# M5 Motorway Westbound Traffic Upgrade

M5WBU-AUR-NWW-UD-RPT-000001
Urban Design Concept

August 2022

NSW GOVERNMENT | Transport for NSW

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Bringing ideas to life

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# CONTENTS

*KI Studio acknowledges the traditional custodians of the land and pays respect to Elders past, present and future, and in particular the home of the Wangal people from where KI Studio operates.*
*We recognise Australian Aboriginal and Torres Strait Islander peoples' unique cultural and spiritual relationships to place and their rich contribution to society. We respect their holistic view of land, water and culture-as inter-related elements.*
*KI Studio's values are inspired by their culture, based on the premise upheld by Aboriginal people, that, if we care for Country, it will care for us.*

# 1 INTRODUCTION

## 1.1 BACKGROUND

The M5 Motorway currently operates as the key through-traffic arterial connection for south west Sydney. It is used by local and regional motorists, freight carriers and businesses, and supports economic and residential growth in the Western Sydney region. The section of the M5 Motorway between Moorebank Avenue and the Hume Highway (the proposal area) accommodates a variety of vehicle movements with high volumes of traffic.

Growth and development in the proposal area and south west Sydney has resulted in more vehicles using the M5 Motorway. This has resulted in traffic congestion for motorists travelling westbound on the M5 Motorway. The existing configuration of the Moorebank Avenue and Hume Highway intersections is a contributing factor for this congestion. The proposal location along the M5 Motorway provides access to industrial areas located on either side of the road corridor, including the Moorebank Logistics Park (MLP) at the southern end of Moorebank Avenue. Additionally, it is expected the M5 Motorway will serve as a major transit link connecting south west Sydney with the future Western Sydney International Airport and Western Sydney Parklands. This will increase vehicles movements and worsen the traffic congestion if traffic arrangements are not changed. The need for upgrades to this section of the M5 Motorway has been identified in several NSW and local government strategic plans and policies. This includes Future Transport Strategy 2056 (NSW Government, 2018). The proposal would contribute to 'supporting a strong economy' by improving the efficiency and safety of the M5 Motorway. It would also contribute to the 'safety and performance' outcome of this strategy as well as form part of the 'safe roads' component of the Road Safety Plan 2021 (a supporting plan of the Future Transport Strategy 2056), which is aimed at reducing fatalities on NSW roads by 30 percent by 2021 (Transport for NSW, 2018a).

## 1.2 PROPOSAL OBJECTIVES

The proposal objectives are to:

- Maximise efficiency of the higher order road network
- Provide efficient and reliable access between the Moorebank Logistics Park precinct and the State road network
- Support the M5 Motorway as the key through-traffic connection for south west Sydney
- Support the growth of and access to the Liverpool CBD through provision of an efficient arterial road access network
- Provide solutions that contribute to improved road safety outcomes
- Contribute to strategic land use outcomes including active transport and development of logistics facilities
- Incorporate necessary active transport measures to contribute to the improved performance of those modes.

## 1.3 KEY ELEMENTS

Transport for NSW proposes to upgrade the M5 Motorway westbound between Moorebank Avenue, Moorebank and the Hume Highway, Casula. The proposal would ease congestion by improving connectivity between the M5 Motorway and the Hume Highway.

The proposal comprises the following elements:

- A new two-lane westbound M5 Motorway exit for Hume Highway traffic, located about 1.5 kilometres east of the existing Hume Highway exit. This exit ramp would include:
  - A grade separated underpass beneath Moorebank Avenue
  - A two-lane 290 metre long bridge over the Georges River, Southern Sydney Freight Line, and the T2 Inner West & Leppington and T5 Cumberland rail lines
- Removal of the current M5 Motorway westbound Hume Highway exit
- Upgrade of the M5 Motorway intersection with Moorebank Avenue to cater for future traffic demand
- Upgrade of the Moorebank Avenue westbound entry ramp maintaining access to the M5 Motorway and Hume Highway
- A new shared path on the southern side of the new Hume Highway exit ramp from Moorebank Avenue, across the Georges River on the new bridge and connecting to the Hume Highway and Lakewood Crescent
- Installation of new drainage infrastructure including:
  - Kerb and gutters, pits and pipes
  - Installation of a new operational spill basin under the new bridge, east of the Georges River
  - Removal of the existing spill basin near Yulong Close, Moorebank
- Intelligent Transport Systems (ITS) including installation and adjustments to traffic/SCATS detection, CCTV, a web camera, an emergency breakdown telephone and stopping bay, variable message signs (VMS) and backbone conduit
- Ancillary work associated with the proposal including:
  - Relocating, adjusting or protecting existing utility services that are in conflict with the proposal
  - Installation of new street lighting and various road furniture
  - Delineation including signage, line-marking and other items to facilitate road user safety of the new infrastructure
  - Landscaping
  - Property adjustments where necessary.
  - Construction is expected to take about 40 months to complete, assuming no unforeseen disruptions. Construction would be staged to minimise disruptions to transport customers and the community. There would be six construction areas across the proposal, with construction stages occurring concurrently to reduce construction time.

## 1.4 STRUCTURE OF THE REPORT

This report is structured as follows:

Chapter 1: Introduction & background
Chapter 2: Contextual analysis, a succinct description of the study area. Identification of landscape character zones.
Chapter 3: Urban design objectives & principles
Chapter 4: Preliminary landscape and visual assessment
Chapter 5: Urban Design Concept Plan
Chapter 6: LCA/VIA

## 1.5 PURPOSE OF THIS REPORT

To support the project objectives, the urban design concept design and VIA/LCA has been developed in line with the brief to:

*(i) To develop and present an integrated engineering and urban design outcome that:*
*a. Fits sensitively into the built, natural and community environments through which it passes, is well designed and contributes to the character and functioning of the area.*
*b. Contributes to the accessibility and connectivity of people within regions and communities.*
*c. Contributes to the overall quality of the public domain for the community and all road users.*

*(ii) To carry out a succinct landscape character and visual impact assessment, the results of which are iteratively fed into the concept development process and environmental assessment.*

*(iii) To develop concept urban design drawings and report for the project (including but not limited to input on the concept drawings for the overall proposal and detailed for bridges, walls, other structures and landscape works).*

## 1.6 REFERENCE DOCUMENTS

Key documents used for development of this Urban Design, LCA and VIA report include the following:

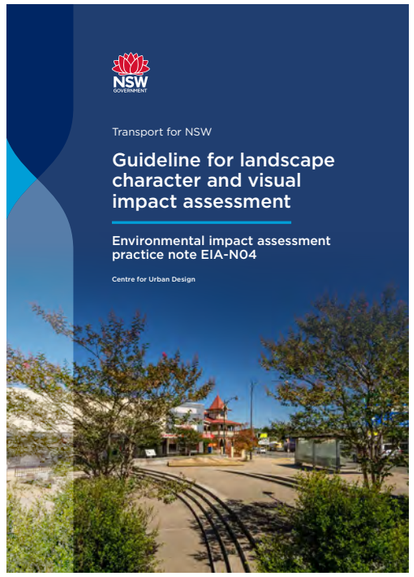
**A. Transport for NSW design Guidelines:**

- 'Beyond the Pavement – Urban design policy, procedures and design principles', Roads and Maritime Services, updated August 2020
- 'Bridge Aesthetics – Design guideline to improve the appearance of bridges in NSW', Centre for Urban Design,February 2019
- 'Noise Wall Design Guideline – Design Guideline to improve the appearance of noise walls in NSW', Roads and Maritime, March 2021
- 'Landscape design guideline- Design guideline to improve the quality, safety and cost effectiveness of green infrastructure in road corridors,' Roads and Maritime, December 2018
- 'Guideline for landscape character and visual impact assessment No. EIA-N04', Version 2.2 Issue Date August 2020
- "Water sensitive urban design guideline- Applying water sensitive urban design principles to NSW transport projects,' March 2016
- Reconciliation Action Plan 2019-2021

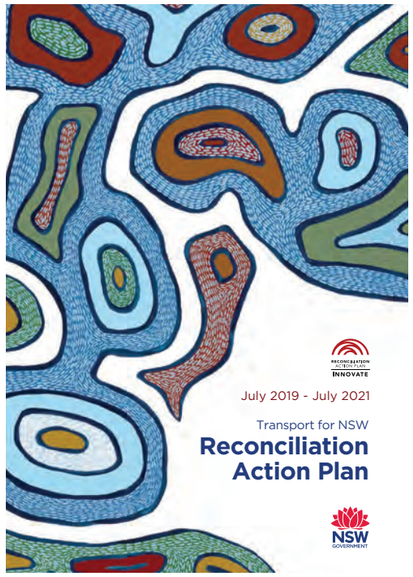
**B. the following NSW government policies :**

- Greening our Cities policy – https://www.dpie.nsw.gov.au/premiers-priorities/greening-our-city
- 5 Million trees for greater Sydney – https://www.planning.nsw.gov.au/Policy-and-Legislation/Open-space-and-parklands/5-million-trees
- Western Sydney District Plan (GSC) – https://www.greater.sydney/western-city-district-plan
- Sydney Green Grid (Govt architect) – https://www.governmentarchitect.nsw.gov.au/projects/sydney-green-grid


Transport for NSW
Beyond the Pavement
2020
Urban design approach and procedures for road and maritime infrastructure planning, design and construction
Centre for Urban Design
NSW GOVERNMENT


NSW GOVERNMENT
Transport for NSW
Guideline for landscape character and visual impact assessment
Environmental impact assessment practice note EIA-N04
Centre for Urban Design


Landscape design guideline
Design guideline to improve the quality, safety and cost effectiveness of green infrastructure in road corridors
Roads and Maritime Services | December 2018
NSW GOVERNMENT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Reconciliation Action Plan
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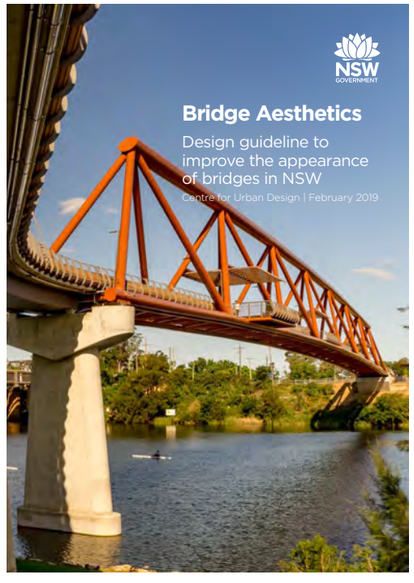
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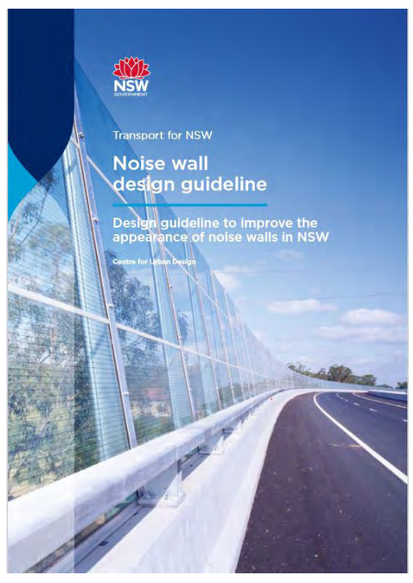
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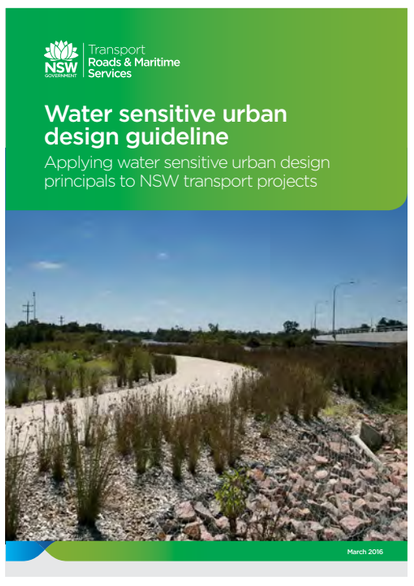
Transport for NSW
Noise wall design guideline
Design guideline to improve the appearance of noise walls in NSW
Centre for Urban Design


NSW GOVERNMENT
Transport
Roads & Maritime
Services
Water sensitive urban design guideline
Applying water sensitive urban design principals to NSW transport projects
March 2016

## 1.7 STUDY AREA

The adjacent plan illustrates the general study area for the landscape character and visual impact assessment.

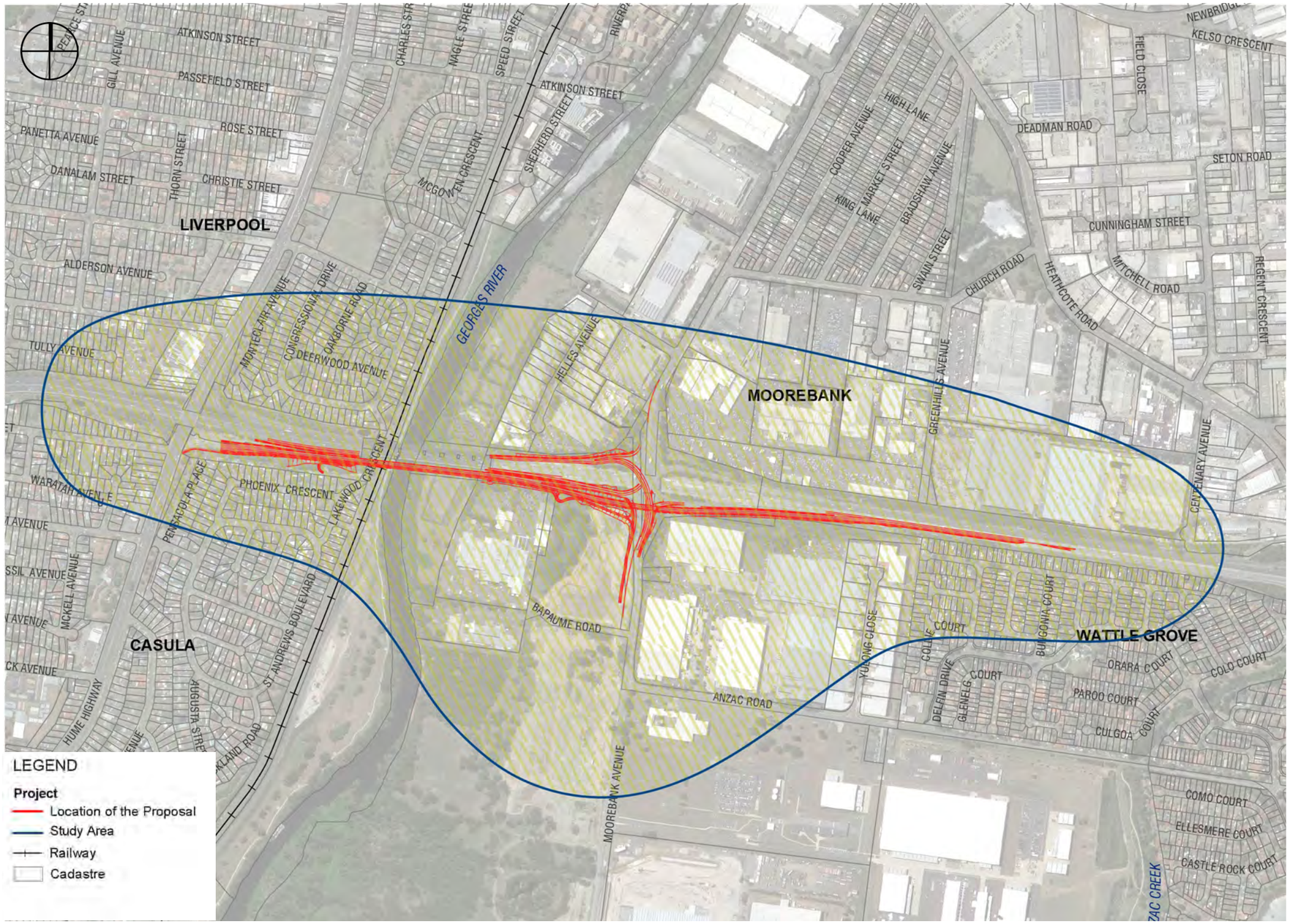



*Figure 2.1 Study Area . Source: PEI Hume Highway West facing Ramps, M5 Motorway, Hume Highway to Moorebank Avenue, 2015*

# 2 CONTEXTUAL ANALYSIS

## 2.1 REGIONAL CONTEXT

The study area is located in the Liverpool Local Government Area (LGA), approximately 30 kilometres south-west of the Sydney central business district. Land use in the study area features a mix of residential, commercial and industrial uses.

The M5 Motorway is a multi-lane dual carriageway road and a major transport route. The verges within the study area include pockets of bush land. This bushland offers opportunities in terms of visual screening, but also constraints in terms of mitigating environmental impacts.

An important waterway, the Georges River, crosses the study area, making it a key natural feature interfacing the proposal.

## 2.2 DESCRIPTION OF THE STUDY AREA

To the east of the Georges River land use is predominantly industrial with the Moorebank Business Park and Greenhills Industrial Estate on either side of the M5 Motorway. To the south east is the residential area of Wattle Grove. The Georges River in this location has a vegetated foreshore with Helles Park to the north and Rifle Range Park to the south. The Main South Railway Line runs along the western side of the river in this location.

To the west of the Georges River are the residential areas of Casula to the south and Liverpool to the north and west. Along the Hume Highway is a mix of industrial and commercial land uses such as car dealerships and other similar enterprises.

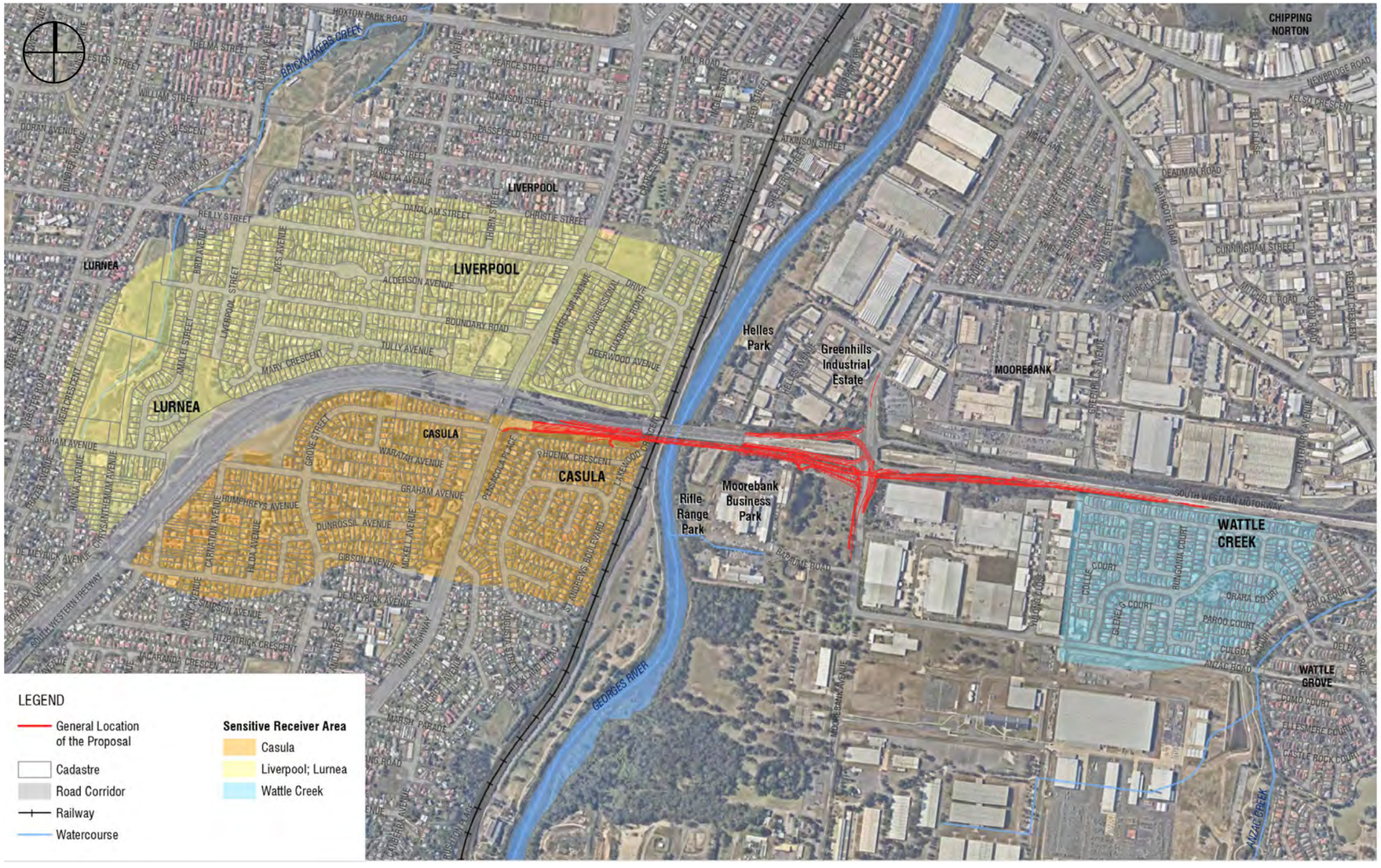



*Figure 2.2 Study Area with sensitive receiver areas . Source: PEI Hume Highway West facing Ramps, M5 Motorway, Hume Highway to Moorebank Avenue, 2015*

## 2.3 PLANNING CONTEXT

The Greater Sydney Commission released the updated Greater Sydney Region Plan: A Metropolis of three cities – connecting people (GSRP) in June 2018. The GSRP highlights the opportunities, challenges and vision for each of the three cities; this proposal site within Liverpool, sits within the Western Parkland City. As a place of emergence and growth, the Western Parkland City is acknowledged as a place that would require new infrastructure as well as supporting infrastructure to enable the shaping of a connected city (GSC, 2018). The GSRP discusses the need to manage interfaces of industrial areas, trade gateways and intermodal facilities through the enhancement and development of new road and rail connections in the Western Parkland City (GSRP, 2018).

