

# Appendix N

## Urban design, landscape and visual





Transport  
for NSW

# Great Western Highway - Blackheath to Little Hartley

Appendix N (Technical report - Urban Design, landscape and visual)

18 January 2023



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# Contents

<b>1.</b>	<b>Introduction</b>	<b>11</b>	<b>5.</b>	<b>Urban Design Concept</b>	<b>67</b>
1.1	Great Western Highway Upgrade Program	11	5.1	Overview	68
1.2	Transport for NSW commitment	11	5.2	Urban Design Vision	69
1.3	The project corridor	12	5.4	Urban design principles	70
1.4	Purpose and outline of this report	14	5.3	Urban design objectives	70
1.5	Project description	18	5.5	Site wide strategy	77
<b>2.</b>	<b>Policy and Planning Setting</b>	<b>25</b>	5.6	Designing with Country	80
2.1	Introduction	25	5.7	Urban design strategic elements	86
2.2	Policy and strategic context	26	5.8	Urban design structural elements	104
<b>3.</b>	<b>Methodology</b>	<b>37</b>	5.9	Urban design concept plans and sections	139
3.1	Contextual analysis	38	5.10	Mitigation measures incorporated into the concept design	164
3.2	Urban design	39	<b>6.</b>	<b>Landscape Character Impact Assessment</b>	<b>167</b>
3.3	Landscape character impact assessment	40	6.1	Landscape character zones	167
3.4	Visual impact assessment	40	6.2	Landscape character impact assessment	167
3.5	Cumulative impact assessment	41	6.3	Impact of construction on landscape character	171
3.6	Mitigation of impact	41	6.4	Summary of impact on landscape character	171
3.7	Conclusion	41	<b>7.</b>	<b>Visual Impact Assessment</b>	<b>173</b>
<b>4.</b>	<b>Contextual Analysis</b>	<b>43</b>	7.1	Blackheath	173
4.1	Introduction	43	7.2	Soldiers Pinch	202
4.2	Corridor place analysis	44	7.3	Little Hartley	206
4.3	Topographical analysis	49	7.4	Summary of visual impact assessment	239
4.4	Vegetation analysis	50	7.5	Discussion of cumulative effects	242
4.5	Land use zoning	53	7.6	Discussion of heritage values	243
4.6	Heritage analysis	54	7.7	Conclusion	243
4.7	Landscape Character Zones	58	<b>8.</b>	<b>Mitigation Strategy</b>	<b>245</b>
			8.1	Management of Impacts	245
			8.2	Mitigation Measures	246
			8.3	Urban design opportunities for further investigation	247
			<b>9.</b>	<b>Conclusion</b>	<b>249</b>



Executive Summary

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# Executive Summary

### The project

The Great Western Highway Upgrade Program (the Upgrade Program) would enhance the existing upgraded sections of the Great Western Highway, further improving connectivity to and from the regions and places of activity and recreation. Improved amenity and reduced traffic flow in the townships will improve the environment for business and leisure.

The Great Western Highway Blackheath to Little Hartley Upgrade (the project) provides an opportunity to redevelop and shape the corridor between Blackheath and Little Hartley. It provides a moving experience of environmental reflection, Connection to Country and ‘place’, that references the Highway design elements while providing a new, legible and unique urban design and landscape experience, through a thoroughly integrated stakeholder and multi-disciplined design approach.

The project is located on the edge of the Blue Mountains National Park and runs between the townships of Blackheath and Little Hartley and acknowledges the relationship between the landscape and the communities that inhabit them.

This report will be integral to shaping the future of this vital transport corridor, its functionality and the user experience.

### The Vision

The urban design Vision for the project has been developed:

**‘to create a highway experience that fits in the landscape, provides improved travel and respects the cultural and heritage values of the area’**

This Vision, with supporting urban design objectives and principles, will give the project an identity and demonstrate a Connection to Country.

It is a vision that highlights both Aboriginal and non-aboriginal heritage as a means to create an enduring legacy for both the community and visitors to the wider corridor area.

It is embedded within recognising that any outcome, whether through landscape design and the visual experience, is ultimately influenced by human settlement over thousands of years.

The following urban design objectives have been developed to reinforce the aspirations of the Vision aligned with the overarching Urban Design Framework;

1. ‘Connect People and Places’
2. ‘Renewal and Liveability’
3. ‘Environmental Responsiveness’
4. ‘Celebrate Culture and Communities’
5. ‘A Safe and Memorable Journey’ and
6. ‘A World Class Transport Asset’

These objectives were developed to form the basis of the concept design and for design evaluation at each phase of implementation of the project.

They will complement the economic, engineering, safety and environmental objectives intended to encourage excellence in the project outcomes, generated by the contributions of the various disciplines involved in the execution of the design. This includes the phases of planning, concept design, design development and documentation, construction and operation.

The Concept

The design aspirations are based on delivering high quality integrated design outcomes that display relevance, fit, durability and delight.

The design seeks to create a project identity that is of place and aims to draw on the project vision of a *Connection to Country* as the basis for an integrated landscape and urban design solution.

The solution would reflect the complex layers of the regional landscape, reliant upon the interaction and shared voices and stories of the Aboriginal people and the non-Aboriginal communities, who share the project area.

The concepts presented in this report will continue to evolve and be refined as feedback from all the project stakeholders is received.

The Experience

The urban design supports the concept that the design decisions create the setting for the urban design experience, built by movement and time by the users of the space.

The user experience occurs through a consecutive suite of natural and varied landscape and bushland characters and engineered elements. It is acknowledged that the majority of the experience for the driver will occur as an uninterrupted journey below surface level in the tunnel.

For the driver, it is a fast, direct movement through a linear space, guided by cultural markers and design elements.

For the pedestrian and cyclist, where active transport corridors are provided, the experience has varied speed, with unconstrained movement through time.

The evolving concept themes recognise the experience as the sequential transition from the landscape realm to the earth realm and back again. The experience of moving through and under Country are the central and primary concepts that serve as the basis to unite the major design elements.

The Landscape

Country commands care and respect between the plants and the earth to sustain life.

The landscape response interprets existing Country by preserving vegetation patterns and view corridors and developing a landscape that is meaningful to encourage biodiversity and a healthy ecosystem.

The integration and fit of the landscape design within the existing context has been incorporated as a means to blend the scale of the civil solution into the existing landform.

The fabricated and natural elements will read as a cohesive solution through use of materials blended with the ochre colours of the land.

Overtime the landscape will flourish, culminating in a positive visual experience, in this way apologising for the initial disturbance and then resting within the landform, balanced, to become part of the landscape.



The Portals

Songlines are an Aboriginal cultural way of communicating mapping and providing direction across Country. These have been interpreted as rhythmic, sinuous, curvaceous lines guiding the conceptual development of the form.

The concept for the portals relies on these interpretations and draws inspiration from the escarpment, balancing the natural landforms with the surrounding natural environment.

The form is to evoke calmness and joy, a juxtaposition of emotion to settle the user as they arrive and heighten anticipation for the journey ahead through the tunnel.





The Tunnel

As the major part of the overall driver experience, the initial concept for the interior of the tunnel began with the narrative of a reflection on The Past, The Present and the Future, interpreted as a continuum of the experience of a journey. The sinuous concept of the Portal structures and the rhythmic lines evoked by this shape might continue through the Tunnel as a representation of The Past walkable travel over the mountains, The Present engineered pathway and The Future direct passage under the mountains.

At least three major lighting visual events in each of the tunnels at around 600 metres each are proposed.

Continued stakeholder engagement will inform these themes as the design develops.

The concept seeks to provide balance with all elements considered to blend into the surrounding context, reflecting the rhythm of the natural landforms and the travel over Country, the existing ecology and the colours and textures of the site.



Landscape Character and Visual Impact Assessment

The project is in a tunnel for a large portion of its total length which helps to minimise the impact on landscape character and views. The focus of the landscape character and visual impact assessment is on the areas of the project where it surfaces and meets existing infrastructure.

The project would result in surface changes at two locations during operation: Blackheath and Little Hartley. Both locations have characteristic elements of the unique 'Blue Mountains' landscape. At Blackheath, the dense bushland fringing the gently curving Great Western Highway as it meanders alongside the rail corridor provides moments of 'wilderness' between townships that characterises the Great Western Highway experience. At Little Hartley, the steep descent down Victoria Pass and out into the open, rural valley below provides a gateway experience into the more rural setting of the landscapes beyond the Blue Mountains. Furthermore, Little Hartley comprises an example of the unique 'verdant valley within rugged escarpments' landscape of the Blue Mountains.

Overall, the project is considered to have a High to Moderate (Adverse) effect on landscape character, however, this impact would be localised to the areas surrounding the surface works at both Blackheath and Little Hartley. The project would contribute to the increase in prominence of the Great Western Highway as a distinct, linear element within the landscape.

The project is considered to have a Moderate (Adverse) impact on surrounding views. This rating considers the changes due to the project within a transport corridor which is already undergoing substantial change along its length due to the Upgrade Program to the east (Katoomba to Blackheath Upgrade) and further west (Little Hartley to Lithgow Upgrade). The substantial increase in scale of infrastructure would fit the overall character of the upgraded Great Western Highway.

The project would have a beneficial effect on both landscape character and views along the Great Western Highway between Blackheath and Little Hartley with the reduction in volume of traffic and the size of the vehicles travelling along the narrower corridor, particularly within the Blackheath township.

The impact of the project on landscape character and views would reduce over time, particularly with the maturation of planting. The adoption of mitigation measures, particularly those around tree planting and surface treatment of larger structures, such as retaining walls and the ventilation outlet (if used) would reduce the visual prominence of the project within the landscape and ultimately its overall impact.

Cumulative Impact Assessment

Overall, the project in addition to the Upgrade Program at Blackheath and Little Hartley would result in substantial changes both to landscape character and views. The scale of the widened road corridor and the larger infrastructure elements that would be incorporated into the landscape (particularly the split carriageways, tunnel portals, ventilation outlets (if used) and lighting), would be uncharacteristic within the landscape setting at both Blackheath and Little Hartley.

The overall combined impact of the project and the Upgrade Program on landscape character is considered to be High (Adverse). The combined impact of the project and Upgrade Program on views is considered to be High (Adverse).



**The Blue Mountains is an ancient special place of the Dharug, Gundungurra and Wiradjuri people, passing through spectacular landscapes and places with cultural meaning.**

**The Great Western Highway is one of NSW's oldest and most important routes, providing access through the Blue Mountains to the Hartley Valley and is the key link to the Central West and beyond.**

Introduction

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**The Blackheath to Little Hartley Upgrade responds to, respects, and reinforces the heritage context, rugged terrain, natural systems, cultural landscapes, and places of the Blue Mountains and the rich historical, rural character of Hartley Valley, through which it passes, creating a memorable and safe experience and a legacy for all.**

The Great Western Highway is a gateway to regional New South Wales, facilitating the journey of millions of people across Australia's iconic Blue Mountains.

The Upgrade Program will enhance the existing upgraded sections of the Highway, further improving connectivity to and from the regions.

Traversing the places and ancient landscapes of the Blue Mountains, the Great Western Highway Upgrade Program will connect places of activity and recreation, provide access to some of the world's most famous views, create new opportunities for business and leisure.

Distinctive and sensitive design responses will highlight key moments along the journey to orientate users, creating a safe and comfortable experience above and below ground.



Figure 1-1: Blackheath to Little Hartley Upgrade location

**"Together, the Australian and NSW Governments are investing more than \$4.5 billion towards upgrading the Great Western Highway between Katoomba and Lithgow."**



# 1. Introduction

## 1.1 Great Western Highway Upgrade Program

The Great Western Highway Upgrade Program (the Upgrade Program) is an infrastructure program of national importance.

It will make the Blue Mountains and the Central West and Orana more attractive places to live, and unlock the potential of regional New South Wales (NSW).

The NSW Government has progressively upgraded sections of the Great Western Highway to make it safer and more reliable for all road users. This upgrade will complete the final 34 km connection of a modern dual-carriageway link across the Blue Mountains.

The Upgrade Program comprises the following components:

- Great Western Highway Upgrade – Medlow Bath (Medlow Bath Upgrade): upgrade and duplication of the existing surface road corridor with intersection improvements and a new pedestrian bridge (approved)
- Great Western Highway East – Katoomba to Blackheath (Katoomba to Blackheath Upgrade): upgrade, duplication and widening of the existing surface road corridor, with connections to the existing Great Western Highway east of Blackheath (approved)
- Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) (Little Hartley to Lithgow Upgrade): upgrade, duplication and widening of the existing surface road corridor, with connections to the existing Great Western Highway at Little Hartley (approved)
- Great Western Highway Blackheath to Little Hartley: construction and operation of a twin tunnel bypass of Blackheath and Mount Victoria and surface road works for tie-ins to the east and west of the tunnel (the project).

Together, the Australian and NSW Governments are investing more than \$4.5 billion towards upgrading the Great Western Highway between Katoomba and Lithgow (the Upgrade Program). Once upgraded, over 95 kilometres of the Great Western Highway will be two lanes in each direction between Emu Plains and Wallerawang.

Once completed, the Upgrade Program will reduce congestion and deliver safer, more efficient and reliable journeys for those travelling in, around and through the Blue Mountains, while also better connecting communities in the Central West.

## 1.2 Transport for NSW commitment

Transport for NSW is committed to providing 'successful places' with the 'liveability, amenity and economic success of communities and places enhanced by transport' (Future Transport 2056).

There are four physical urban design Objectives which should be achieved on all road and maritime infrastructure work:

1. Projects should fit sensitively into the built, natural, and cultural environment in both urban and rural locations.
2. Projects should contribute to the accessibility and connectivity of communities and a general permeability of movement through areas by all modes of movement.
3. The design and management of projects should contribute to the overall design quality of the public domain for the community, including transport users.
4. Projects should help revitalise areas and contribute to the local and broader economy.

These outcomes should be met in a cost effective, safe and sustainable manner. Cost effective, safe and sustainable performance of infrastructure needs be an integral part of project planning, design, building and maintenance.

### 1.2.1 Blackheath to Little Hartley Upgrade

Transport for NSW (Transport) is seeking approval under Division 5.2, Part 5 of the Environmental Planning and Assessment Act 1979 (NSW) (EP&A Act) to upgrade the Great Western Highway between Blackheath and Little Hartley (the project).

The project would comprise the construction and operation of new twin tunnels around 11 kilometres in length between Blackheath and Little Hartley, and associated surface road upgrade work for tie-ins to the east and west of the proposed tunnel portals.

The project would be located around 90 kilometres northwest of the Sydney CBD and located within the Blue Mountains and Lithgow Local Government Areas (LGA).

The majority of the project would be located below ground generally along or adjacent to the west of the existing Great Western Highway between around Blackheath and Little Hartley.

### 1.2.2 Great Western Highway Upgrade Program Objectives

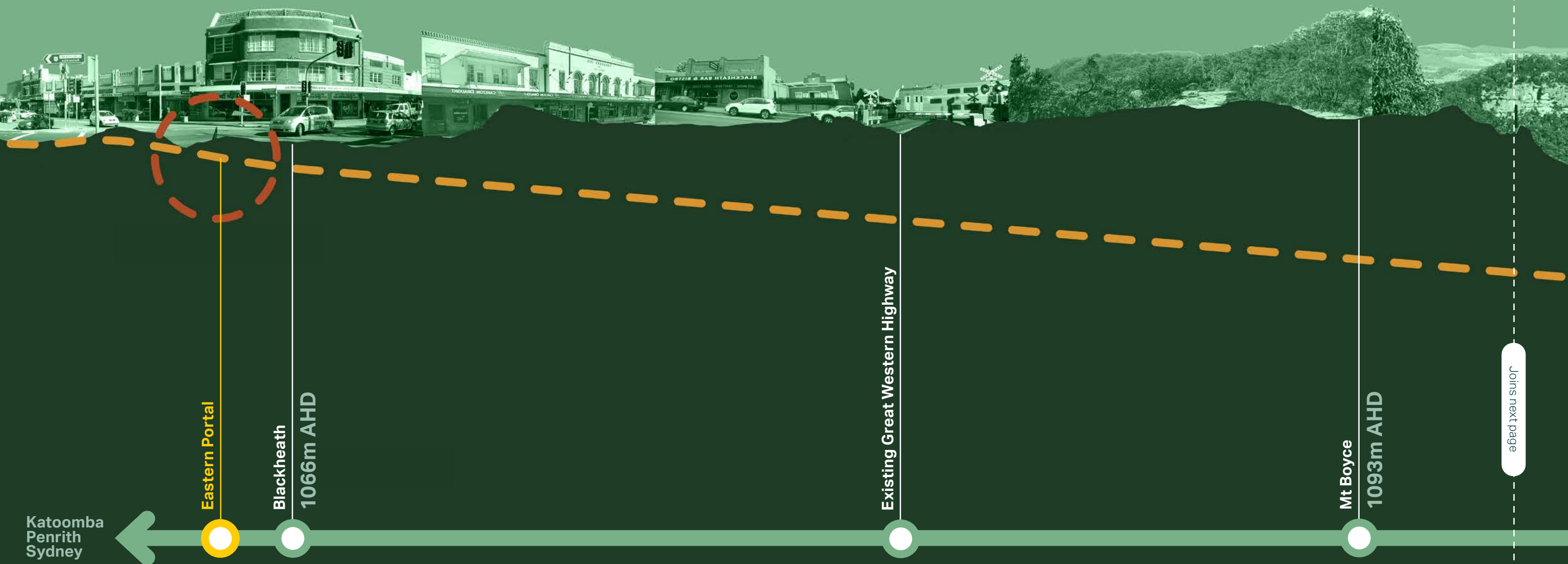
The Upgrade Program Objectives are:



Figure 1-2: Upgrade Program Objectives, from Katoomba to Lithgow SUDF



1.3 The project corridor



Revitalising the Blue Mountains

The proposed corridor between Blackheath and Little Hartley is an opportunity to reshape the movement of people and goods through the Blue Mountains between Greater Sydney, the Central West and Orana.

Building on the places and destinations within the region, the investment in a new transport link will facilitate future economic, environmental and social opportunities for New South Wales.

As a major new piece of infrastructure, the project has a responsibility to consider the corridor’s unique and diverse natural and cultural context.

Revitalising the towns and hamlets bypassed by the proposed tunnel/s are critical social, economic and environment opportunities.

The Urban Design Report reinforces the need for the project to be a good ‘neighbour’, sensitively navigating key interfaces along the corridor.

Figure 1-3 illustrates the diversity of places and landscapes along the corridor, and the role of effective urban design outcomes in ensuring the Urban Design Vision is achieved.

Figure 1-3: Site Wide Graphic Section

Development of the Great Western Highway

The Aboriginal peoples of the Blue Mountains navigated the ridge line creating the original Blue Mountains crossing. In 1813, Governor Macquarie instructed Gregory Blaxland, William Lawson and William Wentworth to lead an expedition from Emu Plains across the Blue Mountains. By following the ridges they were able to confirm the existence of a passable route directly west from Sydney across the Blue Mountains.

Blaxland, Lawson and Wentworth travelled as far west as the point they named Mount Blaxland, 25km south-west of where Lithgow now stands. From this point they were able to see that the worst of the almost impenetrable terrain of the Blue Mountains was behind them, and that there were easy routes available to reach the rolling countryside to the west.

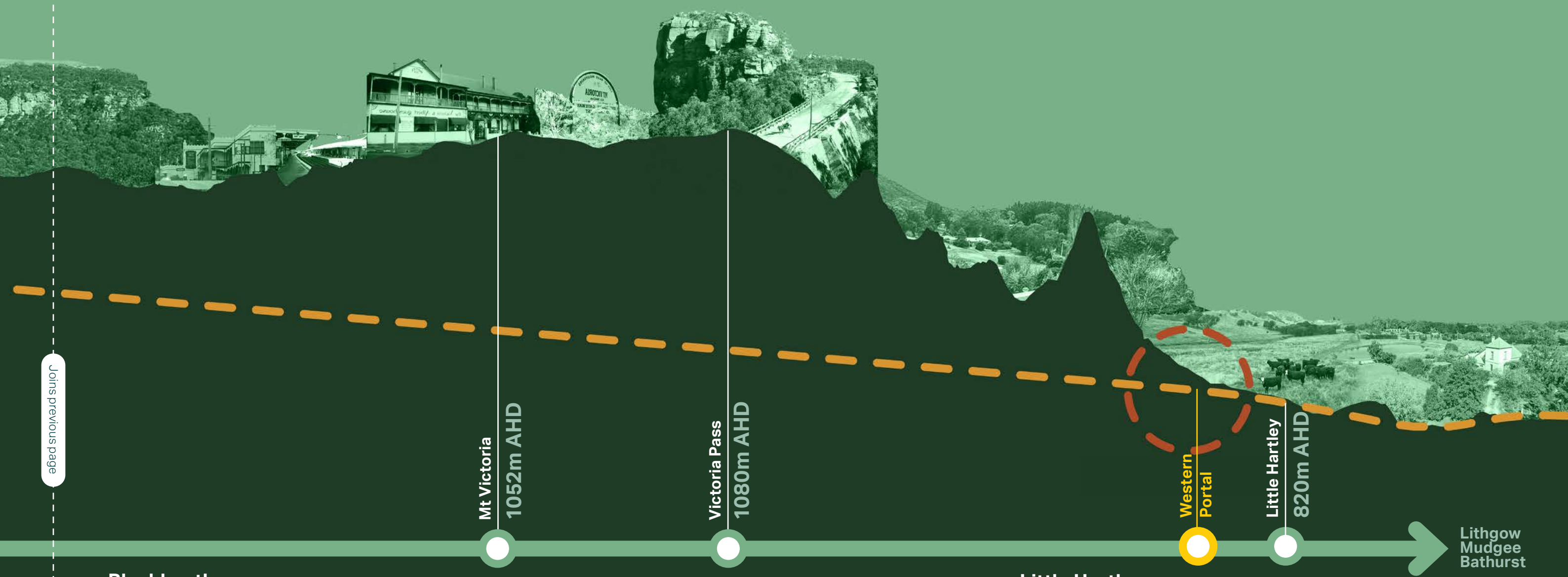
Within a year, Macquarie commissioned William Cox to construct a road west from Emu Plains along this route and the road was finished in 1815. Macquarie himself travelled across it soon after completion, established and named Bathurst, and named the road the Great Western Road.

The section of the Great Western Road as far west as Mount Victoria, with a small number of minor deviations, is still in use today as part of the Great Western Highway. West of Mount Victoria, the route has been superseded by a new route constructed between 1832 and 1836.

Blue Mountains World Heritage Area

The Greater Blue Mountains Area consists of 1.03 million ha of sandstone plateaux, escarpments and gorges dominated by temperate eucalypt forest. The site, comprised of eight protected areas, is noted for its representation of the evolutionary adaptation and diversification of the eucalypts in post-Gondwana isolation on the Australian continent. Ninety-one eucalypt taxa occur within the Greater Blue Mountains Area which is also outstanding for its exceptional expression of the structural and ecological diversity of the eucalypts associated with its wide range of habitats. The site provides significant representation of Australia’s biodiversity, with ten percent of the vascular flora as well as significant numbers of rare or threatened species, including endemic and evolutionary relict species, such as the Wollemi pine, which have persisted in highly-restricted microsites.





### Blackheath

Blackheath is located near the highest point of the Blue Mountains, between Katoomba and Mount Victoria and has a number of eateries, a large antique centre and other shops. It is a common weekend destination for Sydneysiders. A short drive to the east-north-east is Govetts Leap, a well known lookout with views of the Grose Valley and nearby waterfalls. Evans Lookout provides an alternate vantage point for views into Grose Valley. Pulpit Rock, Perrys Lookdown and Anvil Rock are other lookouts to the north-north-east of the town centre off Hat Hill Road. There are several walking tracks starting from the lookouts, including short walks to enjoy different views, longer half and whole day walks, and walks involving camping overnight or several days' walk. The area is known today for its colourful blooms in Spring and golden Autumn foliage as the weather begins to cool. In September, daffodils bloom, and on the first weekend of November, Blackheath hosts an annual Rhododendron Festival. Mount Boyce lookout is located north-west of Blackheath, towards Lithgow. The Megalong Valley can be accessed from Blackheath, about 18 km away to the west via Mount Victoria.

### Victoria Pass and Mt Victoria

Mitchell's Bridge was opened in 1832 as part of Victoria Pass, on the western escarpment. Hand-built by convict labour, it remains in use on the Great Western Highway to this day. Mount Victoria is a small township with a large number of historic buildings and a few attractions including the Post Office, a Hall which is used as a cinema, the Imperial Hotel, the Toll Keepers Cottage and a museum at the railway station. Mt Victoria is the starting point for many bushwalks and features several lookouts over the Kanimbla Valley including the lookout from Mount Piddington.

### Little Hartley

Hartley and Little Hartley are located on the western side of the Blue Mountains and are accessed as part of the Grand Circular Tourist Drive. Descending from Victoria Pass between the Kanimbla Valley and Hartley Valley, several old buildings include the Hartley Historic Site, 'Sheepcombe', the old 'Rose Inn' and 'Mead's Farm' are important local landmarks. Further west is Hartley's River Walk. The River Walk includes a boardwalk that is 200 metres in length and follows along the bank of the River Lett at the Hartley Historic Site. The raised boardwalk overlooks the river and the remains of an early settler's hut. The boardwalk is a small part of a walking track that begins near a building called Corney's Garage (opposite Ivy Cottage and the Shamrock Inn) and follows along beside the pristine river gully past the ruins of Rowson's Hut, then back to the village. This freshwater river is still home to platypus.

1.4 Purpose and outline of this report

The purpose of this report is to:

1. Develop and present an integrated engineering and urban design outcome in accordance with *Beyond the Pavement - Urban design policy procedures and design Principles* (Transport for NSW, 2020) that:
  - Fits sensitively into the built and natural environments through which it passes and contributes positively to the character and function of the area
  - Contributes to the safety, accessibility and connectivity of people within the region and communities
  - Mitigates to the best of its ability any negative landscape or visual impacts that may be imposed on the community and the natural environment
  - Considers the outcomes of the landscape character and visual impact assessment so they are iteratively fed into the concept design development process.
2. To develop an Urban Design Vision, Objectives and Principles which will drive the concept design for the project. The urban design strategy includes conceptual drawings, sections and sketches for the overall project and detailed drawings informing built form, landscape and revegetation.
3. Carry out a landscape character and visual impact assessment, as well as satisfying the environmental impact assessment requirements. Remaining impacts on landscape character and views not addressed during the concept design process are addressed with mitigation measures.

This report sets out a strong Urban Design Vision, with supporting urban design Principles for the project, to give the project and identity and demonstrate a strong Connection to Country.

This will guide the development of the early phases of the project, in support of the Transport specifications and the requirements outlined above as part of the *Beyond the Pavement* urban design guidance.

This report satisfies the Secretary's Environmental Assessment Requirements (SEARs) for the project.

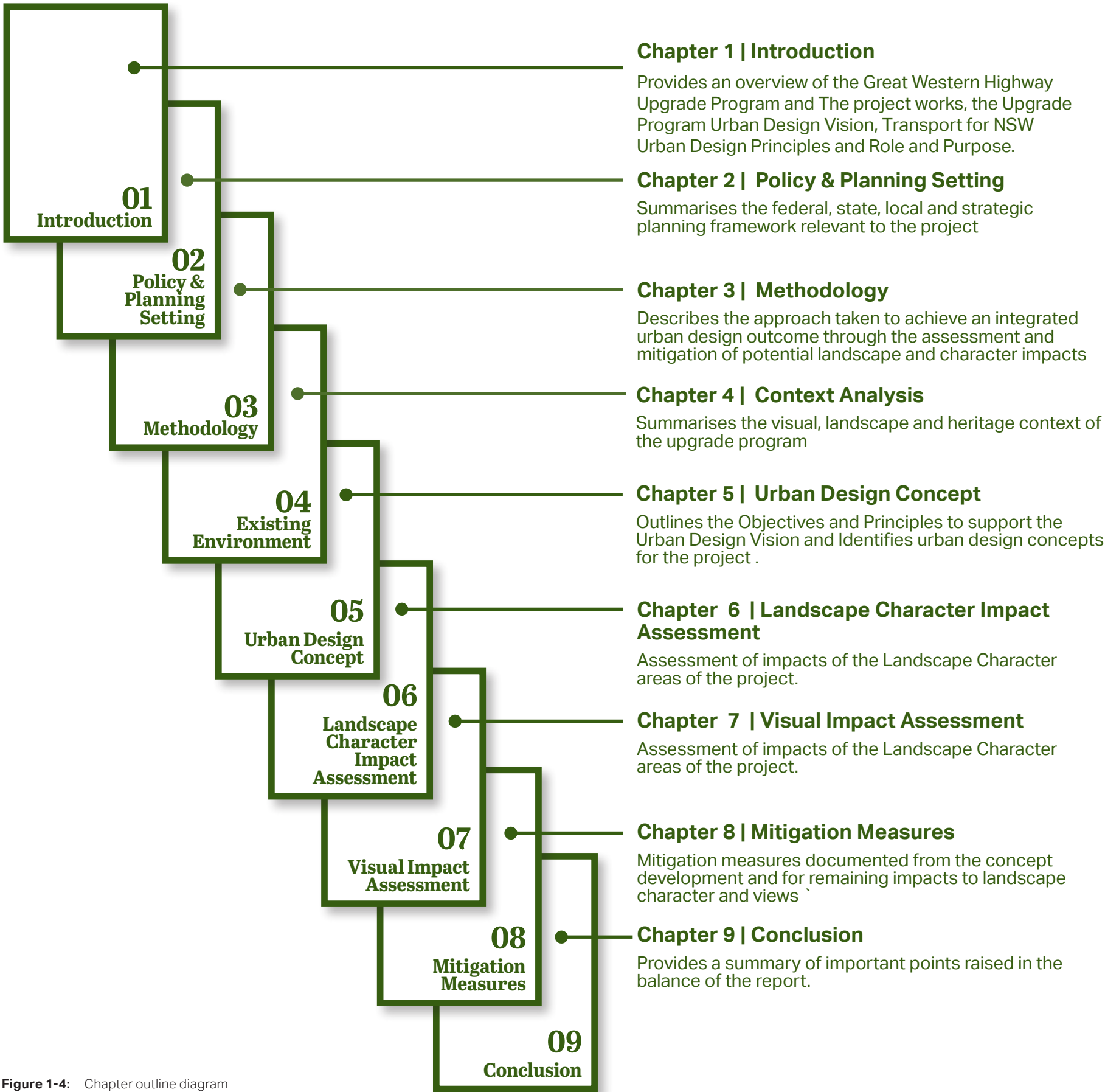


Figure 1-4: Chapter outline diagram



1.4.1 Secretary’s Environmental Assessment Requirements

Secretary’s Environmental Assessment Requirements (SEARs) were issued on the 27th August, 2021. Those requirements relevant to urban design and landscape character and visual impact assessment are listed in Table 1-1, along with where in the report they have been addressed.

Table 1-1: Secretary’s Environmental Assessment Requirements

Requirement	Summary response	Where addressed
<b>Key issue: Design, Place and Movement</b>		
Desired performance outcomes:		
<ul style="list-style-type: none"><li>- The project is well designed and enhances the environment where it is located, including improved accessibility and connectivity for communities and public spaces.</li><li>- The project helps to support the health and wellbeing of Country by valuing, respecting, and being guided by Aboriginal people.</li><li>- The project contributes to greener places through the enhancement and provision of green infrastructure.</li></ul>		
<b>Specific Assessment Requirements</b>		
1. A design led process that is informed, collaborative and iterative, which: <ul style="list-style-type: none"><li>a. utilises good design processes (such as Design Excellence and Design Review)</li><li>b. utilises design experts and multidisciplinary teams</li><li>c. is designed with and connected with Country</li><li>d. demonstrates how design integrity will be maintained in subsequent stages of the assessment process</li><li>e. involves the community, user groups and other stakeholders.</li></ul>	<p>the project is guided by a suite of strategic national, state and local planning policies and guidelines, with an integrated engineering and urban design outcome developed through the vision, objectives and principles for multidisciplinary guidance and action. The urban design responds to the key principles for action around connecting to Country, developed through a contextual analysis of the area and is evolving informing the design outcome and visual interpretation of the cultural identity of the Country we are working on.</p> <p>The project as a whole, beyond the urban design will aim to deliver the additional commitments around equity, enterprise and education and economic benefit.</p>	<ul style="list-style-type: none"><li>- Chapter 1</li><li>- Chapter 2</li><li>- Chapter 3</li><li>- Chapter 4</li><li>- Chapter 5</li><li>- Chapter 6</li><li>- Chapter 7</li></ul>
2. Identify place principles that are reflective of the design objectives in Better Placed.	The urban design response has been developed through a response to the objectives in this policy around place making as described in Chapter 5	<ul style="list-style-type: none"><li>- Section 2.2.1</li><li>- Section 5.3</li></ul>
3. Include and illustrate place designs, outcomes and actions for the project that protect and facilitate improvements to the built environment and place, including in relation to: <ul style="list-style-type: none"><li>a. built form (including key project elements and amenity impacts on the surrounding environment)</li><li>b. public space (including public open space, how that space has been maximised and protected, and access to and the quality of the space)</li><li>c. residual land (where it is known that this will be returned as public open space and the reallocation of space, such as main streets where traffic has been reduced as a result of the project)</li><li>d. views and vistas (including an assessment of visual impact, and visual representations of the project from key locations to illustrate the project where visual impacts that are deemed greater than medium).</li></ul> <p>This should also address maintenance of infrastructure, place, landscaping and residual land.</p>	<p>Chapter 5 develops the concept and theming and includes details, plans, sections and visualisations responding to place that demonstrate laterally integrated movement at the interfaces and longitudinal movement through the project with key visual markers and interventions.</p> <p>The Blue Mountains are a significant tourist destination with countless scenic locations. The project has surface impacts to views and vistas at two locations (Blackheath and Little Hartley). Visual representations have been undertaken at these locations to illustrate the impact of the project, along with a comprehensive landscape character and visual impact assessment. The project was illustrated over images at locations that resulted in a visual impact greater than medium (i.e. ratings of High or High to Moderate), either with visual simulations or indications of extent of the project overlaid onto photos and panoramas of the view. Visual simulations were also produced from those viewpoints with either heritage value or formalised recreational infrastructure, e.g. formalised lookout points along the Mount York escarpment. Methodology for preparation of visual simulations is outlined in Section 3.4.1.</p>	<ul style="list-style-type: none"><li>- Chapter 3</li><li>- Chapter 5</li><li>- Chapter 6</li><li>- Chapter 7</li></ul>

Table 1-1 continued

Requirement	Summary response	Where addressed
<p>4. Identify Movement (accessibility and connectivity) principles, outcomes and actions for the project that facilitate improvements to movement, including in relation to:</p> <p>a. how the project considers the relationship between movement and place;</p> <p>b. how the project contributes to more walking, cycling and public transport use, including along the existing Greater Western Highway corridor;</p> <p>c. how any walking, cycling or public transport provided by the project integrates with wider active and public transport network and access to public space (including Evans Lookout); and</p> <p>The EIS must demonstrate changes to:</p> <p>d. access to public space</p> <p>e. access to community facilities or areas providing services to the community, such as local centres</p> <p>f. active and public transport.</p>	<p><b>Movement outcomes are described in Chapter 5.</b></p> <p><b>Access to public space has been formalised at the above locations to improve the amenity and provide connectivity to existing infrastructure. To the eastern end of Blackheath and From Berghofers car park to the Western project at Little Hartley</b></p>	<p>– Chapter 5</p>
<p>5. Identify green infrastructure design principles that are reflective of the principles in Greener Placed and The Sydney Green Grid.</p>	<p>The principles identifying Green Infrastructure opportunities developed and considered in the Urban Design response are:</p> <ul style="list-style-type: none"><li>– Creating better connections with major centres through new transport infrastructure</li><li>– Provide increased access to open spaces, while improving connections to nature</li><li>– Provide a best practice target of enhanced connectivity by reducing restrictions and barriers to movement of people and animals, the specific ecology of the area can be minimally impacted</li><li>– Promote healthy and active living through design of well connected active transport corridors between places</li><li>– Retain remnant vegetation where possible</li><li>– Add additional tree canopy, where safe and relevant to assist in mitigating heat island effect</li><li>– Replace trees removed as a function of the project to retain biodiversity and ecological conditions</li><li>– Apply WSUD principles to promote ecosystem and waterway health.</li></ul>	<p>– Section 2.2.1</p> <p>– Section 4.4</p> <p>– Chapter 5</p>
<p>6. Include and illustrate green infrastructure designs, actions and outcomes for the project including in relation to:</p> <p>a. green infrastructure, including enhancement of open space that supports recreation, biodiversity and waterway health</p> <p>b. how the project will achieve a net increase in tree numbers and canopy within proximity of the impacted area. (This relates to the number of trees to be cleared by the project (a tree is defined by Australian Standard 4970) that will not be covered by a biodiversity offset strategy).</p>	<p>As part of the site wide strategy, a series of Urban Design strategic elements establish the base case to inform the project development by embedding them into the urban design concept ensuring that the project’s physical, visual and operational attributes are responsive to the surrounding Country.</p> <p>The outcome of these interventions is visible in the plans, sections, elevations and visualisations in the urban design structural elements, Section 5.8 and urban design concept plans, Section 5.9</p> <p>A desktop assessment was carried out using the updated construction footprints and the NSW State Vegetation Type Map (NSVTM) dataset (a regional scale map of NSW Plant Community released in 2022). The assessment was carried out in 2 steps:</p> <ul style="list-style-type: none"><li>– Step 1 – The construction footprints and NSVTM dataset were layered using ArcGIS. Vegetation beyond the footprint was clipped and deleted</li><li>– Step 2 – Vegetation within the footprint was merged and clipped to calculate the existing canopy coverage area.</li></ul>	<p>– Section 2.2.1</p> <p>– Section 5.5</p> <p>– Section 5.7</p> <p>– Section 5.8</p> <p>– Section 5.9</p>



**1.4.2 State Design Review Panel (SDRP)**

As part of ongoing design development, the project design is being regularly reviewed by the State Design Review Panel (SDRP).

The SDRP is an independent panel established by the Government Architect NSW that provides a best-practice state-wide approach to the review of State Significant projects, precincts and infrastructure.

SDRP panellists are independent and highly qualified design professionals representing a variety of skills across design in the built environment and bring a diversity of experience and insight. Panel members have cross disciplinary expertise in the areas of architecture, landscape architecture, urban design, Aboriginal and non-aboriginal culture and heritage and sustainability.

Transport is meeting regularly with the SDRP to review the design and seek advice and recommendations. This is an ongoing process and is anticipated to continue after the exhibition of the EIS throughout design development.

Feedback received from the SDRP to date indicates that a primary challenge of the project is to integrate engineering, design, and Country into a coherent approach that will have minimal impact on the landscape and ecology of this key part of NSW.

The successful alignment of these elements of the project would present a new standard of transport infrastructure in Australia.



1.5 Project description

The Blackheath to Little Hartley Upgrade (the project) would be constructed as part of the wider Upgrade Program along the Great Western Highway (refer Figure 1-5), with the project interfacing directly with the Katoomba to Blackheath Upgrade at its eastern extent and the Little Hartley to Lithgow Upgrade at its western extent. For the purpose of this report, the two adjoining Upgrade Programs have been considered to be the ‘baseline environment’ above which the project has been assessed.

Key operational components of the project are described in Table 1-2.

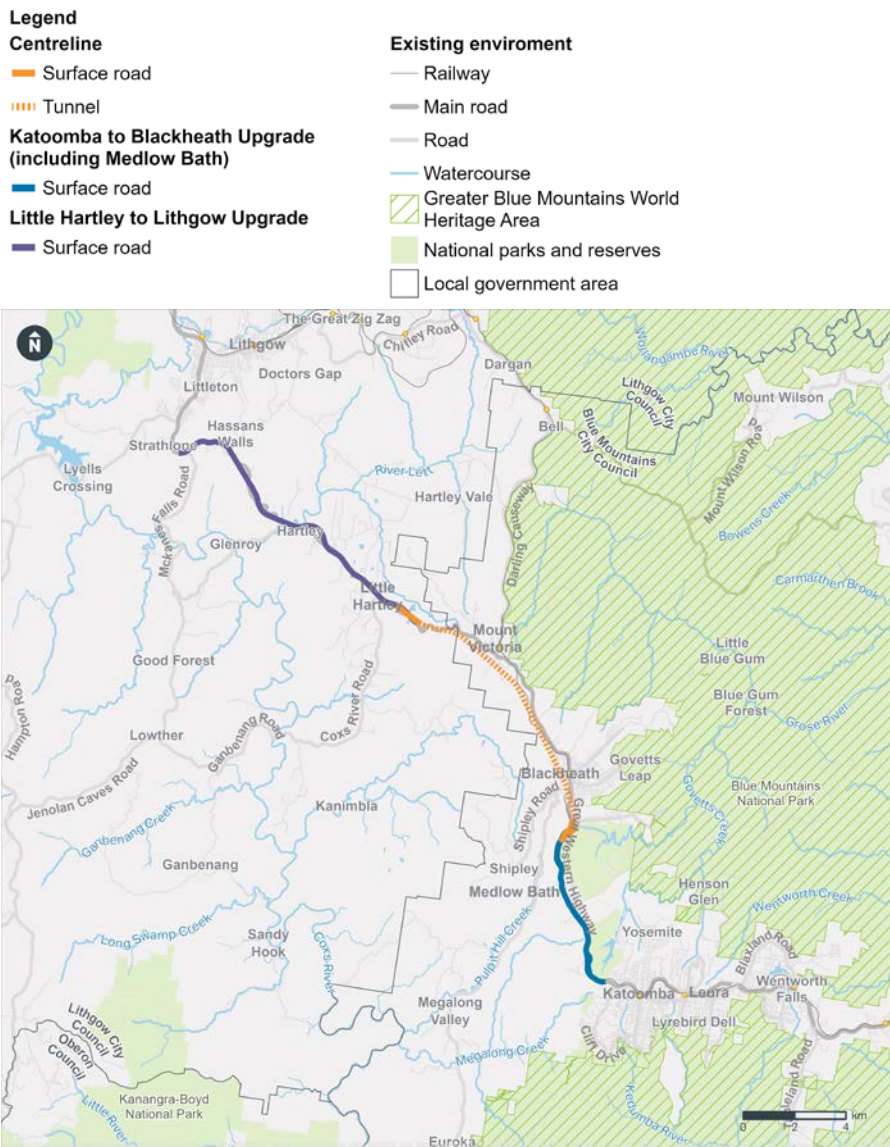


Figure 1-5: The Upgrade Program and project

Table 1-2: Key components of the project

Key project component	Summary
Tunnels	Twin tunnels around 11 kilometres in length between Blackheath and Little Hartley, connecting to the upgraded Great Western Highway at both ends. Each tunnel would include two lanes of traffic and road shoulders and would range in depth from just below the surface near the tunnel portals, to up to around 200 metres underground at Mount Victoria.
Surface work	Surface road upgrade work would be required to connect the tunnels and surface road networks south of Blackheath and at Little Hartley. The twin tunnels would connect to the surface road network via: <ul style="list-style-type: none"><li>mainline carriage ways and on- and off-ramps at the Blackheath portal, located adjacent to the existing Great Western Highway and south of Evans Lookout Road</li><li>mainline carriageways at the Little Hartley portal, located adjacent to the existing Great Western Highway at the base of the western escarpment below Victoria Pass and southwest of Butlers Creek.</li></ul>
Operational infrastructure	Operational infrastructure that would be provided by the project includes: <ul style="list-style-type: none"><li>a tunnel operations facility adjacent to the Blackheath portal</li><li>in-tunnel ventilation systems including jet fans and ventilation ducts connecting to the ventilation facilities</li><li>one of two potential options for tunnel ventilation currently being investigated, being:<ul style="list-style-type: none"><li>ventilation design to support emissions via ventilation outlets</li><li>ventilation design to support emissions via portals</li></ul></li><li>water quality infrastructure including sediment and water quality basins, an onsite detention tank at Blackheath and a water treatment plant at Little Hartley</li><li>fire and life safety systems, emergency evacuation and ventilation infrastructure and Closed Circuit Television (CCTV)</li><li>lighting and signage including variable message signs and associated infrastructure such as overhead gantries.</li></ul>
Utilities	Key utilities required for the project would include: <ul style="list-style-type: none"><li>a new electricity substation at Little Hartley to facilitate construction and operational power supply</li><li>a new pipeline between Little Hartley and Lithgow to facilitate construction and operational water supply</li><li>other utilities connections and modifications, including electricity substations in the tunnel.</li></ul>
Other project elements	The project would also include: <ul style="list-style-type: none"><li>integrated urban design initiatives</li><li>landscape planting.</li></ul>



1.5.1 Project construction

Construction of the project would include:

- site establishment and enabling works
- tunnel portal construction
- tunnelling and associated works
- surface road upgrade works
- operational infrastructure construction and fit-out, including construction of operational environmental controls
- finishing works, testing, and commissioning.

These activities are described in more detail in Chapter 5 (Construction) of the EIS.

The indicative construction footprint for the project is shown in Figure 1-6 to Figure 1-8, including construction site layout and access arrangements.

Construction of the project is expected to take up to six years. Subject to planning approval, construction is planned to commence in 2024 and be completed by late 2031; however, the project would be open to traffic by 2030.



Figure 1-6: Indicative construction footprint at Blackheath



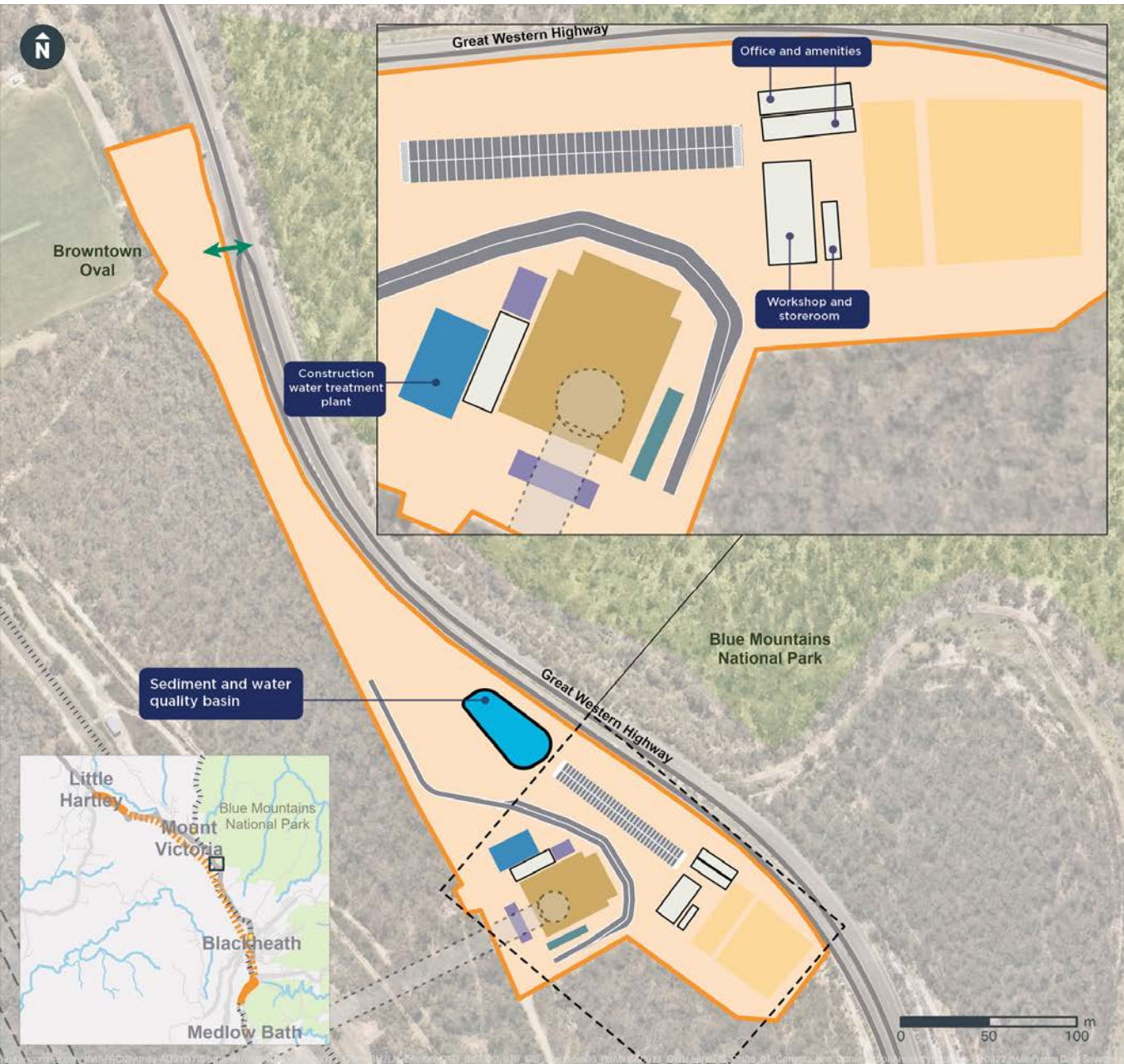


Figure 1-7: Construction footprint at Soldiers Pinch

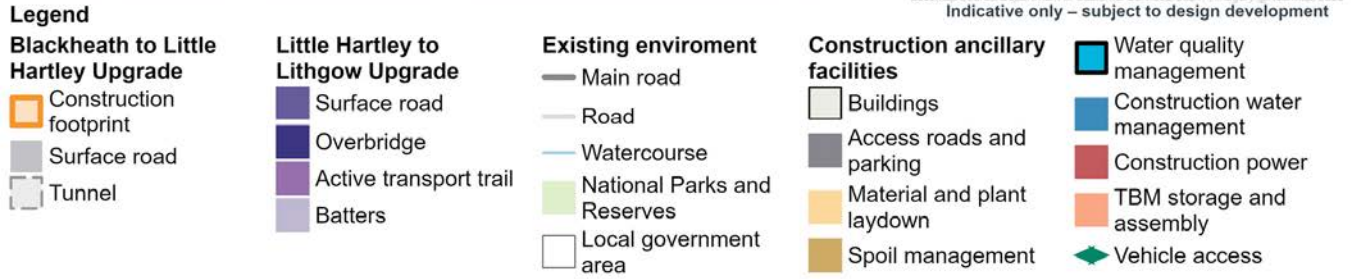
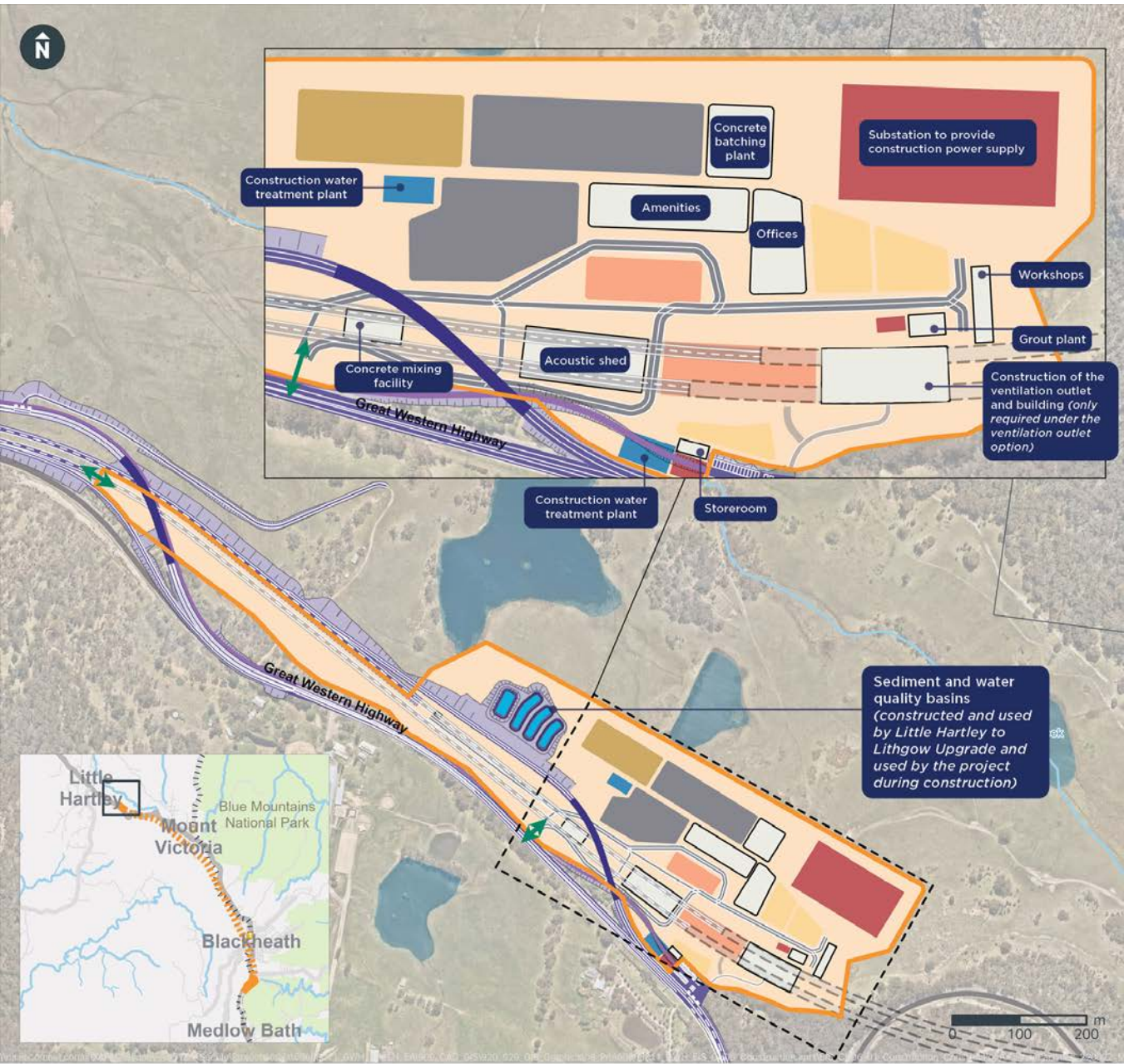


Figure 1-8: Construction footprint of the project at Little Hartley



1.5.2 Baseline environment

The Katoomba to Blackheath and Little Hartley to Lithgow Upgrades adjoining the project to the east and west respectively would be under construction when construction of the project commences. To minimise environmental impacts, parts of the Katoomba to Blackheath Upgrade and Little Hartley to Lithgow Upgrade construction footprints would be used to support construction of the project.

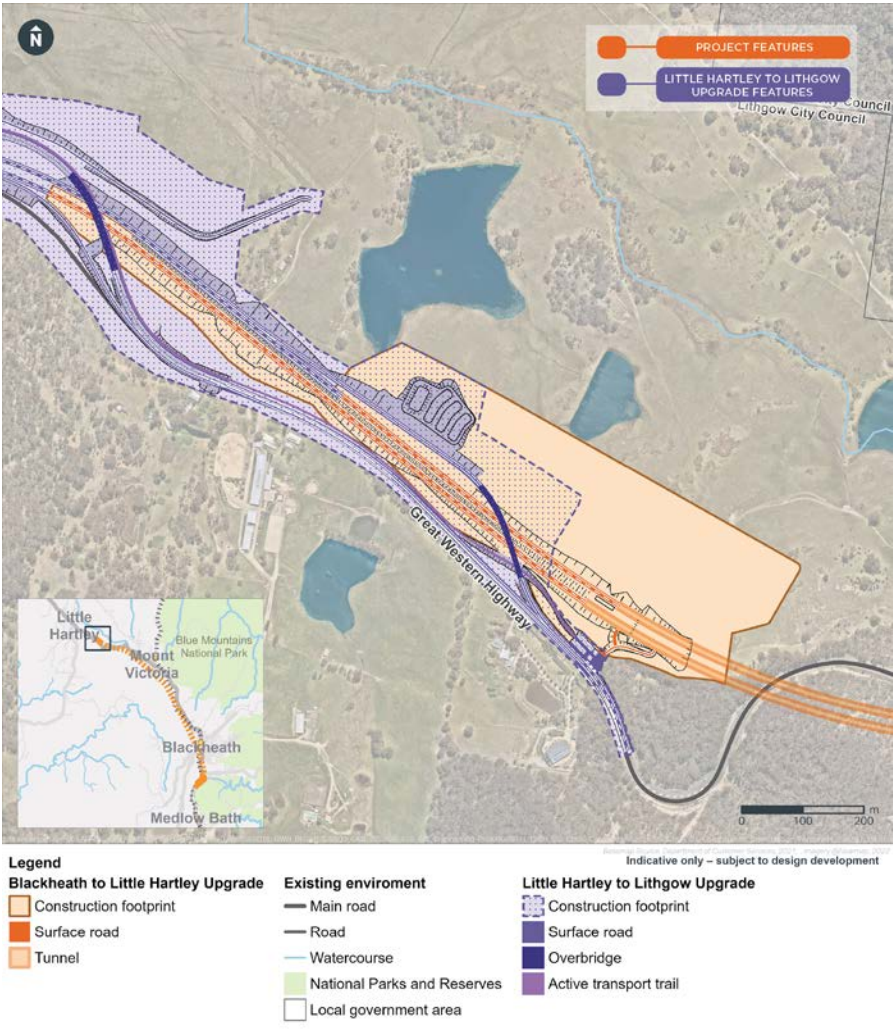
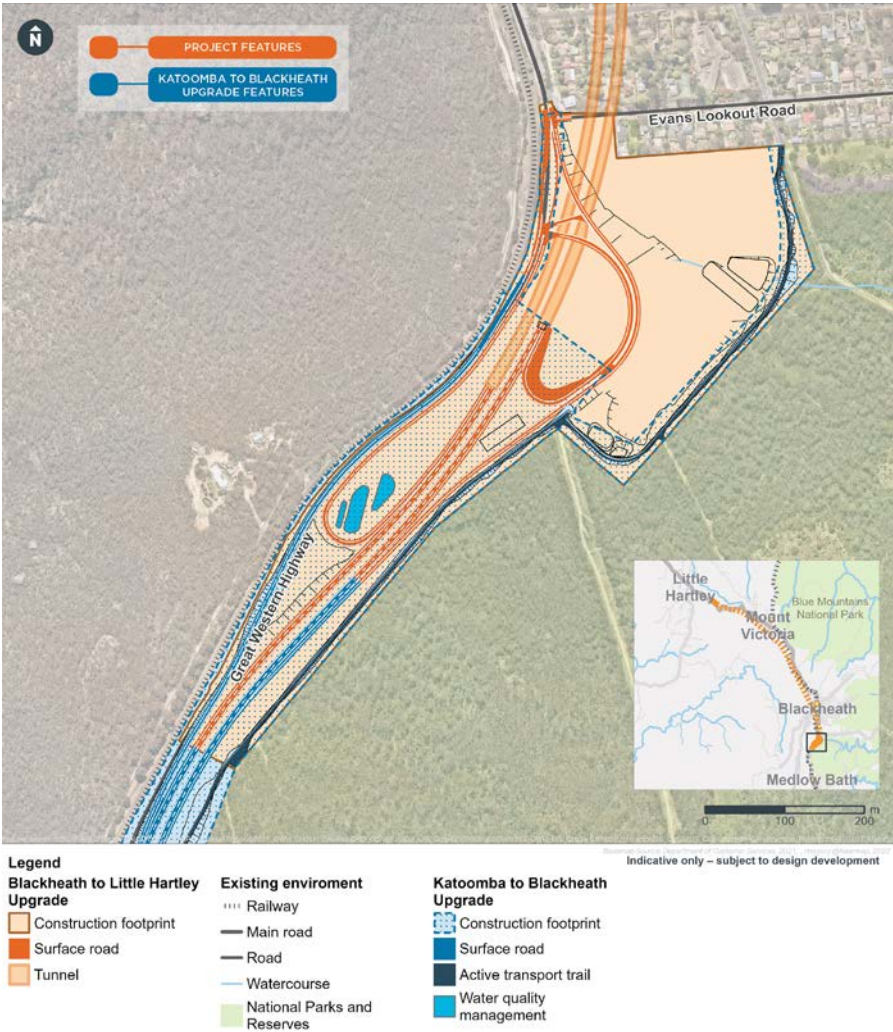
As a result, the following activities will be undertaken at the construction sites as part of the Katoomba to Blackheath and Little Hartley to Lithgow Upgrades:

- vegetation would be cleared
- topsoil would be levelled and compacted
- site access tracks would be established
- water quality controls such as water quality and sediment basins would be installed.

The environmental impacts associated with these works have been assessed as part of the Katoomba to Blackheath Upgrade and the Little Hartley to Lithgow Upgrade.

The construction footprint for these projects are shown in Figure 1-9 and Figure 1-10 and form the baseline environment considered at Blackheath and Little Hartley for the LCVIA. Further information regarding the baseline environment at operation are described in Sections 1.5.3 and 1.5.4.

No work is proposed at Soldiers Pinch as part of the Katoomba to Blackheath Upgrade or the Little Hartley to Lithgow Upgrade and therefore the existing environment forms the baseline environment at this location.





1.5.3 Blackheath

At Blackheath the project overlaps with the Katoomba to Blackheath Upgrade, as shown in Figure 1-11.

Katoomba to Blackheath Upgrade (baseline environment)

The Katoomba to Blackheath Upgrade elements which interact with the project would comprise:

- the westbound connection from Katoomba to the existing Great Western Highway, which would be positioned along the existing Highway alignment
- water quality basins, which would then be integrated into the project
- extension of the dual carriageways of the new Great Western Highway east
- the active transport trail heading north east along the southern side of the Great Western Highway, turning south east and then north adjacent to the Blackheath construction site, linking up with Valley View Road within the residential area to the north
- landscape and revegetation
- other typical road infrastructure such as fencing, safety barriers, lighting and signage.

Blackheath to Little Hartley Upgrade (the project)

Operational elements at Blackheath are shown in Figure 1-11. The project at Blackheath would include:

- mainline carriageway connection for vehicles heading westbound towards Lithgow via the new tunnel
- mainline carriageway connection for vehicles heading eastbound towards Katoomba via the upgraded Great Western Highway
- connection between the tunnel and the existing Great Western Highway at the Blackheath portal area, including:
  - westbound on-ramp into the tunnel from Blackheath town centre
  - eastbound connection from Blackheath onto the mainline carriageway
  - eastbound off-ramp from the tunnel to access Blackheath town centre
  - restricted access connections within the interchange arrangement to provide access from the east and the west to the operations facility, located south of Evans Lookout Road
- upgrade of the existing Great Western Highway / Evans Lookout Road intersection.

Other visible elements at Blackheath include detention basins, lighting, signage, CCTV and other traffic management systems.

The ventilation system for the project has not been determined. There are two options currently under consideration to deal with ventilation of the tunnels.

- emissions via ventilation outlets
- emissions via tunnel portals.

For the purposes of the this LCVIA, the ventilation outlets (if used) are assumed to be a cylindrical form 10 metres in diameter and extending 10 metres above the finished ground level above the tunnel portal.

1.5.4 Little Hartley

At Little Hartley the project overlaps with the Little Hartley to Lithgow Upgrade, as shown in Figure 1-12.

Little Hartley to Lithgow Upgrade (baseline environment)

The Little Hartley to Lithgow Upgrade elements which interact with the project would comprise:

- the extension of the dual carriageways of the new Great Western Highway north west
- the westbound connection to the existing Great Western Highway from the widened Highway alignment to the north, including a bridge over the Great Western Highway connecting to the proposed tunnel portals
- eastbound connection to the existing Great Western Highway alignment, including a bridge of the project and the access track
- a private property access road to the north of the Great Western Highway
- Sediment and water quality basins, which would then be integrated into the project
- the formalisation of Berghofers Pass car park
- the access track heading north west from Berghofers Pass car park
- landscape and revegetation
- other typical road infrastructure such as fencing, safety barriers, lighting and signage.

The construction footprint of the Little Hartley to Lithgow Upgrade is shown in Figure 1-8. While construction is not considered within this assessment, for the purposes of assessing the project it is assumed that the construction footprint for the Little Hartley to Lithgow Upgrade has been cleared even if there are no infrastructure elements built within it.

Blackheath to Little Hartley Upgrade (the project)

Figure 1-12 shows the elements associated with the project at Little Hartley including:

- mainline carriageway connection for vehicles heading eastbound towards Katoomba via the new tunnel
- mainline carriageway connection for vehicles heading westbound towards Lithgow via the upgraded Great Western Highway
- provision of a new intersection from the upgraded Great Western Highway to facilitate access to and from the tunnel ancillary site for operation and maintenance purposes
- other visible elements at Little Hartley include a substation, water treatment plant, ventilation outlet (if selected as the preferred ventilation option), detention basins, lighting, signage, CCTV and other traffic management systems
- urban design and landscaping have been described in Chapter 5.

The ventilation system for the project has not been determined. There are two options currently under consideration to deal with ventilation of the tunnels.

- emissions via ventilation outlets
- emissions via tunnel portals.

For the purposes of the this LCVIA, the ventilation outlets (if used) are assumed to be a cylindrical form 10 metres in diameter and extending 10 metres above the finished ground level above the tunnel portal.





Figure 1-11: Surface operations for the project and Upgrade Program at Blackheath

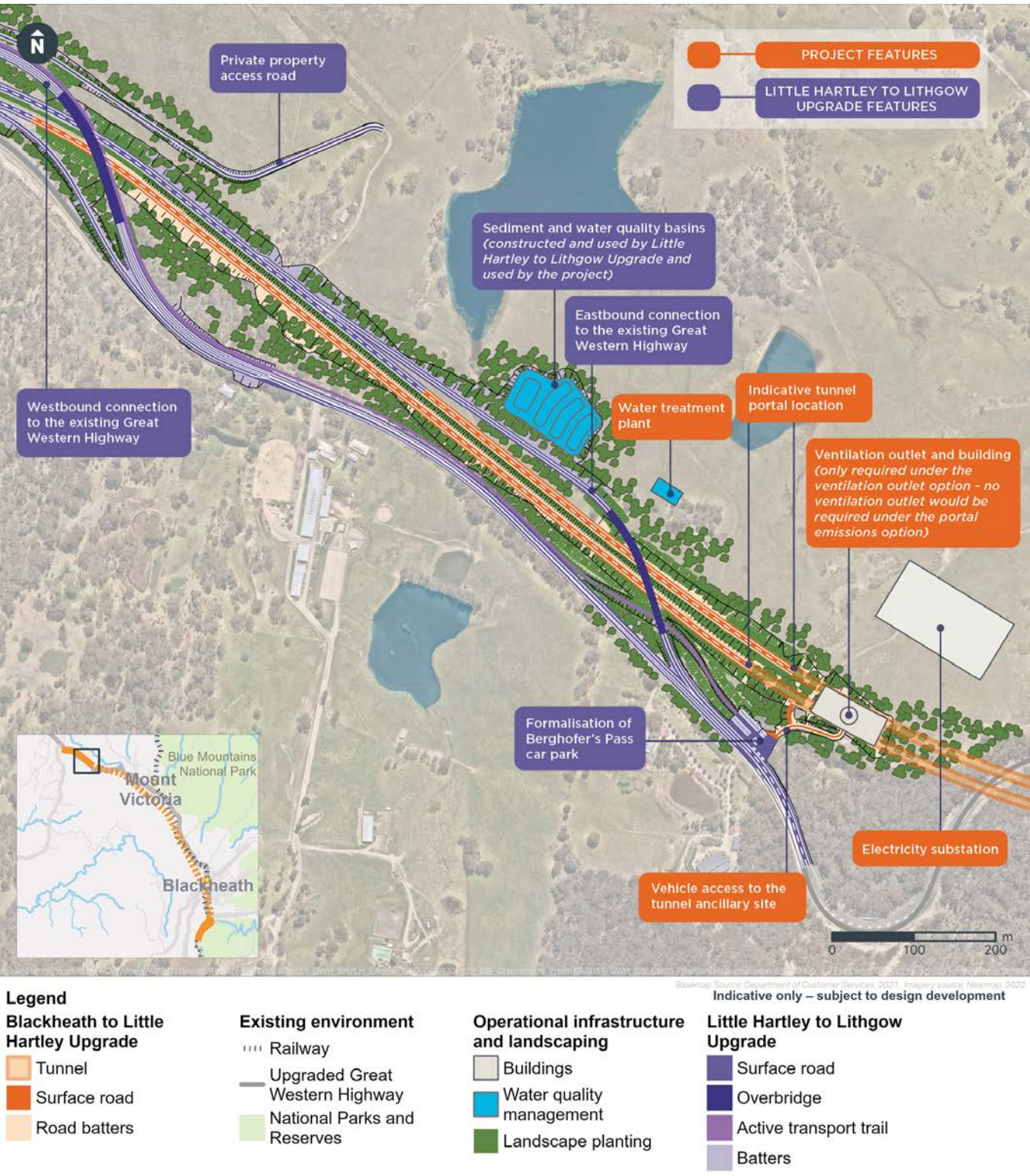


Figure 1-12: Surface operations for the project and the Little Hartley to Lithgow Upgrade at Little Hartley



## Policy and Planning Setting

# 02



## 2. Policy and Planning Setting

The Upgrade Program can provide for a unique experience through the towns and villages of the Blue Mountains, as well as the World Heritage-Listed Blue Mountains National Park and Little Hartley through Lithgow.

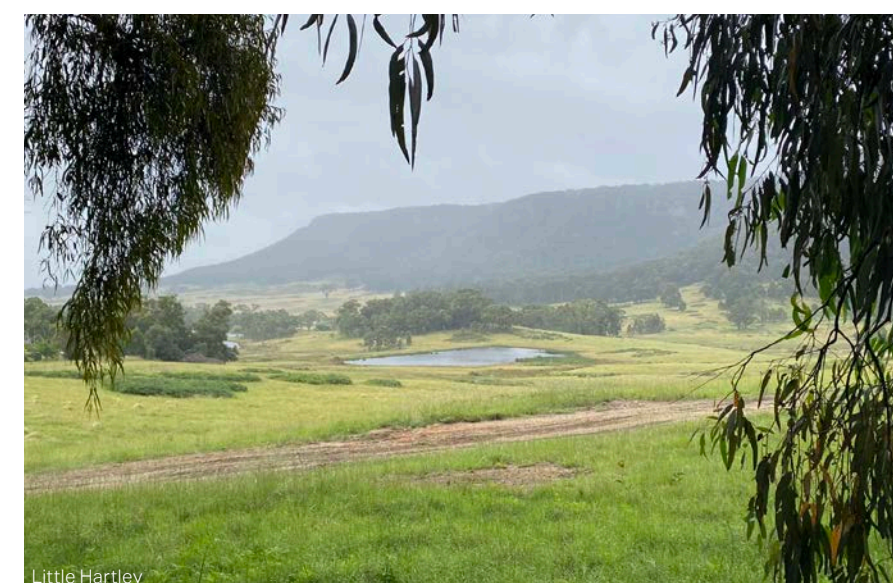
As the UNESCO nomination reports: "Most of the natural bushland of the Greater Blue Mountains Area is of high wilderness quality and remains close to pristine."

### 2.1 Introduction

The following documents provide the policy and guiding context of the project, as a basis to the development of the Urban Design Strategy and concept.

It includes:

- **Policy and strategic context**  
Review of the relevant Australian, State and Local Government policies and strategies
- **Supporting Design Reference Documents and Guidelines**  
Review of the guiding technical documents from Transport and other relevant authorities and stakeholders.



**Figure 13:** Towns and villages within the project area include Blackheath, Mt Victoria and Little Hartley



## 2.2 Policy and strategic context

### 2.2.1 Federal and State Government

The project is informed by a suite of existing Federal and State strategies. These strategies shape the planning, development and delivery of infrastructure across a range of areas, including:

- Planning and development
- Growth and economic prosperity
- Environment and sustainability
- Health and safety.

These strategies identify stronger communities, greener outcomes, improved connectivity, safer streets and public spaces as key outcomes to be delivered by removing large volumes of freight off local roads and creating a more direct vehicle connection from Sydney to the western regions of NSW.

This report seeks to achieve alignment with the following policy documents and strategies in developing the design direction of the project. This will assist in creating a cohesive design response across the extent of the Greater Western Highway, unifying the surface roads and tunnel as a legible and engaging urban design experience.



#### Beyond the Pavement

##### Transport for NSW | August 2020

Beyond the Pavement is an urban design tool developed by the Centre of Urban Design with the objective to assist project managers, engineers and urban designers in delivering the goal of 'transport contributing to successful places in terms of enhancing liveability, amenity and economic success'.

It is outlined that urban design should be considered early, undertake an integrated process (within the project team and organisations) and have longevity throughout the project phases.

The document provides guidance on urban design approach, management and Principles in order to deliver high quality transport infrastructure which is considerate of place, environment, culture, communities and its own presence.

#### Relevance to the project

The concept design of the project takes a collaborative and well integrated approach to urban design from the outset of the project.

Key design Principles identified in Beyond the Pavement which support broader commitments of Transport which should be reflected in the concept design include:

- Principle 5 - Contributing to green infrastructure and responding to natural systems
- Principle 6 - Connecting with Country and incorporating heritage and cultural contexts into projects.

The concept design should deliver safe, cost effective and sustainable solutions for the project's built environment that consider the construction and maintenance phases, along with all potential user groups.



#### Better Placed

##### Government Architect New South Wales | 2017

Better placed sits alongside other Government Architect NSW policies and establishes the value of good design and identifies key concepts, processes and objectives to guide the design outcomes.

Better placed has been created to inform a broad range of policies and approaches within multiple government agencies and has a specific focus on project information and establishment and design of strategic projects.

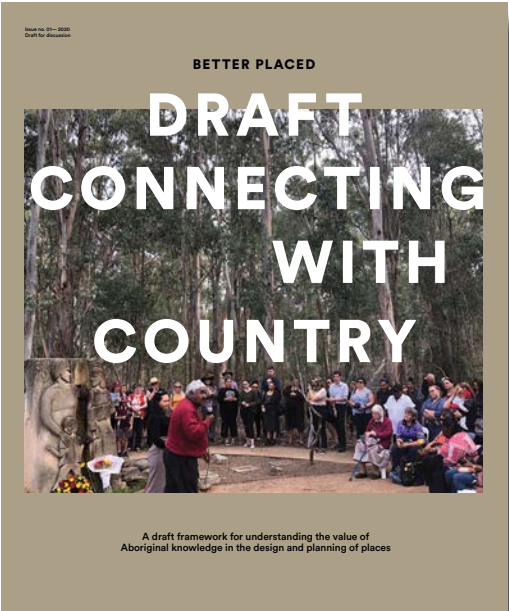
Better Placed objectives have been created to be incorporated to support the state and local government in achieving good design outcomes.

Seven objectives define the key considerations in the design of the built environment.

1. Better Fit - contextual, local and of its place
2. Better Performance - sustainable, adaptable and durable
3. Better for Community - inclusive, connected and diverse
4. Better for People - safe, comfortable and liveable
5. Better Working - functional, efficient and fit for purpose
6. Better Value - creating and adding value
7. Better Look and Feel - engaging, inviting and attractive.

#### Relevance to the project

These objectives have influenced the development of the Vision, Objectives and Principles defining the project concept.



Draft Connecting With Country

Government Architect New South Wales | 2020

Draft Connecting With Country provide a framework for developing connections with Country to inform planning, design and delivery of built environment projects in New South Wales.

It is intended to help project teams gain a better understanding of the strong, vibrant Aboriginal culture in the built environment by advocating ways they can respond to the Aboriginal voice, changes in planning policies relating to Aboriginal culture and heritage and place-led design.

The document explores strategies for connecting with Country:

- 1. Pathways for connecting around cultural expression, relationships with Country, Learning from Country and Knowledge-sharing
- 2. Considering project life cycles with an Aboriginal perspective through Sensing - project formation, Imagining - project design and concept, Shaping - project delivery and Caring for Country - project maintenance.

Relevance to the project

The urban design concept seeks to prioritise Country through engagement with the Aboriginal people to gain cultural awareness and understanding of Country to enable the project to connect with Country



Designing With Country

Government Architect New South Wales | 2020

Designing with Country is a discussion paper which presents questions and conversations for all stakeholders engaged in built environment projects which impact Aboriginal communities as well as their culture and heritage. The responses received from this paper will help inform a set of Cultural Design Principles and a framework to apply to all built environment projects delivered by Government.

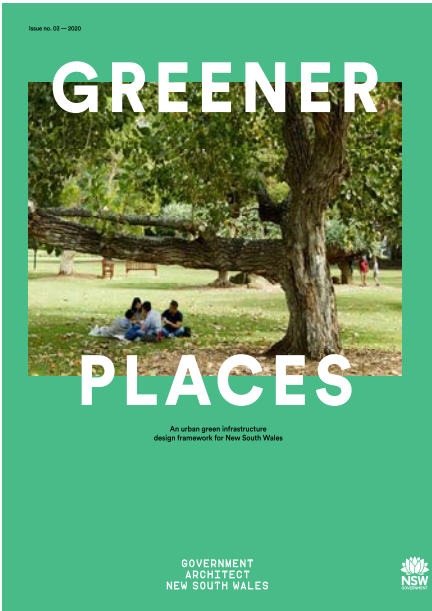
The paper highlights the importance of authentic engagement and requirements for this process to be one which is guided by the Aboriginal community and recognised knowledge holders.

A strong understanding of Country to Aboriginal peoples, along with, ideas on how this knowledge could be translated into the Western planning system to provide acknowledgment, respect and education of Aboriginal culture and heritage is a key objective of the discussion.

The paper suggests three essential elements when designing with Country being nature, people and design and the relationships across these elements offer different design approaches. It is of critical importance that Aboriginal professionals, experts, and community representatives are afforded the opportunity to directly participate in the design making at early stages of these built environment projects.

Relevance to the project

The discussion paper outlines critical process in order to authentically engage, design and educate which should be undertaken to ensure Aboriginal culture and heritage is appropriately integrated and informs the project design.



Greener Places

Government Architect New South Wales | 2020

This framework works in conjunction with the Sydney Green Grid and sets out four main design Principles for delivering green infrastructure in NSW. The Principles include integration, connectivity, multifunctionality, and participation.

Greener Places is a best-practice framework for delivering sustainable and environmentally conscious projects throughout NSW. Following from its development, the Draft Greener Places Design Guide was created to provide direction for open space for recreation, urban tree canopy, and bushlands and waterways.

The main components of the green infrastructure network fall into the three aforementioned categories and have specific goals depending on the landscape use.

Relevance to the project

The framework works alongside the SEPPs at a strategic level, while the Draft Design Guide sits at the regional level with district plans. The Design Guide has been created to provide direction with open space for recreational use, urban tree canopy, and bushlands and waterways. Connectivity is a strong principle for the project as the road conduit creates a linear corridor between multiple townships, landscapes, and urban habitat.

The Draft Design Guide identifies road infrastructure projects as significant projects to have best practice targets that enhance connectivity, rather than reduce it. By reducing restrictions and barriers to movement of species, the specific ecology of the area can be minimally impacted.





**Sydney Green Grid – West District (7) – 2017 – Government Architect New South Wales**

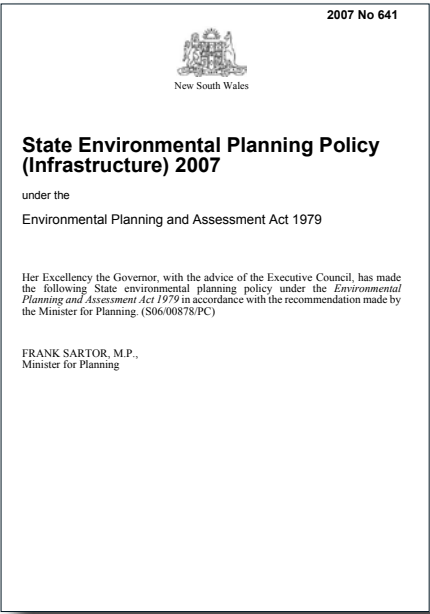
This document identifies the network of blue and green spaces (including waterways, bushland, parks, open space, tree canopy, and private gardens) throughout greater Sydney. The four main types of landscape (or “grids”) which make up the Sydney Green Grid network include:

- The Agricultural Grid
- The Recreational Grid
- The Ecological Grid
- The Hydrological Grid.

**Relevance to the project**

The project is captured by the West District of the Green Grid which contains the Blue Mountains, Hawkesbury-Nepean River Catchment, and important ecological communities such as The Cumberland Plain Woodland and Castlereagh Swamp Woodland.

The network of high quality ecological and hydrological spaces (of national parks, reserves, creeks, and waterfalls) throughout the project make the Great Western Highway an important conduit between metropolitan Sydney and rural NSW. The expanse of the road provides an opportunity for wide scale blue and green infrastructure corridors and increased access to open space which can subsequently improve people’s connection to nature. These are desirable outcomes which should be combined with good design outcomes and materiality that can create high-quality public realm spaces.



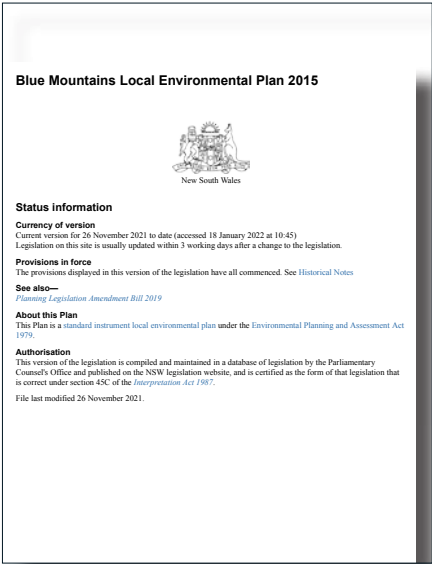
**State Environmental Planning Policy (Infrastructure) | SEPP  
New South Wales Government | 2007**

This policy aims to facilitate the delivery of infrastructure throughout NSW with greater regulatory certainty, flexibility, efficient development and minimising environmental impacts through categorised environmental assessment categories.

**Relevance to the project**

Clause 94 - permitting development on any land for the purpose of a road or road infrastructure can be carried out by or on behalf of a public authority without consent.

**2.2.2 Local Government**



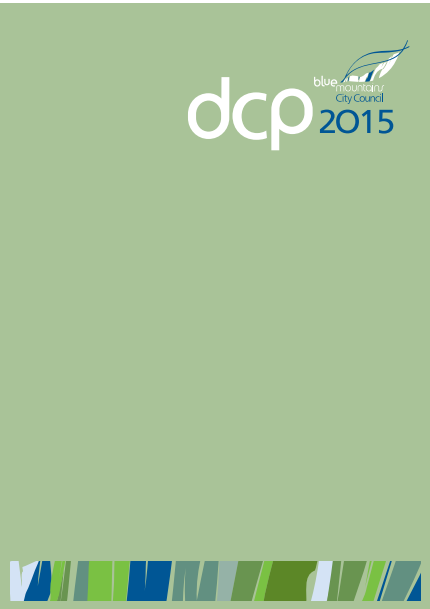
**Blue Mountains Local Environment Plan (LEP)  
Blue Mountains City Council | 2015**

The Blue Mountains Local Environment Plan (LEP) contains all the relevant planning provisions for the Blue Mountains Local Government Area (LGA). It is the standard plan under the *Environment Planning and Assessment Act (1979)* and informs the zoning, overlays, development and land use, in an effort to protect, preserve and promote the land throughout the Blue Mountains region.

**Relevance to the project**

Clauses that are directly relevant to GWH include:

- 6.13 Protected area – land between towns (focused on maintaining land between towns with particular scenic value viewed from GWH).



**Blue Mountains Development Control Plan (DCP)**

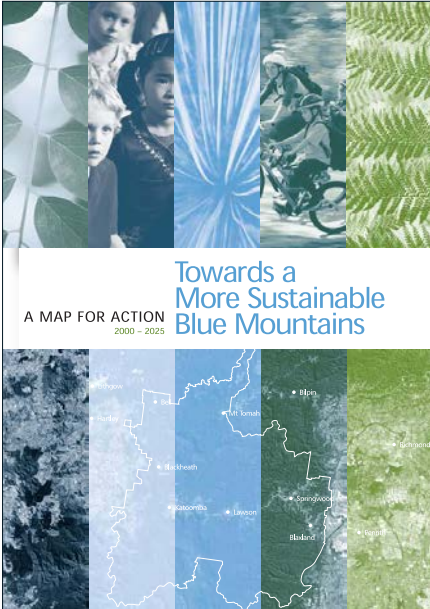
**Blue Mountains City Council | 2015**

The DCP acts a guideline document that works with the BMCC LEP to ensure that development throughout the Blue Mountains complies with Objectives and standards for the region (or has adequate justification for departing from those standards). The DCP and LEP are consistent and compatible documents that provide a strong guide for planners, designers, and developers.

**Relevance to the project**

Part E8 – Public Domain addresses the project directly and sets out the following summarised Objectives:

- Restricting urban growth by maintaining the separation of towns with bushland environment between towns
- Retaining historical, physical remnants and landscape elements
- Integrating new development into the historic environment
- Considering potential impacts to the scenic and character values
- To continue plantings throughout towns and village centres
- Safe and appropriate landscaping that consolidates location character, improves pedestrian amenity, and maintains open sight lines and safety
- Continuing the provision of continuous pedestrian/cycle paths
- Ensuring that infrastructure is appropriate to the surrounding setting
- Ensuring public art opportunities are considered for inclusion where it is appropriate
- Rehabilitation of indigenous vegetation and street trees, stormwater, Water Sensitive Urban Design and intersections with shared use paths.



**A Map for Action: Towards a More Sustainable Blue Mountains**

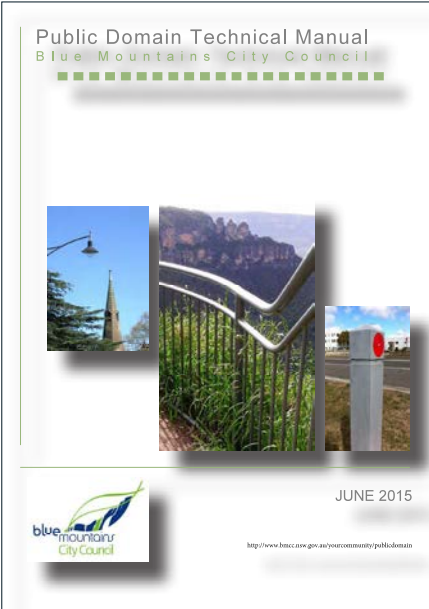
**Blue Mountains City Council**

The 25 year strategy for the Blue Mountains is contained within three main documents, with the Map for Action detailing the stakeholders, community consultation and environmental goals for the region. Striving for a common vision the Map for Action engages with state and local government, community organisations and interest groups to guide projects, plans, and outcomes for the Blue Mountains.

**Relevance to the project**

Key challenges identified by the strategy which are relevant to the project include:

- Traffic congestion from tourism on the Great Western Highway
- Reducing increased traffic congestion from tourism on the Great Western Highway and in towns and villages
- Expanding Blue Mountains tourism beyond a nature based industry
- Retaining a Blue mountains identity and not being subsumed by Sydney
- Reducing the social and environmental impacts of large numbers of people community to work from Sydney.



**Public Domain Technical Manual**

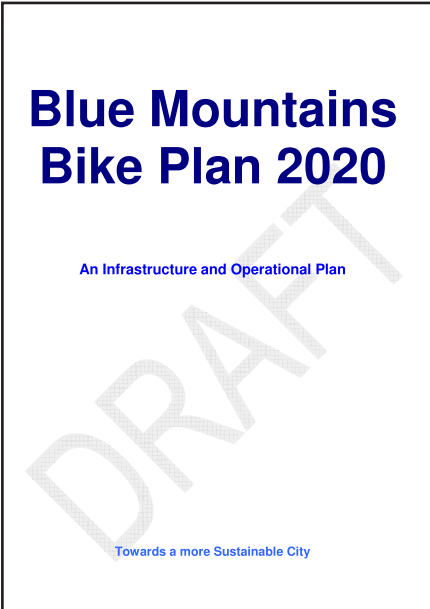
**Blue Mountains City Council | 2015**

Prompted by the Blue Mountains strategic framework *A Map for Action: Towards a More Sustainable Blue Mountains*, the Public Domain Technical Manual aims to enhance and promote better design outcomes throughout the towns and villages of the Blue Mountains.

**Relevance to the project**

The urban design elements within the concept should compliment and integrate with the broader urban design of Blue Mountains townships and public realm. Technical elements likely to be influenced include:

- Pavements (pedestrian, shared use path and car-grade)
- Kerbs and gutter
- Planting (mixes and schedule)
- Signage (road signage, town entry and pedestrian wayfinding).



**Blue Mountains Bike Plan**

**Blue Mountains City Council (draft) | 2020**

This plan aims to create safe and accessible pathways that encourage people of all ages to use bicycles for both transportation and enjoyment. The two main goals are to double bicycle trips made in the BMCC by 2020, and reduce bicycle crashes and causalities.

