Mamre Road Upgrade, Stage 1

Between M4 Motorway & Erskine Park Road, NSW

Urban design report including landscape character and visual impact assessment

21 July 2021

scape DESIGN

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Revision history

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15 October 2020	01	Issue for 20% Concept Design	EA	CH
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Cover page image

Looking south on Mamre Road, north of the intersection with Banks Drive

Acknowledgement of Country

We acknowledge the Darug people whose country today falls within the interests of the Deerubbin Local Aboriginal Land Council. We respect the Darug people as the traditional Custodians of the land, on which the Mamre Road Upgrade is located. We pay our respects to Elders past, present and emerging and appreciate the deep connections and knowledge they have with their Country - lands, seas, rivers and skies.

Contents

Abbreviations

Acronym	Description
ACHAR	Aboriginal Cultural Heritage Assessment Report
AEP	Annual Excedance Probability
AHD	Australian Height Datum
AHIMS	Aboriginal Heritage Information Management System
BAR	Biodiversity Assessment Report
BFPL	Bush fire prone land
BFPV	Bush fire prone vegetation
BOK	Back of kerb
C	Celsius
CBD	Central Business District
CPTED	Crime Prevention through Environmental Design
DPIE	Department of Planning, Industry and Environment
DP	Deposited plan - defining legal boundaries of land
EIS	Environmental Impact Statement
EP&A	Environmental Planning and Assessment Act
GA	General Aviation
HPV	High Productivity Vehicles
LCVIA	Landscape character and visual impact assessment
.KMZ	File extension for a place mark file used by Google Earth
LCZ	Landscape character zone
LEP	Local Environmental Plan
LGA	Local Government Area
m.a.s.l	Metres above mean sea level
mm	Millimetres
NSW	New South Wales
NSW SES	New South Wales State Emergency Service
OEH	Office of Environment and Heritage
PCC	Penrith City Council
PCT	Plant Community Types
NSW RFS	New South Wales Rural Fire Service
SEPP	State Environmental Planning Policies
SHR	State Heritage Register
SHI	State Heritage Inventory
SUP	Shared user path
TfNSW	Transport for NSW (formerly Roads and Maritime)
TSC Act	Threatened Species Conservation Act 1995
UHI	Urban Heat Island

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1 Introduction

1.1 Background

The NSW Government has started planning for a future upgrade of Mamre Road, between the M4 Motorway and Kerrs Road, to support economic and residential growth in this area. For the purpose of delivery, the upgrade has been split into two stages, Stage 1 between M4 Motorway and Erskine Park Road, and Stage 2 between Erskine Park Road and Kerrs Road.

The Mamre Road upgrade is part of a plan to progressively upgrade arterial roads in Western Sydney to deliver a more efficient, reliable network that meets the future needs of the community and the economy. This includes the need to support Western Sydney International (Nancy-Bird Walton) Airport and the Western Sydney Aerotropolis.

The Western Parkland City would be established on the strength of the new international Western Sydney Airport, opening in 2026, and the Western Sydney Aerotropolis. The population at Western Parkland city is projected to grow from 1,070,000 in 2016 to 1,534,450 by 2036. The NSW Government is planning for this growth by reserving residential and employment land for future developments.

1.2 Project description

Transport for NSW (TfNSW) proposes to upgrade about 3.8 kilometres of Mamre Road between the M4 Motorway, St Clair and Erskine Park Road, Erskine Park to a four-lane divided road (the proposal). The proposal is located within the City of Penrith local government area (LGA) in Sydney, New South Wales (NSW). The proposal forms Stage 1 of the larger Mamre Road Upgrade Project, which is proposed to be delivered by TfNSW in two stages. Overall, the Mamre Road Upgrade Project would involve upgrades to a 10 kilometre long section of Mamre Road between the M4 Motorway, St Clair and Kerrs Road, Kemps Creek.

Mamre Road is a key transport corridor, which provides connections to the Western Sydney Employment Area and the proposed Western Sydney Aerotropolis. A key aim of the proposal is to improve road safety and movement between the M4 Motorway and Erskine Park Road through increasing the capacity of Mamre Road, which would support future economic and residential growth in the surrounding area.