The proposal would promote the objectives of the GSRP to upgrade infrastructure to support the growth and accessibility of the Liverpool CBD. The proposal would also provide efficient and reliable access between the MLP and the road network, through provision of a new exit ramp and upgrades at Moorebank Avenue.

### Western City District Plan

To achieve the vision for the Greater Sydney Regional Plan (GSRP), the Greater Sydney Commission developed district plans to connect the outcomes between regional and local planning. The Western City District Plan is a 20-year plan that focuses on the Western Parkland City, incorporating

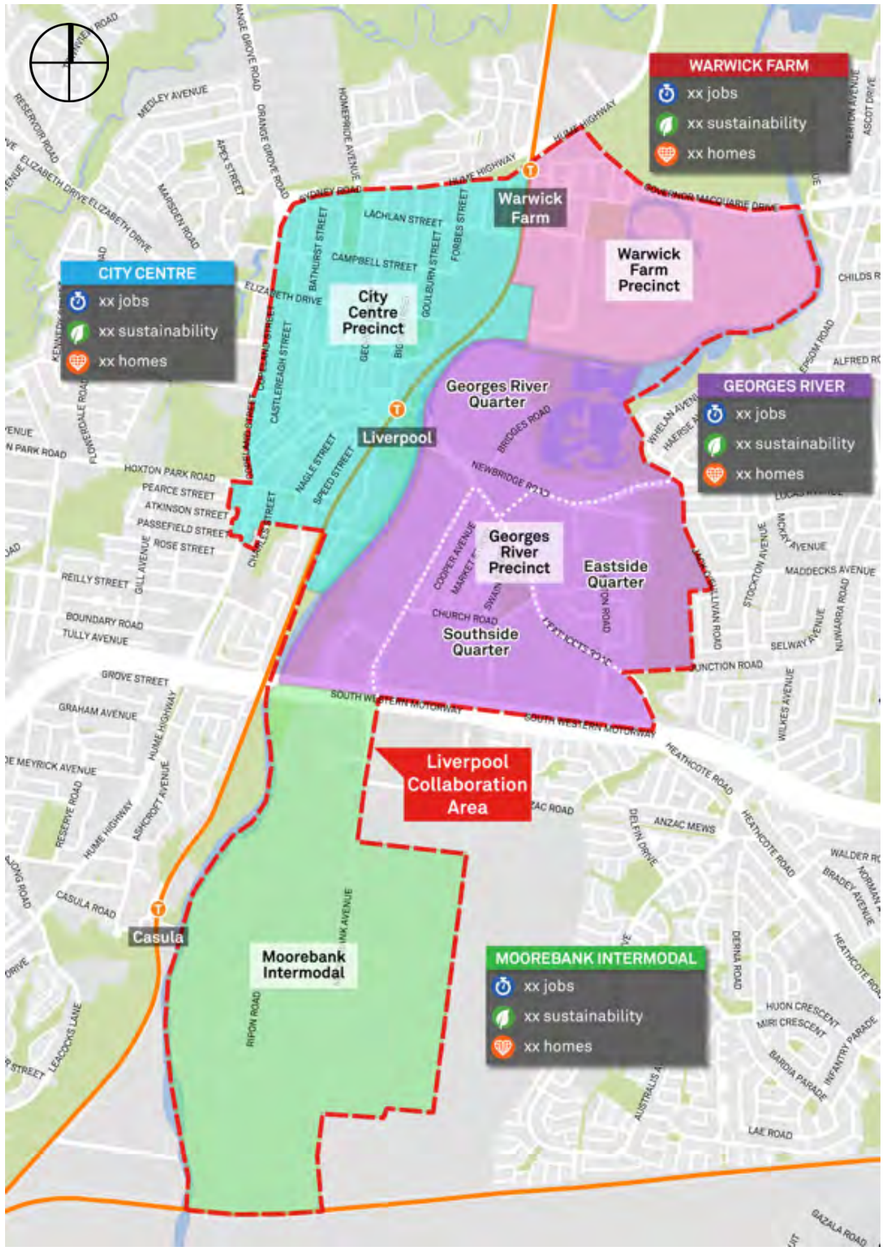



*Figure 2.3 Liverpool Collaboration Area and Sub-Precincts (Source: Draft Western District Plan - Date of Lodgment: 15 Dec 2017 - Mecone)*

local strategies and policies. In planning for the Western Parkland City, initiatives have been identified to support land use and infrastructure planning. The Western City District Plan highlights the key planning priorities of the GSRP relevant to the Western Parkland City particularly in regard to infrastructure and collaboration, liveability and productivity.

The proposal corresponds with the key planning priorities, specifically the need for a balanced approach to freight planning. The balanced approach aims to minimise potential adverse impacts whilst supporting the efficient movement of freight to terminals such as the Moorebank Logistics Park (Transport for NSW, 2018b). As the Western City District develops, opportunities to improve freight network efficiencies and linking important freight precincts is also discussed in the Western City District Plan. The proposal aligns with the planning priorities identified in the plan as the upgrade of the M5 Motorway would aim to maximise efficiency and provide reliable access to the MLP whilst supporting growth.

### Greater Sydney Greening our Cities Policy

This policy regarding the need to increase trees and tree canopy has been addressed within this concept plan.

## 2.4 NETWORK CONTEXT

### Key Arterial Roads

The M5 Motorway is a major transport route in Sydney and is part of the Sydney Orbital Network. Its interface with the Sydney Airport and Port Botany makes it a high demand haulage route.

The Hume Highway and the M5 Motorway are major state roads with high traffic volumes. The intersection of the Hume and M5 is part of a major freight route in south west Sydney.

Moorebank Avenue provides an important connectivity between the various industrial estates and the M5 Motorway.

### Pedestrians and Cyclists

Pedestrian activity in the general study area is limited as the general area is strongly car/truck dominated. Pedestrian activity would be highest along the Hume Highway corridor and Moorebank Avenue, in the vicinity of bus stops.

There is an existing on road cycleway along the M5 Motorway and along the western foreshore of the Georges River.

### Public Transport

There is limited public transport in the area with bus services along Moorebank Avenue and the Hume Highway. In addition, the Liverpool and Casula railway stations are both approximately 1.4 km from the Proposal.

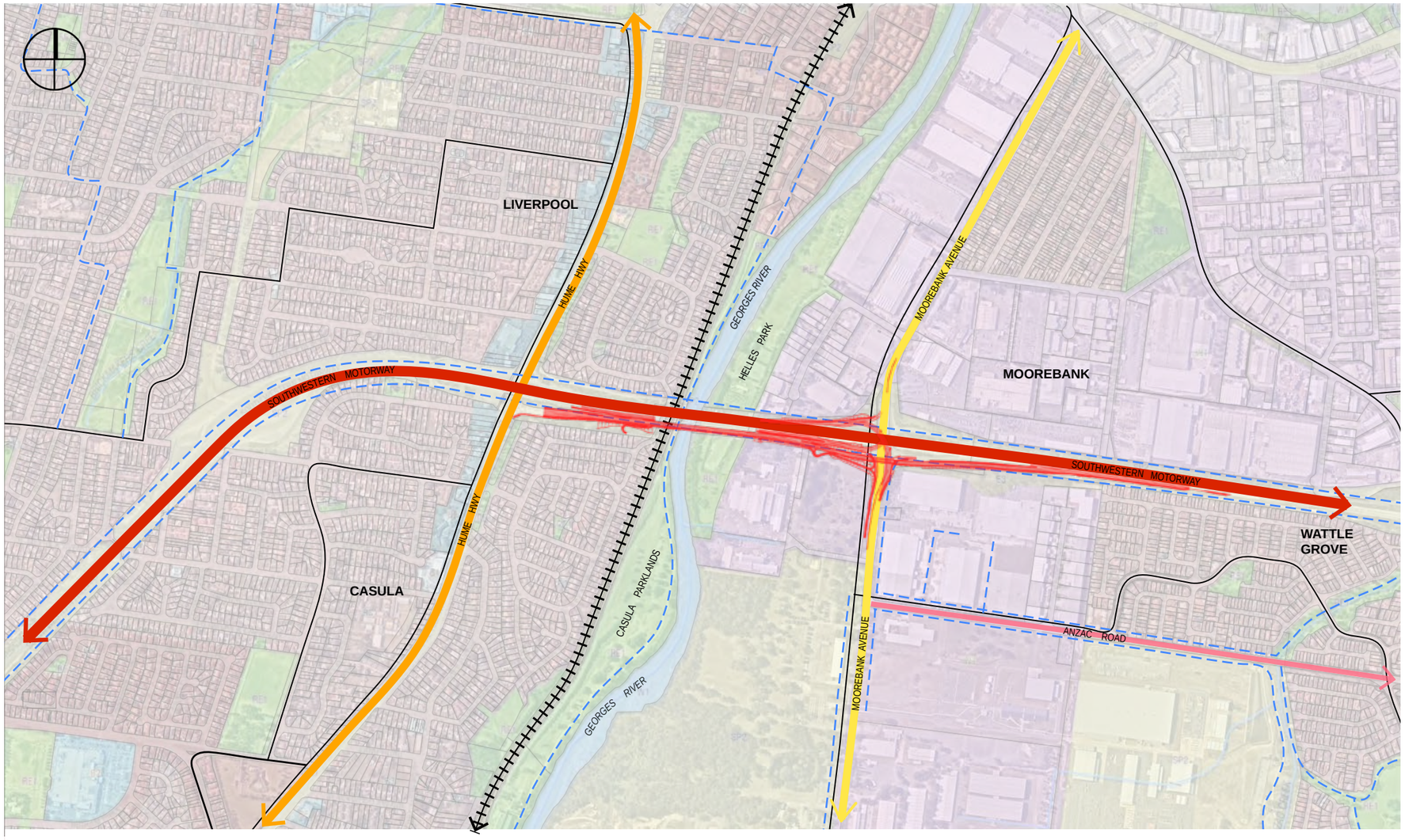



*Figure 2.4 Network Context- KI Studio*

## 2.5 HERITAGE

### Aboriginal History of the Area

The study area was important to the Darug, Tharawal and Gandagara people due to its proximity to Georges River. The land was known as Gunyungalgung to them. The river was a vital corridor for transport, movement, interaction and exchange.

Two Aboriginal sites are registered on the Aboriginal Heritage Information Management System database. One site is MA PAD 1 (AHIMS #45-5-4280), adjacent to the proposal area, located south of the motorway corridor and west of Moorebank Avenue. The latest Heritage Draft Report by Navin Officer Heritage Consultants, 2021, confirms that this site was *"completely destroyed following authorised impacts." Therefore, this site no longer comprises a constraint on the project, and the AHIMS site record has been updated to reflect that the site has been destroyed."*

The second site*, Aboriginal site 45-5-4281 (MA PAD2) overlaps the southwest project area. A PACHCI Stage 2 site inspection concluded that impact to this site could be avoided. It is recommended that temporary fencing is erected to protect the site during construction and that the site's location and significance is identified in the project CEMP. Taking into account the disturbance from past land use, including the salvage and subsequent destruction of 45-5-4280, the capacity to fence and protect 45-5-4821 from inadvertent damage the potential for in situ Aboriginal objects and/or deposits associated with Aboriginal occupation to be present in the proposal area is considered to be low.**

* For further information refer to the *M5 Motorway WestboundTraffic Upgrade, Moorebank Aboriginal and Non-Aboriginal Heritage Impact Assessment (incorporating a Stage 2 PACHCI archaeological assessment) August, 2022*


*Figure 2.5 Aboriginal Heritage Map illustrating Aboriginal heritage area adjacent to the proposal. Source: PEI Hume Highway West facing Ramps, M5 Motorway, Hume Highway to Moorebank Avenue, 2015*

## Non Aboriginal History of the Area

The following heritage items and sites have been identified in the heritage report (*M5 Motorway WestboundTraffic Upgrade, Moorebank Aboriginal and Non-Aboriginal Heritage Impact Assessment)* prepared by Navin Officer, August ,2022. Refer to this report for further information. The items situated within, or partly within the proposal area include:

**Built heritage:**

- Kitchener House (formerly Arpafeelie) (Item #58), listed on Schedule 5 of the Liverpool LEP 2008,is partly with the proposal area,yet beyond the construction footprint.
- The“Yulong” playing field entrance gates (former), whilst not listed on any statutory heritage lists or registers, do meet the criteria for local heritage significance.The gates are beyond the proposed construction footrpint.
- The railway viaduct on Woodbrook Road (item 12,Liverpoot LEP 2008) is within the project area but will not be directly impacted by the proposal.

**Historical archaeology**

- The occupation of Kitchener House has resulted in medium potential for the front yard to contain intact archaeological remains yet they do not meet the threshold to be called “relics”. *
- Surviving historical archaeological remains, if present, are likely to relate to former earthworks (training or practice trenches) to the west of Moorebank Avenue, associated with the military occupation and use of the area in the late 19th and early 20th Century.
- There is low potential for historical archaeological remains within the project area. Potential archaeological remains associated with the Liverpool Camp and military occupation of the area would be of local, and potentially State, significance.

** M5 Motorway WestboundTraffic Upgrade, Moorebank Aboriginal and Non-Aboriginal Heritage Impact Assessment (incorporating a Stage 2 PACHCI archaeological assessment) August, 2022*

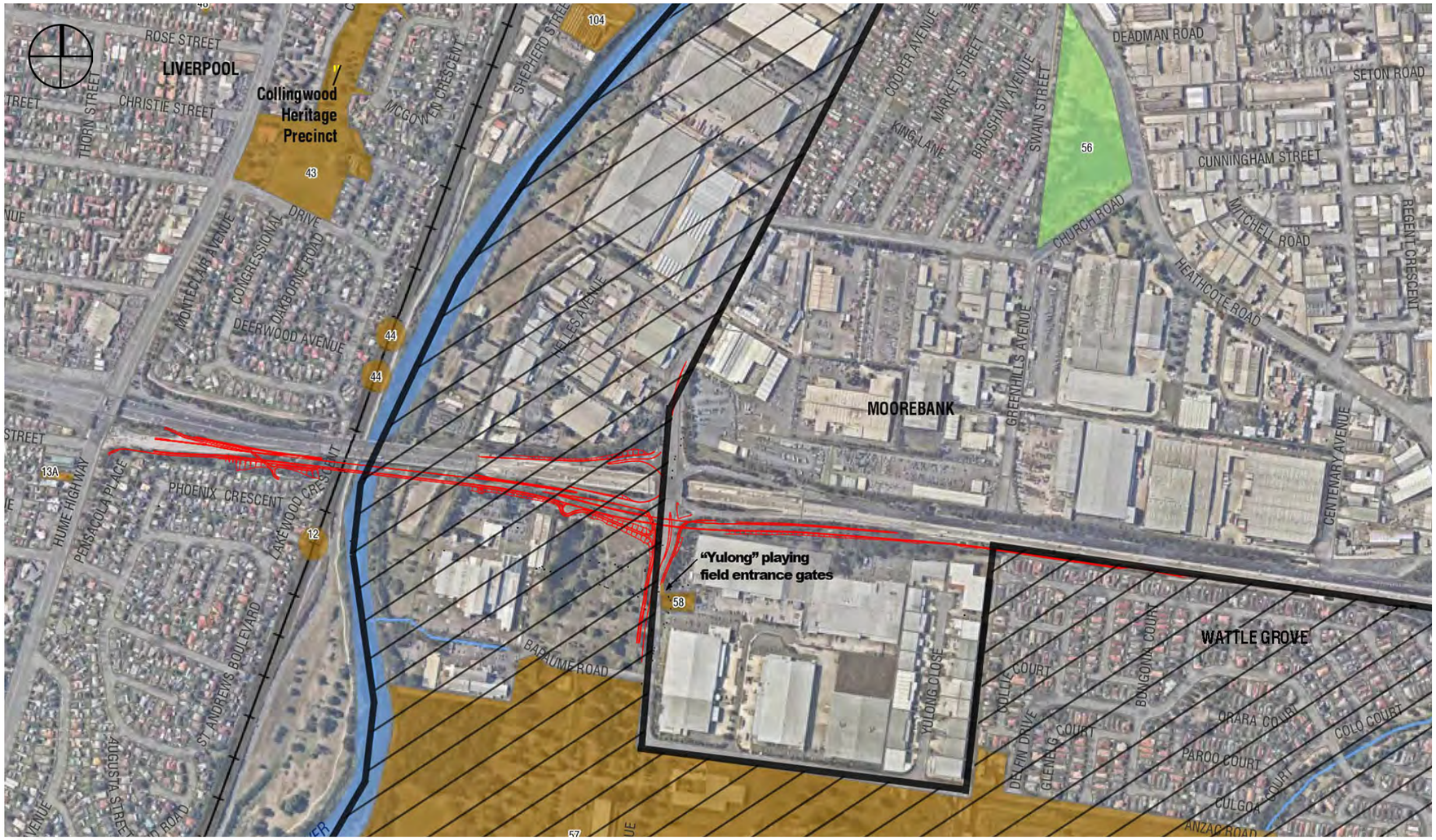



*Figure 2.6 Non Aboriginal Heritage Map. Source: Excerpt from Non Aboriginal Heritage map, PEI Hume Highway West facing Ramps, M5 Motorway, Hume Highway to Moorebank Avenue, 2015*

## 2.6 LANDFORM AND HYDROLOGY

The majority of the site falls within the 1:100 flood zone as indicated in figure 2.7, relating to the presence of the Georges River.

The intersection of M5 and Moorebank Avenue sits on a high knoll, framed by existing trees at present. The land falls away in all directions from the intersection.

To the south, the land falls to the floodplain where large industrial warehouses sit.  East and west the M5 follows a ridgeline, cut in on both sides with more cut to the north west sections where the noise wall sits atop the cutting.

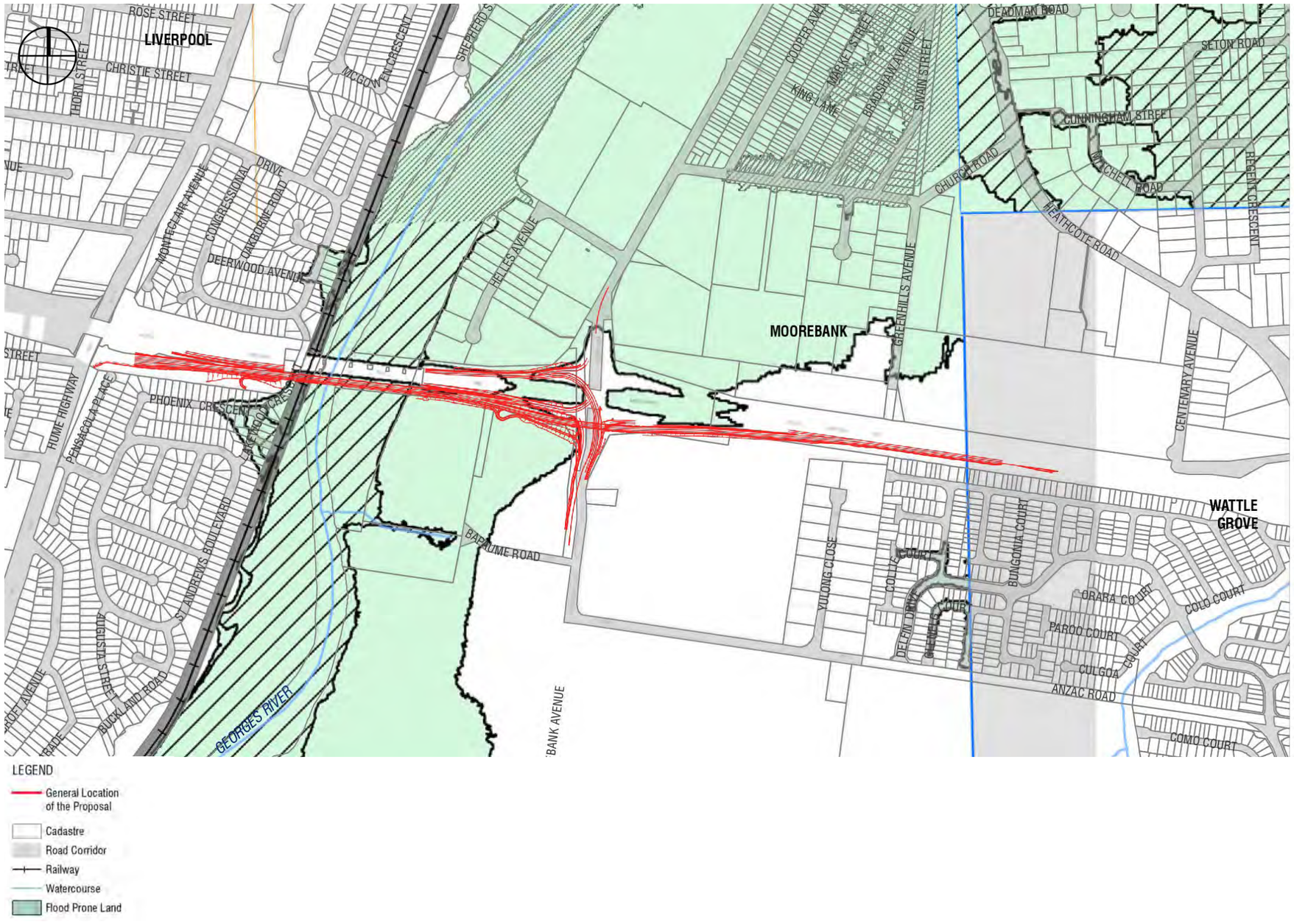



*Figure 2.7 Excerpt Source: Flood Prone Land Map, PEI Hume Highway West facing Ramps, M5 Motorway, Hume Highway to Moorebank Avenue*

## 2.7 VEGETATION

Vegetative screening and framing to the existing M5 includes threatened ecological communities, various plant community types as listed below and planted native trees and shrubs.