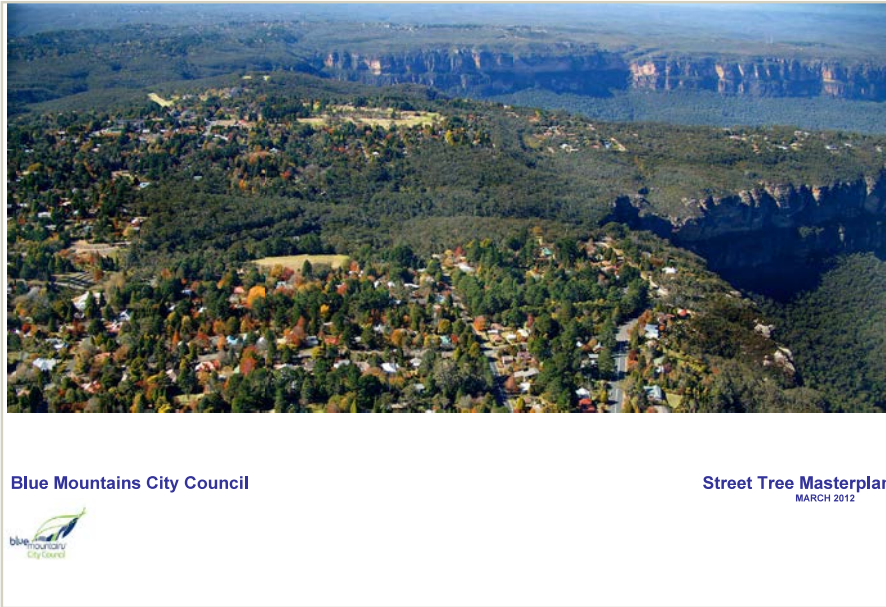
**Relevance to the project**

The 2007 Blue Mountains Bike Plan originally sign posted 70km of regional on road (pavement markings) bike paths along the Great Western Highway.

Some considerations in the plan include:

- Safety along the bike way network (limiting dangerous crossings such as across the Great Western Highway)
- Accommodating bicycles in construction zones.





**Street Tree Masterplan**  
**Blue Mountains City Council | 2012**

This masterplan covers plantings along major roads, town centres and popular tourist routes throughout the Blue Mountains. The main strategic objective of the masterplan is to limit urban sprawl outside of town centres along the Great Western Highway, by consolidating and extending indigenous bushland planting between towns. There are numerous maps throughout the masterplan that specify plant species and planting mixes and where they can/should be used.

**Relevance to the project**

Identified in BMCC DCP there is a control in Part E8 – Public Domain which addresses street trees. It stipulates that:

*“Construction works associated with those parts of the Great Western Highway that are in town areas are to include rehabilitation or new planting of street trees in accordance with Council’s Street Tree Masterplan. These works are to include establishment maintenance for any street trees proposed.”*

The township maps contained in the Street Tree Masterplan show plantings throughout a variety of town centres, with relevant centres needing to be addressed by the Upgrade Program.

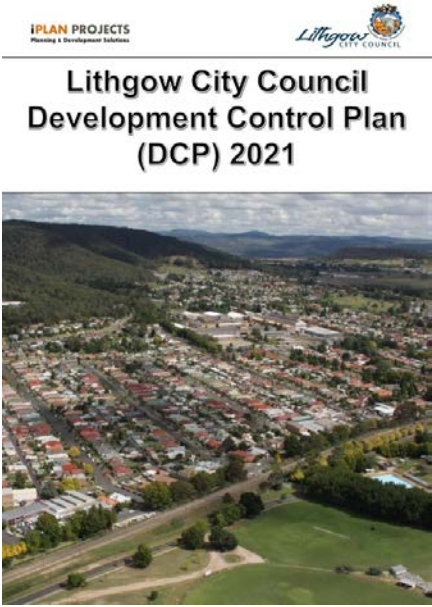


**Lithgow Local Environment Plan 2014**  
**NSW Government | 2014**

The Lithgow Local Environment Plan aims to make local environmental planning provisions for land in Lithgow in accordance with relevant standard environmental instruments. Its purpose is to protect, promote and encourage environmentally sustainable and sensitive development.

**Relevance to the project**

The Lithgow LEP informs development proposed within the Lithgow local government area and has requirements in relation to development for relevant land uses and provisions to consider for sensitive land, bush fire hazard reduction, environmental and urban works ,which are applicable to the concept design.



**Lithgow City Council Development Control Plan (DCP)**  
**Lithgow City Council | 2021**

The Lithgow City Council Development Control Plan aims to support the objectives of the Lithgow Local Environmental Plan 2014 by providing clear and concise development guidelines which promote growth that is orderly, environmentally friendly and sustainable.

**Relevance to the project**

The Lithgow City Council DCP informs development proposed within the Council region and has consideration applicable to the concept design under section:

- Chapter 2: Site requirements
- Chapter 3: Natural Environment and Hazards
- Chapter 4: Heritage and Cultural Conservation.



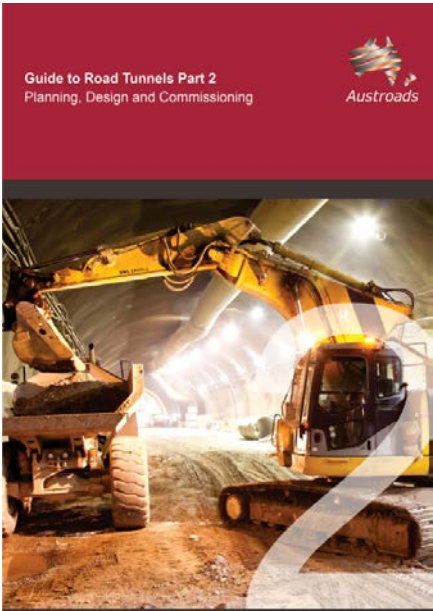
2.2.3 Supporting design reference documents and guidelines

Key design reference documents and guidelines relevant to urban design, landscape, and visual amenity in the vicinity of the project area have been assessed to ensure an understanding of existing and future aspirations for the area and the role of the project within this context.

The project is supported by several initiatives as outlined below, which further describe the vision, Objectives, and Principles for the project.

The Key reference documents used in creating this report include:

- ‘Guide to Road Tunnels Part 2’ – Planning , Design Commissioning – Austroads 2021
- ‘Design for a Positive In Tunnel Experience’ – AECOM – January 2017
- ‘Tunnel urban design guideline’ – Design guideline to improve the customer and community experience of road tunnels – Transport NSW - May 2017
- ‘Guideline for landscape character and visual impact assessment – Environmental impact assessment practice note EIA-NO4 – Centre for Urban Design – Transport for NSW 2020
- ‘Shotcrete Design Guideline – Design guidelines to improve the appearance of shotcrete in NSW’, Roads and Maritime, March 2016
- Water sensitive urban design guideline – Applying water sensitive urban design Principles to NSW transport projects, May 2017
- Guideline for Batter Surface Stabilisation Using Vegetation, Roads and Maritime, April 2015
- Landscape Design Guideline – Design Guideline to improve the quality, safety and cost effectiveness of green infrastructure in road corridors, Roads and Maritime Services, December 2018
- Great Western Highway Katoomba to Mount Victoria - Urban Design Framework - Roads and maritime Services - May 2019
- Great Western Highway Urban Design Framework - Lapstone to Katoomba - Roads and Traffic Authority NSW - November 2006.



Guide to Road Tunnels Part 2

AustRoads | 2021

The Guide to Road Tunnels Part 2 provides specific guidance on the planning, design, operation and maintenance of new roads tunnels across Australia and New Zealand. The document outlines AustRoads standard requirements for appropriate new tunnel design and outlines the importance of the planning phase, time allocation to undertake investigations and demonstrate technical viability with assistance of risk assessment and evaluation prior to proceeding to the tender stage.

Relevance to the project

The document identifies design requirements to inform the development of urban design responses for the concept design.

Increased stress levels in tunnel users is common and urban design contributes significantly in the reduction of this through considering:

- Clear, well located wayfinding
- Tunnel portal or transition design that provides reassurance of safety
- Providing a clear and non monotonous driving experience
- Appropriate lighting levels
- Connection to the context above.

Visual amenity should be considered to ensure that the tunnel fits sensitively into its environment, contextually and visually. This includes the design of the tunnel itself, as well as tunnel portals and supporting infrastructure (ventilation and associated building structures).



Design for a Positive In-Tunnel User Experience

AECOM | January 2017

The Design for a Positive In-Tunnel User Experience discusses the perception of tunnels as being unsafe by users, creating anxiety and increasing stress levels for those who use these on their journeys. Data supports the use of good urban design of tunnel portals and the interior to address anxiety and safety.

The document provides an overview of the urban design considerations in achieving a perception of safety and comfort for all tunnel users.

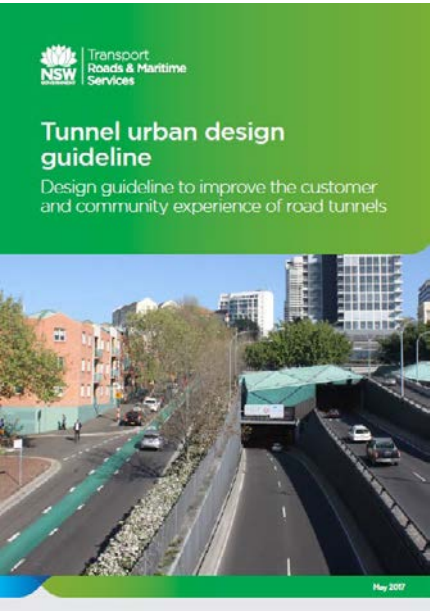
Relevance to the project

The document details design factors that have been identified to reduce tunnel user anxiety including;

- Tunnel entry
- Tunnel exit
- Tunnel road design
- Tunnel communications
- Tunnel signage
- Tunnel lighting
- Tunnel linings
- Orientation and wayfinding.

The data supported commentary should be reviewed and considered for urban design of the tunnel and approach for the concept design to ensure a positive experience for all tunnel users.





**Tunnel urban design guideline**  
**Roads and Maritime Services | May 2017**

The purpose of the Tunnel urban design guideline is to establish a clear best practice approach to the urban design of tunnel infrastructure to assist with the initiation, development and implementation phases of project delivery. The guideline supports the Beyond the Pavement, 2020 document and specifically details five tunnel typologies. These include:

- All tunnels (including underpasses)
- Short tunnels (do not require vertical ventilation exhaust outlets)
- Long tunnels (require vertical ventilation exhaust outlets)
- Urban tunnels (within built up metropolitan area)
- Rural tunnels (away from urban and built environments).

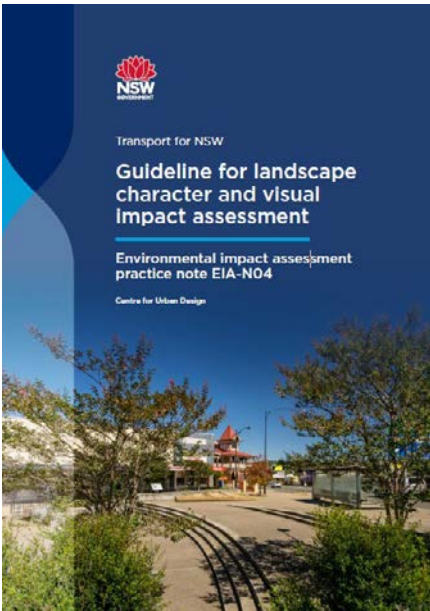
**Relevance to the project**

The guidelines will assist the rationale of establishing an urban design approach which enables tunnel integration into the local context. The approach should allow the tunnel to fit sensitively with the natural, built and community context.

The document identifies four tunnel urban design Objectives:

- Provide a safe, comfortable and attractive journey experience
- Provide a legible, self-explaining journey which enables awareness of location
- Provide a road tunnel which is sensitive to its context
- Deliver a high quality public asset that requires minimal maintenance.

These Objectives should be reviewed and integrated during the concept design phase.



**Guideline for landscape character and visual impact assessment**  
**Transport for NSW | August 2020**

The purpose of the Guideline for landscape character and visual impact assessment is to guide the preparation of landscape character and visual impact assessments in accordance with Beyond the Pavement, 2020.

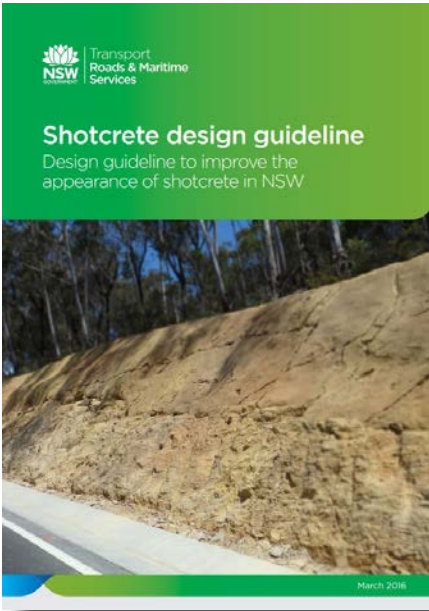
The guideline connects broader planning and design exercises and environmental assessment investigations to inform project teams on the effects of a proposal, while outlining the terminology, methodology and process to ensure consistent, high quality assessments are carried out and integrated within the wider environmental and design considerations of infrastructure projects.

**Relevance to the project**

The guideline clearly identifies that to be meaningful the landscape character and visual impact assessment and concept design must be undertaken simultaneously in an iterative process. This iterative process with the concept design will enable for impacts to be 'designed out' due to early identification/ mitigation.

As set out in the guideline, any analysis should be descriptive, illustrative and capture qualities of the place, along with listing fully described characteristics. This clarity is to be continued when represented as solutions in the concept design and consistency between the LCVIA should be reflected in the Urban Design Report and vice versa.

Outlined within the document are clear assessment requirements and task which should be reviewed during the concept design phase.



**Shotcrete design guidelines**  
**Roads and Maritime Services | March 2016**

The Shotcrete design guideline was prepared in support of the Beyond the Pavement, 2020 document to provide guidance and address the visual impact of shotcrete in transport infrastructure projects. Shotcrete may be a useful and cost effective means for stabilisation of cuttings however its poor aesthetic quality and longer maintenance implications provide good reasoning to avoid or minimise its use where possible. This guideline provides a strategy for dealing with the use of shotcrete consisting of avoidance, minimisation and improve appearance.

**Relevance to the project**

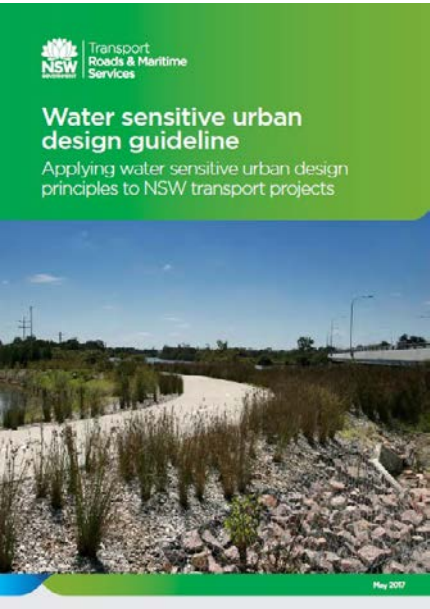
The guideline identifies two reasons for use of shotcrete:

- To protect a surface which, left untreated, would fret and erode (or is already doing so). Such surfaces may be localised or comprise anything up to the entire batter, depending on the circumstances
- To provide structural support for otherwise sound rock which is being undermined by erosion or which is unstable (due to defect orientations or degree of fracturing).

The concept design should carefully evaluate this reasoning and where possible avoid and minimise the use of shotcrete.

Where shotcrete use is required the guideline provides a range of techniques which should be considered in the concept design to reduce the visual impact. These techniques include colour, painting, texture and sculpting, stone pitching, rock mattresses and framing.





**Water sensitive urban design guidelines**

**Roads and Maritime Services | May 2017**

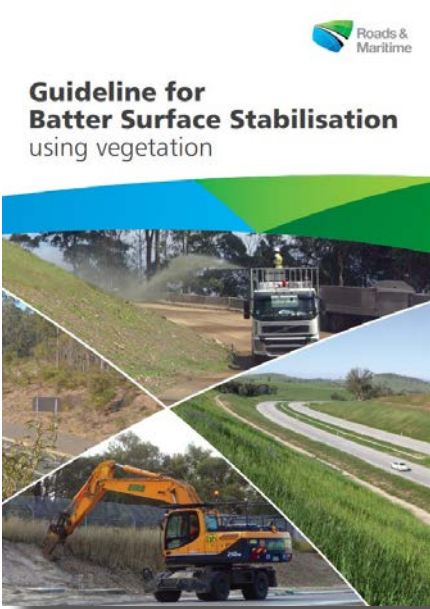
Water sensitive urban design or WSUD is the industry terminology for the integration of water cycle management into planning, design and construction of the built environment. The purpose of the Water sensitive urban design guideline is to guide the design professionals on the best application of a variety of industry standard WSUD Principles, approaches and techniques within road and infrastructure projects.

The document outlines the benefits of adopting a well integrated WSUD approach and the importance of analysing these at the early stages of a project. A guide detailing the process is provided to assist this consideration.

**Relevance to the project**

The WSUD guidelines provide Principles for desired physical outcomes of WSUD systems which should be evaluated against urban design Principles and Objectives developed through the concept design to ensure meaningful integration.

To facilitate project specific WSUD approaches the guidelines provide an assessment of attributes on various WSUD solutions. This should be reviewed in detail to determine which techniques if any are appropriate to consider in the project’s concept design.



**Guideline for Batter Surface Stabilisation using vegetation**

**Roads and Maritime Services | April 2015**

The aim of the Guideline for Batter Surface Stabilisation using vegetation document is to provide guidance on the suitability of a range stabilisation techniques that use vegetation across a variety of site conditions. This guidance considers:

- Factors that should be used to select appropriate batter surface stabilisation solutions
- The aspects of specific batter surface stabilisation techniques
- Existing Roads and Maritime specifications, procedures and guidelines
- Application for both temporary vegetation cover and long-term landscaping requirements
- The ability to use both temporary and long-term methods to achieve stability.

**Relevance to the project**

This guideline provides a clear graphic table to support the decision process in allocating an appropriate stabilisation technique in response to slope suitability. This should be referred to during concept design to ensure effective solutions are proposed.



**Landscape design guidelines**

**Roads and Maritime Services | December 2018**

The landscape design guideline was prepared as a supporting document to Beyond the Pavement, 2020. The purpose of this guideline is to provide landscape architects, designers and contractors with a best practice approach to establishment and maintenance of vegetation on road corridors. The aim of this being to achieve landscapes that are:

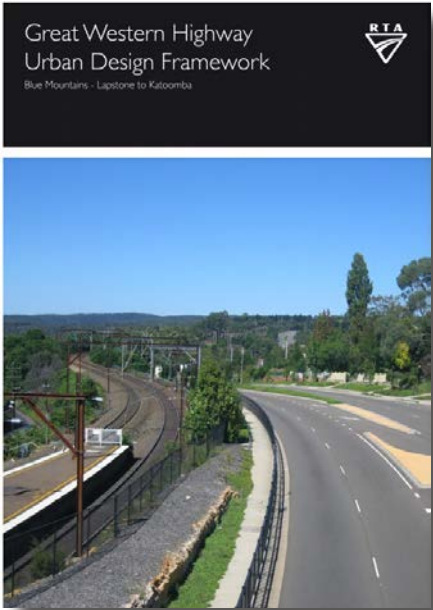
- Integrated into the project and built and natural fabric of the area
- Ecologically sound
- Appropriately designed for road corridors
- Functional and provide value for money
- Safe for road users
- Safe to build and maintain
- Low maintenance.

**Relevance to the project**

The Landscape design guideline identifies landscape Objectives which should be considered during concept design to ensure safe road corridors for all users in relation to planting design and management.

Detailed guidance on soft landscaping for road typologies, water related landscapes, cuttings and infrastructure elements (noise walls, etc) will influence the landscape character and visual impact of the project.





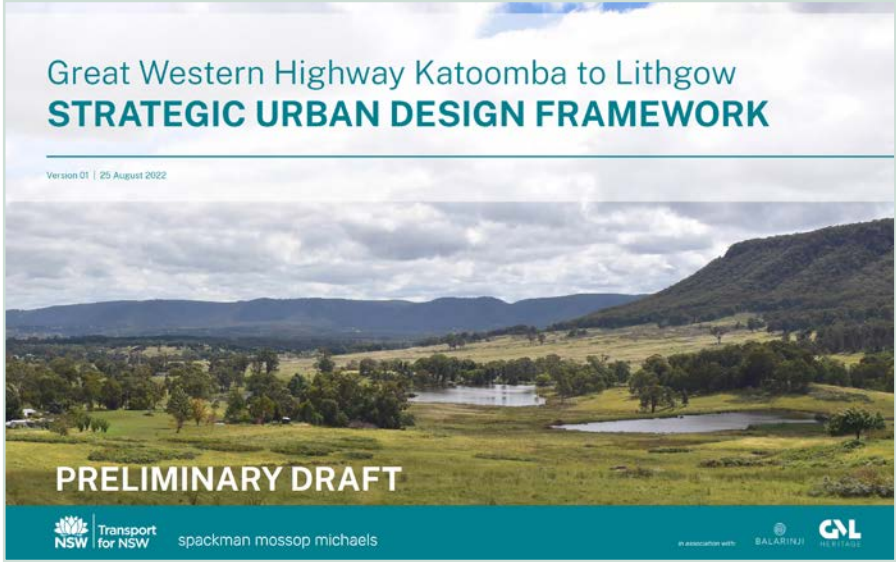
**Greater Western Highway Urban Design Framework Lapstone to Katoomba**

**Roads and Traffic Authority NSW – November 2006**

The Urban Design Framework aims to provide a consistent design approach for the Great Western Highway which is contextually sensitive of its locale in the Blue Mountains. It should inform all design development work and sets out an urban design vision, objectives, and principles to be followed in both bushland and village areas to create a distinction between villages and elevate their uniqueness.

**Relevance to the project**

The framework sets up urban design precedents for the Great Western Highway upgrade to which the Katoomba to Lithgow Strategic Urban Design Framework build upon.



**Great Western Highway Katoomba to Lithgow Strategic Urban Design Framework**

**Transport for NSW | May 2022**

The Urban Design Framework addresses the duplication of the Highway from Katoomba to Lithgow and seeks to provide guidance for a consistent urban design approach. The framework outlines urban design objectives and principles which are modelled in corridor wide typical application examples.

**Relevance to the project**

The framework provides assessment of the landscape character, of which sections overlap extent of scope with the project concept, this should be evaluated during the design phase.

A set of approaches and strategies are described to address specific issues, opportunities and challenges which should be considered during the concept design.



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## Methodology

# 03



# 3. Methodology

This report has been developed in accordance with Transport's *Environmental Impacts Assessment Practice Note – Guideline for Landscape Character and Visual Impact Assessment EIA-N04 (2020)* and *Beyond The Pavement 2020*. As such, concept design and assessment are carried out in parallel (refer Figure 3-1) to ensure that the project fits within the built, natural and community landscape. This report includes both concept design (urban design) and assessment (Landscape character and visual impact assessment).

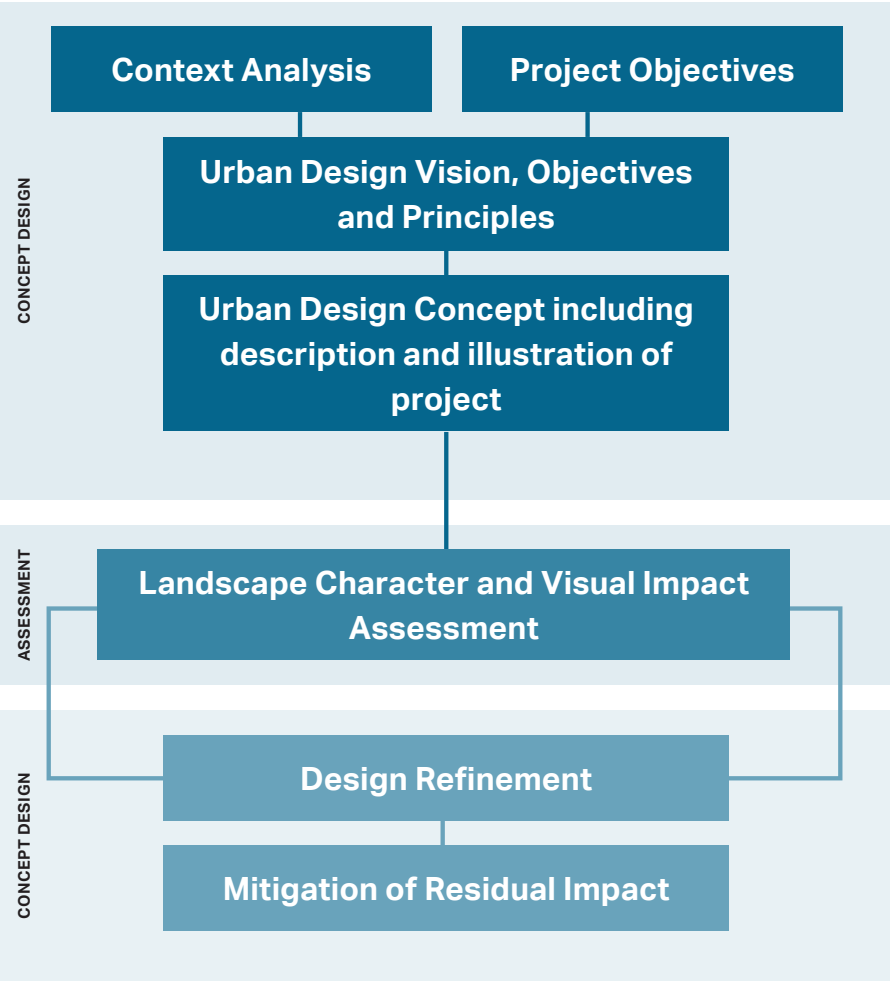


Figure 3-1: Relationship of assessment to project development

The project would be constructed as part of the greater Great Western Highway Upgrade Program as described in Section 1.1.

The project interfaces the Katoomba to Blackheath Upgrade at its eastern extent, and the Little Hartley to Lithgow Upgrade at its western extent (refer Figure 3-2).

The overlap of the three projects creates complexities with the integration of design and the assessment process:

- To ensure continuity of design, the urban design response has considered elements within the scope of works for the Katoomba to Blackheath and Little Hartley to Lithgow Upgrades where they interface with the project
- The Landscape character and visual impact assessment (LCVIA) only assesses the impact of the project on the 'baseline environment' (the existing environment in addition to the Upgrade Program) within the study area described in the following section.

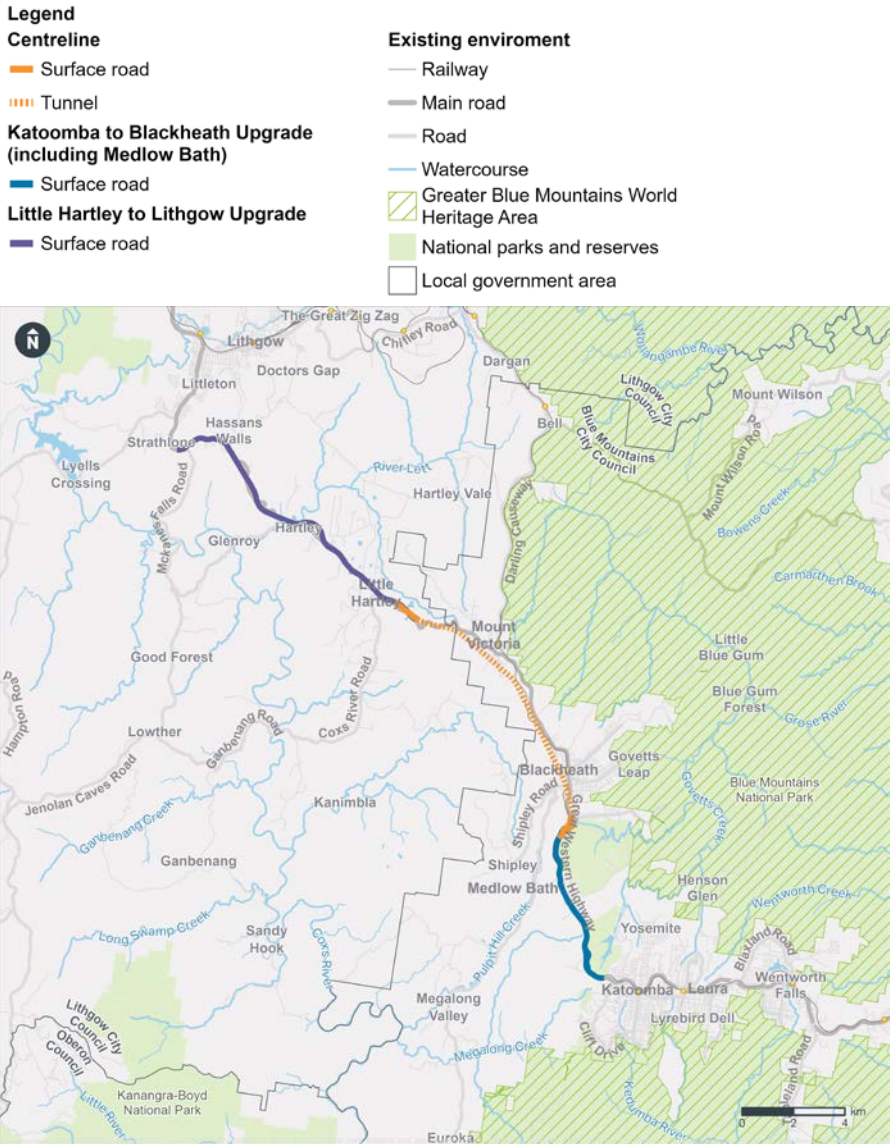


Figure 3-2: The Upgrade Program and project



Steps in the urban design concept development and LCVIA (as outlined in Transport's *Environmental Impacts Assessment Practice Note – Guideline for Landscape Character and Visual Impact Assessment EIA-N04 (2020)*) are:

1. **Contextual analysis** - An analysis of the regional and local context
2. **Urban design vision, objectives and strategy** - The development of urban design vision, with resulting principles delivered through a set of clear and achievable objectives that would guide the overall concept design
3. **Urban design concept** – The preparation of an illustrative urban design concept that reflects the urban design strategy, developed in collaboration with the concept design team
4. **Landscape character impact assessment** - An evaluation of the existing landscape character within a determined study area to inform the early stages of the urban design process, and to assess the anticipated landscape impacts as a result of the final design outcome
5. **Visual Impact Assessment** - An evaluation of the existing views and visual amenity within the study area to identify and assess possible impacts placed on the community by the project
6. **Mitigation** – Design outcomes and mitigation measures to avoid, reduce or mitigate adverse impacts that the project may impose within the study area, developed in collaboration with the project team.

### Study area

The study area within which landscape character and views have been assessed was defined as a 1 kilometre wide corridor, offset 500 metres either side of the Great Western Highway between the southern-most extent of the project and Mount Victoria (refer Figure 3-3). This corridor is considered to adequately assess the impact of the project on landscape character and views due to the extent of the surface elements of the project at Blackheath and Soldiers Pinch and the landscape surrounding these areas.

At Mount Victoria the study area has been widened to capture any impact within Little Hartley, which is spatially enclosed by the steep escarpment extending north from Berghofers Pass to Mount York and the smaller ridge line extending west from Victoria Pass.

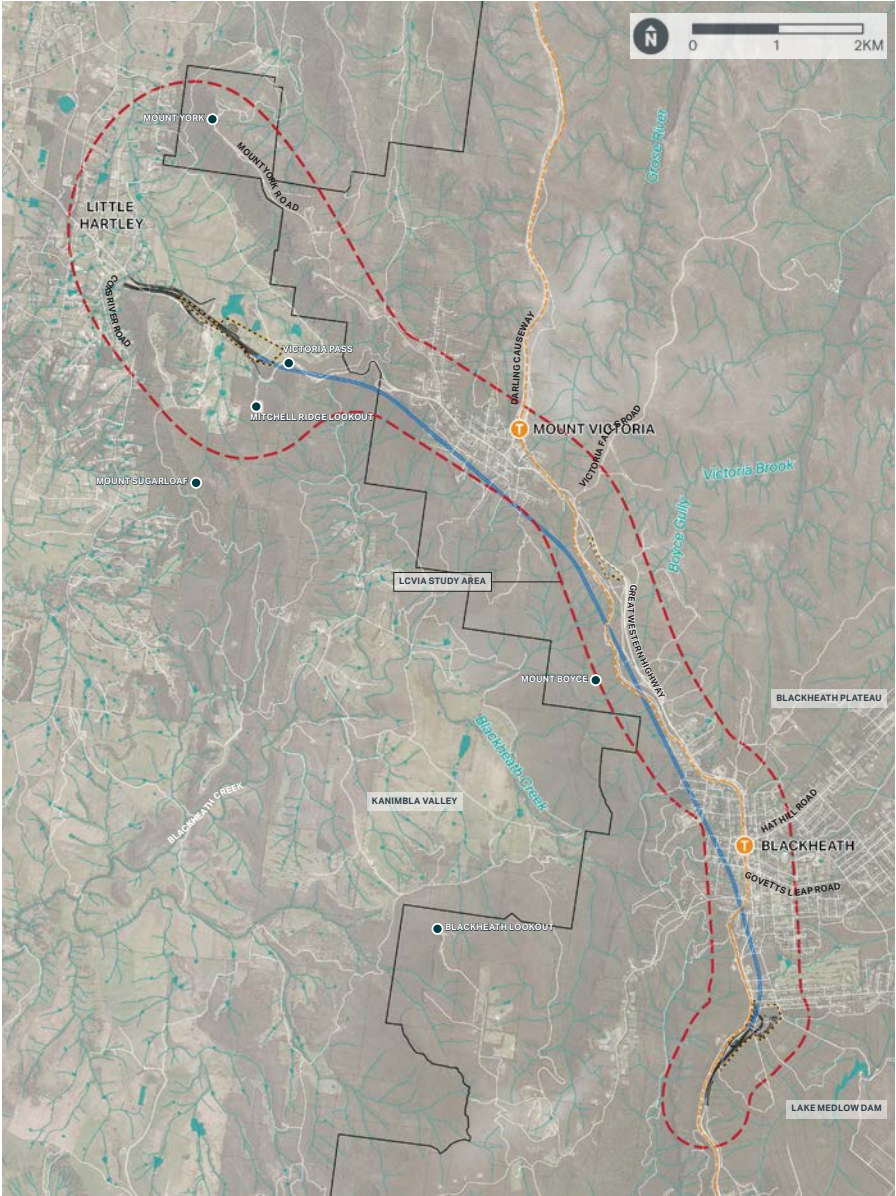


Figure 3-3: The study area

## 3.1 Contextual analysis

The contextual analysis includes a broad description of the landscape within which the project is located including planning and policy documents, site setting, topography, land use, landscape and heritage values. Contextual analysis is undertaken using a combination of desktop analysis (including planning and policy documents, environmental background information, heritage and spatial (GIS) data) and site visits to ground truth desktop findings.

The existing environment has been described for the purposes of concept design, while the assessment of the project must consider the 'baseline environment', comprising the existing environment but with the Upgrade Program described within it.

### Identification of landscape character zones

Drawing from the desktop analysis and the site inspection, a landscape character assessment was undertaken to assist with concept design and subsequent assessment of impact on landscape character. To provide a framework for more clearly describing the area, and assessing how the project would affect the elements that make up the landscape (including the aesthetic and perceptual aspects of the landscape and its distinctive character), distinct parts of the overall landscape have been separately defined and mapped as landscape character zones (LCZs).

LCZs consider the way different elements of the environment, both natural (e.g. the influences of geology, soils, climate, flora and fauna), and cultural (the historical and current impact of land use, settlement, enclosure and other human interventions), interact together and are perceived to form a distinct pattern and sense of place.



### 3.2 Urban design

The Transport *Beyond the Pavement* policy outlines the definition of urban design for transport projects in NSW, as follows:

***Urban design is the generally accepted name for the process of giving physical design direction to urban growth, conservation and change. It is understood to include landscape as well as buildings, both preservation and new construction, and rural areas as well as cities.***

- Jonathan Barnett 1982 -

***Urban design... is ...the process and product of making and designing cities.***

- Jacquelin Robertson 1985 -

The process of providing physical design direction to the development of human settlements should lead to good physical, functional and aesthetic design outcomes and successful places.

In NSW urban design is applicable to a variety of locations: the wilderness landscapes of the Pacific coast and New England tablelands; rural landscapes such as along the Hume and Newell highways; villages such as Nabyac and towns such as Moree; provincial cities such as Coffs Harbour; regional cities such as Newcastle and Wollongong; the landscapes of Sydney Harbour and rivers of New South Wales whose waterfronts accommodate boating and wharf infrastructure; and, Sydney as a global metropolis.

Jonathan Barnett’s definition is particularly appropriate for Transport for NSW where a process and design direction is needed for the complex work and multi disciplinary teams; the work is across the state in urban and rural contexts; the network involves as much landscape as built form; and the work done incorporates both management of the transport network as well as new projects.

*Beyond the Pavement, Centre for Urban Design, Transport for NSW, 2020.*

The Great Western Highway Upgrade passes through very sensitive and unique landscapes and places, requiring a thorough understanding and analysis to inform succinct, targeted and contextual urban design objectives and principles.

### Beyond the Pavement Urban Design Principles

Beyond the Pavement outlines nine broad urban design principles, which form the basis of the urban design approach for the Great Western Highway Upgrade:

1. **Contributing to urban structure, urban quality and the economy**
2. **Fitting with the built fabric**
3. **Connecting modes and communities and promoting active transport**
4. **Fitting with the landform**
5. **Contributing to green infrastructure and responding to natural systems**
6. **Connecting to Country and Incorporating heritage and cultural contexts**
7. **Designing an experience in movement**
8. **Designing self explaining roads that respond to their role and context**
9. **Achieving integrated and minimal maintenance design.**



### 3.3 Landscape character impact assessment

Assessment of impact on landscape character considers the impact of change due to the project on the landscape as a resource in its own right. Impact of the project on landscape character is assessed on the baseline environment (i.e. after the construction of the Upgrade Program, which is considered an existing condition within the landscape).

The consideration of potential impact on landscape character is determined based on the each LCZs sensitivity to change and the magnitude of change that is likely to occur. Sensitivity and magnitude are both assigned a rating based on a series of criteria, and then a matrix is used to combine the ratings to determine an overall impact rating.

#### Sensitivity

The sensitivity of a LCZ to the project is assessed and rated as being High, Moderate, Low or Negligible. The rating is based on:

- Susceptibility to change - the ability of the landscape to accommodate the project without undue consequences for the maintenance of the existing situation or the achievement of landscape planning policies and strategies
- The value of landscape.

#### Magnitude

Magnitude of change is assessed and graded as being High, Moderate, Low or Negligible. The magnitude of the impact refers to the physical scale of the project, how distant it is and the contrast it presents to the existing condition. The project elements assessed include its location, the vertical and horizontal alignment, heights of cuttings and fill embankments, the location and form of bridges and walls, vegetation and planting after two to three years of growth.

#### Overall impact of change

A matrix is then used to combine the ratings for sensitivity and magnitude (refer Table 3-3) to determine an overall rating of landscape character impact. The project has been assessed for two options: an emissions via ventilation outlet option (including a ventilation outlet and Blackheath and Little Hartley) and an emissions via portals option (where no ventilation structures are present).

A qualitative rating of the change to the LCZ due to the project is provided for each LCZ, being Beneficial, Adverse or Neutral. This rating is assigned based on professional judgment, but considers the degree to which the project fits within existing / proposed and desired landscape character and the contribution to the landscape that the project may make through its inherent design quality.

**Table 3-3:** Landscape character and visual impact assessment grading matrix (ref: EIA-N04)

SENSITIVITY	MAGNITUDE OF EFFECT				
		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

### 3.4 Visual impact assessment

Assessment of visual impact considers how changes within a landscape would affect views seen within it. A series of viewpoints were selected from which to assess the visual impact of the project on the baseline environment (i.e. after the construction of the Upgrade Program, which is considered an existing condition within the landscape) using a combination of information gathered from desktop analysis, including visual envelope mapping, and the site visit.

Other factors such as proximity to the project, number of visual receptors at each location and the type of visual receptors were taken into account when selecting viewpoints. Viewpoints were chosen to assess the changes due to the project from publicly accessible locations, although some viewpoints were used to approximate these changes when seen from private locations such as residences or community facilities.

The assessment of potential impacts on visual amenity is based on the sensitivity of the viewpoint to change, and the magnitude of change arising from the project that is likely to occur. Sensitivity and magnitude are both assigned a rating based on a series of criteria, and then a matrix is used to combine the ratings to determine an overall visual impact rating. From all viewpoints, photography was used to record and assist in assessment of views. For some locations, visual simulations were used to illustrate the project within the view (refer Section 3.4.1). At others, linework was overlaid onto photographs to show the position of project elements.

The impact of the project on views has been assessed during construction and at operation.

#### Sensitivity

The sensitivity of a viewpoint to the project is assessed and rated as being High, Moderate, Low or Negligible. The rating is based on the susceptibility to change, i.e. how interested the visual receptor would be to the view and the value attached to the view experienced.

More sensitive viewpoints may include residential areas, places where the quality of the landscape or the views are intrinsic to the enjoyment of activity at that location (e.g. recreational areas), heritage assets or other attractions where views are an important contributor to the experience.

#### Magnitude

The magnitude of change to views and visual amenity depends on the size or scale of change, loss or addition of features, degree of contrast or integration of any new features and geographical extent of the changes.

The extent of magnitude is assessed and graded as being High, Moderate, Low or Negligible.



**Overall impact of change**

A matrix is then used to combine the ratings for sensitivity and magnitude (refer Table 3-3) to create an overall visual impact rating. A qualitative rating of the change to views seen from each viewpoint due to the project is also provided, being Beneficial, Adverse or Neutral. This rating is assigned based on professional judgment, but considers criteria used to assess the sensitivity of the viewpoint and the value of the view in addition to the changes, including the urban design outcome.

**3.4.1 Creation of visual simulations**

Visual simulations were produced from some viewpoints to illustrate the project within views, but are not explicitly necessary for undertaking an assessment of visual impact.

They were prepared as follows:

- The view from a georeferenced location (viewpoint) was photographed using specialist equipment to capture a 124 degree panorama which was stitched in post production
- A3D model of the project was overlaid over the panorama and elements within the view that would be 'removed' due to the project were altered in photoshop to provide an accurate representation of the changes
- Soft landscaping (planting) and surface finishes were added and adjusted in photoshop.

As required by the SEARs, visual simulations were prepared from viewpoints which were deemed to experience the greatest potential impacts from the project. These included places which were positioned closest to the project and / or would include highly sensitive visual receptors. Visual simulations were not produced from other viewpoints for several reasons, including:

- The methodology for preparation of visualisations described above could not be adhered to (e.g. if the view was taken from a vehicle which could not be georeferenced or recorded using specialist equipment)
- They were deemed too far from the project to receive clear views to the project
- Where the changes would be screened from view by landform or vegetation
- Where there were very few receptors or where receptors were deemed of negligible or low sensitivity
- Where a visual simulation had been created from a similar viewpoint that adequately illustrated the change that might be experienced at another.

**3.5 Cumulative impact assessment**

The project interfaces with the Katoomba to Blackheath Upgrade at its eastern extent and the Little Hartley to Lithgow Upgrade at its western extent. These two approved projects have been considered the 'baseline environment' above which the project has been assessed, that is, changes to landscape character and views due to these approved projects are assumed to have occurred prior to the project, with the changes to landscape character and views due to the project then assessed in addition to those. The cumulative impact assessment considers the impact of the combination of these upgrades on the landscape at completion.

**3.6 Mitigation of impact**

During the concept design phase, outcomes of contextual analysis, urban design development and landscape character / visual impact assessment have been fed back to the wider project team. This prompts mitigating measures to be undertaken in the concept design phase to avoid or reduce potential impacts of the project on landscape character, views and visual amenity.

At the completion of the concept design a set of mitigation measures have been developed aimed at reducing or avoiding remaining adverse impacts of the project. These final mitigation measures would be considered during detailed design and later stages of the project.

**3.7 Conclusion**

A final conclusion is provided, summarising the overall impact of the project and the urban and landscape design outcomes.



## Contextual Analysis

# 04



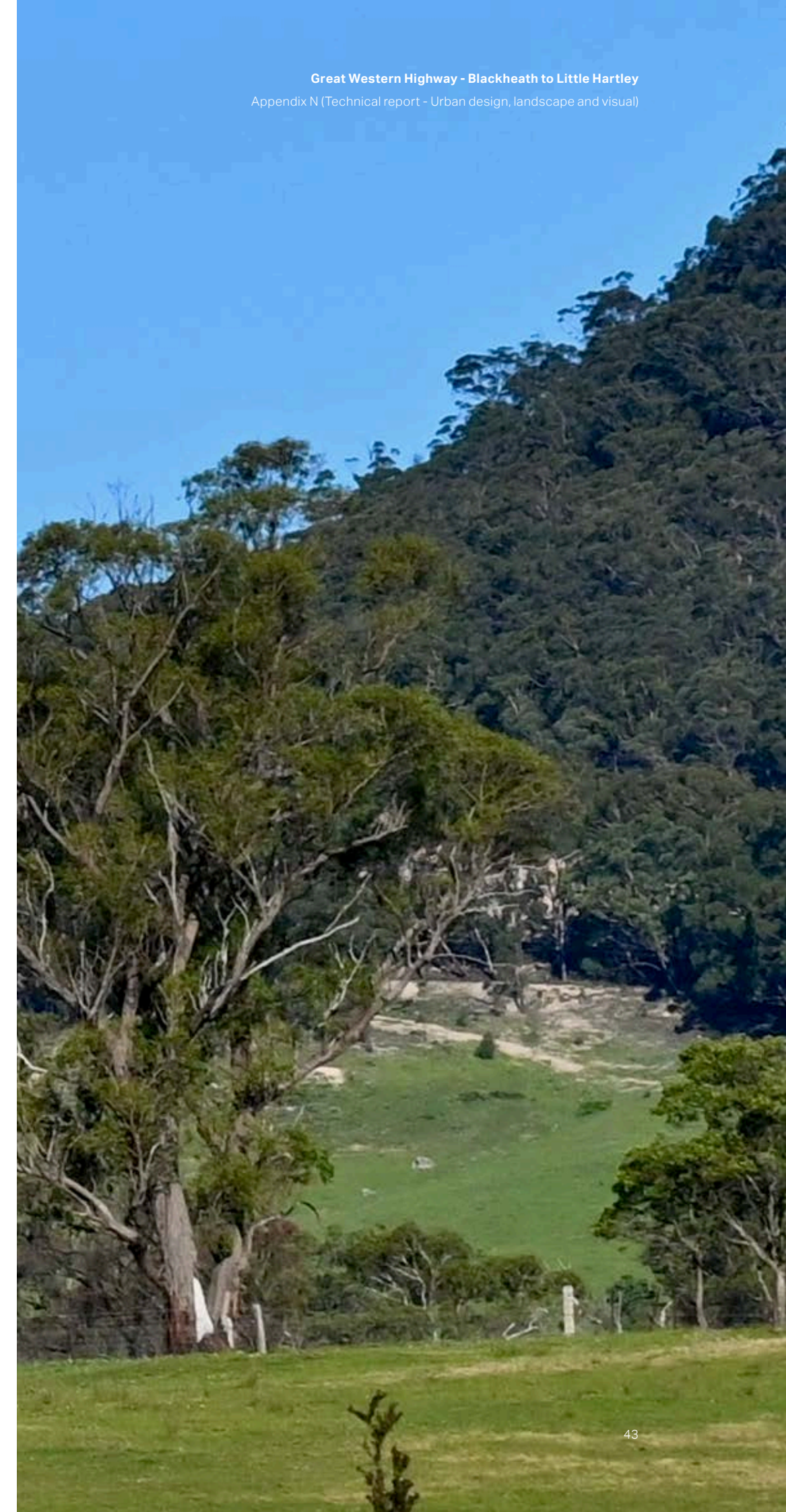
# 4. Contextual Analysis

## 4.1 Introduction

A contextual analysis of the project area was undertaken to understand the existing natural, built and community contexts. The analysis has provided the basis to develop an urban design Concept derived from 'place' that is 'of place'.

The analysis includes:

- **Corridor Place Analysis**  
A photographic and location based assessment of the visual characteristics of the Greater Western Highway and surrounding areas
- **Topographical Analysis**  
Explores the current conditions of the corridor, the arrangement of the natural and physical features and attributes and surrounding context
- **Corridor Vegetation Analysis**  
Identifies the geographical location in which the project falls, the geology and soils which influence the vegetation communities and the different classes of vegetation
- **Land Use Zoning**  
Describes the different land uses over the various Zones as determined by the relevant Local Government Areas (LGA) in which the project traverses, as determined by their respective environmental planning instruments.
- **Heritage Analysis**  
An overview of the adjacent Greater Blue Mountains World Heritage Area, Aboriginal and non-aboriginal Heritage.







## 4.2 Corridor place analysis

The Great Western Highway extends from Sydney in the East through to Bathurst in the West, traversing through the peaks and valleys of the Blue Mountains.

Blackheath is distinguished by undulating topography which has a town footprint of small to medium size in comparison to neighbouring Katoomba and Lithgow, supporting a population of over 4000. The township is diverse in its landscape character with a variety of both native and exotic species. Blackheath's main street, Govetts Leap Road, highlights the rich heritage and unique community with numerous architectural buildings, local businesses and artist murals along its length. Residential properties and green open space connect into numerous trails and Blue Mountains experiences. A cohesive identity is evident however the township presents accessibility, pedestrian and cyclist concerns with a clear reliance on vehicles.

Little Hartley is characterised by flat to undulating topography with a Blue Mountains escarpment backdrop. There are remnant areas of native vegetation however the landscape character is that of an agricultural landscape with expanses of open fields and farm structures. Rural residential properties and small businesses are spread along the Great Western Highway. There are many heritage listed properties in the area which contribute significantly to the character of the place. Although there is a strong community, there is poor wayfinding, signage and landmarks to reflect their presence.

The project passes by numerous significant sites and landmarks including Fort Rock, The Big Rock and Mount Boyce east of Blackheath, Pulpit Rock Lookout, Govetts Leap north of Blackheath, Mount Piddington and Sunset Rock Lookout southeast of Little Hartley and Pass of Victoria, Berghofers Pass and Mount York north of Little Hartley.



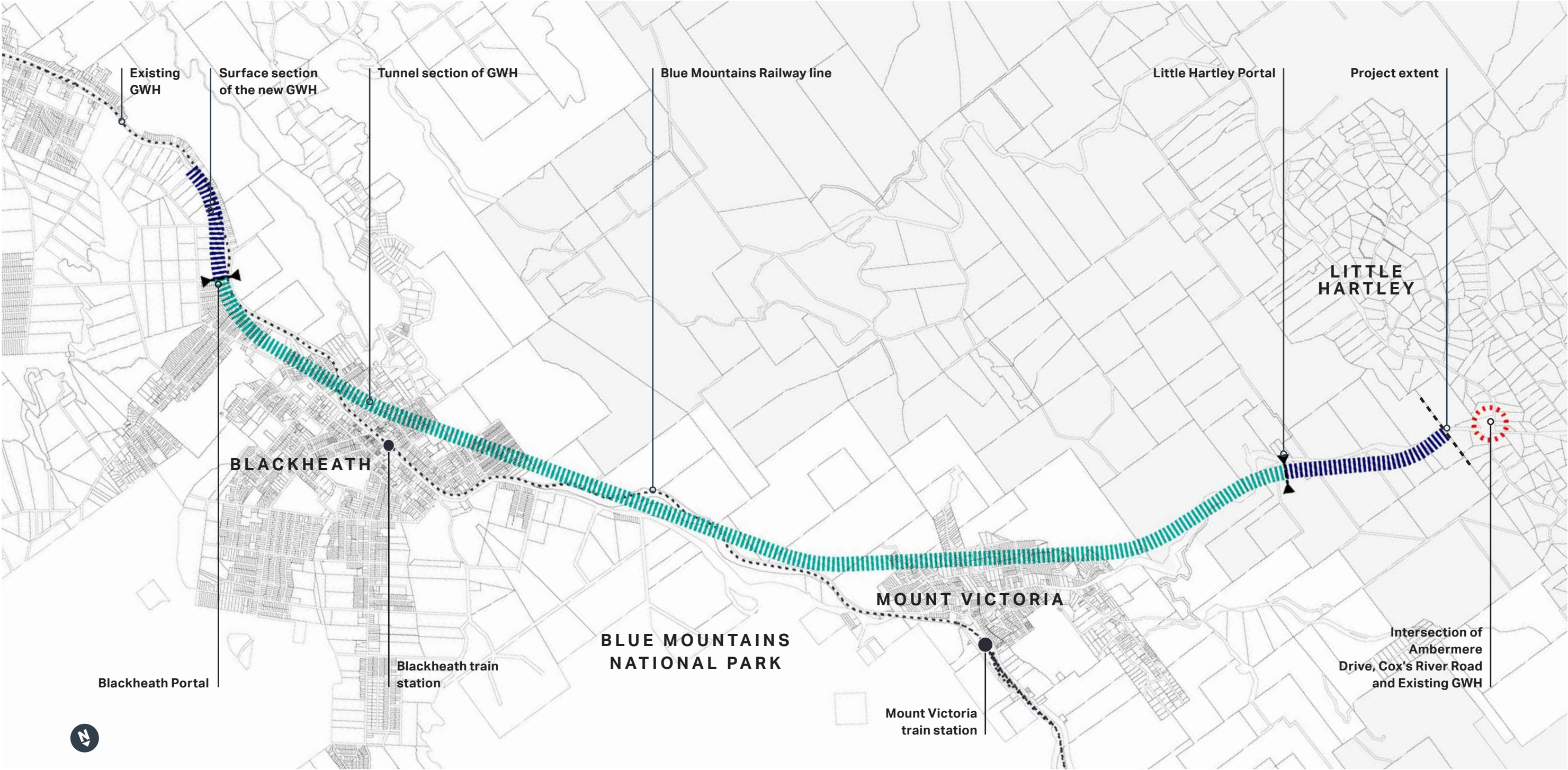


Figure 4-1: Corridor Place Analysis diagram



4.2.1 Blackheath

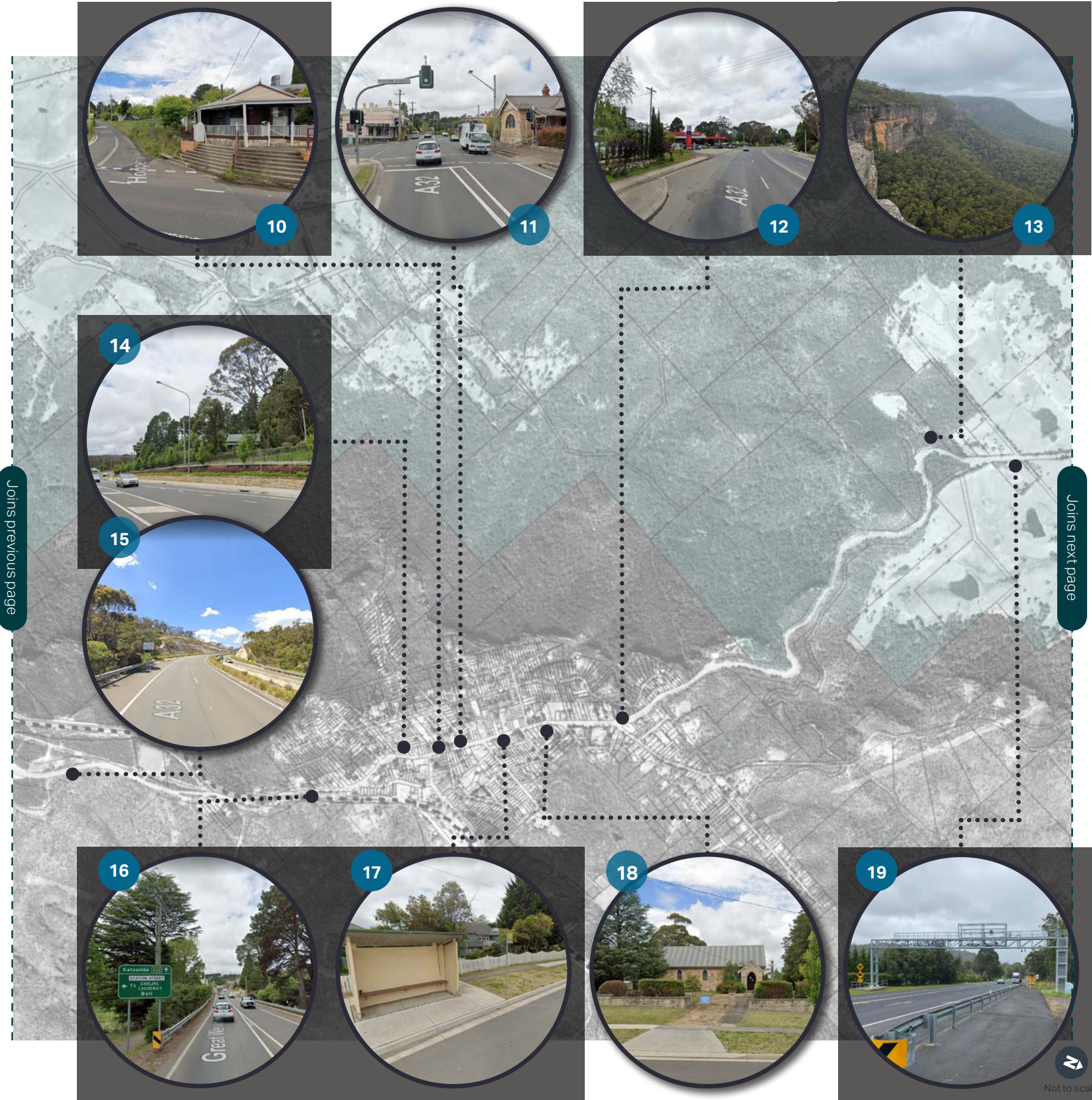
Features

- 01 The landscape character is defined at the township by shotcrete retaining walls, permeable fencing, feature stone blocks and native grass species.
- 02 Adjacent the main street a section of linear park or picnic area provides opportunity for rest and lingering along the Highway.
- 03 Rows of art deco character buildings line Govetts Leap Road highlighting the post colonisation history of the township. The character building typology provides a small scale and sheltered public domain with connected awnings.
- 04 Residential properties on the eastern entrance into Blackheath are set back on a higher level from the road with ample tree canopy cover from an avenue of street trees.
- 05 A landscaped buffer separates the Highway and residential properties with a clear landscape palette. Residential properties are single storey and set back from the roadway.
- 06 The art deco character building home of the Victory Theatre Antique Centre showcases a merging of heritage value and contemporary art with a bright mural.
- 07 The intersection of Hat Hill Road signals arrival into the town heart with the train station and character buildings, Gardner’s Inn, lining the Highway.
- 08 The eastern entry into the township of Blackheath lacks any identity or design language. The adjacent train line has opportunity to be highlighted.
- 09 Bus infrastructure is outdated and does not provide a user friendly or inviting environment that encourages use of public transport. No connection to residential streets adjacent.



Figure 4-2: Plan showing features in Blackheath and Mt Victoria





### 4.2.2 Mount Victoria / Little Hartley

#### Features

- 10** The intersection of Hopper Street is a severely unfavourable environment for pedestrians and cyclist who can only navigate a steep change in levels via stairs.
- 11** The intersection of Station Street signals the presence of a main street or town village with character buildings, many of which require restoration. The intersection however does not appear to be people friendly with steep level changes, poor crossings and lack of amenity (i.e. tree canopy).
- 12** The western entry into the township of Mount Victoria lacks an identity or design language being defined by a services station and wide roadway.
- 13** The Victoria Pass Lookout provides extraordinary views over the Blue Mountains and native bushland.
- 14** Ornamental tree and formal, layered amenity planting offset natural stone retaining walls establish a landscape design language.
- 15** A shotcrete finish is evident to the cutting which allows the Highway to pass through the mountain crest. A concrete barrier dividing directions of traffic is landscaped with grasses.
- 16** The Highway is elevated from the footpath which connects into the adjacent open space. Potential impacts on pedestrians/cyclists from stormwater run off should be considered.
- 17** Bus infrastructure is outdated, highlights CPTED concerns and does not provide a safe or inviting environment that encourages use of public transport.
- 18** St Paul's Anglican Church is set back from the Highway with highly manicured landscaping highlighting the natural stone character building.
- 19** Incline to Victoria Pass is dominated by large, harsh Highway infrastructure.



4.2.3 Little Hartley

Features

- 20 The Lolly Bug was a landmark building on the Great Western Highway before it burned down, with the single storey timber building positioned against a backdrop of dense bushland and a yellow VW 'Beetle' marking the entry.
- 21 Adam's Rural Supplies has industrial shed like appearance and sits below the Highway, separated by visually permeable fencing. Frontage lacks address and vegetation.
- 22 Highway intersection with Mid Hartley Road is evidently designed with large vehicle movements in mind with wide sweeping radius' and multiple lane options.
- 23 Little Hartley lies in a valley setting, with the gently undulating rural landscape fringed by densely vegetated steep escarpments to the north east , south and south west. Residential dwellings sit within expanses of pastoral land with distant valley and mountain views.
- 24 Mere Pantry and Store, single storey cottage like building with long frontage to Highway buffered with non-native formal planting and expanse of turf. Minimal signage to indicate commercial property. Original building constructed in 1845.
- 25 Residential dwelling, single storey with a mix of character styles however predominantly cottage like in appearance.
- 26 Erin's Quality Outdoor Power Centre fronts Highway with lack of delineation between commercial property and roadway. The industrial, shed like building appearance sits low in the land with a backdrop of bushland and mountains.
- 27 St John's Anglican Church is situated higher up from the Highway providing views West.
- 28 Little Hartley predominantly consists of farming land which is highly visible from the highway. The landscape is evident of minimal remnant tree planting, expanses of low level crops and large dams.



Figure 4-3: Plan showing features in Little Hartley

Not to scale



### 4.3 Topographical analysis

#### 4.3.1 Topography

The Great Western Highway, which the project largely follows from Blackheath to Little Hartley, is located along a ridge line through the Blue Mountains. The Highway gently undulates between Medlow Bath and Blackheath, staying at an approximate height of 1060 metres Australian Height Datum (m AHD) as it follows the ridgeline, before rising to a high point at Mount Victoria, which has the highest elevation within the study area at approximately 1080 m AHD. From Mount Victoria the Highway drops steeply, following the ridgeline along a stretch of road known as Victoria Pass, heading north into Little Hartley. Between Mount Victoria and Little Hartley the Highway drops in altitude by approximately 260m into the valley below.

Between Blackheath and the Mt Victoria township, the Great Western Highway lies close to a sandstone escarpment (at times as close as 300m from the Highway) that falls steeply westward into the Kanimbla Valley. To the east of the Great Western Highway the landscape slopes more gently eastwards across the Blackheath Plateau towards the Gross Valley, with a similar sandstone escarpment fringing the Grose Valley to the east. The escarpment lies approximately 2.6km east of the Highway at its closest point at Govetts Leap Lookout.

South of Blackheath township the terrain drops into a valley towards Lake Medlow Dam to the east of the Highway and a steep valley which falls into the Megalong Valley to the south.

Little Hartley lies in a valley at the northern end of the study area. The southern end of the valley is framed to the north east by a steep escarpment culminating in Mount York and a smaller ridgeline associated with Mount Sugarloaf to the south west.

#### 4.3.2 Drainage

Numerous creeks and gullies as tributaries of rivers traverse or extend from the Great Western Highway ridgeline. To the east, creeks flow eastwards to the Grose River and include Govetts Creek, Hat Hill Creek, and at the northern end of the study area near Mount Victoria, the upper reaches of the Grose River. The creeks and river flow through heavily vegetated bushland within the Grose Valley.

South of Blackheath, Lake Medlow Dam lies on Adams Creek. It was constructed in 1907 and is believed to be one of the thinnest dam walls in the world.

To the west of the Highway, smaller creeks including Blackheath Creek and Stony Creek flow westward into the Cox's River, which winds through the more open, rural Kanimbla and Megalong Valleys.

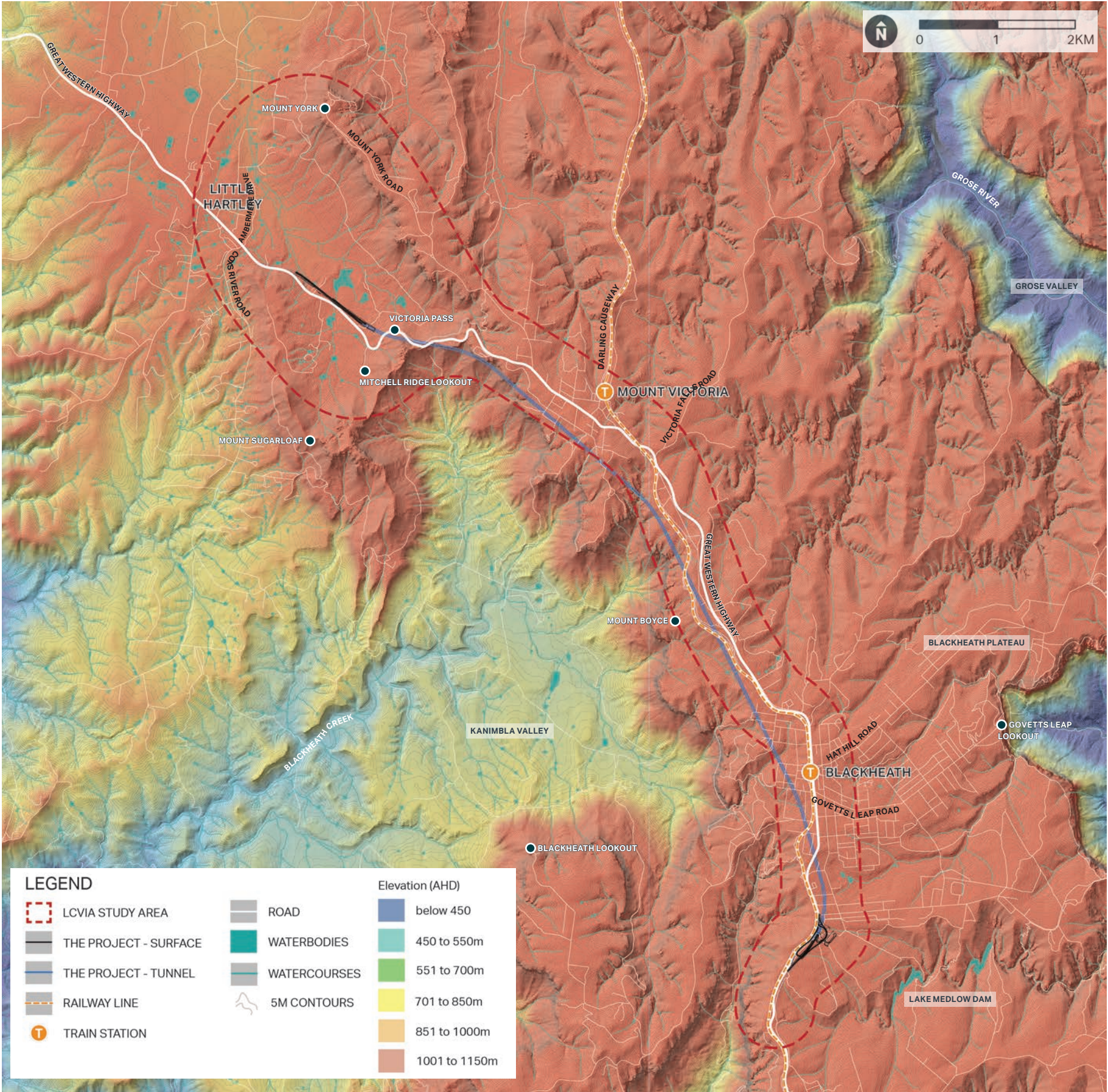


Figure 4-4: Topographical features



4.4 Vegetation analysis

4.4.1 Sydney Basin Bioregion

The project lies within the Sydney Basin bioregion which covers near to 3.7 million ha and is one of the most species diverse in Australia. The Blue Mountains itself forms part of the most significant features within this bioregion, the Great Escarpment, with its reversed drainage, and entrenched meander patterns and high level terrace gravels<sup>1</sup>. It is the third highest area of conservation orientated tenures of the NSW bioregions.

The Sydney Basin bioregion consists of numerous subregions, the project is located within the Wollemi subregion. As described in The Sydney Basin Bioregion (NPWS, 2003), the Wollemi subregion is characterised by vegetation such as,







*'red bloodwood, yellow bloodwood, rough barked apple, smooth barked apple, hard-leaved scribbly gum, and grey gum with diverse shrubs and heaths on plateau. Smooth-barked apple, Sydney peppermint, blue-leaved stringybark, and turpentine and gully rainforests in gullies and canyon heads. Ribbon gum and Blaxland's stringybark on basalt. River oak along main streams.'*

4.4.2 Geology and soils

The underlying geology and soils of the region influence the vegetation communities. Around Blackheath the geology is characterised by Sandstone comprising inter bedded Widden Brook conglomerate, sandstone, siltstone and claystone. The central portion around Mount Victoria is characterised by shale, sandstone, conglomerate and chert with coal and torbanite seams. The western portion around Little Hartley is characterised by shale, conglomerate and sandstone including lenticular development the Megalong conglomerate.

Soils at Blackheath are characterised as Kandosol. Kandosols are red, yellow and grey massive earths, which generally have a sandy to loamy-surface soil, grading to porous sandy-clay subsoils with low fertility and poor water-holding capacity.

Soils at Little Hartley are characterised as Sodosol. Sodosols are texture-contrast soils with impermeable subsoils due to the concentration of sodium. Generally Sodosols have a low-nutrient status and are very vulnerable to erosion and dryland salinity when vegetation is removed.

LEGEND			
	Rainforests		Wet sclerophyll forests
	Heathlands		Grassy woodlands
	Freshwater wetlands		Dry sclerophyll forests

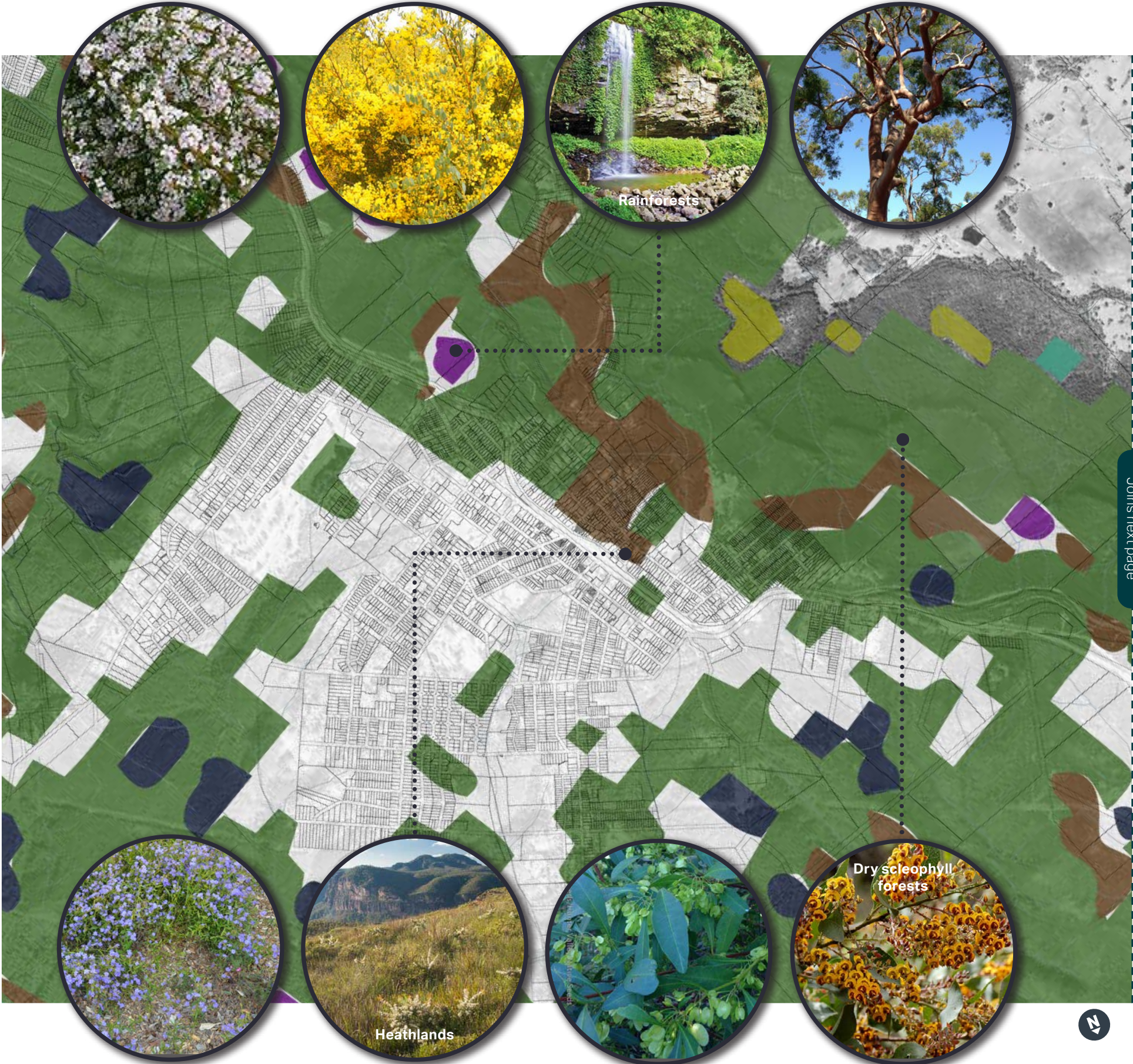


Figure 4-5: Existing vegetation analysis



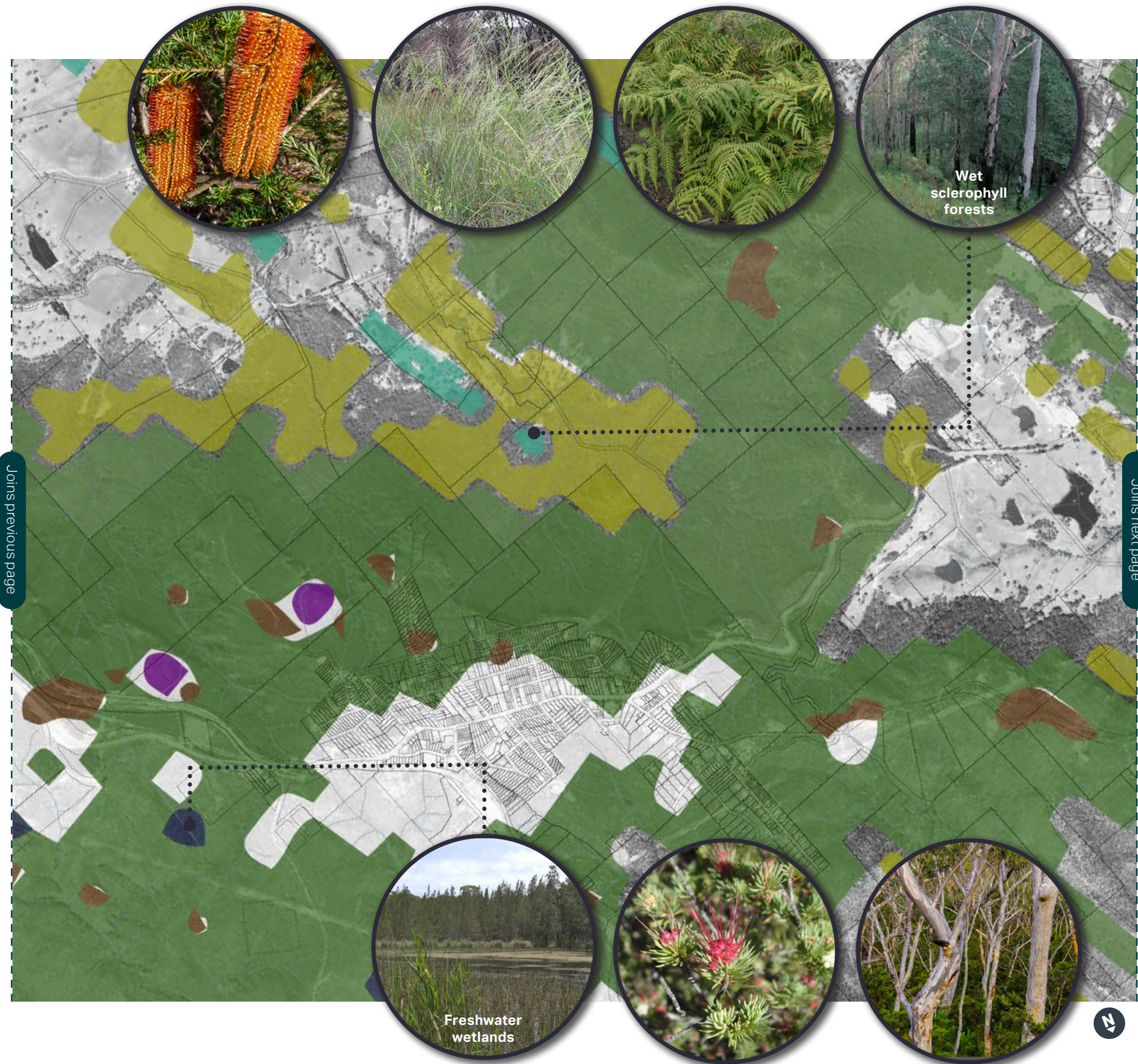


Figure 4-5: Existing vegetation analysis (continued)

#### 4.4.3 Vegetation Classes of NSW (David A. Keith and Christopher C. Simpson. VIS 3848)

The vegetation mapping shows existing coverage of native vegetation classes within the project area. The classes that are identified include:

- 01** Dry sclerophyll forests (Shrub/grass subformation) are defined by their diverse flora and scenic landscapes. Species commonly defining this class include eucalypts, wattles and banksias. They exhibit a grassy understorey with sparse shrubs and define the transition from grassy woodlands and dry sclerophyll forest (shrubby subformation). This vegetation class is prominent of low fertile lows which makes them also undesirable for agriculture meaning native vegetation has remained relatively intact.
- 02** Dry sclerophyll forests (Shrubby subformation) are typical of eucalypts, wattles, waratahs, pea flowers and tea trees. Sparse ground cover of sedges and grasses are rare. This vegetation class is prominent of low fertile lows, usually sandy, which makes them also undesirable for agriculture meaning native vegetation has remained relatively intact.
- 03** Freshwater wetlands play a vital role in the regulation of water flow and quality being ecosystems that have both permanent and temporary inundation. This complex class is dominant of shrubs, sedges and herbs and have been significantly altered by humans.
- 04** The Grassy Woodlands are widespread, dominant by eucalypts, typically box and red gums, and has a relatively open canopy with sparse shrubs, diverse tussock grasses. Rain brings ephemeral grasses and herbs from seed banks.
- 05** Heathlands have a restricted distribution and share many features with the shrubby subformation of dry sclerophyll forests with the distinguishing feature being a lack of trees. This vegetation class is typical of shallow, sandy and low in nutrients soils.
- 06** Rainforests are characterised by their closed and continuous tree canopy which consists of soft and horizontally positions leaves. Typically this class has moist and highly fertile soils, which has lead to significant destruction of vegetation for agricultural use.
- 07** The Wet sclerophyll forests (Grassy subformation) occur on moderately fertile soils in areas which have high rainfall. Typically characterised by a tall and open sclerophyllous tree canopy and an understorey of mesophyllous, shrubs, fern and herbs. Many understorey plants are rainforest species or have close rainforest relatives.

Reference: [https://geo.seed.nsw.gov.au/Public\\_Viewier/index.html?viewer=Public\\_Viewier&locale=en-AU](https://geo.seed.nsw.gov.au/Public_Viewier/index.html?viewer=Public_Viewier&locale=en-AU) (Accessed August 2022)



At Blackheath vegetation classes present include Dry sclerophyll forest (Shrubby subformation), Freshwater wetlands, Heathlands and Rainforests. Some species within the Blackheath area include:

- *Angophora bakeri* (narrow-leaved apple)
- *Eucalyptus macrorhyncha* (red stringybark)
- *E. rossii* (scribbly gum)
- *E. sclerophylla* (hard-leaved scribbly gum)
- *E. piperita* (Sydney peppermint)
- *Acacia buxifolia* (box-leaved wattle)
- *Daviesia latifolia* (broad-leaved bitter pea)
- *Dodonaea triquetra*
- *Leptospermum trinervium* (flaky-barked teatree)
- *Boronia microphylla*
- *Grevillea laurifolia*
- *Dianella revoluta* var. *revoluta* (blue flax lily)
- *Lomandra multiflora* (many-flowered mat-rush)
- *Lomandra glauca* (pale mat-rush).

Within Little Hartley similar predominant vegetation classes are present, including Dry sclerophyll forest (Shrubby subformation) and Heathlands but differs in the presence of Grassy woodlands. Some species within the Little Hartley area include:

- *Angophora costata* (Sydney red gum)
- *Eucalyptus albens* (white box)
- *E. dives* (broad-leaved peppermint)
- *E. pilularis* (blackbutt)
- *E. oreades* (Blue Mountain ash)
- *E. blaxlandii* (brown stringybark)
- *E. laophila*
- *E. stricta* (mallee ash)
- *E. blakelyi* (Blakelys red gum)
- *Bursaria spinosa* (blackthorn)
- *Bulbine bulbosa* (bulbine lily)
- *Convolvulus erubescens* (Australian bindweed)
- *Austrostipa scabra* subsp. *falcata* (rough speargrass)
- *Bothriochloa macra* (red grass)
- *Echinopogon ovatus* (forest hedgehog grass)
- *Lomandra longifolia* (spiny-headed mat-rush)
- *Poa sieberiana* var. *sieberiana* (snowgrass)
- *Schoenus apogon* (common bog-rush)
- *Themeda australis* (kangaroo grass).

Refer to Appendix H (Technical report - Biodiversity) of the EIS.



Figure 4-5: Existing vegetation analysis (continued)



### 4.5 Land use zoning

The towns of Blackheath and Mount Victoria lie within the Blue Mountains local government area (LGA). Little Hartley located within the Lithgow LGA. Land use zoning between Blackheath and Little Hartley is shown in Figure 4-6 and is set by the following environmental planning instruments:

- Blue Mountains Local Environmental Plan 2015 (BLEP 2015)
- Lithgow Local Environmental Plan 2014 (LLEP 2014).

#### Blackheath

The majority of land within this section is characterised by Zone E1-E4 denoting various conservation zones. Towards the town centre, current land uses generally comprise commercial properties located in the Blackheath town centre including restaurants, cafes, retail stores, service station and supermarkets. Beyond the town centre is predominantly low density residential with small pockets of medium density residential land uses. The majority of residential properties consists of one and two story detached dwellings. A small area of industrial land use zoning is located adjacent to Blackheath Station, consisting of mechanical and various other retail stores. Several areas of public recreation zoning are located just outside of the town centre including Campbell Rhododendron Gardens, Blackheath Memorial Park, Blackheath Oval, Whitley Park, Sutton Park and Blackheath Gardens.

#### Blackheath to Mount Victoria

The land use in this location is consistent with the semi-rural character of Mount Victoria. Upon the approach to Mount Victoria town centre, the Great Western Highway alignment is bordered by the Blue Mountains National Park and other nature reserves and recreational areas. Within the Mount Victoria town centre, low density residential and commercial land use zoning adjoin the Great Western Highway. Commercial properties comprise of restaurants, pubs, cafes, specialty stores, service station and a post office. The majority of residential properties consist of one and two story detached dwellings. Public recreation zoning is located at Browntown Oval and Mount Victoria Memorial Park. Mount Victoria Public School is located 150 metres west of the Great Western Highway alignment and places of worship are also located along the road.

#### Mount Victoria to Little Hartley

The land use in this area is generally consistent with the rural character of Little Hartley, with the majority of the section characterised by environmental conservation zones. The Great Western Highway is a dominant feature of the landscape, with some residential and commercial properties either side of the alignment at Little Hartley. Residential properties within this section are detached, single story dwellings and are primarily located on larger pieces of land resulting in the properties being set back from the road. Commercial properties in this location consist of specialty stores, restaurants and other general businesses. A large area designated as primary production zoning is present to the north of the Great Western Highway, with large lot residential land use present in the western portion of this section. Public recreation between Mount Victoria and Little Hartley includes Mitchell Ridge Lookout.

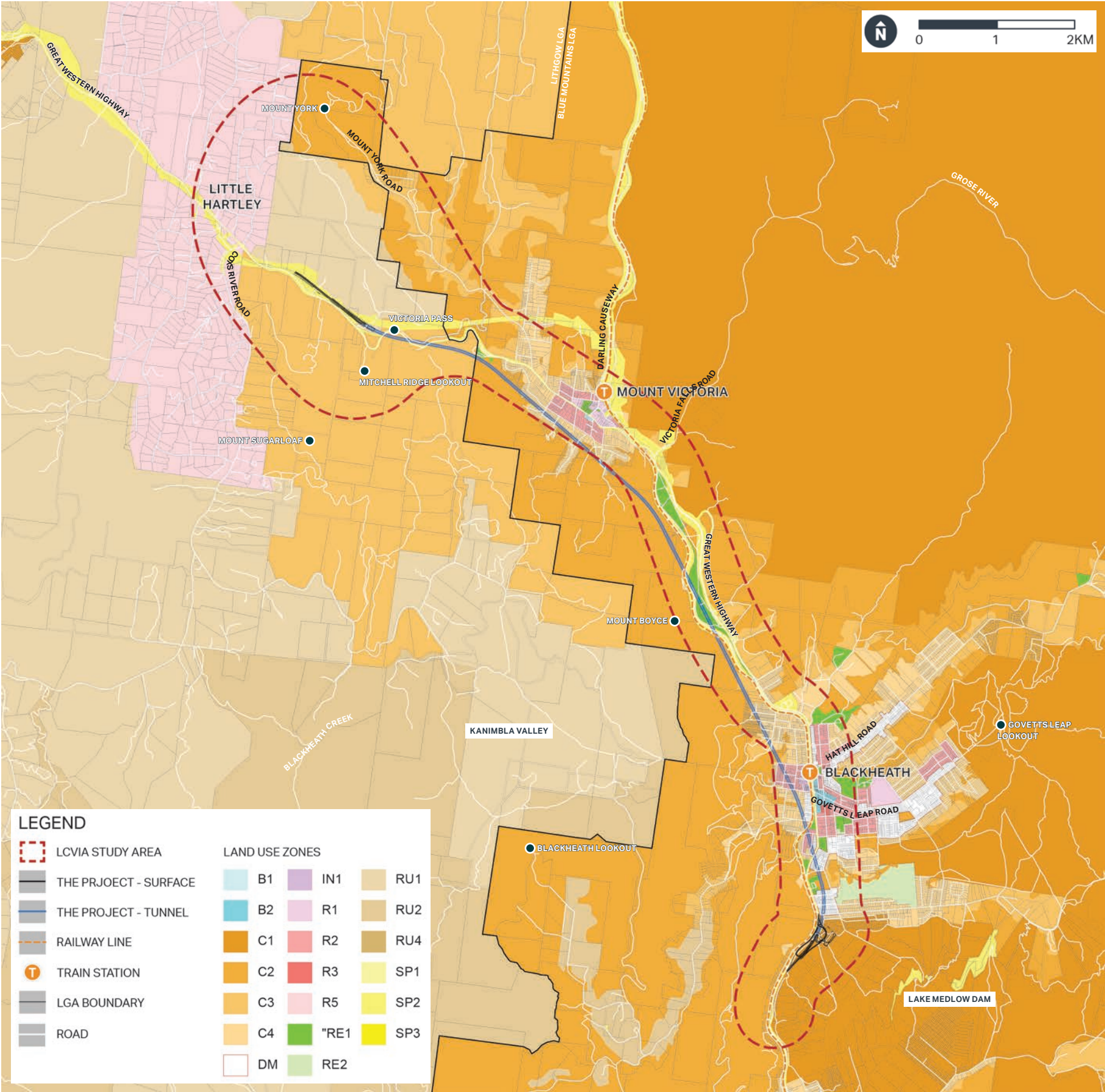


Figure 4-6: Land zoning between Blackheath and Little Hartley





## 4.6 Heritage analysis

### 4.6.1 Heritage within the Blue Mountains

The Greater Blue Mountains Area comprises approximately one million hectares of mostly forested landscape on a sandstone plateau around 60 to 180 kilometres west of Sydney. It is listed on the World Heritage List and National Heritage List and partly encompasses the Blue Mountains National Park.

It is known for breathtaking views, rugged tablelands, sheer cliffs, deep, inaccessible valleys and swamps which support a rich and diverse ecosystem. The unique plants and animals that live in this natural place tell the story of Australia’s antiquity, its diversity of life and its superlative beauty. This area demonstrates the evolution of Australia’s unique eucalypt vegetation and its associated communities, plants and animals.

In addition to its biodiversity values, the Greater Blue Mountains Area also contains ancient, relict species of global significance such as the recently-discovered Wollemi pine which was thought to have been extinct. The few surviving trees of this ancient species are known only from three small populations located in remote, inaccessible gorges within the Greater Blue Mountains Area. Additional areas of the Greater Blue Mountains Area have been nominated to be listed on the NHL (Greater Blue Mountains Area – Additional Values). The nominated area extends further than the WHA and NHL curtilage. While this area is subject to NHL nomination only, it is assumed that the significance of this listing would be identical or similar to that of the WHL.

