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The Northern Road Upgrade | Glenmore Park to South Penrith

Urban and Landscape Design Plan

UD01 Final Detailed Design

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Executive summary

The project
The project will upgrade an important part of The Northern Road and presents an opportunity to deliver excellence in urban and landscape design for public infrastructure within the constraints of existing residential development and in the context of an operating M4 Interchange.

The design proposal meets this challenge.
The design is the outcome of extensive collaboration between all members of the Lendlease team, and other consultants. The urban and landscape design process has drawn together all aspects of the project’s development to produce an aesthetically cohesive approach. This integrated multidisciplinary approach is the foundation of the design, report and submission.
The principal feature of this project is the approximately four kilometre widening of The Northern Road between Glenmore Park and South Penrith. This will provide greater capacity and a better operating environment for the roadway. Key outcomes include:

- Improving travel times by:
  - Increasing the number of lanes along The Northern Road
  - Removing a set of traffic lights at the M4 Interchange
  - Providing additional turning lanes at some intersections
- Allowing for reliable public transport by providing a continuous kerbside bus lane in each direction
- Improving safety for pedestrians and cyclists by providing a new shared path
- Improving connectivity for pedestrians by providing new footpaths
- Improving road safety by:
  - Providing a central median to separate opposing traffic flows
  - Installing new traffic lights at two existing intersections
  - Providing separate turning lanes at some intersections
  - Improving the alignment of the road
- Improving local access by providing an extension of Cross Road to Wentworth Road
- Mitigating local traffic noise impacts by providing two new noise barriers.

Project narrative
A primary consideration of the project is understanding the user experience and how this experience can be enhanced through urban and landscape design. The user experience will form the public’s perception of the project and in turn, its identity and acceptance as a vital piece of Western Sydney infrastructure.

Key to understanding the driver experience is identifying major decision points, an awareness of the driver’s constantly shifting visual field and a sense of what may catch the driver’s attention at any given point in the journey. These attributes form a continuous experience over time.

A complementary experience exists with the public’s interaction with the arterial roadway from surrounding areas and can be understood as a more local or short range experience.

The project narrative has been built around the concept of the project as providing a transition from a rural landscape through to the urban fringe of Penrith City, and recognising the importance of the M4 Interchange as a gateway to Penrith.

The Northern Road currently provides a disjointed journey through rural and urban areas. The design interventions required for the upgrade have been kept straightforward and provide a continuity of urban and landscape experience. The project narrative has been reflected in design to enhance both the linear identity of the project and the integration of surface project elements with the surrounding areas.

Key design considerations for the project include:

- Limit impact and disruption to the community
- Provide a seamless experience for drivers that retains normal driving expectations
- Ensure that the new roadway configuration is easy to use and navigate
- Use the project to provide for a better overall experience for all road users
- Ensure that roadway elements complement existing elements
- Develop noise mitigation measures inspired by the attractive views to the Blue Mountains
- Ensure Safety in Design principles are adopted
- Provide a design that requires low maintenance.

Linear identity
Linear identity is the principle adopted in the establishment of a consistent and unique identity along the length of the route. Linear identity is created by applying a consistent / design approach for all elements throughout the project including:

- Landscape design
- Noise barriers
- Retaining walls
- Road furniture and standard road elements
- Shared paths, bridges, and lighting.
The linear identity is created by, amongst other things:

- Consistent use of components across project elements
- Maintaining a consistent overall corridor landscape
- Consistent use of materials, colours and finishes for project components, and integration of utilities and services along the corridor.
Other key aspects of the integrated urban and landscape design proposals include:

- Equal attention to the design of all elements as seen from both the surface roadway elements and the adjoining neighbourhoods, in particular noise walls and landscape
- The full design integration of all project elements
- Careful placement and sizing of planting to maintain significant views.

**Lateral integration**

Lateral integration is the principle adopted to ensure the project responds to its immediate context. Lateral integration is achieved by developing designs which vary locally along the route for:

- Landscaping to ensure the corridor is environmentally integrated
- Unobtrusive / recessive colouring to reduce visual intrusion of the roadway on surroundings
- Maintain good Crime Prevention Through Environmental Design (CPTED) outcomes so that the new infrastructure establishes a safe public realm
- Maintain pedestrian and shared path connections across the corridor in support of community connectivity.

**M4 Interchange**

The M4 Interchange will be upgraded with a new bridge, new ramps and a noise barrier on the northwest corner along the off-ramp of the western approach. These have been designed as integrated elements, and when relevant follow the general design aesthetic of the existing M4 Motorway.

**Conclusion**

The success of the project will be measured by the seamlessness of its integration and operation within the urban and landscape context.

The design for the project, as set out in this report sustains and builds upon the Roads and Maritime Services' approach to design for contemporary road infrastructure, and establishes new benchmarks for the urban and landscape design of arterial roadways.

This design proposal is significant due to the following:

- A roadway narrative built around the user experience and a seamless integration with Penrith City, rural areas and the existing M4 Motorway
- A fully integrated multidisciplinary design team approach as embodied in this report, continuing through all phases of the project
- Urban and landscape design playing a key role in project design development and implementation of infrastructure projects
- A subtle and contemporary design approach to the project, acknowledging and enhancing the fine qualities of place, inspired by the attractive rural and suburban environment at the foothills of the Blue Mountains.
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<td>C1</td>
<td>Analysis - major open space, watercourses and special uses</td>
<td>4</td>
</tr>
<tr>
<td>TNR3N-DG-UD01-0002</td>
<td>C1</td>
<td>Analysis - geology and soils</td>
<td>5</td>
</tr>
<tr>
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<td>C1</td>
<td>Analysis - vegetation and biodiversity</td>
<td>6</td>
</tr>
<tr>
<td>TNR3N-DG-UD01-0005</td>
<td>C1</td>
<td>Analysis - land use zoning</td>
<td>7</td>
</tr>
<tr>
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<td>C1</td>
<td>Analysis - topography and views</td>
<td>8</td>
</tr>
<tr>
<td>TNR3N-DG-UD01-0007</td>
<td>C1</td>
<td>Analysis - heritage</td>
<td>9</td>
</tr>
<tr>
<td>TNR3N-DG-UD01-0008</td>
<td>C1</td>
<td>Analysis - transport network and road network</td>
<td>10</td>
</tr>
<tr>
<td>TNR3N-DG-UD01-0009</td>
<td>C1</td>
<td>Analysis - bicycle network</td>
<td>11</td>
</tr>
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<td>C1</td>
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<td>C1</td>
<td>Analysis - floor space ratio</td>
<td>13</td>
</tr>
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<td>C1</td>
<td>Analysis - scenic landscape value map</td>
<td>14</td>
</tr>
<tr>
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<td>C1</td>
<td>Analysis - road edge character</td>
<td>15</td>
</tr>
<tr>
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<td>C1</td>
<td>Analysis - flooding</td>
<td>16</td>
</tr>
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<td>C1</td>
<td>Analysis - constraints and opportunities</td>
<td>17</td>
</tr>
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<td>C1</td>
<td>Corridor character zones - key plan</td>
<td>21</td>
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<td>C1</td>
<td>Urban Design concept - key plan</td>
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</tr>
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<tr>
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<td>C1</td>
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<td>51</td>
</tr>
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<tr>
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<td>64</td>
</tr>
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## Glossary

<table>
<thead>
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<td>Australian Height Datum</td>
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<td>Building Code of Australia</td>
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<td>Central Business District</td>
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<td>Crime Prevention Through Environmental Design</td>
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<td>GMS</td>
<td>Galvanised Mild Steel</td>
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### Gateway
There are entrance points which have a high degree of visibility and a distinct sense of transition. Gateways may include landscaping, public art, gateway structures, special lighting and signs.

### Entrances
These are points of entry to a neighbourhood, tunnel or historic zone.

### Node
These are neighbourhood focal points. Nodes are highly visible locations which serve as meeting places for residents or one or more neighbourhoods and have a clear identity as neighbourhood locations. They can be functional or natural.

### Shared path
These are priority routes for pedestrians and cyclists. A pathway adjacent to the road.

### Noise wall
A wall created to mitigate and deflect the effects of predominantly traffic noise.
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Report objective
This report describes the project’s urban and landscape design proposal for the four kilometre upgrade of The Northern Road between Glenmore Park and South Penrith.

The Northern Road upgrade between Glenmore Parkway, Glenmore Park and Jamison Road, South Penrith tender was lodged in October 2016, and following the notification of success, the Lendlease team including Conybeare Morrison (CM+) was commissioned by Roads and Maritime Services to prepare detailed design and documentation for the project commencing on the 6 December 2016.

The design of the various project components has developed through an integrated urban design team approach. This approach encourages a continuous evolution and refinement throughout the detailed design phase of the project. The components have received further design development, addressing detailed engineering requirements, construction constraints, and Roads and Maritimes inputs. Further design modifications are also anticipated as an outcome of community consultation.

The report has taken references from the South Western Sydney Urban Design Strategy.

The Final Detailed Design (FDD) plans for the urban and landscape design contained in this report are based on the engineering drawings provided in the relevant Design Lots prepared by the Arup-Parsons Brinckerhoff Design Joint Venture (APBDJV).
General context
The project includes the design and construction of The Northern Road between Glenmore Parkway, Glenmore Park and Jamison Road, South Penrith to four lanes in each direction, over approximately four kilometres.

Overview
The benefits of The Northern Road upgrade:

- Improving travel times by:
  - Increasing the number of lanes along The Northern Road
  - Removing a set of traffic lights at the M4 Interchange
  - Providing additional turning lanes at some intersections
- Improving safety for pedestrians and cyclists by providing a new shared path
- Improving connectivity for pedestrians by providing new footpaths
- Improving road safety by:
  - Providing a central median to separate opposing traffic flows
  - Installing new traffic lights at two existing intersections
  - Providing separate turning lanes at some intersections
  - Improving the alignment of the road
- Improving local access by providing an extension of Cross Road to Wentworth Road
- Mitigating traffic noise impacts by providing two new noise barriers.

The urban design proposal would:

- Improve driver experience
- Blend the project into the existing built and natural environment
- Improve safety and access for pedestrians
- Provide safe, fast connection for cyclists
- Promote public bus transport and improve user amenity.

The road project
The completed project will be significant in terms of increasing accessibility, reducing travel times, lowering traffic volumes on existing roads and interconnecting with Sydney’s motorway network.

Surface roads through residential areas would likely experience improvements in the connectivity and permeability of the urban fabric.

There would also be the introduction of themed urban and landscape elements to enhance aesthetics associated with the project.

Pedestrian and bicycle networks
The current project corridor includes only very basic provision for pedestrian and cyclist access along the alignment.

A new shared path for pedestrians and cyclists will be provided along both sides of The Northern Road to ensure connectivity, pedestrian safety, neighbourhood amenity and contribute to encouraging use of sustainable modes of transport.

Environmental, aesthetic and safety aspects
Landscaping proposed as part of this project has been designed to feature the indigenous Cumberland Plain species suited to the soils and climate of the region.

Figure 3: Current and planned upgrades to the south west with the existing road network.
(See legend below right)
A Analysis
To understand the existing conditions, a contextual and a local analysis of the route was carried out to assess built, natural and community issues.

The analysis was compiled using GIS modelling, CAD, websites and from other information read as part of background documents.

Natural elements
Analysis of the existing natural features along the route are summarised to represent the following:
• Vegetation
• Creek lines and watercourses
• Topography and views
• Geology and soils.

Built elements
Analysis of the existing built elements along the route, are summarised to represent the following:
• Heritage
• Building heights and Floor Space Ratio (FSR)
• Land use pattern
• Transport network
• Bicycle network
• Open space or special places.

A1 Macro analysis
A1.1 Urban and landscape typology
The Northern Road traverses both a rural landscape and the Penrith City suburban fringe, an environment with a gentle topography. The Northern Road is the main regional arterial perpendicular to the M4 Motorway and parallel to Mulgoa Road. The corridor is largely dominated by rural properties and residential neighbourhoods and carries a high volume of traffic.

Contextual views westwards to the Blue Mountains are possible in elevated sections including at the M4 Interchange.

Through urban landscape typology analysis, major topographic, landscape and built form features are identified.

Design implications
Appropriate contextual design has been achieved through the integration of new built elements into the existing built fabric and landscape, including:
• View catchments and view corridors
• Landform and underlying geology (which impinges upon planting palettes)
• Topography (which contributes significantly to the visual experience of the road journey)
• Vegetation communities
• Built form responses.

A1.2 Site narrative
The project will present a seamless experience with the urban and landscape setting and thereby enhance regional access. The project will not have a separate identity from the broader setting, but rather will be consistent with the surrounding area.

The current experience of travelling along the roadway takes one through a disjointed rural and suburban environment. The design required for the widening has been kept straightforward and the native landscape of the Cumberland Plains is reinforced as the primary landscape theme.

The design expression of the site narrative has been incorporated into both the linear identity of the project, the user experience, the lateral integration of the project and the integration of surface project elements with the surrounding areas.

Design implications
• Limit impact and disruption to the community
• Provide a seamless experience for drivers that retains normal driving expectations including signage and linemarking
• Ensure that the new roadway configuration is easy to use and navigate
• Provide a better overall driving experience for all road users
• Where appropriate, ensure that roadway elements complement existing elements
• Ensure Safety in Design principles are adopted
• Provide a design that requires minimum maintenance.

A1.3 Overall site structure
The project corridor extends from the intersection of Glenmore Parkway and Wentworth Road (in the south) to Jamison Road (in the north). It provides a much needed enhancement of the connection between major western Sydney destinations, including the City of Penrith and the proposed Western Sydney Airport.

Design implications
• Use the design potential of the upgrade to reinforce the regions identity for users passing through the area
• Transform the user experience (pedestrians, cyclists, bus travellers and drivers) of this area from a negative one to a positive one.
### A1.4 Major open space, watercourses and special uses

#### Open space
Rural land holdings in the southeast transition to developed residential neighbourhoods in the north and west. Whilst generally visually open and ‘green’, these rural zoned lands have no formalised open space. In residential areas formal public recreational reserves follow the main creek lines, and there are a series of local parks that adjoin the alignment, occasionally aligned on both sides, such as at the Maxwell Street – Bringelly Road intersection.

The Penrith Golf and Recreation Club is a significant green space that adjoins the southwest of the project alignment and contributes an attractive landscape of trees and golf greens to this section of the corridor. The M4 Motorway supports a significant corridor landscape that is well established and frames views west to the Blue Mountains. The Aspen Street business centre is setback from the alignment and is screened by a linear landscape strip of mature Eucalypts.

**Design implications**
- Capitalise on the landscape of adjoining public open spaces by drawing them into the overall composition and imageability of The Northern Road (a ‘borrowed landscape’ approach)
- Investigate opportunities for using open spaces as markers for improving driver experience.
- Locate surface facilities in a compatible way with any adjacent open spaces
- Where open spaces occur on both sides of the alignment visually connect them with a common landscape theme.