### 2.7.1 Threatened Ecological Communities

As illustrated in the updated report by Niche Environment & Heritage, 2022, there are two threatened vegetation communities (TEC) within the proposed impact area of the study area, as shown on Figure 2.9:

- Cumberland Plain Woodland in the Sydney Basin Bioregion
- River-Flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregion

Additional vegetation survey and reporting was done by Niche in 2021,with additional, more detailed PCT information.

*Figure 2.8 River-flat Eucalypt Forest along the southern verge in vicinity of chainage 325-625, with nursery tree and regeneration. Disturbance to these areas should be minimised. Source: KI Studio*

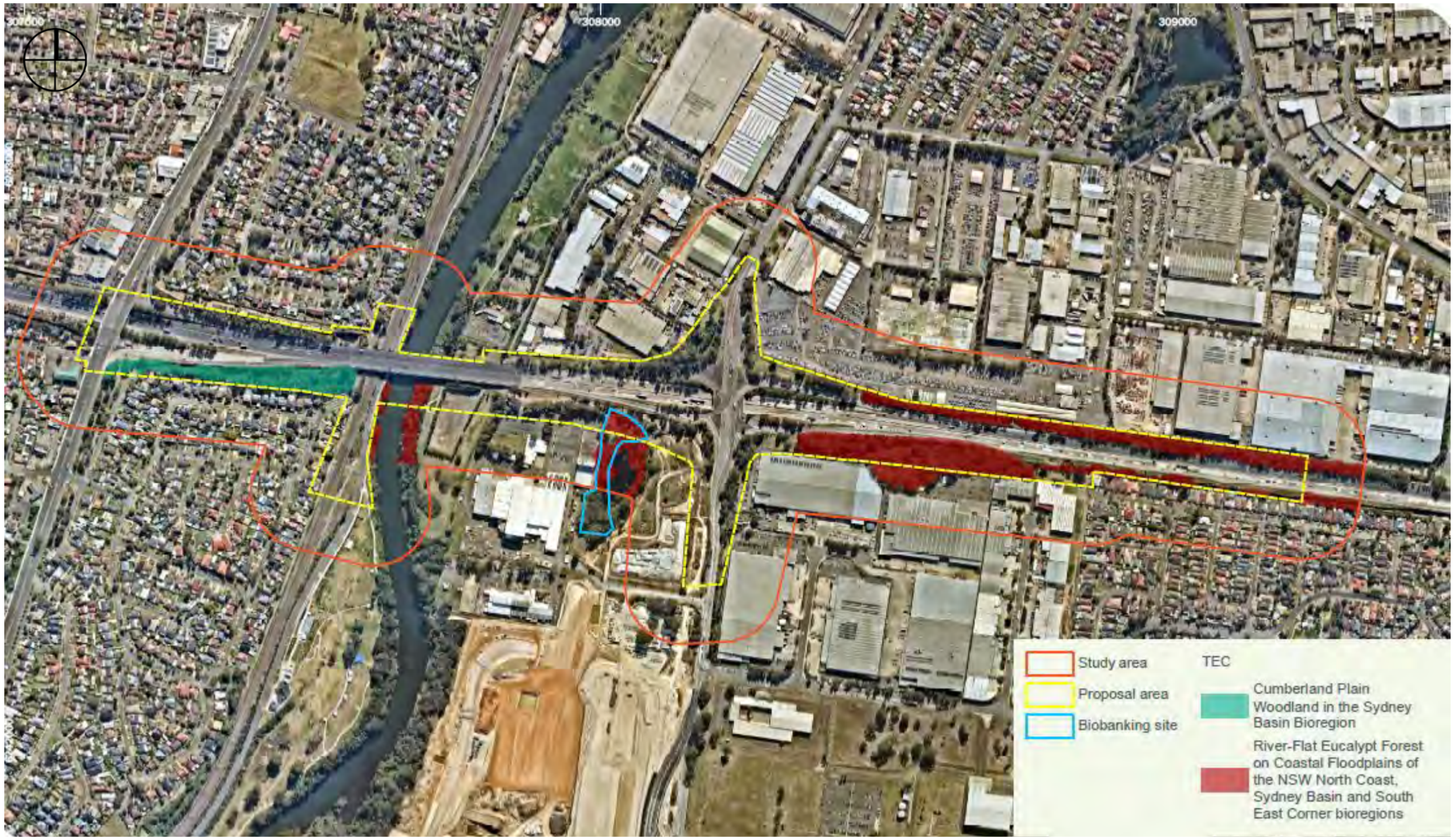



*Figure 2.9 Threatened Ecological Communities, source: Niche M5 Upgrade Report revision, 2022*

## 2.7.2 Plant Community Types

Within the revised Niche Biodiversity Report, 2022, various PCTs are identified within the study area as shown in Figure 2.10, below:

PCT 835- Cumberland Riverflat Forest

PCT 849- Cumberland Shale Plains Woodland

PCT 941- Hinterland Riverflat Eucalypt Forest

The following information has been extracted from the M5 Upgrade Report revision, 2022 by Niche Environment & Heritage

### Cumberland Riverflat Forest (PCT 835)

Forest Red-Gum-Rough barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion.

The BioNet Vegetation Classification describes the Cumberland Riverflat Forest as an open Eucalypt forest located on the alluvial flats along the Hawkesbury, Nepean and Georges River systems, including smaller areas alongside the smaller water bodies that drain the Cumberland Plain. The canopy species often consist of Rough-barked Apple (*Angophora floribunda*) or Broad-leaved Apple (*A. subvelutina*), as well as the presence of one or both of Forest Red Gum (*Eucalyptus tereticornis*) and Cabbage Gum (*E. amplifolia*). Beneath this consists of a sparse to open tree understorey, which includes Paperbark species (Melaleuca spp.) and Wattles (Acacia spp.).

The ground layer has a high cover of grasses, small herbs and some ferns. A sparse lower shrub layer features Blackthorn (*Bursaria spinosa*) at most sites. The ground layer is characterised by an abundant cover of grasses with small herbs and ferns.


*Figure 2.10 PCT mapping study area, source: Niche M5 Upgrade Report revision, 2022*

As noted in the table excerpt below, there are alot of exotic plants and weeds (e.g. lantana) that will all need to be removed within this plant community on site.

| Growth form | Typical species |
|---|---|
| Trees | Forest Red Gum (*Eucalyptus tereticornis*), *Melaleuca* spp. |
| Shrubs | Hickory Wattle (*Acacia falcata*), Parramatta Wattle (*Acacia parramattensis*), Black wattle (*Acacia decurrens*), Coast Myall (*Acacia binervia*), Native Blackthorn (*Bursaria spinosa*) |
| Grass and grass-like | Nil |
| Forb | Whiteroot (*Pratia purpurascens*), Trailing Speedwell (*Veronica plebeian*) |
| Fern | Nil |
| Other | Nil |
| Exotic | Bromus (*Bromus* spp.), Kikuyu (*Cenchrus clandestinus*), Paddy's Lucerne (*Sida rhombifolia*), Lamb's Tongues (*Plantago lanceolata*), Catsear (*Hypochaeris radicata*), *Digitaria aequiglumis*, Fireweed (*Senecio madagascariensis*), Common Sowthistle (*Sonchus oleraceus*) |
| High Threat Exotic | Lantana (*Lantana camara*), Olive (*Olea europaea*), Cobblers Pegs (*Bidens Pilosa*), Bridal Creeper (*Asparagus asparagoides*), Panic Veldtgrass (*Ehrharta erecta*), Small-leaved Privet (*Ligustrum sinense*), African Lovegrass (*Eragrostis curvula*), Asparagus Fern (*Asparagus aethiopicus*) |

*Figure 2.11 Cumberland River-flat Forest PCT 835, Source: Biodiversity Assessment Report M5 Upgrade, report revision, Niche, 2022*

## Cumberland Shale Plains Woodland (PCT 849)

Grey-Box-Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion

The BioNet Vegetation Classification Database describes this PCT, commonly known as the Cumberland shale plains woodland, as an open grassy woodland dominated by Grey Box *(Eucalyptus moluccana*), Forest Red Gum (*E. tereticornis)* and Ironbark *(E. crebra or fibrosa*). Localised patches of Spotted Gum (*Corymbia maculata*) are also known to occur. the loss of some species over time.

| Growth form | Typical species |
|---|---|
| Trees | Grey Box (*Eucalyptus moluccana*), Spotted Gum (*Corymbia Maculata*), Beyer's Ironbark (*Eucalyptus beyeriana*), Parramatta Wattle (*Acacia parramattensis*) |
| Shrubs | Needlebush (*Hakea sericea*) |
| Grass and grass-like | Speargrass (*Austrostipa scabra*), Carex spp., Poa spp., Native Couch Grass (*Cynodon dactylon*), Kangaroo Grass (*Themeda australis*) |
| Forb | Kidney Weed (*Dichondra repens*), *Asperula* spp., *Dianella* spp. |
| Fern | Nil |
| Other | Nil |
| Exotic | Nil |
| High Threat Exotic | Nil |

*Figure 2.12 Shale Plains Woodland PCT 849, Source: Biodiversity Assessment Report M5 Upgrade, report revision, Niche, 2022*

## Hinterland River-flat Eucalypt Forest (PCT 941)

The Hinterland riverflat eucalypt forest is a tall open eucalypt forest with a scattered mesic shrub layer and a grassy and herbaceous ground cover. It predominantly occurs along the sandy riverbanks of the Georges River and its tributaries. It is dominated by both Bangalay (*Eucalyptus botryoides)* and its hybrid with Sydney Blue Gum (*Eucalyptus botryoides saligna*) and at its tallest may reach over 35 metres in height. On the site *E. racemosa* (Narrow-leaved Scribbly Gum) dominates the upper canopy.

| Growth form | Typical species |
|---|---|
| Trees | Parramatta Wattle (*Acacia parramattensis*), Rough-barked Apple (*Angophora floribunda*) |
| Shrubs | Black wattle (*Acacia decurrens*), Coast Myall (*Acacia binervia*), White Sally (*Acacia floribunda*), Hickory Wattle (*Acacia implexa*), White Wattle (*Acacia linifolia*) |
| Grass and grass-like | Spiny-headed Mat Rush (*Lomandra longifolia*), *Poa* spp |
| Forb | NIL |
| Fern | Bracken Fern (*Pteridium esculentum*) |
| Other | NIL |
| Exotic | Paddy's Lucerne (*Sida rhombifolia*), Lamb's Tongues (*Plantago lanceolata*), Catsear (*Hypochaeris radicata*), *Digitaria aequiglumis* |
| High Threat Exotic | Mickey Mouse Plant (*Ochna serrulate*), Camphor laurel (*Cinnamomum camphora*), Cobblers Pegs (*Bidens Pilosa*), Lantana (*Lantana camara*), Olive (*Olea europaea*), African Lovegrass (*Eragrostis curvula*), Panic Veldtgrass (*Ehrharta erecta*), Moth Vine (*Araujia sericifera*), Rhodes Grass (*Chloris gayana*) |

*Figure 2.13 Hinterland River-flat Eucalypt Forest PCT 941, Source: Biodiversity Assessment Report M5 Upgrade, report revision, Niche, 2022*

## 2.8 LAND USE & CONNECTIVITY

The proposal interfaces with a variety of land uses with the predominant being General Industrial. To the west, a large pocket of Low Density Residential defines the land use to either side of the M5 corridor.

The Georges River is defined by Public Recreation along its foreshores. The Main South Railway Line is identified as Infrastructure and creates a divide between the foreshore and the residential areas to the west.

The M5 corridor and the Hume Highway are both identified as SP2 Infrastructure. The variety of land use requires a different response to the various areas. The river foreshore and the residential areas being considered the most sensitive.

Land within the study area on either side of the Georges River is classified as Environmentally Significant Land (refer figure 2.6) under the Liverpool LEP

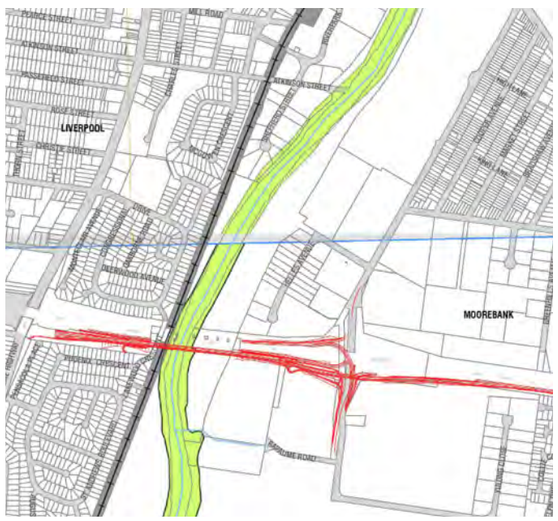



*Figure 2.14 Excerpt Source: Environmentally Significant Land, PEI Hume Highway West facing Ramps, M5 Motorway, Hume Highway to Moorebank Avenue*

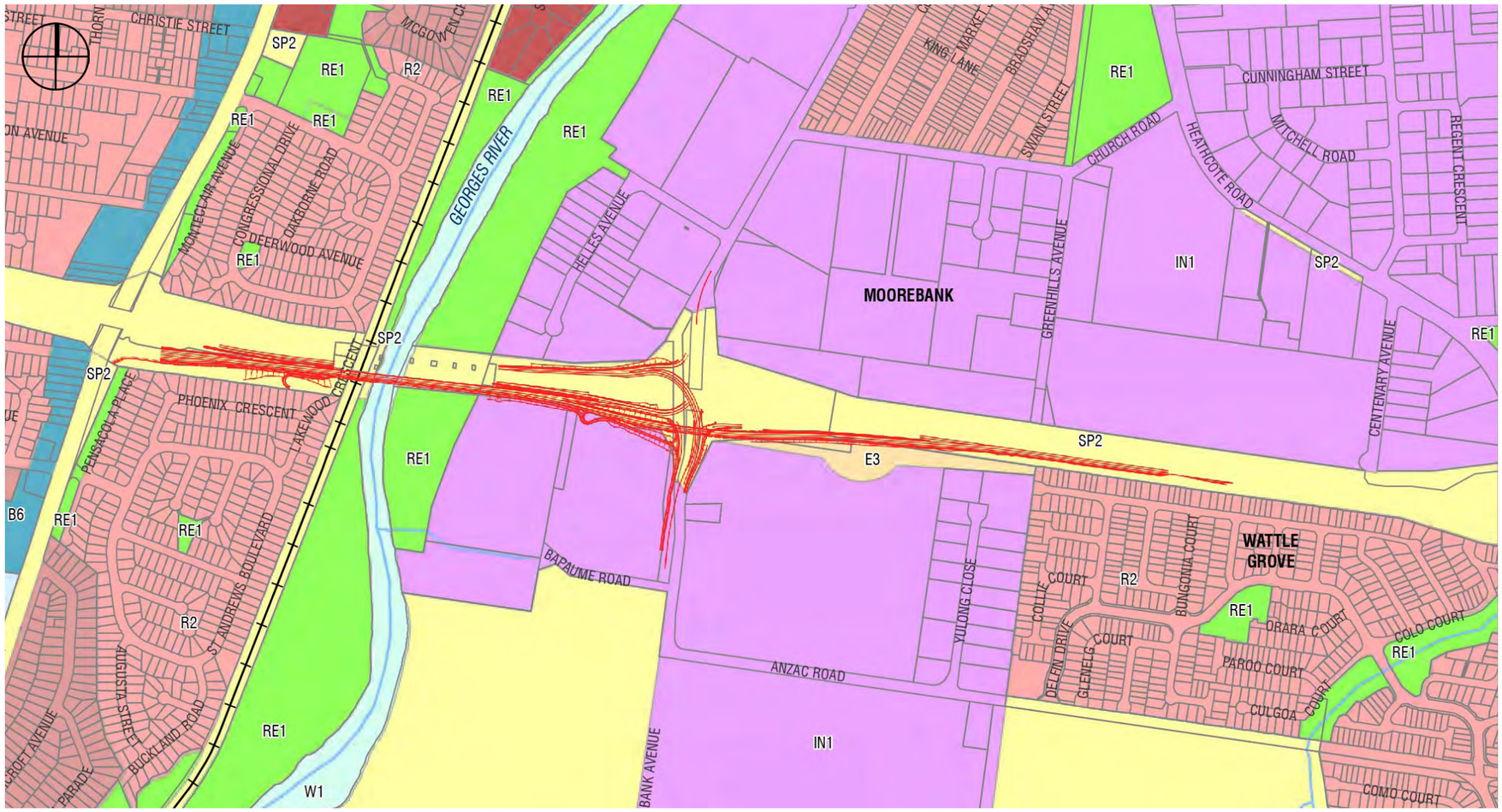



*Figure 2.15 Excerpt Source: Land Use, PEI Hume Highway West facing Ramps, M5 Motorway, Hume Highway to Moorebank Avenue*

## 2.9 ENVIRONMENTAL CONSTRAINTS

As per the M5 Motorway Westbound Traffic Upgrade, Environmental Constraints mapping prepared by Aurecon, as shown in figure 2.16, the main environmental constraints of the project area include:

- Contaminated lands including the ABB site and Helles Park former landfill site located on the eastern side of the Georges River, south of the M5 motorway.
- The location of an Aboriginal site AHIMS #45-5-4281 overlaps with the project area near Powerhouse Road. The heritage report* concluded that the proposal could be implemented without negative impact on the site.
- One built item with local significance, listed on Schedule 5 of the Liverpool Local Environmental Plan 2008, Kitchener House (formerly Arpafeelie) (Item #58), is partly within the proposal area.
- Existing vegetation - the Forest Red Gum-Apple Grassy Woodland and Mountain Blue Gum-Thin-leaved Stringybark Open Forest remaining vegetation communities. These could also be seen as opportunities, in terms of rejuvenating these vegetation communities as part of the project works.

** M5 Motorway WestboundTraffic Upgrade, Moorebank Aboriginal and Non-Aboriginal Heritage Impact Assessment (incorporating a Stage 2 PACHCI archaeological assessment) August, 2022*

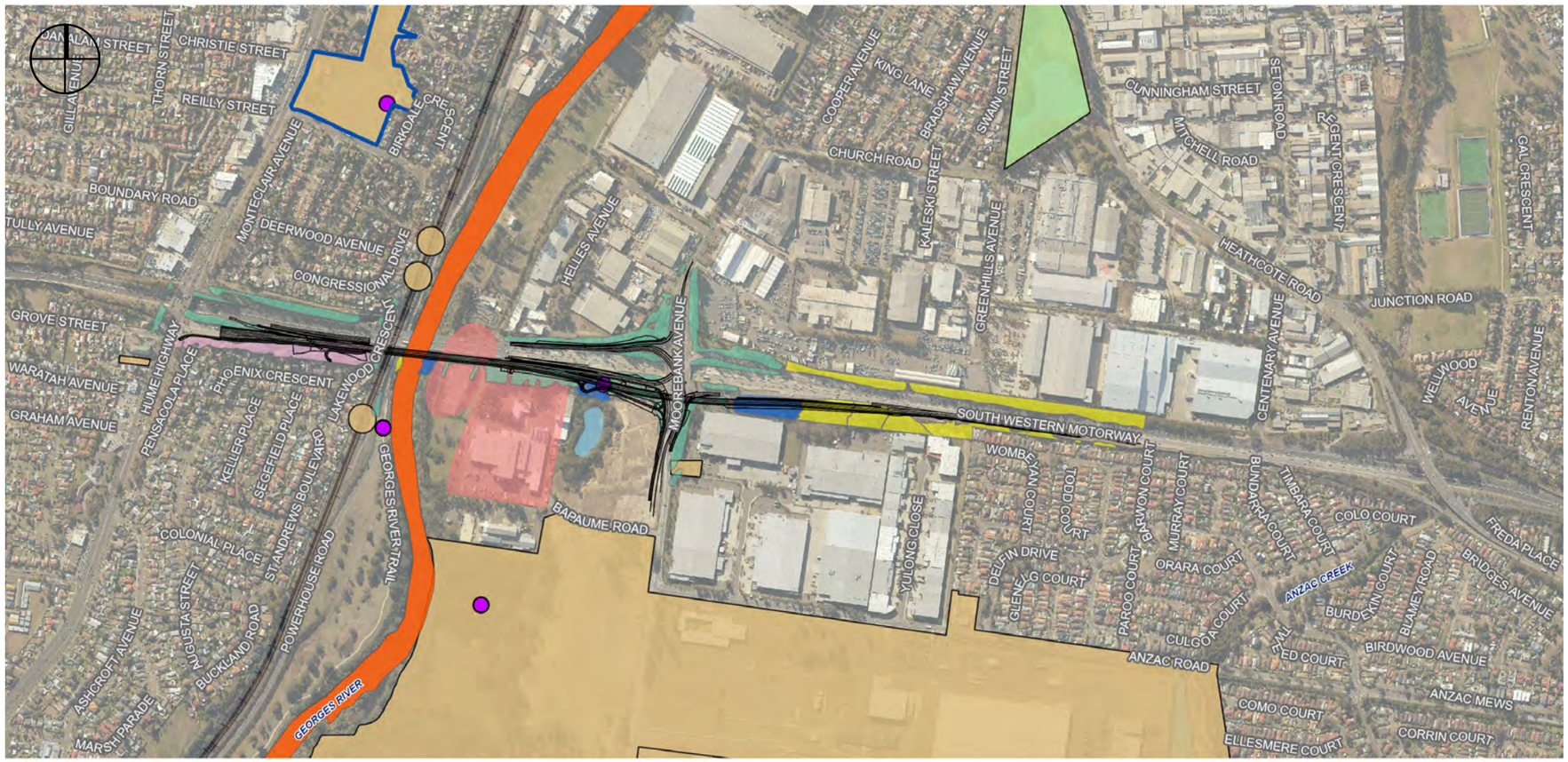



*Figure 2.16 Excerpt Source: Environmental Constraints, Aurecon, M5 Motorway Westbound Traffic Upgrade,updated 2022; Source Aurecon,TfNSW, Spatial Services,Esro*

## 2.10 LANDSCAPE AND BUILT FORM

Due to the varied land use, the built form of the general study area is varied. To the west a filigree and small scale defines the urban fabric whilst to east, the industrial areas are dominated by large box form warehouses.