Key features of the proposal would include:

- an upgrade of Mamre Road to a four-lane divided road with a wide central median that would allow for widening to six lanes in the future, if required
- changes to intersections with Mamre Road including:
  - an upgrade to the existing signalised intersection at Banks Drive including a new western stub for access and a U-turn facility
  - a new signalised intersection at Solander Drive including a new western stub for access and a U-turn facility
  - a new signalised intersection at Luddenham Road with new turning lanes
  - an upgrade to the existing signalised intersection at Erskine Park Road with new turning lanes
  - modified intersection arrangements (left in, left out only) at McIntyre Avenue and Mandalong Close
- a new shared path along the eastern side of Mamre Road and provision for a shared path on the western side
- reinstatement of bus stops near Banks Drive with provision for additional bus infrastructure in the future
- changes to property access to Mamre House, Erskine Park Rural Fire Service and other private properties
- drainage and flooding infrastructure upgrades including culvert crossings, water quality basins, grass swales and channel tail-out work
- new traffic control facilities including new traffic signals and relocation of existing electronic variable message signage
- roadside furniture and street lighting
- noise walls along the eastern side of Mamre Road at St Clair
- utility relocations
- establishment of temporary ancillary facilities to support construction including compound sites, stockpile and laydown locations, temporary access tracks, temporary waterway crossings and concrete batching plants

Construction of the proposal is expected to start in 2022 and be completed in late 2025, subject to approval, funding and weather considerations. Construction of the proposal is planned to be carried out in two stages: early work and main construction work. Early work would involve utility relocations, site establishment activities, property adjustments and other low impact work required to facilitate construction.

1 Introduction

1.3 Purpose and scope of this report

This report presents the urban design considerations and landscape character and visual impact assessment (LCVIA) for Stage 1 of the Mamre Road Upgrade. The purpose of this report is to:

- Analyse the study area, formulating a series of project-specific design principles and urban design vision, illustrating the urban design concept, documenting the potential landscape character and visual impacts of the project and preparing a strategy to mitigate these impacts
- Inform the audience of the REF for the project of the potential landscape character and visual impacts of the proposal in accordance with the relevant environmental assessment requirements of Division 5.1 of the EP&A Act.

Refer Section 5 on page 73 of this report for a detailed description of the landscape character impact assessment methodology and Section 7 on page 99 for a detailed description of the visual impact assessment methodology.

1 Introduction

1.4 Study area

Figure 1-1 shows the extent of the Stage 1 upgrade, which traverses the built up areas of St Clair and Erskine Park in the east and the scenic pastoral and productive landscapes associated with Mamre House and the South Creek corridor to the west.

Along the Mamre Road southbound setback the modestly-scaled detached, brick dwellings within the St Clair estate are divided by two wide turf channels, which control runoff that originates from within the residential estate. These channels are utilised for passive recreation with the southern channel linking to Peter Kearns Reserve, which supports a number of active sports and recreation facilities.

Mamre House curtilage is an important historic/ community node, which is surrounded by productive market gardens with frontage directly onto Mamre Road.

There a number of schools within St Clair, which are:

- Three high schools: St Clair High School, Emmaus Catholic College and Mamre Anglican School
- Four primary schools: St Clair Public School, Banks Public School, Blackwell Public School, Clairgate Public School and Holy Spirit Catholic.

There are a number of activity nodes within the vicinity of the study area and these include:

- St Marys Strategic Centre (2.3 km north)
- St Marys Train Station (2.7 km north)
- Leeholme Horse Stud Rotunda (700 m south-west).

The residential area of St Clair is accessed by the following intersections:

- Banks Drive
- Solander Drive
- McIntyre Avenue.

Eight rural residential properties have access to Mamre Road from Mandalong Close. Surrounding future land use includes residential and urban development to the north western extent of the Proposal, and semi-rural and future residential to the eastern extent. Luddenham Road provides links with the planned Western Sydney Aerotropolis.