#### Watercourses
The Northern Road follows a small north-south ridgeline, with the Hawkesbury/Nepean River located five to six kilometres to the west and the South Creek six to eight kilometres to the east. The alignment does not cross any major watercourses, however, there are small tributaries and drainage lines that run perpendicular to the alignment and drain in a westerly direction. The largest of these small crossings occurs just to the north of the M4 Interchange.

**Design implications:**
- Establish the impact of the proposed built elements on the minor water courses along the corridor. The design of these built elements require resolution so as to limit environmental impact
- Resolve the impact of new drainage structures, water quality ponds and treatment facilities on landscape proposals associated with these facilities.

#### Special uses
There are a number of primary schools and high schools located along the project alignment - a mix of state and private / religious schools.

**Design implications:**
- Ensure safe crossings of The Northern Road on walk-to-school routes and at bus stop locations used by students.

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**Legend**
- The Northern Road upgrade, Glenmore Park to South Penrith
- Waterways
- Hospital and health facilities
- Schools
- Neighbourhood centre
- Public recreation
- Private recreation
- M4 landscape corridor
- Rural land

Source: Penrith LEP 2010 and desktop analysis
A1.5 Geology and soils

The analysis has identified the major soil landscape types along the corridor to assist in understanding the variations of landforms and soil.

Design implications

• Appreciate the underlying substrate of the landscape along the corridor
• Develop an informed landscape design response that is contextually and ecologically appropriate
• Select plant palettes that are suitable for the various soil types and therefore more sustainable.
A1.6 Vegetation and biodiversity

The analysis has identified and assessed the value of existing vegetation types and ecologies in order to determine their location and the compatibility of the proposed vegetation communities with the existing.

**Design implications**

- Derive appearance and shape from existing native and cultural vegetation forms and associations
- Integrate responsively with existing vegetation and soil landscape types
- Provide for the planting of trees in streets, parks and corridor areas where appropriate to create a canopied corridor
- Reinstate Cumberland Plain vegetation as the predominant landscape along the alignment and integrate with the M4 Interchange landscape.

Source: Penrith LEP 2010

LEGEND

- The Northern Road upgrade, Glenmore Park to South Penrith
- Public recreation
- Private recreation
- M4 landscape corridor
- Rural land
A1.7 Zoning

The project crosses the threshold of urban development, resulting in the two primary land zonings under Penrith LEP 2010 being: Low / Medium Density Residential in the north and Primary Production Small Lots / Environmental Living in the south.

Other significant land zones along the alignment includes the Penrith Golf and Recreation Club zoned Private Recreation, and Aspen Street zoned as a Local Centre. The M4 Motorway and The Northern Road corridor are zoned for Infrastructure. Several drainage reserves and local parks to the northwest are zoned for Public Recreation.

Design implications

These land use patterns:

- Influence the location of built form including shared path easements, noise walls and retaining walls
- Influence the visual qualities of the corridor landscape
- Demonstrate the need for, and nature of, lateral connections
- Identify local open space areas and corridors.

**Legend**

- Neighbourhood Centre
- Local Centre
- Commercial Core
- Mixed Use
- Business development
- Enterprise Corridor
- Business Park
- National Parks and Nature Reserves
- Environmental Conservation
- Environmental Management
- Environmental Living
- General Industrial
- Light Industrial
- General/Residential
- Low Density Residential
- Medium Density Residential
- High Density Residential
- Large Lot/Residential/Public Recreation
- Public Recreation
- Private Recreation

The Northern Road upgrade Glenmore Parkway, Glenmore Park to Jamison Road, South Penrith

SWTC Appendix 31 - Contractor’s Urban and Landscape Design
A1.8 Topography and Views

Topography
The topography is experienced as the combination of a series of large sweeping curves in the horizontal alignment, with a series of local hills and valleys in the vertical alignment. The alignment rises quickly from the south, up to the elevated M4 Interchange, and then is followed by small, local rises and falls through to the north.

The combination of the vertical and horizontal alignments creates an interesting and picturesque drive, cycle or walking experience. When elevated sections coincide with major cross roads, attractive views are possible west to the Blue Mountains.

Views
Short distance views of significance include along the corridor itself, both from elevated and lower viewpoints – the ‘snaking’ alignment adds another dimension to these views. Attractive short distance views are possible along the route to adjoining rural properties, the golf course landscape and to local parks.

Middle distance views generally occur along perpendicular streets or reserves, particularly to the west of the alignment, and from elevated vantage points, such as from the M4 Interchange Bridge. The most compelling long distance views are west, to the ridges of the Blue Mountains. These are important views for orientation and wayfinding, and reinforce a strong ‘sense of place’.

The analysis identifies the key views from a user vantage point. The analysis reiterates the importance of:

- Views west to the Blue Mountains from major intersections
- Views from the M4 Interchange, particularly to the west
- Views from local high points along the alignment
- Including rural and golf course landscape views as part of the driver experience
- Maximising the picturesque potential of the roadway.

Design implications
- Design surface facilities and landscape treatments with an understanding of how they affect mid-to-long range views within the corridor
- Provide a design response that enhances wayfinding, identity and a sense of place
- Manage any required regrading with transition zones to mitigate impacts on surrounding landforms and residential properties.
A1.9 Heritage

A search of all available non-Aboriginal heritage registers was undertaken to identify heritage items within or immediately adjacent to the project. The following registers were searched using a combination of online databases derived from spatial data in GIS format as provided by Jacobs on 18 Jan 2016:

- NSW State Heritage Inventory
- NSW State Heritage Register
- Roads and Maritime section 170 Heritage and Conservation Register
- National Trust of Australia (NSW) Register
- Register of the National Estate
- Commonwealth Heritage List
- National Heritage List
- World Heritage List
- Penrith LEP.

No registered heritage items are located within the proposal area. There are two registered heritage items located within 500 metres of the upgrade alignment:
1. Orchard Hills Uniting Church, Penrith LEP, 156, Local, 3 Frogmore Road, Orchard Hills Lot 101, DP 128254
2. Orchard Hills Reservoir, Penrith LEP, s.170, 657, Local, 197-207 Castle Road, Orchard Hills Lot 1, DP 430473.

Refer to Drawing TNR3N-DG-UD01-0007.

Review of Aerial Imagery

Current aerial imagery was viewed to identify areas of heritage potential prior to the field survey. Several properties were identified comprising mostly parks or vacant blocks in the northern section of the proposal area, which is more urban in nature. Areas of heritage potential in the south section of the proposal area included properties where the nature of features or buildings was unable to be identified, but which may have some heritage potential. These identified areas formed the basis of the field survey.

Summary

No registered heritage items are located within the proposal area. A previous heritage assessment identified two previously nominated but unlisted heritage items (The Northern Road and the Great Western Highway) and two previously nominated heritage items relating to rural landscape in the west of the Orchard Hills locality and along The Northern Road. There is the potential for previously unidentified historical heritage items to be situated in the proposal area, based on the review of aerial imagery, and the relatively limited nature of the previous heritage assessments.

Following a search of the above registers, and review of the previous literature, historical background and aerial imagery, the following types of historical heritage items may be found in the proposal area:

- Houses, homesteads and other buildings associated with the settlement of the region
- Past rural uses related to agriculture and orcharding, including stockyards, fences, sheds and outbuildings, orchard trees and wells.

Design Implications

- Develop a non-intrusive approach to roadway design that does not impinge on the visual amenity of nearby cultural/heritage assets.
A1.10 Transport and road network

Bus network
The existing bus network serves the adjoining residential neighbourhoods. Bus routes follow the main collector roads and streets and there are bus stops located at about 400 metre intervals. Walking catchment analysis indicates there is generally good coverage of adjoining residential neighbourhoods (based on a theoretical five minute walking radius i.e. equivalent to a 400 metre radius from each stop).

Design implications
• Optimise bus service efficiency and user amenity (shelter, seating, information) to encourage public transport patronage
• Optimise new alignment bus stop locations and lateral pedestrian connections to facilitate direct, safe and convenient access to maximise the walking catchment.

Road network
The M4 Motorway provides metropolitan access, whilst The Northern Road is an important north-south arterial roadway serving Western Sydney. Planned, staged upgrades of The Northern Road to the south will provide access to Western Sydney Airport and associated employment lands. The Northern Road forms one of the main southern approaches to the city of Penrith.

In the long term, the east-west Glenmore Parkway-Wentworth Road roadway will also develop as a major arterial, opening up access to current rural lands, potentially supporting future development. A series of east-west main roads run perpendicular to The Northern Road and provide access and entry points to neighbouring residential communities, facilities and schools.

Design implications
• Develop a built form and landscape response complementing the road hierarchy
• Develop an appropriate urban and landscape response to the southern approach to the city of Penrith.
A1.11 Bicycle network

Bicycle network
The Penrith City Council bicycle strategy (PATHS 2012) identifies both existing and anticipated regional bicycle networks. The Northern Road is classified as a Regional Trail. The existing roadway has basic bicycle infrastructure provided in the middle portion of the alignment, in the form of a paved shoulder with bicycle markings. There are no bicycle facilities currently provided in the south or north sections of the project alignment.

Design implication
- Integrate the existing and planned bicycle network with proposed project shared pathways for improved connectivity.

Pedestrian access
Current pedestrian infrastructure along The Northern Road consists of narrow footpaths and unpaved sections. There are four signalised crossings (including the M4 Interchange) that provide safe east-west crossing points. Signalised crossings at Jamison, Smith and Maxwell-Bringelly roads link schools and colleges across the alignment to residential catchments. However, the Tukara-Frogmore intersection lacks a safe crossing.

Design implications
- Maximise lateral and longitudinal connectivity of pedestrian access along the alignment – connecting residential neighbourhoods with key destinations including schools, bus stops, shops, services and local parks
- Provide a generous and well-connected regional shared path along the alignment
- Upgrade pedestrian crossing opportunities throughout the alignment to maximise safe access and to mitigate potential for severance
- Maintain connectivity between the alignment shared path and local streets
- Incorporate CPTED principles for personal safety in the design of the access network.
A1.12 Built form including height of building controls

Land holdings to the southeast of The Northern Road alignment consist of rural properties with an average size of two hectares, with freestanding houses or homesteads. These properties currently have no height control in place under Penrith LEP 2010.

Low density residential neighbourhoods dominate the north and west of the alignment, typically consisting of freestanding, one or two storey villas, with a maximum height of 8.5 metres permitted. At Aspen Street business centre a height control of 15 metres, reflecting the commercial building type that requires a higher floor-to-floor height.

**Design implications**
- Locate new built form project elements where they would have lower impacts on surrounding urban form.
A1.13 Floor space ratio

Currently under Penrith LEP 2010 there is no Floor Space Ratio (FSR) control applicable to land holdings along the alignment.

Design implications
- Provide appropriate landscape buffer areas between surface facilities and adjacent structures
- Modify the landscape concept design to address changes in development density, scale and intensity of use.
A1.14 Scenic landscape value

This control in the Penrith LEP 2010 identifies ‘visually sensitive’ lands and gateways that contribute to the scenic and landscape qualities of the Local Government Area (LGA). The rural landscape to the southeast of the alignment is ‘visible from major roads and other public places’, and is therefore classified as having important scenic and landscape value.

Development in these areas is required to minimise ‘likely visual impact’. Views to the Blue Mountains, to the Nepean River, along important creek lines and the M4, vistas from major heritage items and land at important gateways in the City of Penrith are all considered to require a “…special response given their visual sensitivity”.

A designated ‘Land Use Interface’ gateway is identified at the Glenmore Parkway east/rural interface, highlighting the importance of this threshold / location.

Design implications

- Develop a non-intrusive approach to roadway design that does not impinge on the visual amenity of the adjoining scenic landscape
- Develop a landscape concept that frames and opens up views to this important scenic landscape and that responds to important gateways or thresholds identified in the mapping.

Source: Penrith LEP 2010
A1.15 Road edge character

The driver, bus passenger, cyclist or walker’s experience of traversing the project will be influenced by the urban or landscape character present along the road edge. Edge conditions transition from continuous urban frontages in the north to rural and golf course landscapes in the south.

Design implications

- Develop an overall urban and landscape design that unifies the whole length of The Northern Road (and integrates the M4 Motorway Interchange) and sets the standard for the further roll out of upgrades planned, extending south.

Source: Sixmaps satellite imagery
A1.16 Flooding
The Northern Road follows a small north-south ridgeline, with the Hawkesbury/Nepean located five to six kilometres to the west. Flood analysis shows that 1 in 100 year flood events will be straightforward to manage following the upgrade of road and drainage infrastructure.

**Design implications**
- Design culverts and project drainage structures as integrated elements within the overall corridor urban and landscape context
- Utilise finishes to visible drainage structures that are natural in appearance and integrate them within the urban or rural context.
A1.17 Constraints and opportunities

Urban and landscape analysis has identified the following project constraints and opportunities, that have been considered in the development of the design.
B Urban Design objectives

This chapter sets out the overall design vision, objectives and principles which guide the project’s urban and landscape design proposals.

B1 Design vision and objectives

The South Western Sydney Urban Design Strategy document identifies the overall urban design vision for the south west as: “a functional and integrated road network for all road users that responds to and extends the landscape character of south west Sydney.”

Based on the vision, the following project specific objectives have been established:

- Create a simple and integrated engineering and urban design solution
- Limit the impact of the project footprint on the local community
- Integrate cost effective, yet sustainable initiatives as part of the design
- Provide a consistent design throughout the length of the upgrade
- Provide a safe facility for traffic, pedestrians, cyclists and disabled persons
- Maintain existing neighbourhood connectivity and local access for local traffic
- Aesthetically enhance the road facility and associated works and structures
- Integrate new elements with existing work as seamlessly as possible to fulfil the urban design requirements
- Improve existing environmental sustainability wherever possible
- Enhance the existing landscape and integrate new landscape both across and into the corridor
- Enhance the user experience and the visual contribution to the built environment, where possible.

B2 Urban Design principles

The principles described below are derived from Roads and Maritime’s urban design manual Beyond the Pavement and a detailed analysis of The Northern Road corridor and its context.

The road and it’s neighbours

Ensure that the urban and landscape design of the project delivers a safe, positive, functional, and pleasing visual experience for public transport, traffic, pedestrians, cyclists, disabled persons, and the corridor’s neighbours.

Lateral integration

Ensure the project responds to its immediate context, whether natural or man-made, by relating visual and other sense experiences of the corridor, at any moment, to the neighbouring environment and connectivity. This makes the road a good neighbour but also avoids the risk of monotony likely to result from the development of linear identity alone. The application of lateral integration and linear identity design principles simultaneously is achievable by applying them in different measure to the project’s different physical elements.

Linear identity

Establish a continuous, consistent and individual identity for the full length of the corridor. It is important that the corridor has a distinctive character so that users identify and recall it. This assists city-wide orientation and helps distinguish regions within the metropolis, thus furthering the urban experience.