### 4.6.2 Non-aboriginal heritage

Gregory Blaxland, William Charles Wentworth and William Lawson were the first Europeans to cross the mountain range from Sydney in 1813 which allowed for the first major road routes to be built from the Nepean River to Bathurst. Many years of European settlement since has seen the shaping of the project area as we know it today which lies within the National Heritage places of The Greater Blue Mountains Area and Hartley Valley.

#### Key Sites in the region

##### 01 Mount Victoria Stockade

Early roads through the Blue Mountains were built using convict labour, which required accommodation for both the convicts and their military guards. There were numerous stockades built along the alignments of these roads, including one at Mount Victoria (Little Hartley). The Mount Victoria Stockade Site is associated with convict labour, road construction and the expansion of the colony of New South Wales. While its surface has been previously disturbed by surface collections, any archaeological deposits relating to the convict stockade are likely to be to be present and are considered to be of State heritage significance.



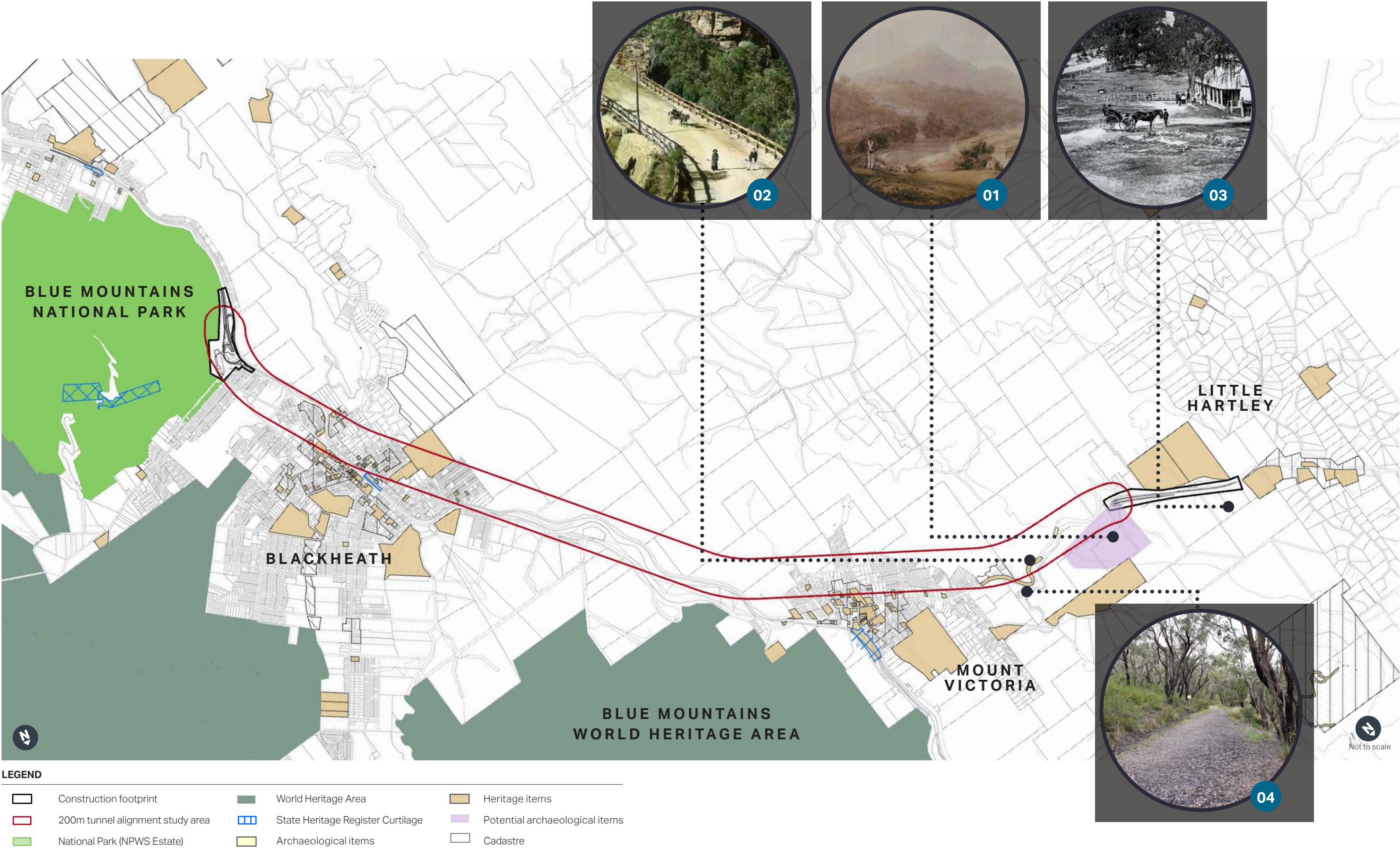


Figure 4-7: Cultural heritage surrounding the alignment



02 Mount Victoria

Originally marked as 'One Tree Hill' by Blaxland, Wentworth and Lawson in the mapping of their 1813 journey, but then renamed 'Vittoria Pass' by Sir Thomas Mitchell when working on Victoria Pass. Both the mountain and the pass were finally renamed 'Victoria Pass' after Queen Victoria 2 years after she ascended the throne in 1837.

Victoria Pass is the last of five early colonial mountain passes providing a means of descent from the Blue Mountains to the west. As such it is representative of the important achievements in crossing the Mountains and the resulting opening of the western plains to colonial settlement. Its construction demonstrates the need in this early phase of settlement to provide a safer and more direct descent for the increasing traffic of goods and people. The Victoria Pass Causeway derives part of its historic significance from being a key component of Victoria Pass and thus shares the aspects of significance. Its construction allowed the Pass to take a direct line of descent, ensuring its continuing longevity as the most practical route to central and western NSW from Sydney. As such, it is now the oldest of a small number of colonial masonry road works in NSW that are still in use.

03 Rosedale and Nioka

The construction of roads through the mountains spurred development in the area in the form of inns and accommodation for travellers along the route westward to Bathurst. Townships often followed these inns at sites such as Mount Victoria, Blackheath, Little Hartley and Weatherboard (Wentworth Falls). In Little Hartley, the Victoria Inn (now Rosedale) operated from 1839, the Farriers Arms (now Nioka) from 1856 and the Royal Garter (c. 1831-1832, now Billesdene Grange) Rosedale is one of the oldest surviving inns associated with the earliest roads across the Blue Mountains.

04 Berghofers Pass

Berghofers Pass is one of the longest intact lengths of road constructed prior to the introduction of heavy machinery in road making. The 2.5 kilometres of road was built using methods similar to those used on nearby convict roads nearly a century earlier. The presence of a trough, dry stone walls and prefabricated cement pipes as well as the grading of 1:15, designed for low-powered early cars, provide a rare juxtaposition of fabric and design that locates the time of the road construction at a transitional phase between the era of handmade roads and those built by machinery and modern materials. Berghofers Pass provides important evidence of part of the history of road making and road transport in NSW.



Figure 4-8: Convict stockade



Figure 4-9: Victoria Pass - sketch by Sir Thomas Mitchell

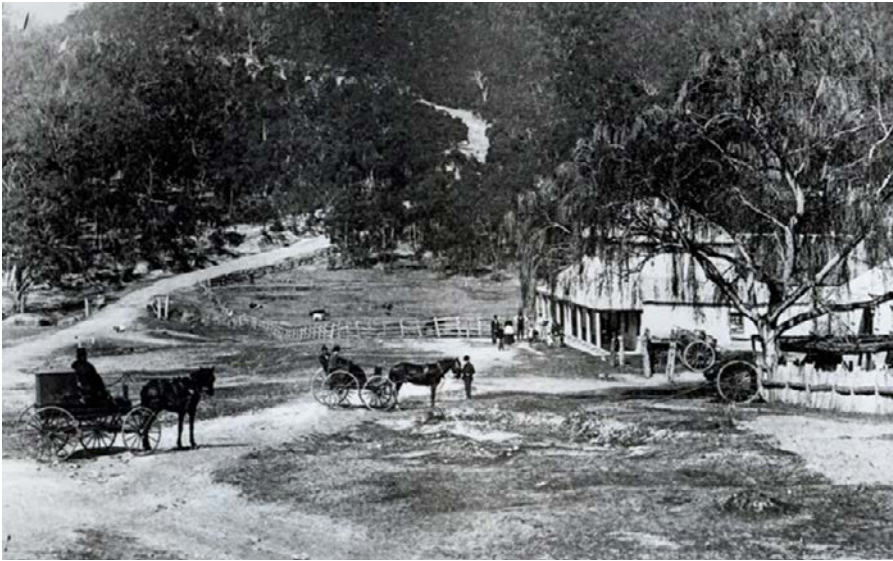


Figure 4-10: Rosedale and Victoria Pass



Figure 4-11: The view to Little Hartley from Berghofers Pass



4.6.3 Aboriginal Heritage

The project is situated on Dharug Country to the east, Wiradjuri Country to the west and Gundungurra Country to the south. The project Area sits on an area of overlapping Country with no formal distinctions between Nations. The project is situated on a meeting place for Peoples of the Dharug, Wiradjuri, Gundungurra and Darkinjung nations.

A Procedure for Aboriginal Cultural Heritage Consultation and Investigation (PACHCI) Addendum was prepared as part of the investigations for the Great Western Highway Upgrade Program. The study focused on three main areas along the Great Western Highway corridor: Soldiers Pinch and Little Hartley.

Several Aboriginal objects were discovered at Blackheath and Little Hartley, including scar trees, a potential rock engraving and pieces of mudstone. However, the landscape was noted to have been greatly modified by contemporary uses. No Aboriginal objects were discovered at Soldiers Pinch.

An Aboriginal Cultural Heritage Assessment Report (ACHAR) was also prepared for the project. This report focused mainly on the areas associated with the tunnel portals at Blackheath and Little Hartley; as well as the tunnel mid-point access at Soldiers Pinch. The previous results for Soldiers Pinch were confirmed. Two previously unidentified Aboriginal sites (scared trees) were identified. One at Blackheat and one at Little Hartley. Two other sites were reassessed at Little Hartley and found to no longer contain potential archaeological deposits.

Transport is conducting further investigations into the historical Aboriginal narrative of the area surrounding the wider Great Western Highway Upgrade Program. This has highlighted several key themes which pay particular attention to the Country and culture of the project location. The Blue Mountains, extending to Lithgow and the surrounding areas, are rich in songlines and trading paths which would have been used regularly prior to colonisation. The GWH is commonly considered to follow a prominent Songline that existed prior to European settlement. Valleys, ridgelines and high places were particularly significant to the Aboriginal peoples of the area, including Mount Victoria and Mount York, in close proximity to the project. These mounts have examples of rock engravings and paintings and were used as ceremonial sites for both Darug and Gundungurra people. The ongoing investigations and interviews with key stakeholders seek to uncover further detail about the stories and significance of sites from the local Aboriginal custodians and community.

Sites in the region

Other sites in the region have been identified below. The information regarding these sites is found from websites that may not contain accurate information and further investigation is required to ascertain their significance for the local Aboriginal peoples.

Walls Cave

Blackheath is home to a significant woman’s site, Walls Cave. Walls Cave is an Aboriginal shelter and a significant woman’s site on the traditional lands of the Dharug Peoples, with activity in the Cave dating back over 12,000+ years.

Grand Canyon

The Grand Canyon in Blackheath is an Aboriginal Shelter with activity in the area dating back over 12,000+ years. The area is popular for tourist walks to see the canyon and immerse themselves in the strong presence of Aboriginal culture. The Grand Canyon Walking Track is located at the eastern end of Evans Lookout Road, at Blackheath.



Figure 4-12: Walls Cave



Figure 4-13: The Grand Canyon



4.7 Landscape Character Zones

Four (4) Landscape character zones (LCZs) have been identified within the study area:

- LCZ 1: Great Western Highway
- LCZ 2: Township
- LCZ 3: Butlers Creek Valley
- LCZ 4: Bushland.

The LCZs are identified in Figure 4-14 . The basis for the delineation of these landscape character zones is further described in the following pages.

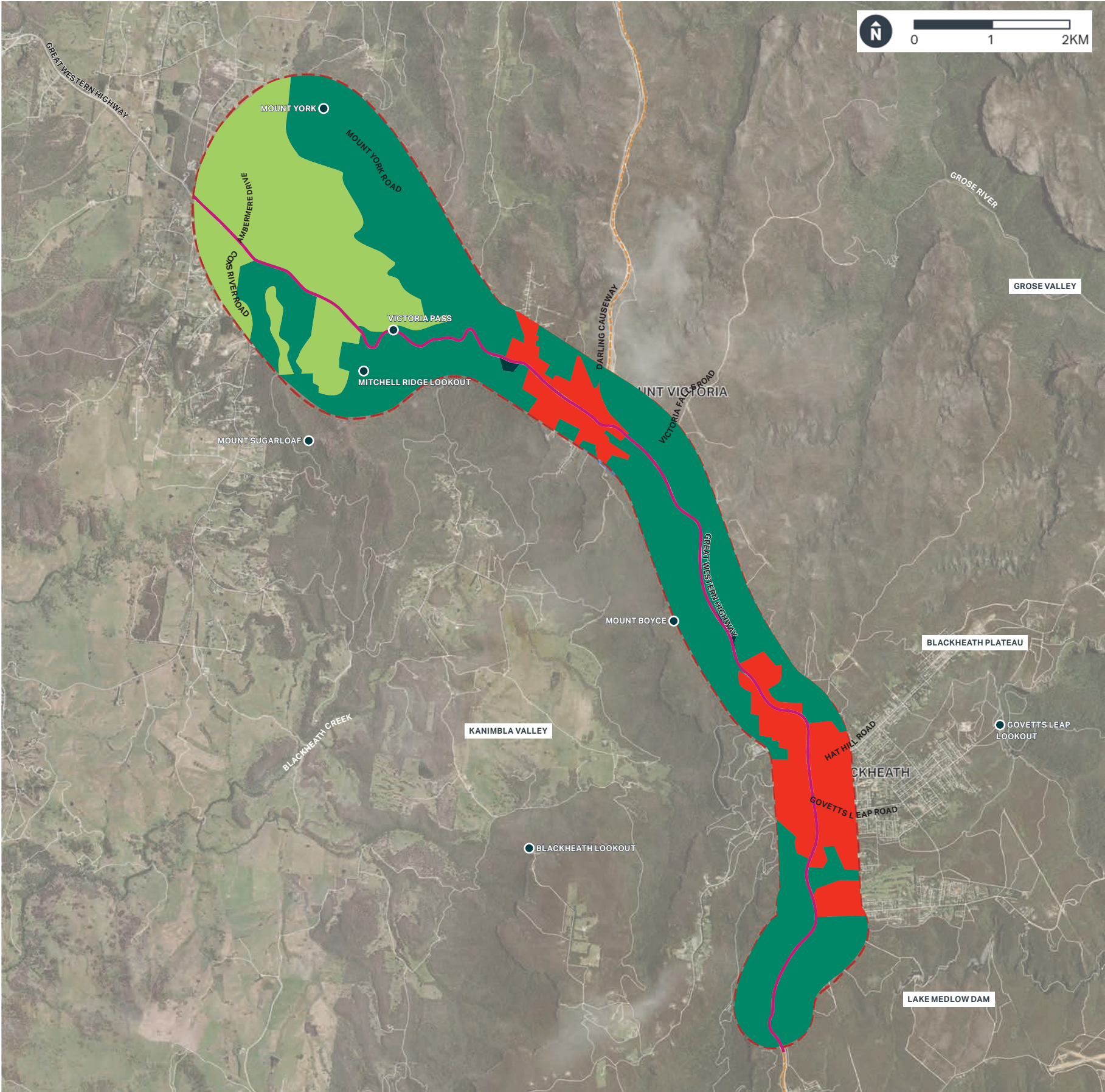


Figure 4-14: Landscape Character Zones



4.7.1 LCZ 1: Great Western Highway

This LCZ comprises the Great Western Highway within the study area. The overall LCZ is bound by the common characteristics of the linear corridor: typically one to two lanes of traffic in either direction, widening at intersections with other major roads. The Great Western Highway in places runs parallel to the rail corridor, the stations of which typically align with the more densely populated townships of Blackheath and Mount Victoria.

While the Great Western Highway can be defined as a LCZ in itself, the narrow width of the corridor makes it susceptible to the influence of the surrounding landscape, regardless of which LCZ lies adjacent to the road corridor. For this reason, the LCZ 1 has been broken into three character precincts to capture the different typical characteristics as it passes through (refer Figure 4-15):

- LCZ 1a: GWH Township
- LCZ 1b: GWH Butlers Creek Valley
- LCZ 1c: GWH Bushland.

4.7.1.1. LCZ 1a: GWH Township

Description of LCZ

Existing environment

This character precinct occurs as the Great Western Highway passes through the townships of Blackheath and Mount Victoria. The Great Western Highway typically widens within these areas, with an increase in building density and a change in built form from mostly residential houses to commercial and community buildings. Larger road infrastructure is also found within these areas, such as larger signalised intersections (refer Figure 4-16). The Great Western Highway typically flattens and straightens as it passes through townships. Vegetation includes formalised avenues of street trees and exotic plantings. The Great Western Highway is also fringed with local and state heritage items, typically older buildings that front the road, contributing to the unique character of the Blue Mountains townships.

Baseline environment

No changes would occur within this LCZ due to the Katoomba to Blackheath Upgrade or the Little Hartley to Lithgow Upgrade.

Sensitivity: Low

The value of the landscape within this LCZ would normally be high due to the picturesque qualities of the townships, often coupled with heritage elements and high tourism value. However, as no built changes would occur within or adjacent to elements of those townships with high heritage or tourism value, the susceptibility to change due to the project lowers the overall sensitivity rating.

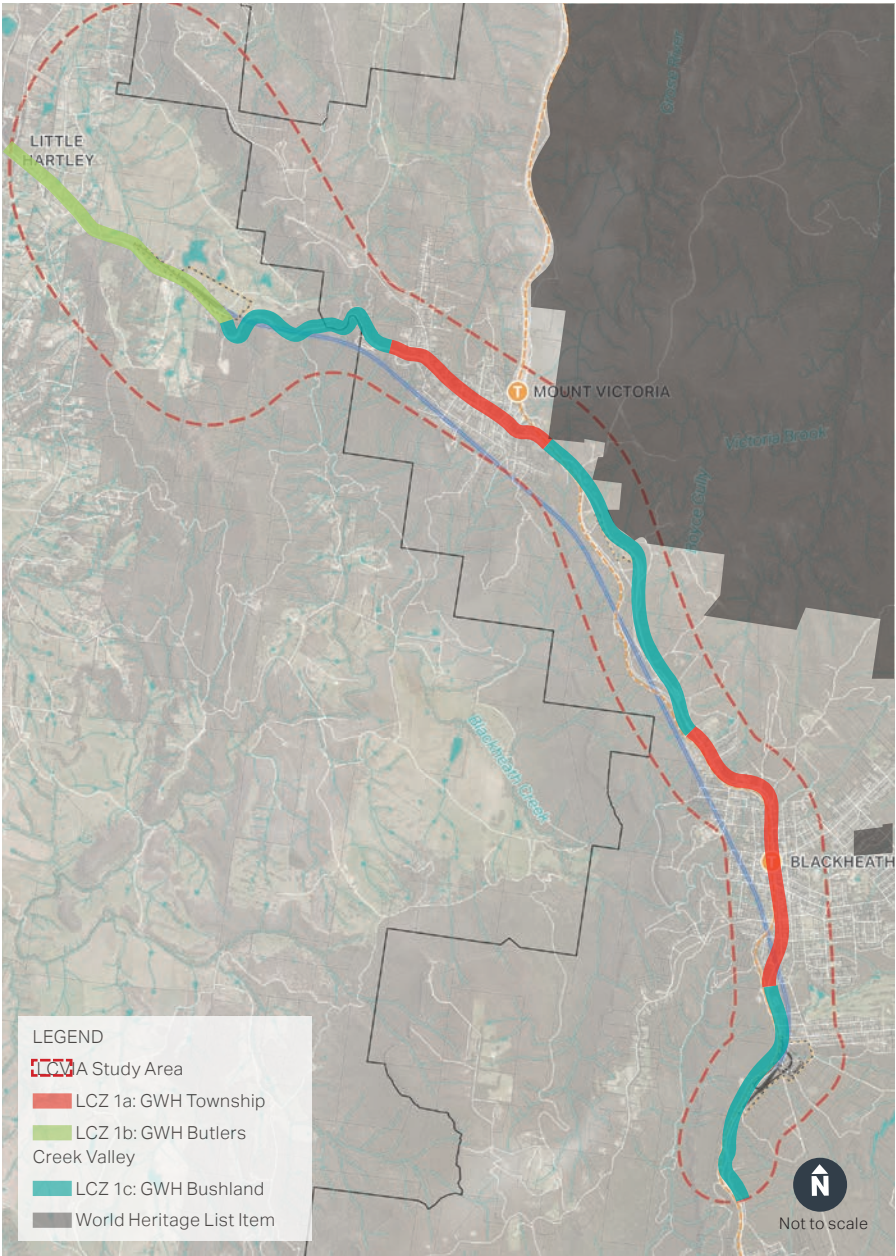


Figure 4-15: Character precincts within LCZ 1: Great Western Highway



Figure 4-16: The intersection at the commercial centre of Blackheath on the Great Western Highway



4.7.1.2. LCZ 1b: GWH Butlers Creek Valley

Description of LCZ

Existing environment

This character precinct is located at the northern end of the study area, where the road narrows, straightens and flattens out as it leaves Victoria Pass and enters the valley at Little Hartley. The landscape is typically spatially open to the north east of the Great Western Highway, fringed with patches of taller vegetation, fences and occasional rural properties. The road pavement edges become informal gravel verges with pasture grass and weeds (refer Figure 4-17). Local and state heritage items contribute to the character of this stretch of road, including unique rural residences such as ‘Rosedale’ at Hartley Valley Holiday Farm.

Baseline environment

Much of the proposed upgrades to infrastructure within the Little Hartley to Lithgow Upgrade is positioned to the north east of LCZ 1b, within LCZ 3: Butlers Creek Valley, as illustrated in Figure 4-18. This would result in the widening of LCZ 1b to the north east, creating a localised interchange area within the transport corridor which includes substantially larger infrastructure, such as bridges and batters (refer Figure 4-19), which is in contrast to the existing narrow, curving road fringed by rural properties and clumps of native and exotic trees.

Changes within this new widened LCZ 1b corridor include:

- the widening of the Great Western Highway from the western end of the study area east to meet the project, including substantial battering to raise the Great Western Highway above the surrounding landscape to the north east
- westbound connection to the existing Great Western Highway
- eastbound connection from the existing to proposed Great Western Highway
- formalisation of Berghofers Pass car park.

A private property access road and sediment and water quality basins would be positioned adjacent to the Great Western Highway but lie within LCZ 3.

Sensitivity: Moderate

LCZ 1b effectively behaves as a gateway between the steep, densely vegetated Blue Mountains with dramatic sandstone escarpments and the flatter, more rural landscape heading west. Areas of the Great Western Highway within this LCZ are protected by landscape conservation zones (as delineated by the Lithgow LEP), and as such have a high landscape value.

However, while the project occurs over the length and width of the LCZ within the study area, the susceptibility of the LCZ to change due to the project would be lessened as the LCZ would already have been subject to change due to the Little Hartley to Lithgow Upgrade.



Figure 4-17: The Great Western Highway heading north at Little Hartley



Figure 4-19: Visualisation showing the widened Great Western Highway approaching the northernmost bridge of the Little Hartley to Lithgow Upgrade

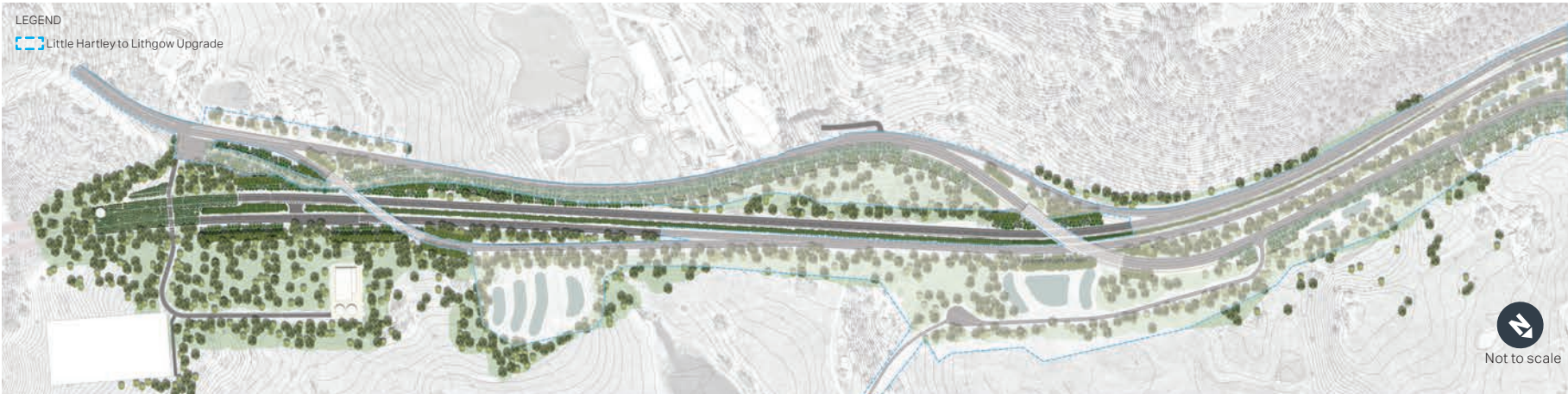


Figure 4-18: The indicative extent of the Little Hartley to Lithgow Upgrade shown with the project at Little Hartley



4.7.1.3. LCZ 1c: GWH Bushland

Description of LCZ

Existing environment

This character precinct occurs when the Great Western Highway passes through areas where bushland either fringes the road, or where the bushland behind the housing is visible from the road corridor. Within the study area this occurs to the south of the Blackheath township, between Blackheath and Mount Victoria townships, and from Mount Victoria north through Victoria Pass (refer Figure 4-20) as the Great Western Highway extends down to Little Hartley. Within this character precinct, the Great Western Highway is typically steeper in places and curves through the undulating terrain. Bushland fringing the road sometimes comprises part of the World Heritage List item and the Blue Mountains National Park, but collectively is characteristic of the unique ‘Blue Mountains’ bushland that contributes to the overall character of the area.

Baseline environment

The Katoomba to Blackheath Upgrade would result in substantial changes along the Great Western Highway within this character precinct, as illustrated in Figure 4-21. While the existing road corridor would remain as a link to Blackheath, the Great Western Highway connecting to Little Hartley would widen substantially to the east, with the east and westbound carriageways split between a vegetated median. Sediment and water quality basins to the east of the existing Highway alignment, which would eventually sit within the westbound on-ramp loop.

An active transport trail would lie adjacent to the Great Western Highway at the southern extent of the LCZ, resulting in changes to trees and roadside planting, but would then split from the new road alignment, heading east and then north, linking back into the southern end of Valley View Road.

Sensitivity: High

The stretches of the Great Western Highway fringed with bushland add to the unique driving experience along the journey through the Blue Mountains. They express the pristine bushland of the Blue Mountains beyond the road corridor, with glimpses through the trees to expansive views where the terrain allows. The bushland fringing the road corridor sometimes lies within the Blue Mountains National Park and the World Heritage List item.

The LCZ is susceptible to change due to the project as access to the Blackheath tunnel portal lies within the LCZ at the southern end of the study area, however, this area would have already undergone changes due to the Katoomba to Blackheath Upgrade.



Figure 4-20: The Great Western Highway looking north along Victoria Pass

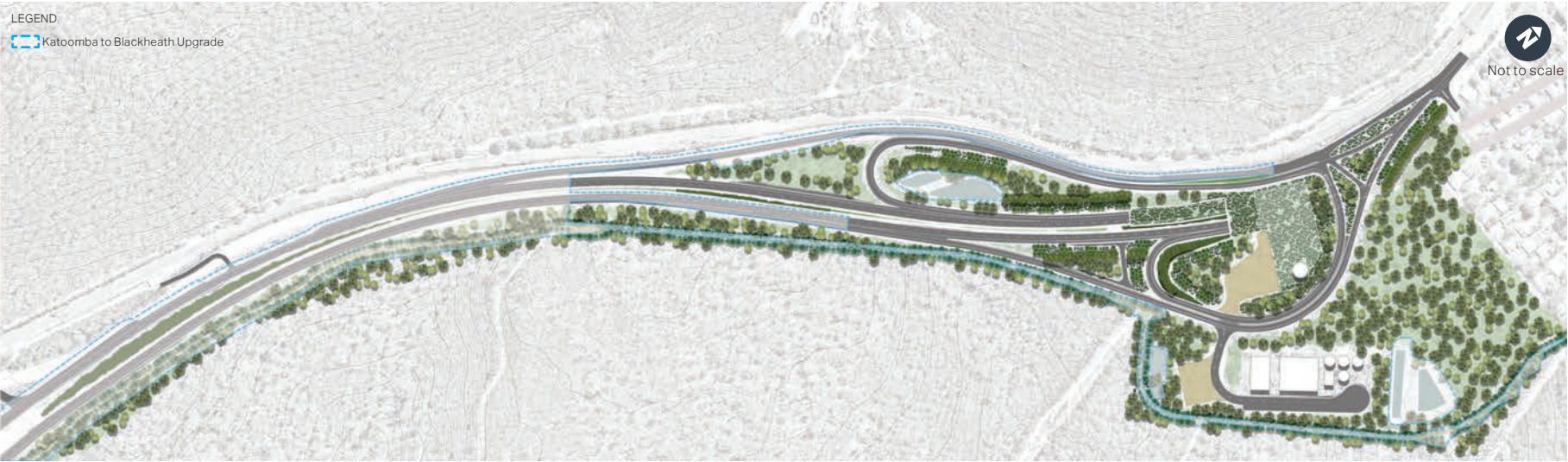


Figure 4-21: The indicative extent of the Katoomba to Blackheath Upgrade shown with the project at Blackheath



4.7.2 LCZ 2: Township

Description of LCZ

Existing environment

This LCZ includes the more densely populated townships of Blackheath and Mount Victoria which are clustered along the Great Western Highway as it winds through the Blue Mountains. The townships typically comprise a central commercial area (refer Figure 4-22) surrounded by low density residential development (refer Figure 4-23). Mount Victoria does not have a prominent main commercial area, contrary to Blackheath, and only comprise a cluster of denser residential development.

The townships are positioned on the higher, flatter plateaus and ridge lines. A commercial area is located centrally around a formal, straight main road running roughly perpendicular off the Great Western Highway (refer Figure 4-24). Residential areas occupy the steeper, gently undulating landscape surrounding the town centre, with older dwellings clustered around the commercial town centres (refer Figure 4-25). The road arrangement gets more organic and the houses typically newer the further from the centre the development lies (refer Figure 4-26).

Townships often contain multiple heritage items, within the study area these typically comprise older commercial buildings (e.g. the Victory Theatre at Blackheath, refer Figure 4-27) or individual or areas of residential houses, classified as Heritage Conservation Areas.

Baseline environment

There would be no changes within the townships due to the Upgrade Program.

Sensitivity: Low

The unique character of the townships with multiple heritage items and conservation areas would typically result in a highly sensitive LCZ. However, the location and nature of the project in relation to the LCZ results in a very limited susceptibility of the LCZ to change due to the project.

The tall vegetation and built form resulting in spatially enclosed streets, coupled with the topography which ranges from flatter ridge lines to steeper, more irregular terrain substantially limits the effect of changes outside the LCZ on the overall character. However, where the residential housing does meet bushland areas, this interface influences the character of these boundary areas.



Figure 4-22: Commercial main street at Blackheath



Figure 4-24: Commercial main street at Blackheath



Figure 4-23: Residence in Blackheath



Figure 4-27: The Victory Theatre at Blackheath



Figure 4-25: Straight, formal residential street near the centre of Blackheath



Figure 4-26: Newer residential street on the outskirts of Blackheath



4.7.3 LCZ 3: Butlers Creek Valley

Description of LCZ

Existing environment

This LCZ lies at the western end of the study area, comprising a wide, open, pastoral landscape partially framed by the steep, densely vegetated ridge line of Mount York to the north east and Mount Sugarloaf to the south (refer Figure 4-28). The valleys gently undulating topography and paddocks dotted with occasional farm dams and houses are in stark contrast to the steep, rugged slopes of the surrounding mountains. Butlers Creek extends north from Berghofers Pass, with drainage within the valley channelled into numerous dams of varying sizes.

The vegetation in the LCZ typically comprises pasture grasses with small pockets of native vegetation scattered throughout. Changes in rainfall and temperature throughout the year result in the pasture varying from lush pale green (as shown in Figure 4-29) to honey browns (refer Figure 4-30).

Residential housing is scattered across the valley, with very few homes at the southern end clustered near the Great Western Highway and more densely spaced housing further south, nearing Ambermere Drive. Residences are typically surrounded by pockets of exotic vegetation including wind breaks of dense conifers, deciduous trees (including fruit trees) and ornamental gardens.

This LCZ contains several heritage items and a landscape conservation zone listed within the Lithgow LEP.

Baseline environment

The Great Western Highway would be widened to the east into LCZ 3 as part of the Upgrade Program. This would essentially reduce the amount of land considered LCZ 3, converting it to a transport corridor and therefore part of LCZ 1: Great Western Highway.

Changes due to the broader Upgrade Program which would lie along the new boundary between LCZ 1 and LCZ 3 include:

- the edge of the widened Great Western Highway, including substantial battering to raise the Great Western Highway above the surrounding landscape
- part of the westbound connection to the existing Great Western Highway
- a private property access road
- sediment and water quality basins, fringed by the eastbound connection from the new Great Western Highway alignment (within the Little Hartley to Lithgow Upgrade) to the existing Great Western Highway.

Sensitivity: High

The landscape is susceptible to change due to the project given the position of the changes within the existing LCZ boundary (i.e. prior to the Upgrade Program, which would widen LCZ 1 and reduce the extent of LCZ 3). The Great Western Highway defines the south western ‘edge’ of the valley within the study area, with the darker band of trees and occasional homesteads helping to define the valley extents.

The open spatial structure of the paddocks with patches of taller vegetation, dams and low density of built form results in a landscape where changes within it can have far-reaching consequences in terms of landscape character. The gently undulating valley floor topography is homogeneous and clearly defined by the sharp contrast of the wooded ridge lines that wrap around it.

The steep escarpment to the north west, culminating in Mount York, has several heritage items where lookouts over Little Hartley and the landscape beyond are integral to the importance of the place.



Figure 4-29: Looking north within Butlers Creek Valley to Mount York after a period of rainfall



Figure 4-28: View south west from the Mount York escarpment across Butlers Creek Valley, with the Mount Sugarloaf ridge line in the middleground



Figure 4-30: Looking south within Butlers Creek Valley in winter after a period with limited rainfall



4.7.4 LCZ 4: Bushland

Description of LCZ

Existing environment

Within the study area LCZ 4: Bushland occurs both east and west of the Great Western Highway from the southern extent near Medlow Bath extending north to meet Butlers Creek Valley. Bushland within this LCZ ranges in vegetation type, health and density, but typically comprises eucalypt woodlands and forests with a shrub and grass understorey.

The dense, rugged bushland is unique to the Blue Mountains and characteristic of the place as a major tourist destination and World Heritage Listed area (refer Figure 4-31). The steep slopes punctuated by exposed sandstone cliffs are dramatic features within the landscape, framing valley floors with riparian corridors below (refer Figure 4-32). The evaporated oils from the bushland creates a blue haze due to scattered short wavelengths of light, giving the Blue Mountains their name.

Typically, the bushland is most disturbed by weeds and exotic species closer to residential land and road corridors. The top of plateaus and ridge lines often feature woodland communities with shorter trees and more open structure (refer Figure 4-33), while the deeper soils in the gullies contain taller, denser forests, including some rainforest areas. Bushland areas contain multiple hiking tracks (refer Figure 4-34) with occasional picnic areas. Lookouts are common along accessible ridge lines.

Baseline environment

The Katoomba to Blackheath Upgrade would result in a localised widening of LCZ 1: Great Western Highway and a reduction in the extent of LCZ 4: Bushland, nearing Blackheath, as shown in Figure 4-35. An active transport trail would extend into LCZ 4 from the edge of the broader Upgrade Program road corridor to the east, heading north east then north to join up to the southern end of Valley

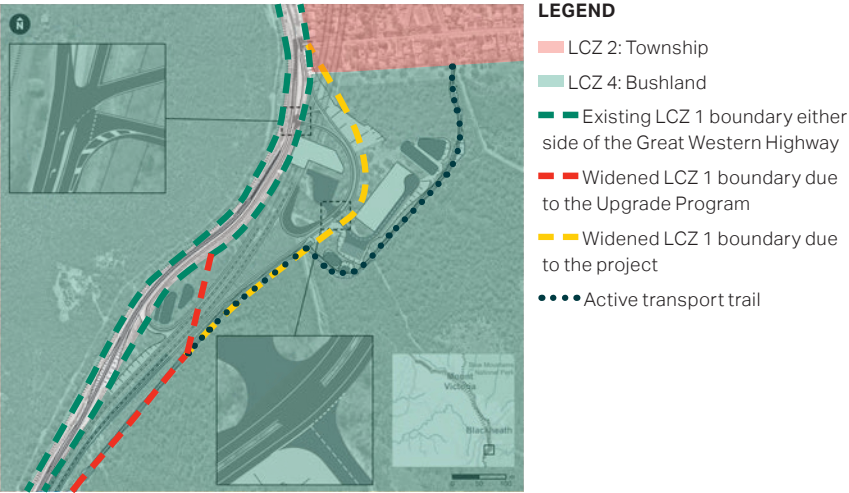


Figure 4-35: The Upgrade Program and the project would extend the Great Western Corridor to the east

View Road.

Sensitivity: High

This LCZ is one of the characteristic landscapes that make the Blue Mountains important. The picturesque, rugged bushland is typically most spectacular in areas further from the Great Western Highway, but stretches of bushland that do extend the Great Western Highway are important for the maintenance of the character of the Great Western Highway corridor itself, an expression of the scenic qualities of the overall landscape. The bushland to the east of the Great Western Highway near the project is protected as part of the Blue Mountains National Park, although it is not part of the listed World or National Heritage items.

The landscape is susceptible to change due to the position of the project, although this is slightly lessened by some disturbance due to the Upgrade Program with the extension of the active transport trail, the boundary of within which the project lies. Trails are, however, an existing typical element within the LCZ.

The removal of a ventilation outlet from the project would not change the ratings for the project within LCZ 4: Bushland. The ventilation outlet would be positioned within a widened transport corridor rather than within the new extents of LCZ 4.



Figure 4-31: Dramatic views to bushland areas



Figure 4-32: Sandstone escarpments fringe valley floors



Figure 4-33: Shorter, more open woodlands on higher plateaus and ridge lines



Figure 4-34: Walking trails are common through bushland areas



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**“The Upgrade Program will connect people and places, create great journeys, create social and economic opportunities, leave a legacy and celebrate the Blue Mountains’ unique culture and heritage.”**

Urban Design Concept

05



# 5. Urban Design Concept

**The Upgrade Program provides an opportunity to redevelop and shape the corridor between Blackheath and Little Hartley, providing an experience of movement, environmental reflection, connection to Country and place that references the Great Western Highway design elements while providing a legible and unique urban design and landscape response.**

This urban design concept chapter comprises the following:

- Overview
- Urban design vision
- Urban design objectives
- Urban design principles
- Site wide strategy
- Designing with Country
- Urban design strategic elements
- Urban design structural elements
- Urban design concept plans and sections.

The design aspirations are based on delivering high quality integrated design outcomes that display low maintenance, relevance, fit, durability and delight.

The design team has aimed to draw on the project vision of a *Connection to Country* by *Designing with Country* as a methodology for an integrated landscape and urban design solution which reflects the complex layers of the regional landscape.



## 5.1 Overview

Establishing a Vision and supporting Urban Design Objectives:

- ensures the project is designed and delivered with a high quality, well-resolved, multidisciplinary team approach to deliver an integrated urban design solution
- provides a basis for evaluating urban design responses as the project progresses
- ensures the visual and landscape impacts are addressed, with guidance on a range of project elements.

The Urban Design addresses how the project fits into the surrounding context, supports local connections along the corridor and contributes to the overall quality of the public domain.

The experience of travel influences how people understand the surrounding environment, whether above or below ground.

The project shares boundaries with the Wiradjuri, Dharug and Gundungurra people.

Development of the final Objectives, Principles and ultimately the concept design will be through consultation with the Aboriginal groups and communities through which the project passes.

This will lead to meaningful physical design interventions to interpret the Aboriginal Heritage, through representation of the Aboriginal people themselves, their knowledge of the project location and the broader area of this part of Country.

From the eastern and western approaches, above and below ground, the response will promote a legible and safe journey paying respect to the beauty of the Blue Mountains World Heritage status through simplicity of form, legibility, and visual storytelling, with a clear vision to reflect the local and wider bushland context.

The application of the Urban Design Objectives and Principles will lead to an innovative physical, functional, and aesthetically sensitive, low maintenance outcome with a 'less is more' approach by describing how the project builds on the Upgrade Program Strategic Urban Design Framework as well as reflecting stories relevant to the local community in the physical design.

This becomes equally as important where the functionality of the design overpowers the aesthetic intent due to the constraints of the corridor.

Beyond the Pavement provides a series of design Principles deemed best practice to achieve excellence in design and form the basis of the urban design approach to the Upgrade Program;

- 1. Contributing to urban structure, urban quality and the economy**
- 2. Fitting with the built fabric**
- 3. Connecting modes and communities and promoting active transport**
- 4. Fitting with the landform**
- 5. Contributing to green infrastructure and responding to natural systems**
- 6. Connecting to Country and Incorporating heritage and cultural contexts**
- 7. Designing an experience in movement**
- 8. Designing self explaining roads that respond to their role and context**
- 9. Achieving integrated and minimal maintenance design.**

'Better Placed' provides a series of objectives guiding place making. The Urban Design responds to these objectives in the following ways;

- **Objective 1: Better Fit:** A design that is responsive to the landform, place and corridor context contributing to the richness of the area, views and vistas
- **Objective 2. Better Performance:** A design to be constructed to provide an enduring purpose and amenity, contributing positively to the environmental constraints to deliver enhanced economic and social outcomes
- **Objective 3. Better for Community:** A design which responds to economic and social disparity through connecting with the diverse communities and the end users by delivering quality and accessible places
- **Objective 4. Better for People:** A safe, user friendly design response, cognisant of the relationship between movement and place, providing an environment to promote emotional enjoyment and well being for the communities and end users
- **Objective 5. Better Working:** A fit for purpose design with innovative and practical applications for usage to ensure longevity of the asset
- **Objective 6. Better Value:** A considered design, providing travel options and connectivity to places, satisfy the existing social and economic needs of the community
- **Objective 7. Better Look & Feel:** An aesthetically pleasing design response seamlessly integrating with the existing landform with significant innovation and best practice place principles contributing to the visual impact where function is before form.

The 'Sydney Green Grid' and 'Greener Places' provide principles identifying Green Infrastructure opportunities that have been developed and considered in the Urban Design response and are:

- Creating better connections with major centres through new transport infrastructure
- Provide increased access to open spaces, while improving connections to nature
- Provide a best practice target of enhanced connectivity; by reducing restrictions and barriers to movement of people and animals, the specific ecology of the area can be minimally impacted
- Promote healthy and active living through design of well connected active transport corridors between places.
- Retain remnant vegetation where possible
- Add additional tree canopy, where safe and relevant to assist in mitigating heat island effect
- Replace trees removed as a function of the project to retain biodiversity and ecological conditions.

The objectives and principles developed in this Urban Design report have been built from these criteria to guide the design process and ensure a coordinated response. One or more Principles have been identified as applying to each of the Objectives with the goal of achieving these outcomes so that the project is considered to have achieved positive outcomes.

A whole of corridor design approach is being adopted to ensure that the overall experience is legible and integrated into the contextual fabric.



## 5.2 Urban Design Vision

**The Blackheath to Little Hartley Upgrade responds, respects, and reinforces the heritage context, rugged terrain, natural systems, cultural landscapes, and places of the Blue Mountains and the rich historical, rural character of Little Hartley Valley through which it passes, creating a memorable and safe experience and a positive legacy for all.**

The Vision expresses the powerful ‘Connection to Country’ and responds to the bushland character to integrate the design of built and natural environments in a legible, complementary, and sustainable way.

The aim is to demonstrate a connection to Country by designing with Country as the basis to achieve the following outcomes:

- Create a visual, connected experience through quality placemaking and renewal
- Design a safe and comfortable highway and in tunnel experience for users and local stakeholders through legibility, movement, ease of use and orientation throughout the journey above and below ground
- Contribute to the economic status of the existing communities and to those beyond the project influence
- Provide innovative environmental responsiveness through a high level of landscape and urban design, sustainability and a natural system response
- Acknowledge and respect cultural heritage in both the urban and rural locations
- Provide a high quality, low maintenance asset consistent with the broader requirements of the Transport design objectives and performance criteria that is a benchmark for future development, through innovation in design, engineering and construction.

The Vision for this corridor is consistent with the objectives outlined in ‘Beyond the Pavement’ and the Great Western Highway Katoomba to Lithgow Strategic Urban Design Framework (Transport for NSW, May 2022).

**‘to create a highway experience that fits in the landscape, provides improved travel and respects the cultural and heritage values of the area’**

It is a vision that highlights both Aboriginal and non Aboriginal heritage as a means to create an enduring legacy for both the community and visitors to the area. It is embedded within recognising that any outcome, whether through, landscape design and the visual experience, is ultimately influenced by human occupation over thousands of years.



### 5.3 Urban design objectives

Six Objectives provide the framework to deliver the Urban Design Vision. These objectives outline the desired direction of the design and govern the overall quality of the outcomes.

They build upon those set out in Beyond The Pavement and Better Placed and developed in the Urban Design Vision, each articulating representations of combinations of the aspiration of all 9 principles from Beyond the Pavement, while committing to connecting to Country, sustainability, liveability and amenity, to the community and user experience.

The 'Connect People and Places' and 'Renewal & Liveability' urban design objectives have a stronger connection with Beyond The Pavement principles;

1. Contributing to urban structure, urban quality and the economy
2. Fitting with the built fabric
3. Connecting modes and communities and promoting active transport.

The 'Environmental Responsiveness' and 'Celebrate Culture and Communities' urban design objectives with:

4. Fitting with the landform
5. Contributing to green infrastructure and responding to natural systems
6. Connecting to Country and incorporating heritage and cultural contexts.

'A safe and memorable journey' and 'A world class transport asset' relate more closely with principles;

7. Designing an experience in movement
8. Designing self explaining roads that safely respond to their role and context
9. Achieving integrated and minimal maintenance design.

These objectives will form the basis of the design and evaluation at each phase of implementation of the project.

They will complement the economic, engineering, safety and environmental objectives intended to encourage excellence in the project outcomes, generated by the contributions of the various disciplines involved in the execution of the design. This includes the phases of planning, concept design, design development and documentation, construction and maintenance.



Figure 5-1: Urban design objectives

### 5.4 Urban design principles

The previous urban design objectives form the strategic basis of the design and evaluation through to construction and future management. The project must deliver on these objectives.

To assist in the realisation of these objectives, a further set of Urban Design Principles have been developed for each Urban Design Objective and provide a guide for stakeholders to engage in discussion, design and the decision making process.

The Principles outlined for each of the objectives are an extension of those in Beyond The Pavement, are not exhaustive and should be supplemented by those outlined in Beyond The Pavement itself.





1 **Connect People and Places**

Connections are located at key access and egress points of the local communities and link adjacent streets, places, pedestrian, cycle, rail, and bus facilities.

These connections should seek to influence the creation of beautiful structures and landscape where the Highway and towns meet , which draw their character from the surrounding context, in form and materiality.

These locations will serve as key moments along the corridor, and will occur at junctions, intersections, gateway sites, tunnel portals, bridges, viaducts and around and including surface structures.

**Principles:**

- Create a legible arrival and transition sequence into Blackheath and Little Hartley, reflecting the landscape character and cultural histories and historic identities, with appropriately scaled endemic vegetation as nominated by Blue Mountains City Council
- Reinforce key intersections as 'gateways' and transition zones along the corridor
- Enhance local connectivity to contribute to the functioning of urban life along the corridor
- Connect and co locate vehicular, pedestrian and cycle networks to create place and movement ensuring they are fully integrated with the overall design
- Respond to identified Aboriginal and non Aboriginal heritage values and provide a meaningful interpretation of these values
- Respect the urban structure and richness of the local towns by avoiding road alignments that confuse their function and layout or impact the use by local communities and visitors
- Create safe, universal access opportunities for all users responding to desire lines along and around the Highway corridor while maintaining and improving existing pedestrian connections
- Install high quality urban elements – street furniture, signage, pavement, and lighting
- Use a palette of materials derived from the surrounding context, celebrating the landscape, urban and historical context and responding to the natural and cultural qualities of each town
- Provide a simple, legible and self-explanatory way finding and signage strategy that is located where deemed appropriate to safely direct the user through the corridor, rationalised to reduce visual clutter
- Reveal landscape vistas to contribute to the understanding of place and draw in its scenic qualities to engage users along the route.

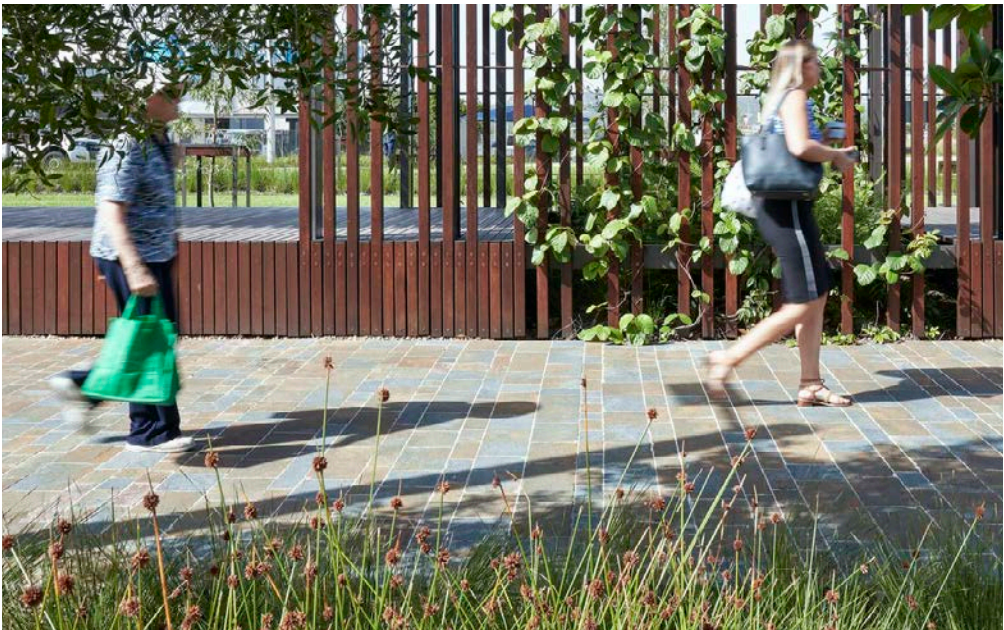


Figure 5-2: Install high quality urban elements – street furniture, signage, pavement, and lighting



Figure 5-3: Connect and co locate fully integrated transport networks to create place and movement





2 A Safe and Memorable Journey

The landscapes and townships of the Blue Mountains will provide a strong sense of place, with framed views where possible, capturing existing bushland, landmarks, escarpments and mountains, with the expression of the natural landforms and site characteristics being preferable to walls and retaining structures.

Using design elements consistent with the current Great Western Highway verge, medians and road furniture and providing a unified language around the design of the newer road elements, such as bridges, retaining walls, tunnel approach and portals and the experience inside the tunnel, will consolidate the natural and digital visual experience and enhance the journey, providing familiarity and safety.

The tunnel experience will be safe, calming and reassuring, with subtle references to the context above the tunnels to provide orientation and wayfinding.

- Principles:
- Provide a memorable, sequential and cohesive journey experience along the Highway corridor that contributes to and references the context of the whole area including landmarks and places of cultural and community significance
  - Create safe, easy and universal access for all, along and across the corridor, designed equally for daytime and night time usage
  - Improve the driver experience by providing legibility and clarity in design, through an assemblage of unified design elements, while encouraging safe decision making throughout the design and using best practice and future forward thinking and technologies to enhance driver safety
  - Design for movement within the corridor and tunnel through built form and landscape to promote safe and appropriate driver behaviour
  - Create a distinctive, simple and clean tunnel portal approach integrated into the landform and dressed with characteristics of the local context to vary the driver experience and provide geographical awareness
  - Provide location signage in the tunnel at intervals to explain user location and progression in line with their surface position
  - Provide materials and lighting to the tunnels to visually and psychologically break up the monotony of the journey.

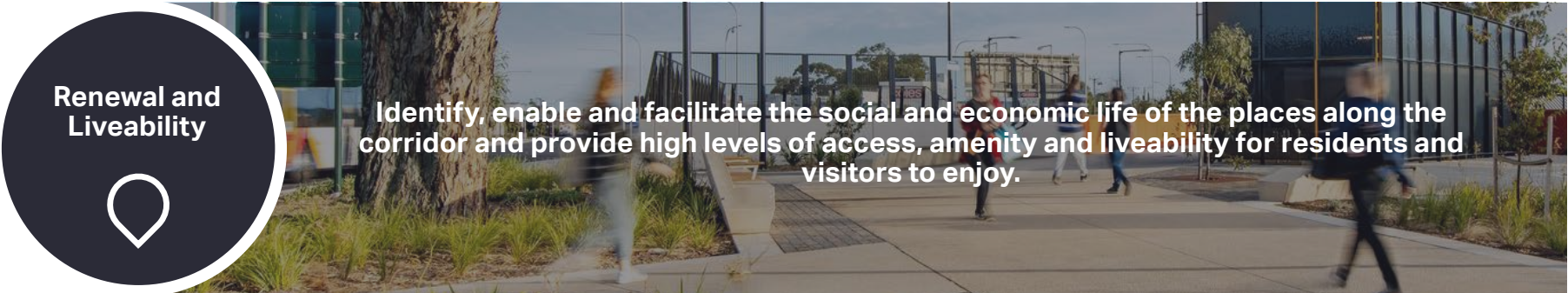


Figure 5-4: The landscapes and townships of the Blue Mountains provide a strong sense of place



Figure 5-5: Provide lighting to the tunnels to visually stimulate and enhance the driver experience





**3    Renewal and Liveability**

Opportunities for new business and economic investment through enhanced movement networks and place creation should be realised, building on the key towns of Blackheath, Mount Victoria and Little Hartley to achieve broader social and employment benefits

Improved conditions should seek to influence beyond the boundaries of the project, integrating and supporting adjacent local communities up and down the Blue Mountains corridor guided by the relevant local council.

**Principles:**

- Consider the provision of well defined entry intersections, sufficient space at intersections, overpasses, ramps and junctions to promote connectivity and improve amenity and liveability of the local community and tourism while minimising access impacts to existing residences and commercial property
- Provide additional tree canopy planting of endemic species to address urban heat island effect and to provide continuous cover for shade, shelter and habitat creation
- Use vegetation, materials and site as a tool to reflect the cultural values of the towns along the corridor
- Explore strategies to improve long term air quality and noise from the corridor to the surrounding urban environs
- Integrate Crime Prevention Through Environmental Design (CPTED) Principles to ensure user safety and comfort at the community connection points at all times. Encourage passive surveillance through design
- Avoid creation of vacant spaces around connection points and structures that are hard to gain access to for maintenance and are vulnerable to vandalism
- Investigate urban renewal opportunities along the corridor and consider the impact of the Highway by ensuring adequate access and that dead zones are not created
- Leverage travel time efficiencies to support off corridor renewal.



**Figure 5-6:** Improved conditions should seek to integrate and support adjacent local communities



**Figure 5-7:** Place creation should be realised to achieve broader social and employment benefits





Create greener and resilient places through a highly considered sustainable, environmental approach where impact is minimised and biodiversity and landscape character of the corridor is enhanced.

4 Environmental Responsiveness

Planning, Design, Construction, Maintenance and Future Management decisions will be derived from a highly considered, sustainable, environmental approach where impact is minimised on cultural landscapes, sensitive areas and heritage elements considered of high visual and ecological value.

This approach will aim to protect and preserve existing ecological habitats while re establishing endemic vegetation, wildlife habitats and endangered plant communities, encouraging the recycling of materials, minimising waste and generating energy to reduce recurrent costs both economically and environmentally.

Water Sensitive Urban Design solutions will enhance the existing streetscapes, improving the water quality in local waterways and improving green connections within and beyond the corridor.

- Principles:
- Promote the creation of a green grid with high quality open spaces that support biodiversity and waterway health, integrating natural patterns and ecology into the design and retaining physical continuity of natural systems
  - Respond to natural and cultural patterns and reinforce the distinction of the villages with the application of appropriate landscape design around bushland re establishment and vegetation management for longevity
  - Maximise the retention of existing vegetation with the goal to plant additional vegetation and expand the tree canopy to assist in reduction of the heat island effect
  - Consider native grasses and grassy plants as they are resilient, attractive to pollinators, resilient to pests and aesthetically attractive and a low fire risk and use endemic and proven local plant species to reduce the visual prominence of structures and elements of the project and enhance biodiversity
  - Integrate detention basins and water quality ponds as part of the overall water sensitive urban design strategy designed appropriate for the contexts of their locations
  - Use re-vegetated cuttings with appropriate batter slopes in preference to retaining and noise walls where possible
  - Consider the introduction of wire rope barriers or other appropriate measure to protect sensitive vegetation along the corridor and to minimise vegetation clearing and assist with mature tree retention
  - Minimise the footprint of any surface structures and associated mechanical and service structures to maintain the integrity and beauty of untouched landscapes or high quality visual or ecological value zones where possible.

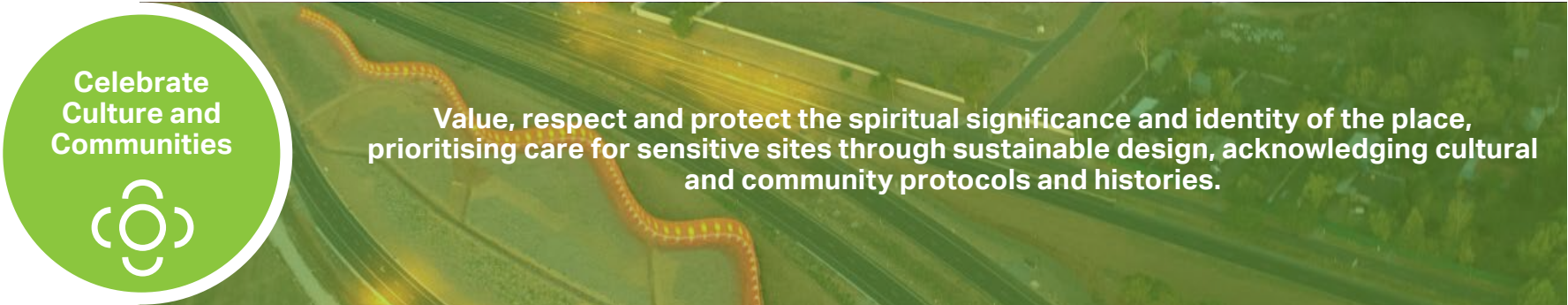


Figure 5-8: Integrate the natural landform and existing vegetation patterns to enhance the corridor



Figure 5-9: Minimise impact on cultural landscapes, sensitive areas and elements of high ecological value





5 Celebrate Culture and Communities

Seek to understand and appreciate Aboriginal and non Aboriginal cultural knowledge.

Aboriginal people will determine the representation of their cultural materials, customs and knowledge, co leading the design and development of the project, complementing the rich experiences and celebrated heritage of the non aboriginal communities around the townships of the Blue Mountains.

Acknowledge that a variety of user groups will experience and perceive the project differently both physically and visually through different cultural lenses, particularly around the narrative and themes derived from memories and stories of the cultural landscape.'

Principles:

- Engage with and respond to the cultural practices led by local Aboriginal knowledge holders
- Engage with First Nations languages and the meaning of first place names to understand more about Country and through consultation to develop meaningful design outcomes to interpret Aboriginal Heritage
- Include impacts to Country and develop indicators to measure impacts to Country and culture in the evaluation of economic, environmental and social opportunities and constraints of the project
- Develop mutually beneficial relationships by sharing emotions and experiences and find common ground
- Reawaken memories of cultural landscapes through consultation and walking on Country
- Identify and nurture opportunities over the short and long term to support cultural practices on Country
- Respect cultural landscapes and minimise the impacts to the integrity and values of heritage elements whether built form or vegetation
- Create considered moments of infrastructure which are unique to Country and place
- Develop a holistic language of art, architecture, landscape and structure
- Draw from natural materials considered important to Aboriginal and local community culture and express these in interpretive elements and structures
- Avoid the adverse impacts of engineering on indigenous and non indigenous heritage and culturally significant settings
- Engage with communities, local artists and local groups in the design of the Highway, its places, structures and zones.



Figure 5-10: Respect and protect the spiritual significance and identity of Country



Figure 5-11: Draw from natural materials and express these in interpretive elements and structures





6 A world-class transport asset

Convey a balance between the composition of the natural landscape elements and the built form elements through considered and simplistic design, where design complements the landscape and less is more.

Principles:

- Minimise the footprint of the road corridor
- Adopt an approach to art and design that is contextually relevant and contributes to the form, function and safety of the Highway
- Ensure all structural forms are low maintenance in design and fully integrated with engineering, art and architecture
- Celebrate visual connections along the corridor through landscape and interpretive design of structures and the natural environment to provide a unique travel experience and anticipation of what is upcoming
- Use materials that are low maintenance, robust, high quality, durable and vandal proof, borrowing where possible from the palette available along the corridor
- Ensure that any highway fittings that are visible, including railing or barrier design, bridges or retaining walls allow permeability with views into the landscape and are considered as part of an integrated, low maintenance set
- Design any bridges or other structures to be used as visual markers or aid in travel orientation
- Ensure that medians and verge zones are planted with endemic, low maintenance species and consider screen planting to limit the visual presence of the Highway where appropriate, improving environmental outcomes and re establishing the bushland aesthetic

- Use the topography to limit the visual prominence of the road to areas beyond while maintaining view corridors from the road itself
- Ensure the corridor and tunnel are designed to be robust and durable to provide reduced whole of life maintenance economics
- Provide visual stimulus within the corridor approach and in the tunnel, appropriate to the designed speed limit that creates a progressive sequence of visual events to narrate the story of the area
- Provide vertical and horizontal visual way finding cues for drivers to understand their location in relation to the urban setting through the use of materials, finishes and lighting
- Ensure that all transition zones, above, below and in and out of the tunnel are clearly articulated with the use of early warning of decision making points to maintain traffic flow and comfort
- Integrate technologies and sustainability into the design process to assist in offsetting the environmental footprint of the corridor works
- Explore water sensitive design opportunities, solar energy and material sciences to assist in reduction of energy usage and carbon emissions
- Adopt a design verification process including peer review to ensure quality though each stage of the process from inception to completion.



Figure 5-13: Convey balance between the composition of the natural and built form elements



Figure 5-12: Ensure verges are well planted with endemic, low maintenance species to re establish the bushland aesthetic



5.5 Site wide strategy

The site wide strategy firstly seeks to create a project identity that is of ‘place’, and connected with Country; an integrated urban design response reliant upon the interaction and shared voices and stories of the Aboriginal people and the Non Aboriginal communities who share the project area.

The connection with Country will be provided through linear and lateral integration. This has been achieved by examining a series of strategic elements that define these features and offer opportunities for the project. These elements cover the topography and landscape, the experience, connection, safety and sustainability and will form the base criteria to guide the development of the visual experience along the project corridor.

A suite of structural elements will be considered in conjunction with the strategic elements by creating a visual family of throughout the experience to ensure a legible connection between the distinctive above and below ground upgrade works at the western and eastern ends respectively and in the tunnel environment.

Across the project, we look further to embed the urban design and landscape objectives and principles through considered changes to the landforms and the vegetation, to enhance the experience and to protect and re-establish the natural ecological systems, while achieving an integrated and low maintenance design.

Maintenance is considered through the design and impementation of every strategic and structural element of the integrated design and is further discussed and explored in the following chapters.

\* East, Central and West refer to the Upgrade Program as follows:

East:

- Great Western Highway Upgrade – Medlow Bath (Medlow Bath Upgrade)
- Great Western Highway East – Katoomba to Blackheath (Katoomba to Blackheath Upgrade)

West

- Great Western Highway Upgrade Program – Little Hartley to Lithgow (West Section) (Little Hartley to Lithgow Upgrade)

Central

- Great Western Highway Blackheath to Little Hartley (the project)

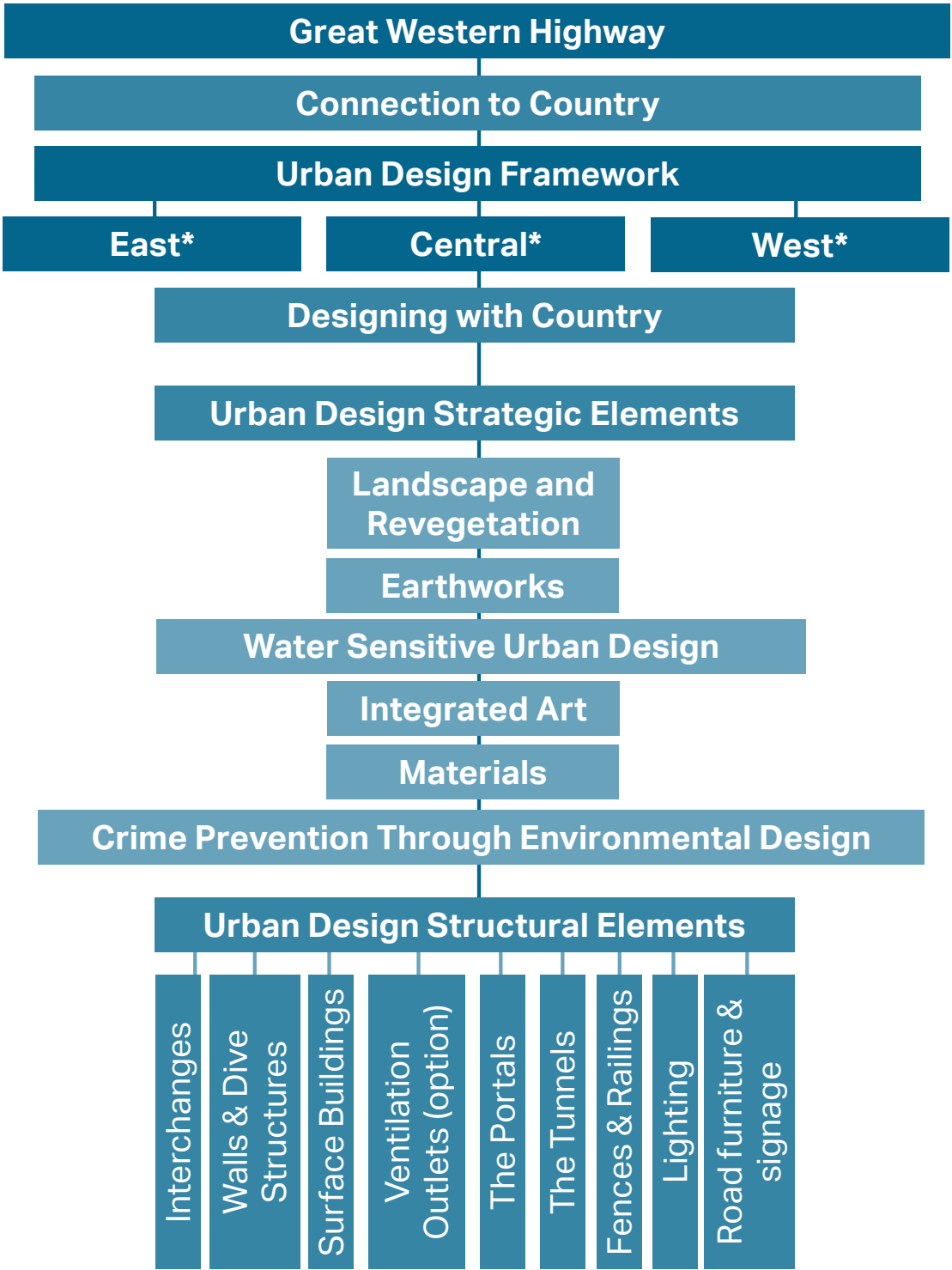


Figure 5-14: Site wide strategy



Integrated urban design

Development of Urban Design Concept, including Key Nodes 1-8

- 1. Western Approach
- 2. Western Portal
- 3. Ventilation Outlet (Option)
- 4. Tunnel Interior
- 5. Ventilation Outlet (Option)
- 6. Eastern Portal
- 7. Eastern Approach
- 8. Visual Events

Landscape Character Zones 1-4

Figure 5-15: Site Wide Strategy





Figure 5-16: Site Wide Graphic Section





5.6 Designing with Country

**We acknowledge the Traditional Owners of the land, The Dharug, Gundungurra and Wiradjuri peoples. The project travels across the land which has been home to the Dharug, Gundungurra and Wiradjuri cultural groups for thousands of years and they maintain an ongoing connection to Country.**

Country

Country could be described as where all things natural are interconnected spiritually and physically. A 'continuum of place' where people move through Countries, in respect of cultural protocols, where past, present and future interconnect and are shared with thinking, Dreaming and stories.

Aboriginal people relate to place and people in differing and varied ways, making Country and cultural boundaries difficult to define in Western terms.

Most of the written and historical research available is eurocentric and excludes the Aboriginal voices. It is only through engagement with the locally connected Aboriginal communities is essential to gain insight into the culture and stories of the project area and understand the physical and spiritual connection to Country of the Dharug, Gundungurra and Wiradjuri peoples.



Figure 5-17: Aboriginal Language Map

Urban Design

The Urban Design proposal is specific to 'place' and movement through and across 'Country'. Early eurocentric historical interpretations have been supplemented and challenged by the information gained at recent workshops with representatives of the local Dharug, Gundungurra and Wiradjuri communities. Reports prepared from these workshops provide guidance on how to connect and design with Country, which informed the initial concept design and themes.

Transport for NSW are concurrently running a process of consultation with representatives of the Dharug, Gundungurra and Wiradjuri peoples in order to gain cultural knowledge. Continued engagement will provide a broader, balanced account of the history, culture, Country and the enduring Aboriginal land stewardship of the project. to support and develop the design process further.

The Urban Design considers responses to the key principles for action in Connecting with Country and is ongoing and evolutionary informing the design outcome and visual interpretation of the cultural identity of the Country we are working on by:

- Respecting the rights of Aboriginal peoples through ongoing engagement, mindful of their cultural and intellectual property with a goal to care for Country through considered and sensitive design
- Delivering an interpretive design solution that provides tangible and intangible benefits for current and future generations, with the Aboriginal peoples determining the representation of their cultural materials, customs and knowledge
- Prioritising consideration of the local, place specific cultural identities, and the enduring stewardship of the Aboriginal peoples, supporting a reciprocal relationship with Country.

The project as a whole, beyond the urban design, will aim to deliver the additional commitments around equity, enterprise and education and economic benefit through an integrated low maintenance design.

The responses received from ongoing stakeholder engagement around nature, people and design - and the relationship across the different elements - are informing a set of holistically considered design aspirations to apply to the concept. These aspirations are conscious of the direct impacts (visual and cumulative) on places of Aboriginal heritage significance, objects and cultural protocols.

This is coming from ongoing, authentic engagement and a process guided by the Aboriginal communities, to ensure Aboriginal culture and heritage is respected and integrated and informs the concept.

At this stage, any themes considered and discussed are what an element or concept 'might look like' or how it 'could be interpreted' or 'may be applied'.

Interpretations derived from the project desktop research and preliminary workshops with the locally connected Aboriginal communities produced some overarching preliminary themes to explore, that have driven the project Vision, Objectives and Principles and the current project Urban Design concept, in anticipation of further outcomes from meaningful engagement with the Aboriginal groups.



## Urban Design Experience

Design creates the setting for the urban design experience, built by movement and time by the users of the space.

There are two main urban design experiences.

- The driver experience moving towards the tunnel on the surface, along the Highway on approach and upon exiting the tunnel in both directions. This occurs through a sequential suite of natural and varied landscape and bushland characters and engineered elements. This is discussed previously in ‘The Landscape’ and ‘the Portals’ and
- The driver experience while travelling through the tunnel is a fast, direct movement through a relatively linear space, again a sequential suite of character and cultural markers and design elements to inform, guide and engage, but referencing and representing the interplay of surface elements and the above ground urban environment, in a graphical and static, visual form. This is discussed in ‘The Tunnel’ on the previous page and further developed in the following pages.

The evolving themes recognise that the majority of the experience in the project will occur as an uninterrupted element below surface level in the tunnel.

To understand the driver experience is to identify the major decision points, what may catch the drivers attention and focusing the driver’s drifting visual field as they travel through the tunnel. Together these criteria form a continuous experience.

## Design Methodology

The preliminary in tunnel theme and experience has emerged from the developing narrative, as has been described and is supported by visual events on the approach and through the tunnel, distilling the geographical transition from urban to country.

Driver engagement, and thus safety, is a fundamental objective.

Application of a design methodology allows the translation of the attributes of Country and the above ground urban and landscape experience into the expression of the form of the infrastructure, as previously discussed, but also the physical expression of the visual events.

The Tunnel user may ask:

- Where am I?
- How far have I got to go?
- What is memorable?
- Am I engaged? Am I safe?

Responding to these questions is the key to developing the early principles that determine consideration of the appropriate visual events within the tunnel.

## Principles



Precedent for signage linked to urface features



Precedent for signage



Cavern lighting Laerdal tunnel



Precedent for lighting event

### Where am I?

Increase the legibility of the experience with visual links to surface features.

### How far have I got to go?

Create reference points as visual indicators of progress in time, graphically and digitally

### What is memorable?

Create points of difference, using tunnel features

### Am I engaged? Am I safe?

Use lighting events to break the monotony of the journey into smaller experiences and catch the driver’s attention to assist in safety



## Preliminary Themes

**Cultural Interpretation - Songlines and Patterns in the landscape**

**Reflections on Place - The Past, The Present and The Future**

**Balance - No beginning - No End and Nature**

## Application of Concept

### The Landscape and Earthworks

Everything starts with Country, connected through ceremony, living and ecological management. Country commands care and respect between the people, plants, animals and the earth to sustain life.

The landscape response generally across the project, particularly at the Blackheath and Little Hartley portals and approaches, **interprets existing Country** by preserving existing vegetation and view corridors and developing a landscape that is meaningful, planting new trees and creating revegetated spaces that will encourage biodiversity and a healthy ecosystem.

The patterns in the landscape have influenced the way the scale of the earthworks solution has been blended into the existing landform. The goal is to reinstate native plant species and cover large volume ancillary facilities by burying them into the landform, screening them and promoting new planting to grow over time.

The fabricated and natural elements sensitively revegetate the incursion into the landscape, acknowledging the construction while concurrently blending it into the landscape to read as a holistic and **balanced** solution through use of materials combined with the ochres of the land.

From day one the landscape will begin to blend and grow into the land, overtime the **landscape** will flourish, culminating in a positive visual experience. In this way apologising for the initial disturbance and then resting within the landform, **balanced**, to become part of the landscape.



### The Portals and Landform

**Songlines** reflect the diversity of Country's **organic landforms** and ecosystems. They are also a way of communicating mapping and providing direction across Country.

**Songlines** have been interpreted, physically as rhythmic, sinuous, curvaceous and powerful guiding stories, interconnecting the function with design.

The concept for the portals relies on these interpretations to sensitively communicate direction and follow a unique form of ochre, lightly textured walls that begin low and lead the user towards the minimal, clean lines of the portal, **interpreting the natural landforms** and welcoming them with a curved embrace as they begin the journey through the tunnel, visually and contextually **balanced** with the surrounding **natural** environment.

The form is to evoke calmness and joy, a juxtaposition of emotion to settle the user as they arrive and heighten anticipation for the journey ahead through the tunnel. The pattern on the structure, simplistic grooves, indicating direction and connection.

At the exits, a similar, comforting form welcomes the road user into their new environment and widens to the above ground vistas of Country.

This minimal design approach has been applied at Blackheath and Little Hartley Portals alike, demonstrating continuity of travel with **no beginning and no end**.



### The Tunnel

A themeing idea for the interior of the tunnel began with the concept of a reflection on **The Past, The Present and The Future**, interpreted as a continuum of the experience of a journey.

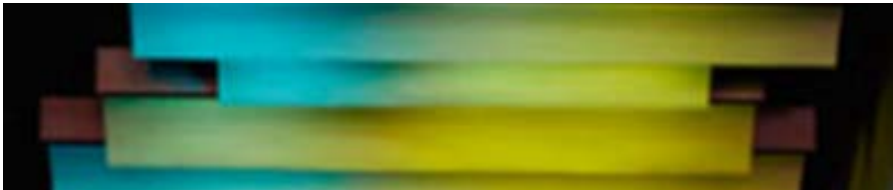
The sinuous concept of the Portal structures and the rhythmic **Songlines** evoked by this shape might continue through the Tunnel as a representation of the ongoing Aboriginal journey over the mountains beginning in the pre-colonial **Past**, **The Present** Western engineered pathway and **The Future** direct passage under the mountains.

This could be used on the wall panel elements and adapted for location signage, as a continuous thread or a 'string of pearls'.

We propose at least three major lighting visual events in each of the tunnels at around 600 metres each, located equidistant between the portals and between the top of the wall panels and on the tunnel ceiling,.

Each of the visual events would begin as a visible light marker, expanding into a motif before tapering away, to engage the user's senses, excite, positively distract and assist in driver safety.

The theme for the major lighting events could be one of **nature**, flora and fauna, **reflecting on place**, or elements of Country, with vibrant colours that reflect the dynamic culture and art of the Dharug, Gundungurra and Wiradjuri peoples.





## Designing with Country Methodology

A number of actions are proposed to investigate the Aboriginal culture and heritage of the area to inform and influence design integration for the project:

- **Stakeholder Engagement**  
Initial engagement with the relevant Aboriginal subject matter expert (SME) to prepare research
- **Preliminary Research**  
SME engaged by Transport. SME to undertake desktop research to inform a preliminary Aboriginal narrative report
- **Preliminary Reporting**  
SME to provide a preliminary report identifying initial cultural narratives and themes for consideration in the concept design
- **Consultation**  
SME to engage with the relevant Aboriginal stakeholders to identify opportunities to deepen understanding of the Aboriginal context on the project
- **Preliminary Reporting**  
SME to provide an Aboriginal Core Narrative Report summarising processes and opportunities for consideration in collaboration with the design team.

The project is currently at this point in the process. The scope has grown to take into consideration community feedback and to satisfactorily address protocols around intellectual property usage. To address this, the following additional reporting actions are required:

- **(Further) Consultation**  
SME to engage with Transport and the relevant Aboriginal stakeholders to manage and respond to community feedback to develop a final Aboriginal Core Narrative Report (which will provide permissibility and direction around intellectual property usage in the concept design process)
- **Reporting**  
SME to provide a final Aboriginal Core Narrative Report summarising processes and opportunities for consideration in collaboration with the design team
- **Design**  
Develop design responses which allow the themes identified in consultation to be expressed in the concept design, working with the Aboriginal groups. (see Next Steps)

## Preliminary Aboriginal Narrative Report

An Aboriginal strategy and design agency, has been engaged by Transport to manage the Aboriginal stakeholder engagement. They have prepared a preliminary Aboriginal Narrative report for the project area to assist in integrating cultural values into the design.

The report was acknowledged as a desktop review informed by historical records, prepared in the absence of recorded Aboriginal oral and written histories and notes that in depth engagement with the locally connected Aboriginal groups and stakeholders is required for an authentic response.

The report identified themes emerging from the narrative, particularly around Connection to Country and the Culture of the project location.

These themes are:

- **Country**  
The Aboriginal worldview and their spiritual and cultural connection to Country
- **Significant/Sacred Sites**  
The Songlines and Dreaming tracks associated with key sites around the Highway
- **Culture**  
Key traditional practices and Dreaming stories around the project area.
- **Seasons, Flora and Fauna**  
How the Aboriginal people used and respected Country in their daily life and how that knowledge is still being shared today
- **Early Colonial Era and Dispossession and the Modern Cultural Landscape**  
The history of interactions between Aboriginal people and settlers since first contact up until today

## (Preliminary) Body of Story Report

This report aims to assist with the interpretation and integration of Aboriginal cultural values collected during the Aboriginal consultation and exploratory workshops by giving the Aboriginal communities a voice. This will assist Transport in achieving respect and appreciation of Aboriginal culture and stories within the built environment.

The report includes a series of core narratives and stories and outlines a set of overarching Cultural Design Principles to inform the projects design principles. These highlight opportunities to develop a design that will deepen the understanding of place and the rich history of the Aboriginal cultural, spiritual and physical connection to the area. Importantly, facilitating greater Aboriginal visibility.

The report was developed through inclusive consultation with representatives and community members who identify as Dharug, Gundungurra and Wiradjuri as well as the wider Blue Mountains Aboriginal community. Transport was involved directly to hear the Aboriginal narrative of place.

- The report includes:
- The core narratives, based on themes, stories and sites of significance for the GWH Upgrade Program
  - Developed Cultural Design Principles relating to the site
  - Recommendations for next steps.



## Initial Outcomes and Application

### Consultation Process

The consultation process has provided a genuine opportunity for the Dharug, Gundungurra and Wiradjuri communities to provide input into the projects design, demonstrating that the Aboriginal voice has been invited and heard in the early stages, with a commitment to collaborate through all stage of the project’s progress.

The process included one-on-one interviews with locally connected key Aboriginal stakeholders and five Aboriginal exploratory workshops attended by the Dharug, Gundungurra and Wiradjuri communities.

The one-on-one interviews included discussions around the exploratory workshops, content and outcomes, establishing a community-endorsed approach. Following this, the SME contacted locally connected Aboriginal stakeholders to gauge interest in the workshops. The attendees were asked to provide details outlining their personal connections to the project area.

The purpose of the workshops was to understand the Aboriginal context and to discuss what should be considered and integrated into the project by the GWHUP team.

Workshops were held initially with all three Aboriginal community groups and it became clear that additional workshops would be needed to allow stakeholders to discuss narratives as a cultural group and align on their concerns around the planned route and the effect on scared sites.

A combined workshop was held following the three separate workshops to provide attendees with an opportunity to ask questions, voice concerns and raise issues while providing direction and themes for the project.

The communities were fairly happy to share knowledge, but decided that until issues raised around impacts of the project are resolved, the knowledge shared and explored in the report was not to be used to develop future phases of the project.

**Note: The following sections act as a summary of the information shared during the consultation process and as represented in the Body of Story report . This will be further developed and discussed following the next iteration of the reporting , which will deliver a final Aboriginal Core Narrative Report.**

### Cultural Design Principles

***‘A successful outcome for the Aboriginal communities would be to create a highway where people can reflect and connect with Country, acknowledge Dharug, Gundungurra and Wiradjuri people and celebrate the oldest continuous living culture in the world.’***

Body of Story Report, September 22

The Cultural Design Principles are intended to guide the GWHUP design team's thinking around interpretation and embedding Aboriginal sensibility into the project in a new way. They are both specific to the project and are more broadly reflective of universal Aboriginal experience and thinking.

#### Connection to Country

Country always lends its name to the people connected to it and for those who call it home. Connecting through reintroducing native planting, materials and respecting the earth is significant to the community and will reconnect the site to culture. Country is ever changing and ephemeral.

#### Aboriginal Culture is a Living Culture

The GWH UP is located on Country where there are many Songlines and stories. The old and new are deeply intertwined, with Aboriginal history and culture, informing culture today and in the future, developing resilient and thriving communities. The Dharug, Gundungurra and Wiradjuri cultures have thrived despite hardship and wish their stories and connection to Country to be evident in the project’s design.

#### The Importance of Language

The use of language is a celebration of people and culture, depicting resilient and vibrant communities. Language promotes understanding and supports the cultural pride of younger members of the Aboriginal communities, feeding learning and culture back into Country.

#### Water Country

Water Country is the ‘giver of life’, connecting Aboriginal people with each other and showers the land with rain from the sky to the rivers that weave throughout Australia. Its tides and currents connect to Sky Country ensuring an eternal flow to sustain, manage and cleanse all living things.

#### Interconnectedness

The Songline of the Great Western Highway stretches from Sydney Harbour through various Countries along the Blue Mountains. The Songline is a connection for the Dharug, Gundungurra and Wiradjuri but also for numerous other cultural groups who travel to and through these Countries. It is a vehicle for mutual dependence in caring for Country through which stories, knowledge and resources are shared. The Aboriginal groups would like to see this represented in the project to allow non-aboriginal people to connect to and respect Country as they travel.

#### Healing Country

Country needs to be healed and rehabilitated in site-specific ways. Country is connected by a web of ecosystems that give life to each other. Everyone on Country has a responsibility to care for and heal Country.

#### Truth-telling

Truth-telling is the process of looking back and looking forward. It acknowledges the history and ongoing impacts of colonialism and dispossession and the strength of the Aboriginal communities to withstand efforts to disconnect them from their Countries. Looking forward is about reconciliation, celebrating and changing attitudes.



## Overarching Narratives and Stories

The narratives and stories shared during the consultation process have been organised into four groups in the report.

- Country
- People and Culture
- Stories and History
- Opportunities.

### Country

Country explores the key aspects of Country along the project corridor and identifies ways the Country can be healed, regenerated and celebrated to support the users of the highway and connect them with Country.

People travelling along the highway should have a sense of how sacred this place is and the deep connection the Aboriginal communities have with it.

### People and Culture

People and Culture engages with the culture of the area from the perspective of the Aboriginal communities, identifying cultural practices, connection and belonging. The recognition of the Aboriginal peoples both past and present is important to the communities views on the success of design integration. Language should be embedded along the upgrade through dual naming , signposting and totems, while artefacts remain intact where possible.

### Stories and History

Permission to share the Stories and History has not been recieved to date. Cultural groups are yet to form a consensus as to whether to share sacred stories and how they should be interpreted and represented.

### Opptorunities

Opportunities were shared around education, art and ongoing partnerships and community engagement. These are all closely aligned to the need for the wider community to learn about the Aboriginal history, stories and people along the highway and the need for continued consultation and partnerships with the local Aboriginal communities. Education being broadly inclusive of the wider community and the local Aboriginal people and youth. Art is to be representative of the different styles of the different groups, highlighting the evident change in art style as you travel though the changing Countries.

## Potential design outcomes to take forward into the Concept Design

Spirituality and connection with Country can be explored through design, language and art integration. Installations allow a sense of Aboriginal culture to be represented in the GWHUP. Consultation highlighted that the prospect of reconnection through design to Country, the waterways and traditional and contemporary culture, excites the Aboriginal communities.

The concepts discussed in this section are indicative only. Story, materiality, scale, typology, colour and placement would be explored further in the next phase of the project when concepts would be developed in conjunction with locally connected Aboriginal artists.

Some of the concepts that could be taken forward are:

- **Planting that is of place** - Celebrating the seasonal landscape by highlighting the unique flora and fauna cycles. Incorporating a palette of flowering species which reflect the changing seasons and using a diverse range of endemic and identified planting across the study area and within individual zones. This would explore the meaningful integration of native species into the landscape design to allow the experience of being on and in Country.
- **Sky Country** - Exploring the universal connection of sky gazing and the importance of astronomy and how the constellations link to the land, indicating seasonal changes. The sky and stars have been used by indigenous cultures universally for navigation and tracking. These relate to the theming around the Songlines and the tracks woven across Country.
- **Waterways** - Water Country being the giver of life, ensuring a flow of water to sustain life, manage and cleanse all living things.
- **Songlines** - further development of this theme, already considered in the conceptual design of the tunnel portals, to highlight that the GWH route has a deep history with the Aboriginal people as major trading route and well travelled pathway between meeting places and ceremonial sites.

The following project elements could be considered for the application of these concepts:

- Dual language signposting
- Lighting events in the tunnel
- Throw screens
- Retaining walls and dive structures
- Tunnel wall cladding
- Earthworks
- Planting design.

## Next Steps

### Response to Community Feedback

Transport will continue to consult with the community regarding the feedback shared throughout the consultative process. Upon resolution, the SME will finalise the Aboriginal Core Narrative Report. This will provide permission for the project team to use the Intellectual Property and Indigenous Cultural Intellectual Property protocols developed throughout the consultation to develop the concepts further.

### Body of Art Workshop

This workshop will be scheduled to bring together locally sourced and recommended artists to take the agreed Aboriginal Core narrative report and develop interpretive opportunities for the site in conjunction with the GWH upgrade program design team. An artists brief will be developed from the themes outlined in the final version of the report to create a Body of Art that represents the narrative as told by the community.

### Design Development

The SME will work with the artists to develop designs across public art, interiors, exteriors and the landscaping to provide conceptual design direction to the design team of how to ‘ground’ design ‘in Country’ along the GWH. This would include a number of inclusive workshops to ensure conceptual alignment with the project’s direction.