Along the riverside, a rather open and green space with limited structures provides relief from the built up environment.

Large high rise apartment buildings can be seen further afield and to the north, yet these are outside the direct study area.

Within the motorway corridor, the built form appears somewhat inconsistent and utilitarian. Exception to this would be the recently installed noise walls as part of the M5 West Widening project, with their distinctive burnt yellow feature panels.

In addition, Moorebank Avenue overpass has a distinctive architecture with its “V” shape central piers and the texture abutment walls.

The crossing over the Georges River marks a key feature along the journey, providing vistas to the wider area.

*Figure 2.17 The residential areas to the west of the Georges River provide a filigree and modest scale built form.*

*Figure 2.18 Residential high rise structures can be seen further afield towards Liverpool.*

*Figure 2.22 The piers and retaining wall treatment of the Moorebank underpass have a distinctive form language.*

*Figure 2.20 The riverfront includes expansive green areas with limited built form elements.*

*Figure 2.21 The large scale industrial building typology dominates the skyline.*

*Figure 2.19 The residential area of Wattle Grove also has a small scale and filigree character compared to the industrial estates.*

# 3 LANDSCAPE CHARACTER ZONES

The purpose of identifying landscape character zones is to identify areas of similar character to facilitate assessment and provide a description of each zone, giving the proposal its context and interface.

This section also discusses the sensitivity values for each landscape character zone. The sensitivity assessment has been based on Transport for NSW's Environmental Impact Assessment Practice Note - Guideline for Landscape Character and Visual Impact Assessment No. EIA-N04, Version 2.2 Issue (August 2020).

The sensitivity value refers to the qualities of a particular character zone, which may include the number and type of receivers and how sensitive the existing character of the setting is to the proposed change. For example a pristine natural environment would likely to be more sensitive to change than a built up industrial area. Five character zones have been identified, each with its distinct qualities:

Eight Landscape Character Zones (LCZs) have been identified surrounding the study area (refer figure 3.1).

It should be noted, that even though some of these landscape character zones may have a similar quality, their interface with the proposal differs; hence the distinction.

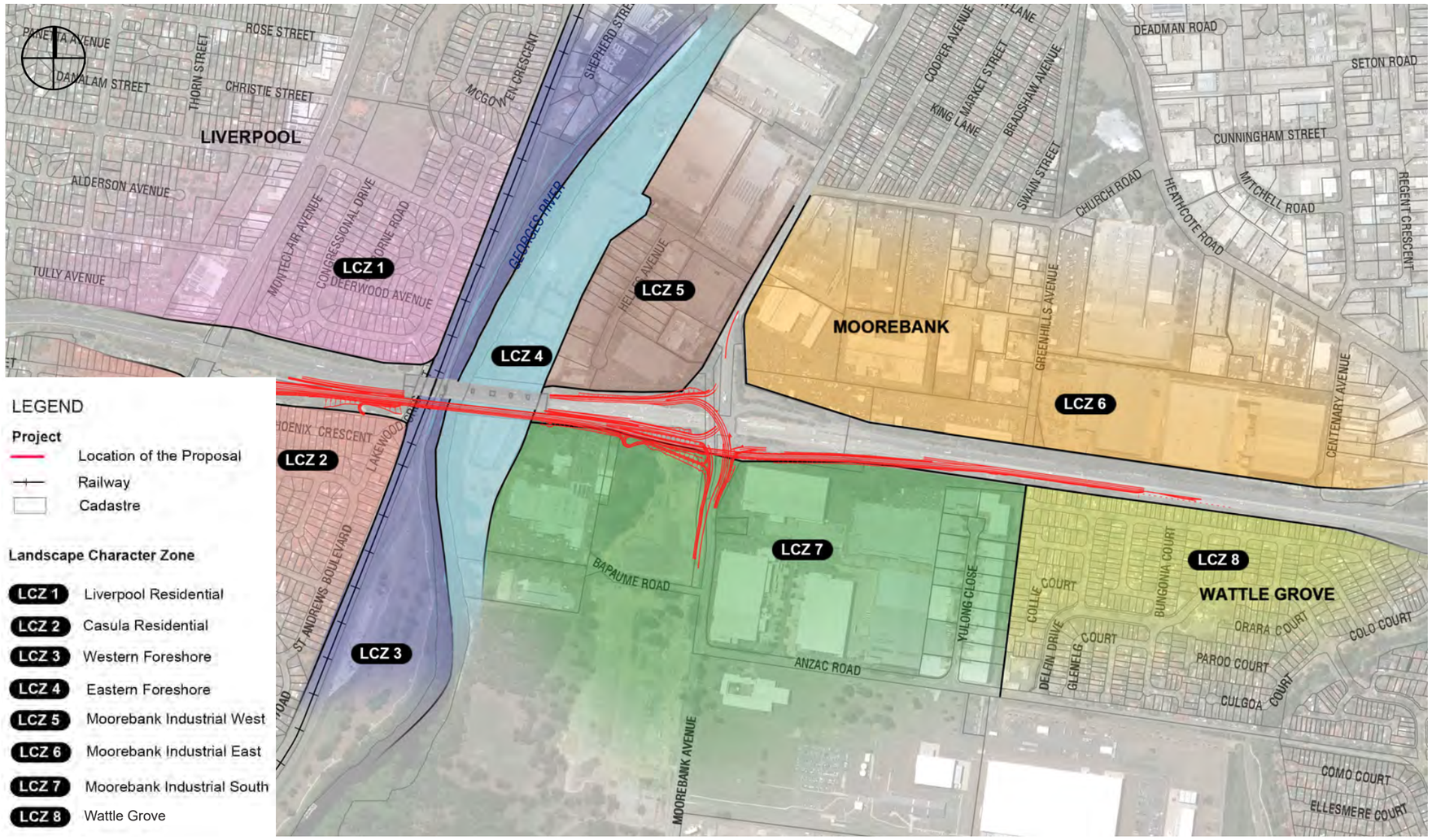



*Figure 3.1 Landscape Character Zone map*

*Figure 2.23 View along Congressional Drive. Expansive landscaped areas devoid of fencing create a inviting character.*

*Figure 2.24 Buildings tend to be either single or double storey well set back from the road.*

*Figure 2.25 Manicured gardens and established vegetation contribute to the well established character of the neighbourhood.*

## 3.1 LCZ 1 - LIVERPOOL RESIDENTIAL

| | |
|---|---|
| Location | This residential pocket is wedged between the Hume Highway and the Georges River and is located north of the M5 Motorway. The area consists predominantly of single and double storey homes set in a leafy and well established neighbourhood. |
| Natural Environment | This zone is part of a highly modified urban environment. Manicured front yards and gardens dominate the setting. |
| Built Environment | Residences are predominantly of a modern style with brick facades and tiled pitched roofs. Front yards tend to be grassed and devoid of fencing giving the area a green and inviting character. |
| Spatial Character | Somewhat open character with vistas beyond the immediate site. |
| Infrastructure | Local roads and street lighting present limited infrastructure elements. |
| Sensitivity | The sensitivity of this area is considered high. Its land use would be sensitive to change. |

## 3.2 LCZ 2 - CASULA RESIDENTIAL

| | |
|---|---|
| Location | Located south of the motorway and west of the Georges River, this residential area consists of undulating, gently rolling land, with modern villas.<br>This zone is wedged between the Hume Highway and the Main Southern railway line. |
| Natural Environment | Similar to LCZ 1, this zone is a highly modified urban environment with manicured gardens. |
| Built Environment | The neighbourhood is characterised by single and double storey villas with expansive front and back yards. Well established greenery provides a leafy character. |
| Spatial Character | Somewhat open character with vistas beyond the immediate site. |
| Infrastructure | Local roads and street lighting present limited infrastructure elements. |
| Sensitivity | The sensitivity of this area is considered high driven by its residential land use and sense of peaceful community. |

*Figure 2.26 Casula is a well established residential area with a green character.*

*Figure 2.27 The built form include double and single storey homes of various architectural styles.*

*Figure 2.28 View from the M5 bridge looking overlooking parts of Casula. Note the strong greenery providing screening to residences.*

Figure 2.29 *View along the foreshore with the M5 Motorway crossing in the background.*

Figure 2.30 *A shared path follows the shoreline. Steep banks make the foreshore inaccessible.*

Figure 2.31 *The riverscape foreshore provides welcomed greenery to surrounding urban areas.*

## 3.3 LCZ 3 - WESTERN FORESHORE

| | |
|---|---|
| Location | It is a linear landscape wedged between the river and the railway line. A key feature of it includes a shared use path running along the foreshore. |
| Natural Environment | The riverscape setting with parklands and foreshore greenery. There are limited opportunities to directly interface with the waterway due to steep embankments and a rather untidy and densely vegetated foreshore. |
| Built Environment | Shared user path, a local road and the railway line define the built form elements. From within this zone, the bridge over the Georges River is a dominant element that defines the skyline. |
| Spatial Character | The western foreshore is characterised by its open character with vistas to the Georges River, parklands and greenery. |
| Infrastructure | Local road, railway line and shared user path. The setting also includes overhead powerlines. |
| Sensitivity | The sensitivity of this area is considered high. This zone is a popular recreational route for the community. The setting has scenic qualities contributing to this rating. |

## 3.4 LCZ 4 - EASTERN FORESHORE

| | |
|---|---|
| Location | This zone comprises the eastern foreshore and is wedged between the river and the industrial estates to the east. |
| Natural Environment | The eastern foreshore includes a strong ribbon of dense greenery running along the foreshore. Behind this ribbon are grassed and hard stand areas used for a variety of recreational activities. |
| Built Environment | The Helles Park nature reserve, located to the north of the motorway corridor, houses a number of clubs and includes a number of activities such as barefoot water skiing, archery and remote control car racing. |
| Spatial Character | The park has a fairly self-contained character driven by the ribbon of vegetation defining the perimeter of the park. |
| Infrastructure | Local road, railway line and shared user path. The setting also includes overhead powerlines. |
| Sensitivity | The sensitivity of this area is considered moderate. This zone provides for recreational space used by a limited number of community members. This, combined with the self-centered nature of its usage limits the sensitivity. |

Figure 2.32 *The eastern foreshore is strongly vegetated, giving it a parklike character south of the motorway bridge.*

Figure 2.33 *North of the motorway, expansive grassed areas define the character. In the background the club house of the NSW Barefoot Water Ski Club.*

Figure 2.34 *Hardstand areas used as parking lots for club members, just south of the motorway.*

*Figure 2.38 This industrial area includes welcomed greenery (mature Eucalypts in particular) that contributes to the streetscape quality.*

*Figure 2.39 There is a variety of built form and architectural styles within this zone.*


*Figure 2.40 Large hard stand areas are typical and contribute to the industrious character.*

## 3.5 LCZ 5 - MOOREBANK INDUSTRIAL WEST

| | |
|---|---|
| Location | There is a pocket of industrial estates situated between Moorebank Avenue and the Georges River. This zone has a well established character with ample of mature street greenery. |
| Natural Environment | Mature street trees and some greenery with exotic vegetation. |
| Built Environment | Double storey factory and large warehouse type buildings define the built form, including extensive hard stand areas. |
| Spatial Character | Even though the built form is not cohesive, the mature street trees help settle the streetscape. |
| Infrastructure | Local streets with street lighting and some overhead powerlines. |
| Sensitivity | The sensitivity of this area is considered low. Its introverted character and land use contribute to this rating. |

## 3.6 LCZ 6 - MOOREBANK INDUSTRIAL EAST

| | |
|---|---|
| Location | Located east of Moorebank Avenue and north of the M5 Motorway. |
| Natural Environment | Although this zone has a similar character than LCZ 5, yet the lack of mature street trees creates a less cohesive streetscape and makes the built form dominant. |
| Built Environment | The built form consists of factory style buildings and large warehouses. The architectural style is varied and hard stand areas and parking lots are a dominant feature of this zone. |
| Spatial Character | This area has an industrious quality with extensive heavy vehicles being present providing a rather utilitarian character with limited visual quality. |
| Infrastructure | Local streets with street lighting and extensive overhead powerlines. |
| Sensitivity | The sensitivity of this area is considered low. Its introverted character and land use contribute to this rating. |

*Figure 2.35 Large scale box like warehouse buildings are typical and create a utilitarian and industrious character.*

*Figure 2.36 Factory type buildings, two storey in height, are present in this zone.*

*Figure 2.37 Parking lots and hard stand areas are a dominant feature in this zone. The skyline trees in the photograph front the motorway.*

*Figure 2.41 Large warehouse buildings along Moorebank Avenue dominate the backdrop.*

*Figure 2.42 Smaller factory type buildings are present along Yulgong Close. Eucalypts provide relief to the streetscape.*

*Figure 2.43 At western end of this zone is ABB, a tele-communications service provider and undeveloped land.*

## 3.7 LCZ-7-MOOREBANK INDUSTRIAL SOUTH

| | |
|---|---|
| Location | Located east of Moorebank Avenue and south of the M5 Motorway. The dominance and scale of the built form is a key characteristic of this zone. |
| Natural Environment | There is some vegetation present providing visual relief to the streetscape. |
| Built Environment | This area is characterised by large factory style buildings in the form of bulky warehouses. The western side of this zone occupies the larger buildings with local and international companies being present.<br><br>The eastern side of this zone affronts the residential area of Wattle Grove and includes smaller industrial buildings two and three storeys in height. |
| Spatial Character | Overall, the area has a light industrial and homogeneous and enclosed character with limited visual quality. This zone also includes undeveloped land to the west of Moorebank Avenue. |
| Infrastructure | Local streets with street lighting. devoid of overhead powerlines. |
| Sensitivity | The sensitivity of this area is considered low. Its introverted character and land use contribute to this rating. |

## 3.8 LCZ 8- WATTLE GROVE

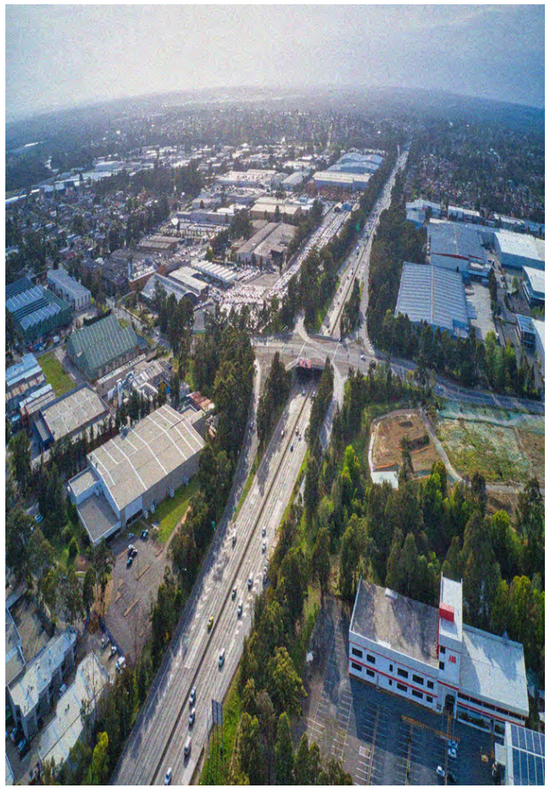
| | |
|---|---|
| Location | Situated at the eastern end of the study area, Wattle Grove is a residential zone with single storey brick facade residences with open front yards and manicured gardens. |
| Natural Environment | Stands of trees and mature vegetation gives the neighbourhood a settled and established character. |
| Built Environment | The ordered built form with hipped roofs, consistent facade treatments and built form setbacks gives the area a cohesive character. |
| Spatial Character | Somewhat open character with vistas beyond the immediate site. |
| Infrastructure | Local streets, devoid of line markings contribute to the suburban and more intimate character of the residential area. Some street lighting and pedestrian paths are present but are not dominant elements. |
| Sensitivity | The sensitivity of this area is considered high. Its land use would be sensitive to change. |

*Figure 2.44 The area has a quiet and somewhat detached character.*

*Figure 2.45 A homogeneous form language with generous setbacks contributes to the identity of the area.*

*Figure 2.46 The windy road layout and homogeneous residential land use gives the area a strong suburban character.*

# 4 URBAN DESIGN OBJECTIVES & PRINCIPLES



The interchange of the M5 and Moorebank Avenue sits high in the topography, therefore it is expected to be highly prominent. Any earthworks or tree removals will be noticeable and therefore mitigation strategies will be required, and where possible, other design alternatives should be investigated to minimise impacts.

Most of the existing trees/vegetation that provide dense screening and containment to the main intersection area will be removed with the proposed design.

The project specific draft urban design objectives and design principles have been developed in light of the site's sensitivity and are outlined on the following pages.

## 1. TO FIT SENSITIVELY WITHIN THE TREED & TOPOGRAPHICAL SETTING

Principles:

- Limit the extent of earthworks to retain important vegetation groups and provide for visual screening.
- Vary the earthworks batters where possible to integrate with adjoining landform.
- Minimise extent of ramps and height of bridge to better integrate access with existing facilities.
- Minimise vegetation clearing and consider construction methodologies that minimise the construction footprint.
- Consolidate design of construction access tracks to minimise the impact of temporary works.
- Minimise disturbance to drainage lines.
- Reinforce the indigenous vegetation patterns as part of re-vegetation works, in particular the riverine character..
- Carefully integrate the earthworks and access requirements for water quality treatment elements with the landscape, and maximise using already disturbed areas such as construction footprints.
- Locate structures such as underpass where they integrate with the landform.

## 2. TO ENSURE CONNECTIVITY AND PERMEABILITY FOR COMMUNITIES IS ENHANCED

Principles:

- Create a seamless pedestrian, cyclist and road network with existing and planned adjacent infrastructure development along Moorebank Avenue
- Enhance urban permeability and travel experience for pedestrians and cyclists between Moorebank and Casula/Liverpool. Improve traffic movements to enhance local and regional productivity, particularly access to the Hume Highway from the M5 Motorway.
- Use best-practice design and universal access principles.
- Ensure efficient access is achieved to the Georges River foreshore as a key north south access route for pedestrians and cyclists and ensure a seamless integration with the Georges River Foreshore Master Plan.
- Provide a legible connection from the bridge for pedestrians and cyclists to the foreshore of the Georges River, considering the existing railway alignment.
- Minimise disturbances to existing pedestrian and cycle facilities throughout the site corridor.
- Plan with awareness of the CPTED (Crime Prevention Through Environmental Design) principles.
- Extend shared user path from Georges River to link with the Hume Highway.

## 3 TO DESIGN BUILT FORM ELEMENTS THAT FIT WELL IN THEIR SETTING AND MINIMISE DISTURBANCE TO EXISTING CONNECTIVITY

Principles:

- Combine shared use path and road requirements as a single bridge structure.
- Ensure retaining structures are well integrated into the site and are located and designed to maximise retention of critical vegetation screening as the vegetation currently creates a visual buffer to adjacent industrial facilities.
- Develop a bridge design that is sympathetic to the adjacent existing bridge. Align pier locations. Consider a headstock arrangement that visually relates to the existing structure to create a ensemble.
- Situate bridge height in line with the existing bridge to ensure visual integration.
- Extend retaining wall cladding elements to act as a railing to avoid the use of utilitarian Monowills
- Ensure that the top of retaining walls follow a smooth top edge.
- Integrate headstocks with piers into a single composition.
- Apply appropriate materials and colours to retaining and abutment walls to visually recede in their surroundings
- Evaluate the introduction of some colour to enhance the identity and legibility of the project including the Georges River crossing.
- Apply consistency between built form elements to create a family of components and to reinforce the identity of the project.

## 4. TO DESIGN THE ROADS AS AN EXPERIENCE IN MOVEMENT & CREATE SELF-EXPLAINING ROAD ENVIRONMENTS

Principles:

- Create a legible road corridor and ensure good legibility at key decision making points (particularly for cyclists) to achieve a user friendly facility both at local and regional level.
- Reinforce the river setting and ensure vistas to the waterway are reinforced. Limit the height of barriers and introduce double rail barriers to ensure visual permeability.
- Utilise landscape strategies to reinforce the setting and change of character across the route.
- Ensure visual continuity between elements such as safety fences and balustrade treatments.
- Avoid creating chasm type spaces along the cycleway to achieve a better user experience for this group.

## 5. DESIGN TO RESPOND TO NATURAL PATTERNS, CULTURAL CONTEXTS & MINIMISE VISUAL IMPACTS FOR COMMUNITIES

Principles:

- Identify opportunities for the incorporation of site related themes within the built form elements such as retaining walls and other components.
- Identify cultural interpretation themes in line with the Reconciliation Action Plan.
- Use the river setting in conjunction with the Georges River shared user path as a key inspiration for landscape and urban design themes.
- Minimise impacts to local residences along the project and consider landscape screening strategies.
- Ensure a landscaped buffer zone is retained where practical between the project and private properties.
- Carefully assess potential impacts to the surrounding community and in particular west of the Georges River to limit visual impacts.
- Evaluate the effect of night glare issues and impacts of street lighting, particularly along the bridge.

## 6. ACHIEVE INTEGRATED DESIGN AND MINIMAL MAINTENANCE

Principles:

- Carefully consider the location of maintenance bays to ensure ease of access.
- Consolidate the various elements to create a unified composition- bridge, throw screens, retaining walls, and noise walls.
- Use materials for built form and landscape purposes that require minimal maintenance, and enhance the visual amenity of the area.
- Design for anti-graffiti as an integrated design process. This is particularly important within the bushland setting where self surveillance is limited.
- Ensure operational water quality treatment structures are designed integrally with the verge setting and/or landscape context, and that they have adequately considered maintenance requirements.
- Evaluate opportunities for the shared path to also act as a maintenance access.
- Consider alternative WSUD approaches to water quality basins that take less space, disturb less bushland and are integrated with landscape revegetation practices.