Route diversity

This principle is essentially an outcome of lateral integration. In urban situations, the humanisation of an arterial roadway project requires that its scale be reduced by creating variation along its length. Differentiation along the route assists users in orienting themselves. Route diversity assists in the development of an aesthetically enhanced road experience.

Views

Views from the road offer a positive visual experience and help users appreciate that the environment should be maintained and enhanced. Similarly, positive views to the road from selected outside positions are to be encouraged.

Environmental considerations

Ensure that the design proposal respects and, where possible, enhances the natural, environmental and ecological systems within the corridor and its related context. Existing indigenous vegetation unaffected by construction works would be retained.

Environmental generators

Natural physical characteristics of the corridor and region, including soil types, topography, watercourses and drainage patterns, endemic vegetation and micro-climatic conditions should, wherever possible, become design drivers, particularly for landscape design.

Residual land

Land within the corridor which is not required for the road, or shared path and their associated engineering works (cuttings, embankments and interchanges) should be integrated into local public open space systems or evaluated for its potential for future development wherever possible and appropriate.

Heritage

Identify significant heritage items or locales and incorporate and interpret them within the design proposal where appropriate.
B3 Road user experience

A primary consideration of the project is understanding the road user’s experience and how this forms the public’s perception of the project and in turn, its identity and acceptance as an important piece of Western Sydney’s infrastructure.

Key to understanding the user experience is identifying major decision points, an awareness of the traveller’s constantly shifting visual field and a sense of what may catch their attention at any given point in the journey. These attributes form a continuous experience over time.

A complementary experience exists with the local interaction with The Northern Road. This experience of the roadway tends to be more immediate.

The urban design expression of the project has been developed around a narrative theme that supports a positive user experience, and allows for a flexible yet complementary approach for surface features.

The roadway journey is about providing a continuous, consistent and pleasant driving experience from rural lands (and Sydney’s future airport) to Penrith, with minimal impact to the community.

Key attributes of these experiences include:

- Linear experience
- Opening and closing views
- Transition from a rural to an urban fringe condition
- Anticipation of destinations towards city or suburbs
- Continuous movement
- Multiple elements, but consistent
- M4 Interchange experience.

Figure 13: The Northern Road – existing roadscape
B4 Urban Design strategy

This diagram describes the overall urban and landscape design strategy for the project.

The success of The Northern Road upgrade from Glenmore Park to South Penrith will be measured in terms of the seamlessness of its integration and operation with the rural, residential and city fringe context.

The design for the project, as set out in this report sustains and builds upon Roads and Maritimes’ guidelines for contemporary road infrastructure, and establishes new benchmarks for the urban and landscape design of arterial roadways.

This design proposal is significant due to the following:

- A roadway narrative built around the user experience and a seamless integration of the roadway

A fully integrated multidisciplinary design team approach as embodied in this report, continuing through all phases of the project

- Urban and landscape design playing a key role in project design development and implementation of infrastructure projects

- A suble and contemporary design approach to the project, acknowledging and enhancing the qualities of existing rural and urban environments.

Key overall landscape design strategies include:

- Employ a holistic approach to the urban and landscape design to ensure integration of all project elements

- Integrate earthworks and basins into the surrounding landforms

- Limit impact upon natural ecology and drainage systems

- Maintain appropriate curtilage of areas of environmental significance and of natural beauty

- Limit vegetation clearing and prioritise use of endemic species

- Utilise batters at 2H:1V to reduce existing vegetation clearing

- Place new vegetation to frame desirable views for road users

- Ensure residents are screened from the upgrade works with appropriate planting where required

- Provide a coordinated family of high quality, simplified project elements, with a hierarchy based on visual significance

- Reduce visual clutter by careful placement of road furniture elements

- Reduce the visual impacts of drainage structures

- Maintain clear sight distance requirements, utilise frangible poles, trees and shrubs within clearzones

- Utilise planting techniques to notionally reduce headlight glare, where applicable

- Create a low maintenance project design

- Deep mulch around plants to reduce water use

- Utilise ponds to improve water quality.
B5  Corridor character zones

Three distinct but related character zones have been identified along the project alignment and their unique urban and landscape characteristics are described as follows:

**Rural landscape character zone**

Sweeping curves and undulating topography generates picturesque vistas within the alignment and panoramas over pastoral landscapes. Built form is sparse, with individual residences nestled within the rural landscape. The golf course landscape presents to the corridor a more refined man-made landscape.

**Urban landscape character zone**

A transition zone exist and is characterised by both large rural residential allotments and low density residential neighbourhoods. There is a combination of residential property, rear fence and commercial local shop frontage conditions. School facilities are set back from the alignment presenting a mostly landscape frontage.

**Urban fabric character zone**

Consistent residential frontages predominate along both sides of this zone, interspersed with a series of local parks contributing landscape to The Northern Road. At the major cross streets, views to the Blue Mountains enrich the traveller’s experience. Road verges are more restricted in width and are more urban in character.

![Figure 14: The Northern Road looking north from Glenmore Parkway intersection](image)

![Figure 15: The Northern Road looking north from Tukara Road intersection](image)

![Figure 16: The Northern Road looking north from Park Street intersection](image)
C  Urban Design concept

Introduction
The urban design for the project has been undertaken with the understanding that the urban experience occurs on two scales. These are the driver experience, moving along the roadway, and the surface user experience, moving through the residential and rural precincts along the corridor.

C1 The theme
The project theme has emerged from an observation of the current context. The driver experience is of movement through continuous space and sequential elements. The urban and landscape design theme is multifaceted, and can be described as providing:
• A fitting regional gateway to Penrith City
• A fitting northern approach to Western Sydney Airport
• An appropriate transition from a pastoral landscape to Penrith City’s residential fringe
• A new ‘armature’ of accessibility and amenity for public transport, cyclists and pedestrians
• A renewed and reconnected Cumberland Plain landscape.

Design description
The urban and landscape design reinforces the existing spatial design, relationship of elements and appropriate vegetation patterns along the route. The design will:
• Provide a self reliant and low maintenance landscape outcome
• Encourage views in cleared areas and strategic locations
• Retain vegetation wherever possible
• Provide vegetative screening of residences, structures and elements within the corridor
• Upgrade pedestrian and shared path links to the community
• Incorporate safe design principles, through CPTED
• Incorporate sustainable design principles.

The landscape design reflects the adjoining landscape and vegetation patterns identified in the environmental documents.

As specified in the SWTC, the landscape and planting design:
• Matches the existing spatial sequence of the landscape along the route
• Provides long distance and district views when such views are available
• Provides visual interest and enjoyment reducing the potential for driver fatigue.

The revegetation of the road corridor will be prioritised to areas where it will achieve the greatest impact, visual benefit to motorists and surrounding residences, and satisfy road safety and clear zone requirements. Planting priority areas are detailed in the following pages.

Biodiversity protection and recovery
The landscape and revegetation treatments of the upgrade corridor are designed with the intention of protecting biodiversity. There are no areas of existing vegetation with any habitat/fauna sensitivity. Some vegetation loss will occur along the road corridor due to widening activities. Endemic species will be used for all revegetation.

Riparian zones
The various tributaries that traverse the route are valuable as habitat, drainage corridors and also provide visual interest. These features will reinforce and sustain habitats.

Medians and verges
The medians and immediate road verges offer an opportunity for the development of a cohesive landscape character for the road user. Requirements for the design of the median include:
• Completing the visual integration of the roadway into the surrounding landscape
• Demarcation of riparian crossings in roadway plantings to create visual continuity and habitat connectivity
• Establishment of a bold and attractive landscape for the enjoyment of road users
• Planting of frangible species in clear zones for road user safety
• Maintenance of sightlines on curved and ridging sections of the road
• Screening of headlights from oncoming traffic for road user safety.

The median will be planted with frangible species (to assist with headlight glare) related to the immediate vegetation community where there is sufficient space.

Planting design principles
Planted vegetation typically includes mass planted trees, shrubs and groundcovers. The planted vegetation will be selected from a mix of low maintenance and locally occurring species, selected from the Cumberland Plain, and suited to the Penrith locality.

Interchange landscape design principles
The landscape design ensures the following principles:
• The Northern Road user experience is highlighted by the selection and use of landscape and planting material.

Typical exit markers / signs
• Provide an early visual prompt when approaching from the M4 Interchange
• Distinguishable plant arrangement and species selection provide memorable visual link with upcoming interchange.

Typical approach and ramps
• Stylistic planting of endemic and select native species alongside ramps visually links the interchange landscape at the exit sign locations and the median with The Northern Road landscape
• Planting detail, layout and plant sizes are tailored in response to the travel speed, with the landscape design responding to the slowing down on approach to The Northern Road.

Typical local roads
• The use of culturally appropriate planting creates identity and highlights the local road experience
• Street tree species selection is informed by the existing local street tree palette and reinforces the local street character with avenue planting
• When seen from The Northern Road, street trees signify the local road.

Typical feature median
• Stylistic low shrubs (about up to one metre) planting provides visual interest to the median, and provides contrast with the standard median landscape
• The interchange landscape design is reinforced to create a memorable experience for current and future road users
• Stylistic planting of culturally appropriate and selected native species is utilised.

Noise walls and retaining walls
Noise walls and retaining walls are key urban design elements on the project. Their design adopts an aesthetic that is seamless along the roadway and has a quality appearance from both the roadway and neighbourhood sides. Fast growing, screening plants are also proposed to soften potential visual impacts of noise walls to adjacent properties.

A patterned finish in a recessive colour in visually prominent areas will help to modulate the visual appearance of the walls.
C2 CPTED principles

Crime Prevention Through Environmental Design (CPTED) is a crime prevention strategy that focuses on the planning, design and structure of places. This strategy is based on the principle of reducing opportunities for crime by using appropriate design and place management principles that make it easier for the public and law enforcement entities to navigate and understand the spaces they occupy and discourage offenders from seeing these same places as opportunities for crime and anti-social behaviour.

CPTED seeks to influence the design of the public domain by:

• Increasing the perception of risk to criminals by increasing the possibility of detection, challenge and capture
• Increasing the effort required to commit crime by increasing the time, energy or resources which need to be expended
• Reducing the potential rewards of crime by minimising, removing or concealing ‘crime benefits’
• Removing conditions that create confusion about required norms of behaviour.

There are four principles that are used to minimise the opportunity for crime:

• Surveillance
• Access control
• Territorial reinforcement
• Space management.

These principles are identified in the Crime Prevention and the Assessment of Development Applications Guidelines under Section 79C of the Environmental Planning and Assessment Act 1979 issued by the (former) Department of Urban Affairs and Planning.

Application to The Northern Road Upgrade

Specific areas of the project where CPTED is most relevant are the areas where the public, in the form of pedestrians and cyclists have access to the corridor. The existing and continuous shared path system that runs along the corridor and areas where there are noise walls or retaining walls, are the main focus for the CPTED review of the project.

Key strategies employed on the project include:

• Reducing potential for hidden pockets of space to be created
• Maintaining continuity of all pedestrian and shared paths to avoid secluded spaces
• Providing sufficient visual distance at changes in directions of shared paths or where required introducing local transparent panels to avoid accidental contact with other users
• Maintaining lighting levels below structures
• Maintaining clear sight lines when vegetation is planted along pedestrian and shared paths
• Maintaining, where possible, sightlines that connect streets across the corridor.
Urban Design concept

The project Urban Design (Final Detailed Design) is illustrated on eight 1:4000 scale detail plans. The adjoining Key Plan provides the overall layout for the individual sheets.

A set of project cross-sections are provided following the plans, and are cross-referenced to the plan set.
The Northern Road upgrade Glenmore Parkway, Glenmore Park to Jamison Road, South Penrith

SWTC Appendix 31 - Contractor’s Urban and Landscape Design

Provide new entry landscape and signage for Penrith Golf and Recreation Club

Provide landscape gateway to residential community and rural landscape

Maintain and enhance rural views

The Northern Road

LEGEND

General

PROJECT BOUNDARY
NOISE WALL WITH PATTERN
NOISE WALL WITHOUT PATTERN
PAVEMENT THROUGH LOCATED AT THE TRANSPARENT NOISE WALL.
FLOW
PRIVATE PROPERTY
CUT CONDITION
FILL CONDITION
NOISE WALL DETAIL
DRAWING REFERENCE NUMBER
MOUND
BUS STOP
RETAINING WALL NUMBER
MINIMUM HEIGHT (METRES)
FINISH - SMOOTH (S), PATTERNED (P) or TRANSPARENT (T)
CONDITION - F (F), C (C) or noise wall above (N)
TYPE - Reinforced Soil Wall (T1), Post-Panel (T2) or Blockwork (T3).
Reinforce gateway to Penrith and views west to the Blue Mountains
Strengthen ‘green’ gateway to Penrith and local park landscape

Frame views to the Blue Mountains

Integrate water detention structures into park landscape

Pedestrian access point through noise wall

Flower Power Garden Centre

Local Shops Rotary Park

Flavel Street

Maxwell Street

Kingswood Lions Park

Kingswood South Primary School

The Northern Road

The Northern Road upgrade Glenmore Parkway, Glenmore Park to Jamison Road, South Penrith
Integrate retaining walls into residential context

Maximise verge and median planting to improve micro-climate

Frame views to the Blue Mountains

The Northern Road upgrade Glenmore Parkway, Glenmore Park to Jamison Road, South Penrith

SWTC Appendix 31 - Contractor’s Urban and Landscape Design

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**Legend**

- Project Boundary
- Retaining Wall - Cut
- Retaining Wall - Fill
- Noise Wall without Pattern
- Noise Wall with Pattern
- Passage through located at the transparent noise wall
- Mound
- Bus Stop

**Key Plan**

- Scale 1:4000 @ A3

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**Urban Design Concept Plan**

- TNR3N-DG-UD01-0104-C3

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**Notes**

- Integrate retaining walls into residential context.
- Maximise verge and median planting to improve micro-climate.
- Frame views to the Blue Mountains.