### Assurance Mapping

This will be established as a two way assurance frame, to provide a clear methodology for ongoing best practice to ensure that the engagement is carried through all stages of progress of the project moving forward.

This is a mutual commitment from the GWHUP design team and Aboriginal stakeholders to build capacity and support in the retention and regeneration of cultural knowledge.



## 5.7 Urban design strategic elements

This section describes corridor wide strategic elements discussed in 'Site wide strategy', Section 5.5, to embed into the urban design concept ensuring that the project's physical, visual and operational attributes are responsive to the site.

The following elements driving the concept design development are;

1. Landscape and Revegetation
2. Earthworks
3. Water Sensitive Urban Design (WSUD)
4. Integrated art
5. Materials
6. Crime Prevention through Environmental Design (CPTED).

Together, these elements establish the base criteria to inform the evolution of the project concept design to create;

- An integrated and unified visual experience, appropriate to Country, establishing new gateway opportunities between the east at Blackheath and the west at Little Hartley
- An enhanced landscape, by creating a network of high quality landscape interventions that support the biodiversity of the location
- A sustainable, low maintenance, innovative and safe response for all users, connecting the current local centres, transport hubs and residential areas, mindful of future opportunities along and beyond the project boundaries.



The Landscape and revegetation strategy for the project confirms the identity of the existing landscape character of the 'place' and builds upon this through additional mass planting and vegetation, selected as appropriate to the context.

The aim is a sensitive response with the consideration of movement over and through Country, protecting what is existing and complementing with new low maintenance planting.

The landscape approach seeks to re-establish balance, creating harmony between the new and existing built and natural environments.

This section discusses corridor wide landscape principles and the interface with the landscape experience.



The Earthworks must respond sensitively to the natural topography and landforms, mindful of the aspirations of the Aboriginal people and the surrounding communities.

This section demonstrates the influence of the earthworks interventions over the concept design and maintenance through the operational phase.



Water Sensitive Urban Design is a design approach which integrates the design of the water cycle into the urban design to minimise environmental degradation and improve aesthetic appeal and must be considered in all aspects of ecological and recreational aspects of the project.

This section reviews the criteria to be applied to the WSUD strategy, including principles to meet the strategic outcomes of successful integration into the project, ongoing maintenance and the design methodology around basin form and function

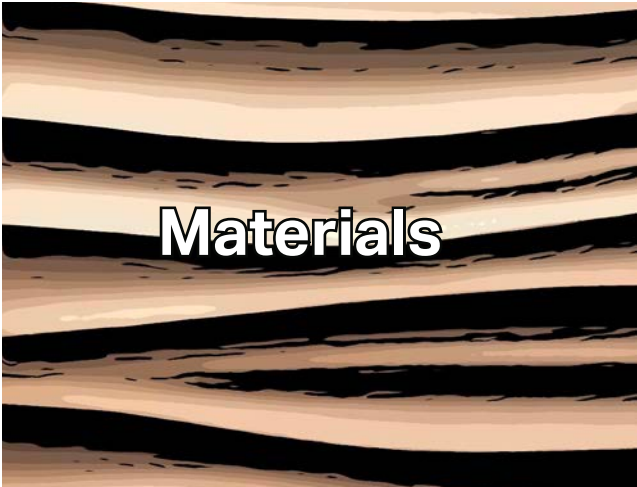




**Integrated Art**

*The Integrated Art response will be developed post the next iteration of reporting from the Aboriginal Core Narrative Report prepared from in-depth engagement with the locally connected Aboriginal groups and stakeholders.*

*This report should develop any concepts and themeing to be applied to the project based on the voices and stories of the Aboriginal groups in conjunction with the Non-Aboriginal heritage report aspirations of the project area.*



**Materials**

The materials and colours applied to the project design, should reflect Country and the character of the existing environment.

They should appear as visually appealing, yet recessive, complementing the sensitivities of the ecology and environment, echoing and responding to the natural context, be robust and low maintenance.

This section provide principles around material selection and colour.



**Crime Prevention  
Through Environmental  
Design (CPTED)**

CPTED focuses on the planning, design and structure of place to minimise or prevent opportunities for crime. This must be considered throughout the project at all stages of the design and design development, including the selection of textures and materials used for visible surfaces to ensure low ongoing operational management and maintenance.

This section describes the psychology behind CPTED and the importance of implementation across the corridor.



5.7.1 Landscape and revegetation

The landscape strategy for the project corridor is to celebrate and enhance the existing character of the Blue Mountains region, creating consistent and meaningful landscape interventions within the landforms, maximising the landscape volume, while preserving view corridors.

The overarching strategy has been developed from the existing physical characteristics of the landscape character zones identified in the landscape character zone assessment and the contextual analysis, including, the topography, heritage, drainage, existing vegetation patterns and endemic plant typologies. Planting choices must celebrate the elements of these zones so that the new planting reflects the old and remains into the future.

The approach is to balance the structural compositions with the natural landform through re vegetation, screening and the addition of trees to promote sustainability, a reduction in the heat island effect and provide amenity to the project user and visual appeal.

Large areas of new tree planting would be incorporated along the length of the visible corridor in alignment with the Green Grid aspirations, supporting biodiversity. This will also assist in visually mitigating the scale of the new infrastructure at these locations.

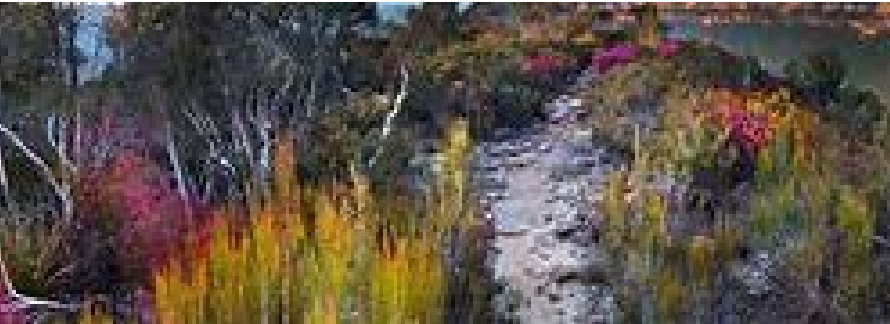


Figure 5-18: Examples of Blue Mountains Character

**Landscape Strategy**

The strategy is used to enhance the driver experience as views constantly reveal themselves along the corridor journey. The planting must ensure the vistas and views of the Blue Mountains are maintained.

With each reveal, the user experiences a visual celebration of place and a Connection with Country through the landscape design, responsive to the character zones, derived from an understanding of the historical stories, the current experience and what emotions the future travel experience along and across Country might convey.



The landscape design is mindful of the transformation at the interfaces from engineered interventions and aims to protect and restore the endemic vegetation by avoiding any unnecessary clearing, corralling identified threatened species during the construction process and re vegetating to reflect the structure of the existing.

In addition to endemic planting, there is an opportunity for the integration of the Aboriginal peoples knowledge of re vegetation that captures land stewardship and maintenance principles into a sustainable, biodiverse and resilient landscape, determined by further engagement with the Aboriginal people.

The re vegetation would be prioritised to areas where it will achieve the greatest impact, visual benefit to the users and satisfy road safety and clearance requirements, increasing the level of biodiversity along the corridor.

The design must incorporate all of the required clear zones and sight line safety requirements, avoiding 'dead ends' while maximising passive surveillance. This approach applies to the carriageways, the multi use path and the active transport corridor.

The resultant corridor will benefit the local ecological communities and aim to regenerate the flora and appearance of fauna around the project edges, reconnecting Country and presenting as a clean, healthy, low maintenance, green environment to promote amenity and user interaction.



Principles

- Ensure that planting around portal entrances is non woody and low height to assist in bushfire mitigation
- Use vegetation appropriate to the location and of a low maintenance nature where possible, to reinforce and enhance existing landscape patterns along the corridor
- Plant species selection should be of place, contextually relevant and growing in the areas where they will be replaced.
- Selection should satisfy safety requirements (frangibility) and functional requirements (suitability to location, erosion control)
- Blend planting with cut and fill structures where possible
- Use visual solutions to heighten awareness of key interfaces, nodes and transition points along the corridor
- Integrate landscape around any bioretention and water quality ponds or swales
- Minimise, where possible, the amount of clearing and earthworks to control the conservation of the existing flora and fauna communities
- Consider maintaining and integrating existing drainage corridors to promote natural biodiversity and waterway health.



Figure 5-20: Endemic Blue Mountains plant species

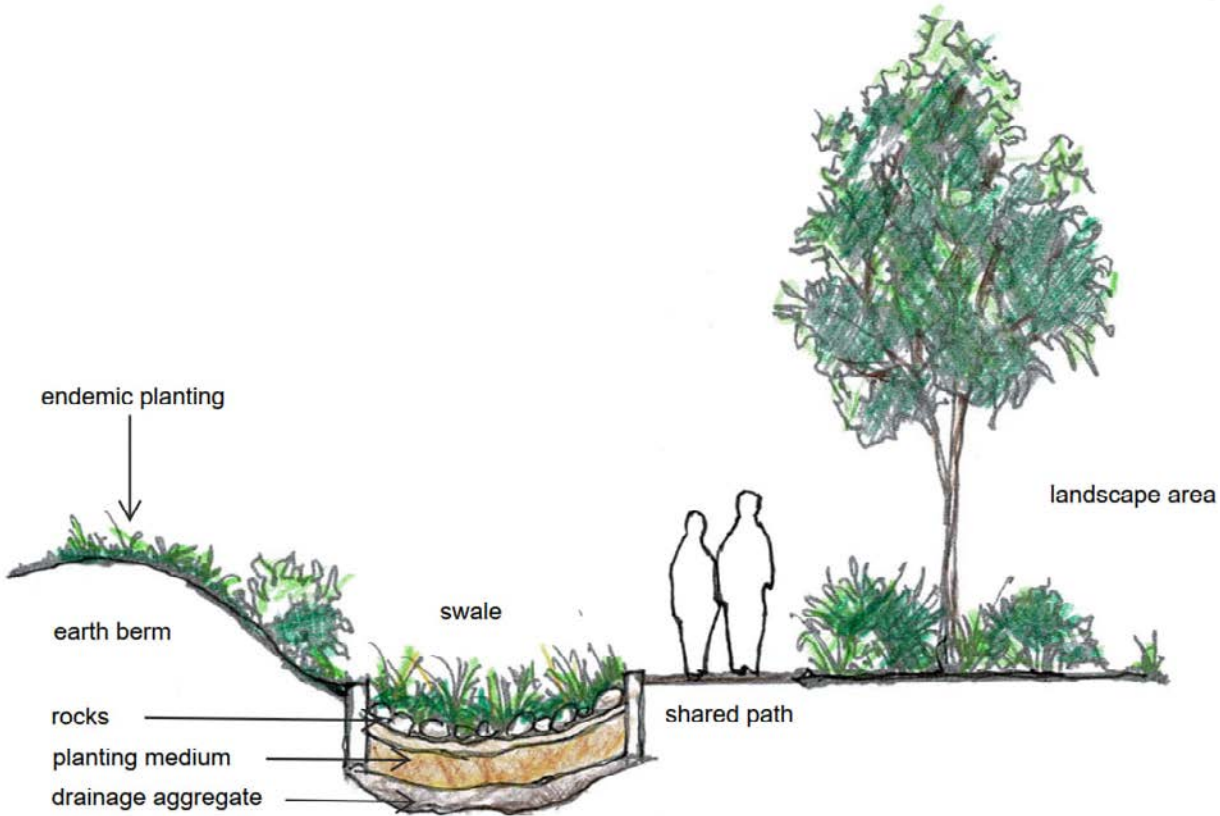


Figure 5-19: Typical landscape arrangement including drainage swale / rain garden



Design Objectives

The project’s location within the highly significant and World Heritage listed environment of the Blue Mountains requires a sensitivity to place and landscape. While providing a memorable experience for highway users the planting will reflect the local character and soften the highway and required infrastructure into the surrounding environment. The three objectives identified to enable this are:

- 1. Create space for landscape
- 2. Create an experience for community
- 3. Sensitive of environment.

Planting across the project is considered from a holistic and individual aspect, playing an important role in defining both the Blackheath and Little Hartley portals and orientating users while also providing a consistent language to the whole of the project.

Design Considerations

- The planting response should be designed in such a way that the character contributes to the local context, through careful design of open space and mindful connection to Country and place
- Retain and reinstate plants, trees or other green infrastructure endemic to the site
- Protect, enhance and extend the tree canopy and preserve high quality vegetation
- On approach the design should maximise the driver experience before entering the tunnel – references can be continued through the tunnel through visual display
- All overhead structures should be designed with open support structures to ensure transparency and distance visibility of landscape over, under and around the structure.



Figure 5-21: WestConnex , Sydney | peckvonhartel



Figure 5-22: National Arboretum, Canberra | Tonkin Zulaikha Greer and David Lancashire Design



Figure 5-23: Eastlink, VIC | Connect East and Heaven Pictures



Planting Response

The project planting response focuses on plant species that are contextual, reflect the character of the landscape, and are climate responsive. It also provides a palette for new works, responds to tree canopy cover replacement and increased biodiversity.

The planting response is derived from the Ecological Vegetation Communities (EVC’s) that are present in the Blackheath and Little Hartley regions. The two locations share common EVC’s which provide a consistent landscape language defining the project. Definition between the two portals is established with the utilisation of EVC’s which are located only within either Blackheath or Little Hartley but not both.

The EVC’s common to both Blackheath and Little Hartley include:

- Dry sclerophyll forests (Shrubby subformation) – South Tablelands
- Dry sclerophyll forests (Shrubby subformation) – Sydney Hinterland
- Dry sclerophyll forests (Shrubby subformation) – Sydney Montane.

The EVC’s Found in Blackheath include:

- Heathlands – South Tablelands.

The EVC’s found in Little Hartley include:

- Grassy woodlands – Southern Tableland.

Planting selection should take into consideration culturally significant species identified by the Aboriginal groups whom lands are modified by the project. At the time of this Urban Design Report engagement with the appropriate stakeholders and groups has not been undertaken. Any recommendations of culturally significant species, land management or theming should be provided by the appropriate Aboriginal representatives and stakeholders.

All planting must reflect the guidelines and standards as outlined in Beyond the Pavement and supporting documents.

Net Increase in Trees

In accordance with the SEARs , the project must include and illustrate green infrastructure designs, actions and outcomes for the project including in relation to how the project will achieve a net increase in tree numbers and canopy within proximity of the impacted area. This relates to the number of trees to be cleared by the project, (a tree is defined by Australian Standard 4970), that will not be covered by a biodiversity offset strategy.

The majority of vegetation that would need to be cleared to enable construction of the project meets the definition of native vegetation. The Biodiversity Development Assessment Report (BDAR) for the project, concludes that 9.71ha of native vegetation would be cleared and would be covered by a biodiversity offset strategy (refer to Appendix H of the EIS (Technical report - Biodiversity)).

In addition to the 9.71ha of native vegetation which would be cleared, around 11.02ha of other vegetation would also be cleared at Blackheath, Soldiers Pinch and Little Hartley. This other vegetation, which does not meet the definitions of native vegetation, includes sparsely treed pasture, exotic vegetation and some native trees.

Trees in these areas can be categorised as feature trees (visible to highway and user paths/active transport), feature bushland trees (visible to highway and user paths/active transport) and bushland trees (in areas which will be revegetated as part of the project).

Tree Replacement and Revegetation

The project would provide new tree planting for both feature and bushland trees, to replace trees removed by the project that are not included in the biodiversity offset strategy.

The aim of the tree replacement and revegetation would be to replace those trees removed and to improve and increase the tree canopy, tree quantities and vegetation areas within the project boundary.

To achieve this outcome:

- A tree survey would be undertaken by an arborist during the detailed design phase of the project, to confirm the number of trees to be cleared, that are not covered by the biodiversity offset strategy for the project
- A landscape revegetation strategy would be developed using the outcomes of the tree survey as the basis for achieving a net increase in trees for the project at a ratio of 2:1.

Planting Selection

The following planting selection is an indicative sample of species commonly associated with relevant EVC’s. As the project is located within a highly significant and culturally important environment any areas of planting must be native and where possible endemic, low maintenance and locally sourced.

Refer to Species List for details on planting selection species that follow.





Figure 5-24: Plant species



Species List

1.	<i>Eucalyptus macrorhyncha</i> (red stringybark)	38.	<i>Syncarpia glomulifera</i> (turpentine)	77.	<i>E. langleyi</i>
2.	<i>E. rossii</i> (scribbly gum)	39.	<i>Dodonaea triquetra</i>	78.	<i>E. stricta</i> (mallee ash)
3.	<i>E. dalrympleana</i> subsp. <i>dalrympleana</i> (mountain gum)	40.	<i>Leptospermum trinervium</i> (flaky-barked teatree)	79.	<i>Allocasuarina nana</i>
4.	<i>E. cinerea</i> (Argyle apple)	41.	<i>Leucopogon muticus</i>	80.	<i>Baeckea brevifolia</i> (short-leaved heath)
5.	<i>E. dives</i> (broad-leaved peppermint)	42.	<i>Persoonia levis</i> (broad-leaved geebung)	81.	<i>Banksia ericifolia</i> (heath banksia)
6.	<i>E. mannifera</i> (brittle gum)	43.	<i>P. linearis</i>	82.	<i>Boronia anemonifolia</i> (sticky boronia)
7.	<i>E. radiata</i> subsp. <i>radiata</i> (narrow-leaved peppermint)	44.	<i>Phyllanthus hirtellus</i>	83.	<i>B. microphylla</i> (small-leaved boronia)
8.	<i>E. albens</i> (white box)	45.	<i>Pultenaea microphylla</i>	84.	<i>Darwinia fascicularis</i> subsp. <i>Oligantha</i>
9.	<i>E. goniocalyx</i> (bundy)	46.	<i>Elaeocarpus reticulatus</i> (blueberry ash)	85.	<i>D. taxifolia</i> subsp. <i>Taxifolia</i>
10.	<i>E. nortonii</i> (large-flowered bundy)	47.	<i>Platysace lanceolata</i>	86.	<i>Lambertia formosa</i> (mountain devil)
11.	<i>Acacia buxifolia</i> (box-leaved wattle)	48.	<i>Pultenaea flexilis</i>	87.	<i>Petrophile pulchella</i> (conesticks)
12.	<i>Daviesia latifolia</i> (broad-leaved bitter pea)	49.	<i>Calochlaena dubia</i> (common ground fern)	88.	<i>Philotheca obovalis</i>
13.	<i>Exocarpos strictus</i> (dwarf cherry)	50.	<i>Pteridium esculentum</i> (bracken)	89.	<i>Pultenaea canescens</i>
14.	<i>Hibbertia obtusifolia</i>	51.	<i>Anisopogon avenaceus</i> (oat speargrass)	90.	<i>Dampiera stricta</i>
15.	<i>Lissanthe strigosa</i> (peach heath)	52.	<i>Aristida vagans</i> (threeawn speargrass)	91.	<i>Goodenia bellidifolia</i>
16.	<i>Monotoca scoparia</i> (prickly broom-heath)	53.	<i>Caustis flexuosa</i> (curly wig)	92.	<i>Patersonia sericea</i> (silky purple-flag)
17.	<i>Persoonia chamaepeuce</i> (dwarf geebung)	54.	<i>Entolasia stricta</i> (wiry panic)	93.	<i>Lepidosperma viscidum</i>
18.	<i>Platylobium formosum</i> subsp. <i>formosum</i>	55.	<i>Lomandra glauca</i> (pale mat-rush)	94.	<i>Schoenus villosus</i> (hairy bog-rush)
19.	<i>Hardenbergia violacea</i> (false sarsaparilla)	56.	<i>Eucalyptus oreades</i> (Blue Mountain ash)	95.	<i>Eucalyptus blakelyi</i> (Blakelys red gum)
20.	<i>Asperula scoparia</i> (prickly woodruff)	57.	<i>E. piperita</i> (Sydney peppermint)	96.	<i>E. bridgesiana</i> (apple box)
21.	<i>Dianella revoluta</i> var. <i>revoluta</i> (blue flax lily)	58.	<i>E. radiata</i> (narrow-leaved peppermint)	97.	<i>E. melliodora</i> (yellow box)
22.	<i>Gonocarpus tetragynus</i>	59.	<i>E. sieberi</i> (silvertop ash)	98.	<i>E. rubida</i> subsp. <i>rubida</i> (candlebark)
23.	<i>Stylidium graminifolium</i> (grass triggerplant)	60.	<i>E. blaxlandii</i> (brown stringybark)	99.	<i>Acacia dealbata</i> (silver wattle)
24.	<i>Stypandra glauca</i> (nodding blue lily)	61.	<i>E. pauciflora</i> (white sally)	100.	<i>Bursaria spinosa</i> (blackthorn)
25.	<i>Joycea pallida</i> (silvertop wallaby grass)	62.	<i>Acacia dorothea</i> (Dorothys wattle)	101.	<i>Cassinia longifolia</i>
26.	<i>Lomandra filiformis</i> subsp. <i>filiformis</i> (wattle mat-rush)	63.	<i>A. terminalis</i> (sunshine wattle)	102.	<i>Exocarpos cupressiformis</i> (native cherry)
27.	<i>L. longifolia</i> (spiny-headed mat-rush)	64.	<i>Amperea xiphoclada</i> var. <i>xiphoclada</i> (broome spurge)	103.	<i>Hibbertia obtusifolia</i>
28.	<i>Poa sieberiana</i> var. <i>sieberiana</i> (snowgrass).	65.	<i>Banksia cunninghamii</i> subsp. <i>cunninghamii</i>	104.	<i>Asperula conferta</i> (common woodruff)
29.	<i>Angophora bakeri</i> (narrow-leaved apple)	66.	<i>Daviesia latifolia</i> (broad-leaved bitter pea)	105.	<i>Bulbine bulbosa</i> (bulbine lily)
30.	<i>Angophora costata</i> (Sydney red gum)	67.	<i>Hakea dactyloides</i> (broad-leaved hakea)	106.	<i>Convolvulus erubescens</i> (Australian bindweed)
31.	<i>Eucalyptus beyeriana</i> (Beyers ironbark)	68.	<i>Lomatia silaifolia</i> (crinkle bush)	107.	<i>Desmodium varians</i> (slender tick-trefoil)
32.	<i>E. consideniana</i> ( <i>yertchuk</i> )	69.	<i>Petrophile canescens</i> (conesticks)	108.	<i>Dichondra repens</i> (kidney weed)
33.	<i>E. deanei</i> (mountain blue gum)	70.	<i>Phyllota squarrosa</i> (dense phyllota)	109.	<i>Geranium solanderi</i> var. <i>solanderi</i> (native geranium)
34.	<i>E. pilularis</i> (blackbutt)	71.	<i>Telopea speciosissima</i> (waratah)	110.	<i>Hypericum gramineum</i> (small St. Johns wort)
35.	<i>E. punctata</i> (grey gum)	72.	<i>Grevillea laurifolia</i>	111.	<i>Ranunculus lappaceus</i> (common buttercup)
36.	<i>E. sclerophylla</i> (hard-leaved scribbly gum)	73.	<i>Patersonia glabrata</i> (leafy purple-flag)	112.	<i>Stellaria pungens</i>
37.	<i>E. sparsifolia</i> (narrow-leaved stringybark)	74.	<i>Austrostipa pubescens</i>	113.	<i>Tricoryne elatior</i>
		75.	<i>Lomandra multiflora</i> (many-flowered mat-rush)	114.	<i>Bothriochloa macra</i> (red grass)
		76.	<i>Eucalyptus laophila</i>	115.	<i>Echinopogon ovatus</i> (forest hedgehog grass)
				116.	<i>Themeda australis</i> (kangaroo grass)



5.7.2 Earthworks

The project is experienced through visual transitions through different landforms and landscaped character zones. They occur along the approaches and exits to the tunnel, and separately, but concurrently within the tunnel itself.

A number of vistas and views have been identified along the corridor at the interfaces at Blackheath and Little Hartley. Through considered landform modification and landscape interventions, these vistas and view corridors are enhanced to ensure that the journey on the approach to the tunnel and upon leaving the tunnel is integrated into the existing topography and landscape, providing a connected, recognisable and heightened experience of ‘place’.

Significant vistas identified that would be retained and enhanced through design and placement of the required highway elements are :

- Large stands of existing vegetation to the north, including the Blue Mountains National Park and south of the Highway corridor at Blackheath
- The existing riparian corridors and identified protected vegetation at Blackheath and Little Hartley
- Views of the Blue Mountains and escarpments in all directions on the approaches at Blackheath and at Little Hartley
- Significant dams and water bodies to the north of the Blackheath approach, including the Medlow Dam and to the north and south at the Little Hartley interface
- The pastureland, including The Mount Victoria Stockade lands and Butlers Creek, to the north of the Highway at Little Hartley.



Figure 5-25: Medlow Dam

The Earthworks need to respond sensitively to the natural topography and landforms, mindful of the aspirations of connecting with Country and the significance of this area to the Aboriginal people and the surrounding communities.

The road landscape is integrated into the existing vegetation patterns through retention of the existing vegetation scale. Where design of the function of the Highway prohibits this, re vegetating in a similar pattern and scale, with identified endemic species and the addition of large trees, where space is available, is sensitively applied.

In this way, the connection with the landscape patterns and scale assists in retaining views and vistas, most evident at the portal works at the Blackheath and Little Hartley interfaces.

Here the form of the portals appear to flow sinuously with the rhythm of the existing landforms and blend with minimal visual impact, integrated into the landscape. The landscape strategy, visually screens, blends and camouflages the scale and function of the surface buuildings into the topography, embellished with a similar landscape pattern to complement the existing surrounding vegetation.



Figure 5-26: Blackheath Portal Design - indicative only subject to design development



Cut and fill embankments have been minimised to blend with the surrounding landscape. Where possible the battering and embankments have been laid back to provide an acceptable and low maintenance planting environment. Where these constructed forms join the existing landform, the edges have been seamlessly integrated to provide lateral continuity.

All cut and fill batters should be designed with appropriate slope to allow for the establishment of landscape and designed to improve aesthetics and maintenance.

Where possible, any excess fill would be used as the preferred solution for any noise barriers or mounding required and planted to provide a more sustainable and visually sensitive, integrated approach. This is further discussed in 'noise barriers and headlight screens', Section 5.8.3 with a series of principles to guide this approach.

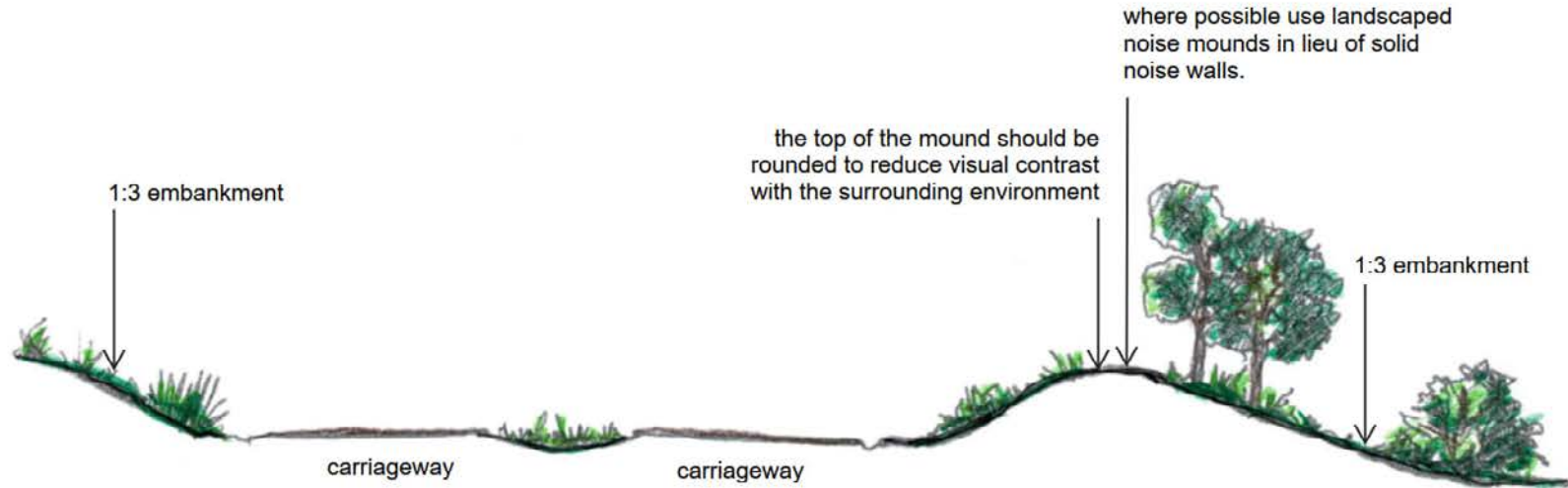


Figure 5-27: Typical section showing a natural noise/landscape mound



5.7.3 Water Sensitive Urban Design - WSUD

Water Sensitive Urban Design is a design approach which integrates the design of the water cycle into the urban design to minimise environmental degradation and improve aesthetic appeal. This includes the integration of stormwater, groundwater, waste water management and water supply.

There are different water quality typologies and principles around the methods to integrate them into the project, with the objective to create them to become an asset to the visual and ecological amenity of the area, ensuring adjacent areas of the project are not adversely affected by their function during the operational phases.

The project must ensure that design aspects are considered in the implementation of a WSUD strategy to integrate the function with the experience.



Figure 5-29: Example of WSUD by Blacktown City Council



Figure 5-30: Example of WSUD at Sydney Park

The design of the drainage infrastructure is an integral part of the landscape and WSUD systems. Opportunities and constraints around location and function of the WSUD must be considered to achieve an integrated land use planning approach to the management of waste and storm waters.

The design should consider ongoing maintenance, climate, urban heat and thermal comfort as an integral part of the project landscape and must provide solutions adjacent to hardstand areas to avoid drainage over the pavement.

There are a number of water quality control ponds and basins located throughout the project and the project would use re-vegetation to help filter the water captured before it moves into the natural, surrounding watercourses. This can be through a combination of swales and hard drainage solutions.

An opportunity has been identified to further examine the shape of the basins and biodiversity ponds and their re vegetation and grading, to respond to the local topography and conditions, in the future stages of the concept design development.

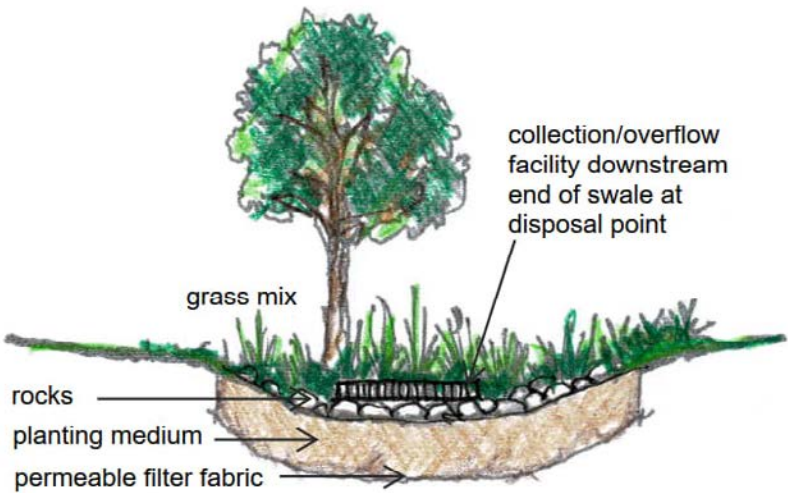


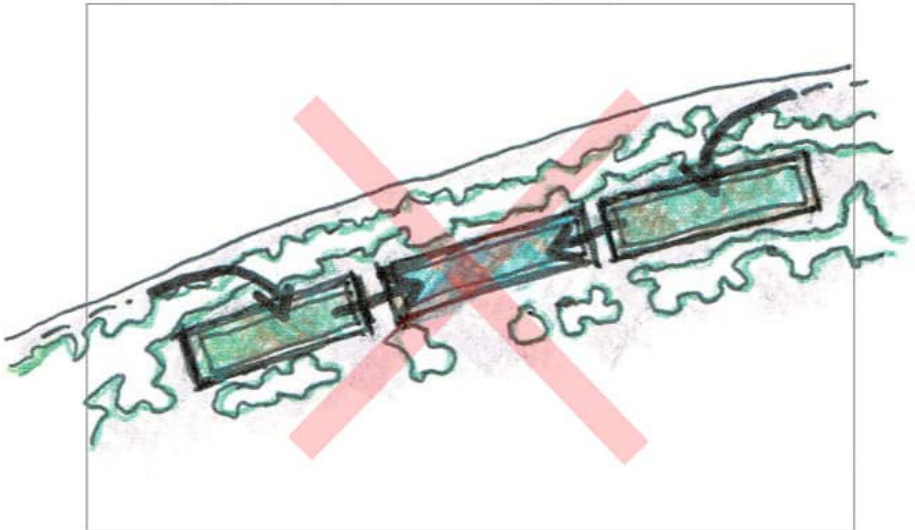
Figure 5-28: Typical drainage swale diagram



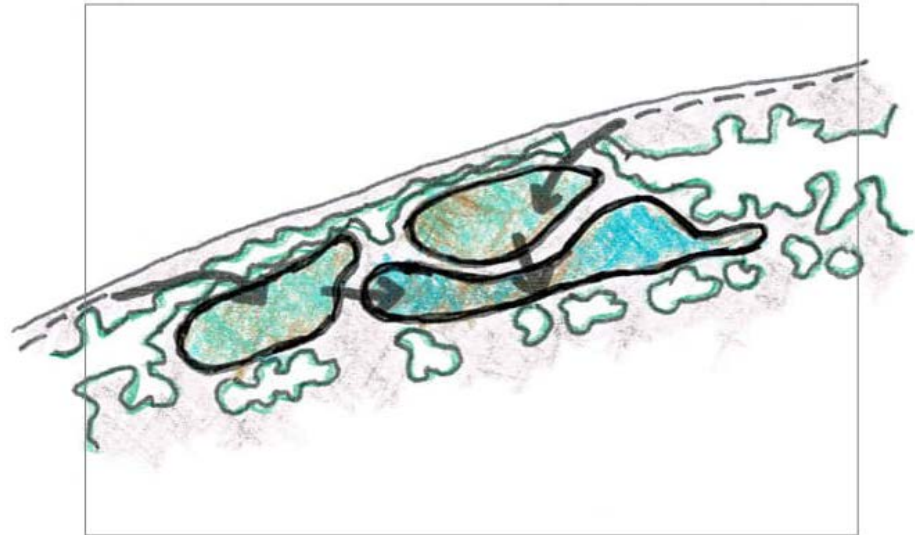
**Design Principles:**

The design should align with the Transport water sensitive urban design guideline in order to satisfy the desired implementation outcomes; and should adopt the following methodology;

- Stormwater management elements should aim to be low maintenance in function and visually and physically integrate with the adjacent context, built or natural across the corridor
- The solution should consist of a combination of multiple elements 'a chain of basins' approach, adjacent to points of hard surface discharge to achieve the desired water quality output
- Minimise hard surfaces
- The approach to treatment should be sensitive to the receiving environment
- Elements should be designed to suit the contours, with cross falls designed to run off directly to treatment ponds
- Incorporate swales to direct flow to the treatment ponds
- Aim to minimise the effect of stormwater events on the catchment by managing the quantity of water passing through the project site, directing it to discharge into planted areas.



**Figure 5-31:** Rectilinear basins are undesirable as they do not respond to local conditions



**Figure 5-32:** Carefully shaping the basins to respond to the context to create visual wetlands is preferred



5.7.4 Integrated art

Through consultation with the Aboriginal communities, as discussed in Chapter 5.6, the process of preparing the Body of Story demonstrated genuine opportunities for the local Aboriginal voice to be heard and for the Aboriginal groups to engage in the process to make their culture visible, by sharing their stories, knowledge and histories.

The report has identified that a successful outcome for the Aboriginal communities would be to create a highway where people can reflect and connect with Country, acknowledge the Dharug, Gundungurra and Wiradjuri peoples and celebrate the oldest continuous living culture in the world.

With this in mind, there are opportunities to create integrated art and theming along the project and on the project elements.

They would be identifiable markers, informed by the Aboriginal and Non-Aboriginal voice, unique to the project and relative to Country and ‘place’ .

Stakeholders highlighted how there are different styles of art relative to the different Aboriginal groups The Dharug, Gundungurra and Wiradjuri peoples each have their own intrinsic style and any artwork on the highway should represent the local art style of the relevant cultural group.



Westconnex - Art interpreted and integrated into the surface structure



Installation art by Punga ribben



CreativeBrimbank - Community Public Art Collection

Any artwork needs to be specific to Country and local to place. As people travel along the highway, they should get an idea of the changing Country through the changing of the style of the art, uncovering another level of the narrative.

The integration of artwork would be appreciated at different scales, speeds and at different times of the day in differering locations, by motorists, cyclists and pedestrians alike.

The following project elements could be considered for integrated art:

- Signposting for Country
- Lighting events in the tunnel
- Stand alone art works
- Interpretive signage
- Throw screens
- Retaining walls
- Tunnel wall cladding
- Earthworks
- Planting design



Silo Art Trail - South Australia



*The Integrated Art response will be developed from the final Aboriginal Body of Story Report prepared from further engagement with the locally connected Aboriginal groups and stakeholders.*

*The final report will develop any permissible stories and themeing to be applied to the project concept, based on the voices and stories of the Aboriginal groups in conjunction with the Non-Aboriginal heritage representation aspirations of the project area.*



South Road Sculptures - SA Native title



Djab Wurrung tree - Sacred tree



5.7.5 Materials

The materials applied to the project corridor will reflect the objectives and principles outlined earlier in the report and are indicative only and subject to further design development. They should be reflective of the ‘Connection to Country’ response from stakeholder engagement and demonstrate a relationship to the natural environment existing along and around the project corridor and the wider Blue Mountains area.

Early selections and themeing has been considered based on desktop research and will be further developed once the Aboriginal Core Narrative Report and the Non Aboriginal Heritage Report are received to further confirm and amend concept design decisions as the project design progresses. The outcomes from this report will be applied to the design.

Consultation with the Aboriginal communities will highlight other significant materials within local Aboriginal culture which may be included in the overall material selection.

Current materials are derived from an understanding of the contextual analysis around the heritage, geographical location and topography and flora and fauna producing a suite of materials and tones of a low maintenance nature and sympathetic to this understanding,

The concept design response is of a minimal material and colour palette of earth tones and natural materials applied to the main structural fabric. The colours would be applied based on their raw form, while referencing the visual change as they are exposed to natural elements.

Inspiration is taken from the sandstone, cut earth, the leaves, the filtering of light through the tree canopies and the ensuing shadows.



Figure 5-34: Materials selection will reflect the local environment

The project location is not an urban environment, so the concept does not need to be informed by or compete with the colour and structural diversity of the built form characteristics inherent to an urban environment.

Instead the concept design relies upon becoming integrated with the natural and created landform, to be embedded as a recessive composition within its environment.

The majority of the colour and visual interest is supplied by the landscape interventions and as visual events and theming in the tunnel. Additional material and tonal applications will be determined for identified interpretive elements or applied to road furniture and other selected urban design elements, discussed later in the report, as stakeholder engagement continues and further themes emerge.

The approach to material treatment should create a recognisable visual identity, in line with the principles guiding all of the project elements, where a unified family of designed objects is desirable.



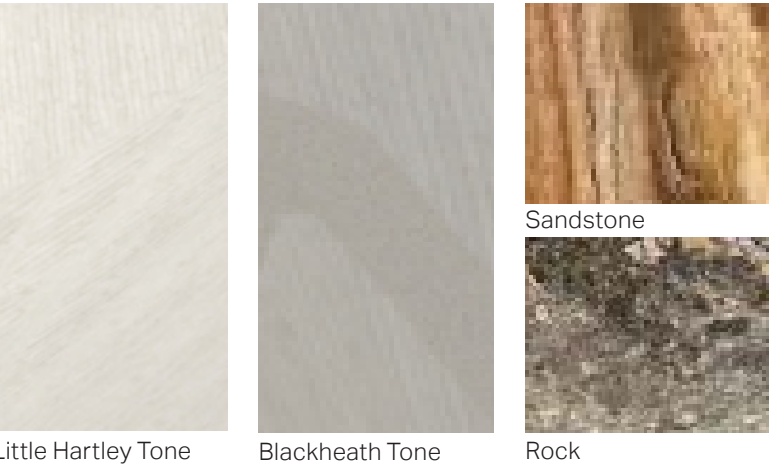
The materials should be cost effective, sustainably fabricated on site where possible, practical, hard wearing and low maintenance, demonstrating the innovation concurrent with the concept design’s form and function.

The following reference imagery shows the materials and colours considered in the following structural locations:

- The Wall and Dive Structures, The Portal superstructure and the suite of retaining walls along the corridor
- Road Furniture, including the lighting, fencing and any identified shared path structures or amenity items
- Surface Buildings.

Materials Palette

Wall and Dive Structures, Portals and Retaining Walls





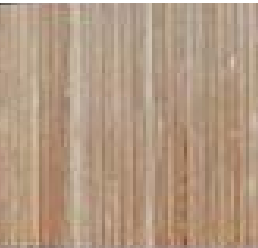
Roadside Furniture, Wayfinding Signage and Elements



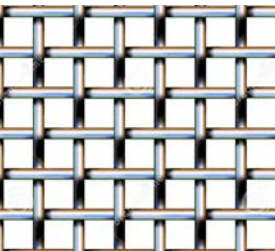
Concrete



Galvanised railings



Timber



Barrier Mesh



Transparent Screen



Corten Steel

- To achieve a sustainable and consistent corridor approach, the treatments applied at this stage to support the concept design are summarised to include:
- Favours materials with the lowest carbon footprint
  - Longitudinal consistency of materials and colours over a family of elements
  - Lateral integration with the interfaces to create contextual harmony
  - The use of natural earth tone oxides, representing the colours of the excavated landscape materials applied to strong ridged ribbing for the walls and drive structures and retaining wall panels along the Highway
  - Retaining walls facing the Highway would consider a similar application, particularly in cuttings where any shotcrete applications or degradable materials will be covered with panelling
  - Small retaining walls could be finished in natural sandstone
  - Any swales constructed other than with a WSUD methodology should be stone pitched and visually recessive
  - Any visible fencing is to be finished in black, consistent with the Blue Mountains to Katoomba Urban Design Framework
  - Placemaking elements would use this palette in order to maintain a consistent character.

Surface Buildings



Precast Panels



Metal Deck Roofing - light colour



5.7.6 Crime Prevention Through Environmental Design - CPTED

CPTED focuses on the planning, design and structure of place to minimise or prevent opportunities for crime throughout the project.

CPTED should guide the project design through:

- The aspirations of **community engagement**
- the application of **clear signage and surveillance**
- **activation of shared spaces**
- the nature of the **materials used** and their **ability to be maintained** and repaired as required.

Any infrastructure provided must be resilient.

Safety is concerned with the protection against unintentional threats, such as accidents, while security is the protection from intentional harm. The two are complementary and without appropriate security, the structure cannot be deemed as 'safe'.



Figure 5-35: CPTED provides safe, usable places



COMMUNITY ENGAGEMENT

Engaging the members of the Aboriginal groups and non aboriginal groups of the local communities of Blackheath, Mount Victoria and Little Hartley during the design process will lead to investment in the design outcomes.

An engaged community is more likely to provide passive surveillance and to intervene in any crime, vandalism or graffiti prevention, should it occur.



SIGNAGE AND SURVEILLANCE

Ensuring that all urban design elements are well designed and placed in highly visible areas and maintain sight lines, assists in providing user comfort and deterring people from using areas with low surveillance.

An effective signage strategy incorporating landscape interventions as barriers, prevents access to undesirable areas and may reduce the need for excessive technical surveillance.



SHARED SPACE ACTIVATION

Well designed spaces are attractive places for people to want to pass through or spend time in,

A number of elements can activate spaces throughout the day and night. Throughout the day People activate space and provide security through passive surveillance, just by being there.

The application of lighting and feature lighting in these spaces continues the surveillance at night.

Artworks, road furniture, considered landscape, associated amenities and interpretive signage all contribute to the feeling of being safe and comfortable in a space.



MATERIALS AND MAINTENANCE

Material selection, including robust, darker and textured surfaces can deter vandalism and are easier to repair and maintain.

If designed safely, activated and frequented regularly, the spaces are less likely to attract crime, vandalism and graffiti and may require less maintenance and repairs.

Protective coatings can assist in maintenance should graffiti be an issue.





Governance, Personal Security, Physical security and Cyber security must be addressed in the overall strategy through appropriate design, engineered and technological intervention and innovation.

With this in mind, design and place management principles have been considered, developed and applied to all built elements.

These principles make it easier for the user, the asset owner and law enforcement to navigate and understand the experience and places created, while discouraging potential offenders from viewing these places as opportunities for crime and anti social behaviour.

CPTED is most relevant to the project at the main highway interfaces, the operational structures and through the tunnel and is handled by urban and engineered design, material selection and proprietary mechanical and technological safety and security applications.

CPTED Strategies

- Removing conditions that would suggest or encourage any type of behaviour other than what is considered socially or legally acceptable, including preventing access, through the use of well designed security fencing around buildings and key assets
- Reducing the potential of the rewards of crime by designing these opportunities out at the beginning of the design process
- Increasing risk perception by providing visual deterrents in the form of visual warnings and surveillance, both passively and with CCTV
- Reducing the desire to commit offences by providing a designed environment free of crime attractors, such as large blank walls for graffiti or flimsy structures that can be easily damaged.



Key urban design and landscape CPTED considerations occur at areas where the pedestrians and cyclists have access to the corridor and where they tie in to existing and proposed future networks.

CPTED Design Principles

- Maintaining a linear and continuous pedestrian and cyclist shared path experience to avoid any dead ends or hidden alcoves
- Providing adequate lighting and maximising passive surveillance to the shared paths at grade and at any underpasses
- Providing adequate visual distance to avoid conflict with other users
- Preventing access to operational areas through appropriate and safe fencing
- Maintaining clear sight lines where vegetation is proposed on either side of the shared path route and where the paths are adjacent to the Highway and connect across the Highway.

The strategies and principles listed above form the basis for the development of the concept design and must be considered further in any future design development.



## 5.8 Urban design structural elements

In developing the Urban Design and Landscape concept design, we have considered the following structural elements as a part of a 'corridor wide' integrated design response:

1. Interchanges
2. Walls and dive structures
3. Surface buildings
4. Ventilation outlets (Option)
5. The portals
6. The tunnels
7. Fences and railings
8. Lighting
9. Road furniture and signage.



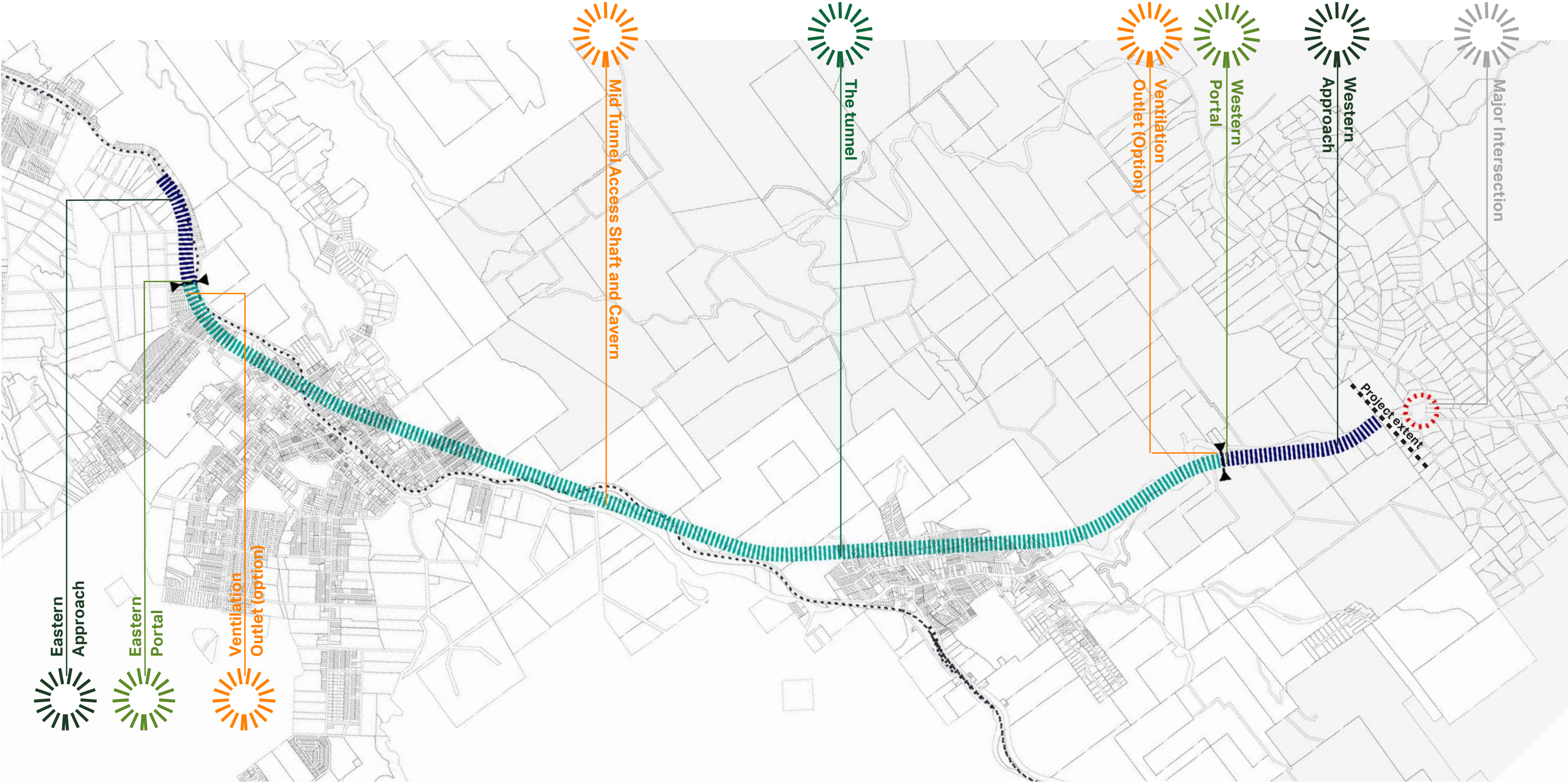


Figure 5-36: Plan showing urban design elements



Not to scale



### 5.8.1 Interchanges

Where the existing Great Western Highway and the project upgrade works interface, key user decisions are made. These decisions must be guided by orderly, safe design interventions with clear visual prompts:

- Decision elements
- Significant Markers
- Distance Visibility.

All new road design, structures and built elements must be integrated sustainably and harmoniously with the existing context, while clearly indicating merge and diverge opportunities from the existing highway to the new approaches, to and through the tunnel, in both directions, and to the townships at Blackheath and Little Hartley.

The strategy is integrating these intersection interfaces with appropriate considered urban design elements and landscape design, visually acting as ‘the signage’ for the change.

A set of principles has been developed to assist in this integration:

- Ensure the design at the interface is aesthetically simple and clean, applying the narrative and theming around connecting through and across Country
- All urban design elements should contribute to a low maintenance, functional and legible design outcome, with increased user amenity
- Connectivity should be safe and visually appealing for the road users, guided by the consistent application of the established urban design objectives and principles
- The design should reflect and satisfy community urban and environmental aspirations
- The materials, finishes and colours should respond to their immediate and diverse contexts in both locations in section and elevation.

#### The driver experience at Blackheath interchange

Drivers travelling west will travel along the Great Western Highway (GWH) until they reach a highly visible at grade decision making point where the Blackheath exit diverges to the left and continues towards Blackheath and the new (GWH) diverges to the right and continues towards the tunnel .

As the driver diverges right, they will sweep around a gentle bend, visually prompted by hints of the approaching portals and experience the change in the re-vegetated landscaping adjacent to the approach lanes.

Once around the curve, the driver will feel the momentum of the experience increase as the unexpected language of the portal forms appears, buried in the existing landform.

Considered signage and remote infrastructure will provide initial wayfinding prompts and the dive structure and portal walls will begin to rise in form and scale as the driver is swept into their embrace and fed into the tunnel.

#### The driver experience at the Little Hartley interchange

Drivers travelling east from Little Hartley make their decision earlier and outside of the project boundary, if they will remain on the existing GWH or enter the new GWH carriageways to use the tunnel.

Should they remain on the existing GWH, the driver will diverge left and continue travelling uninterrupted on new carriageways and over the western most bridge, rejoining the existing highway. They will experience scenic views over the Little Hartley Valley and distant glimpses of the portal structures.

For the drivers who have decided to enter the new GWH, as they travel along the new carriageways, they will pass under two bridges, both sweeping in an arc over the new carriageways.

When continuing to the tunnel, a similar driver experience to that at Blackheath greets the driver as they pass under the last bridge and enter the approach to the tunnel, where they will be greeted visually by a different landscape vista, yet comforted by a similar language of the portals and surrounding dive structure walls.

Again, considered signage and remote infrastructure will provide initial wayfinding prompts and the dive structure and portal walls will begin to rise in form and scale as the driver is swept into their embrace and fed into the tunnel.



Figure 5-37: Examples of local landscapes



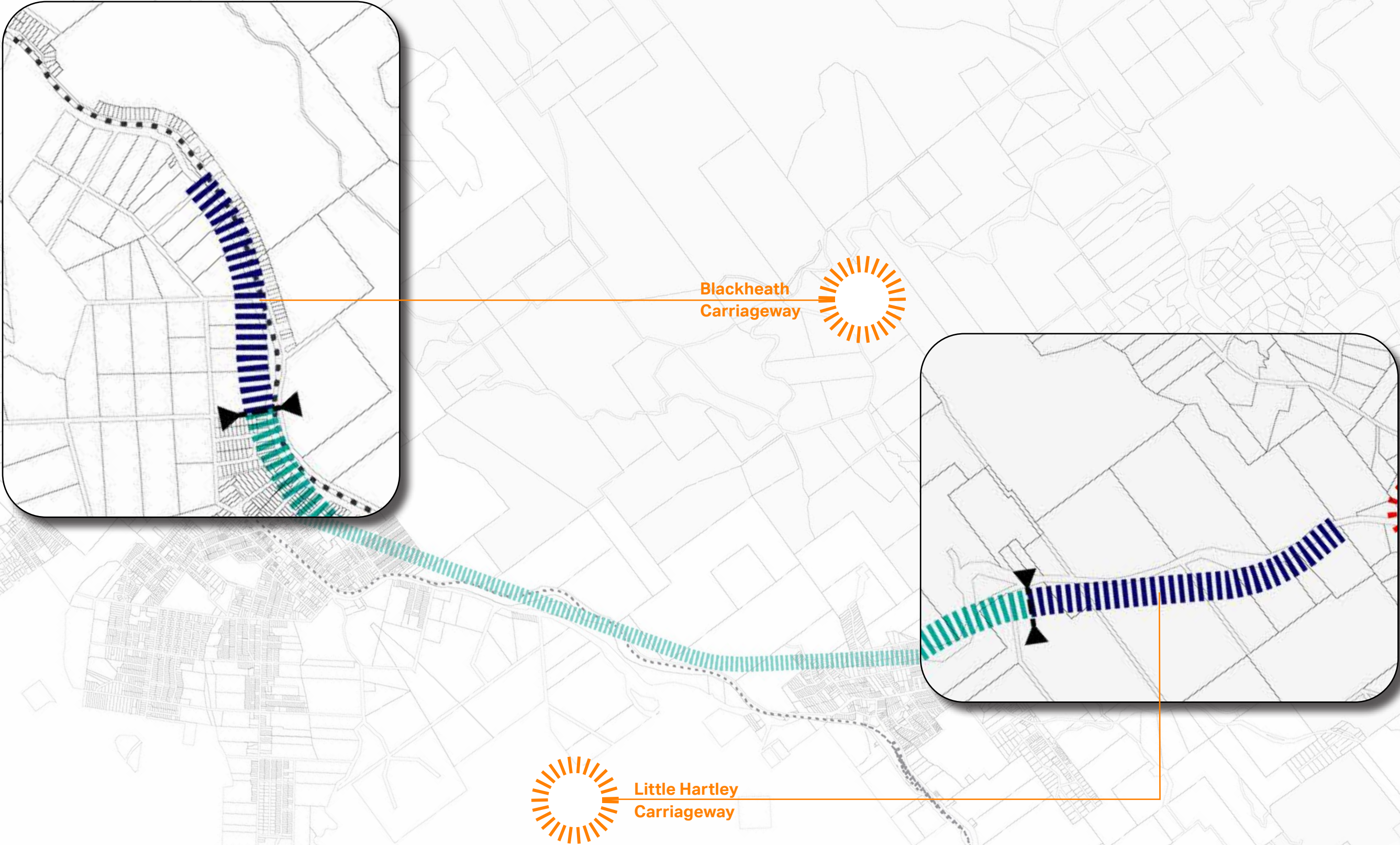


Figure 5-38: Plan showing carriage way locations





Indicative only subject to design development

Figure 5-39: Artist Impression - Blackheath Interchange





Figure 5-40: Artist Impression - Little Hartley Interchange

Indicative only subject to design development



5.8.2 Walls and dive structures

Walls and Dive Structures includes the structural walls on the approaches and exits to the portals and the general retaining walls throughout the project and around associated project facilities.

The design of all retaining structures must consider all of the other project elements to provide a cohesive design outcome where all elements appear to be of the same family, consistent with the visual language of the project.

Walls along the Great Western Highway approach and through the project, occur in a number of disconnected segments, with varied lengths, heights and typologies. Due to the complexity of this constraint, the overall design approach is simplistic and refined with minimal decoration.

A number of general principles for the Walls around and including the dive structures have been developed;

- Walls should be consistent and continuous along the corridor and should relate to the site context and place
- Avoid mixing wall types and materials, form, colour and detailing should be aesthetically consistent
- Materials should be considered for maintenance, durability, weathering, vandal proof, graffiti and safety
- The tops of the walls should run parallel to the road surface and should follow the road grade where possible. Stepping of the walls distracts the road user as the visual parallel continuity is disturbed
- The walls and dive structures should be designed in context as part of the visual experience. Keep them aesthetically consistent with the corridor design elements and tunnel experience
- Avoid blocking views, overshadowing and surveillance sight lines
- Angling the walls away from the road – not installing vertically, can have significant visual benefit, reducing wall dominance and opening up view lines and vistas, making the user feel less ‘boxed in’
- Consider strategic planting to assist in the reduction of the wall dominance, provide visual amenity and relief and to assist in noise reduction
- Where space is available, noise mounds should be considered in lieu of walls as they are more easily integrated into the landscape
- Walls should be neutral in colour with non reflective finishes
- Conceal all fixings or expressed as a function of the design if concealment is not an option
- Layout should be simple with linear or large radius curved alignment - avoid changes of direction to maintain rhythm and the horizontal experience
- All structures to be fully integrated into the adjacent location.

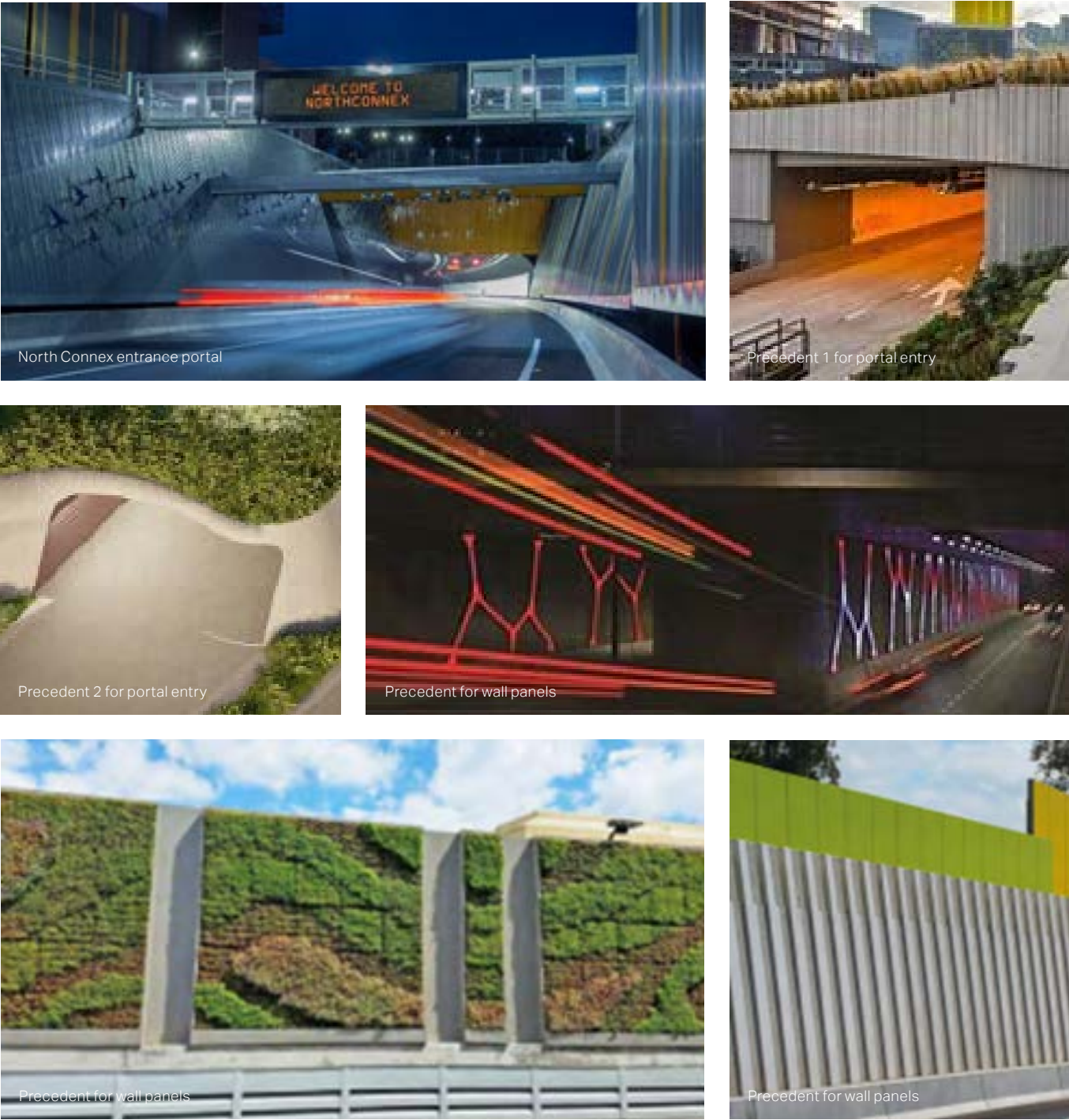


Figure 5-41: Precedent images for walls and dive structures



The design strategy developed for retaining wall finishes in conjunction with the civil designs are based on the following criteria and assist in determining texture, pattern and typology.

- Where possible and subject to scale, rock cuttings are to be left exposed as retaining elements to minimise the extent of engineered insertions into the landscape
- Where visible, the walls have a consistent theme of an embedded, angled ribbed pattern to the surface, providing light and shadow and describing direction through placement. Even those walls that are not easily visible will also provide a similar aesthetic, consistent with the suite of design elements and portal wall and dive structures
- Where alternative horizontally panelled retaining walls are interstitially proposed as a result of engineering requirements and their function, the intent is to fabricate the horizontal panels to be visually consistent with the angled ribbed pattern design
- The angled ribbed panels, or alternative surfaces with the same design aesthetic are selected so as to appear visually consistent in large or small applications.

Additional principles applicable to guide the design of the general retaining walls throughout the project are as follow;

- All of the retaining walls must be integrated within a linear identity to maintain continuity along the corridor, while being laterally integrated at identified key intersections/interchanges
- Maximise the response opportunities to the existing landforms and ecosystem by the sensitive design of retaining walls and concurrently minimise the disturbance by considering natural alternatives
- Colours, texture, finishes and materials should be low maintenance and consistent with those described for walls and dive structures.

To ensure successful application of the walls, dive structures and retaining walls, all of the applied finishes or structures must be relevant to their context, suitable to the structure and consistent with the suggested theming detailing. The landscaping strategy must be fully integrated to allow for the softening of any visual impacts.

General wall panels

There are various methods used to integrate pattern into or onto the surface of a structural element, the most common being to imprint or recess the pattern into the surface of the panel.

This can be done in a range of ways including off form, and casting and finishes can be applied during the process, in the substrate mix or after the process with applied finishes, to achieve the desired outcome.

To achieve the angled ribbed pattern theme, the off form imprinting method, with a coloured substrate would be most suitable and would be the desired approach.

For structural stability and durability, the depths of any of the ribs should be a minimum of 40mm, although the depths may vary if more varied texture is desirable. The depth of the panel to be determined by the engineers.

As the panels are part of a contiguous suite, the pattern imprints should extend to the edges and be arranged to maintain visual repetition.

Wall colour

Colour Selection should ensure that the walls remain visually recessive and blend with the natural landscape and tone of the landform. This should be consistent along the project corridor to ensure the linear identity is maintained.

The preference for durability is that the retaining walls across the project are integrally coloured, to avoid the application of a paint finish, to ensure a low maintenance and consistent finish.

The colours would typically be ochre and earth tones, reflecting the colour of the existing landforms and geology at each of the interfaces and across the project.



Figure 5-42: Selected Wall Materials



Figure 5-43: Marstunnel Zutphen, Netherlands



Figure 5-44: Bowen Place Crossing, Australian Capital Territory



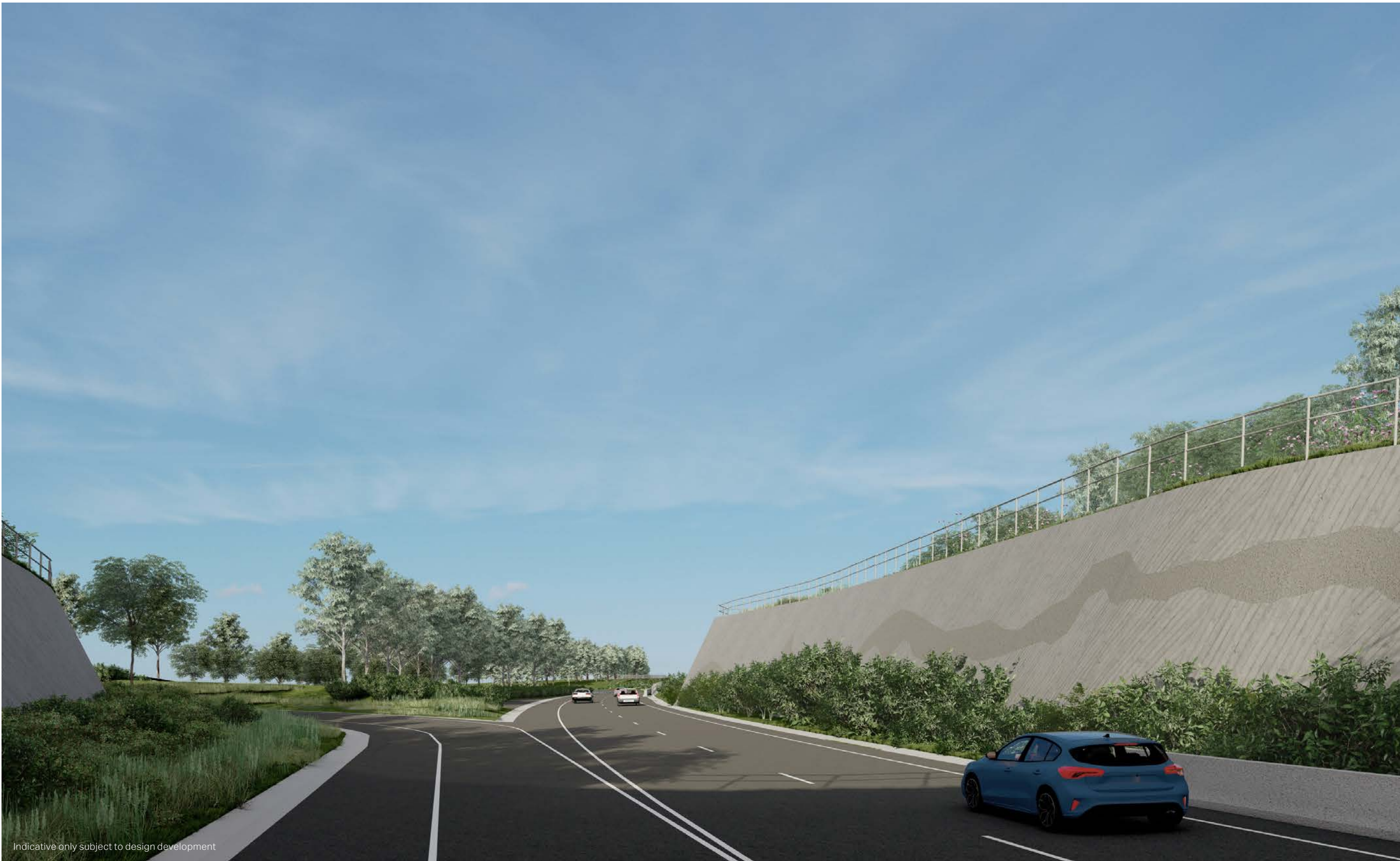


Figure 5-45: Artist impression Blackheath dive structure





Figure 5-46: Artist impression Little Hartley Portals



5.8.3 Surface buildings

Surface buildings generally consist of control centres, ventilation facilities (option), weighing stations, pump structures, electrical substations, water tanks, maintenance and emergency management facilities.

Careful design of the surface structures and the open space surrounding these structures adds to the community value, particularly above the portals, dive sites and any overhead structures.

There is an opportunity to create visual moments at the structure locations so that they become a part of the identity and memorable, where applied integrated art and landscape design can create character and hide the undesirable nature of the function.

Burying or sensitively screening the surface structures can mitigate visual impacts as the structure merges seamlessly into the landform and can create land bridges, re-inforcing the narrative around connecting to and across Country.

Principles developed to influence the surface structure form and placement include:

- Structures should be low maintenance, sustainable and used as expressions of place, identity and value
- Structures should be designed as high quality pieces of architecture sympathetic to and integrated as a best fit with the surrounding context and vernacular
- Designs should attempt to reduce the visual impact of these structures and any associated out buildings
- Locating surfaces structures too far from the tunnel spreads the impact over a wider area which is a direct conflict with the urban design aspirations of the project
- Any integrated art on any structural elements must be able to be appreciated at speeds of 80 kilometres per hour or above



Figure 5-47: Precedent images for surface buildings





Figure 5-48: Artist Impression Little Hartley surface buildings showing ventilation outlet (option)



5.8.4 Ventilation outlets (option)

Ventilation outlets are located at the portals at Blackheath and Little Hartley and shown as integrated into the structure.

Ventilation outlets remove motor vehicle emissions from within the tunnel so that it can be used safely by motorists. They discharge these emissions into the atmosphere at sufficient height to protect the health and well being of the community near the outlet.

The appearance and location of ventilation outlets can be contentious in the community and are perceived as an unwelcome intervention in the landscape. It follows that the outlets should be designed to be complementary with the characteristics of the surrounding environment and to community aspirations.

Principles developed to influence the form and placement of the outlet structure include:

- A simple and refined design, responding to the surrounding rural character either in form or decoration
- Colours selected should allude to the bushland character and assist in the visual reduction of the form and provide visual calming where integrated with the portal structures
- The design could reflect the dynamic movement of traffic. Use of diverse forms, textures and colours can break down the monolithic scale and attempt to create a less industrial visual experience
- Consider low maintenance planting cover to grow up and around the structure to assist in camouflaging the scale and providing a visually ‘green’ solution
- Sites should be selected close to the portals and away from highly sensitive land uses.



Figure 5-49: Precedent images for ventilation outlet





Indicative only subject to design development

Figure 5-50: Artist Impression optional ventilation outlet Blackheath



5.8.5 The portals

The portal design should be kept simple to reflect the nature of the existing landforms and surrounding landscape, respectful of Country.

By design, the portal becomes a major visual element as it extends along the length of the approaches, wraps around the stagger of each of the east and west apertures and finally around the surrounding landforms as one contiguous element, blending back into the landscape at both the Blackheath and Little Hartley project sites.

Road safety elements, including signage and overhead truck gantries, detection and security systems will be located in the approach zones to and at the portals, which further necessitates the simplistic design of the form to avoid visual clutter.

Design Principles have been developed to influence the design, user experience and driver comfort at the Portal Approaches, the Threshold Transition Zones and the Portals themselves and include:

Portal approach

- Upcoming length of travel in distance and time measures to the exit should be posted well in advance of the portal so the portal is clean, legible and free of distraction
- Avoid mass signage in the last 200metres before the portal to avoid driver distraction and confusion
- Maintain the shoulder width (or emergency lane width) on approach where possible. Any change in road width should be managed well in advance of the entry portal
- Provide clearly defined lanes
- Detailing, bulk, mass and sympathetic material selections are key in design of all elements in this zone
- Provide vegetation to assist in glare reduction and support a bushland re establishment.

Threshold transition zones

- The threshold is where drivers tend to fixate on the road and may slow down to adapt to change. Ensuring this zone is designed free from visual clutter is key
- The first 70metres is the most important zone for adaptation of the eyes. Higher lux levels in lighting at the entrance can assist with this – while not increasing reflectivity. Materials selected around this zone and the portal can minimise reflected light
- Use of overhead lane indication displaying green arrows assists in the perception of safety
- Any merges, diverges or junctions should be well clear of entry and exit zones.

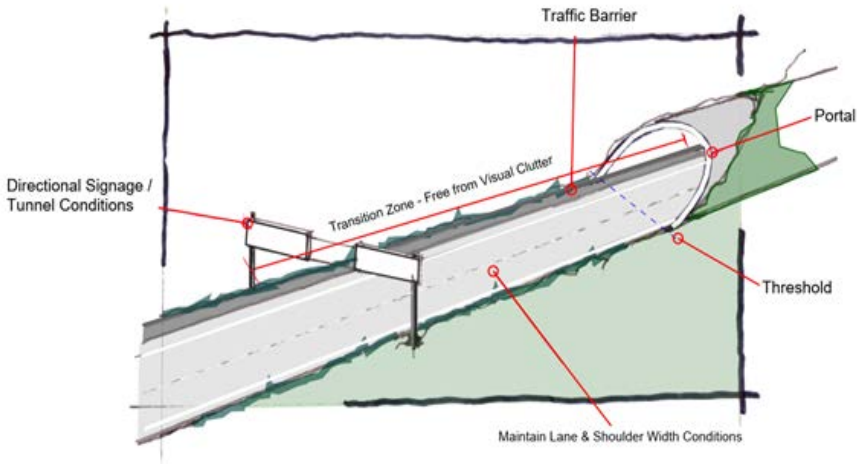


Figure 5-51: Conceptual sketch of tunnel profile



Figure 5-52: Precedent images for portals



Portal design principles

A distinctive portal design marks the tunnel entrances and exits. The visual impact of the tunnel portal should be well considered and integrated into the surrounding environment, determined by the principles around designing with Country, existing landforms, landscape conditions and geomorphology.

A simple, low maintenance, sculptural form, integrating the local landform against a background of vegetation, providing legibility and clarity of the journey experience is desirable.

- Provide a welcoming entry. Aperture size is critical to reduce user sensations of fear and claustrophobia
- Wider and larger apertures can assist in air exhaustion to minimise short term health effects
- Simple, refined walling creates a neat approach
- A well lit portal and entrance provides a more inviting driver experience
- Use materials to suit the contextual setting at each location
- Considered landscape should be used to soften the tunnel structure and integrated into the approach lanes to enhance the corridor driving experience, connecting drivers to Country. These should be low maintenance and easily accessible
- The portal can be used to frame views at the exit to continue the driver experience along the corridor
- Avoid portal surface reflectivity to keep the sun out of the eyes of the user on approach
- Signage should be sensitively located and easy to read.

Pavement

Asphalt or concrete are the main road pavement options on the approaches and concrete will be the in tunnel pavement finish to engineers specifications.

- Albedo levels of the surface options should be examined to inform the pavement selection to assist in driver comfort and assist in heat island effect mitigation
- Lighter surfaces provide more reflectivity which could assist in the reduction in the lighting load
- Open grade asphalt is not permitted in the tunnel, as it may retain flammable or toxic spillage
- The pavement type should consider the expected project life, aquaplaning potential near the entry and exit zones to the tunnel, should there be surface change and road geometry
- Avoid drainage pits in trafficable lanes.

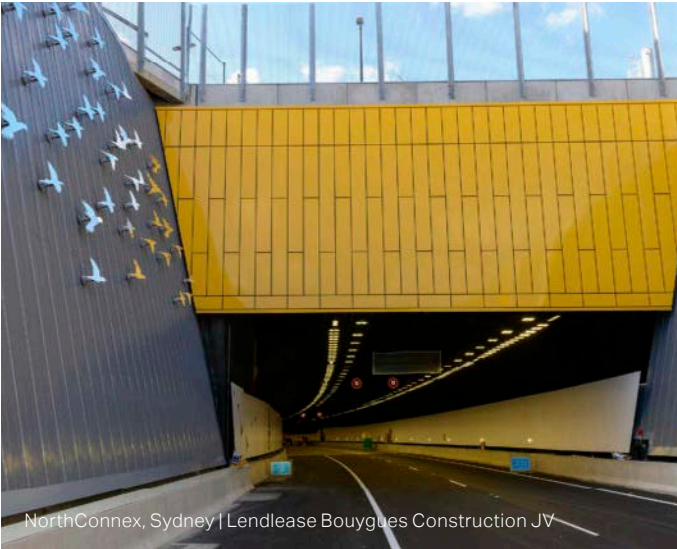


Figure 5-53: Precedent images for portals





Indicative only subject to design development

Figure 5-54: Artist impression Blackheath Portal





Figure 5-55: Artist Impression - Little Hartley Portal



5.8.6 The tunnels

The tunnel concept builds from the continuation of the themes around designing with Country applied at the approaches and portals and continues the above ground experience as a transition of linear movement through the landscape context as one that is visually connected.

The vision is setting up the context to create an integrated tunnel and surface user and driver experience that is memorable while providing a wayfinding narrative linking Blackheath to Little Hartley and beyond, through the connection of form and journey.

The concept should provide an environment recognising the link between the two experiences of the driver and the interaction with the tunnel from the above ground surrounding areas where the portals are located and provide a low maintenance asset during the operational phase.

The user will inform the perception of the projects identity and legibility, Understanding their experience by being aware of their needs around decision making and providing prompts addressing their shifting visual field is vital to deliver a continuous travel experience.

These are two different, 'disconnected ' experiences, yet the concept seeks to express these as an interwoven, continuous experience, travelling along the Highway through the form with wayfinding triggers and continuous unified visual elements.

The preliminary themes considered to be applied are:

- Cultural Interpretation - Songlines and Patterns in the landscape
- Reflections on Place - The Past, The Present and The Future
- Balance - No beginning - No End and Nature.

And include:

- References to the undulating typography of the above ground condition
- Interpretation of the natural elements, scaled and altered to suit the tunnel
- Animation of the enclosed tunnel environment
- Establishment of a visual rhythm through graphical theming
- The patterns of light and shadow in nature driving the visual experience.



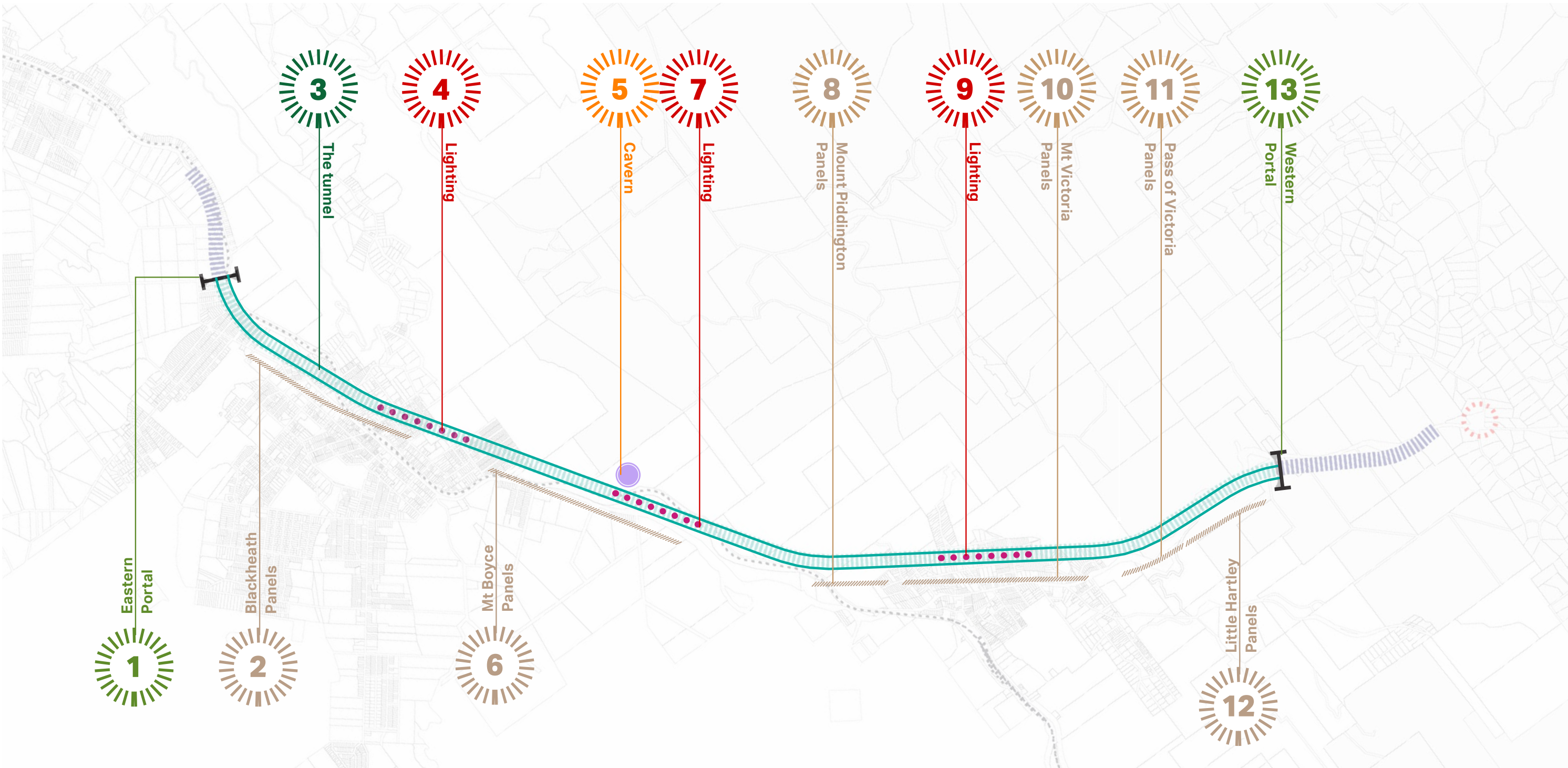


Figure 5-56: Key assets along the alignment



Not to scale



Design principles

- Create a narrative that reference the surface identities along the corridor through visual events in the tunnel
- Ensure major decision points are enhanced to include visual stimulation and movement with colour and feature panels relevant to the local context
- A successful and safe driver experience should include features that add:
  - Interest and variety
  - Provide wayfinding clues
  - Ensure a smooth transition between inside and outside environments.

Long tunnel characteristics

- The tunnel is an enclosed, controlled environment, usually speed restricted with horizontal, lateral and vertical restrictions. Internal restrictions can change user perceptions and provide design challenges
- There is more embedded carbon, greater maintenance cost and more cubic metres of exhaust material to dispose of, potentially more junctions and required ventilation shafts
- Length affects driver behaviour, safety and security, vehicle recovery, emergency access and evacuation
- Driver concentration is reduced and the monotony of length can be sleep inducing.

Challenges

- The increasing length of the tunnel and the change in potential human behaviour to contribute positively to the journey
- Integration into the built environment /context to ensure the best relationship with character of the area and landscape
- Breaking up the potential monotonous journey through a long tunnel
- Stimulating the driver to reduce fatigue and loss of attention
- Ensuring driver connection and orientation to the place/context
- Providing the appropriate dimension to minimise user confinement sensations and provide for adequate mechanical requirements
- Appropriate colour selection to provide consistency at portals and throughout the tunnel to balance light levels and reduce sudden contrasts, while promoting a feeling of spaciousness.
- Providing and managing merge, diverge zones and appropriate safety mitigation.

The tunnel user

The way people react to situations and changed conditions is varied. Their needs and coping mechanisms have significant effect on the tunnel design. Understanding driver behaviour is essential to mitigating safety risk.

There are three tunnel user types identified and each have different needs.

- Daily commuters – Should quickly become accustomed to the tunnel environment and are likely to benefit from successful wayfinding and orientation signage as well as features designed to stimulate awareness throughout the journey
- Commercial and Freight Drivers – May use the tunnel frequently and current usage mandates suggest they would also become quickly accustomed to the environment with experience through multiple tunnel journeys
- Occasional Users – Most likely to benefit from a positive tunnel experience, way finding, orientation, clarity and spatial awareness by design.

The perception of tunnels being dangerous, dark, confined and noisy with unhealthy air quality, drives fear into the user and the design must provide a solution to each of those fears through safe design, an appropriate lighting strategy, a spacious cross section, innovative ventilation and exhaust extraction.

Driving in tunnels requires heightened attention and focus which can lead to heightened vigilance, but this can also cause increased fatigue. Various methods of visual engagement should be introduced along the tunnel journey to assist in providing visual interest as well as mitigating the risks from driver fatigue.

- Colour or theme change should be used to improve legibility of special features – such as exits points
- Ensuring that the tunnel journey replicates the external road features in both design and scale while keeping the journey as consistent as possible, can assist in avoiding behaviour change at the key entry and exit transitions
- Estimating distance and time travelled and orientation is challenging underground, so adequate and smart way-finding and signage should be used to show distance and time travelled and distance and time remaining as a minimum, as well as indicating above ground landmarks along the way.



Figure 5-57: Precedent images for tunnels



## Tunnel interiors

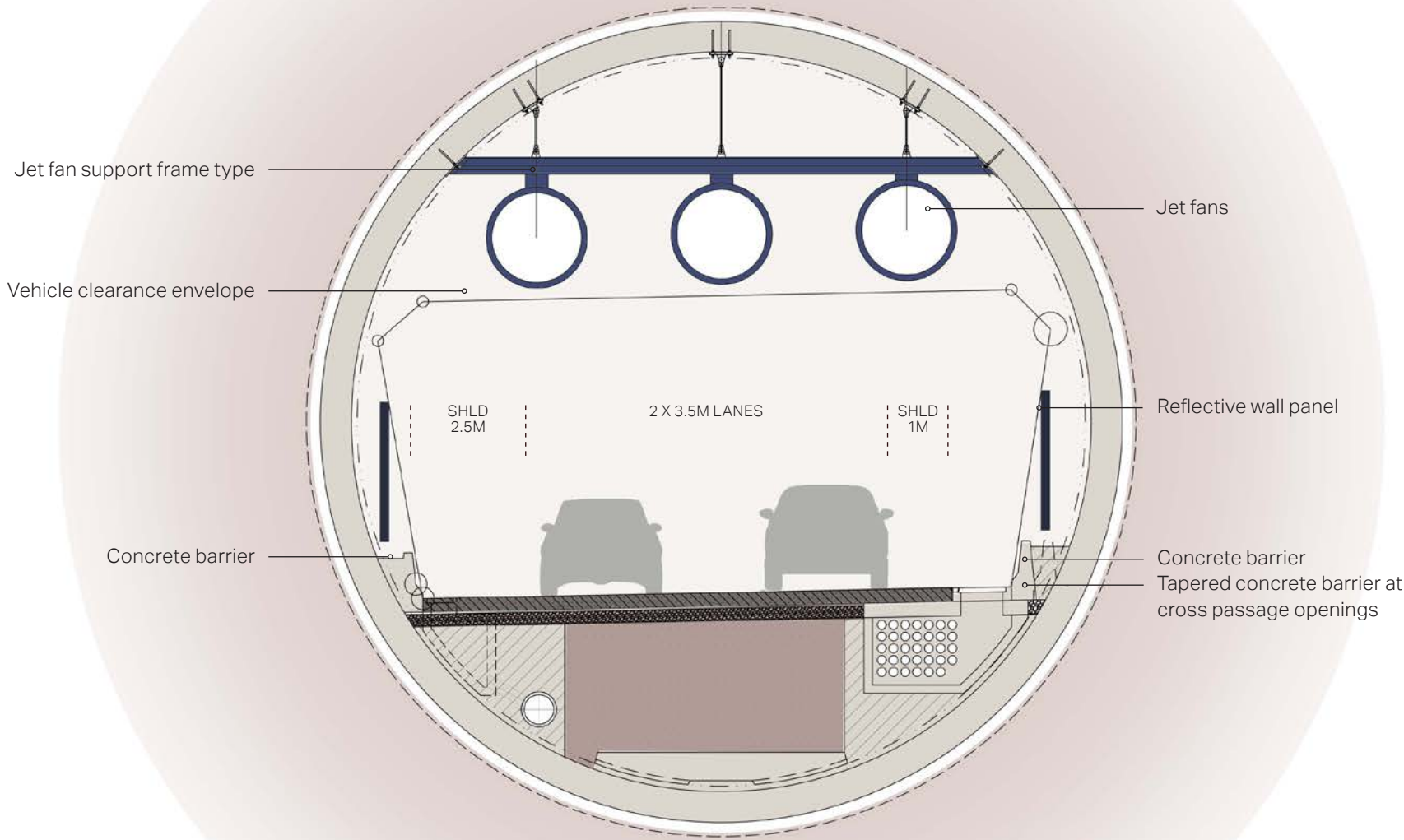
### Design considerations

PIARC Report 2008, Human Factors and Road Tunnel Safety Regarding Users (Report 2008R17) provides recommendations to improve road user safety.

