidelines* (TfNSW, 2022b) is three artificial hollows for every occupied hollow removed, assuming an occupancy rate of 20 per cent. In this case, it could be assumed one of the hollows is occupied. Therefore, three artificial hollows would be required.

Transport have two options to meet the tree and hollow replacement requirements:

1. Make a payment into the TfNSW Conservation Fund, or
2. Replacement plantings within the subject land or in proximity.

Its unlikely that the trees could be planted on the subject land or in proximity given the steep topography and limited spatial availability, though artificial hollows may. As such, it is recommended that Transport pay into the Transport for NSW Conservation Fund to offset tree removal. If trees can be replanted in proximity or artificial hollows installed, a Tree and Hollow Replacement plan is required. A template for this plan is included as a resource to the *Tree and Hollow Replacement Guidelines* (Transport for NSW, 2022b).

6.4 Geology and soils

This section provides an assessment of the potential impacts of the proposal on geology and soils and identifies safeguards and management measures to avoid or minimise these impacts.

6.4.1 Methodology

This assessment included the following:

- Desktop review of the relevant geotechnical and soil landscape maps:
  - NSW Seamless Geology mapping (NSW Government 2022)
- Consideration of the geotechnical field work and investigations carried out for the proposal and documented in:
  - *Bells Line of Road – Slope 033459 Geotechnical Interpretation and Detailed Design Report (GIDR)* (Jacobs, 2022a)
  - *Bells Line of Road – Slope 096403 Geotechnical Interpretation and Detailed Design Report (GIDR)* (Jacobs, 2022b)
  - *Remediation of Slope 093282 Technical Memorandum* (Jacobs, 2022c)
- Identification of potential geotechnical and soil issues for the proposal and identification of safeguards and management measures to minimise these impacts throughout construction and operation of the proposal.

6.4.2 Existing environment

Topography

The three slope sites are located in relatively mountainous terrain, with the peak of Mount Tomah located south-south-west of the proposal. Topography ranges from steep to undulating. The approximate elevation at each slope is identified in Table 6-21, with the largest topographical feature being Mount Tomah with an approximate elevation of 991 metres. The majority of the land surrounding Mount Tomah and the proposal is classified as a Protected Area – Slope Constraint Area (>20%) according to the Blue Mountains LEP. The locations of Slope 33459, 96403 and 93282 in areas classified as Protected Area – Landslide Risk Area and are shown in Figure 6-14.

Table 6-21: Approximate elevation of each Slope 33459, 93282 and 96403

Slope ID	Approximate elevation (m)
33459	925
93282	970
96403	930

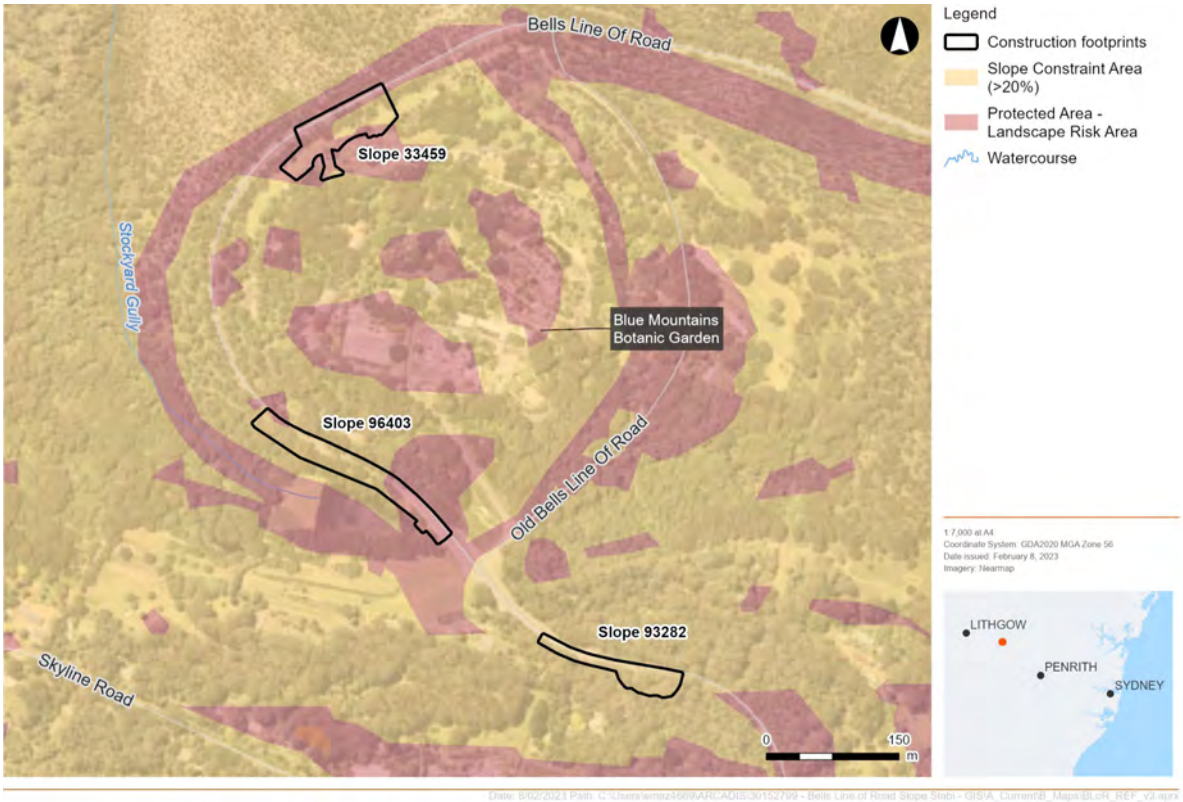


Figure 6-14: Protected Area – Slope Constraint Area (>20%) and Protected Area - Landslide Risk Area (Blue Mountains LEP)

Soil and geology

NSW Seamless Geology (Geology Survey of NSW, 2022) mapping of the proposal and surrounds, as shown in Figure 6-15, indicates that the sites are underlain by the Blue Mountains volcanics, consisting of Tertiary aged olivine basalt. The olivine basalt unit overlays Ashfield Shale belonging to the Wianamatta Group of Triassic age. This unit comprises of typically dark grey shale with thin sandstone bands. The Ashfield Shale unit overlays Hawksbury Sandstone also belonging to the Wianamatta Group. This formation is typically made up of coarse grained quartz sandstone with very minor shale and laminate lenses (Jacobs, 2022a).

Basalt was not encountered at Slope 33459, except in the form of small cobbles within colluvial and possible localised fill (Jacobs, 2022a). Slope 96403 was similar, encountering basalt cobbles and boulders within the embankment fill material (Jacobs, 2022b). The bedrock observed at both sites was Ashfield Shale. Historic quarrying of basalts in the area may have contributed to the lack of basalts observed.

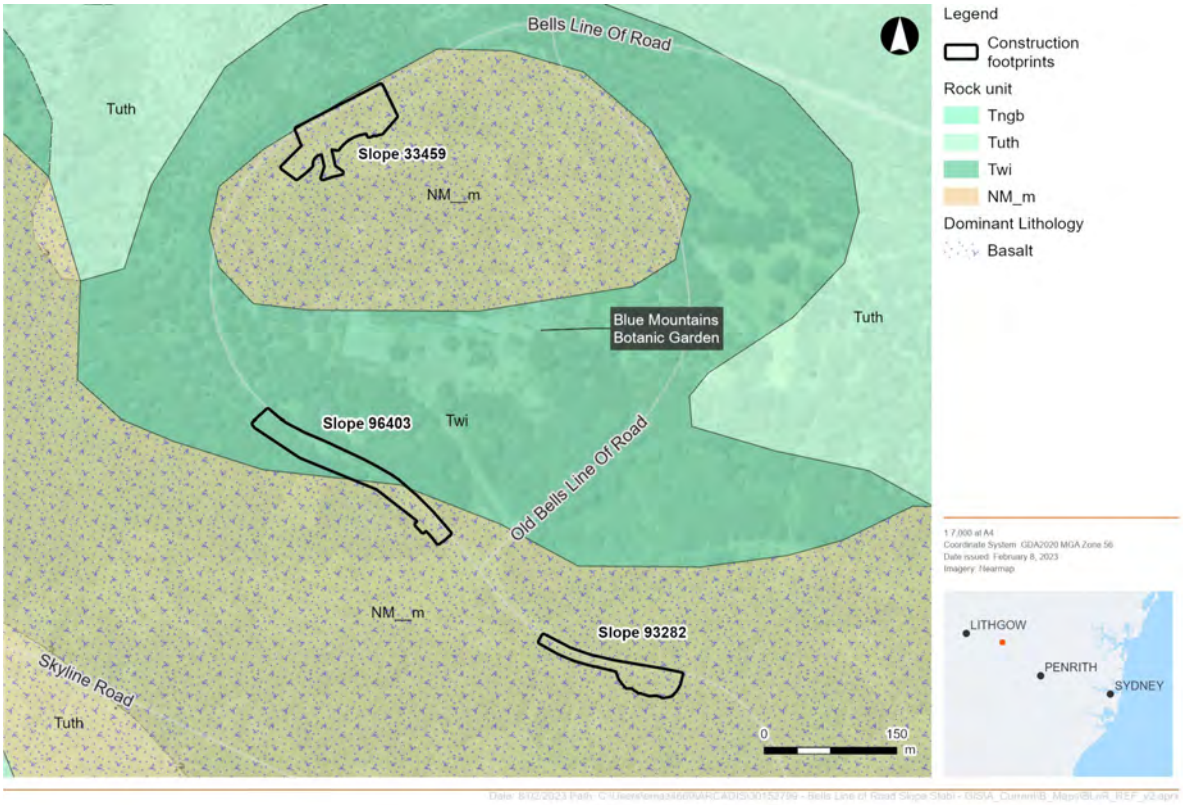


Figure 6-15: Geology of the area surrounding Slope 33459, Slope 96403 and Slope 93282

Blue Mountains Volcanics – Olivine Basalt

The Western Blue Mountains has been subject to volcanic activity following the development of the Sydney Basin, including isolated fissure eruptions and a later larger flow event. These isolated eruptions are estimated to have occurred during the late Jurassic period and are now represented topographically by ridge like structures (Branagan, 1960). A second larger flow occurred during the Tertiary period, covering most of the Blue Mountains and extending as far as Penrith. The rapid cooling of the basalt formed columns at locations including Mount Tomah. Following the basalt flows, tectonic activity caused the Blue Mountains to be pushed up. Most of the basalt was eroded, with the exception of the Western Blue Mountains, following the uplift. The remaining basalt flows include Mount Tomah, Mount Bell, Mount Banks, Mount Irvine, Mount Caley, and Mount Wilson (Jacobs, 2022a).

The basalt located at Mount Tomah is estimated to cover 240 hectares, with localised thickness up to 81 metres (Goldbery, 1969). At Slope 33459, columnar basalt was quarried during the 1960's, with many walls throughout the Blue Mountains Botanic Garden built from columnar basalt blocks.

Ashfield Shale (Wianamatta Group)

Ashfield shale forms the basal unit of the Wianamatta Group and has a thickness of about 60 metres. The rock types found are generally dark grey sandy shales with frequent sideritic clay ironstone bands and thin sandstone beds present in the basal portion of the unit. This comprises of four subdivisions, listed in stratigraphic sequence below:

- Mulgo Laminate
- Regentville Siltstone
- Kellyville Laminate
- Rouse Hill Siltstone.

Ashfield shale bedding is close to horizontal with the exception of small scale cross bedding in sandier zones. The Kellyville Laminate unit does have steeper bedding, recorded as dipping up to 30 degrees (Jacobs, 2022a). Mapping of Ashfield shale on the eastern side of Mount Tomah shows that it is located about 50 metres below the basalt caps (Bembrick, 2015).

Hawksbury Sandstone

Hawksbury Sandstone is present throughout much of the Sydney Basin and was formed in the Middle Triassic. The Hawksbury Sandstone of the western Blue Mountains is a massive quartzose sandstone with occasional irregular spaced lenticular shale inclusions (Jacobs, 2022a). At Mount Tomah the Hawksbury Sandstone is about 52 metres thick with the top of the unit at the base of the Ashfield Shale formation. In this area the sandstone is typically yellow white, medium to coarse grained, quartzose and hard with well-developed cross bedding dipping 15 degrees to the east (Goldbery, 1969).

Subsurface units

As part of the geotechnical assessments carried out, subsurface materials have been categorised into distinct categories. Table 6-22 outlines subsurface units for Slope 33459 and Slope 96403 (Jacobs, 2022a), with Table 6-23 outlining subsurface units for Slope 93282 (Jacobs, 2022c).

Table 6-22: Subsurface units of Slope 33459 and Slope 96403

ID	Unit	Description
1a	Topsoil	Typically, high plasticity silty clays, dark brown, trace rootlets.
1b	Colluvium (possibly fill)	Typically, medium to high plasticity clays and silts, dark brown to red and orange-brown, trace sands and basalt gravels, occasional basalt cobbles.
2a	Residual Soil	Typically, high plasticity (medium to high for Slope 96403) orange-brown and grey clays, trace gravels, stiff to very stiff.
2b	Extremely weathered material	Typically, high plasticity clays, grey and orange-brown, with siltstone gravels. Very stiff to hard, with weathered siltstone visible.
3a	Class IV-V Siltstone	Interlaminated siltstone, fine grained, pale grey stained orange-brown, indistinctly sub-horizontally laminated exhibit soil properties, very low to low strength.
3b	Class III siltstone	Interlaminated siltstone (80%) and sandstone (20%), fine grained, pale grey stained orange-brown, distinctly laminated at 0-5°, low to medium strength.

Table 6-23: Subsurface units of Slope 93282

ID	Unit	Description
1a	Fill (existing pavement	Wearing surface (asphalt) and base course (clayey gravel) of existing pavement.
1b	Fill	Silty clayey sand, low to medium plasticity, light orange-brown, sand fine-grained, moist.
1c	Extremely weathered rock material (derived from siltstone)	Extremely weathered siltstone, silty sandy clay, low to medium plasticity, light brown, fine grained sand, moist, with siltstone rock fabric visible.
2a	Colluvium	Clayey sandy silt, high plasticity, dark brown, fine grained sand, stiff to very stiff, moist, with basalt cobbles.
2b	Residual soil/extremely weathered rock material (derived from basalt)	Clayey silt, medium plasticity, orange-brown, fine grained sand, very stiff, moist, with basalt cobbles.
3a	Basalt	Basalt, core stones in soil matrix. Dark grey, slightly weathered, extremely high strength.
4a	Class IV-V siltstone	Siltstone, pale grey, laminated (siltstone and fine-grained sandstone), extremely to highly weathered, very low strength.
4b	Class II-III siltstone	Siltstone, dark grey, interlaminated (siltstone and fine-grained sandstone), medium to slightly weathered, medium strength.

Acid Sulphate Soils

According to the National Acid Sulphate Soil Atlas (Australian Soil Resource Information System, 2013) the area in the vicinity of slopes to be stabilised are classified as having extremely low probability of occurrence of acid sulphate soils.

6.4.3 Potential impacts

Construction

Soil erosion and sedimentation

As a result of construction activities, primarily vegetation clearing and earthworks, there would be an increased risk of soil erosion and sediment transport occurring at Slopes 33459, 96403 and 93282 and associated ancillary facilities. Activities with the potential to result in soil erosion and sediment transport at each slope are provided in Table 6-24.

Soil erosion has the potential to lead to the transportation of soils and sediments via stormwater runoff and wind into nearby watercourses. This has the potential to impact the water quality of affected watercourses, as discussed further in Section 6.5. This would be managed in accordance with an Erosion and Sediment Control Plan (ESCP) to be included within the CEMP.

Table 6-24: Activities with the potential to result in soil erosion and sediment transport at each slope

Site	Slope stabilisation method	Activities with potential soil erosion and sediment transport
Slope 33459	Piles, soil nails and reinforced shotcrete, drainage works	– Earthworks, including stripping of vegetation and topsoil and excavation of trench trains – Transportation of materials – Movement of heavy vehicles across exposed earth – Installation of soil nails and bore piles.
Slope 96403	Pile wall with capping beam	– Earthworks, including stripping of vegetation and topsoil and boring for piles – Transportation materials – Movement of heavy vehicles across exposed earth – Installation of bore piles.
Slope 93282	Gabion wall	– Earthworks, including stripping of vegetation and topsoil, excavation and filling – Transportation of cut or fill materials – Movement of heavy vehicles across exposed earth.
Ancillary facilities	-	– Stockpiling of material

Acid sulphate soils

Acid sulphate soils are not expected to be encountered as a result of construction activities associated with the proposal. As discussed in Section 6.4.2, there is extremely low probability of acid sulphate soils occurring within or surrounding the proposal.

Operation

As each slope would be stabilised in accordance with *Guide to Slope Risk Analysis* (Roads and Maritime Services, 2014), the risk of impacts occurring as a result of erosions, sedimentation or land slip risk would be significantly minimised. Aggressivity testing of the soil in the vicinity of Slopes 33459 and 96403 and durability of steel and concrete piles was carried out to determine potential impacts to concrete and steel and is shown in Table 6-25. The results indicated that the exposure of concrete and steel to pH, sulphide and chloride and resistivity would be non-aggressive, with the exception of concrete exposure to pH at Slope 33459. This interaction was classified as mild. Infrastructure would be subject to monitoring and maintenance in accordance with Transport's schedules.

Table 6-25: Exposure classification

Slope	Material	Exposure classification		
		pH	Sulphate and chloride	Resistivity
33459	Concrete	Mild	Non-aggressive	-
	Steel	Non-aggressive	Non-aggressive	Non-aggressive
96403	Concrete	Non-aggressive	Non-aggressive	Non-aggressive
	Steel	Non-aggressive	Non-aggressive	Non-aggressive

6.4.4 Safeguards and management measures

Safeguards and management measures to address soil impacts are identified in Table 6-26.

Table 6-26: Soils safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
SW01 Erosion and sediment control	A site-specific Erosion and Sediment Control Plan/s will be prepared and implemented as part of the CEMP. The Plan will include arrangements for managing wet weather events, including monitoring of potential high-risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather.	Contractor	Detailed design / pre-construction	Section 2.2 of *QA G38 Soil and Water Management*
SW02 Contaminated land	If unexpected contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Transport for NSW Senior Manager Environment and Sustainability.	Contractor	Construction	Section 4.2 of QA *G36 Environment Protection*
SW03 Accidental spill	A site-specific emergency spill plan will be developed and include spill-management measures in accordance with the Transport *Code of Practice for Water Management* (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Transport EPA officers).	Contractor	Pre-construction	Section 4.3 of QA *G36 Environment Protection*

Impact	Environmental safeguards	Responsibility	Timing	Reference
SW04	Erosion and sediment control measures are to be implemented and maintained to: – Prevent sediment moving off-site and sediment laden water entering any water course, drainage lines, or drain inlets – Reduce water velocity and capture sediment on site – Minimise the amount of material transported from site to surrounding pavement surfaces – Divert clean water around the site. (in accordance with the Landcom/Department of Housing Managing Urban Stormwater, Soils and Construction Guidelines (the Blue Book)).			

6.5 Flooding and surface water

This section provides an assessment of the potential impacts of the proposal on flooding and surface water and identifies safeguards and management measures to avoid or minimise these impacts.

6.5.1 Methodology

The flooding and surface water assessment included the following:

- A desktop review of available information including:
  - Existing waterways surrounding the proposal
  - Existing drainage structures
  - Proposal design files
  - Drainage study carried out as part of geotechnical investigations at Slope 96403 (Jacobs, 2022b)
- Identification and assessment of construction and operational activities that have the potential to cause flooding and surface water impacts
- Recommendation of safeguards and management measures to manage potential flooding and surface water impacts.

6.5.2 Existing environment

Catchment and waterways

The proposal is located within the overall Blue Mountains catchment, which comprises of three smaller catchments including:

- Katoomba - five square kilometres
- Woodford – 9.8 square kilometres
- Blackheath – 7.2 square kilometres.

The area surrounding the proposal includes a number of small creeks including:

- Mill Creek, fed by Stockyard Gully
- Tomah Creek.

Mistake Gully and Bald Hills Gully are also located on the south and north side of Bells Line of Road respectively in the vicinity of Ancillary Facility 5 and 6.

A manmade dam is located about 20 metres south-west of Slope 96403.

Existing drainage structures

An existing drainage system is located in the vicinity of Slope 96403 was subject to a high-level assessment of the existing hydraulic capacity, highlight existing issues and develop solutions to safely discharge flows along the existing Bells Line of Road embankment. Generally, the existing drainage consists of a dish drain which runs along the westbound lane that collects and conveys surface runoff from part of the Blue Mountains Botanic Garden catchment and the Bells Line of Road carriageway to three existing cross drainage culverts. The culverts then discharge into the manmade dam south of Bells Line of Road.

The outlet headwall of Culvert 446877, located at the eastern edge of the proposed works on Slope 96403, shows signs of damage, with erosion observed on the underside of the headwall apron and existing gabions and concrete apron collapsing. The culvert pip was observed to be in good condition with minimal sediment deposition.

Aside from curb side dish drains, there is no other drainage infrastructure at Slope 33459 or Slope 93282. There is no existing formalised water quality treatment observed at existing drainage systems.

Peak flows

The catchment from the Blue Mountains Botanic Garden to Slope 96403 was delineated and DRAINS model developed to assess the performance and capacity of the existing drainage systems (Figure 6-16). Existing peak flows resulting from a 10 per cent annual exceedance probability (AEP) event were modelled. The results showed non-compliant flow width extending more than one metre into the trafficable southbound lane for flows in sub-catchment EX2, or where flows by-pass the existing drainage pit, combines with flows from sub-catchment EX3 and EX4, follows the road cross fall and discharges as sheet flow down the road embankment to dam south of Bells Line of Road.

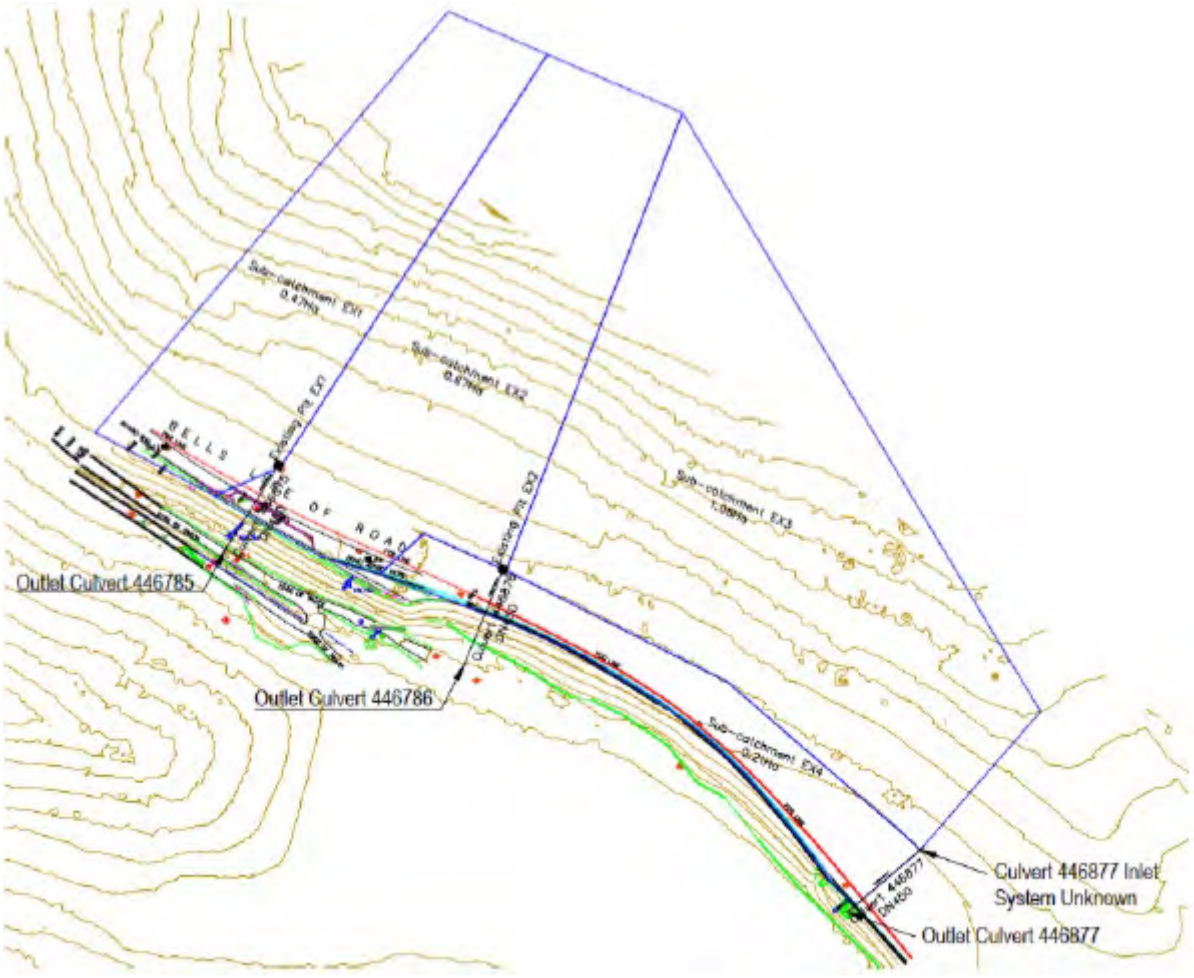


Figure 6-16: Slope 96403 sub-catchment plan

6.5.3 Potential impacts

Construction

Flooding

During construction, potential impacts from flood events would be associated with further destabilisation of the proposal slopes. This may include the creation of new tensions cracks or enlargement of existing ones, as well as increased risk of further landslides.

Construction of the proposal would not increase the temporary potential impacts to the surrounding environment due to the relatively small scale of the works and the topography at which the works is being completed.

Surface water

Construction of the proposal may result in an increase in sediment entering the water course within and surrounding the proposal construction footprint. This could potentially occur through the following activities:

- Sediment release from stockpiles and earthworks

- Runoff from stockpiles after a flood event
- Removal of vegetation to accommodate the proposal slope works
- Movement of heavy vehicles across exposed earth
- Transport of material to, from and within the construction footprint
- Settlement of dust generated from construction activities.

An increase in the volume of sediment discharged to watercourses has the potential to increase turbidity, erosion and scouring. The subsequent settlement in waterways could impact aquatic ecosystem health. Construction activities associated with Slope 96403 is of particular risk of sedimentation entering the local waterway, as the nearest water source is a man-made dam located about 20 metres south-west of the slope. The construction of an access track to access Culvert 446877 from Bells Line of Road, and works associated with the culvert and outlet, have the potential to cause sedimentation of the dam.

Construction of the proposal could also mobilise contaminants and gross pollutants into the local watercourses and impacting water quality. Potential mechanisms for mobilisation and discharge could include:

- Spills and leaks from construction plant and equipment
- Runoff and spills from chemical storage areas at ancillary facilities
- General construction waste material and litter entering the watercourse.

The above potential impacts would be minor and temporary in nature, managed through the implementation of erosion and sediment control measures detailed in Section 6.4.4. The watercourses in proximity to the construction footprints include a man-made dam and minor streams.

Operation

The proposal aims to preserve the life of the existing infrastructure and improve road user safety. These objectives have been addressed through the incorporation of drainage structures at each of the affected slopes, as described in Section 3.2.3. Once operational, the proposal would result in decreased potential of roadside flooding and land slips.

The proposed formalised trench drains and roadside discharge at Slope 33459 are considered one of the main measures to improve the overall stability of the slope. This structure will minimise uncontrolled flows that have potential to destabilise the slope in future heavy rainfall events.

The additional drainage pits and upgrade of Culvert 446877 at Slope 96403 would mitigate non-compliant flow widths and minimise sheet flows that cascade down the embankment uncontrolled.

Drainage structures installed at Slope 93282 would ensure flows are collected and discharged to curb side drains and would not build up behind the gabion wall and cause destabilisation.

Regular clean out of existing drainage systems is recommended due to the high risk of tree leaf blockage in the area.

6.5.4 Safeguards and management measures

An ESCP would be developed for the proposal, as stated in Safeguards SW01 in Table 6-26.

6.6 Groundwater

This section provides an assessment of the potential impacts of the proposal on groundwater and identifies safeguards and management measures to avoid or minimise these impacts.

6.6.1 Methodology

The groundwater assessment included the following:

- Desktop review of existing information, including searches of registered groundwater bores in the vicinity of the proposal
- Consideration of the relevant findings with respect to presence of groundwater documented in the *Geotechnical Interpretation and Detailed Design Report (GIDR)* for Slope 33459 (Jacobs, 2022a) and Slope 96403 (Jacobs, 2022b)
- Identification and assessment of construction and operational activities that have the potential to disturb or impact on water quality of registered groundwater users
- Recommendation of safeguards and management measures to manage potential groundwater impacts.

6.6.2 Existing environment

Site specific groundwater information has been derived from the *Geotechnical Interpretation and Detailed Design Report* for Slope 33459 (Jacobs, 2022a) and Slope 96403 (Jacobs, 2022b) and the *Detailed Design Technical Memorandum* for Slope 93282 (Jacobs, 2022c). Geotechnical investigations were conducted to determine the presence and subsequent depths of groundwater levels in the vicinity of the three slopes.

It should be noted that groundwater levels are affected by seasonal climatic conditions and can therefore vary with time. The results presented represent the groundwater levels at the time of the investigation and subsequent visits.

Aquifer systems

Slope 33459

Measurements to determine the presence and depth of groundwater at Slope 33459 were conducted at Borehole (BH)02, shown in Figure 6-17, during concept design investigations. Table 6-27 identifies the date and time of sampling at BH02 and the groundwater depths measured.

Water inflows were also found to be as shallow as 1.4 metres below ground level at Hand Auger (HA) 02 and 1.9 metres at BH02.

Table 6-27: Groundwater levels at Slope 33459

Bore ID	Date/Time	Groundwater level (m BGL)	Top of casing (m AHD)	Groundwater RL (m AHD)
BH02	15/05/2021 16:30	4.90	923.82	918.93
BH02	01/07/2021 10:30	4.95	923.83	918.88
BH02	26/04/2022 11:00	4.40	923.83	919.43

Slope 96403

Groundwater levels were measured at BH02, BH10 and BH11, as shown in Figure 6-17. Table 6-28 identifies the date and time of and the corresponding groundwater levels at each borehole. The presence of the storage dam in close proximity to BH10 and BH02 may be a reason for the shallower groundwater level observed at HB11, as a result of potential water recharge. BH02 also appears to be highly responsive to rainfall, however, generally returns to a baseline level of 4.5 metres below ground level.

Table 6-28: Groundwater levels at Slope 96403

Investigation ID	Date and Time	Groundwater level (m bgl)	Groundwater RL (m AHD)
BH02	4/8/2022 10:40 (after 15 months)	3.7	923.72
BH10	8/6/22 08:40 (initial)	0.38	929.92
	8/6/22 09:13 (after bailing)	8.91	921.39
	8/6/22 13:34 (after 4 hours)	5.49	924.81
	6/7/22 9:00 (after 1 month)	1.43	928.87
	4/8/2022 10.45 (after 2 months)	2.70	927.60
BH11	8/6/22 13:42 (initial)	10.06	921.46
	8/6/22 13:50 (after bailing)	11.29	920.23
	6/7/22 9:00 (after 1 month)	8.21	923.31
	4/8/2022 10.30 (after 2 months)	10.20	921.32

Slope 93282

No groundwater was encountered in BH01 and BH02 for Slope 93282 as of the 14 to 15 May 2021.

Figure 6-17: Borehole locations

Groundwater bores

A search of the Bureau of Meteorology Groundwater Explorer (Bureau of Meteorology, 2022) identified no groundwater bores within the proposal areas defined in Figure 6-18. Within two kilometres of the sites there are 12 bores that are generally used for water supply, with one bore used for irrigation purposes and another of with unknown purpose. The nearest bore is located about 200 metres southwest of Slope 93282.

Figure 6-18: Location and purpose of surrounding groundwater bores

6.6.3 Potential impacts

Construction

Aquifer systems

Groundwater may be encountered during excavation activities associated with the proposal. This may include the installation of concrete piles at Slopes 33459 and 96403 and excavation associated with the gabion wall at Slope 93282. In particular, the concrete piles to be installed at Slope 33459 are specified to be a minimum of seven metres in length with a one metre rock socket. There is potential for intersection between these piles and localised groundwater levels as recent measurements at BH02 of Slope 33459 have ranged between 4.4 to 4.9 metres, as described in Table 6-27. As a result of this potential intersection, groundwater seepage may occur.

Should any groundwater infiltration be experienced during construction, the area would be dewatered and managed to limit discharge of groundwater to the surrounding environment and maintain safe construction work environment. If trench side walls collapse due to saturated ground, shore boxes would be used.

Groundwater bores

There are no existing groundwater bores in close proximity to the proposal construction footprint and as such would not be impacted by construction of the proposal.

Operation

No operational impacts to groundwater are expected.

6.6.4 Safeguards and management measures

Safeguards and management measures to address groundwater impacts are identified in Table 6-29.

Table 6-29: Groundwater safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
GR01 Dewatering procedures	A dewatering procedure will be prepared as part of the CEMP in line with the *Environmental Management of Construction Site Dewatering* (RMS, 2011).	Contractor	Pre-construction	

6.7 Non-Aboriginal heritage

This section provides an assessment of the potential impacts of the proposal on non-Aboriginal heritage and identifies safeguards and management measures to avoid or minimise these impacts.

6.7.1 Methodology

A Statement of Heritage Impact (SoHI) was prepared for the proposal (Appendix E), which included:

- Desktop searches of relevant heritage registers
- Review of proposed design and construction documentation
- Background research into the historical development of Mount Tomah using historic plans, historical photographs, and other primary and secondary historical sources a relevant and referenced
- Assessment of the proposal against the heritage significance of the site, carried out in light of the conservation processes and principles found in the *Australian ICOMOS Charter for Places of Cultural Significance* (The Burra Charter) (ICOMOS, 2013)
- Proposed safeguards and management measures.

6.7.2 Existing environment

Historical background and land use

Bells Line of Road

The development of the Bells Line of Road (one of the first routes to cross the Blue Mountains) is most directly associated with Archibald Bell, who followed the route from Kurrajong Heights to Mount Tomah in 1823. The first attempt to formally survey the Bells Line of Road occurred one month after Bell proclaimed the success of his initial journey. Although thought to be a potential route along the often steep and rocky terrain, the road was considered to be dangerous and potentially unusable by a later Surveyor General Thomas Mitchell.

Mitchell refused to provide funding for the construction of the road and it was not until 1841 that construction of the road commenced due to pressure from locals, settlers and fruit growers seeking more efficient routes in and out of the area. The road was initially a bridle track, accommodating horse drawn transport and later became a dray road, accommodating carts and other forms of early transport.

There was some revival in the use of the road following the discovery of gold in the 1850s. The route was frequented by foot traffic and a number of inns were established to cater to the gold seekers. Despite the renewal of interest in this route to the west, the road was described as little more than a dray road up until 1872. This was largely due to the difficulty of negotiating Mount Tomah. The descent of the Western Pass, known as Jacobs Ladder, was acutely steep and contained dangerous rock steps called 'jumps'. There was no safe wheeled vehicle route over Mount Tomah until after road works were organised by a local Road Trust in 1877-8.

Several different routes over Mount Tomah were developed throughout the 19th and 20th centuries. In 1928, the Bells Line of Road was proclaimed Main Road 184 (from Richmond to Mount Victoria) and became the responsibility of the Main Roads Board.

After the war the Department of Main Roads embarked on works of great magnitude to transform the Western Pass. In 1947 part of the mountain was cut away and thousands of tonnes of debris fell over the old road and into the ravine. The passage was closed entirely for two months and the present Western Pass was opened in July 1947. The stretch of road from Mount Tomah to Bilpin and east to Kurrajong Heights was upgraded in 1947-8, with a bridge and road re-alignment at Wheeny Creek near Kurrajong.

Mount Tomah Road Cutting

The Mount Tomah Road Cutting on the southern side of the Bells Line of Road is associated with improvements made to the road during the Second World War. Prior to this, the steep gradient, winding nature and poor sealing of the Bells Line of Road meant the Great Western Highway was considered to be the best route in and out of Sydney. However, the outbreak of the Second World War, with attacks on Sydney anticipated, the Government began to look for alternative evacuation routes away from the city. By this stage, the Bells Line of Road (now the Old Bells Line of Road) on the eastern side of Mount Tomah had fallen into

disrepair and works to form a new alignment along the steep and rugged landscape of Mount Tomah began in 1942. A lack of funding ceased work soon afterwards and it was not until 1945 that construction along the western side of Mount Tomah recommenced (Figure 6-19). As described above, after all passage was closed entirely for two months, the present Western Pass was opened in July 1947.

Figure 6-19: Mount Tomah road cutting under construction in 1947 (left) and completed in 1950 (right)

Mount Tomah

Mount Tomah was originally known as Fern Tree Hill and received its name from the word 'Tomah' the Darug word for 'tree fern'. The first European to visit Fern Tree Hill was George Caley in 1804. Caley was a naturalist and explorer, who would later become the first botanist to make a concerted effort to study Eucalyptus. After Bell's survey of the area, the first land grant was given to Susannah Bowen in 1830 and consisted of 1,280 acres. The grant was then occupied by three sawmills and used for dairying and cattle resting paddocks.

The surrounding natural environment of Bowen's grant has been partially preserved within The Jungle (LEP no. MT010), which is included in the Mount Tomah conservation area (LEP no. MT002). The Bowen property remained in the family until the 1860s when George Bartley Bowen built Mount Tomah Cottage, a wooden cottage with a large stone chimney, within the area now occupied by the Mount Tomah Botanic Garden.

Although George Bartley Bowen lived primarily at Bowen Mount near Kurrajong, he continued to exploit his significant holding on Mount Tomah, running his cattle there and planting orchards. In 1893, he sold his beef cattle and his Clydesdale horses — and instead built up a dairy herd on Mount Tomah, with a cream separator and a butter factory.

Soon afterwards, in June 1895 Bowen sold the Mount Tomah farm to Philip Charley, who bred horses and exercised his animals on the rugged slopes of Mount Tomah to enhance their stamina. Charley also established a sawmill on the property.

On Christmas Day, 1909, a bush-fire tore through the area and is likely to have burnt all of the residential dwellings on Mount Tomah. As a result, only the stone chimney of the Mount Tomah Cottage was standing in 1918. Charley began to subdivide the mountain property and in 1927 sold a thickly vegetated block of land, to the west of the study area to 'a syndicate of public men' called 'The Jungle Ltd.'

The syndicate was comprised of twenty five shareholders, each contributing one hundred pounds, to create a Public Reserve 'to save the forest for the people for all time'. The land was not untouched, however, as the sawmill established by Philip Charley operated up to World War I.

In 1934, Alfred Brunet-a French-born horticulturist-and his Australian-born wife Effie, purchased a portion of the grant now occupied by the Mount Tomah Botanic Garden. In 1972 the Brunets donated their land for use as a Botanic Garden and in 1987 the Garden opened to the public. Today Mount Tomah consists of a small community of houses on large landholdings. The community has developed due to the fertile soil which supports substantial gardens and small agricultural activities such as orcharding. The Mount Tomah section of Bells Line of Road represents one of the many improvements and deviations undertaken on the steep and winding road since it was first surveyed in 1823.

Existing heritage listings

The following heritage listings are within or in the vicinity of the proposal:

- The Greater Blue Mountains Area (World Heritage List Place ID 105127; National Heritage List Place ID 105999)
- MT002 Mount Tomah and Environs (Blue Mountains LEP – locally significant)
- MT006 Mount Tomah Botanic Garden (Blue Mountains LEP – locally significant)
- Mount Tomah Road Cuttings, Bells Rd, Mount Tomah via Bilpin, NSW, Australia (Register of the National Estate ID 3003)
- Cave Hotel – locally significant (Blue Mountains LEP – locally significant)
- Sunrise (Blue Mountains LEP – locally significant)
- The Jungle (SHI 1170624 – state significant).

The location of these heritage sites, where data is publicly available, is shown in Figure 6-20.

Historical archaeological context

Evidence of early road building techniques

The southernmost portion of the proposal, adjacent to slope 93282, follows the original alignment of Bells Line of Road. There is some limited potential of encountering structural elements associated with the early construction of the road such as buried culverts, retaining walls and rock cuttings in these areas. However, as the road was relatively underused by traffic prior to the mid-20th century, it is unlikely to have been formally surfaced for much of its existence and has only undergone extensive upgrading in the later years of the 20th century. It is therefore unlikely that evidence of original road building infrastructure survives in the study area.

The northern and eastern portions of the study area, slope 33459 and slope 96403, were constructed after 1947 during post-WWII upgrades to the road corridor. Dry stone pertaining walls and rock cuttings associated with this phase have been identified elsewhere on Bells Line of Road.

Overall, as the works are focused on specific areas of failed slope, it is unlikely that infrastructure associated with former road building would be identified during the proposed works. There is low potential that archaeological evidence associated with early phases of Bells Line of Road to be located within the construction footprint. Any archaeological evidence is unlikely to be intact due to ongoing maintenance, stabilisation and upgrades of the road throughout the 20th century.

Evidence of early occupation

The proposal is located within Susannah Bowen's 1280 acres, granted in 1830. The Bowen cottage was located to the south and east of all three proposed works areas. During Bowen family ownership the majority of the grant was used for dairying, orcharding and cattle grazing. Late 19th century land use was associated with horse breeding and sawmilling. There is no evidence that any of these activities were focused within the study area, and the construction of the western portion of Bells Line of Road c.1947 is likely to have substantially altered the original landform, removing archaeological evidence of these earlier uses.

Overall, there is nil to low potential that archaeological evidence associated with the Bowen family is located within the study area and any remains are unlikely to be intact due to the ongoing maintenance, stabilisation and upgrades of the road throughout the 20th century.

Significance statement

There is limited potential for the construction footprint to contain archaeological evidence of former use of the study area. Any archaeological evidence is unlikely to be intact and therefore unlikely to reach the local significance threshold. Construction footprint has nil potential to contain archaeological 'relics' as defined by the NSW Heritage Act 1977, and nil to low potential to contain significant archaeological 'works.'

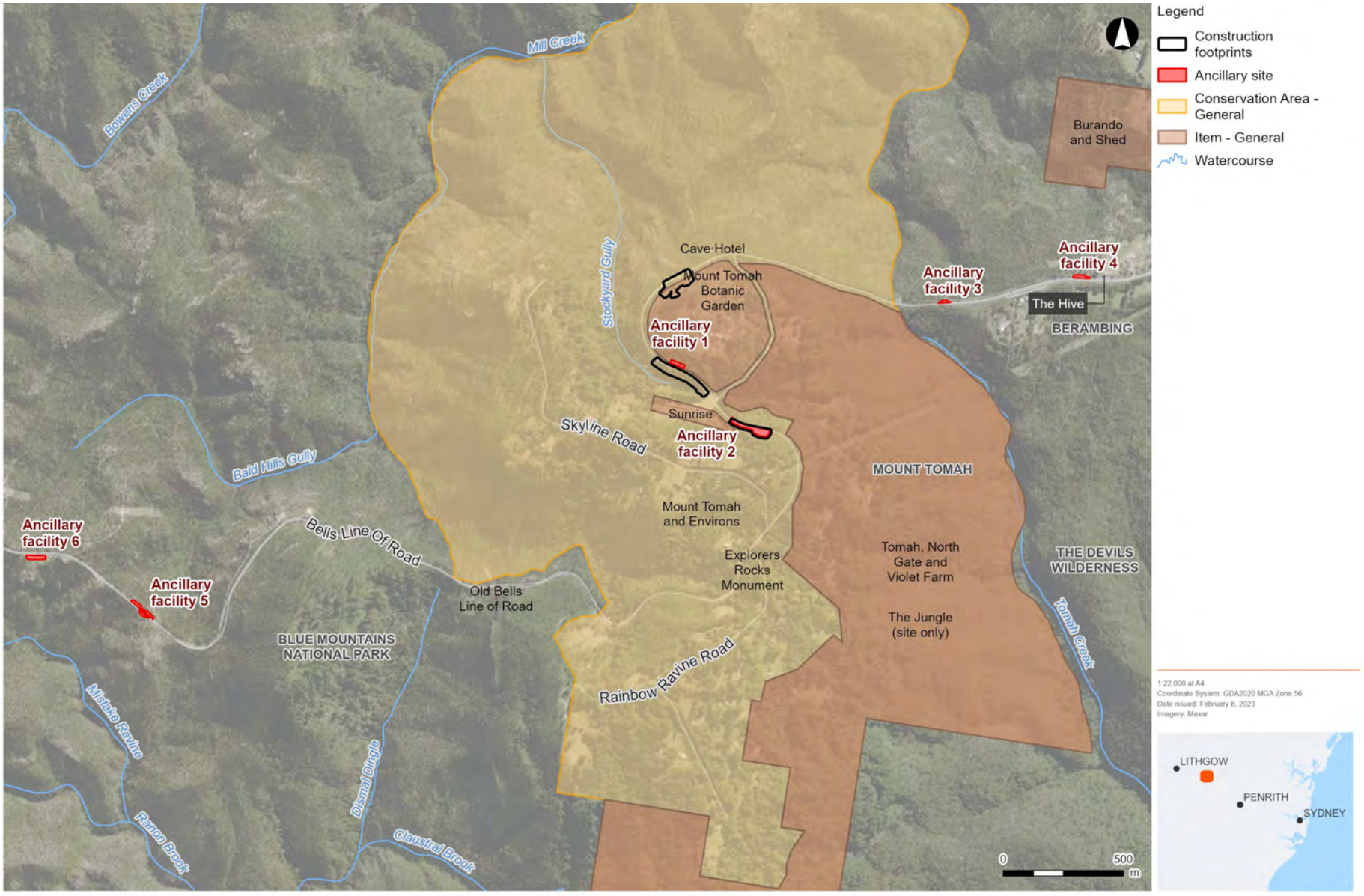


Figure 6-20: Conservations areas surrounding the proposal

6.7.3 Potential impacts

Construction

Direct impacts will predominantly be limited to the existing road embankments or road surfaces of the Bells Line of Road in three finite areas where there have been slope failures. The design scope is limited to undertaking slope remediate and drainage works specific to those areas, and keeps to a minimum new works, machinery access and vegetation removal. The limited scope of the works and focus on three specific areas of slope failure within the road corridor ensures that the aesthetic significance and character of the Mount Tomah and Environs Conservation Area remain unchanged. The limitation of works within the Mount Botanic Garden heritage item to installation of a trench drain in the northern boundary area of the heritage item will result in minor-adverse direct and indirect (visual) impacts to that heritage item.

A summary of impacts to heritage items is presented in Table 6-30, with a detailed impact assessment provided in Section 1.10 of the SoHI (Appendix E).

Table 6-30: Summary of impacts to non-Aboriginal heritage items

Item	Slope	Impact
Greater Blue Mountains Area	Ancillary Facility 6	Neutral
Mount Tomah Botanic Garden (MT006)	33459	Minor adverse
	96403	Neutral
Mount Tomah and Environs Conservation Area (MT002)	33459	Negligible
	96403	Negligible
	93282	Negligible
	Ancillary Facility 1 and 2	Neutral
Sunrise (MT007)	93282	Neutral

Operation

The operation of the proposal would not result in any impacts to any known non-Aboriginal heritage items. Following completion of the proposal.

6.7.4 Safeguards and management measures

Safeguards and management measures to address impacts to non-Aboriginal heritage are identified in Table 6-31.

Table 6-31: Non-Aboriginal heritage safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
NAH01 Unexpected finds	The *Standard Management Procedure – Unexpected Heritage Items* (Transport for NSW, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of non-Aboriginal origin are encountered. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Construction	Section 4.9 of QA *G36 Environment Protection*
NAH02 Photographic Archival Recording	Prior to commencement of works, a Photographic Archival Recording of the portion of works within the Mount Tomah Botanic Gardens must be undertaken. The Photographic Archival Recording should be undertaken by a heritage professional in accordance with the Heritage NSW 'Guidelines for	Transport for NSW	Pre-construction	

Impact	Environmental safeguards	Responsibility	Timing	Reference
	Photographic Recording of Heritage Items'. The PAR should be lodged with The Royal Botanic Gardens Doman and Trust.			
NAH03 Material colour choice	Transport for NSW must liaise with The Royal Botanic Gardens Domain and Trust to coordinate colour finishes for the trench drain within Mount Tomah Botanic Garden. The colours selected for the drain grill must be a colour such as dark grey or black that ensures the new fabric does not visibly contrast with surrounding garden beds and grass cover. If any of the concrete structure of the drain will be visible on the ground surface consideration must be given to dying the concrete a darker colour to ensure the new fabric does not visibly contrast with the surrounding garden. Colour selection will be critical to minimising the intrusiveness of the new fabric. The final colour finishes selected must be coordinated with The Royal Botanic Gardens Doman and Trust.	Transport for NSW / Contractor	Construction	
NAH04 Material colour choice	The colour selected for shotcrete used on slope 33459 must consider the colour used for previous shotcrete repairs on the cutting in the immediate vicinity and the colour of the exposed bedrock in the area.	Transport for NSW / Contractor	Construction	
NAH05 Heritage induction	All staff, including design professionals and tradespeople, involved in the proposed works must receive a heritage induction prior to the commencement of works. The heritage induction should cover the heritage significance of the Mount Tomah Botanic Gardens and the Mount Tomah and Environs Conservation Area.	Transport for NSW / Contractor	Pre-construction	
NAH06 Heritage induction	The heritage induction must ensure all staff are aware of the heritage significance of the surrounding area, including specific listed heritage items such as MT001 Cave Hotel and MT007 Sunrise. Under no circumstances will **any** works, including temporary storage or stockpiling, be located within 50 metres of MT001 Cave Hotel.	Transport for NSW / Contractor	Pre-construction	
NAH07 Limit of assessment	If works extend beyond the locations assessed in this report, further heritage investigation must be undertaken. This assessment is prepared under the assumption that physical works will be limited to the specific trench, piling, shotcrete, slope stabilisation, and gabion wall, extent as shown in the design plans. Any extension of those works or any other works within each construction footprint must be subject to additional heritage assessment.	Transport for NSW / Contractor	Construction	

Impact	Environmental safeguards	Responsibility	Timing	Reference
NAH08 Construction footprint	Care must be taken to ensure that the impacts within each construction footprint are minimised to what is necessary to undertake the works and to ensure consistency with this assessment. This includes minimising vehicle movements on grass, minimising vegetation removal to only what is necessary to complete the works, using protective mats on the ground if deemed necessary to minimise surface impact within Mount Tomah Botanic Gardens.	Contractor	Construction	
NAH09 Limit of assessment	If additional ancillary sites are used that have not assessed in this report, additional heritage assessment must be undertaken.	Transport for NSW / Contractor	Construction	
NAH10 Construction footprint	Ancillary facilities must not extend beyond the existing gravel / bitumen surfaces at each ancillary site location. Particular care must be taken at Ancillary Site 6, which overlaps with the Blue Mountains Heritage Area. Works must not harm any intact sandstone or vegetation surrounding the existing flat roadside clearing.	Contractor	Construction	
NAH11 Botanic Garden restoration	The construction footprint within the Mount Tomah Botanic Garden must be restored to pre-construction condition. This work must be undertaken in consultation with The Royal Botanic Gardens Domain and Trust. This includes restoration of grass, restoration of garden beds, and restoration of any other features moved or impacted during works to pre-construction condition. Soils and vegetation types used for restoration must be consistent with what is currently on site and approved by The Royal Botanic Gardens Domain and Trust. Post-construction restoration works must not result in areas becoming eroded or visibly different in appearance to the surrounding Garden.	Contractor	Post-construction	
NAH12 Photographic Archival Recording	A Photographic Archival Recording of the portion of works within the Mount Tomah Botanic Gardens must be undertaken following completion of works. The Photographic Archival Recording should be undertaken by a heritage professional in accordance with the Heritage NSW 'Guidelines for Photographic Recording of Heritage Items'. The PAR should be lodged with The Royal Botanic Gardens Doman and Trust.	Transport for NSW	Post-construction	

6.8 Aboriginal cultural heritage

This section provides an assessment of the potential impacts of the proposal on Aboriginal cultural heritage and identifies safeguards and management measures to avoid or minimise these impacts.

6.8.1 Methodology

This assessment included the following:

- A Stage 1 assessment under the Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI) Guidelines (Roads and Maritime Services, 2011) (Appendix F)
- A desktop review to provide an overview of the Aboriginal history of the area and to determine if Aboriginal sites have been previously identified within the within and surrounding the proposal, including a review of the Aboriginal Heritage Information Management System (AHIMS)
- Identification and assessment of construction and operational activities that have the potential to disturb or impact Aboriginal cultural heritage
- Recommendation of safeguards and management measures to manage potential Aboriginal cultural heritage impacts.

6.8.2 Existing environment

Aboriginal historical and archaeological context

The Greater Blue Mountains region was the traditional homeland of six indigenous groups, including the Dharawal and Gundungurra in the south, Wiradjuri in the west and north-west, and the Wanaruah, Darkinjung and Darug in the north-east. The Darug people were thought to live between Port Jackson and Botany Bay to the East, the Georges River to the south and south-west, the Hawksbury River to the north-west and in the west up in the Blue Mountains including the Mount Tomah area (The Blue Mountains Botanic Garden Mount Tomah, N.D). Their language differed between the coastal, hinterland and mountain regions Cumberland City Council,N.D). It is estimated that their history extends back tens of thousands of years with a history steeped in culture, art, stories of the Dreaming and an intuitive and respectful relationship with the flora and fauna of the land.

European settlement of the region was delayed, largely due to the rough terrain of the Blue Mountains. Jagged rock formations, uneven ground and thick bushland made it difficult for the Europeans to traverse. In 1813, Gregory Blaxland William Charles Wentworth and Lieutenant Lawson formed an exploration group to explore the Blue Mountains regions.

Aboriginal heritage sites within proximity to the proposal

An extensive search of the AHIMS database on 16 January 2023 identified seven Aboriginal archaeological heritage sites in the vicinity of the proposal, identified in Figure 6-21. Two sites, 45-4-1005 and 45-4-1006 are restricted sites with no location data provided, therefore are not mapped. The proposal and associated ancillary facilities are not located in close proximity and would not impose on the identified Aboriginal heritage sites. The Stage 1 PACHCI assessment has been conducted, concluding that there is low likelihood of encountering additional Aboriginal heritage within the construction footprint.

Construction

No Aboriginal heritage sites are within the proposal construction footprint. Construction activities would also be primarily confined within the road corridor, with the exception of activities occurring within the Blue Mountains Botanic Garden. These areas are highly disturbed with negligible potential for Aboriginal heritage items.

In the event that an unknown or potential Aboriginal object is found during construction the Unexpected Heritage Items Procedure (Transport for NSW, 2022) would be followed, as outlined in Table 6-32.

Operation

There would be no expected impacts to Aboriginal heritage significance during the operation of the proposal as earthworks would be restricted to the construction phase.

6.8.3 Safeguards and management measures

Safeguards and management measures to address impacts to Aboriginal cultural heritage are identified in Table 6-32.

Table 6-32: Aboriginal heritage safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
AH01 Unexpected finds	– The *Standard Management Procedure - Unexpected Heritage Items* (Transport, 2015) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Transport does not have approval to disturb the object/s or where a specific safeguard for managing the disturbance (apart from the Procedure) is not in place. – Work will only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Construction	Section 4.9 of QA *G36 Environment Protection*

Figure 6-21: AHIMS sites surrounding the proposal Potential impacts

6.9 Landscape character and visual impacts

This section provides an assessment of the potential landscape character and visual impacts of the proposal and identifies safeguards and management measures to avoid or minimise these impacts.

6.9.1 Methodology

This assessment included the following:

- Initial site visit and field investigation, review of relevant literature, and analysis of aerial imagery and topographic maps
- Review of the concept design and supporting material to gain an appreciation of the proposal
- Identification and description of landscape character zones
- Assessment of the impact of the proposal on these landscape character zones
- Identification of the visual catchment of the proposal
- Assessment of the visual impacts of the proposal through viewpoints
- Identification of urban design and landscape safeguards and management measures.

The landscape character and visual impact assessment was based on the current design which is subject to refinement as the proposal progresses.

Visual impacts of the proposal have been assessed using the Transport for NSW *Guideline for landscape character and visual impact assessment* (EIA-N04) (TfNSW, 2020). A visual impact rating matrix has been adopted from the Guideline and is shown in Figure 6-22.

Sensitivity \ Magnitude	High	Moderate	Low	Negligible
High	High	High-Moderate	Moderate	Negligible
Moderate	High-Moderate	Moderate	Moderate-low	Negligible
Low	Moderate	Moderate-low	Low	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

Figure 6-22: Visual impact rating matrix (TfNSW, 2020)

6.9.2 Existing environment

The proposal is located within the township of Mount Tomah in the Blue Mountain local government area, a rural area surrounded by bushland. Rural residential dwellings are located along Bells Line of Road, Old Bells Line of Road and Skyline Road. The landscape surrounding the proposal is rural in nature, dominated by the surrounding Blue Mountains National Park.

The topography surrounding the proposal is primarily mountainous, with Bells Line of Road cut into the slopes of Mount Tomah. Dense vegetation is located on both sides of the road and is made up of large trees and smaller shrubs and grasses.

Areas surrounding the proposal, as well as within Slope 33459, are listed as Protected Area – Escarpment under the Blue Mountains Local Environmental Plan 2015. Figure 6-23 identifies these protected areas below.

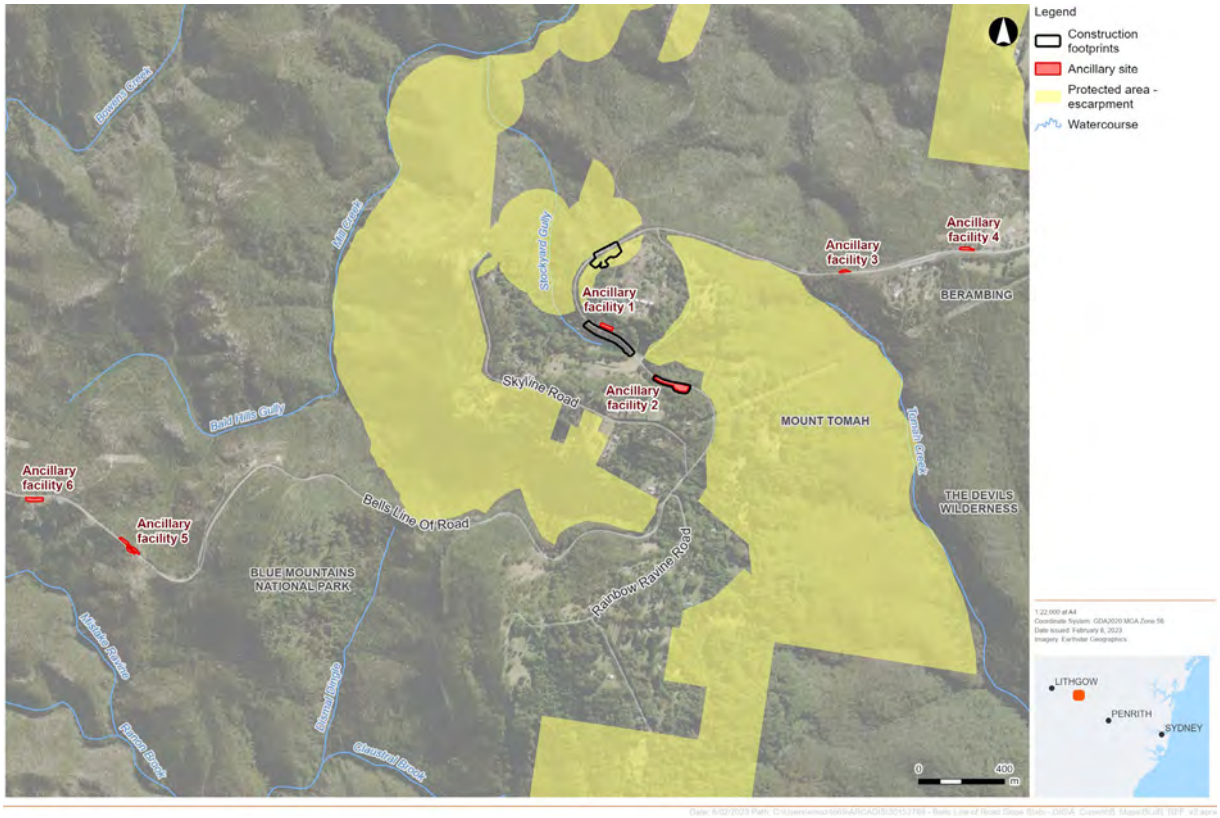


Figure 6-23: Areas surrounding the proposal listed as Protected Area - Escarpment under the Blue Mountains LEP 2015

Landscape character zones

Within and surrounding the proposal, three landscape character zones (LCZs) have been identified in Figure 6-24 and are further described below.