# 5 URBAN DESIGN CONCEPT

## 5.1 URBAN DESIGN CONCEPT PLANS

Following on from the urban design principles, the urban concept design as illustrated on the following pages ( sheets 1-3) applies the following design elements/ approaches:

### 5.1.1 Landscape design

- Introduction of rock (drystone) retainer edges and local steepening of batters to minimise impacts to existing trees (refer sheets 1 and 3)
- Varying of earthworks batters where feasible as suggested on southern verge, where space permits- e.g. sheet 2
- Landscape revegetation that reinforces the two main indigenous vegetation patterns – Castlereagh Scribbly Gum Forest and Cumberland River flat Forest
- Adequate vegetated buffer zones to private properties
- Reinforcement of treed settings to complement existing stands of trees and to screen adjacent residences/ warehouses
- Whilst there appear to be minimal opportunities to implement WSUD due to space restrictions, a vegetated swale and infiltration areas to ends of culverts are integrated.

*Figure 5.1 Example of drystone boulders (" rock retainers") used to minimise impacts to levels around trees*

- Hardy native grasses and low shrubs to wider median sections to assist in visually articulating and mitigating the new roadworks

The Urban Design Concept Plan reinforces the indigenous trees of the area and maximises tree plantings wherever possible. This is in line with the DPIE and Greater Sydney Commission policies around increasing trees and tree canopy. Whilst many trees will be removed, there are approximately 2,800 tubestock trees plus 200 advanced (45L ) trees proposed to ensure greening is given high priority.

There will be visual impact with the required clearing of vegetation along the southern side of the M5 Motorway between Wattle Grove (after the existing noise wall and residential area to the east of Moorebank Avenue) and the Georges River to allow for the proposed new exit ramp. Whilst a few trees are shown removed in this area on the landscape plans, it is noted that there is currently substantial shrub screening that creates effective greening.

### 5.1.2 Built form elements

#### Underpass at Moorebank Avenue

A new underpass structure is proposed at Moorebank Avenue as part of the Hume Highway off-load ramp. The footprint of this underpass has been kept to a minimum, introducing retaining walls along its approaches. This will maximise the opportunity for plantings at the interchange level and provide the partial re-establishment of skyline vegetation.

#### Georges River Bridge

The new bridge proposed across the Georges River will closely follow the alignment of the existing motorway to create an ensemble of structures, consistent in form language.

#### Cycleway

The new cycle way affords views of the Georges River, with double rail barriers to ensure visual permeability.

The cycle path is wrapped around (sheet 3) in a concise way to minimise the construction footprint and to reconnect with existing path levels beside the area of the Main Southern Railway.


LEGEND

**EXISTING ELEMENTS**
- PROJECT BOUNDARY
- EXISTING CONTOURS
- BATTERS AS SHOWN
- TREES PROTECTED & RETAINED
- TREES REMOVED

**SPOT PLANTING**
- TREES (Cumberland Shale Plains Woodland Spp.) - 45L
- TREES (Hinterland Riverflat Eucalypt Forest Spp.) - 45L
- TREES (Cumberland Riverflat Forest Spp.) - 45L

**LANDSCAPE / REVEGETATION**
- PARKLAND GRASS
- NATIVE GRASSES / GROUNDCOVERS
- LOW SHRUBS & NATIVE GRASSES
- SHRUB DOMINANT
- MIXED CANOPY (Cumberland Shale Plains Woodland)
- MIXED CANOPY (Hinterland Riverflat Eucalypt Forest)
- TREE PODS

**WSUD**
- VEGETATED SWALE
- INFILTRATION AREA

**RETAINING WALLS**
- PINNED LOGS
- ROCK RETAINER

**PAVEMENTS & ELEMENTS**
- FOOTPATH
- CYCLE PATH
- SHARED PATH
- TYPE F BARRIER
- NOISE WALL
- RETAINING WALL

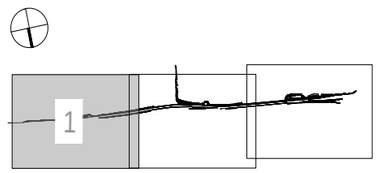



*Figure 5.2 Urban Design Concept Plan, Sheet 1*

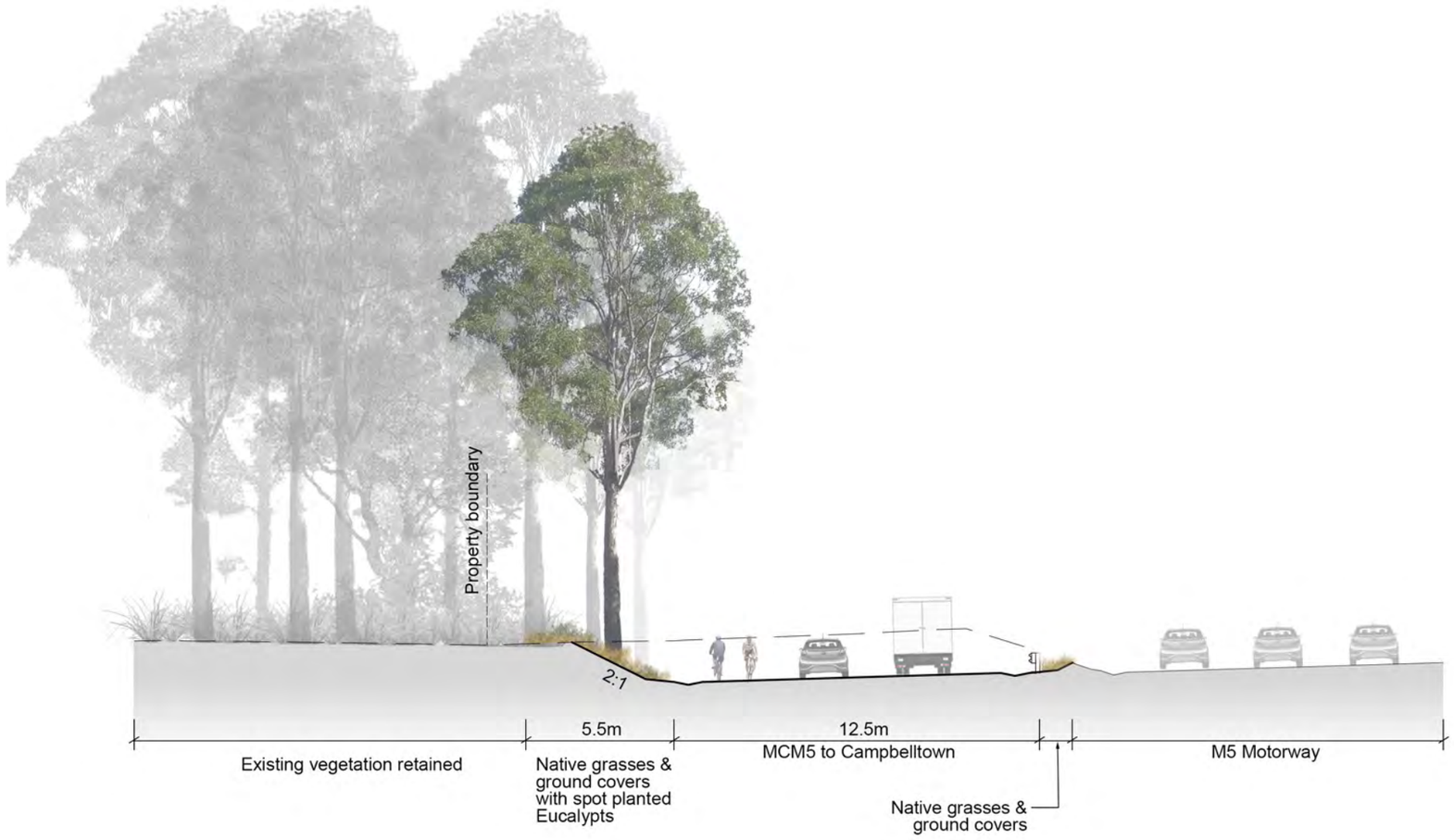



*Figure 5.3 Section at CH 500 1:200*

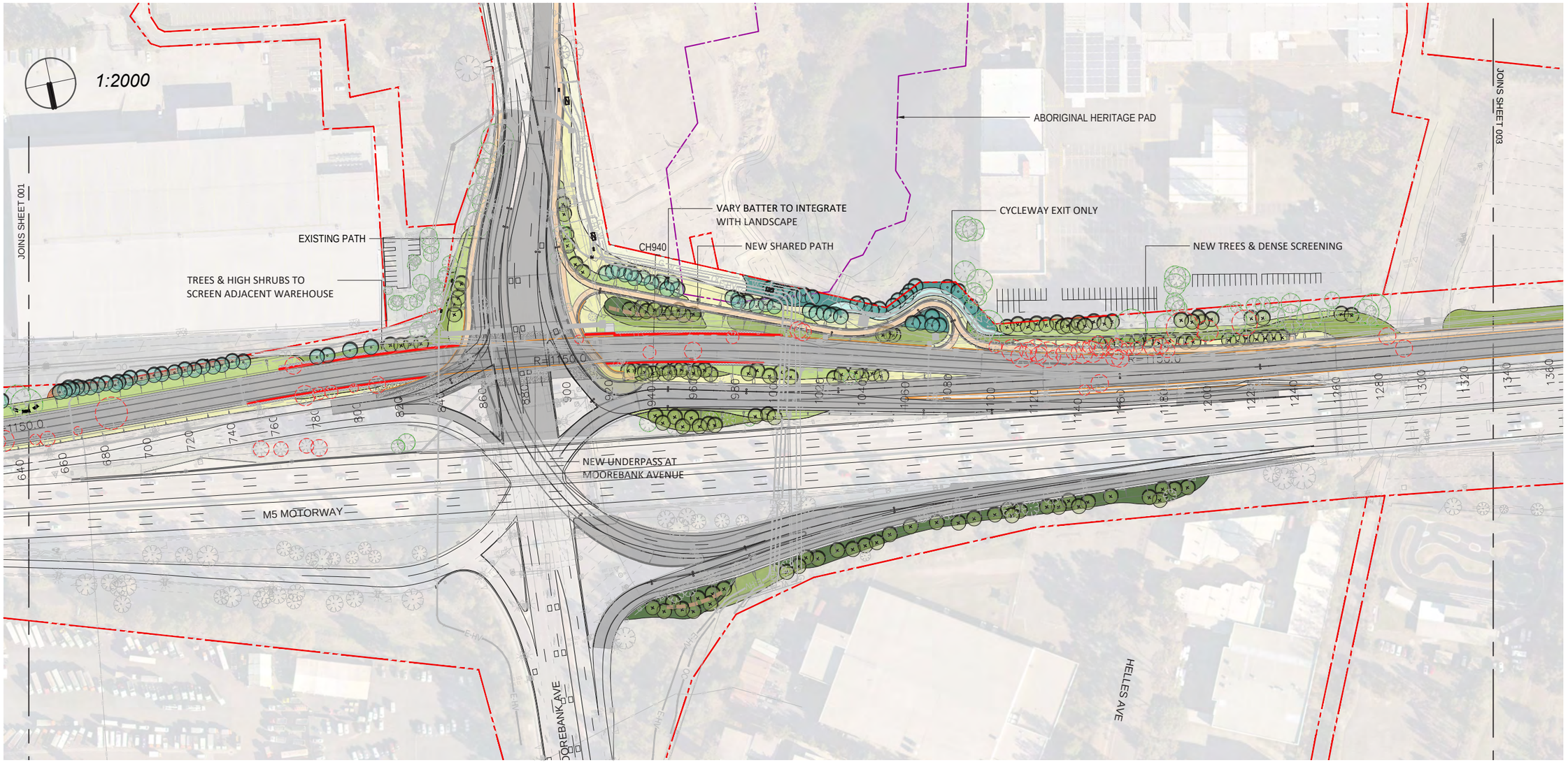



*Figure 5.4 Urban Design Concept Plan, Sheet 2*

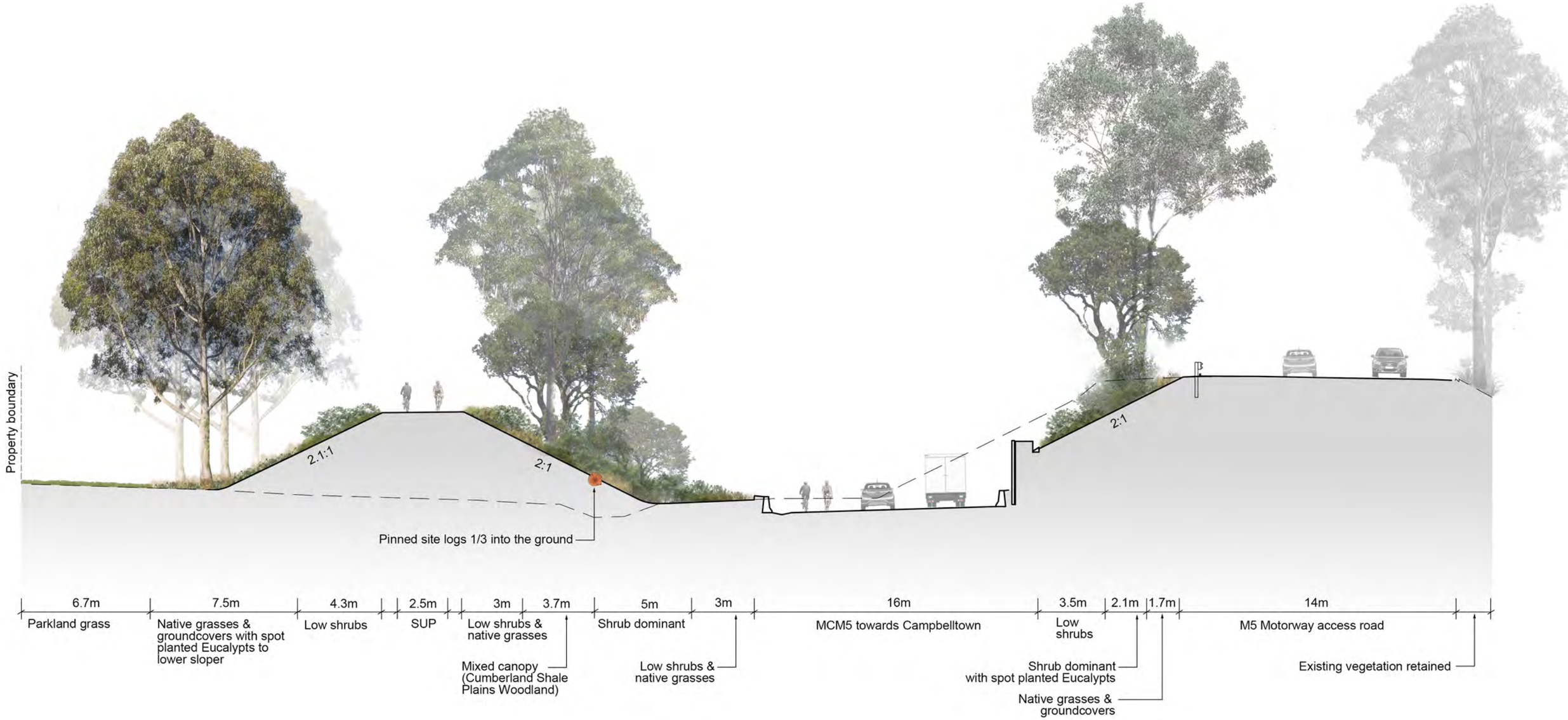
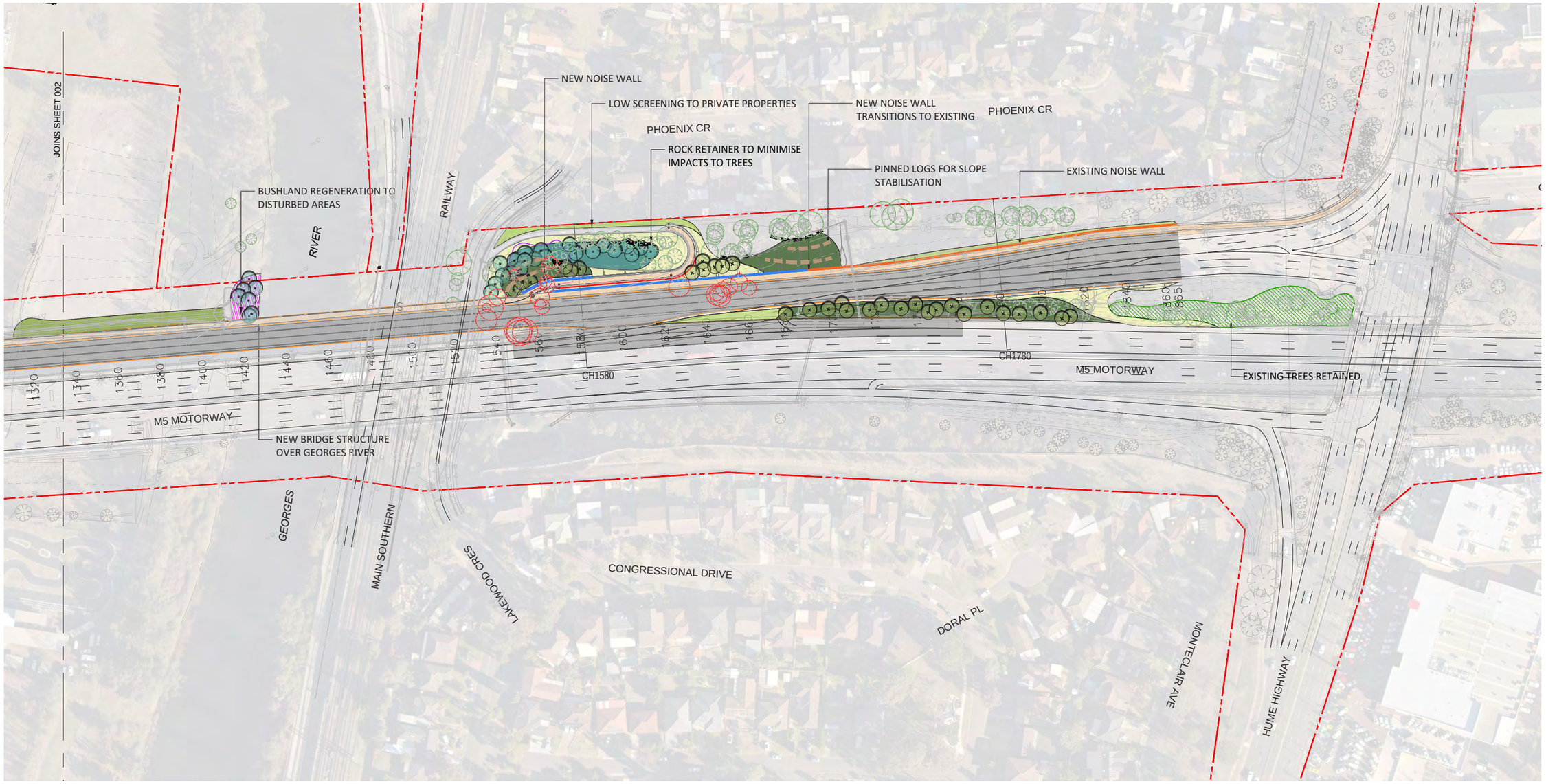



*Figure 5.5 Section at CH 940 1:200*




LEGEND

**EXISTING ELEMENTS**
- PROJECT BOUNDARY
- EXISTING CONTOURS
- BATTERS AS SHOWN
- TREES PROTECTED & RETAINED
- TREES REMOVED

**SPOT PLANTING**
- TREES (Cumberland Shale Plains Woodland Spp.) - 45L
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- PARKLAND GRASS
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- VEGETATED SWALE
- INFILTRATION AREA

**RETAINING WALLS**
- PINNED LOGS
- ROCK RETAINER

**PAVEMENTS & ELEMENTS**
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- CYCLE PATH
- SHARED PATH
- TYPE F BARRIER
- NOISE WALL
- RETAINING WALL