- Portal design and architecture should ensure a smooth transition at entry and exits, interchanges and junctions to ensure full attention is on these transition points so that the driver feels safe and relaxed when entering, exiting, merging and diverging
- It follows that signage should be positioned in advance of the portal and should not be placed at the portal entry to provide a clean distraction free transition
- The interior and entire length of the tunnel should focus on legibility of the experience, safety and driver comfort
- Wider and larger tunnels provide a more desirable feeling of spaciousness and assist in reducing the issues discussed in 2.2.2
- By design, the wider diameter provides a larger space for air exhaustion
- The cross section should promote feelings of safety and comfort and should avoid design that elicits feelings of narrowness and confinement
- The inclusion of an emergency lane or at least 2m of shoulder/carriage width can assist in comfort and assist in avoiding lane deviation and speed
- Breakout bays where possible assist in reducing monotony. Where not possible lighting can be used to split zones and provide visual interest
- If the lane width in the tunnel is less than that outside the tunnel, then the appropriate lane width mitigation measures should be achieved and speed limit change well in advance of the portal.

### Lane and shoulder width recommendations

- Shoulders: dimensions between 1m and 2m lead to operational problems because of potential confusion and issues of drivers attempting to make an additional lane and its not quite wide enough to stop
- Dimensions less than 1metre may result in drivers shying away from the side wall and lane deviation.



**Figure 5-58:** Cross section of tunnel showing interior elements - (indicative only and subject to design development)



Wall linings and tunnel ceilings

The cladding is located on both sides of the tunnel and should be of open jointed compressed fibre cement panels (see detail) with concealed fixings and should be unreflective, clean and uncluttered and in a neutral tone for low maintenance.

The use of brighter walls has been found to be an impediment for tunnel safety. Lighter colours provide feelings of spaciousness and appear less oppressive than darker linings. (Kircher & Ahlstrom 2012; Kircher & Ahlstrom 2011)

Panels should be light in colour and ceilings should be dark and simply set out with neat rows of lighting, to keep the driver’s visual attention forward, in line with current NSW tunnel precedents.

The light panel colour and can be used as a background for panel design to introduce variety and provide visual stimulation for drivers.

Note the following:

- Changing geometric shapes may reduce the perception of the tunnel length and enhance positive feelings (Zheng 2015)
- Greens and blues induce calm (unless in an underwater tunnel), avoid red, orange and yellow combinations as these suggest danger or fire (Flo & Jenssen 2007)
- Vertical elements can provide clues on speed and curvature, but can be distracting (Zheng 2015)
- Horizontal elements don’t show wall curvature well and can be distracting, neat clean lines in panels and barriers is desirable.

All service and safety equipment and elements, such as emergency lighting and signage, Emergency equipment cabinets (EEC) and Motorist equipment cabinets (MEC) should be included, either flush mounted or recessed in to the panels.

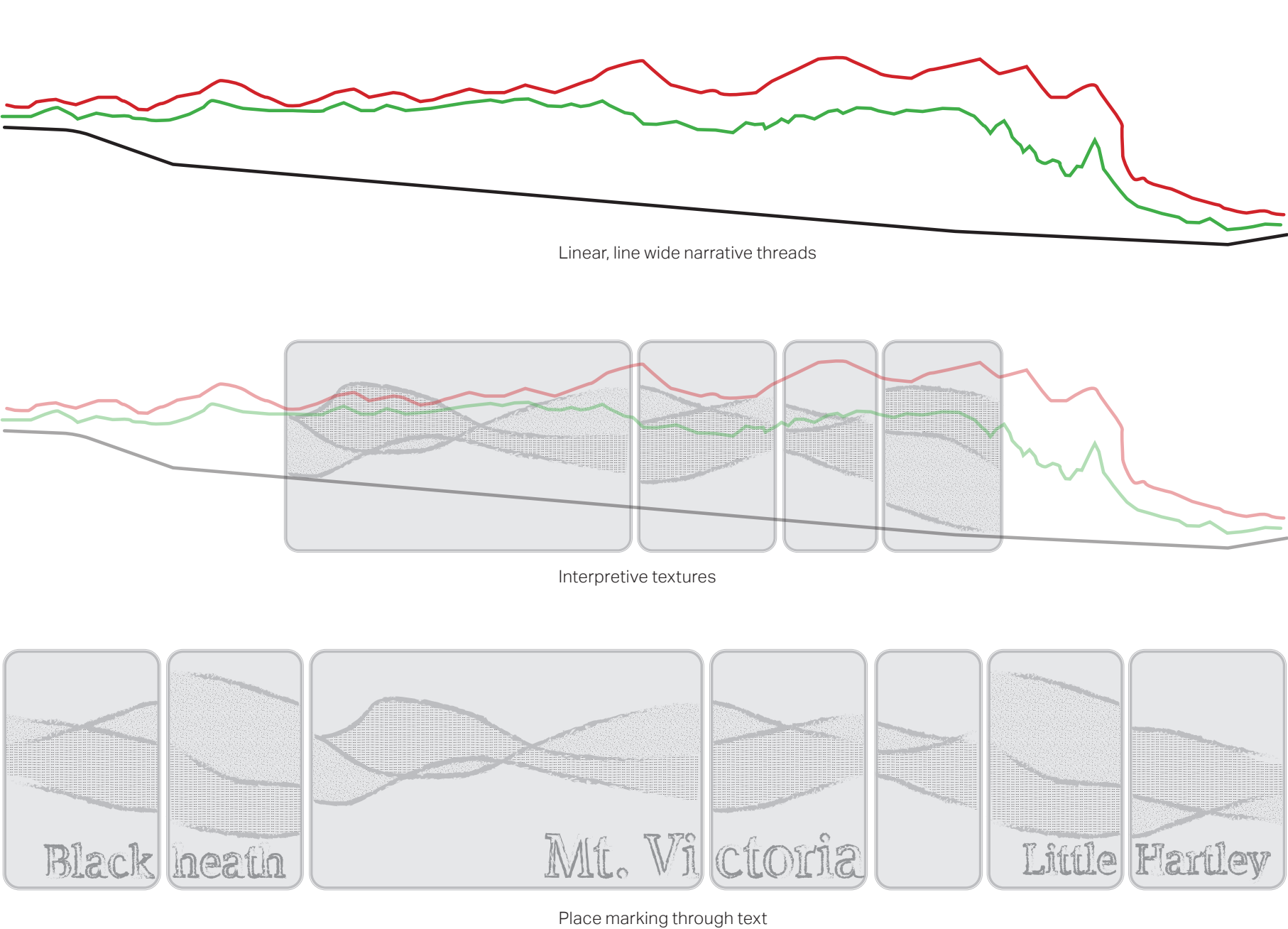
All other services such as piping, cable trays, cameras and other equipment are located above the cladding, with general lighting at the ceiling and as visual design highlights where identified.

All concrete, rock and other tunnel structure, including the ceilings will be painted black.



Figure 5-59: Precedent images for tunnels





**Integrated art and wayfinding**

There is significant opportunity within the tunnel to explore the integration of art and wayfinding on the wall and ceiling panels. Explorations of the site's layered history and surrounding context make for compelling exploration through material, lighting, texture, patination and text.

The stories embedded within art works, and location along the tunnel are to be determined in conjunction with the local Aboriginal communities and project stakeholders. Meaningful collaboration and consultation with all parties will ensure the production of site specific pieces reflecting the multi-layered history of the Blue Mountains and the Great Western Highway.

**Linear, line wide narrative threads**

Consideration of multiple narrative threads along the length of the tunnel walls, embedded within wall panels and reflecting Aboriginal, European and contemporary stories amongst others.

**Interpretive textures**

The use of textures and graphic elements at specific locations along the tunnel, perhaps in conjunction with lighting interventions, representative of flora, fauna and historic sites above surface.

**Place marking through text**

Town and significant location names included within tunnel panel system help the user understand where they are along the journey, and break the continuity of the blank panel system.

**Figure 5-60:** Example tunnel panel graphic to be developed further through consultation with stakeholders

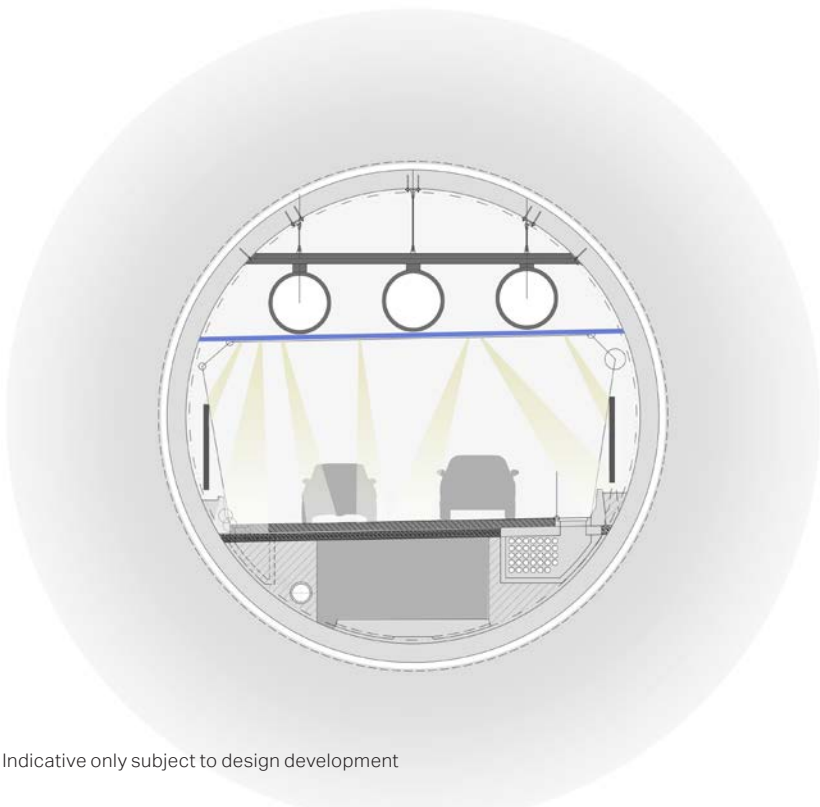


Visual Events

- **Location markers** - these are the points in between exits where suburb names are located on the wall panelling to provide local identity and identify progress and interest, potentially integrated into the developing in tunnel theme as a continuous visual experience
- **Lighting events** - wall and ceiling mounted light displays to stimulate and change the mood to assist in driver safety and provide relief from the standard tunnel experience.
- **Time displays** - these should be considered at intervals along the tunnel to show quantum of time left to travel in the tunnel
- **The cavern** - a mid point engineered marker
- **Exit markers** - exit points represented through alternative visual graphics on the wall panels to announce the approaching change of the user environment.

*Note: These elements will be more fully developed and realised in subsequent reports as they are currently under development through the cultural interpretation consultation and civil design processes.*

*Lighting effects, fixing modelling and lux differentials to achieve the desired effects need to be confirmed and studied to ensure functionality, safe distraction and positive outcomes*



Indicative only subject to design development

Figure 5-61: Cross section across tunnel showing example of light installation



Indicative only subject to design development

Figure 5-62: Long cross section through tunnel showing example of light installation





Figure 5-63: Plan showing portals and visual events



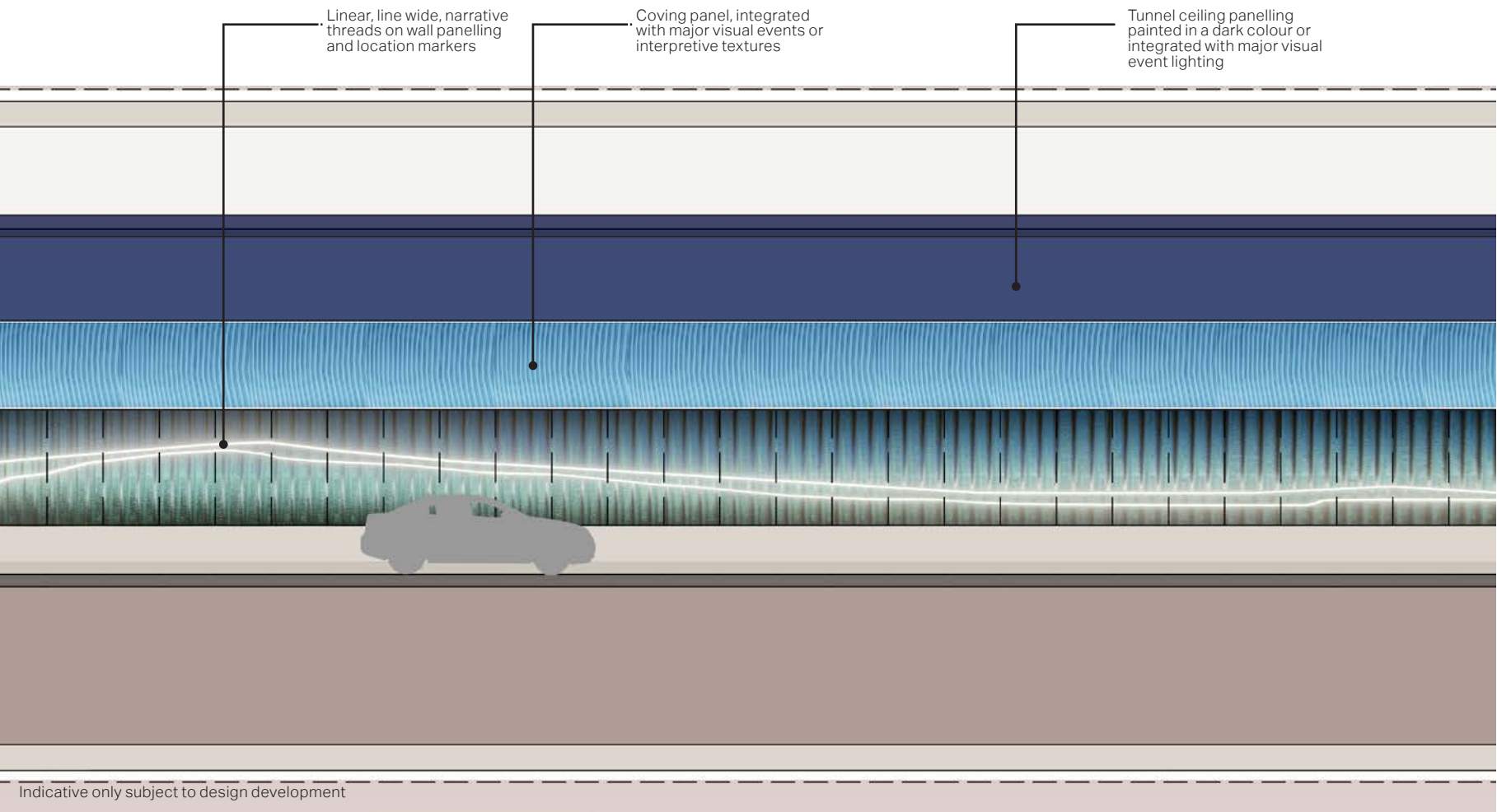


Figure 5-64: Long cross section demonstrating tunnel experience (tunnel interior to be developed further through consultation)

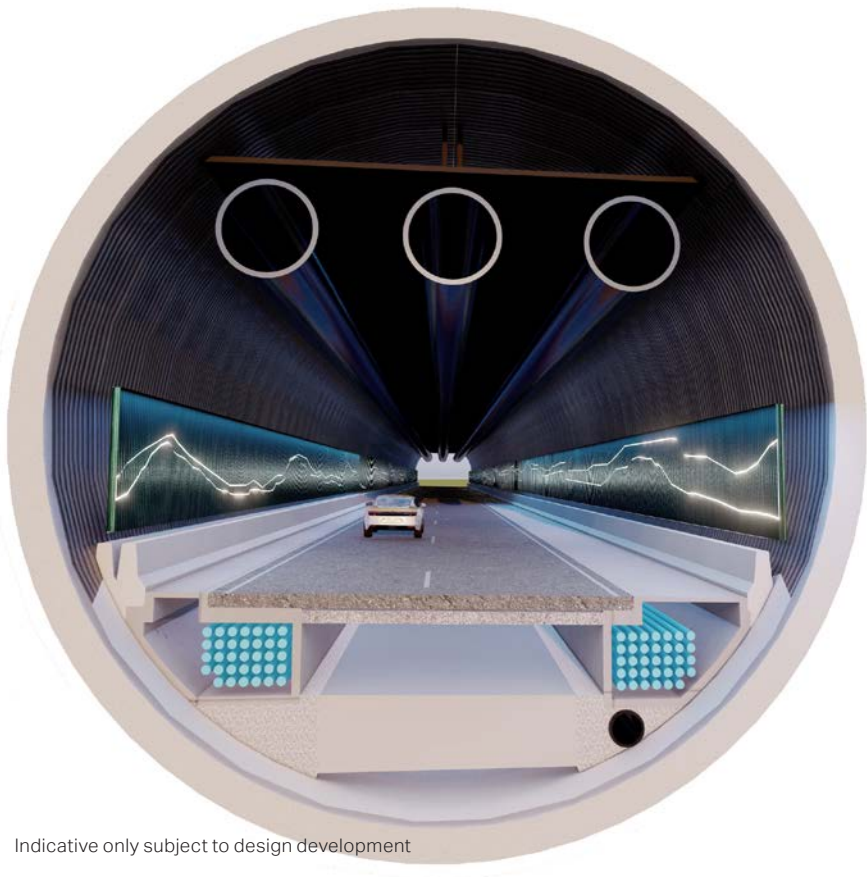


Figure 5-65: Lateral cross section demonstrating tunnel experience (tunnel interior to be developed further through consultation)





**Figure 5-66:** Artist impression demonstrating tunnel experience (tunnel interior to be developed further through consultation)



**Study: Effects of lane width, lane position & edge shoulder width on driving behaviour in underground urban expressways. A driving simulator study.**

*International Journal of Environmental Research & Public Health*

Driving Simulator

- 3 Lanes tested
- Shoulder widths of 0.5, 0.75 and 1m tested
- Speed, Lane deviation & subjective perception of driving behaviour collected as performance measures.

Results/Summary – specific to shoulder width only:

- With a narrow road shoulder, drivers tended to drive far away from the wall, with some deviating into the other lane. As the shoulder became wider, the impact became less significant
- With a wider shoulder, drivers tended to drive faster
- Wider shoulder would bring the drivers a higher perception of safety and reduce the proportion of dangerous displacement, eg transgressing-lane driving.

General findings:

- Lane & Shoulder width have significant effect on speed. Average speed at test was 60km/hr at the narrowest and 80km/hr at the widest
- Narrower lanes and shoulders resulted in reduced speeds and lateral lane deviations as drivers tend to try to stay away from the tunnel wall.
- As the lane or shoulder gets wider, drivers tend to stay in the middle of the lane and deviate less
- When more space is provided to the tunnel wall, drivers tended to move towards the inside of the road
- The wider lane and wider shoulder width gave the driver more freedom in lateral space, higher perceived safety and increased the driving speed.

**Provision for alternative fuel and autonomous vehicles**

- As Connected Autonomous Vehicles (CAVs) are developed, uninterrupted signalling must be provided to allow for safe operation. Inclusion of a consistent GPS and digital signal array must be considered
- Design should allow for space to install appropriate infrastructure for connectivity and communication between CAVs
- Electric Vehicles (EVs), Plug In Hybrid Vehicles (PHVs) and Fuel Cell Vehicles (FCVs) can affect design decisions. Risk is posed due to the release of toxic and flammable gases found in alternative fuelled vehicles within confined spaces
- Batteries can overheat or overcharge and can ignite and are difficult to extinguish. There is potential to cause further safety issues in an enclosed road environment.

**Traffic barriers**

- Used to protect the tunnel from impact
- Placement is influenced by the cross section width and also influences horizontal and vertical clearances
- Placement influences pedestrian egress during an emergency and must provide appropriate access to a place of refuge.

**Vehicle safety bays**

- This is challenging in a bored tunnel, however the larger diameter cross section allowing for a 2.5m wide shoulder, allows for the vehicle to stop, clear of traffic. Appropriate lane management would assist with risk mitigation of accidents
- If the shoulder is not continuous, or is narrow, the bays can be used at selected intervals as a design feature, as well as a functional item to split the tunnel into shorter segments – see Laerdal Tunnel Study. The benefit of these breaks in the journey are to assist in maintaining driver concentration and to reduce the monotony of the journey
- Where a cavern is considered to break the long project tunnel, the safety bay should be collocated in these areas with proposed turning bays.

**General in tunnel signage**

- Underground signage should be used to promote awareness of above ground features. Location names can be incorporated into the wall panels to achieve this
- Overhead lane indicators displaying green arrows to show lanes are open promotes a feeling of safety and that the tunnel is being monitored
- Upcoming time and distance to exit, should be posted well in advance of the exit
- Emergency exit signage should be visible and legible to enhance comfort but should not attract attention
- Avoid visual clutter, particularly at entrances, exits and junctions
- Provide in a timely location to prepare drivers for grade change, speed change, exits
- All signage in the tunnel should be consistent with that experienced outside the tunnel
- Flashing lights should only operate in an emergency.



Figure 5-67: Precedent images for tunnels



**In tunnel lighting**

Lighting should be used to delineate merges and diverges and to indicate progress and assist in wayfinding.

Different coloured illuminated zones can be used to break up the standard white light monotony. Variations in colour and pattern can be used to reduce the monotony of travel by providing visual interest.

- All age group vision constraints must be considered (Jenssen 2010)
- LED lighting can provide visualisation of alignment and distance between vehicle perception. It is also more cost effective
- Avoid lighting gaps and unlit areas.

Centrally mounted luminaires

- Basic lighting is provided by luminaires mounted continuously end to end by utilising only LEDs. This lighting type provides a high quality lighting system with good visibility and a comfortable lux level for drivers
- Additional lighting required to reinforce the entrance and exit transition zones can be achieved by the addition of further lines of luminaires
- LED lighting can be used in these zones and in the pavement for additional visibility and way finding
- In a two lane tunnel, access to luminaires is likely to require closure of the tunnel since both lanes may be obstructed. Offset lighting positioning may avoid this if practicable.

Side mounted luminaires

- Lighting mounted on both sides of the tunnel is often used when there is reduced vertical clearance, however side mounting offers the benefit of ease of access for maintenance as traffic may be able to continue to flow
- Side mounting is also used to effect in considered locations for feature lighting.

Feature lighting

- Feature lighting should be designed to stimulate alertness and reduce anxiety but not distract. (Flo & Jenssen 2010)
- By varying the lighting and landscape, this can assist in reducing driver fatigue (Yan et al. 2016).



Figure 5-68: Precedent images for tunnels



**Emergency egress, fire fighting, mechanical and communication equipment**

Unobstructed pedestrian egress from the tunnel in emergencies to relative safety is mandatory. This egress should be at the same level of the roadway surface.

In a bored tunnel, the shoulder/verge will usually be used for this, in conjunction with the tunnel cross passages, so adequate width must be available in the cross section design.

Fire deluge must be designed aesthetically and functionally into the cross section and must ensure simultaneous supply to the deluge zones and to hydrant lines informed by the relevant Australian Standards and the specialist design.

If dangerous goods are permitted in the tunnel, the drainage system should be adequate to manage the size of any potential fire.

Consideration of the integration of all mechanical equipment and services, emergency telephones and fire fighting cabinets and their placement in the tunnel interior is imperative to informing the overall interior design response.



**Tunnel exit**

- The driver must be reassured and that appropriate way finding signage is clear indicating the exit approach
- Transitional lighting is to be used for the driver to adapt to the outside travel conditions (day/night/ rain)
- Glare reduction measures should be employed – particularly in the east west nature of the project tunnel.



**Figure 5-69:** Precedent images for tunnel exits



5.8.7 Fences and railings

Fences are an integral part of road safety, defining the road corridor and preventing access to dangerous areas. The design of fencing and railing types are proposed based on their location and relevance to the surrounding environment and should be integrated with the other elements along the corridor, so that they are appropriate to their location, are detailed to suit the design language of the other road elements and contribute to the identity of the project.

The visual impact of the design should be minimised to reduce the impact on views across the carriageway and along the corridor. The fences and railings must be integrated with both the engineering and landscape design and must incorporate CPTED principles.

The design may be integrated with art outcomes around ‘Connection to Country’, from further stakeholder engagement processes with the Aboriginal groups.

Principles developed to influence the design of these elements and their placement include:

- The design, detailing and materials shall be integrated with all other urban design elements to be of low maintenance and to be recessive in their environment to reduce visual impact, with a simple appearance that serves the function
- Ensure sight lines are maintained that are suitable for safety and amenity
- Fence panels should provide a level of transparency to maximise views out from the bridge approaches
- Anti vandalism measures to be incorporated into the design and finishes for maintenance
- Where new work meets existing work, ensure that the connection is as seamless as possible.



Figure 5-70: Conceptual model of railing type 2

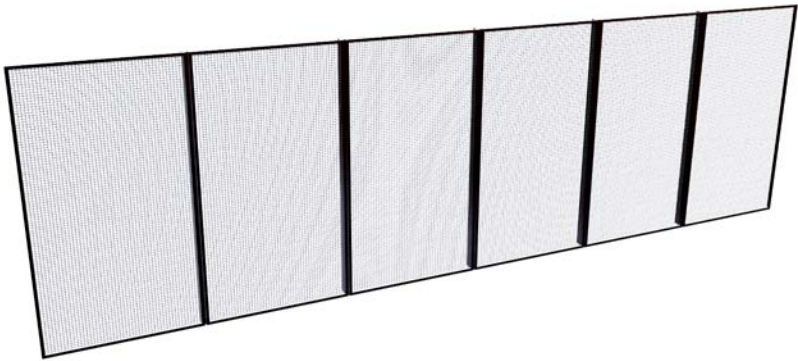


Figure 5-71: Surface building screen concept model



Figure 5-72: Examples of mesh



5.8.8 Lighting

Roadside lighting

The main vertical elements along the project corridor, at the approaches and interfaces, are the lighting poles. The selection of a suitable design that complements the suite of urban design elements used for other obligatory road items, offers an opportunity to assist in elevating the visual experience and add to the project identity.

Light poles are an accepted part of the driving experience and need to be designed to provide function, integrated into the urban and landscape design experience, but not be dominant, particularly in the Blackheath and Little Hartley environments which are both areas of high scenic value.

Further opportunities exist to brand the light poles with subtle thematic interpretations of colour or pattern, on either the vertical upright or the outreach arm.

Feature lighting could be integrated as complementary to the required road lighting, representing the colours of the landscape at either of the project interchanges and referenced in the tunnel feature lighting.

Development of design treatments will follow further stakeholder engagement with the Aboriginal groups.

In pavement lighting

This is an opportunity to develop further to assist with potential lane closures and traffic diversion

Feature lighting

The project concept provides a visually highlighted driver experience that can be appreciated throughout the day with clear wayfinding markers, forms, detailing, materials and landscape design, providing safety, direction and comfort. It is equally as important to enhance this experience at night when the natural daylight markers fall into shadow and darkness.

The sensitive and considered integration of feature lighting, will provide the visual clarity and character for the night driver experience and enhance the project identity, over and above the required lighting for safety, to ensure legibility is equally consistent for daytime travel as it is for nighttime travel.

In combination with the visual events proposed in the tunnel experience, for most road users , the feature lighting interventions at the interchanges at Blackheath and Little Hartley will be the first and last memory you have on your journey.

Principles developed to influence the design of feature lighting include:

- Be located in selected locations as identified
- Should highlight the urban forms of walls, art and relevant signage structures to highlight the nighttime experience
- Proposed lighting should be low maintenance and energy efficient, integrated to meet functional requirements, but not overpowering general safety and amenity requirements
- Selections to be based on an assessment of cost, safety, and context.

Artworks and signage

Project artworks and signage are visually legible throughout the daylight hours. As night approaches, they have a responsibility to continue their designated function as destination markers along the corridor.

Development of feature lighting treatments to complement any identified artworks or art integrated into elements, will follow further stakeholder engagement with the Aboriginal groups.

The use of feature lighting can assist in highlighting signage and wayfinding markers and can reverse the perception of what normally may appear as undesirable in the public realm of the project.

Making these markers visible at night assists in 24 hour legibility and enhances the amenity and project identity.



Figure 5-73: Example of in pavement lighting



5.8.9 Road furniture and signage

Various types of road furniture and signage is required along the project route. The most visible of those being the gantries, regulatory or directional signage and the other types including, vehicle barriers, security cameras and antennas, emergency phones, service boxes and associated access equipment and lighting (discussed separately in the previous section).

All of these elements are an accepted part of the driving experience and need to be designed to provide their function, but not appear as ‘features’, particularly in the Blackheath and Little Hartley environments which are both areas of high scenic value and environmental sensitivity.

- Road furniture needs to be designed as a simple suite of elements, integrated within the location and context of the road experience
- Barrier design should be visually simple, yet legible to perform their function where required.

Road signage provides wayfinding and legibility and assists in safety by managing the driver experience and is provided along the entire project corridor highlighting directional change, time, speed and distance travelled.

The form of these signs is the Transport standard for all roads and provides:

- Directional Signage - Destination and route guidance (green and white)
- Advisory Signage - Variable message signage, (digital and static - red and white)
- Warning Signage - Approaching curves, inclines and declines (yellow and black).

Signage placement should ensure that the driver experience is not obstructed or impeded by visual clutter. Clearance between the Highway and the signage should be consistent to ensure sight lines are maintained and that the visual impact on the surrounding environment is reduced.

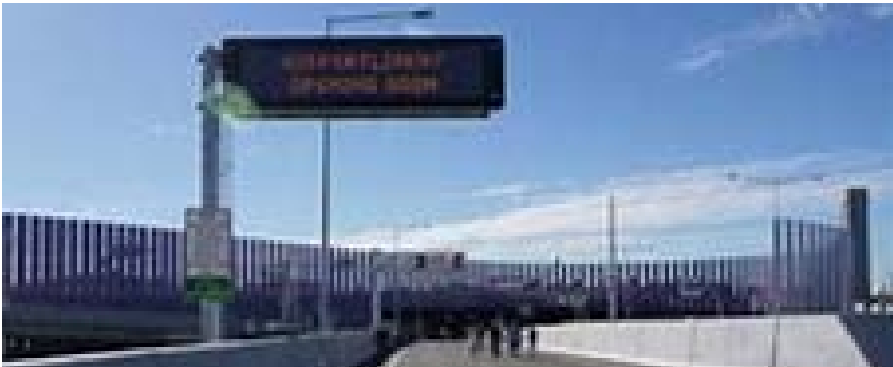
- Any planting around signage should be low to maintain visibility and for easy maintenance access
- Wherever possible single multi signage structures should be considered as an alternative to a number of separate structures to reduce visual impact and increase legibility without obstructing views.

Remote infrastructure, such as Variable Message Signs (VMS), Over Height Detectors (OHD), any overheight signage (OHS), Close Circuit TV Cameras (CCTV)

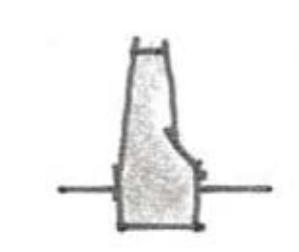
and Road Side Cabinets (RSC), should be consistently placed along the Highway in locations that best serve the function, but are not visually disruptive to sight lines within the concept design context and the environment.

- The infrastructure should be designed as a family, with a unified design and with any applied finishes relevant to their context - darker colours used to reduce visual impact
- The clearance relationships with the Highway must be consistent.

In all cases, material should be used that are easily maintainable and repairable from damage - including graffiti and vandalism and Landscape must be integrated to reduce visual impact.



Type F Barrier

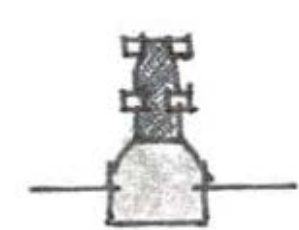


- In medians - double sided
- Along highway edges - single sided
- Bushland zones with no views
- Avoid on both side of carriageway
- Current typology used on the project.

Type F - Single sided



Modified Type F Barrier

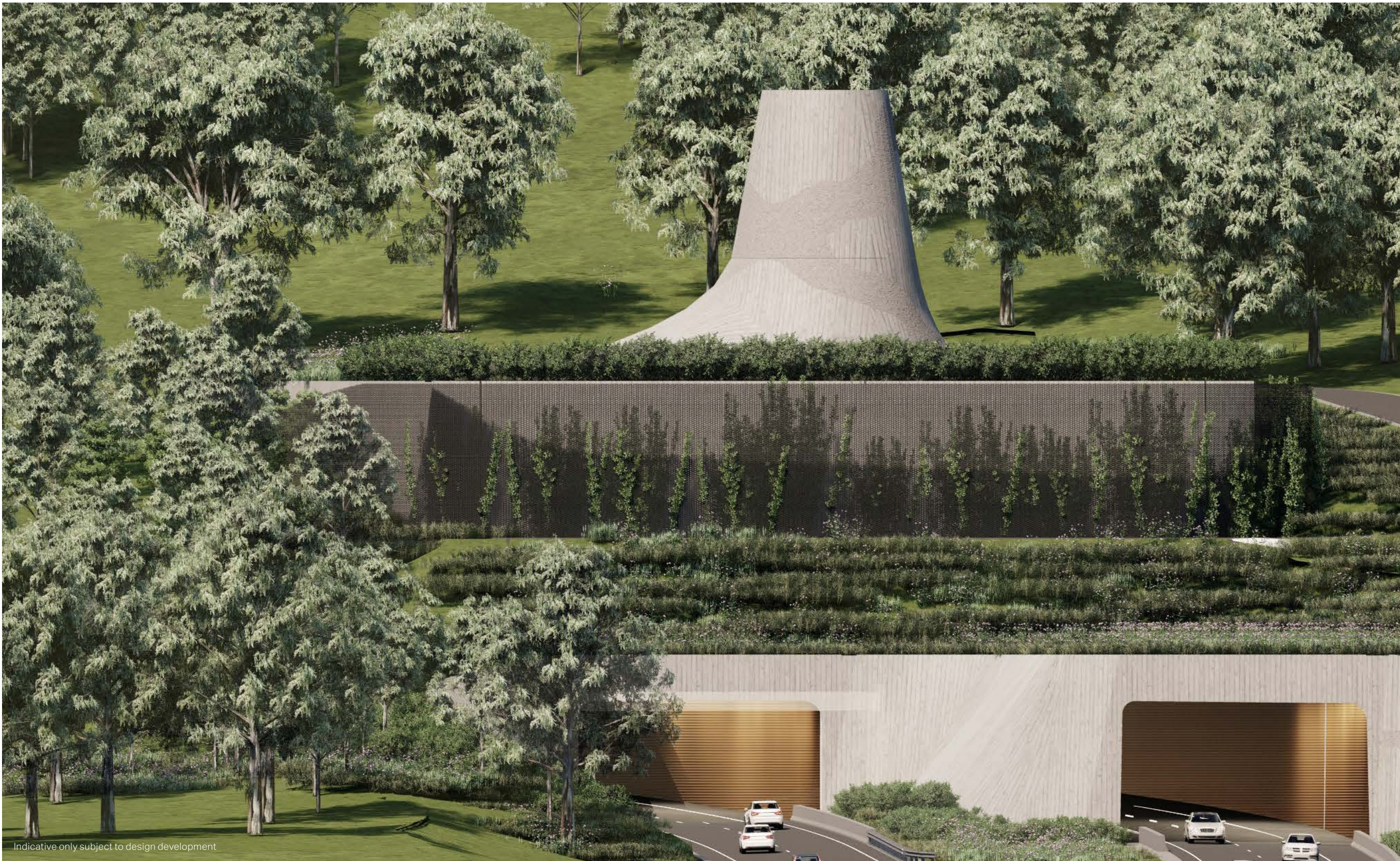


- In medians - double sided
- Along highway edges - single sided
- Bushland zones where transparency is required
- Current typology used on the Katoomba to Blackheath Upgrade
- Opportunity to incorporate into the project.

Modified Type F Barrier







Indicative only subject to design development

**Figure 5-74:** Artist impression



5.9 Urban design concept plans and sections

The project consists of three distinct urban design experiences; the Blackheath approach and portal at the eastern end, the tunnel interior under the Blue Mountains and the western approach and portal at Little Hartley

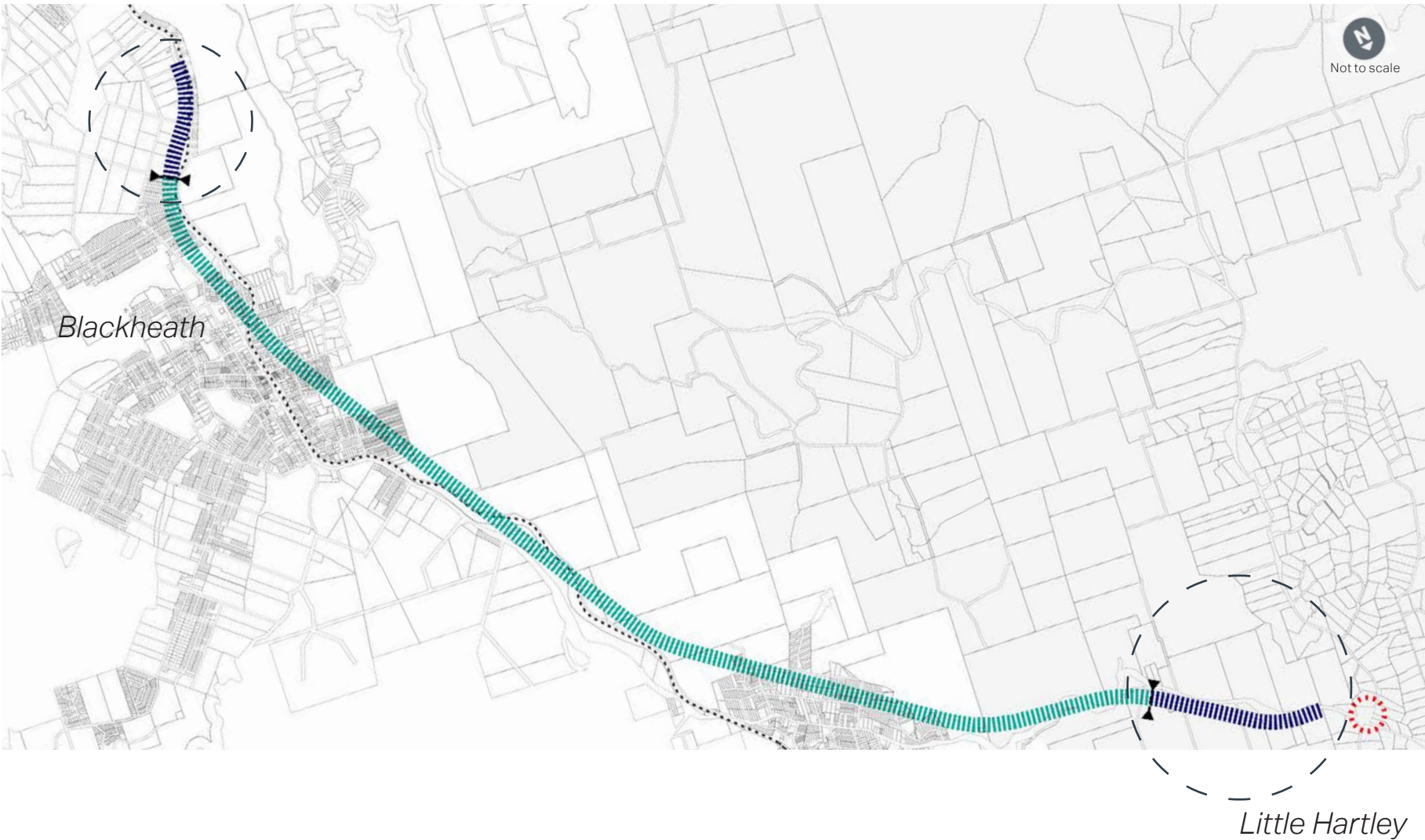


Figure 5-75: Key Plan



5.9.1 Blackheath interchange

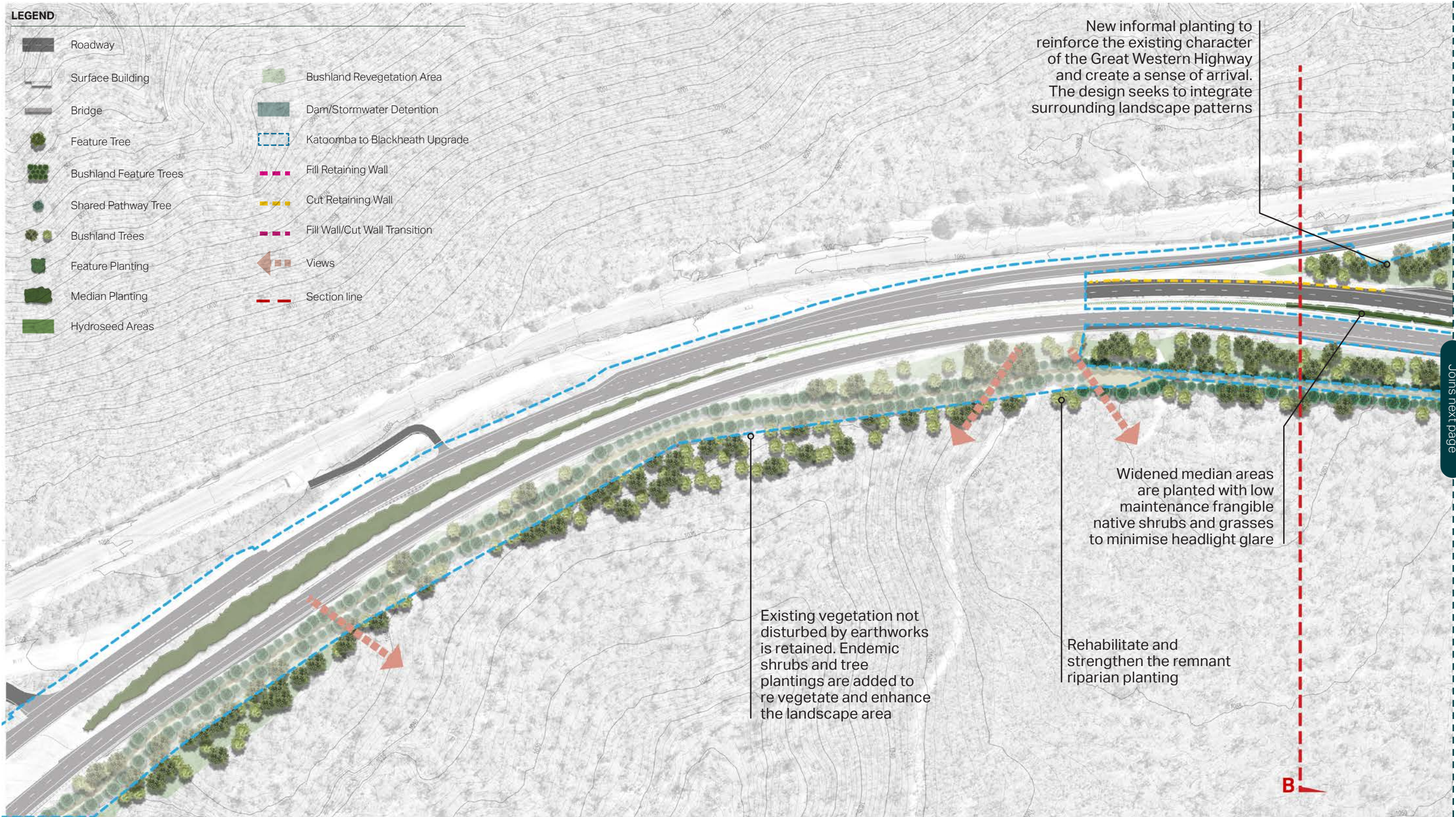
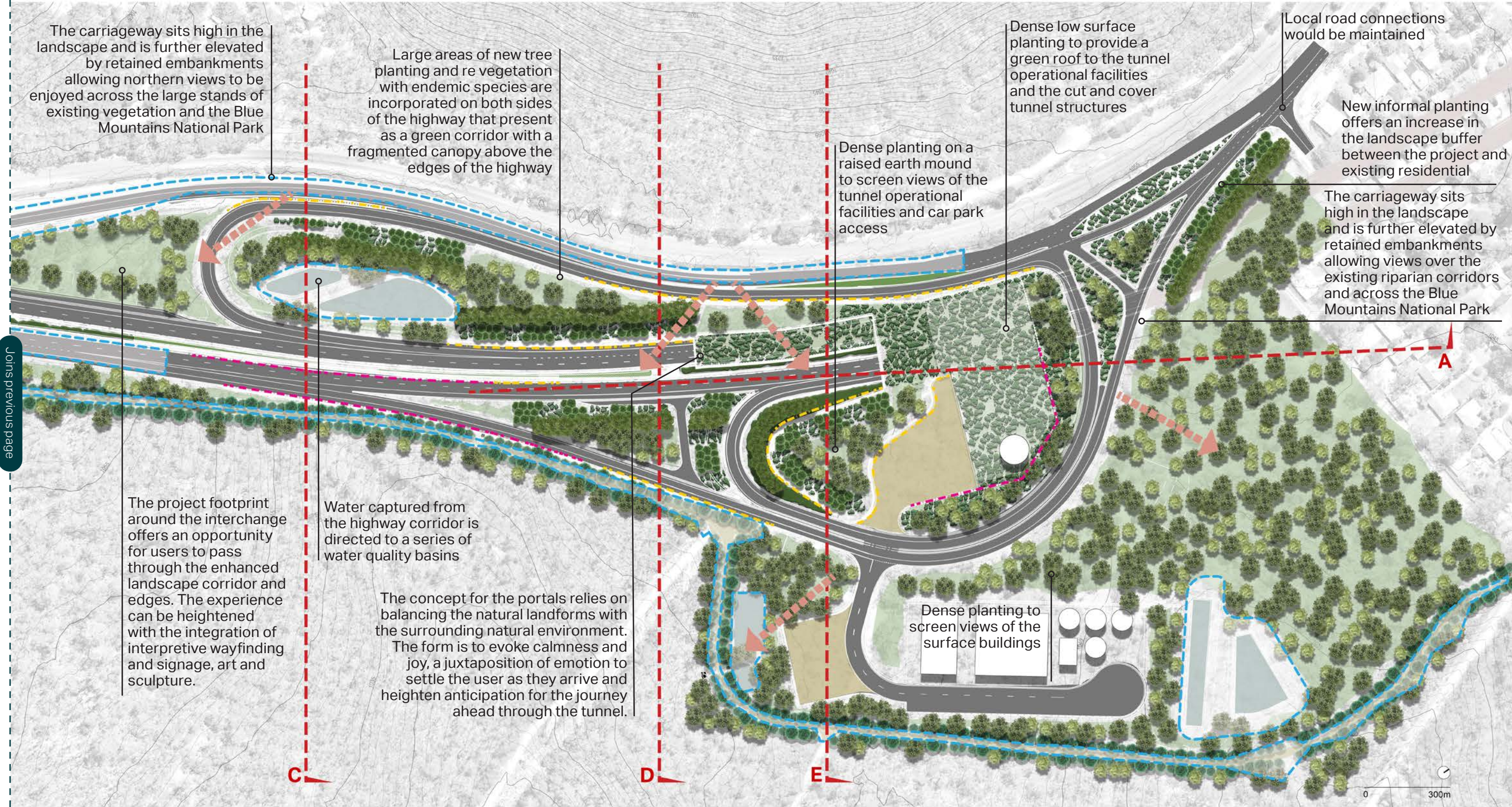


Figure 5-76: Plan of Blackheath





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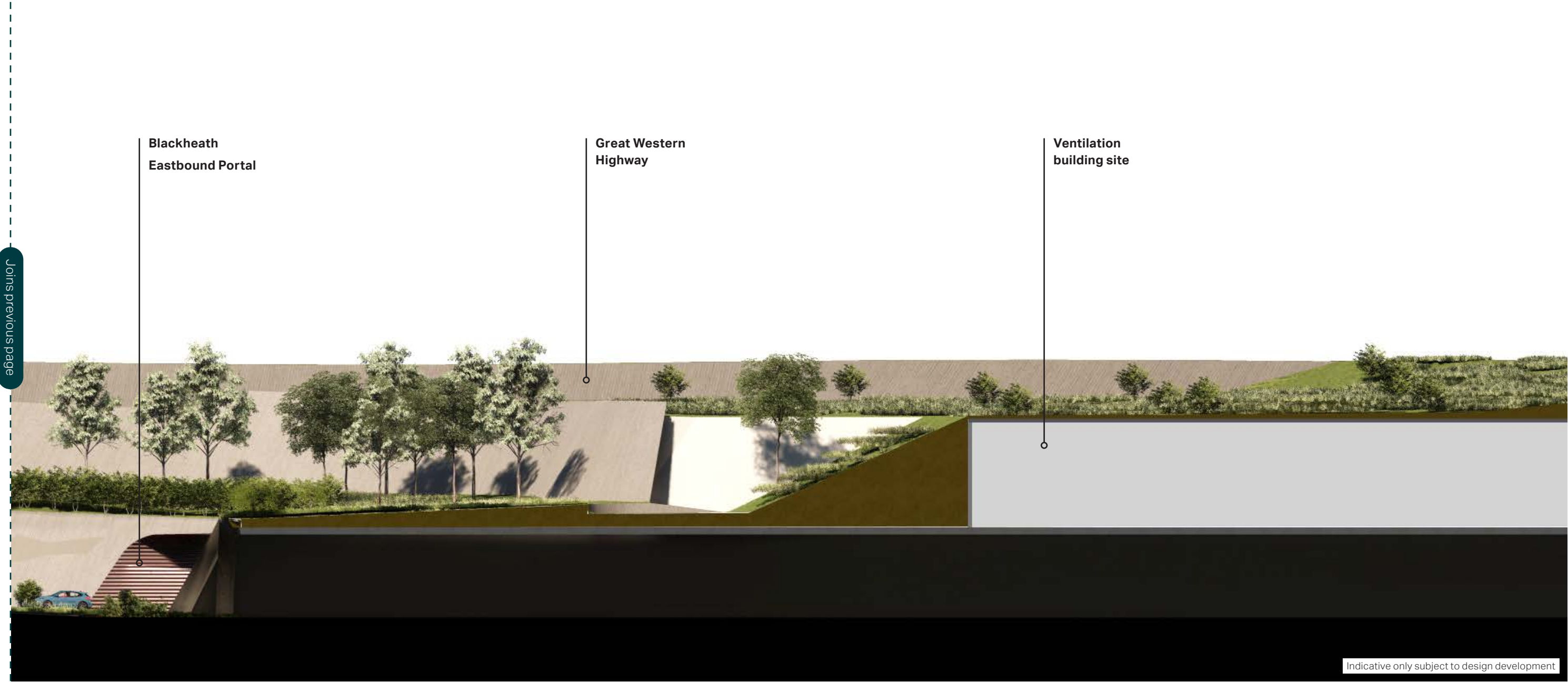




Figure 5-77: Section A - Blackheath Portal | Longitudinal Section

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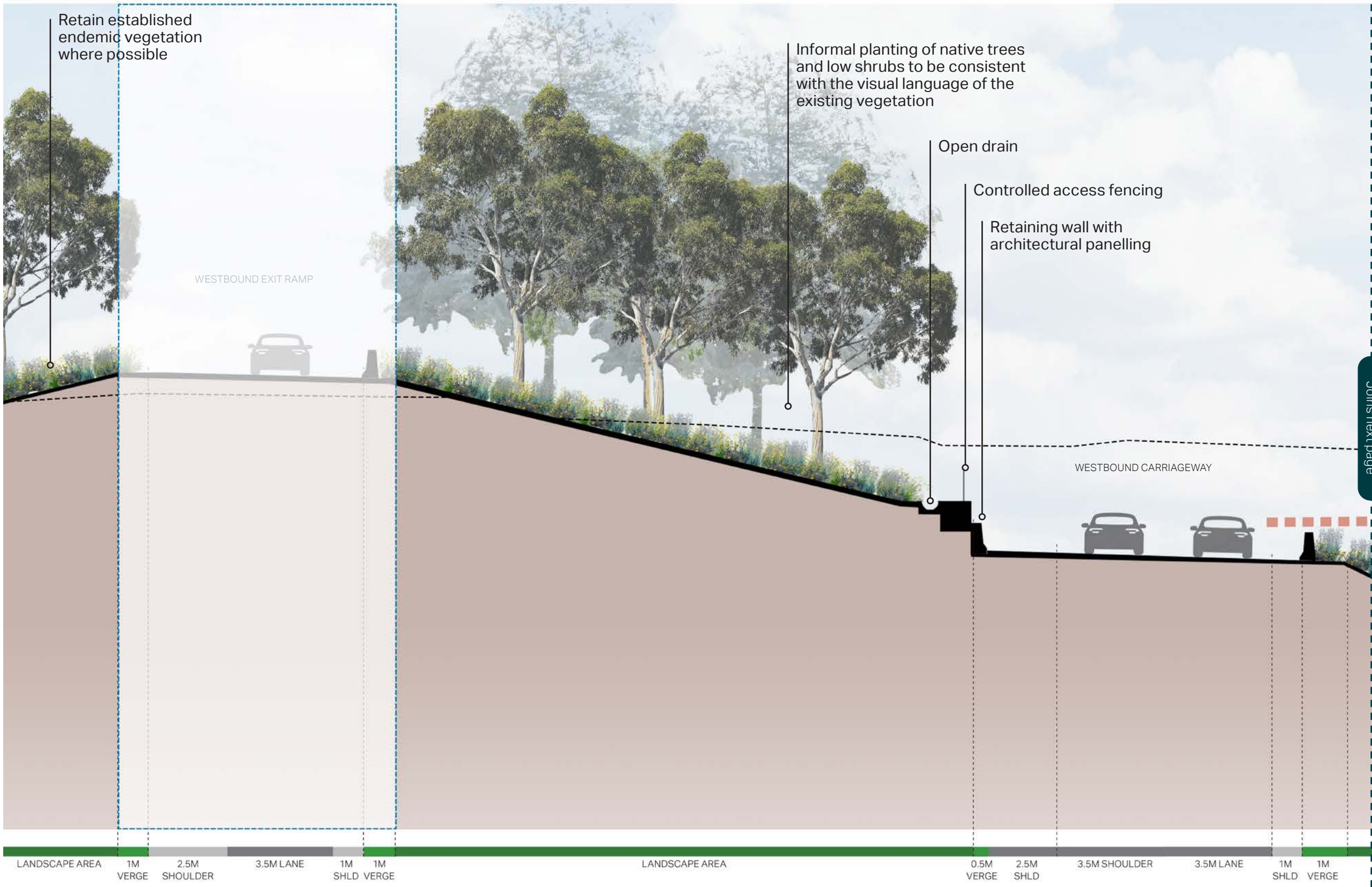
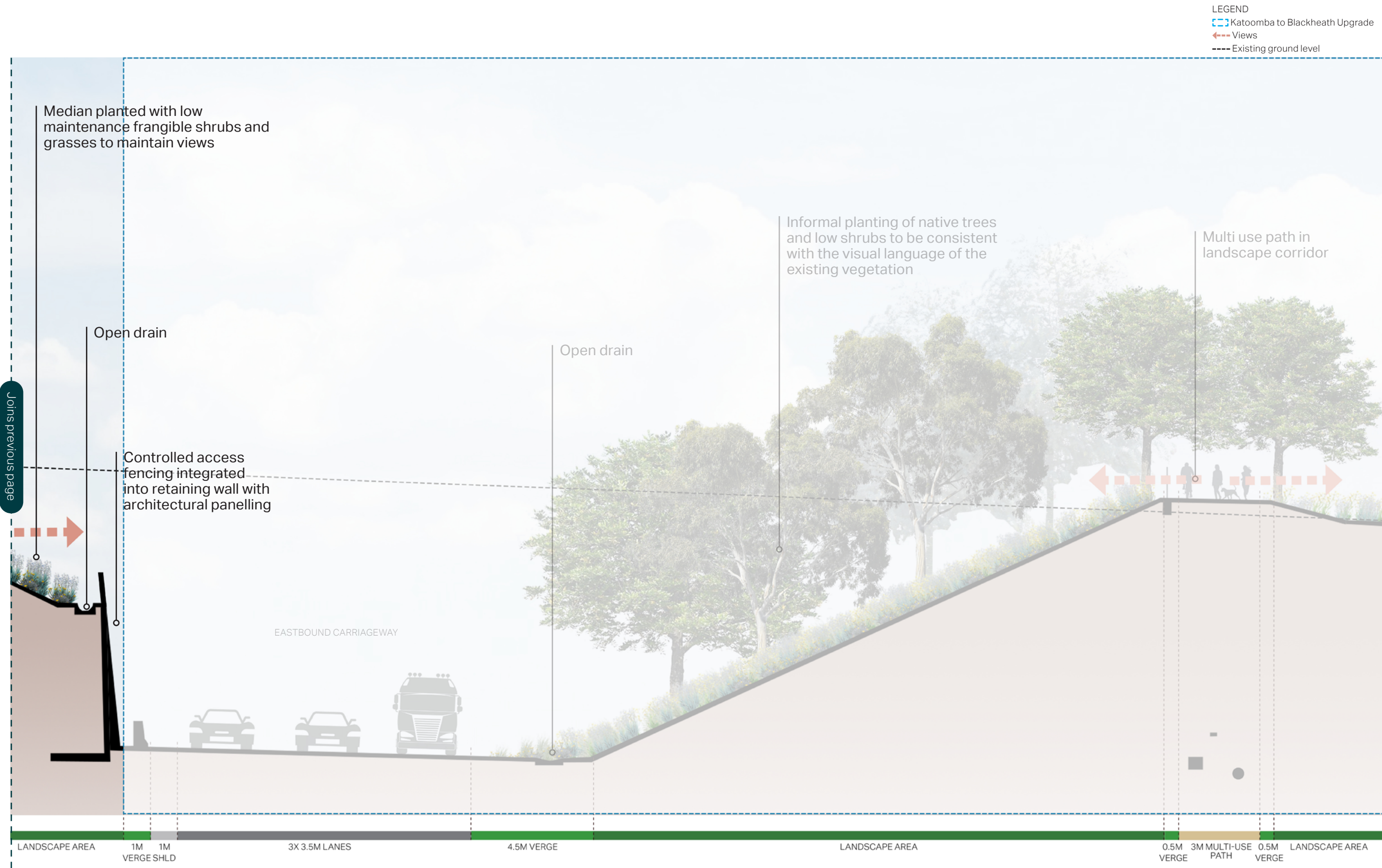


Figure 5-78: Section B (CHAINAGE 6545)







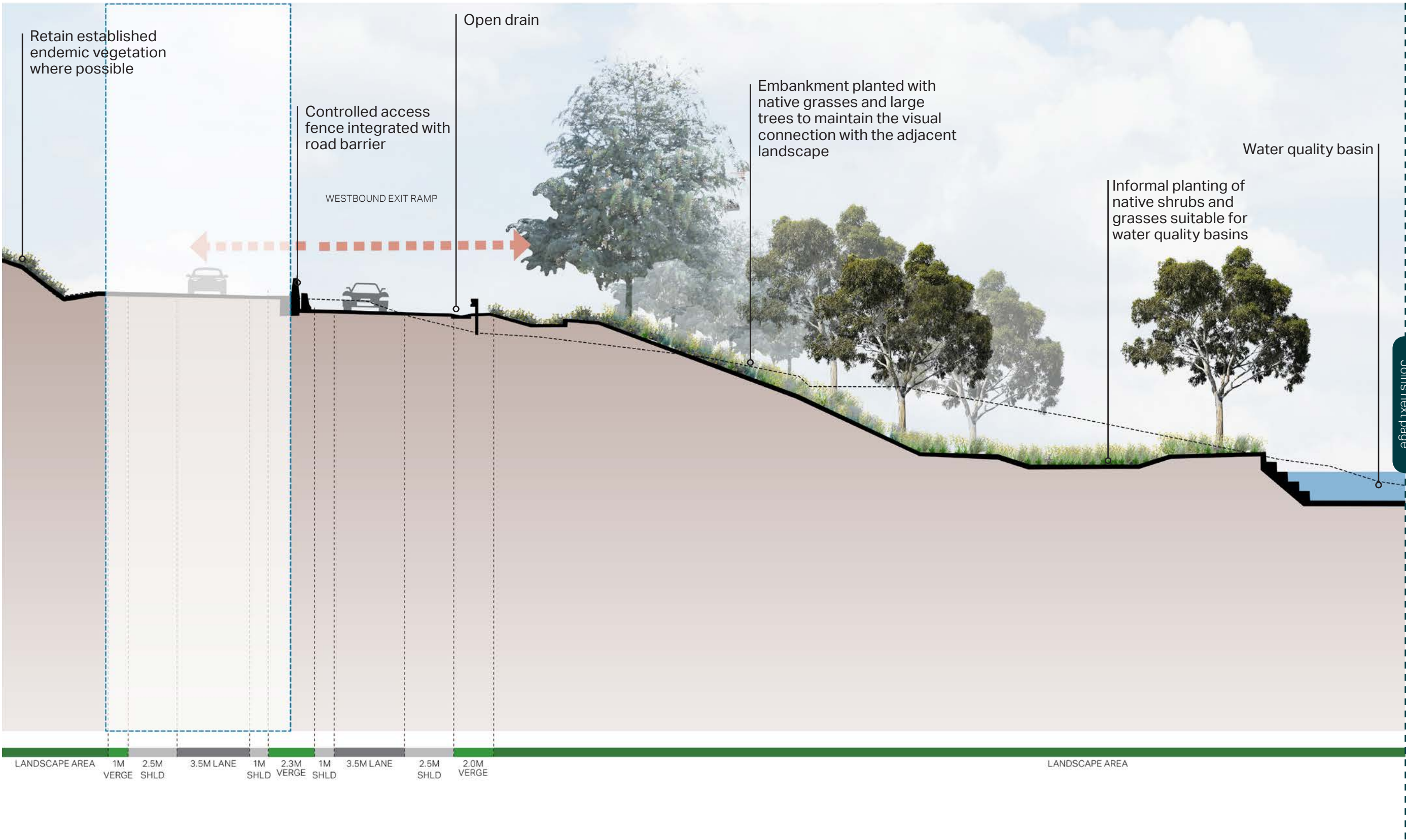
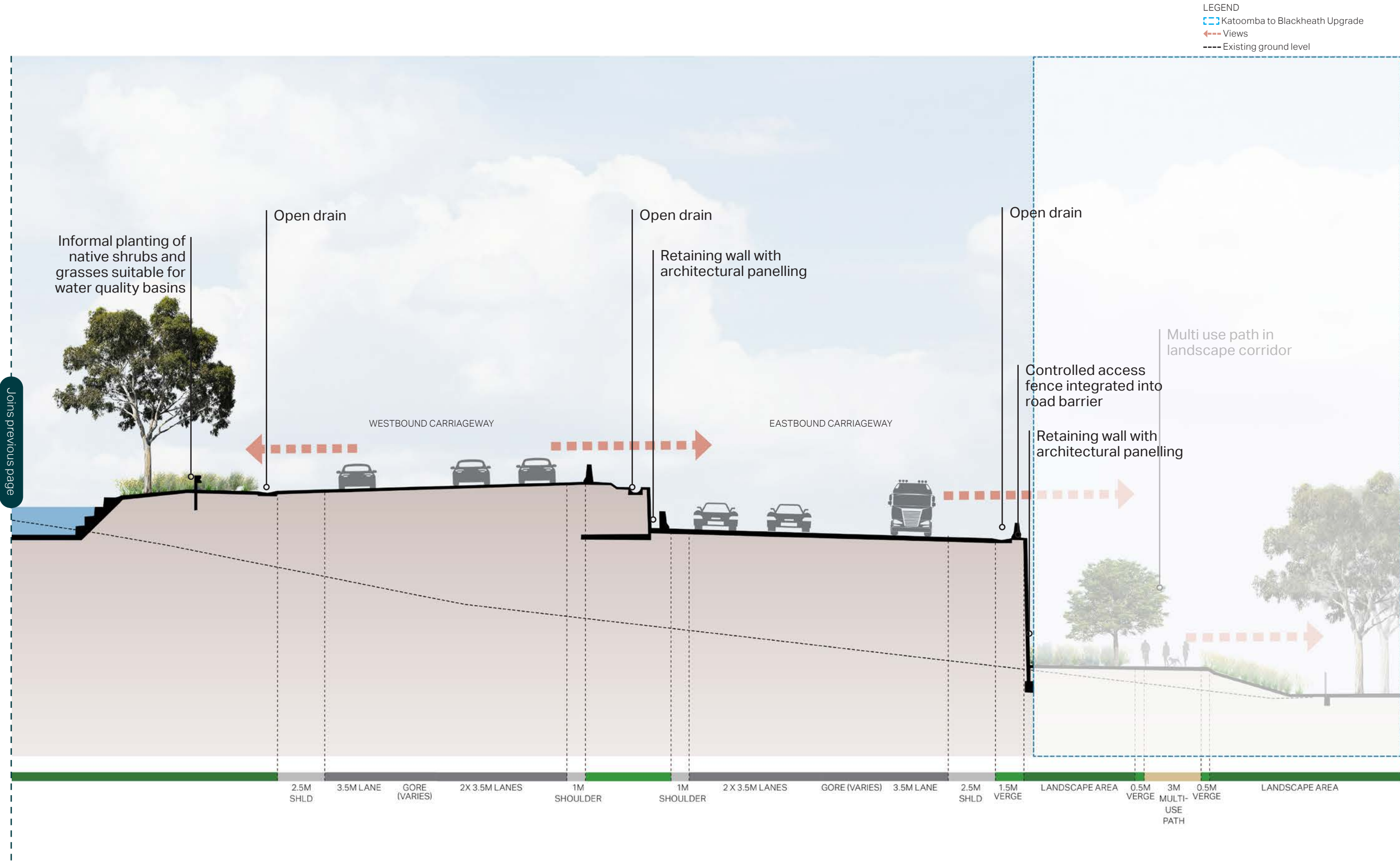


Figure 5-79: Section C (CHAINAGE 6780)







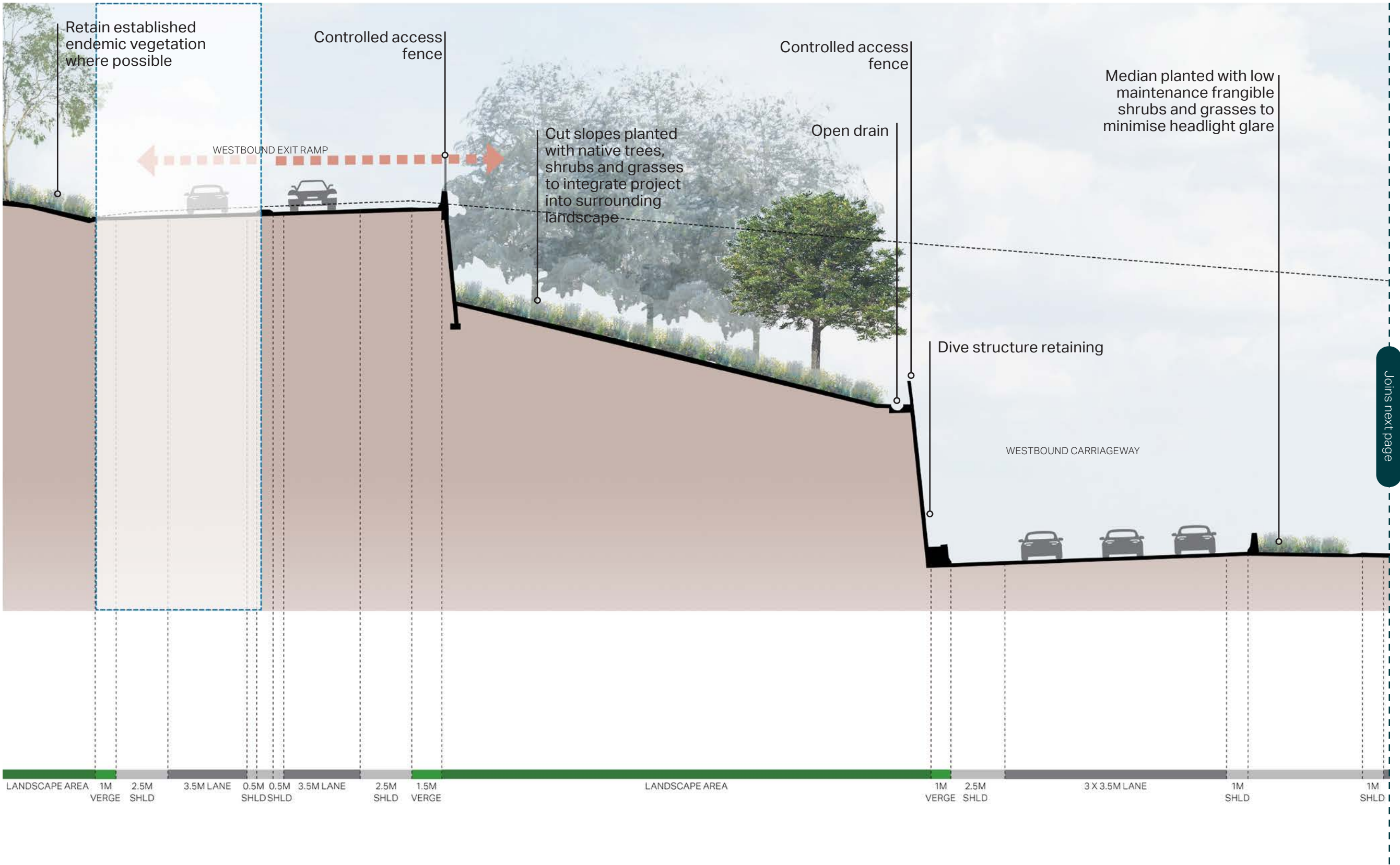
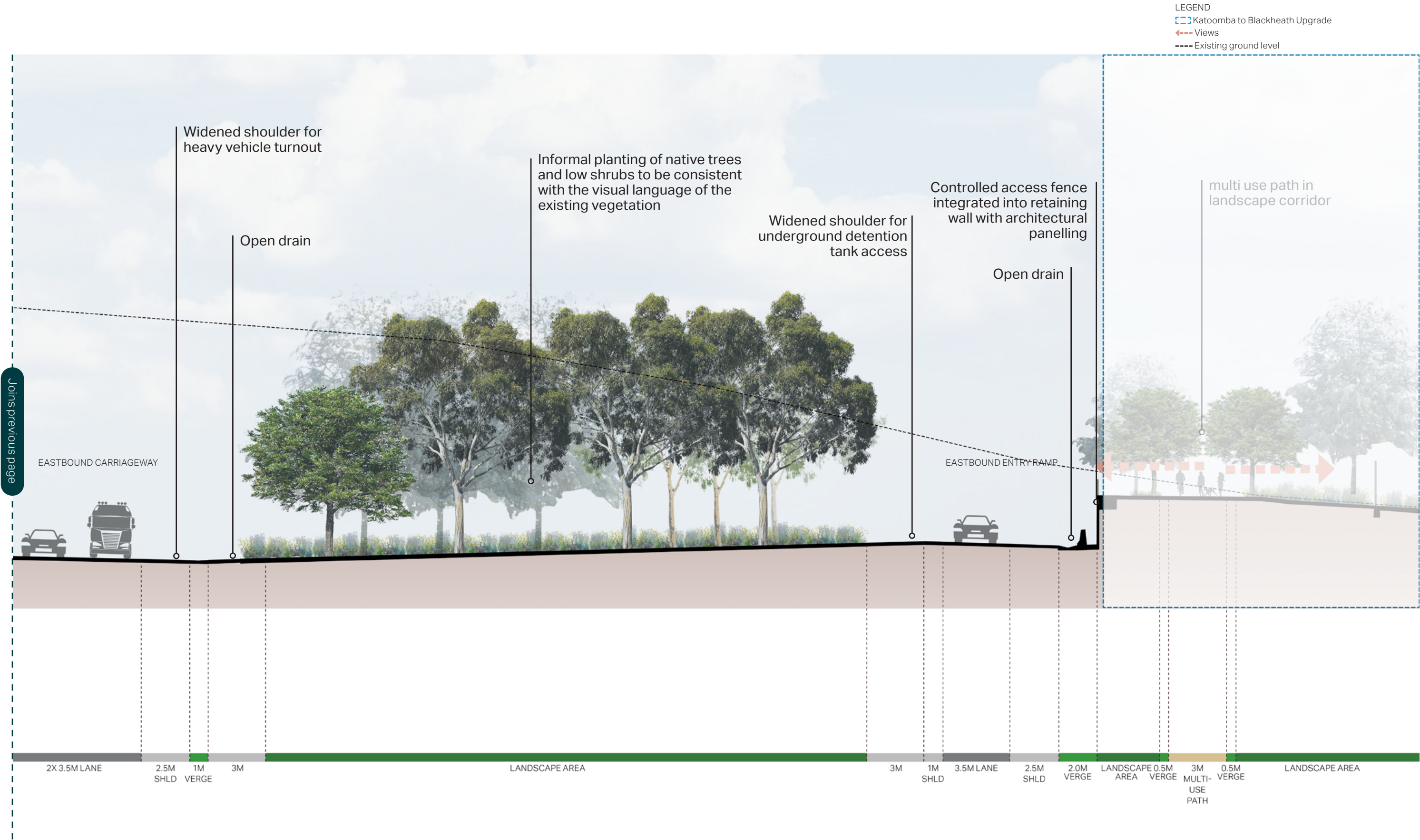


Figure 5-80: Section D (CHAINAGE 6960)







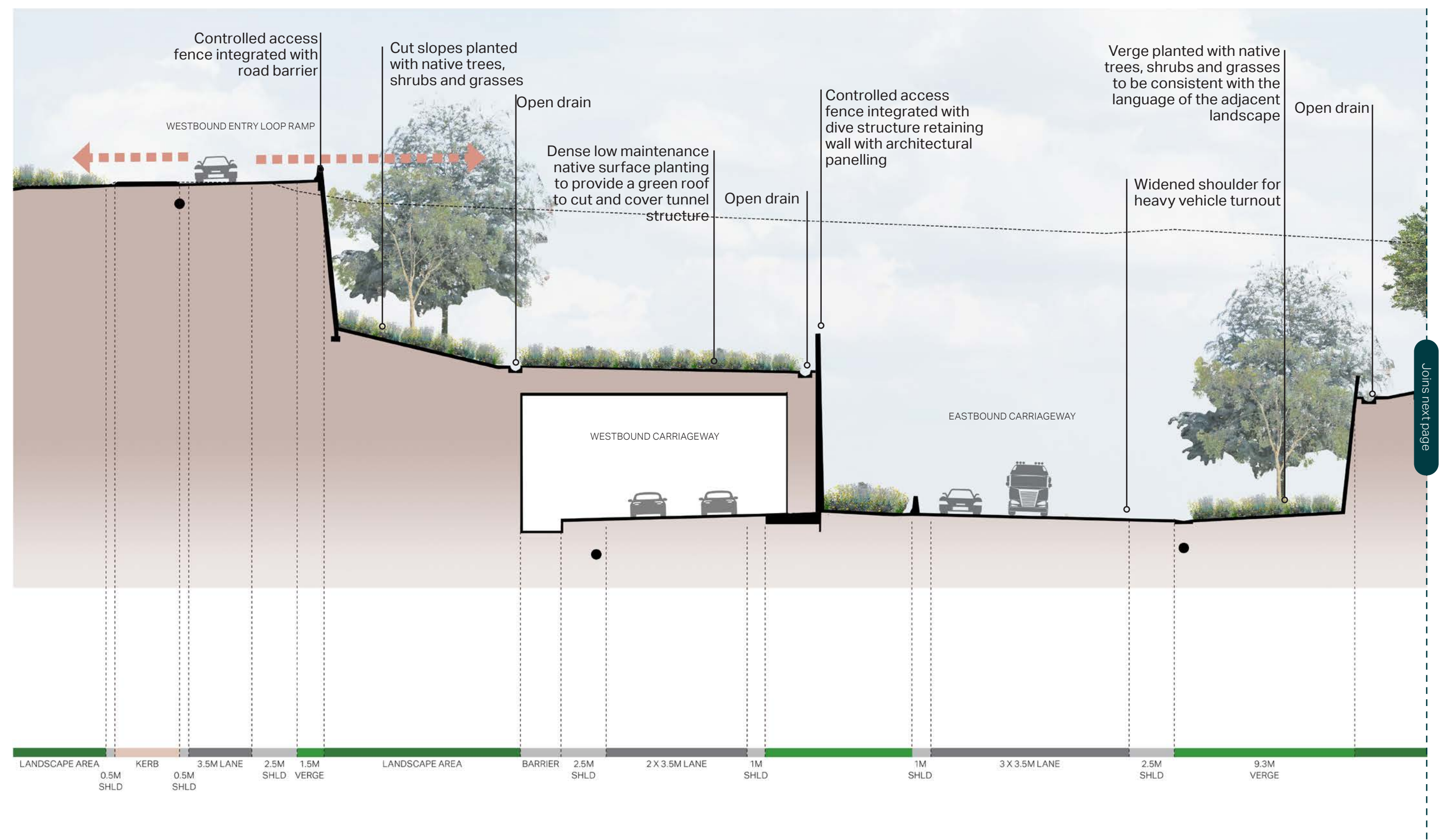
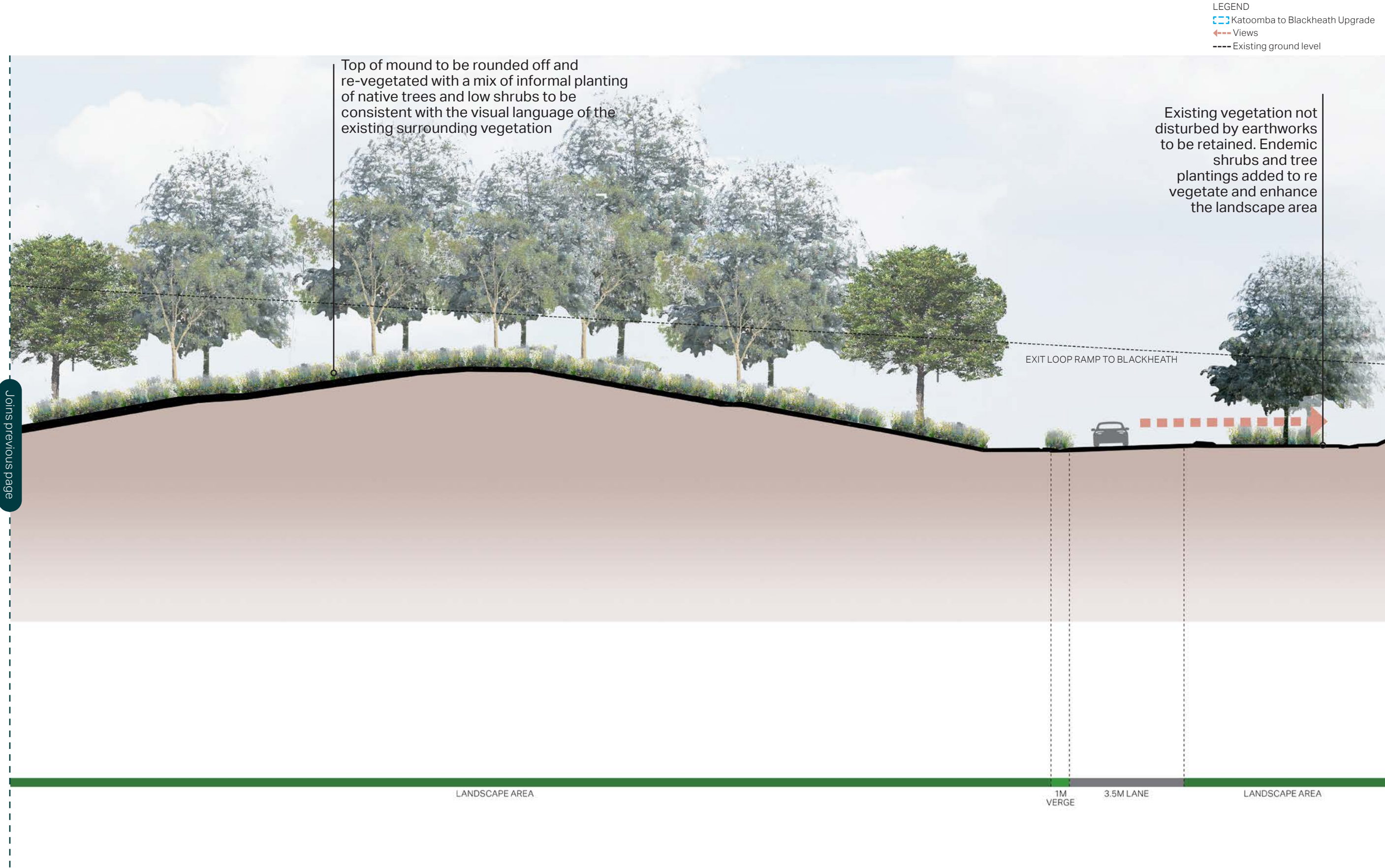


Figure 5-81: Section E (CHAINAGE 250)







5.9.2 Little Hartley interchange

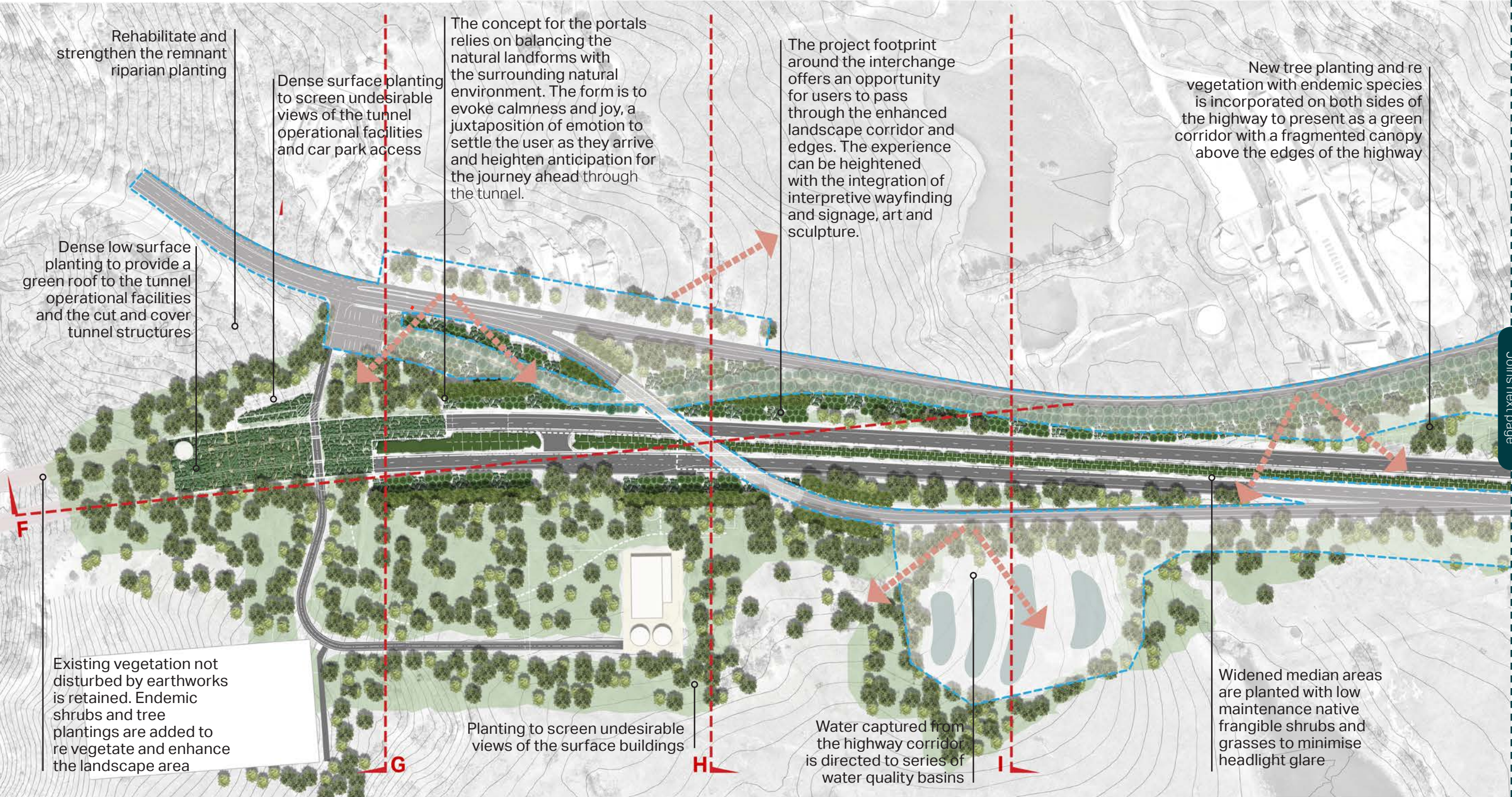
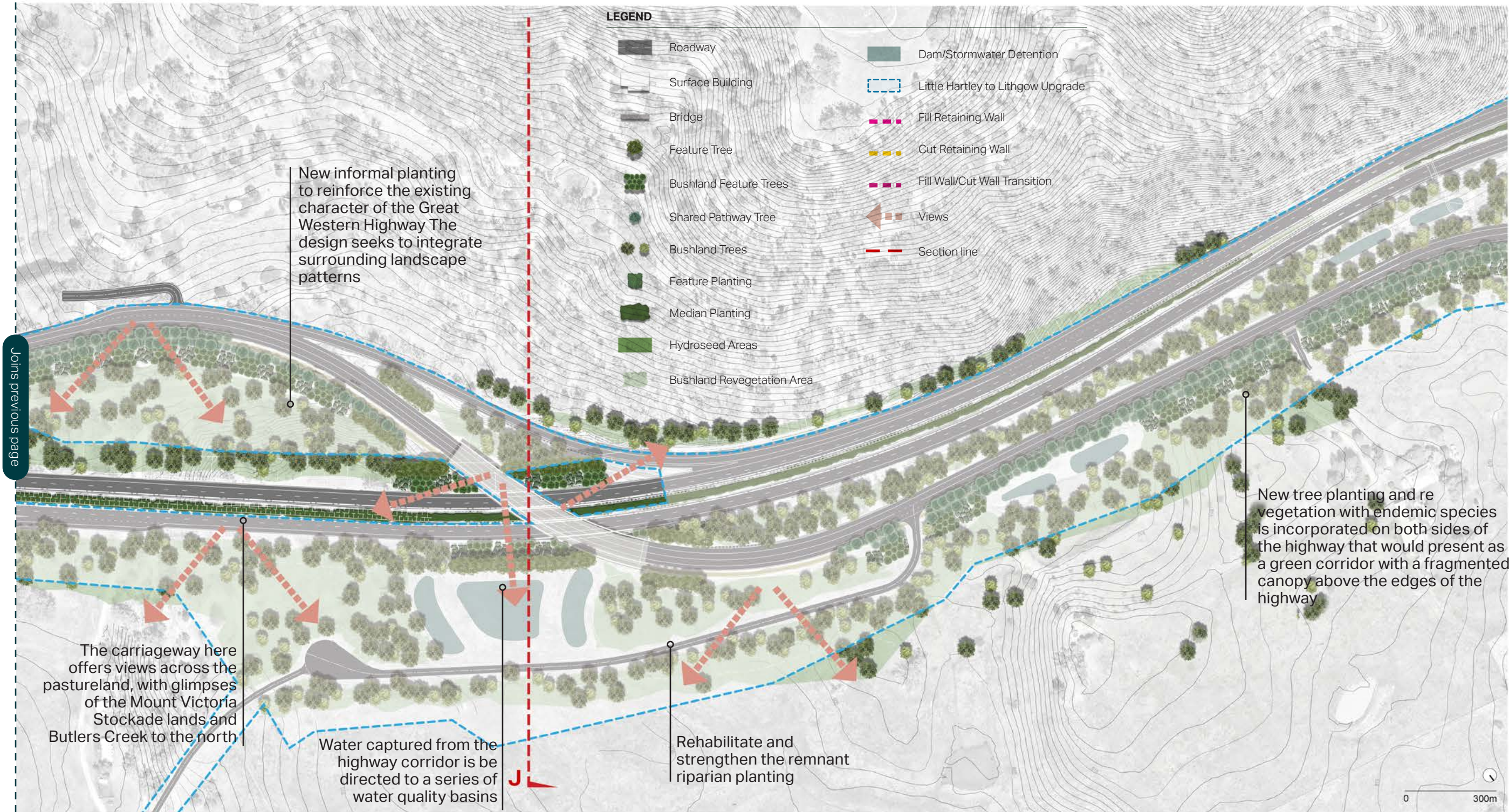


Figure 5-82: Plan of Little Hartley









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Section F - Little Hartley | Longitudinal Section