LCZ 1 - Rural residential

LCZ 1 includes the rural residential properties located along Bells Line of Road, as well as Old Bells Line of Road and Skyline Road. The properties typically comprise of large size lots with mostly single storey residences. Most of the properties retain dense stands of vegetation which provide screening to the road corridors and contribute to the scenic quality of the area. The topography of this zone is primarily mountainous with the highest points located along Skyline Road.

LCZ 2 – Garden

LCZ 2 includes the Blue Mountains Botanic Garden, located off Bells Line of Road, which is under the management and stewardship of the Royal Botanic Gardens and Domain Trust. The garden displays 13,956 plants, some of which are not suited to Sydney's climate. Also located within the garden are various footpaths, café and picnic areas, buildings and a car park.

LCZ 3 – Bushland

LCZ 3 includes the dense native vegetation found throughout the Blue Mountains National Park. It contains mostly continuous tree canopy and understorey, which provide an enclosed, high scenic quality to the motorist's experience. The existing vegetation in only interrupted by road infrastructure, unsealed tracks, easements and power lines.

Viewpoints

Seven viewpoints have been selected for the purpose of this assessment that represent a range of directions and distances to the proposal, as shown in Figure 6-25. The viewpoints selected are summarised in Table 6-33 .

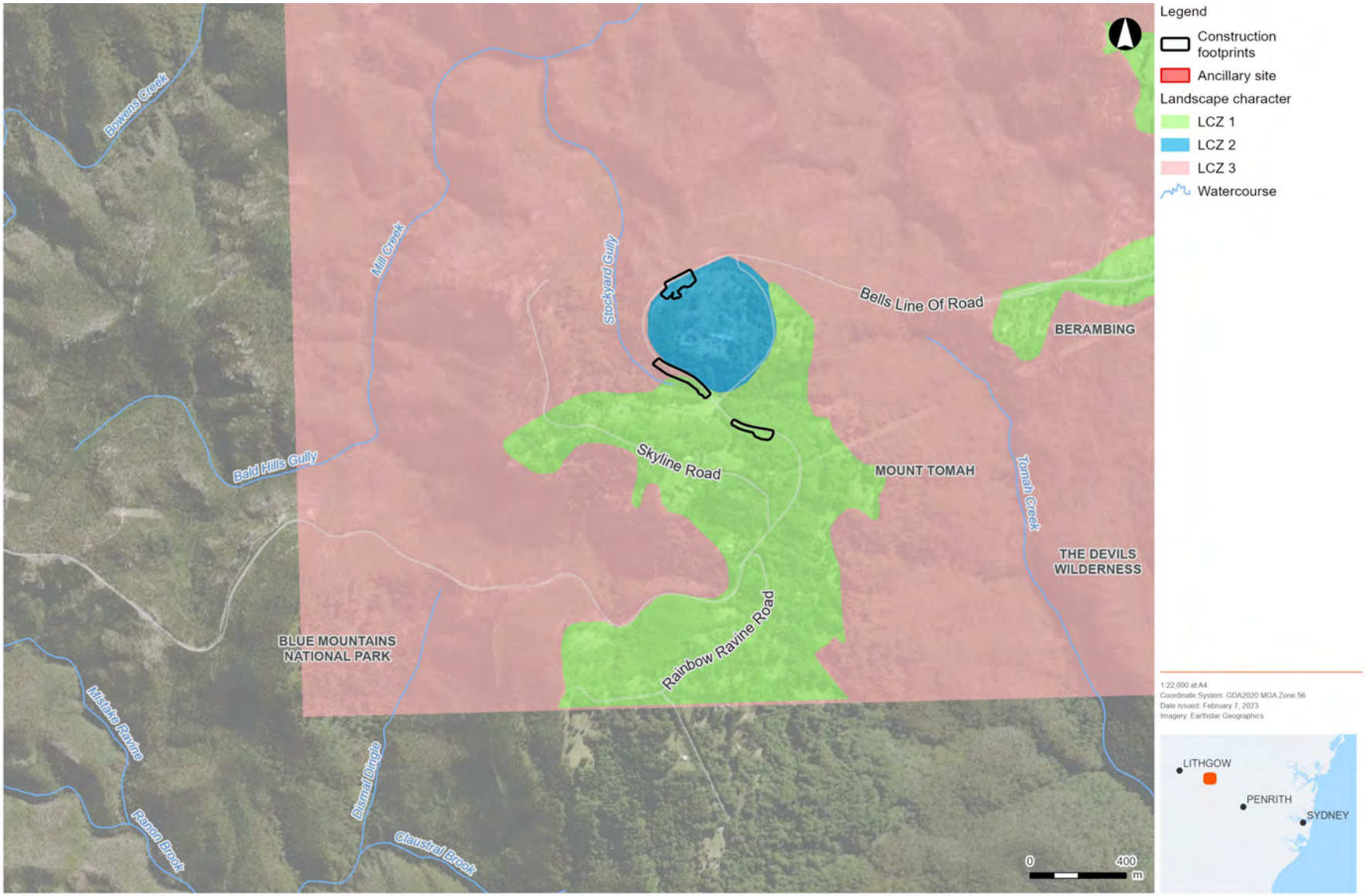


Figure 6-24: Landscape character zones

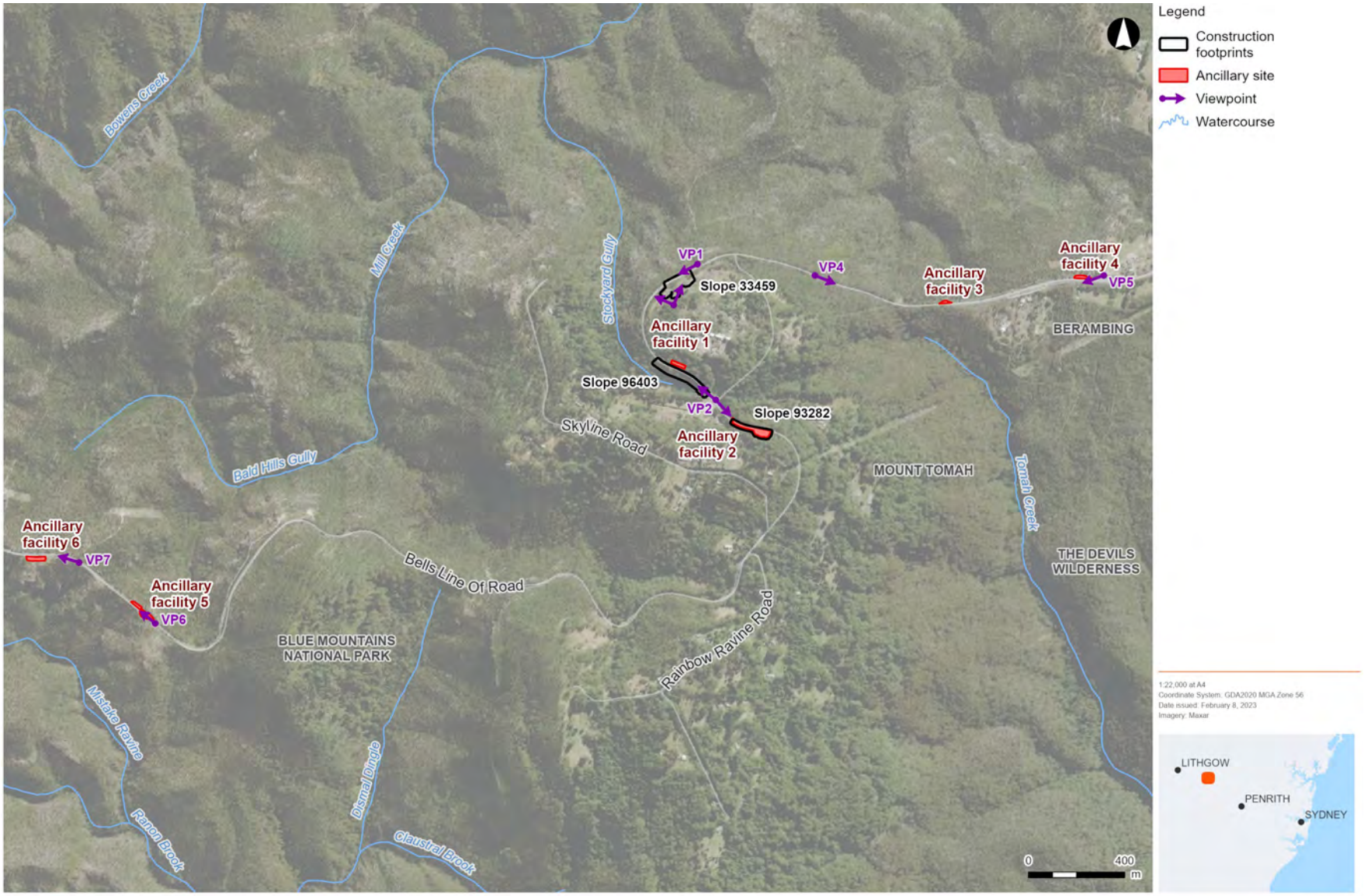
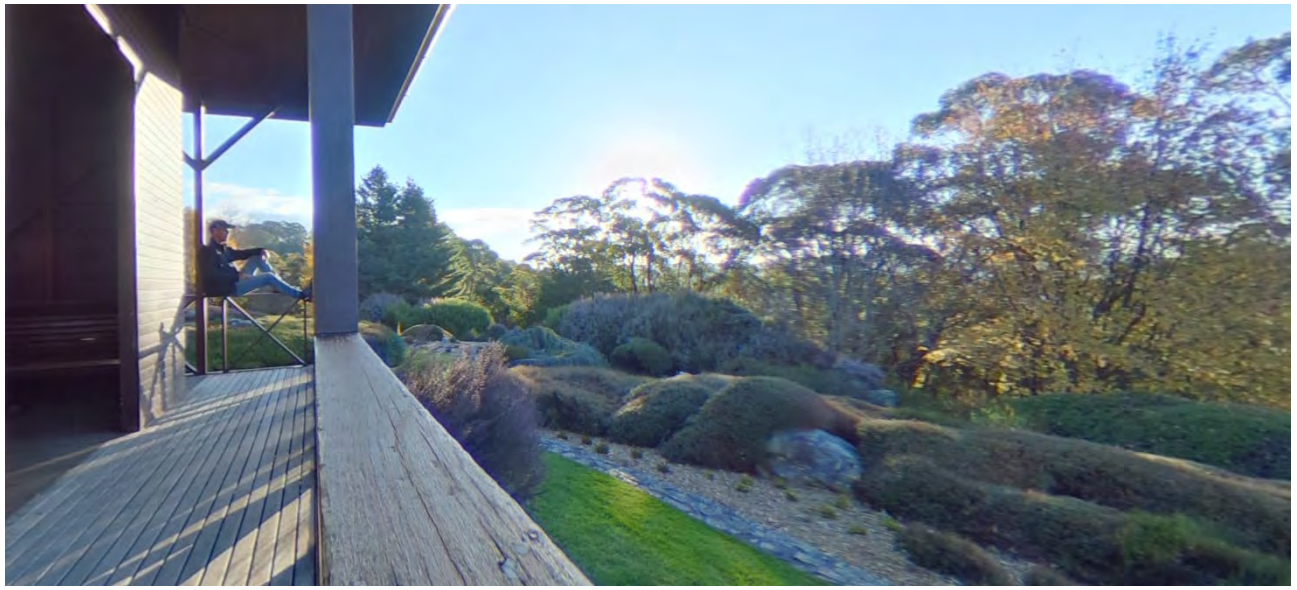


Figure 6-25: Location of viewpoints

Table 6-33: Visual representation of each viewpoint

Viewpoint	Location	Representative view
VP1	Looking west towards slope 33459. The landslip is visible on the left hand side of the road, and trees have been removed at the slip site as part of emergency works.	

Viewpoint	Location	Representative view
VP2	View towards the east (first image) looking towards slope 96403, and west (second image) towards slope 93282, including location of proposed Ancillary Facility 2	 

Viewpoint	Location	Representative view
VP3	View from Botanic Garden looking west (first image) and north (second image)	 

Viewpoint	Location	Representative view
VP4	Ancillary Facility 3 (looking east), located on the left-hand side of the road	
VP5	Ancillary Facility 4 (near Hive café) (looking west), located on right-hand side of the road	

Viewpoint	Location	Representative view
VP6	Ancillary Facility 5 (looking west), located on right-hand side of the road	
VP7	Ancillary facility 6 (looking west), located on the left-hand side of the road	

6.9.3 Potential impacts

Construction

Throughout construction there would be temporary landscape character and visual impacts. Views of plant and equipment, construction activities, stockpiling and vegetation clearing at the proposal, as well as the ancillary facilities, would be evident along Bells Line of Road. The landscape character of the Blue Mountains Botanic Garden would also be temporarily impacted by construction works occurring at the north-west boundary of the garden.

Scenic views of the Blue Mountains National Park, a main feature of Bells Line of Road, may also be temporarily impacted at Ancillary Facility 5 and 6. This impact would be minor due to views being partially obscured by the tree line along Bells Line of Road.

Light spill associated with out of hours work for the proposal is expected to be negligible due to the thick tree line and mountainous terrain along Bells Line of Road.

Operation

Following completion of the proposal the affected slopes would be sufficiently stabilised to improve safety and travel times for road users. Methods to stabilise the slopes are primarily through the use of with shotcrete and gabion baskets.

Gabion baskets (shown in Figure 6-26), proposed for Slope 93282, have been utilised across multiple road projects including Transport's Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section). Potential visual impacts associated with the installation of gabion baskets would be minimised due to the relatively short expanse required and reducing vegetation to be cleared where possible. Current slope stabilisation solutions employed include an anchored mesh system.

A shotcrete wall would be utilised at Slope 33459 to stabilise the slope. An example of a shotcrete wall on Bells Line of Road is shown in Figure 6-27. This would be consistent with existing stabilisation techniques employed on other road projects and would therefore be familiar to road users. Due to the relatively short expanse required to stabilise Slope 33459, the impacts associated with the shotcrete wall would be minimal. Additionally, shotcrete work would be carefully planned and executed to achieve visual integration against the surrounding rock face and form a plane flush with the adjacent rock cuts. As with the gabion baskets vegetation would be retained were possible, maintaining the existing bushland visual environment. Existing shotcrete faces are also located in the vicinity of Slope 33459.

An assessment of impacts to viewpoints is provided in Table 6-34. The following acronyms have been used in the assessment: L = Low, ML = Moderately Low, M = Moderate, MH = Moderately High, H = High.

Overall, permanent changes to viewpoints are considered low impact.

Views to the Blue Mountains National Park would not be impacted as a result of the proposal's operation.

Figure 6-26: Example of a gabion wall

Figure 6-27: Example of existing shotcrete wall on Bells Line of Road

Table 6-34: Viewpoint impact assessment

Viewpoint	Element of proposal visible	Nature of impact	Sensitivity of viewpoint	Magnitude of impact	Overall rating of impact	Comment
VP1	Construction footprint for slope 33459. Removal of vegetation at land slip site plus 10-metre buffer.	L	L	L	`L	Temporary construction related visual impacts such as slope stabilisation equipment, plant and machinery, vehicles, traffic control measures and personnel. Operational visual changes include slope stabilisation infrastructure and vegetation removal. The slope stabilisation measure (shotcrete) would change the visual amenity of the stretch of road impacted, however it is considered a low impact due to its consistency with slope stabilisation methods along Bells Line of Road and limited visual receivers (road users only) or other scenic views in the immediate vicinity.
VP2	Construction footprints for slopes 96403 and 93282. Temporary use of road reserve for Ancillary Facility number 2. Removal of vegetation at land slip site plus 5-metre buffer.	ML	L	L	L	Temporary construction related visual impacts such as slope stabilisation equipment, plant and machinery, site office and amenities, temporary stockpiling, vehicles, traffic control measures and personnel. Operational visual changes include slope stabilisation infrastructure and vegetation clearing. The slope stabilisation measure at Slope 93282 (gabion wall) would change the visual amenity of the stretch of road impacted, however it is considered a low impact due its consistency with slope stabilisation methods on main roads and limited visual receivers (road users only) or other scenic views in the immediate vicinity.
VP3	Construction related machinery, plant and equipment, stockpiles and material lay down, fencing and personnel associated with Slope 33459.	ML	ML	L	L	The construction footprint for slope 33459 includes part of the Blue Mountains Botanic Gardens, and temporary visual impacts would be experienced by staff and visitors. Vegetation removal as part of the slope stabilisation works may reduce screening, however due to the topography of the site, the magnitude of impact is low. Groundcover (turf) would be restored at completion of construction.
VP4	Temporary stockpiling of material.	L	L	L	L	Ancillary Facility 3 is located unsealed pull off area. The temporary facility would be used for stockpiling of materials, creating minor visual impacts for road users. No operational impacts – site would be restored to its existing state at completion of construction.

Viewpoint	Element of proposal visible	Nature of impact	Sensitivity of viewpoint	Magnitude of impact	Overall rating of impact	Comment
VP5	Temporary stockpiling of material.	L	ML	L	L	Ancillary Facility 4 is located in the vicinity of The Hive, a roadside café on the Bells Line of Road. Temporary stockpiling at the ancillary facility would result in minor visual impacts for road users and café patrons. No operational impacts – site would be restored to its existing state at completion of construction.
VP6	Temporary stockpiling of material.	L	L	L	L	Ancillary Facility 5 is located at an existing unsealed pull off area. Temporary stockpiling at the ancillary facility would result in minor visual impacts for road users. No operational impacts – site would be restored to its existing state at completion of construction.
VP7	Temporary stockpiling of material. Permanent compaction of excavated material.	ML	L	L	L	Ancillary Facility 6 is located at an existing unsealed pull off area. With views from the road across the Blue Mountains. Temporary stockpiling at the ancillary facility would result in minor visual impacts for road users. 500 cubic metres of excavated material would be levelled and compacted at the site. This would not result in long-term visual impacts from the viewpoint

6.9.4 Safeguards and management measures

Safeguards and management measures to address landscape character and visual impacts are identified in Table 6-35.

Table 6-35: Landscape character and visual safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
LV01 Urban design	The design of slope stabilisation infrastructure will consider relevant urban design guidelines, including (but not limited to): – Beyond the Pavement urban design policy, process and principles (Transport, 2020) – Landscape Guideline (Centre for Urban Design, 2008) – Shotcrete Design Guideline (Centre for Urban Design, 2016).	Contractor	Detailed design	
LV02 Lighting and signage	Lighting and signage will be installed in Accordance with relevant Australian Standards and guidelines, and without reducing the amenity of residential receivers where feasible and reasonable.	Transport for NSW	Detailed design	

6.10 Property and land use

This section provides an assessment of the potential impacts to property and land use as a result of the proposal and identifies safeguards and management measures to avoid or minimise these impacts.

6.10.1 Methodology

The assessment methodology for impacts on land use and property included the following key tasks:

- A desktop assessment of property ownership and existing land uses in and around the proposal, which included a review of available government sources and aerial imagery
- Assessment of potential impacts on properties including those that would need to be acquired to construct and operate the proposal
- Identification of measures to avoid, minimise and manage impacts on land use and property.

6.10.2 Existing environment

Land use zoning

The proposal is located in the vicinity of Mount Tomah within the Blue Mountains Local Government Area. Existing land use zones in and around the construction areas, as shown in Figure 4-1 and defined by the Blue Mountains LEP, include:

- SP2 – Infrastructure (Classified Road)
- RU2 – Rural Landscape
- RE1 – Public Recreation
- C1 – National Parks and Nature Reserves.

Existing land use

Existing land uses in and around the proposal include Bells Line of Road, zoned SP2 – Infrastructure (Classified Road). Bells Line of Road is a major road, providing an alternative crossing of the Blue Mountains to the Great Western Highway. Rural residences and public recreation areas are also located in the vicinity of the proposal. The Blue Mountains National Park (zoned C1) surrounds the area zoned RU2.

6.10.3 Potential impacts

Construction

Potential impacts to property and land use resulting from construction of the proposal would include temporary loss of some open space to the north-west of the Blue Mountains Botanic Garden, zoned RU2. This area would only be required for stabilisation works associated with Slope 33459, including excavation of trench drains. The construction footprint within the garden would be fenced off during construction.. Construction activities for Slope 96403 and 93282 would be located within and accessed from the road corridor, with impacts to rural residential property access not expected to occur.

Use of the carpark within the Blue Mountains Botanic Garden would be required to house Ancillary Facility 1 for the duration of construction. Extensive consultation has taken place with the Blue Mountains Botanic Garden, with access to the road surrounding the garden to be maintained throughout construction. The remaining ancillary facilities are located at pull off areas along Bells Line of Road to the east and west of the proposal, as described in Section 3.4. These areas fall within the road corridor, zoned SP2. For the duration of construction, the affected pull off areas would not be available for public use. Alternative pull off areas would still be available for use along Bells Line of Road.

Operation

Following completion of the proposal, land use within the Blue Mountains Botanic Garden would be restored to its previous state prior to construction. An easement may be established to enable Transport to conduct maintenance on the trench drains. This would be agreed at a later date with Blue Mountains Botanic Garden.

The safety and functioning of Bells Line of Road would be restored during operation of the proposal.

6.10.4 Safeguards and management measures

Safeguards and management measures to address property and land use impacts are identified in Table 6-36.

Table 6-36: Property and land use safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
PL01 Temporary use of land	Land subject to temporary use will be restored as soon as practicable to an appropriate land use, taking into consideration the location, land use characteristics, area and adjacent land uses. This would be carried out in consultation and agreement with the landowner.	Contractor	Construction	

6.11 Other impacts

6.11.1 Air quality

This section assesses the potential air quality impacts occurring from the construction and operation of the proposal, including identification of safeguards and management measures.

Existing environment

Air quality in NSW is generally compliant with the national standards, established under the National Environment Protection (Ambient Air Quality) Measure. However, heavy concentrations of particles (such as PM10 and PM2.5) and ozone can sometimes exceed national standards, due to pollution events such as bushfires and dust storms.

A 2020 study of the Blue Mountains and Lithgow ambient air quality identified that the region had generally very good air quality. Air pollutants were found to be below the Australian air quality standards (EPA, 2020). The study found that the primary causes of reduced air quality in the area occurred from extreme weather events such as bush fires and dust storms.

The closest operational Bureau of Meteorology monitoring station is located at Mount Boyce, about 16 kilometres from the proposal. Table 6-37 includes climatic statistics gathered from the station.

Table 6-37: Climate statistics from Mount Boyce monitoring station

Climate statistics	Mount Boyce	
Mean annual rainfall (mm)	1005.9	
Wettest month (mm)	March, 144.6	
Driest Month (mm)	May, 55.6	
Mean wind speed (9 am and 3 pm respectively) (km/h)	14.8	17.1

Potential impacts

Construction

Construction activities from the proposal have the potential to cause air quality impacts to surrounding sensitive receivers as a result of increased dust generation. The extent of impacts associated with dust generation would be dependent on wind speed and direction. These impacts are expected to be confined to the area of the immediate works and would be short-term and minor. Potential dust impacts during construction may arise from excavation, materials handling, soil nailing, stockpiling and levelling/compaction activities. Standard air quality mitigation measures would be implemented in an Air Quality Management Plan (AQMP) to manage dust impacts.

Other potential air quality risks during construction include emissions from construction plan and equipment are associated with the combustion of fossil fuels. A list of indicative plant and equipment required for construction is presented in Section 0.

Operation

No operational air quality impacts associated with dust generation are not expected to occur. Operation of the proposal would not result in an increase in vehicle traffic and as such would not result in an increase in vehicle related emissions.

Safeguards and management measures

Safeguards and management measures to address air quality impacts are identified in Table 6-38.

Table 6-38: Air quality safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
AQ01 Air quality	An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to: – Potential sources of air pollution – Air quality management objectives consistent with any relevant published EPA and/or Office of Environment and Heritage (OEH) guidelines – Mitigation and suppression measures to be implemented – Methods to manage work during strong winds or other adverse weather conditions – A progressive rehabilitation strategy for exposed surfaces.	Contractor	Pre-construction / Construction	Section 4.4 of *QA G36 Environment Protection*

6.11.2 Socio-economic

This section assesses the potential socio-economic impacts occurring from the construction and operation of the proposal, including identification of safeguards and management measures.

Existing environment

Population and demographics

The proposal is located at Mount Tomah, a small regional town within the northern reaches of the Blue Mountains LGA. According to 2021 census data (ABS, 2022), the township has a total population of 68 people with a median age of 57.

51 private dwellings are located within the Mount Tomah area, with an average household number of 2.1. The locality also has a median weekly household income of $2,125 compared to $1,829 for New South Wales (ABS, 2022).

Social infrastructure

Social infrastructure refers to the facilities and services that enhance the social capacity of communities and would provide a reference point against which the social impacts of the proposal can be measured. The following social infrastructure is in the vicinity of the proposal:

- Parks, reserves and ovals (Blue Mountains Botanic Garden)
- Transport infrastructure (Berambing Picnic Area bus stop)
- Tourist information sign and resting area (Berambing Picnic Area bus stop).

Local business

There are a range of businesses in the vicinity of the proposal, including:

- Food services
- Accommodation facilities
- Retail trade
- Commercial.

Potential impacts

Construction

Construction impacts associated with the proposal are expected to be minor and temporary due to the extent and timeframe of the proposed works and the rural area in which works would occur. This may include noise and dust impacts, temporary changes to access and partial road/lane closure conditions.

Social infrastructure

Ancillary 1 and construction works for Slope 33459 would occupy part of the Blue Mountains Botanic Garden. This would impact the following uses of the garden:

- The overflow carpark, located to the south of the Blue Mountains Botanic Garden, would be temporarily occupied by Ancillary Facility 1 for the duration of construction. The car park would be closed to visitor and staff parking. Impacts are expected to be minor due to extensive consultation with the Blue Mountains Botanic Garden and alternative parking spaces are available on the property and the road surrounding the garden would remain in use
- The Heath and Heather Garden and the Northern Pavilion are located to the north-west of the garden and are commonly used as venues for functions including wedding ceremonies and receptions. The venue does not fall within the construction footprint, however there is the potential for temporarily impacts to occur due to construction works on Slope 33459. This may include economic impacts through booking cancellations or the venue not operating during construction. The Heath and Heather Garden and Northern Pavilion have a capacity of 30 (Blue Mountains Botanic Garden, 2022a) and 100 guests (Blue Mountains Botanic Garden, 2022b) respectively.

Use of the Berambing Picnic Area bus stop and tourist information sign would be maintained throughout construction.

Local business

The Hive Berambing is a local café that is regularly used as a stopping point for people travelling along Bells Line of Road. The Hive is located about 60 metres east of proposed Ancillary Facility 3. Existing access and parking would be maintained throughout construction.

Operation

Operation of the proposal is not expected to cause any socio-economic impacts. The proposal would restore road safety and traffic flow along the Mount Tomah section of Bells Line of Road. The proposal would not require permanent acquisition of privately owned land.

Safeguards and management measures

Safeguards and management measures to address socio-economic impacts are identified in Table 6-39.

Table 6-39: Socio-economic safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference

SE01
Socio-economic
	A Communication Strategy will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The strategy will include (as a minimum):
	– Mechanisms to provide details and timing of proposed activities to affected residents and businesses, including:
	  – Changed traffic conditions as a result of excavation works
	  – High noise and night works likely to impact noise sensitive receivers
		Contractor	Pre-construction	

Impact	Environmental safeguards	Responsibility	Timing	Reference
	– Road/lane closures – Works requiring access to the Blue Mountains Botanic Garden – Contact name and number for complaints. The Communication Strategy will be prepared in accordance with the *Community Involvement and Communications Resource Manual* (RTA, 2008).			

6.11.3 Waste management

This section describes the potential waste that may be generated by construction and operation of the proposal, including identification of safeguards and management measures.

Existing environment

Bells Line of Road and the area in the vicinity of the proposal generates little waste. Waste may be generated from vegetation clearing and maintenance on the roadside as well as maintenance occurring in nearby rural dwellings and the Blue Mountains Botanic Garden. Litter may also be generated from motorists travelling along Bells Line of Road.

Potential impacts

Construction

Various waste streams would be generated during construction of the proposal and include:

- Cleared excavation
- Spoil
- General construction waste
- Vegetation clearing
- Domestic solid and liquid waste from site compound
- Packaging
- Scrap metal.

500 cubic metres from Slope 93282 would be spread, levelled and compacted at Ancillary Facility 6. All other excavated material would be disposed of appropriately at a licensed facility as per this REF and the future construction contractor's CEMP.

Operation

Waste generated during operation would be similar to existing waste that currently occurs along Bells Line of Road. No long-term waste-related impacts are anticipated. The design and materials selected for the proposal have considered the 100-year design life of the gabion structure and piled wall structure, soil nails and reinforced shotcrete.

Safeguards and management measures

Safeguards and management measures to address waste impacts are identified in Table 6-40.

Table 6-40: Waste safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
WA01	A Waste Management Plan (WMP) will be prepared and implemented as part of the	Contractor	Pre-construction	Section 4.2 of QA G36

Waste management	CEMP. The WMP will include but not be limited to: – Measures to avoid and minimise waste associated with the proposal – Classification of wastes and management options (re-use, recycle, stockpile, disposal) – Statutory approvals required for managing on- and off-site waste, or application of any relevant resource recovery exemptions – Procedures for storage, transport and disposal – Monitoring, record keeping and reporting. The WMP will align with the *Environmental Procedure - Management of Wastes on Transport for NSW Land* (Transport, 2014) and relevant Transport Waste fact sheets.			Environment Protection

6.11.4 Climate change and greenhouse gas

This section describes the potential climate change impacts that may be generated by or affect construction and operation of the proposal, including identification of safeguards and management measures.

Existing environment

Local climate

Historical climate data from the Bureau of Meteorology (BoM) was analysed from 1989 to 2022 at Mount Boyce. The proposal is located in an area which has a warm-temperate climate with warm summers and cool winters. The warmest month is January with a mean temperature of 24.3 degrees Celsius and the coldest month is July with a mean temperature of 2.6 degrees Celsius. Rainfall fluctuates slightly throughout the year but is highest in January to March. The highest average rainfall occurs in the month of March with a mean rainfall of 144.6 millimetres.

Historic and current climate risks

A review of current and historic climate hazards and risks relevant to the proposal was carried out and summarised as follows:

- Bushfire – Bushfire mapping indicates that Slope 33459 and Slope 93282 are located in a Vegetation Category 1 area. Slope 96403 is located within the vegetation buffer area
- Sea level rise – land within the proposal is not considered to be vulnerable to future sea level rise
- Drought – The region has been prone to drought throughout the years, with acute drought periods in 2002 and 2006 (BoM, 2021)
- Extreme weather events and storms – The recent extreme weather event of March 2021 resulted in destabilisation of several slopes along Bells Line of Road.

Greenhouse gas emissions

The Australian National Greenhouse Gas Accounts *National Inventory Report 2018* (Department of Industry, Science, Energy and Resources, 2020a) and *State and Territory Greenhouse Gas Inventories 2018* (Department of Industry, Science, Energy and Resources, 2020b) provides an overview of the latest available estimates of greenhouse gas emissions at a national and state level.

Australia's total greenhouse gas emissions were estimated to be 537.4 million tonnes of carbon dioxide equivalent (Mt CO_2-e) in 2018. 24.5 per cent (131.7 Mt CO_2-e) where from New South Wales. The transport sector accounted for 18.8 per cent (100.8 Mt CO_2-e) of total greenhouse gas emissions nationally and about 21.8 per cent (28.7 Mt CO_2-e) of total greenhouse emissions in New South Wales. About 85 per cent of the

Australian transport sector and 85 per cent of the New South Wales transport sector was attributable to road transportation in 2018.

Potential impacts

Construction

Potential impacts of climate change are expected to be minimal due to the relatively short timeframe of the construction phase of the proposal, as described in Section 3.

Construction emissions associated with the proposal would result from the following:

- Vegetation clearing and decomposition of green waste
- Consumption of electricity from fossil fuel sources
- Consumption of fuel and direct exhaust emissions through use of plant and equipment
- Production and use of construction materials that have a high embodied energy content.

Operation

Greenhouse gas emissions during operation of the proposal are expected to be negligible, with the proposal improving traffic flow, restoring it to its existing state prior to the extreme weather events of March 2021. No increase in operation traffic, and hence traffic emissions, would occur as a result of the proposal.

The proposal would also provide a safer environment for road users in the event of future extreme weather events through the stabilisation of previously landslide prone slopes.

Safeguards and management measures

Safeguards and management measures to address climate change and greenhouse gas emission impacts are identified in Table 6-41.

Table 6-41: Climate change and greenhouse gas safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
GHG01 Procurement Greenhouse emissions	The procurement strategy developed for the construction phase will demonstrate value for money and consideration for opportunities to procure goods and services: – From local suppliers – That are energy efficient or have low embodied energy – That minimise the generation of waste – That make use of recycled materials.	Contractor	Construction	
GHG02 Fuel efficiency	Fuel efficient plant, equipment and vehicles will be selected for use during construction where feasible and reasonable. Construction plant and equipment will be well maintained to maximise fuel efficiency.	Contractor	Construction	

6.12 Cumulative impacts

Cumulative impacts may arise from the interaction of construction and operation activities of the proposal and other existing or planned projects in the wider area. This may include other Transport projects or large-scale projects surrounding the proposal.

Specific projects may be considered minor in isolation, however these minor impacts may become more substantial when the impacts of multiple projects on the same receivers are considered. The extent to which the proposal contributes to the cumulative impacts of existing and planned developments or activities on the environment has been assessed.

6.12.1 Study area

Recently completed, ongoing, or proposed projects within Mount Tomah and their associated impacts have been considered. Potential cumulative impacts from the Great Western Highway Upgrade Program – Katoomba to Lithgow have also been considered as the Great Western Highway and Bells Line of Road form the two main roads crossing the Blue Mountains. This analysis was prepared based on the publicly available information as of December 2022.

6.12.2 Other projects and developments

There is no past, present or existing projects or developments located in the immediate vicinity of the Mount Tomah township.

Projects and developments located within the study area and their environmental impacts are discussed in Table 6-42.

Table 6-42: Past, present and future projects

Project	Construction impacts	Operational impacts
Great Western Highway Upgrade Program The program involves five packages: – Medlow Bath Upgrade – Katoomba to Blackheath Upgrade – Blackheath to Little Hartley Upgrade – Little Hartley to Lithgow Upgrade – Coxs River Road Upgrade. Construction early works for Coxs River Road is expected to commence in early 2023.	Construction impacts of the Great Western Highway Upgrade Program vary for each package, but generally consist of traffic, heritage, noise, biodiversity, property, socio-economic, water quality and visual impacts.	Improve the connection between Central West NSW and Sydney, reduce congestion, improve resilience and freight productivity, and provide a safer and more reliable journey for thousands of residents, commuters, tourists and freight operators who travel in, around and through the Blue Mountains.

6.12.3 Potential impacts

Temporary cumulative traffic impacts have the potential to occur along Bells Line of Road as a result of early works construction activities for the Great Western Highway Upgrade Program – Coxs River Road Upgrade, with both construction programs expected to commence in early 2023.

The two main roads are used by motorists to cross the Blue Mountains include the Great Western Highway and Bells Line of Road. As construction activities associated with the Coxs River Road Upgrade would cause potential traffic disruptions along the Great Western Highway, motorists may choose Bells Line of Road as an alternate route to cross the Blue Mountains. This may lead to increased traffic along Bells Line of Road, including the Mount Tomah area. Conversely, during lane and partial road closures on Bells Line of Road, Great Western Highway would be the alternative/detour route.

The distance between the proposal means there would be no other potential cumulative impacts associated with the project.

There are no cumulative operational impacts as result of the proposal.

6.12.4 Safeguards and management measures

Safeguards and management measures to address cumulative impacts are identified in Table 6-43.

Table 6-43: Cumulative safeguards and management measures

Impact	Environmental safeguards	Responsibility	Timing	Reference
CI01 Cumulative traffic	Transport will coordinate with the Great Western Highway Upgrade Program – Coxs River Road Upgrade team to reduce potential cumulative traffic impacts where possible.	Contractor	Construction	

7. Environmental management

7.1 Environmental management plans (or system)

Safeguards and management measures have been identified in the REF in order to minimise adverse environmental impacts, including social impacts, which could potentially arise as a result of the proposal. Should the proposal proceed, these safeguards and management measures would be incorporated into the detailed design and applied during the construction and operation of the proposal.

A Construction Environmental Management Plan (CEMP) will be prepared to describe the safeguards and management measures identified. The CEMP will provide a framework for establishing how these measures will be implemented and who would be responsible for their implementation.

The CEMP will be prepared prior to construction of the proposal and must be reviewed and certified by the Transport for NSW Environment and Sustainability Officer], prior to the commencement of any on-site works. The CEMP will be a working document, subject to ongoing change and updated as necessary to respond to specific requirements. The CEMP would be developed in accordance with the specifications set out in the *QA Specification G36 - Environmental Protection (Management System)*, *QA Specification G38 - Soil and Water Management (Soil and Water Plan)*, *QA Specification G40 - Clearing and Grubbing, QA Specification G10 - Traffic Management.*

7.2 Summary of safeguards and management measures

Environmental safeguards and management measures outlined in this REF will be incorporated into the detailed design phase of the proposal and during construction and operation of the proposal, should it proceed. These safeguards and management measures will minimise any potential adverse impacts arising from the proposed works on the surrounding environment. The safeguards and management measures are summarised in Table 7-1.

7.3 Licensing and approvals

No licenses or additional approvals are required for the proposal.

Table 7-1: Summary of safeguards and management measures

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
GEN1	General - minimise environmental impacts during construction	A CEMP will be prepared and submitted for review and endorsement of the Transport for NSW Senior Manager Environment and Sustainability prior to commencement of the activity. As a minimum, the CEMP will address the following: – any requirements associated with statutory approvals – details of how the project will implement the identified safeguards outlined in the REF – issue-specific environmental management plans – roles and responsibilities – communication requirements – induction and training requirements – procedures for monitoring and evaluating environmental performance, and for corrective action – reporting requirements and record-keeping – procedures for emergency and incident management – procedures for audit and review. The endorsed CEMP will be implemented during the undertaking of the activity.	Contractor / Transport for NSW project management team	Pre-construction / detailed design	
TR01	Traffic management during construction	A Traffic Management Plan (TMP) will be prepared and implemented as part of the CEMP. The TMP will be prepared in accordance with the Transport *Traffic Control at Work Sites Manual* (RTA, 2010) and *QA Specification G10 Control of Traffic* (Transport for NSW, 2008). The TMP includes: – confirmation of haulage routes – measures to maintain access to local roads and properties – site-specific traffic control measures (including signage) to manage and regulate traffic movement – requirements and methods to consult and inform the local community of impacts on the local road network – access to construction sites including entry and exit locations and measures to prevent construction vehicles queuing on public roads – a response plan for any construction traffic incident	Contractor	Pre-construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		– consideration of other developments that may be under construction to minimise traffic conflict and congestion that may occur due to the cumulative increase in construction vehicle traffic – details of ongoing consultation and plans in place with emergency services regarding road closures – monitoring, review and amendment mechanisms.			
TR02	Road closures	Night road closures will be scheduled to minimise traffic disruption and impact on businesses. The community and stakeholders will be notified prior to any closure.	Contractor	Construction	
TR03	Consultation	Consultation will be carried out with Blue Mountains Botanic Gardens regarding potential impacts to parking and grounds during the construction period.	Transport for NSW	Pre-construction/ Construction	
TR04	Traffic Property access	Where possible, current traffic movements and property accesses are to be maintained during the works. Any disturbance is to be minimised to prevent unnecessary traffic delays.	Contractor	Construction	
NV01	Noise and vibration management	A Noise and Vibration Management Plan (NVMP) will be prepared and implemented as part of the CEMP. The NVMP will generally follow the approach in the *Interim Construction Noise Guideline (ICNG)* (DECC, 2009) and identify: – all potential significant noise and vibration generating activities associated with the activity – feasible and reasonable mitigation measures to be implemented – requirements for the development and implementation of an out of hours work protocol – a monitoring program to assess performance against relevant noise and vibration criteria – arrangements for consultation with affected neighbours and sensitive receivers, including notification and complaint handling procedures – contingency measures to be implemented in the event of non-compliance with noise and vibration criteria.	Contractor	Pre-construction	Section 4.6 of *QA G36 Environment Protection*
NV02	Sensitive receiver notification	All sensitive receivers likely to be affected will be notified at least 5 working days prior to commencement of any works associated with the activity that may have an adverse noise or vibration impact. The notification will provide details of: – the proposal – the construction period and construction hours – contact information for project management staff	Contractor	Construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		– complaint and incident reporting – how to obtain further information.			
NV03	Induction	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: – all proposal specific and relevant standard noise and vibration mitigation measures – relevant licence and approval conditions – permissible hours of work – any limitations on high noise generating activities – location of nearest sensitive receivers – construction employee parking areas – designated loading/unloading areas and procedures – site opening/closing times (including deliveries) – environmental incident procedures.			
NV04	Out of hours works	Where out of hours works are required, the following measures should be considered, as per the Construction and Maintenance Noise Estimator (Transport for NSW, 2022): – for those where noise is clearly audible, in addition to initial notification, duration respite should be considered – for those where noise is moderately intrusive, in addition to the above, phone calls and specific notification should be considered – for those where noise is highly intrusive, in addition to the above, alternative accommodation should be offered. – additionally, noisy works requiring plant such as rock breakers are required to be completed by midnight.	Contractor	Construction	
NV05	Highly intrusive activities	Any out of hours works involving highly intrusive activities, such as rock breakers, will be completed by midnight.	Contractor	Construction	
BI01	Biodiversity management	A Flora and Fauna Management Plan will be prepared in accordance with Transport for NSW's *Biodiversity Guidelines: Protecting and Managing Biodiversity on Projects* (RMS, 2011) and implemented as part of the CEMP. It will include, but not be limited to:	Contractor	Pre-construction	Section 4.8 of *QA G36 Environment Protection*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		– plans showing areas to be cleared and areas to be protected, including exclusion zones, protected habitat features and revegetation areas – requirements set out in the Landscape Guideline (RMS, 2008) – pre-clearing survey requirements – procedures for unexpected threatened species finds and fauna handling – protocols to manage weeds and pathogens.			
BI02	Pre-clearing surveys	Pre-clearing surveys will be undertaken in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	Pre-construction	
BI03	Removal of native vegetation and threatened fauna habitat	Vegetation and habitat removal will be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	Construction	
BI04	Exclusion zones	Exclusion zones will be set up at the limit of clearing in accordance with *Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	Pre-construction	
BI05	Unexpected species finds	The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened ecological communities or threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal site.	Contractor	Construction	
BI06	Hollow-bearing trees	Hollow-bearing tree removal at Slope 33459 would not be undertaken between March and October to minimise potential to impact breeding fauna species	Contractor	Construction	
BI07	Hollow-bearing trees	Hollow-bearing tree removal at Slope 96403 would not be undertaken between May and January to minimise potential to impact breeding fauna species	Contractor	Construction	
BI08	Fauna management	Fauna will be managed in accordance with *Guide 9: Fauna handling* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	Construction	
BI09	Invasion and spread of weeds	Weed species will be managed in accordance with *Guide 6: Weed management* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	Construction	
BI10	Invasion and spread of pathogens and disease	Pathogens will be managed in accordance with *Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Contractor	Construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
BI11	Noise, vibration and light	Works at Slope 96403 would be scheduled between February and April to avoid breeding seasons of these species, October to January (Gang-gang Cockatoo) and May to August (Powerful Owl) and indirect noise, vibration and light impacts.	Contractor	Construction	
BI12	Offsetting	Tree replacement would be undertaken in accordance with *Work Cover Amenity Code of Practice* (1998) and the *Work Safe Guide to Tree Trimming and Removal* (2006). Contractor would keep a register of the number of trees to be removed, the height of trees, and the diameter of trees. These trees would be either replanted in the close vicinity of removed trees or fund would be allocated as per the *Transport Biodiversity Policy* (2022) and *Tree and Hollow Replacement Guidelines* (2022).	Transport for NSW	Construction	
SW01	Erosion and sediment control	A site-specific Erosion and Sediment Control Plan/s will be prepared and implemented as part of the CEMP. The Plan will include arrangements for managing wet weather events, including monitoring of potential high-risk events (such as storms) and specific controls and follow-up measures to be applied in the event of wet weather.	Contractor	Detailed design/ pre-construction	Section 2.2 of *QA G38 Soil and Water Management*
SW02	Contaminated land	If unexpected contaminated areas are encountered during construction, appropriate control measures will be implemented to manage the immediate risks of contamination. All other works that may impact on the contaminated area will cease until the nature and extent of the contamination has been confirmed and any necessary site-specific controls or further actions identified in consultation with the Transport for NSW Senior Manager Environment and Sustainability.	Contractor	Construction	Section 4.2 of *QA G36 Environment Protection*
SW03	Accidental spill	A site-specific emergency spill plan will be developed and include spill-management measures in accordance with the Transport *Code of Practice for Water Management* (RTA, 1999) and relevant EPA guidelines. The plan will address measures to be implemented in the event of a spill, including initial response and containment, notification of emergency services and relevant authorities (including Transport EPA officers).	Contractor	Pre-construction	Section 4.3 of *QA G36 Environment Protection*
SW04	Erosion and sedimentation	Erosion and sediment control measures are to be implemented and maintained to: – Prevent sediment moving off-site and sediment laden water entering any water course, drainage lines, or drain inlets – Reduce water velocity and capture sediment on site – Minimise the amount of material transported from site to surrounding pavement surfaces – Divert clean water around the site. (in accordance with the Landcom/Department of Housing Managing Urban Stormwater, Soils and Construction Guidelines (the Blue Book)).	Contractor	Pre-construction	Section 2.2 of *QA G38 Soil and Water Management*
GR01	Dewatering procedures	A dewatering procedure will be prepared as part of the CEMP in line with the *Environmental Management of Construction Site Dewatering* (RMS, 2011).	Contractor	Pre-construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
NAH01	Unexpected finds	The *Standard Management Procedure – Unexpected Heritage Items* (Transport for NSW, 2015) will be followed in the event that any unexpected heritage items, archaeological remains or potential relics of non-Aboriginal origin are encountered. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Construction	Section 4.9 of *QA G36 Environment Protection*
NAH02	Photographic Archival Recording	Prior to commencement of works, a Photographic Archival Recording of the portion of works within the Mount Tomah Botanic Gardens must be undertaken. The Photographic Archival Recording should be undertaken by a heritage professional in accordance with the Heritage NSW 'Guidelines for Photographic Recording of Heritage Items'. The PAR should be lodged with The Royal Botanic Gardens Doman and Trust.	Transport for NSW	Pre-construction	
NAH03	Material colour choice	Transport for NSW must liaise with The Royal Botanic Gardens Domain and Trust to coordinate colour finishes for the trench drain within Mount Tomah Botanic Garden. The colours selected for the drain grill must be a colour such as dark grey or black that ensures the new fabric does not visibly contrast with surrounding garden beds and grass cover. If any of the concrete structure of the drain will be visible on the ground surface consideration must be given to dying the concrete a darker colour to ensure the new fabric does not visibly contrast with the surrounding garden. Colour selection will be critical to minimising the intrusiveness of the new fabric. The final colour finishes selected must be coordinated with The Royal Botanic Gardens Doman and Trust.	Transport for NSW / Contractor	Construction	
NAH04	Material colour choice	The colour selected for shotcrete used on slope 33459 must consider the colour used for previous shotcrete repairs on the cutting in the immediate vicinity and the colour of the exposed bedrock in the area.	Transport for NSW / Contractor	Construction	
NAH05	Heritage induction	All staff, including design professionals and tradespeople, involved in the proposed works must receive a heritage induction prior to the commencement of works. The heritage induction should cover the heritage significance of the Mount Tomah Botanic Gardens and the Mount Tomah and Environs Conservation Area.	Transport for NSW / Contractor	Pre-construction	
NAH06	Heritage induction	The heritage induction must ensure all staff are aware of the heritage significance of the surrounding area, including specific listed heritage items such as MT001 Cave Hotel and MT007 Sunrise. Under no circumstances will **any** works, including temporary storage or stockpiling, be located within 50 metres of MT001 Cave Hotel.	Transport for NSW / Contractor	Pre-construction	
NAH07	Limit of assessment	If works extend beyond the locations assessed in this report, further heritage investigation must be undertaken. This assessment is prepared under the assumption that physical works will be limited to the specific trench, piling, shotcrete, slope stabilisation, and gabion wall, extent as shown in the design plans. Any extension of those works or any other works within each construction footprint must be subject to additional heritage assessment.	Transport for NSW / Contractor	Construction	

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
NAH08	Construction footprint	Care must be taken to ensure that the impacts within each construction footprint are minimised to what is necessary to undertake the works and to ensure consistency with this assessment. This includes minimising vehicle movements on grass, minimising vegetation removal to only what is necessary to complete the works, using protective mats on the ground if deemed necessary to minimise surface impact within Mount Tomah Botanic Gardens.	Contractor	Construction	
NAH09	Limit of assessment	If additional ancillary sites are used that have not assessed in this report, additional heritage assessment must be undertaken.	Transport for NSW / Contractor	Construction	
NAH10	Construction footprint	Ancillary facilities must not extend beyond the existing gravel / bitumen surfaces at each ancillary site location. Particular care must be taken at Ancillary Site 6, which overlaps with the Blue Mountains Heritage Area. Works must not harm any intact sandstone or vegetation surrounding the existing flat roadside clearing.	Contractor	Construction	
NAH11	Botanic Garden restoration	The construction footprint within the Mount Tomah Botanic Garden must be restored to pre-construction condition. This work must be undertaken in consultation with The Royal Botanic Gardens Domain and Trust. This includes restoration of grass, restoration of garden beds, and restoration of any other features moved or impacted during works to pre-construction condition. Soils and vegetation types used for restoration must be consistent with what is currently on site and approved by The Royal Botanic Gardens Domain and Trust. Post-construction restoration works must not result in areas becoming eroded or visibly different in appearance to the surrounding Garden.	Contractor	Post-construction	
NAH12	Photographic Archival Recording	A Photographic Archival Recording of the portion of works within the Mount Tomah Botanic Gardens must be undertaken following completion of works. The Photographic Archival Recording should be undertaken by a heritage professional in accordance with the Heritage NSW 'Guidelines for Photographic Recording of Heritage Items'. The PAR should be lodged with The Royal Botanic Gardens Doman and Trust.	Transport for NSW	Post-construction	
AH01	Unexpected finds	The *Standard Management Procedure - Unexpected Heritage Items* (Transport, 2015) will be followed in the event that an unknown or potential Aboriginal object/s, including skeletal remains, is found during construction. This applies where Transport does not have approval to disturb the object/s or where a specific safeguard for managing the disturbance (apart from the Procedure) is not in place. Work will only re-commence once the requirements of that Procedure have been satisfied.	Contractor	Construction	Section 4.9 of QA *G36 Environment Protection*
LV01	Urban design	The design of slope stabilisation infrastructure will consider relevant urban design guidelines, including (but not limited to): – *Beyond the Pavement urban design policy, process and principles* (Transport, 2020)	CTransport for NSW	Detailed design	

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		– *Landscape Guideline* (Centre for Urban Design, 2008) – *Shotcrete Design Guideline* (Centre for Urban Design, 2016).			
LV02	Lighting and signage	Lighting and signage will be installed in Accordance with relevant Australian Standards and guidelines, and without reducing the amenity of residential receivers where feasible and reasonable.	Contractor	Detailed design	
PL01	Temporary use of land	Land subject to temporary use will be restored as soon as practicable to an appropriate land use, taking into consideration the location, land use characteristics, area and adjacent land uses. This would be carried out in consultation and agreement with the landowner.	Contractor	Construction	
AQ01	Air quality	An Air Quality Management Plan (AQMP) will be prepared and implemented as part of the CEMP. The AQMP will include, but not be limited to: – Potential sources of air pollution – Air quality management objectives consistent with any relevant published EPA and/or Office of Environment and Heritage (OEH) guidelines – Mitigation and suppression measures to be implemented – Methods to manage work during strong winds or other adverse weather conditions – A progressive rehabilitation strategy for exposed surfaces.	Contractor	Pre-construction/ Construction	Section 4.4 of *QA G36 Environment Protection*
SE01	Socio-economic	A Communication Strategy will be prepared and implemented as part of the CEMP to help provide timely and accurate information to the community during construction. The strategy will include (as a minimum): – Mechanisms to provide details and timing of proposed activities to affected residents and businesses, including: – Changed traffic conditions as a result of excavation works – High noise and night works likely to impact noise sensitive receivers – Road/lane closures – Works requiring access to the Blue Mountains Botanic Garden – Contact name and number for complaints. The Communication Strategy will be prepared in accordance with the *Community Involvement and Communications Resource Manual* (RTA, 2008).	Contractor	Pre-construction	
WA01	Waste management	A Waste Management Plan (WMP) will be prepared and implemented as part of the CEMP. The WMP will include but not be limited to:	Contractor	Pre-construction	Section 4.2 of *QA G36*

No.	Impact	Environmental safeguards	Responsibility	Timing	Reference
		– Measures to avoid and minimise waste associated with the proposal – Classification of wastes and management options (re-use, recycle, stockpile, disposal) – Statutory approvals required for managing on- and off-site waste, or application of any relevant resource recovery exemptions – Procedures for storage, transport and disposal – Monitoring, record keeping and reporting. The WMP will align with the *Environmental Procedure - Management of Wastes on Transport for NSW Land* (Transport, 2014) and relevant Transport Waste fact sheets.			*Environment Protection*
GHG01	Procurement Greenhouse emissions	The procurement strategy developed for the construction phase will demonstrate value for money and consideration for opportunities to procure goods and services: – From local suppliers – That are energy efficient or have low embodied energy – That minimise the generation of waste – That make use of recycled materials.	Contractor	Construction	
GHG02	Fuel efficiency	Fuel efficient plant, equipment and vehicles will be selected for use during construction where feasible and reasonable. Construction plant and equipment will be well maintained to maximise fuel efficiency.	Contractor	Construction	
CI01	Cumulative traffic	Transport will coordinate with the Great Western Highway Upgrade Program – Coxs River Road Upgrade team to reduce potential cumulative traffic impacts where possible.	Contractor	Construction	

8. Conclusion

This section provides the justification for the proposal taking into account its biophysical, social and economic impacts, the suitability of the site and whether or not the proposal is in the public interest. The proposal is also considered in the context of the objectives of the EP&A Act, including the principles of ecologically sustainable development as defined in Section 193 of the Environmental Planning and Assessment Regulation 2021.

8.1 Justification

8.1.1 Social factors

The proposal would have some negative social impacts during the construction phase. These would include:

- Disruptions for motorists and road users due to temporary changes to road conditions, reductions in speed limits, temporary traffic lane closures and access changes. These changes have potential to result in traffic delays and disruptions, and increased road safety risks for motorists using the Bells Line of Road
- Temporary noise and light spill from night works, potentially impacting night-time amenity at residential properties closest to these works and impacts on health and wellbeing due night works
- Dust from construction activities, resulting in possible effects on the health and wellbeing of some people near to construction works who may be more sensitive to changes in air quality
- Temporary disruptions to use of the Blue Mountains Botanic Garden, including closure of the overflow carpark and indirect impacts to the Heath and Heather Garden and the Northern Pavillion
- Temporary disruption for patrons of the Hive Berambing, located adjacent to Ancillary Facility 4.

Once operational, proposal would restore road safety and traffic flow along the Mount Tomah section of Bells Line of Road.

8.1.2 Biophysical factors

The proposal would result in the removal of of native vegetation (PCT 3209), consisting of about 0.57 hectares thst is associated with Blue Mountains Basalt Forest in the Sydney Basin Bioregion (Endangered, BC Act), of which 0.26 hectares is associated with the Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion (Endangered, EPBC Act).

This native vegetation could potentially serve as habitat for threatened fauna species. Vegetation removal will be minimised wherever possible.

Mortality and injury of terrestrial fauna species could potentially occur, including potential mortality and injury of threatened fauna species. This occurrence would be minimised through pre-clearing procedures during construction.

The proposal would require excavation, removal of vegetation, disturbance of soil and the construction of road surfaces and drains, which may lead to exposed soils, sediment entering waterways and the degradation of water quality.

8.1.3 Economic factors

The proposal would improve road safety and restore accessibility, which would impact positively on local businesses in the surrounds of the proposal.

8.1.4 Public interest

The public interest is best served through the equitable distribution of resources, and investment in public infrastructure that fulfils the need of the majority. The proposal represents a cost-efficient investment in public infrastructure that would maximise the long-term social and economic benefits, while minimising the long-term negative impacts on communities and the environment. By restoring safe and efficient road access along Bells Line of Road, the proposal would better enable movement of people, goods and services.

There are a number of Commonwealth and State strategic plans that specifically aim to improve safety and efficiency of the road network, with which the proposal is consistent.

8.2 Objects of the EP&A Act

Table 8-1: Objects of the Environmental Planning and Assessment Act 1979

Instrument	Requirement
1.3(a) To promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources.	Development of the proposal has considered potential impacts to all environmental resources, including air, water, land and biodiversity, that may be affected by the development of the proposal. Wherever possible, the the proposal has avoided and minimised impacts and safeguards have been developed to further reduce and mitigate impacts on the environment.
1.3(b) To facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment.	The principles of ecologically sustainable development, being the precautionary principle, intergenerational equity, conservation of biological diversity and ecological integrity and improved valuation, pricing and incentive mechanisms have been considered for the proposal in Section 8.2.1. The consideration of these principles has found that ecologically sustainable development had been facilitated throughout the development of the proposal and the safeguards developed in this REF
1.3(c) To promote the orderly and economic use and development of land.	The proposal is primarily located within the existing road reserve.
1.3(d) To promote the delivery and maintenance of affordable housing.	Not relevant to the project.
1.3(e) To protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats.	The proposal would result in the removal of native vegetation (PCT 3209), consisting of about 0.57 hectares that is associated with Blue Mountains Basalt Forest in the Sydney Basin Bioregion (Endangered, BC Act), of which 0.26 hectares is associated with the Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion (Endangered, EPBC Act). This native vegetation could potentially serve as habitat for threatened fauna species. Vegetation removal will be minimised wherever possible. Mortality and injury of terrestrial fauna species could potentially occur, including potential mortality and injury of threatened fauna species. This occurrence would be minimised through pre-clearing procedures during construction. The proposal would require excavation, removal of vegetation, disturbance of soil and the construction of road surfaces and drains, which may lead to exposed soils, sediment entering waterways and the degradation of water quality.
1.3(f) To promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage).	An assessment of potential impacts to non-Aboriginal heritage and Aboriginal heritage is provided in Section 6.7 and Section 6.8 respectively. The assessment includes measures to avoid or mitigate impacts due to the proposal to promote the

Instrument	Requirement
	sustainable management of built and cultural heritage (including Aboriginal cultural heritage).
1.3(g) To promote good design and amenity of the built environment.	The proposal has been designed to be consistent with the existing road environment. Stabilisation methods chosen are commonly used on this type of road and would be imposing on amenity.
1.3(h) To promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants.	Not relevant to the project.
1.3(i) To promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State.	Not relevant to the project.
1.3(j) To provide increased opportunity for community participation in environmental planning and assessment.	Consultation with relevant government agencies was carried out during the development of the proposal. There would be further consultation with nearby sensitive receivers who would be potentially impacted during construction.

8.2.1 Ecologically sustainable development

Ecologically sustainable development (ESD) is development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends. The principles of ESD have been an integral consideration throughout the development of the project.

ESD requires the effective integration of economic and environmental considerations in decision-making processes. The four main principles supporting the achievement of ESD are discussed below.

The precautionary principle

The precautionary principle deals with reconciling scientific uncertainty about environmental impacts with certainty in decision-making. It provides that where there is a threat of serious or irreversible environmental damage, the absence of full scientific certainty should not be used as a reason to postpone measures to prevent environmental degradation.

. The precautionary principle has guided the assessment of environmental impacts for this REF and the development of mitigation measures.

- Construction of the proposal would minimise vegetation clearance, with particular consideration of sensitive areas of EPBC-significance.
- Conservative ‘worst case’ scenarios were considered while assessing biodiversity impact.
- Biodiversity and heritage specialist studies were incorporated to gain a detailed understanding of the existing environment.
- A CEMP would be prepared before construction starts. This requirement would ensure the proposal achieves a high level of environmental performance. No mitigation measures or management mechanisms would be postponed because of a lack of information.

Intergenerational equity

Social equity is concerned with the distribution of economic, social and environmental costs and benefits. Inter-generational equity introduces a temporal element with a focus on minimising the distribution of costs to future generations.

The principle states: “the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations”.

The proposal would not result in any impacts that are likely to adversely impact on the health, diversity or productivity of the environment for future generations.

The proposal would benefit future generations by improving safety and accessibility of Bells Line of Road and futureproof the existing infrastructure.