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**Details**

- **CONDITION**: F - fill condition, C - cut condition
- **FINISH**: S - smooth, P - patterned, T - transparent
- **MAXIMUM HEIGHT (METRE)**: 0.6, 0.7, 0.8, 0.9, 1.0, 1.2, 1.3, 1.5
- **RETAINING WALL NUMBER**
- **NOISE WALL DETAIL DRAWING REFERENCE NUMBER**
- **DRAWING REFERENCE NUMBER**

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**Locations**

- Kingswood South Primary School
- The Northern Road
- Smith Street
- Jamison Road
- South Penrith

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**Additional Notes**

- **URBAN DESIGN CONCEPT PLAN**
- **TNR3N-DG-UD01-0104-C3**

The Northern Road upgrade Glenmore Parkway, Glenmore Park to Jamison Road, South Penrith

SWTC Appendix 31 - Contractor's Urban and Landscape Design

LIMIT OF WORKS

Cross Road
Homestead Road
Wentworth Road

Re-establish grass verge and informal tree planting

URBAN DESIGN CONCEPT PLAN

PRIVATE PROPERTY
C - cut condition
N - cut condition with noise wall on top

RE-ESTABLISH GRASS VERGE AND INFORMAL TREE PLANTING

FRAME INTERMITTENT VIEWS TO PASTORAL LANDSCAPE

PRIVATE PROPERTY

THE NORTHERN ROAD
F - fill condition

RETAINING WALL

RE-ESTABLISH GRASS VERGE AND INFORMAL TREE PLANTING

FRAME INTERMITTENT VIEWS TO PASTORAL LANDSCAPE

PRIVATE PROPERTY

THE NORTHERN ROAD

FRAME INTERMITTENT VIEWS TO PASTORAL LANDSCAPE

PRIVATE PROPERTY

THE NORTHERN ROAD

FRAME INTERMITTENT VIEWS TO PASTORAL LANDSCAPE

PRIVATE PROPERTY

THE NORTHERN ROAD

FRAME INTERMITTENT VIEWS TO PASTORAL LANDSCAPE

PRIVATE PROPERTY

THE NORTHERN ROAD

FRAME INTERMITTENT VIEWS TO PASTORAL LANDSCAPE

PRIVATE PROPERTY

THE NORTHERN ROAD

FRAME INTERMITTENT VIEWS TO PASTORAL LANDSCAPE

PRIVATE PROPERTY
This drawing may be prepared in colour and may be incomplete if copied on an A3 size original.

**Key Section**

<table>
<thead>
<tr>
<th>TREES, SHRUBS AND GROUNDCOVERS</th>
<th>MAINTENANCE ACCESS PATH</th>
<th>1M VERGE PLANTING</th>
<th>THE NORTHERN ROAD - NORTH</th>
<th>MEDIAN WITH SHRUBS AND LOW PLANTED GRASSES</th>
<th>THE NORTHERN ROAD - SOUTH</th>
<th>1M VERGE PLANTING</th>
<th>TREES SHRUBS AND GROUNDCOVERS</th>
<th>SHALE PLAIN WOODLAND SEEDING</th>
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<tbody>
<tr>
<td><strong>PROJECT BOUNDARY</strong></td>
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**NOTE:** DECELERATION LANES WILL BE LOWER SPEEDS THEREFORE THE CLEAR ZONE WILL BE REDUCED.

*CLIENT*

*EDMS No.*

*DS2017/000012*

*DSN 2017-000012 FINAL DETAILED DESIGN*
The Northern Road upgrade Glenmore Parkway, Glenmore Park to Jamison Road, South Penrith

SWTC Appendix 31 - Contractor’s Urban and Landscape Design

CUMBERLAND PLANTING

PLANTING

EXISTING ROTARY PARK TO BE

SHARED PLANTING

3.5M CLEAR ZONE

SHARED PLANTING

1M PATH

OPEN TURF PLANTING

INTERMITTENT TREE PLANTING

VERGE

PLANTING WITH

THE NORTHERN ROAD - SOUTH

NORTH

THE NORTHERN ROAD - NORTH

CONCRETE BARRIER

3M SHARED PATH

3M SHARED PATH

NOISE WALL

RESIDENCE

FLAVEL STREET

PLANTING VARIES

3M VERGE PLANTING

1M VERGE PLANTING

3.5M CLEAR ZONE

3.5M CLEAR ZONE

SCALE 1:250

CROSS SECTION - M110 CONTROL (CH 2075)

SCALE 1:250

CROSS SECTION - (CH 2675)

PROJECT BOUNDARY

PLAIN GRASSLAND VEGETATION

PROJECT BOUNDARY

WESTERN SYDNEY PROGRAM OFFICE

© Roads and Maritime Services

TNR3N-DG-UD01-0112

Urban Design cross section @ Ch 2075

SWTC Appendix 31 - Contractor’s Urban and Landscape Design

The Northern Road upgrade Glenmore Parkway, Glenmore Park to Jamison Road, South Penrith
The Northern Road upgrade Glenmore Parkway, Glenmore Park to Jamison Road, South Penrith

SWTC Appendix 31 - Contractor's Urban and Landscape Design

View north of Glenmore Parkway - Existing
Residential area north of Maxwell Street - View north existing
The Northern Road upgrade Glenmore Parkway, Glenmore Park to Jamison Road, South Penrith

SWTC Appendix 31 - Contractor’s Urban and Landscape Design

Residential area north of Maxwell Street - View north proposed

TNR3N-DG-UD01-0118

The Northern Road upgrade Glenmore Parkway, Glenmore Park to Jamison Road, South Penrith

(i) General - Page 43
0. Russell St
1. Kingswood Rd
2. Kent Rd
3. Mamre Rd

<table>
<thead>
<tr>
<th>Bridge Ref</th>
<th>Throw Screen</th>
<th>Artwork Piers</th>
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Figure 17: M4 Overbridge typology study
M4 interchange

Introduction
This section describes the new M4 Interchange Bridge and abutments. Abutments, parapets and barriers are generally specified as precast concrete to assist in reducing construction time and maintaining the quality of finish.

Principles
The guiding principles in the development of the designs for these elements are to:

- Ensure the bridge addresses safety issues
- Ensure the bridge contributes to the desired character of the project and complements the design language of existing M4 Motorway bridges
- Implement the principles of both linear identity and lateral integration in the design of these components
- Maintain consistency in design and detailing of these components.

Strategies
Strategies to ensure the successful application of the guiding principles include to provide:

- Suitable sight lines, height and width to underpasses
- Safe and vandal resistant lighting
- Anti-graffiti treatment to all new concrete structures.

Precedent study
A study was undertaken of existing overbridges along the M4 Motorway – from the M7 Interchange in the east, to the Russell Street Bridge in the west at the foothills of the Blue Mountains.

The type of throw screens, bridge piers and artwork was assessed. This study has informed the proposed design for the faceted central piers and throw screens for the M4 Interchange Bridge.

M4 Interchange Bridge - throw screen artwork
The existing Olympic era throw screen artwork will be replaced on the new bridge throw screens with a contemporary artwork that provides an abstract representation of the rolling Blue Mountains, that are visible from The Northern Road and are integral with the user’s experience of traversing the Penrith region. This mountain theme is carried through into the design of the project noise walls and retaining walls along the alignment.

A Elevation / section
The proposed M4 Motorway Bridge structure is:
- Precast concrete Super T girders
- PSC concrete planks (for corner trims at ramps).

Refer to drawing: TNR3N - DG - UD01 - 0202.

B Cross sections
Refer to drawing: TNR3N - DG - UD01 - 0201.

C Perspectives
Refer to aerial photomontage (existing and proposed), drawings TNR3N - DG - UD01 - 0203 and 0204 and driver’s level view (existing and proposed), drawings TNR3N - DG - UD01 - 0205 and 0206.
The Northern Road upgrade Glenmore Parkway, Glenmore Park to Jamison Road, South Penrith

The typical east-west cross section/elevation

- GALVANISED M.S. T-SECTION SUPPORTS
- GALVANISED M.S. WELD MESH 50x50 SAFETY SCREEN WITH INTEGRATED ARTWORK TO MOUNTAIN THEME
- TWIN RAIL TRAFFIC BARRIER
- PRECAST CONCRETE PARAPET
- CONCRETE SUPER 'T' BEAM
- TAPERED CONCRETE PIER
- INTEGRATED PIER/BEAM - 10mm CHAMFERS TO ALL EDGES
- 20 x 20 mm SHADOW JOINT
- STORM WATER AND SERVICES CONCEALED BETWEEN SUPER-T-BEAMS
- LIGHT POLE WITH SHAPED CONCRETE FIXING BRACKET (REFER TO TNR3N-DG-UD01-0602)

201C - TYPICAL EAST-WEST CROSS SECTION ELEVATION

SCALE 1:50

The Northern Road upgrade Glenmore Parkway, Glenmore Park to Jamison Road, South Penrith
The Northern Road upgrade Glenmore Parkway, Glenmore Park to Jamison Road, South Penrith

Western Safety Screen Sequence (looking from the inside)

Eastern Safety Screen Sequence (looking from the inside)

SAFETY SCREEN ARTWORK SEQUENCE - ELEVATION

SCALE 1:20

TYPICAL SAFETY SCREEN SECTION

SCALE 1:20

LEGEND

01) GALVANISED M.S. T-SECTION SUPPORTS

02) GALVANISED 50x50mm M.S. WELD MESH SAFETY SCREEN

03) GALVANISED 25x25mm M.S. WELD MESH WELDED TO SAFETY SCREEN REPRESENTING MOUNTAIN THEME

04) LIGHT POLE (REFER TO TNR3N-DG-UD01-0602)

05) TWIN RAIL TRAFFIC BARRIER

TNR3N-DG-UD01-0207-C1

M4 Interchange - safety screen artwork details

(i) New M4 Motorway Interchange bridge - Page 47
M4 Interchange - aerial view northwest (existing)
Retaining walls

Introduction

This section includes information on all retaining structures. The structural systems related to each retaining wall, whilst not included in this report have informed the design of each retaining wall type.

For retaining wall location plans refer to Chapter (i) General – drawings: TNR3N - DG - UD01 - 0101 to 0107 and 0120 inclusive.

A Retaining structures

Principles

The guiding principles in the development of the designs for the retaining wall structures are:

• Limit the physical and visual intrusion of earthworks and retaining structures upon the surrounding areas
• Limit the disturbance of existing flora, particularly significant trees
• Enhance the project environment by the sensitive design of earthworks and retaining structures
• Implement the principle of linear identity to maintain continuity and consistency along the length of the route.

Strategies

Strategies to ensure the successful application of the guiding principles are to:

• Ensure the applied finishes to retaining structures are consistent to their degree of visibility from the alignment and the adjoining context
• Ensure design detailing of finishes is consistent along the length of the route
• Integrate landscape design to mitigate visual impacts
• Ensure that the panelling system is suitable to the structure
• Ensure detailing is of the highest standard.

There are three types of retaining walls from a design and structural point of view:

• Type 1 – Reinforced Soil Wall (RSW) - precast concrete face panel with a simple 2 metres (H) x 1 metre (V) grid expression and textured face
• Type 2 - Precast concrete post and panel wall – an approximately 3 metre long, 1.2 metre high, 200 millimetre thick precast concrete panel fixed between 310 or 250 galvanised steel Universal Column (UC) supports at 3 metre intervals. This wall type is used as a stand alone wall (two situations) and at the base of a combined noise wall and retaining wall
• Type 3 – Concrete Block Wall – vertical or for taller walls a 1 in 40 sloped face, split face, concrete block wall and capping, core filled and reinforced to engineer’s details and specification with a select aggregate / colour.

Aesthetic considerations

Key design considerations include:

• Ensuring a high quality, long life outcome
• Ensuring that wall module and pattern is appropriately in scale with the context and viewpoint
• Developing an integrated noise wall on top of retaining wall design outcome
• Integrating structural posts, brackets and fixings into the design expression.

Where there are noise walls above retaining walls ie a Type 2 Retaining Wall, they have been integrated to maintain a singular aesthetic. In these walls the UC flanges are visually integrated into the design of the overall wall face, by introducing a ‘ribbed’ pattern with the same dimension as the UC flange width.

Refer to drawings: TNR3N - DG - UD01 - 0301, 303 and 302 respectively for Retaining Wall Types 1, 2 and 3.
Reinforced soil wall type 1 - typical detail

- 20mm WIDE VERTICAL AND HORIZONTAL JOINTS OR GROOVES WITH 10mm CHAMFERS.
- TYPE F BARRIER
- 2000mm x 2000mm PRECAST CONCRETE FACE PANEL WITH EXPRESSION JOINT AT MID POINT
- LINED CATCH DRAIN
- SELECTED GRANULAR BACKFILL PER ENGINEER'S REQUIREMENTS
- 30mm WIDE VERTICAL AND HORIZONTAL JOINTS OR GROOVES WITH 10mm CHAMFERS.
- MONOWILLS SAFETY HANDRAIL
- FUTURE F-TYPE LOCATION FOR M4-WIDENING

SCALE 1:50 @ A3

SCALE 1:50
M4 INTERCHANGE BRIDGE ABUTMENT - RSW TYPICAL ELEVATION

- Precast Concrete RSW Facing Panel: 2000mm x 2000mm with horizontal expression joint at midpoint, natural concrete colour, textured panel face.

- Smooth finish frame and chamfered edges.

- Expression joint (false joint).

- 20mm wide vertical and horizontal joints with 10mm chamfers.

- Compacted select fill layers and straps to engineer's details.

RSW TYPICAL SECTION

- PRECAST CONCRETE RSW FACING PANEL: 2000mm x 2000mm with horizontal expression joint at mid-point, natural concrete colour, textured panel face.

- Smooth finish frame and chamfered edges.

- Expression joint (false joint).

- 20mm wide vertical and horizontal joints with 10mm chamfers.

- Compacted select fill layers and straps to engineer's details.

SCALE 1:10 @ A3

The Northern Road upgrade Glenmore Parkway, Glenmore Park to Jamison Road, South Penrith
Precast concrete post and panel wall type 2 - typical detail
Concrete noise wall and post and panel retaining wall type 2 - typical detail

Note: generally 6000mm lengths of panels - when the length of the panel is smaller the length gets adjusted within the space between the first and last rib and the columns on either side.

AUTOCLAVED AERATED CONCRETE PANELS
RETAINING WALL

ELEVATION - TYPICAL COMBINED NOISE WALL AND RETAINING WALL

LEGEND
- 300X473 SUPPORT COLUMNS, PAINTED FINISH TO MATCH CONCRETE PANELS
- UC FLANGE SITS OUT FROM AAC PANELS AND PRECAST CONCRETE RETAINING WALL
- WHEN REQUIRED UC FLANGE SITS FLUSH WITH AAC AND PRECAST CONCRETE RETAINING WALL PANELS
- 100MM THICK AUTOCLAVED AERATED CONCRETE PANEL WITH 14MM PATTERNING ROUTED TO 'MOUNTAIN' DESIGN THEME
- 10MM HORIZONTAL JOINT BETWEEN AAC PANELS
- WHEN REQUIRED UC FLANGE SITS FLUSH WITH AAC AND PRECAST CONCRETE RETAINING WALL PANELS
- SET OUT PATTERN FROM THREE PANELS DOWN FROM TOP OF WALL

The Northern Road upgrade Glenmore Parkway, Glenmore Park to Jamison Road, South Penrith
Blockwork retaining wall type 3 - typical detail

Figure 15: Concrete block wall type 3 - split face

Figure 16: Concrete block wall type 3 - wall with capping block
Earthworks

Introduction
This section identifies urban design principles and strategies for earthworks, landform and slope stabilisation. Please refer to engineers’ drawings with regard to the related structural systems.