The *Western City District Plan*, informed by the *Sydney Green Grid*, identifies a number of priority corridors and projects for Penrith to promote a connected Green and Blue grid for the City. Two within the local context of the study area are:

- South Creek (700 m west) – creating a continuous open space corridor along all of South Creek that provides ecological protection and enhancement, better storm water treatment and a regionally significant corridor for recreation uses
- Blaxland Creek and Bushland Reserve (2.7 km west of Luddenham Road intersection) – protecting important future open spaces for the Western Sydney Aerotropolis.

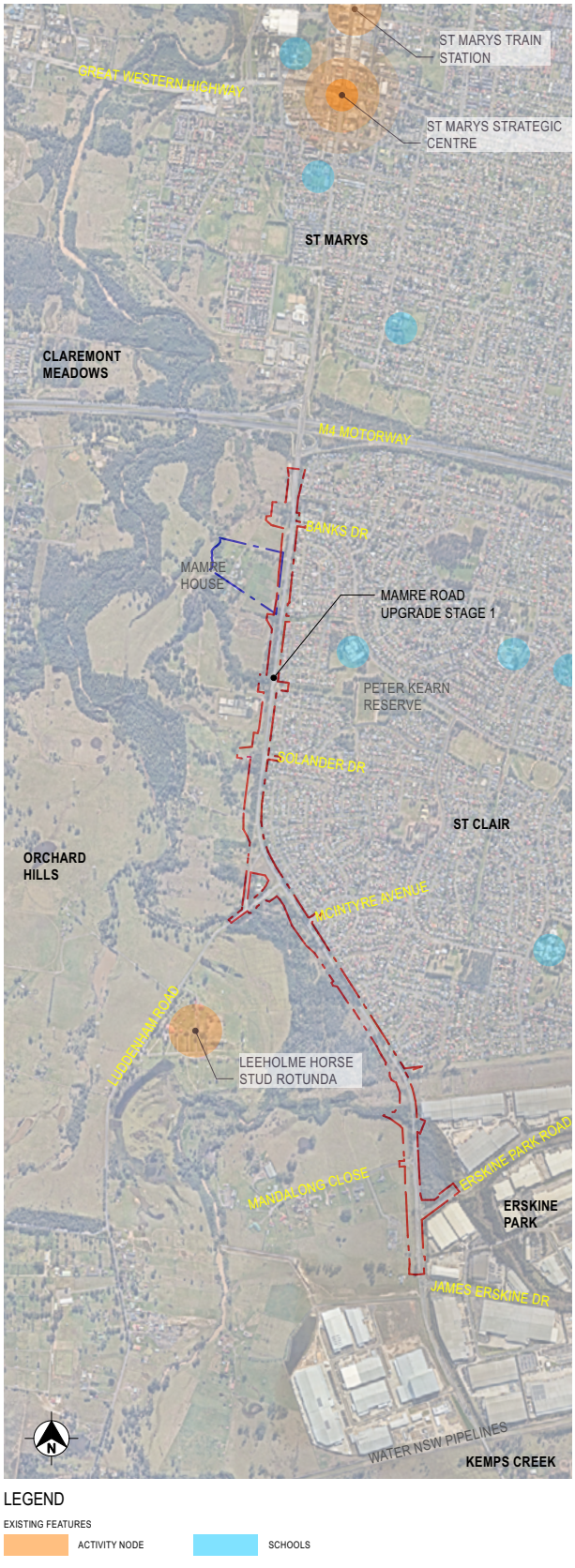


Figure 1-1: Study area

1 Introduction

1.5 Planning framework

The proposal is subject to environmental assessment under Division 5.1 of the Environmental Planning and Assessment Act 1998 (EP&A Act), which requires Transport for NSW to prepare a review of environmental factors (REF) for the proposal. This urban design report and LCVIA has been prepared to support the REF.