Conservation of biological diversity and ecological integrity

The principle of conservation of biological diversity and ecological integrity requires the maintenance and improvement of genes, specie, populations and communities, as well as the ecosystems and habitats to which they belong, to ensure their survival. An assessment of the existing local environment was undertaken to identify and manage any potential impacts of the proposal on local biodiversity (refer to Section 6.3).

The proposal would result in the removal of native vegetation, consisting of about 0.57 hectares that is associated with Blue Mountains Basalt Forest in the Sydney Basin Bioregion (Endangered, BC Act), of which 0.26 hectares is associated with the Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion (Endangered, EPBC Act).

This native vegetation could potentially serve as habitat for threatened fauna species. Vegetation removal will be minimised wherever possible.

Mortality and injury of terrestrial fauna species could potentially occur, including potential mortality and injury of threatened fauna species. This occurrence would be minimised through pre-clearing procedures during construction.

Improved valuation, pricing and incentive mechanisms

The principle of internalising environmental costs into decision making requires consideration of all environmental resources that may be affected by the carrying out of a project, including air, water, land and living things.

This REF has examined the environmental consequences of the proposal and identified mitigation measures to manage the potential for adverse impacts. The requirement to implement these mitigation measures would result in an economic cost to Transport and would increase the capital and operating costs of the proposal. The costs of the generation and management of waste and pollution would be captured in any waste disposal charges for construction activities. This signifies that environmental resources have been given appropriate valuation.

The proposal has been developed with an objective of minimising potential impacts on the surrounding environment. This indicates that the proposal is being developed with an environmental objective in mind.

8.3 Conclusion

The proposed slope remediation at slope 33459, Slope 93282 and Slope 96403 on Bells Line of Road at Mount Tomah is subject to assessment under Division 5.1 of the EP&A Act. The REF has examined and taken into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of the proposed activity.

This has included consideration (where relevant) of conservation agreements and plans of management under the NPW Act, biodiversity stewardship sites under the BC Act, wilderness areas, areas of outstanding value, impacts on threatened species and ecological communities and their habitats, and other protected fauna and native plants. It has also considered potential impacts to matters of national environmental significance listed under the EPBC Act.

A number of potential environmental impacts from the proposal have been avoided or reduced during the concept design development and options assessment. The proposal, as described in the REF, best meets the project objectives but would still result in some impacts on noise, traffic, water and biodiversity[. Safeguards and management measures as detailed in this REF would ameliorate or minimise these expected impacts. The proposal would also improve the slope stability and minimise the risk of slope failure, thereby preserving the life og the infrastructure and improving road user safety On balance, the proposal is considered justified and the following conclusions are made.

Significance of impact under NSW legislation

The proposal would be unlikely to cause a significant impact on the environment. Therefore, it is not necessary for an environmental impact statement to be prepared nor approval to be sought from the Minister for Planning under Division 5.2 of the EP&A Act. A Biodiversity Development Assessment Report or Species Impact Statement is not required. The proposal is subject to assessment under Division 5.1 of the EP&A Act. Consent from Council is not required.

Significance of impact under Australian legislation

The proposal is not likely to have a significant impact on matters of national environmental significance nor the environment of Commonwealth land within the meaning of the *Environment Protection and Biodiversity Conservation Act 1999 (*Commonwealth). A referral to the Australian Department of Climate Change, Energy, the Environment and Water is not required.

10. EP&A Regulation publication requirement

Table 10-1: EP&A Regulation publication requirement

Requirement	Yes/No
Does this REF need to be published under section 171(4) of the EP&A Regulation?	Yes

11. References

Australian Soil Resource Information System 2013, *Atlas of Australian Acid Sulfate Soils*

Bembrick 2015, *The Geology of the Blue Mountains – with reference to Cox's Road*

The Blue Mountains Botanic Garden 2022a, *Heath & Heather Garden*

Blue Mountains Botanic Garden N.D, *History of the Blue Mountains Botanic Garden*

Blue Mountains Botanic Garden 2009, *Prevention of Soil Diseases – Procedures for Contractors Entering the Site*

Blue Mountains Botanic Garden 2022b, *The Northern Pavilion*

Branagan 1960, *Structure and sedimentation in the Western Coalfield of New South Wales*Cumberland City Council N.D, *History and land*

Goldbery 1969, *Geology of the Western Blue Mountains, Geological Survey of NSW 1st edition*

Bureau of Metoerology 2022, *Previous droughts*

Department of Industry, Science, Energy and Resources 2020a, *National Inventory Report 2018*

Department of Industry, Science, Energy and Resources 2020b, *State and Territory Greenhouse Gas Inventories 2018*

Jacobs 2022a, *Bells Line of Road – Slope 033459 Geotechnical Interpretation and Detailed Design Report (GIDR)*

Jacobs 2022b, *Bells Line of Road – Slope 096403 Geotechnical Interpretive and Detailed Design Report (GIDR)*

Jacobs 2022c, *Remediation of Slope 093282 Technical Memorandum*

Geological Survey of NSW, *Minview Seamless Geology (https://minview.geoscience.nsw.gov.au/#/?lon=148.5&lat=-32.5&z=7&l=)*

NSW Environment Protection Authority 2020, *Blue Mountains and Lithgow Ambient Air Quality Monitoring – Final Report 1st June 2019 – 31st May 2020*

NSW Government 2021, *State Heritage Inventory Mount Tomah Botanic Garden*

Roads and Maritime Services 2014, *Guide to Slope Risk Analysis*

The Royal Botanic Garden Sydney 2022, *A trip down memory lane*

Transport for NSW 2022, *Construction and Maintenance Noise Estimator*

Terms and acronyms used in this REF

Term / Acronym	Description
AusLink	Mechanism to facilitate cooperative transport planning and funding by Commonwealth and state and territory jurisdictions
BC Act	*Biodiversity Conservation Act 2016 (NSW)*
BH	Bore hole
CEMP	Construction environmental management plan
CNVG	*Construction Noise and Bibration Guideline*
CP	Communication Plan
EIA	Environmental impact assessment
EP&A Act	*Environmental Planning and Assessment Act 1979 (NSW).* Provides the legislative framework for land use planning and development assessment in NSW
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth).* Provides for the protection of the environment, especially matters of national environmental significance, and provides a national assessment and approvals process
ESD	Ecologically sustainable development. Development which uses, conserves and enhances the resources of the community so that ecological processes on which life depends, are maintained and the total quality of life, now and in the future, can be increased
FM Act	*Fisheries Management Act 1994 (NSW)*
Heritage Act	*Heritage Act 1977 (NSW)*
ICNG	*Interim Construction Noise Guideline*
LALC	Local Aboriginal Land Council
LEP	Local Environmental Plan. A type of planning instrument made under Part 3 of the EP&A Act.
LGA	Local government area
LoS	Level of Service. A qualitative measure describing operational conditions within a traffic stream and their perception by motorists and/or passengers
NML	Noise Management Level
MNES	Matters of national environmental significance under the *Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)*
NPW Act	*National Parks and Wildlife Act 1974 (NSW)*
OEH	Office of Environment and Heritage within the Department of Planning and Environment.
PEA Act	*Protection of the Environment Administration Act 1991.*
QA Specifications	Specifications developed by Transport for use with road work and bridge work contracts let by Transport.
RBL	Rating Background Level
REF	Review of environmental factors
rms	Root-mean-square
RMS	NSW Roads and Maritime Services, now Transport for NSW
SEPP	State Environmental Planning Policy. A type of planning instrument made under Part 3 of the EP&A Act.
SEPP (Biodiversity and Conservation)	State Environmental Planning Policy (Biodiversity and Conservation) 2021

SEPP (Planning Systems)	State Environmental Planning Policy (Planning Systems) 2021
SEPP (Precincts – Central River City)	State Environmental Planning Policy (Precincts – Central River City) 2021
SEPP (Precincts – Eastern Harbour City)	State Environmental Planning Policy (Precincts – Eastern Harbour City) 2021
SEPP (Precincts – Regional)	State Environmental Planning Policy (Precincts – Regional) 2021
SEPP (Resilience and Hazards)	State Environmental Planning Policy (Resilience and Hazards) 2021
SEPP (Transport and Infrastructure)	State Environmental Planning Policy (Transport and Infrastructure) 2021
Transport	Transport for NSW
VDV	Vibration Dose Value
V_{rms}	Vibration velocity levels

Appendix A – Consideration of section 171 factors and matters of national environmental significance and Commonwealth land

Section 171 Factors

In addition to the requirements of the Guideline for Division 5.1 assessments (DPE 2022) and the Roads and Related Facilities EIS Guideline (DUAP 1996) as detailed in the REF, the following factors, listed in section 171 of the Environmental Planning and Assessment Regulation 2021, have also been considered to assess the likely impacts of the proposal on the natural and built environment.

Factor		Impact
a	Any environmental impact on a community? The proposal would have construction impacts including the traffic impacts, construction noise and visual amenity. These impacts could negatively impact the local community as described in this REF. These would be managed through the implementation of the safeguards listed in Section 7. The proposal will improve the slope stability and minimise the risk of slope failure, thereby preserving the life og the infrastructure and improving road user safety.	Short-term, minor, negative Long-term, moderate, positive
b	Any transformation of a locality? No transformation of the locality would occur as a result of the proposal.	N/A
c	Any environmental impact on the ecosystems of the locality? The proposal would result in the removal of native vegetation (PCT 3209), consisting of about 0.57 hectares that is associated with Blue Mountains Basalt Forest in the Sydney Basin Bioregion (Endangered, BC Act), of which 0.26 hectares is associated with the Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion (Endangered, EPBC Act). This native vegetation could potentially serve as habitat for threatened fauna species. Vegetation removal will be minimised wherever possible. Mortality and injury of terrestrial fauna species could potentially occur, including potential mortality and injury of threatened fauna species. This occurrence would be minimised through pre-clearing procedures during construction. The proposal would require excavation, removal of vegetation, disturbance of soil and the construction of road surfaces and drains, which may lead to exposed soils, sediment entering waterways and the degradation of water quality.	Long-term, minor, negative Short-term, minor, negative
d	Any reduction of the aesthetic, recreational, scientific or other environmental quality or value of a locality? During construction, the proposal would have the potential to create a reduction in the existing aesthetic quality of the local area as a result of construction impacts including dust and noise generation, visual impacts and increased traffic movements, including increased heavy vehicle movements. These impacts would be minimised as far as practicable through the implementation of the safeguards outlined in Section 7. It is considered that the overall amenity of the proposal area would not be substantially reduced as a result of the operation of the proposal, however the locality would be impacted in a minor way due to the required clearance of vegetation for the new road alignment. Additionally, no recreational or scientific qualities of the proposal area are anticipated to be impacted during the construction or operation of the proposal.	Short-term, minor, negative
e	Any effect on a locality, place or building having aesthetic, anthropological, archaeological, architectural, cultural, historical, scientific or social significance or other special value for present or future generations?	Long-term, minor, negative

Factor		Impact
	The proposal would result in some direct impact to the local heritage item, Mount Tomah Botanical Garden due to the installation of trench drainage with the garden grounds.	
f	Any impact on the habitat of protected fauna (within the meaning of the *National Parks and Wildlife Act 1974*)? The proposal would result in the removal of native vegetation (PCT 3209), consisting of about 0.57 hectares that is associated with Blue Mountains Basalt Forest in the Sydney Basin Bioregion (Endangered, BC Act), of which 0.26 hectares is associated with the Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion (Endangered, EPBC Act). This native vegetation could potentially serve as habitat for threatened fauna species. Vegetation removal will be minimised wherever possible.	Long-term, minor, negative
g	Any endangering of any species of animal, plant or other form of life, whether living on land, in water or in the air? The proposal is considered unlikely to endanger any species of flora or fauna due to the limited extent of vegetation proposed to be removed and the presence of large areas of protected habitat present in the broader area including the Blue Mountains National Park.	N/A
h	Any long-term effects on the environment? The proposal would have an overall minor negative long-term impact on the existing environment through the permanent clearance of up to 0.57 hectares of native vegetation.	Long-term, minor, negative
i	Any degradation of the quality of the environment? The proposal would result in the removal of 0.57 hectares of native vegetation. Potential water and visual impacts have the potential to result in the degradation of the quality of the environment. Water quality could be reduced as a result of pollutants such as sediment, soil nutrients, waste, and spilt fuels and chemicals entering drainage lines and creeks. Visual amenity would be impacted during construction. Mitigation measures would be implemented to reduce impacts to water quality. Air quality, noise and traffic impacts would result from the construction phase. These impacts would be minimised through the implementation of safeguards outlined in Section 7. No additional degradation of the quality of the environment is expected to occur during operation of the proposal.	Long-term, minor, negative Short-term, minor, negative Nil
j	Any risk to the safety of the environment? There are potential road safety risks associated with construction along Bells Line of Road. Traffic management safeguards, including the preparation of a Construction Traffic Management Plan, would address these safety risks (refer to Section 6.2). Environmental management plans and work health and safety plans would be implemented to minimise any safety risk during the construction of the proposal. The proposal will improve the slope stability and minimise the risk of slope failure, thereby preserving the life og the infrastructure and improving road user safety.	Short-term, minor, negative Long-term, minor, positive
k	Any reduction in the range of beneficial uses of the environment? No reduction in the range of beneficial uses is anticipated.	

Factor		Impact
		Nil
l	Any pollution of the environment? The proposal would have the potential to result in some minor, negative short-term water pollution risks of impacts resulting from sediments, soil nutrients, waste, and spilt fuels and chemicals. Management of water quality impacts would be undertaken in accordance with the safeguards outlined in Section 7. Short-term noise and air quality impacts are expected during the construction phase of the proposal from plant and machinery and the generation of dust during construction. Management of noise and air quality impacts would be undertaken in accordance with the safeguards outlined in Section 7. Operation of the proposal would not result in pollution of the environment.	Short-term, minor, negative Nil
m	Any environmental problems associated with the disposal of waste? Waste would be managed in accordance with the resource management hierarchy principles outlined in the Waste Avoidance and Resource Recovery Act 2001. It is not anticipated that there would be issues encountered with the disposal of waste.	Nil
n	Any increased demands on resources (natural or otherwise) that are, or are likely to become, in short supply? All resources required are not likely to be in short supply and would be readily available.	Nil
o	Any cumulative environmental effect with other existing or likely future activities? There would be minor cumulative impacts associated with the Great Western Highway Upgrade Program should the construction programs overlap, as discussed in Section 6.12.	Short-term, minor, negative
p	Any impact on coastal processes and coastal hazards, including those under projected climate change conditions? The proposal is not located within a coastal area.	Nil
q	Applicable local strategic planning statements, regional strategic plans or district strategic plans made under the Act, Division 3.1, Alignment with relevant local, regional and district strategic plans is provided in Section 2 of this assessment.	Nil
r	Other relevant environmental factors.	In considering the potential impacts of this proposal all relevant environmental factors have been considered, refer to Section 6 of this assessment.

Matters of National Environmental Significance and Commonwealth land

Under the environmental assessment provisions of the EPBC Act, the following matters of national environmental significance and impacts on Commonwealth land are required to be considered to assist in determining whether the proposal should be referred to the Australian Department of Climate Change, Energy, the Environment and Water .

A referral is not required for proposed actions that may affect nationally-listed threatened species, endangered ecological communities and migratory species. Impacts on these matters are still assessed as part of the REF in accordance with Australian Government significant impact criteria and taking into account relevant guidelines and policies.

Factor		Impact
a	Any impact on a World Heritage property?	Nil
b	Any impact on a National Heritage place?	Nil
c	Any impact on a wetland of international importance?	Nil
d	Any impact on a listed threatened species or communities? The proposal would result in the removal of native vegetation (PCT 3209), consisting of 0.26 hectares that is associated with the Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion (Endangered, EPBC Act). This native vegetation could potentially serve as habitat for threatened fauna species. Vegetation removal will be minimised wherever possible.	Long-term, negative, minor
e	Any impacts on listed migratory species?	Nil
f	Any impact on a Commonwealth marine area?	Nil
g	Does the proposal involve a nuclear action (including uranium mining)?	Nil
h	Additionally, any impact (direct or indirect) on the environment of Commonwealth land?	Nil

Appendix B – Statutory consultation checklists

Transport and Infrastructure SEPP

Certain development types

Development type	Description	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
Car Park	Does the project include a car park intended for the use by commuters using regular bus services?	No	Blue Mountains City Council Adjoining landowners	Section 2.110
Bus Depots	Does the project propose a bus depot?	No	Blue Mountains City Council Adjoining landowners	Section 2.110
Permanent road maintenance depot and associated infrastructure	Does the project propose a permanent road maintenance depot or associated infrastructure such as garages, sheds, tool houses, storage yards, training facilities and workers' amenities?	No	Blue Mountains City Council Adjoining landowners	Section 2.110

Development within the Coastal Zone

Development type	Description	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
Development with impacts on certain land within the coastal zone	Is the proposal within a coastal vulnerability area and is inconsistent with a certified coastal management program applying to that land?	No	Blue Mountains City Council	Section 2.14

Note: See interactive map at ***Planning Portal NSW spatial viewer - find a property***. Note the coastal vulnerability area has not yet been mapped.

Note: a certified coastal zone management plan is taken to be a certified coastal management program.

Council related infrastructure or services

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
Stormwater	Are the works likely to have a *substantial* impact on the stormwater management services which are provided by council?	No	Blue Mountains City Council	Section 2.10
Traffic	Are the works likely to generate traffic to an extent that will *strain* the capacity of the existing road system in a local government area?	No	Blue Mountains City Council	Section 2.10

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
Sewerage system	Will the works involve connection to a council owned sewerage system? If so, will this connection have a *substantial* impact on the capacity of any part of the system?	No	Blue Mountains City Council	Section 2.10
Water usage	Will the works involve connection to a council owned water supply system? If so, will this require the use of a *substantial* volume of water?	No	Blue Mountains City Council	Section 2.10
Temporary structures	Will the works involve the installation of a temporary structure on, or the enclosing of, a public place which is under local council management or control? If so, will this cause more than a *minor* or *inconsequential* disruption to pedestrian or vehicular flow?	No	Blue Mountains City Council	Section 2.10
Road & footpath excavation	Will the works involve more than *minor* or inconsequential excavation of a road or adjacent footpath for which council is the roads authority and responsible for maintenance?	No	Blue Mountains City Council	Section 2.10

Local heritage items

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
Local heritage	Is there is a local heritage item (that is not also a State heritage item) or a heritage conservation area in the study area for the works? If yes, does a heritage assessment indicate that the potential impacts to the heritage significance of the item/area are more than minor or inconsequential?	No	Blue Mountains City Council	Section 2.11

Flood liable land

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
Flood liable land	Are the works located on flood liable land? If so, will the works	No	Blue Mountains City Council	Section 2.12

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
	change flood patterns to more than a *minor* extent?			
Flood liable land	Are the works located on flood liable land? (to any extent). If so, do the works comprise more than minor alterations or additions to, or the demolition of, a building, emergency works or routine maintenance?	No	State Emergency Services Email: erm@ses.nsw.gov.au	Section 2.13

Note: Flood liable land means land that is susceptible to flooding by the probable maximum flood event, identified in accordance with the principles set out in the manual entitled Floodplain Development Manual: the management of flood liable land published by the New South Wales Government.

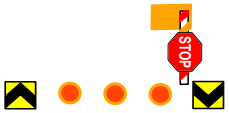
Public authorities other than councils

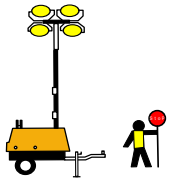
Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
National parks and reserves	Are the works adjacent to a national park or nature reserve, or other area reserved under the *National Parks and Wildlife Act 1974*, or on land acquired under that Act?	Yes	Environment and Heritage Group, DPE	Section 2.15
National parks and reserves	Are the works on land in Zone E1 National Parks and Nature Reserves or in a land use zone equivalent to that zone?	No	Environment and Heritage Group, DPE	Section 2.15
Navigable waters	Do the works include a fixed or floating structure in or over navigable waters?	No	Transport for NSW - Maritime	Section 2.15
Bush fire prone land	Are the works for the purpose of residential development, an educational establishment, a health services facility, a correctional centre or group home in bush fire prone land?	No	Rural Fire Service (RFS) [Refer to the NSW RFS publication: *Planning for Bush Fire Protection (2006)*]	Section 2.15
Artificial light	Would the works increase the amount of artificial light in the night sky and that is on land within the dark sky region as identified on the dark sky region map? (Note: the dark sky region is within 200 kilometres of the Siding Spring Observatory)	No	Director of the Siding Spring Observatory	Section 2.15
Defence communications buffer land	Are the works on buffer land around the defence communications facility near Morundah? (Note: refer to Defence Communications Facility	No	Secretary of the Commonwealth Department of Defence	Section 2.15

Development type	Potential impact	Yes / No	If 'yes' consult with	SEPP (Transport and Infrastructure) Section
	Buffer Map referred to in section 5.15 of Lockhart LEP 2012, Narrandera LEP 2013 and Urana LEP 2011.			
Mine subsidence land	Are the works on land in a mine subsidence district within the meaning of the *Mine Subsidence Compensation Act 1961*?	No	Mine Subsidence Board	Section 2.15

Appendix C – Traffic Management Plan

Four traffic cones are to be installed on the centre line at 4m spacing, with a T5_5(L) at both ends.
TC must remain 1.2 from live traffic and maintain a clear escape route at all times whilst operating PORTABOOM





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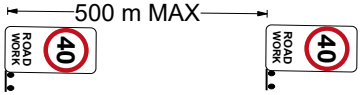

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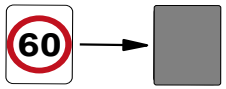

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Protecting freshly painted lines	55 to 75 greater than 75	24 60*
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Recommended Taper Length (m)

	Recommended taper length (m)		
Speed (km/h)	Traffic control taper	Lateral shift taper	Merge taper
45 or less	15	15	15
46 to 55	15	15	30
56 to 65	30	30	60
66 to 75	N/A	70	115
76 to 85	N/A	80	130
86 to 95	N/A	90	145
96 to 105	N/A	100	160
Greater than 105	N/A	110	180

Minimum Taper Lengths

Speed (km/h)	Distance between tapers (m)
45 or less	10
46 to 55	25
56 to 65	70
greater than 65	1.5 x Speed

Allowable Tolerance on amending Spacing

Tolerance	Positioning of signs, length of tapers or markings	Spacing of delineating devices
Minimum	10% less than the distances or lengths given	Nil
Maximum	25% more than the distances or lengths given	10% more than the spacing shown

MACK CIVIL ENGINEERING

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DATE: _____/_____

TRAFFIC GUIDNACE SCHEME INSTALLER:

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ITCP/TCT NUMBER: _____
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SITE INSPECTION DATE PRIOR TO IMPLEMENTATION:
____/____/_____

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MACK CIVIL ENGINEERING

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- Minor adjustments can be completed in accordance with Section 7.10.3 - Tolerances on positioning of signs & devices. All modifications will be recorded on the TGS checklist & a signed copy will be available on-site

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NOTES:

- This Traffic Guidance Scheme has been developed by a competent & experienced persons in accordance with all requirements that are outlined in the TfNSW TCAWS Issue 6.1, AS1742.3 & the Road Management Act 2004
- Prior to the implementation of this TGS, Mack Civil Engineering will carry out an inspection & Risk Assessment of the worksite
- Plan your emergency escape route & document on pre-start
- Inspections to be completed after set up, during closure & upon completion of pack up or as specified/requested.
- A PWZTMP and/or ITCP) qualified person must ensure that the TGS is implemented & the work area maintained in accordance with the attached TGS. Otherwise, modifications will be recorded in the shift paperwork.
- Signed copy of both the SWMS & Toolbox Talks will be available on site
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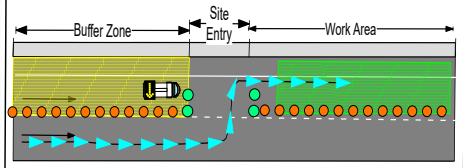
- Signs to be installed out of obstruction & to be visible to traffic
- Generic TGSs must be reviewed by a PWZTMP qualified person every 12 months so they remain appropriate. Once reviewed the date & details of the PWZTMP person must be updated on the TGS to ensure persons selecting can confirm currency
- Mack Civil Engineering does not accept liability for the implementation of this TGS, when not directly involved in carrying out the subject works.

NIGHT TIME WORKS:

- Lighting at a work site shall illuminate the following areas:
(i) Traffic control station & locations where workers or plant might encroach on traffic lanes
(ii) intersections in which works are taking place
(iii) Wherever practical, it is recommended that the entire work area & immediate approach be lit.
- Workers & Traffic Controllers shall be wearing High Visibility garments which is a combination of florescent & retroflective material that doesn't require illumination
- Flood lighting is recommended as traffic route lighting levels will not normally be adequate for an active work site
- Dimming controls on illuminated flashing arrow signs should be checked for correct operation.

Site Entry & Exit Process



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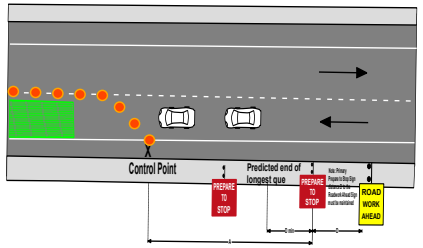
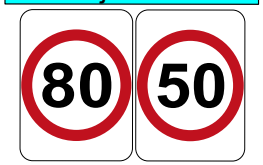
  - Radio Traffic Management on approach to Site will use the nominated UHF channel
- Traffic Controllers will ensure no local traffic follow work vehicles into the work site

Avoiding end-of-que Collisions (see TCAWS V6.14.6.3)



Posted Speed Limit of Subject Road/s



Dimension 'D'

AS 1742.3: A distance expressed in metres, determined in accordance with Clause 4.1.5, and used for the positioning of advanced warning signage

Speed Limit (km/H)	Dimension D (m)
< 55 km/H	15 m
60 km/H	45 m
> 60 km/H	Approach Speed

MACK CIVIL ENGINEERING

TGS PLAN	Bells Line of Road Mt Tomah Slope	CLIENT:	TfNSW	DESIGNED BY	Karim Mahmoud	APPROVED BY		IMPLEMENTED BY			
ROAD NAME	Bells Line Of Road			SIGNATURE	Karimmahmoud	SIGNATURE		SIGNATURE			
SUBURB	Mount Tomah	ROL REQUIRED	YES	DATE	12.09.22	DATE		DATE			
WORK LOCATION	Eastbound	SZA REQUIRED	YES	CERTIFICATE #	TCT0052349515	CERTIFICATE #		CERTIFICATE #			

Task	HAZARD	RISK RATING	CONTROL MEASURES	RESIDULE RISK RATING	STAFF RESPONSIBLE FOR CONTROL MEASURES
Implementation of approved traffic devices	Struck by vehicle Manual Handling Slips, Trips & Falls Cuts & abrasions	4B	- Follow safe work methods outlined in SWMS - Clear communication with spotter/driver with potential oncoming motorists - Use cover vehicle or TMA at all times	3C	ALL STAFF
Working on foot implementing delineation as per TGS	Struck by vehicle Manual Handling Slips, Trips & Falls Cuts & abrasions	4B	- Follow safe work methods outlined in SWMS - Clear communication with spotter/driver with potential oncoming motorists - Use cover vehicle or TMA at all times	3C	ALL STAFF
Stopping traffic at stoppage or cross over point	Struck by vehicle Slips, Trips & Falls	4C	- Only stop traffic with approved PCTD - Select safe stopping distance - Ensure correct amount of TCs are onsite to safely & effectively manage traffic flow as per the TGS - TC's must have escape route	3D	ALL STAFF
Dealing with irate MOP/ Motorists	Struck by vehicle Verbal, physical & mental abuse	3C	- DO NOT engage with irate MOP/Motorists - Report all incidents to TL immediately - De-escalate the situation by continuing on with your duties until TL or supervisor is available to handle the situation - TC's must have escape route	3C	ALL STAFF
Pedestrian interaction with work zones & exclusion zones	Struck by vehicle Verbal, physical & mental abuse Slips, trips & falls	4B	- Set up clear exclusion zones for MOP & WOD, around work zones - Where practical use physical barriers or delineations to guide MOP/WOF safely around exclusion zone - Ensure correct amount of TCs are onsite to safely & effectively manage work site	3C	ALL STAFF
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1. **RISK RATING TABLE (USE FOR INITIAL AND RESIDUAL RISK ASSESSMENTS).**

LIKELIHOOD	CONSEQUENCE				
	1.Insignificant	2.Minor	3. Major	4. Severe	5. Catastrophic
A. Almost Certain	Medium (1A)	High (2A)	Extreme (3A)	Extreme (4A)	Extreme (5A)
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D. Unlikely	Low (1D)	Low (2D)	Medium (3D)	High (4D)	Extreme (5D)
E. Rare	Low (1E)	Low (2E)	Low (3E)	Medium (4E)	High (5E)

4 Extreme	URGENT - Stop work immediately, the risk requires immediate attention
3 High	Continue with supervision and control measures in SWMS or site risk assessment
2 Medium	Use control measures to ensure risk is low as reasonably possible
	Manage by routine procedures and safe practices

MACK CIVIL ENGINEERING

MACK CIVIL ENGINEERING

TGS PLAN	Slope 33459 - Bells Line of Road Mt Tomah Slope	CLIENT:	TfNSW	DESIGNED BY	Karim Mahmoud	APPROVED BY		IMPLEMENTED BY		#TC Required	x5
ROAD NAME	Bells Line Of Road			SIGNATURE	Karimmahmoud	SIGNATURE		SIGNATURE		#Utes Required	x 1
SUBURB	Mount Tomah	ROL REQUIRED	YES	DATE	12.09.22	DATE		DATE		#TMA Required	x 2
WORK LOCATION	Eastbound	SZA REQUIRED	YES	CERTIFICATE #	TCT0052349515	CERTIFICATE #		CERTIFICATE #			

Manifest

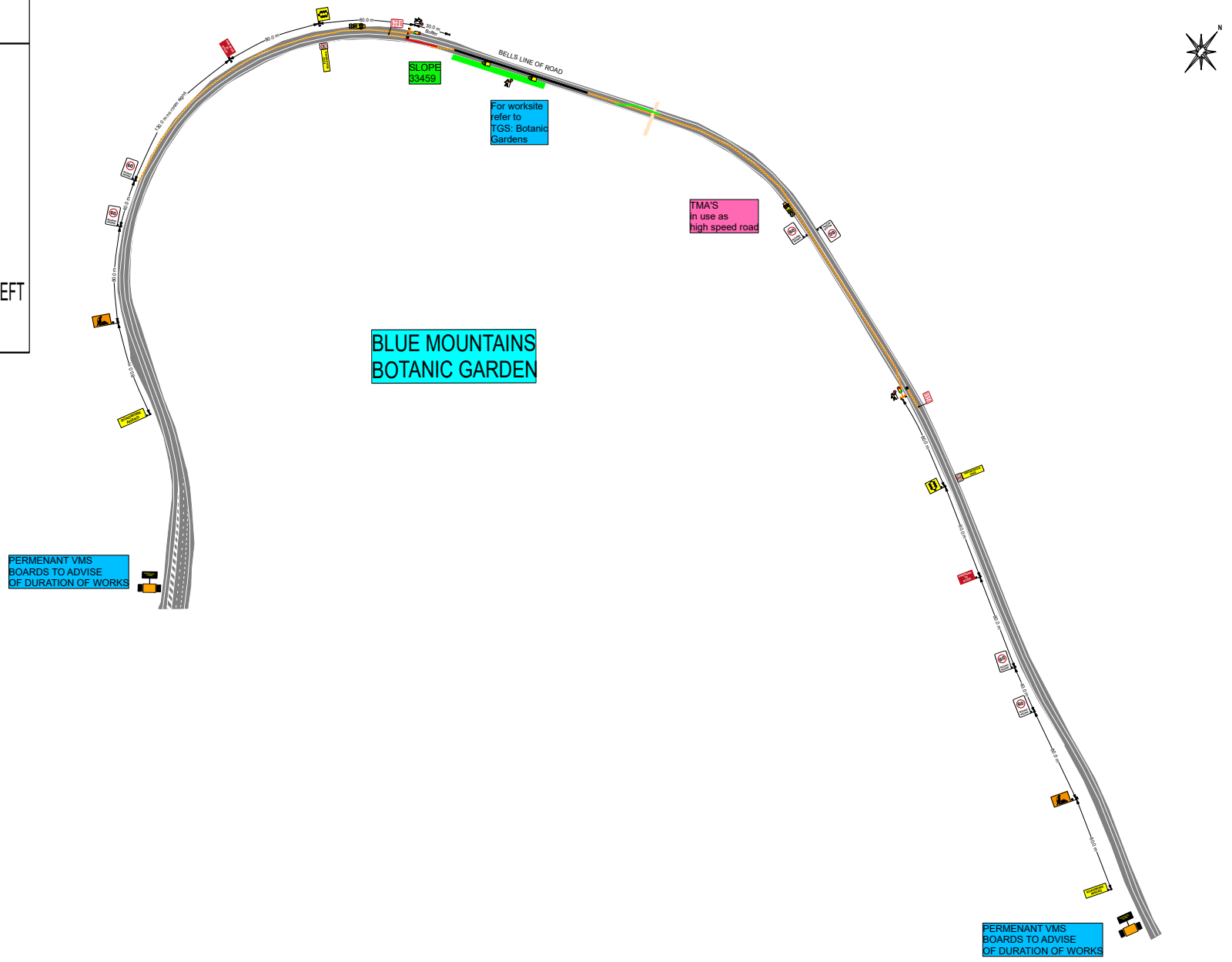
- 2 x R4-1 (80) SPEED LIMIT 80
- 2 x R6-6 STOP HERE ON RED SIGNAL
- 2 x T1-1 ROADWORK AHEAD
- 2 x T1-18 PREPARE TO STOP
- 2 x T1-5 WORKERS AHEAD
- 2 x T2-16 END ROADWORK
- 2 x T5-5 (L) HAZARD WARNING MARKER LEFT
- 2 x TM1-30A Signals Ahead (Rectangle)

Legend

- Cones
- Portable Traffic Lights
- Site Entry
- Site Exit
- TMA Truck
- Traffic Controller
- Truck
- VMS Board
- Water Barriers
- Work Area

USE OTHER FOOTPATH	PEDESTRIANS WATCH YOUR STEP
FOOTPATH CLOSED	PEDESTRIANS →
	← PEDESTRIANS

Pedestrian Signage to be implemented to ensure 1.2m access at all times



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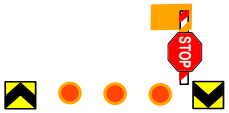

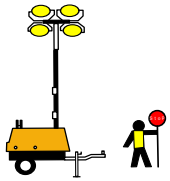

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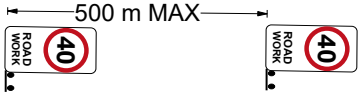

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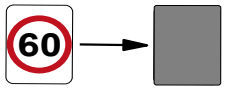

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MACK CIVIL ENGINEERING

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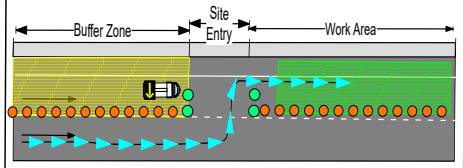

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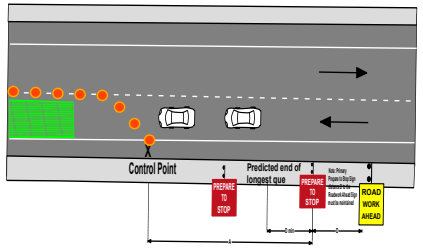

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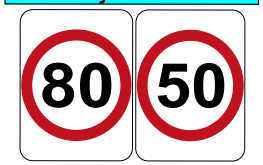

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MACK CIVIL ENGINEERING

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SUBURB	Mount Tomah	ROL REQUIRED	YES	DATE	12.09.22	DATE		DATE			
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Task	HAZARD	RISK RATING	CONTROL MEASURES	RESIDULE RISK RATING	STAFF RESPONSIBLE FOR CONTROL MEASURES
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Working on foot implementing delineation as per TGS	Struck by vehicle Manual Handling Slips, Trips & Falls Cuts & abrasions	4B	- Follow safe work methods outlined in SWMS - Clear communication with spotter/driver with potential oncoming motorists - Use cover vehicle or TMA at all times	3C	ALL STAFF
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1. **RISK RATING TABLE (USE FOR INITIAL AND RESIDUAL RISK ASSESSMENTS).**

LIKELIHOOD	CONSEQUENCE				
	1.Insignificant	2.Minor	3. Major	4. Severe	5. Catastrophic
A. Almost Certain	Medium (1A)	High (2A)	Extreme (3A)	Extreme (4A)	Extreme (5A)
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C. Possible	Low (1C)	Medium (2C)	High (3C)	High (4C)	Extreme (5C)
D. Unlikely	Low (1D)	Low (2D)	Medium (3D)	High (4D)	Extreme (5D)
E. Rare	Low (1E)	Low (2E)	Low (3E)	Medium (4E)	High (5E)

4 Extreme	URGENT - Stop work immediately, the risk requires immediate attention
3 High	Continue with supervision and control measures in SWMS or site risk assessment
2 Medium	Use control measures to ensure risk is low as reasonably possible
	Manage by routine procedures and safe practices

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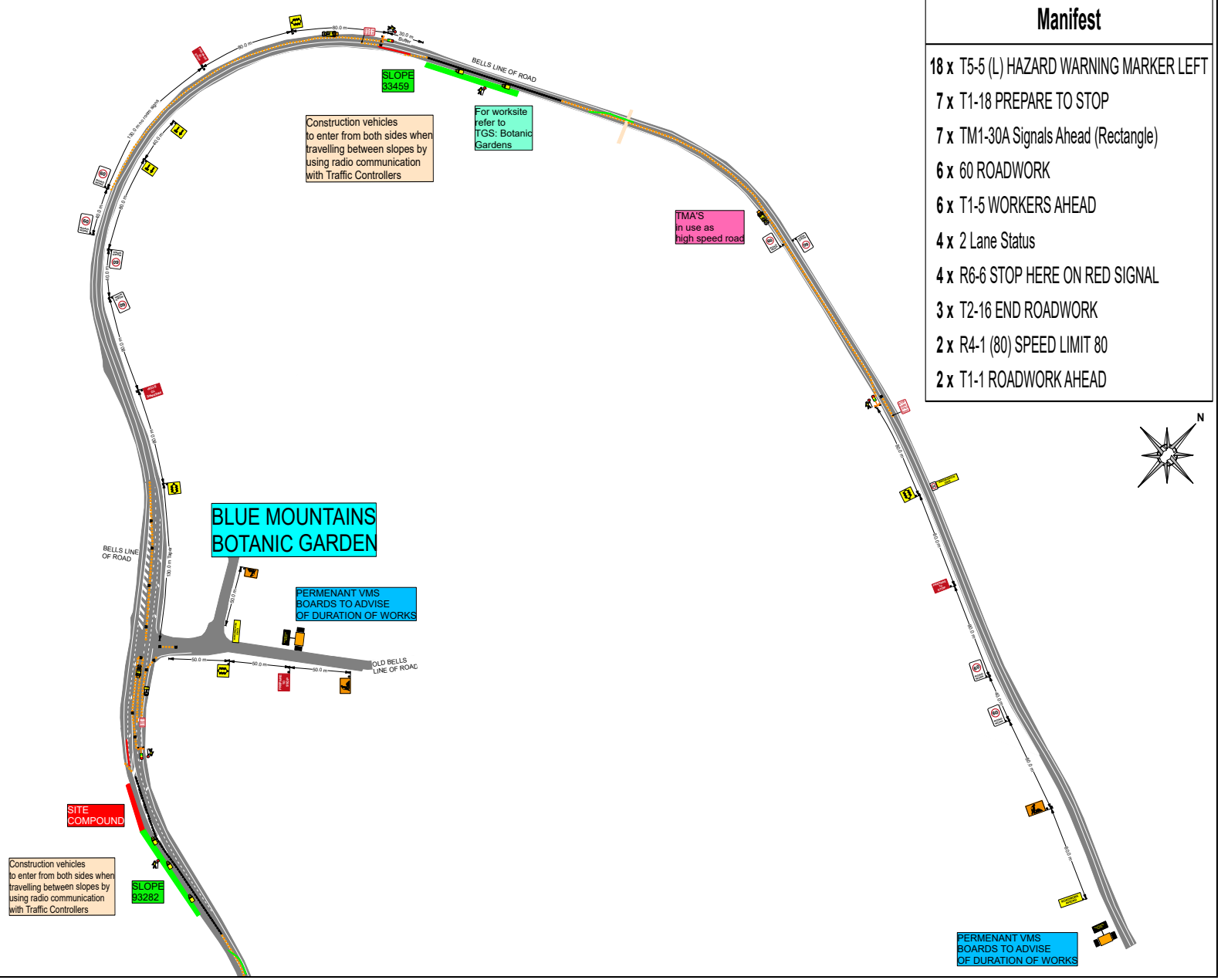
TGS PLAN	Slope 33459 & 93282 - Bells Line of Road Mt Tomah Slope	CLIENT:	TfNSW	DESIGNED BY	Karim Mahmoud	APPROVED BY		IMPLEMENTED BY		#TC Required	x 8
ROAD NAME	Bells Line Of Road			SIGNATURE	KarimMahmoud	SIGNATURE		SIGNATURE		#Utes Required	x 4
SUBURB	Mount Tomah	ROL REQUIRED	YES	DATE	12.09.22	DATE		DATE		#TMA Required	x 2
WORK LOCATION	Eastbound	SZA REQUIRED	YES	CERTIFICATE #	TCT0052349515	CERTIFICATE #		CERTIFICATE #		#Page	1/2

Legend

- Cones
- Portable Traffic Lights
- Site Compoud
- Site Entry
- Site Exit
- TMA Truck
- Traffic Control Ute
- Traffic Controller
- Truck
- VMS Board
- Water Barriers
- Work Area

USE OTHER FOOTPATH	PEDESTRIANS WATCH YOUR STEP
FOOTPATH CLOSED	PEDESTRIANS →
	← PEDESTRIANS

Pedestrian Signage to be implemented to ensure 1.2m access at all times



Manifest

18 x	T5-5 (L) HAZARD WARNING MARKER LEFT
7 x	T1-18 PREPARE TO STOP
7 x	TM1-30A Signals Ahead (Rectangle)
6 x	60 ROADWORK
6 x	T1-5 WORKERS AHEAD
4 x	2 Lane Status
4 x	R6-6 STOP HERE ON RED SIGNAL
3 x	T2-16 END ROADWORK
2 x	R4-1 (80) SPEED LIMIT 80
2 x	T1-1 ROADWORK AHEAD

Legend

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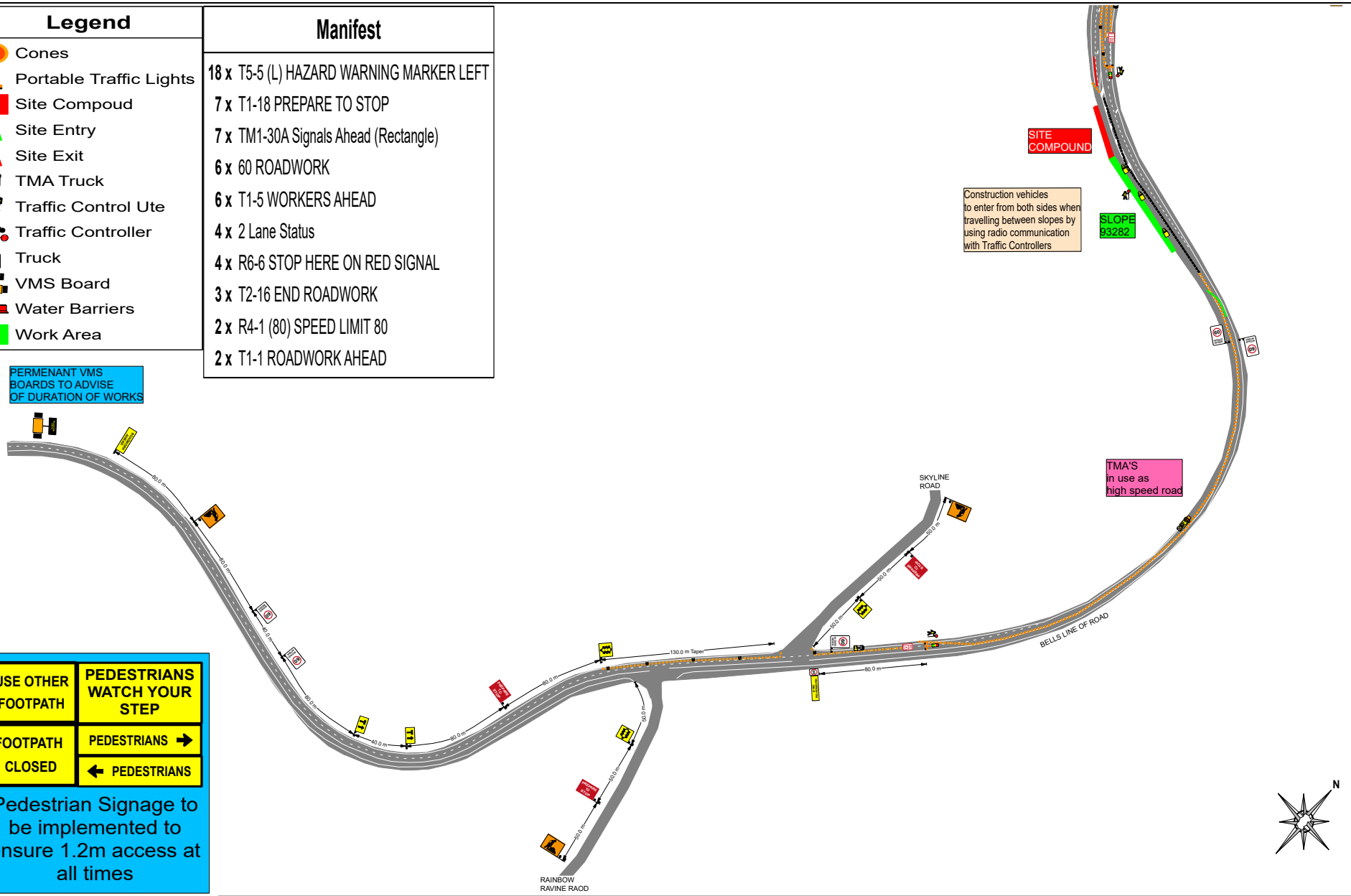

USE OTHER FOOTPATH	PEDESTRIANS WATCH YOUR STEP
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Pedestrian Signage to be implemented to ensure 1.2m access at all times

MACK CIVIL ENGINEERING

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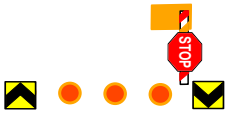
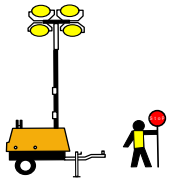
ROAD NAME	Bells Line Of Road			SIGNATURE	karimmahmoud	SIGNATURE		SIGNATURE		#Utes Required	x 4
SUBURB	Mount Tomah	ROL REQUIRED	YES	DATE	12.09.22	DATE		DATE		#TMA Required	x 2
WORK LOCATION	Eastbound	SZA REQUIRED	YES	CERTIFICATE #	TCT0052349515	CERTIFICATE #		CERTIFICATE #		#Page	1/2

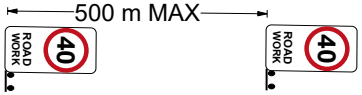
Four traffic cones are to be installed on the centre line at 4m spacing, with a T5_5(L) at both ends.
TC must remain 1.2 from live traffic and maintain a clear escape route at all times whilst operating PORTABOOM



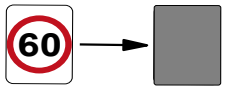


Light Towers to be used where required to Illuminate TC's if lighting is insufficent

Speed Reduction Signage to be repeated at a distance of 500m Max



Existing Speed Signs to be covered with opaque material



Spacing of Cones/Devices

Purpose and usage	Speed zone of device location km/h	Maximum spacing m
On approach to a traffic control position (centreline or edge line)	All cases	4
Merge tapers	55 to 75 greater than 75	9 12
Lateral shift tapers	55 to 75 greater than 75	12 18
Protecting freshly painted lines	55 to 75 greater than 75	24 60*
All other purposes	less than 55 55 to 75 greater than 75	4 12 18

Recommended Taper Length (m)

	Recommended taper length (m)		
Speed (km/h)	Traffic control taper	Lateral shift taper	Merge taper
45 or less	15	15	15
46 to 55	15	15	30
56 to 65	30	30	60
66 to 75	N/A	70	115
76 to 85	N/A	80	130
86 to 95	N/A	90	145
96 to 105	N/A	100	160
Greater than 105	N/A	110	180

Minimum Taper Lengths

Speed (km/h)	Distance between tapers (m)
45 or less	10
46 to 55	25
56 to 65	70
greater than 65	1.5 x Speed

Allowable Tolerance on amending Spacing

Tolerance	Positioning of signs, length of tapers or markings	Spacing of delineating devices
Minimum	10% less than the distances or lengths given	Nil
Maximum	25% more than the distances or lengths given	10% more than the spacing shown

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TRAFFIC GUIDNACE SCHEME INSTALLION:

DATE: _____/_____

TRAFFIC GUIDNACE SCHEME INSTALLER:

FULL NAME: _____
ITCP/TCT NUMBER: _____
EXPIRY DATE/ISSUE DATE: ____/____/_____
SIGNATURE: _____
DATE: _____/_____/_____

TRAFFIC GUIDNACE SCHEME MODIFICATIONS:

FULL NAME: _____
PWZTMP/TCT NUMBER: _____
EXPIRY DATE/ISSUE DATE: ____/____/_____
SIGNATURE: _____
DATE: _____/_____/_____

SITE INSPECTION DATE PRIOR TO IMPLEMENTATION:
____/____/_____

TRAFFIC GUIDNACE SCHEME MODIFICATIONS:

_____
_____
_____
_____
_____

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ADJUSTING OR MODIFYING A TGS:

ITCP HOLDER:

- The TGS must be installed, maintained & removed in a planned & safe manner. The implementation of a TGS must only be undertaken by an ITCP qualified person
- Minor adjustments can be completed in accordance with Section 7.10.3 - Tolerances on positioning of signs & devices. All modifications will be recorded on the TGS checklist & a signed copy will be available on-site

PWZTMP HOLDER:

- All modifications of a Site Specific TGS must be approved by the PWZTMP or relevant qualification holder, and must be supported by a TMP or risk assessment to ensure all TGSs consider & mitigate identified site-specific conditions & risks.
- If it is identified that risk will be generated through the implementation of a TGS that requires modification outside of the tolerances, then works must be stopped (including the implementation of the TGS), the site must be made safe & an updated TGS must be provided by a PWZTMP qualified person prior to works recommencing .

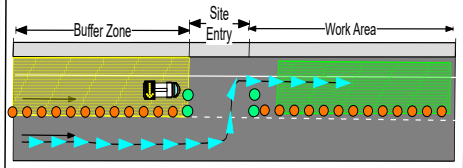
NOTES:

- This Traffic Guidance Scheme has been developed by a competent & experienced persons in accordance with all requirements that are outlined in the TfNSW TCAWS Issue 6.1, AS1742.3 & the Road Management Act 2004
- Prior to the implementation of this TGS, Mack Civil Engineering will carry out an inspection & Risk Assessment of the worksite
- Plan your emergency escape route & document on pre-start
- Inspections to be completed after set up, during closure & upon completion of pack up or as specified/requested.
- A PWZTMP and/or ITCP) qualified person must ensure that the TGS is implemented & the work area maintained in accordance with the attached TGS. Otherwise, modifications will be recorded in the shift paperwork.
- Signed copy of both the SWMS & Toolbox Talks will be available on site
- Team leader on site will patrol site for pedestrian safe access & ensure that the pedestrian management is supported by a risk assessment.
- Signs to be installed out of obstruction & to be visible to traffic
- Generic TGSs must be reviewed by a PWZTMP qualified person every 12 months so they remain appropriate. Once reviewed the date & details of the PWZTMP person must be updated on the TGS to ensure persons selecting can confirm currency
- Mack Civil Engineering does not accept liability for the implementation of this TGS, when not directly involved in carrying out the subject works.

NIGHT TIME WORKS:

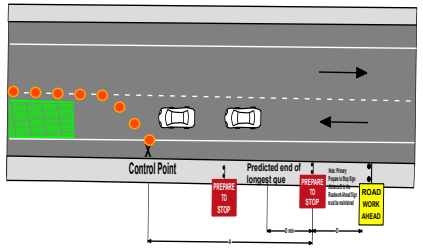
- Lighting at a work site shall illuminate the following areas:
(i) Traffic control station & locations where workers or plant might encroach on traffic lanes
(ii) intersections in which works are taking place
(iii) Wherever practical, it is recommended that the entire work area & immediate approach be lit.
- Workers & Traffic Controllers shall be wearing High Visibility garments which is a combination of florescent & retroflective material that doesn't require illumination
- Flood lighting is recommended as traffic route lighting levels will not normally be adequate for an active work site
- Dimming controls on illuminated flashing arrow signs should be checked for correct operation.