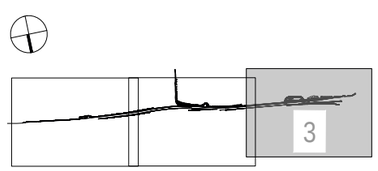


*Figure 5.6 Urban Design Concept Plan, Sheet 3*

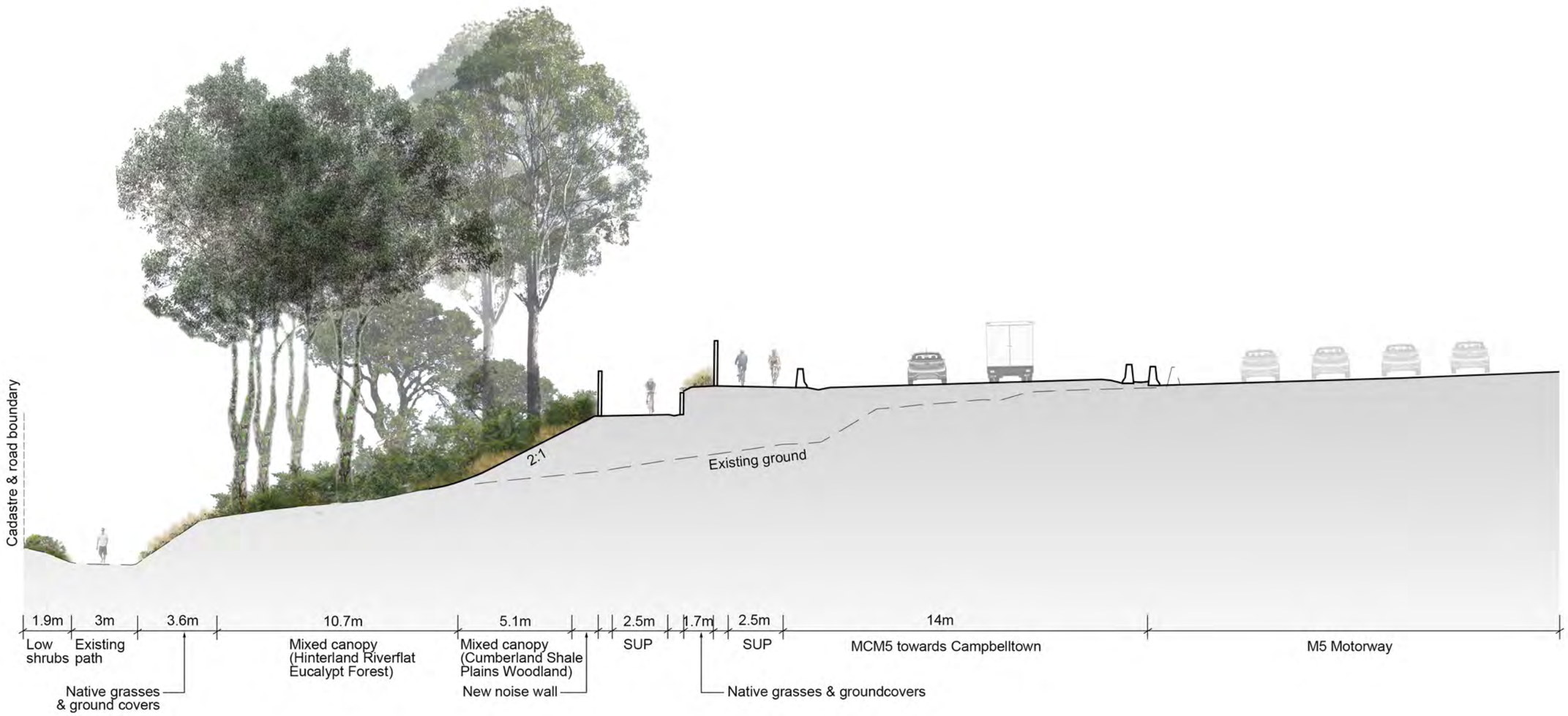


*Figure 5.7 Section at CH1580 1:200*

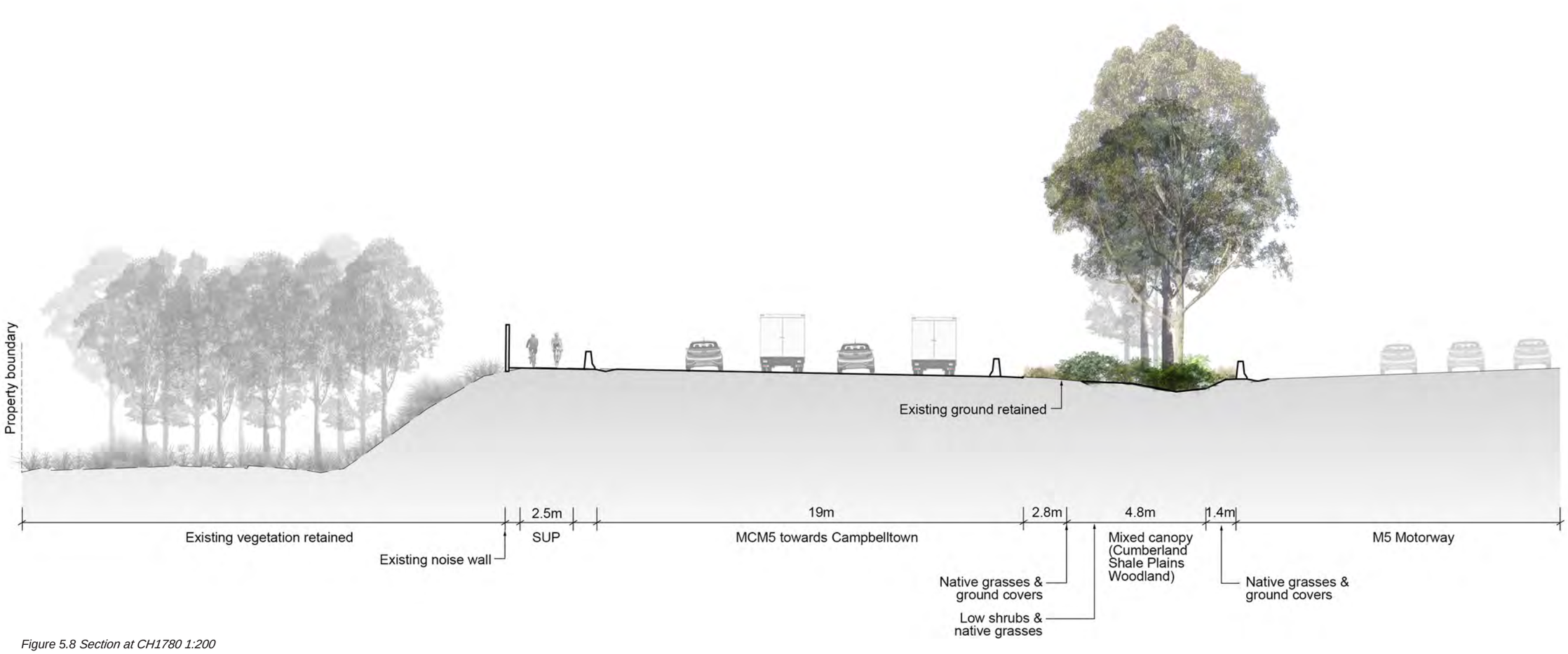


*Figure 5.8 Section at CH1780 1:200*

## 5.2 PLANTING DESIGN

There are three main ecological vegetation community groups across the site that are reflected in the planting design :

- Cumberland Riverflat Forest
- Cumberland Shale Plains Woodland
- Hinterland Riverflat Eucalypt Forest

In the low lying areas adjacent to the Georges River and in low lying areas, the Cumberland Riverflat Forest vegetation is proposed.

On the higher new fill batters and other areas the Cumberland shale plains woodland and Hinterland riverflat eucalypt forest species are applied.

Key species recommended for revegetation from each vegetation community are illustrated on the following pages. They have been composed from an assessment of the original soil landscape vegetation community species plus those identified on site in the Biodiversity report, 2021 and updated Niche M5 Traffic Upgrade Environment report, 2022.

### Cumberland Riverflat Forest

Cumberland Riverflat Forest as an open Eucalypt forest located on the alluvial flats along the Hawkesbury, Nepean and Georges River systems, including smaller areas alongside the smaller water bodies that drain the Cumberland Plain.

**Cumberland Riverflat Forest species**

**Trees**

| | |
|---|---|
| *Angophora floribunda* | Rough Barked Apple |
| *Eucalyptus amplifolia* | Cabbage Gum |
| *Eucalyptus botryoides* | Bangalay |
| *Eucalyptus elata* | River Peppermint |
| *Eucalyptus moluccana* | Grey Box |
| *Eucalyptus saligna* | Sydney Blue Gum |
| *Eucalyptus tereticornis* | Forest Red Gum |
| *Melaleuca decora* | White Feather Honeymyrtle |

**Shrubs / Ground Covers**

| | |
|---|---|
| *Acacia binervia* | Coast Myall |
| *Acacia falcata* | Sickle Wattle |
| *Backhousia myrtifolia* | Grey Myrtle |
| *Bursaria spinosa* | Native Blackthorn |
| *Dianella revoluta* | Blueberry Lilly |
| *Dichondra repens* | Kidney Weed |
| *Entolasia marginata* | Bordered Panic Grass |
| *Lomandra longifolia* | Spiny-head Mat-rush |
| *Ozothamnus diosmifolius* | Rice Flower |
| *Pratia purpurascens* | White Root |

Cumberland Riverflat Forest - Trees

*Angophora floribunda* 'Rough Barked Apple' | *Eucalyptus amplifolia* 'Cabbage Gum' | *Eucalyptus botryoides* 'Bangalay' | *Eucalyptus saligna* 'Sydney Blue Gum' | *Eucalyptus tereticornis* 'Forest Red Gum' | *Eucalyptus elata* 'River Peppermint'

Cumberland Riverflat Forest - Shrubs / Ground Covers

*Acacia binervia* 'Coast Myall' | *Backhousia myrtifolia* 'Grey Myrtle' | *Dianella revoluta* 'Blueberry Lilly' | *Dichondra repens* 'Kidney Weed' | *Lomandra longifolia* 'Spiny-head Mat-rush'

## Cumberland Shale Plains Woodland

This community is an open grassy woodland dominated by Grey Box (*Eucalyptus moluccana*), Forest Red Gum (*E. tereticornis*) and Ironbark (E. *crebra or fibrosa*). Localised patches of Spotted Gum (*Corymbia maculata*) are also known to occur. The understorey typically consists of a sparse to moderate cover of shrubs plus high cover of grasses and forbs.

### Cumberland Shale Plains Woodland Species

**Trees**

| | |
|---|---|
| *Acacia parramattensis* | Parramatta Wattle |
| *Angophora bakeri* | Narrow-leaved Apple |
| *Corymbia maculata* | Spotted Gum |
| *Eucalyptus moluccana* | Grey Box |
| *Eucalyptus punctata* | Grey Gum |
| *Eucalyptus sclerophylla* | Hard Leaved Scribbly Gum |
| *Eucalyptus tereticornis* | Forest Red Gum |

**Shrubs**

| | |
|---|---|
| *Acacia falcata* | Sickle Wattle |
| *Acacia linifolia* | White Wattle |
| *Banksia oblongifolia* | Rusty Banksia |
| *Banksia spinulosa* | Hairpin Banksia |
| *Callistemon linearis* | Narrow-Leaved Bottlebrush |
| *Callistemon pinifolius* | Pine-Leaved Bottlebrush |
| *Daviesia ulicifolia* | Gorse Bitter Pea |
| *Goodenia hederacea* | Ivy Goodenia |
| *Grevillea sericea* | Pink Spider Flower |
| *Hakea sericea* | Bushy Needlewood |
| *Leptospermum trinervium* | Slender Tea Tree |
| *Melaleuca nodosa* | Pricky Leaved Paperbark |
| *Pimelea linifolia* | Slender Rice Flower |

**Grasses / Ground Covers**

| | |
|---|---|
| *Austrodanthonia tenuior* | Wallaby Grass |
| *Austrostipa scabra* | Spear Grass |
| *Carex spp.* | *Sedges* |
| *Dianella revoluta* | Blueberry Lilly |
| *Dichondra repens* | Kidney Weed |
| *Entolasia stricta* | Wiry Panic |
| *Helichrysum scorpioides* | Button Everlasting |
| *Imperata cylindrica var. major* | Blady Grass |
| *Poa labillardierei* | Common Tussock Grass |
| *Themeda australis* | Kangaroo Grass |

Cumberland Shale Plains Woodland - Trees

*Acacia parramattensis* 'Parramatta wattle' | *Angophora floribunda* 'Rough- Barked Apple' | *Eucalyptus amplifolia* 'Cabbage Gum' | *Eucalyptus moluccana* 'Grey Box' | *Eucalyptus tereticornis* 'Forest Red Gum' | *Eucalyptus crebra* 'Narrow-leaved Ironbark'

Cumberland Shale Plains Woodland - Shrubs

*Bursaria spinosa* 'Sweet Bursaria' | *Dodonea triquetra or Dodonea viscosa subsp.* Cuneata 'Hopbush' | *Hakea sericea* 'Needlebush' | *Indigofera australis* 'Austral Indigo'

Cumberland Shale Plains Woodland - Grasses / Ground Covers

*Dianella caerulea* 'Blue Flax Lily' | *Hardenbergia violaceae* 'False Sarsparilla' | *Imperata cylindrica* 'Blady Grass' | *Lomandra longifolia* 'Spiny- headed Mat-rush' | *Themeda australis* 'Kangaroo Grass' | *Austrostipa spp.* 'Spear Grass'

## Hinterland Riverflat Eucalypt Forest

Hinterland Riverflat Eucalypt Forest is a tall open eucalypt forest with a scattered mesic shrub layer and a grassy and herbaceous ground cover. It predominantly occurs along the sandy riverbanks of the Georges River and its tributaries.

It also occurs on gentle, narrowly incised valleys that drain the north-west Woronora Plateau west from the Woronora River. It is dominated by both Bangalay (*Eucalyptus botryoides*) and its hybrid with Sydney Blue Gum (*Eucalyptus botryoides saligna)* and at its tallest may reach over 35 metres in height.  On site *Eucalyptus racemosa* is dominant in the upper canopy.

### Hinterland Riverflat Eucalypt Forest Species

**Trees**

| | |
|---|---|
| *Acacia decurrrens* | Black Wattle |
| *Acacia parramattensis* | Parramatta Wattle |
| *Angophora floribunda* | Rough Barked Apple |
| *Eucalyptus botryoides* | Bangalay |
| *Eucalyptus elata* | River Peppermint |
| *Eucalypts racemosa* | Narrow-leaved Scribbly Gum |
| *Eucalyptus saligna x botryoidies* | Sydney Blue Gum |
| *Eucalyptus tereticornis* | Forest Red Gum |
| *Melaleuca decora* | White Feather Honeymyrtle |

**Shrubs / Ground Covers**

| | |
|---|---|
| *Acacia binervia* | Coast Myall |
| *Acacia implexa* | Hickory Wattle |
| *Acacia floribunda* | Gossamer Wattle |
| *Acacia linifolia* | Flax Wattle |
| *Backhousia myrtifolia* | Grey Myrtle |
| *Bursaria spinosa* | Native Blackhorn |
| *Dianella revoluta* | Blueberry L:ily |
| *Dichondra repens* | Kidney Weed |
| *Echinopogon ovatus* | Hedgehog Grass |
| *Hibbertia diffusa* | Guinea Flower |
| *Entolasia marginata* | Bordered Panic Grass |
| *Lomandra longifolia* | Spiny-head Mat-rush |
| *Microlaena stipoides* | Weeping Grass |
| *Ozothamnus diosmifolius* | Rice Flower |
| *Pittosporum* | Sweet Pittosporum |
| *Pteridium esculentum* | Bracken Fern |
| *Wahlenbergia gracilis* | Australian Bluebell |

Hinterland River flat Eucalypt Forest - Trees

*Acacia parramattensis* 'Parramatta wattle' | *Eucalyptus botryoides* 'Bangalay' | *Eucalyptus racemosa* 'Narrow-leaved Scribbly Gum' | *Eucalyptus saligna* 'Sydney Blue Gum' | *Eucalyptus tereticornis* 'Forest Red Gum'

Hinterland River flat Eucalypt Forest - Shrubs / Ground Covers

*Acacia binervia* 'Coast Myall' | *Backhousia myrtifolia* 'Grey Myrtle' | *Lomandra longifolia* 'Spiny-head Mat-rush' | *Poa labillardierei* 'Common Tussock-grass' | *Wahlenbergia gracilis* 'Australian Bluebell'

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## 5.3 STRUCTURES

### 5.3.1 New Underpass at Moorebank Avenue

A westbound underpass structure is proposed directly south of the existing underpass at the Moorebank Avenue interchange. This structure would service the new proposed separate dual lane carriageway for traffic exiting the M5 motorway for the Hume Highway. The new underpass that would have a length of approximately 55 metres, would run underneath Moorebank Avenue, whilst retaining the existing bridge and interchange.

The structure, including the approach retaining walls, would be bored piles with cast in place concrete and precast facing panels, running parallel to the carriageway. The cast in place concrete would fill the cavity between the piles and precast panels to minimise any maintenance issues.

To unify the overall form language of the interchange, the panels would be 2 metres wide and textured with a pattern that matches the existing bridge structure abutment walls. If sourcing such a pattern is difficult, a similar pattern could be used such as 2/49 Saale by Reckly.

Due to the interchange above, the opening of the underpass has a strong skew and requires cross beams to support the interchange above. The portal's form is an open wedge that maximises natural ventilation within the ramp and reduces the length of the underpass. The cross beams have a rounded edge along their leading edge and vary in spacing, increasing away from the underpass.

In plan view, the beams are rounded next to the retaining wall to create an enclosing transition as one approaches the underpass.

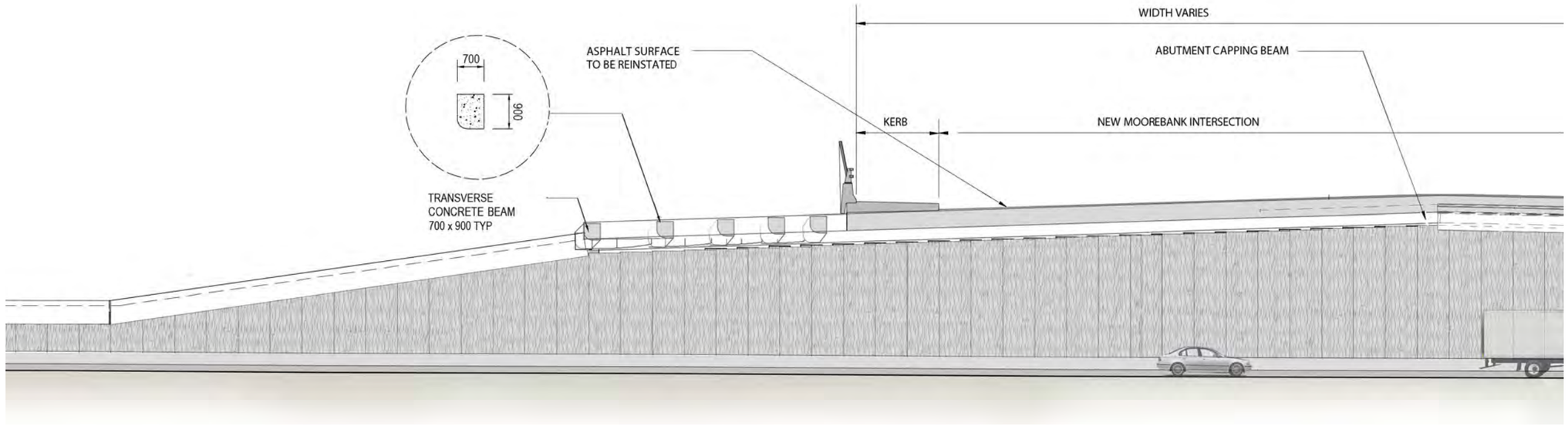


*Figure 5.9 Longitudinal section along the underpass at Moorebank Avenue. NTS*

*Figure 5.10 Pattern of the precast concrete panels of the existing reinforced earth abutment wall of the existing bridge.*

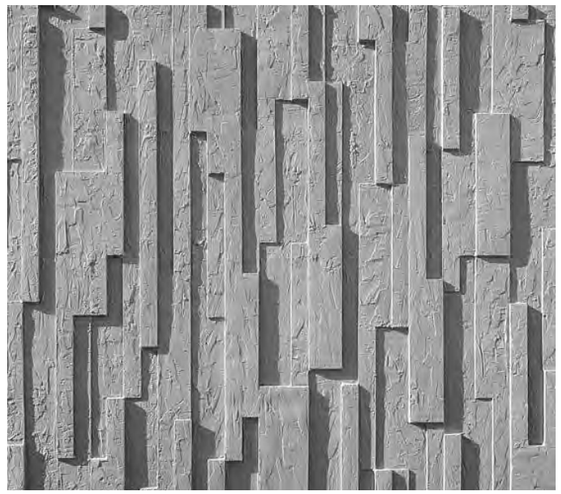

*Figure 5.11 Alternative cladding pattern 2/49 Saale by Reckly*

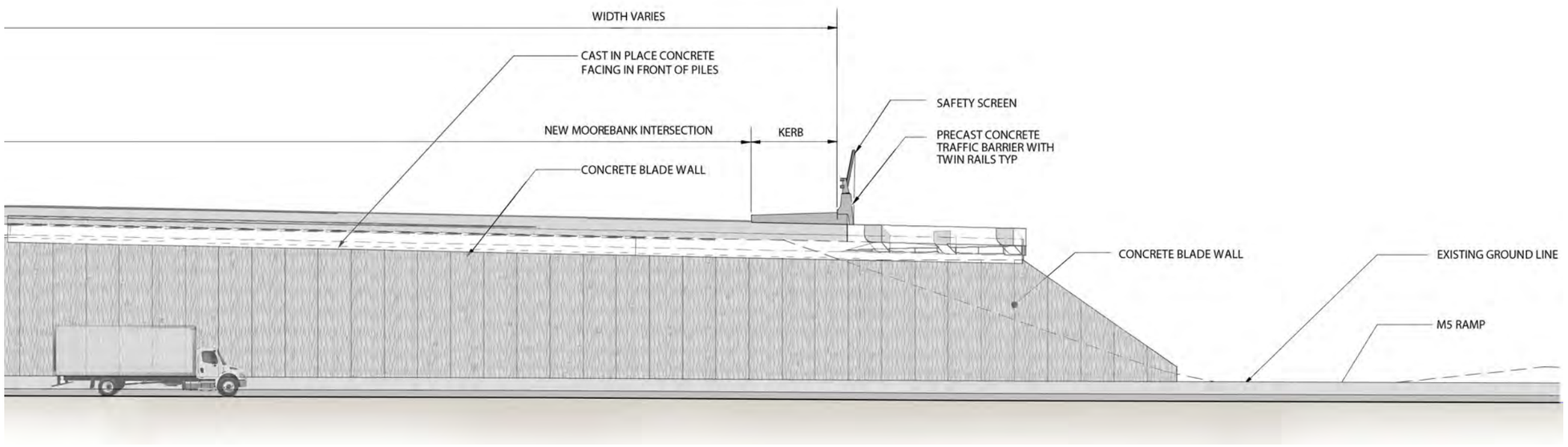

*Figure 5.12 Plan of the proposed underpass at Moorebank Avenue. Scale 1:500*

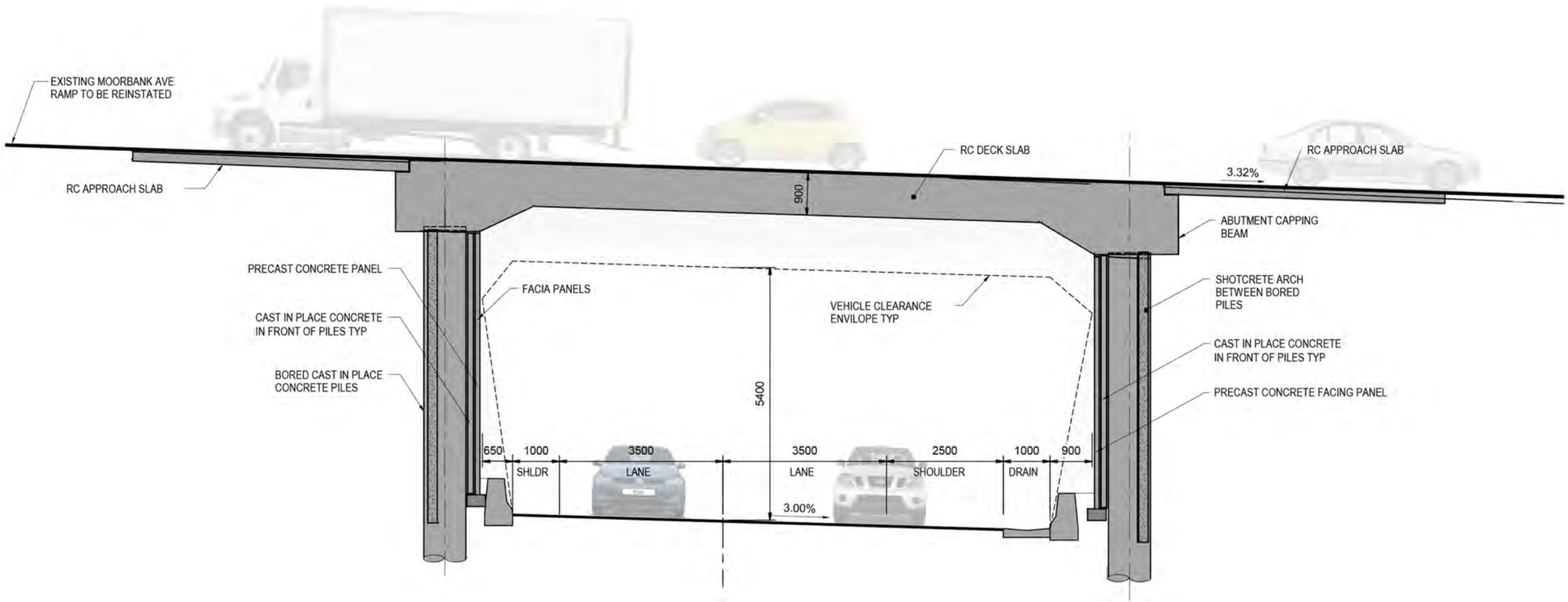


*Figure 5.13 Cross section of the underpass at Moorebank Avenue. Scale 1:100*

### 5.3.2 New Bridge over the Georges River

The proposed bridge would be 290 metres long and run adjacent to the other two existing bridges over the Georges River.