Principles
The guiding principles in the development of the designs for these elements have been to:

• Limit the extent of disturbance to existing road corridor landscape areas
• Limit the extent of disturbance to adjacent residents
• Integrate earthworks into the existing road corridor character.

Strategies
Strategies to ensure the successful application of the guiding principles have been to:

• Create fill embankments / cut batters at a maximum 2H:1V for stability, maintainability and vegetation establishment
• In isolated areas where steeper batters are employed, planting with erosion control matting is proposed
• Rounding of embankments at the base and at the top of fill has been developed to assist with the integration of the batters into surrounding landforms
• Retaining walls have been employed in locations to reduce excessively steep grading and in some instances to protect existing trees.

Section / details
Earthworks and slope stabilisation typical cross sections are illustrated in drawings: TNR3N - DG - UD01 - 0401, 0402 and 0404.
TOP OF EMBANKMENT
ROAD SHOULDER

**TOP OF EMBANKMENT**

**TOP OF EMBANKMENT**

**TNR3N-DG-UD01-0404-C3**

**SLOPE STABILISATION**

**BREAKUP AND CULTIVATE SUBGRADE TO MIN 400mm AS SPECIFIED**

**COMPACTED FILL REFER ENGINEER’S DRAWINGS**

**TUBESTOCK PLANTING. REFER TO PLAN FOR LOCATIONS**

**50MM TOPSOIL TO NATIVE TURF AREAS**

**COMPACTED FILL REFER ENGINEER’S DRAWINGS**

**3:1 SLOPE PLANTING**

**404A**

**NTS**

**2:1 SLOPE COMPOST BLANKET STABILISATION**

**404B**

**NTS**

**2:1 SLOPE JUTEMASTER STABILISATION**

**404C**

**NTS**

**SLOPE STABILISATION**

**LEGEND**

**3**

**BREAKUP AND CULTIVATE SUBGRADE TO MIN 400mm AS SPECIFIED**

**4**

**COMPACTED FILL REFER ENGINEER’S DRAWINGS**

**5**

**BREAKUP SIDES AND BASE OF PLANT HOLE. BACKFILL AND CONSOLIDATE WITH TOPSOIL AS SPECIFIED**

**6**

**TUBESTOCK PLANTING. REFER TO PLAN FOR LOCATIONS**

**7**

**50MM TOPSOIL TO NATIVE TURF AREAS**

**8**

**COMPACTED FILL REFER ENGINEER’S DRAWINGS**

**9**

**BREAKUP AND CULTIVATE SUBGRADE TO MIN 200mm AS SPECIFIED**

**10**

**EROSION CONTROL MAT: (JUTEMASTER FINE MAT OR APPROVED EQUIVALENT) TO BE INSTALLED TO MANUFACTURER’S RECOMMENDATIONS AS SPECIFIED. MIN 3 PINS PER SQUARE METRE.**

**11**

**EROSION CONTROL MAT TO BE SEEDED PRIOR TO INSTALLATION OF EROSION CONTROL MAT. REFER SPECIFICATION**

**12**

**TUBESTOCK PLANTING. REFER TO PLAN FOR LOCATIONS**

**13**

**50MM TOPSOIL TO NATIVE TURF AREAS**

**14**

**BREAKUP AND CULTIVATE SUBGRADE TO 200MM MINIMUM**

**15**

**COMPACTED FILL REFER ENGINEER’S DRAWINGS**

**16**

**BREAKUP AND CULTIVATE SUBGRADE TO MIN 200mm AS SPECIFIED**

**17**

**COMPACTED FILL REFER ENGINEER’S DRAWINGS**

**18**

**BREAKUP AND CULTIVATE SUBGRADE TO MIN 200mm AS SPECIFIED**

**19**

**COMPACTED FILL REFER ENGINEER’S DRAWINGS**

**20**

**BREAKUP AND CULTIVATE SUBGRADE TO MIN 200mm AS SPECIFIED**

**21**

**COMPACTED FILL REFER ENGINEER’S DRAWINGS**

**22**

**BREAKUP AND CULTIVATE SUBGRADE TO MIN 200mm AS SPECIFIED**

**23**

**COMPACTED FILL REFER ENGINEER’S DRAWINGS**
Landscape design

Introduction

The proposed landscape design for the project responds to the landscape character of the Shale Plains Woodland (the most widely distributed community on the Cumberland Plain) and Alluvial Woodland vegetation communities, and urban areas through which it passes. Due to the proximity to some residences and the prominence of the interchange, the majority of landscape areas are planted for immediate effect. Larger areas where greater biodiversity can be achieved are seeded using a compost blanket application. Tree plantings consist of forestry tube-stock, super-advanced and semi-mature stock for early visual effect.

Informal native tree planting with an understorey of frangible native shrubs, grasses and groundcovers selected from the Shale Plains Woodland and Alluvial Woodland vegetation communities will provide a sense of identity and will assist in integrating the road and bridge infrastructure into its local environmental setting.

South of the M4 Motorway the landscape character is rural. North of the M4 Motorway the landscape character is increasingly urban. The landscape design responds to this changing character with informal planting to the south, and increasingly formal planting to the north.

Principles

The guiding principles in the development of the landscape design are:

- Respond to the context and character of the adjacent landscape through which it passes and consider the drivers' experience of the landscape along the whole of the road
- Maintain, enhance and / or ameliorate views including those available to motorists on the new alignment and for those who may be visually impacted by the motorway
- Maintain vegetation safety clearances and other performance and safety requirements
- Provide a methodology for the successful establishment of vegetation
- Provide suitable vegetation to facilitate habitat linkages and minimise habitat fragmentation
- Provide a self-reliant and minimal maintenance landscape outcome
- Reinstate endemic vegetation
- Maximise the extent of retained vegetation where possible
- Provide vegetative screening of residences, structures and other elements within the corridor.

Landscape strategies

The key landscape strategies used to ensure that the landscape design contributes to the successful integration with its surroundings are:

- Incorporate a planted zone to the front of the proposed noise walls where space is available. Dense screen planting will be provided to the rear with a maintenance strip of gravel immediately behind the noise wall
- Match with the existing spatial sequence of the landscape along The Northern Road
- Ensure the vegetative slope stabilisation treatments are effective
- Ensure that the selected planting and seeding is composed of species known to establish well in difficult environments
- Integrate landscape design to mitigate visual impacts of structures
- Create a robust, low maintenance landscape that is responsive to sight lines, safety and impacts from operational activities
- Use of native species to reinforce the Cumberland Plain character of the immediate setting of the area
- Provide a distinctive landscape character at the M4 Interchange itself which distinguishes it as an important transport node and major entry to the local area.
Planting design

The revegetation of The Northern Road will be undertaken using a mix of direct planting and seeding via the method of compost blanket. Endemic native planting is used throughout the alignment of The Northern Road. The planting is prioritised to areas where it will achieve the greatest revegetation impact, visual benefit to motorists and surrounding residences, and satisfy road safety and clear zone requirements.

Plants may be established using either:

- Compost blanket containing native seed at rate of 8 kg / hectare
- Hydroseeding (for turf grasses only)
- Laying turf rolls
- Planting of forestry-tube plant stock
- Planting of advanced, semi-advanced and semi-mature planting stock (150 millimetre, 200 millimetre, 25 and 75 litre containerised plants).

The planting design has been devised based upon the Cumberland Plain plant community through which the road passes. Cumberland Plain is listed as a Critically Endangered Ecological Community (CEEC) under both the EPBC Act and the TSC Act.

Planting mixes

Planted vegetation typically includes mass planted trees, street trees, shrubs, native grasses and groundcovers grouped according to mix type and size.

Type 1: Low shrub median planting

Selected species of low native shrubs and grasses are proposed for the median. The planting design will ensure clear sight lines where required. Low native grasses will be planted from 150 millimetre pots at six per square metre and shrubs at 200 millimetre pots at four per square metre. Refer to the planting schedules for species used.

Type 2: Low riparian planting (not used)

This vegetation type will be located along existing watercourses and basins and will aid in stabilising the banks, while providing greater habitat and biodiversity potential. The planting will also protect the watercourse/basins from potential silt and sedimentation erosion as a result of construction works. Riparian sedge species are selected from the Alluvial Woodland and Freshwater Wetland vegetation communities and planted from tubes at four to six per square metre. Refer to the planting schedules for species used.

Type 3: Shrubs grasses and groundcovers with wildflower feature planting

Planting in front of noise walls, at the interchange and intersections and other highly visible areas will consist of a mix of appropriate flowering shrubs, grasses and groundcovers planted in informal clusters to create a naturalistic canopy. Plants in this mix are planted from 150 millimetre containers at six per metre for native grasses and groundcover, 200 millimetre containers for shrubs and 75 litres for trees. Refer to the planting schedules for species used.
**Type 4: Verge and median groundcover edge planting**

Low native grasses are used as a landscape buffer between the road and the shared pathway or as a landscape buffer to more non-frangible landscape types on the outer edge of the shared pathway. This strip of planting along the edges of the motorway, paths and access roads ensures clear sight lines. Low native grasses and groundcovers will be planted from 150 millimetre containers at six per square metre. Shrubs will be planted from 200 millimetre pots at 3 per square metre. Refer to the planting schedules for species used.

**Type 5: Turf rolls**

In highly visible areas and where foot traffic is high, turf rolls are used to establish turf quickly with minimal maintenance. A hybrid Couch grass, Wintergreen is specified.

**Seeding mixes**

**Type 1: Shale plain woodland**

Further from the roadside, and in locations where sight lines are not obscured, a seeding mix of frangible, hardy and drought tolerant native trees, shrubs, grasses and groundcovers has been devised for verges and batter slopes. The composition of the mix of species has been selected from the Shale Plain Woodland vegetation community to improve local biodiversity and provide habitat for small birds. Native seed will be applied to areas to be vegetated by compost blanket application at the rate of 8 kg per hectare. Refer to the seeding schedules for species used.

**Type 2: Turf grass seeding**

Former pasture areas, for example at compound sites, where foot and vehicle traffic will be low during establishment, will be seeded with a turf grass mix containing Couch grass seed with annual cover crops.

**Feature trees**

Feature trees are planted individually or in informal groups at the interchange, intersections and to provide shade where space is available adjacent to the shared path and footpaths. The selected feature trees include Corymbia maculata (Spotted Gum), Eucalyptus crebra (White Stringybark) and Angophora floribunda planted at semi mature sizes in 75 litre containers at specific locations where shown on the plans. Smaller feature trees are planted from 25 litre containers and are used in front of noise walls and retaining walls and for screening purposes. Refer to the planting schedules for species used.
The Northern Road upgrade Glenmore Parkway, Glenmore Park to Jamison Road, South Penrith

Landscape masterplan

Notes: Retain and protect existing trees.
Provide landscape gateway

LEGEND

PROJECT BOUNDARY
NOISE WALL
RETAINING WALL

PROPOSED FEATURE TREES
(EACH SYMBOL REPRESENTS THREE TREES)

EXISTING TREES TO RETAIN

LANDSCAPE TYPE

PLANTING T1: LOW SHRUB MEDIAN PLANTING
PLANTING T2: LOW RIPARIAN PLANTING
PLANTING T3: SHRUBS, GRASSES AND GROUNDCOVERS WITH WILDFLOWER FEATURE PLANTING
PLANTING T4: VERGE AND MEDIAN GROUNDCOVER EDGE PLANTING
PLANTING T5: TURF ROLL
MULCH

ST1: SHALE PLAINS WOODLAND
ST2: SHALE PLAINS WOODLAND SEEDING (WITHOUT TREE SPECIES)
ST3: TURF GRASS SEEDING

NOTES: RETAIN AND PROTECT EXISTING TREES.
Existing trees to be retained or protected

Trees proposed for retention within the construction footprint and significant groups of trees adjacent to the corridor works will be retained and protected. The highest priority is placed on protecting these existing trees for their amenity and biodiversity value. By minimising the clearing of existing vegetation as a result of the road upgrade, the overall environmental impact of the proposed works is reduced by:

- Ensuring the survival and enhancement of flora communities, in particular remnants of the existing vegetation communities
- Enhancing the visual quality and landscape character
- Maintaining established landscape views for road users.

All existing trees to be retained will be protected according to Australian Standards AS 4970 Protection of Trees on Development Sites and if pruning is required, AS 4373 Pruning of Amenity Trees.

Clear zones

Non-frangible trees (typically trees with trunk diameters greater than 100 millimetre at one metre from the ground) must be located beyond the clear zone to prevent accidents. The setback distance is predicated on the design travel speed of the road. The northern end of the road has a design speed of 80 kilometres per hour with the southern portion being 90 kilometres per hour. Non-frangible trees have been located a minimum of 6.5 metres and 7.5 metres respectively from the edge of the closest travel lane to take into account mature spread and branch overhang to ensure minimal future maintenance.

Within the clear zone only grasses, groundcovers and frangible shrubs are used.

Where trees are located behind a safety barrier they must be planted beyond the dynamic deflection zone of the barrier. A minimum two metres has been allowed. In the case where it has been determined that limb drop may occur, trees have been located further than two metres from the barrier.

Topsoils

Site topsoil

Topsoil stripped from the site and stockpiled for later re-use must be tested to ascertain its suitability for use in the landscape works. Any measures recommended in the soil test certificates to ameliorate the topsoil must be carried out prior to use. Weed contaminated topsoil must not be used.

Imported general-purpose topsoil

Where site topsoil does not meet the volume requirements for the project, imported general purpose topsoil must be used for revegetation areas and must comply with the requirements of AS 4419 Soils for Landscape and Garden Use.

Imported organic topsoil

Where site topsoil does not meet the volume requirements for the project, imported organic topsoil must be used for revegetation areas and must comply with the requirements of AS 4419 Soils for Landscape and Garden Use. Compost

Where compost blanket is specified it must comply with RMS ‘Guideline for Batter Stabilisation – Fact Sheet 13: Compost Blanket’ and must contain a minimum 8kg per hectare of native seed as specified in the seed schedules. Compost blanket contains a growing media of compost and does not require topsoil or other growing media and can be applied directly over the prepared batter slope. Installation of compost blanket is to be in accordance with supplier’s requirements and is to be supported by a guarantee of 80% strike rate.

Turf underlay

Turf underlay may be general-purpose topsoil.

Drainage

Vegetated drainage channels are either planted with planting type 2; low riparian planting, or seeded with turf grasses depending on the context. In both cases organic fibre mesh is used to assist erosion resistance. Around culvert headwalls, planting is used to provide screening of the structure.

Waterways

Where proposed landscaping is to be installed adjacent to waterways at the unnamed tributaries of Surveyors Creek, species from the Alluvial Woodland Vegetation Community are used.

Utilities

Landscape is affected by utilities in several locations along the alignment. Utility assets typically relevant to vegetation management are overhead lines, poles, towers, substations, access tracks, streetlights, sewers, water pipes, communication cables and warning signs. Clearances will be observed from utilities for proposed seeding and planting and will comply with ISSC3 Guide for the Management of Vegetation in the Vicinity of Electricity Assets Issue Date: November 2016.