1.6 Strategic planning policy context

A number of state wide legislative and policy guideline documents have been referred to in order to guide the project and these include:

- *A Plan for Growing Sydney, NSW Planning and Environment, December 2014*
- *Greater Sydney Region Plan: A Metropolis of Three Cities, Western City District Plan, March 2018*
- *NSW Premiers Priorities, 2020*
- *Future Transport Strategy 2056*
- *NSW Freight and Ports Strategy, NSW Government, 2013*
- *Our Greater Sydney 2056 - Western City District Plan, Greater Sydney Commission, March 2018*
- *NSW Infrastructure Strategy 2018-2038*
- *Western Sydney Aerotropolis Final Planning Package 2020 and DRAFT Precinct Plans.*

A number of Local Government Area policy guideline documents were also reviewed in order to inform the development of the project and these include:

- *Penrith Local Environment Plan, 2010 (LEP)*
- *PCC Development Control Plan (DCP)*
- *Penrith Community Plan, 2017*
- *Penrith Local Strategic Planning Statement, 2020*
- *Penrith City Strategy, 2013*
- *PCC Bushfire Prone Land Map, 2014*
- *SEPP (Western Sydney Employment Lands), 2009.*

Other documents that have provided background reference information for the study area include:

- *Preliminary Environmental Investigation Report, Hills Environmental, Version 2, 2016*
- *Mamre Road - Strategic Design Report, August 2017*
- *Mamre Road Upgrade - Kerrs Road to M4 Motorway, Roads and Maritime Services, November 2017.*

1.7 Urban design guidance

NSW guidance

The following guideline and policy documents define best practice for road infrastructure projects across NSW, these documents include:

- *Beyond the Pavement,* Transport for NSW, 2020
- *Reconciliation Action Plan*, Transport for NSW, 2019-2021.
- *Bridge Aesthetics,* Roads and Maritime Services, 2019
- *Guideline for Batter Surface Stabilisation using vegetation,* Roads and Maritime Services, 2015
- *Landscape Design Guideline,* Roads and Maritime Services, December 2018
- *Biodiversity Guidelines,* Roads and Maritime Services, September 2011
- *Noise wall design guideline,* TfNSW, March 2021

At a state level *Beyond the Pavement* is the over-arching document that provides guidance for the development of infrastructure projects ensuring that urban design is considered early, integrated from the initial phase and continued through to the finalisation and operation phases.

Broad physical urban design objectives

Project specific urban design objectives and principles are listed in Table 3-1 on page 24 and have been adapted from the following four physical urban design objectives listed in *Beyond the Pavement*:

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

1 Introduction

Broad urban design principles

Complimenting these four objectives are nine urban design principles that further help to ensure an integrated urban design and engineering outcome. These are:

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

Western Sydney urban design guidance

The following guideline and policy documents define best practice for road infrastructure upgrade projects across western Sydney, these documents include:

- *Draft Cumberland Plain Conservation Plan, NSW Department of Planning, Industry and Environment, August 2020*
- *Sydney Green Grid Spatial Framework and Project Opportunities, Government Architect NSW, Final report 23.03.17.*

Penrith City Council urban design guidance

The following strategy and policy documents define the best practice for works within the Penrith City Council LGA and include:

- *Community Safety Plan*
- *Crime Prevention through Environmental Design*
- *Penrith Biodiversity Strategy*
- *Cooling the City Strategy*
- *Penrith Public Domain Manual*
- *Water Sensitive Urban Design (WSUD) Policy and Technical Guidelines*
- *PCC Water Sensitive Urban Design (WSUD) Policy*
- *Public Domain Lighting Policy, 2004*
- *Penrith Accessible Trails Hierarchy Strategy (PATHS)*
- *Penrith Public Domain Manual*
- *Street and Park Tree Management Plan.*

1.8 Reference documents

This report is to be read in conjunction with the following documents:

- The REF and associated specialist reports
- Urban design drawings within this report:
  - L.SK-4001-Opportunities and constraints 1 [02]
  - L.SK-4002-Opportunities and constraints 2 [02]
  - L.SK-4003-Landscape character zones [02]
  - L.SK-4004-Visual envelope mapping [02]
  - L.SK-4005-Viewpoint locations [02]
  - L.SK-4006-Mitigation measures 1 [02]
  - L.SK-4007-Mitigation measures 2 [02]
  - DU-1101-1119-Urban design plans [02]
  - DU-2101-2103-Urban design sections [02]
  - DU-2102A-Urban design section (SUP alignment) [02].