Site Entry & Exit Process

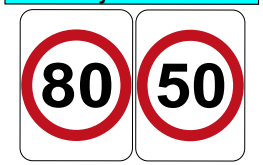


- Entry point will be highlighted with double green cones & a small break will be left as per diagram above
- Before entering the Worksite, Work Vehicles Will:
  - Turn on beacons
  - Radio Traffic Management on approach to Site will use the nominated UHF channel
- Traffic Controllers will ensure no local traffic follow work vehicles into the work site

Avoiding end-of-que Collisions (see TCAWS V6.14.6.3)



Posted Speed Limit of Subject Road/s



Dimension 'D'

AS 1742.3: A distance expressed in metres, determined in accordance with Clause 4.1.5, and used for the positioning of advanced warning signage

Speed Limit (km/H)	Dimension D (m)
< 55 km/H	15 m
60 km/H	45 m
> 60 km/H	Approach Speed

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TGS PLAN	Bells Line of Road Mt Tomah Slope	CLIENT:	TfNSW	DESIGNED BY	Karim Mahmoud	APPROVED BY		IMPLEMENTED BY			
ROAD NAME	Bells Line Of Road			SIGNATURE	Karimmahmoud	SIGNATURE		SIGNATURE			
SUBURB	Mount Tomah	ROL REQUIRED	YES	DATE	12.09.22	DATE		DATE			
WORK LOCATION	Eastbound	SZA REQUIRED	YES	CERTIFICATE #	TCT0052349515	CERTIFICATE #		CERTIFICATE #			

Task	HAZARD	RISK RATING	CONTROL MEASURES	RESIDULE RISK RATING	STAFF RESPONSIBLE FOR CONTROL MEASURES
Implementation of approved traffic devices	Struck by vehicle Manual Handling Slips, Trips & Falls Cuts & abrasions	4B	- Follow safe work methods outlined in SWMS - Clear communication with spotter/driver with potential oncoming motorists - Use cover vehicle or TMA at all times	3C	ALL STAFF
Working on foot implementing delineation as per TGS	Struck by vehicle Manual Handling Slips, Trips & Falls Cuts & abrasions	4B	- Follow safe work methods outlined in SWMS - Clear communication with spotter/driver with potential oncoming motorists - Use cover vehicle or TMA at all times	3C	ALL STAFF
Stopping traffic at stoppage or cross over point	Struck by vehicle Slips, Trips & Falls	4C	- Only stop traffic with approved PCTD - Select safe stopping distance - Ensure correct amount of TCs are onsite to safely & effectively manage traffic flow as per the TGS - TC's must have escape route	3D	ALL STAFF
Dealing with irate MOP/ Motorists	Struck by vehicle Verbal, physical & mental abuse	3C	- DO NOT engage with irate MOP/Motorists - Report all incidents to TL immediately - De-escalate the situation by continuing on with your duties until TL or supervisor is available to handle the situation - TC's must have escape route	3C	ALL STAFF
Pedestrian interaction with work zones & exclusion zones	Struck by vehicle Verbal, physical & mental abuse Slips, trips & falls	4B	- Set up clear exclusion zones for MOP & WOD, around work zones - Where practical use physical barriers or delineations to guide MOP/WOF safely around exclusion zone - Ensure correct amount of TCs are onsite to safely & effectively manage work site	3C	ALL STAFF
Performing Dynamic Works (Mobile Works) Including set up & Pack down	Vehicle Collision Vehicle interaction with WOF/MOP	4C	- Abide to safe distance outlined in TCAWS V 6.1 - Use cover/tail/shadow vehicles & or TMA were possible -Avoid WOF if possible - Follow Safe Work Methods outlined in SWMS	4D	ALL STAFF

1. **RISK RATING TABLE (USE FOR INITIAL AND RESIDUAL RISK ASSESSMENTS).**

LIKELIHOOD	CONSEQUENCE				
	1.Insignificant	2.Minor	3. Major	4. Severe	5. Catastrophic
A. Almost Certain	Medium (1A)	High (2A)	Extreme (3A)	Extreme (4A)	Extreme (5A)
B. Likely	Medium (1B)	High (2B)	High (3B)	Extreme (4B)	Extreme (5B)
C. Possible	Low (1C)	Medium (2C)	High (3C)	High (4C)	Extreme (5C)
D. Unlikely	Low (1D)	Low (2D)	Medium (3D)	High (4D)	Extreme (5D)
E. Rare	Low (1E)	Low (2E)	Low (3E)	Medium (4E)	High (5E)

4 Extreme	URGENT - Stop work immediately, the risk requires immediate attention
3 High	Continue with supervision and control measures in SWMS or site risk assessment
2 Medium	Use control measures to ensure risk is low as reasonably possible
	Manage by routine procedures and safe practices

MACK CIVIL ENGINEERING

TGS PLAN	Slope 93282 - Bells Line of Road MtTomah Slope	CLIENT:	TfNSW	DESIGNED BY	Karim Mahmoud	APPROVED BY		IMPLEMENTED BY		#TC Required	x6
ROAD NAME	Bells Line Of Road			SIGNATURE	Karimmahmoud	SIGNATURE		SIGNATURE		#Utes Required	x 2
SUBURB	Mount Tomah	ROL REQUIRED	YES	DATE	12.09.22	DATE		DATE		#TMA Required	x 2
WORK LOCATION	Eastbound	SZA REQUIRED	YES	CERTIFICATE #	TCT0052349515	CERTIFICATE #		CERTIFICATE #		#Page	1/2

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Manifest

- **16 x** T5-5 (L) HAZARD WARNING MARKER LEFT
- **6 x** T1-5 WORKERS AHEAD
- **5 x** T1-18 PREPARE TO STOP
- **5 x** TM1-30A Signals Ahead (Rectangle)
- **4 x** 2 Lane Status
- **4 x** 60 ROADWORK
- **3 x** T2-16 END ROADWORK
- **2 x** R4-1 (80) SPEED LIMIT 80
- **2 x** R6-6 STOP HERE ON RED SIGNAL
- **2 x** T1-1 ROADWORK AHEAD

Legend

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- Site Compoud
- Site Exit
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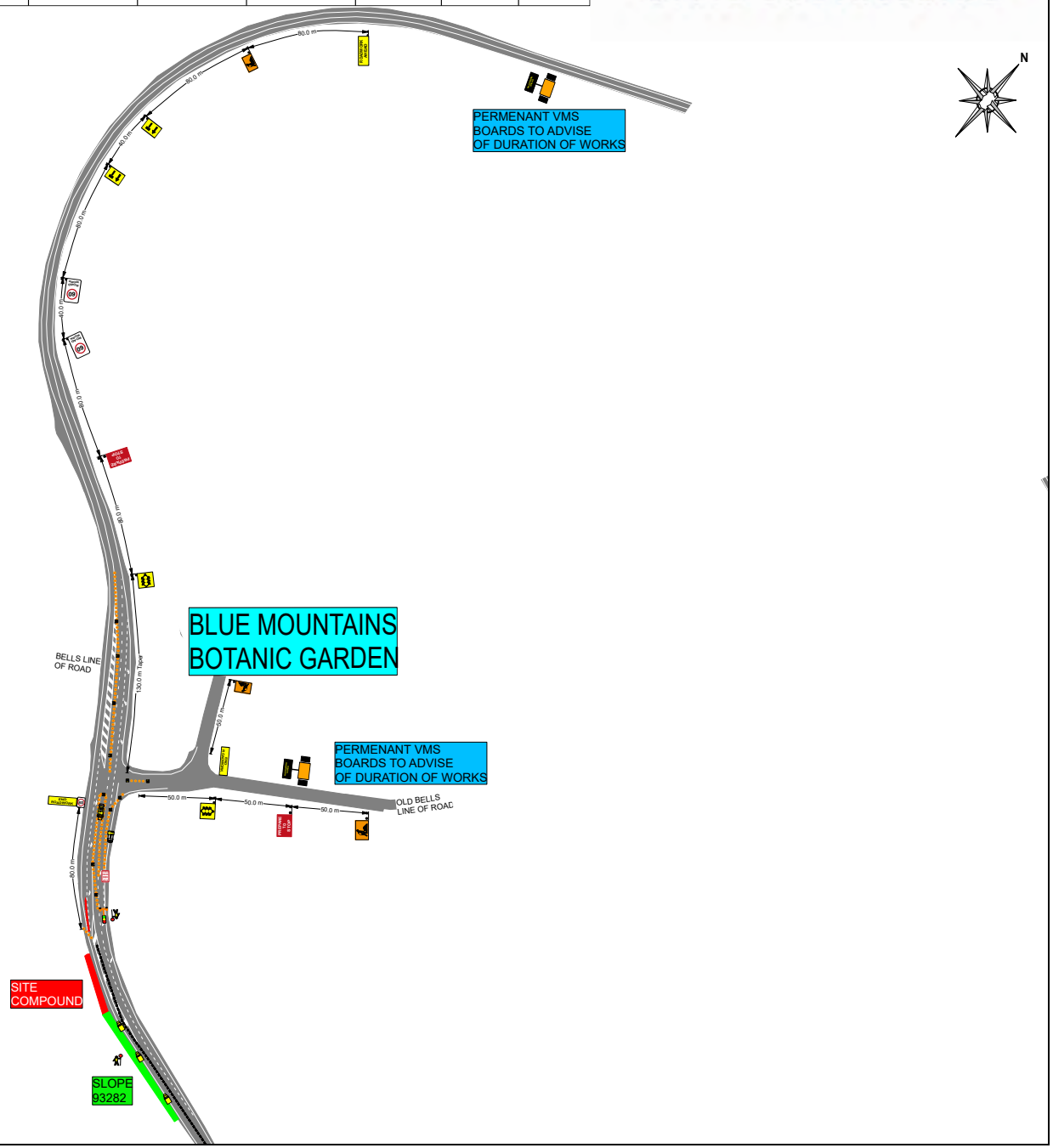
- Traffic Control Ute
- Traffic Controller
- Truck
- VMS Board
- Work Area

USE OTHER FOOTPATH	PEDESTRIANS WATCH YOUR STEP
FOOTPATH CLOSED	PEDESTRIANS →
	PEDESTRIANS ←

Pedestrian Signage to be implemented to ensure 1.2m access at all times



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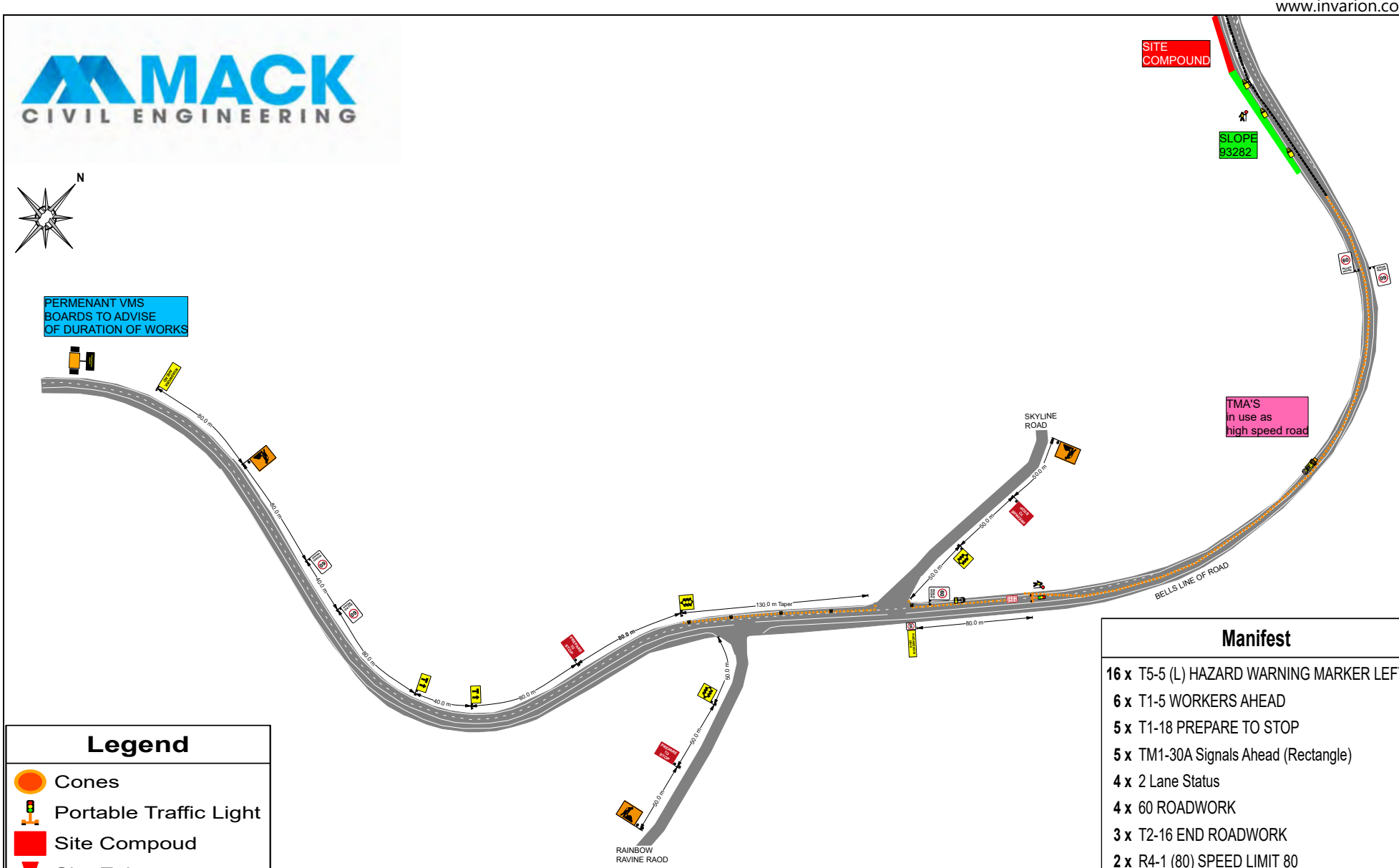

Legend

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SUBURB	Mount Tomah	ROL REQUIRED	YES	DATE	12.09.22	DATE		DATE		#TMA Required	x 2
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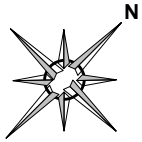
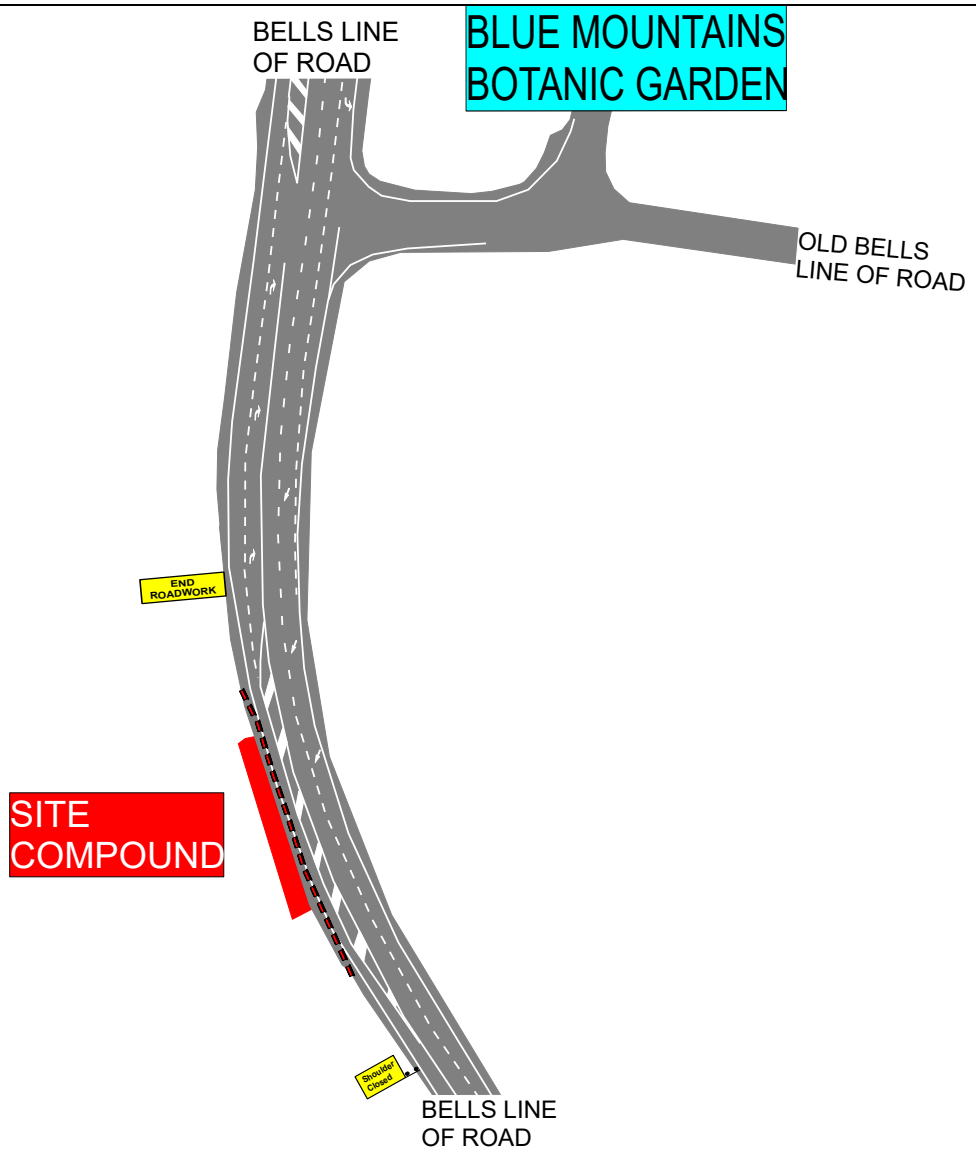
Site Compound - Aftercare

Legend

- Site Compoud
- Water Barriers





TGS PLAN	Slope 93282 - Site Compound Aftercare	CLIENT:	TfNSW	DESIGNED BY	**Karim Mahmoud**	APPROVED BY		IMPLEMENTED BY			
ROAD NAME	**Bells Line Of Road**			SIGNATURE	Karimmahmoud	SIGNATURE		SIGNATURE			
SUBURB	**Mount Tomah**	ROL REQUIRED	NO	DATE	**12.09.22**	DATE		DATE			
WORK LOCATION	**Eastbound**	SZA REQUIRED	NO	CERTIFICATE #	**TCT0052349515**	CERTIFICATE #		CERTIFICATE #			

Appendix D – Biodiversity Assessment Report

Transport for NSW

Biodiversity assessment report for REF

Bells Line of Road Slope Stabilisation

December 2022

NSW GOVERNMENT

transport.nsw.gov.au

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Executive summary

Transport for NSW (Transport) proposes to remediate three slopes (Slopes 33459, 93282 and 96403) on Bells Line of Road at Mount Tomah (the proposal) within the Blue Mountains local government area. A review of environmental factors (REF) has been prepared by Arcadis Australia Pacific Pty Ltd (Arcadis) on behalf of Transport. This Biodiversity Assessment Report (BAR) has been prepared to support the REF. The subject land consists of steep slopes adjoining Bells Line of Road in Mount Tomah and lies within the Sydney Basin bioregion and the Wollemi subregion. Six locations have been considered for location of ancillary facilities.

The subject land was surveyed in November 2022 and included two BAM plots and ground-truthing of native vegetation communities at Slopes 93282 and 96403. The native vegetation at Slope 33459 could not be accessed but was assessed from adjoining land. Blue Mountains Basalt Cap Forest (PCT 3209) was found present at all three slopes, covering an area of 0.57 hectares. It is a tall to extremely tall sclerophyll open forest, commonly including a high cover of *Eucalyptus blaxlandii* and *Eucalyptus cypellocarpa*, occasionally *Eucalyptus radiata*. This PCT occurs in wet, cool environments on high elevation (above 800 metres asl) basalt and basalt enriched sandstones, and rarely shale in the Blue Mountains.

Blue Mountains Basalt Cap Forest (PCT 3209) is associated with the Threatened Ecological Community (TEC) Blue Mountains Basalt Forest in the Sydney Basin Bioregion, listed as Endangered under the BC Act. It is also associated with the TEC Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion, listed as an Endangered under the EPBC Act. All of the 0.57 hectares of PCT 3209 meet the definition of the BC Act TEC. Only the vegetation in Slope 96403 is considered to be consistent with the TEC as defined under the EPBC Act, covering an area of 0.26 hectares.

No threatened species were recorded during surveys. The following threatened species were targeted and were considered to have a high or moderate likelihood of occurrence:

Species name	EPBC Act	BC Act	Identification method	Survey effort compliant?	Notes
Lastreopsis hispida Bristly Shield Fern	-	E	Not recorded	Yes	Survey was within seasonal timeframes, however not all areas were accessible for survey
Zieria murphyi Velvet Zieria	V	V	Not recorded	Yes	Survey was within seasonal timeframes, however not all areas were accessible for survey
Callocephalon fimbriatum Gang-gang Cockatoo	E	V	Assumed present	No targeted survey conducted	Assumed present based on presence of associated PCT and potential breeding habitat (hollows with >9cm diameter).
Cercartetus nanus Eastern Pygmy-possum	-	V	Assumed present	No targeted survey conducted	Assumed present based on presence of associated PCT, although notable feed trees of the Banksia and Bottlebrush genera are absent on site.
Chalinolobus dwyeri Large-eared Pied Bat	V	V	Assumed present	No targeted survey conducted	Foraging habitat is assumed to be present based on presence of associated PCTs within 2km of rocky areas containing caves, escarpments, overhangs, outcrops, crevices.
Dasyurus maculatus Spotted-tail Quoll	E	V	Assumed present	No targeted survey conducted	Foraging and dispersal habitat is assumed to be present based on presence of associated PCTs.
Ninox strenua Powerful Owl	-	V	Assumed present	No targeted survey conducted	Assumed present based on presence of associated PCT and potential

Species name	EPBC Act	BC Act	Identification method	Survey effort compliant?	Notes
					breeding habitat (hollows >20cm diameter, >4m above ground).
Petauroides volans Greater Glider	E	E	Assumed present	No targeted survey conducted	Assumed present based on presence of associated PCT and potential breeding habitat (hollows).
Phascolarctos cinereus Koala	E	E	Assumed present	No targeted survey conducted	Assumed present based on presence of associated PCT and Koala feed trees.

Clearing of 0.57 hectares of native vegetation is required for the proposal. It is assumed that all areas of native vegetation at Slopes 33459 and 93282 (0.31 hectares) will be cleared and some, if not all the native vegetation at Slope 96403 (0.26 hectares) will also be cleared. Vegetation clearing would result in the removal of 2 medium sized hollows which has the potential to impact Eastern Pygmy-possum, Spot-tailed Quoll and Greater Glider. Large hollow-bearing trees on Slope 96403 which are suitable for Powerful Owl and Gang-gang Cockatoo would be cleared outside the breeding season for these species.

Threatened species and TEC impacts were assessed under BC Act and EPBC Act assessments of significance. No significant impacts were determined and a Referral would not be required in any case due to the application of the EPBC Act strategic assessment.

Offsets would be required to offset the loss of tree hollows and trees. Approximately 100 replacement tree plantings would be required and three artificial hollows.

1. Introduction

1.1 Proposal background

Transport for NSW (Transport) proposes to remediate three slopes (Slopes 33459, 93282 and 96403) on Bells Line of Road at Mount Tomah (the proposal) within the Blue Mountains local government area. Bells Line of Road provides a vital link between Central West NSW and the Sydney road network. While the Great Western Highway remains the primary route across the Blue Mountains, Bells Line of Road performs as an important secondary route for cross-mountain traffic, as well as functioning as a local access road.

In response to slope failures caused by the extreme weather events of March 2021, Transport proposes to stabilise Slope 33459, Slope 96403 and Slope 93282 on Bells Line of Road at Mount Tomah, located about 25 kilometres east of Lithgow in the Blue Mountains local government area.

A review of environmental factors (REF) has been prepared by Arcadis Australia Pacific Pty Ltd (Arcadis) on behalf of Transport. For the purposes of these works, Transport is the proponent and determining authority under Division 5.1 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act). This Biodiversity Assessment Report (BAR) has been prepared to support the REF and consider Section 5.5 of the EP&A Act including that Transport examine and take into account, to the fullest extent possible, all matters affecting or likely to affect the environment, including biodiversity. This BAR also considers the significance of any impact on threatened species as defined by the *Biodiversity Conservation Act, 2016* (BC Act), and/or the *Fisheries Management Act 1994* (FM Act) and the significance of any impact on nationally-listed biodiversity matters under the Australian Government's *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

1.2 The proposal

Key features of the proposal, as shown in Figure 3-1, Figure 3-2 and Figure 3-3 in the REF, would include:

- Remediation and stabilisation of Slope 33459, Slope 96403 and Slope 93282
- Installation and/or upgrade of drainage infrastructure, such as trench drains, pipes and culvert outlets
- Installation or reinstatement of roadside furniture, such as safety barriers and line marking
- Establishment and use of temporary ancillary facilities during construction
- Revegetation of disturbed areas.

The location of the proposal is shown in Figure 1-1 and an overview of the proposal is provided in Figure 1-2. Details of the works required at each slope are outlined in Table 1-1.

Table 1-1 Works required for the proposal

Component	Proposed works
Slope 33459	
Stabilisation	Slope 33459 would be stabilised using a combination of soil nails, reinforced shotcrete and concrete piles. Three rows of three-metre soil nails would be installed on the slope. Reinforcements and anchors would be installed, followed by the slope being sprayed with shotcrete. A wall of 21 piles would be installed near the crest of the slope, with each pile measuring 450 millimetres in diameter and a minimum of seven metres deep with one metre rock sockets. The piled wall would extend five metres beyond the slide tension crack at each side.
Drainage	A series of trench drains would be installed on the grassy area above Slope 33459. There would be a one-metre-wide central trench, with five 600-milimetre-wide limb trenches adjoining. These drains would lead to a 900 by 900 by 1350-milimetre drainage pit near the crest of the slope. A 225-milimetre diameter drainage pipe would be recessed into the slope prior to shotcrete placement and would drain to a roadside fibrecrete drain.
Property access	Primary access to Slope 33459 would be via existing sealed internal roads inside the Blue Mountains Botanic Garden. A temporary three-metre-wide access track would be

Component	Proposed works
	established from the existing road to the construction works area. The construction works area would allow adequate space for vehicles to turn around and egress via the same track. Slope 33459 would also be accessed via the westbound lane of Bells Line of Road which would be closed for the duration of construction.
Roadside furniture	At the completion of construction, the chain mesh fence marking the property boundary between the Blue Mountains Botanic Garden and the road reserve would be reinstated. Line marking on Bells Line of Road would be repainted, as required.
Slope 96403	
Stabilisation	Slope 96403 would be stabilised by sealing the tension crack with bentonite and road pavement materials and the installation of a piled retaining wall. The piled retaining wall would consist of 60 bore piles with a reinforced concrete capping beam on top linking the piles.
Drainage	The existing drainage system in the vicinity of Slope 96403 has been reviewed and is under capacity. The primary catchment contributing to the existing drainage system is from the Blue Mountains Botanic Garden. Additional inlet pits would be installed on the westbound curb to assist in reducing peak surface flows to Bells Line of Road drainage systems and improve the road drainage system to manage road reserve catchment flows. New drainage would also be installed along the eastbound kerb of Bells Line of Road. This would provide continuous inlets for flows and would discharge via a dedicated outlet at the existing culvert at the eastern edge extent of the works (Culvert 446877). The culvert outlet, which drains into manmade dam southwest of Bells Line of Road on Blue Mountains Botanic Garden land, would be upgraded.
Property access	Access to Slope 96403 would be via the Bells Line of Road. The eastbound lane would be closed for the duration of construction. The Blue Mountains Botanic Garden access track would also be utilised for visual inspection and assessment during construction. No plant or equipment would be permitted without prior approval from Blue Mountains Botanic Garden.
Roadside furniture	At the completion of construction, the guard rail on the westbound kerb would be reinstated and the line marking on Bells Line of Road would be repainted, as required.
Slope 93282	
Stabilisation	Slope 93282 would be stabilised using a gabion wall. Rock-filled gabions would be installed on top of a reinforced concrete base layer. The wall would range from one to four metres in height depending on the height of the slope. The bottom layer of gabion baskets would be sprayed with shotcrete. The slope behind the wall would be backfilled with a layer of free-draining rock fill and compacted select fill and covered with topsoil and jute.
Drainage	A concrete surface drain would be installed immediately behind the top of the gabion wall to capture runoff from the above slope. Behind the base of the gabion wall, a corrugated perforated drainage pipe would be installed under the free-draining rock fill to capture any flow that permeates through and avoid water building up behind the gabion wall. As the bottom layer of gabion baskets would be sprayed with shotcrete, a pipe would be installed at the base of each basket to allow water to drain out. A fibrecrete drain would be installed along the edge of Bells Line of Road adjacent to the gabion wall.
Property access	Access to Slope 93282 would be via the Bells Line of Road. The eastbound lane would be closed for the duration of construction.

Component	Proposed works
Roadside furniture	At the completion of construction, line marking on Bells Line of Road would be repainted, as required.

Ancillary facilities

A number of ancillary facilities would be required to support delivery of the proposal. Six locations have been identified and assessed, outlined in Table 1-2.

Table 1-2 Proposed ancillary sites

Facility	Purpose
Ancillary Facility 1	Site office, amenities, stockpile site, laydown, car park and storage areas (TfNSW has been granted permission by the Botanic Gardens to use Ancillary Facility 1 for this purpose as needed)
Ancillary Facility 2	Site office, amenities and stockpile site
Ancillary Facility 3	Stockpile site
Ancillary Facility 4	Stockpile site
Ancillary Facility 5	Stockpile site
Ancillary Facility 6	Stockpile site, permanent levelling and compaction of about 500 cubic metres of excavated materials

Subject to the proposal obtaining planning approval, slope stabilisation works are anticipated to commence in early 2023 and is expected to take about seven months, weather permitting.

1.2.1 Assessment areas

Subject land

The area required to deliver the slope stabilisation works, including proposed ancillary facilities, is presented in Figure 1-1 and Figure 1-2. This area is referred to in this report as the subject land and all biodiversity values within the area are assumed as potential direct impacts.

Figure 1-1 shows the subject land as well as areas proposed for ancillary facilities. Ancillary facilities comprising site compound areas, stockpile sites and roadside pull of areas will be located within cleared roadside areas with no native vegetation.

The landscape assessment area is comprised of the area of land within the 1500-meter buffer zone surrounding the subject land as determined in section 3.1.2 of the BAM. This area is also shown on Figure 1-1.

The area surveyed and subject to assessment in this BAR, herein referred to as the study area, was restricted to the slopes and is shown in Figure 1-2. The study area excluded survey of ancillary facilities due to the absence of biodiversity values.

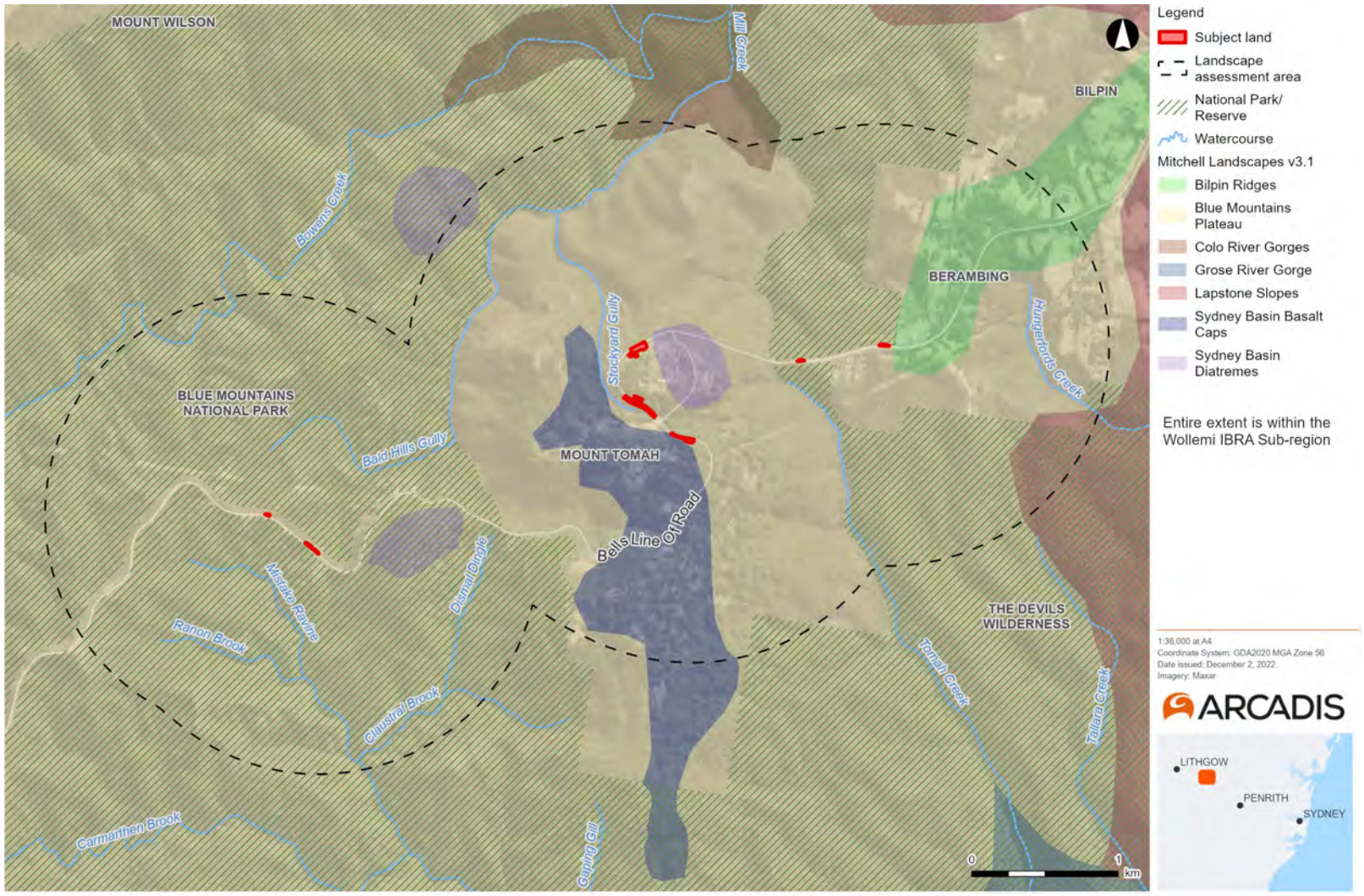

Figure 1-1: Proposal context

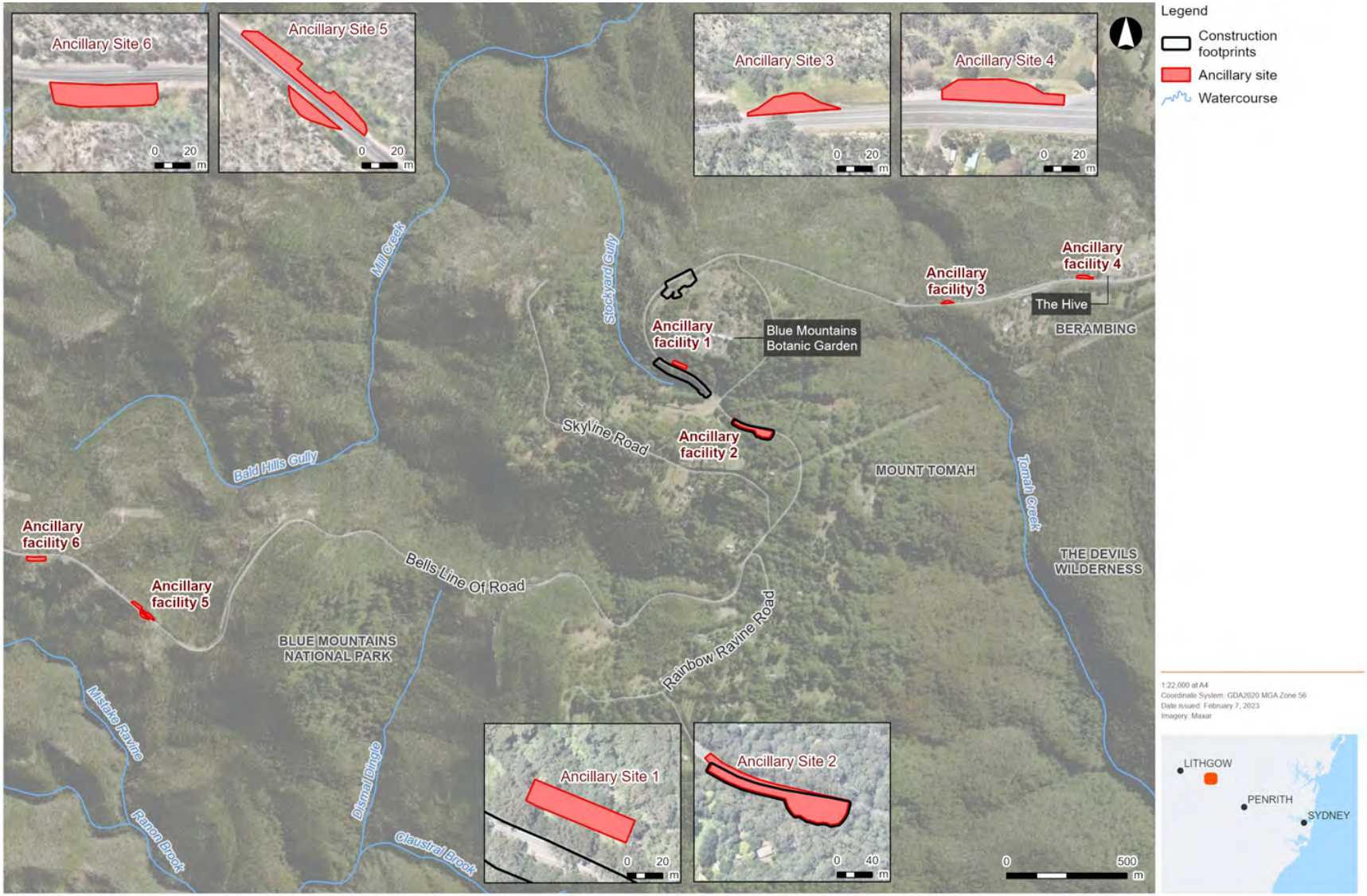

Figure 1-2: The proposal

1.3 Legislative context

A REF is prepared to satisfy Transport duties under Section 5.5 of the *Environmental Planning & Assessment Act 1979* (EP&A Act) to "examine and take into account to the fullest extent possible all matters affecting or likely to affect the environment by reason of that activity" and Section 5.5 in making decisions on the likely significance of any environmental impacts. This BAR forms part of the REF being prepared for the proposal and assesses the biodiversity impacts of the proposal to meet the requirements of the EP&A Act.

The *Biodiversity Conservation Act 2016* (BC Act) requires that the significance of the impact on threatened species, populations and threatened ecological communities is assessed using the test listed in Section 7.3 of the BC Act. Similarly, Part 7A of the *Fisheries Management Act 1994* (FM Act) requires that significance assessments are undertaken in accordance with Division 12 of the FM Act. Where a significant impact is likely to occur, a Species Impact Statement (SIS) must be prepared in accordance with the Environment Agency Head's requirements, or a Biodiversity Development Assessment Report (BDAR) must be prepared by an accredited assessor in accordance with the Biodiversity Assessment Method (BAM) (DPIE 2020a).

1.3.1 Commonwealth Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is Commonwealth legislation that provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities and heritage places, defined in the EPBC Act as Matters of National Environmental Significance (MNES). MNES identified in the EPBC Act include:

- World heritage properties
- National heritage places
- Wetlands of international importance (listed under the Ramsar Convention)
- Threatened species and communities
- Migratory species protected under international agreements
- Commonwealth marine areas
- The Great Barrier Reef Marine Park
- Nuclear actions (including uranium mines).

In September 2015, a "strategic assessment" approval was granted by the Minister for the Environment in accordance with the EPBC Act. The approval applies to Transport for NSW activities being assessed under Division 5.1 (formerly Part 5) of the EP&A Act with respect to potential impacts on nationally listed threatened species, ecological communities and migratory species. As a result, Transport for NSW road proposals assessed via a REF:

- Must address and consider potential impacts on nationally listed threatened species, populations, ecological communities and migratory species, including application of the "avoid, minimise, mitigate and offset" hierarchy
- Do not require referral to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) for these matters, even if the activity is likely to have a significant impact
- Must use the Biodiversity Assessment Method (BAM) to calculate credits that would offset significant impacts on EPBC Act listed threatened species, populations, ecological communities and migratory species.

To assist with this, assessments of impact significance are required for all relevant biodiversity values in accordance with the *Matters of National Environmental Significance: Significant impact guidelines 1.1. Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth of Australia 2013a).

1.3.2 NSW Biodiversity Conservation Act 2016

The purpose of the NSW *Biodiversity Conservation Act 2016* (BC Act) is to maintain a healthy, productive and resilient environment for the greatest well-being of the community, now and into the future, consistent with the principles of ecologically sustainable development.

The NSW Biodiversity Offset Scheme is established under Part 6 of the BC Act and the BAM is established under Section 6.7 of the BC Act. The purpose of the BAM is to prescribe requirements for the assessment of certain impacts on threatened species and Threatened Ecological Communities (TECs), and their habitats, and the impact on biodiversity values, where required under the BC Act.

Section 7.3 of the BC Act provides a test for determining whether proposed development or activity is likely to significantly affect threatened species or ecological communities, or their habitats. Where a significant impact is likely to occur, a Species Impact Statement must be prepared in accordance with the Director-General's requirements, or a BDAR must be prepared by an accredited assessor in accordance with the BAM.

1.3.3 NSW Biosecurity Act 2015

The NSW *Biosecurity Act 2015* requires any person who deals with any biosecurity matter, including who knows (or ought to know) of any biosecurity risk, to ensure the risk is prevented, eliminated or minimised, so far as is reasonably practicable. Biosecurity matters include weeds and pathogens. Weeds are managed in accordance with control regions. Within each of the regions are listed Priority Weeds. These Priority Weeds are allocated different measures based on their threat level.

The site investigation area for the proposal is located entirely within the South East Local Land Services area. Lists of potentially occurring Priority Weeds for the South East Local Land Services area, and Commonwealth listed Weeds of National Significance (WoNS), were reviewed prior to the commencement of targeted vegetation surveys across the study area.

1.3.4 NSW Fisheries Management Act 2004

The NSW *Fisheries Management Act 1994* (FM Act) provides for the identification, conservation and recovery of threatened fish, aquatic invertebrates and marine vegetation. The Act also covers the identification and management of Key Threatening Processes (which affect threatened species or could cause other species to become threatened).

If a planned development or activity is likely to have any impact on a threatened species listed under the FM Act, an Assessment of Significance must be undertaken. If the impacts are likely to be significant, or if critical habitat is affected, a Species Impact Statement must be prepared.

Section 199 of the FM Act states that consultation with the Minister (Minister for Primary Industries) must be undertaken by a public authority prior to carrying out dredging or reclamation works. Under the FM Act, dredging or reclamation works include the following:

- Dredging work – excavation or removal of material from water land
- Reclamation work – using any materials to fill in water land, or depositing materials for construction of anything on water land (e.g. bridge) or draining of water from water land for the purposes of reclamation.

Should the activities include either dredging or reclamation, written notice of the proposed work must be given to the Minister, with consideration given to any comments provided within 21 days.

1.3.5 State Environmental Planning Policies

State Environmental Planning Policies (SEPPs) applicable to the proposal and surrounding area are identified in the sub-sections below.

1.3.5.2 State Environmental Planning Policy (Biodiversity and Conservation) 2022

On 1 March 2022, the *State Environmental Planning Policy (Biodiversity Conservation) 2021* (Biodiversity Conservation SEPP) came into effect, consolidating and repealing the former State Environmental Planning Policies (SEPPs) and Regional Environmental Plans (REPs) relating to biodiversity in NSW:

- SEPP (Vegetation in Non-Rural Areas) 2017 (Vegetation SEPP)
- SEPP (Koala Habitat Protection) 2020 (Koala SEPP 2020)
- SEPP (Koala Habitat Protection) 2021 (Koala SEPP 2021)
- Murray Regional Environmental Plan No 2 — Riverine Land (Murray REP)
- SEPP No 19 — Bushland in Urban Areas (SEPP 19)
- SEPP No 50 — Canal Estate Development (SEPP 50)
- SEPP (Sydney Drinking Water Catchment) 2011 (Sydney Drinking Water SEPP)
- Sydney Regional Environmental Plan No 20 – Hawkesbury – Nepean River (No 2 – 1997) (Hawkesbury–Nepean River SREP)
- Sydney Regional Environmental Plan (Sydney Harbour Catchment) 2005 (Sydney Harbour Catchment SREP)

- Greater Metropolitan Regional Environmental Plan No 2 – Georges River Catchment (Georges River REP)
- Willandra Lakes Regional Environmental Plan No 1 – World Heritage Property (Willandra Lakes REP)

Chapters 3 and 4 of the Biodiversity Conservation SEPP incorporate Koala SEPP 2020 and Koala SEPP 2021, respectively. Chapter 4 applies to all land in the City of Blue Mountains LGA, irrespective of land zoning. However as the proposal does not require development consent in accordance with the *State Environmental Planning Policy (Transport and Infrastructure) 2021*, the Biodiversity Conservation SEPP does not apply to the proposal. Regardless, this document has been considered when assessing potential impacts on koalas and koala habitat (see chapter 3.9).

2. Methods

2.1 Personnel

A list of personnel involved in this assessment and an overview of their qualifications and experience is provided in Table 2-1.

Table 2-1: Personnel involved in assessment

Name	Qualifications	Experience/ Role
Jane Rodd	Bachelor of Science (Ecology) Accredited Biodiversity Assessment Method Assessor (Accreditation number BAAS17030)	Jane has over twenty years of experience in biodiversity assessment, specialising in flora ecology. She has extensive experience in designing and implementing surveys of native ecosystems as well as targeted searches for threatened species. Her expertise is focused on biodiversity constraints assessment, impact assessment, identification of plant community types and threatened ecological communities, vegetation mapping including GIS analysis, threatened species assessments, impact mitigation and management, and biodiversity offsetting. She is accredited to apply the BAM under the NSW BC Act.
Lara Keller	Bachelor of Environmental Science (Honours)	Lara is a graduate fauna ecologist with experience in flora and fauna field surveys and the writing of ecological assessment reports. Lara has undertaken targeted surveys for threatened fauna and flora species in QLD and NSW, and was part of a survey team conducting BioCondition assessment of Regional Ecosystems and identification of Threatened Ecological Communities. Lara has experience in data analysis and report writing, including the preparation of an Artificial Hollow Strategy, Flora and Fauna Management Sub-plan and Environmental Assessment Reports.
Kate Carroll	Bachelor of Science (Ecology) (Hons) Accredited Biodiversity Assessment Method Assessor (Accreditation number BAAS17070)	Kate has delivered biodiversity assessments for a range of projects, with a focus on linear infrastructure, including road, rail, renewable energy, gas, urban development and waste over the past 13 years in consulting. She has strong experience in threatened fauna survey and assessment. Kate is accredited to apply the BAM under the NSW BC Act.

2.2 Background research

2.2.1 Database searches

Database searches were undertaken in October 2022 to identify State and Commonwealth records of threatened entities and Commonwealth MNES that occur or have the potential to occur in the study area (ie within 10 kilometres of study area). Additional database searches were undertaken in relation to fisheries, weeds and vegetation types. Databases searched are listed in Table 2-2.

Table 2-2 Database searches

Database	Purpose of search	Search extent	Date of database search
BioNet, website for the Atlas of NSW Wildlife and Threatened Biodiversity Data Collection (TBDC)	Used to compile a list of threatened species records listed under the	10-kilometre radius	7 October 2022

Database	Purpose of search	Search extent	Date of database search
	BC Act within the study area.		
Protected Matters Search Tool (PMST), managed by the Commonwealth Department of Climate Change, Energy, the Environment and Water (DCCEEW)	Used to compile a list of potentially occurring Matters of National Environmental Significance listed under the EPBC Act within the study area.	10-kilometre radius	7 October 2022
BioNet Vegetation Classification database	Information on PCTs and their relationship to a vegetation formation and vegetation class is managed and maintained in the BioNet Vegetation Classification data collection.	Site investigation area	Consulted throughout assessment
NSW DPI Fisheries Spatial Data Portal	Used to identify mapped threatened fish species distribution in NSW.	Site investigation area	11 October 2022
NSW DPE register of declared Areas of Outstanding Biodiversity Value (AOBV)	Used to identify any AOBV for threatened species in the study area.	10-kilometre radius	16 November 2022
Commonwealth Bureau of Meteorology Atlas of Groundwater Dependent Ecosystems (GDE)	Used to identify any groundwater dependent ecosystems in the study area.	10-kilometre radius	11 October 2022
BAM Calculator (BAM-C)			Consulted throughout assessment
National Flying-fox monitoring viewer	Used to identify the location of any flying-fox camps in the study area.	10-kilometre radius	11 October 2022
NSW WeedWise, managed by DPE	Identifies species listed as priority weeds for a weed control area and their control requirements.	Subject land	16 November 2022

In addition to the resources listed above:

- The preliminary and provisional determinations to list species and ecological communities as threatened under the BC Act were viewed on the NSW Threatened Species Scientific Committee website on 16 November 2022
- The annual Final Priority Assessment List of nominated species and ecological communities that have been approved for assessment by the Minister responsible for the EPBC Act were viewed on the Commonwealth DCCEEW website on 16 November 2022.

2.2.2 Literature review

A review of relevant, existing information was undertaken to identify the existing environment of the study area and provide an understanding of ecological values occurring or potentially occurring in the site investigation area and locality. The review focused on relevant ecological reports and guidelines that apply to the subject land and surrounding areas, as well as property boundaries, vegetation maps, topographic maps, aerial photography and relevant GIS layers. Relevant literature included, but was not limited to:

- NSW State Vegetation Type Map (SVTM) (DPE, 2022c)
- Descriptions for NSW (Mitchell) Landscapes Version 2 (NPWS, 2002)
- Fisheries NSW Spatial Data Portal (DPI 2022)

Field surveys and the preparation of this assessment have been undertaken in accordance with, or with reference to:

- The Biodiversity Assessment Method (DPIE, 2020a)
- Threatened Biodiversity Survey and Assessment: Guidelines for Developments and Activities working draft (DEC, 2004)
- Threatened Species Assessment Guidelines: the assessment of significance (DECC, 2007)
- Matters of National Environmental Significance: Significant Impact Guidelines 1.1 (Commonwealth of Australia, 2013a)
- Surveying threatened plants and their habitats: NSW survey guide for the Biodiversity Assessment Method (DPIE, 2020c)
- NSW Threatened Species Profiles Database (DPE, 2022d)
- Survey guidelines for Australia's threatened mammals: guidelines for detecting mammals listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (CoA, 2011b)
- 'Species credit' threatened bats and their habitats: NSW survey guide for the Biodiversity Assessment Method (OEH, 2018a)
- Threatened reptiles Biodiversity Assessment Method survey guide (DPE, 2022e)
- Survey guidelines for Australia's threatened birds: guidelines for detecting birds listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (CoA, 2010b)
- Survey guidelines for Australia's threatened bats: guidelines for detecting bats listed as threatened under the *Environment Protection and Biodiversity Conservation Act 1999* (CoA, 2010a).

2.3 Vegetation assessment

2.3.1 Vegetation mapping

Prior to surveys, an assessment of the available regional vegetation mapping relevant to the assessment area was undertaken. The NSW State Vegetation Type Map is the most recent and relevant mapping of plant community types (PCTs) and was used to determine the extent of surveys required and the potential or threatened flora and fauna species that may be present on study area.

The definition of native vegetation in accordance with section 1.6 of the BC Act and Part 5A 60B of the *Local Land Services Act 2013* (LLS Act) is any trees (including any sapling or shrub or any scrub), understorey plants, groundcover (being any types of herbaceous vegetation), and plants occurring in a wetland that are native to NSW. A plant is deemed to be native to NSW if it was established in NSW before European settlement. This definition was utilised to determine the extent of PCTs in the study area.

2.3.2 Vegetation survey and classification

Vegetation surveys were undertaken over one day on 3 November 2022 and consisted of ground truthing of regional vegetation mapping and PCT identification, rapid assessment points and Biodiversity Assessment Method vegetation integrity plots, where the study area was safely accessible.

Plot-based vegetation survey

Two 0.1 hectare vegetation plots were used to sample the vegetation of the study area. The layout of vegetation plots is illustrated in Figure 2-1, comprising a 20 metre by 50 metre plot with a nested 20 metre by 20 metre plot and five one by one metre litter sub-plots.

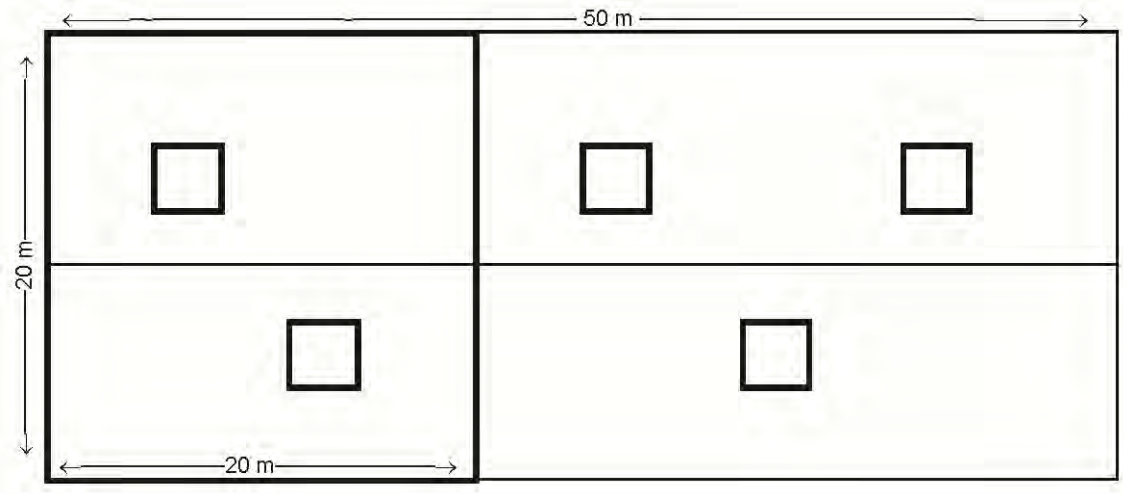

Figure 2-1: Flora quadrat layout

Both plots sampled Blue Mountains Basalt Cap Forest (PCT 3209), with one plot (Q1) located on Slope 93282 and another plot (Q2) located on Slope 96403. It was not possible to sample the vegetation mapped as Sydney Hinterland Yellow Bloodwood Woodland on Slope 33459 due to access being limited by a chain link fence and dangerously steep slope. The plot requirement per vegetation zone, as determined in reference to Table 2-3, and number of plots completed are presented in Table 2-4.

Table 2-3: Minimum number of plots required per zone area

Vegetation zone area (ha)	Minimum number of plots/midlines
<2	1 plot/midlines
>2-5	2 plots/midlines
>5-20	3 plots/midlines
>20-50	4 plots/midlines
> 50–100	5 plots/midlines
> 100–250	6 plots/midlines
> 250–1000	7 plots/midlines; more plots may be needed if the condition of the vegetation is variable across the zone.
> 1000	8 plots/midlines; more plots may be needed if the condition of the vegetation is variable across the zone.

Table 2-4: Minimum number of plots required and completed per vegetation zone

Veg zone	PCT	Condition	Area (ha)	No. plots required	No. plots completed (plot IDs)
Zone 1	PCT 3209: Blue Mountains Basalt Cap Forest	Moderate	0.57	1	2 plots (Plots 1 and 2)

2.3.3 Patch size

As specified in Section 4.3.2 of the BAM, patch size for each vegetation zone was calculated by determining the area of vegetation on and adjoining the subject land that is contiguous with the vegetation zone. A patch includes native vegetation that has a gap of less than 100 metres from the next area of native vegetation.

For each vegetation zone, the patch was determined using area measurements in GIS and assigned to one of the following patch size classes:

- <5 hectares
- 5-<25 hectares
- 25-<100 hectares
- ≥100 hectares

2.3.4 Native vegetation cover

In accordance with Section 3.1.2 of the BAM, a buffer of 1500 metres surrounding the outside edge of the boundary of the subject land was applied, herein referred to as the landscape assessment area. Native vegetation extent within the landscape assessment area was then determined using the most recent vegetation mapping relevant to the subject land and locality, NSW State Vegetation Type Map (DPE, 2022c). The results are shown in Table 2-5.

Table 2-5: Native vegetation cover in the landscape assessment area

Landscape assessment area (ha)	987
Total area of native vegetation cover (ha)	926
Percentage of native vegetation cover (%)	94%
Class (0-10, >10-30, >30-70 or >70%)	>70%

Figure 2-2: Vegetation plot-based survey locations – Slope 96403

Figure 2-3: Vegetation plot-based survey locations – Slope 93282

2.4 Threatened species assessment

This section of the report details the process of threatened species habitat assessment and survey requirements. Threatened species assessment aligns with Chapter 5 of the BAM. The BAM-C was used to generate a list of threatened species that require assessment. Threatened species are separated into two groups for assessment:

- 'Ecosystem-credit' species listed only under the BC Act – these species are assessed by habitat suitability assessment and do not strictly require targeted surveys.
- 'Species-credit' species listed under the BC Act and any species listed under the EPBC Act – any of these species that are associated with PCTs (as defined by the TBDC and BAM-C) being impacted and have a moderate to high likelihood of occurrence (an outcome of Appendix B) should be targeted by surveys in accordance with applicable guidelines.

2.4.1 Habitat suitability assessment

The results of the searches of BioNet records (DPE, 2022f) and Protected Matters Search Tool (PMST) (DCCEEW, 2022a) were used to prepare a list of threatened flora, fauna and ecological communities known or considered likely to occur within the study area. This list was then refined based on suitability of habitat features present within the study area, including associated PCTs, soil and geological preferences.

A habitat assessment was then undertaken to determine the likelihood for each of these threatened entities to occur within the study area, and as such, to be potentially impacted by the proposal.

The 'likelihood of occurrence' for each threatened entity identified from the database searches and literature review is provided in Annexure B. Criteria used to determine likelihood of occurrence categories for the assessment are provided in Table 2-6.

Marine species were excluded from this habitat assessment due to the distance of the study area from the ocean and consequent lack of marine habitat within the study area.

Table 2-6: Likelihood of occurrence criteria

Likelihood of occurrence	Criteria
Recorded	The species was observed in the site investigation area during the current survey.
High	It is highly likely that a species inhabits the site investigation area and is dependent on identified suitable habitat (ie for breeding or important life cycle periods such as winter flowering resources), has been recorded recently in the study area (10 kilometres) and is known or likely to maintain resident populations in the study area. Also includes species known or likely to visit the site investigation area during regular seasonal movements or migration.
Moderate	Potential habitat is present in the site investigation area. Species unlikely to maintain sedentary populations, however, may seasonally use resources within the site investigation area opportunistically or during migration. The species is unlikely to be dependent (ie for breeding or important life cycle periods such as winter flowering resources) on habitat within the site investigation area, or habitat is in a modified or degraded state. Includes cryptic flowering flora species that were not seasonally targeted by surveys and that have not been recorded.
Low	It is unlikely that the species inhabits the site investigation area and has not been recorded recently in the study area (10 kilometres). It may be an occasional visitor, but habitat similar to the site investigation area is widely distributed in the study area, meaning that the species is not dependent (ie for breeding or important life cycle periods such as winter flowering resources) on available habitat. Specific habitat is not present in the site investigation area or the species are a non-cryptic perennial flora species that were specifically targeted by surveys and not recorded.
None	Suitable habitat is absent from the site investigation area.

2.4.2 Targeted flora surveys

Targeted flora surveys of the accessible areas of the study area were undertaken in November 2022. This ensured that species were surveyed during their time of optimal detectability, and surveys adhered to the

timing requirements for each targeted flora species as detailed in the Threatened Species Profile Database (DPE, 2022d).

Accessible areas of potential habitat for threatened flora species considered likely to occur within the subject land were surveyed using the parallel field traverse technique. This survey technique consists of walking in parallel traverses using both a GPS and tablet. The spacing between traverses is determined in accordance with Table 1 of the *NSW Surveying threatened plants and their habitats* (DPIE, 2020c) which specifies that a five metre spacing is appropriate for surveying herbs and forbs in dense vegetation. The timing of the surveys adheres to the survey timing requirements as detailed in the Threatened Species Profile Database (DPE, 2022d) for each targeted flora species.

Targeted flora surveys were completed for all threatened flora species with a 'moderate' or 'high' likelihood of occurrence in the study area within accessible areas of potential habitat. Survey effort and threatened flora targeted during field surveys are summarised in Table 2-7.

Table 2-7: Targeted threatened flora survey details

Species name	Common name	Prescribed survey period	Associated PCTs in the subject land	Minimum survey requirements[1]	Survey completed
Lastreopsis hispida	Bristly Shield Fern	All year	3209	Parallel field traverses. Has been confused with similar species. Requires voucher to identify.	All accessible areas were searched. Survey was within seasonal timeframes.
Zieria murphyi	Velvet Zieria	September - November	3209	Parallel field traverses. Use flowers to identify. Survey September – November when in flower.	All accessible areas were searched. Survey was within seasonal timeframes.

Note: 1. based on BAM survey guidelines (DPIE 2020c).

2.4.3 Targeted fauna surveys

Targeted fauna surveys were not undertaken for threatened fauna species given the seasonal constraints and access limitations as well as the small size of the subject land.

The habitat assessment identified 11 threatened fauna species with a moderate to high likelihood of occurrence in the subject land. Of these, six are classified as species credit species (or split species/ecosystem credit species) under the BAM, or are listed under the EBPC Act. These species and their seasonal survey requirements are listed in Table 2-8.

Table 2-8: Targeted threatened fauna survey details

Species name	Prescribed survey period	Associated PCTs in the subject land	Minimum survey requirements[1]	Survey completed
Callocephalon fimbriatum Gang-gang Cockatoo	October – January (breeding habitat survey)	3209	Breeding: Surveying for lone adult males from October to January or identifying potential nest sites (eucalypts with hollows at least nine metres above ground with hollow diameter 10 cm+) (DPE, 2022d).	No

Species name	Prescribed survey period	Associated PCTs in the subject land	Minimum survey requirements[1]	Survey completed
			Inspection of potential breeding habitat identified within the subject land during habitat assessments (ie hollow-bearing trees >9 m, hollow >9-10 cm) during breeding season (October – January).	
Cercartetus nanus Eastern Pygmy-possum	October – March	3209	Small Elliot traps and arboreal Elliot traps for 100 trap nights and 24 trap nights, respectively. Pitfall traps for 24 trap nights (DEC 2004).	No
Chalinolobus dwyeri Large-eared Pied Bat	November – January	3209	Ultrasonic call detectors placed in suitable habitat for a minimum of four nights. Minimum total effort of 16 detector nights per 50 ha of suitable habitat (DEC, 2004) (CoA, 2010b) (OEH, 2018a). The subject land and areas areas accessed or visible within 100 m of the subject land do not contain rocky areas, caves, overhangs, crevices, cliffs and escarpments, or old mines or tunnels, old buildings and sheds. As such, potential breeding habitat is not present.	No
Dasyurus maculatus Spotted-tail Quoll	All year	3209	Placement of baited camera traps in areas of suitable habitat. Minimum of two surveys, each of 14 days duration and timed at least one month apart (DEC, 2004) (CoA, 2011).	No
Ninox strenua Powerful Owl	May – August (breeding habitat survey)	3209	General detection: Nocturnal spotlighting transects (including call detection and observation) in areas of suitable habitat and call playback for at least 5 nights (DEC, 2004). Breeding: Identifying adult pairs or duetting adults or identifying potential nest sites (living or dead trees with hollows at least four metres above ground with hollow diameter 20 cm+) (DPE, 2022d). Suitable hollow-bearing trees for breeding were identified within the subject land during habitat assessments (ie hollow-bearing trees >20 cm). As such, surveys to confirm breeding are required in May – December (eg stag-watching surveys) if trees are to be impacted.	No
Petauroides volans Greater Glider	All year	3209	Nocturnal spotlighting transects (including call detection and observation) in areas of suitable habitat. Avoid wet and windy weather (DEC, 2004).	No

Species name	Prescribed survey period	Associated PCTs in the subject land	Minimum survey requirements[1]	Survey completed
			Placement of baited camera traps in areas of suitable habitat. Minimum of two surveys, each of 14 days duration and timed at least one month apart (DEC, 2004) (CoA, 2011).	
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala	All year	3209	1. Spot Assessment Technique (SAT) (Phillips & Callaghan, 2011) or detection dogs, and 2. Spotlighting or passive acoustic or drones (DPE, 2022b)	No

2.5 Habitat assessment

Fauna habitat assessments were initially conducted across the study area. Survey for the following fauna habitat features was carried out:

- Vegetation type, structure and extent
- Forage trees including blossom and fruit trees for birds and Grey-headed Flying-fox (*Pteropus poliocephalus*) (listed as vulnerable under the BC Act and EPBC Act) and feed trees for Koala (*Phascolarctos cinereus*) (listed as endangered under the BC Act and EPBC Act)
- Terrestrial shelter habitat such as coarse woody debris, rocky outcrops and artificial shelter (ie corrugated iron sheets, building refuse, rubbish) for invertebrates, amphibians, reptiles and small terrestrial mammals.

During fauna habitat assessments, the following general fauna surveys were also undertaken to detect threatened species and/or important fauna habitat:

- Hollow-bearing tree surveys: hollow-bearing trees were recorded opportunistically across the study area to detect potential sheltering, roosting and/or breeding habitat for threatened and non-threatened fauna. Hollow-bearing tree surveys involved traversing the study area and identifying tree hollows with the naked eye and binoculars. Hollow size and the position of the hollow on the tree (eg branch, trunk) was recorded. Signs of fauna occupation, tree species, diameter at breast height, and whether it was living, or a stag were also noted.
- Canopy searches: canopy searches were undertaken opportunistically across the site investigation area to detect presence of threatened fauna (in addition to targeted surveys, see below). Canopy searches were also undertaken to detect the presence of important fauna habitat features such as large stick nests. Canopy searches involved traversing the study area and inspecting the canopy of trees with the naked eye and binoculars. Signs of fauna occupation and presence of fauna habitat features (eg nests) were noted.

Field surveys also included incidental searches for indirect evidence of fauna, such as scats, nests, burrows, tracks, scratches, chewed cones and diggings. Incidental diurnal fauna surveys also involved recording all fauna species opportunistically seen or heard during surveys (Appendix A).

2.6 Aquatic surveys

There are no streams, wetlands or waterbodies containing aquatic habitat within the subject land. There is a large dam located to the south of the subject land at Slope 96403. This dam was not inspected in detail as it is considered unlikely that it will be affected by the proposed works, given that there is a vegetated slope between the subject land and the dam. No assessment of aquatic habitat was undertaken. No Key Fish Habitat is mapped in the subject land.

2.7 Limitations

Field surveys and survey effort largely met the requirements of the BAM and a majority of the study area was able to be surveyed. The native vegetation at Slope 33459 could not be accessed as it is located outside a chain link fence that forms the boundary of the Blue Mountains Botanic Gardens and is on a hazardously steep and unstable slope above Bells Line of Road. This vegetation was assessed from behind the fence, and only limited data could be collected. The vegetation on the steep lower face of Slope 93282 also could not be traversed on foot due to safety considerations, and was assessed from the top of the slope.

Vegetation within the study area was assigned to a PCT using the BioNet Vegetation Classification data collection (DPE, 2022g). Assignment to a PCT was based on the observed species composition, landscape position and underlying geology and soils recorded during field surveys. In some instances, mapped PCTs may not directly correlate to published mapping, as mapping for the proposal is on a localised scale, as opposed to regional, and is supported by on ground observations and quantitative data. Similarly, the boundaries of each vegetation zone may change over time as these are based on both the PCT and the broad condition of vegetation, which is dynamic.

Species recorded in the study area should be treated as an indication of species presence at the time of field surveys, not a fully comprehensive list, as some species are only present or apparent at certain times of the year (eg annual herbs and grasses). Further, some species require specific conditions for optimum detection. For example, orchid species in the *Cryptostylis* genus flower at specific times and can remain cryptic at all other times throughout the year.

Given that surveys were conducted for one day, access to the study area was limited and the area of impact is relatively small, targeted surveys for threatened fauna species were not undertaken. In order to address the potential impact on threatened fauna, detailed habitat assessment was conducted and presence of some species assumed where appropriate.