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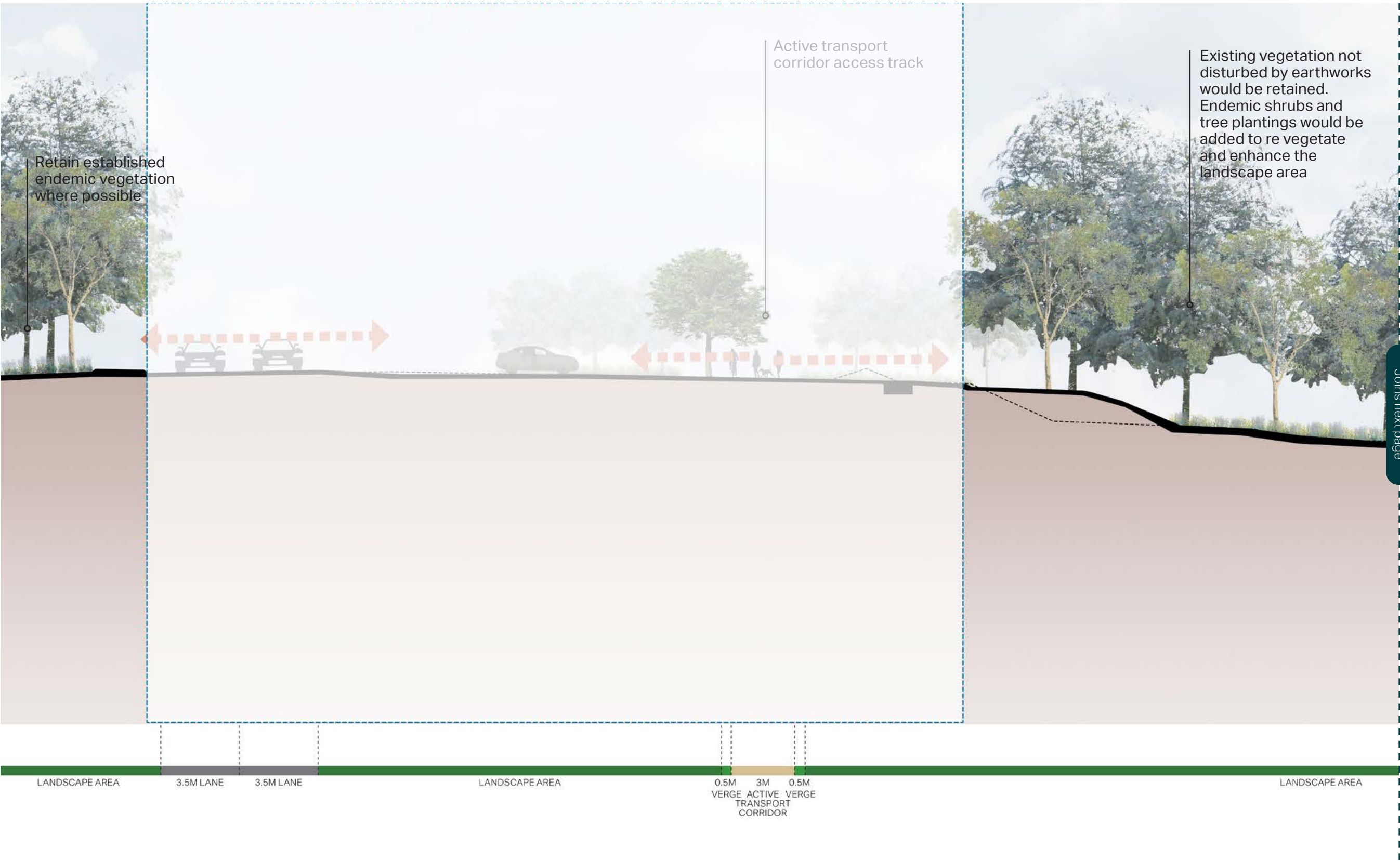
Little Hartley Eastbound Portal

Little Hartley Westbound Portal



Indicative only subject to design development

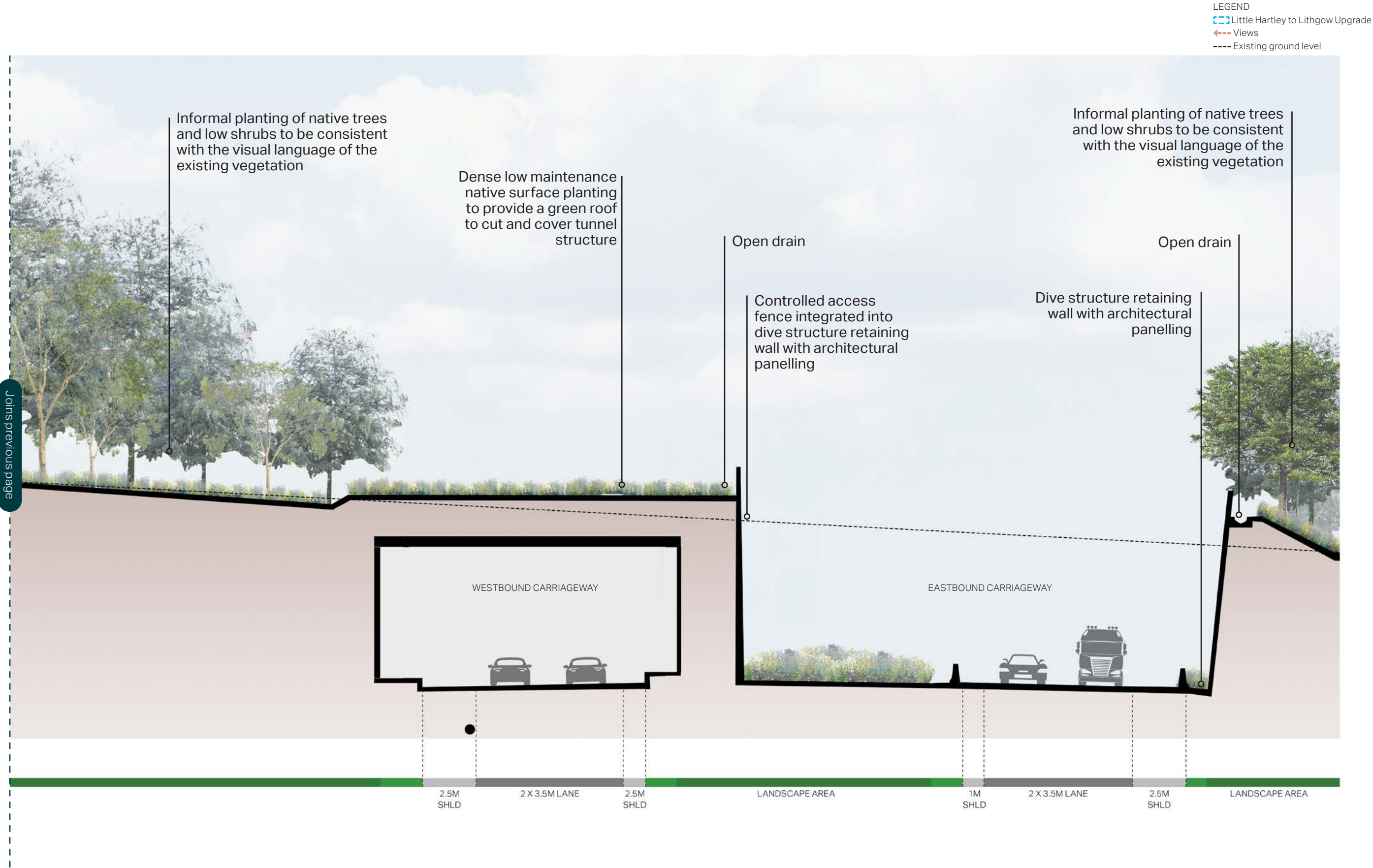




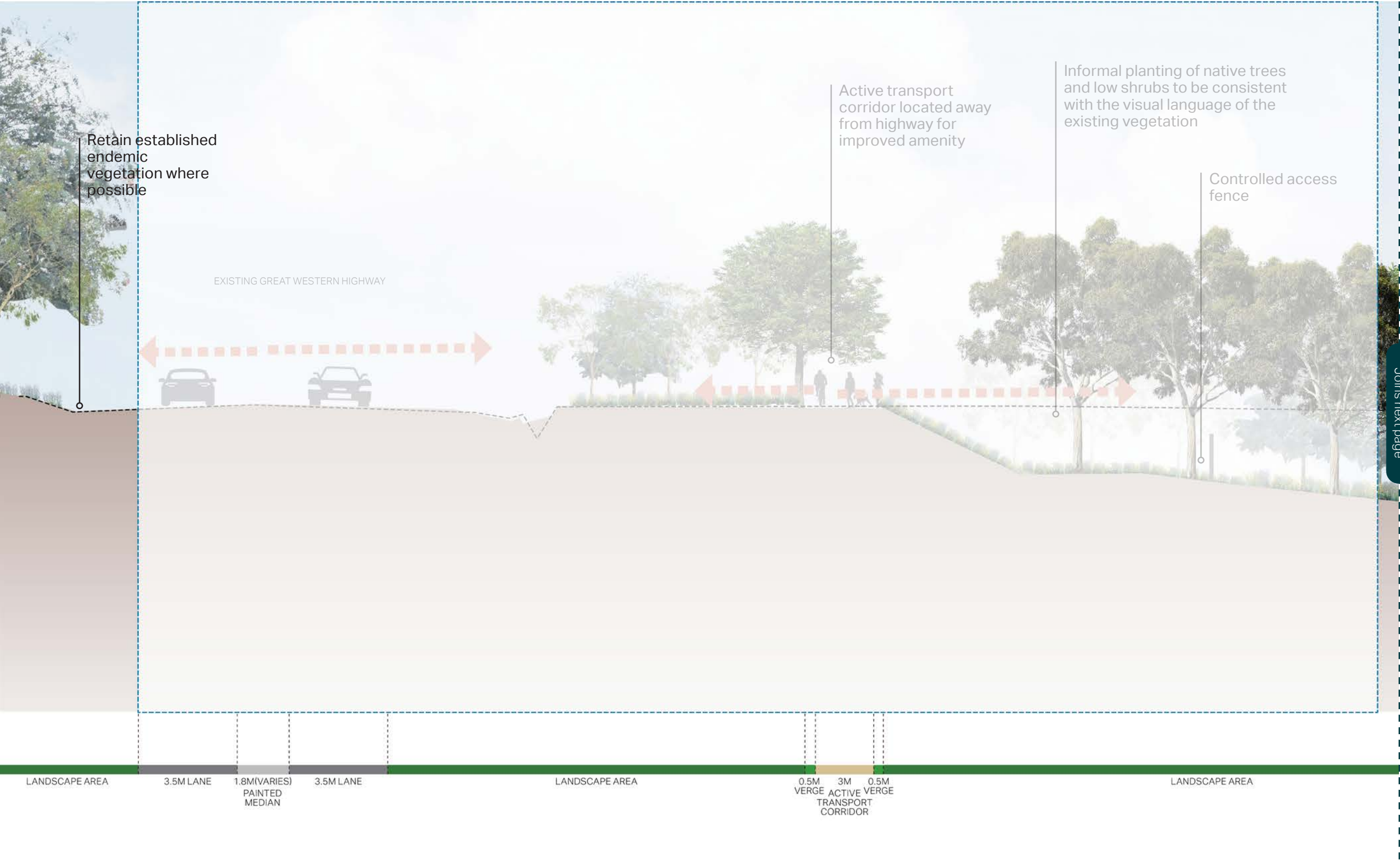
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Figure 5-83: Section G (CHAINAGE 17685)







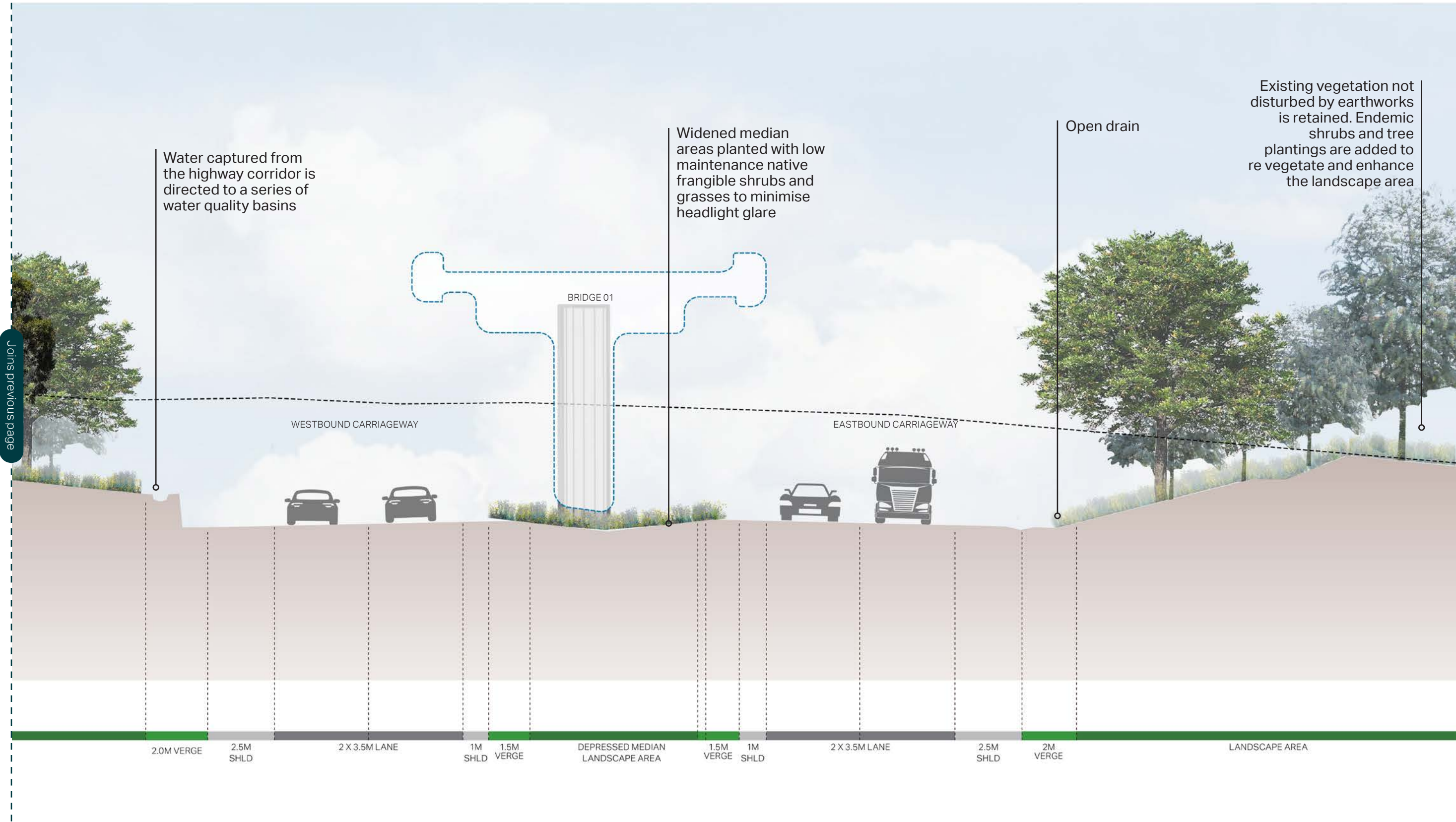


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Figure 5-84: Section H (CHAINAGE 17890)



- LEGEND
- Little Hartley to Lithgow Upgrade
  - Views
  - Existing ground level





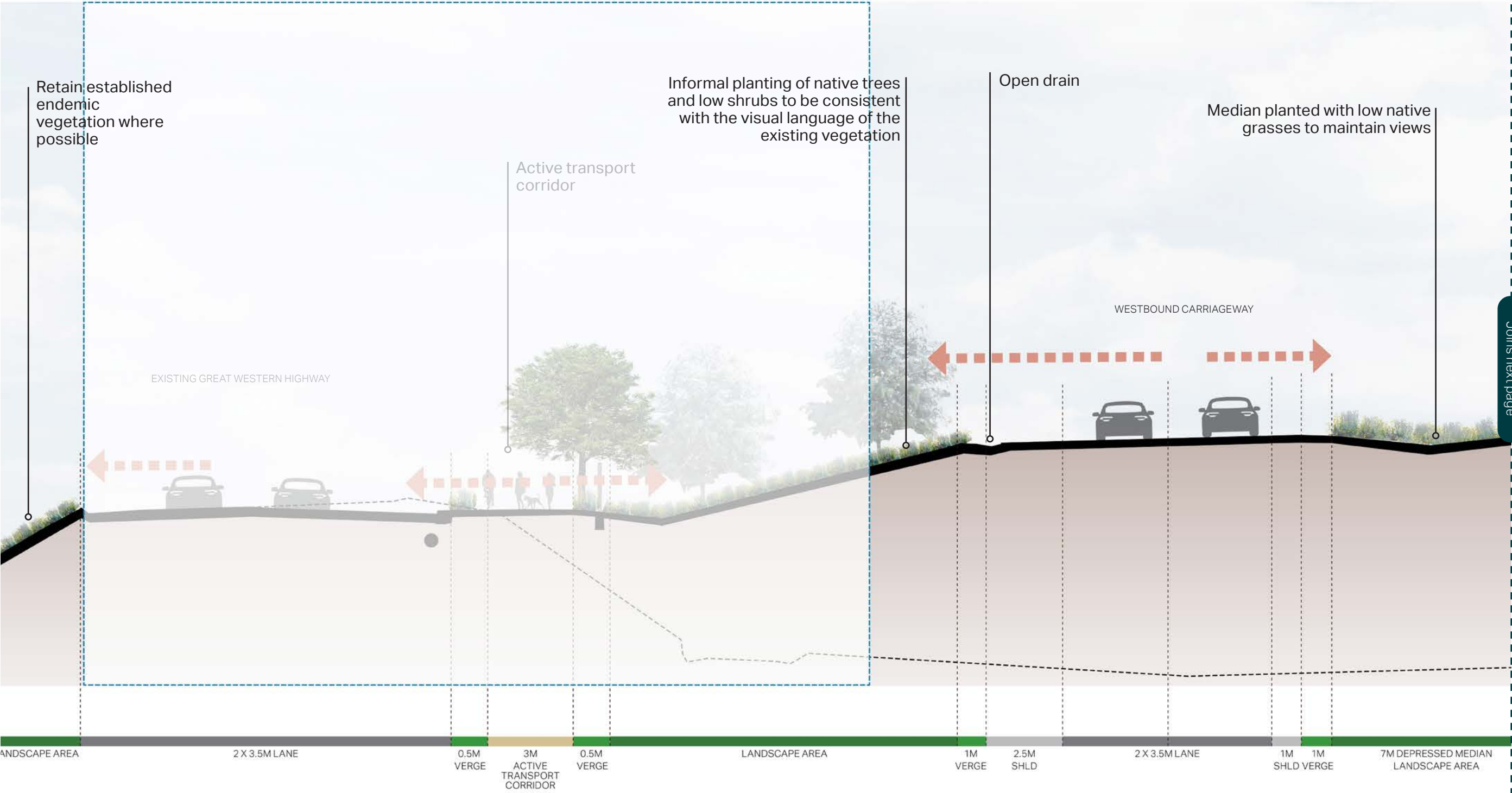
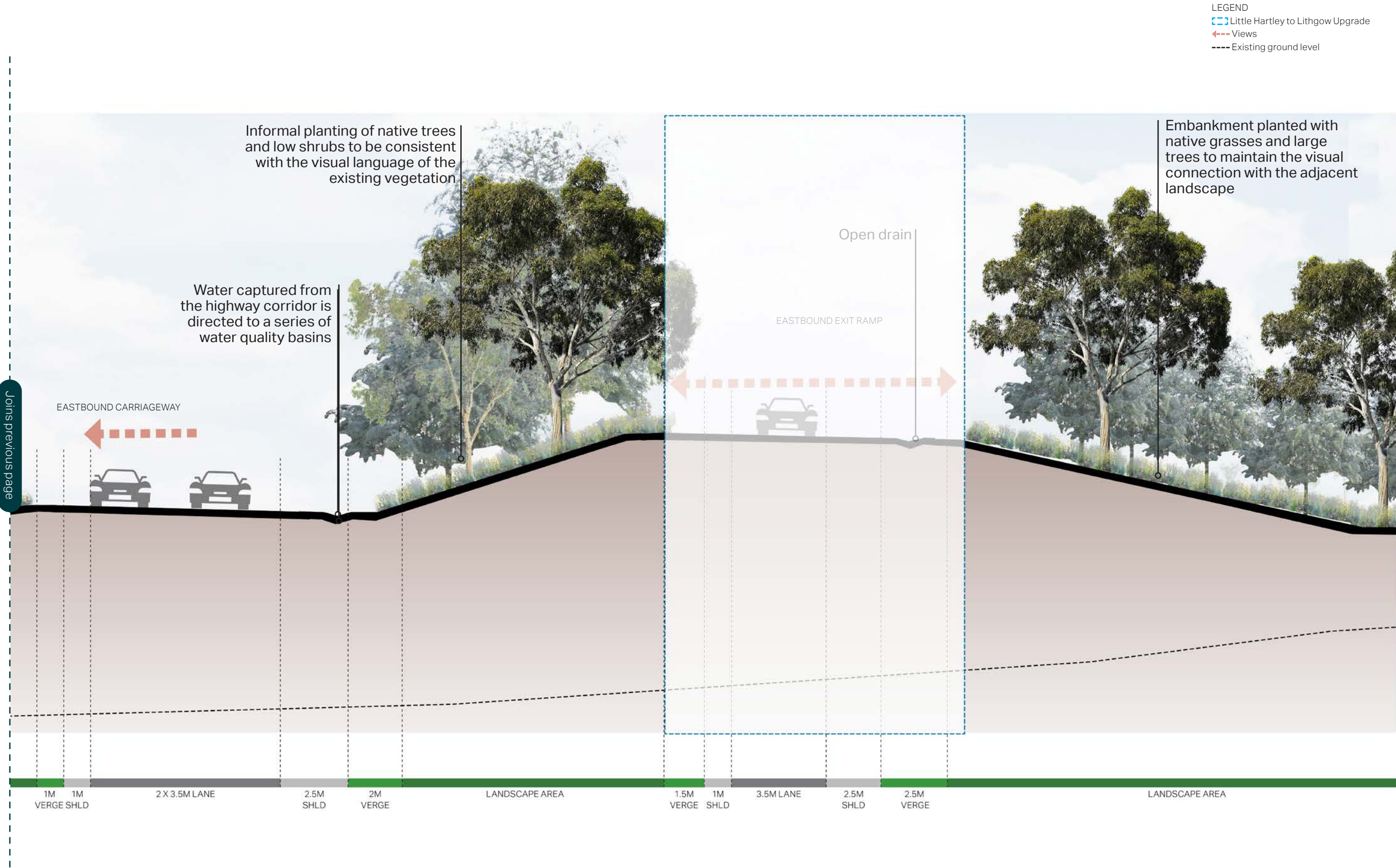
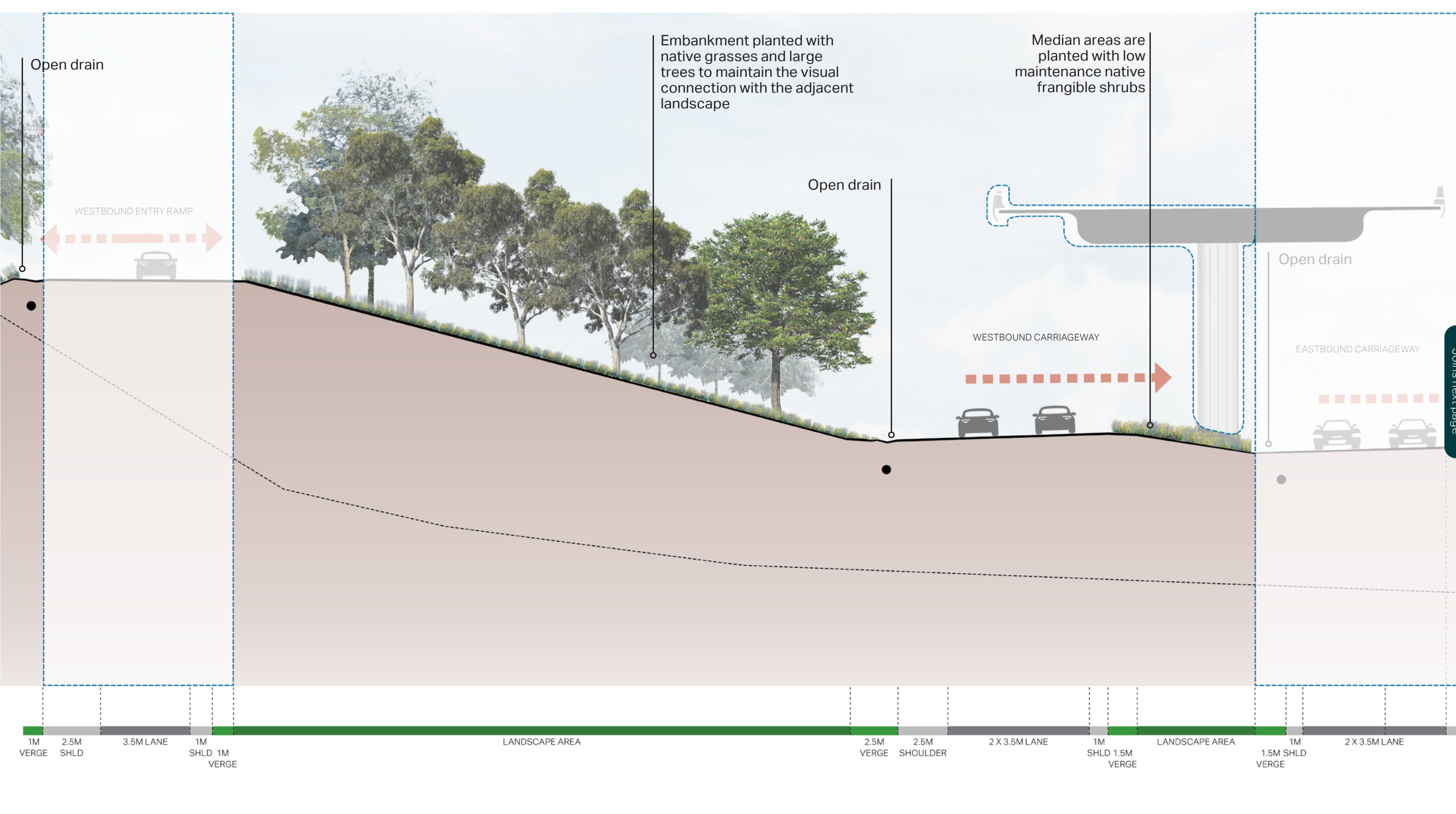


Figure 5-85: Section I (CHAINAGE 18140)





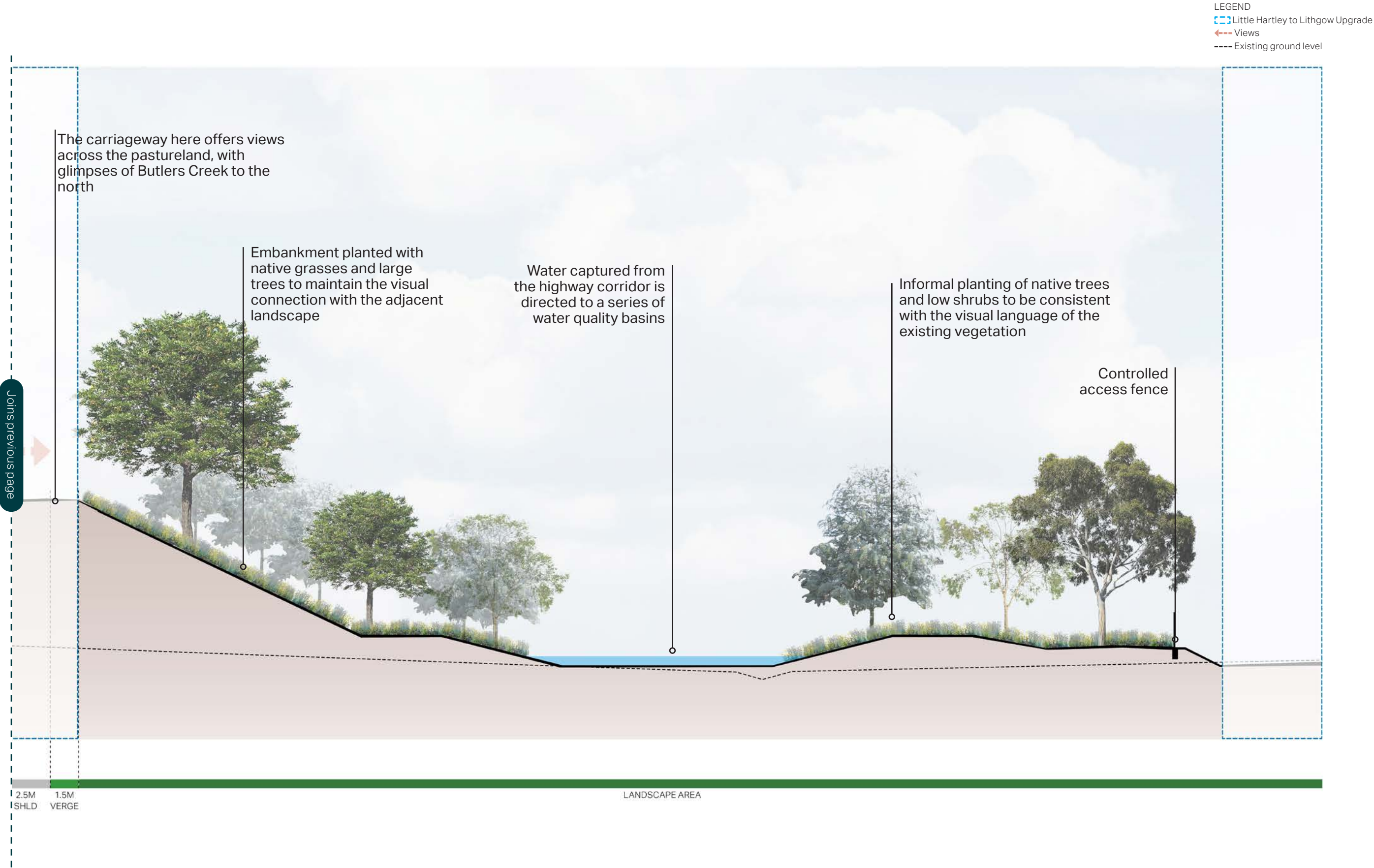




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Figure 5-86: Section J (CHAINAGE 18750)







5.10 Mitigation measures incorporated into the concept design

The urban design outcome for the project was the result of an iterative approach to testing ideas and diverse proposals through a range of discussions and workshops with the design team and stakeholders.

This process aimed to arrive at a preferred arrangement to best address the project requirements and other issues raised along the way.

Features and details have been embedded in the concept design as an outcome of this process which seeks to mitigate impacts identified during the assessment process. Key features are categorised into three main groups:

- Construction
- Safety
- Landscape and visual impact.

Table 5-4: Mitigation measures

Measures implemented to improve the design outcome and minimise impact on the landscape		
Category	Number	Mitigation Measure
Construction	C-01	Construction has been staged to minimise impact to the landscape through avoiding duplication of works. Critical infrastructure is to be installed first (e.g. water treatment plant and switching station) to be used during construction and retained during operation.
	C-02	Elements used during the construction of the Upgrade Program are to be re-purposed within the project, e.g. the active transport trail at Blackheath, which would be used during the construction phase of the Upgrade Program for access, then re purposed for public usage during the project for use at operation.
	C-03	Temporary access roads have been designed to be used during construction and then at operation, rather than removed at operation.
Safety	S-01	The option for an 8.5m carriageway was disregarded as research suggests a 10.5m carriageway works better for safety, and driver management, particularly as this would be a long tunnel with no turnaround space.
	S-02	Suggested caverns and turn around spaces were adopted during concept design development to set up contraflow in the case of emergencies.
	S-03	Positioning of in-tunnel ‘visual distractors’, such as lighting, have been designed into the tunnel interiors to increase interest and safety within the tunnels.
Landscape and visual Impact	L-01	Tunnel portals were designed on a camber to reduce the visual impact and reduce the scale of the cut in the landscape. This would provide opportunities for planting and tunnel user benefits to ease receptors into the tunnels rather than an entry that is flat and ‘hole-like’.
	L-02	The design of the portals and associated overpasses and underpasses was considered in a way which is integrated with the existing topography and applies finish materials which relate with the colour and tonality of the Blue Mountains. These measures promote the integration of the tunnel portals and associated infrastructure with the existing landscape.
	L-03	Landscape berms were suggested over noise walls where the project would lie adjacent to private properties.
	L-04	Structures were co-located where possible (e.g. ventilation, amenities and utilities) at Blackheath and Little Hartley to reduce the land-take for these items and provide opportunities for mitigation of impact by planting.
	L-05	Realignment of the eastern off-ramp at Little Hartley was undertaken to remove the need for a 16m high retaining wall, thereby reducing the impact on landscape character and views.
	L-06	Tree cover was increased within the design to both match landscape character at the interchanges and to shade hard surfaces, increasing the lifespan of infrastructure and reduce heat island effect.
	L-07	The portals were physically separated to suit the landform and provide the opportunity for tunnel ventilation via portal emissions, which would remove the need for ventilation outlets and thereby reduce impact to landscape character and views.
	L-08	Surface finishes of retaining walls and tunnel portal structures have been designed in earth tones and with grooved, articulated surface finishes to ‘bed down’ the structures into the landscape, replicating patterns of light and shade within the existing landscape.
	L-09	At Little Hartley the rural landscape is dotted with clumps of native and exotic trees. These clumps (rather than bands or banks) allow intermittent views across the landscape. This planting could be used along the Great Western Highway through the valley to allow views through clumps of trees to the valley and Mount York escarpment beyond, rather than screening it altogether.



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## Landscape Character Impact Assessment

# 06



# 6.Landscape Character Impact Assessment

## 6.1 Landscape character zones

Four (4) Landscape character zones (LCZs) have been identified within the study area, as described in Section 4.7:

- LCZ 1: Great Western Highway
  - LCZ 1a: GWH Township
  - LCZ 1b: GWH Butlers Creek Valley
  - LCZ 1c: GWH Bushland
- LCZ 2: Township
- LCZ 3: Butlers Creek Valley
- LCZ 4: Bushland.

## 6.2 Landscape character impact assessment

### 6.2.1 LCZ 1: Great Western Highway

#### 6.2.1.1. Landscape impact assessment: LCZ 1a: GWH Township

##### Changes due to the project

While no physical (i.e. built) changes would occur on the Great Western Highway as it passes through townships, it is anticipated that there would be a substantial reduction in traffic volume and larger vehicles (trucks), as those passing through would use the tunnel rather than the existing Great Western Highway.

##### Magnitude: Low

A reduction in the volume of traffic and the size of passing vehicles are considered a small-scale change within the character of the Great Western Highway as it passes through townships. It would reduce the ‘feel’ of the road as a high volume transport corridor, creating a more intimate, local atmosphere within the immediate surrounding landscape.

##### Landscape character impact ratings

Table 6-1 shows the landscape impact rating of LCZ 1a, illustrating the impact of the project with (emissions via ventilation outlet) and without (emissions via portal) a ventilation outlet.

##### Emissions via ventilation outlet option: Low (Beneficial)

The reduction in traffic travelling through the townships along the Great Western Highway within the study area has a beneficial effect on the overall character of the Great Western Highway in these areas, potentially creating the feeling of a more intimately scaled road at the township entry. This is particularly true of Blackheath, where commercial enterprises (including cafes) are positioned facing the Great Western Highway. A reduction in traffic would also benefit residential development fronting the Great Western Highway, reducing the hierarchy of the road with the reduction of vehicles passing.

##### Emissions via portals option: Low (Beneficial)

There would be no change to the assessment ratings for this LCZ if no ventilation outlets were included in the project.

Table 6-1: Landscape impact assessment - LCZ 1a

LCZ 1a: GWH Township		
	Emissions via ventilation outlet	Emissions via portals
Sensitivity	Low	Low
Magnitude	Low	Low
Landscape character impact rating	Low	Low
Qualitative rating	Beneficial	Beneficial

#### 6.2.1.2. Landscape impact assessment: LCZ 1b: GWH Butlers Creek Valley

##### Changes due to the project

Within the widened LCZ 1b created by the broader Upgrade Program as described above, changes due to the project would include:

- The tunnel portals and ventilation outlet (optional)
- The new widened split carriageways of the proposed Great Western Highway
- Larger road furniture and infrastructure, such as overhead gantries and VMS
- Water quality basins and a water treatment plant
- Batters, retaining walls, fencing and protective barriers
- Landscaping
- Other operational infrastructure positioned to the north east of the tunnel portals and southern proposed Great Western Highway alignment, comprising a band of built structures fringing the tunnel portals and road corridor as it joins the tunnels.

##### Magnitude: High

The widening of the LCZ into the valley would already have occurred due to the Little Hartley to Lithgow Upgrade, as shown in Figure 6-1. The addition of bridges, batters and water quality basins within the transport corridor as part of the Little Hartley to Lithgow Upgrade introduces a substantially larger scale of infrastructure elements within the road corridor prior to the project, which somewhat reduces the magnitude of change due to the project itself.

However, the scale of the tunnel portals and associated operational infrastructure would comprise new built form within and fringing the road corridor, the character of which are new within the LCZ. The wide, straight, split carriageways that extend from the tunnels are raised on batters, and are in contrast to the existing narrow curving Highway.

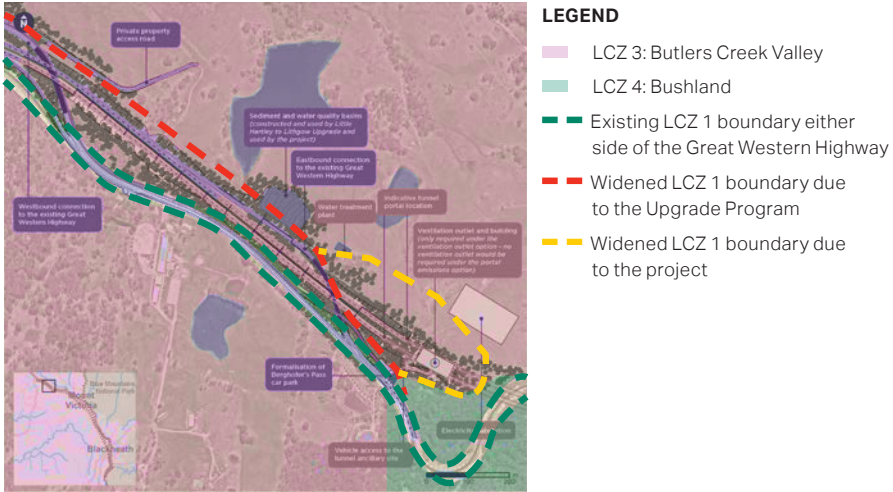


Figure 6-1: The Upgrade Program and the project would extend the extent of LCZ 1: Great Western Highway to the north



Landscape character impact ratings

Table 6-2 shows the landscape impact rating of LCZ 1b, illustrating the impact of the project with (emissions via ventilation outlet) and without (emissions via portal) a ventilation outlet.

Emissions via ventilation outlet option: High to moderate (Adverse)

The project would comprise the addition of the tunnel portals and new Highway carriageways extending east/west within an already widened transport corridor. The scale of the proposed road and many of the infrastructure elements within the corridor would be comparable to the proposed road corridor and infrastructure (such as bridges and batters). The scale and position of the ventilation outlet would comprise an adverse impact on the quality of the landscape character, however, other elements within the project are considered more typical within the transport corridor setting.

Emissions via portals option: High to moderate (Neutral)

While there would be no change to the sensitivity or magnitude ratings if there was no ventilation outlet within the project, the qualitative rating for the project would change to 'Neutral', as the other elements of the project are somewhat characteristic within a transport corridor and more 'bedded down' into the landform, while the ventilation outlet would be positioned in a more prominent position. While tree planting surrounding the other built structures, no taller tree planting would be provided to reduce the prominence of this structure due to the limited soil depth on the ventilation building.

Table 6-2: Landscape impact assessment - LCZ 1b

LCZ 1b: GWH Butlers Creek Valley		
	Emissions via ventilation outlet	Emissions via portals
Sensitivity	Moderate	Moderate
Magnitude	High	High
Landscape character impact rating	High to moderate	High to moderate
Qualitative rating	Adverse	Neutral

6.2.1.3. Landscape impact assessment: LCZ 1c: GWH Bushland

Changes due to the project

The surface works at Blackheath would lie within this LCZ, extending into the neighbouring LCZ 4: Bushland to the east. The changes would include:

- Entry and exit portal to the tunnels
- Entry / exit roads between the existing Great Western Highway (joining the Katoomba to Blackheath Upgrade) and the proposed tunnels
- Westbound on-ramp and eastbound off-ramp to the proposed tunnels
- Access road to the proposed tunnel operations facility
- Upgrade of the existing intersection of the Great Western Highway and Evans Lookout Road
- Proposed water quality basins
- Ventilation outlet within the eastbound off-ramp loop
- Retaining walls and fencing associated with level changes
- Landscaping, including tree, shrub and groundcover planting
- Signage, CCTV, and other small pieces of road infrastructure.

The proposed tunnel operations management area would lie within LCZ 4: Bushland.

Magnitude: Moderate

The scale of the project is substantially larger than existing interchange infrastructure within the study area and would result in the localised widening of the LCZ approaching the tunnel portals (refer Figure 6-2). These changes, however, would be in keeping with other existing interchanges and widened road infrastructure outside the study area along the Great Western Highway, e.g. the land bridge / underpass at the entry to Leura or the split road with carriageways elevated on high retaining walls at Wentworth Falls.

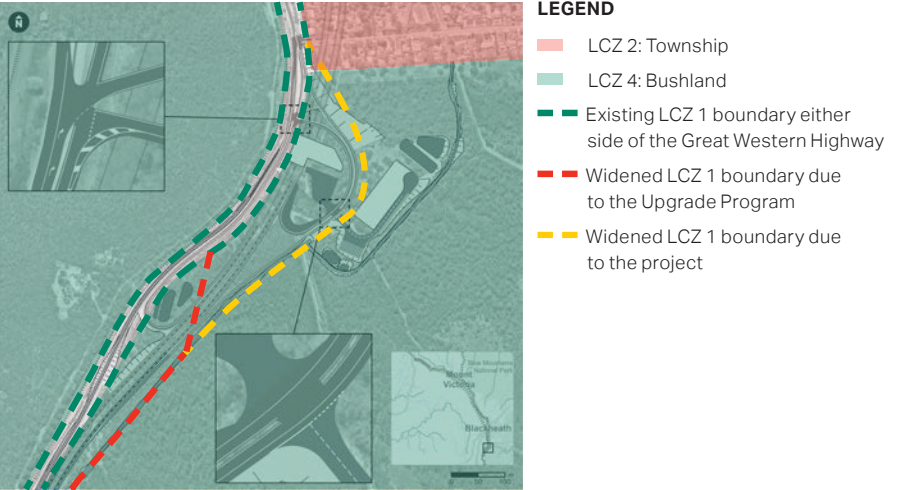


Figure 6-2: The Upgrade Program and the project would extend the extent of LCZ 1: Great Western Highway to the east

Additionally, elements of the Katoomba to Blackheath Upgrade that would comprise a change within or adjacent to the LCZ, such as the sediment and water quality basins to the south of the proposed tunnel portals, would be integrated into the project, resulting in a reduction of the magnitude of change as these newer elements would already have existed within the landscape.

Soft landscaping (areas of planting) integrated into the verges and within widened areas between roads assist in 'bedding down' the interchange into the surrounding landscape, reducing the perceived scale of the overall project. The 'stepping down' of carriageways as they extend to and from the proposed tunnels would also reduce the impact of the works, with the natural slope of the land used within the overall design of the project.

The operational infrastructure positioned to the east of the tunnel portals and eastbound off-ramp would lie within LCZ 4: Bushland, and would comprise an additional built element adjacent to the Great Western Highway, not unlike other operational facilities such as the existing heavy vehicle safety station near Soldiers Pinch.

Landscape character impact ratings

Table 6-3 shows the landscape impact rating of LCZ 1c, illustrating the impact of the project with (emissions via ventilation outlet) and without (emissions via portal) a ventilation outlet.

Emissions via ventilation outlet option: High to moderate (Adverse)

The substantially large scale of the project within the study area coupled with the sensitivity of the LCZ results in a high to moderate change in landscape character. The project would comprise a new transport interchange within an existing transport corridor. There would be a local widening of the LCZ at the project, with the road corridor extending east into an area of steeply sloping bushland. The project would be well integrated into the landscape with the 'stepping down' of individual carriageways in the descent to the tunnels, further blending with the character of the surrounding area with the use of tree and shrub planting.

The adverse qualitative rating is due to the addition of the ventilation outlet, which would comprise a substantially large cylindrical element that is uncharacteristic within the existing Great Western Highway corridor.

Emissions via portals option: High to moderate (Neutral)

While there would be no change to the sensitivity or magnitude ratings if there was no ventilation outlet within the project, the qualitative rating for the project would change to 'Neutral', as the other elements of the project are somewhat characteristic within a transport corridor.

Table 6-3: Landscape impact assessment - LCZ 1c

LCZ 1c: GWH Bushland		
	Emissions via ventilation outlet	Emissions via portals
Sensitivity	High	High
Magnitude	Moderate	Moderate
Landscape character impact rating	High to moderate	High to moderate
Qualitative rating	Adverse	Neutral



6.2.1.4. Discussion of impact on LCZ 1: Great Western Highway

The Great Western Highway is a major transport corridor that passes through the Blue Mountains and to regional townships beyond. Its sensitivity is in part due to its world, national, state and local heritage and cultural values. Tourism within and beyond the Blue Mountains also increases the importance of the Great Western Highway as a travel experience in itself as well as a gateway to regions beyond.

The experience of travelling along the Great Western Highway is in part due to the rhythm of LCZs that it passes through, each with their own particular characteristics. Within the study area, the LCZ was split into three character precincts which correlated to when the Great Western Highway travelled through bushland, through or past a township, and as it entered Butlers Creek Valley after descending Victoria Pass. Each of these character precincts have their own typical features and sensitivities and were effected by the project to different extents.

LCZ 1c: GWH Bushland and LCZ 1b: GWH Butlers Creek Valley were considered the most sensitive of the three character precincts because the project was positioned within these stretches of the Great Western Highway and were therefore directly effected by the works. LCZ 1a: GWH Township would be indirectly effected by the project due the potential reduction in traffic, particularly through Blackheath, and therefore was less susceptible to changes.

At the two portal locations (Blackheath and Little Hartley), the LCZ corridor would be locally widened to accommodate the broader Upgrade Program and proposed road infrastructure. At Blackheath, more of the widening of the LCZ would be due to the project rather than the broader Upgrade Program, where at Little Hartley, the LCZ widening would be more of a result of the broader Upgrade Program rather than the project. This was a factor in the determination of sensitivity between the two character precincts to the project.

The most uncharacteristic elements of the project would be typically the operational infrastructure at Little Hartley, followed by the scale of the proposed tunnel portals and ventilation outlets. The ‘straight lines’ generated by the proposed infrastructure were also an uncharacteristic element within the Great Western Highway corridor, e.g. the straightened lengths of the Great Western Highway in contrast to the sinuous line of the existing road and the straight sided water quality basins within the interchanges. A softening of some of these elements, particularly with landscaping, would integrate the project further within the existing LCZ.

6.2.2 LCZ 2: Township

Changes due to the project

The project would occur near the southern boundary of this LCZ at Blackheath. No changes due to the project would occur within this LCZ.

Magnitude: Negligible

The project would result in an area of regenerated landscape positioned adjacent to a corner of the LCZ and the upgrade of an existing intersection which would fall within LCZ 1: Great Western Highway. These changes are considered negligible in relation to the greater LCZ and would not result in any changes within it.

Landscape character impact ratings

Table 6-4 shows the landscape impact rating of LCZ 2, illustrating the impact of the project with (emissions via ventilation outlet) and without (emissions via portal) a ventilation outlet.

Emissions via ventilation outlet option: Negligible (Neutral)

The very small area of the project that lies adjacent to the south western corner of the LCZ would not result in any changes that would effect the character of the LCZ. For this reason the qualitative rating is considered to be Neutral.

Emissions via portals option: Negligible (Neutral)

There would be no change to the assessment ratings for this LCZ under the portal ventilation option.

Table 6-4: Landscape impact assessment - LCZ 2

LCZ 2: Township		
	Emissions via ventilation outlet	Emissions via portals
Sensitivity	Low	Low
Magnitude	Negligible	Negligible
Visual impact rating	Negligible	Negligible
Qualitative rating	Neutral	Neutral

6.2.3 LCZ 3: Butlers Creek Valley

Changes due to the project

Changes due to the project which would lie along the new boundary between LCZ 1 and LCZ 3 include the road corridor existing the tunnel portals, which would extend north west, but would be somewhat ‘bedded down’ into the landscape falling northeast into Butlers Creek Valley, utilising the natural fall of the topography.

Built form and landscaping associated with the operational infrastructure would be positioned to the north of the tunnel portals and proposed Great Western Highway alignment. The largest element within the landscape would be the ventilation outlet positioned above the tunnel portals, which would be positioned at a high point and with no tall planting proposed to surround it. Large road furniture, such as signage gantries and VMS, would be positioned within the road corridor, often at a lower level due to the more depressed elevation of the proposed road. Other built form, such as the water treatment plant and the substation, would be positioned north of the tunnel portals within the rural valley, outside the immediate road corridor.

Magnitude: Moderate

The widening of LCZ 1 east into LCZ 3 would result in a reduction of the open, pastoral landscape spatially contained within the neighbouring ridge lines and Great Western Highway corridor, however, this change would have already begun with the Little Hartley to Lithgow Upgrade, with the project comprising an additional area of change at the southern end of the valley. The addition of large built forms and landscape structures (such as the tunnel portals, ventilation outlet, water treatment plant and other buildings) within the neighbouring LCZ 1 would elevate the prominence of the transport corridor within the more low-key rural landscape, however, as with the increase in road corridor area as discussed above, the upgrade of the Great Western Highway would already have occurred due to the Upgrade Program, particularly with the addition of the bridges linking the new Great Western Highway alignment to the existing Highway.

The position of the project elements, particularly the tunnel portal and the operational facilities compound on an open, raised hillside overlooking the valley would result in an increase in the prominence of the proposed structures within the valley setting. These changes present uncharacteristically large elements adjacent to the rural setting.



Landscape character impact ratings

Table 6-5 shows the landscape impact rating of LCZ 3, illustrating the impact of the project with (emissions via ventilation outlet) and without (emissions via portal) a ventilation outlet.

Emissions via ventilation outlet option: High (Adverse)

The project would result in the reduction of the LCZ, where the LCZ extent was already clearly defined by larger, prominent natural landscape formations. The addition of built form and transport infrastructure is uncharacteristic within the LCZ and existing surrounds, although somewhat reduced in impact by the broader Upgrade Program. Nevertheless, the qualitative rating of the changes result in an adverse effect on landscape character.

Emissions via portals option: High (Adverse)

While the lack of ventilation outlet would result in a reduction of the large scaled infrastructure adjacent to the LCZ, the remaining built form within the operations facility, including water treatment plant and substation would still comprise uncharacteristically large elements added to the LCZ. There would also be no change to the overall reduction in the area comprising the open, rural setting with limited structures, and the increase of the Great Western Highway corridor adjacent to this LCZ. Without the ventilation outlet, there are enough changes to the landscape character to retain the High (Adverse) rating.

Table 6-5: Landscape impact assessment - LCZ 3

LCZ 3: Butlers Creek Valley		
	Emissions via ventilation outlet	Emissions via portals
Sensitivity	High	High
Magnitude	Moderate	Moderate
Landscape character impact rating	High to moderate	High to moderate
Qualitative rating	Adverse	Adverse

6.2.4 LCZ 4: Bushland

Changes due to the project

Within LCZ 4, changes due to the project include the tunnel operations facility, comprising a cluster of buildings with surrounding access road and car parking. Water quality basins would be positioned to the north and south of the facility. Other infrastructure within the LCZ would include:

- retaining walls and fencing
- battering around the facility and water quality basins
- landscaping, including tree, shrub and groundcover planting
- larger infrastructure, such as overhead gantries, VMS and the ventilation outlet
- signage, CCTV, and other small pieces of road infrastructure.

Magnitude: Moderate

Most of the changes due to the project at Blackheath would result in a localised widening of LCZ 1: Great Western Highway, reducing the extent of LCZ 4: Bushland. The widened highway corridor and tunnel portals would be larger in scale than the existing infrastructure at this location. The ventilation outlet (if option used) and tunnel operations facility would be larger in scale than other infrastructure within the study area.

LCZ 4 would reduce in size at this location, although considering the large expanse of this LCZ within and outside the study area, this small change would not be likely to effect overall landscape character. The addition of the tunnel operations facility within the bushland setting would, however, comprise a series of uncharacteristic elements within the LCZ.

Soft landscaping (areas of planting) integrated into the verges of the proposed road and around the proposed tunnel operations facility would assist in ‘bedding down’ the project into the surrounding landscape, reducing the perceived scale of the overall project.

The spatially enclosed nature of the bushland setting would limit the impact of the project on surrounding landscape, meaning that the impact of the project on landscape character within LCZ 4 would be localised to the immediate extents of the project at Blackheath.

Landscape character impact ratings

Table 6-6 shows the landscape impact rating of LCZ 4, illustrating the impact of the project with (emissions via ventilation outlet) and without (emissions via portal) a ventilation outlet.

Emissions via ventilation outlet option: High to Moderate (Adverse)

The project would result in a local reduction in the extent of the LCZ 4 within the study area. The uncharacteristic built form of the project within LCZ 4, coupled with the scale of the proposed tunnel operations facility, would result in an adverse effect of the project on landscape character.

Emissions via portals option: High to moderate (Adverse)

The removal of a ventilation outlet from the project would not change the ratings for the project within LCZ 4: Bushland. The ventilation outlet would be positioned within a widened transport corridor rather than within the new extents of LCZ 4.

Table 6-6: Landscape impact assessment - LCZ 4

LCZ 4: Bushland		
	Emissions via ventilation outlet	Emissions via portals
Sensitivity	High	High
Magnitude	Moderate	Moderate
Landscape character impact rating	High to moderate	High to moderate
Qualitative rating	Adverse	Adverse



### 6.3 Impact of construction on landscape character

Construction activity would occur at three surface locations within the study area:

- At Blackheath, within LCZ 1c: GWH Bushland and LCZ 4: Bushland
- At Soldiers Pinch, within LCZ 4: Bushland
- At Little Hartley, within LCZ 1b: GWH Butlers Creek Valley and LCZ 3: Butlers Creek Valley.

Within LCZ 1, three character precincts were delineated due to the different areas that the Great Western Highway passes through. While the Great Western Highway has a high landscape value as a scenic route through a major tourist destination (with areas listed on the World and National heritage lists), LCZ 1b and LCZ 1c are considered the most sensitive, given their susceptibility to change due to the project.

Construction activity along the Great Western Highway (but outside the study area) has been somewhat of a common occurrence for the past few years due to the greater Upgrade Program. As construction of the project would commence, construction would have already been underway due to the Katoomba to Blackheath Upgrade at Blackheath, and the Little Hartley to Lithgow Upgrade at Little Hartley. As found in the landscape character impact assessment of the project at operation, the magnitude of change due to the construction of the project would be somewhat lessened due to the existing construction activity because of the Upgrade Program within these character precincts, and ultimately within LCZ 1: Great Western Highway.

Construction activity would comprise an extension of construction at Blackheath and Little Hartley, both in the area affected by construction and the amount of time over which construction would occur. Overall, the impact of construction of the project on LCZ 1 is considered to be High to Moderate (Adverse).

At Blackheath, the extension of bushland clearing from the existing footprint of Katoomba to Blackheath Upgrade would result in the spatial widening of the Great Western Highway into LCZ 4: Bushland, with a distinct shift in the local character of that area, both within the Great Western Highway corridor and within the local area of bushland to the east, which lies within the Blue Mountains National Park. This would comprise a substantial change in landscape character considered to be High (Adverse).

At Little Hartley, while the extension of the construction footprint for the Little Hartley to Lithgow Upgrade due to the project would increase the area subject to construction activity, there would be less removal of trees, but a more sprawling site impacted by construction within the open, rural LCZ 3: Butlers Creek Valley.

Overall, this would substantially impact the quiet, rural valley centred around Butlers Creek, fringed with dramatic, bush-clad escarpments and a more low-key Great Western Highway corridor, adding the clutter of construction, including large equipment, activity, and ancillary facilities within the landscape. This change is considered to be a High (Adverse).

### 6.4 Summary of impact on landscape character

Table 6-7 summarises the landscape impact ratings of the LCZs, illustrating the difference in the impact of the project with the ventilation outlet (emissions via ventilation outlet) and without the ventilation outlet (emissions via portal) .

Four LCZs were identified within the study area, comprising the Great Western Highway (LCZ 1), townships (LCZ 2), Butlers Creek Valley (LCZ 3) and bushland (LCZ 4). LCZ 1 was split into 3 character precincts for assessment due to the linear nature of the LCZ, the character of which was greatly effected by the landscape along the corridor. These character precincts correlated with the LCZs of townships, Butlers Creek Valley and bushland.

Within LCZ 1: Great Western Highway, an impact rating of High to Moderate (Adverse) was assessed for those areas where the project occurred (within bushland and Butlers Creek Valley). The LCZ had localised widening at the two tunnel portal areas, with substantially larger transport infrastructure than the existing environment. However, the project, when assessed in addition to the broader Upgrade Program, only recorded a Moderate magnitude of change. The changes returned an adverse qualitative rating in both character precincts for options that included ventilation outlets. These qualitative ratings were lowered to Neutral qualitative rating in the option with no ventilation outlets as the widened corridor would be similar to other wider interchanges along the Great Western Highway outside of the study area. The project elements were characteristic (if not larger in scale) to typical elements found within the transport corridor.

In the townships, the only change to landscape character would be the reduction in traffic, which would result in a Beneficial qualitative rating.

LCZ 3: Butlers Creek Valley returned a landscape character impact rating of High to Moderate (Adverse). Within the valley setting the widening of the Great Western Highway corridor would result in a reduction of the extent of the rural valley setting, which is already constricted between bushland ridge lines on two sides. However, this would comprise an additional expansion of the widened road corridor due to the Little Hartley to Lithgow Upgrade, which would already have widened the corridor to the north of the project within the valley. The scale of the project and the position of the tunnel portals and operational facilities infrastructure on an exposed hillside would result in the effect of the project impacting the spatially open, rural setting.

LCZ 4: Bushland returned a High to Moderate (Adverse) rating. The increase in LCZ 1: Great Western Highway and a reduction in the extent of LCZ 4 was not considered as critical within the study area due to the more spatially enclosed landscape, where surrounding dense bushland was more likely to reduce the effects of the project on the surrounding landscape.

Overall, the project is considered to have a High to Moderate (Adverse) effect on the landscape, but this would be localised surrounding the surface works at Blackheath and Little Hartley.

Table 6-7: Landscape character impact assessment summary

Landscape Character Zone		Sensitivity	Magnitude	Landscape impact rating	Qualitative rating	
					Emissions via ventilation outlet	Emissions via portals
LCZ 1: Great Western Highway	LCZ 1a: GWH Township	Low	Low	Low	Beneficial	Beneficial
	LCZ 1b: GWH Butlers Creek Valley	Moderate	High	High to Moderate	Adverse	Neutral
	LCZ 1c: GWH Bushland	High	Moderate	High to Moderate	Adverse	Neutral
LCZ 2: Township		Low	Negligible	Negligible	Neutral	Neutral
LCZ 3: Butlers Creek Valley		High	Moderate	High to Moderate	Adverse	Adverse
LCZ 4: Bushland		High	Moderate	High to Moderate	Adverse	Adverse



## Visual Impact Assessment

# 07



# 7. Visual Impact Assessment

The visual impact assessment of the project has been assessed at each of the three locations subject to change derived from the project: Blackheath, Soldiers Pinch and Little Hartley. During construction, all three locations would be subject to changes, however, operational changes would be limited to Blackheath and Little Hartley only.

## 7.1 Blackheath

### 7.1.1 Visibility of the project

The visual envelope of the project at Blackheath is mapped in Figure 7-1.

Overall, the visual catchment of the proposed works is almost contained within the boundaries of the construction footprint. The rail line to the west provides a visual barrier to any potential visual receptors to the west of it, however most of the area to the west comprises dense bushland. The rail lies at a higher level than the Great Western Highway, with passing trains getting an elevated view down to the project.

The landscape slopes towards the south east from the Great Western Highway, falling into a steep valley which is heavily vegetated with dense bushland. Few trails pass through the bushland, however, at entry points to the land there are warning signs restricting access to these areas due to the land comprising the Sydney Drinking Water Catchment for the Lake Medlow Dam. The dense bushland screens distance views from the east.

Views to the project would be seen from the Great Western Highway heading north and south, from passing trains, from the eastern end of Evans Lookout Road and from a row of residences to the north of the project on Evans Lookout Road. The two southern most houses on Valley View Road may also see the project.

During the Katoomba to Blackheath Upgrade, much of the vegetation within the construction footprint of that project would have been cleared. While the remaining dense vegetation on the project site would be cleared, when complete, the project would still be largely surrounded by bushland to the south and west.

During construction, the most visually prominent elements would include clearing of vegetation and earthworks, set up of the construction ancillary facilities within and outside the Great Western Highway corridor, including stockpile and spoil handling area, and construction equipment and activity.

At operation, the most visually prominent elements would include the tunnel portal, ventilation outlet (optional) and tunnel operations facility, the Great Western Highway carriageways, on-ramps and off-ramps to and from the tunnels and the water quality basins.

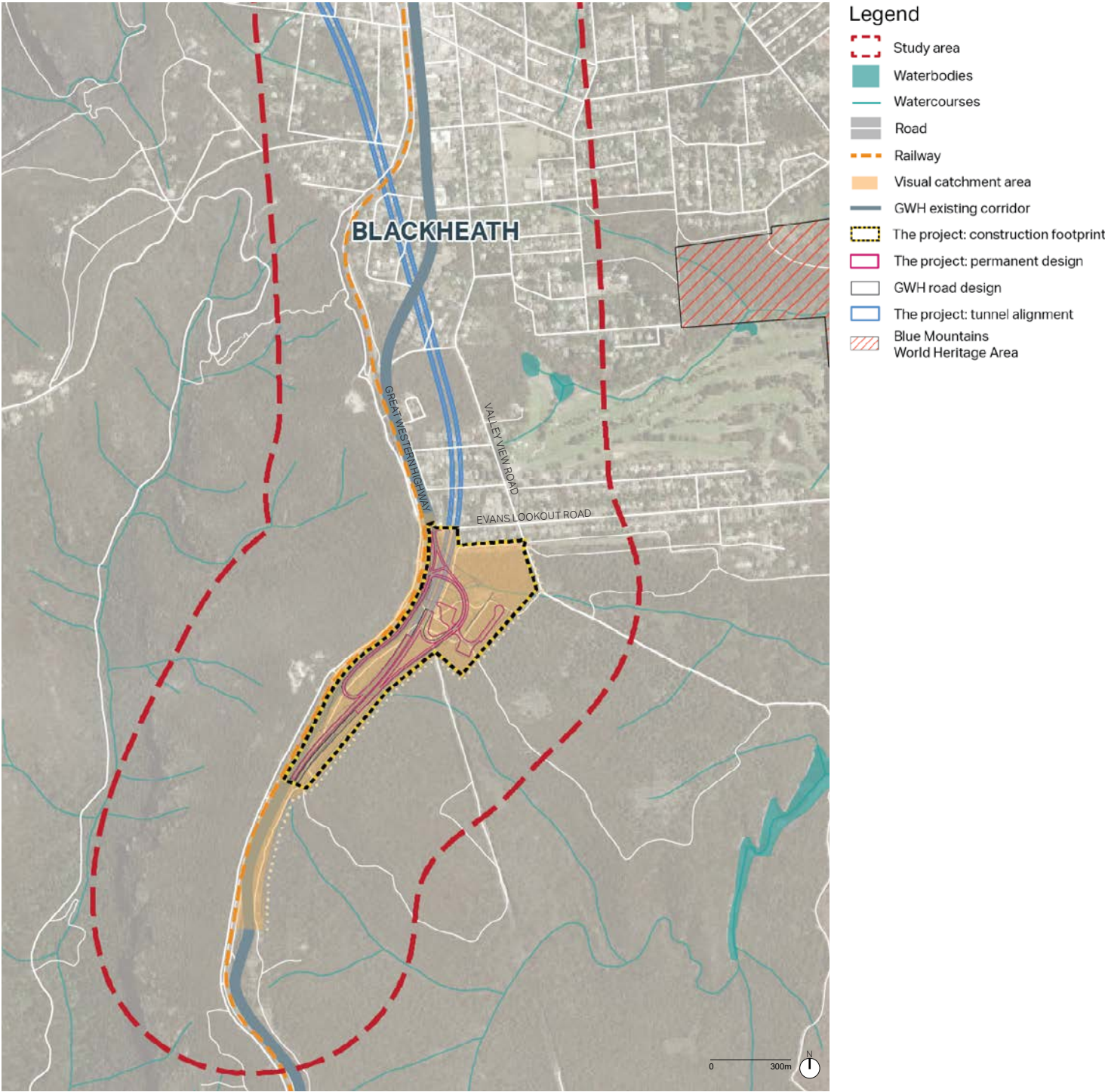


Figure 7-1: Visual envelope of the project at Blackheath



7.1.2 Representative Viewpoints

Seven (7) representative viewpoints have been chosen to assess potential impacts on existing views seen by visual receptors at Blackheath (refer Figure 7-2). These were chosen to illustrate typical views that are likely to be seen from the public realm, including views that would be seen by higher numbers of visual receptors, or by sensitive visual receptor groups. The rationale for choice of viewpoint locations comprises:

- **Viewpoint 1: Great Western Highway**  
Representative view for travellers on the Great Western Highway heading north to Blackheath. This viewpoint is positioned approaching the proposed intersection with the westbound lane which will provide access to Blackheath town centre
- **Viewpoint 2: Great Western Highway at Tennyson Road (looking north and south)**  
Representative view for travellers on the Great Western Highway travelling north and south near the proposed tunnel portals
- **Viewpoint 3: Evans Lookout Road**  
This viewpoint is representative of the view south seen by visual receptors travelling along Evans Lookout Road and local residents with views to the project from the rear of their properties
- **Viewpoint 4: Great Western Highway at Evans Lookout Road**  
This viewpoint is representative of visual receptors travelling west and looking north through the intersection of Evans Lookout Road and the Great Western Highway
- **Viewpoint 5: Great Western Highway at Brightlands Avenue**  
This viewpoint is representative of the view south seen by those travelling along Brightlands Avenue and by local residents on the Great Western Highway
- **Viewpoint 6: Valley View Road**  
This viewpoint is representative of views south seen from local residences on the southern edge of Blackheath adjacent to the northern edge of the project. This location would also be the entry to the active transport trail within the Upgrade Program works
- **Viewpoint 7: The Train from Blackheath**  
This viewpoint is representative of views south seen from the train between Blackheath and Medlow Bath past the project.

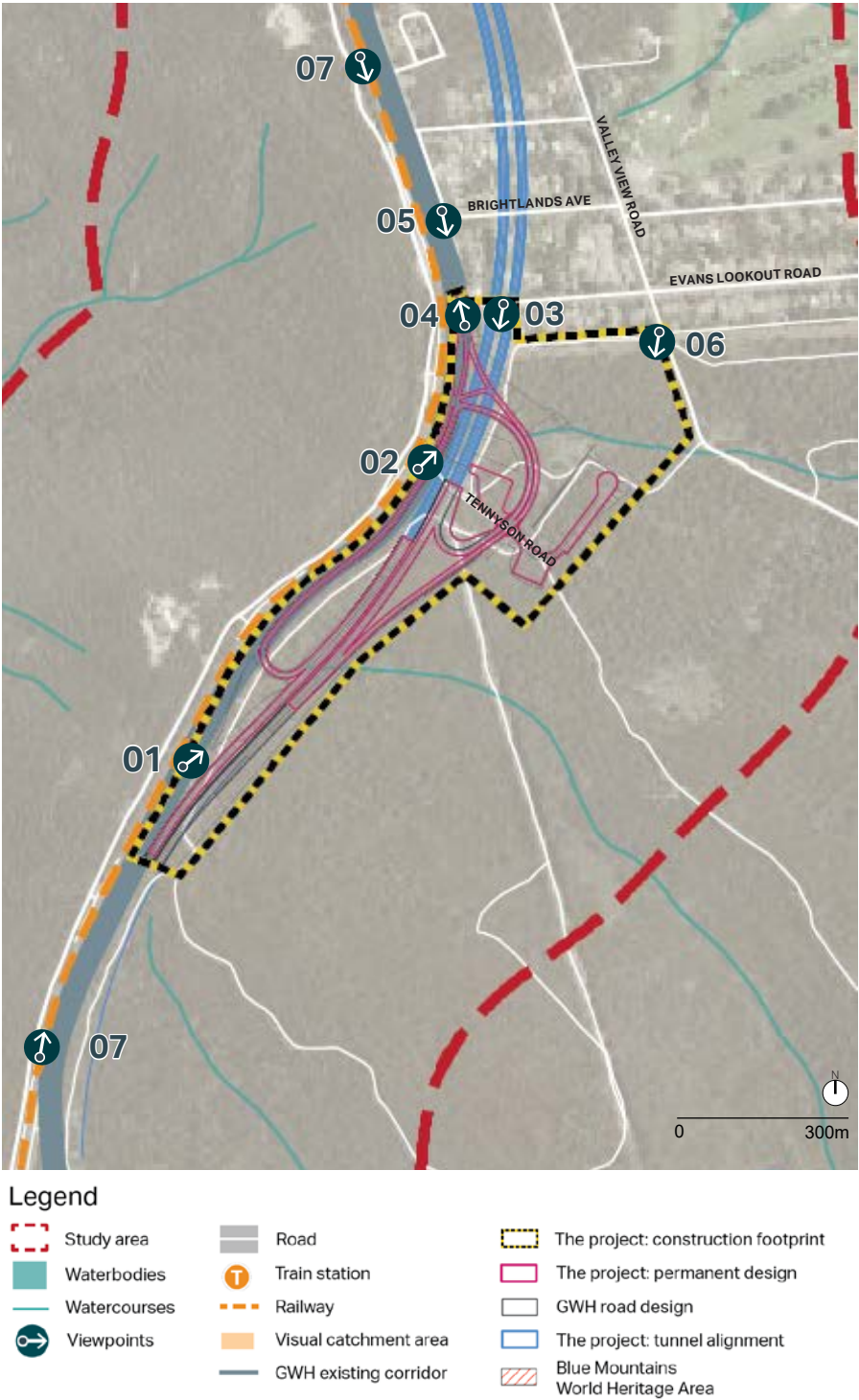


Figure 7-2: Representative viewpoint locations at Blackheath



7.1.2.1. Viewpoint 1: Great Western Highway

This viewpoint is located on the eastern verge of the existing Great Western Highway, looking north as shown in Figure 7-3.

The viewpoint is representative of the view seen by travellers heading north along the Great Western Highway, approaching the intersection with the slip lane which would provide access to Blackheath town centre.



Figure 7-3: Key plan showing Viewpoint 1 in relation to the project and the Upgrade Program

Sensitivity: Moderate

Visual receptors at this viewpoint are motorists on the Great Western Highway who would be expected to primarily be focusing on the road and traffic. Motorists would comprise a mix of people, including locals driving to and from work / home, or as part of work-related activities (e.g. truck drivers) and tourists travelling to or through the Blue Mountains from the east or the west.

Given the scenic nature of the route through the Blue Mountains and the presence of the Blue Mountains National Park to the east (right of frame) at the viewpoint, the sensitivity of this viewpoint is considered to be higher than a typical transport corridor.

However, the susceptibility of the viewpoint to change is somewhat lessened by changes within the baseline environment of the view as part of the Upgrade Program. Much of the bushland to the east (which is a highly valued element within the view) would have been removed to allow for the expansion of the road corridor.

Existing view

- The existing view from this location is shown in Figure 7-4 and currently comprises:
- The foreground includes the existing two lane Great Western Highway extending north into the distance, with a widened gravel verge to the east (right of frame)
  - To the east (right of frame), the Great Western Highway is fringed by dense bushland and to the west (left of frame) by a band of native vegetation partially screening the rail corridor, which runs parallel to the Great Western Highway, raised by batters above the level of the road pavement, at this location. Taller rail infrastructure can be seen in the middle to background of the view
  - The horizon is screened from view by the canopy of bushland, with the Great Western Highway disappearing from view as it bends to the northeast in the middle to background, screened by bushland to the east (right of frame) within the view.

Baseline view

The view from this viewpoint would include changes made within the Katoomba to Blackheath Upgrade (refer Figure 7-6 and Figure 7-7).

During construction, the Katoomba to Blackheath Upgrade would result in most of the bushland to the east of the Great Western Highway in the fore and middle ground cleared from within the view.

At operation, the existing Great Western Highway would have been narrowed to a single lane heading north, while the new alignment of the Great Western Highway would comprise a split carriageway road positioned to the east and descending, following the contours of the sloped landscape.

The newly aligned Great Western Highway corridor would be positioned between grassed batters to the east and west of the carriageways. Fencing would be positioned at the boundary of the road corridor, fringed by existing bushland to the east.

Visual impact assessment: construction

Anticipated change to the view

During construction the additional area over that for the Katoomba to Blackheath Upgrade required for the project would not be visible within the view as it would be positioned approximately 500m to the north of this viewpoint. Night lighting would be visible within the construction footprint within the otherwise darkened context.

Magnitude: Negligible

Construction activity for the project would comprise an extension of the construction activity for the Katoomba to Blackheath Upgrade to the north. As such, it is considered that there would be a negligible impact on the view due to the project from this location.

Visual impact assessment: Negligible (Neutral)

Table 7-1 shows the visual impact rating of the project on the view from this viewpoint during construction.

While construction activity would be seen during the construction of the project, this would be due to the Katoomba to Blackheath Upgrade and there would be no change to the view due to the project. As such, there would also be no change in the quality of the view, which has been assessed as neutral.

Table 7-1: Visual impact rating (construction) - Viewpoint 1: Great Western Highway

Visual Impact Assessment - construction	
Sensitivity	Moderate
Magnitude	Negligible
Visual impact rating	Negligible
Qualitative rating	Neutral





Figure 7-4: Existing view from Viewpoint 1



Visual impact assessment: operation

Anticipated change to the view

Changes due to the project are illustrated in Figure 7-6 and Figure 7-7. As shown, most of the changes in the foreground within the view would have occurred due to the Upgrade Program rather than the project.

The clearing and earthworks to widen the road corridor nearing the proposed tunnel portals would open up the view to the horizon substantially, with distant landform potentially seen in the background in the distance above the new infrastructure.

The north bound carriageway of the newly aligned Great Western Highway would be seen in the foreground of the view to the right of frame descending towards the tunnel portals in the distance. The proposed widened interchange (including on and off ramps, tunnel portals and the ventilation outlet) would be seen in the middle to background of the view. Tree planting positioned between the northbound carriageway, the existing Great Western Highway heading north and the westbound on ramp to the tunnel would screen some of the proposed road infrastructure from the view, including the ventilation outlet (optional). Further planting to the eastern side of the proposed Great Western Highway upgrades would screen views to the north east, including to the proposed tunnel operations facility. Night lighting on the approach to the tunnel would be visible while contrasting with the surrounding darkened landscape.

Note: for a detailed description of visible project infrastructure, refer Section 5.8 of this report.

Magnitude: Moderate

The scale of the road corridor and visible transport infrastructure seen within the proposed view would be substantially larger than the existing condition. However, much of the widening of the road corridor in the foreground of the view would have been due to the Katoomba to Blackheath Upgrade rather than the project, thereby lessening the impact to Moderate.

The project would result in the addition of the northbound carriageway of the Great Western Highway extending towards the tunnel portals and the westbound on-ramp positioned between the existing Great Western Highway alignment and the northbound carriageway. The tunnel portals and on / off ramps and associated retaining walls would be seen in the middle to background of the view. However, these elements may be partially screened by tree and shrub planting in the verges and on the batters. It is likely that the ventilation outlet would be screened by trees from this location.

Fencing, signage and other road infrastructure may be seen within the view and would comprise new elements, however, would be typical elements seen within the view along a road corridor and would not in themselves comprise a substantial change. Lighting along the road corridors (both the existing Great Western Highway and the proposed new alignment) and in the lead up to the tunnel is anticipated to be brighter than lighting supplied within the existing road corridor at this location.

The changes would be seen across a majority of the view, with the Upgrade Program works seen in more detail due to the further distance to viewing of the project elements in the middle to background. The opening up of a distant view to the horizon would comprise a substantial change to the overall composition of the view, however, how much of the compositional change to the view due to the project or the Upgrade Program is difficult to calculate, given the extent of clearing that would have already occurred due to the Katoomba to Blackheath Upgrade.

The changes to the view would be permanent but the road infrastructure within the view would reduce in visual prominence as the planting matured, particularly tree planting to the east adjacent to existing bushland areas. A return to the existing view of a Highway fringed by dense bushland could be achieved with extensive batter planting, albeit a widened highway corridor with more substantially scaled infrastructure.

Visual impact rating (Emissions via ventilation outlet option): Moderate (Neutral)

Table 7-2 shows the visual impact ratings of the project the view from this viewpoint at operation with (emissions via ventilation outlet) and without (emissions via portal) a ventilation outlet.

While the widening of the Great Western Highway corridor, reducing the extent of the fringing bushland to the east is considered an adverse change within the view, this cannot be wholly attributed to the project, but rather to the Katoomba to Blackheath Upgrade. As the project would visually comprise the addition of carriageways extending from the widened Great Western Highway and other similar, typical road infrastructure including lighting, these changes would not effect the overall quality of the view, resulting in the Neutral rating. The provision of views to the horizon would add interest to the view, particularly as the view would include bushland within the Blue Mountains National Park.

Visual impact rating (Emissions via portals option): Moderate (Neutral)

It is unlikely that the ventilation outlet would be seen within the view from this location, therefore there would be no change to the ratings with the emissions via portals option.

Table 7-2: Visual impact rating (operation) - Viewpoint 1: Great Western Highway

Visual Impact Assessment - operation		
	Emissions via ventilation outlet	Emissions via portals
Sensitivity	Moderate	Moderate
Magnitude	Moderate	Moderate
Visual impact rating	Moderate	Moderate
Qualitative rating	Neutral	Neutral



Figure 7-5: Plan showing Viewpoint 1 in relation to the Upgrade Program and the project



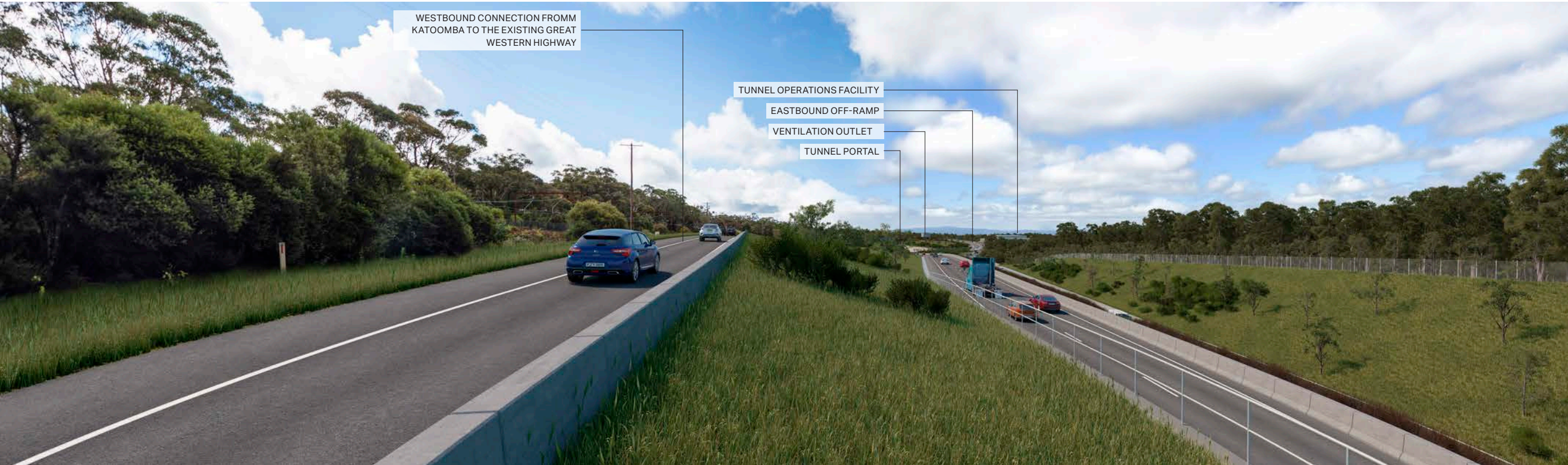


Figure 7-6: Visual simulation showing changes due to the Upgrade Program and the project

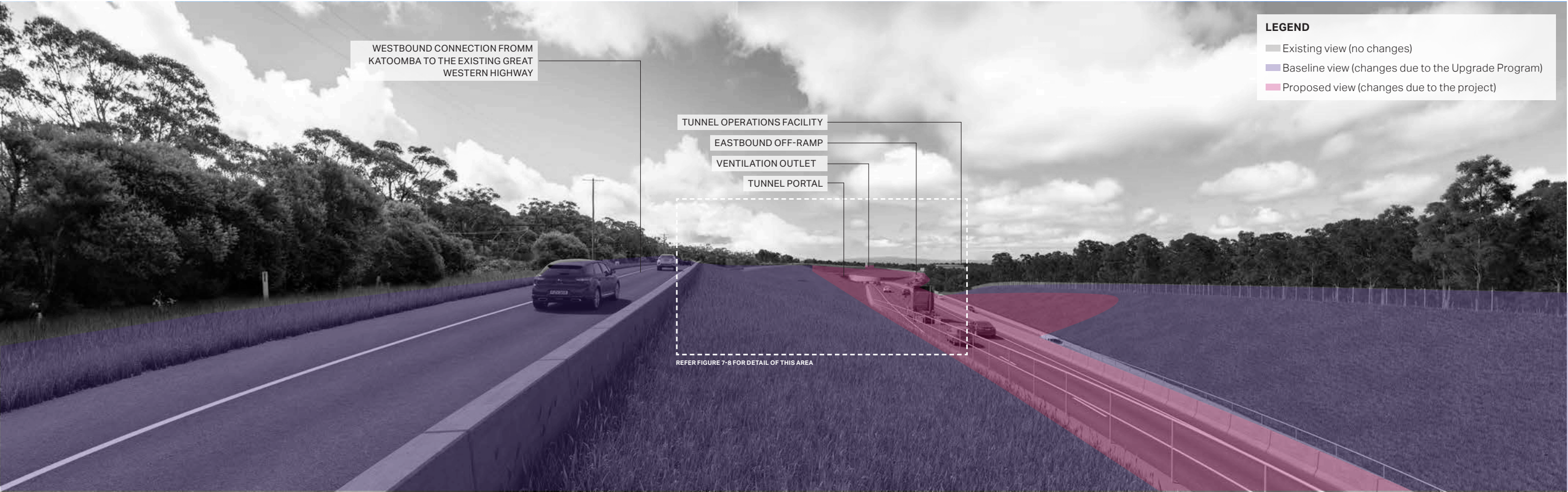


Figure 7-7: Visual simulation illustrating the changes due to the Upgrade Program and the project but with trees and shrubs removed from the desaturated image to show the extent of each project





**Figure 7-8:** Detail of Figure 7-7 showing the project without any tree planting to clearly see infrastructure which would be potentially visible within the view



7.1.2.2. Viewpoint 2a: Great Western Highway at Tennyson Road looking north

This viewpoint is located on the eastern verge of the Great Western Highway, facing north east, as shown in Figure 7-9. This viewpoint is representative of visual receptors travelling north along the Great Western Highway.



Legend

	Study area		Road		The project: construction footprint
	Waterbodies		Train station		The project: permanent design
	Watercourses		Railway		GWH road design
	Viewpoints		Visual catchment area		The project: tunnel alignment
			GWH existing corridor		Blue Mountains World Heritage Area

Figure 7-9: Keyplan showing Viewpoint 2a in relation to the project

Sensitivity: High

Visual receptors at this viewpoint are motorists driving along the existing Great Western Highway who would be expected to primarily be focusing on the road and traffic. Motorists would comprise a mix of people, including locals driving to and from work / home, or as part of work-related activities (e.g. truck drivers) and tourists travelling to or through the Blue Mountains from the east or the west.

Given the scenic nature of the route through the Blue Mountains and the presence of the Blue Mountains National Park to the east (right of frame) at the viewpoint, the sensitivity of this viewpoint is considered to be higher than a typical transport corridor.

The viewpoint is highly susceptible to change due to the project.



**Existing view**

The existing view from this location is shown in Figure 7-10. The view comprises:

- The existing two lane Great Western Highway extending to the north into the distance, with safety barrier and DENSE bushland adjacent to the barrier visible in the foreground. Electrical wires are visible overhead
- The rail corridor runs parallel to the road at this location, elevated above a vegetated batter to the left of frame. Electrical infrastructure and passing trains are visible in the middle ground of the view
- The background of the view comprises the canopy of surrounding bushland vegetation to the west beyond the rail corridor, to the north and east. Bushland screens the views to the horizon.

**Baseline view**

During construction, the northern-most extent of the construction footprint for the Katoomba to Blackheath Upgrade would be seen, comprising a strip of construction extending north along the Great Western Highway corridor.

At operation, the eastern verge of the existing Great Western Highway would be upgraded to include safety barriers as part of the Katoomba to Blackheath Upgrade, as shown in Figure 7-11 and Figure 7-12.

**Visual impact assessment: construction**

**Anticipated change to the view**

During construction, a majority of the construction activity seen within the view would be due to the project, rather than the Katoomba to Blackheath Upgrade. A large area to the north east and east of the viewpoint would be cleared of bushland vegetation, followed by earthworks that would extend down the hillside to the east. The construction of the ventilation outlet (optional) would be seen to the north east, with the visual clutter of the ancillary facilities seen behind them further down the hillside (including workshops, stockpiling areas, offices, stores and amenities buildings).



Figure 7-10: Existing view from Viewpoint 2a looking north





Figure 7-11: Visual simulation showing the proposed changes within the view due to the Upgrade Program and the project

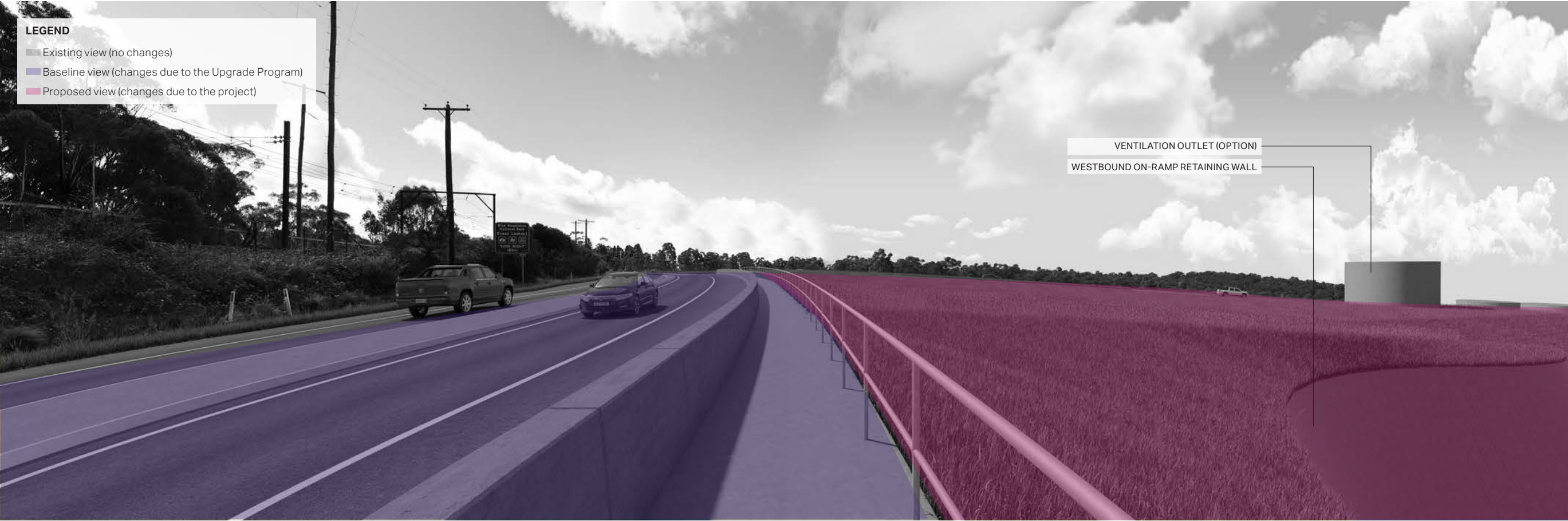


Figure 7-12: Visual simulation illustrating the changes due to the Upgrade Program and the project but with trees and shrubs removed from the desaturated image to show the extent of each project





**Figure 7-13:** Plan showing Viewpoint 2a in relation to the Upgrade Program and the project

**Magnitude: High**

Construction activity for the project would be seen across a majority of the view to the north and northeast, resulting in a visual ‘opening up’ of the view with the initial clearing of vegetation, followed by the substantial clutter of construction equipment and activity. The scale of the earthworks, activity and equipment (including the tunnel boring machine, which would be collected and dismantled at this location) would be uncharacteristic within the view. Night lighting would be visible within the construction footprint within the otherwise darkened context.