No tree or shrub shall be planted which, at maturity, will exceed 1.5 metres in height if it is under an electricity transmission line or close enough to the line for the mature canopy to come within 5 metres of any conductor.

Ancillary facilities

The project will require ancillary facilities to support the construction activities associated with it. Ancillary facilities are temporarily erected for construction, including for example an office and amenities compound, construction compound, etc. The land on which ancillary facilities are located will be rehabilitated to at least their pre-construction condition or better, unless otherwise agreed by the landowner. Some sites may be integrated into the local public open space system or evaluated for future development potential.

The REF recommends reinstating Cumberland Plain Woodland cover in all compound sites and temporary work zones. This has been addressed in the landscape design.

The intention with all temporary construction sites is to rehabilitate them as soon as possible after they are no longer required for the road construction operations.
**Landscape visual screening**

Where existing retained vegetation does not provide sufficient screening, tree and shrub planting will be utilised to minimise the visual impact of the road and M4 Motorway interchange for nearby affected residences. The Review of Environmental Factors for The Northern Road upgrade was amended following public submissions and additional environmental safeguards were added, some of which were applicable to the landscape package and visual screening which include:

<table>
<thead>
<tr>
<th>Submissions Report – amended safeguards and management measures</th>
<th>Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provide strong visual buffer planting between the M4 Motorway and residents on the southern side, including in Homestead Road and South Street.</td>
<td>In addition to seeding of Shale Plain. Woodland vegetation in these locations – extensive tree planting has been implemented between the M4 Motorway and residences.</td>
</tr>
<tr>
<td>Provide strong visual buffer planting between the M4 Motorway and the Penrith Christian School.</td>
<td>On the motorway side of the retaining wall in this location the planting space available is constrained, therefore a formal row of small trees are used. Tafer Eucalypts are used as a backdrop on the school side in an informal layout.</td>
</tr>
<tr>
<td>Reviewing tree planting between the Northern Road and the Penrith Christian School.</td>
<td>In addition to seeding of Shale Plain. Woodland vegetation in this location, intermittent tree planting is also proposed.</td>
</tr>
<tr>
<td>Maximise median planting of low shrubs (about up to one metre in height) along the Northern Road to provide headlight glare screening and to visually separate carriageways to create the sense of a landscape corridor.</td>
<td>Median planting of low shrubs is proposed in the median wherever space is available.</td>
</tr>
</tbody>
</table>

Where it is identified that the proposed landscaping does not satisfy the visual screening requirements of adjacent residences and businesses, at-receptor landscaping will be considered in consultation with the relevant landowner and Roads and Maritime and will be implemented during the construction of the project.

**Landscape Maintenance Plan**

A Landscape Maintenance Plan (LMP) will be prepared as part of the landscape documentation and will be implemented following completion of each stage of the works. The LMP will detail procedures for monitoring and maintaining landscaped or rehabilitated areas including weed management during the period of construction and during the landscape maintenance period for landscape works until final completion.

Maintenance is to include the following activities:

- Monitor weed control and plant growth to assess whether the landscape will be successful and record findings in relation to seeded material as well as planted
- Replace failed plants as identified, every four weeks
- Undertake weed control using a combination of control methods as required
- Hand water plants to support new growth for the first 12 weeks
- Top up mulch to garden beds as required.

**Weed management**

Weed management is a crucial aspect of landscape maintenance within new and existing landscape areas to prevent further infestation, increase the prevalence of endemic species, support biodiversity and improve the visual quality of the corridor. Weed management tasks will include those listed below:

**Strategy**

- Weed Management Strategy and Survey
  - To be carried out prior to construction commencement.
- Undertake regular weed control in habitat plantings and adjacent bushland.
  - Undertake regular weed control in habitat plantings, bushland.
- Control aquatic weeds at disturbed sites adjacent to watercourses.
  - Collect and dispose of weed infested topsoil in an environmentally sensitive manner. Separate weed infested topsoil from topsoil that is to be reused in landscaping. Reuse topsoil from cleared vegetation areas in close proximity to its original location. Cleared material is to be assessed and all weeds and undesirable species (i.e. species with vigorous germination habits) are to be separated and removed from the cleared material, prior to chipping. Use mulch in close proximity to where it was derived. Clear earthmoving machinery prior to being used in non–weed infested areas.
- Educate contractors on tree protection during construction.
  - No machinery or personnel is permitted outside the construction buffer without the approval of the Project Co Project Manager.

**Ongoing landscape maintenance**

The ongoing maintenance, beyond the contractor’s specified maintenance period would be carried out by the Roads and Maritime team for routine maintenance and by the local Council on local roads. The maintenance team would include qualified landscape contractors, experienced in horticultural maintenance and management techniques, who would undertake the monitoring, assessment, identification and completion of ongoing maintenance works. In particular, the team would undertake the tasks as outlined in the following table:

<table>
<thead>
<tr>
<th>Task</th>
<th>Timeline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sightlines</td>
<td>Monthly</td>
</tr>
<tr>
<td>Clear Zones</td>
<td>Six Monthly</td>
</tr>
<tr>
<td>Weed Control</td>
<td>Monthly</td>
</tr>
<tr>
<td>Erosion Control</td>
<td>Monthly</td>
</tr>
<tr>
<td>Fences</td>
<td>Six Monthly</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Task</th>
<th>Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sightlines</td>
<td>Ensure vegetation growth is maintained within the required threshold, so as not to restrict safety sightlines within the road corridor. This would include grass cutting and pruning of shrubs and trees, if required.</td>
</tr>
<tr>
<td>Clear Zones</td>
<td>Ensure the removal of regenerates, inappropriate woody species within designated frangible clear zones.</td>
</tr>
<tr>
<td>Weed Control</td>
<td>On-going weed control.</td>
</tr>
<tr>
<td>Erosion Control</td>
<td>Ensure the repair and revegetation of any area where erosion occurs.</td>
</tr>
<tr>
<td>Fences</td>
<td>Removal of tall shrubs, trees and climbers around fences.</td>
</tr>
</tbody>
</table>
The Northern Road upgrade Glenmore Parkway, Glenmore Park to Jamison Road, South Penrith

SWTC Appendix 31 - Contractor’s Urban and Landscape Design

### Planting table - south

<table>
<thead>
<tr>
<th>Landscape Areas/symbol</th>
<th>Species</th>
<th>Common Name</th>
<th>Total Numbers</th>
<th>Pot Size</th>
<th>Fertiliser (Grams/plant)</th>
<th>Total Fertiliser per area</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trees</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Af</td>
<td>Angophora floribunda</td>
<td>Rough-barked Apple</td>
<td>3</td>
<td>75Litre</td>
<td>160</td>
<td>480</td>
</tr>
<tr>
<td>Cg</td>
<td>Casuarina glauca</td>
<td>Swamp Oak</td>
<td>12</td>
<td>200mm</td>
<td>40</td>
<td>480</td>
</tr>
<tr>
<td>Crm</td>
<td>Corymbia maculata</td>
<td>Spotted Gum</td>
<td>66</td>
<td>200mm</td>
<td>40</td>
<td>2640</td>
</tr>
<tr>
<td>Ec</td>
<td>Eucalyptus crebra</td>
<td>Narrow-leaved Ironbark</td>
<td>32</td>
<td>200mm</td>
<td>40</td>
<td>1280</td>
</tr>
<tr>
<td>Ee</td>
<td>Eucalyptus eugenioides</td>
<td>Thin-leaved Stringbark</td>
<td>22</td>
<td>200mm</td>
<td>40</td>
<td>880</td>
</tr>
<tr>
<td>Em</td>
<td>Eucalyptus melanoxylon</td>
<td>Grey Box</td>
<td>33</td>
<td>200mm</td>
<td>40</td>
<td>1320</td>
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<tr>
<td>Et</td>
<td>Eucalyptus tereticornis</td>
<td>Forest Red Gum</td>
<td>85</td>
<td>200mm</td>
<td>40</td>
<td>3400</td>
</tr>
<tr>
<td>Et</td>
<td>Eucalyptus tereticornis</td>
<td>Forest Red Gum</td>
<td>7</td>
<td>75Litre</td>
<td>160</td>
<td>1120</td>
</tr>
<tr>
<td>Mf</td>
<td>Metrosideros linifolia</td>
<td>Flax-leaved Paperbark</td>
<td>0</td>
<td>200mm</td>
<td>40</td>
<td>0</td>
</tr>
<tr>
<td><strong>Total 200 mm</strong></td>
<td></td>
<td></td>
<td>250</td>
<td></td>
<td></td>
<td>40,720</td>
</tr>
<tr>
<td><strong>Total 75 Ltr</strong></td>
<td></td>
<td></td>
<td>192</td>
<td></td>
<td></td>
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</tr>
<tr>
<td><strong>PT18: Low Shrub Median Planting</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Area m²</strong></td>
<td></td>
<td></td>
<td>1772</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calistemon citrinus cultivar</td>
<td>“Captain Cook”</td>
<td>1418</td>
<td>200mm</td>
<td>40</td>
<td>56704</td>
<td></td>
</tr>
<tr>
<td>Doryanthes excelsa</td>
<td>Gymeila Lily</td>
<td>532</td>
<td>200mm</td>
<td>40</td>
<td>21264</td>
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</tr>
<tr>
<td>Leptospermum polygalloides cultivar</td>
<td>“Copper Glow”</td>
<td>1772</td>
<td>200mm</td>
<td>40</td>
<td>70880</td>
<td></td>
</tr>
<tr>
<td>Leptospermum polygalloides cultivar</td>
<td>“Pacific Beauty”</td>
<td>1772</td>
<td>200mm</td>
<td>40</td>
<td>70880</td>
<td></td>
</tr>
<tr>
<td>Westringia filicosa</td>
<td>“Blue Gem”</td>
<td>1772</td>
<td>150mm</td>
<td>20</td>
<td>35440</td>
<td></td>
</tr>
<tr>
<td><strong>Total 200 mm</strong></td>
<td></td>
<td></td>
<td>5493</td>
<td></td>
<td></td>
<td>255,168</td>
</tr>
<tr>
<td><strong>Total 150 mm</strong></td>
<td></td>
<td></td>
<td>1772</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PT25: Low Rieberian Planting (NOT USED)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Area m²</strong></td>
<td></td>
<td></td>
<td>10125</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Banksia spinulosa</td>
<td>Harpin Banksia</td>
<td>911</td>
<td>200mm</td>
<td>40</td>
<td>36450</td>
<td></td>
</tr>
<tr>
<td>Brachyscome multifida cultivar</td>
<td>“Sheek O’ Day”</td>
<td>1823</td>
<td>150mm</td>
<td>20</td>
<td>36450</td>
<td></td>
</tr>
<tr>
<td>Chrysoeclipsis apiculata cultivar</td>
<td>“Silver Sunburst”</td>
<td>3038</td>
<td>150mm</td>
<td>20</td>
<td>60750</td>
<td></td>
</tr>
<tr>
<td>Calistemon citrinus cultivar</td>
<td>“King’s Park Special” Bottlebrush</td>
<td>3038</td>
<td>200mm</td>
<td>40</td>
<td>121500</td>
<td></td>
</tr>
<tr>
<td>Calistemon viridiflora cultivar</td>
<td>“Hannah Ray” Bottlebrush</td>
<td>3038</td>
<td>200mm</td>
<td>40</td>
<td>121500</td>
<td></td>
</tr>
<tr>
<td>Chrysoeclipsis apiculata cultivar</td>
<td>“Crest Flame” Yellow Buttons</td>
<td>3038</td>
<td>150mm</td>
<td>20</td>
<td>60750</td>
<td></td>
</tr>
<tr>
<td>Hardenbergia violacea</td>
<td>Native Sarsaparilla</td>
<td>2925</td>
<td>150mm</td>
<td>20</td>
<td>45300</td>
<td></td>
</tr>
<tr>
<td>Indigofera australis</td>
<td>Native Indigo</td>
<td>3038</td>
<td>150mm</td>
<td>20</td>
<td>60750</td>
<td></td>
</tr>
<tr>
<td>Leptospermum polygalloides cultivar</td>
<td>“Pacific beauty”</td>
<td>911</td>
<td>200mm</td>
<td>40</td>
<td>36450</td>
<td></td>
</tr>
<tr>
<td>Lomandra longifolia</td>
<td>Mat-rush</td>
<td>6075</td>
<td>150mm</td>
<td>20</td>
<td>121500</td>
<td></td>
</tr>
<tr>
<td>Metrosideros decora</td>
<td>Flat-leaved Paperbark</td>
<td>1823</td>
<td>200mm</td>
<td>40</td>
<td>36450</td>
<td></td>
</tr>
<tr>
<td>Monotropa hypogea</td>
<td>Warrigal Grass</td>
<td>3038</td>
<td>150mm</td>
<td>20</td>
<td>60750</td>
<td></td>
</tr>
<tr>
<td>Poa edwardii</td>
<td>Tussock Grass</td>
<td>3038</td>
<td>150mm</td>
<td>20</td>
<td>60750</td>
<td></td>
</tr>
<tr>
<td>Themeda triandra</td>
<td>Kangaroo Grass</td>
<td>7290</td>
<td>150mm</td>
<td>20</td>
<td>145800</td>
<td></td>
</tr>
<tr>
<td>Westringia filicosa</td>
<td>Coastal Rosemary</td>
<td>3240</td>
<td>150mm</td>
<td>20</td>
<td>64800</td>
<td></td>
</tr>
<tr>
<td>Wahlenbergia gracilis</td>
<td>Australian Bluebell</td>
<td>3038</td>
<td>150mm</td>
<td>20</td>
<td>60750</td>
<td></td>
</tr>
<tr>
<td><strong>Total 200 mm</strong></td>
<td></td>
<td></td>
<td>9720</td>
<td></td>
<td></td>
<td>1,162,350</td>
</tr>
<tr>
<td><strong>Total 150 mm</strong></td>
<td></td>
<td></td>
<td>38878</td>
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<td></td>
<td></td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td></td>
<td></td>
<td>48,398</td>
<td></td>
<td></td>
<td>1,162,350</td>
</tr>
</tbody>
</table>
### Planting table - south

<table>
<thead>
<tr>
<th>P T S : Verge and Median Groundcover Edge Planting</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Area (m²)</strong></td>
<td><strong>Plant</strong></td>
<td><strong>P T S : Turf Rolls</strong></td>
<td><strong>P T S : Turf Rolls</strong></td>
<td><strong>P T S : Turf Rolls</strong></td>
</tr>
<tr>
<td><strong>15525</strong></td>
<td>Blue Flax Lily</td>
<td>23288</td>
<td>150mm</td>
<td>20</td>
</tr>
<tr>
<td><strong>9015</strong></td>
<td>Creeping Myoporum</td>
<td>3215</td>
<td>150mm</td>
<td>20</td>
</tr>
<tr>
<td><strong>23288</strong></td>
<td>Mat-rush</td>
<td>23288</td>
<td>150mm</td>
<td>20</td>
</tr>
<tr>
<td><strong>6210</strong></td>
<td>Mat Rush</td>
<td>6210</td>
<td>150mm</td>
<td>20</td>
</tr>
<tr>
<td><strong>13973</strong></td>
<td>Kangaroo Grass</td>
<td>13973</td>
<td>150mm</td>
<td>20</td>
</tr>
<tr>
<td><strong>13973</strong></td>
<td>Tussock Grass</td>
<td>13973</td>
<td>150mm</td>
<td>20</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>80,045</strong></td>
<td><strong>Total</strong></td>
<td><strong>1,800,900</strong></td>
<td><strong>1,800,900</strong></td>
</tr>
</tbody>
</table>

**Note 1:** All existing trees to be retained will be protected, refer to project specific flora & fauna management plan

**Note 2:** 100mm site won woodchip mulch will be applied at the rate of 3m² per tree and 2m² per shrub or ground cover for individual plantings.