The conclusions of this report are based upon available data and field surveys and are therefore indicative of the environmental condition of the study area at the time of the survey. It should be recognised that conditions, including the presence of threatened species, could change with time.

3. Existing environment

3.1 Landscape features

The subject land consists of steep slopes adjoining Bells Line of Road in Mount Tomah. A summary of the landscape features in and surrounding the subject land is provided in Table 3-1.

Table 3-1: Landscape features of the subject land

Landscape feature	Subject land
IBRA bioregions and subregions	The subject land lies within the Sydney Basin bioregion and the Wollemi subregion.
NSW landscape regions (Mitchell landscapes)	The subject land lies within the Blue Mountains Plateau Mitchell Landscape, as mapped by Eco Logical Australia (2008). The Blue Mountains Plateau is described as an elevated, dissected plateau of Triassic quartz sandstones (Eco Logical Australia 2008).
Cleared areas	Of the 1.58 hectares of land in the subject land, 1.01 hectares is cleared. Cleared land comprises mostly of the landscaped areas of the Blue Mountains Botanic Gardens and existing road areas and hardstand ancillary sites.
Rivers and streams	There are no rivers or streams crossing the subject land. The closest mapped stream is Stockyard Gully, located about 30 metres south of the subject land at Slope 96403.
Wetlands	There are no wetlands in the subject land. The closest wetland is an artificial dam to the south of the subject land at Slope 96403.
Connectivity features	The subject land adjoins and is surrounded by large areas of native vegetation in the Blue Mountains World Heritage Area.
Areas of Geological Significance and Soil Hazard Features	The subject land does not contain any karst, caves, crevices, cliffs or other areas of geological significance. It is located within the Blue Mountains, which contains substantial geological formations of exposed sandstone cliffs sitting above deep incised valleys. The soil landscape of the subject land is largely mapped as the Mount Tomah soil landscape; limitations of this soil landscape include localised steep slopes and localised mass movement hazard.

3.2 Plant community types and vegetation zones

The vegetation of the subject land is mapped in the SVTM (DPE, 2022c). Six Plant Community Types (PCTs) were mapped on the subject land (Table 3-1).

Table 3-2: Plant community types mapped in the SVTM within the subject land

PCT	PCT Name	Area (hectares) mapped within subject land
3037	Sydney Basin Warm Temperate Rainforest	0.02
3209	Blue Mountains Basalt Cap Forest	0.52
3210	Blue Mountains Cool Wet Eucalypt Forest	0.003
3261	Sydney Sandstone Plateau Shale Forest	0.008

PCT	PCT Name	Area (hectares) mapped within subject land
3622	Sydney Hinterland Yellow Bloodwood Woodland	0.30
3692	Upper Blue Mountains Moist Forest	0.05

The regional vegetation mapping was ground truthed and PCT boundaries and classifications were refined to reflect the site observations. The PCTs and vegetation zones identified in the subject land are listed in Table 3-3 and mapped in Figure 3-1 to Figure 3-3. Vegetation zones area described in detail below.

Table 3-3: Plant community types and vegetation zones including patch size and vegetation integrity (VI) score

Veg. zone	Plant community type (PCT)	Threatened ecological community	Area (ha) Subject land	Patch size class	VI score
Zone 1	PCT 3209: Blue Mountains Basalt Cap Forest (Equivalent PCT 706 entered into BAM calculator)	Endangered (BC Act and EPBC Act)	0.31	>100 ha	37.5
Zone 2	PCT 3209: Blue Mountains Basalt Cap Forest (Equivalent PCT 706 entered into BAM calculator)	Endangered (BC Act and EPBC Act)	0.26	>100 ha	48.4

3.2.1 PCT 3209: Blue Mountains Basalt Cap Forest

Description

Blue Mountains Basalt Cap Forest (PCT 3209) is described in the BioNet Vegetation Classification Database as a tall to extremely tall sclerophyll open forest, commonly including a high cover of *Eucalyptus blaxlandii* and *Eucalyptus cypellocarpa*, occasionally *Eucalyptus radiata* or rarely, *Eucalyptus oreades* and other cool climate eucalypts. There is a sparse layered mid-stratum of one or more Acacia species, commonly including *Acacia melanoxylon* and occasionally *Acacia falciformis*. Occasionally there is also a sparse cover of the tree fern *Cyathea australis*. A sparse layer of lower shrubs very frequently includes *Indigofera australis* and commonly *Polyscias sambucifolia*. The ground layer is composed of a diverse range of ferns, forbs, climbers, grasses and graminoids. This PCT occurs in wet, cool environments on high elevation (above 800 metres asl) basalt and basalt enriched sandstones, and rarely shale in the Blue Mountains.

Table 3-4 PCT 3209: Blue Mountains Basalt Cap Forest

PCT ID	3209 (formerly PCT 706)
PCT name	Blue Mountains Basalt Cap Forest
Vegetation class	Southern Escarpment Wet Sclerophyll Forests
Vegetation formation	Wet Sclerophyll Forests (Shrubby sub-formation)
Estimate of per cent cleared	9.74 %
Area in subject land	0.57 ha
Conservation status	Blue Mountains Basalt Forest in the Sydney Basin Bioregion (Endangered, BC Act) Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion (Endangered, EPBC Act)

Vegetation zones (condition) and plots	Zone 1 (Moderate condition - Disturbed) – Plot Q1 Zone 2 (Moderate condition) – Plot Q2

Justification for PCT selection:

The identification of PCT 3209 in the subject land was based on:

- Existing regional mapping as an equivalent vegetation type
- Landscape position
- Soil landscape mapping
- Characteristic tree species present
- Structure and species composition consistent with descriptions in the BioNet Vegetation Classification Database

The composition and structure of areas of PCT 3209 in the subject land varies between the different Slope sites, however all areas have greater floristic and landscape affinities to PCT 3209 than to other PCTs mapped nearby. A description of the vegetation at each Slope within the subject land is provided below.

Table 3-5: Floristic and structural summary of PCT 3209 within the subject land

Growth form	Typical species
Trees	*Eucalyptus fastigata* (Brown Barrel), *Eucalyptus blaxlandii* (Blaxland's Stringybark), *Eucalyptus radiata* (Narrow-leaved Peppermint), *Angophora costata* (Sydney Red Gum)
Shrubs	*Pittosporum undulatum* (Sweet Pittosporum), *Polyscias sambucifolia* (Elderberry Panax), *Melicytus dentatus* (Tree Violet), *Indigofera australis* (Australian Indigo), *Goodenia ovata* (Hop Goodenia), *Solanum aviculare* (Kangaroo Apple)
Grass and grass-like	*Carex appressa* (Tall Sedge), *Lomandra longifolia* (Spiny-headed Mat-rush), *Imperata cylindrica* (Blady Grass)
Forb	*Geranium homeanum, Hydrocotyle sibthorpioides, Senecio linearifolius* (Fireweed Groundsel), *Urtica incisa* (Stinging Nettle), *Hackelia latifolia*
Fern	*Lastreopsis microsora* (Creeping Shield Fern), *Pteridium esculentum* (Bracken), *Blechnum neohollandicum*
Other	*Cyathea australis* (Rough Treefern), *Tylophora barbata* (Bearded Tylophora), *Eustrephus latifolius* (Wombat Berry), *Smilax australis* (Lawyer Vine), *Sarcochilus falcatus* (Orange Blossom Orchid)
Exotic	*Dactylis glomerata* (Cocksfoot), *Ehrharta erecta* (Panic Veldtgrass), *Anthoxanthum odoratum* (Sweet Vernal Grass), *Geranium robertianum* (Herb Robert), *Solanum nigrum* (Black-berry Nightshade), *Ranunculus repens* (Creeping Buttercup), *Potentilla indica* (Indian Strawberry), *Jasminum polyanthum* (White Jasmine), *Lunaria annua* (Honesty)
High Threat Exotic	*Ehrharta erecta* (Panic Veldtgrass), *Cenchrus clandestinus* (Kikuyu Grass), *Ranunculus repens* Creeping Buttercup)

Vegetation zones

The vegetation was divided into two zones, based on the level of disturbance present. The vegetation on the two slopes that are located above the level of the road and that have steeper, more exposed slopes, lower tree cover and higher exotic cover (Slope 33459 and 93282) have been assigned to Zone 1, and the vegetation on the slope below the level of the road, which has higher tree cover and lower exotic cover (Slope 96403) has been assigned to Zone 2.

Zone 1

Slope 33459

The vegetation in the subject land at Slope 33459 consisted of a strip of disturbed but regenerating open-forest on a steep slope above Bells Line of Road. The forest vegetation is located on the northern side of a chain link fence that forms the boundary of the Blue Mountains Botanic Gardens, and the remainder of this portion of the subject land to the south of the fence consists of cleared mown grassland and landscaped garden areas. Due to access and safety restrictions, the forest vegetation could not be traversed on foot and assessment was limited to observations from behind the fence.

This area was burnt during bushfires in December 2019. The forest vegetation, which includes mature trees on the western and eastern sides of the subject land and a lower juvenile canopy in the centre, is characterised by mixed eucalypts, most of which exhibit epicormic resprouting. Given access restrictions and the regenerating stage of the eucalypts, identification of all species in this area was not possible, but *Eucalyptus blaxlandii* (Blaxland's Stringybark), *Eucalyptus radiata* (Narrow-leaved Peppermint) and *Angophora costata* (Sydney Red Gum) were tentatively identified based on bark characteristics and collection of fruit.

There is a dense shrub layer at the crest of the slope. with abundant growth of the native species *Indigofera australis* (Australian Indigo), *Acacia longifolia*, *Polyscias sambucifolia* (Elderberry Panax), *Cassinia longifolia* and *Goodenia ovata* (Hop Goodenia). The ground layer includes the fern *Pteridium esculentum* (Bracken), forbs such as *Geranium homeanum* and *Hydrocotyle sibthorpioides*, and the native grass *Imperata cylindrica* (Blady Grass). The exotic grass *Anthoxanthum odoratum* (Sweet Vernal Grass) is abundant in areas adjoining the fenceline.

Plate 3-1 Slope 33459

Plate 3-2 View of Slope 33459 showing regenerating eucalypts

The face of the slope could not be accessed and was only able to be viewed briefly while driving past. The vegetation on the slope consisted of scattered shrub, forb and fern growth and appeared to contain many of the same species that were observed at the top of the slope, such as *Cassinia longifolia, Goodenia ovata* and ferns including *Blechnum spp.*

The vegetation at Slope 33459 is mapped as PCT3622 Sydney Hinterland Yellow Bloodwood Woodland in the SVTM (DPE 2022c), however the vegetation is not characteristic of this PCT, which is typically dominated by *Corymbia eximia* (Yellow Bloodwood) and *Angophora bakeri* (Narrow-leaved Apple) with a mid-dense shrub layer that almost always includes *Leptospermum trinervium*, very frequently *Persoonia linearis* and commonly *Banksia spinulosa, Grevillea buxifolia* and *Persoonia levis*. The canopy at Slope 33459 appears to be transitional between characteristic eucalypts of the basalt and sandstone areas, and the shrub and ground layer is typical of PCT 3209, featuring more mesic shrubs such as *Indigofera australis* and *Polyscias sambucifolius.* Although the vegetation at Slope 33459 is somewhat different in floristics and structure to the other slopes, as it is in the same PCT and could not be accessed for detailed survey, it has been assigned to the same vegetation zone as the similarly disturbed Slope 93282 (Zone 1).

Slope 93282

The vegetation at Slope 93282 consists of disturbed forest on the slope above Bells Line of Road. This vegetation was sampled with a BAM plot (Q1) At the top of the slope next to the road is a row of small trees of *Eucalyptus fastigata* and *Pittosporum undulatum* (Sweet Pittosporum); there is a flat area at the top of the slope, forming the end of an access track, that extends west below another embankment that supports a row of taller trees of *Eucalyptus fastigata.* The trees on the embankment support several individuals of the native epiphytic orchid *Sarcochilus falcatus* (Orange Blossom Orchid) and the native epiphytic fern *Pyrrosia rupestris* (Rock Felt Fern).

There is localised dense growth of *Cyathea australis* along the sheltered edge of the embankment, as well as shrubs of *Melicytus dentatus* (Tree Violet) and *Solanum aviculare*. The ground layer at the crest and on the face of the slope is disturbed and dominated by exotic forb species including *Geranium robertianum* (Herb Robert), *Solanum nigrum* (Blackberry Nightshade), *Potentilla indica* (Indian Strawberry), *Lunaria annua* (Honesty) and *Ranunculus repens* (Creeping Buttercup) as well as abundant cover of exotic grass species, particularly on the face of the slope, most prominently *Dactylis glomerata* and *Ehrharta erecta.* The native forbs *Geranium homeanum, Urtica incisa* and *Viola spp.* are also abundant at the top of the slope.

Plate 3-3 Slope 93282

Plate 3-4 Slope 93282

Zone 2

Slope 96403

The vegetation in the subject land at Slope 96403 consists of tall eucalypt forest immediately downslope of Bells Line of Road an upslope of a large dam associated with Stockyard Gully. This vegetation was sampled with a BAM plot (Q2). The canopy is characterised by *Eucalyptus fastigata* (Brown Barrel) with some dense patches of *Cyathea australis* (Rough Treefern) adjoining the cleared track downslope of the patch of forest. A scattered shrub layer is present with *Doryphora sassafras* (Sassafras), *Solanum aviculare* (Kangaroo Apple) and *Pittosporum* spp. The ground layer is dominated by the native forbs *Senecio linearifolius* (Fireweed Groundsel), *Hydrocotyle sibthorpioides* and *Stellaria flaccida,* with *Hackelia latifolia, Urtica incisa* (Stinging Nettle) and the native vine *Tylophora barbata* (Bearded Tylophora) also abundant. Although the vegetation on the slope appears disturbed, native cover is high and exotic cover is low, with only a few exotic species observed and most occurring in proximity to the cleared road edge, including the exotic grasses *Ehrharta erecta* (Panic Veldtgrass), *Bromus catharticus* (Prairie Grass) and *Dactylis glomerata* (Cocksfoot).

Plate 3-5 Slope 96403

Plate 3-6 Slope 96403

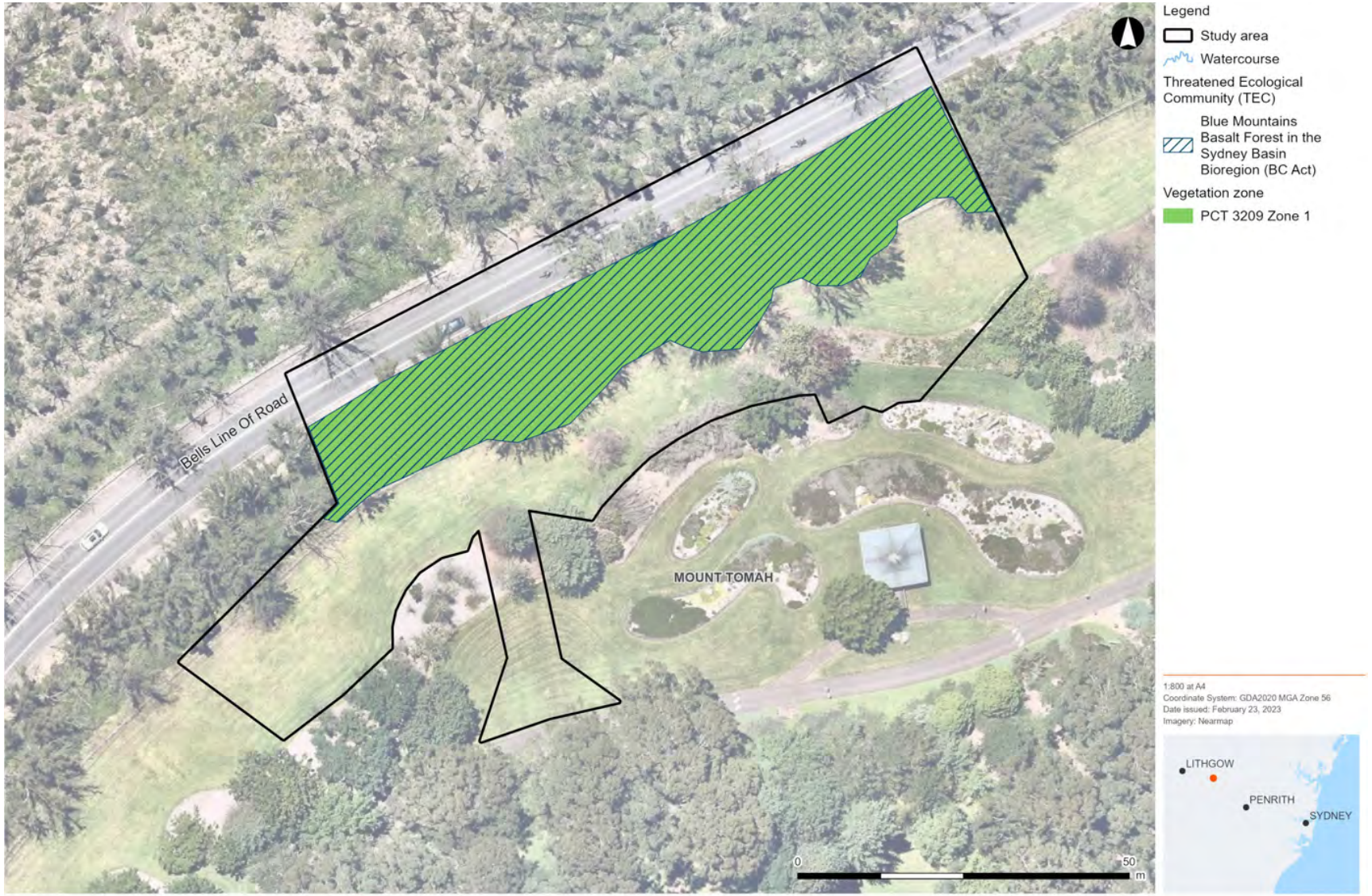

Figure 3-1: Plant community types and vegetation zones – Slope 33459

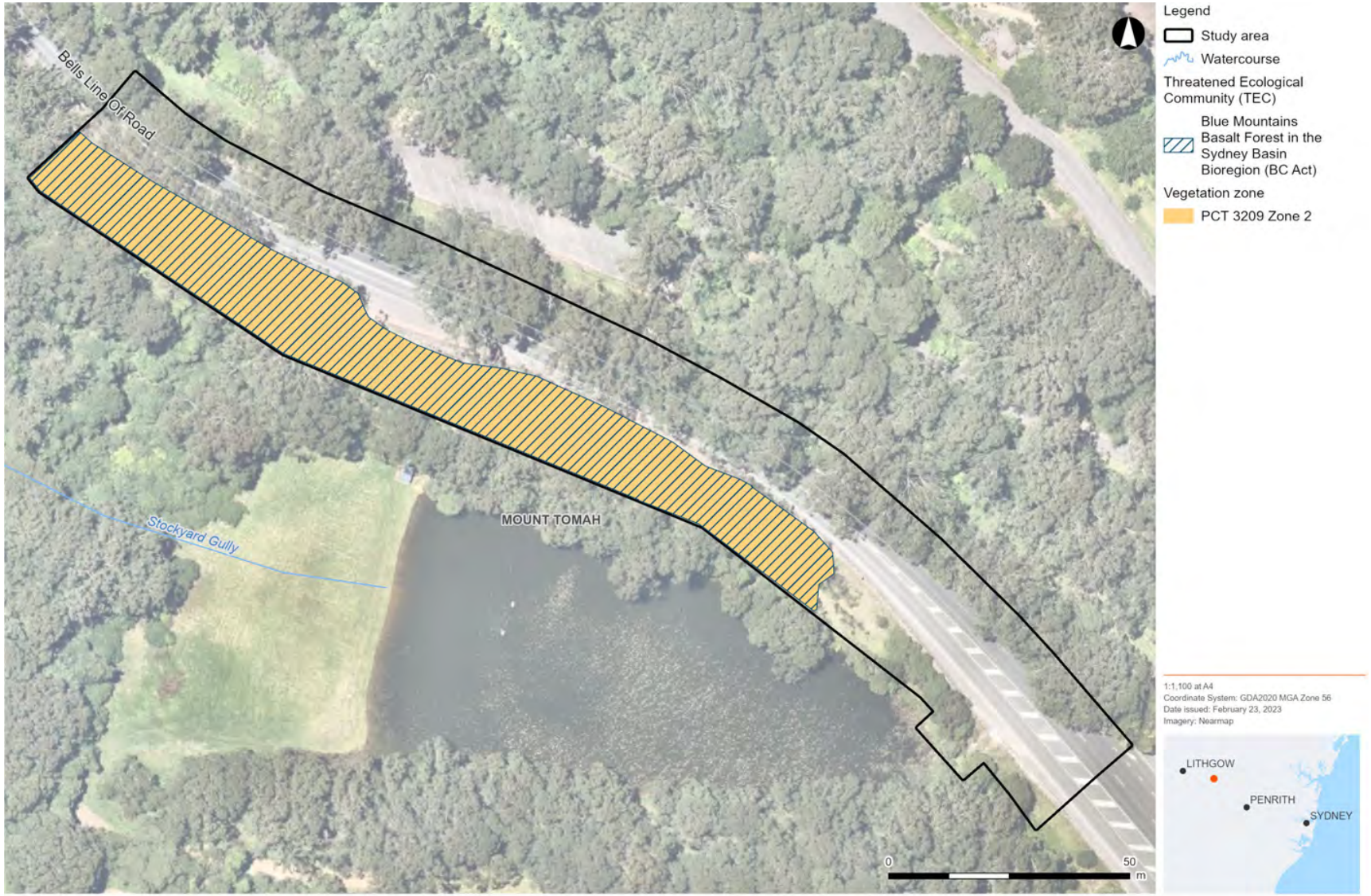

Figure 3-2: Plant community types and vegetation zones – Slope 96403

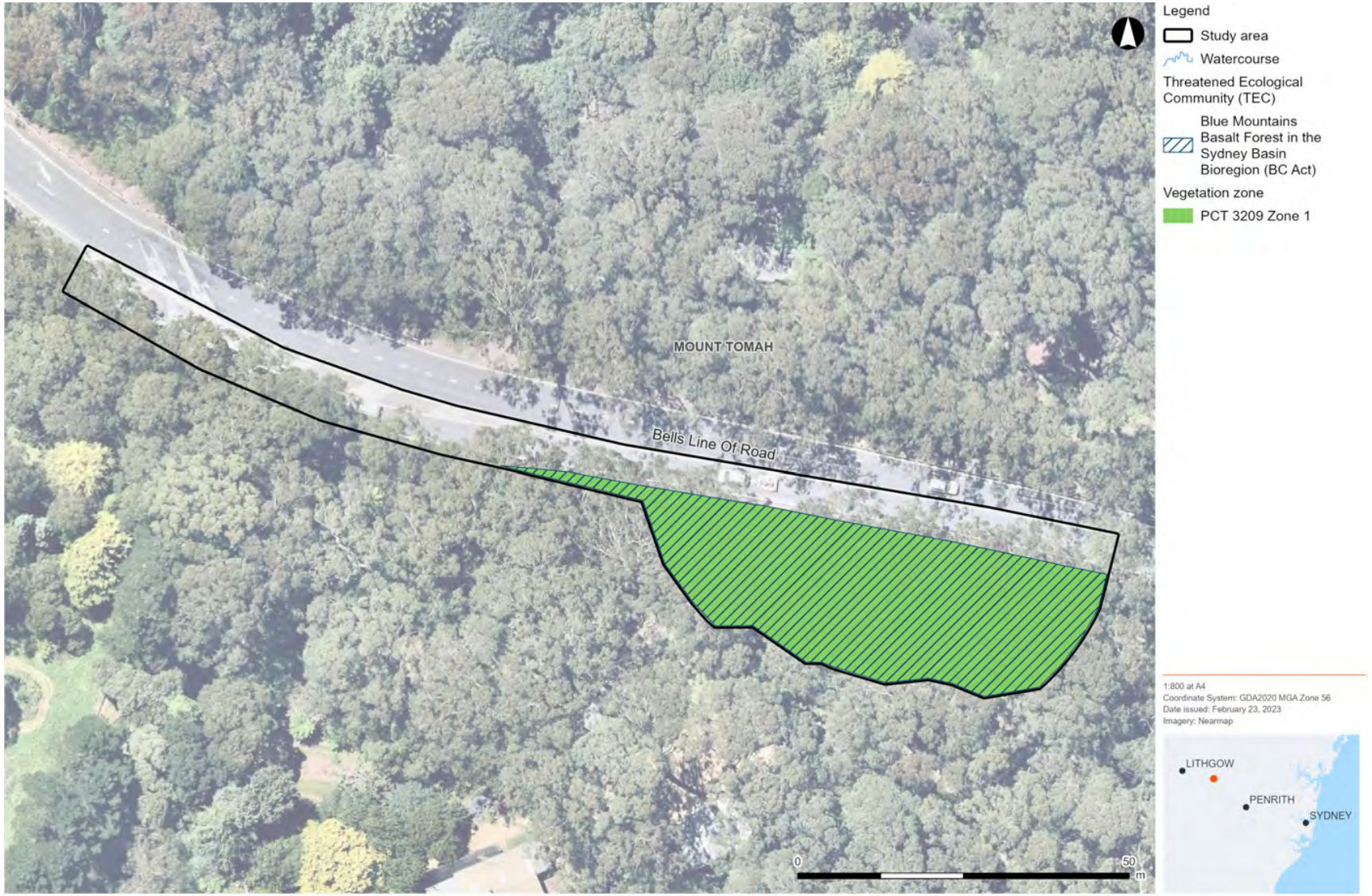

Figure 3-3: Plant community types and vegetation zones – Slope 93282

3.3 Threatened ecological communities

Blue Mountains Basalt Cap Forest (PCT 3209) is associated with the Threatened Ecological Community (TEC) Blue Mountains Basalt Forest in the Sydney Basin Bioregion, listed as Endangered under the BC Act. To confirm the presence of this TEC in the subject land, the recorded vegetation was compared with the relevant paragraphs of the Final Determination for this TEC (TSSC, 2011) (Table 3-6).

Table 3-6: Comparison of PCT 3209 in the subject land with relevant paragraphs of the Final Determination for Blue Mountains Basalt Forest in the Sydney Basin Bioregion (TSSC, 2011)

Extract from Final Determination	Comparison with areas of PCT3209 in the subject land
1.1 Blue Mountains Basalt Forest in the Sydney Basin Bioregion (hereafter referred to as Blue Mountains Basalt Forest) is characterised by the assemblage of species listed below [34 species listed]	Of the 34 species listed, a total of 22 (65%) were recorded in the subject land.
2.2 Blue Mountains Basalt Forest occurs on basalt caps overlying sandstone and adjacent areas where soils are influenced by weathering of upslope basalt.	The subject land is located on and adjacent to areas mapped as the Mount Tomah soil landscape, which is restricted to small basalt cappings on the Blue Mountains Plateau. The subject land at Slope 33459 is mapped as the Hawkesbury soil landscape which overlies sandstone, but the floristics in this location suggest a basalt influence, presumable from areas upslope.
4.1 Blue Mountains Basalt Forest is usually a tall eucalypt forest (over 30 m in mature stands) with a dense shrub or small tree layer, often including tree ferns (Cyathea spp.) and moist herbaceous groundcover (Tozer et al. 2010). The canopy composition is variable but usually dominated by one or more of the species *Eucalyptus fastigata E blaxlandii E cypellocarpa or E radiata* subsp. *radiata* Other canopy species which may be locally common or dominant include *E oreades* (which is often dominant on south-facing slopes at the transition to a sandstone substrate) and *E viminalis* (Tozer et al. 2010, D. Connolly pers. comm. Nov. 2013). A eucalypt canopy may be absent from previously cleared or otherwise highly disturbed stands.	The vegetation in the subject land at slopes 93282 and 96403 consists of tall eucalypt forest with a sparse to moderately dense shrub layer, including tree ferns and moist herbaceous ground cover. The canopy at both these slopes is dominated by *Eucalyptus fastigata* (Brown Barrel). The vegetation in the subject land at Slope 33459 consists of regenerating areas that were burnt in December 2019, and includes a canopy of *Eucalyptus sp.,* possibly including *E. blaxlandii, E. radiata* and *Angophora costata.* There is a dense shrub layer in this vegetation.
4.2 Blue Mountains Basalt Forest has been recorded south of the Wolgan and Colo Rivers in Wollemi IBRA subregion (SEWPaC 2012). The major area of distribution is the Blue Mountains including the basalt caps of Mount Irvine, Mount Wilson, Mount Bell, Mount Tomah, Mount Banks, Mount Caley and Mount Hay. However, there may be isolated outliers north to Mount Cameron and Mount Monundilla. Blue Mountains Basalt Forest occurs mostly between 750 m and 1050 m altitude, in areas with annual rainfall of 950 to 1350 mm (Tozer et al. 2010).	The subject land is located on the basalt cap of Mount Tomah in the Wollemi IBRA subregion.

Based on comparison of the vegetation recorded in the subject land with the Final Determination for Blue Mountains Basalt Forest in the Sydney Basin Bioregion, all areas of native vegetation in the subject land are considered to be consistent with the TEC.

The areas of Blue Mountains Basalt Cap Forest in the subject land may also meet the criteria for Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion, listed as an endangered ecological community under the EPBC Act. The TEC is broadly similar to Blue Mountains Basalt Forest in the Sydney Basin Bioregion, but only includes patches that meet certain size, condition and species composition thresholds. In order to qualify as the TEC under

the EPBC Act, a patch must meet the following diagnostic criteria and condition thresholds as defined in the Commonwealth listing advice for the community (TSSC, 2011) (Table 3-7).

Table 3-7: Comparison of PCT 3209 in the subject land with diagnostic criteria and condition thresholds in the Commonwealth listing advice for Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion

Extract from Commonwealth listing advice (TSSC, 2011)	Comparison with areas of PCT 3209 in the subject land
Key Diagnostic Characteristics	
Generally confined to the Sydney Basin IBRA Bioregion although some occurrences may extend outside the Sydney Basin Bioregion boundary, e.g. the southern extent at Sassafras, east of Nerriga NSW, and patches on the Boyd Plateau and Mt Werong;	The subject land is in the Sydney Basin Bioregion.
Confined to soils derived from basalt and basalt-like substrates;	The subject land is located on and adjacent to areas mapped as the Mount Tomah soil landscape, which is restricted to small basalt cappings on the Blue Mountains Plateau.
Typically occurs at elevations between 650–1050 m above sea level (a.s.l.), with certain outlying occurrences at lower (to 350 m a.s.l.) or higher (above 1200 m a.s.l.) elevations;	The elevation of the subject land varies from around 910 m a.s.l. to 960 m a.s.l.
Occurs in areas with a high mean annual rainfall, typically 950–1600 mm/year;	The closest weather station to the subject land is at Mount Boyce, located about 16 kilometres away. The mean annual rainfall at Mount Boyce is 1006 mm.
The tree canopy layer is present and is dominated by eucalypt trees (see Appendix A for a list of appropriate species), and has a minimum canopy cover of 30%;	A tree canopy layer is present at in all areas of native vegetation in the subject land. The minimum canopy cover varies depending on the extent of disturbance of the vegetation.
A shrub layer is usually present but varies from sparse to dense; and	Native vegetation in the subject land contains a sparse to moderately dense shrub layer.
The ground layer is generally a diverse mix of grasses, forbs and ferns; vines and scramblers also can be present.	The ground layer consists of a mixture of grasses, forbs, ferns, vines and scramblers.
Condition Thresholds	
A. Core Thresholds	
A minimum patch size at least 0.5 ha AND	The minimum patch size of native vegetation in the subject land is over 0.5 hectares.
A total foliage cover of native trees greater than 50% in the patch (not including saplings and smaller regenerating trees to 5 m in height) AND	Native tree canopy is below 50% foliage cover in all areas of vegetation in the subject land.
At least 20 native species are present in the understorey (mid and ground layers) of the patch AND	There are over 20 native species in the understorey of Zone 2 only, as sampled in Q2.
Non-native perennial weeds account for no more than 40% of the foliage cover of the understorey (mid and ground layers) in the patch.	Non-native perennial weeds account for no more than 40% of the foliage cover of the understorey of Zone 2 only, as sampled in Q2.
B. Variations to Core Thresholds	

Extract from Commonwealth listing advice (TSSC, 2011)	Comparison with areas of PCT 3209 in the subject land
A lower tree canopy cover with percent foliage cover of native trees in the patch 30% or more; and a lower native species richness of at least 10 native species in the understorey of the patch are acceptable if:	Native tree canopy is above 30% foliage cover in Zone 2 only, as sampled in Q2. There are over 10 native species present in the understorey in all areas of vegetation in the subject land.
B1 The patch of the ecological community is larger (2 ha or more) OR	The larger patch of PCT 3209 including adjoining areas is over 2 hectares in area for all vegetation in the subject land.
B2 The patch of the ecological community is part of a larger native vegetation remnant that has a total area of 2 ha or more. Note that: 1) the patch of the ecological community proper should be at least 0.5 ha or more in size; and 2) the total area of the native vegetation remnant refers to the patch of the ecological community plus the area of other native vegetation types that is connected to that patch. The other vegetation types that make up a remnant are not considered to be formally part of the national ecological community. However, they are important in providing landscape level protection to the ecological community e.g. as buffers against further damage and to promote movement of individual organisms and their genes	N/A

Based on comparison of the vegetation recorded in the subject land with the Commonwealth listing advice for Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion, only the vegetation in Zone 2 (Slope 96403) within the subject land is considered to be consistent with the TEC as defined under the EPBC Act. This TEC occupies 0.26 hectares of the subject land.

3.4 Groundwater dependent ecosystems

Groundwater Dependent Ecosystems (GDEs) are ecological communities that are dependent, either entirely or in part, on the presence of groundwater for their health or survival. The DPI *Water risk assessment guidelines for Groundwater Dependent Ecosystems* (Serov *et al.*, 2012) adopts the definition of a GDE as "*Ecosystems which have their species composition and natural ecological processes wholly or partially determined by groundwater*".

The Bureau of Meteorology's (BoM) GDEs Atlas (BoM, 2022) was reviewed in October 2022 to determine the occurrence of potential GDEs within the site investigation area and surrounding study area. No potential GDEs were identified in the subject land; the closest mapped GDEs are areas of Hinterland Sandstone Gully Forest located about 1.2 kilometres to the north.

3.5 Threatened species

The results of threatened species searches are provided in Table 3-8 for all species considered to have a moderate or high likelihood of occurrence.

Table 3-8: Threatened species surveys results

Species name	EPBC Act	BC Act	Identification method	Survey effort compliant?[1]	Notes
Lastreopsis hispida	-	E	Not recorded	Yes	Survey was within seasonal timeframes, however not all areas were accessible for survey

Species name	EPBC Act	BC Act	Identification method	Survey effort compliant?[1]	Notes
Bristly Shield Fern					
Zieria murphyi Velvet Zieria	V	V	Not recorded	Yes	Survey was within seasonal timeframes, however not all areas were accessible for survey
Callocephalon fimbriatum Gang-gang Cockatoo	E	V	Assumed present	No targeted survey conducted	Assumed present based on presence of associated PCT and potential breeding habitat (hollows with >9cm diameter).
Cercartetus nanus Eastern Pygmy-possum	-	V	Assumed present	No targeted survey conducted	Assumed present based on presence of associated PCT, although notable feed trees of the Banksia and Bottlebrush genera are absent on site.
Chalinolobus dwyeri Large-eared Pied Bat	V	V	Assumed present	No targeted survey conducted	Foraging habitat is assumed to be present based on presence of associated PCTs within 2km of rocky areas containing caves, escarpments, overhangs, outcrops, crevices.
Dasyurus maculatus Spotted-tail Quoll	E	V	Assumed present	No targeted survey conducted	Foraging and dispersal habitat is assumed to be present based on presence of associated PCTs.
Ninox strenua Powerful Owl	-	V	Assumed present	No targeted survey conducted	Assumed present based on presence of associated PCT and potential breeding habitat (hollows >20cm diameter, >4m above ground).
Petauroides volans Greater Glider	E	E	Assumed present	No targeted survey conducted	Assumed present based on presence of associated PCT and potential breeding habitat (hollows).
Phascolarctos cinereus Koala	E	E	Assumed present	No targeted survey conducted	Assumed present based on presence of associated PCT and Koala feed trees.

Note: 1. As identified in Section 2.4 of this BAR.

3.6 Fauna habitat assessment

Slope 33459

Terrestrial shelter habitat (i.e. coarse woody debris, rocky outcrops, bushrocks and leaflitter) was primarily absent on Slope 33459. The site predominantly consisted of a dense understorey of native vegetation regrowth, approximately 2.5 m tall, that was used by small woodland bird species (i.e. Superb Fairywren) for foraging habitat. There were sections of dense, weedy grass that could provide suitable cover for reptile species, although this area is less likely to be used due to the absence of rocky outcrops and bushrocks. Two hollow-bearing trees (HBTs) were present on site (Figure 3-4) and a total of two medium-sized hollows were identified. There were no signs of occupancy, and neither hollow was of sufficient size for owl breeding habitat. Furthermore, no indirect signs of fauna use (i.e. scats, nests, burrows, diggings or tracks) were identified on site.

Slope 96403

Similar to the previous slope, terrestrial shelter habitat features were primarily absent on Slope 96403. Fire damage was evident along the slope and the site was dominated by a weedy understorey, approximately 0.5 – 1 m

tall. The understorey was sparser and did not comprise optimal foraging habitat for small woodland bird species, although a select few individuals were observed gleaning. Two hollow-bearing trees were present in close proximity to the road, with 10 hollows in total (Figure 3-4). Three large hollows were of suitable size for owl species, with the remaining hollows being suitable for glider, possum and parrot species. However, there were no signs of occupancy. One small culvert (approximately 30 cm diameter) was present, although it would be unsuitable for microbat species. There were minimal indirect signs of fauna use, with only one potential burrow (approximately 5 cm diameter) located at the base of a Eucalyptus tree. Aquatic habitat in the form of a human-made dam is closely located to the site that could serve as potential suitable habitat for certain frog and waterbird species.

Slope 93282

Slope 93282 was dominated by a dense, weed understorey and some native vegetation regrowth. The trees on the slope had been previously cleared, and no hollow-bearing trees were identified on site. Fauna habitat features on site were minimal, as the understorey was too low (approximately 0.5 m tall) to serve as foraging habitat for small woodland bird species, and no rocky outcrops, bushrocks or notable coarse woody debris were present. A Section along the top of the slope consisted of ample leaflitter (>5 cm depth), which could serve as suitable habitat for invertebrates and small reptile species. No indirect signs of fauna use were identified on site.

3.7 Areas of outstanding biodiversity value

Areas of Outstanding Biodiversity Value (AOBVs), as defined under the BC Act, are currently limited to areas previously declared as critical habitat under the TSC Act. A review of the AOBV register did not identify any AOBV occurring within or surrounding the subject land.

3.8 Wildlife connectivity corridors

There are no mapped areas of connectivity or fauna corridors identified in the subject land or surrounding areas, however the subject land adjoins vast areas of native bushland conserved in the Blue Mountains World Heritage Area. There is high connectivity for wildlife and few hostile barriers to fauna in the vicinity; Bells Line of Road and residential properties with associated fencing are the only barriers to fauna connectivity in the locality.

3.9 SEPPs

Chapter 4 of the Biodiversity Conservation SEPP 2022 is relevant to the proposal, in relation to Koala habitat. No Koala Plan of Management has been prepared for the Blue Mountains LGA under the SEPP. Koala feed trees are listed in Schedule 3 of the SEPP, in relation to Chapter 4. One species was recorded in the subject land - *Eucalyptus radiata* – that is listed in Schedule 3. This tree was potentially identified on Slope 33459.

In Chapter 4 of the SEPP, Core koala Habitat means:

(a) an area of land which has been assessed by a suitably qualified and experienced person as being highly suitable koala habitat and where koalas are recorded as being present at the time of assessment of the land as highly suitable koala habitat, or

(b) an area of land which has been assessed by a suitably qualified and experienced person as being highly suitable koala habitat and where koalas have been recorded as being present in the previous 18 years.

No signs of Koalas were recorded on Slope 33459, though part of the slope was not accessed. There are 15 records of the species within 10 kilometres of the subject land, with the closest records being 850 metres and 1 kilometre east of Slope 33459 from 1996 and 1994, respectively. There is no evidence of recent activity in close proximity to the subject land. All bionet records are more than 20 years old, with the exception of one record from 2014 about 9.5 kilometres northeast. It is unlikely the subject land is core koala habitat.

3.10 Matters of national environmental significance

A search of the EPBC Protected Matters Search Tool was completed for an area within 10 kilometres of the study area. The results of this search are provided in Annexure G of this report and discussed below.

3.10.1 World Heritage Properties/National Heritage Places

One World Heritage Properties/National Heritage Places has been identified in the EPBC Protected Matters Search Tool within a 10-kilometres radius of the study area: The Greater Blue Mountains Area.

The Greater Blue Mountains Area is listed on the National Heritage List and declared on the World Heritage Properties as a Natural heritage item. This Natural heritage item includes eight protected areas including the Blue Mountains, Wollemi, Yengo, Nattai, Kanangra-Boyd, Gardens of Stone and Thirlmere Lakes National Parks, and the Jenolan Caves Karst Conservation Reserve. The National Heritage Listing describes the Greater Blue Mountains Area as an area of "breathtaking views, rugged tablelands, sheer cliffs, deep, inaccessible valleys and swamps teeming with life. The unique plants and animals that live in this outstanding natural place relate an extraordinary story of Australia's antiquity, its diversity of life and its superlative beauty. This is the story of the evolution of Australia's unique eucalypt vegetation and its associated communities, plants and animals." (DCCEEW, 2022b). The study area is located within The Greater Blue Mountains Area.

3.10.2 Wetlands of international significance

Searches for Nationally Important Wetlands were undertaken using the EPBC Protected Matters Search Tool. The closest wetland of international importance is the Macquarie Marshes, about 408 kilometres northwest of the study area. The study area does not contain any wetlands.

3.10.3 Terrestrial threatened species and communities

A search of the EPBC Protected Matters Search Tool on 7 October 2022 found eight TECs, 33 threatened flora species, 13 threatened bird species, four threatened frog species, 10 threatened terrestrial mammal species and two threatened terrestrial reptile species listed under the EPBC Act that have potential to occur within 10 kilometres of the study area. Annexure B assesses the likelihood of these TECs and threatened species to occur in the study area.

One TEC listed under the EPBC Act was identified in the subject land:

- Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion (Endangered)

Of the species identified in the PMST, six threatened fauna species were considered to have a moderate or higher likelihood to occur in the subject land including:

- Broad-headed Snake (*Hoplocephalus bungaroides*), vulnerable under EPBC Act
- Gang-gang Cockatoo (*Callocephalon fimbriatum*), vulnerable under EPBC Act
- Greater Glider (*Petauroides volans*), vulnerable under EPBC Act
- Koala (*Phascolarctos cinereus*), endangered under EPBC Act
- Large-eared Pied Bat (*Chalinolobus dwyeri*), vulnerable under EPBC Act
- Spotted-tailed Quoll (*Dasyurus maculatus maculatus*), endangered under EPBC Act

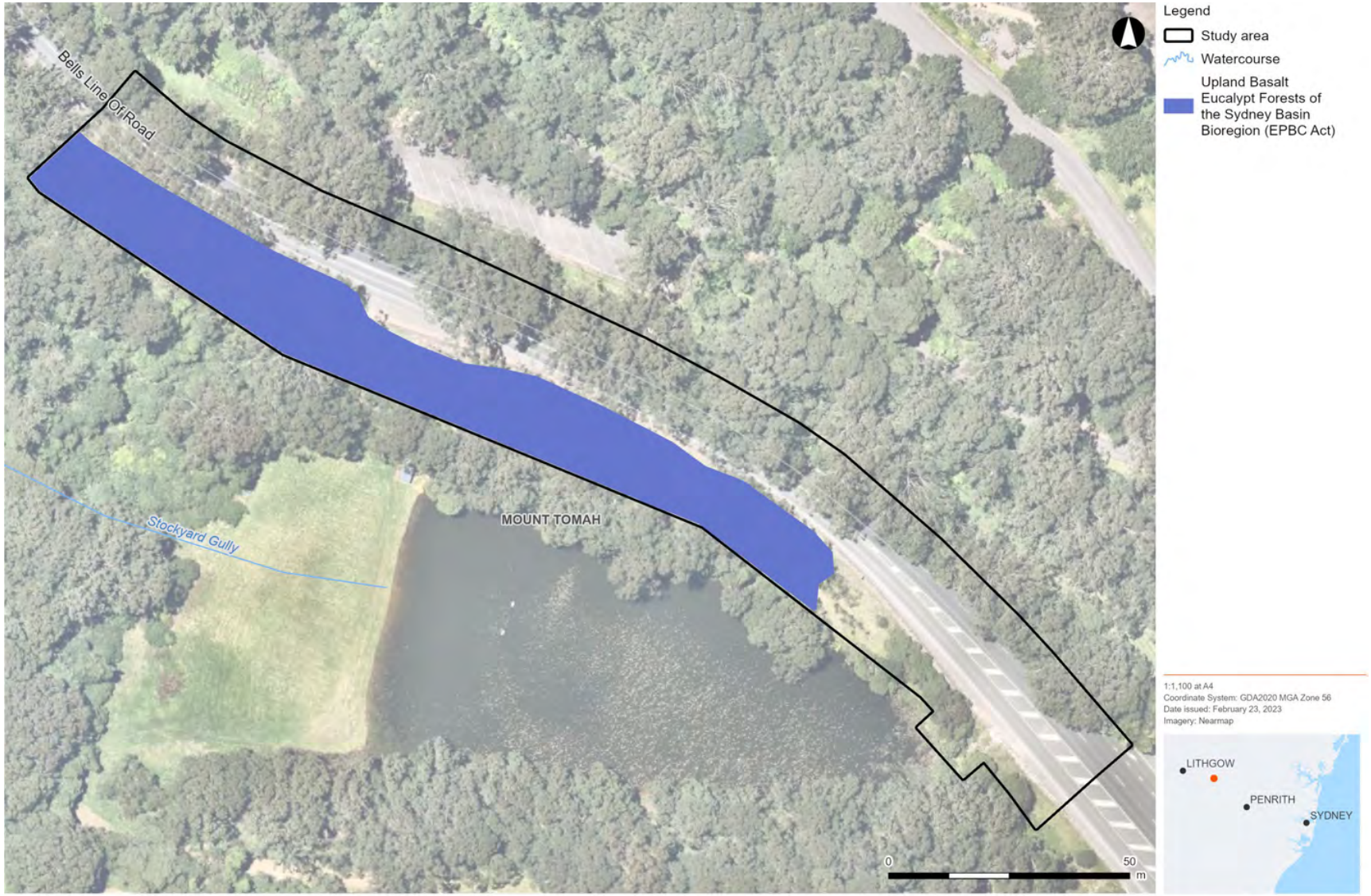

Figure 3-4: Matters of national environmental significance recorded and fauna habitat features

4. Avoidance and minimisation

A key part of TfNSW's management of biodiversity for this proposal is the application of the 'avoid, minimise, mitigate and offset' hierarchy as follows:

1. Avoid and minimise impacts.
2. Mitigate impacts.
3. Offset impacts in accordance with TfNSW guidelines.

This chapter of the BAR demonstrates the efforts taken to avoid and minimise impacts on biodiversity values.

The principles in Section 7.1 of the BAM (DPIE (EES), 2020a) have been considered to avoid and minimise impacts on native vegetation and habitat, where possible, through the corridor assessment, route options and design refinement processes as described in Table 4-1.

Table 4-1 Consistency of the proposal with avoidance and minimisation principles

Principles	Proposal consistency
Direct impacts on native vegetation and habitat can be avoided and minimised by:	
Locating the proposal in areas where there are no biodiversity values.	Areas of biodiversity value could not be entirely avoided but impacts to these areas have been minimised. The subject land consists of managed roadside areas.
Locating the proposal in areas where the native vegetation or threatened species habitat is in the lowest condition (i.e., areas that align with the definition of low condition listed in subsection 2.3.2a).	Although the native vegetation in the subject land is largely in moderate to good condition, the areas of native vegetation that would be impacted by the proposal generally consist of existing roadside vegetation that is currently subject to edge effects and fragmentation.
Locating the proposal in areas that avoid habitat for threatened species that may be at risk of a significant impact or native vegetation that is part of a critically endangered ecological community (CEEC) or an endangered ecological community (EEC).	Impacts to the endangered ecological community Blue Mountains Basalt Cap Forest are unavoidable, as the areas with slope failure support this community. Impacts to the areas of EEC will be minimised as far as possible.
Locating the proposal such that connectivity enabling movement of species and genetic material between areas of adjacent or nearby habitat is maintained.	The proposal will not further fragment the native vegetation in the areas surrounding the subject land such that connectivity will be further fragmented.
In selecting a proposal location, the following should be addressed, as they apply to the proposal:	
An analysis of alternative modes or technologies that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed mode or technology.	There are no alternative locations for the proposal as the works are being undertaken to address slope failure within the subject lands.
An analysis of alternative routes that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed route.	
An analysis of alternative locations that would avoid or minimise impacts on	

Principles	Proposal consistency
biodiversity values and justification for selecting the proposed location.	
An analysis of alternative sites within a property on which the proposal is proposed that would avoid or minimise impacts on biodiversity values and justification for selecting the proposed site.	
Proposal design, including the location of temporary and permanent ancillary construction and maintenance facilities, should avoid and minimise clearing of native vegetation and habitat by:	
Reducing the clearing footprint of the proposal.	The clearing footprint will be minimised as far as possible to achieve the safety outcomes of the proposal.
Locating ancillary facilities in areas where there are no biodiversity values.	Ancillary facilities including the site compound, stockpile areas and pull-over area are proposed to be located in cleared roadside areas with no native vegetation.
Locating ancillary facilities in areas where the native vegetation or threatened species habitat is in the lowest condition (i.e., areas that align with the definition of low condition listed in subsection 2.3.2a).	
Locating ancillary facilities in areas that avoid habitat for threatened species and vegetation in high threat status categories (e.g., endangered or critically endangered).	

5. Impact assessment

5.1 Construction direct impacts

5.1.1 Removal of native vegetation

Clearing of 0.57 hectares of native vegetation is required for the proposal. It is assumed that all areas of native vegetation in Zone 1 (Slopes 33459 and 93282) will be cleared and some if not all the native vegetation in Zone 2 (Slope 96403) will also be cleared. The area of native vegetation to be cleared for the proposal is about 0.31 hectares in Zone 1, with potential impacts to a further 0.26 hectares retained in Zone 2. The areas of vegetation zones to be cleared are listed in Table 5-1.

Table 5-1: Summary of direct impacts on native vegetation

Veg. zone	Plant community type (PCT)	Broad condition class	TEC	Area to be impacted (ha)		
				Slope 33459	Slope 96403	Slope 93282
Zone 1	PCT 3209: Blue Mountains Basalt Cap Forest	Moderate condition – Disturbed	Endangered (BC Act)	0.18	-	0.13
Zone 2	PCT 3209: Blue Mountains Basalt Cap Forest	Moderate condition	Endangered (BC Act and EPBC Act)	-	0.26	-
-	Grass	-	-	0.27	-	-
Total				**0.45**	**0.26**	**0.13**

5.1.2 Removal of threatened fauna habitat

The proposal would require about 0.57 hectares of native vegetation removal. This includes the removal of up to five hollow-bearing trees containing two medium sized hollows at Slope 33439 and three large hollows at Slope 96403. Removal of these hollow-bearing trees could impact species credit species habitat including Eastern Pygmy-possum, Spot-tailed Quoll, Powerful Owl, Gang-gang Cockatoo and Greater Glider.

Hollow-bearing tree removal at Slope 33439 would be undertaken outside the breeding period of Greater Glider (March to June) (NSW Threatened Species Scientific Committee, 2022) and Spot-tailed Quoll (July to August) (DCCEEW, 2022c) and therefore unlikely impact the breeding cycle of these species. Eastern Pygmy-possum breed opportunistically when foraging resources are available, and therefore could be impacted during breeding.

Hollow-bearing tree removal at Slope 33439 would be undertaken outside the breeding period of Powerful Owl (May to August) (DPE, 2022d) and Gang-gang Cockatoo (October to January) (DPE, 2022d) and therefore unlikely impact the breeding cycle of these species.

Impacts to all threatened fauna species are limited to a very small area of vegetation (0.57 hectares) that is edge-affected, adjacent to the road and suboptimal relative to the vast expanse of connected vegetation. It is unlikely that vegetation removal would impact any species significantly as outlined in Appendix D and chapter 5.4.

Table 5-2: Summary of direct impacts on threatened fauna and habitat

Species name	EPBC Act	BC Act	Credit type[1]	Potential occurrence (Moderate, High, Recorded)	Associated habitat in subject land	Impact (ha)
Callocephalon fimbriatum Gang-gang Cockatoo	E	V	Species/ecosystem Species credits are breeding habitat	Moderate	Foraging habitat at PCT 3209 (all zones), hollows suitable for breeding in PCT 3209 zone 2	0.57
Cercartetus nanus Eastern Pygmy-possum	-	V	Species	Moderate	PCT 3209 (all zones)	0.57
Chalinolobus dwyeri Large-eared Pied Bat	V	V	Species	Moderate (foraging habitat only)	PCT 3209 (all zones) (foraging habitat only)	0.57
Dasyurus maculatus Spotted-tail Quoll	E	V	Ecosystem	High	PCT 3209 (all zones)	0.57
Ninox strenua Powerful Owl	-	V	Species/ecosystem Species credits are breeding habitat	High	Foraging habitat at PCT 3209 (all zones), hollows suitable for breeding in PCT 3209 zone 2	0.57
Petauroides volans Greater Glider	E	E	Species	High	PCT 3209 (all zones)	0.57
Phascolarctos cinereus Koala	E	E	Species	Moderate	PCT 3209 (zone 1 and Slope 33459 only)	0.18

5.1.3 Removal of threatened flora

No threatened flora species were identified in the subject land following targeted seasonal surveys. Surveys for species with a moderate or high likelihood of occurrence were within seasonal timeframes, however not all areas were accessible for survey. It is unlikely threatened flora would be impacted by the proposal.

5.1.4 Aquatic impacts

There is no aquatic habitat in the subject land. There is a dam to the south of Slope 96403 associated with Stockyard Gully (a mapped watercourse); there will be no direct or indirect impacts to the dam or waterway.

5.1.5 Injury and mortality

The proposal has the potential to result in an increase to injury and mortality of native fauna during both construction and operation stages. The primary cause of increased fauna injury and mortality during the construction stage of the proposal would be as a result of vegetation clearing activities (particularly during the felling of hollow-bearing trees or trees containing arboreal mammals (e.g. possums, gliders), reptiles or active nests) or may result from collisions with work vehicles or plant, or accidental entrapment in plant, trenches or other works.

The removal of fauna habitat has inherent risks that can, in part, be mitigated through implementing appropriate clearing procedures. The majority of native and threatened fauna species that have habitat within the study area are highly mobile and typically vacate the vegetation in which they reside at the commencement of vegetation clearing. Other, typically ground dwelling, species are less mobile and at higher risk of construction phase mortality. Measures to reduce accidental injury or mortality to fauna are proposed in Section 6.

5.1.6 Groundwater dependent ecosystems

There are no groundwater dependent ecosystems in the subject land or adjoining areas.

5.2 Indirect and operational impacts

Indirect impacts occur when the proposal or activities relating to the construction, operation and general change in land-use patterns of the proposal affect native vegetation, threatened ecological communities, threatened species and their habitats beyond the subject land (direct impact area).

5.2.1 Edge effects on adjacent native vegetation and habitat

The native vegetation in the subject land is located in roadside areas and is currently subject to edge effects, including weed incursion at the road margin and adjoining cleared areas such as the Botanic Gardens boundary fence. The proposal is unlikely to result in additional edge effects through the creation of new edges.

5.2.2 Wildlife connectivity and habitat fragmentation

The proposal would have negligible impacts to fauna connectivity as there would be minimal clearing over small areas. The clearing would results in a minor reduction of canopy cover at two slopes, increasing the crossing distance for fauna over Bells Line of Road. This is limited to two short stretches of road and is unlikely to impact any species life cycles, dispersal and migration patterns.

5.2.3 Injury and mortality

The subject land adjoins Bells Line of Road, an 80 km/h arterial road. Fauna injury and mortality from vehicle collisions on the road are likely, given the large areas of adjoining habitat. The proposal is located in roadside areas and unlikely to increase fauna injury and mortality resulting from vehicle strike.

5.2.4 Invasion and spread of weeds

The invasion and spread of weeds pose a high risk to biodiversity and is a potential consequence of construction and operation activities when the appropriate management strategies are not implemented. Weeds present a high biodiversity risk as they compete with native vegetation and invade and transform ecosystems (Downey & Grice, 2008).

A total of 18 exotic species were recorded in the subject land, of which three are identified as high threat weeds in the BAM-C: *Cenchrus clandestinus* (Kikuyu Grass), *Ehrharta erecta* (Pandic Veldtgrass) and *Ranunculus repens* (Creeping Buttrcup). High threat weeds are defined as plants that, if not controlled, will invade and outcompete native plant species (DPIE (EES), 2020a). One of the exotic plant species recorded in the subject land, *Rubus fruticosus* (Blackberry), is listed as a Priority Weed for the Greater Sydney region under the Biosecurity Act 2015; this species is also included on the Commonwealth list of 32 Weeds of National Significance (WoNS).

Specific measures for impacts relating to the invasion and spread of weeds are included in Chapter 6.

5.2.5 Noise, light, dust and vibration

Noise, light, dust and vibration can impact on surrounding biodiversity during the construction phase of the proposal. Dust as a result of the proposal is expected to be minimal and limited and would have a minor or negligible impact on ecological values in the vicinity of the subject land.

Some works will be undertaken at night, which could result in an increase in artificial lighting in the area and deter fauna from the area or disrupt activities. Impacts to fauna would be localised and restricted to small areas in direct vicinity of the subject land.

Activities such as vegetation clearing, habitat removal, increased human presence, plant and machinery during construction of the proposal have the potential to increase noise and vibration within the subject land and surrounding area. The proposal exists within a bushland area, where there is relatively low baseline of noise and vibration from existing roads and residential properties, with the exception of traffic noise along Bells Line of Road. Sudden additional noise and vibration has the potential to disrupt foraging, breeding and/or movement behaviour of both common and threatened fauna on the subject land and surrounds. Noise and vibration impacts are not considered likely to have a significant, long-term impact on fauna, including threatened fauna, as impacts are considered to be short-term and would be limited to the construction period and carried out in a very small area. Adjoining vegetation would provide refuges for fauna to retreat. Within the impact area, some sensitive species (e.g. woodland birds) may avoid the noise and vibrations, while some more tolerant species (e.g. small mammals) can habituate over the longer-term (Byrnes, et al., 2012). Given the subject land is directly adjacent to traffic noise, species inhabiting the subject land would have some tolerance to noise. Any breeding individuals could be disrupted, including threatened hollow-dependant fauna if they inhabit hollow-bearing trees at or within the vicinity of the subject land. Clearing would be scheduled for February to avoid breeding seasons of threatened fauna species, reducing the potential for indirect impacts,

5.3 Cumulative impacts

There are no major road upgrade proposals or other major project proposals in the vicinity of the subject land. As such, cumulative impacts on biodiversity values impacted by the proposal are considered to be negligible.

5.4 Assessments of significance

Assessments of significance were undertaken for each threatened species and ecological community that has been recorded or with a moderate to high likelihood of occurrence in the subject land. Results of the BC Act significance assessment findings (5 part test/test of significance) are provided in Appendix D and summarised in Table 5-3. Results of EPBC Act significance assessments are provided in Appendix E and summarised in Table 5-4. Impacts to threatened entities on the BC Act and EPBC Act would not be significant.