**Visual impact assessment: High (Adverse)**

Table 7-3 shows the visual impact rating of the project on the view from this viewpoint during construction.

Changes within the view would comprise an extension of the existing construction footprint for the Katoomba to Blackheath Upgrade northwards into an area of bushland which would subsequently be cleared and become a large area of construction activity for the project. The removal of bushland, large scale earthworks, the addition of construction equipment, night lighting and other activity would be an adverse effect on the view.

**Table 7-3:** Visual impact rating (construction) - Viewpoint 2a: Great Western Highway

Visual Impact Assessment - construction	
Sensitivity	High
Magnitude	High
Visual impact rating	High
Qualitative rating	Adverse

**Visual impact assessment: operation**

**Anticipated change to the view**

The view to the east would be opened up, with the horizon visible due to the removal of roadside vegetation and earthworks to the east (refer Figure 7-11 and Figure 7-12).

The proposed westbound on-ramp and associated retaining walls would be visible in the foreground to the right of the existing Highway alignment. The top of the tunnel portals would also be visible in the middle ground of the view, with the ventilation building and ventilation outlet (optional) seen to the east (right of frame).

The existing Great Western Highway carriageways would remain visible within the view, largely in their current condition. The existing and proposed Great Western Highway road corridors would be lit within the otherwise dark landscape.

Note: for a detailed description of visible project infrastructure, refer Section 5.8 of this report.

**Magnitude: High**

The composition of the view would be substantially different, changing from a narrow view along the Great Western Highway corridor fringed with bushland to a wide, open view across a substantial piece of road infrastructure.

Night lighting on the approach to the tunnel would be visible while contrasting with the surrounding darkened landscape.

The scale of the road corridor and visible transport infrastructure seen within the proposed view would be substantially larger than the existing condition. The addition of proposed road infrastructure, tunnel portals, ventilation outlet and associated facilities would be in contrast to the existing view to the east to the Blue Mountains National Park. The proposed infrastructure would be in full view and be seen in close proximity. The view to the north and east across the valley would be exposed with the removal of the trees.

The change would effect a large portion of the view and would be permanent.



**Visual impact rating (Emissions via ventilation outlet option): High (Adverse)**

Table 7-4 shows the visual impact ratings of the project from this viewpoint at operation with (emissions via ventilation outlet) and without (emissions via portal) a ventilation outlet.

The overall visual impact of the project on the view from this location is considered to be high. The changes to the view comprise the replacement of a view to highly valued Blue Mountains bushland with a substantially scaled-up infrastructure corridor, impacting the natural character of the scenic route through the Blue Mountains. Lighting of the road corridor would contribute to the change in the upgraded corridor.

The qualitative rating of the impact is considered adverse due to the loss of vegetation, the overall ‘hardening’ of the view and the inclusion of large infrastructure such as the ventilation outlet within the view.

Over time the quality of the view would be anticipated to improve as the vegetation grew and partially screened the view to the infrastructure, reducing the visual prominence of the road within the view.

**Visual impact rating (Emissions via portals option): High (Adverse)**

The removal of the ventilation outlet from within the view is unlikely to lower the magnitude of the change at this location. The qualitative rating would still remain as adverse given the level of change to the view due to the earthworks and road corridor widening.

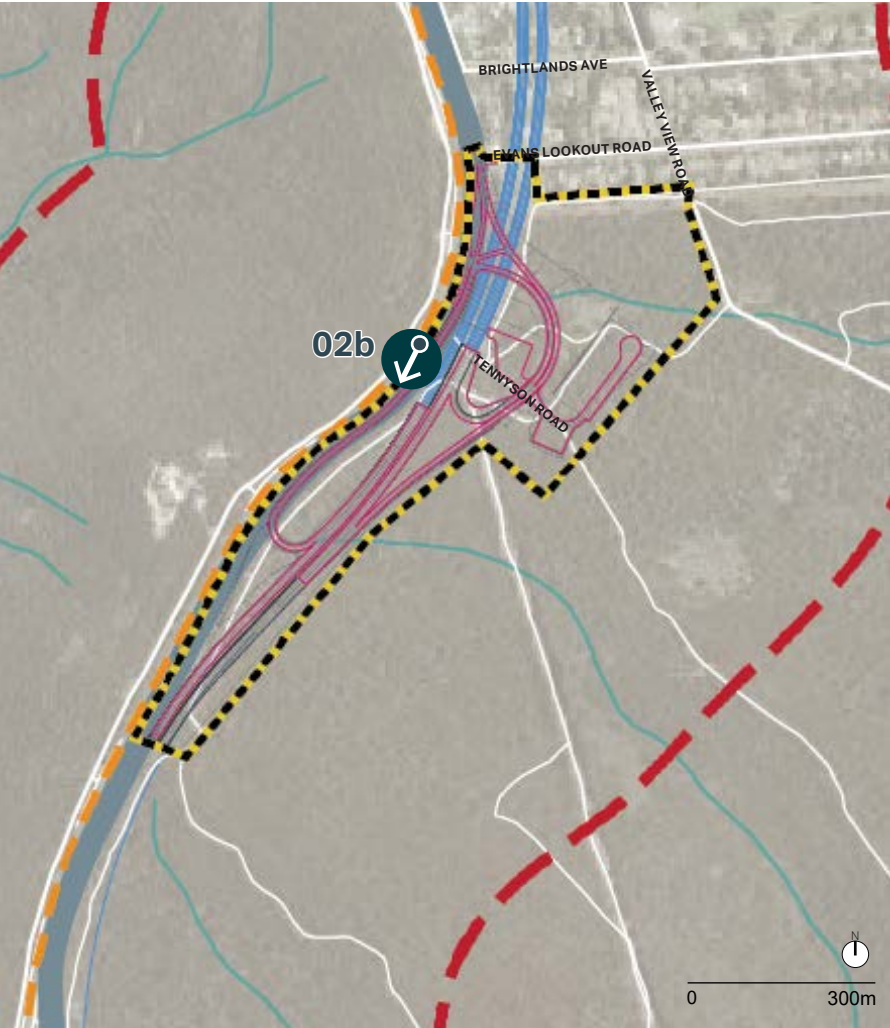
**Table 7-4:** Visual impact assessment - Viewpoint 2a: Great Western Highway at Tennyson Road

Visual Impact Assessment - operation		
	Emissions via ventilation outlet	Emissions via portals
Sensitivity	High	High
Magnitude	High	High
Visual impact rating	High	High
Qualitative rating	Adverse	Adverse



7.1.2.3. Viewpoint 2b: Great Western Highway at Tennyson Road looking south

This viewpoint is the same as Viewpoint 2a, but looking south along the existing Great Western Highway (refer Figure 7-14).



Legend

Study area	Road	The project: construction footprint
Waterbodies	Train station	The project: permanent design
Watercourses	Railway	GWH road design
Viewpoints	Visual catchment area	The project: tunnel alignment
	GWH existing corridor	Blue Mountains World Heritage Area

Figure 7-14: Keyplan showing Viewpoint 2b in relation to the project

Sensitivity: High

The sensitivity of the viewpoint has been assessed as High within Section 7.1.2.2.

Existing view

The existing view from this location is shown in Figure 7-15 and comprises:

- The existing two lane Great Western Highway extending to south and curving out of view, with safety barrier, signage and bushland adjacent visible in the foreground. Electrical wires are visible overhead
- The rail corridor runs parallel to the road at this location, elevated above a vegetated batter to the right of frame. Electrical infrastructure and passing trains are visible in the middle ground of the view
- The background of the view comprises the canopy of surrounding bushland vegetation to the west beyond the rail corridor, to the south and east. Bushland screens the views to the horizon.

Baseline view

During construction, the view would include the existing construction footprint of the Katoomba to Blackheath Upgrade. The area would have been cleared within the construction footprint, with construction activity already underway for the Upgrade Program.

At operation, the eastern verge of the existing Great Western Highway would be upgraded to include safety barriers and fencing as part of the Katoomba to Blackheath Upgrade, as shown in Figure 7-16 and Figure 7-17. The Great Western Highway would extend north to meet the project highway carriageways as they travel away from the tunnel portals.

Visual impact assessment: construction

Anticipated change to the view

During construction the area within the view would already have been cleared to accommodate the Katoomba to Blackheath Upgrade. While the construction of the project would be seen within the view, it would not comprise new elements of construction, only a continuation of already existing works. The works visible in this view would occur within the footprint already defined by the Katoomba to Blackheath Upgrade project scope. Night lighting would be visible within the construction footprint within the otherwise darkened context.

Magnitude: Negligible

Construction activity for the project would comprise an extension of activity for the Katoomba to Blackheath Upgrade and as such, it is considered that there would be a negligible impact on the view due to the project from this location.

Visual impact assessment: Negligible (Neutral)

Table 7-5 shows the visual impact rating of the project on the view from this viewpoint during construction.

While construction activity would be seen during the construction of the project, this would be due to the Katoomba to Blackheath Upgrade and there would be no change to the view due to the project. As such, there would also be no change in the quality of the view, which has been assessed as neutral.

**Table 7-5:** Visual impact rating (construction) - Viewpoint 2b: Great Western Highway

Visual Impact Assessment - construction	
Sensitivity	High
Magnitude	Negligible
Visual impact rating	<b>Negligible</b>
Qualitative rating	<b>Neutral</b>





Figure 7-15: Existing view from Viewpoint 2 looking south

Visual impact assessment: operation

Anticipated change to the view

The view to the east would be opened up, with the horizon visible due to the removal of roadside vegetation and earthworks to the east (refer Figure 7-16 and Figure 7-17).

The proposed eastbound off-ramp would be visible in the foreground to the left of the existing Highway alignment. Part of the retaining walls adjacent to the off-ramp would also be visible in the middle ground of the view.

Note: for a detailed description of visible project infrastructure, refer Section 5.8 of this report.

Magnitude: High

While some of the changes extending into the distance (including the existing alignment of the Great Western Highway) would be due to the Katoomba to Blackheath Upgrade, a majority of the changes within the view would be due to the project.

Night lighting on the approach to the tunnel would be visible while contrasting with the surrounding darkened landscape.

The scale of the road corridor and visible transport infrastructure seen within the proposed view would be substantially larger than the existing condition, with the extent of the upgraded interchange area also visible at night due to lighting of all road areas. The stepping down of road infrastructure to the east within the widened road corridor would be in contrast to the existing view to the east to the Blue Mountains National Park. The proposed infrastructure would be in full view and be seen in close proximity. The view to the south and east across the valley would be exposed with the removal of the trees.

The change would effect a large portion of the view and would be permanent.





Figure 7-16: Visual simulation showing the proposed changes within the view due to the Upgrade Program and the project

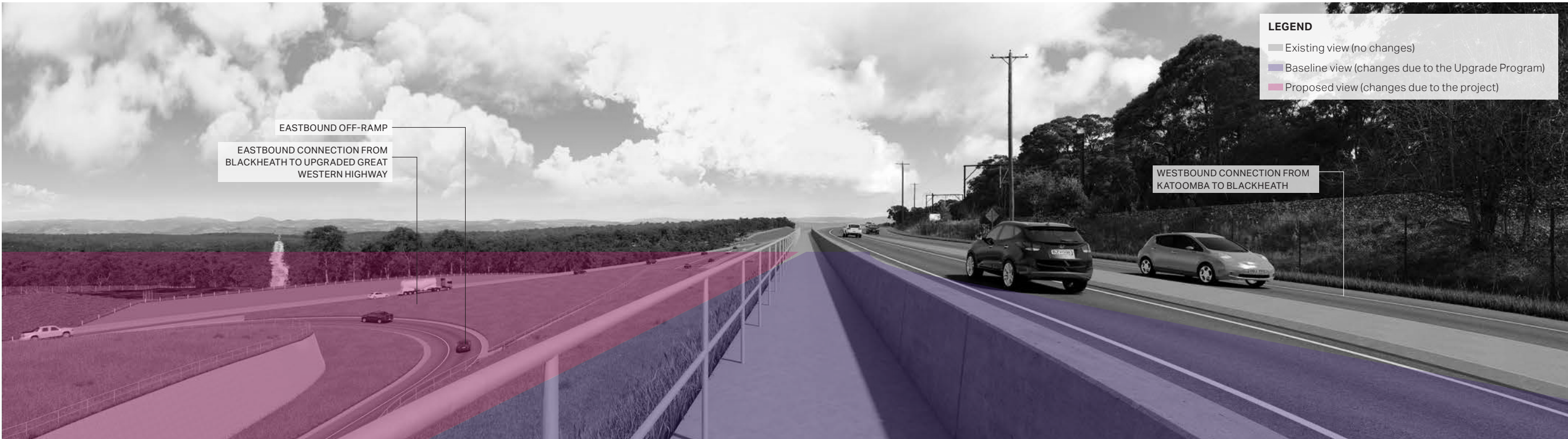


Figure 7-17: Visual simulation illustrating the changes due to the Upgrade Program and the project but with trees and shrubs removed from the desaturated image to show the extent of each project





Figure 7-18: Plan showing Viewpoint 2b in relation to the Upgrade Program and the project

**Visual impact rating (Emissions via ventilation outlet option): High (Adverse)**

Table 7-6 shows the visual impact ratings of the project the view from this viewpoint at operation with (emissions via ventilation outlet) and without (emissions via portal) a ventilation outlet.

The changes to the view comprise the replacement of a view to fringing bushland with a substantially scaled-up infrastructure corridor. The widening of the road corridor would provide scenic, distant view towards the Grose Valley, the qualitative rating of the impact is considered adverse due to the overall 'hardening' within the foreground of the view and the inclusion of large infrastructure such as retaining walls, slip lanes and additional lighting infrastructure.

Over time the quality of the view would be anticipated to improve as the vegetation grew and partially screened the view to the infrastructure, reducing the visual prominence of the road within the view.

**Emissions via portals option: High (Adverse)**

The ventilation outlet would not be visible within this view, therefore its removal from the project would not alter the impact ratings.

**Table 7-6:** Visual impact assessment - Viewpoint 2b: Great Western Highway at Tennyson Road looking south

Visual Impact Assessment - operation		
	Emissions via ventilation outlet	Emissions via portals
Sensitivity	High	High
Magnitude	High	High
Visual impact rating	High	High
Qualitative rating	Adverse	Adverse



7.1.2.4. Viewpoint 3: Evans Lookout Road

This viewpoint is located at the western end of Evans Lookout Road, near the intersection with the existing Great Western Highway looking south, as shown in Figure 7-19. This viewpoint is representative of visual receptors travelling along Evans Lookout Road and nearby residents.

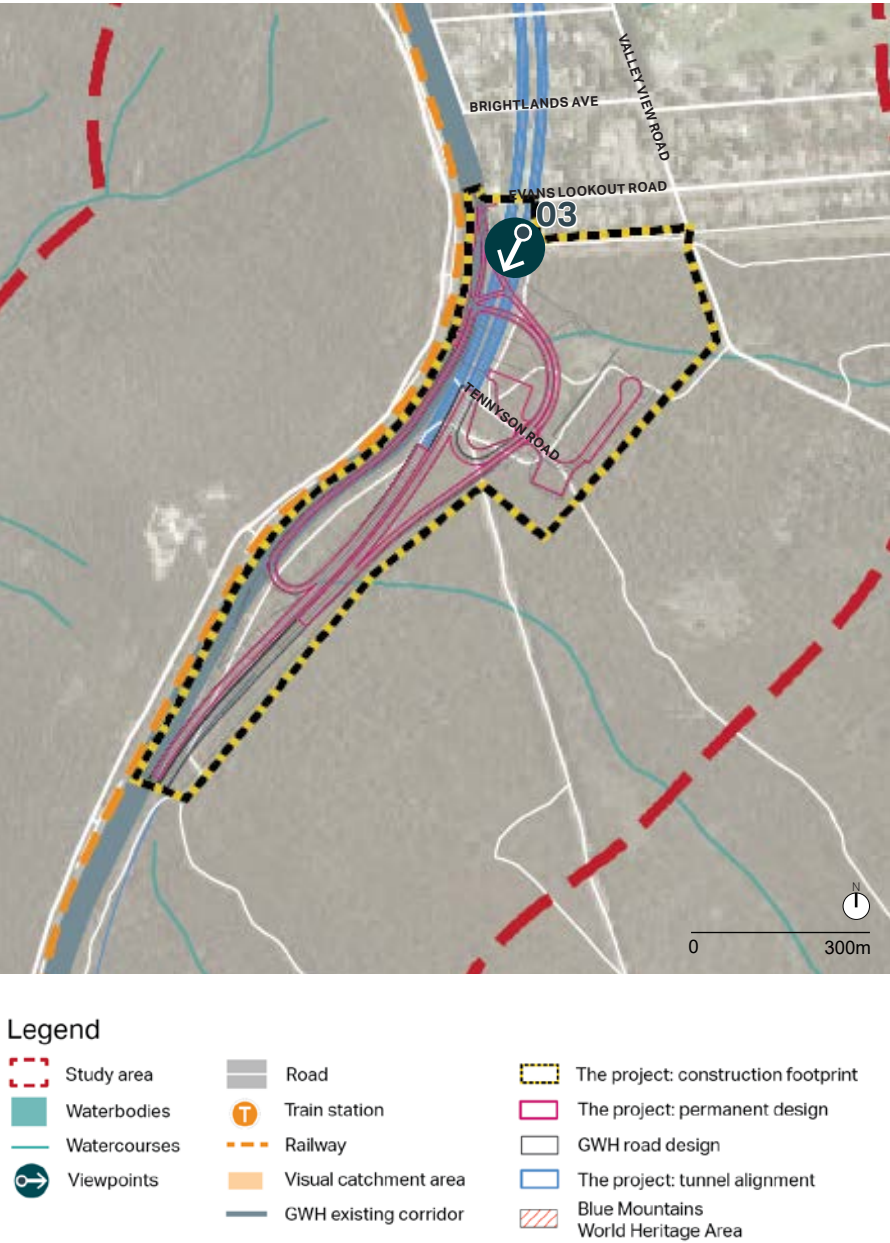


Figure 7-19: Keyplan showing Viewpoint 3 in relation to the project

Sensitivity: Moderate

Evans Lookout Road provides access to several lookout points and hiking trails at the eastern end of the road. These destinations are within the Blue Mountains National Park and lie within the World Heritage listed area of the Grose Valley. A such, it is anticipated that as well as residents, a high number of tourists and recreational hikers would travel along the road to access these locations.

These visual receptors, in addition to local residents, would comprise a sensitive receptor group at this viewpoint.

However, the overall sensitivity rating is lowered due to the reduced susceptibility of the viewpoint to change due to the project, as it is unlikely that larger pieces of infrastructure would be seen from this location due to screening by proposed vegetation.

Existing view

The existing view from this location is shown in Figure 7-20 and comprises the gravel road verge and wire fencing on Evans Lookout Road in the foreground, and a wide managed asset protection zone (APZ) that extends south from this viewpoint, then east along the rear fences of properties on Evans Lookout Road. The APZ is vegetated with low grasses and occasional trees and includes regular ‘No Entry’ signs at access points.

Dense bushland vegetation fringes the APZ to the south, with the landscape dropping to the south into a steep valley.

The Great Western Highway is visible in the middle ground of the view to the west at the top of Evans Lookout Road, with the rail corridor higher still and running parallel to the Great Western Highway to the west.

Baseline view

It is anticipated no changes would be seen within the view due to the Katoomba to Blackheath Upgrade during construction or at operation.

Visual impact assessment: construction

Anticipated change to the view

During construction the area to the south would be cleared of vegetation. The view to the project would comprise fencing / hoarding, with earthworks and construction activity associated with the upgrade of the intersection of Evans Lookout Road and the Great Western Highway, and the construction of the eastbound on-ramp and eastern connection with the upgraded Great Western Highway in the fore to middle ground of the view. Night lighting would be visible within the construction footprint within the otherwise darkened context.

Magnitude: High

Construction activity for the project would be seen across a majority of the view to the south, resulting in a visual ‘opening up’ of the view with the initial clearing of vegetation, followed by the substantial clutter of construction equipment and activity, which may or may not be screened behind fencing or hoarding. The scale of the earthworks, activity and equipment would be uncharacteristic within the view.

Visual impact assessment: High to Moderate (Adverse)

Table 7-7 shows the visual impact rating of the project on the view from this viewpoint during construction.

Changes within the view would comprise the removal of bushland, large scale earthworks, the addition of construction equipment, night lighting and other activity, which would have an adverse effect on the view.

Table 7-7: Visual impact rating (construction) - Viewpoint 3: Evans Lookout Road

Visual Impact Assessment - construction	
Sensitivity	Moderate
Magnitude	High
Visual impact rating	High to Moderate
Qualitative rating	Adverse

Visual impact assessment: operation

Anticipated change to the view

The landscape to the south would have been replanted with shrubs and trees at completion of the works (refer Figure 7-21). The Great Western Highway would have been upgraded, with the new batters on the eastern edge of the Great Western Highway visible in the centre and to the right of frame within the view. Batters would be planted with shrubs and trees.

The intersection to the far right of frame would have been upgraded, with new road surface, fencing and signage potentially seen within the view. The top of the ventilation outlet (optional) could be visible within the view in the background, seen against the sky, however, it is most likely that it would be screened from view by trees and shrubs planted on the batters and within the foreground of the view. A portion of the tunnel operations facility buildings would be seen in the middle to background of the view to the left of frame, however, these too would be screened by replanted vegetation within the landscape in the foreground.

Note: for a detailed description of visible project infrastructure, refer Section 5.8 of this report.

Magnitude: Moderate

While the cleared areas within the project would have been replanted, some infrastructure may still be seen. Glimpse views to the ventilation outlet and tunnel operations facility, as well as a localised narrowing of the bushland area seen to the south. The overall view would have been visually widened due to the project, with this change lessening over time as the replanted trees and shrubs matured.





Figure 7-20: Existing view from Viewpoint 3



Figure 7-21: Visual simulation showing changes due to the project from Viewpoint 3





**Figure 7-22:** Visual simulation showing the project with no planting so structural elements potentially seen from this viewpoint are clearly articulated

**Visual impact rating (Emissions via ventilation outlet option): Moderate (Adverse)**

Table 7-8 shows the visual impact ratings of the project the view from this viewpoint at operation with (emissions via ventilation outlet) and without (emissions via portal) a ventilation outlet.

Changes to the overall view are anticipated to comprise the removal and replanting of vegetation to the south, with glimpse views to new road infrastructure and lighting, potentially including the ventilation outlet. The upgraded intersection and Great Western Highway to the west would still be visible within the view.

Although much of this is expected to be screened from view, the ventilation outlet would comprise a large, uncharacteristic piece of infrastructure seen against the horizon in the background of the view.

**Visual impact rating (Emissions via portals option): Moderate (Adverse)**

If the ventilation outlet was removed from the project, the resulting qualitative rating would not change as the ventilation outlet would not be a visually prominent element within the view. The regenerating bushland planting within the land to the south is likely to screen most road infrastructure, resulting in the replacement of vegetation within the view.

**Table 7-8:** Visual impact rating (operation) - Viewpoint 3: Evans Lookout Road

Visual impact assessment - operation		
	Emissions via ventilation outlet	Emissions via portals
Sensitivity	Moderate	Moderate
Magnitude	Moderate	Moderate
Visual impact rating	Moderate	Moderate
Qualitative rating	Adverse	Adverse



**Figure 7-23:** Plan showing Viewpoint 3 in relation to the Upgrade Program and the project



7.1.2.5. Viewpoint 4: Great Western Highway at Evans Lookout Road

This viewpoint is located at the intersection of Evans Lookout Road and the Great Western Highway looking north, as shown in Figure 7-7. The viewpoint is representative of travellers on the Great Western Highway and those turning onto Evans Lookout Road.



Figure 7-24: Keyplan showing Viewpoint 4 in relation to the project

Sensitivity: Moderate

While nearby residential receptors and travellers on the Great Western Highway and Evans Lookout Road may comprise sensitive visual receptor groups, the susceptibility of the viewpoint to change at this location lowers the overall sensitivity rating substantially.

Existing view

The existing view from this location is shown in Figure 7-25 and comprises:

- The intersection of the Great Western Highway and Evans Lookout Road within the foreground of the view, including road signage and a widened gravel verge
- The Great Western Highway extending to the north into the distance.
- The Birgitte Hansen Art and Mural Services building to the right of frame within the view, comprising a landmark due to its unusual murals on the facade of the building
- The rail corridor running parallel to the Great Western Highway, with electrical gantries and passing trains visible elevated above batters with pasture grass and weeds
- The background of the view includes the canopy of trees behind the rail corridor to the west, between the Great Western Highway and a service road to the north, and to the east behind residential buildings.

Baseline view

No changes to the permanent elements within the view would be seen due to the Katoomba to Blackheath Upgrade.

Visual impact assessment: construction

Anticipated change to the view

Construction activity would be associated with the upgrade of the intersection at this location. The view would include general construction activity within the road corridor, including roadworks, earthworks, construction equipment and machinery, hoarding and fencing. Construction vehicles would be seen turning between the Great Western Highway and Evans Lookout Road as vehicles travel too and from the access point on Valley View Road, however, this access would have been used during the construction period of the Katoomba to Blackheath Upgrade, therefore this would not be a change to the baseline view.

Magnitude: High

Construction activity would be in contrast to the existing (baseline) view. These changes would be seen over a substantial portion of the view in the foreground and middle ground. It is not anticipated that night lighting would have impacts on this view as the change would occur beyond the tree line seen in the foreground.

Visual impact assessment: High to Moderate (Adverse)

Table 7-9 shows the visual impact rating of the project on the view from this viewpoint during construction.

The visual clutter of construction would be seen over a substantial portion of the view would comprise an adverse change within the view.

Table 7-9: Visual impact rating (construction) - Viewpoint 4: Great Western Highway at Evans Lookout Road

Visual Impact Assessment - construction	
Sensitivity	Moderate
Magnitude	High
Visual impact rating	High to Moderate
Qualitative rating	Adverse

Visual impact assessment: operation

Anticipated change to the view

From this viewpoint, changes within the view would comprise the upgrade of the existing intersection, with the Great Western Highway then remaining unchanged as it extends north within the view. New fencing, safety barriers and road signage may be seen due to the project.

Magnitude: Low

The size and scale of the change would be small within the view and would comprise the upgrade of an existing intersection with no changes to the more dominant elements within the view, particularly the rail corridor to the west, the existing Highway extending north into the distance, and the unusual decorated building to the east.

Visual impact rating (Emissions via ventilation outlet option): Moderate to low (Neutral)

Table 7-10 shows the visual impact ratings of the project on the view from this viewpoint at operation with (emissions via ventilation outlet) and without (emissions via portal) a ventilation outlet.

The overall visual impact of the project on the view from this location is considered to be moderate to low considering the preservation of the composition of the view. The qualitative rating is considered neutral as the existing view is characterised by the road environment at the intersection and this would largely remain the same.

Visual impact rating (Emissions via portals option): Moderate to low (Neutral)

The ventilation outlet would not be visible within this view, therefore its removal from the project would not alter the impact ratings.

Table 7-10: Visual impact assessment (operation) - Viewpoint 4: Great Western Highway at Evans Lookout Road

Visual impact assessment - operation		
	Emissions via ventilation outlet	Emissions via portals
Sensitivity	Moderate	Moderate
Magnitude	Low	Low
Visual impact rating	Moderate to low	Moderate to low
Qualitative rating	Neutral	Neutral





Figure 7-25: Existing view from Viewpoint 4



7.1.2.6. Viewpoint 5: Great Western Highway at Brightlands Avenue

This viewpoint is located on the southeast corner of the intersection of the Great Western Highway and Brightlands Avenue, looking south, as shown in Figure 7-26. This viewpoint is representative of the view seen by those entering / leaving Brightlands Avenue and by residences fronting onto the Great Western Highway. Motorists travelling south along the Great Western Highway would also see this view.



Legend

- Study area
- Waterbodies
- Watercourses
- Viewpoints
- Road
- Train station
- Railway
- Visual catchment area
- GWH existing corridor
- The project: construction footprint
- The project: permanent design
- GWH road design
- The project: tunnel alignment
- Blue Mountains World Heritage Area

Figure 7-26: Keyplan showing Viewpoint 5 in relation to the project

Sensitivity: Low

While there are nearby residential receptors, it is unlikely that these would see views to the project from their residences from their properties due to the tall vegetation within the properties and in the road corridor. Vehicles heading south along the Great Western Highway or at the at Brightlands Avenue may contain more sensitive viewers as described in Viewpoint 1, however, the susceptibility of the viewpoint to change lowers the overall sensitivity of this viewpoint.

Existing view

The existing view from this location is shown in Figure 7-27 and comprises the Great Western Highway extending south within the view, fringed to the east by a wide gravel verge providing access to a service road running parallel to the Great Western Highway. The existing Great Western Highway is two lanes at this location, with a localised widening near the access point to the service road to allow turning vehicles to slow down / speed up out of the path of through traffic.

A tall band of trees and shrubs screen the view to residences positioned to the east (left of frame), with another band of tall vegetation positioned between the service road and the Great Western Highway in the middle ground.

The elevated rail corridor is visible to the west (right of frame), with the tracks elevated above the grade of the Great Western Highway on a vegetated batter. The canopy of tall trees are seen in the background to the west, behind the rail corridor.

The view along the Great Western Highway culminates in a band of dark bushland vegetation in the distance.

Baseline view

It is unlikely that any changes due to the Katoomba to Blackheath Upgrade would be seen within this view due to the distance to the works and screening from fringing roadside vegetation and the elevated rail corridor. Occasional construction vehicles may be seen entering or leaving Evans Lookout Road in the distance.

Visual impact assessment: construction

Anticipated change to the view

Initially, the bank of bushland in the background of the view seen within the existing Great Western Highway corridor would be removed. The view to general construction activity within the road corridor would be seen, including roadworks, earthworks, construction equipment and machinery, hoarding and fencing.

Magnitude: Moderate

While construction activity may be seen and would be in contrast to the existing view, particularly the removal of the dark band of bushland vegetation seen on the horizon, these changes would only be seen over a small portion of the overall view, within the road corridor. It is not anticipated that night lighting would have impacts on this view as the change would occur beyond the tree line seen in the foreground.

Visual impact assessment: Moderate to Low (Adverse)

Table 7-11 shows the visual impact rating of the project on the view from this viewpoint during construction.

The visual clutter of construction and the removal of bushland vegetation within a small portion of the view would comprise an adverse change within the view.

Table 7-11: Visual impact rating (construction) - Viewpoint 5: Brightlands Avenue

Visual Impact Assessment - construction	
Sensitivity	Low
Magnitude	Moderate
Visual impact rating	Moderate to Low
Qualitative rating	Adverse





Figure 7-27: Existing view from Viewpoint 5

Visual impact assessment: operation

Anticipated change to the view

Changes seen due to the project would comprise the removal of the vegetation seen in the background of the view between the rail corridor vegetation and the bank of trees between the service road and the Great Western Highway. It is unlikely that the resurfacing works at Evans Lookout Road would be seen from this location, nor works associated with the portals of widened Highway as they lie at a lower level to the existing Great Western Highway. It is not anticipated that night lighting would have impacts on this view as the change would occur beyond the tree line seen in the foreground.

Magnitude: Low

The changes would result in the removal of a small amount of vegetation seen in the distance and within the view along the road corridor. It is unlikely that any pieces of road infrastructure would be seen, and if some of the upgrade of the intersection at Evans Lookout Road were seen, these would comprise elements of a similar character, scale and composition to the existing situation.

The changes would be seen in a small proportion of the view and from a distance.

Visual impact rating (Emissions via ventilation outlet option): Low (Adverse)

Table 7-12 shows the visual impact ratings of the project on the view from this viewpoint at operation with (emissions via ventilation outlet) and without (emissions via portal) a ventilation outlet.

While the changes are minimal, the removal of vegetation comprises an adverse effect within the view.

Visual impact rating (Emissions via portals option): Low (Adverse)

It is unlikely that the ventilation outlet would be seen within the view from this location, therefore there would be no change to the ratings with the emissions via portals option.

Table 7-12: Visual impact rating (operation) - Viewpoint 5: Brightlands Avenue

Visual impact assessment - operation		
	Emissions via ventilation outlet	Emissions via portals
Sensitivity	Low	Low
Magnitude	Low	Low
Visual impact rating	Low	Low
Qualitative rating	Adverse	Adverse



7.1.2.7. Viewpoint 6: Valley View Road

This viewpoint is located on the southern end of Valley View Road looking south west as shown in Figure 7-28.

This viewpoint is representative of views seen from local residences on the southern edge of Blackheath adjacent to the northern edge of the project (shown in Figure 7-29). This location would also be the entry to the active transport trail within the Katoomba to Blackheath Upgrade works.



Figure 7-28: Keyplan showing Viewpoint 6 in relation to the project

Sensitivity: Moderate

While this viewpoint is representative of the view seen from residential properties, the view from these residential properties would only be available from beyond their rear boundaries. It is unlikely that these properties would have clear views from within them to the project as they would likely be at least partially screened by back fences and vegetation within rear gardens.

The active transport trail (which would be constructed as part of the Katoomba to Blackheath Upgrade) linking to Valley View Road at this location would bring cyclists and pedestrians into the existing quiet cul-de-sac, however, it is unlikely that this trail would be open prior to the project, therefore these receptors have not been considered in the sensitivity rating.

The distance from the viewpoint to the built form of the project, including roads, water quality basins and the tunnel operations facility would decrease the susceptibility of the viewpoint to change, considering the replanting of the landscape between the viewpoint and these built elements.



Figure 7-29: Residences at the southern end of Valley View Road

Existing view

The existing view to the south west from this location is shown in and comprises a wide, managed APZ that runs the length of the rear fences of properties that back onto the project boundary. The APZ is vegetated with low grasses and occasional trees and includes regular 'No Entry' signs at access points, one of which can be seen in the foreground of the existing view.

Dense bushland vegetation fringes the APZ, with the landscape dropping to the south into a steep valley. A trail heading south into the valley provides a glimpse view to bushland within the valley in the background.

Baseline view

During construction, the road in the viewpoint would be used for access to the construction footprint of the Katoomba to Blackheath Upgrade via the proposed active transport trail route.

At operation, the active transport trail would comprise a paved pathway that would link up with the existing trail seen in the middle ground of the view, and roughly follow the trail until it drops from sight due to the steep landform. It is anticipated that some vegetation clearing would be required to construct the trail, but that landscaping either side of it would restore fringing vegetation.





Figure 7-30: Existing view from Viewpoint 6 with linework showing position of project elements

Visual impact assessment: construction

Anticipated change to the view

Initially, bushland would be cleared, opening up the view to the valley to the south. The boundary may have hoarding and fencing, which would limit views into the construction footprint, however, if views were seen, general construction activity would be clearly visible in the fore and middle ground, including earthworks, construction equipment and machinery, stockpiling and amenities buildings. The construction within the view would primarily be the project, however, some access and works would be associated with the Katoomba to Blackheath Upgrade and would have existed prior to the project. It is not anticipated that night lighting would have impacts on this view as the change would occur beyond the tree line seen in the foreground.

Magnitude: High

The initial clearing of the bushland vegetation would be a substantial change to a large proportion of the view. The spatial characteristics of the view, as well as the overall view to a picturesque outlook, would have changed, replaced with either fencing and hoarding and / or construction activity.

Visual impact assessment: High to Moderate(Adverse)

Table 7-13 shows the visual impact rating of the project on the view from this viewpoint during construction. The visual clutter of construction and the removal of bushland vegetation within a large portion of the view would comprise an adverse change.

Table 7-13: Visual impact rating (construction) - Viewpoint 6 - Valley View Road

Visual Impact Assessment - construction	
Sensitivity	Moderate
Magnitude	High
Visual impact rating	High to Moderate
Qualitative rating	Adverse



Visual impact assessment: operation

Anticipated change to the view

At operation, the landscape would be replanted with shrubs, grasses and trees as indicated in Figure 7-31, therefore the density of shrub and tree planting would determine the level of screening of built elements of the project. If planting was similar in density and species to the existing bushland, over time the bush would regenerate resulting in a similar view to existing. The tallest element (the ventilation outlet) may be seen over the tops of the trees. It is not anticipated that night lighting would have impacts on this view as the change would occur beyond the tree line seen in the foreground.

Magnitude: Low

From this viewpoint the most visually prominent element of the project would be the regenerated bushland, which, over time, is assumed to replace the existing vegetation within the view.

While the scale of the road corridor and infrastructure would be considerably larger than existing, it is most likely that these elements would be screened by vegetation at completion of the project, providing the replanting of the landscape to the north of the road and tunnel operations facility is dense enough.

Glimpse views through the vegetation to larger infrastructure, such as the ventilation outlet and facilities buildings, may be seen, but these are unlikely to remain prominent structures within the view as the vegetation matures.

Glimpses of road lighting between the vegetation may be seen within small portions of the view.

Visual impact rating (Emissions via ventilation outlet option): Moderate to Low (Neutral)

Table 7-14 shows the visual impact ratings of the project the view from this viewpoint at operation with (emissions via ventilation outlet) and without (emissions via portal) a ventilation outlet.

Overall, the project would result in the replacement of vegetation within the large portion of land between the roads and tunnel operations facility and the viewpoint. Built form within the landscape would occur at a lower level than the viewpoint, further limiting views to built form. The qualitative rating of the project is therefore neutral, with the changes reducing in visual prominence as the vegetation matures.

Visual impact rating (Emissions via portals option): Moderate to low (Neutral)

There would be no change to the ratings from this viewpoint due to the removal of the ventilation outlet from the project as it would be predominantly screened by replanted vegetation and would therefore not substantially impact views.

Table 7-14: Visual impact assessment - Viewpoint 6: Valley View Road

Visual impact assessment		
	Emissions via ventilation outlet	Emissions via portals
Sensitivity	Moderate	Moderate
Magnitude	Low	Low
Visual impact rating	Moderate to low	Moderate to low
Qualitative rating	Neutral	Neutral



Figure 7-31: Plan showing Viewpoint 6 in relation to the Upgrade Program and the project



7.1.2.8. Viewpoint 7: The Train Between Blackheath and Medlow Bath

This viewpoint is representative of views seen to the project on the train travelling between Blackheath and Medlow Bath. The locations where the photos were taken as the train passed the project are shown on Figure 7-32.

Sensitivity: High

Similar to visual receptors on the Great Western Highway, travellers on the train would comprise a mix of people, including locals travelling to and from work / home and tourists either visiting the Blue Mountains or regional towns beyond. Given the scenic nature of the journey through the Blue Mountains and the presence of the Blue Mountains National Park to the east, the sensitivity of this viewpoint is considered to be higher than a typical transport corridor.

In addition to this, the viewpoint is highly susceptible to change given the elevated nature of the view to the project, which would be seen in the fore, middle and background of the view. At points along the journey the changes would be seen within the entire view from the train looking east.

Existing view

A series of views to the east, south and while passing the project footprint at Blackheath have been recorded from the upper level of a south-bound train (refer Figure 7-33). The rail corridor is elevated above the level of the Great Western Highway as it passes the project, providing clear views to the landscape to the east.

As the train approaches Chelmsford Avenue (view A) the view comprises the two lane Great Western Highway in the foreground at the intersection with Chelmsford Avenue. A service road lies in the middle ground of the view, partially screened by a strip of vegetation separating residential houses from the Great Western Highway. Tall trees partially obscure residential houses fronting the service road and Chelmsford Avenue in the middle to background. The horizon is screened by the dense canopy of the trees.

The Great Western Highway corridor widens within the view at the intersection of Evans Lookout Road (view B), with a wider painted median separating north and south bound laneways, and a turning lane provided for Evans Lookout Road. A distinctive painted building is positioned at the intersection, facing the Great Western Highway. The background of the view comprises the dense bushland with distinctive pale trunked eucalypts.

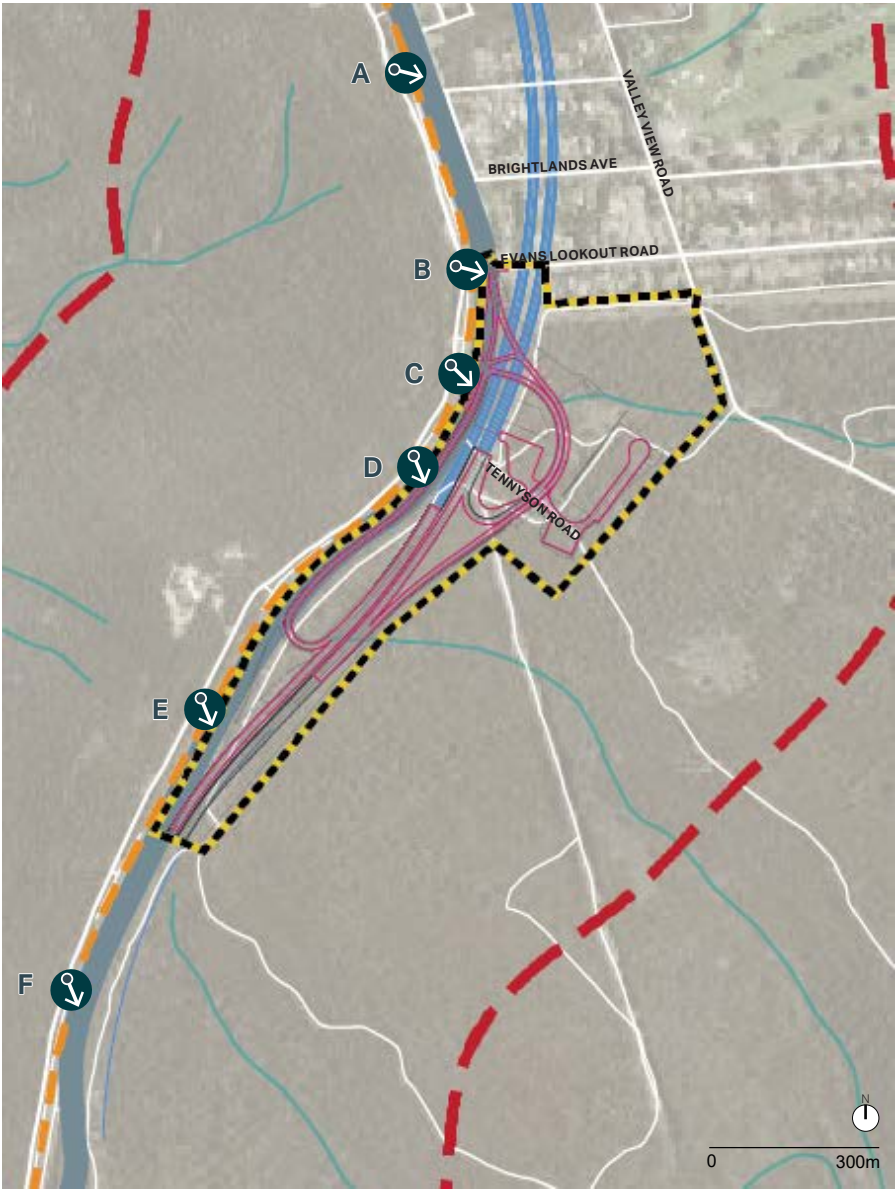


Figure 7-32: Keyplan showing the series of locations where photos were taken to represent Viewpoint 7 in relation to the project and the Katoomba to Blackheath Upgrade



Figure 7-33: Views A and B shown in Figure 7-32



Passing the intersection (view C, refer Figure 7-34), the view is simplified to the widened Highway corridor in the foreground edged with a low safety barrier. Dense bushland with the distinctive white trunked eucalypts is seen in the middle to background, screening the view to the landscape beyond.

Further south at the entry to Tennyson Road (view D), the view is similar to that seen in image C, however, an electricity easement provides a break in the vegetation, providing views along the cleared easement and allowing views to the steep, densely vegetated valley to the east.

As the trains travels south, the view to the Great Western Highway fringed with dense bushland is occasionally screened by taller vegetation between the rail corridor and the Great Western Highway (view E), until the Great Western Highway and rail corridor bend, and views along the Great Western Highway towards Medlow Bath are seen (view F).

**Baseline view**

During construction, the existing construction footprint of the Katoomba to Blackheath Upgrade would extend north and east on the opposite side of the existing Great Western Highway, seen in the fore and middle ground of the view. Views C, D, E and F would obtain views over the construction footprint for the Upgrade Program.

At operation, views towards Tennyson Road south (within views C, D, E and F) would have changes due to the Katoomba to Blackheath Upgrade. These changes would include the substantial widening of the Great Western Highway to the east, with the removal of the dense vegetation fringing the road corridor. It is likely that views over the canopy of remaining trees to the valley beyond would be visible. New elements within the view would include:

- The widening of the Great Western Highway, with split carriageways extending north east away from the existing Highway alignment
- The westbound connection from Katoomba would follow the alignment of the existing Great Western Highway
- The active transport trail, which would lie to the east of the widened road corridor but would probably disappear from view where clearing had ended at the construction footprint boundary of the Upgrade Program.

**Visual impact assessment: construction**

**Anticipated change to the view**

The clearing of bushland to the north of the Katoomba to Blackheath Upgrade would further open up views into the valley to the east. The elevated viewing position would ensure views over any boundary fencing or hoarding, allowing views into the construction footprint.

General construction activity would be clearly visible in the fore and middle ground of the view, including earthworks, construction equipment and machinery, stockpiling and amenities buildings. The construction within the view would primarily be the project, however, would include tie in works to the Katoomba to Blackheath Upgrade to the south of the project. Night lighting would be visible within the construction footprint within the otherwise darkened context.



Figure 7-34: Views C, D, E and F shown in Figure 7-32



Magnitude: High

The initial clearing of the bushland vegetation would be a substantial change to a large proportion of the view. The picturesque outlook to bushland would change, although would already have begun to change with the construction of the Katoomba to Blackheath Upgrade. Night lighting would be visible within the construction footprint within the otherwise darkened context.

Visual impact assessment: High (Adverse)

Table 7-15 shows the visual impact rating of the project on the view from this viewpoint during construction.

The visual clutter of construction and the removal of bushland vegetation within a large portion of the view would comprise an adverse change.

Table 7-15: Visual impact rating (construction) - Viewpoint 7: The Train Between Blackheath and Medlow Bath

Visual Impact Assessment - construction	
Sensitivity	High
Magnitude	High
Visual impact rating	High
Qualitative rating	Adverse

Visual impact assessment: operation

Anticipated change to the view

Changes would be seen between Evans Lookout Road and the southern project boundary (views B, C, D, and E) and would comprise a widening of the Great Western Highway corridor, including:

- Entry / exit roads between the existing Great Western Highway (joining the Katoomba to Blackheath Upgrade) and the proposed tunnels, with an additional T-intersection on the existing Great Western Highway south of Evans Lookout Road. All of these would be lit at night
- West bound on-ramp and eastbound off-ramp to the proposed tunnels
- Potential ventilation outlet within the eastbound off-ramp loop
- Upgrade of the existing intersection of the Great Western Highway and Evans Lookout Road
- Fencing and landscaping, including tree, shrub and groundcover planting
- signage, CCTV, and other small pieces of road infrastructure
- The proposed tunnel operations facility buildings
- Night lighting on the approach to the tunnel would be visible while contrasting with the surrounding darkened landscape.

It is unlikely that retaining structures (including the tunnel portals) and lower road surfaces would be seen from this location due to the slope of the landscape eastwards away from this viewpoint. Night lighting would be visible within the construction footprint within the otherwise darkened context.

Note: for a detailed description of visible project infrastructure, refer Section 5.8 of this report.

Magnitude: High

The scale of the road corridor within the landscape would have increased substantially, including several larger elements such as the ventilation outlet and buildings within the tunnel operations facility. The ventilation outlet would be a substantial, uncharacteristic element within the view and would be seen against the bushland valley backdrop. The top of the structure may be seen in relief against the sky above the canopy behind it due to its position on top of the tunnel portals.

While the view to the project would be seen as a brief moment within a greater journey, the ventilation outlet would comprise a landmark within the view due to its size, position and form.

The approach to the tunnel portals would be lit at night, adding to the landmark function of the project as a whole.

Visual impact rating (Emissions via ventilation outlet option): High (Adverse)

Table 7-16 shows the visual impact ratings of the project the view from this viewpoint at operation with (emissions via ventilation outlet) and without (emissions via portal) a ventilation outlet.

The elevated viewing position from the train, coupled with the characteristic ‘Blue Mountains bushland’ setting surrounding the project and the scale of the proposed infrastructure, particularly the ventilation outlet, results in a high visual impact rating. The interchange area would be lit at night, highlighting the change within the otherwise darkened landscape.

The adverse qualitative rating is mostly due to the scale and uncharacteristic form of the ventilation outlet within the view, which would elevate the project to a landmark moment within the journey between Blackheath and Medlow Bath.

Visual impact rating (Emissions via portals option): Moderate (Neutral)

The removal of the ventilation outlet from within the view would lower the magnitude of the change at this location to Moderate. The widening of the Great Western Highway would comprise a visual continuation of the widening experienced due to the Katoomba to Blackheath Upgrade, with much of the road infrastructure positioned stepping down the hillside away from the viewpoint, reducing its visual prominence within the bushland setting.

The qualitative rating would also be lowered to ‘neutral’, as the proposed infrastructure would be in keeping with other transport interchanges along the Great Western Highway, some of which would be visible from the train.

Table 7-16: Visual impact rating (operation) - Viewpoint 7: The Train Between Blackheath and Medlow Bath

Visual impact assessment		
	Emissions via ventilation outlet	Emissions via portals
Sensitivity	High	High
Magnitude	High	Moderate
Visual impact rating	High	High to Moderate
Qualitative rating	Adverse	Neutral



LEGEND  
Areas to be cleared of vegetation included in the project

Figure 7-35: Views B and C showing areas of cleared of vegetation



## 7.2 Soldiers Pinch

### 7.2.1 Visibility of the project

The visibility of the project at Soldiers Pinch is mapped in Figure 7-36. The construction footprint is positioned to the west of the Great Western Highway with most of the project lying below the road level. A pedestrian underpass under the Great Western Highway links walking trails on either side of the Great Western Highway, as shown in Figure 7-37.

From the Great Western Highway itself, views to the construction footprint area are screened by the canopy of trees on the road verges and batters on the western edge of the Great Western Highway.

During construction, the most visually prominent elements would include:

- Clearing of vegetation and localised earthworks near the ventilation shaft.
- Construction ventilation and compressor equipment, including a mid-tunnel access shaft
- Construction plant and material laydown
- Amenities, workshop and storeroom.

At operation the mid-tunnel access shaft would be removed and the tunnel filled. The construction footprint would be planted with trees, shrubs and groundcovers. As the site would be rehabilitated after construction, no visual impact assessment has been undertaken at operation.

#### Existing view

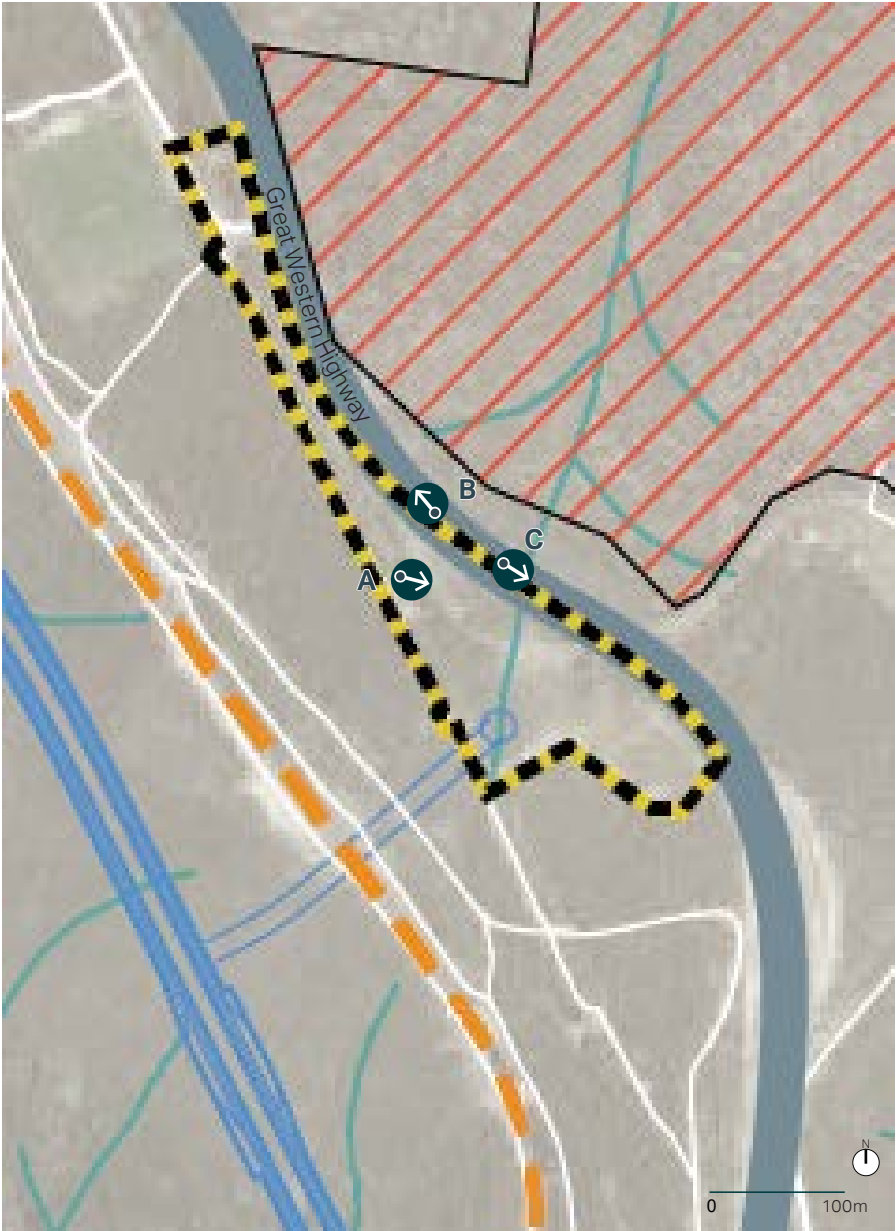
The existing view from this location is shown in Figure 7-38 and Figure 7-39 and currently comprises the Great Western Highway extending into the distance, fringed with bushland to the east and west. The two lane carriageways are separated by a median, which is planted with native grasses.

The road corridor falls from higher points to the north and south of the project, with the road elevated on batters and a bridge, however, this infrastructure is hidden from view with substantial bushland vegetation on either side of the road.

The site is already used for some construction activity at present, with mapping showing occasional stockpiling within the construction footprint.

#### Baseline view

There would be no changes due to the Upgrade Program within the view.



#### Legend

Study area	Road	The project: construction footprint
Waterbodies	Train station	The project: permanent design
Watercourses	Railway	GWH road design
Viewpoints	Visual catchment area	The project: tunnel alignment
	GWH existing corridor	Blue Mountains World Heritage Area

**Figure 7-36:** Visibility of changes within the project construction footprint at Soldiers Pinch





**Figure 7-37:** Existing view A from within the construction footprint looking towards the Great Western Highway





**Figure 7-38:** Existing view B looking northwest along the Great Western Highway with the project positioned to the west (left of frame)



**Figure 7-39:** Existing view C looking southeast along the Great Western Highway with the project positioned to the south (right of frame)



7.2.2 Visual impact during construction

Sensitivity: Moderate

Visual receptors would be limited during the construction period due to the following reasons:

- Walking trails would be closed during construction, therefore those using recreational trails would be limited to the eastern side of the Great Western Highway, who would not see views to the project
- Views to the project from the Great Western Highway would be limited due to the level change between the Great Western Highway and the site and the fringing vegetation on the road corridor batters.

Motorists on the Great Western Highway would be expected to primarily be focusing on the road and traffic. Motorists would comprise a mix of people, including locals driving to and from work / home, or as part of work-related activities (e.g. truck drivers) and tourists travelling to or through the Blue Mountains from the east or the west. The view to the east includes the World Heritage Listed area.

Given the scenic nature of the route through the Blue Mountains and the presence of the Blue Mountains National Park to the east (right of frame) at the viewpoint, the sensitivity of this viewpoint is considered to be higher than a typical transport corridor.

The project would be seen by a high number of passers-by heading north and south along the Great Western Highway. These visual receptors would see glimpse views to these changes as they pass.

Night lighting would be visible within the construction footprint within the otherwise darkened context.

Anticipated change to the view

Some clearing of some areas of bushland to the west of the Great Western Highway would be seen within the construction footprint. The tallest elements within the construction footprint would be seen after the initial clearing, particularly cranes, the access shaft, and any taller infrastructure.

Magnitude: Low

The construction activity would be experienced due to the project for a short period of time by travellers on the Great Western Highway as they passed by. The initial removal of vegetation would be seen as the removal of some canopy to the west of the road corridor, however, the band of fringing trees would remain on the batters, which would reduce the seen extent of the clearing. The construction activity seen would change over time as elements are constructed during the 6 year period.

Visual impact assessment: Moderate to Low (Adverse)

Table 7-17 shows the visual impact rating of the project on the view from this viewpoint during construction.

The visual clutter of construction, night lighting and the removal of bushland vegetation within a large portion of the view would comprise an adverse change.

Table 7-17: Visual impact rating (construction) - Soldiers Pinch

Visual Impact Assessment - construction	
Sensitivity	Moderate
Magnitude	Low
Visual impact rating	Moderate to Low
Qualitative rating	Adverse

7.2.3 Visual impact at operation

No operational infrastructure is proposed to remain at Soldiers Pinch upon completion of the works. The access shaft would be filled in. The site would be replanted after construction.



## 7.3 Little Hartley

### 7.3.1 Visibility of the project

The visual envelope of the project at Little Hartley is mapped in Figure 7-40. Little Hartley comprises a rural valley framed by two rugged escarpments to the north east (associated with Mount York) and to the south and south west (associated with Mount Sugarloaf).

Elements limiting views to the project comprise:

- Mount York escarpment to the north
- Mount Sugarloaf ridge line to the south
- The densely vegetated Berghofers Pass and Victoria Pass to the east
- The Great Western Highway, which also limits views to the project from the south due to fringing vegetation and built form
- The distance of viewing from the western areas of Little Hartley, with rural residences dotted through the landscape and often surrounded by tall windbreaks.

Views to the project would be seen from the Great Western Highway (including motorists and properties along the Great Western Highway), a string of lookout points dotted along the Mount York escarpment, Berghofers Pass and Victoria Pass and from properties within the Butlers Creek Valley. While views to the project may be seen from within the visual catchment, the extensive distance between the project and areas to the north (as shown in Figure 7-40) would limit the visibility of the project within the landscape.

During construction, the most visually prominent elements would include:

- Clearing of vegetation and earthworks
- Set up of the construction ancillary facilities
- Hoarding surrounding the site, the concrete batching plant, the tunnel boring machine assembly and launch area, and the acoustic shed
- Construction equipment and activity within the construction footprint.

At operation, the most visually prominent elements would include:

- Tunnel portal and ventilation outlet
- Operational infrastructure positioned to the north east of the tunnel portals, including a water treatment plant
- Great Western Highway carriageways.

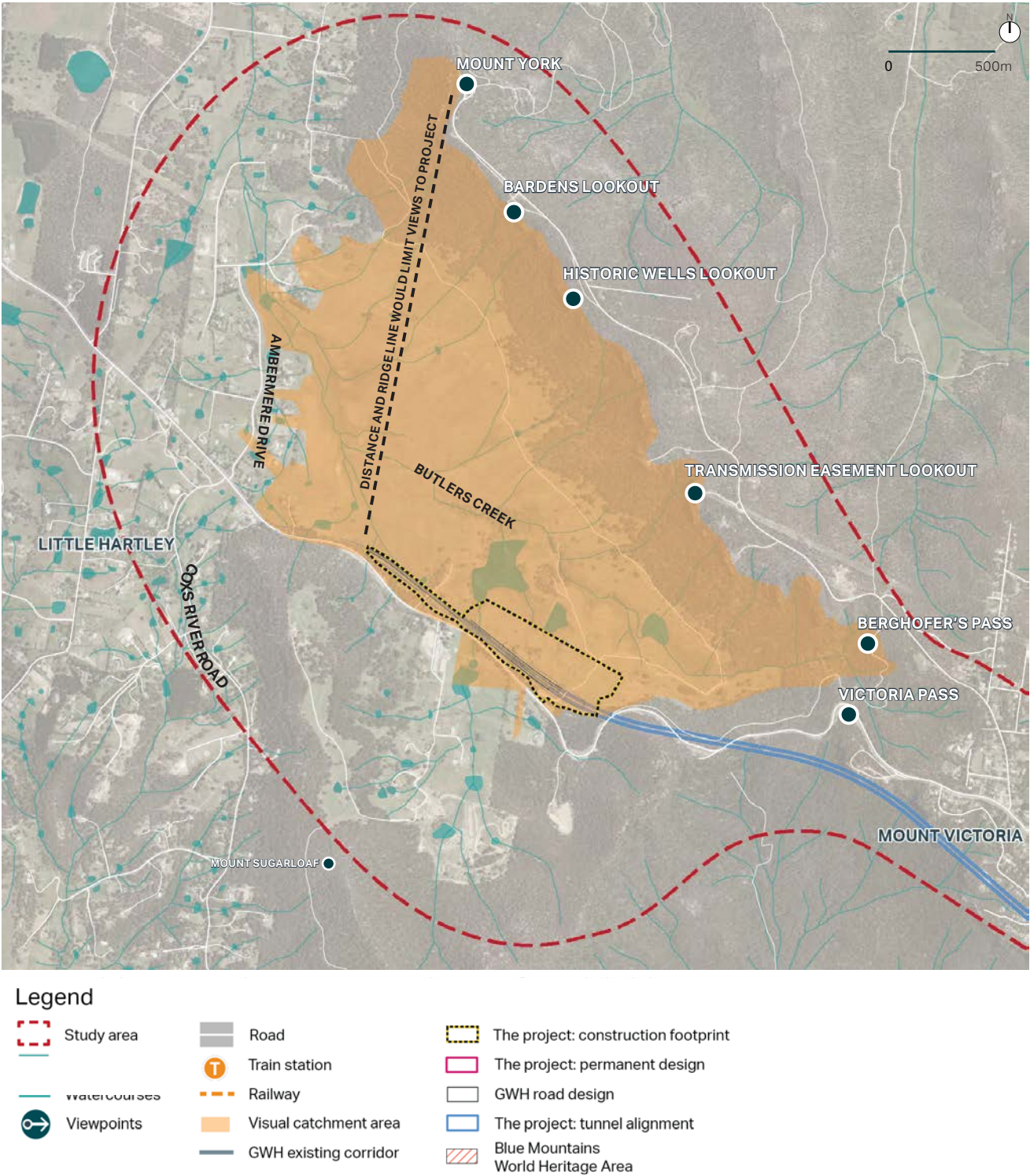


Figure 7-40: Project visibility at Little Hartley



7.3.2 Representative Viewpoints

Eleven representative viewpoints have been chosen to assess potential impacts on existing views seen by visual receptors at Little Hartley. These are roughly grouped into those viewpoints that would see the project from elevated lookouts and hiking trails, those that would see the project from and adjacent to the Great Western Highway, and those that would see the project from within the Butlers Creek Valley. The rationale for choice of viewpoint locations (refer Figure 7-41) is outlined below:

- Elevated viewpoints: representative of views seen from lookouts and hiking trails where visual receptors would comprise those undertaking recreational activities involving an appreciation of the landscape:
  - Viewpoint 8: Berghofers Pass
  - Viewpoint 9: Transmission easement lookout
  - Viewpoint 10: Historic Wells Lookout
  - Viewpoint 11: Bardens Lookout
  - Viewpoint 12: Mount York Lookout
- Viewpoints along Great Western Highway, where receptors would comprise travellers on the Great Western Highway, residents in neighbouring rural properties including a holiday farm:
  - Viewpoint 13: Great Western Highway
  - Viewpoint 14: Great Western Highway
  - Viewpoint 15: Hartley Valley Holiday Farm
- Viewpoints within Butlers Creek Valley, comprising residents on rural properties looking at the project from within the valley setting:
  - Viewpoint 16: Great Western Highway
  - Viewpoint 17: Ambergmere Drive.

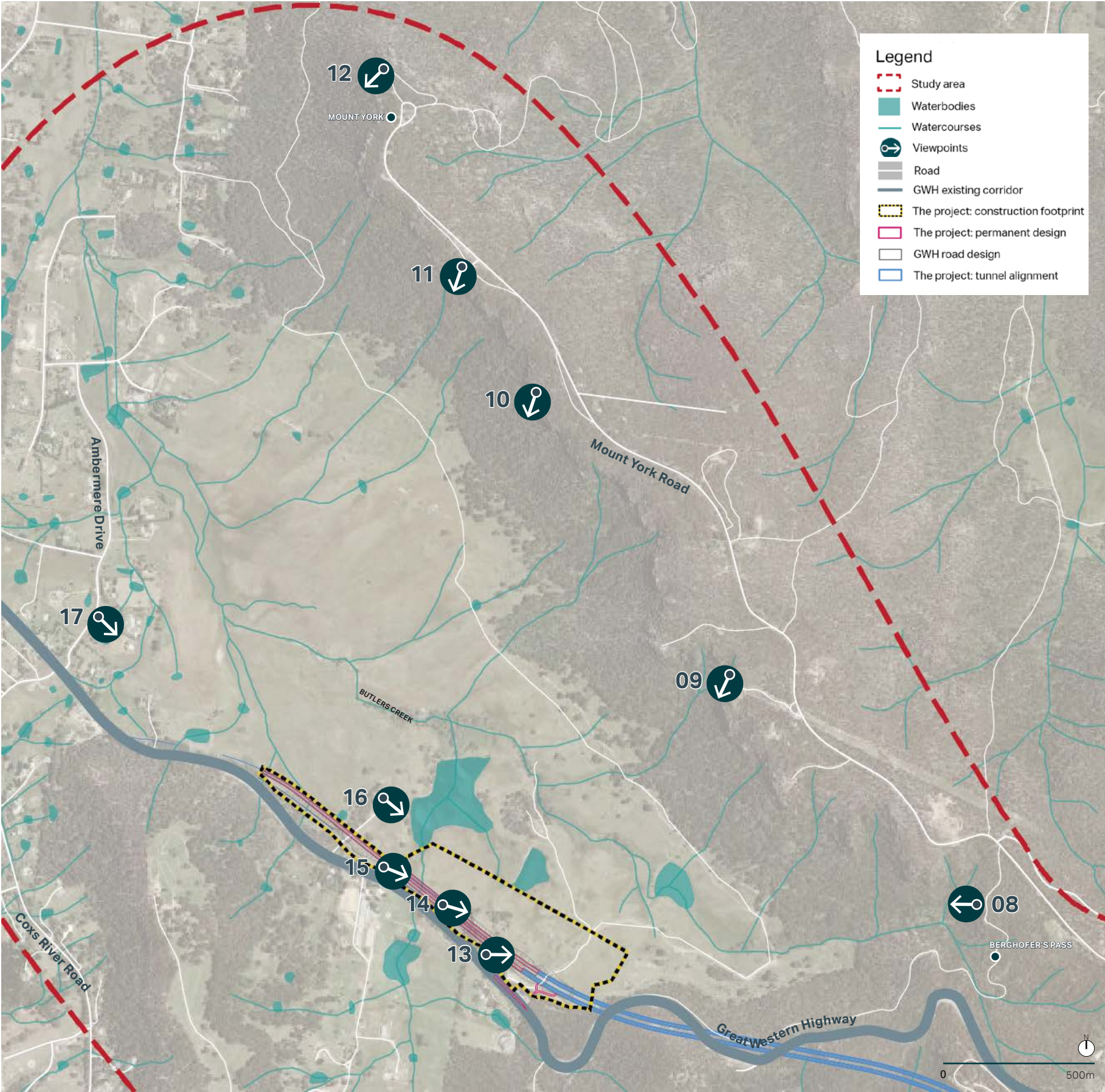


Figure 7-41: Representative viewpoint locations at Little Hartley



7.3.2.1. Viewpoint 8: Berghofers Pass

This viewpoint is located on the hiking trail of Berghofers Pass which connects Mount York Road to the Great Western Highway at Little Hartley, shown in Figure 7-42. The trail is signposted at various positions along its length, providing historical information (refer Figure 7-43) or identifying interesting viewpoints with historical importance. This viewpoint is representative of visual receivers hiking the trail, looking west at the informal lookout point with signage describing heritage items within the view (refer Figure 7-44).

Sensitivity: Moderate

Visual receptors at this viewpoint would be recreational hikers walking along the trail. Their enjoyment of this activity is highly dependent on the scenic qualities of the walk, which include elevated views over a dramatic landscape.

While the view does not include the World Heritage listed landscape, it does include historic elements that are signposted along the way which add to the sensitivity of the viewpoint. The proximity to the World Heritage listed landscape conveys a level of character to the walk and the views which also add to the sensitivity of the viewpoint.

This view would be seen as one of many on the journey along the trail, with this view the most susceptible to change due to its position. The project would not be seen from the trail to the north of the viewpoint, and the availability of views to the project would reduce as the track winds south and south west due to the angle of viewing and the reducing elevation.

The susceptibility of the viewpoint to change is somewhat lessened by the changes within the view as part of the Little Hartley to Lithgow Upgrade Program and the distance to the project.



Figure 7-43: Signage at the start of the Berghofers Pass trail



Figure 7-44: Signage at the viewpoint

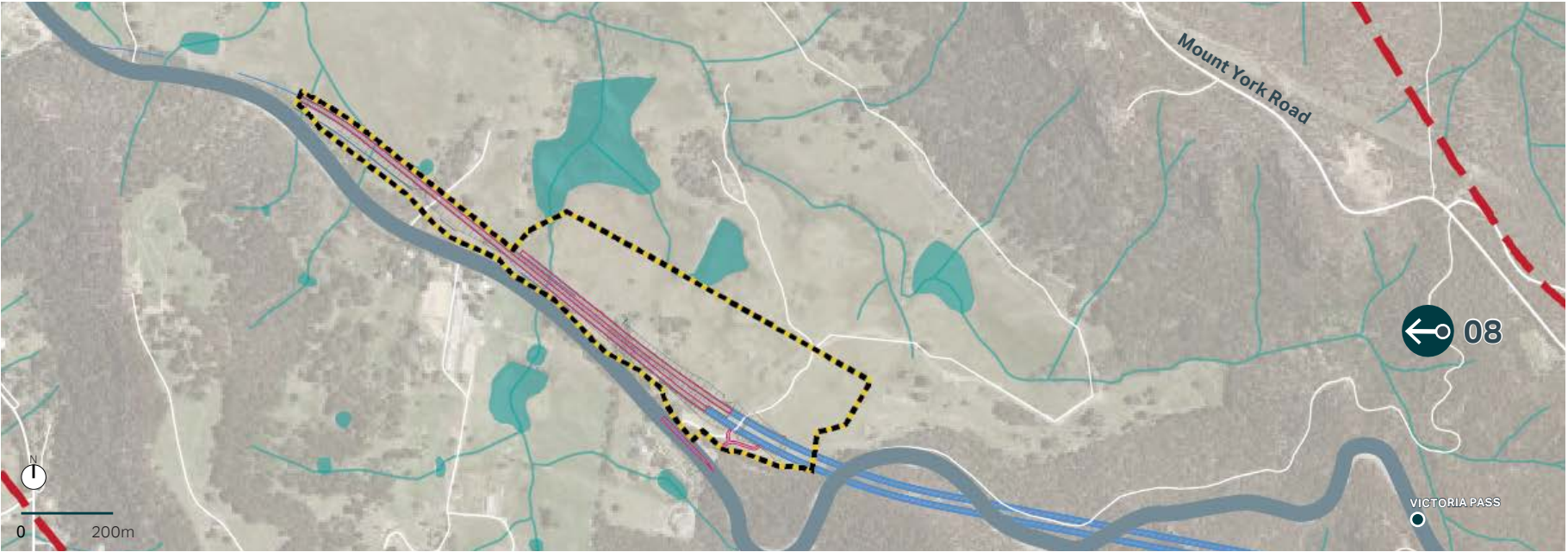
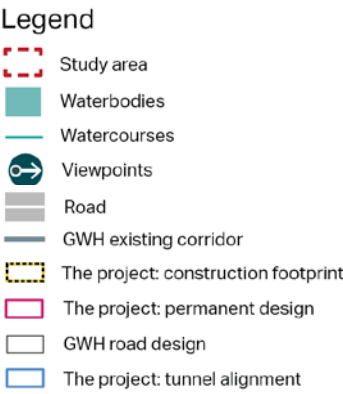


Figure 7-42: Keyplan showing Viewpoint 8 in relation to the project



**Existing view**

The existing view from this location is shown in Figure 7-45, comprising an elevated view north to Little Hartley framed by the trees bordering the trail.

The foreground of the view includes the surrounding bushland, dropping steeply to the north towards Little Hartley. The middle ground of the view includes the open rural valley in the centre between the dark, densely forested escarpments of ridge lines to the left (Victoria Pass) and right (Mount York). Characteristic 'Blue Mountains' sandstone outcropping is seen to the left of frame, identified in the signage to locate Victoria Pass within the view.

Butlers Creek is visible in the centre of the valley. The existing alignment of Great Western Highway is visible as a meandering band of vegetation on the far side of the valley.

The background view expands to the west towards the NSW hinterland, seen as a dark, mountainous band on the horizon.

**Baseline view**

During construction, the Little Hartley to Lithgow Upgrade would comprise a sinuous stretch of construction activity, including clearing of vegetation, earthworks and general construction activity. From this distance the extent of the construction activity would be seen stretching northwest into the distance, but not any detail (refer Figure 7-46 to Figure 7-49).

At operation, the following changes would be seen within the view due to the Little Hartley to Lithgow Upgrade (highlighted in purple in Figure 7-49):

- Eastbound and westbound connections (the most visually prominent element being bridges) between the existing and proposed Great Western Highway
- The upgraded private access to one property on the Great Western Highway
- Sediment and water quality basins
- Landscaping along the northern batters of the Great Western Highway.

Vertical elements within the upgrade, particularly bridges and retaining walls, would be the most visually prominent structures within the view. The general widening would increase the visual prominence of the Great Western Highway within the view.



Figure 7-45: Existing view from Viewpoint 8





Figure 7-46: Visual simulation showing the proposed changes within the view due to the Upgrade Program and the project



Figure 7-47: Detailed view of the visualisation of the project within the view



Visual impact assessment: construction

Anticipated change to the view

During construction, the construction footprint for the project would visually comprise an extension of the construction footprint for Little Hartley to Lithgow Upgrade south towards Victoria Pass. There would be little clearing of vegetation as the land is predominantly open pasture. Earthworks and general construction activity would be seen extending south from the Little Hartley to Lithgow Upgrade construction footprint, however, from this distance it is unlikely that much detail of this activity would be discernible. Night lighting would be visible within the construction footprint within the otherwise darkened context.

Magnitude: Moderate

Construction activity would be seen within the valley, but would be hard to see in detail. Earthworks would comprise a substantial change, as well as the larger of the construction equipment (e.g. the tunnel boring machine), within the view. Works at night would require lighting within a currently largely unlit area. This would comprise the greatest change, however, it is unlikely that visual receptors would see the view from this viewpoint at night as few would be hiking after dark.

Visual impact assessment: Moderate (Adverse)

Table 7-18 shows the visual impact rating of the project on the view from this viewpoint during construction. Construction activity would comprise an extension of works from the existing Little Hartley to Lithgow Upgrade construction footprint, but with substantial earthworks seen against the forested Victoria Pass in the southern ‘corner’ of the valley.

Table 7-18: Visual impact rating (construction) - Viewpoint 8

Visual Impact Assessment - construction	
Sensitivity	Moderate
Magnitude	Moderate
Visual impact rating	Moderate
Qualitative rating	Adverse





Figure 7-48: Visual simulation illustrating the changes due to the Upgrade Program and the project but with trees and shrubs removed from the image

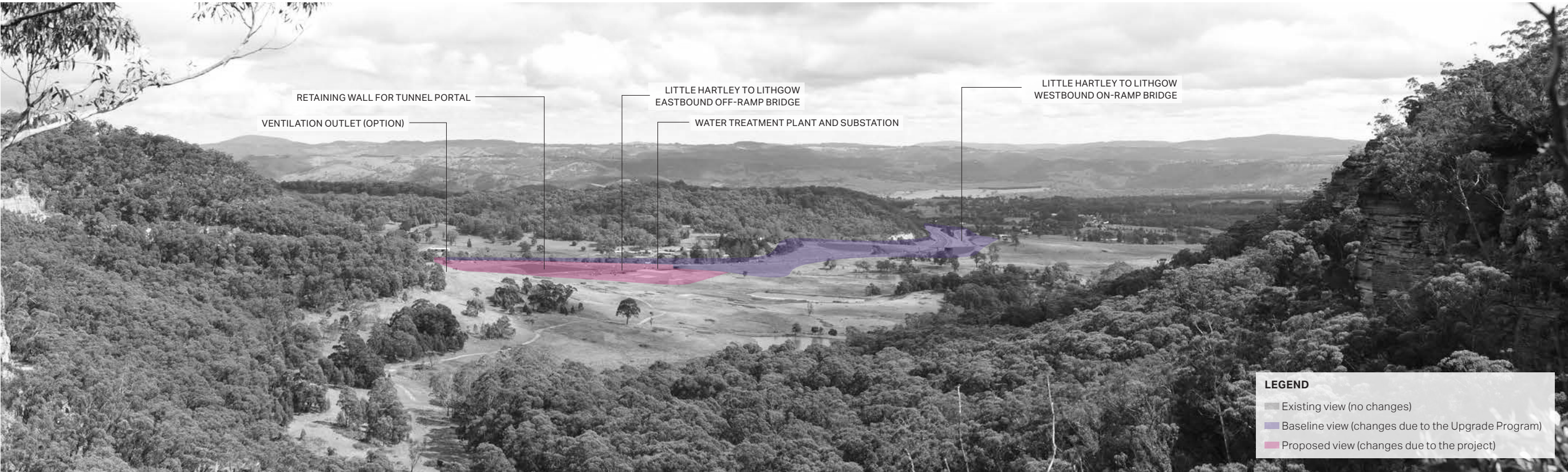


Figure 7-49: Visual simulation illustrating the changes due to the Upgrade Program and the project but with trees and shrubs removed from the desaturated image to show the extent of each project



Visual impact assessment: operation

Anticipated change to the view

Changes due to the project would be visible at the southern end of the realigned Great Western Highway, as shown in highlighted in pink in Figure 7-49. The changes would occur within the central portion of the middle ground of the view as the tunnel exits the mountain and the carriageways extend to the west as they connect to the Little Hartley to Lithgow Upgrade Highway alignment.

Elements seen within the view would include:

- The operational infrastructure positioned to the north east of the tunnel portals, including building associated with water infrastructure
- The Great Western Highway carriageways extending just west from the tunnels, although these may only be seen as they extend north of the eastbound connection bridges associated with the Little Hartley to Lithgow Upgrade
- The tunnel portal retaining walls
- The ventilation outlet above the tunnel portals.
- Landscaping.

Note: for a detailed description of visible project infrastructure, refer Section 5.8 of this report.

Magnitude: Moderate

While the project would comprise the introduction of a series of large road infrastructure elements within the view, it is unlikely that these would be visually prominent. Taller elements, such as the ventilation outlet and operations infrastructure on the eastern side of the tunnel portals, would be visible, but at least partially screened by surrounding planting, which would include bands of trees. This scale of infrastructure would already be present within the valley due to the Little Hartley to Lithgow Upgrade, particularly the bridges, which would be the largest road infrastructure within the view.

Batters and retaining walls facing the valley may be seen, but the visual prominence of these would reduce over time as landscaping matured and the realigned Highway visually ‘bedded down’ into the landscape.

The changes would occur approximately 1.3 kilometres from the viewpoint location within a very small, central portion of the overall view.

Visual impact assessment (Emissions via ventilation outlet option):  
Moderate (Adverse)

Table 7-19 shows the visual impact ratings of the project the view from this viewpoint at operation with (emissions via ventilation outlet) and without (emissions via portal) a ventilation outlet.

While the viewpoint would typically be sensitive due to the recreational hiking trail with heritage value and high quality of visual amenity of the surrounding landscape, the changes to the view would occur at some distance from the viewpoint and be predominantly visually recessive within the view. In addition, most of the widening of the Great Western Highway would occur within the Little Hartley to Lithgow Upgrade works rather than the project. The changes would constitute a permanent and irreversible alteration of the existing landscape, however, visually integrating into landscape as the planting matured.

The adverse qualitative rating is due to the addition of larger infrastructure within the view, particularly the tunnel portal walls, operational infrastructure and ventilation outlet, which would be new additions within the edges of the valley setting.

Visual impact assessment (Emissions via portals option: Moderate  
(Adverse)

The visual prominence of the project would be not be altered with the removal of the ventilation outlet from the tunnel portals, which is somewhat ‘tucked’ into the heavily vegetated hillside when viewed from this location. The distance to the location of the ventilation outlets translates into a small level of change.

Table 7-19: Visual impact assessment (operation) - Viewpoint 8: Berghofers Pass

Visual impact assessment		
	Emissions via ventilation outlet	Emissions via portals
Sensitivity	Moderate	Moderate
Magnitude	Moderate	Moderate
Visual impact rating	Moderate	Moderate
Qualitative rating	Adverse	Adverse



7.3.2.2. Viewpoint 9: Transmission easement lookout

This viewpoint is located at the north western end of an existing transmission easement, which is used as an informal lookout point along the Mount York escarpment, as shown in Figure 7-50. This viewpoint is representative of visual receptors visiting the lookout and the view seen by nearby residents located to the south along the ridge line.

Sensitivity: Moderate

The view is experienced by visual receptors purposefully visiting the transmission easement lookout to experience the view. Their attention is anticipated to be focused on the visual amenity and qualities of the visual experience. However, the lookout point is informal, and no infrastructure (including signage, seating, formalised walking tracks or fencing) has been provided from which to enjoy the view. There is no signage near the road to indicate that the viewpoint is available for view opportunities.

Two houses are positioned approximately 200 and 400 metres south east of this viewpoint near the escarpment edge and are anticipated to see similar views to the valley below. Residential receptors are highly sensitive to changes within the view from their houses.

The viewpoint is moderately susceptible to change due to the project. Factors that lessen the susceptibility include the Little Hartley to Lithgow Upgrade positioned to the north west, the position of the project hugging the bushland to the south and the distance to the changes.

Existing view

The existing view from this location is shown in Figure 7-51.

The location provides a vantage point over the Butlers Creek Valley below. The foreground includes the sandstone escarpment of the Mount York escarpment, with rocky outcrops framing the valley view to the left of frame and the steep forested slopes to the north to the right of frame. Butlers Creek Valley is seen as an open rural valley in the middle ground, including paddocks, dams, stands of darker native vegetation and Butlers Creek meandering through the bottom of the valley. The existing Great Western Highway alignment defines the valley to the south, seen in the centre of the view from the bottom of Victoria Pass to a point where it visually integrates with the surrounding rural landscape to the north west.

Mount Sugarloaf is visible in the background of the view, with the dark forested ridgeline extending north west into the distance. The rolling hills of the NSW hinterland extend towards the horizon in the background.

Baseline view

During construction the project would comprise an extension of the construction footprint for the Little Hartley to Lithgow Upgrade to the south, towards Victoria Pass.

At operation the following changes would be seen within the view due to the Little Hartley to Lithgow Upgrade:

- Eastbound and westbound connections between the existing and proposed Great Western Highway, including bridges
- The upgraded private access to one property on the Great Western Highway
- Sediment and water quality basins
- Landscaping along the northern batters of the Great Western Highway.

As with Viewpoint 8, these elements would technically be visible within the view but would most likely be seen as a general widening of the Great Western Highway corridor within the view resulting in the dark band of roadside vegetation encroaching further into the rural valley. The likely extent of the changes are shown highlighted in purple in Figure 7-52.

Visual impact assessment: construction

Anticipated change to the view

During construction, the most visually prominent elements would be seen within the construction footprint, such as earthworks, larger equipment (such as the launching of the tunnel boring machine), stockpiling, amenities and office buildings, the acoustic shed and concrete batching plant. Other general construction would visually comprise general areas of activity. Sediment and water quality basins may be seen from this distance. Night lighting would be visible within the construction footprint for the hauling of spoil within the otherwise darkened valley.

Magnitude: High

From this viewpoint the construction would be seen along its longest edge, however, similar to that seen from Viewpoint 8, would comprise an extension of the construction footprint for the Little Hartley to Lithgow Upgrade. The construction footprint would be visible as a large area of construction seen within the rural setting, but would occur over only a small proportion of the greater view. It is unlikely that people at the lookout would see the change to night lighting, however, residents in nearby houses would see this change, which would be in contrast to the existing night time environment.

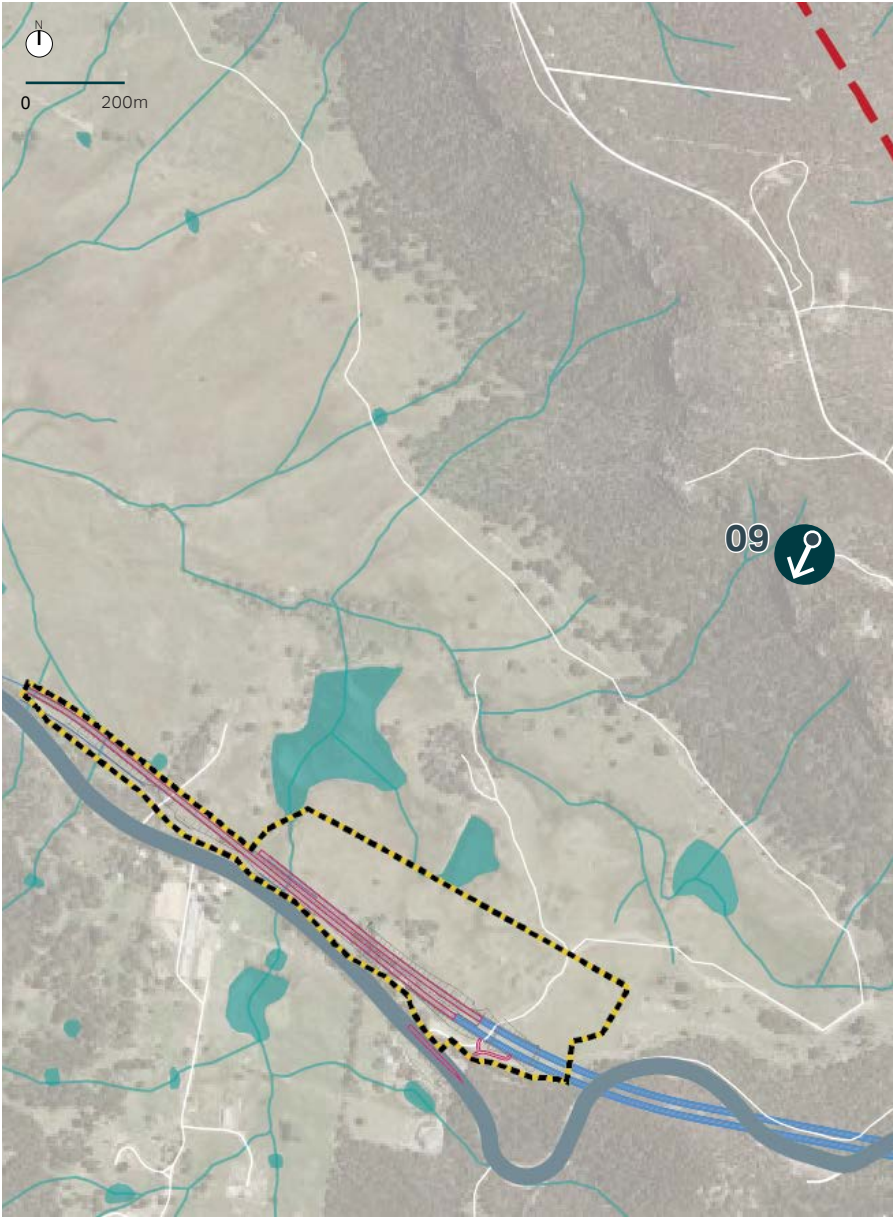


Figure 7-50: Keyplan showing Viewpoint 9 in relation to the project





Figure 7-51: Existing view from Viewpoint 9



Figure 7-52: Existing view from Viewpoint 9 with desaturated image to show the extent of each project, the extent of which is highlighted with pink and purple



Visual impact assessment: High to Moderate (Adverse)

Table 7-20 shows the visual impact rating of the project on the view from this viewpoint during construction.

The construction would comprise an extension of existing construction within the Butlers Creek Valley, but would also extend the length of time construction occurred within the view. The visual clutter of the construction within the rural valley would result in an adverse affect on the view.