**Note 3:** Street Trees are classified as those on secondary side streets.
### Planting table - north

#### THE NORTHERN ROAD STAGE 3 NORTH (TNR3N): Planting Schedule

<table>
<thead>
<tr>
<th>Landscape Areas/Symbol</th>
<th>Species</th>
<th>Common Name</th>
<th>Total Numbers</th>
<th>Pot Size</th>
<th>Plant Size (Grams/plant)</th>
<th>Total Plant Size per area</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trees</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Af</td>
<td>Angophora floribunda</td>
<td>Rough-barked Apple</td>
<td>18</td>
<td>200mm</td>
<td>80</td>
<td>1440</td>
</tr>
<tr>
<td>As</td>
<td>Acmena smithii cultivar</td>
<td>“Hedgermaster” Lilly Pilly</td>
<td>54</td>
<td>200mm</td>
<td>60</td>
<td>3240</td>
</tr>
<tr>
<td>Cm</td>
<td>Corymbia maculata</td>
<td>Spotted Gum</td>
<td>22</td>
<td>200mm</td>
<td>80</td>
<td>1760</td>
</tr>
<tr>
<td>Cm</td>
<td>Corymbia maculata</td>
<td>Spotted Gum</td>
<td>11</td>
<td>75Litre</td>
<td>160</td>
<td>1760</td>
</tr>
<tr>
<td>Ec</td>
<td>Eucalyptus crebra</td>
<td>Narrow-leaved Ironbark</td>
<td>24</td>
<td>230mm</td>
<td>60</td>
<td>1488</td>
</tr>
<tr>
<td>Et</td>
<td>Eucalyptus fibrosa</td>
<td>Red Ironbark</td>
<td>19</td>
<td>75Litre</td>
<td>160</td>
<td>3040</td>
</tr>
<tr>
<td>Em</td>
<td>Eucalyptus moluccana</td>
<td>Grey Box</td>
<td>5</td>
<td>200mm</td>
<td>80</td>
<td>400</td>
</tr>
<tr>
<td>Et</td>
<td>Eucalyptus moluccana</td>
<td>Grey Box</td>
<td>176</td>
<td>75Litre</td>
<td>160</td>
<td>28160</td>
</tr>
<tr>
<td>Er</td>
<td>Elaeocarpus reticulatus</td>
<td>Blueberry Ash</td>
<td>37</td>
<td>75Litre</td>
<td>160</td>
<td>5920</td>
</tr>
<tr>
<td>Et</td>
<td>Eucalyptus resinifera</td>
<td>Red Mahogany</td>
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<td>2560</td>
</tr>
<tr>
<td>Et</td>
<td>Eucalyptus tereticornis</td>
<td>Forest Red Gum</td>
<td>28</td>
<td>200mm</td>
<td>80</td>
<td>2240</td>
</tr>
<tr>
<td>Et</td>
<td>Eucalyptus tereticornis</td>
<td>Forest Red Gum</td>
<td>37</td>
<td>75Litre</td>
<td>160</td>
<td>5920</td>
</tr>
<tr>
<td>Ml</td>
<td>Melaleuca linariifolia</td>
<td>Flax-leaved Paperbark</td>
<td>10</td>
<td>200mm</td>
<td>60</td>
<td>600</td>
</tr>
<tr>
<td>Ti</td>
<td>Tristaniopsis laurina</td>
<td>Water Gum</td>
<td>199</td>
<td>200mm</td>
<td>60</td>
<td>11940</td>
</tr>
</tbody>
</table>

| **Total 200 mm** | 361 | **Total 75 Lire** | 298 |

#### PT1N : Low Shrub Median Planting

<table>
<thead>
<tr>
<th>Area (m²)</th>
<th>738</th>
</tr>
</thead>
<tbody>
<tr>
<td>Callistemon citrinus cultivar</td>
<td>&quot;Captain Cook&quot;</td>
</tr>
<tr>
<td>Doryanthes excelsa</td>
<td>Gymea Lily</td>
</tr>
<tr>
<td>Leptospermum polygalifolium cultivar</td>
<td>&quot;Copper Glow&quot;</td>
</tr>
<tr>
<td>Leptospermum polygalifolium cultivar</td>
<td>&quot;Pacific Beauty&quot;</td>
</tr>
<tr>
<td>Westringia fruticosa cultivar</td>
<td>&quot;Blue Gem&quot;</td>
</tr>
</tbody>
</table>

| **Total 150 mm** | 738 |
| **Total 200 mm** | 3,026 |
| **Total 110,700** |

#### PT2N : Low Riverbank Planting (NOT USED)

| Area (m²) | 0 |

#### PT3N : Shrubs, Grasses and Groundcovers with Wildflower Feature Planting

<table>
<thead>
<tr>
<th>Area (m²)</th>
<th>11413</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bankia spinulosa</td>
<td>Harpin Bankia</td>
</tr>
<tr>
<td>Brachyscome multiflora cultivar</td>
<td>&quot;Break O’ Day&quot; Cut-leaved daisy</td>
</tr>
<tr>
<td>Chrysanthemum coccineum cultivar</td>
<td>&quot;Silver Sunbursts&quot; Yellow Buttons</td>
</tr>
<tr>
<td>Callistemon citrinus cultivar</td>
<td>&quot;Kings Park Special&quot; Bottlebrush</td>
</tr>
<tr>
<td>Callistemon viminalis cultivar</td>
<td>&quot;Hannah Ray&quot; Bottlebrush</td>
</tr>
<tr>
<td>Chrysanthemum coccineum cultivar</td>
<td>&quot;Desert Flame&quot; Yellow Buttons</td>
</tr>
<tr>
<td>Hardenbergia violacea</td>
<td>Native Sarsaparilla</td>
</tr>
<tr>
<td>Indigenous australis</td>
<td>Native Indigo</td>
</tr>
<tr>
<td>Leptospermum polygalifolium cultivar</td>
<td>&quot;Pacific beauty&quot;</td>
</tr>
<tr>
<td>Lomandra longifolia</td>
<td>Mat Rush</td>
</tr>
<tr>
<td>Melaleuca decora</td>
<td>Prickly-leaved Paperbark</td>
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<tr>
<td>Micranthera stipoides</td>
<td>Weeping Grass</td>
</tr>
<tr>
<td>Poa labillardier</td>
<td>Lussock Grass</td>
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<tr>
<td>Themeda triandra</td>
<td>Kangaroo Grass</td>
</tr>
<tr>
<td>Westringia fruticosa</td>
<td>Coast Rosemary</td>
</tr>
<tr>
<td>Wahlenbergia gracilis</td>
<td>Australian Bluebell</td>
</tr>
</tbody>
</table>

| **Total 150 mm** | 43598 |
| **Total 200 mm** | 10956 |
| **Total 1,310,212** |
Planting table - north

<table>
<thead>
<tr>
<th>PTAN : Verge and Median Groundcover Edge Planting</th>
<th>Area (m²)</th>
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<tbody>
<tr>
<td>Danellia caerulea</td>
<td></td>
<td>19958</td>
<td>150mm</td>
<td>20</td>
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<tr>
<td>Myoporum parvifolium</td>
<td></td>
<td>7983</td>
<td>150mm</td>
<td>20</td>
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<tr>
<td>Lomandra longifolia &quot;Tanika&quot;</td>
<td></td>
<td>5322</td>
<td>150mm</td>
<td>20</td>
</tr>
<tr>
<td>Themeda triandra</td>
<td></td>
<td>11975</td>
<td>150mm</td>
<td>20</td>
</tr>
<tr>
<td>Poa abildareni</td>
<td></td>
<td>11975</td>
<td>150mm</td>
<td>20</td>
</tr>
<tr>
<td>Totals</td>
<td></td>
<td>77,169</td>
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</tr>
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</table>

<table>
<thead>
<tr>
<th>PTSN : Turf Rolls</th>
<th>Area (m²)</th>
<th></th>
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<tbody>
<tr>
<td>Cynodon dactylon selection</td>
<td>23069</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
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<tr>
<td>Total turf (m²)</td>
<td></td>
<td>23,069</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note 1: All existing trees to be retained will be protected, refer to project specific flora and fauna management plan
Note 2: 100 mm site won woodchip mulch will be applied at the rate of 3m² per tree and 2m² per shrub or groundcover for individual plantings.
Note 3: Street trees are classified as those on secondary side streets
Seeding schedule - south

### Cover Crop

- **Pre treatment to assist germination by immerging seeds contained in a bag in hot water (90°C) for 60 minutes**

### Areas

<table>
<thead>
<tr>
<th>Species</th>
<th>Cost Centre</th>
<th>Area to be seeded per m²</th>
<th>Application rate of seed (Kg/Ha)</th>
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<tbody>
<tr>
<td>Eclipse Rye</td>
<td>C-4 (South)</td>
<td>20.091</td>
<td>0.212</td>
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<tr>
<td>Secale cereale (Apr-Aug)</td>
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<td></td>
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</tr>
<tr>
<td>Echinochloa itilis (Sep-Mar)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Unhulled Couch</td>
<td></td>
<td>5 13.885</td>
<td>0.236</td>
</tr>
<tr>
<td>Kangaroo Grass</td>
<td></td>
<td>0.45</td>
<td></td>
</tr>
<tr>
<td>Themeda triandra</td>
<td></td>
<td>0.283</td>
<td></td>
</tr>
<tr>
<td>Hairy Bush-Pea</td>
<td></td>
<td>0.6</td>
<td></td>
</tr>
<tr>
<td>Slender Flat-sedge</td>
<td></td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>Melaleuca decora</td>
<td></td>
<td>0.212</td>
<td></td>
</tr>
<tr>
<td>White Feather Honeymyrtle</td>
<td></td>
<td>0.02</td>
<td></td>
</tr>
<tr>
<td>Lomandra filiformis</td>
<td></td>
<td>0.236</td>
<td></td>
</tr>
<tr>
<td>Juncus usitatus</td>
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<tr>
<td>Echinopogon caespitosus</td>
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<tr>
<td>Eragrostis leptostachya</td>
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<tr>
<td>Paddock Lovegrass</td>
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<td>Hairy Bush-Pea</td>
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<td>Eragrostis leptostachya</td>
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<tr>
<td>Paddock Lovegrass</td>
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<td>Blackthorn</td>
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<tr>
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<td>Japanese Millet</td>
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<td>Melaleuca decora</td>
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<td>White Feather Honeymyrtle</td>
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<td>Lomandra filiformis</td>
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<tr>
<td>Juncus usitatus</td>
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</tr>
<tr>
<td>Eragrostis leptostachya</td>
<td></td>
<td>0.1</td>
<td></td>
</tr>
<tr>
<td>Paddock Lovegrass</td>
<td></td>
<td>0.25</td>
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</tr>
<tr>
<td>Hedgehog Grass</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Dichelachne micrantha</td>
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</tr>
<tr>
<td>Slender Flat-sedge</td>
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<td>Cyperus gracilis</td>
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<td>Scented Top Grass</td>
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</tr>
<tr>
<td>Willow Bottlebrush</td>
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<td>Callistemon salignus</td>
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</tr>
<tr>
<td>Blackthorn</td>
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<tr>
<td>Three-awned Spear Grass</td>
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<tr>
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<tr>
<td>Acacia brownii</td>
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</tbody>
</table>

*Note: Subject to final quantities / area check

---

**The Northern Road upgrade Glenmore Parkway, Glenmore Park to Jamison Road, South Penrith**

(v) Landscape design - Page 83

Figure 259: Eucalyptus crenata in seeded Cumberland Plain understorey
### Seeding Schedule - North

#### ST3N: Torf Grasses

<table>
<thead>
<tr>
<th>Species</th>
<th>Area to be seeded (ha)</th>
<th>Total (Kg) 12,808</th>
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</thead>
<tbody>
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<td>32,997</td>
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<td>Echinochloa itilis <em>Japanese Millet or Rye Corn 20</em></td>
<td>4.4 8.50</td>
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<tr>
<td>Themeda triandra <em>Kangaroo Grass 0.45</em></td>
<td>3.3 6.50</td>
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<td>Jacksonia scoparia <em>Hairy Bush-Pea 0.6</em></td>
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<tr>
<td>Pultenaea villosa <em>Hairy Bush-Pea 0.6</em></td>
<td>1.8 3.60</td>
<td>109.061</td>
</tr>
<tr>
<td>Rice Flower <em>Ozothamnus diosmifolius</em></td>
<td>1.2 2.40</td>
<td>42.656</td>
</tr>
<tr>
<td>Rice Flower <em>Poa labillardieri</em></td>
<td>1.2 2.40</td>
<td>42.656</td>
</tr>
<tr>
<td>Poo labillardieri <em>Weeping Grass 0.45</em></td>
<td>0.9 1.80</td>
<td>27.388</td>
</tr>
<tr>
<td>Microlaena stipoides <em>Weeping Grass 0.45</em></td>
<td>0.9 1.80</td>
<td>27.388</td>
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<tr>
<td>Cynodon dactylon <em>Unhulled Couch 5 6.005</em></td>
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<td>5.407</td>
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<tr>
<td>Themeda triandra <em>Kangaroo Grass 0.45</em></td>
<td>0.6 1.20</td>
<td>5.407</td>
</tr>
<tr>
<td>Pultenaea villosa <em>Hairy Bush-Pea 0.6</em></td>
<td>0.4 0.80</td>
<td>2.424</td>
</tr>
<tr>
<td>Rice Flower <em>Poa labillardieri</em></td>
<td>0.4 0.80</td>
<td>2.424</td>
</tr>
</tbody>
</table>

*Note: Subject to final quantities / area check

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#### ST3N: Shale Plains Woodland Seeding - Trees