Table 5-3: Summary of BC Act significance assessments findings

Significance assessment question *(per Section 7.2 of the BC Act and Threatened Species Test of Significance Guidelines (OEH 2018b))*						
Threatened species, or communities	**a**	**b**	**c**	**d**	**e**	**Likely significant impact?**
Blue Mountains Basalt Forest in the Sydney Basin Bioregion	X	N	N	N	Y	No
Brown Treecreeper (*Climacteris picumnus*)	N	X	N	N	Y	No
Eastern Pygmy-possum (*Cercartetus nanus*)	N	X	N	N	Y	No
Flame Robin (*Petroica phoenicea*)	N	X	N	N	Y	No
Gang-gang Cockatoo (*Callocephalon fimbriatum*)	N	X	N	N	Y	No
Greater Glider (*Petauroides volans*)	N	X	N	N	Y	No
Koala (*Phascolarctos cinereus*)	N	X	N	N	Y	No
Large-eared Pied Bat (*Chalinolobus dwyeri*)	N	X	N	N	Y	No
Powerful Owl (*Ninox strenua*)	N	X	N	N	Y	No
Scarlet Robin (*Petroica boodang*)	N	X	N	N	Y	No
Spotted-tailed Quoll (*Dasyurus maculatus maculatus*)	N	X	N	N	Y	No
Yellow-bellied Sheathtail-bat (*Saccolaimus flaviventris*)	N	X	N	N	Y	No

Significance assessment question *(per Section 7.2 of the BC Act and Threatened Species Test of Significance Guidelines (OEH 2018b))*						
Threatened species, or communities	**a**	**b**	**c**	**d**	**e**	**Likely significant impact?**
Y *= Yes (negative impact),* ***N*** *= No (no or positive impact),* ***X*** *= Yes/No answer not applicable,* ***...*** *= unknown impact.*						

Table 5-4: Summary of EPBC Act significance assessments findings

Threatened species, or communities	Important population *(per Significant Impact Guidelines 1.1 (Commonwealth of Australia 2013a))*	Likely significant impact?
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion	N/A	No
Gang-gang Cockatoo (*Callocephalon fimbriatum*)	Unlikely	No
Greater Glider (*Petauroides volans*)	Unlikely	No
Koala (*Phascolarctos cinereus*)	Unlikely	No
Large-eared Pied Bat (*Chalinolobus dwyeri*)	Unlikely	No
Spotted-tailed Quoll (*Dasyurus maculatus maculatus*)	Unlikely	No
Y *= Yes (negative impact),* ***N*** *= No (no or positive impact),* ***X*** *= Yes/No answer not applicable,* ***...*** *= unknown impact.*		

6. Mitigation

Measures to minimise impacts to threatened species, TECs, fauna injury and mortality and other ecological impacts have been provided in Table 6-1.

Table 6-1: Mitigation measures

ID	Impact	Mitigation measure	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated?	Responsibility
B01	**Removal of native vegetation**	Native vegetation removal will be minimised through detailed design.	Detailed design	Effective	Maximum 0.57 hectares of native vegetation removal	Transport, project engineer
B02		Pre-clearing surveys will be undertaken in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Prior to construction	Effective	Maximum 0.57 hectares of fauna habitat removal including displacement of fauna species	Project ecologist
B03		Vegetation removal will be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	Maximum 0.57 hectares of native vegetation removal	Construction contractor
B04		Native vegetation will be re-established in accordance with *Guide 3: Re-establishment of native vegetation* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	Post construction	Effective	Maximum 0.57 hectares of native vegetation removal	Construction contractor
B05		The unexpected species find procedure is to be followed under *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened ecological communities, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven	Impacts to threatened species	Construction contractor
B06	**Removal of threatened fauna habitat**	Hollow-bearing tree removal at Slope 33459 would not be undertaken between March and October to minimise potential to impact breeding fauna species	Prior to construction	Effective	Loss of hollow resources	Transport
B07		Hollow-bearing trees would be retained on Slope 96403 and impacts to the tree dripline avoided. If removal or tree drip lines impacts cannot be avoided, targeted seasonal surveys of hollow-bearing trees would be required.	During construction	Proven	Indirect noise and vibration impacts	Transport and contractor
B08		Threatened fauna habitat removal will be minimised through detailed design.	Detailed design	Effective	Maximum 0.57 hectares of fauna habitat removal including	

ID	Impact	Mitigation measure	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated?	Responsibility
					displacement of fauna species	
B09		Fauna will be managed in accordance with *Guide 9: Fauna handling* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	Fauna injury or mortality	Project ecologist
B10		Habitat removal will be undertaken in accordance with *Guide 4: Clearing of vegetation and removal of bushrock* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	Maximum 0.57 hectares of fauna habitat removal Fauna injury or mortality	Project ecologist, construction contractor
B11		Habitat will be replaced or re-instated in accordance with *Guide 5: Re-use of woody debris and bushrock* and *Guide 8: Nest boxes* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Proven	Maximum 0.57 hectares of fauna habitat removal including displacement of fauna species	Project ecologist, Transport
B12		The unexpected species find procedure is to be followed under *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) if threatened fauna, not assessed in the biodiversity assessment, are identified in the proposal site.	During construction	Proven	Maximum 0.57 hectares of fauna habitat removal including displacement of fauna species	Construction contractor
B13		Pre-clearing surveys will be undertaken in accordance with *Guide 1: Pre-clearing process* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Proven	Fauna injury or mortality	Project ecologist
B14		Exclusion zones will be set up at the limit of clearing in accordance *with Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	Maximum 0.57 hectares of fauna habitat removal including displacement of fauna species	Construction contractor
B15		A Tree and Hollow Replacement plan is required to offset the loss of 10-20 trees and two hollows. This would require between XXX and XX tree plantings of payments into the fund and 3 artificial hollows.	Pre-construction	Effective	Maximum 0.57 hectares of fauna habitat removal including	Transport

ID	Impact	Mitigation measure	Timing and duration	Likely efficacy of mitigation	Residual impacts anticipated?	Responsibility
					displacement of fauna species	
B16	**Injury and mortality of fauna**	Fauna will be managed in accordance with *Guide 9: Fauna* handling of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	Fauna injury or mortality	Project ecologist, construction contractor, Transport
B17	**Invasion and spread of weeds**	Weed species will be managed in accordance *with Guide 6: Weed management* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011).	During construction	Effective	Weed spread	Project ecologist, construction contractor
B18	Invasion and spread of pathogens and disease	Pathogens will be managed in accordance with *Guide 2: Exclusion zones* of the *Biodiversity Guidelines: Protecting and managing biodiversity on RTA projects* (RTA 2011) and the *Prevention of Soil Diseases - Procedures for Contractors Entering the Site* (Royal Botanic Garden, 2009).	During construction	Effective	Pathogen spread	Project ecologist, construction contractor
B19	Noise, light, dust and vibration	Shading and artificial light impacts will be minimised through detailed design.	Detailed design	Effective	Disruption to fauna behaviours	Transport, project engineer

7. Offsets and other measures

If impacts are unable to be avoided or safeguarded against, biodiversity offsets may be used to counterbalance the impact of development on biodiversity. Offsets for the proposal are determined with reference to the TfNSW No Net Loss Guidelines (TfNSW 2022a) and supporting resources, and Tree and Hollow Replacement Guidelines (TfNSW 2022b) and supporting resources.

7.1 Thresholds

This section details the process of identifying the biodiversity impacts in this BAR that trigger thresholds set out by No Net Loss Guidelines (TfNSW 2022a). The offset thresholds under TfNSW (2022a) are set out in Table 7-1. Residual impacts that do not exceed offset thresholds are then considered in accordance with the requirements of the Tree and Hollow Replacement Guidelines (TfNSW 2022b). An assessment of direct impacts of the proposal against the offset thresholds is provided in Table 7-2. The offset threshold is not triggered.

Table 7-1: Offset thresholds (TfNSW No Net Loss Guidelines)

Impact	Threshold
Works involving clearing of a CEEC	Where there is any clearing of an CEEC in 'moderate to good' condition
Works involving clearing of an EEC	Where clearing of a EEC ≥ 2 ha in 'moderate to good' condition
Works involving clearing of VEC	Where clearing of VEC ≥ 5 ha in 'moderate to good' condition
Works involving clearing of any habitat for a known species credit fauna species or clearing of breeding habitat (as defined by the TBDC) for dual-credit fauna species (excluding exotic and planted vegetation that cannot be assigned to a plant community type)	Where clearing ≥ 1 ha in 'moderate to good' condition
Works involving removal of known threatened flora species and their habitat	Where loss of individuals is ≥10 or where clearing of habitat is ≥ 1 ha
Type 1 or Type 2 key fish habitats	Where there is a net loss of habitat
Any residual biodiversity impact that doesn't require offsets in accordance with the No Net Loss Guideline is to be assessed against the requirements of the Tree and Hollow Replacement Guideline.	**Any clearing of hollows and/or trees ≥5cm DBH**

Table 7-2: Assessment of vegetation impacts against thresholds

Veg. zone	Plant community type (PCT)	Condition	TEC	Impact area (ha)	Threshold triggered?
Zone 1	PCT 3209: Blue Mountains Basalt Cap Forest	Moderate condition – Disturbed	Endangered (BC Act)	0.31	No offset triggered. The number of trees ≥5cm DBH to be removed will depend on detailed design and construction techniques.

Veg. zone	Plant community type (PCT)	Condition	TEC	Impact area (ha)	Threshold triggered?
Zone 2	PCT 3209: Blue Mountains Basalt Cap Forest	Moderate condition	Endangered (BC Act and EPBC Act)	0.26	No offset triggered. The number of trees ≥5cm DBH to be removed will depend on detailed design and construction techniques.

7.2 Preliminary offset calculations

Offsets are not required for ecosystem and species credits as offset thresholds are not triggered in chapter 7.1. Nonetheless, biodiversity credit reports are provided in Appendix F.

Tree and hollow offsets are required. A preliminary estimate of tree clearing is that between 10 and 30 trees would be removed. Tree replacement ratios range from 1:16 to 1:2, depending on size of trees. A range of size classes were recorded. Extrapolated out this would require approximately 140 replacement plantings. Tree data would be collected again upon vegetation clearing and offset ratios recounted.

Up to five hollows would be removed. The replacement requirement as per the Tree and hollow replacement guidelines (TfNSW, 2022b) is three artificial hollows for every occupied hollow removed, assuming an occupancy rate of 20%. In this case, it could be assumed one of the hollows is occupied therefore three artificial hollows would be required.

7.3 Biodiversity offset strategy/tree and hollow replacement plan

Transport have two options to offset tree and hollow loss:

a) Make a payment into the TfNSW Conservation Fund

b) Replacement plantings within the subject land or in proximity

Its unlikely that the trees could be planted on the subject land or in proximity, though artificial hollows may. As such, it is recommended that Transport pay into the TfNSW Conservation Fund to offset tree removal. If trees can be replanted in proximity or artificial hollows installed, a Tree and Hollow Replacement plan is required. A template for this plan is included as a resource to the Tree and Hollow Replacement Guidelines (TfNSW, 2022b).

8. Conclusion

The proposal would impact 0.57 hectares of Blue Mountains Basalt Cap Forest (PCT 3209) which is associated with the Threatened Ecological Community (TEC) Blue Mountains Basalt Forest in the Sydney Basin Bioregion, listed as Endangered under the BC Act and Endangered under the EPBC Act.

The proposal would not impact any threatened flora species.

Impacts to fauna habitat would occur from the loss of native vegetation and five hollow-bearing trees. Indirect noise and vibration impacts could occur to adjacent and retained hollows. Th following threatened flora species could be impacted directly or indirectly:

- *Callocephalon fimbriatum* Gang-gang Cockatoo (E – EPBC Act, V – BC Act)
- *Cercartetus nanus* Eastern Pygmy-possum (V – BC Act)
- *Chalinolobus dwyeri* Large-eared Pied Bat (V – EPBC Act, V – BC Act) (foraging habitat only)
- *Dasyurus maculatus* Spotted-tail Quoll (E – EPBC Act, V – BC Act)
- *Ninox strenua* Powerful Owl (V – BC Act)
- *Petauroides volans* Greater Glider (E – EPBC Act, E – BC Act)
- *Phascolarctos cinereus* Koala (E – EPBC Act, E – BC Act)

Assessments of significance were undertaken for each threatened species and TEC. Impacts to threatened entities on the BC Act and EPBC Act were found not to be significant.

9. Glossary

Term	Definition
Accredited person or assessor	Means as person accredited under section 6.10 (of the BC Act) to prepare reports in accordance with the BAM.
Biodiversity Assessment Method	The Biodiversity Assessment Method is established under section 6.7 of the BC Act. The BAM is established for the purpose of assessing certain impacts on threatened species and threatened ecological communities (TECs), and their habitats, and the impact on biodiversity values.
Biodiversity Assessment Method Calculator	Biodiversity Assessment Method Calculator (BAM-C) – the online computer program that provides decision support to assessors and proponents by applying the BAM and referred to as the BAM-C. The BAM-C contains biodiversity data from the BioNet Vegetation Classification and the Threatened Biodiversity Data Collection that the assessor is required to use in a BAM assessment. The BAM-C applies the equations used in the BAM, including those to determine the number and class of biodiversity credits required to offset the impacts of a development, or created at a biodiversity stewardship site. It is published by the Department (DPIE 2020a).
Biodiversity credit report	The report produced by the BAM-C that sets out the number and class of biodiversity credits required to offset the remaining adverse impacts on biodiversity values at a development site, or on land to be biodiversity certified, or that sets out the number and class of biodiversity credits that are created at a biodiversity stewardship site (DPIE 2020a).
Biodiversity offsets	The gain in biodiversity values achieved from the implementation of management actions on areas of land, to compensate for losses to biodiversity values from the impacts of development (DPIE 2020a).
Biodiversity Offsets and Agreement Management System	The online system used to administer the Biodiversity Offsets Scheme. The BOAMS is used by accredited assessors (to carry out specific BAM-related tasks involving access to the BAM-C to perform assessments, submit data, generate credits and calculate a credit price), by landholders (to apply for a Biodiversity Stewardship Agreement and manage ongoing reporting obligations for their agreement) and by proponents of developments (to view their credit obligation or the payment required to the Biodiversity Conservation Fund).
Biodiversity risk weighting	A factor of the formulas used by the BAM to calculate credits. The biodiversity risk weighting (BRW) is a score given to each vegetation zone and species based on the 'sensitivity to loss' versus the 'sensitivity to gain'. The value is set for threatened species and listed in the TBDC. The BRW for vegetation is calculated for each vegetation zone by the BAM-C using a factor of the 'sensitivity to loss' of the PCT or TEC (located in the BioNet vegetation classification) and the 'sensitivity to gain' of the ecosystem credit species (in the TBDC) that are predicted to occur.
Biodiversity Stewardship site	Refers to land which is the subject to a Biodiversity Stewardship Agreement under the BC Act.
BioNet Atlas	The DPIE database of flora and fauna records (formerly known as the NSW Wildlife Atlas). The Atlas contains records of plants, mammals, birds, reptiles, amphibians, some fungi, some invertebrates (such as insects and snails listed under the BC Act) and some fish (DPIE 2020a).
BioNet Vegetation classification	Refers to the vegetation community-level classification for use in vegetation mapping programs and regulatory biodiversity impact assessment frameworks in NSW. Refer About BioNet Vegetation Classification | NSW Environment and Heritage (DPE 2020a).

Term	Definition
Construction footprint	The area to be directly impacted by the proposal during construction activities. See also definition for subject land.
Cumulative impact	The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Refer to Clause 228(2) of the EP&A Regulation 2000 for cumulative impact assessment requirements.
Direct impact	Direct impacts on biodiversity values include those related to clearing native vegetation and threatened species habitat and impacts on biodiversity values prescribed by the Biodiversity Conservation Regulation 2017 (the BC Regulation) (DPIE 2020a).
Ecosystem credit species	Threatened species or components of species habitat that are identified in the Threatened Species Data Collection as requiring assessment for ecosystem credits. This is analogous with the definition of 'predicted species'.
Ecosystem credits	A measurement of the value of threatened ecological communities, threatened species habitat for species that can be reliably predicted to occur with a PCT, and PCTs generally. Ecosystem credits measure the loss in biodiversity values at a development, activity, clearing or biodiversity certification site and the gain in biodiversity values at a biodiversity stewardship site (DPIE 2020a).
Habitat	An area or areas occupied, or periodically or occasionally occupied, by a species, population or ecological community, including any biotic or abiotic component (DPIE 2020a).
Indirect impact	Impacts that occur when the proposal affects native vegetation and threatened species habitat beyond the development footprint or within retained areas (e.g. transporting weeds or pathogens, dumping rubbish). This includes impacts from activities related to the construction or operational phase of the proposal and prescribed impacts (DPIE 2020a).
Landscape assessment area	The area which includes the subject land and a 1500 m buffer surrounding the outside edge of the boundary of the subject land or 500 m along each side of the centre line of a linear-shaped proposal
Local population	The population that occurs in the study area. The assessment of the local population may be extended to include individuals beyond the study area if it can be clearly demonstrated that contiguous or interconnecting parts of the population continue beyond the study area, according to the following definitions: • *The local population of a threatened plant species comprises those individuals occurring in the study area or the cluster of individuals that extend into habitat adjoining and contiguous with the study area that could reasonably be expected to be cross-pollinating with those in the study area.* • *The local population of resident fauna species comprises those individuals known or likely to occur in the study area, as well as any individuals occurring in adjoining areas (contiguous or otherwise) that are known or likely to utilise habitats in the study area.* • *The local population of migratory or nomadic fauna species comprises those individuals that are likely to occur in the study area from time to time or return year to year (OEH 2018b).*
Matter of national environmental significance	A matter of national environmental significance (MNES) is any of the nine defined components protected by a provision of Part 3 of the EPBC Act (Commonwealth).
Mitigation	Action to reduce the severity of an impact.

Term	Definition
Native vegetation	Has the same meaning as in section 1.6 of the BC Act and section 60B of the LLS Act. In summary, a) trees (including any sapling or shrub or any scrub) b) understorey plants c) groundcover (being any type of herbaceous vegetation) d) plants occurring in a wetland. A plant is native to New South Wales if it was established in New South Wales before European settlement (BC Act). Native vegetation does not extend to marine vegetation (being mangroves, seagrasses or any other species of plant that at any time in its life cycle must inhabit water other than fresh water). Marine vegetation is covered by the provisions of the FM Act.
NSW (Mitchell) landscape	Landscapes with relatively homogeneous geomorphology, soils and broad vegetation types, mapped at a scale of 1:250,000 (DPIE 2020a).
Operational footprint	The area that will be subject to ongoing operational impacts from the proposal. This includes the road, surrounding safety verges and infrastructure, fauna connectivity structures and maintenance access tracks and compounds.
Patch size	An area of native vegetation that: • *occurs on the development site or biodiversity stewardship site* • *includes native vegetation that has a gap of less than 100 m from the next area of native vegetation (or ≤30 m for non-woody ecosystems).* Patch size may extend onto adjoining land that is not part of the development site or biodiversity stewardship site (DPIE 2020a).
PlantNET	An online database of the flora of New South Wales which contains currently accepted taxonomy for plants found in the State, both native and exotic.
Population	A group of organisms, all of the same species, occupying a particular area (DPIE 2020a).
Spatial datasets	Spatial databases required to prepare a BAR • *BioNet NSW (Mitchell) Landscapes – Version 3.1* • *NSW Interim Biogeographic Regions of Australia (IBRA region and sub-regions) – Version 7* • *NSW soil profiles* • *hydrogeological landscapes* • *acid sulfate soils risk* • *digital cadastral database* • *Vegetation Information Systems maps* • *Geological sites of NSW.*
Species credit species	Threatened species or components of species habitat that are identified in the Threatened Species Data Collection as requiring assessment for species credits (DPIE 2020a). This is analogous with the definition of 'candidate species'.
Species credits	The class of biodiversity credits created or required for the impact on threatened species that cannot be reliably predicted to use an area of land based on habitat surrogates. Species that require species credits are listed in the Threatened Biodiversity Data Collection (DPIE 2020a).
Species polygon	An area of land identified in Chapter 5 (of the BAM) that contains habitat or is occupied by a threatened species (DPIE 2020a).

Term	Definition
Study area	The area directly affected by the proposal (subject land or construction footprint) and any additional areas likely to be affected by the proposal, either directly or indirectly.
Subject land	Land subject to a development, activity, clearing, biodiversity certification or a biodiversity stewardship proposal. It excludes the landscape assessment area which surrounds the subject land (i.e., the area of land in the 1500 m buffer zone around the subject land or 500m buffer zone for linear proposals). In the case of a biodiversity certification proposal, subject land includes the biodiversity certification assessment area (DPIE 2020a). See also definition for construction footprint.
Threatened Biodiversity Data Collection	A publicly assessable online database (registration required) which contains information for listed threatened species, populations and ecological communities (DPIE 2020a). Part of the BioNet database, published by the EHG and accessible from the BioNet website at www.bionet.nsw.gov.au.
Vegetation integrity (score)	The condition of native vegetation assessed for each vegetation zone against the benchmark for the PCT. The vegetation integrity score is the quantitative measure of vegetation condition calculated by the BAM-C (DPIE 2020a).
Vegetation zone	A relatively homogeneous area of native vegetation on a development site, clearing site, land to be biodiversity certified or biodiversity stewardship site that is the same PCT and has the same broad condition state (DPIE 2020a).

10. Abbreviations

Term	Definition
AOBV	Area of Outstanding Biodiversity Value
BAM	Biodiversity Assessment Method
BAM-C	Biodiversity Assessment Method calculator
BC Act	Biodiversity Conservation Act 2016 (NSW)
BC Regulation	Biodiversity Conservation Regulation 2017 (NSW)
BDAR	Biodiversity Development Assessment Report
BOAMS	Biodiversity Offsets and Agreement Management System
BOS	Biodiversity Offset Scheme
BRW	Biodiversity risk weighting
CEEC	Critically Endangered Ecological Community
CEMP	Construction Environmental Management Plan
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DIWA	Directory of Important Wetlands in Australia
DPE	Department of Planning and Environment
DPI	Department of Primary Industries
EEC	Endangered ecological community
EHG	NSW Environment and Heritage Group within the Department of Planning and Environment
EIS	Environmental Impact Statement
EP&A Act	*Environment Planning and Assessment Act 1979* (NSW)
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Commonwealth)
Fisheries NSW Policy and guidelines	Fisheries NSW Policy and guidelines for fish habitat conservation and management (Update 2013)
FM Act	Fisheries Management Act 1994 (NSW)
GDE	Groundwater dependent ecosystems
IBRA	Interim Biogeographically Regionalisation of Australia
MNES	Matters of national environmental significance
PCT	Plant community type
PMST	Protected Matters Search Tool
REF	Review of Environmental Factors
SAII	Serious and Irreversible Impacts
SEARs	Secretary's Environmental Assessment Requirements
SEPP	State Environmental Planning Policy
SSD	State Significant Development
SSI	State Significant Infrastructure
TBDC	Threatened Biodiversity Data Collection
TECs	Threatened ecological communities (VECs, EECs and CEECs)
TfNSW	Transport for NSW
VEC	Vulnerable Ecological Community

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Appendix A: Species recorded

Recorded flora

Family	Scientific name	Common name	Exotic	Status		Cover (%) in each plot*		Incidental observation
				BC Act	EPBC Act	Q1	Q2	
Apiaceae	*Hydrocotyle sibthorpioides*						50.0	X
Apocynaceae	*Tylophora barbata*	Bearded Tylophora					1.0	
Araliaceae	*Polyscias sambucifolia*	Elderberry Panax				0.1	0.1	X
Asteraceae	*Cassinia longifolia*							X
Asteraceae	*Cirsium vulgare*	Spear Thistle				0.2	0.1	
Asteraceae	*Coronidium elatum*		Y					X
Asteraceae	*Senecio linearifolius*	Fireweed Groundsel					30.0	
Bignoniaceae	*Pandorea pandorana*	Wonga Wonga Vine					0.1	
Blechnaceae	*Blechnum neohollandicum*							X
Boraginaceae	*Hackelia latifolia*		Y				2.0	
Brassicaceae	*Cardamine lilacina*		Y				0.1	
Brassicaceae	*Lunaria annua*	Honesty				1.0		
Campanulaceae	*Lobelia purpurascens*	whiteroot	Y				0.1	
Caryophyllaceae	*Stellaria flaccida*					2.0	25.0	
Cyatheaceae	*Cyathea australis*	Rough Treefern				10.0	15.0	
Cyperaceae	*Carex appressa*	Tall Sedge	Y				0.1	
Dennstaedtiaceae	*Pteridium esculentum*	Bracken						X

Family	Scientific name	Common name	Exotic	Status		Cover (%) in each plot*		Incidental observation
				BC Act	EPBC Act	Q1	Q2	
Dryopteridaceae	*Lastreopsis microsora*	Creeping Shield Fern	Y			1.0	5.0	
Fabaceae (Faboideae)	*Glycine tabacina*	Variable Glycine					0.1	
Fabaceae (Faboideae)	*Indigofera australis*	Australian Indigo						X
Fabaceae (Faboideae)	*Kennedia rubicunda*	Dusky Coral Pea						X
Fabaceae (Faboideae)	*Trifolium repens*	White Clover					0.2	
Fabaceae (Mimosoideae)	*Acacia longifolia*							X
Fabaceae (Mimosoideae)	*Acacia melanoxylon*	Blackwood						X
Geraniaceae	*Geranium homeanum*		Y			30.0	1.0	X
Geraniaceae	*Geranium robertianum*	Herb Robert				10.0		
Goodeniaceae	*Goodenia ovata*	Hop Goodenia						X
Haloragaceae	*Gonocarpus tetragynus*	Poverty Raspwort						X
Liliaceae	*Lilium formosanum*	Formosan Lily				0.1		
Lomandraceae	*Lomandra longifolia*	Spiny-headed Mat-rush				2.0		X
Luzuriagaceae	*Eustrephus latifolius*	Wombat Berry	Y			0.1	0.1	
Monimiaceae	*Doryphora sassafras*	Sassafras					2.0	
Monimiaceae	*Hedycarya angustifolia*	Native Mulberry					0.1	
Myrtaceae	*Angophora costata*	Sydney Red Gum						X
Myrtaceae	*Eucalyptus blaxlandii*	Blaxland's Stringybark	Y					X
Myrtaceae	*Eucalyptus fastigata*	Brown Barrel				5.0	30.0	

Family	Scientific name	Common name	Exotic	Status		Cover (%) in each plot*		Incidental observation
				BC Act	EPBC Act	Q1	Q2	
Myrtaceae	*Eucalyptus radiata*	Narrow-leaved Peppermint						X
Myrtaceae	*Eucalyptus spp.*		Y					X
Oleaceae	*Jasminum polyanthum*	White Jasmine				5.0		
Orchidaceae	*Sarcochilus falcatus*	Orange Blossom Orchid				0.1	0.1	
Pittosporaceae	*Pittosporum spinescens*	Wallaby Apple	Y			0.1	0.1	
Pittosporaceae	*Pittosporum undulatum*	Sweet Pittosporum				20.0	0.1	
Poaceae	*Anthoxanthum odoratum*	Sweet Vernal Grass						X
Poaceae	*Bromus catharticus*	Praire Grass				1.0	0.2	
Poaceae	*Cenchrus clandestinus*	Kikuyu Grass						X
Poaceae	*Dactylis glomerata*	Cocksfoot				20.0	0.2	
Poaceae	*Ehrharta erecta*	Panic Veldtgrass				30.0	0.5	
Poaceae	*Imperata cylindrica*	Blady Grass	Y					X
Polygonaceae	*Rumex conglomeratus*	Clustered Dock				1.0		
Polypodiaceae	*Pyrrosia rupestris*	Rock Felt Fern				0.1		
Ranunculaceae	*Clematis aristata*	Old Man's Beard	Y			0.1	0.1	
Ranunculaceae	*Ranunculus repens*	Creeping Buttercup	Y			3.0		
Rhamnaceae	*Pomaderris aspera*	Hazel Pomaderris						X
Rosaceae	*Potentilla indica*	Indian Strawberry				2.0		
Rosaceae	*Rubus fruticosus*	Blackberry complex	Y			1.0	0.2	
Rosaceae	*Rubus moluccanus*	Molucca Bramble				0.1		

Family	Scientific name	Common name	Exotic	Status		Cover (%) in each plot*		Incidental observation
				BC Act	EPBC Act	Q1	Q2	
Rosaceae	*Rubus rosifolius*	Rose-leaf Bramble					0.1	
Rubiaceae	*Coprosma robusta*	Karamu				2.0		
Smilacaceae	*Smilax australis*	Lawyer Vine				0.1	0.1	
Solanaceae	*Solanum aviculare*	Kangaroo Apple	Y			2.0	5.0	
Solanaceae	*Solanum nigrum*	Black-berry Nightshade				5.0	0.2	X
Urticaceae	*Urtica incisa*	Stinging Nettle	Y			5.0	2.0	
Violaceae	*Melicytus dentatus*	Tree Violet				2.0	0.2	
Violaceae	*Viola spp.*					5.0		
Zingiberaceae	*Hedychium gardneranum*	Ginger Lily				0.1		

*Note: *Cover determined in accordance with the BAM.*

Recorded fauna

Class	Scientific name	Common name	Status	
			BC Act	EPBC Act
Bird	*Alisterus scapularis*	Australian King Parrot	-	-
Bird	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike	-	Marine
Bird	*Dacelo novaeguineae*	Laughing Kookaburra	-	-
Bird	*Gymnorhina tibicen*	Australian Magpie	-	-
Bird	*Malurus cyaneus*	Superb Fairywren	-	-
Bird	*Meliphaga lewinii*	Lewin's Honeyeater	-	-

Class	Scientific name	Common name	Status	
			BC Act	EPBC Act
Bird	*Pardalotus punctatus*	Spotted Pardalote	-	-
Bird	*Platycercus elegans*	Crimson Rosella	-	-
Bird	*Podargus strigoides*	Tawny Frogmouth	-	-
Bird	*Psophodes olivaceus*	Eastern Whipbird	-	-
Frog	*Crinia signifera*	Eastern Common Froglet	-	-

Appendix B: Habitat suitability assessment

Use the below criteria to determine the likelihood that a threatened species could occur in the study area. The criteria are designed for use in a BAR only and is not applicable for use in a BDAR (i.e., where the BAM-C is being used). Only recorded sightings from BioNet are valid for these criteria.

Likelihood	Criteria
Recorded	The species was observed in the study area during the current survey or has been recorded within the past five years (known from a reputable source).
High	A species is considered highly likely to occur in the study area if: • *There are previous credible records on BioNet within the study area from the last 10 years and suitable habitat is present.* **OR** • *The species is highly mobile, is dependent on identified suitable habitat within the study area (i.e., for breeding or important life cycle periods such as winter flowering resources) and has been recorded recently (within five years) on BioNet in the locality. This also includes species known or likely to visit the study area during regular seasonal movements or migration.*
Moderate	A species is considered moderately likely to occur in the study area if: • *Any suitable habitat (e.g., foraging) is present in the study area, the species is highly mobile and has been recorded in the locality in the last 10 years on BioNet. The species may be unlikely to maintain sedentary populations, however, may seasonally use resources within the study area opportunistically or during migration. The species is unlikely to be dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitat within the study area.* **OR** • *The species is not highly mobile, is dependent on identified suitable habitat features (e.g., hollows, rocky outcrops) within the study area and has been recorded in the locality in the last 10 years on BioNet.* **OR** • *For flora species that are associated with PCTs in the study area (see TBDC) or have been recorded in the locality in the last 10 years on BioNet – the associated PCT/habitat present in the study area is not degraded and the species was not targeted by surveys in accordance with the BAM and relevant survey guidelines. In addition, for flora species known to occur in disturbed areas (e.g., orchids), records from any time within the locality may warrant inclusion in this category.*
Low	A species is considered to have a low likelihood of occurring in the study area if: • *For highly mobile species, the species may be an occasional visitor, but habitat similar to the study area is widely distributed in the locality, meaning that the species is not dependent (i.e., for breeding or important life cycle periods such as winter flowering resources) on habitats in the study area and the species has not been recorded in the locality in the last 10 years on BioNet.* **OR** • *The species is not highly mobile, is dependent on identified suitable habitat features (e.g., hollows, rocky outcrops) within the study area and has not been recorded in the locality in the last 10 years on BioNet.* **OR** • *For flora species that are associated with PCTs in the study area (see TBDC) and the species was not identified following targeted surveys in accordance with the BAM and relevant survey guidelines. Flora species that have been recorded in the locality on BioNet at any time, associated suitable habitat (see the TBDC) is not present in the study area, though similar habitats of the same vegetation formation is present in the study area.*
Unlikely	Suitable habitat for the species is absent from the study area.

Habitat suitability assessment table

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
Plants								
Acacia baueri subsp. aspera		V	-	Species		Restricted to the Sydney region, occurring on the Kings Tableland in the central Blue Mountains and with sporadic occurrences on the Woronora Plateau in the Royal National Park, Mt. Keira district and at Wedderburn. May also occur on the escarpment/Woronora Plateau in the Flat Rock Junction and Stanwell Tops area of the Illawarra. Occurs in low, damp heathlands, often on exposed rocky outcrops over a wide range of climatic and topographical conditions.	2 – BioNet (1984)	Low – no recent records (<20 years ago) within 10km of the study area, no suitable habitat in the study area.
Acacia bynoeana	Bynoe's Wattle	E	V	Species		The species is found in central eastern NSW, from the Hunter District (Morisset) south to the Southern Highlands and west to the Blue Mountains. Found in heath or dry sclerophyll forest on sandy soils, often in slightly disturbed areas, in association with Red Bloodwood, Scribbly Gum, Parramatta Red Gum, Saw Banksia and Narrow-leaved Apple.	4 – BioNet (1899), PMST	Low – no recent records (<20 years ago) within 10km of the study area, no suitable habitat in the study area.
Acacia flocktoniae	Flockton Wattle	V	V	Species		The Flockton Wattle is found only in the Southern Blue Mountains (at Mt Victoria, Megalong Valley and Yerranderie). Grows in dry sclerophyll forest on sandstone.	PMST	Low – no records within 10km of the study area, no suitable habitat in the study area.
Acacia gordonii	-	E	E	Species		Restricted to the north-west of Sydney, it has a disjunct distribution occurring in the lower Blue Mountains in the west, and in the Maroota/Glenorie area in the east. Grows in dry sclerophyll forest and heathlands amongst or within rock platforms on sandstone outcrops.	PMST	Low – no records within 10km of the study area, no suitable habitat in the study area.
Acacia pubescens	Downy Wattle, Hairy Stemmed Wattle	V	V	Species		Concentrated around the Bankstown-Fairfield-Rookwood area and the Pitt Town area, with outliers occurring at Barden Ridge, Oakdale and	PMST	Low – no records within 10km of the study area, which is beyond the current known geographic range of

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
						Mountain Lagoon. Occurs in on alluviums, shales and between shales and sandstones in open woodland and forest. Occurs in a variety of plant communities including Cooks River/Castlereagh Ironbark Forest, Shale/Gravel Transition Forest and Cumberland Plain Woodland.		the species. No suitable habitat in the study area.
Acrophyllum australe	-	V	V	Species		This species has a restricted distribution from Faulconbridge to Lawson, South of Bilpin and near Kings Tableland, in the Blue Mountains area. The species is currently known from 27 sites. Grows in sheltered gullies beneath waterfalls and drip zones of rock overhangs and cliff faces, usually with a south-east to south-west aspect. Typically found in areas where there is a more or less constant supply of water.	1 – BioNet (2008), PMST	Low – the species was last recorded in 2008 (>10 years ago) within 10km of the study area, and specific habitat requirements are not present.
Astrotricha crassifolia	Thick-leaf Star-hair	V	V	Species		Occurs near Patonga (Gosford LGA), and in Royal NP and on the Woronora Plateau (Sutherland and Campbelltown LGAs). There is also a record from near Glen Davis (Lithgow LGA). Occurs in dry sclerophyll woodland on sandstone.	PMST	Low – no records within 10km of the study area. Study area is beyond the current known geographical range of the species, although it is within the predicted species range. No suitable habitat in the study area.
Boronia deanei	Deane's Boronia	V	V	Species		Scattered populations between the far south-east of NSW and the Blue Mountains with the species found on Newnes Plateau (Newnes State Forest), Nalbaugh Plateau (South East National Park), Kanangra-Boyd National Park, Budderoo National Park and Morton National Park. Grows in wet heath, often at the margins of open forest adjoining swamps or along streams.	PMST	Low – no records within 10km of the study area. Study area is beyond the current known geographical range of the species, although it is within the predicted species range. No suitable habitat in the study area.
Caesia parviflora var. minor		V	-	Species		This variety occurs uncommonly in Tasmania, southern Victoria and south-east South Australia with an outlying population in NSW, in Barcoongere State Forest, between Grafton and Coffs Harbour. This variety may be more common than currently known, as Pale Grass-	1 – BioNet (1904), BAM-C (Candidate)	Low – the species was last recorded within 10km of the study area in 1904 and only marginal suitable habitat is present.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
						lilies are often not identified to variety level. Found in damp places in open forest on sandstone.		
Cryptostylis hunteriana	Leafless Tongue-orchid	V	V	Species		Recorded from as far north as Gibraltar Range National Park south into Victoria. Known historically from a number of localities on the NSW south coast and has been observed in recent years at many sites between Batemans Bay and Nowra (although it is uncommon at all sites). Also recorded at Munmorah State Conservation Area, Nelson Bay, Wyee, Washpool National Park, Nowendoc State Forest, Ku-Ring-Gai Chase National Park and Ben Boyd National Park. Does not appear to have well defined habitat preferences and is known from a range of communities, including swamp-heath and woodland.	PMST	Low – no records within 10km of the study area. Study area is beyond the current known geographical range of the species.
Cynanchum elegans	White-flowered Wax Plant	E	E	Species		Restricted to eastern NSW from Brunswick Heads to Gerroa. Locations include the Cumberland Plain, the Forster area, Manning Valley, Hunter Valley, Yabbra State Forest, Brunswick Heads, Gerroa, Merriwa and northeast of Tenterfield. It is most common in the Kempsey region. The species occurs on a variety of lithologies and soil types, usually on steep slopes with varying degrees of soil fertility. It occurs mainly at the ecotone between dry subtropical rainforest and sclerophyll forest/woodland communities.	PMST	Low – No records within 10km of the study area and no suitable habitat is present.
Darwinia peduncularis		V	-	Species		Occurs as local disjunct populations in coastal NSW with a couple of isolated populations in the Blue Mountains. It has been recorded from Brooklyn, Berowra, Galston Gorge, Hornsby, Bargo River, Glen Davis, Mount Boonbourwa and Kings Tableland. Usually grows on or near rocky	1 – BioNet (1963)	Low – no recent records (<10 years ago) within 10km of the study area and no suitable habitat is present.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
						outcrops on sandy, well drained, low nutrient soil over sandstone.		
Dillwynia tenuifolia		V	-	Species		The core distribution is the Cumberland Plain from Windsor and Penrith east to Dean Park near Colebee. Other populations in western Sydney are recorded from Voyager Point and Kemps Creek in the Liverpool LGA, Luddenham in the Penrith LGA and South Maroota in the Baulkham Hills Shire. Disjunct localities outside the Cumberland Plain include the Bulga Mountains at Yengo in the north, and Kurrajong Heights and Woodford in the Lower Blue Mountains.	1 – BioNet (1963)	Low – no recent records (<10 years ago) within 10km of the study area. The study area is beyond the current known geographical range for the species and no suitable habitat is present.
Epacris hamiltonii	-	E	E	Species		Occurs in the Blue Mountains, west of Sydney. Found at 72 sites within three creek catchments. The creeks occur in an altitude range of 810 - 940 m a.s.l. and are all located on the northern side of the escarpment and flow into the Grose Valley. All known sites occur within a radius of approximately 5 km. Has a very specific habitat, being found on or adjacent to Narrabeen sandstone cliffs alongside perennial creeks, often below plateau hanging swamps. The soil generally has a spongy/peat-like consistency, with a very high moisture content.	1 – BioNet (2014), PMST	Low – recent record (<10 years ago) within 10km of the study area, however specific habitat requirements are not present on site.
Epacris sparsa	-	V	V	Species		Restricted to the lower Grose River, within the Hawkesbury and Blue Mountains LGAs. Grows in Riparian Sandstone Scrub, where it is found on the base of cliffs or rock faces, on rock ledges or among rocks in the riparian flood zone. Grows in small pockets of damp clay soil, chiefly on south-west facing slopes.	PMST	Low – no records within 10km of the study area. No suitable habitat is present within the study area.
Euphrasia arguta	-	CE	CE	Species		*Euphrasia arguta* was rediscovered in the Nundle area of the NSW north western slopes and tablelands in 2008. Prior to this, it had not been	PMST	Low – No records within 10km of the study area. The study area is beyond the current known geographical range

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
						collected for 100 years. Historically, *Euphrasia arguta* has only been recorded from relatively few places within an area extending from Sydney to Bathurst and north to Walcha. The Royal Botanic Gardens Specimen Register records an additional location reported and vouchered in 2002 from near the Hastings River; and Euphrasia arguta was also recorded from the Barrington Tops in 2012.		for this species and no suitable habitat is present.
Genoplesium baueri	Yellow Gnat-orchid	E	E	Species		The species has been recorded from locations between Ulladulla and Port Stephens. About half the records were made before 1960 with most of the older records being from Sydney suburbs including Asquith, Cowan, Gladesville, Longueville and Wahroonga. No collections have been made from those sites in recent years. Currently the species is known from just over 200 plants across 13 sites. The species has been recorded at locations now likely to be within the following conservation reserves: Berowra Valley Regional Park, Royal National Park and Lane Cove National Park. May occur in the Woronora, O'Hares, Metropolitan and Warragamba Catchments. Grows in dry sclerophyll forest and moss gardens over sandstone.	PMST	Low – no records within 10km of the study area. The study area is beyond the current known geographical range for this species and no suitable habitat is present.
Haloragis exalata subsp. exalata	Wingless Raspwort	V	V	Species		Occurs in four widely scattered localities in eastern NSW including the Central Coast, South Coast and North Western Slopes botanical subdivisions of NSW. The species requires protected and shaded damp situations in riparian habitats.	PMST	Low – no records within 10km of the study area. The study area is beyond the current known geographical range for this species.
Haloragodendron lucasii	-	E	E	Species		The known locations of this species are confined to a very narrow distribution on the north shore of Sydney. Associated with dry sclerophyll forest. Reported to grow in moist sandy loam soils in	PMST	Low – no records within 10km of the study area. The study area is beyond the current known geographical range for this species.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
						sheltered aspects, and on gentle slopes below cliff-lines near creeks in low open woodland.		
Homoranthus darwinioides	-	V	V	Species		Rare in the central tablelands and western slopes of NSW, occurring from Putty to the Dubbo district. It is found west of Muswellbrook between Merriwa and Bylong, and north of Muswellbrook to Goonoo SCA. The species has been collected from Lee's Pinch, but not relocated at its original locality north of Mt Coricudgy above the headwaters of Widden Brook. Grows in various woodland habitats with shrubby understoreys, usually in gravelly sandy soils. Recorded growing on flat sunny ridge tops with scrubby woodland, sloping ridges, gentle south-facing slopes, and a slight depression on a roadside with loamy sand.	PMST	Low – no records within 10km of the study area. The study area is beyond the current known geographical range for this species and no suitable habitat is present.
Isopogon fletcheri	Fletcher's Drumsticks	V	V	Species		Restricted to a very small area in the Blackheath district of the Blue Mountains on the Central Tablelands. The entire known population occurs within Blue Mountains National Park. Restricted to moist sheltered cliffs within the spray zone of a waterfall. Grows in dry sclerophyll forest and heath on sandstone and is confined to sheltered moist positions.	131 – BioNet (2022), PMST	Low – although there are numerous recent records (<10 years ago) within 10km of the study area, these are located over 7 km to the south-west and the specific habitat requirements of this species are not present on site.
Kunzea cambagei	-	V	V	Species		*Kunzea cambagei* mainly occurs in the western and southern parts of the Blue Mountains, NSW, mainly the Yerranderie/Mt Werong area, with four main populations with 20 to 150 individuals. Populations are also located west of Berrima, along the Wingecarribee River; Loombah Plateau east of Mount Werong; the Oberon-Colong Stock Route within Kanangra-Boyd National Park (NP); and Wanganderry Plateau within the Nattai NP. Restricted to damp, sandy soils in wet heath or mallee open scrub at	PMST	Low – no records within 10km of the study area. The study area is beyond the current known geographical range of the species.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
						higher altitudes on sandstone outcrops or Silurian group sediments.		
Lastreopsis hispida	Bristly Shield Fern	E	-	Species		Rare in NSW with the only recent confirmed records from Mt Wilson in the Blue Mountains. Also occurs in southern Victoria and Tasmania, and is common in New Zealand. Grows in moist humus-rich soils in wet forest and rainforest gullies.	3 – BioNet (1979), BAM-C (Candidate)	Moderate – although there are no recent records (<10 years ago) within 10km of the study area, there is a record from Mount Wilson (4 km north-west of the site) in 2011 and suitable habitat is present in PCT 3209.
Leionema lachnaeoides	-	E	E	Species		Occurs at 10 sites in the upper Blue Mountains, within a 12 km range between Katoomba and Blackheath. Potential habitat occurs in the Megalong and Jamison Valleys. Occurs on exposed sandstone cliff tops and terraces, at 960 – 1000m altitude and with asepcts from south-east to south-west. Habitat vegetation is montane heath and commonly includes *Eucalyptus stricta, Allocasuarina nana, Dillwynia retorta, Epacris microphylla* and *Caustis flexuosa*.	PMST	Low – no records within 10km of the study area. The study area is beyond the current known geographical range of the species.
Leucopogon exolasius		V	V	Species		Woronora Beard-heath is found along the upper Georges River area and in Heathcote National Park. Occurs in woodland on sandstone.	1 – BioNet (2012)	Low – recent record (<10 years ago) with 10km of the study area but no suitable habitat is present.
Melaleuca deanei	Deane's Melaleuca	V	V	Species		Species occurs in two distinct areas, Ku-ring-gai/Berowra and Holsworthy/Wedderburn. There are also isolated occurrences in Springwood, Wollemi National Park, Yalwal and Central Coast (Hawkesbury River areas). Occurs mostly in ridgetop woodland, with only 5% of sites in heath and sandstone.	PMST	Low – no records within 10km of the study area. Study area is beyond the current known geographical range of the species.
Persicaria elatior	Knotweed, Tall Knotweed	V	V	Species		Recorded in south-eastern NSW (Mt Dromedary (an old record), Moruya State Forest near Turlinjah, the Upper Avon River catchment north of Robertson, Bermagui, and Picton Lakes. In	PMST	Low – no records within 10km of the study area. Study area is beyond the current known geographical range of the species.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
						northern NSW it is known from Raymond Terrace (near Newcastle) and the Grafton area (Cherry Tree and Gibberagee State Forests). The species also occurs in Queensland. Typically grows in damp places, especially beside streams and lakes. Occasionally is found in swamp forest or associated with disturbance.		
Persoonia acerosa	Needle Geebung	V	V	Species		The Needle Geebung has been recorded only on the central coast and in the Blue Mountains, from Mt Tomah in the north to as far south as Hill Top where it is now believed to be extinct. Mainly in the Katoomba/ Wentworth Falls/ Springwood area. Occurs in dry sclerophyll forest, scrubby low-woodland and heath on low fertility soils.	7 – BioNet (1999), PMST	Low – no recent records (<10 years ago) within 10km of the study area and no suitable habitat is present.
Persoonia hirsuta	Hairy Geebung, Hairy Persoonia	E	E	Species		*Persoonia hirsuta* has a scattered distribution around Sydney. The species is distributed from Singleton in the north, along the east coast to Hilltop in the south west, Dombarton in the south east and the Blue Mountains to the west. *Persoonia hirsuta* has a large area of occurrence, but occurs in small populations or isolated individuals, increasing the species' fragmentation in the landscape. Occurs in clayey and sandy soils in dry sclerophyll open forest, woodland and heath, primarily on the Mittagong Formation and on the upper Hawkesbury Sandstone.	PMST	Low – no records within 10km of the study area and no suitable habitat is present.
Prasophyllum fuscum	Tawny Leek-orchid, Slaty Leek-orchid	CE	V	Species		The species is believed to be confined to the Blue Mountains area, although some authorities believe Prasophyllum species from this area are not *P. fuscum*, but an undescribed species. Grows in moist heath, often along seepage lines. The known population grows in moist sandy soil over sandstone amongst sedges and grasses in an area that appears to be regularly slashed by the local council.	1 – BioNet (2001), PMST	Low – no recent records (<10 years ago) within 10km of the study area and no suitable habitat is present.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
Prasophyllum pallens		V	-	Species		*P. pallens* is endemic to New South Wales where it is known only from the Blue Mountains, west of Sydney. The species is presently known from four distinct populations: Mt Banks and Mt Hay in Blue Mountains National Park, and near the townships of Blackheath and Wentworth Falls. Historical records suggest that it once occurred near Leura, Bell and Mount Victoria, although these townships have expanded since the species was collected and it is unclear whether these populations persist. Grows in dense low heath, often along seepage lines, in moist to wet shallow sandy soils over sandstone, mostly at altitudes greater than 900m above sea level.	6 – BioNet (2020)	Low – although there are several recent records (<10 years ago) within 10km of the study area, these are located over 6 km to the south-west and no suitable habitat is present on the site.
Pultenaea glabra	Smooth Bush-pea	V	V	Species		Restricted to the higher Blue Mountains and has been recorded from the Katoomba-Hazelbrook and Mount Victoria areas, with unconfirmed sightings in the Mount Wilson and Mount Irvine areas. All known populations occur within the Blue Mountains Local Government Area. Primarily associated with riparian or swamp habitat areas in the mid to upper altitudes of the central Blue Mountains on sandstone derived soils. Grows in swamp margins, hillslopes, gullies and creekbanks and occurs within dry sclerophyll forest and tall damp heath on sandstone.	7 – BioNet (2019), PMST	Low – although there are several recent records (<10 years ago) within 10km of the study area, no suitable habitat is present on the site.
Rhizanthella slateri	Eastern Underground Orchid	V	E	Species		Occurs from south-east Queensland to south-east NSW. In NSW, currently known from fewer than 10 locations, including near Bulahdelah, the Watagan Mountains, the Blue Mountains, Wiseman's Ferry area, Agnes Banks and near Nowra. Known to occur in sclerophyll forest, although habitat requirements are poorly understood and no particular vegetation type has been associated with the species.	PMST	Low – no records within 10km of the study area and no suitable habitat is present on the site.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
Rhodamnia rubescens	Scrub Turpentine, Brown Malletwood	CE	CE	Species		Occurs in coastal districts north from Batemans Bay in New South Wales, approximately 280 km south of Sydney, to areas inland of Bundaberg in Queensland. Populations of *R. rubescens* typically occur in coastal regions and occasionally extend inland onto escarpments up to 600m above sea level. in areas with rainfall of 1,000-1,600 mm. Found in littoral, warm temperate and subtropical rainforest and wet sclerophyll forest usually on volcanic and sedimentary soils.	PMST	Low – no records within 10km of the study area. Suitable habitat is present in PCT 3209, however the site is at higher altitude than the species is known to occur at.
Thesium australe	Austral Toadflax, Toadflax	V	V	Species		Found in small populations scattered across eastern NSW, the coast, and the Northern and Southern Tablelands. Populations occur in grassland on coastal headlands or grassland and grassy woodland away from the coast. The species is often found in association with Kangaroo Grass (Themeda australis).	PMST	Low – no records within 10km of the study area and no suitable habitat is present.
Velleia perfoliata	-	V	V	Species		Only known from the Hawkesbury district and upper Hunter Valley. Found in shallow depressions on Hawkesbury sandstone shelves, on rocky hill sides, under cliffs or on rocky/sandy soils along tracks and trails.	PMST	Low – no records within 10km of the study area and no suitable habitat is present.
Veronica blakelyi	Veronica blakelyi	V	-	Species		Restricted to the western Blue Mountains, near Clarence, near Mt Horrible, on Nullo Mountain and in the Coricudgy Range. Over this range, occurrences are patchy and generally small in in size. Occurs in eucalypt forest, often in moist and sheltered areas. Associated canopy species include *Eucalyptus dives*, *E. dalrympleana*, *E. rossii* and *E. pauciflora*.	BAM-C (Candidate)	Low – no records within 10km of the study area. Suitable habitat is present in PCT 3209.
Wollemia nobilis	Wollemi Pine	CE	CE	Species		Restricted to remote canyons in the Wollemi National Park, north-west of Sydney. Occurs in warm temperate rainforest and rainforest margins in remote sandstone canyons.	PMST	Low – no records within 10km of the study area. The study area is beyond the current known geographical range of the species.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
Xanthosia scopulicola		V	-	Species		Known only from scattered locations between Kings Tableland (Wentworth Falls) and Boars Head rock (west of Katoomba) in the Blue Mountains. Most populations are within Blue Mountains National Park, though only near the boundary of the reserve. Grows in cracks and crevices of sandstone cliff faces or on rocky outcrops above the cliffs.	12 – BioNet (2022)	Low – recent records (<10 years ago) within 10km of the study area, however specific habitat requirements are not present on site.
Xerochrysum palustre	Swamp Everlasting, Swamp Paper Daisy	-	V	Species		Grows in swamps and bogs which are often dominated by heaths and also at the edges of bog margins on peaty soils with a cover of shrubs and grasses. Found in Kosciuszko National Park and the eastern escarpment south of Badja. Also found in eastern Victoria.	PMST	Low – no records within 10km of the study area and no suitable habitat is present.
Zieria involucrata	-	E	V	Species		Has a disjunct distribution north and west of Sydney, in the Baulkham Hills, Hawkesbury, Hornsby and Blue Mountains local government areas. Recent records for the species come from 22 populations in the catchments of the Macdonald, Colo and Hawkesbury Rivers between Melon Creek and Mogo Creek in the north to Little Cattai Creek (Hillside) and Wheeny Creek (Colo) in the south and from a single population in the upper Blue Mountains north of Katoomba. In addition, historical records exist for at least two other localities in the eastern Blue Mountains: south of Springwood Valley Heights and north-west of Kurrajong. Occurs primarily on Hawkesbury sandstone, in sheltered forests on mid- to lower slopes and valleys. The canopy typically includes *Syncarpia glomulifera* subsp. *Glomulifera* (Turpentine), *Angophora costata* (Smooth-barked Apple), *Eucalyptus agglomerata* (Blue-leaved Stringybark) and *Allocasuarina torulosa* (Forest Oak).	PMST	Low – no records within 10km of the study area and no suitable habitat is present.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
Zieria murphyi	Velvet Zieria	V	V	Species		Velvet Zieria is found in the Blue Mountains at Mt Tomah and in the southern highlands where it has been recorded in Morton National Park in the Bundanoon area, and at Penrose. Several populations of fewer than 1000 plants are known to occur in both the Blue Mountains and Morton National Parks. The few populations in the Penrose area are believed to be within Morton NP and the largest is between 250 and 500 plants, but the others are much smaller. Found in sheltered positions in moist gullies in moist eucalypt forest with sandy soil.	8 – BioNet (2015), PMST	Moderate – recent records (<10 years ago) within 10km of the study area. The species is known to be associated with PCT 3209, however specific habitat requirements may not be present on the site.
Birds								
Artamus cyanopterus cyanopterus	Dusky Woodswallow	V	-	Ecosystem		Dusky Woodswallow is widespread in eastern, southern and south western Australia. The species occurs throughout most of New South Wales, but is sparsely scattered in, or largely absent from, much of the upper western region. Most breeding activity occurs on the western slopes of the Great Dividing Range. Primarily inhabit dry, open eucalypt forests and woodlands, including mallee associations, with an open or sparse understorey of eucalypt saplings, acacias and other shrubs, and ground-cover of grasses or sedges and fallen woody debris. It has also been recorded in shrublands, heathlands and very occasionally in moist forest or rainforest. Also found in farmland, usually at the edges of forest or woodland.	BAM-C (Predicted)	Low – no records within 10km of the study area.
Anthochaera phrygia	Regent Honeyeater	CE	CE	Species/ Ecosystem	Habitat: As per mapped areas	The Regent Honeyeater mainly inhabits temperate woodlands and open forests of the inland slopes of south-east Australia. The species is also found in drier coastal woodlands and forests. The species range has contracted to between north-eastern Victoria and south-eastern Queensland. There are only three known key breeding regions remaining: North-east	PMST	Low – no records within 10km of the study area.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
						Victoria (Chiltern – Albury) and the Capertee Valley and Bundarra-Barraba region in NSW. In NSW, the distribution is very patchy and mainly confined to the two listed breeding areas and surrounding fragmented woodlands. In some years, flocks converge on flowering coastal woodlands and forests. The species inhabits dry open forest and woodland, particularly Box-Ironbark woodland, and riparian forests of River Sheoak. Regent Honeyeaters inhabit woodlands that support a significantly high abundance and species richness of bird species; these woodlands generally have a large number of mature trees, high canopy cover, and an abundance of mistletoes. Nonbreeding flocks are observed foraging in flowering coastal Swamp Mahogany and Spotted Gum forests, particularly on the Central Coast and occasionally on the upper North Coast. Individuals are occasionally seen on the South Coast. In the last decade, the species has been recorded in urban areas around Albury where Mugga Ironbark and Yellow Box were planted 20 years ago. Key eucalypt species include Mugga Ironbark, Yellow Box, White Box and Swamp Mahogany. Other tree species may be regionally important.		
Callocephalon fimbriatum	Gang-gang Cockatoo	V	E	Species/ Ecosystem	Habitat: Hollows in Eucalypt trees with >9cm diameter	The Gang-gang Cockatoo is distributed from southern Victoria through south and central-eastern NSW. In NSW, the species is distributed from the southeast coast to the Hunter region, and inland to the Central Tablelands and south-west slopes. The Gang-gang Cockatoo occurs regularly in the ACT and is rare at the extremities of its range, with isolated records known from as far north as Coffs Harbour and as far west as Mudgee. During spring and summer, the species is generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In	20 – BioNet (2020), PMST, BAM-C (Candidate), BAM-C (Predicted)	Moderate - The species has recently (<10 years ago) been recorded within 10km of the study area and the study area contains marginally suitable habitat for the species including breeding habitat.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
						autumn and winter, the species typically moves to lower altitudes to inhabit drier, open eucalypt forests and woodlands (particularly Box-Gum and Box-Ironbark assemblages) or in dry forest in coastal and urban areas. It may also occur in sub-alpine Snow Gum (Eucalyptus pauciflora) woodland, and occasionally in temperate rainforests. The species favours old growth forest and woodland for nesting and roosting.		
Calyptorhynchus lathami lathami	Glossy Black-Cockatoo	V	V	Species/ Ecosystem	Habitat: Hollows >15cm diameter in live or dead trees >8m above ground	The Glossy Black-Cockatoo is widespread but uncommon throughout suitable forest and woodland habitats from the central Queensland coast to East Gippsland in Victoria, and inland to the southern tablelands and central western plains of NSW, with a small population in the Riverina. An isolated population also exists on Kangaroo Island in South Australia. The species inhabits open forest and woodlands of the coast and the Great Dividing Range where stands of Sheoak occur. The species feeds almost exclusively on Casuarina and Allocasuarina species, with Black Sheoak (*Allocasuarina littoralis*) and Forest Sheoak (*A. torulosa*) being important foraging resources for the species. Inland populations feed on a wider range of Sheoaks, and Belah may also be a critical food source for some populations. In the Riverina, birds are associated with hills and rocky rises supporting Drooping Sheoak and Belah.	2 – BioNet (2007), PMST, BAM-C (Candidate), BAM-C (Predicted)	Low – the species has specific habitat requirements that are not present within the study area.
Climacteris picumnus	Brown Treecreeper	V	-	Ecosystem		The species is endemic to eastern Australia and occurs in eucalypt forests and woodlands of inland plains and slopes of the Great Dividing Range. It is less commonly found on coastal plains and ranges.	2 – BioNet (2019)	Moderate - the species has recently (<10 years ago) been recorded within 10km of the study area and the study area contains marginally suitable habitat for the species.
Daphoenositta chrysoptera	Varied Sittella	V	-	Ecosystem		The Varied Sittella is sedentary and inhabits most of mainland Australia except the treeless deserts and open grasslands. Distribution in	1 – BioNet (2002),	Low – the species has not been recorded within 10km of the study area since 2002.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
						NSW is nearly continuous from the coast to the far west. The Varied Sittella's population size in NSW is uncertain but is believed to have undergone a moderate reduction over the past several decades. The species inhabits eucalypt forests and woodlands, especially those containing rough-barked species and mature smooth-barked gums with dead branches, Mallee and Acacia woodland.	BAM-C (Predicted)	
Erythrotriorchis radiatus	Red Goshawk	CE	V	Species		The Red Goshawk is distributed sparsely through northern and eastern Australia, from the western Kimberley Division of northern Western Australia to north-eastern Queensland and south to far north-eastern NSW, and with scattered records in central Australia. The species is very rare in NSW, extending south to about 30°S, with most records north of this, in the Clarence River Catchment, and a few around the lower Richmond and Tweed Rivers. Formerly, it was at least occasionally reported as far south as Port Stephens.	PMST	Low – no records within 10km of the study area.
Falco hypoleucos	Grey Falcon	E	V	Ecosystem		The Grey Falcon is sparsely distributed in NSW, primarily throughout the Murray-Darling Basin, with the occasional vagrant east of the Great Dividing Range. The breeding range has contracted since the 1950s with most breeding now confined to arid parts of the range. There are possibly less than 5000 individuals left. Population trends are unclear, though it is believed to be extinct in areas with more than 500mm rainfall in NSW.	PMST	Low – no records within 10km of the study area.
Falco subniger	Black Falcon	V	-	Ecosystem		The Black Falcon is widely, but sparsely, distributed in NSW, mostly occurring in inland regions. Some reports of 'Black Falcons' on the tablelands and coast of New South Wales likely refer to the Brown Falcon. In New South Wales there is assumed to be a single population that is	1 – BioNet (2001)	Low – the species has not been recorded within 10km of the study area since 2001.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
						continuous with a broader continental population, given that falcons are highly mobile, commonly travelling hundreds of kilometres (Marchant & Higgins 1993). The Black Falcon occurs as solitary individuals, in pairs, or in family groups of parents and offspring.		
Glossopsitta pusilla	Little Lorikeet	V	-	Ecosystem		The Little Lorikeet is distributed widely across the coastal and Great Divide regions of eastern Australia from Cape York to South Australia. In NSW, lorikeets are found westward as far as Dubbo and Albury, and the State provides a large portion of the species core habitat. The Little Lorikeet forages primarily in the canopy of open Eucalyptus forest and woodland, yet also finds food in Angophora, Melaleuca and other tree species. Riparian habitats are highly used, due to higher soil fertility and greater productivity. The species targets isolated flowering trees in open country, such as in paddocks or in roadside remnants and street trees, which help sustain viable populations.	1 – BioNet (2001), BAM-C (Predicted)	Low – the species has not been recorded in the study area since 2001. However, the study area contains suitable habitat for the species.
Grantiella picta	Painted Honeyeater	V	V	Ecosystem		The Painted Honeyeater is nomadic and occurs at low densities throughout its range. The greatest concentrations of Painted Honeyeater, as well as all breeding events, occur on the inland slopes of the Great Dividing Range in NSW, Victoria and southern Queensland. During the winter, it is more likely to be found in the north of its range. The species inhabits Boree/Weeping Myall (Acacia pendula), Brigalow (A. harpophylla), Box-Gum Woodlands and Box-Ironbark Forests. The Painted Honeyeater is also a specialist feeder on the fruits of mistletoes growing on woodland eucalypts and acacias; preferring mistletoes of the genus Amyema.	1 – BioNet (2009), PMST	Low – the species has been recorded within 10km of the study area since 2009 (>10 years ago). However, the study area contains suitable habitat for the species.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
Hieraaetus morphnoides	Little Eagle	V	-	Species/ Ecosystem	Habitat: Nest trees – live (occasionally dead) large old trees within vegetation	The Little Eagle is found throughout the Australian mainland excepting the most densely forested parts of the Dividing Range escarpment. It occurs as a single population throughout NSW. It occupies open eucalypt forest, woodland or open woodland. Sheoak or Acacia woodlands and riparian woodlands of interior NSW are also used. The species nest in tall living trees within a remnant patch, where pairs build a large stick nest in winter.	2 – BioNet (2001), BAM-C (Candidate), BAM-C (Predicted)	Low – no recent records (<10 years ago) within 10km of the study area. However, suitable habitat is present within the study area.
Lathamus discolor	Swift Parrot	E	CE	Species/ Ecosystem	Habitat: As per mapped areas	The Swift Parrot breeds in Tasmania during spring and summer, migrating in the autumn and winter months to south-eastern Australia from Victoria and the eastern parts of South Australia to south-east Queensland. In NSW, it mostly occurs on the coast and south west slopes. On the mainland they occur in areas where eucalypts are flowering profusely or where there is abundant lerp (from sap-sucking bugs) infestations. Favoured feed trees include winter flowering species such as Swamp Mahogany (Eucalyptus robusta), Spotted Gum (Corymbia maculata), Red Bloodwood (C. gummifera), Mugga Ironbark (E. sideroxylon), and White Box (E. albens). Commonly used lerp infested trees include Inland Grey Box (E. microcarpa), Grey Box (E. moluccana) and Blackbutt (E. pilularis).	PMST	Low – no records within 10km of the study area.
Lophoictinia isura	Square-tailed Kite	V	-	Species/ Ecosystem		The Square-tailed Kite ranges along coastal and subcoastal areas from south-western to northern Australia, Queensland, NSW and Victoria. In NSW, scattered records of the species throughout the state indicate that the species is a regular resident in the north, north-east and along the major west-flowing river systems. It is a summer breeding migrant to the south-east, including the NSW south coast, arriving in September and leaving by March. Found in a variety of timbered habitats including dry woodlands and open	BAM-C (Candidate), BAM-C (Predicted)	Low – no records within 10km of the study area.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
						forests. Shows a particular preference for timbered watercourses.		
Melithreptus gularis gularis	Black-chinned Honeyeater	V	-	Ecosystem		The Black-chinned Honeyeater has two subspecies, with only the nominate (gularis) occurring in NSW. The other subspecies (laetior) was formerly considered a separate species (Golden-backed Honeyeater) and is found in northern Australia between central Queensland west to the Pilbara in Western Australia. The eastern subspecies extends south from central Queensland, through NSW, Victoria into south eastern South Australia, though it is very rare in the last state. In NSW it is widespread, with records from the tablelands and western slopes of the Great Dividing Range to the north-west and central-west plains and the Riverina. It is rarely recorded east of the Great Dividing Range, although regularly observed from the Richmond and Clarence River areas. It has also been recorded at a few scattered sites in the Hunter, Central Coast and Illawarra regions, though it is very rare in the latter.	1 – BioNet (1988)	Low – no recent records (<20 years ago) within 10km of the study area. However, suitable habitat is present within the study area.
Ninox connivens	Barking Owl			Species/ Ecosystem	Habitat: Hollows >20cm diameter in living or dead trees >4m above ground	The Barking Owl is found throughout continental Australia except for the central arid regions. Although still common in parts of northern Australia, the species has declined greatly in southern Australia and now occurs in a wide but sparse distribution in NSW. Core populations exist on the western slopes and plains and in some northeast coastal and escarpment forests. Many populations crashed as woodland on fertile soils was cleared over the past century, leaving linear riparian strips of remnant trees as the last inhabitable areas. Surveys in 2001 demonstrated that the Pilliga Forest supported the largest population in southern Australia. The owls sometimes extend their home range into	BAM-C (Candidate), BAM-C (Predicted)	Low – no records within 10km of the study area.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
						urban areas, hunting birds in garden trees and insects attracted to streetlights. Extensive wildfires in 2019-20 reduced habitat quality further, burnt many old, hollow-bearing trees needed as refuge by prey species and reduced the viability of some regional owl populations. Inhabits woodland and open forest, including fragmented remnants and partly cleared farmland. It is flexible in its habitat use, and hunting can extend in to closed forest and more open areas. Sometimes able to successfully breed along timbered watercourses in heavily cleared habitats (e.g. western NSW) due to the higher density of prey found on these fertile riparian soils.		
Ninox strenua	Powerful Owl	V	-	Species/ Ecosystem	Habitat: Hollows >20cm diameter in living or dead trees >4m above ground	The Powerful Owl is endemic to eastern and south-eastern Australia, mainly on the coastal side of the Great Dividing Range from Mackay to southwestern Victoria. In NSW, it is widely distributed throughout the eastern forests from the coast inland to tablelands, with scattered records on the western slopes and plains suggesting occupancy prior to land clearing. Throughout its eastern range is occurs at low densities and are rare along the Murray River. Former inland populations may never recover. The species inhabits a range of vegetation types, from woodland and open sclerophyll forest to tall open wet forest and rainforest. The Powerful Owl typically requires large tracts of forest or woodland habitat with dense wet gullies and creek areas but can also occur in fragmented landscapes. The species breeds and hunts in open or closed sclerophyll forest of woodlands and occasionally hunts in open habitats. It roosts by day in dense vegetation comprising species such as Turpentine (Syncarpia glomulifera), Black She-	3 – BioNet (2015), BAM-C (Candidate), BAM-C (Predicted)	High – the species has been recently recorded (<10 years ago) within 10km of the study area and suitable breeding and foraging habitat is present.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
						oak (Allocasuarina littoralis), Blackwood (Acacia melanoxylon), Rough-barked Apple (Angophora floribunda), Cherry Ballart (Exocarpos cupressiformis) and a number of eucalypt species. The Powerful Owl requires large, mature trees with hollows for breeding, and dense areas of vegetation for foraging and roosting.		
Petroica boodang	Scarlet Robin	V	-	Ecosystem		The Scarlet Robin is found from southeast Queensland to south-east South Australia and in Tasmania, and southwest Western Australia. In NSW, it occurs from the coast to the inland slopes. After breeding, some Scarlet Robins disperse to the lower valleys and plains of the tablelands and slopes. Some birds may appear as far west as the eastern edges of the inland plains in autumn and winter. The species inhabits dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. The species lives in both mature and regrowth vegetation, occasionally occurring in mallee or wet forest communities, or in wetlands and tea-tree swamps. Abundant logs and fallen timber are key components of the species habitat. In autumn and winter, the Scarlet Robin may occupy open grassy woodlands and grasslands or grazed paddocks with scattered trees.	15 – BioNet (2018), BAM-C (Predicted)	Moderate – the species has recently (<10 years ago) been recorded within 10km of the study area and the study area contains marginally suitable habitat for the species.
Petroica phoenicea	Flame Robin	V	-	Ecosystem		The Flame Robin is endemic to southeastern Australia, ranging from the Queensland border to south-east South Australia and Tasmania. In NSW, it breeds in upland areas and in winter, many birds move to the inland slopes and plains. It is likely that there are two separate populations in NSW: one in the Northern Tablelands, and one ranging from the Central to Southern Tablelands. The species breeds in upland tall moist eucalypt forests and woodlands, often of ridges and slopes. The Flame	40 – BioNet (2020), BAM-C (Predicted)	Moderate – the species has been recently recorded (<10 years ago) within 10km of the study area and marginally suitable habitat is present.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
						Robin prefers clearings or areas with open understoreys and are often found in recently burnt areas. The species occasionally occurs in temperate rainforest, as well as herbfields, heathlands, shrublands and sedgelands at high altitudes. Breeding habitat is typically dominated by native grasses and the shrub layer may either be sparse or dense.		
Pycnoptilus floccosus	Pilotbird	-	V	N/A		The Pilotbird occurs from the Blue Mountains National Park and Wollemi National park in New South Wales and extends to the Dandenong Ranges in Victoria. The species occupies temperate wet sclerophyll forests and occasionally temperate rainforest, where dense undergrowth occurs.	13 – BioNet (2019), PMST	Low – the species has been recently recorded (<10 years ago) within 10km of the study area, however suitable habitat is not present within the study area.
Stagonopleura guttata	Diamond Firetail	V	-	Ecosystem		The Diamond Firetail is endemic to south-eastern Australia, extending from central Queensland to the Eyre Peninsula in South Australia. It is widely distributed in NSW, with a concentration of records from the Northern, Central and Southern Tablelands, the Northern, Central and Southwestern Slopes and the North West Plains and Riverina. Not commonly found in coastal districts, though there are records from near Sydney, the Hunter Valley and the Bega Valley. This species has a scattered distribution over the rest of NSW, though is very rare west of the Darling River. The species is found in grassy eucalypt woodlands, including Box-Gum Woodlands and Snow Gum Eucalyptus pauciflora Woodlands. Also occurs in open forest, mallee, Natural Temperate Grassland, and in secondary grassland derived from other communities.	1 – BioNet (2009)	Low – the species has been recorded in the past 20 years within 10km of the study area and the study area contains marginally suitable habitat for the species.
Tyto novaehollandiae	Masked Owl	V	-	Species/ Ecosystem	Habitat: Hollows >20cm diameter in	The Masked Owl is most abundant on the coast but extends to the western plains. About 90% of overall records occur within NSW, excluding the most arid north-western corner. The species	1 – BioNet (2001), BAM-C (Candidate),	Low – the species has not been recorded since 2001 within 10km of the study area. However, the study