The span configuration and layout of the piers has been developed carefully, taking into consideration the site constraints as well as aesthetics.

It should be noted, that as the two existing bridges have different span configurations, this results in the piers not aligning between the two bridges.

Where possible, in order to avoid creating a random 'forest' of columns, the piers have been aligned with the existing piers of the westbound carriageway bridge. This is considered important, as the piers are perpendicular to the deck above.

At the western riverside, site constraints do not allow aligning the piers with the adjacent bridge due to spatial constraints with the Main Southern Railway corridor, afflux and environmental issues with the river. In this case, the location of the piers is a direct consequence of these constraints.

By taking the above mentioned approach, the eastern pier of the main river span would also not align with the adjacent bridge. This is driven by the span length in order to achieve a reasonable span that is still cost effective.

The discrepancy between the adjacent spans to either side of the main span is considered minimal, yet allows the eastern foreshore to have a more regimented resolution.

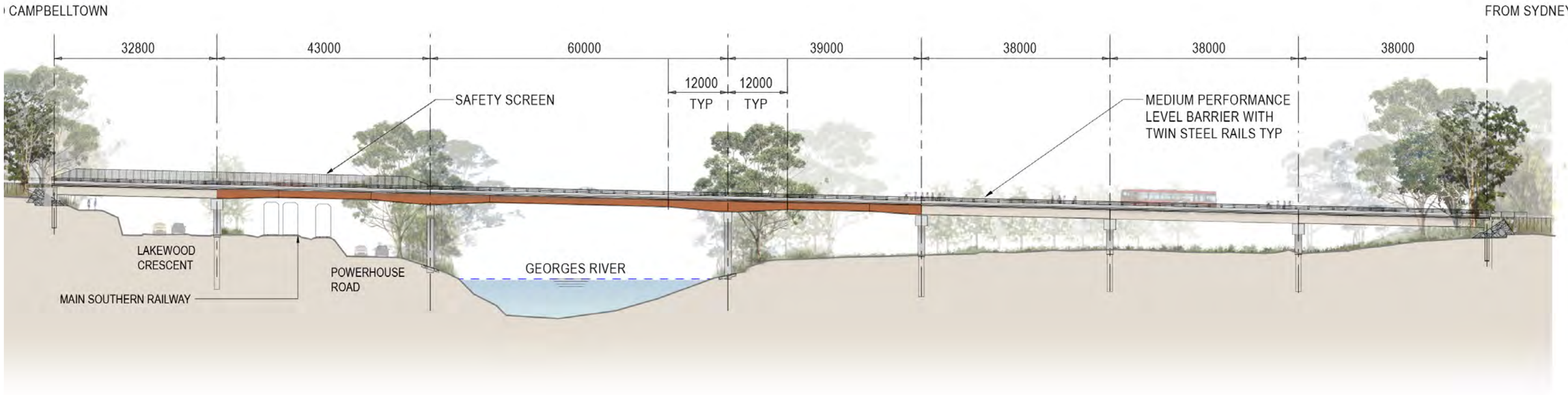


*Figure 5.14 Elevation of the proposed bridge over the Georges River. NTS*

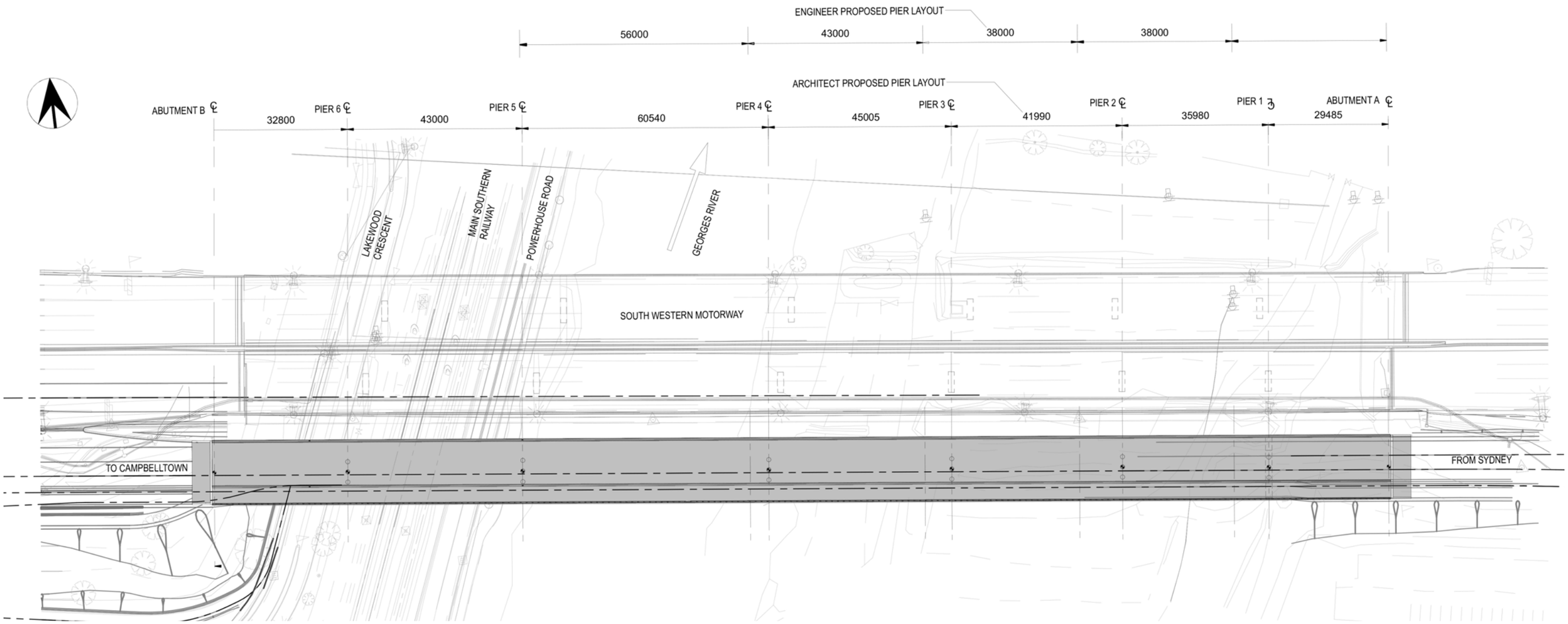


*Figure 5.15 Plan of the proposed bridge over the Georges River. NTS*

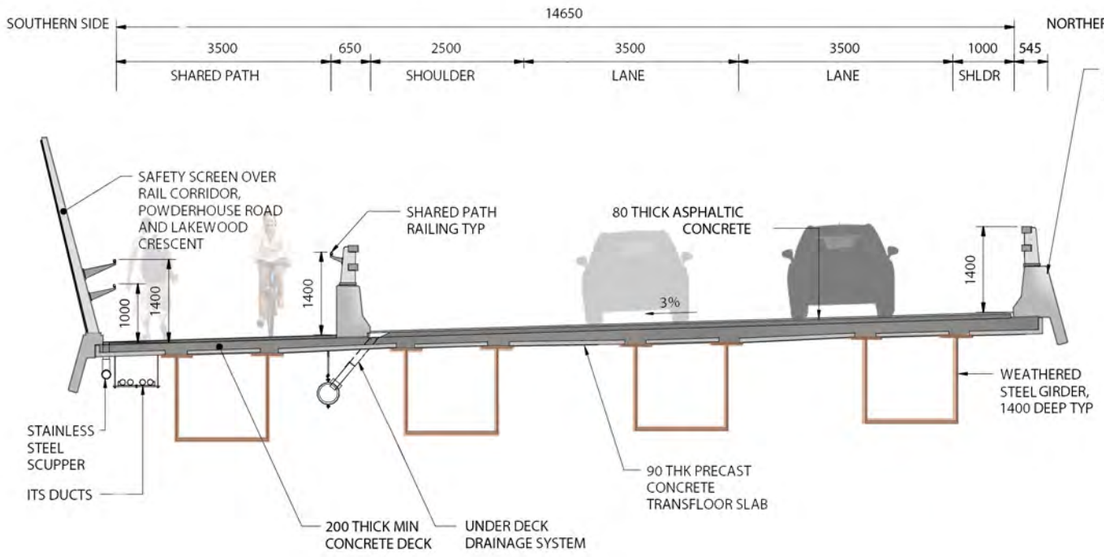


*Figure 5.16 Typical cross section at the main river span. Scale 1:100*

## Superstructure

A number of options were considered for the superstructure, including steel through girders, Super-T girders and Bulb-T girders. The preferred option is based on a hybrid superstructure combining weathered steel girders for the main river span and precast concrete super-tees for the approach spans. This hybrid approach was driven by cost factors.

The main span is based on the weathering steel option as the lower weight of this superstructure reduces demand on plant and equipment and improves safety during construction.

In addition, the weathering steel span minimises the number of bearings and avoids painting, thereby reducing maintenance requirements in the long term.

A haunch is introduced to the girders at the main span over the river to deal with the increased span.

It will be important to resolve the transition between the superstructure typologies, particularly when seen in elevations as their depth varies.

To achieve this, it is proposed to haunch the steel girder in span 4 as it approaches pier 3 to match the same depth in elevation as the Super-tees.

The current design proposes a precast Super-tee for span 7. A similar approach could be adopted as proposed in span 4, however, it is preferred from an urban design point of view to continue the weathered steel girder for visual consistency.

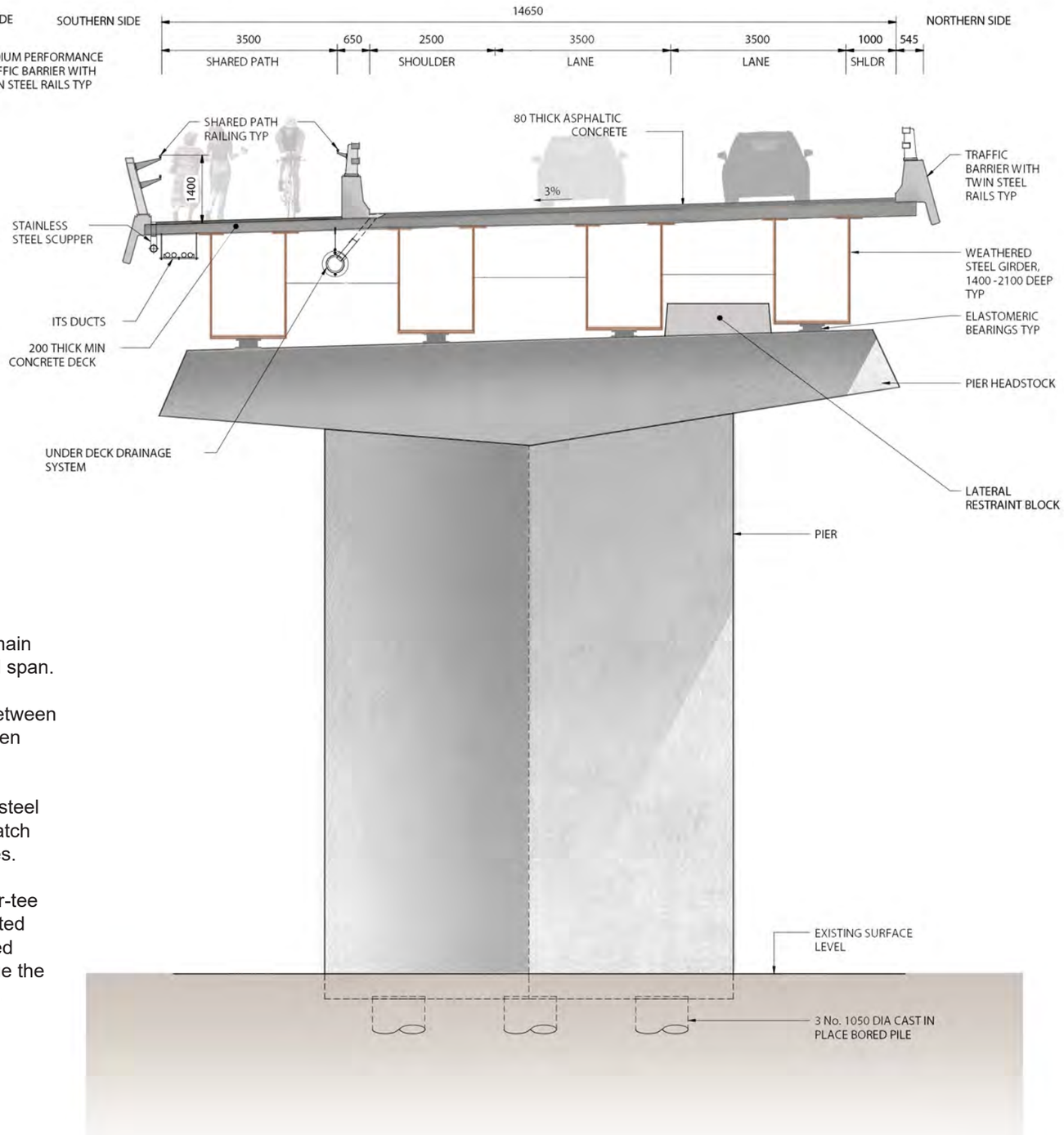


*Figure 5.17 Typical cross section at the main river span near the piers. Scale 1:100*

## Piers

The form language of the piers emulates the existing structures to provide for a consistent form language. A reveal is introduced to articulate the pier's mass and to express the headstock taper.

## Parapet

The outer face of parapets are tilted outwards to catch the sunlight and their depth has been minimised to allow for an elegant proportion between parapet and superstructure depth.

Double rail traffic barriers are proposed for the new bridge to maximise visual permeability.

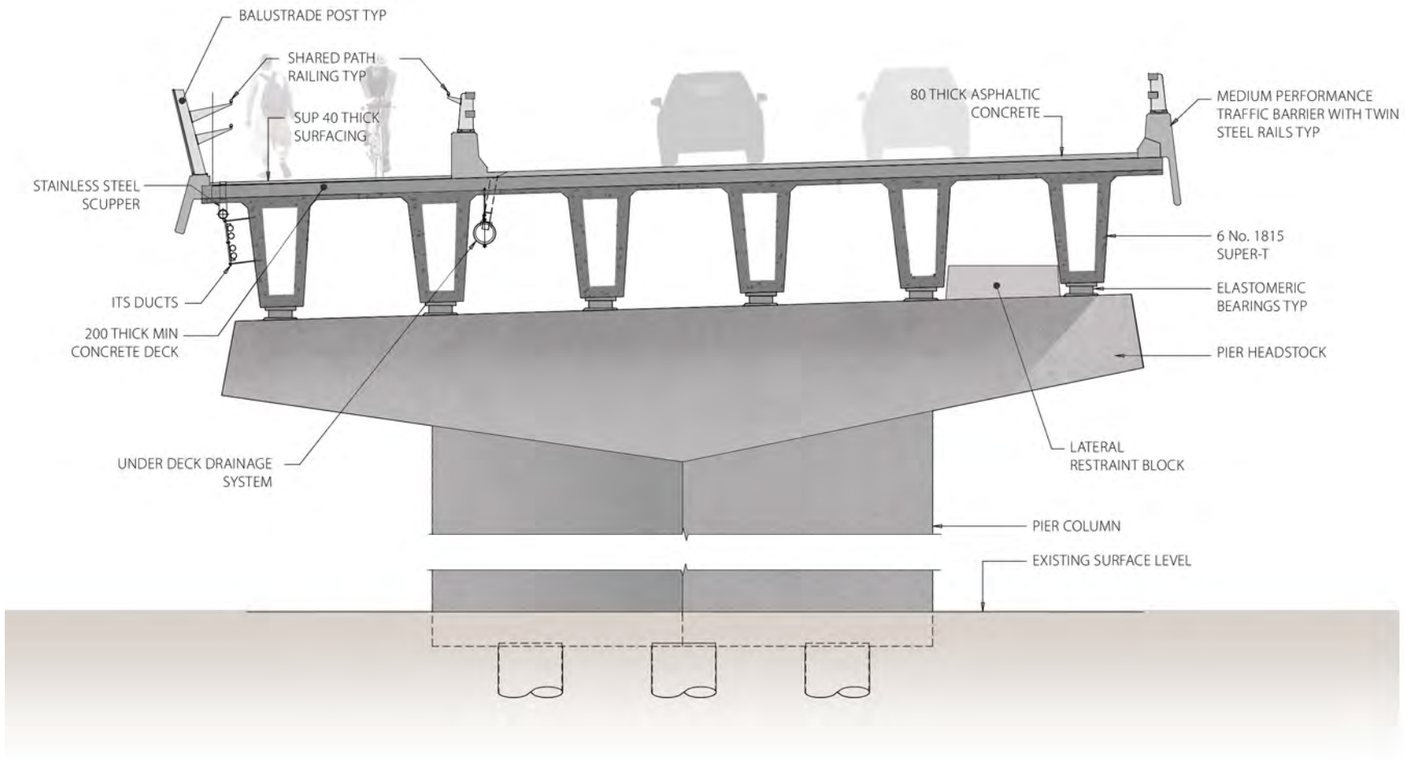


*Figure 5.18 Typical cross section at the approach spans using Super-T girders. The location of ITS ducts will be refined in the next stage of the design. Scale 1:100*

### Abutments

Abutment walls would be executed in plain concrete and in line with the other two bridges to create a unified composition.

Spill through batters at the abutments would be treated with interlocking concrete pavers, consistent with the existing situation.

*Figure 5.21 Example of interlocking concrete pavers proposed for the spill batters at the abutments.*

## 5.3.4 Noise Walls

As part of the new works, parts of the existing noise wall would be removed to make way for the off-load ramp and cycleway.

The new sections of wall will follow the colour and finish of the existing noise wall.


*Figure 5.19 The existing noise wall would be partially removed at this location.*

*Figure 5.20 The existing noise wall includes older style concrete panels and a new version behind using recycled materials.*

## 5.4 INTERPRETATION OPPORTUNITIES

As part of Connection to Country, the Georges River played an important role for the Aboriginal people. Hence, the opportunity exists to express the significance of the river through artworks painted on the piers. This would require consultation with the Aboriginal community to develop appropriate themes and strategies. The intent is to add interest below the bridge structure and create a highlight that expresses the history of the land.

In relation to military history, there is also opportunity to link heritage theming with “Remembrance Driveway”, Hume Highway, through artwork and planting of trees in remembrance of the armed forces who served in WW11.

These strategies would be further investigated in the detail design stage.

*Figure 5.22 There are numerous examples of artwork on bridge piers such as the Lachlan River Bridge in Cowra.*


*Figure 5.23 The Seaford Road Bridge with its painted piers creates a visual highlight.*


*Figure 5.24 References to the military history of the site could be considered in the next phase of the design through signage, planting and other measures.*

# 6 LANDSCAPE CHARACTER & VISUAL IMPACT ASSESSMENT

## 6.1 LANDSCAPE CHARACTER IMPACT ASSESSMENT

The landscape character impact is based on the aggregate of an area's built, natural and cultural character and sense of place. In this regard, it is measured by the combination of the area's sensitivity and the magnitude (scale, character and distance).