<table>
<thead>
<tr>
<th>Species</th>
<th>Area to be seeded (per m²)</th>
<th>Total (Kg) 12,808</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eucalyptus tereticornis</td>
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<td>16.000</td>
</tr>
<tr>
<td>Eucalyptus resinifera</td>
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<td>16.000</td>
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<tr>
<td>Eucalyptus robusta</td>
<td>0.8 1.60</td>
<td>16.000</td>
</tr>
<tr>
<td>Eucalyptus moluccana</td>
<td>0.8 1.60</td>
<td>16.000</td>
</tr>
<tr>
<td>Eucalyptus fibrosa</td>
<td>0.8 1.60</td>
<td>16.000</td>
</tr>
<tr>
<td>Corymbia maculata</td>
<td>0.8 1.60</td>
<td>16.000</td>
</tr>
<tr>
<td>Angophora floribunda</td>
<td>0.8 1.60</td>
<td>16.000</td>
</tr>
<tr>
<td>Allocasuarina torulosa</td>
<td>0.8 1.60</td>
<td>16.000</td>
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</tbody>
</table>

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#### ST3N: Shale Plains Woodland Seeding - Shrubs

<table>
<thead>
<tr>
<th>Species</th>
<th>Area to be seeded (per m²)</th>
<th>Total (Kg) 12,808</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leptospermum polygalifolium</td>
<td>0.8 1.60</td>
<td>16.000</td>
</tr>
<tr>
<td>Common Rush <em>Eragrostis leptostachya</em></td>
<td>0.8 1.60</td>
<td>16.000</td>
</tr>
<tr>
<td>Hedgehog Grass <em>Dichelachne micrantha</em></td>
<td>0.8 1.60</td>
<td>16.000</td>
</tr>
<tr>
<td>Windmill Grass <em>Chloris truncata</em></td>
<td>0.8 1.60</td>
<td>16.000</td>
</tr>
<tr>
<td>Capillipedium spicigerum <em>Scented Top Grass 0.5</em></td>
<td>0.8 1.60</td>
<td>16.000</td>
</tr>
</tbody>
</table>

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#### ST3N: Shale Plains Woodland Seeding - Groundcovers

<table>
<thead>
<tr>
<th>Species</th>
<th>Area to be seeded (per m²)</th>
<th>Total (Kg) 12,808</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Rush <em>Eragrostis leptostachya</em></td>
<td>0.8 1.60</td>
<td>16.000</td>
</tr>
<tr>
<td>Hedgehog Grass <em>Dichelachne micrantha</em></td>
<td>0.8 1.60</td>
<td>16.000</td>
</tr>
<tr>
<td>Windmill Grass <em>Chloris truncata</em></td>
<td>0.8 1.60</td>
<td>16.000</td>
</tr>
<tr>
<td>Capillipedium spicigerum <em>Scented Top Grass 0.5</em></td>
<td>0.8 1.60</td>
<td>16.000</td>
</tr>
</tbody>
</table>

---

*Note: Subject to final quantities / area check

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![Dense Cumberland Plain seeding will provide screening around the M4 Interchange](image-url)
Road furniture
A coordinated ‘family’ of high quality road furniture is proposed for the project including:
• Road lighting
• Bus shelters
• Shared path and footpath paving
• Handrails
• Property fences
• Wire rope safety barriers.

Introduction
The rationalising of existing utility services, generally to be relocated in a services zone beneath the shared path or footpath, and the introduction of new roadway lighting and roadway furniture will result in an attractive, safe and functional streetscape experience.

Principles
The guiding principles in the development of a suite of road furniture include:
• A coordinated overall ‘minimal’ design aesthetic
• Road furniture will be consistent in design aesthetic, and material and finishes, with other arterial road elements such as the M4 Interchange Bridge, noise walls, retaining walls, safety screens, lighting, safety barriers and signage
• Bus shelters will be consistent with Penrith City Council standards and suited to the climate
• A long life, sustainable design approach
• Road furniture and paving will be safe, functional and provide a high level of amenity to road users.

Lighting
• General road lighting will also be used to light the shared path / footpath.

Road lighting
Where existing street light poles are not reused, eg in local streets, The Northern Road alignment is lit by tapering galvanised steel ‘goose neck’ light poles with luminaires, located along the sides of the road, setback the required distance to satisfy clearzone requirements. Light pole footings are subsurface type. Refer to drawing TNR3N - DG - UD01 - 0601.

Lighting of local roads is assessed on a case-by-case basis and may involve minimal improvements to existing street lighting in order to achieve statutory lighting standards.

M4 bridge light pole
The central M4 bridge light pole is supported on the bridge parapet on the west and east sides, by a special bracket design, which has been developed.

Bus shelters
Nine bus shelters are provided along the upgrade alignment serving adjoining residential catchments, local shops, businesses and community destinations. The provision of dedicated bus lanes and new bus shelters, in conjunction with new shared pathways will significantly improve local access and user amenity, encouraging public transport use.

Bus shelters serve an important function including providing shade and...
protection from rain and wind for commuters. The bus shelter design is minimal and refined in design aesthetic, is visually open to maximise personal safety, and is low impact visually on the immediate environment – they incorporate minimal steel members and glass infill panels, and utilise a kit of parts approach, leading to a low maintenance design.

Seating is made of robust hardwood timber battens which provide an attractive and comfortable solution. A notice panel is incorporated fostering a sense of community.

Wherever possible the shared pathway is directed via the rear of the shelter for safety, to minimise conflict with pedestrian waiting areas. Standard Sydney Buses signage totems are incorporated in the bus stop design. Tactile indicators, including directional and warning types are provided to guide sight impaired persons to a safe place to embark. A wheelchair parking area is provided within the shelter.

Adequate street lighting is provided at shelters to maximise personal safety and access.
COMMUNITY NOTICE BOARD
2500mm CLEAR SHARED PATH HEIGHT
BENCH SEAT WITH HARDWOOD BATTONS
WHEEL CHAIR AREA
GLASS PANEL WEATHER SCREEN
REAR ROOF SECTION IS NOT INSTALLED WHEN BUS SHELTER IS ADJACENT TO A RETAINING WALL
GROUND LEVEL

Bus Shelter Detailed Drawings

TNR3N-DG-UD01-0605-C1

The Northern Road upgrade Glenmore Parkway, Glenmore Park to Jamison Road, South Penrith

SWTC Appendix 31 - Contractor's Urban and Landscape Design

Road furniture - Page 88
**Paths**

Shared paths, footpaths, pram ramps, and private driveways (unless otherwise agreed as part of property adjustment negotiations) are constructed of insitu-concrete with a broom finish.

**Handrails**

Handrails are required at the top of retaining walls for pedestrian and cyclist safety, adjacent to the shared path when the level change is greater than 0.25m with a verge of 2m or less or for any batters steeper than 3:1. RMS Type 1 handrails are used within the clearzone (refer Figure 32). Galvanised tubular steel (Monowills) type handrails as illustrated below are used outside of the clearzone. On the M4 Bridge abutment walls, tubular handrails are bolt fixed to the dish drain and pathway at the rear of the wall.

![Galvanised tubular steel handrail](image1.jpg)

**Residential fences**

At residential frontages in the north of the alignment, existing fences and garden walls will be reinstated on a 'like-for-like' basis, as part of property adjustment works. However, there are properties where no fence currently exists and a new fence will be required due to the new change in level. In locations where the height difference requires a fence, RMS Type 1 palisade fences will be used within the corridor clearzone. Beyond the clearzone, a black painted metal palisade fence will be installed, as illustrated in Figure 33.

![Standard road design drawing - type 1 Pedestrian Verge Fence (used within Clearzone) (Source: RMS)](image2.jpg)

![Black metal palisade fence (used in the north residential section outside of the Clearzone) (Source: bringfull.com)](image3.jpg)
This page has been intentionally left blank.
Noise barriers

Introduction
Noise mitigation is to be provided by noise walls and mounds designed to suit the particular situations along the route and the width available in the corridor.

Principles
The guiding principles in the development of the designs for these elements have been to:

- Moderate the visual impact of noise walls as much as possible
- Design noise walls to provide a subtle and consistent background for planting, and positively contribute to the corridor aesthetic experience.

Strategies
Strategies to ensure the successful application of the guiding principles have been to:

- Design new noise walls to be consistent with other project elements
- New noise walls will:
  - Be consistent along the length of the corridor
  - Be integrated with other project elements
  - Be simple, clean and elegant in form
  - Be recessive in the environment
  - Be elegantly detailed at transition zones between change of materials, grade and heights, terminations
  - Ensure adequate buffer planting / screening opportunities wherever possible in front and behind noise walls.

Using recessive colours for noise walls will reduce reflectivity and complement other design components along the upgrade. The noise walls have a special articulated pattern to give consistent aesthetic to the walls, from both road and neighbourhood sides. Structures and footings are generally concealed or integrated, and the walls adopt a smooth profile.

Aesthetic considerations
- Panel patterning allows walls and noise walls to read as a family of forms
- Noise wall patterning provides good shadow lines so that a consistent textured surface is achieved across the surface of the wall. This gives a cleaner and more contemporary appearance.

Mountain pattern
A feature noise wall panel design has been developed, inspired by the dramatic views from the alignment west to the Blue Mountains. The special feature patterning to the precast panels provides an abstract representation of the series of rolling hills and ridges that can be seen in the distance. Refer to Figure 36. Located at the foothills of the Blue Mountains, this unique design feature is inspired by the unique context to create a memorable patterning, assisting wayfinding and defining a unique ‘sense of place’.

Figure 34: View of Grose Valley, Blue Mountains (Source: Flickr user: Alpha)
**Noise wall patterning strategy**

The diagram below describes the overall urban design strategy for the type of finish used on the three noise walls on the project. The 'mountain' pattern is utilised in the most prominent locations, where landscape screening is not always possible and when residents in local streets overlook the wall. A small transparent section of wall ensures pedestrian safety is achieved at the pedestrian passage through the wall. The remaining sections of wall are simply finished panels, generally laid out in an overlapping arrangement, which conceals the columns and fixing ‘z’ clips.
Autoclaved aerated concrete noise wall - pattern A and B

Pattern A

Pattern B
Pattern C (Typical Noise Wall Termination)

Pattern A or B

End rib of pattern design
varies - minimum 300

Tolerance of the pattern
to allow for different panel lengths
varies (2800-3400)

Tolerance of the pattern
to allow for different panel lengths
varies (2800-3000)

Pattern A or B

TNR3N-DG-UD01-0712-C3

Typical post and AAC panel noise wall at termination

LEGEND

159 AutoClave Aerated Concrete panel, with routed pattern in areas indicated with paint finish as specified.

258.4C73 Support columns top cut at an angle to match top edge of the AAC panels.

03 Concrete bored pile to engineer's detail

Height specified in Appendix 30 - Contractors' Concept Design
The Northern Road upgrade Glenmore Parkway, Glenmore Park to Jamison Road, South Penrith

**SWTC Appendix 31 - Contractor's Urban and Landscape Design**

**713A** TYPICAL ELEVATION

- Scale 1:50

**713B** PLAN

- Scale 1:50

**713C** SECTION

- Scale 1:50

**713D** TYPICAL ELEVATION

- Scale 1:50

**LEGEND**

- Edge of Paveement
- G4 Guardrail
- Concrete bored pile
- Painted galv. steel UB column
- 150 AutoClave aerated concrete panel with single or double sided routed pattern in areas indicated with paint finish as specified.
- Fill gap with two part thixotropic epoxy resin to achieve wall curvature in plan.
- Concealed fixing Z clips

**AutoClaved aerated concrete noise wall - no pattern**

2.0 m landscape zone

**Details**

- 20/50
- 300-450

**Appendix 30 – Contractors Concept Design**
The Northern Road upgrade Glenmore Parkway, Glenmore Park to Jamison Road, South Penrith

SWTC Appendix 31 - Contractor's Urban and Landscape Design

5000
4250
4250
4250
4250
4250
5650
6000
150

TNR3N-DG-UD01-0714-C3

NOISE WALL - TERMINATION AT NOISE MOUND

LEGEND
01 NOISE MOUND
02 AUTOCLAVED AERATED CONCRETE PANEL WITH PAINT FINISH AS SPECIFIED
03 CONCRETE BORED PILE TO ENGINEER'S DETAIL
04 PAINTED GALV. STEEL UC COLUMN
05 CAST IN SITU CONCRETE PANELS AT BASE OF WALL

SCALE 1:100@A3

TYPICAL ELEVATION

PLAN

714A
714B

Autoclaved aerated concrete noise wall - termination

The Northern Road upgrade Glenmore Parkway, Glenmore Park to Jamison Road, South Penrith

(vii) Noise barriers- Page 97
Pedestrian access through the noise wall

LEGEND

1. 3m CLC SUPPORT COLUMN PAINTED FINISH TO MATCH CONCRETE PANELS
2. 1.5mm THICK AAC PANEL WALL WITH HAMMER ROUTED PATTERNING TO MOUNTAIN DESIGN THEME
3. TRANSPARENT NOISE WALL - ELEO OF WALL ELEMENTS TO MAINTAIN NOISE ATTENUATION
4. CARREAGION (MAX 7m AWAY FROM NOISE WALL)
5. HERB & GUTTER
6. VEGETATED BUFFER (SWTC - MIN 2m)
7. LANDSCAPE STRIP
8. STAINLESS STEEL TABULAR HAND RAIL TO RAMP
9. CEMENT STABILISED GRAVEL
10. SHARED PATH TRAFFIC SIGN
11. STAINLESS STEEL TABULAR HAND RAIL TO RAMP
12. CEMENT STABILISED GRAVEL
13. SHARED PATH TRAFFIC SIGN

TNR3N-DG-UD01-0750-C1
Pedestrian access through the noise wall

The Northern Road upgrade Glenmore Parkway, Glenmore Park to Jamison Road, South Penrith
PEDESTRIAN ACCESS THROUGH THE NOISE WALL

SCALE 1:100@A3

LEGEND

T-BEAMS TO SUPPORT TRANSPARENT PANELS

galvanised and painted steel T-beams to support transparent panels

TRANSPARENT NOISE WALL PANELS

150MM THICK AAC PANEL WITH FLUID FINISH

or 14MM PATTERNING TO MOUNTAIN DESIGN THEME

Pedestrian access through the noise wall
Noise wall - 3D visualisation
**Conclusion**

The success of The Northern Road upgrade project will be measured by the seamlessness of its integration and operation within the urban and landscape context.

The design for the project, as set out in this report, sustains and builds upon Roads and Maritime’s high level of design for contemporary road infrastructure, and establishes new benchmarks for the urban and landscape design of arterial roadways.

This design proposal is significant due to the following:

- A roadway narrative built around the user experience and a seamless integration with Penrith City, rural areas and the existing M4 Motorway
- A fully integrated multidisciplinary design team approach as embodied in this report, continuing through all phases of the project
- Urban and landscape design playing a key role in project design development and implementation of infrastructure projects
- A subtle and contemporary design approach to the project, acknowledging and enhancing the fine qualities of place, inspired by the attractive rural and suburban environment, at the foothills of the Blue Mountains.