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
					live or dead trees	occupies dry, eucalypt forests and woodlands up to 1,100m altitude. The Masked Owl typically prefers open forest with low shrub density and requires old trees for roosting and nesting.	BAM-C (Predicted)	area contains suitable breeding and foraging habitat.
Tyto tenebricosa	Sooty Owl	V	-	Species/ Ecosystem	Habitat: Caves or cliff lines/ledges, and live or dead trees with hollows >20cm.	Occupies the easternmost one-eighth of NSW, occurring on the coast, coastal escarpment and eastern tablelands. Territories are occupied permanently. Occurs in rainforest, including dry rainforest, subtropical and warm temperate rainforest, as well as moist eucalypt forests.	5 – BioNet (2018), BAM-C (Candidate) & BAM-C (Predicted) for PCT 706. Not associated with PCT 3209	Low – the species has been recently recorded (<10 years ago) within 10km of the study area but no suitable habitat/associated PCTs.
Mammals								
Cercartetus nanus	Eastern Pygmy-possum	V	-	Species		The Eastern Pygmy Possum is found in south-eastern Australia, from southern Queensland to eastern South Australia and in Tasmania. In NSW, the species is found from the coast to inland on the western slopes, around the Pilliga, Dubbo, Parkes and Wagga Wagga. The Eastern Pygmy Possum is found in a broad range of habitats from rainforest through sclerophyll (including Box-Ironbark) forest and woodland to heath. Woodlands and heath appear to be preferred, except in north-eastern NSW where they are most frequently found in rainforests. The species feeds largely on nectar and pollen collected from banksias, eucalypts and bottlebrushes; an important pollinator of heathland plants such as banksias; soft fruits are eaten when flowers are unavailable. Shelters in tree hollows, rotten stumps, holes in the ground, abandoned bird-nests, Ringtail Possum (*Pseudocheirus peregrinus*) dreys or thickets of vegetation, (eg grass-tree skirts); nest-building	1 – BioNet (2018), BAM-C (Candidate)	Moderate – the species has been recently recorded (<5 years ago) within 10km of the study area and marginally suitable habitat is present.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
						appears to be restricted to breeding females; tree hollows are favoured but spherical nests have been found under the bark of eucalypts and in shredded bark in tree forks.		
Chalinolobus dwyeri	Large-eared Pied Bat	V	V	Species	Habitat: Cliffs, within 2km of rocky areas containing caves, escarpments, overhangs, outcrops, crevices, or within 2km of old mines and tunnels	The Large-eared Pied Bat is found mainly in areas with extensive cliffs and caves, and in well-timbered areas containing gullies, from Rockhampton in Queensland to Bungonia in the NSW Southern Highlands. In NSW, the species is generally rare with a very patchy distribution. Scattered records exist from the New England Tablelands and North West Slopes. The species roosts in cave entrances, crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of Fairy Martins (Petrochelidon ariel), frequenting low to mid-elevation dry open forest and woodland close to these features.	4 – BioNet (2018), PMST, BAM-C (Candidate)	Moderate – the species has recently (<10 years) been recorded within 10km of the study area and the study area contains marginally suitable habitat for the species (foraging habitat only).
Dasyurus maculatus maculatus (SE mainland population)	Spotted-tailed Quoll	V	E	Ecosystem		The range of the Spotted-tailed Quoll has contracted considerably since European settlement. It is now found in eastern NSW, eastern Victoria, southeast and north-eastern Queensland, and Tasmania. Only in Tasmania is it still considered relatively common. The species has been recorded across a range of habitat types, including rainforest, open forest, woodland, coastal heath and inland riparian forest, from the sub-alpine zone to the coastline. Individual animals use hollow-bearing trees, fallen logs, small caves, rock outcrops and rocky-cliff faces as den study areas, and have communal latrine study areas; often on flat rocks among boulder fields, rocky cliff-faces or along rocky stream beds or banks.	18 – BioNet (2022), PMST, BAM-C (Predicted)	High – the species has recently (<5 years) been recorded within 10km of the study area and the study area contains suitable habitat for the species.
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V	-	Ecosystem		The Eastern False Pipistrelle is found on the south-east coast and ranges of Australia, from southern Queensland to Victoria and Tasmania. The species prefers moist habitats, with trees	2 – BioNet (2003), BAM-C (Predicted)	Low – the species was last recorded within 10km of the study area in 2003. The study area contains suitable habitat for the species.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
						over 20 m tall. The Eastern False Pipistrelle generally roosts in eucalypt hollows but has also been found under loose bark on trees, or in buildings.		
Isoodon obesulus obesulus	Southern Brown Bandicoot	E	E	Species	Habitat: Requires dense ground cover in a variety of habitats	The Southern Brown Bandicoot has a patchy distribution. It is found in southeastern NSW, east of the Great Dividing Range south from the Hawkesbury River, southern coastal Victoria and the Grampian Ranges, south-eastern South Australia, southwest Western Australia and the northern tip of Queensland. Southern Brown Bandicoots are largely crepuscular (active mainly after dusk and/or before dawn). They are generally only found in heath or open forest with a heathy understorey on sandy or friable soils.	PMST	Low – no records within 10km of the study area.
Micronomus norfolkensis	Eastern Coastal Free-tailed Bat	V	-	Ecosystem		The Eastern Coastal Free-tailed Bat is found along the east coast from south Queensland to southern NSW. The species occurs in dry sclerophyll forest, woodland, swamp forests and mangrove forests east of the Great Dividing Range. They roost mainly in tree hollows but will also roost under bark or in man-made structures.	1 – BioNet (2002)	Low – the species has not been recorded within 10km of the study area since 2002. The study area contains suitable habitat for the species.
Miniopterus australis	Little Bent-winged Bat	V	-	Species/ Ecosystem	Habitat: Caves, tunnel, mine, culvert or other structure known or suspected to be used for breeding.	The Little Bent-winged Bat occurs along the east coast of Australia, from Cape York in QLD to Wollongong in NSW. They inhabit moist ecualypt forest, rainforest, vine thicket, wet and dry sclerophyll forest, Melaleuca swamps, dense coastal forests and banksia scrub. The species is generally found in well-timbered areas. They roost during the day in caves, tunnels, tree hollows, abandoned mines, stormwater drains. Culverts, bridges and sometimes buildings.	BAM-C (Candidate), BAM-C (Predicted)	Low – no records within 10km of the study area.
Miniopterus orianae oceanensis	Large Bent-winged Bat	V	-	Species/ Ecosystem	Habitat: Caves, tunnel, mine, culvert	The Large Bent-winged Bat (formerly the Eastern Bentwing-bat) occurs along the east and north-west coasts of Australia. Their primary	4 – BioNet (2014), BAM-C	Low – the species has recently (<10 years ago) been recorded within 10km of the study area, however

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
					or other structure known or suspected to be used for breeding.	roosting habitat are caves, but the species is also known to use derelict mines, stormwater tunnels, buildings and other human-made structures.	(Candidate), BAM-C (Predicted)	specific habitat requirements are not present on site.
Myotis macropus	Southern Myotis	V	-	Species		The Southern Myotis is found in the coastal band from the north-west of Australia, across the top-end and south to western Victoria. It is rarely found more than 100 km inland, except along major rivers. The species generally roosts in groups of 10 - 15 close to water in caves, mine shafts, hollow bearing trees, storm water channels, buildings, under bridges and in dense foliage.	1 -BioNet (2002)	Low – the species has not been recorded within 10km of the study area since 2002 and the study area contains marginally suitable habitat for the species.
Notamacropus parma	Parma Wallaby	V	V	Species		The species once occurred in north-eastern NSW from the Queensland boarder to the Bega area in the southeast. Their range is now confined to the coast and ranges of central and northern NSW from the Gosford district to south of the Bruxner Highway between Tenterfield and Casino. The species' preferred habitat is moist eucalypt forest with thick, shrubby understorey, often with nearby grassy areas, rainforest margins and occasionally drier eucalypt forest.	PMST	Low – no records within 10km of the study area.
Petauroides volans	Greater Glider	-	E	Species	Habitat: Hollows	The Greater Glider is endemic to eastern Australia, ranging from Windsor Tableland in far northern Queensland to the Wombat Forest in central Victoria, except in altitudes above 1,200 m. The species is largely restricted to eucalypt forests and woodlands, with higher abundances occurring in taller, denser, montane, moist eucalypt forests with old trees and abundant hollows.	10 – BioNet (2018), PMST, BAM-C (Candidate)	High – the species has recently (<5 years ago) been recorded within 10km of the study area and the study area contains suitable habitat for the species.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
Petaurus australis	Yellow-bellied Glider	V	V	Ecosystem		The Yellow-bellied Glider is found along the eastern coast to the western slopes of the Great Dividing Range, from southern Queensland to Victoria. Occur in tall mature eucalypt forest generally in areas with high rainfall and nutrient rich soils. Forest type preferences vary with latitude and elevation; mixed coastal forests to dry escarpment forests in the north; moist coastal gullies and creek flats to tall montane forests in the south. Feed primarily on plant and insect exudates, including nectar, sap, honeydew and manna with pollen and insects providing protein. Extract sap by incising (or biting into) the trunks and branches of favoured food trees, often leaving a distinctive 'V'-shaped scar.	PMST, BAM-C (Predicted)	Low – no records within 10km of the study area.
Petrogale penicillata	Brush-tailed Rock-wallaby	E	V	Species	Habitat: Land within 1km of rocky escarpments, gorges, steep slopes, bolder piles, rock outcrops or cliff lines	The Brush-tailed Rock-wallaby is distributed from south-east Queensland to the Grampians in western Victoria, roughly following the lines of the Great Diving Range. In NSW, the species occurs from the Queensland border in the north, to Shoalhaven in the south. The population in the Warrumbungle Ranges is the western limit of the species range. Brush-tailed Rock-wallaby occupy rocky escarpments, outcrops and cliffs with a preference for complex structures with fissures, caves and ledges often facing north.	3 – BioNet (1993), PMST, BAM-C (Candidate)	Low – no recent records (<10 years ago) within 10km of the study area and study area does not contain habitat.
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)	Koala	E	E	Species		The Koala has a fragmented distribution throughout eastern Australia from north-east Queensland to the Eyre Peninsula in South Australia. In NSW, it mainly occurs on the central and north coasts with some populations in the west of the Great Dividing Range. It also has sparse and possibly disjunct populations in the Southern Tablelands. The Koala is also known from several study areas on the Southern Tablelands. The species inhabits eucalypt woodlands and forests, and feeds on select species; about 70 eucalypt species and 30 non-	15 – BioNet (2014), PMST, BAM-C (Candidate)	Moderate – species was recently recorded (<10 years ago) within 10km of the study area and some parts of the study area could contain suitable habitat (*E. radiata* at Slope 33459).

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
						eucalypt species but will select preferred browse species in any one area.		
Pseudomys novaehollandiae	New Holland Mouse	-	V	Ecosystem		The New Holland Mouse has a fragmented distribution across Tasmania, Victoria, NSW and Queensland. The species is known to inhabit open heathlands, woodlands and forests with a heathland understorey and vegetated sand dunes.	PMST, BAM-C (Predicted)	Low – no records within 10km of the study area.
Pteropus poliocephalus	Grey-headed Flying-fox	V	V	Species/ Ecosystem	Habitat: Breeding camps	The Grey-headed Flying-fox is generally found within 200 km of the coast in eastern Australia, from Rockhampton in Queensland to Adelaide in South Australia. In times of natural resource shortages, the species can occur in unusual locations. The Grey-headed Flying-fox occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps as well as urban gardens and cultivated fruit crops. Roosting camps are generally located within 20 km of regular food sources, and are commonly found in gullies, close to water, in vegetation with a dense canopy. Study area fidelity to camps are high, and the species travels up to 50 km from these camps to forage, typically commuting distances up to 20 km from the camp study area.	1 – BioNet (2007), PMST	Low – no recent records (<10 years ago) within 10km of the study area. Suitable habitat is present in the study area, however the nearest camps are at least 25km away. The species is unlikely to maintain a resident population in the study area, however may occasionally utilise resources within the study area.
Saccolaimus flaviventris	Yellow-bellied Sheathtail-bat	V	-	Ecosystem		The Yellow-bellied Sheathtail-bat is a wide ranging species found across northern and eastern Australia. In the most southerly part of its range - most of Victoria, south-western NSW and adjacent South Australia - it is a rare visitor in late summer and autumn. There are scattered records of this species across the New England Tablelands and North West Slopes. The species roosts singly or in groups of up to six, in tree hollows and buildings; in treeless areas they are known to utilise mammal burrows.	1 – BioNet (2018), BAM-C (Predicted)	Moderate – the species was recently recorded (<10 years ago) within 10km of the study area and study area contains suitable habitat.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
Scoteanax rueppellii	Greater Broad-nosed Bat	V	-	Ecosystem		The Greater Broad-nosed Bat is found mainly in the gullies and river systems that drain the Great Diving Range, from north-eastern Victoria to the Atherton Tableland. The species extends to the coast over much of its range. In NSW, the Greater Broadnosed Bat is widespread over the New England Tablelands, however it does not occur at altitudes above 500 m. The species utilises a variety of habitats from woodland through to moist and dry eucalypt forest and rainforest, though it is most commonly found in tall wet forest. Although the species predominantly roosts in tree hollows, it has also been recorded roosting in buildings.	3 – BioNet (2003), BAM-C (Predicted)	Low – the species has not been recorded within 10km of the study area since 2003.
Amphibians								
Heleioporus australiacus	Giant Burrowing Frog	V	V	Species		The Giant Burrowing Frog is distributed in south eastern NSW and Victoria and appears to exist as two distinct populations: Northern (largely confined to the sandstone geology of the Sydney Basin, extending as far south as Ulladulla) and Southern (occurring from north of Narooma through to Walhalla, Victoria). The species is found in heath, woodland and open dry sclerophyll forest on a variety of soil types except those that are clay based. The Giant Burrowing Frog requires ephemeral and permanent freshwater wetlands, ponds and dams with an open aspect and fringed by Typha, as well as free from predatory fish. The species spends more than 95% of its time in non-breeding habitat, burrowing below the soil surface or in the leaf litter. Individuals occupy a series of burrow study areas, some of which are used repeatedly. Non-breeding study areas are usually located up to 300 m from breeding study areas, and home ranges are approximately 0.04 hectares in size.	1 – BioNet (2013), PMST	Low – limited number of recent Records (<10 years ago) within 10km of the study area and no suitable habitat is present on site.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
Litoria booroolongensis	Booroolong Frog	E	E	Species		The Booroolong Frog is restricted to NSW and north-eastern Victoria, predominantly along the western-flowing streams of the Great Dividing Range. It has disappeared from much of the Northern Tablelands, however several populations have recently been recorded in the Namoi catchment. The species is rare throughout most of the remainder of its range. They live along permanent streams with some fringing vegetation cover such as ferns, sedges or grasses. Adults occur on or near cobble banks and other rock structures within stream margins.	PMST	Low – no records within 10km of the study area and no suitable habitat is present.
Litoria littlejohni	Littlejohn's Tree Frog	V	E	Species		The Littlejohn's Tree Frog is distributed on plateaus and eastern slopes of the Great Diving Range, from Watagan State Forest in NSW, to Buchan in Victoria. Most records are from within the Sydney Basin Bioregion, with only scattered records south to the Victorian border. This species has not been recorded in southern NSW within the last decade. Records are isolated and tend to be at higher altitudes. The species breeds in the upper reaches of permanent streams and in perched swamps. Non-breeding habitat is heath-based forests and woodlands where it shelters under leaf litter and low vegetation.	1 – BioNet (1963), PMST, BAM-C (Candidate)	Low – no recent records (<10 years ago) within 10km of the study area.
Mixophyes balbus	Stuttering Frog	E	V	Species		Stuttering Frogs occur along the east coast of Australia from southern Queensland to north-eastern Victoria. Considered to have disappeared from Victoria and to have undergone considerable range contraction in NSW, particularly in south-east NSW. It is the only Mixophyes species that occurs in south-east NSW and in recent surveys it has only been recorded at three locations south of Sydney. The Dorrigo region, in northeast NSW, appears to be a stronghold for this species. Found in rainforest and wet, tall open forest in the foothills and	PMST, BAM-C (Candidate)	Low – no records or suitable habitat present in the study area.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
						escarpment on the eastern side of the Great Dividing Range.		
Mixophyes iteratus	Giant Barred Frog	E	E	Species		The Giant Barred Frog is distributed along the coast and ranges from Eumundi in south-east Queensland to Warrimoo in the Blue Mountains. Declines appear to have occurred at the margins of the species' range, with no recent records south of the Hawkesbury River and disappearances from a number of streams in QLD. Northern NSW, particularly the Coffs Harbour-Dorrigo area, is a stronghold. The species occurs along freshwater streams with permanent or semi-permanent water, generally (but not always) at lower elevation.	BAM-C (Candidate)	Low – no records within 10km of the study area and no suitable habitat is present.
Pseudophryne australis	Red-crowned Toadlet	V	-	Species		The Red-crowned Toadlet has a restricted distribution. It is confined to the Sydney Basin, from Pokolbin in the north, the Nowra area to the south, and west to Mt Victoria in the Blue Mountains. The species occurs in open forests, mostly on Hawkebury and Narrabeen Sandstones. Inhabits periodically wet drainage lines below sandstone ridges that often have shale lenses or cappings. Shelters under rocks and amongst masses of dense vegetation or thick piles of leaf litter. Breeding congregations occur in dense vegetation and debris beside ephemeral creeks and gutters. Red-crowned Toadlets have not been recorded breeding in waters that are even mildly polluted or with a pH outside the range 5.5 to 6.5.	7 – BioNet (2014)	Low – the species has been recently recorded (<10 years ago) within 10km of the study area, however no suitable habitat is present on site.
Reptiles								
Eulamprus leuraensis	Blue Mountains Water Skink	E	E	Species		The Blue Mountains Water Skink is restricted to the middle and upper Blue Mountains west of Sydney, the Blue Mountains Water Skink is known from approximately 70 threatened highland peat swamps extending	PMST	Low – no records within 10km of the study area.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
						from the Newnes Plateau in the north-west to just south of Hazelbrook in the south-east. It is possible that additional locations will be identified, and these may lie outside the currently known distribution. Recent genetic work has established that populations on the Newnes Plateau are genetically and morphologically distinct from populations in the Blue Mountains. Each local population is also genetically distinct, even from populations less than 0.5 km away. Dispersal between populations appears to be very rare and appears to involve mostly males. The species occurs at high elevations between 560 – 1140m. It is restricted to an isolated and naturally fragmented habitat of sedge and shrub swamps that have boggy soils and appear to be permanently wet. The vegetation in these swamps typically takes the form of a sedgeland interspersed with shrubs, but may occur as a dense shrub thicket.		
Hoplocephalus bungaroides	Broad-headed Snake	E	V	Species/ Ecosystem	Habitat: Rocky areas – including escarpments, outcrops and pagodas within the Sydney Sandstone geologies	The Broad-headed Snake is largely confined to Triassic and Permian sandstones, including the Hawkesbury, Narrabeen and Shoalhaven groups, within the coast and ranges in an area within approximately 250 km of Sydney. The species is nocturnal and shelters in rock crevices and under flat sandstone rocks on exposed cliff edges during autumn, winter and spring. Moves from the sandstone rocks to shelters in cervices or hollows in large trees within 500m of escarpments in summer. Feeds mostly on geckos and small skinks; will also eat frogs and small mammals occasionally.	11 – BioNet (2018), PMST	Low – the species has been recently recorded (<10 years ago) within 10km of the study area but no suitable habitat or associated PCTs present. Site does not contain rocky escarpments.
Invertebrates								

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
Petalura gigantea	Giant Dragonfly	E	-	Species		The Giant Dragonfly is found along the east coast of NSW from the Victorian border to northern NSW. It is not found west of the Great Dividing Range. There are known occurrences in the Blue Mountains and Southern Highlands, in the Clarence River catchment, and on a few coastal swamps from north of Coffs Harbour to Nadgee in the south. The species lives in permanent swamps and bogs with some free water and open vegetation.	2 – BioNet (2005)	Low – no recent records (<10 years ago) within 10km of the study area and no suitable habitat is present.
Fish								
Macquaria australasica	Macquarie Perch	-	E	N/A		Macquarie Perch have declined considerably from their historical distribution within NSW and they are now considered isolated to the upper reaches of the Lachlan and Murrumbidgee Rivers in southern NSW. It is also found in low number in the Mongarlowe River, where the population is considered likely to be the result of a translocation from the Murray-Darling Basin. Other populations exist in Cataract Dam in the Nepean River catchment, as well as a 2008 record from Georges River near Campbelltown, the first record from the river since 1894. The Macquarie Perch is a riverine, schooling species. It prefers clear water and deep, rocky holes with lots of cover. As well as aquatic vegetation, additional cover may comprise of large boulders, debris and overhanging banks	PMST	Low – no records within 10km of the study area and no suitable habitat is present.
Prototroctes maraena	Australian Grayling	-	V	N/A		Currently, the Australian Grayling occurs in streams and rivers on the eastern and southern flanks of the Great Dividing Range, from Sydney, southwards to the Otway Ranges of Victoria and in Tasmania. The species is found in fresh and brackish waters of coastal lagoons, from Shoalhaven River in NSW to Ewan Ponds in South Australia.	PMST	Low – no records within 10km of the study area and no suitable habitat is present.

Scientific name	Common name	Status		BAM credit type	Habitat constraints and/or geographic limitations	Distribution and habitat	Number of records (BioNet), latest record	Likelihood of occurrence
		BC Act	EPBC Act					
Migratory species								
Apus pacificus	Fork-tailed Swift	-	M	N/A		In NSW, the Fork-tailed Swift is recorded in all regions. They often occur over cliffs and beaches and also over islands and sometimes well out to sea. They also occur over settled areas, including towns, urban areas and cities. They mostly occur over dry or open habitats, including riparian woodland and tea-tree swamps, low scrub, heathland or saltmarsh. They are also found at treeless grassland and sandplains covered with spinifex, open farmland and inland and coastal sand-dunes. The sometimes occur above rainforests, wet sclerophyll forest or open forest or plantations of pines. They forage aerially, up to hundreds of metres above ground, but also less than 1 m above open areas or over water.	1 – BioNet (2001)	Low – migratory species. One recent record (<20 years ago) within 10km of the study area and limited suitable habitat is present.
Hirundapus caudacutus	White-throated Needletail	-	V, M	Ecosystem		White-throated Needletails are nonbreeding migrants in Australia between late spring and early autumn, but most common in summer. The species often occur in large numbers over eastern and northern Australia. White-throated Needletails are aerial birds and for a time it was commonly believed that they did not land while in Australia. It has now been observed that birds will roost in trees, and radio-tracking has since confirmed that this is a regular activity.	PMST	Low – migratory species and no records within 10km of the study area.

Appendix C: Plot-based field data sheets

Appendix D: Tests of Significance (BC Act)

Appendix E: Assessments of significance (EPBC Act)

Appendix F: Biodiversity credit reports

Appendix G: Protected Matter Search Tool Report

NSW GOVERNMENT

Appendix E – Statement of Heritage Impacts

artefact

24 February 2023

Rachel Perry
Senior Environmental Consultant
Arcadis

Dear Rachel,

Re: Bells Line of Road Slope Stabilisation Review of Environmental Factors: Non-Aboriginal (Historical) Statement of Heritage Impact

Artefact Heritage (Artefact) have been engaged by Arcadis to prepare a non-Aboriginal (Historical) Statement of Heritage Impact (SoHI) for proposed slope stabilisation works on the Bells Line of Road at Mount Tomah.

This report will be included in a Review of Environmental Factors (REF) being prepared by Arcadis for the project for determination by Transport for NSW under the *Environmental Planning and Assessment Act 1979* (EPA Act 1979).

1.1.1 Proposed Works and Investigation Area

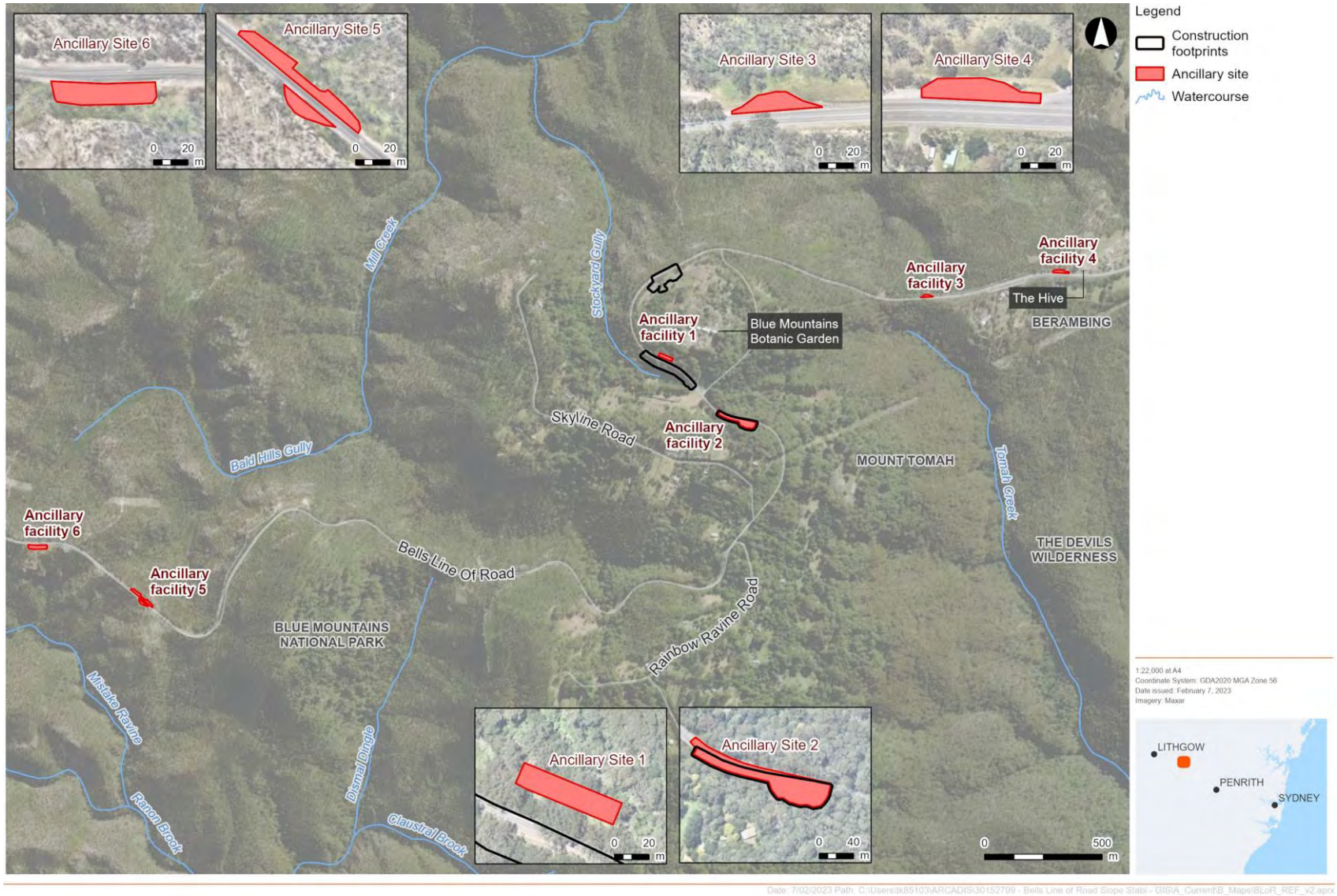
In response to slope failures caused by the extreme weather events of March 2021, Transport proposes to stabilise Slope 33459, Slope 96403 and Slope 93282 on Bells Line of Road at Mount Tomah, located about 25 kilometres east of Lithgow in the Blue Mountains local government area.

Key features of the proposal include:

- Remediation and stabilisation of Slope 33459, Slope 96403 and Slope 93282 (a description of the major design features at each slope is presented in Section 1.9)
- Installation and/or upgrade of drainage infrastructure, such as trench drains, pipes and culvert outlets
- Installation or reinstatement of roadside furniture, such as safety barriers and line marking
- Establishment and use of temporary ancillary facilities during construction (as described in Section 1.9)
- Revegetation of disturbed areas.

The investigation area for this report consists of the construction footprints and proposed ancillary sites shown in Figure 1.

Figure 1: Location of proposed ancillary sites and construction footprints (investigation area)



1.1.2 Consultation with The Royal Botanic Gardens Doman and Trust

Arcadis and Transport for NSW have undertaken consultation with Mount Tomah Botanic Gardens during the design process for the slope remediation works. A key excerpt from the project REF outlining consultation with The Royal Botanic Gardens Domain and Trust is shown in Figure 2. Arcadis has informed Artefact that the design and scope of the proposed slope remediation works within the Mount Tomah Botanic Gardens has been reviewed and approved by The Royal Botanic Gardens Domain and trust.

Figure 2: Excerpt from project REF listing consultation between Transport for NSW, Arcadis, and Mount Tomah Botanic Gardens

Based on the construction methodology, the construction footprint of Slope 33459 is partially within the Blue Mountains Botanic Garden and access will be required from within the garden in order to carry out the works. In addition, Ancillary Facility 1 utilises the existing sealed carpark within the Blue Mountains Botanic Gardens. Therefore, ongoing consultation has taken place between Transport for NSW and the Blue Mountains Botanic Gardens to discuss concerns and issues.

Key concerns and items discussed have been summarised in Table 5-1 below.

Table 5-1: Summary of key concerns and items discussed with the Blue Mountains Botanic Gardens

Date/Time	Method of Communication	Items discussed / Key concerns
16th Aug 2022 17th Aug 2022	Email Teams Meeting	Management plans discussed and provided to the Blue Mountains Botanic Gardens to review and comment. Plans include: - Traffic Management Plan within the Garden - Compound site use within the Garden - Dilapidation Reporting - Events - Review of Environmental Factors (REF)
13th Sept 2022	Email	- Gardens sent through '*Prevention of Soil Diseases – Procedures for Contractors entering the site*' to be included as part of the delivery contract. Transport has confirmed this will be included
23rd Sept 2022	Site Visit In person meeting	- Discussed possible tree removal by the Gardens prior to Transport works. The removal will provide access to Transport organised Slope delivery contractors - Discussed possible eastern and western site accesses Finalised traffic plan to involve access from the western side, subject to the removal of three trees by the Gardens
27th Oct 2022	Teams Meeting	New item discussed – Slope 96403 requires access from within the Gardens on the western side of Bells Line of Road in order to carry out the culvery outlet treatment and slope delivery
10th Nov 2022	Email	Slope 33459 Rev D Design Plans issued to Gardens for review
16th Nov 2022	Email	Transport requestion any restriction dates from the Gardens due to peak periods and/or special events to be factored into delivery program
18th Nov 2022	Email	Gardens raised concerns about construction license request by Transport needing Ministerial approval. Transport has actioned and re-issued as License Agreement
5th Dec 2022	Email	Gardens Director George Salouros, Asset Management, Planning and Projects signed an agreement with Transport granting access to the Garden and carry out Slope 33459 works

1.1.3 Authorship

This report was prepared by Josh Symons (Technical Director – Artefact Heritage) and Jenny Winnett (Principal – Artefact Heritage).

1.1.4 Limitations

This SoHI provides an assessment of Historical heritage only. Aboriginal heritage assessment and advice is excluded.

A site inspection was not undertaken during preparation of this SoHI. Photos and descriptions of the investigation area were provided to Artefact by Arcadis.

1.2 Legislative Context

1.2.1 Overview

This section discusses the heritage management framework, notably legislative and policy context, applicable to the proposed development and study area.

1.2.2 Identification of heritage listed items

Heritage listed items were identified through a search of relevant state and federal statutory and non-statutory heritage registers:

- World Heritage List (WHL)
- Commonwealth Heritage List (CHL)
- National Heritage List (NHL)
- State Heritage Register (SHR)
- Section 170 Heritage and Conservation Registers
- NSW State Heritage Inventory database
- Cumberland Local Environmental Plan (LEP) (2021)
- Register of the National Estate (RNE)
- National Trust of Australia (NSW) register.

Items listed on these registers have been previously assessed against the NSW Heritage Assessment guidelines. Assessments of heritage significance as they appear in relevant heritage inventory sheets and documents, are provided in this assessment.

There are several items of legislation that are relevant to the current study area. A summary of the relevant Acts and the potential legislative implications are provided below.

1.2.3 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legislative framework for the protection and management of matters of national environmental significance, that is, flora, fauna, ecological communities and heritage places of national and international importance. Heritage items are protected through their inscription on the World Heritage List, Commonwealth Heritage List, or the National Heritage List. The EPBC Act stipulates

that a person who has proposed an action that will, or is likely to, have a significant impact on a World, National or Commonwealth Heritage site must refer the action to the Minister for Sustainability, Environment, Water, Population and Communities (hereafter Minister). The Minister will then determine if the action requires approval under the EPBC Act. If approval is required, an environmental assessment would need to be prepared. The Minister would approve or decline the action based on this assessment. A significant impact is defined as "an impact which is important, notable, or of consequence, having regard to its context or intensity." The significance of the action is based on the sensitivity, value and quality of the environment that is to be impacted, and the duration, magnitude and geographic extent of the impact. If the action is to be undertaken in accordance with an accredited management plan, approval is not needed and the matter does not need to be referred to the Minister.

1.2.3.1 The World Heritage Convention

The Convention Concerning the Protection of World Cultural and National Heritage (the World Heritage Convention) was adopted by the General Conference of the United Nations Educational, Scientific and Cultural Organisation (UNESCO) on 16 November 1972, and came into force on 17 December 1975. The World Heritage Convention aims to promote international cooperation to protect heritage that is of such outstanding universal value that its conservation is important for current and future generations. It sets out the criteria that a site must meet to be inscribed on the World Heritage List and the role of State Parties in the protection and preservation of world and their own national heritage.

World Heritage List

The Greater Blue Mountains Area is listed on the World Heritage List as **The Great Blue Mountains Area World Heritage List Place ID 105127**.

- Ancillary site 6 is partially located within the Great Blue Mountains Area World Heritage curtilage
- Ancillary sites 3, 4, and 5 are located immediately adjacent to the Great Blue Mountains Area World Heritage curtilage
- The three construction footprints and ancillary sites 1 and 2 are located outside the Great Blue Mountains Area World Heritage curtilage

1.2.3.2 Commonwealth Heritage List

The Commonwealth Heritage List (CHL) has been established to list places of outstanding heritage significance to Australia. Established under the EPBC Act, the CHL comprises natural, Indigenous and historic heritage places on Commonwealth lands and waters or under Australian Government control.

There are **no items** listed on the Commonwealth Heritage List within or near the investigation area:

1.2.3.3 National Heritage List

The National Heritage List (NHL) has been established to list places of outstanding heritage significance to Australia, including places overseas. There are nine matters of national environmental significance, these include Australia's world heritage properties (as listed on the World Heritage List [WHL]), national heritage places, wetlands of international importance (listed under the Ramsar Convention), migratory species, listed threatened and ecological communities, Commonwealth marine areas, the Great Barrier Reef Marine Park, nuclear actions including uranium mining, and water resources in relation to coal seam gas developments and large coal mining developments.

The Greater Blue Mountains Area is listed on the National Heritage List as **The Great Blue Mountains Area National Heritage List Place ID 105999**.

- Ancillary site 6 is partially located within the Great Blue Mountains Area National Heritage List curtilage
- Ancillary sites 3, 4, and 5 are located immediately adjacent to the Great Blue Mountains National Heritage List curtilage
- The three construction footprints and ancillary sites 1 and 2 are located outside the Great Blue Mountains Area National heritage List curtilage

1.2.4 Heritage Act 1977

The NSW *Heritage Act 1977* (Heritage Act) provides protection for items of 'environmental heritage' in NSW. 'Environmental heritage' includes places, buildings, works, relics, movable objects or precincts considered significant based on historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic values. Items considered to be significant to the State are listed on the SHR and cannot be demolished, altered, moved or damaged, or their significance altered without approval from the Heritage Council of NSW.

1.2.4.1 State Heritage Register

The SHR was established under Section 22 of the Heritage Act and is a list of places and objects of particular importance to the people of NSW, including archaeological sites. The SHR is administered by Heritage NSW, and includes a diverse range of over 1,500 items, in both private and public ownership. To be listed, an item must be deemed to be of heritage significance for the whole of NSW. For works to an SHR item, a Section 60 application must be prepared for works that are not exempt under Section 57(2) of the Heritage Act.

There are **no items** listed on the State Heritage Register within or near the investigation area.

1.2.4.2 The 'Relics provisions' 2009

The Heritage Act also provides protection for 'relics', which includes archaeological material or deposits. According to Section 139 (Division 9: Section 139, 140-146):

> *(1) A person must not disturb or excavate any land knowingly or having reasonable cause to suspect that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, damaged or destroyed unless the disturbance is carried out in accordance with an excavation permit.*
>
> *(2) A person must not disturb or excavate any land on which the person has discovered or exposed a relic except in accordance with an excavation permit.*
>
> *(3) This section does not apply to a relic that is subject to an interim heritage order made by the Minister or a listing on the State Heritage Register.*
>
> *(4) The Heritage Council may by order published in the Gazette create exceptions to this section, either unconditionally or subject to conditions, in respect of any of the following:*
>
> *a. Any relic of a specified kind or description,*
>
> *b. Any disturbance of excavation of a specified kind or description,*
>
> *c. Any disturbance or excavation of land in a specified location or having specified features or attributes,*

> *d. Any disturbance or excavation of land in respect of which an archaeological assessment approved by the Heritage Council indicates that there is little likelihood of there being any relics in the land.*

Section 4 (1) of the Heritage Act (as amended in 2009) defines a relic as:

> *...any deposit, artefact, object or material evidence that:*
>
> *relates to the settlement of the area that comprises New South Wales, not being Aboriginal settlement, and is of State or local heritage significance*

A relic has been further defined as:

> *Relevant case law and the general principles of statutory interpretation strongly indicate that a 'relic' is properly regarded as an object or chattel. A relic can, in some circumstances, become part of the land be regarded as a fixture (a chattel that becomes permanently affixed to land).*[1]

Excavation approvals are issued by the Heritage Council of NSW or its Delegate under Section 140 of the Heritage Act for relics outside of an SHR curtilage, or under Section 60 for significant archaeological remains within an SHR curtilage. Minor works that will have a minimal impact on archaeological relics may be granted an exception under Section 139 (4) of the Heritage Act for areas not within an SHR curtilage or an exemption under Section 57 (2) of the Heritage Act for areas within an SHR curtilage.

The Heritage Act identifies 'works' as being in a separate category to archaeological 'relics.' 'Works' refer to past evidence of infrastructure. 'Works' may be buried, and therefore archaeological in nature, however, exposure of a 'work' does not trigger reporting obligations under the Heritage Act.

1.2.5 Environmental Planning and Assessment Act 1979 (NSW)

The *Environmental Planning and Assessment Act 1979* (EP&A Act) establishes the framework for cultural heritage values to be formally assessed in the land use planning and development consent process. The EP&A Act requires that environmental impacts are considered prior to land development; this includes impacts on cultural heritage items and places as well as archaeological sites and deposits.

The EP&A Act also requires that local governments prepare planning instruments (such as Local Environmental Plans and Development Control Plans [DCPs]) in accordance with the EP&A Act to provide guidance on the level of environmental assessment required. The study area falls within the Blue Mountains LGA. Schedule 5 of the *Blue Mountains Local Environmental Plan 2015* (Blue Mountains LEP) includes a list of items/sites of heritage significance within this LGA.

1.2.5.1 Blue Mountains Local Environmental Plan 2015

Heritage items listed on the Blue Mountains LEP 2015 are managed in accordance with the provisions of Section 5.10 Heritage Conservation of this LEP. Under Clause 5 of this section of the Blue Mountains LEP 2015:

> *The consent authority may, before granting consent to any development—*

[1] Heritage Office, 2009. *Assessing Significance for Historical Archaeological Sites and 'Relics'*, p. 7.

> *(a) on land on which a heritage item is located, or*
>
> *(b) on land that is within a heritage conservation area, or*
>
> *(c) on land that is within the vicinity of land referred to in paragraph (a) or (b),*
>
> *require a heritage management document to be prepared that assesses the extent to which the carrying out of the proposed development would affect the heritage significance of the heritage item or heritage conservation area concerned.*

The investigation area overlaps with the following heritage items listed in Schedule 5 of the Blue Mountains LEP 2015:

- **MT002 Mount Tomah and Environs**
- **MT002 Old Bells Line of Road**
- **MT006 Mount Tomah Botanic Garden**

Items listed in Schedule 5 of the Blue Mountains LEP 2015 that are within 200m of the investigation area includes:

- **MT001 Cave Hotel**
- **MT003 Old Bells Line of Road**
- **MT007 Sunrise**

1.3 State Environmental Planning Policy (Transport and Infrastructure) (TISEPP) 2021

State Environmental Planning Policy (Transport and Infrastructure) 2021 (the Transport and Infrastructure SEPP) aims to facilitate the effective delivery of transport and infrastructure across NSW. The Transport and Infrastructure SEPP assists local government, the NSW Government and the communities they support, by simplifying the process for providing essential infrastructure in areas such as education, hospitals, roads and railways, emergency services, water supply and electricity delivery.

Generally, where there is conflict between the provisions of the TISEPP and other environmental planning instruments, the TISEPP prevails. While the TISEPP overrides the controls included in the LEPs and DCPs, the proponent is required to consult with the relevant local councils when development “is likely to have an impact that is not minor or inconsequential on a local heritage item (other than a local heritage item that is also a State heritage item) or a heritage conservation area”.

When this is the case, the proponent must not carry out such development until it has (TISEPP 2021 Clause 2.11.2):

> *(a) had an assessment of the impact prepared, and*
>
> *(b) given written notice of the intention to carry out the development, with a copy of the assessment and a scope of works, to the council for the area in which the heritage item or heritage conservation area (or the relevant part of such an area) is located, and*

(c) taken into consideration any response to the notice that is received from the council within 21 days after the notice is given.

1.3.1 Non-Statutory Considerations

1.3.1.1 Register of the National Estate

The Register of the National Estate (RNE) is a list of natural, Aboriginal, and historic heritage places throughout Australia. It was originally established under the Australian Heritage Commission Act 1975. Under that Act, the Australian Heritage Commission entered more than 13,000 places in the register. Following amendments to the Australian Heritage Council Act 2003, the RNE was frozen on 19 February 2007 and ceased to be a statutory register in February 2012. The RNE is now maintained on a non-statutory basis as a publicly available archive and educational resource.

There are **no items** listed on the RNE within the study area.

There is one item listed on the RNE in the vicinity of the study area. Mount Tomah Road Cuttings Place ID 3003 includes sections of road cutting with significance for their geology and associated educational values. The significant road cuttings are not within the three areas proposed for slope remediation works.

1.3.1.2 National Trust of Australia (NSW)

The National Trust of Australia maintains a register of places within Australia that are of cultural heritage significance. The National Trust Heritage Register is intended to promote the preservation and conservation of heritage significant places. Listing on the National Trust Heritage Register does not impose statutory obligations, but is a good indication of the heritage significance held by the community.

There are **no items** listed on the 2006 database of the National Trust Heritage Register within the study area.

1.4 Summary of heritage listings

The study area comprises the warehouse complex at 26 Ferndell Street and 464 Blaxcell Street, South Granville. As outlined in Table 1, the study area is located adjacent to the Acrow Building at 7-11 Ferndell Street, which is listed on the Cumberland LEP 2021. The curtilages of the study area in relation to nearby heritage items are illustrated in **Error! Reference source not found.**.

Table 1: Results of register searches for the study area and adjacent heritage items

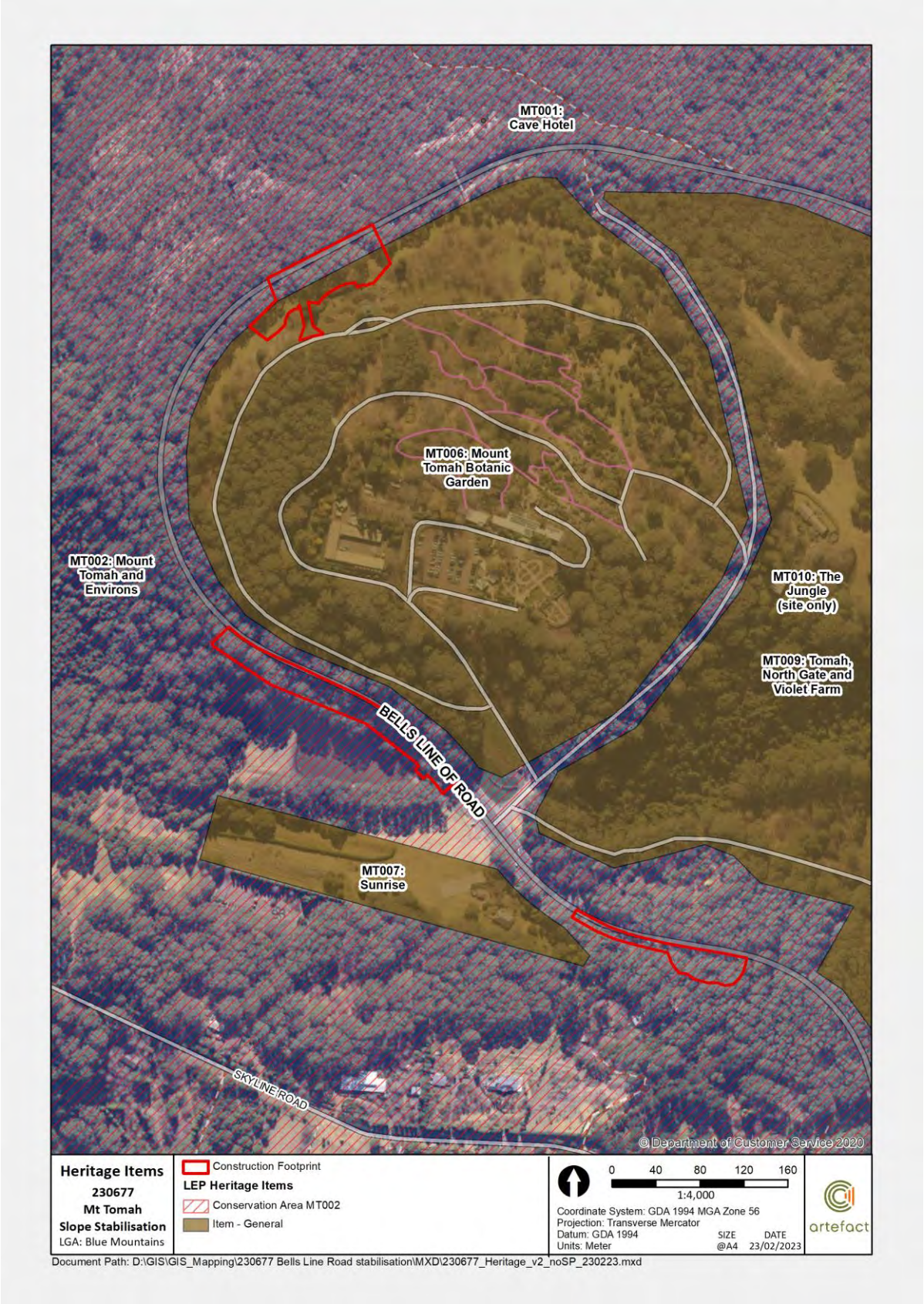
Table 2: Res

Register	Items within study area	Items within 100m
World Heritage List	Blue Mountains World Heritage Area 105127	Blue Mountains World Heritage Area 105127
National Heritage List	The Great Blue Mountains Area National Heritage List Place ID 105999	The Great Blue Mountains Area National Heritage List Place ID 105999

Register	Items within study area	Items within 100m
Commonwealth Heritage List	None	None
State Heritage Register	None	None
Blue Mountains LEP 2015	MT002 Mount Tomah and Environs MT002 Old Bells Line of Road MT006 Mount Tomah Botanic Garden	MT007 Sunrise (within 100m) MT001 Cave Hotel (within 200m) MT003 Old Bells Line of Road (within 200m)
Register of the National Estate (RNE) (Non-Statutory)	None	Mount Tomah Road Cuttings Place ID 3003 (within 400m)
National Trust of Australia (NT) NSW Register (Non-Statutory)	None	None

Figure 3: Listed heritage items and construction footprints. Note – this map does not show ancillary facilities (please see Figure 1)

Figure 4: Listed heritage items and construction footprints. Note – this map does not show ancillary facilities (please see Figure 1)



1.5 Historical Context

1.5.1 Bells Line of Road

The development of the Bells Line of Road (one of the first routes to cross the Blue Mountains) is most directly associated with Archibald Bell, who followed the route from Kurrajong Heights to Mount Tomah in 1823. The first attempt to formally survey the Bells Line of Road occurred one month after Bell proclaimed the success of his initial journey. Accompanied by surveyor Robert Hoddle and 'government men', Bell re-traced his route.[2] Although thought to be a potential route along the often steep and rocky terrain, the road was considered to be dangerous and potentially unusable by a later Surveyor General Thomas Mitchell.