Table 7-20: Visual impact rating (construction) - Viewpoint 9

Visual Impact Assessment - construction	
Sensitivity	Moderate
Magnitude	High
Visual impact rating	High to Moderate
Qualitative rating	Adverse

Visual impact assessment: operation

Anticipated change to the view

The extent of changes due to the project would be visible at the southern end of the realigned Great Western Highway, as shown in highlighted in pink in Figure 7-52. The changes would occur within the central portion of the middle ground of the view as the tunnel exits the mountain and the carriageways extend to the west as they connect to the Little Hartley to Lithgow Upgrade Highway alignment.

Elements seen within the view would include:

- The operational infrastructure positioned to the north east of the tunnel portals, including building associated with water infrastructure
- The Great Western Highway carriageways extending just west from the tunnels, although these may only be seen as they extend north of the eastbound connection bridges associated with the Little Hartley to Lithgow Upgrade
- The ventilation outlet above the tunnel portals
- Landscaping
- Night lighting of the tunnel portals.

Note: for a detailed description of visible project infrastructure, refer Section 5.8 of this report.

Magnitude: High

The magnitude of change at this viewpoint is predominantly influenced by:

- The widening of the Great Western Highway into the rural paddocks at the base of Victoria pass, which would result in a narrowing of the valley within the view.
- The introduction of a large scale of infrastructure within the view, including the ventilation outlet and buildings associated with the operational infrastructure of the project.
- The project would be seen along its widest edge and within the middle ground of the view, unobstructed and from an elevated location.
- The change to the landscape and views would be permanent and irreversible, however, would become more visually recessive as the landscape matured and partially screened the project.

Visual impact assessment (Emissions via ventilation outlet option): High to Moderate (Adverse)

Table 7-21 shows the visual impact ratings of the project the view from this viewpoint at operation with (emissions via ventilation outlet) and without (emissions via portal) a ventilation outlet.

While the viewpoint would typically be sensitive due to the scenic quality of the view, the informal nature of the lookout and the presence of changes due to the Little Hartley to Lithgow Upgrade within the view lower the susceptibility of the viewpoint to change due to the project. The scale of infrastructure seen within the view, particularly the ventilation outlet and operational infrastructure buildings, night lighting, in conjunction of the position of the project within the view, would result in a high magnitude of change and an overall high to moderate rating.

The adverse qualitative rating is due to the widening of the Great Western Highway corridor and the addition of larger infrastructure within the view, particularly the ventilation outlet, which would comprise a landmark within the edges of the valley setting.

Visual impact assessment (Emissions via portals option): High to Moderate (Adverse)

The visual prominence of the project would be reduced with the removal of the ventilation outlet from the tunnel portals, however, this would not reduce the impact ratings of the project as the angle of viewing would still mean that the operational infrastructure would be clearly seen within the rural valley setting. Although vegetation would reduce the visual prominence of the uncharacteristic infrastructure within the view over time, it is unlikely to screen larger built forms entirely.

Table 7-21: Visual impact assessment (operation) - Viewpoint 9: Transmission Easement Lookout

Visual impact assessment		
	Emissions via ventilation outlet	Emissions via portals
Sensitivity	Moderate	Moderate
Magnitude	High	High
Visual impact rating	High to moderate	High to moderate
Qualitative rating	Adverse	Adverse



7.3.2.3. Viewpoint 10: Historic Wells Lookout

This viewpoint is located at a rock outcrop on the sandstone escarpment near the Historic Wells Lookout which is used as a lookout point (refer Figure 7-53). The Historic Wells site is a signposted historic location (refer Figure 7-54) with an informal parking area and camp site (refer Figure 7-55). A track extends from the Historic Wells site (refer Figure 7-56) to a large rock outcrop offering sweeping views of Little Hartley.

Sensitivity: Moderate

The sensitivity of the viewpoint would be similar to that of Viewpoint 9 in that:

- Visual receptors purposefully visiting the viewpoint to experience the view, but in this case potentially drawn to the spot by signage from nearby historical element.
- The lookout point is informal, and no infrastructure (e.g. seating, formalised walking tracks or fencing) have been provided from which to enjoy the view.
- The viewpoint is moderately susceptible to change due to the project, with factors lessening the susceptibility including the extent of the Little Hartley to Lithgow Upgrade seen to the north west, the position of the project hugging the bushland to the south and the distance to the changes, which is even further from this viewpoint than from Viewpoint 9.



Figure 7-54: Signage at the Historic Wells site



Figure 7-55: Informal camp site at the Historic Wells site



Figure 7-56: Track from the Wells site to the lookout

Existing view

The existing view from this location is shown in Figure 7-57. As the rock outcrop extends west beyond the escarpment of the Mount York escarpment, this location offers the clearest views south east towards the project.

The view is panoramic, with Butlers Creek Valley seen in the fore and middle ground of the view, fringed on three sides by dense bushland of the surrounding ridgelines. The sandstone escarpments and rock cuttings of Berghofers Pass and Victoria Pass are seen to the south east (left of frame) within the densely vegetated mountains. Beyond Victoria Pass and Mount Sugarloaf the deep blue ridgeline and Blackheath Lookout, at the southern edge of the Kanimbla Valley are seen in the distance, almost 10 kilometres away.

The Mount Sugarloaf ridge line extends north within the view, forming the opposite 'edge' of the valley in the middle ground. To the north (right of frame), Little Hartley extends, with the patchy rural landscape punctuated with patches of darker bushland, properties and roads. The hills of the NSW hinterland are visible in the background.

Within Little Hartley, Butlers Creek and the largest of the dams are visible in the in the centre of the valley. Rural homesteads located along Ambermere Drive and Dicker Drive are visible to the right of frame. The Great Western Highway is visible between the base of Victoria pass and the northern most point of the Mount Sugarloaf ridge line, passing through the two 'halves' of Butlers Creek Valley.

Baseline view

The following changes would be seen within the view due to the Little Hartley to Lithgow Upgrade:

- Eastbound and westbound connections between the existing and proposed Great Western Highway, including bridges
- The upgraded private access to one property on the Great Western Highway
- Sediment and water quality basins
- Landscaping along the northern batters of the Great Western Highway.

As with Viewpoint 9, these elements would be visible within the view but would most likely be seen as a general widening of the Great Western Highway corridor within the view resulting in the dark band of roadside vegetation encroaching further into the rural valley. The likely extent of the changes are shown highlighted in purple in Figure 7-58 and Figure 7-59.



Figure 7-53: Keyplan showing Viewpoint 10 in relation to the project



Visual impact assessment: construction

Anticipated change to the view

Similar to that seen from Viewpoint 9, the project would comprise an extension of the construction footprint of the Little Hartley to Lithgow Upgrade. Only the larger elements within the construction footprint would be discernible against the visual clutter within the construction footprint, including the larger of the buildings and stockpile areas, earthworks and sheds. Night lighting for the hauling of spoilage would be seen within the otherwise darkened valley.

Magnitude: High

The magnitude of change would be similar to that assessed in Viewpoint 9, however, as the viewpoints move further north along the Mount York ridge line, the more oblique the viewing angle along the length of the construction footprint and the less detail would be seen. The oblique viewing angle would allow more ‘front on’ views to the tunnel construction. From this viewpoint the magnitude would still be high.

Visual impact assessment: High to Moderate

Table 7-22 shows the visual impact rating of the project on the view from this viewpoint during construction.

The construction would comprise a substantial change to the view within the valley, resulting in an adverse affect on the view.

Table 7-22: Visual impact rating (construction) - Viewpoint 10

Visual Impact Assessment - construction	
Sensitivity	Moderate
Magnitude	High
Visual impact rating	High to Moderate
Qualitative rating	Adverse

Visual impact assessment: operation

Anticipated change to the view

The extent of changes due to the project would be visible at the southern end of the Little Hartley to Lithgow Upgrade realigned Highway, as shown in Figure 7-58 and Figure 7-59 and highlighted in pink in Figure 7-60. The changes would occur to the left of the central portion of the middle ground of the view as the tunnel exits the mountain and the carriageways extend to the west as they connect to the Little Hartley to Lithgow Upgrade Highway alignment.



Figure 7-57: Existing view from Viewpoint 10



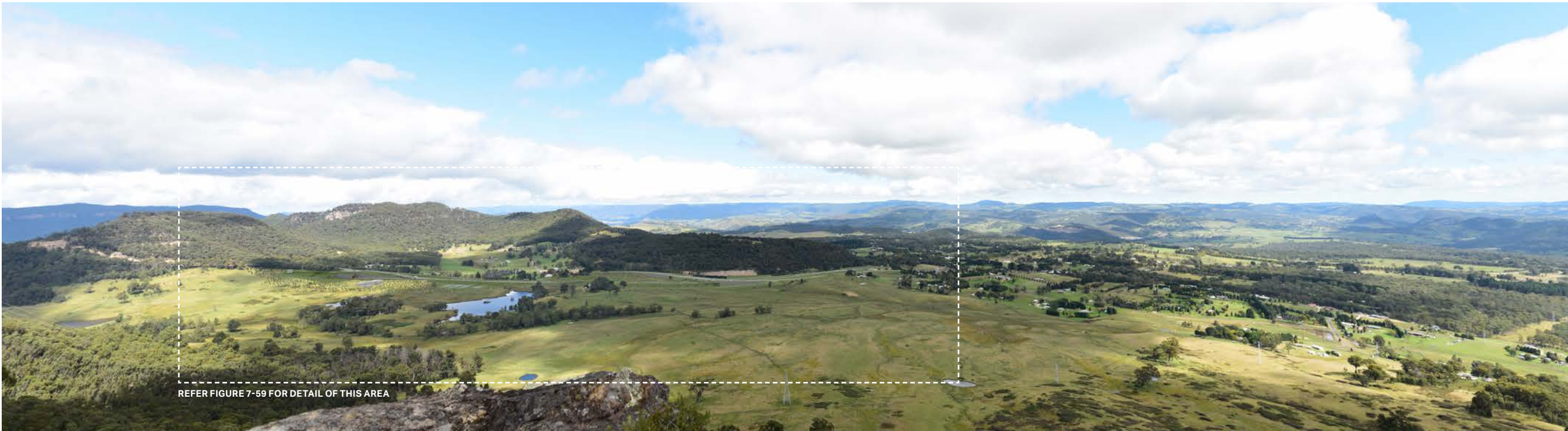


Figure 7-58: Visual simulation showing the changes due to the project and the Upgrade Program



Figure 7-59: Detail of Figure 7-58, showing the project and the Upgrade Program



From this distance, individual elements would be more difficult to see within the view but would include:

- The operational infrastructure positioned to the north east of the tunnel portals, including building associated with water infrastructure
- The Great Western Highway carriageways extending north west from the tunnels, although these may only be seen as they extend north of the eastbound connection bridges associated with the Little Hartley to Lithgow Upgrade
- The ventilation outlet above the tunnel portals
- Landscaping
- Night lighting of the tunnel portals.

Note: for a detailed description of visible project infrastructure, refer Section 5.8 of this report.

**Magnitude: Moderate**

The magnitude of change would be similar to that of Viewpoint 9, but lessened due to the further viewing distance and the more expansive view seen from this viewpoint (i.e. the valley view is not framed, but more open, extending to the horizon across the entire panorama).

The project would blend with the closer Little Hartley to Lithgow Upgrade, viewed as a darker widening of the Great Western Highway corridor eventually blending somewhat with the dark vegetation at the base of Victoria Pass.

The increased scale of the infrastructure would be more visually prominent the further north along the Mount York escarpment you go, with even the largest element (the ventilation outlet) beginning to blend into the landscape from this location. Lighting of the Great Western Highway would be seen as an extension of the lit road corridor provided within the Upgrade Program.

**Visual impact assessment (Emissions via ventilation outlet option): Moderate (Adverse)**

Table 7-23 shows the visual impact ratings of the project the view from this viewpoint at operation with (emissions via ventilation outlet) and without (emissions via portal) a ventilation outlet.

The overall visual impact of the project on the view from this location is considered to be moderate. The project and the changes to the landscape it proposes would be in full view from the vantage point . The vantage point is a well known destination representative of the heritage value of the region. The qualitative rating for the change of the view is considered adverse.

**Visual impact assessment (Emissions via portals option): Moderate (Adverse)**

From this distance the ventilation outlet would only just be recognisable within the landscape. There would be no change in the ratings from this location.

**Table 7-23:** Visual impact assessment (operation) - Viewpoint 10: Historic Wells Lookout

Visual impact assessment - operation		
	Emissions via ventilation outlet	Emissions via portals
Sensitivity	Moderate	Moderate
Magnitude	Moderate	Moderate
Visual impact rating	Moderate	Moderate
Qualitative rating	Adverse	Adverse



**Figure 7-60:** Visual simulation illustrating the changes due to the Upgrade Program (purple) and the project (pink) but with trees and shrubs removed from the desaturated image to show the extent of each project





Figure 7-61: Keyplan showing Viewpoint 11 in relation to the project



Figure 7-62: Bardens Lookout from the main viewing area, looking southwest to the framed view

7.3.2.4. Viewpoint 11: Bardens Lookout

This viewpoint is located at Bardens Lookout, off Mount York Road, looking south as shown in Figure 7-61. The lookout has parking, a large cleared area with seating, signage and fencing (refer Figure 7-62).

Sensitivity: Moderate

While the sensitivity of the viewpoint would typically be high given the importance of the view to the visual receptors visiting the formalised lookout, the scenic nature of the view and the signposted information, the susceptibility of the viewpoint substantially lessens the sensitivity due to the limited impact the project is expected to have within the view.

Existing view

The existing view from this location is shown in Figure 7-63. This view is located at the northern edge of the lookout, looking due south towards the project. The natural viewing angle of the lookout due to its design and set out is to the south west, with the view framed by fringing vegetation and the escarpment to the north and south.

The view south comprises the lookout and sandstone outcropping in the foreground. Little Hartley extends within the middle ground of the view, with the base of Victoria Pass just visible beyond the fringing vegetation. The less vegetated northern section of Little Hartley is seen within the centre of the view, with the patchwork landscape of rural properties, paddocks and bushland visible beyond. The view to the horizon includes the undulating landform towards the NSW hinterland.

Baseline view

The Little Hartley to Lithgow Upgrade would be seen within the view, although due to the distance would comprise the widening of the Great Western Highway corridor into the rural valley. It is unlikely that individual elements of the works would be seen from this distance.

Visual impact assessment: construction

Anticipated change to the view

Construction activity would be seen as an area of visual clutter extending to the south from the existing Little Hartley to Lithgow Upgrade construction footprint. It is unlikely much detail would be seen from this distance or oblique viewing angle.

Magnitude: Moderate

The distance of viewing begins to reduce the magnitude of change due to the construction, as the perceived ‘area’ of construction appears smaller due to the oblique viewing angle and less detail in the works is seen. Bardens Lookout is a more formalised lookout which could be visited at night time, although it is unlikely this would be a popular place at night. If the view at night was seen, the lighting within the construction footprint would be a change within the existing, darkened valley setting.





Figure 7-63: Existing view from Viewpoint 11

Visual impact assessment: Moderate (Adverse)

Table 7-24 shows the visual impact rating of the project on the view from this viewpoint during construction.

The works, while difficult to see any detail in, would comprise an extension in the visual clutter of construction that is seen within the valley, both in physical area affected and the time that construction activity is visible within the view.

Table 7-24: Visual impact rating (construction) - Viewpoint 11

Visual Impact Assessment - construction	
Sensitivity	Moderate
Magnitude	Moderate
Visual impact rating	Moderate
Qualitative rating	Adverse

Visual impact assessment: operation

Anticipated change to the view

The extent of the project would be just visible at the southern end of the Little Hartley to Lithgow Upgrade, however, it is unlikely that individual elements of the project would be discernible due to the distance and the angle of viewing. The project would be seen as a darkened area of road fringed with vegetation, with a narrowing of the rural valley landscape to the far right of the view.

Note: for a detailed description of visible project infrastructure, refer Section 5.8 of this report.

Magnitude: Low

The project would result in changes over a very small proportion of the overall view, seen from an oblique viewing angle and partly screened by vegetation. The distance to the changes diminishes the amount of detail of the infrastructure that would be seen.

Visual impact assessment (Emissions via ventilation outlet option): Moderate to low (Neutral)

Table 7-25 shows the visual impact ratings of the project the view from this viewpoint at operation with (emissions via ventilation outlet) and without (emissions via portal) a ventilation outlet.

Changes within the view would not be visually prominent and would occur mainly in the middle to background. Changes would not be located within the main focus of interest in the central portion of the valley. The lookout is publicly accessible and a regional destination point. It is unlikely that individual elements of the project would be discernible at this viewing distance, therefore the qualitative rating is considered neutral.

Visual impact assessment (Emissions via portals option): Moderate to low (Neutral)

From this distance the ventilation outlet may only just be recognisable within the landscape. There would be no change in the ratings from this location.

Table 7-25: Visual impact assessment (operation) - Viewpoint 11: Bardens Lookout

Visual impact assessment - operation		
	Emissions via ventilation outlet	Emissions via portals
Sensitivity	Moderate	Moderate
Magnitude	Low	Low
Visual impact rating	Moderate to low	Moderate to low
Qualitative rating	Neutral	Neutral





Figure 7-64: Keyplan showing Viewpoint 12 in relation to the project

7.3.2.5. Viewpoint 12: Mount York Lookout

This viewpoint is located at Mount York Lookout, the northern most lookout on the Mount York escarpment as shown in Figure 7-64. This lookout is the most developed ‘destination’ of the lookouts available on Mount York Road, with picnic tables, a rotunda, several heritage items, interpretive signage, a formalised (fenced, paved) lookout point and numerous signposted walking trails extending from the picnic ground and car parking area.

Sensitivity: Low

While the viewpoint would be highly sensitive as a formalised lookout with a high visitation rate, historical items and elements and numerous recreational facilities, the susceptibility of the view to change due to the project reduces the sensitivity of the viewpoint to change to Low.

Existing view

The existing view from this location is shown in Figure 7-65. The view is characterised by an expansive view of the northern end of Little Hartley to the south west and horizon can be seen, fringed by dense bushland vegetation and sandstone outcrops of the Mount York escarpment.

The ridge line of Hassan Walls is visible in the background to the right, and the view opens to the hills of the NSW hinterland to the left. The alignment of the existing Great Western Highway corridor is not immediately recognisable in this viewpoint as it crossed in a northwesterly direction along the opposite edge of the bushland.

Baseline view

It is anticipated no major changes would be seen within the view due to the Little Hartley to Lithgow Upgrade as all the works are located south west of the view point, to the left of the view, and are not within the view range.



**Anticipated change to the view**

There are no anticipated changes to the view as a result of the project during construction or at operation. The project would be positioned further southwest (left of frame) screened by the adjacent ridge.

**Magnitude: Negligible**

The magnitude of change at this viewpoint is considered negligible as none of the changes as result of the project will be visible from this viewpoint.

**Visual impact assessment (Emissions via ventilation outlet option): Negligible (Neutral)**

As shown in Table 7-26, the overall visual impact of the project on the view from this location is considered to be Negligible, as the changes to the existing landscape will not be visible from this view. The qualitative rating for this view is considered neutral.

**Emissions via portals option: Negligible (Neutral)**

There would be no change in the ratings from this location with the removal of the ventilation outlet from the project.

**Table 7-26:** Visual impact assessment - Viewpoint 12: Mount York Lookout

Visual impact assessment - construction and operation	
Sensitivity	Low
Magnitude	Negligible
Visual impact rating	<b>Negligible</b>
Qualitative rating	<b>Neutral</b>



**Figure 7-65:** Existing view from Viewpoint 12



7.3.2.6. Viewpoint 13: Great Western Highway

This viewpoint is located on the southern verge of Great Western Highway near the entry driveway to a property, looking east, as shown in Figure 7-66.

This viewpoint is representative of visual receptors travelling along Great Western Highway as they initiate the climb to the Blue Mountains and residents of the property near the boundary.

Sensitivity: Low

Visual receptors at this viewpoint would comprise motorists (including locals driving to and from work / home, or as part of work-related activities and tourists) and nearby residents. While both groups elevate the sensitivity of the viewpoint, the susceptibility of the viewpoint to change is lessened by the changes within the view as part of the Upgrade Program and the limited views to the project that would be available.

Existing view

The existing view from this location is shown in Figure 7-68, comprising an enclosed view along the Great Western Highway as it extends to the south east, beginning the climb towards Victoria Pass. The road corridor is fringed by tall vegetation, screening views to the landscape beyond.

The dark, forested ridge line associated with Victoria Pass is seen in a break in the trees fringing the Great Western Highway.

Baseline view

During construction the view to the Mount York escarpment would be opened up by the removal of vegetation along the existing Highway.

At operation the following changes would be seen within the view due to the Little Hartley to Lithgow Upgrade (refer Figure 7-67 and Figure 7-69):

- The eastbound connection and overbridge between the existing and proposed Great Western Highway
- The active transport trail adjacent to the existing Great Western Highway
- The formalisation of Berghofers Pass car park .

Visual impact assessment: construction

Anticipated change to the view

While the Little Hartley to Lithgow Upgrade would already comprise construction activity along the existing Great Western Highway in the foreground, the project construction would be seen beyond this in the middle to background of the view. This would include the acoustic shed and tunnel boring machine assembly area, both which would comprise large elements positioned very close to the viewpoint. Other construction activity would include materials laydown areas, fencing, hoarding and other general construction activity. Trucks hauling spoilage would access the construction footprint all times during the day and night, and night lighting to facilitate this movement and other construction activity would be seen.

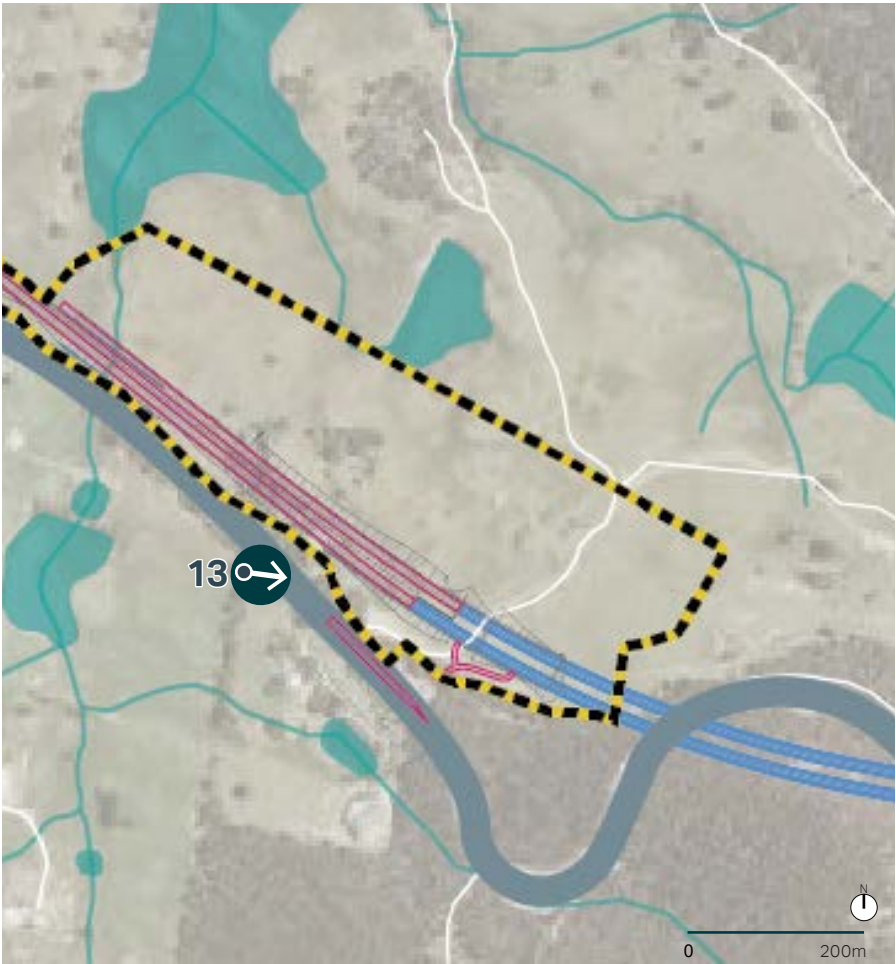


Figure 7-66: Keyplan showing Viewpoint 13 in relation to the project and the Upgrade Program



Figure 7-67: Plan showing Viewpoint 13 in relation to the project and the Upgrade Program





Figure 7-68: Existing view from Viewpoint 13

Magnitude: High

Construction activity due to the project would be seen as an extension of existing construction due to the Little Hartley to Lithgow Upgrade to the north and east of the viewpoint, extending the area of activity into the rural valley setting. Substantially large built structures (such as the acoustics shed) would comprise additional elements within the view in contrast to the scale of existing structures. The addition of night lighting within the predominantly darkened view would also comprise a substantial change from existing.

Visual impact assessment: Moderate (Adverse)

Table 7-27 shows the visual impact rating of the project on the view from this viewpoint during construction. While the construction activity would comprise a substantial extension of existing construction activity and include larger built form and equipment than would exist prior to the project commencing, the low sensitivity of the viewpoint results in an assessment rating of moderate. The construction would comprise an adverse affect on the view, with additional temporary built form, general construction activity, night lighting and a higher volume of construction traffic throughout the day and night.

Table 7-27: Visual impact rating (construction) - Viewpoint 13

Visual Impact Assessment - construction	
Sensitivity	Low
Magnitude	High
Visual impact rating	Moderate
Qualitative rating	Adverse

Visual impact assessment: operation

Anticipated change to the view

Changes due to the project would be predominantly screened by structures and vegetation within the Little Hartley to Lithgow Upgrade, as show in Figure 7-69. When proposed vegetation was removed from the visual simulation, a small portion of the project may be visible in the background of the view, as show in Figure 7-70, comprising the top of the ventilation outlet and the top of the tunnel portals, which would be planted.

Note: for a detailed description of visible project infrastructure, refer Section 5.8 of this report.

Magnitude: Low

While the overall view has changed substantially due to the Little Hartley to Lithgow Upgrade (particularly the removal of roadside trees to allow views to the Mount York escarpment beyond), it is unlikely that the project would be seen within the view. The scale of the existing road corridor remains unchanged, with the changes due to the project comprising a very small portion of the overall view. These would most likely screened by trees planted within the Little Hartley to Lithgow Upgrade.

Visual impact assessment (Emissions via ventilation outlet option): Low (Neutral)

As shown in Table 7-28, the overall visual impact of the project on the view from this location is considered to be low. While the view is impacted by the Little Hartley to Lithgow Upgrade, it is unlikely that the project would be seen. The existing Great Western Highway would be lit as part of the Upgrade Program, which would mask any additional light spill from the project road corridor or tunnel entry / exit. There would be no change in the quality of the view.

Visual impact assessment (Emissions via portals option): Negligible (Neutral)

As the ventilation outlet is the only element of the project that may be seen within the view, its removal would lower the magnitude to negligible. Due to the low profile of the top of the tunnel portals, this would be screened by vegetation and not be seen.

Table 7-28: Visual impact assessment (operation) - Viewpoint 13: Great Western Highway

Visual impact assessment - operation		
	Emissions via ventilation outlet	Emissions via portals
Sensitivity	Low	Low
Magnitude	Low	Negligible
Visual impact rating	Low	Negligible
Qualitative rating	Neutral	Neutral





Figure 7-69: Visual simulation illustrating the changes due to the Upgrade Program and the project



Figure 7-70: Visual simulation illustrating the changes due to the Upgrade Program (purple) and the project (pink) but with trees and shrubs removed from the desaturated image to show the extent of each project



7.3.2.7. Viewpoint 14: Great Western Highway

This viewpoint is located on the northern verge of Great Western Highway, looking east along the Great Western Highway towards Victoria Pass, as shown in Figure 7-71.

This viewpoint is representative of visual receptors travelling along Great Western Highway at the start of the climb to the Blue Mountains. While residential properties are nearby on the western side of the Great Western Highway, views from these residences to the project would be screened by vegetation within the property boundaries and along the road corridor.

Sensitivity: Low

Visual receptors at this viewpoint are motorists on the Great Western Highway who would be expected to primarily be focusing on the road and traffic. Motorists would comprise a mix of people, including locals driving to and from work / home, or as part of work-related activities (e.g. truck drivers) and tourists to the Blue Mountains region.

Given the scenic nature of the route through Little Hartley and the Blue Mountains, the sensitivity of this viewpoint is considered to be higher than a typical transport corridor.

The susceptibility of the viewpoint to change due to the project lessened by the changes within the view as part of the Little Hartley to Lithgow Upgrade being the dominant elements within the view.

Existing view

The existing view from this location is shown in Figure 7-73. The foreground of the view comprises the batter to the road vegetated with pasture grass and weeds. A wire property boundary fence extends parallel to the road into the middle ground, separating the paddock within the private property to the north of the Great Western Highway (to the right of frame).

The middle ground of the view comprises a band of native vegetation extending along a localised ridgeline within the paddock to the left of frame to a band of tall trees to the right of frame fringing the Great Western Highway. The canopy of the middle ground vegetation screens views to the horizon to the right and left of the Great Western Highway.

The Great Western Highway extends south east within the view, culminating in a break in the middle ground vegetation where a densely forested peak is seen framed within the road corridor in the background.

Baseline view

During construction, the removal of vegetation and earthworks during construction have opened up views to the ridgelines associated with Victoria Pass (refer Figure 7-74, central within the frame) and Mount York (to the left of frame). Construction within the existing Great Western Highway corridor and just beyond would be visible in the foreground of the view, as well as the construction of a bridge over the realigned Great Western Highway.

At operation the following changes would be seen within the view due to the Little Hartley to Lithgow Upgrade (refer purple highlighted area in Figure 7-75):

- The eastbound connection and overbridge between the existing and proposed Great Western Highway, both of which would be lit at night
- The active transport trail is visible to the right of frame, extending into the distance almost parallel to the existing Highway corridor within the view
- Landscaping adjacent to the active transport trail.

Visual impact assessment: construction

Anticipated change to the view

During construction the viewpoint would be positioned near an access point to the project construction footprint. While the foreground construction associated with the Upgrade Program would be seen, much of the construction seen within

the view would be due to the project. Larger elements visible within the view due to the project would include the concrete batching plant, the top of the acoustics shed and earthworks and equipment associated with construction of the new highway alignment. Night lighting would be seen within the construction footprint, as well as construction traffic that supports 24/7 tunnelling activities from the site.

Magnitude: High

The close proximity of the entry point to the viewpoint would result in the traffic accessing the construction footprint both day and night. Construction on the project would be seen as additional to that seen due to the Upgrade Program, however, substantially larger construction elements would be seen within the view due to the project.



Figure 7-71: Keyplan showing Viewpoint 14 in relation to the project



Figure 7-72: Plan showing Viewpoint 14 in relation to the project and the Upgrade Program





Figure 7-73: Existing view from Viewpoint 14 looking south east along the Great Western Highway

Visual impact assessment: Moderate (Adverse)

Table 7-29 shows the visual impact rating of the project on the view from this viewpoint during construction. While the construction activity would substantially increase due to the project, visual receptors would see short views to the changes as they passed by. An increase in construction seen within the view would reduce the quality of the view. Note that the construction phase impacts are temporary.

Table 7-29: Visual impact rating (construction) - Viewpoint 14

Visual Impact Assessment - construction	
Sensitivity	Low
Magnitude	High
Visual impact rating	Moderate
Qualitative rating	Adverse

Visual impact assessment: operation

Anticipated change to the view

The project would be screened from view by the Little Hartley to Lithgow Upgrade built structures, earthworks and landscaping (refer Figure 7-74). If no landscaping were present, a small part of the tunnel portal would be seen under the bridge in the middle ground, with a very small top corner of built form within the operational infrastructure visible on the far side of the project (refer Figure 7-75).

Note: for a detailed description of the infrastructure potentially visible at this location, refer Section 5.8 of this report.

Magnitude: Negligible

With landscaping planted for the Little Hartley to Lithgow Upgrade the project would not be visible from this viewpoint.

Visual impact assessment (Emissions via ventilation outlet option): Negligible (Neutral)

As shown in Table 7-30 , the overall visual impact of the project on the view from this location is considered to be negligible. The impacts occurring from the introduction of the tunnel access roads would occur below the batters, further

screened by tree and shrub planting along the active transport trail. There would be no change to the quality of the view due to the project.

Visual impact assessment (Emissions via portals option): Negligible (Neutral)

The ventilation outlet would not be visible from this location, therefore there would be no change to any ratings due to the removal of the ventilation outlet from the project.

Table 7-30: Visual impact assessment - Viewpoint 14: Great Western Highway

Visual impact assessment - operation		
	Emissions via ventilation outlet	Emissions via portals
Sensitivity	Low	Low
Magnitude	Negligible	Negligible
Visual impact rating	Negligible	Negligible
Qualitative rating	Neutral	Neutral





Figure 7-74: Visual simulation illustrating the changes due to the Upgrade Program and the project

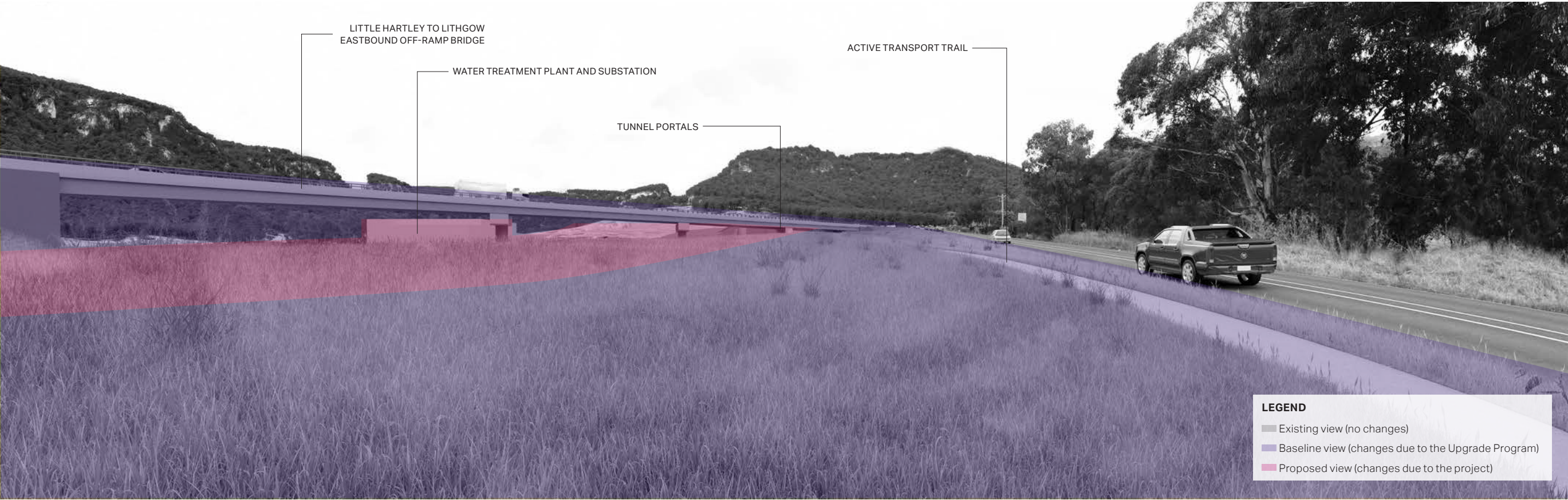


Figure 7-75: Visual simulation illustrating the changes due to the Upgrade Program (purple) and the project (pink) but with trees and shrubs removed from the desaturated image to show the extent of each project



7.3.2.8. Viewpoint 15: Hartley Valley Holiday Farm

This viewpoint is located on the southern verge of the Great Western Highway in front of the Hartley Holiday Farm looking east, as shown in Figure 7-76 and Figure 7-78. The viewpoint is positioned in front of ‘Rosedale’, a heritage listed inn built in 1836 (refer Figure 7-77).

This viewpoint is representative of visual receptors travelling along Great Western Highway and also approximates the view seen from the Hartley Holiday Farm near the Great Western Highway corridor.

Sensitivity: High

Visual receptors at this viewpoint are motorists on the Great Western Highway who would be expected to primarily be focusing on the road and traffic. Motorists would comprise a mix of people, including locals driving to and from work / home, or as part of work-related activities (e.g. truck drivers) and tourists either visiting the Blue Mountains area, as well as the Hartley Valley Holiday Farm (including the heritage listed ‘Rosedale’).

Given the scenic nature of the route towards and through the Blue Mountains and the presence of both a landscape conservation area and a heritage item within the viewpoint, the sensitivity of this viewpoint is considered to be higher than a typical transport corridor.

The susceptibility of the viewpoint to change due to the project is reasonably high due to the potential visibility of the dual carriageway Great Western Highway beyond the existing Highway.

Existing view

The existing view from this location is shown in Figure 7-79. The existing two lane Great Western Highway is seen in the foreground of the view, extending south east towards Victoria Pass. Clumps of taller roadside vegetation screen and frame views to the Butlers Creek Valley to the north east. In a gap in vegetation a strip of open pasture within the valley can be seen running parallel to the Great Western Highway before it is met in by the dark dense bushland of the steeper terrain behind.

The background of the view is dominated by Mount York escarpment, including dark bushland vegetation and patches of outcropping sandstone.

Baseline view

During construction, the removal of vegetation fringing the existing Great Western Highway would have opened up views along the Great Western Highway corridor and to the south eastern edge of the Butlers Creek Valley and Victoria Pass / Berghofers Pass ridge line behind.

At operation the following elements of the Little Hartley to Lithgow Upgrade are likely to be seen within the view:

- The eastbound connection and overbridge between the existing and proposed Great Western Highway, both of which would be lit at night
- The proposed active transport trail.



Figure 7-77: ‘Rosedale’



Figure 7-76: Keyplan showing Viewpoint 15 in relation to the project and the Upgrade Program



Figure 7-78: Plan showing Viewpoint 15 in relation to the project and the Upgrade Program





Visual impact assessment: construction

Anticipated change to the view

During construction the main activity seen within the view would be the construction activity associated with earthworks and roadworks. The trees along the existing Great Western Highway would already have been removed, opening up the view across the valley. Construction activity seen in the middle to background would be an even mix between the project and the Upgrade Program. Night lighting associated with the removal of spoil would be seen within the valley, along with an increase in construction traffic on the existing Great Western Highway.

Magnitude: Moderate

Due to the placement of the project and the Upgrade Program within the view, it would be difficult to ascertain what construction activity would be due to each project. The project would extend the area over which construction would be seen to the south, and would lengthen the time over which it would be seen. Additional lighting within the otherwise darkened valley would be seen at night in the middle to background, against the backdrop of Victoria Pass.

Visual impact assessment: High to Moderate (Adverse)

Table 7-31 shows the visual impact rating of the project on the view from this viewpoint during construction. The high sensitivity of the viewpoint due to the nearby holiday farm and heritage item, coupled with the large expanse of the view within which construction would be seen would result in a High to Moderate assessment. Construction activity, including the construction of the project as well as potential structures seen within the construction footprint, would reduce the quality of the view.

Table 7-31: Visual impact rating (construction) - Viewpoint 15

Visual Impact Assessment - construction	
Sensitivity	High
Magnitude	Moderate
Visual impact rating	High to Moderate
Qualitative rating	Adverse



Figure 7-79: Existing view from Viewpoint 15





Figure 7-80: Visual simulation illustrating the changes due to the Upgrade Program and the project



Figure 7-81: Visual simulation illustrating the changes due to the Upgrade Program (purple) and the project (pink) but with trees and shrubs removed from the desaturated image to show the extent of each project



Visual impact assessment: operation

Anticipated change to the view

The proposed carriageways of the Great Western Highway would be visible beyond the existing Great Western Highway at this location as the carriageways are elevated on batters as they approach and pass this viewpoint, including safety barriers, signage, passing traffic and tree and shrub planting. Tree plantings may partially screen views to the landscape beyond, depending on the planting density.

While the removal of existing vegetation due to the Little Hartley to Lithgow Upgrade would have already have opened up views towards the tunnel portals and operational infrastructure, these items would be screened from view by existing trees retained to the south of the Great Western Highway, the Little Hartley to Lithgow Upgrade overbridges and landscaping. The top of the proposed substation would only just be visible above the southern most bridge of the Little Hartley to Lithgow Upgrade.

Additional lighting due to the project would be somewhat masked by the lighting of the Great Western Highway in the foreground of the view (within the Upgrade Program).

Note: for a detailed description of the infrastructure potentially visible at this location, refer Section 5.8 of this report.

Magnitude: Moderate

The project would result in a widening of the Great Western Highway corridor to allow for the introduction of the roads accessing the tunnel, with a substantial increase in the scale of the infrastructure within the quiet valley setting. The changes would be seen within a large proportion of the overall view, with the Great Western Highway corridor extending south east towards Victoria Pass. However, the extent of the changes to the east would also comprise elements of the Little Hartley to Lithgow Upgrade, particularly the taller bridges over the project.

Most visual receptors would see the view from this viewpoint as they travel past along the existing Highway, however, a small number would see more prolonged views to the project from within the Hartley Valley Holiday Farm.

Visual impact assessment (Emissions via ventilation outlet option): High to moderate (Adverse)

The project would result in an increase in the visual prominence of road infrastructure within the view and would potentially screen some of the views across the picturesque valley and to the Mount York escarpment beyond due to tree planting. These changes would result in an adverse change to the overall view from this viewpoint.

Visual impact assessment (Emissions via portals option): High to moderate (Adverse)

As it is unlikely that the ventilation outlets would be seen from this location, the removal of this element from the project would not alter the ratings from this viewpoint.

Table 7-32: Visual impact assessment - Viewpoint 15: Hartley Valley Holiday Farm

Visual impact assessment - operation		
	Emissions via ventilation outlet	Emissions via portals
Sensitivity	High	High
Magnitude	Moderate	Moderate
Visual impact rating	High to moderate	High to moderate
Qualitative rating	Adverse	Adverse



7.3.2.9. Viewpoint 16: Great Western Highway

This viewpoint is located within one of the rural properties on the northern side of Great Western Highway, adjacent to the house looking east, as shown in Figure 7-82. This viewpoint is representative of views from this property which would experience the closest views to the project from within Butlers Creek Valley.

Sensitivity: Moderate

Visual receptors at this viewpoint comprise the residents living in the one house on the property. The residence is orientated towards the project, looking south east. While typically very sensitive to views from their houses and gardens, the sensitivity of this viewpoint is lowered due to the limited area of the project that would be seen from this location, in part due to the Little Hartley to Lithgow Upgrade.

Existing view

The existing view from this location is shown in Figure 7-83. The view is characterised by the undulating rural landscape within the valley, surrounded by darker forested ridgelines and escarpments.

The foreground of this view is dominated by the existing paddocks falling from north towards Butlers Creek near the centre of the valley. Clumps of native trees are scattered throughout the paddocks in the foreground and middle ground of the view. The Great Western Highway is visible to the south (right of frame) fringed by a mix of exotic and native trees, extending south east towards Victoria Pass. The heritage building of Hartley Holiday Farm is visible in the middle ground to the right of frame adjacent to the Great Western Highway.

The steep escarpment of the Mount York escarpment frames the valley to the north, extending south east to meet with the ridge line associated with Victoria Pass, then turns towards the south west to meet up with the Mount Sugarloaf ridge line.

Baseline view

During construction, the removal of vegetation within the valley and along the existing Great Western Highway would make the Great Western Highway more visually prominent within the rural setting.

At operation, the following changes would be seen within the view due to the Little Hartley to Lithgow Upgrade (refer Figure 7-84 and Figure 7-86):

- The new alignment of the Great Western Highway would extend from the south west (far right of frame) south east, visible as a steep vegetated batter within the valley
- The batters surrounding the sediment and water quality basins to the south of the largest dam in the valley are visible to the north of the new Highway alignment
- The eastbound connection and overbridge between the existing and proposed Great Western Highway would be partly screened by a remaining paddock tree
- Signage, fencing and safety barriers would be visible along the Great Western Highway.

Visual impact assessment: construction

Anticipated change to the view

The construction footprint would be seen along its shortest edge and initially comprise the removal of a small patch of vegetation in a nearby residential property adjacent to the Highway.

The nearest construction activity would occur due to the Upgrade Program, with the construction of the eastbound Great Western Highway and the sediment and water quality basins. Construction due to the project would be seen beyond these changes, including stockpiling, a construction water treatment plant, and the visual clutter within the construction footprint seen from a reasonable distance away.

Lighting during the night would be seen with the removal of spoil, which would be a change to the darkened valley and would be seen against the backdrop of Victoria Pass and Mount Sugarloaf.

Magnitude: Moderate

The construction due to the project would comprise an extension of existing construction due to the Little Hartley to Lithgow Upgrade, and would only be seen over a small proportion of the overall view. The construction activity would be seen from a reasonable distance away, and it is unlikely that most of the activity would be discernible. Larger structures on site (such as the acoustic shed) are positioned closer to the Great Western Highway and would be seen beyond construction activity due to the Upgrade Program. Night lighting would be seen from a distance, but would comprise a change within the currently darkened valley.

Visual impact assessment: Moderate (Adverse)

Table 7-33 shows the visual impact rating of the project on the view from this viewpoint during construction. Construction activity would comprise an extension of existing activity seen due to the Little Hartley to Lithgow Upgrade, both in the amount of area taken up within the view and the amount of time construction activity would be seen. The introduction of night lighting would be a distant addition to the view at night. These changes would result in an adverse affect on the view.

Table 7-33: Visual impact rating (construction) - Viewpoint 16

Visual Impact Assessment - construction	
Sensitivity	Moderate
Magnitude	Moderate
Visual impact rating	Moderate
Qualitative rating	Adverse

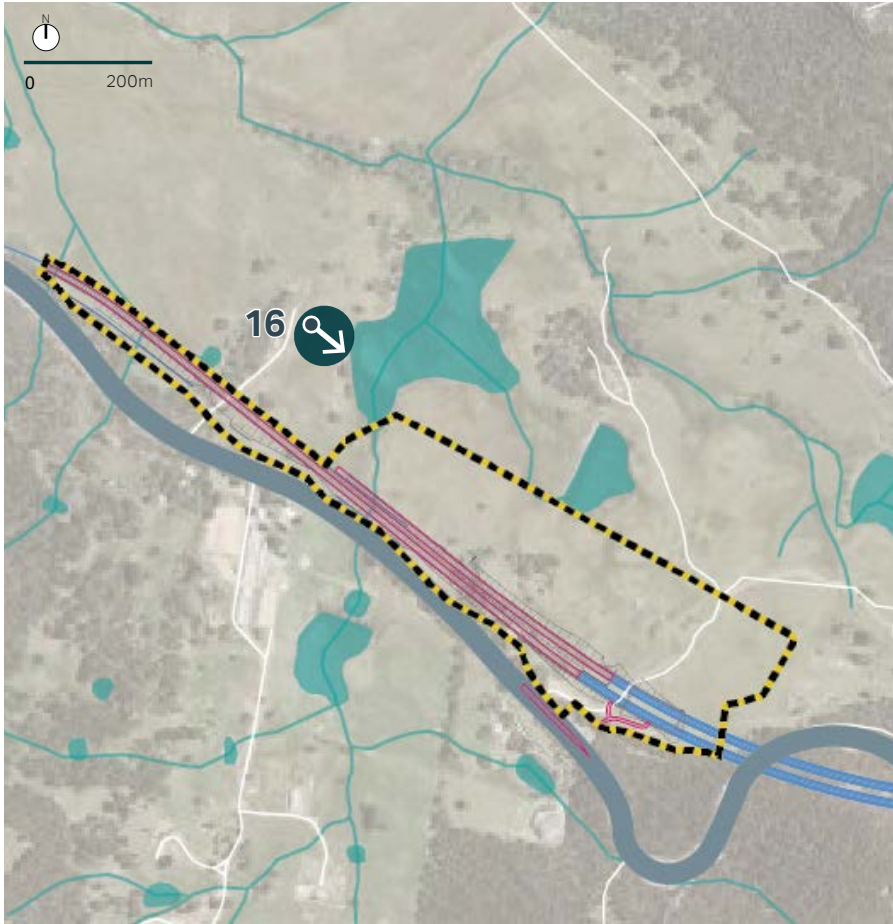


Figure 7-82: Keyplan showing Viewpoint 16 in relation to the project







Figure 7-83: Existing view from Viewpoint 16



Figure 7-84: Visual simulation showing changes due to the project and the Upgrade Program





**Figure 7-86:** Visual simulation illustrating the changes due to the Upgrade Program (purple) and the project (pink) but with trees and shrubs removed from the desaturated image to show the extent of each project



**Figure 7-85:** Detail of Figure 7-84 showing the tunnel portals and ventilation outlet

**Visual impact assessment: operation**

**Anticipated change to the view**

Changes due to the project would be predominantly seen in the background of the view, south of the sediment and water quality basins. The tunnel portals would be just visible below the ventilation outlet (is used ) (refer Figure 7-84). A small slither of the new carriageways extending north west from the tunnel would be seen in the middle ground of the view nearing the heritage building associated with the Little Hartley Holiday Farm, however, most of the new Great Western Highway associated with the project rather would be screened from view by the Little Hartley to Lithgow Upgrade infrastructure.

Built form associated with the operational infrastructure would be seen to the north (left) of the tunnel portals and ventilation outlet. Landscaping would also be seen, which over time would reduce the visual prominence of the road infrastructure within the valley.

Note: for a detailed description of the infrastructure potentially visible at this location, refer Section 5.8 of this report.

**Magnitude: Low**

The project is visible within a very small portion of the overall view. The most visually prominent elements would be the retaining walls of the tunnel portals, the substation, water treatment plant and the ventilation outlet. The ventilation outlet and tunnel portals would be ‘tucked’ within the hillside at the bottom of Victoria Pass, with the dark mass of the vegetation and hillside behind them reducing the visual prominence of the structures within the view. Further, due to the low elevation of the viewpoint, it is likely that tree planting along the road corridor and around the operational infrastructure near the tunnel portals would eventually screen these elements from view.

While some additional lighting due to the project may be seen, this would comprise a very small amount of lighting above that within the lit Upgrade Program lighting on the Great Western Highway.

**Visual impact assessment (Emissions via ventilation outlet option): Moderate to low (Adverse)**

As shown in Table 7-34, the overall visual impact of the project on the view from this location is considered to be moderate to low as the change would occur in the distance and be largely screened from view by other elements of the project. The introduction of the tunnel portal walls, water treatment plant, substation and ventilation outlet would be new distant infrastructure within the landscape.

**Visual impact assessment (Emissions via portals option): Moderate to low (Adverse)**

The ventilation outlet is not the largest nor the most visually prominent proposed structure within the view. Its removal from the project would not alter the overall impact rating nor the quality of the resulting view.

**Table 7-34:** Visual impact assessment - Viewpoint 16: Great Western Highway

Visual impact assessment - operation		
	Emissions via ventilation outlet	Emissions via portals
Sensitivity	Moderate	Moderate
Magnitude	Low	Low
Visual impact rating	Moderate to low	Moderate to low
Qualitative rating	Adverse	Adverse



7.3.2.10. Viewpoint 17: Ambergmere Drive

This viewpoint is located at the entrance to a property on Ambergmere Drive looking east, as shown in Figure 7-87. This viewpoint is representative of visual receptors travelling and residing along Ambergmere Drive.

Sensitivity: Moderate

The visual receptors at Ambergmere Drive are local residents who would be sensitive to changes within the rural setting of their properties. However, due to the distance of viewing, the susceptibility of this viewpoint to change lowers the overall sensitivity.

Existing view

The existing view from this location is shown in Figure 7-88.

An existing timber fence and the dam are visible in the foreground, with the view framed on both sides by the existing exotic trees within the residential property. The middle ground of the view comprises lawns, rural residential buildings and vegetation within gardens. The background of the view includes the dark, forested ridgelines and escarpments that surround Butlers Creek Valley to the north, east and partially to the west.

The existing Great Western Highway is barely visible within the view, with a glimpse view of a roadside cutting seen in the middle to background to the right of frame.

Baseline view

It is anticipated that no changes would be seen within this view due to the Little Hartley to Lithgow Upgrade. The works would occur behind the existing hill crest visible in the centre of the existing view, as described above.

Anticipated change to the view

Although project (during both construction and at operation) would technically be located within the view, it is unlikely that the activity or elements would be distinguishable from this distance, with the exception of night lighting. Light spill during construction and operation stages would be visible in the distance.

Magnitude: Low

It is unlikely that the changes would be distinguishable from this viewpoint during daytime. The effects of light spill during night time are also anticipated to occur in a distance.

Visual impact assessment (Emissions via ventilation outlet option: Negligible (Neutral))

As shown in Table 7-35, the overall visual impact of the project on the view from this location is considered to be Negligible due to the distance from this viewpoint. While some residences within the vicinity of this viewpoint may get clearer views to the project, these would depend strongly on the vegetation surrounding the properties, the position within the Butlers Creek Valley, surrounding landform and the orientation of the house. All would be viewing from a distance of approximately 2.5 kilometres away and from a lower, valley position.

The qualitative rating for this view is considered neutral given the fact that it is unlikely that the changes would be seen in any detail great enough to affect the quality of the view.

Emissions via portals option: Negligible (Neutral)

As it is unlikely that the ventilation outlet would be seen from this location, the removal of this element from the project would not alter the ratings from this viewpoint.

Table 7-35: Visual impact assessment - Viewpoint 17: Ambergmere Drive

Visual impact assessment - construction and operation	
Sensitivity	Moderate
Magnitude	Low
Visual impact rating	Moderate to Low
Qualitative rating	Neutral



Figure 7-88: Existing view from Viewpoint 17

Legend

- Study area
- Waterbodies
- Watercourses
- Viewpoints
- Road
- GWH existing corridor
- The project: construction footprint
- The project: permanent design
- GWH road design
- The project: tunnel alignment

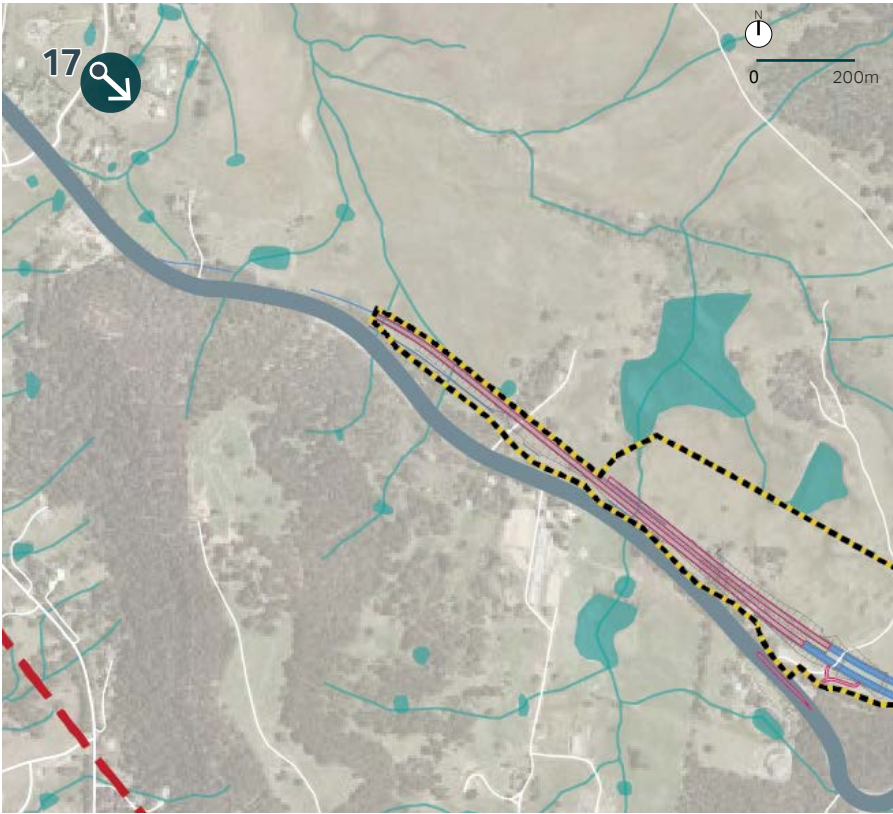


Figure 7-87: Keyplan showing Viewpoint 17 in relation to the project



7.4 Summary of visual impact assessment

Overall, the visual impact is substantially lessened by the existing impact of the Upgrade Program within the landscape (i.e. the assessment of the project within the ‘baseline environment’ rather than the ‘existing environment’):

- The sensitivity of typically sensitive receptors (such as residents, hikers and tourists) and LCZs was reduced by the changes due to the Upgrade Program within the landscape, which in most cases lessened the susceptibility of the viewpoints and LCZs to change as they were already subject to change prior to the project
- The project was often embedded within the Upgrade Program works, therefore the ‘existing’ extent of works screened or lessened the impact of the project
- The impact of the larger scale of the infrastructure in the project was often lessened by other larger pieces of infrastructure within the Upgrade Program (such as the bridges at Little Hartley), therefore were no longer ‘uncharacteristic’ within the landscape
- Clearing of vegetation would already have happened due to the Upgrade Program, so the ‘opening up’ of views along the road corridor and the visual prominence of the Great Western Highway within the landscape was not assessed within the project, but rather assumed to have already have happened.

7.4.1 Construction

The construction footprints of the project overlap with the construction footprint of the Upgrade Program at both Blackheath and Little Hartley. At both locations, the impact of the project construction would be seen as a continuation of construction activity from the Upgrade Program of the Great Western Highway as it extends north towards the project from Katoomba at Blackheath, and south from Lithgow at Little Hartley.

The visual impact of the project during construction at Blackheath is summarised in Table 7-36. Five of the 7 viewpoints were assessed as having either a High or High to Moderate visual impact. These viewpoints were either positioned very close to the construction footprint boundary or had views from an elevated viewpoint, and had views to the project construction footprint seen without the substantial existing influence of the Upgrade Program within the view (which reduced the susceptibility of the view to change when seen in conjunction with the project).

Vegetation clearing and earthworks would comprise a substantial change at Blackheath from the original condition, as the construction footprint lies within an area of existing dense bushland on a steeply sloping site. Removal of bushland would facilitate views east across the valley that were previously screened by tall vegetation.

Other than the removal of vegetation, construction elements seen within the view at Blackheath would include earthworks, construction of larger structures (such as the ventilation outlet (optional) and tunnel operations facility) stockpile and spoil handling areas and workshops, stores and amenities buildings.

The impact of construction on views at Soldiers Pinch is also shown in Table 7-36. Construction at Soldiers Pinch would only be due to the project, however, the visual impact would be limited by the visibility of the construction footprint within the landscape. Views to the construction footprint would be seen from the Great Western Highway, where views were substantially limited by landform and screened by roadside vegetation. Only the tallest construction elements, such as cranes and boring machines would be likely to be visible from the Great Western Highway.

The impact of construction at Little Hartley is summarised in Table 7-37. Three of the ten viewpoints were assessed as experiencing a High to Moderate visual impact during construction. Visual receptors with views to construction activity from close proximity typically had the highest impact due to construction, including from the edge of the Mount York escarpment near the project, and on the Great Western Highway. The highest volume of visual receptors would be those travelling on the Great Western Highway, for whom construction activity due to the project would be experienced for a short period of time as they passed by.

At Little Hartley, where the landscape is more open and rural (and there is less tall vegetation), the removal of vegetation would be less of a change from existing view. Roadside vegetation would already have been removed due to the Little Hartley to Lithgow Upgrade, with very little vegetation left to clear within the project construction footprint.

Table 7-36: Summary of visual impact assessment during construction: Blackheath and Soldiers Pinch

	Sensitivity	Magnitude	Visual impact rating	Qualitative rating
Viewpoint 1: Great Western Highway	Moderate	Negligible	Negligible	Neutral
Viewpoint 2a: Great Western Highway at Tennyson Road looking north	High	High	High	Adverse
Viewpoint 2b: Great Western Highway at Tennyson Road looking south	High	Negligible	Negligible	Neutral
Viewpoint 3: Evans Lookout Road	Moderate	High	High to Moderate	Adverse
Viewpoint 4: Great Western Highway at Evans Lookout Road	Moderate	High	High to Moderate	Adverse
Viewpoint 5: Great Western Highway at Brightlands Avenue	Low	Moderate	Moderate to Low	Adverse
Viewpoint 6: Valley View Road	Moderate	High	High to Moderate	Adverse
Viewpoint 7: The Train from Blackheath	High	High	High	Adverse
Soldiers Pinch	Moderate	Low	Moderate to Low	Adverse

Table 7-37: Summary of visual impact assessment during construction: Little Hartley

	Sensitivity	Magnitude	Visual impact rating	Qualitative rating
Viewpoint 8: Berghofers Pass	Moderate	Moderate	Moderate	Adverse
Viewpoint 9: Transmission Easement Lookout	Moderate	High	High to Moderate	Adverse
Viewpoint 10: Historic Wells Lookout	Moderate	High	High to Moderate	Adverse
Viewpoint 11: Bardens Lookout	Moderate	Moderate	Moderate	Adverse
Viewpoint 12: Mount York Lookout	Low	Negligible	Negligible	Neutral
Viewpoint 13: Great Western Highway	Low	High	Moderate	Adverse
Viewpoint 14: Great Western Highway	Low	High	Moderate	Adverse
Viewpoint 15: Hartley Valley Holiday Farm	High	Moderate	High to Moderate	Adverse
Viewpoint 16: Great Western Highway	Moderate	Moderate	Moderate	Adverse
Viewpoint 17: Ambermere Drive	Moderate	Low	Moderate to Low	Neutral



Large construction infrastructure at Little Hartley would include parking, water treatment plant, acoustic shed, offices, stockpiling areas, concrete making facility and an area to assemble and launch the tunnel boring machine. These elements would be positioned at the southern end of the valley, tucked into an open area at the foot of Victoria Pass.

Night lighting at Little Hartley was a new element within the view at Little Hartley. While night lighting is considered a substantial change within the relatively unlit Butlers Creek Valley, the places where the lighting would be most visually prominent (along the Mount York escarpment) are also the areas with the least visual receptors at night. While residents within the Butlers Creek Valley would also see glimpses of night lighting, these views are predominantly from distances that would reduce the visual impact of the lighting and be partly screened by structures within the construction footprint such as the acoustic shed.

All three sites would have construction fencing and hoarding, an increase in construction traffic, and general construction activity seen where views into the construction footprints are available. While the construction period would be temporary, it would be seen over an extended period of time (6 years).

Overall, the construction of the project is considered to have a High to Moderate (Adverse) affect on views from the surrounding area.

7.4.2 Operation

Overall, the project would result in changes to views at Blackheath and Little Hartley during operation (there would be no operational infrastructure at Soldiers Pinch). Table 7-38 provides a summary of the visual impact assessment for viewpoints located at Blackheath. The table is summarised to include the assessment and ratings for the options for tunnel emissions only for viewpoints where the results differ (Viewpoint 3 and Viewpoint 7).

At Blackheath, seven viewpoints were selected from which to assess visual impact. One of these viewpoints was assessed twice (2a and 2b) to capture views looking in both directions along the Great Western Highway.

Two viewpoints returned a high visual impact rating: that from the Great Western Highway when passing near the tunnel portals (Viewpoint 2a and 2b), and when passing the site on the train (Viewpoint 7). Of the more ‘static’ viewpoints (i.e. those where visual receptors included residents), the impact ratings tended to be lower (around moderate to low) as these locations were typically further away or had areas of replanted landscapes of trees and shrubs screening views to the larger infrastructure elements.

The increased width of the overall Great Western Highway corridor as it widened on the approach to the tunnel portals (including large road furniture such as VMS and gantries), the ventilation outlet (optional), the large retaining walls and fencing, and the tunnel operations facility were the most substantial changes within the views. The scale of these elements were uncharacteristic within the site, particularly the tunnel operations facility and ventilation outlet. However, the removal of the ventilation outlet only moderately reduced the rating at two viewpoints. Lighting of the existing and realigned Great Western Highway would comprise a change within the darkened landscape, and from higher viewing angle of the train, would illuminate the extent of the interchange within the landscape. However, this is considered to be a minimal impact on overall views as the realigned road corridor heading into the tunnels would be visible from the existing road and train, but not from any locations where night lighting would be a problem (e.g. from residences).

Overall, the visual impact of the project at Blackheath is considered to be moderate (adverse). It is noted that considering the large scale of the proposed infrastructure and the unique sensitivities that would be linked to changes within the Blue Mountains (given the high value of landscape and views linked to tourism, the natural environment and heritage values) this rating seems low. However, the project was assessed on the assumption that the Katoomba to Blackheath Upgrade would be an existing feature within the landscape (the baseline environment). For a discussion on the cumulative impact of the project in conjunction with changes due to the Katoomba to Blackheath Upgrade, refer to Section 7.5.

Table 7-38: Summary of visual impact assessment at operation: Blackheath

Viewpoint		Sensitivity	Magnitude	Visual impact rating	Qualitative rating
Blackheath	Viewpoint 1: Great Western Highway	Moderate	Moderate	Moderate	Neutral
	Viewpoint 2a: Great Western Highway at Tennyson Road looking north	High	High	High	Adverse
	Viewpoint 2b: Great Western Highway at Tennyson Road looking south	High	High	High	Adverse
	Viewpoint 3: Evans Lookout Road	Emissions via ventilation outlet	Moderate	Moderate	Adverse
		Emissions via portals	Moderate	Moderate	Adverse
	Viewpoint 4: Great Western Highway at Evans Lookout Road	Moderate	Low	Moderate to low	Neutral
	Viewpoint 5: Great Western Highway at Brightlands Avenue	Low	Low	Low	Adverse
	Viewpoint 6: Valley View Road	Moderate	Low	Moderate to low	Neutral
	Viewpoint 7: The Train from Blackheath	Emissions via ventilation outlet	High	High	Adverse
		Emissions via portals	High	High to moderate	Neutral



At Little Hartley ten representative viewpoints were chosen to assess potential impacts on existing views.

Table 7-39 provides a summary of the visual impact assessment for viewpoints located at Little Hartley. The table is summarised to include the assessment and ratings for the options for tunnel emissions only for viewpoints where the results differ (Viewpoint 13).

These were roughly grouped into those viewpoints that would see the project from elevated lookouts and hiking trails ('views from height'), those that would see the project from and adjacent to the Great Western Highway ('views from Highway'), and those that would see the project from within the Butlers Creek Valley ('views from valley').

The 'views from height' category comprised viewpoints from lookouts on the Mount York escarpment, fringing Little Hartley to the north. These viewpoints would typically be visited by high numbers of visitors using the hiking, camping or picnic facilities, and would have a high level of interest in the landscape, particularly from the designated lookouts at the northern end of the escarpment.

The visual impact ratings from this group diminished the further north the viewpoint, due to the increasing distance to the project. While unobstructed, elevated views to the changes would be seen, at the more sensitive, 'formalised' lookouts (Mount York and Bardens Lookout), the project would be seen as a very small southern portion of the greater extent of the Little Hartley to Lithgow Upgrade works along the Great Western Highway.

From the Great Western Highway, the position of the Little Hartley to Lithgow Upgrade works typically screened or at least lessened the impact of the project when seen by motorists and residents on the southern side of the Great Western Highway. One location rated a High to Moderate (in front of the Little Hartley Holiday Farm), where the new Highway alignment would potentially be seen from a slightly elevated position, where views over the Butlers Creek Valley currently exist. At this point the widened Highway corridor and planting threaten to partially block this view, with the changes predominantly due to the project rather than the Little Hartley to Lithgow Upgrade.

From within the Butlers Creek Valley, the substantial distance from the project coupled with the undulating rural landform (including stands of paddock trees and trees within rural gardens surrounding houses) typically limits the overall impact of the project on these viewpoints. The closest residence (Viewpoint 16) returned a Moderate to Low rating as most of the changes effecting views from this property would be due to the Little Hartley to Lithgow Upgrade. Night lighting of the tunnel entry and along the realigned Great Western Highway may be seen by residents within Butlers Creek Valley, however, the distance of viewing, coupled by taller vegetation planted in the road corridor would limit the affect of this lighting within the valley when seen from these locations.

Within Little Hartley the most prominent elements were the tunnel portals, the ventilation outlet and the operations management buildings near the tunnel portals. Proposed tree planting around these structures would lessen their impact on views within the valley as the trees matured. Furthermore, the Little Hartley to Lithgow Upgrade introduces larger transport infrastructure within the view prior to the project (i.e. the overbridges linking the existing and new Highway sections). This inclusion of taller structures within the landscape raises the prominence of the Great Western Highway within the valley setting prior to the project.

Overall, the visual impact of the project at Little Hartley is considered to be moderate (adverse). There would be no change to the overall rating or the quality of the resulting view if the ventilation outlet was removed from the project.

As with Blackheath, this rating seems low when considering the picturesque character of the valley, the high volume of tourist traffic and activity, and the recreational hiking trails on the overlooking escarpment at Mount York with numerous lookout opportunities. However, the project was assessed on the assumption that the Little Hartley to Lithgow Upgrade would be an existing feature within the landscape (the baseline environment). For a discussion on the cumulative impact of the project in conjunction with changes due to the Upgrade Program, refer to Section 7.5.

Table 7-39: Summary of visual impact assessment at operation: Little Hartley

Viewpoint			Sensitivity	Magnitude	Visual impact rating	Qualitative rating	
Little Hartley	Views from height	Viewpoint 8: Berghofers Pass		Moderate	Moderate	Moderate	Adverse
		Viewpoint 9: Transmission Easement Lookout		Moderate	High	High to Moderate	Adverse
		Viewpoint 10: Historic Wells Lookout		Moderate	Moderate	Moderate	Adverse
		Viewpoint 11: Bardens Lookout		Moderate	Low	Moderate to Low	Neutral
		Viewpoint 12: Mount York Lookout		Low	Negligible	Negligible	Neutral
	Views from Highway	Viewpoint 13: Great Western Highway	Emissions via ventilation outlet	Low	Low	Low	Neutral
			Emissions via portals	Low	Negligible	Negligible	Neutral
		Viewpoint 14: Great Western Highway		Low	Negligible	Negligible	Neutral
		Viewpoint 15: Hartley Valley Holiday Farm		High	Moderate	High to Moderate	Adverse
	Views from valley	Viewpoint 16: Great Western Highway		Moderate	Low	Moderate to Low	Adverse
Viewpoint 17: Ambergmere Drive		Moderate	Low	Moderate to Low	Adverse		



## 7.5 Discussion of cumulative effects

Cumulative effects have the potential to occur when benefits or impacts from a project overlap or interact with those of other projects, potentially resulting in a larger overall effect (positive or negative) on the environment or local communities. Cumulative impacts may occur when projects are constructed or operated concurrently or consecutively.

The extent to which another development or activity could interact with the construction and/or operation of the project would depend on its scale, location and/or timing of construction. Generally, cumulative impacts would be expected to occur where multiple long-duration construction activities are undertaken close to, and over a similar timescale to, construction activities for the project, or where consecutive construction occurs in the same area.

Two key concurrent projects would have cumulative impacts with the Great Western Highway Blackheath to Little Hartley Upgrade. The Katoomba to Blackheath Upgrade and Little Hartley to Lithgow Upgrade adjoining the project to the east and west respectively would be under construction when construction of the project commences. To minimise environmental impacts, the construction footprints used for the Katoomba to Blackheath Upgrade and the Little Hartley to Lithgow Upgrade would be repurposed to support construction of the project. Overall, the project in addition to the Upgrade Program at Blackheath and Little Hartley would result in substantial changes both to landscape character and views. The scale of the widened road corridor and the larger pieces of infrastructure that would be added to the landscape (particularly the split carriageways, bridges, tunnel portals, ventilation outlet (if used) and lighting) would be uncharacteristic within the landscape setting at both Blackheath and Little Hartley.

The construction of the project in addition to the construction of the Katoomba to Blackheath Upgrade (at Blackheath) and the Little Hartley to Lithgow Upgrade (at Little Hartley) would comprise an increase in the construction footprints at either location and the length of time construction activity would occur at these locations. In comparison to the extent of these two Upgrade Programs at Blackheath and Little Hartley, the additional footprints required are relatively small. The addition of a construction site at Soldiers Pinch would be the only additional surface works that are spatially secluded from the 'existing' Upgrade Program construction.

### 7.5.1 Landscape character

At Blackheath, during construction the Great Western Highway corridor would widen between Medlow Bath and the tunnel portals, with the removal of stands of bushland vegetation to the east of the Great Western Highway (within and adjacent to the Blue Mountains National Park) to accommodate the widening, substantially opening up views east across the valley. This impact would occur partially as a cumulative impact from the Katoomba to Blackheath Upgrade construction footprint, and partially due to the extension of that footprint necessary for the establishment of the construction support facilities for the Blackheath to Little Hartley project (including workshops, stockpile, stores, offices, car parking).

At operation, the narrow, winding Great Western Highway embedded within the landscape would increase in prominence, with the larger scale of the infrastructure enforcing more of a presence on the surrounding landscape rather than the other way around. Lighting of the new, widened Great Western Highway would also increase the prominence of the road corridor within the landscape, with existing areas of the Great Western Highway unlit between townships.

Similarly at Little Hartley, during construction the widened Highway corridor with associated construction infrastructure would be an uncharacteristic addition to the quiet, rural valley setting. This impact would occur partially as a cumulative impact from the Little Hartley to lithgow construction footprint in addition to the extension of that footprint necessary for the establishment of the construction support facilities for the project (workshops, acoustics shed, stockpile, stores, offices, car parking, concrete batching plant). Night lighting within the currently unlit Butlers Creek Valley would comprise a change within the landscape setting.

At operation, the position of the upgraded Great Western Highway, hugging the edges of forested mountains on the southern side of Butlers Creek Valley, would assist in reducing the overall impact of the Great Western Highway widening within the valley. However, would still result in a more prominent road corridor and a reduction of the extent of the rural landscape.

Tree planting, particularly within and around the works at Blackheath and at the southern end of Little Hartley near the tunnel portals, ventilation outlet and operations management buildings, would assist in 'bedding down' the upgraded road corridor within the landscape over time.

The overall combined impact of the project and the Upgrade Program on landscape character is considered to be high (adverse).

### 7.5.2 Visual impact

When the project is considered in conjunction with the Upgrade Program (both during construction and at operation), particularly at Little Hartley, the sensitivity of the viewpoints surrounding the combined works substantially grows due to the increase of the susceptibility of each viewpoint to change. Visual receptors within the Butlers Creek Valley (predominantly residents), at lookouts along the Mount York escarpment (typically hikers and tourists), and travelling along the Great Western Highway at both Blackheath and Little Hartley would be classified as being highly sensitive, both due to the relationship of these receptors to the views seen from their properties or while engaging in recreational activities, and to the threat of change to these views.

The magnitude of change experienced at most viewpoints would also increase. The cumulative effect of the project and Upgrade Program would be the substantial widening of the Great Western Highway corridor (at both Blackheath and Little Hartley) with the addition of uncharacteristic larger infrastructure at both construction and operation phases.

During construction the existing vegetation would be cleared to make way for all the construction support facilities and operations. This would comprise a more substantial change at Blackheath, where the bushland fringing the Great Western Highway characterised the views. At Little Hartley, the more open, rural character of the landscape results in less taller vegetation that would need to be cleared during construction. Night lighting within Butlers Creek Valley would be limited to the project construction footprint and would not be compounded by lighting within the construction footprint of the Upgrade Program.

At operation, views to the realigned Great Western Highway at either ends of the proposed tunnel would be characterised by larger operational infrastructure, including bridges, ventilation outlets, retaining walls and batters associated with the realignment of the dual carriageway of the Great Western Highway. Road furniture would be substantially larger, including gantries, VMS, signage and lighting. At Blackheath, this would be more of a change to the existing condition, while at Little Hartley, larger road furniture already exists within the immediate surrounds on the Great Western Highway.

Tree planting, particularly within and around the works at Blackheath and at the southern end of Little Hartley near the tunnel portals, ventilation outlet and operations management buildings, would reduce the impact of the scale of the road and infrastructure on views over time, particularly when seen from the Mount York escarpment and from residences within the Butlers Creek Valley.

The visual impact at Little Hartley would vary depending on particular viewpoint locations however, overall the combined impact of the project and Upgrade Program on views is considered to be high (adverse).



## 7.6 Discussion of heritage values

The Greater Blue Mountains Area (GBMA) is a 1.03 million hectare area listed on both the World Heritage List (WHL) and National Heritage List (NHL) located outside but adjacent to the project footprint. It is closest at the Soldiers Pinch construction footprint. An additional site has been nominated for the NHL which include the Blackheath and Soldiers Pinch surface works areas, however, the outcome of this nomination is not known.

Its significance has been assessed under the World Heritage significance criteria and the National Heritage significance criteria and are closely tied to the ecological, biological and conservation importance of the landscape.

Views to and from the GBMA to the project are not available for assessment through this report. At Blackheath, the GBMA is visually segregated by the existing Blue Mountains National Park and the existing bushland vegetation which borders the project to the east acts as a visual buffet. The clear border between bushland and GBMA is not discernible through the views from Blackheath to the east. Furthermore, the project is not located within or near any views which include the WHL or NHL item, nor any viewpoint where important or notable views to the WHL item are seen from.

The presence of the GBMA is a consideration of the value of the landscape in the area surrounding the project, and has been included in the general sensitivity of the LCZs assessed within this report.

Heritage items within or adjacent to the project include the Mount Victoria Stockade, Victoria Pass, 'Rosedale' and 'Nioka', Berghofers Pass and the Little Hartley Heritage Conservation Area. These items were considered in assessment of the project, as a contributor to overall landscape value within the LCZs they fell within, or as a criteria relating to sensitivity when they lay near viewpoints or within views.

## 7.7 Conclusion

The project is in tunnel for a large portion of its total length which helps to minimise its impact on landscape character and views. The focus of the landscape character and visual impact assessment is on the areas of the project where it surfaces and meets existing infrastructure.

The project would result in surface changes at two locations during operation: Blackheath and Little Hartley. Both locations have characteristic elements of the unique 'Blue Mountains' landscape. At Blackheath, the dense bushland fringing the gently curving Great Western Highway as it meanders alongside the rail corridor provides moments of 'wilderness' between townships that characterises the Great Western Highway experience. At Little Hartley, the steep descent down Victoria Pass and out into the open, rural valley below provides a gateway experience into the more rural setting of the landscapes beyond the Blue Mountains. Furthermore, Little Hartley comprises an example of the unique 'verdant valley within rugged escarpments' landscape of the Blue Mountains.

Overall, the project is considered to have a High to moderate (adverse) effect on landscape character, however, this impact would be localised to the areas surrounding the surface works at both Blackheath and Little Hartley. The project would contribute to the increase in prominence of the Great Western Highway as a distinct, linear element within the landscape.

The project is considered to have a Moderate (adverse) impact on surrounding views. This rating considers the changes due to the project within a transport corridor which is already undergoing substantial change along its length due to the Upgrade Program to the south (Katoomba to Blackheath Upgrade) and the north (Little Hartley to Lithgow Upgrade). The substantial increase in scale of infrastructure would fit the overall character of the upgraded Great Western Highway.

The project would have a beneficial effect on both landscape character and views along the Great Western Highway between Blackheath and Little Hartley with the reduction in volume of traffic and the size of the vehicles travelling along the narrower corridor, particularly within the Blackheath township.

The impact of the project on landscape character and views would reduce over time, particularly with the maturation of planting. The adoption of mitigation measures, particularly those around tree planting and surface treatment of larger structures, such as retaining walls and the ventilation outlet (if used) would reduce the visual prominence of the project within the landscape and ultimately its overall impact.



## Mitigation Measures

# 08



# 8.Mitigation Strategy

## 8.1 Management of Impacts

### 8.1.1 Performance Outcomes

Performance outcomes have been developed that are consistent with the SEARs for the project. The performance outcomes for the project are summarised below in Table 8-1 and identify measurable, performance-based standards for environmental management.

**Table 8-1:** Performance outcomes for the project - Urban Design, Landscape Character and Visual Impact Assessment

SEARs desired performance outcome	Project performance outcome	Timing
The project is well designed and enhances the environment where is it located, including improved accessibility and connectivity for communities and public spaces.  The project helps to support the health and wellbeing of Country by valuing, respecting and being guided by Aboriginal people.	Design the project to respond to the surrounding landscape character and integrate the design of built and natural environments in an understandable, complementary, and sustainable way, establishing a robust Connection to Country.  Incorporate Aboriginal heritage interpretation and Aboriginal cultural design principles into the design of the project in consultation with Aboriginal stakeholders.	Design
The project contributes to greener places through the enhancement and provision of green infrastructure.	Design and construct the project to include green infrastructure as part of surface operational infrastructure, where feasible.	Design and construction



8.2 Mitigation Measures

A construction environment management plan (CEMP) would be prepared for the project. The CEMP would detail the proposed approach to environmental management, monitoring and reporting during construction. A number of sub-plans and other supporting documentation, as required, would also be prepared as part of the CEMP.

A community and stakeholder engagement plan (Engagement Plan) has been prepared for the Upgrade Program and would be used to guide community and stakeholder engagement activities during construction of the project. Engagement during construction would include updates on planned construction activities and would respond to concerns and enquiries in a timely manner, seeking to minimise potential impacts where possible.

Mitigation measures to manage potential urban design, landscape character and visual impacts of the project are outlined in Table 8-2.

Table 8-2: Management and mitigation measures – urban design, landscape character and visual impact

ID	Mitigation Measure	Timing
LV1	<p>A Place Design and Landscape Plan (PDLP) will be prepared to minimise landscape character and visual impacts, and detail and guide the implementation of landscape features to be installed as part of the project. This would include requirements for:</p> <ul style="list-style-type: none"><li>– landscape and re-vegetation</li><li>– the provision of vegetative screening to soften the appearance of structural elements of the project and provide screening of sensitive views to the project</li><li>– requirements of the Aboriginal and non-Aboriginal cultural and heritage interpretation</li><li>– site levels and grades for the project that integrate with the surrounding terrain to assist with the visual assimilation of the project into the surrounding landscape where practicable. The gradients of engineered slopes will seek to maximise the establishment of vegetation and allow for appropriate maintenance.</li></ul> <p>The PDLP will be prepared in accordance with applicable guidelines, be consistent with the project identity in the EIS and relevant urban design objectives and principles for the project including consideration of implementation of Crime Prevention Through Environmental Design (CPTED) principles, and in consultation with the relevant councils.</p>	Construction

Table 8-2 continued Management and mitigation measures – urban design, landscape character and visual impact

ID	Mitigation Measure	Timing
LV2	<p>As part of further design development, opportunities to visually integrate the project into the landscape, will be considered and will reflect the landscape and revegetation requirements identified in environmental mitigation measures for biodiversity and non-Aboriginal heritage. This will consider measures including:</p> <ul style="list-style-type: none"><li>– retention and protection of existing trees where reasonable and feasible, particularly along the unaltered edges of the existing Great Western Highway</li><li>– avoidance of formal rows of trees or blocks of shrub and grass plantings as these would be uncharacteristic within both the Blackheath and Little Hartley landscape settings</li><li>– reinstatement of cleared native vegetation to achieve a net increase in tree numbers and canopy in proximity to the project that will not be covered by a biodiversity offset strategy</li><li>– strategic placement and planting of vegetation in line with the surrounding landscape character zone(s)</li><li>– sourcing locally endemic native species</li><li>– carrying out appropriate soil analysis and identification of soil preparation requirements for landscaping treatments to inform the PDLP and vegetation management in accordance with the Batter Surface Stabilisation Guideline (RMS, 2015).</li></ul>	Design
LV3	<p>The Construction Environmental Management Plan (CEMP) will include specific measures to minimise the visual intrusion of construction areas and construction compounds.</p>	Construction
LV4	<p>Lighting employed during construction and operation will be minimised, taking into account:</p> <ul style="list-style-type: none"><li>– minimum lighting requirements and design standards to maintain safety during construction and safety for operational traffic</li><li>– guidance on the management of obtrusive lighting effects in AS4282-1997: Control of the Obtrusive Effects of Outdoor Lighting</li><li>– guidance on good lighting principles provided in Part 4 of Dark Sky Planning Guideline (DPE, 2016a)</li><li>– the biodiversity lighting requirements for the project (refer to environmental mitigation measure B8).</li></ul>	Design, construction and operation



### 8.3 Urban design opportunities for further investigation

The project is important for the Blue Mountains in terms of scale and its contribution to connecting the broader region to Sydney, and vice versa.

There are key design and opportunities that have been identified during the development of the Concept Design process that may enhance and improve the quality, safety and amenity of the urban design outcome.

While the opportunities do not necessarily relate to an identified impact, they have been recognised during this assessment process and should be considered further during future stages of design.

These opportunities listed below have been recognised and collected during the review process and should be examined further:

- Incorporation of pace maker technology to assist in reducing congestion and regulating traffic flow. This would consist of strips of automated lighting moving along the tunnel at the designated travel speed
- Installing rumble strips on the lane edges of the pavement on the approach to and in the tunnel to prompt drivers when lane drifting. These could be used over the extent of the project as an additional safety measure
- Enhancement of the cavern experience as a mid point journey breaker, through additional visual or traffic management strategies to reduce driver fatigue (see Laerdal Tunnel literature review)
- Examine design and constructibility of the eastern and western approach walls, with testing and refinement to provide concurrence between the civil design and the urban design concept
- Consider an on-site component manufacturing plant to make the wall, dive and retaining structures, using a combination of excavated and new materials
- Review the engineered wall and natural battering gradients at the eastern and western approaches to reduce visual impact of the height of the structures
- Consider optimum functional locations and integration of the overheight truck gantries into the western and eastern portal approaches
- Consider alternative locations for VMS in portal approaches, rather than on portal facade
- Further develop the tunnel lighting design to incorporate themes emerging from the stakeholder engagement process
- The theming and narrative to be further developed, reliant upon the Aboriginal Core Narrative Report and the Non-Aboriginal Heritage report due October 2022, for integration of Aboriginal cultural context, seamlessly into the selected urban design elements, including tunnel lighting events and overall visual themeing
- Propose alternatives to the safety fencing style that is currently adopted above and around the portals and approaches for a more sensitive and visually appealing outcome. Potential for extending the retaining walls to incorporate safety function and remove the need for additional fencing

- Consider use of wire rope barriers in the medians to reduce visual impact of the barriers and allow for low maintenance planting to and to include larger trees where appropriate
- Review of road barrier types to provide consistency at the connection point with the Upgrade Program and as an option for better visual amenity where identified on the project
- Develop and maximise opportunities for Water Sensitive Urban Design (WSUD) integration into the project
- Remove any existing topsoil (including seedbank) from reasonably healthy bushland and either re use and or use to source potential provenance material. This could be complemented by seed collection in the prior 12 months to site establishment and clearing for construction
- Integration of the Aboriginal peoples knowledge into the re vegetation strategy that captures land stewardship principles, into sustainable, biodiverse and resilient landscape provision
- Consider screening around ancillary facilities at Blackheath to reduce visual impact
- Utilisation of recycled materials in road base to maximise sustainability outcomes
- Consideration of albedo levels during design, and consider raising the reflectivity of hard surfaces to reduce the heat island effect.



## Conclusion

# 09



# 9. Conclusion

The urban design report has considered the existing landscape character and has provided conceptual reference details of the design elements of the project.

The report has assessed the changes to landscape character and provided a visual impact assessment driven by cultural sensitivities at points along the project and will continue to be developed with the incorporation of the stories of the Aboriginal people.

A suite of federal, state and local government reference documents, Transport best practice guidelines, planning policies and stakeholder reporting has been applied in the research and development of the project and the concept design.

A whole of corridor vision is outlined, consistent with the overall Upgrade Program stages in the Eastern, Central and Western locations of the corridor, while strategic objectives have been developed to guide the concept design and provide an evaluation logic from initial concepts through to construction and operation.

These objectives have been supplemented with a series of endorsed principles and methodologies to guide the stakeholder engagement, the decision making processes between the project disciplines and contributors and ultimately the physical design and delivery of the project.

An identified range of options have been implemented and integrated to test and validate the civil and engineering works. This process is ongoing and includes a commitment to designing on and connecting to Country, enhancing and re-establishing the natural systems, providing amenity to the user experience through lateral and longitudinal integration and giving the project a contextual identity above and below ground in the tunnel.

The concept provides balance between the existing location and form and the required functionality and alignment of the project, connecting at the project interfaces. All elements have been considered to blend into the surrounding context, reflecting the rhythm of the natural landforms and the travel over Country, the existing ecology and the colours and textures of Country.

Place will be created through the union of the natural and the engineered, retention and enhancement of views and vistas, activation of the corridor with interpretive art, the landscape and environmental legacy through biodiversity and a unified legible aesthetic along the project.

Visual impacts arising from the project relate to the overall scale of the engineered interventions, new permanent operational infrastructure, superstructures impacting on existing views and the alignment earthworks.

Mitigation measures have been incorporated into the concept design to avoid impacts where possible.

The project requires substantial earthworks and landscape modifications at Blackheath and Little Hartley to construct the interfaces between the old GWH and the project and to bore and construct the tunnel in what is generally a non urban rural environment. New bridges rise over the project at Little Hartley.

With this in mind, measures have been incorporated into the concept design to reduce the visual impact of these works through:

- burying the main structures into the landscape
- camouflaging the scale of the operational facilities through considered landscape and revegetation
- using a minimal palette of contextual tones on a unified suite of simple elements.

These concept landscape and design recommendations, in conjunction with the Transport design guidelines, must form the basis for all continuing design development and detail design works related to the project.



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