Table 6.1 illustrates how the level of sensitivity and magnitude are combined to achieve an overall level of impact for both the landscape character impact and the visual impact. It should be noted that the ratings are measured relative to each other rather then assigned through an absolute scale. Hence the resulting landscape character impact rating is project specific and identifies those areas with the highest and lowest impacts.

The sensitivity value refers to the qualities of a particular character zone, which may include the number and type of receivers and how sensitive the existing character of the setting is to the proposed change. For example a pristine natural environment will be more sensitive to change than a built up industrial area.

The assessment has been based on Transport for NSW's Environmental Impact Assessment Practice Note - Guideline for Landscape Character and Visual Impact Assessment No. EIA-N04, Version 2.2, issue (August 2020).

Based on the concept design, the following impact has been assessed.

| Sensitivity \ Magnitude | high | moderate | low | negligible |
|---|---|---|---|---|
| high | high impact | high- moderate | moderate | negligible |
| moderate | high- moderate | moderate | moderate-low | negligible |
| low | moderate | moderate-low | low | negligible |
| negligible | negligible | negligible | negligible | negligible |

*Table 6.1 Example of a Landscape Visual Impacts Rating Table - TfNSW EIA Guidance Note EIA-N04.*

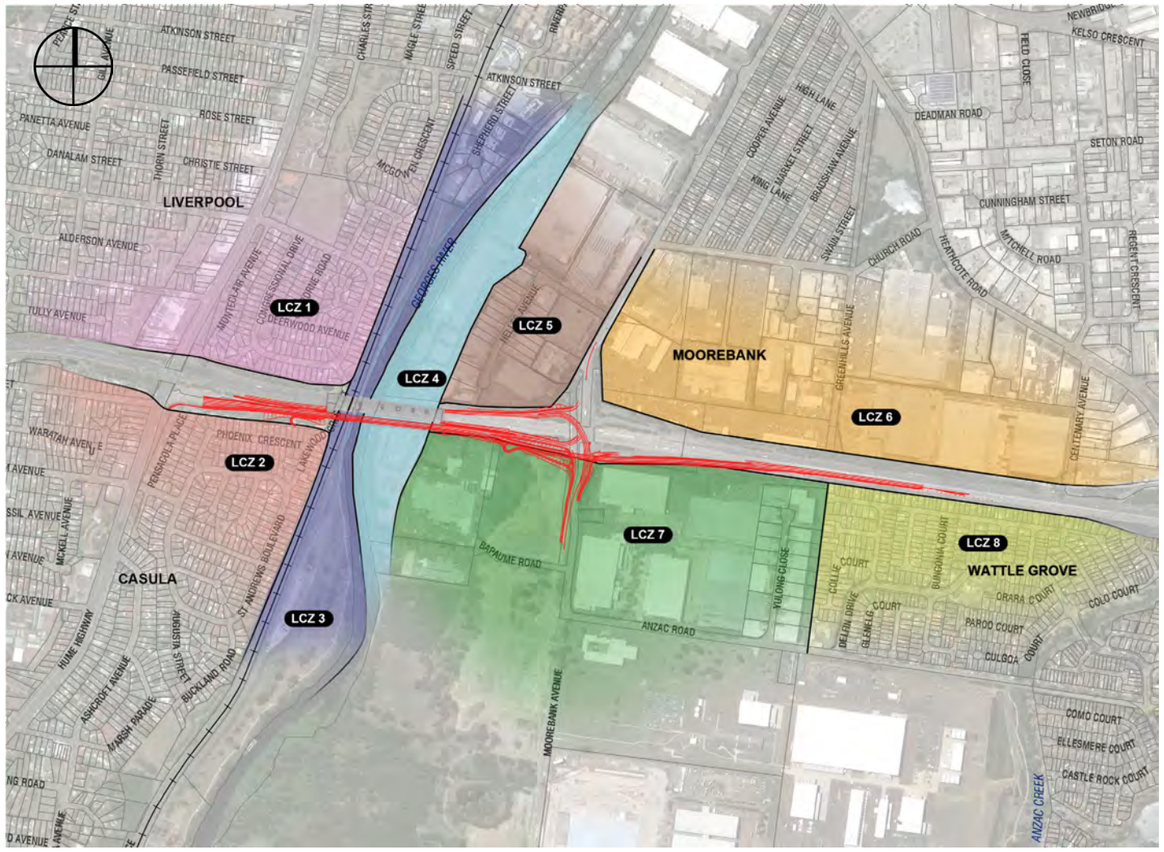


*Table 6.2 Landscape Character Zone map*

| LANDSCAPE CHARACTER ZONE | SENSITIVITY LEVEL | MAGNITUDE OF IMPACT | LANDSCAPE CHARACTER IMPACT |
|---|---|---|---|
| LCZ 1<br>LIVERPOOL RESIDENTIAL | High: established residential area susceptible to change. | Negligible: The proposed works would have a minimal impact to the identity and sense of place of this zone. It should be noted however that the shared path link from Casula to Moorebank Avenue is considered a positive development for the urban connectivity of the area. | Negligible: no impact identified except for improved connectivity. |
| LCZ 2 -<br>CASULA RESIDENTIAL | High: established residential area susceptible to change. | Negligible: The proposed works would have a minimal impact to the identity and sense of place of this zone. It should be noted however that the shared path link from Casula to Moorebank Avenue is considered a positive development for the urban connectivity of the area. | Negligible: no impact identified except for improved connectivity. |
| LCZ 3<br>WESTERN FORESHORE | High: important recreational corridor widely used by the community. | Low: the new bridge would create a longer section of shared path beneath the bridge and impact the foreshore, slightly reducing its amenity. | Moderate: the extension of shared path under the bridge would create a more enclosed character and reinforce the urbanity and built form of the area. |
| LCZ 4<br>EASTERN FORESHORE | Moderate: recreational area with limited access. Note: this zone is likely to be more accessible in the future. | Low: the new bridge would create a longer section beneath the bridge and slightly deter from the character and identity of the club grounds. However, this impact is consider limited, hence the low rating. | Low to moderate: the area's character would slightly change with car park areas being partially located beneath the bridge. However, the overall functioning of the facilities is not expected to change until Council implements its foreshore strategy. |
| LCZ 5<br>MOOREBANK INDUSTRIAL WEST | Low: industrial area with a high absorption capacity to change. | Negligible: although the project would have some effect on the green outlook for some properties, the overall effect on this zone is minimal and does not affect the identity and functioning of this area. | Negligible: minor localised impact. |
| LCZ 6<br>MOOREBANK INDUSTRIAL EAST | Low: industrial area with a high absorption capacity to change. | Negligible: the project would have no effect on the character and functioning of this area. | Negligible: no noteworthy impact identified as a result of the proposal. |
| LCZ 7<br>MOOREBANK INDUSTRIAL SOUTH | Low: industrial area with a high absorption capacity to change. | Low: the overall sense of place and identity would not be greatly impacted; accessibility to the area would be improved with the incorporation of a shared path and improved pedestrian amenities. | Low: the impact to this zone is considered low and provides an improvement in urban permeability. |
| LCZ 8<br>WATTLE GROVE | High: established residential area susceptible to change. | Negligible: the project would not impact this zone. | Negligible: no impact identified as a result of the proposal. |

*Table 6.3 Landscape character impacts assessment table.*

### 6.1.1 Summary of Landscape Character Impacts

Table 6.4 summarises the landscape character impact for each of the identified landscape character zones. Of the eight zones, five are considered to have a negligible impact, one with a low impact, one with a low to moderate impact and one with a moderate impact respectively.

Hence, the overall project appears to have a limited impact to the general surrounding areas of the proposal.

It should be noted that although the eastern foreshore would experience a low to moderate landscape character impact, the proposal would positively contribute to the urban connectivity of the area.

| Character zones | | Sensitivity | Magnitude | Impact |
|---|---|---|---|---|
| 1 | Liverpool Residential | High | Negligible | Negligible |
| 2 | Casula Residential | High | Negligible | Negligible |
| 3 | Western Foreshore | High | Low | Moderate |
| 4 | Eastern Foreshore | Moderate | Low | Low to Moderate |
| 5 | Moorebank Industrial West | Low | Negligible | Negligible |
| 6 | Moorebank Industrial East | Low | Negligible | Negligible |
| 7 | Moorebank Industrial South | Low | Low | Low |
| 8 | Wattle Grove | High | Negligible | Negligible |

*Table 6.4 Landscape character impacts assessment summary table.*

## 6.2 VISUAL IMPACT ASSESSMENT

This section of the report discusses the visual impact of the proposal on the surrounding area.

### 6.2.1 Visibility of the Proposal

In order to assess the visual impact, a Visual Envelope Map (VEM) of the proposal's visual catchment from the surrounding area has been prepared. The visual catchment is defined either by topographical features, built form elements or screening vegetation if appropriate.

There would be limited visibility of the proposal from the northern side of the motorway corridor. This is greatly due to the fill embankments surrounding the Moorebank Avenue Interchange as well as other screening elements such as vegetation and large built form elements, including the existing bridge.

To the south, the proposal would be more visually exposed, particularly near the Georges River. Other areas would be less exposed due to the geometric nature of the alignment, being greatly concealed as an underpass.

It should noted however, that the proposal would require the removal of skyline vegetation near the Moorebank Avenue Interchange and as a result a noticeable change would be perceived.

The proposal would also be visible from some of the high rise apartment blocks further north, located in the Paper Mill Precinct in Liverpool. These views would be from afar and would have minimal impact to residences, hence they have not been included in the study area.


*Figure 4.1 Visual envelope map illustrating the visibility of the proposal. Note the limited visibility to the north compared to the south. Hence most viewpoints for the assessment are taken from the southern side of the motorway corridor.*

### 6.2.2 Selected Viewpoints

The visual impact assessment has been based on selected representative viewpoints from the immediately surrounding visually exposed areas. Eight viewpoints have been selected from various locations. The viewpoint locations were selected to include the various situations the proposal interfaces, including residences, roadways, commercial properties and open space.

Figure 2.47 *Viewpoint 1 - View looking from the pedestrian path along Lakewood Crescent looking towards the existing bridge.*

Figure 2.48 *Viewpoint 2 - View from next to 9 Lakewood Crescent looking towards the existing bridge.*

Figure 2.49 *Viewpoint 3 - View looking north along the shared user path next to Powerhouse Road.*

Figure 2.50 *Viewpoint 4 - View looking from Casula Parklands towards the M5 Motorway with the bridge in the background.*

Figure 2.51 *Viewpoint 5 - View from the M5 Motorway overlooking the Georges River.*

Figure 2.52 *Viewpoint 6 - View looking east towards the eastbound Moorebank Avenue off-load ramp. Note the mixed canopy vegetation along the verge.*

Figure 2.53 *Viewpoint 7 - View looking west along the westbound Moorebank Avenue interchange on-load ramp.*

Figure 2.54 *Viewpoint 8 - View from Bapaume Road looking north towards the Moorebank Avenue interchange.*

Figure 2.55 *Viewpoint 9 - View from the Moorebank Avenue interchange looking towards the southeast.*

Figure 2.56 *Viewpoint 10 - View looking along the westbound off-load ramp of the Moorebank Avenue interchange.*


LEGEND

**Project**

- Location of the Proposal
- Railway
- Cadastre
- Viewpoints

Figure 2.57 *Viewpoints map*

## 6.2.3 Visual Sensitivity

The following visual sensitivity has been assessed for each of the viewpoints identified as outlined in the table below.

| View | Description of setting | Sensitivity of view | |
|---|---|---|---|
| V01 | Pedestrian path within a residential neighbourhood looking towards a bridge crossing next to a railway corridor and open space as part of a road reserve. | M | Moderate; the transient nature of the viewer limits the sensitivity, whilst the somewhat scenic quality makes it more sensitive to change, hence the moderate rating. |
| V02 | Low density residential area set in an gently undulating setting with a leafy character. | M | This view is representative of the adjacent residence. Hence, the sensitivity is considered high as viewers would be sensitive to change and potentially enjoying prolonged viewing periods. |
| V03 | Streetscape setting along a shared user path/local road within a scenic setting alongside a river. | H | High; the existing facility provides a high degree of visual amenity and is used for recreational purposes. Although the viewer is of a transient nature, its popularity would make it sensitive to change. Hence the high rating even though the utilitarian railing somewhat detracts from the streetscape. |
| V04 | Park setting adjacent to a river with greenery and stands of trees set in a quiet suburban area. The riverfront setting is scenic and provides for recreational activities. | H | High; the recreational land use, its scenic value, the high number of viewers and the potential to experience the viewpoint for extended periods, makes this viewpoint more sensitive. |
| V05 | Panoramic vistas overlooking a riverfront and suburban residential area. | M | Moderate; the transient nature that viewers from both the road and SUP enjoy limits the sensitivity, whilst the scenic vista makes it an important feature during the journey, hence the moderate rating. |
| V06 | Motorway off-load ramp set in a suburban industrial area with limited visual qualities. The mature greenery of the road reserve provides visual relief from the otherwise urban environment. | L | Low; the transient nature of the viewer limits the sensitivity within a roadway setting with limited scenery. |
| V07 | Motorway on-load ramp set in a suburban industrial area with limited visual qualities. The greenery of the road reserve does provide visual relief from the otherwise urban environment. | M | Moderate; the transient nature of the viewer limits the sensitivity within a roadway setting with limited scenery. Yet the absorption capacity is limited, hence the moderate rating. |
| V08 | Open land for development of an industrial estate with open vistas to the surrounding landscape. | L | This view is representative of the industrial/commercial land use. Its introverted character and activities makes it low in sensitivity. |
| V09 | Streetscape setting along a major road at a motorway interchange and surrounded by greenery. The site has a limited absorption capacity due to its ridgeline location and vegetative framing of the intersection. | M | Moderate; the transient nature of the viewer limits the sensitivity within a roadway setting with limited scenery. Yet, the ridgeline setting makes it more sensitive to change, hence driving the moderate rating. |
| V10 | Motorway setting approaching an interchange off-load ramp within an urban setting. | L | Low; the transient nature of the viewer limits the sensitivity within a roadway setting with limited scenery. The site has a higher absorption capacity with the wider green verge and lower elevation. |

### 6.2.4 Magnitude of Visual Change

Each viewpoint has been assessed in regard to the perceived magnitude of change with a description of the likely visual effects of the proposal.

| View | Element of proposal visible | Magnitude of change | | Nature of impact |
|---|---|---|---|---|
| V01 | Filtered view of the proposed new bridge structure over the Georges River. | M | Moderate. The bridge structure would become more dominant, yet the filtered views limit the exposure of the new structure, limiting the magnitude of change. The change in materiality of the superstructure is not desirable. | Adverse. The crossing beneath the motorway would be longer and less friendly. |
| V02 | Minor glimpses of the new bridge structure possible in the distance. The new structure would appear slightly closer to the viewer. | N | Negligible. The new bridge would have a limited impact on the viewscape. This is greatly driven by the screening effect of existing vegetation which would be retained. | Adverse with minimal effect. |
| V03 | Open vista towards the new bridge from mid-distance. The new structure would appear closer to the viewer. | M | Moderate. The general setting would not dramatically change, yet the widened bridge would slightly compromise the scenic quality of the setting by making the bridge structure more dominant. The change in materiality of the superstructure is not desirable. | Adverse, yet limited impact along the river foreshore. |
| V04 | Partial view of the proposal in the distance. | N | Negligible. The new bridge would have a limited effect on the viewscape, resulting in a negligible magnitude of change. This is greatly due to the distance to the new structure. | Adverse with minimal effect. |
| V05 | Partial view of the proposal from close range showing the new bridge structure clearly visible. | H | High. The new bridge would impact the panoramic vistas that the motorist viewers enjoy in the existing situation. For shared path users, the magnitude of change is negligible as similar vistas would be retained. | Adverse, noticeable change |
| V06 | Vistas towards new re-established landscape and modified off-load ramp. | H | The loss of skyline trees and dense mixed canopy vegetation will be noticeable. However, the re-establishment of vegetation would mitigate the visual impact in the long term. Views towards the industrial estates will be possible, contrasting with the existing situation. | Adverse, noticeable change. A strong landscape treatment is important to mitigate impacts. |
| V07 | Vistas towards new re-established landscape with filtered views towards the new Hume Highway off-load ramp below. | H | The loss of skyline trees will be noticeable. However, the re-establishment of vegetation would mitigate the visual impact in the long term. Filtered views towards the retaining walls of the underpass would contrast with the existing situation. | Adverse, noticeable change. A strong landscape treatment is important to mitigate impacts. |
| V08 | View of new re-established landscape, new fill batter in the distance and shared user path. | L | Low. The introduction of a new fill batter would not contrast with the existing situation/backdrop. The loss of skyline trees would be noticeable, yet the re-establishment of new vegetation would limit the visual contrast, particularly over time. Hence the low rating. | Adverse with limited effect. |
| V09 | Open vista over the Hume Highway exit ramp below. Vegetation clearance clearly noticeable from short range. | H | High. Extensive removal of established vegetation, including skyline trees, resulting in a high magnitude of visual change compared to the existing situation. | Adverse, with noticeable change. |
| V10 | View of the proposed new Hume Highway exit ramp, including modifications to the verge and planting removal. | H | High. The introduction of the new exit ramp would require extensive vegetation removal and the introduction of new paved areas. This would have a strong contrast with the existing situation. | Adverse, with noticeable change. |

### 6.2.5 Visual Impact

The resulting visual impact for each identified viewpoint has been outlined in the table below. The proposed mitigation measures have been adapted in the design.

| View | Sensitivity | Magnitude | Visual impact | Comments/proposed mitigation |
|---|---|---|---|---|
| V01 | Moderate | Moderate | Moderate. The proposal would increase the presence of the motorway bridges, yet the general visual amenity would greatly be retained. There is some loss of greenery, yet this is limited. | Limited opportunity for visual mitigation. Ensure that safety screen elements are of a light colour to limit contrast with the sky backdrop. |
| V02 | Moderate | Negligible | Negligible. The perceived change is minimal due to the screening effect of existing vegetation which would be retained. | No mitigation opportunity required. |
| V03 | High | Moderate | Moderate to high. The proposal would make the bridge crossing a more dominant element in the landscape. It should be noted, that the moderate to high rating is driven by the high sensitivity. The weathered steel girder would add interest by introducing colour to the structure. | Limited opportunity for visual mitigation. Ensure that safety screen elements are of a light colour to limit contrast with the sky backdrop.<br>Ensure large scale vegetation is intermittently situated in front of the bridge to visually settle the structure in its setting. |
| V04 | High | Negligible | Negligible. The proposal would have a minimal impact to this viewshed due to the distance of the viewer to the proposal. In addition, vegetation partially screening the proposal contributes to mitigating the effect of the proposal. | No mitigation opportunity required. |
| V05 | Moderate | High | Moderate to high. The scenic quality of the view would be reduced as the new bridge would be in the foreground. This would compromise the journey experience for motorists. For shared path users, the visual impact would be negligible. | No mitigation opportunity identified. For shared path users no mitigation measure is required. |
| V06 | Moderate | High | Moderate. The loss of extensive vegetation and the re-establishment of new vegetation would contribute to this rating. The visual amenity of the viewscape would be compromised. | Ensure dense vegetation including shrubs and stands of trees provide effective screening. |
| V07 | Low | High | Moderate to high. The loss of some vegetation and the re-establishment of new vegetation would contribute to this rating. The visual amenity of the viewscape would be compromised, yet not to a detrimental effect. | Ensure dense vegetation including shrubs and stands of trees, provide effective screening. |
| V08 | Low | Low | Low. The proposal would not be very noticeable from the distance, except for the loss of skyline vegetation. The re-introduction of greenery would limit this effect. | Ensure that stands of trees and dense shrubs are planted along batters. |
| V09 | Moderate | High | Moderate to high. The proposal would likely expose large scale industrial buildings, detracting from the streetscape. The marking of the interchange would be compromised. | Maximise large scale tree planting along the southeastern verge to provide for visual screening and re-establish the green character of the current interchange. |
| V10 | Low | High | Moderate. The introduction of new paved areas and removal of screening vegetation would reinforce the dominance of the motorway setting. This is underpinned by the multi-exit off-load ramps, that would increase the visual prominence of the interchange. | Identify opportunities for interplanting of trees to maximise greenery. |

# 7 CONCLUSION

The proposal is situated in an urbanised area, interfacing an important ecological and open space corridor that supports a variety of recreational activities.

The urban areas that interface the proposal are varied, with the more sensitive areas situated to the west.

Overall, the proposal has a limited impact to the landscape character and visual quality of the surrounding areas due to:

- the limited scale of the intervention of the proposal, in context with the presence of the existing M5 Motorway,and
- parts of the proposal are greatly screened in the vicinity of the Moorebank Avenue interchange, despite the required removal of skyline vegetation.

It will be important that the new bridge structure is sensitively integrated with the adjacent structures to create a unified ensemble. In this regard, further design refinement is required to better align the bridge design in line with the ‘Bridge Aesthetics – Design guideline to improve the appearance of bridges in NSW’, Centre for Urban Design.

In the next phase of detail design, opportunities need to be investigated for heritage interpretation, including Connection to Country.

The success of the project hinges on limiting environmental impacts, particularly along the foreshore, maximising the indigenous mature vegetation communities, re-establishing the vegetation at the Moorebank Avenue interchange, ensuring the retention of vegetation buffers between Casula residences and creating a legible and safe alignment for road users.

The sensitive river environment and presence of EEC vegetation communities require careful consideration of construction methodologies to minimise impacts to the environment. In this regard, selection of plant, equipment and transport logistics are important.