Mitchell refused to provide funding for the construction of the road and it was not until 1841 that construction of the road commenced due to pressure from locals, settlers and fruit growers seeking more efficient routes in and out of the area. A committee— comprised of influential local businessmen and fruit growers— were keen to use the road as a route between the Hawkesbury towns and the coast. Although convicts were not made available for the work, the road was formalised as far as Mount Tomah.[3]

The road was initially a bridle track, accommodating horse drawn transport and later became a dray road, accommodating carts and other forms of early transport.[4]

There was some revival in the use of the road following the discovery of gold in the 1850s. The route was frequented by foot traffic and a number of inns were established to cater to the gold seekers. The last inn on the road west was the 'Goldfinder's Home' at Wheeny Creek, Kurrajong, although it is highly probable that other residents also catered to the travellers on the sly. Workers camps associated with the construction of the Great Western Railway Line in the 1860s were responsible for the establishment of a number of inns at the western end of Bells Line. Despite the renewal of interest in this route to the west, the road was described as little more than a dray road up until 1872. This was largely due to the difficulty of negotiating Mount Tomah. The descent of the Western Pass, known as Jacobs Ladder, was acutely steep and contained dangerous rock steps called 'jumps'. There was no safe wheeled vehicle route over Mount Tomah until after road works were organised by a local Road Trust in 1877-8.

Several different routes over Mount Tomah were developed throughout the 19th and 20th centuries. The following description has been extracted from the SHI listing for the Old Bells Line of Road (Blue Mountains 2016 Heritage Register Review):

> *Approaching Mount Tomah from the east, the road, at all stages, has used the Eastern Pass. The original road, however, up to 1877, took a route well to the south of the present road. In 1877 the Elbow was developed, in a triangular shape to the north, with a sharp come-back at its north-western extremity. This comeback was eliminated in 1939 and thereafter the main road went in a most gentle bend to the west of the old road. Just on the old come-back bend, on the south side of the road, striking retaining walls of the nineteenth –century road remain (formerly MT 005) and can be approached from the Old Line of road running south past The Jungle, while the new road runs on the opposite, western side of the Botanic Garden.. The Old Line again deviates from the present line*

[2] Morgan H. 1956, p 34
[3] Morgan 1956: 37
[4] Percival D. 2005. Heritage assessment of stone wall and culvert-Bells Line of Road for Roads and Maritime Services s170 register. Site accessed in 2015
http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=4310585

along Charleys Road, lying higher than the present road and to the south, swinging around to plunge northwards in what was known as Jacobs Ladder, the most fearsome stretch of the original road. Jacobs Ladder is partly destroyed by twentieth-century road-works, but part of it constitutes the fire trail from the western end of Charleys Road.

In 1928, the Bells Line of Road was proclaimed Main Road 184 (from Richmond to Mount Victoria) and became the responsibility of the Main Roads Board.

After the war the Department of Main Roads embarked on works of great magnitude to transform the Western Pass. In 1947 part of the mountain was cut away and thousands of tonnes of debris fell over the old road and into the ravine. The passage was closed entirely for two months and the present Western Pass was opened in July 1947. The stretch of road from Mount Tomah to Bilpin and east to Kurrajong Heights was upgraded in 1947-8, with a bridge and road re-alignment at Wheeny Creek near Kurrajong.

Figure 5: Bells Line of Road at Mount Tomah with Bowen land grant c. 1897. Crown Plan 05912-1603

1.5.2 Mount Tomah

Mount Tomah was originally known as Fern Tree Hill and received its name from the word 'Tomah' the Darug word for 'tree fern'. The first European to visit Fern Tree Hill was George Caley in 1804.[5] Caley was a naturalist and explorer, who would later become the first botanist to make a concerted effort to study Eucalyptus.[6] After Bell's survey of the area, the first land grant was given to Susannah Bowen in 1830 and consisted of 1280 acres (see Figure 5 and Figure 6). The grant was then occupied by three sawmills and used for dairying and cattle resting paddocks.

The surrounding natural environment of Bowen's grant has been partially preserved within The Jungle (LEP no. MT010), which is included in the Mount Tomah conservation area (LEP no. MT002). The Bowen property remained in the family until the 1860s when George Bartley Bowen built Mount Tomah Cottage, a wooden cottage with a large stone chimney, within the area now occupied by the Mount Tomah Botanic Garden.

Although George Bartley Bowen lived primarily at Bowen Mount near Kurrajong, he continued to exploit his significant holding on Mount Tomah, running his cattle there and planting orchards. In 1893, he sold his beef cattle and his Clydesdale horses— and instead built up a dairy herd on Mount Tomah, with a cream separator and a butter factory.

Soon afterwards, in June 1895 Bowen sold the Mount Tomah farm to Philip Charley, who bred horses and exercised his animals on the rugged slopes of Mount Tomah to enhance their stamina. Charley also established a sawmill on the property.

On Christmas Day, 1909, a bush-fire tore through the area and is likely to have burnt all of the residential dwellings on Mount Tomah. As a result, only the stone chimney of the Mount Tomah Cottage was standing in 1918. Charley began to subdivide the mountain property and in 1927 sold a thickly vegetated block of land, to the west of the study area to 'a syndicate of public men' called 'The Jungle Ltd.'

The syndicate was comprised of twenty five shareholders, each contributing one hundred pounds, to create a Public Reserve 'to save the forest for the people for all time'. The land was not untouched, however, as the sawmill established by Philip Charley operated up to World War I.[7]

In 1934, Alfred Brunet-a French-born horticulturist-and his Australian-born wife Effie, purchased a portion of the grant now occupied by the Mount Tomah Botanic Garden (adjacent to the study area). In 1972 the Brunets donated their land for use as a Botanic Garden and in 1987 the Garden opened to the public.[8] Today Mount Tomah consists of a small community of houses on large landholdings. The community has developed due to the fertile soil which supports substantial gardens and small agricultural activities such as orcharding. The Mount Tomah section of Bells Line of Road (the study area) represents one of the many improvements and deviations undertaken on the steep and winding road since it was first surveyed in 1823.

[5] Garden History - Blue Mountains Botanic Garden
[6] Else-Mitchell, R. 1966. George Caley. Site accessed on 19/09/2014 at: http://adb.anu.edu.au/biography/caley-george-1866
[7] NSW Department of Environment and Heritage State Heritage Inventory entry for Item MT002 Mount Tomah and environs http://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=1170619
[8] Garden History - Blue Mountains Botanic Garden

Figure 6: Susannah Bowen's land grant. Crown Plan 00011-0635, no date

1.5.3 Mount Tomah Road Cutting[9]

The Mount Tomah Road Cutting on the southern side of the Bells Line of Road (the study area) is associated with improvements made to the road during the Second World War. Prior to this, the steep gradient, winding nature and poor sealing of the Bells Line of Road meant the Great Western Highway was considered to be the best route in and out of Sydney. However, the outbreak of the Second World War, with attacks on Sydney anticipated, the Government began to look for alternative evacuation routes away from the city. By this stage, the Bells Line of Road (now the Old Bells Line of Road) on the eastern side of Mount Tomah had fallen into disrepair and works to form a new alignment along the steep and rugged landscape of Mount Tomah began in 1942. . A lack of funding ceased work soon afterwards and it was not until 1945 that construction along the western side of Mount Tomah recommenced (Figure 7 and Figure 8). It is within the northernmost portion of these 1945 road cuttings that the study area is located. In 1947 part of the mountain was cut away and thousands of tonnes of debris fell over the old road and into the ravine. After all passage was closed entirely for two months, the present Western Pass was opened in July 1947.

[9] The majority of this section has been taken from Oz Roads, 2006. Bells Line of Road: History and development: http://www.ozroads.com.au/NSW/RouteNumbering/State%20Routes/40/bellslineofroad.htm

Figure 7. Construction of the Mount Tomah cutting underway during 1947. Source. Department of Main Roads.[10]

Figure 8. Mount Tomah cutting in 1950, showing completed earthworks and base course laid. Source. Department of Main Roads.

1.6 Significance assessment

1.6.1 Methodology

Determining the significance of heritage items or a potential archaeological resource is undertaken by utilising a system of assessment centred on the *Burra Charter* (Australia ICOMOS 2013). The principles of the charter are relevant to the assessment, conservation and management of sites and

[10] Oz Roads, Bells Line of Road: History and development: http://www.ozroads.com.au/NSW/RouteNumbering/State%20Routes/40/bellslineofroad.htm

relics. The assessment of heritage significance is outlined through legislation in the Heritage Act and implemented through the *NSW Heritage Manual*, the *Archaeological Assessment Guidelines*[11] and the document *Assessing Significance for Historical Archaeological Sites and 'Relics'.*[12]

If an item meets one of the seven heritage criteria and retains the integrity of its key attributes, it can be considered to have heritage significance (see Table 3). The significance of an item or potential archaeological site can then be assessed as being of local or State significance. If a potential archaeological resource does not reach the local or state significance threshold, then it is not classified as a relic under the *Heritage Act*.

'State heritage significance', in relation to a place, building, work, relic, moveable object or precinct, means significance to the State in relation to the historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value of the item.

'Local heritage significance', in relation to a place, building, work, relic, moveable object or precinct, means significance to an area in relation to the historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value of the item.[13]

[11] NSW Heritage Office 1996, 25-27.
[12] NSW Heritage Branch 2009
[13] This section is an extract based on the Heritage Office Assessing Significance for Historical Archaeological Sites and Relics 2009:6.

Table 3. NSW heritage assessment criteria

Criteria	Description
A – Historical Significance	An item is important in the course or pattern of the local area's cultural or natural history.
B – Associative Significance	An item has strong or special associations with the life or works of a person, or group of persons, of importance in the local area's cultural or natural history.
C – Aesthetic or Technical Significance	An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievement in the local area.
D – Social Significance	An item has strong or special association with a particular community or cultural group in the local area for social, cultural or spiritual reasons.
E – Research Potential	An item has potential to yield information that will contribute to an understanding of the local area's cultural or natural history.
F – Rarity	An item possesses uncommon, rare or endangered aspects of the local area's cultural or natural history.
G - Representativeness	An item is important in demonstrating the principal characteristics of a class of NSW's cultural or natural places of cultural or natural environments (or the cultural or natural history of the local area).

1.7 Existing heritage assessments

1.7.1 The Greater Blue Mountains Area (World Heritage List Place ID 105127; National Heritage List Place ID 105999)

The GBMWHA was inscribed on the World Heritage List in 2000 because it satisfies two of the criteria for natural values of outstanding universal significance. The following synthesis of this significance has been extracted from the UNESCO World Heritage Convention database for the heritage item, and is also reproduced on the Department of Climate Change, Energy, the Environment and Water website:

The Greater Blue Mountains Area (GBMA) is a deeply incised sandstone tableland that encompasses 1.03 million hectares of eucalypt-dominated landscape just inland from Sydney, Australia's largest city, in south-eastern Australia. Spread across eight adjacent conservation reserves, it constitutes one of the largest and most intact tracts of protected bushland in Australia. It also supports an exceptional representation of the taxonomic, physiognomic and ecological diversity that eucalypts have developed: an outstanding illustration of the evolution of plant life. A number of rare and endemic taxa, including relict flora such as the Wollemi pine, also occur here. Ongoing research continues to reveal the rich scientific value of the area as more species are discovered.

The geology and geomorphology of the property, which includes 300 metre cliffs, slot canyons and waterfalls, provides the physical conditions and visual backdrop to support these outstanding biological values. The property includes large areas of accessible wilderness in close proximity to

4.5 million people. Its exceptional biodiversity values are complemented by numerous others, including indigenous and post-European-settlement cultural values, geodiversity, water production, wilderness, recreation and natural beauty.

Criterion (ix): be outstanding examples representing significant on-going ecological and biological processes in the evolution and development of terrestrial, fresh water, coastal and marine ecosystems and communities of plants and animals:

The Greater Blue Mountains include outstanding and representative examples in a relatively small area of the evolution and adaptation of the genus Eucalyptus and eucalypt-dominated vegetation on the Australian continent. The site contains a wide and balanced representation of eucalypt habitats including wet and dry sclerophyll forests and mallee heathlands, as well as localised swamps, wetlands and grassland. It is a centre of diversification for the Australian scleromorphic flora, including significant aspects of eucalypt evolution and radiation. Representative examples of the dynamic processes in its eucalypt-dominated ecosystems cover the full range of interactions between eucalypts, understorey, fauna, environment and fire. The site includes primitive species of outstanding significance to the evolution of the earth's plant life, such as the highly restricted Wollemi pine (Wollemia nobilis) and the Blue Mountains pine (Pherosphaera fitzgeraldii). These are examples of ancient, relict species with Gondwanan affinities that have survived past climatic changes and demonstrate the highly unusual juxtaposition of Gondwanan taxa with the diverse scleromorphic flora.

Criterion (x): contain the most important and significant natural habitats for in-situ conservation of biological diversity, including those containing threatened species of Outstanding Universal Value from the point of view of science or conservation:

The site includes an outstanding diversity of habitats and plant communities that support its globally significant species and ecosystem diversity (152 plant families, 484 genera and c. 1,500 species). A significant proportion of the Australian continent's biodiversity, especially its scleromorphic flora, occur in the area. Plant families represented by exceptionally high levels of species diversity here include Myrtaceae (150 species), Fabaceae (149 species), and Proteaeceae (77 species). Eucalypts (Eucalyptus, Angophora and Corymbia, all in the family Myrtaceae) which dominate the Australian continent are well represented by more than 90 species (13% of the global total). The genus Acacia (in the family Fabaceae) is represented by 64 species. The site includes primitive and relictual species with Gondwanan affinities (Wollemia, Pherosphaera, Lomatia, Dracophyllum, Acrophyllum, Podocarpus and Atkinsonia) and supports many plants of conservation significance including 114 endemic species and 177 threatened species.

The diverse plant communities and habitats support more than 400 vertebrate taxa (of which 40 are threatened), comprising some 52 mammal, 63 reptile, over 30 frog and about one third (265 species) of Australia's bird species. Charismatic vertebrates such as the platypus and echidna occur in the area. Although invertebrates are still poorly known, the area supports an estimated 120 butterfly and 4,000 moth species, and a rich cave invertebrate fauna (67 taxa).[14]

1.7.2 MT002 Mount Tomah and Environs (Blue Mountains LEP 2015)

The following significance assessment has been extracted from the State Heritage Inventory (SHI) sheet for the heritage item:

[14] World Heritage places - Greater Blue Mountains Area, DECCEEW. Accessed 23/02/2023 via https://www.dcceew.gov.au/parks-heritage/heritage/places/world/blue-mountains#outstanding-universal-value

Although Mount Tomah has a number of historical features of heritage significance, arising from the routing and rerouting of Bells Line of Road and from the early land grant of the mountain to Mrs Bowen, the actual village area as it exists today has little historical significance.[15]

1.7.3 MT006 Mount Tomah Botanic Garden (Blue Mountains LEP 2015)

The following significance assessment has been extracted from the State Heritage Inventory (SHI) sheets for the heritage item:

The site of Mt Tomah Botanic Garden has been exploited by Europeans for a remarkably long period, over 170 years, and the modifications imposed by cattle, sheep, dairy cows, agriculture and finally flower-growing before it was converted to a Botanic Garden.

Mt Tomah Botanic Garden is important for its association with botanical explorer and collector, George Caley, who visited there in 1804; with Archibald Bell who with the aid of Aboriginal guides found a route across the Blue Mountains, now known as Bells Line of Road in 1823, and with botanist Allan Cunningham who followed his route in the same year. Of the early owners, the Bowens, mother, son and grandson, have local significance, while Philip Charley, of Broken Hill fame, who built the great house at North Richmond which is now St John of God Hospital, was a figure of State significance.

Mt Tomah Botanic Garden is of aesthetic importance at a State level as an accomplished design with magnificent panoramic views over the Grose Valley, which comprises formal compartments and mature remnant plantings of the earlier garden and nursery (1935) of Alfred and Effie Brunet, a three-hectare scree slope and rock garden and local rainforest trees within an overall informal framework. Important elements include the tradition of Cherry Laurel (Prunus laurocerasus) hedges, used by the Brunets to form windbreaks to protect their nursery stock, substantial hedges of Callitris sp. in the formal garden and old Brunet plantings including Juglans regia, Cornus kousa var Kousa and Pyrus pyrifolia Quillaja saponaria, the Chinese/Japanese conifer Thujopsis dolabrata and the California Redwood, Sequoia sempervirens. retained in what is now known as 'Brunet Meadow'.

The Botanic Garden comprises 28 hectares, with 34,520 plants many of them of known provenance, over 1,000 of which are botanically significant, and the oldest tree in the Garden is a specimen of Eucalyptus fastigata (Brown Barrel), estimated at over 400 years old. Remaining stands of natural vegetation include warm temperate rainforest dominated by coachwood, sassafras (Doryphora) and Hedycarya in the western gully and eastern boundary. Since 1993, Mount Tomah Botanic Garden has included 186 hectares of sandstone woodland and gullies that is a conservation area, significant in botanic terms for its diversity within the Sydney sandstone group, comprising five vegetation types, including very tiny hanging swamps, with significant species of heath, sclerophyll and Blue Mountains rainforest plants.

1.7.4 MT007 Sunrise (Blue Mountains LEP 2015)

The following has been extracted from the State Heritage Inventory (SHI) sheets for the heritage item:

Sunrise is a good example of an Inter-war bungalow. The use of sandstone suggests a higher class of construction and gives the house a feeling of permanence.[16]

[15] Mount Tomah and Environs, State Heritage Inventory. Accessed 23/02/2023 via https://www.hms.heritage.nsw.gov.au/App/Item/ViewItem?itemId=1170619
[16] Sunrise, State Heritage Inventory. Accessed 23/02/2023 via https://www.hms.heritage.nsw.gov.au/App/Item/ViewItem?itemId=1170632

1.7.5 Mount Tomah Road Cuttings, Bells Rd, Mount Tomah via Bilpin, NSW, Australia (Register of the National Estate ID 3003)

The following statement of significance was extracted from the RNE listing for the item:

The cuttings referred to display basalt with conspicuous columnar jointing, overlying Triassic sediments. The columnar jointing is among the best exposed, most accessible example of this phenomenon available close to Sydney. It is therefore frequently visited or viewed by students on geological excursions, and was also inspected by visiting scientists on several of the field trips conducted during the International Geological Congress in 1976.[17]

1.8 Historical archaeological context

1.8.1 Evidence of the early road building techniques

The southernmost portion of the study area, adjacent to slope 93282, follows the original alignment of Bells Line of Road. There is some limited potential of encountering structural elements associated with the early construction of the road such as buried culverts, retaining walls and rock cuttings in these areas. However, as the road was relatively underused by traffic prior to the mid-20th century, it is unlikely to have been formally surfaced for much of its existence and has only undergone extensive upgrading in the later years of the 20th century. It is therefore unlikely that evidence of original road building infrastructure survives in the study area.

The northern and eastern portions of the study area, slope 33459 and slope 96403, were constructed after 1947 during post-WWII upgrades to the road corridor. Dry stone pertaining walls and rock cuttings associated with this phase have been identified elsewhere on Bells Line of Road.

Overall, as the works are focused on specific areas of failed slope, it is unlikely that infrastructure associated with former road building would be identified during the proposed works.

Overall, there is low potential that archaeological evidence associated with early phases of Bells Line of Road to be located within the study area. Any archaeological evidence is unlikely to be intact due to ongoing maintenance, stabilisation and upgrades of the road throughout the 20th century.

5.2.3 Evidence of early occupation of the study area

The study area is located within Susannah Bowen's 1280 acres, granted in 1830. The Bowen cottage was located to the south and east of all three proposed works areas (see Figure 5). During Bowen family ownership the majority of the grant was used for dairying, orcharding and cattle grazing. Late 19th century land use was associated with horse breeding and sawmilling. There is no evidence that any of these activities were focused within the study area, and the construction of the western portion of Bells Line of Road c.1947 is likely to have substantially altered the original landform, removing archaeological evidence of these earlier uses.

Overall, there is nil to low potential that archaeological evidence associated with the Bowen family is located within the study area and any remains are unlikely to be intact due to the ongoing maintenance, stabilisation and upgrades of the road throughout the 20th century.

[17] Mount Tomah Road Cuttings, Bells Rd, Mount Tomah via Bilpin, NSW, Australia, Register of the National Estate. Accessed 23/02/2023 via http://www.environment.gov.au/

1.8.2 Significance statement

There is limited potential for the study area to contain archaeological evidence of former use of the study area. Any archaeological evidence is unlikely to be intact and therefore unlikely to reach the local significance threshold. The study area has nil potential to contain archaeological 'relics' as defined by the NSW *Heritage Act 1977*, and nil to low potential to contain significant archaeological 'works.'

1.9 Project Description

1.9.1 Slope 33459

1.9.1.1 Stabilisation

Slope 33459 would be stabilised using a combination of soil nails, reinforced shotcrete and concrete piles. Three rows of three-metre soil nails would be installed on the slope. Reinforcements and anchors would be installed, followed by the slope being sprayed with shotcrete. A wall of 21 piles would be installed near the crest of the slope, with each pile measuring 450 millimetres in diameter and a minimum of seven metres deep with one metre rock sockets. The piled wall would extend five metres beyond the slide tension crack at each side.

1.9.1.2 Drainage

A series of trench drains would be installed on the grassy area above Slope 33459. There would be a one-metre-wide central trench, with five 600-milimetre-wide limb trenches adjoining. These drains would lead to a 900 by 900 by 1350-milimetre drainage pit near the crest of the slope. A 225-milimetre diameter drainage pipe would be recessed into the slope prior to shotcrete placement and would drain to a roadside fibrecrete drain.

1.9.1.3 Property access

As shown in Figure 12, primary access to Slope 33459 would be via existing sealed internal roads inside the Blue Mountains Botanic Garden. A temporary three-metre-wide access track would be established from the existing road to the construction works area. The construction works area would allow adequate space for vehicles to turn around and egress via the same track. Slope 33459 would also be accessed via the westbound lane of Bells Line of Road which would be closed for the duration of construction.

1.9.1.4 Roadside furniture

At the completion of construction, the chain mesh fence marking the property boundary between the Blue Mountains Botanic Garden and the road reserve would be reinstated. Line marking on Bells Line of Road would be repainted, as required.

1.9.1.5 Area description

The remediation area within the Garden has been affected by the slope failure in the road corridor:

- Erosion has created at least one gully through the manicured grass
- The area is currently closed off to public access due to safety concerns

Figure 9: Erosion within the proposed works area in the Mount Tomah Botanic Garden

Figure 10: Location of proposed trench within Mount Tomah Botanic Garden in an area currently closed to public access due to issues associated with the adjacent slope failure in the road corridor

Figure 11: Proposed shotcrete and chain mesh fencing at slope 33459

Figure 12: Location of construction footprint and ground disturbing works at slope 33459

1.9.2 Slope 96403

1.9.2.1 Stabilisation

Slope 96403 would be stabilised by sealing the tension crack with bentonite and road pavement materials and the installation of a piled retaining wall. The piled retaining wall would consist of 60 bore piles, with each pile measuring 900 millimetres in diameter and 11.4 to 13.5 metres deep, and a reinforced concrete capping beam on top linking the piles.

1.9.2.2 Drainage

The existing drainage system in the vicinity of Slope 96403 has been reviewed and is under capacity. The primary catchment contributing to the existing drainage system is from the Blue Mountains Botanic Garden. Additional inlet pits would be installed on the westbound curb to assist in reducing peak surface flows to Bells Line of Road drainage systems and improve the road drainage system to manage road reserve catchment flows. New drainage would also be installed along the eastbound kerb of Bells Line of Road. This would provide continuous inlets for flows and would discharge via a dedicated outlet at the existing culvert at the eastern edge extent of the works (Culvert 446877).

The culvert outlet, which drains into manmade dam southwest of Bells Line of Road on Blue Mountains Botanic Garden land, would be upgraded. This would involve restoring the broken lintel, reshaping the outlet channel, installing a trench drain outlet and installing a rock mattress.

1.9.2.3 Property access

As shown in Figure 14, access to Slope 96403 would be via the Bells Line of Road. The eastbound lane would be closed for the duration of construction. The Blue Mountains Botanic Garden access track would also be utilised for visual inspection and assessment during construction. No plant or equipment would be permitted without prior approval from Blue Mountains Botanic Garden.

A temporary access track would be constructed within the road reserve from Bells Line of Road to Culvert 446877 to enable safe access down the slope for a mini excavator and construction personnel.

1.9.2.4 Roadside furniture

At the completion of construction, the guard rail on the westbound kerb would be reinstated and the line marking on Bells Line of Road would be repainted, as required.

Figure 13: Proposed works at slope 96403

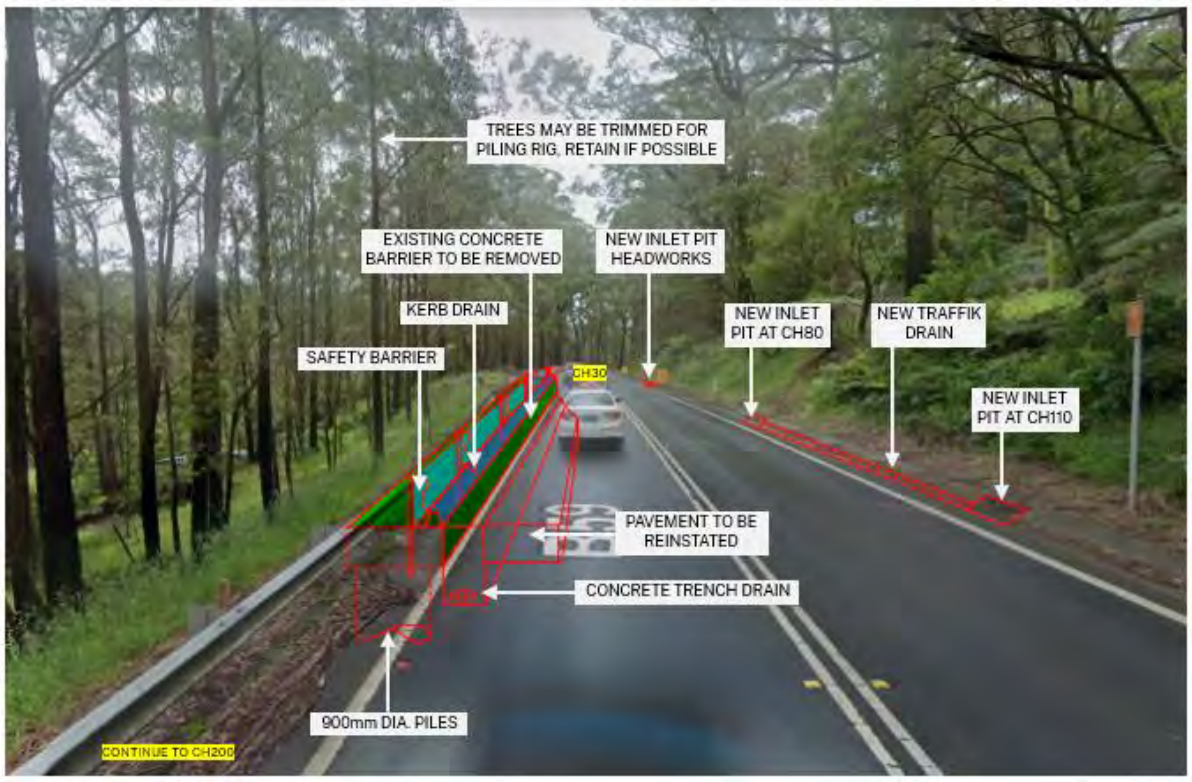
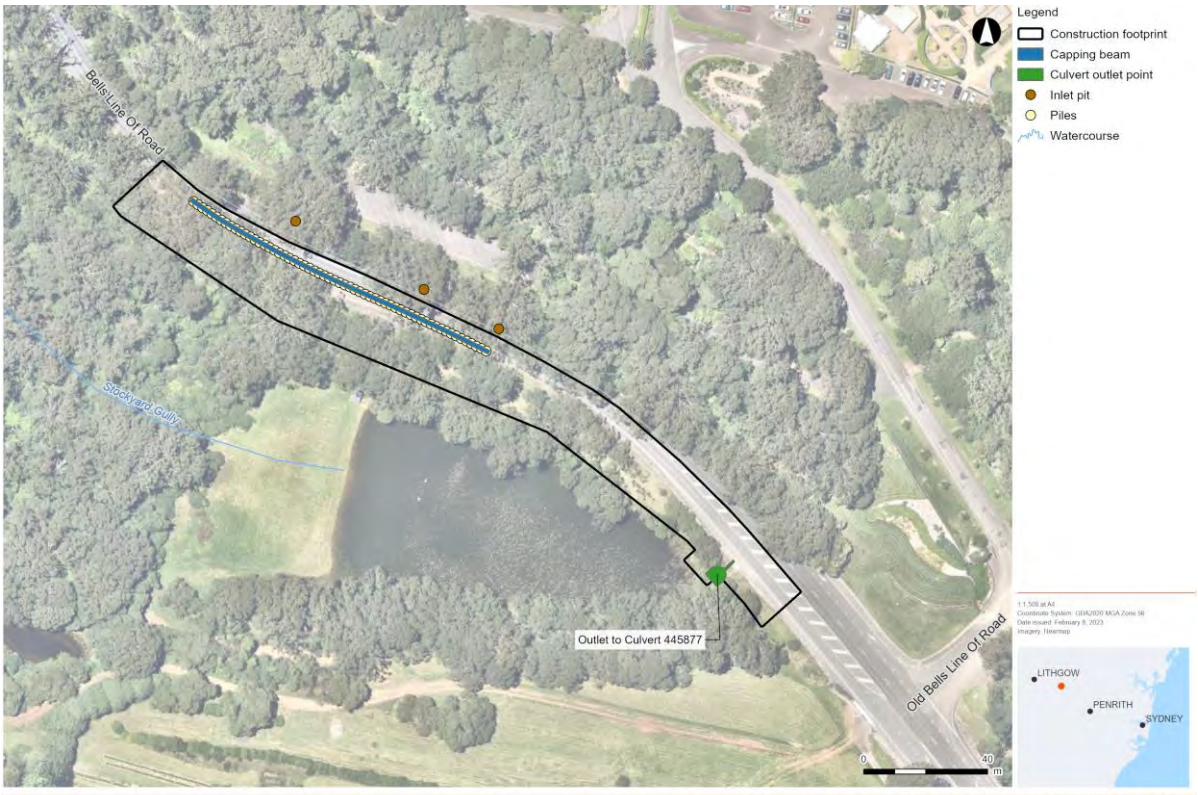


Figure 14: Location of construction footprint and ground disturbing works at slope 96403



1.9.3 Slope 93282

1.9.3.1 Stabilisation

Slope 93282 would be stabilised using a gabion wall. Rock-filled gabions would be installed on top of a reinforced concrete base layer. The wall would range from one to four metres in height depending on the height of the slope. The bottom layer of gabion baskets would be sprayed with shotcrete. The slope behind the wall would be backfilled with a layer of free-draining rock fill and compacted select fill and covered with topsoil and jute.

1.9.3.2 Drainage

A concrete surface drain would be installed immediately behind the top of the gabion wall to capture runoff from the above slope. Behind the base of the gabion wall, a corrugated perforated drainage pipe would be installed under the free-draining rock fill to capture any flow that permeates through and avoid water building up behind the gabion wall. As the bottom layer of gabion baskets would be sprayed with shotcrete, a pipe would be installed at the base of each basket to allow water to drain out. A fibrecrete drain would be installed along the edge of Bells Line of Road adjacent to the gabion wall.

1.9.3.3 Property access

Access to Slope 93282 would be via the Bells Line of Road and an existing track on the southern side of the slope remediation works. The eastbound lane of Bells Line of Road would be closed for the duration of construction.

1.9.3.4 Roadside furniture

At the completion of construction, line marking on Bells Line of Road would be repainted, as required.

Figure 15: Location of gabion wall and slope remediation works at 93282

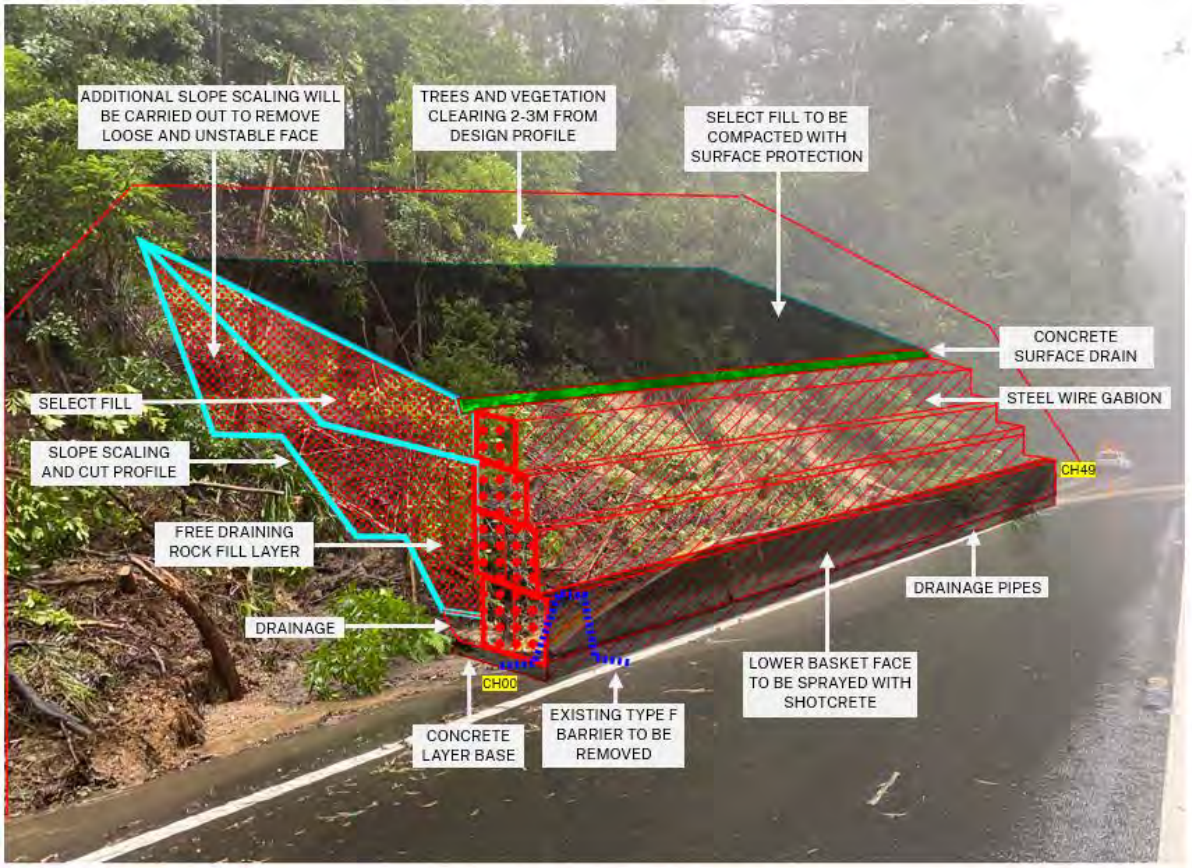
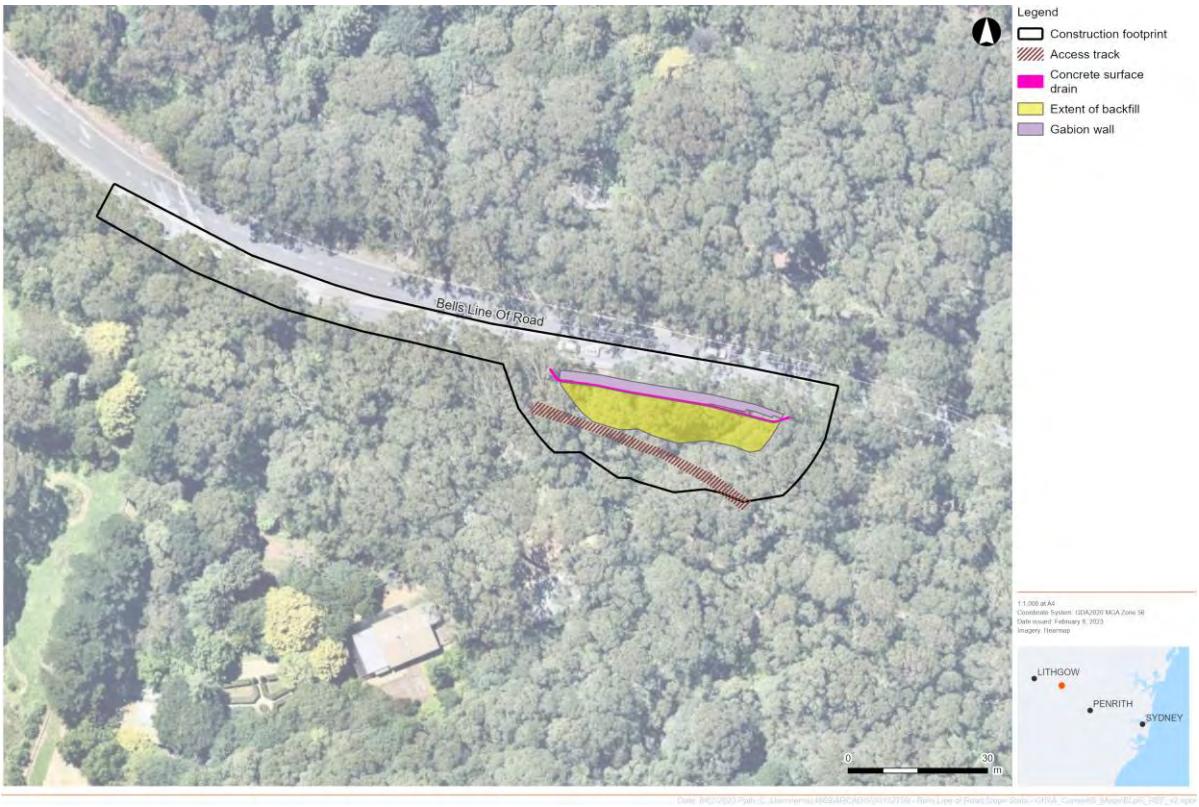


Figure 16: Location of construction footprint and ground disturbing works at slope 93282



1.9.4 Ancillary Sites

A number of ancillary facilities would be required to support delivery of the proposal. Six locations have been identified and assessed, outlined in Table 4and shown in Figure 1. Ancillary Facility 1 is located within the Blue Mountains Botanic Garden, while Ancillary Facilities 2, 3, 4, 5 and 6 are located within the Bells Line of Road road reserve.

All ancillary facilities are located on relatively level land and would not require native vegetation clearing or impacts to heritage items. They are located on land adjacent to or nearby land where the proposal would be carried out, or with ready access to the road network to enable safe and efficient transport to and from site.

Table 4: Proposed ancillary sites

Site	Location	Approximate size	Site description and proposed use
Ancillary Facility 1	-33.539839, 150.420596	830 m^2	• Existing sealed carpark within the Blue Mountains Botanic Garden • Over 200 metres to nearest sensitive receiver • Proposed use: – Site office – Amenities – Temporary stockpiling – Laydown – Car park – Storage areas
Ancillary Facility 2	-33.542432, 150.423349	760 m^2	• Sealed eastbound lane of Bells Line of Road • Adjacent to Slope 93282 • About 40 metres to nearest sensitive receiver • Proposed use: – Site office – Amenities – Temporary stockpiling
Ancillary Facility 3	-33.5380691, 150.4325938	350 m^2	• Existing unsealed pull off area on Bells Line of Road eastbound • About 1.2 kilometres along road to nearest construction site • Over 200 metres to nearest sensitive receiver • Proposed use: – Temporary stockpiling
Ancillary Facility 4	-33.5372757, 150.438604	700 m^2	• Existing unsealed pull off area on Bells Line of Road eastbound with tourist information sign and bus stop • About 1.8 kilometres along road to nearest construction site • About 30 metres north of the nearest residential receiver and about 50 metres west of the nearest commercial receiver • Proposed use: – Temporary stockpiling

Site	Location	Approximate size	Site description and proposed use
Ancillary Facility 5	-33.548777, 150.396415	1090 m^2	• Existing unsealed pull off area on Bells Line of Road eastbound • About four kilometres along road to nearest construction site • No nearby sensitive receivers • Proposed use: – Temporary stockpiling
Ancillary Facility 6	-33.546763, 150.391728	1300 m^2	• Existing unsealed pull off area on Bells Line of Road westbound • About 4.4 kilometres along road to nearest construction site • No nearby sensitive receivers • Proposed use: – Temporary stockpiling – Permanent deposit of about 500 cubic metres of excavated material from Slope 93282 (300-millimetre thickness, levelled and compacted)

1.10 Impact Assessment

This section assesses the heritage impact of the proposed works at the study area on heritage values within the study area. Justifications are also provided for the proposed works.

Within this approach, the objective of a heritage impact assessment is to evaluate and explain how the proposed works will affect the heritage value of the study area and/or place. A heritage impact assessment should also address how the heritage value of the site/place can be conserved or maintained, or preferably enhanced by the proposed works.

In order to consistently identify the impact of the proposed works, the terminology contained in the following table has been references throughout this document. The terminology and definitions are based on those contained in guidelines produced by the International Council on Monuments and Sites (ICOMOS) and the Heritage Council of NSW and are shown in Table 5.[18]

Table 5: Terminology for assessing the magnitude of heritage impact.

Grading	Definition
Major adverse	Actions that would have a severe, long-term and possibly irreversible impact on a heritage item. Actions in this category would include partial or complete demolition of a heritage item or addition of new structures in its vicinity that destroy the visual setting of the item. These actions cannot be fully mitigated.
Moderate adverse	Actions that would have an adverse impact on a heritage item. Actions in this category would include removal of an important part of a heritage item's setting or temporary removal of significant elements or fabric. The impact of these actions could be reduced through appropriate mitigation measures.

[18] ICOMOS, 2011: 9. Heritage NSW, 2020.

Grading	Definition
Minor adverse	Actions that would have a minor adverse impact on a heritage item. This may be the result of the action affecting only a small part of the place or a distant/small part of the setting of a heritage place. The action may also be temporary and/or reversible.
Negligible	Actions that are so minor that the heritage impact is considered negligible.
Neutral	Actions that would have no heritage impact.
Minor positive	Actions that would bring a minor benefit to a heritage item, such as an improvement in the item's visual setting.
Moderate positive	Actions that would bring a moderate benefit to a heritage item, such as removal of intrusive elements or fabric or a substantial improvement to the item's visual setting.
Major positive	Actions that would bring a major benefit to a heritage item, such as reconstruction of significant fabric, removal of substantial intrusive elements/fabric or reinstatement of an item's visual setting or curtilage.

Table 6: Terminology for heritage impact types

Impact	Definition
Direct	Impacts resulting from works located within the curtilage boundaries of the heritage item.
Potential direct	Impacts resulting from increased noise, vibrations and construction works located outside the curtilage boundaries of the heritage item.
Indirect	Impact to views, vistas and setting of the heritage item resulting from proposed works outside the curtilage boundaries of the heritage item.
Archaeological	Impacts to potential archaeological remains located within the curtilage boundaries of the heritage item.

1.10.1 Slope 33459

1.10.1.1 Direct (physical) heritage impacts

Mount Tomah Botanic Garden (MT006)

The works at Slope 33459 will predominantly focus on the existing road cutting, which is located outside the Mount Tomah Botanic Garden heritage curtilage. Proposed works along the northern perimeter of the Garden includes removal of a section of the existing boundary fence and piling to anchor the slope and associated slope remediation works. Works **within** the Garden will include a trench drain on a manicured grass area and a small portion of a landscaped garden bed. There are erosion gullies in the area associated with run-off from the Garden onto the slope failure area. The

trench drain will drain water into a drainage pit that will direct water down the remediated cutting face in order to minimise water damage in the Garden and to that portion of the road corridor in the future. Temporary construction works will include machinery movement and parking whilst installing the trench drain and piles.

The trench drain will involve the permanent alteration of a small portion of the manicured grass and landscaped gardens in the Garden grounds. The trench drain will be flush with the ground surface and be covered by a grill. The scale of the trench work is minor in relation to the heritage item as a whole and is restricted to the northern boundary at the base of a slope. Trees being removed within the proposed access path are being removed by Botanic Gardens due to bush fire damage and separate to this project. It is understood that no significant tree or vegetation plantings will be removed to install the trench Much of the existing vegetation along the boundary of the Garden was removed or fell when the slope failed. Removal of the fence will be a temporary impact, as the fence will be reinstalled following completion of works. The piling will involve permanent alteration of a small portion of the Garden boundary. The piling will be flush with the ground surface once installed, and the fence reinstated along the Garden.

Temporary works within the construction footprint includes movement of machinery and stockpiling materials. A small portion of vegetation will be removed by the Botanic Gardens to assist in machinery access to the worksite. Trees being removed within the proposed access path are being removed by Botanic Gardens due to bush fire damage and separate to this project Machinery access and stockpiling are temporary works with any damage to the ground surface to be reinstated following the completion of works.

Slope remediation works on the road cutting will involve shotcrete, soil nails, and wire mesh installation on the cutting face. Those works are outside the Mount Tomah Botanic Garden heritage item.

The proposed slope remediation works at Slope 33459 will result in a **minor-adverse** direct impact to the significance of the Mount Tomah Botanic Gardens heritage item.

Mount Tomah and Environs Conservation Area (MT002)

The proposed works at Slope 33459 are situated within the Mount Tomah and Environs Conservation Area. Due to the small scale of the works and confinement of the works area predominantly to an existing road cutting, the proposed slope remediation works will result in **negligible** direct impact to the Mount Tomah and Environs Conservation Area.

1.10.1.2 Indirect (visual) heritage impacts

Mount Tomah Botanic Garden (MT006)

The trench drain within the Garden and piling along the northern perimeter of the Garden will be flush with the ground surface and will not substantially impact views of the northern portion of the Garden. The natural downward slope in that area means that the new works will not impede the visual and sensory setting of the area, particularly from the nearby path and viewing platform.

Remediation works on the road cutting will not result in a visual impact within the Garden. The views to and from Bells Line of Road to the Garden will be altered through installation of shotcrete and mesh on the cutting face. However, the works will be limited to a small section of road cutting and only briefly visible to passing vehicles.

Machinery movement and access to the worksite will result in temporary visual impact to the significance of the Mount Tomah Botanic Gardens heritage item. The movement of machinery will be confined to the lower slope along the northern boundary of the Garden.

The proposed slope remediation works at Slope 33459 will result in a **minor-adverse** visual impact to the significance of the Mount Tomah Botanic Gardens heritage item.

Mount Tomah and Environs Conservation Area (MT002)

The proposed works at Slope 33459 are situated within the Mount Tomah and Environs Conservation Area. Due to the small scale of the works and confinement of the works area predominantly to an existing road cutting, the proposed slope remediation works will result in **negligible** visual impact to the Mount Tomah and Environs Conservation Area.

1.10.2 Slope 96403

1.10.2.1 Direct (physical) heritage impacts

Mount Tomah Botanic Garden (MT006)

The works at Slope 96403 are confined to the existing road surface and failed slope on the southern side of the road. The works at Slope 96403 are not located within the Mount Tomah Botanic Garden and will result in **neutral** direct impact to the significance of the Mount Tomah Botanic Gardens heritage item.

Mount Tomah and Environs Conservation Area (MT002)

The proposed works at Slope 96403 are situated within the Mount Tomah and Environs Conservation Area. The proposed works will include some vegetation removal along the southern side of the Bells Line of Road as part of the slope remediation works. Due to the small scale of the works and minor vegetation removal on an existing embankment slope, the proposed remediation works will result in **negligible** direct impact to the Mount Tomah and Environs Conservation Area.

1.10.2.2 Indirect (visual) heritage impacts

Mount Tomah Botanic Garden (MT006)

The works at Slope 96403 are confined to the existing road surface and failed slope on the southern side of the road. The works at Slope 96403 are not located within the Mount Tomah Botanic Garden and will result in **neutral** visual impact to the significance of the Mount Tomah Botanic Gardens heritage item.

Mount Tomah and Environs Conservation Area (MT002)

The proposed works at Slope 96403 are situated within the Mount Tomah and Environs Conservation Area. The proposed works will include some vegetation removal along the southern side of the Bells Line of Road as part of the slope remediation works. Due to the small scale of the works in the Conservation Area as a whole and minor vegetation removal on an existing embankment slope, the proposed remediation works will result in **negligible** visual impact to the Mount Tomah and Environs Conservation Area.

1.10.3 Slope 93282

1.10.3.1 *Direct (physical) heritage impacts*

Mount Tomah and Environs Conservation Area (MT002)

The proposed works at Slope 93282 are situated within the Mount Tomah and Environs Conservation Area. The proposed works will includes remediation of a portion of collapsed embankment on the southern side of Bells Line of Road. The works will involve some vegetation clearance around the edge of the collapsed slope to assist with slope remediation works and access by machinery. Due to the small scale of the works and minor vegetation removal on an existing embankment slope, the proposed remediation works will result in **negligible** direct impact to the Mount Tomah and Environs Conservation Area.

Sunrise (MT007)

The works at Slope 93282 are confined to the existing road embankment on the southern side of Bells Line of Road and will not be located within the curtilage of the Sunrise heritage item. The principle values associated with the Sunrise heritage item are associated with the inter-war period cottage situated approximately 250m west of the slope remediation works area.

The proposed slope remediation works at Slope 93282 will result in **neutral** direct impact to the Indirect (visual) heritage impacts.

1.10.3.2 Indirect (visual) heritage impacts

Mount Tomah and Environs Conservation Area (MT002)

The proposed works at Slope 93282 are situated within the Mount Tomah and Environs Conservation Area. The proposed works will includes remediation of a portion of collapsed embankment on the southern side of Bells Line of Road. The works will involve some vegetation clearance around the edge of the collapsed slope to assist with slope remediation works and access by machinery. The proposed gabion wall and slope scaling will appear new and visually differentiated from the existing vegetation covered slope to the east and west. However, due to the small scale of the works and minor vegetation removal on an existing embankment slope, the proposed remediation works will result in **negligible** visual impact to the Mount Tomah and Environs Conservation Area.

Sunrise (MT00X7

The works at Slope 93282 are confined to the existing road embankment on the southern side of Bells Line of Road and will not be located within the curtilage of the Sunrise heritage item. The remediation works will not be visible from the cottage. The principle values associated with the Sunrise heritage item are associated with the inter-war period cottage situated approximately 250m west of the slope remediation works area.

The proposed slope remediation works at Slope 93282 will result in **neutral** direct impact to the Indirect (visual) heritage impacts.

1.10.4 Ancillary sites

1.10.4.1 Direct (physical) heritage impacts

All ancillary facilities are located on relatively level land and would not require native vegetation clearing or impacts to heritage items. They are located on land adjacent to or nearby land where the proposal would be carried out, or with ready access to the road network to enable safe and efficient transport to and from site. The ancillary facilities will result in **neutral** direct impacts to the Blue Mountains World Heritage Area and National Heritage item (ancillary site 6). The ancillary will result in **neutral** direct impact to the Mount Tomah and Environs Conservation Area (ancillary site 1 and 2).

1.10.4.2 Indirect (visual) heritage impacts

The ancillary sites will involve temporary storage of materials and compound facilities on existing hardstand areas in the road corridor only. The ancillary facilities will result in **neutral** visual impacts to the Blue Mountains World Heritage Area and National Heritage item (ancillary site 6). The ancillary will result in **neutral** visual impact to the Mount Tomah and Environs Conservation Area (ancillary site 1 and 2).

1.10.5 Impact summary

Direct impacts will predominantly be limited to the existing road embankments or road surfaces of the Bells Line of Road in three finite areas where there have been slope failures. The design scope is limited to undertaking slope remediate and drainage works specific to those areas, and keeps to a minimum new works, machinery access and vegetation removal.

The limited scope of the works and focus on three specific areas of slope failure within the road corridor ensures that the aesthetic significance and character of the Mount Tomah and Environs Conservation Area remain unchanged.

The limitation of works within the Mount Botanic Garden heritage item to installation of a trench drain in the northern boundary area of the heritage item will result in minor-adverse direct and visual impacts to that heritage item.

1.10.6 Statement of Heritage Impact

A statement of heritage impact has been prepared according to NSW Heritage Office guidelines in **Error! Reference source not found.** below.

Table 7: Statement of Heritage Impact for the proposed works

Development	Discussion
What aspects of the Proposal respect or enhance the heritage significance of the study area?	• The proposed works are being undertaken to remediate areas of slope failure within the Bells Line of Road road corridor. • The proposed works will repair damage to the area and minimise the potential for further damage in those areas • Repair of existing damage and a focus on minimising future recurrences in those locations is a positive outcome for the aesthetic significance and character of the area • The proposed works will help manage erosion caused by erosion in the Mount Tomah Botanic Garden. Water run-off adjacent to the slope failure area has caused at least one erosion gully in the manicured grass
What aspects of the Proposal could have a detrimental impact on the heritage significance of the study area?	• Installation of a new trench drain within the Mount Tomah Botanic Gardens will result in minor-adverse direct and visual impacts to that heritage item. Although minimised to a small area near the northern boundary of the item, the trench drain will be a new permanent addition to the Garden • Although minimised to very small portions of the area as a whole, the use of shotcrete and gabion wall at Slope 33459 and 93282 respectively is not in keeping with the natural bedrock and vegetation covered slopes typical of the visual aesthetic of the Mount Tomah and Environs Conservation Area.

Development	Discussion
Have more sympathetic options been considered and discounted?	• The proposed locations for the slope remediation works are limited to areas of existing slope failure only. The works will not be undertaken in other sections of the road corridor that have not been subject to existing slope failure • The design approach and use of materials and finishes have been tailored to the specific characteristics of each area of slope failure. The use of shotcrete and soil bolts at Slope 33459 is in keeping with previous slope failure remediation works undertaken in 2015/2016 approximately 60m to the east •

1.11 Assessment against relevant policies

1.11.1 Burra Charter

The conservation articles provided in Table 8 below from the Burra Charter, which are of particular relevance to the proposal, should be followed.[19]

Table 8: Relevant articles from the *Burra Charter*

Article No.	Article	Proposal
8.0	*Conservation requires the retention of an appropriate setting. This includes retention of the visual and sensory setting, as well as the retention of spiritual and other cultural relationships that contribute to the cultural significance of the place.* *New construction, demolition, intrusions or other changes which would adversely affect the setting or relationships are not appropriate.*	The new trench drain and construction vehicle access within the Mount Tomah Botanic Garden heritage item will be localised to a portion of the northern perimeter of the Garden. The natural downward slope in that area means that the new works will not impede or adversely impact the visual and sensory setting of the area, particularly from the nearby path and viewing platform.
22.1	*New work such as additions or other changes to the place may be acceptable where it respects and does not distort or obscure the cultural significance of the place, or detract from its interpretation and appreciation.*	The new trench and construction vehicle access within the Mount Tomah Botanic Garden heritage item will be limited to temporary works and installation of a trench drain flush with ground level. The localisation of the works to a portion of the northern perimeter of the Garden and visually low key finish means that the works will not distort or obscure the significance of the item.

[19] Australia ICOMOS, 2013

1.12 Recommendations and Mitigation Measures

1.12.1 Pre-construction

NAH01 (Non-Aboriginal Heritage 01)	Prior to commencement of works, a Photographic Archival Recording of the portion of works within the Mount Tomah Botanic Gardens must be undertaken. The Photographic Archival Recording should be undertaken by a heritage professional in accordance with the Heritage NSW 'Guidelines for Photographic Recording of Heritage Items'. The PAR should be lodged with The Royal Botanic Gardens Doman and Trust.
NAH02	Transport for NSW must liaise with The Royal Botanic Gardens Domain and Trust to coordinate colour finishes for the trench drain within Mount Tomah Botanic Garden. The colours selected for the drain grill must be a colour such as dark grey or black that ensures the new fabric does not visibly contrast with surrounding garden beds and grass cover. If any of the concrete structure of the drain will be visible on the ground surface consideration must be given to dying the concrete a darker colour to ensure the new fabric does not visibly contrast with the surrounding garden. Colour selection will be critical to minimising the intrusiveness of the new fabric. The final colour finishes selected must be coordinated with The Royal Botanic Gardens Doman and Trust.
NAH03	The colour selected for shotcrete used on slope 33459 must consider the colour used for previous shotcrete repairs on the cutting in the immediate vicinity and the colour of the exposed bedrock in the area.

1.12.2 Construction

NAH04	All staff, including design professionals and tradespeople, involved in the proposed works must receive a heritage induction prior to the commencement of works. The heritage induction should cover the heritage significance of the Mount Tomah Botanic Gardens and the Mount Tomah and Environs Conservation Area.
NAH05	The heritage induction must ensure all staff are aware of the heritage significance of the surrounding area, including specific listed heritage items such as MT001 Cave Hotel and MT007 Sunrise. Under no circumstances will **any** works, including temporary storage or stockpiling, be located within 50 metres of MT001 Cave Hotel.
NAH06	The colour selected for shotcrete used on slope 33459 must consider the colour used for previous shotcrete repairs on the cutting in the immediate vicinity and the colour of the exposed bedrock in the area.
NAH07	If works extend beyond the locations assessed in this report, further heritage investigation must be undertaken. This assessment is prepared under the assumption that physical works will be limited to the specific trench, piling, shotcrete, slope stabilisation, and gabion wall, extent as shown in the design plans. Any extension of those works or any other works within each construction footprint must be subject to additional heritage assessment.
NAH08	If works extend beyond the construction footprint, additional heritage assessment must be undertaken.
NAH09	Care must be taken to ensure that the impacts within each construction footprint are minimised to what is necessary to undertake the works and to ensure consistency with this assessment. This includes minimising vehicle movements on grass, minimising vegetation removal to only what is necessary to complete the works, using protective mats on the ground if deemed necessary to minimise surface impact within Mount Tomah Botanic Gardens.

NAH10	If additional ancillary sites are used that have not assessed in this report, additional heritage assessment must be undertaken.
NAH11	Ancillary facilities must not extend beyond the existing gravel / bitumen surfaces at each ancillary site location. Particular care must be taken at Ancillary Site 6, which overlaps with the Blue Mountains Heritage Area. Works must not harm any intact sandstone or vegetation surrounding the existing flat roadside clearing.
NAH12	Any unexpected finds encountered during the works must be managed in accordance with the Transport for NSW unexpected finds procedure.

1.12.3 Post-construction

NAH13	The construction footprint within the Mount Tomah Botanic Garden must be restored to pre-construction condition. This work must be undertaken in consultation with The Royal Botanic Gardens Domain and Trust. This includes restoration of grass, restoration of garden beds, and restoration of any other features moved or impacted during works to pre-construction condition. Soils and vegetation types used for restoration must be consistent with what is currently on site and approved by The Royal Botanic Gardens Domain and Trust. Post-construction restoration works must not result in areas becoming eroded or visibly different in appearance to the surrounding Garden.
NAH14	A Photographic Archival Recording of the portion of works within the Mount Tomah Botanic Gardens must be undertaken following completion of works. The Photographic Archival Recording should be undertaken by a heritage professional in accordance with the Heritage NSW ‘Guidelines for Photographic Recording of Heritage Items’. The PAR should be lodged with The Royal Botanic Gardens Doman and Trust.

Appendix F – PACHCI Stage 1 Assessment

6th of February 2023

Nathan Anthonipillai
Project Manager/Engineer
Infrastructure and Place
Transport for NSW

Dear Nathan,

Preliminary assessment results for Slope Stabilisation Works - Bells Line of Road (Slopes 33459, 93282 & 96403 Mount Tomah) based on Stage 1 of the *Procedure for Aboriginal cultural heritage consultation and investigation* (the procedure).

The project, as described in the Stage 1 assessment checklist was assessed as being unlikely to have an impact on Aboriginal cultural heritage.

The assessment is based on the following due diligence considerations:

- The project is unlikely to harm known Aboriginal objects or places.
- The AHIMS search did not indicate moderate to high concentrations of Aboriginal objects or places in the study area.
- The study area does not contain landscape features that indicate the presence of Aboriginal objects, based on the Office of Environment and Heritage's *Due diligence Code of Practice for the Protection of Aboriginal objects in NSW* and the Roads and Maritime Services' procedure.
- The cultural heritage potential of the study area appears to be reduced due to past disturbance.
- There is an absence of sandstone rock outcrops likely to contain Aboriginal art.

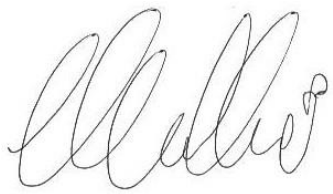
Your project may proceed in accordance with the environmental impact assessment process, as relevant, and all other relevant approvals.

If the scope of your project changes, you must contact The Aboriginal Engagement Section, Greater Sydney Region, and your regional environmental staff to reassess any potential impacts on Aboriginal cultural heritage.

If any potential Aboriginal objects (including skeletal remains) are discovered during the course of the project, all works in the vicinity of the find must cease. Follow the steps outlined in the Roads and Maritime Services' *Unexpected Heritage Finds Procedure*.

For further assistance in this matter do not hesitate to contact me.

Yours sincerely



Corrine Quinlan
Aboriginal Cultural Heritage Advisor – Greater Sydney Region

NSW GOVERNMENT