1 Introduction

1.9 Report methodology

Preparation of this urban design and landscape character and visual impact assessment report has been an iterative process with the whole design team. Urban design opportunities and constraints have been fed into the design development process to ensure integration and cost efficiencies. The steps have included:

- Visual inspection of the study area and surrounding broader context on 19 June 2020 with photographic records
- Desktop studies of the regional context and site analysis of the local natural and built environment, human intervention and the shaping of the landscape and the interaction between place and community
- Desktop review of background reports and relevant planning policies
- Development of urban design vision and objectives and principles
- Development of the urban design concept
- Assessment of the potential landscape character impacts of the project
- Assessment of the potential visual impacts of the project
- Development of mitigation strategy, which includes principles and strategies to mitigate landscape character and visual impacts in the ongoing development of the design.

This process has occurred in collaboration with the project team and with TfNSW urban designers with the aim of achieving an integrated urban design and engineering outcome that realises the design outcomes described in TfNSW urban design guideline and policy documents listed in Section 3 on page 23.

1.10 Report structure

The LCVIA report is structured into nine sections:

1. **Introduction**

Provides a brief overview, report purpose, assessment requirements, the legislative context and the report structure

2. **Existing environment**

Describes the urban and landscape setting and character, and how they have informed the design and assessment process. Defines distinct landscape character zones according to topography, drainage and urban form etc.

3. **Urban design vision**

Presents the urban design strategy for the project including an urban design vision, objectives and principles that are derived from the contextual analysis

4. **Urban design concept**

Describes the major elements of the project and offers design approaches for the future development of these elements

5. **Landscape character impact assessment**

Assesses impacts from the project on the identified landscape character zones by analysing how well the project fits into the natural and built landscape

6. **Visibility of the project**

Identifies the areas where the project would be visible, also known as the visual envelope and determines a range of representative viewpoints within that catchment

7. **Visual impact assessment**

Assesses impacts of the project on each of the selected viewpoints and leads to the identification of mitigation measures

8. **Mitigation strategy**

Outlines recommended mitigation measures to be incorporated into future planning and design of the project. These measures would be discussed with the design team and would be integrated into future design stages

9. **Summary of Urban Design Findings**

Provides a summary of the outcomes the community can expect including urban and landscape design outcomes, the likely level of landscape character and visual impacts, and how they could be further reduced through the application of mitigation measures in future stages.

View east across existing drainage channel through St Clair estate

2 Existing environment

2.1 Chapter overview

The following section of the report provides a summary of the existing landscape context and cultural influences on the study area. This background information has inform the development of the concept design and ultimately the mitigation measures that respond to any residual impacts. Further detail on each sub-section can be obtained by reviewing the relevant specialist report provided in the appendix of the REF.

2.2 Regional context

Stage 1 of the Mamre Road upgrade is located in Sydney's west within the Penrith local government area (LGA) around 50 km west of Sydney's CBD. It extends over a distance of about twelve kilometres between Elizabeth Drive at Kemps Creek/ Mount Vernon (south) and the M4 Motorway at St Clair/ Orchard Hills (north).

Mamre Road is a key transport north-south transport corridor passing through the Western Sydney Aerotropolis and the Greater Penrith to Eastern Creek Investigation Area and providing connections to the Western Sydney Employment Area.

Considerable population and employment growth is expected across not only the Penrith LGA but the wider Western Sydney region. Major regional development areas are illustrated in Figure 2-1 and listed below:

1. Western Sydney Aerotropolis
2. Western Sydney International (Nancy-Bird Walton) Airport (16 km south-west)
3. Greater Penrith to Eastern Creek Investigation Area
4. Western Sydney Priority Growth Area (WSPGA)
5. Western Sydney Employment Area
6. South West Growth Area
7. North West Growth Area.

Major open space areas, National Parks and Nature Reserves across the wider region include:

8. Wianamatta Regional Park
9. Blaxland Creek Reserve
10. Prospect Nature Reserve (21 km south-east)
11. Western Sydney Parklands
12. Kemps Creek Nature Reserve.

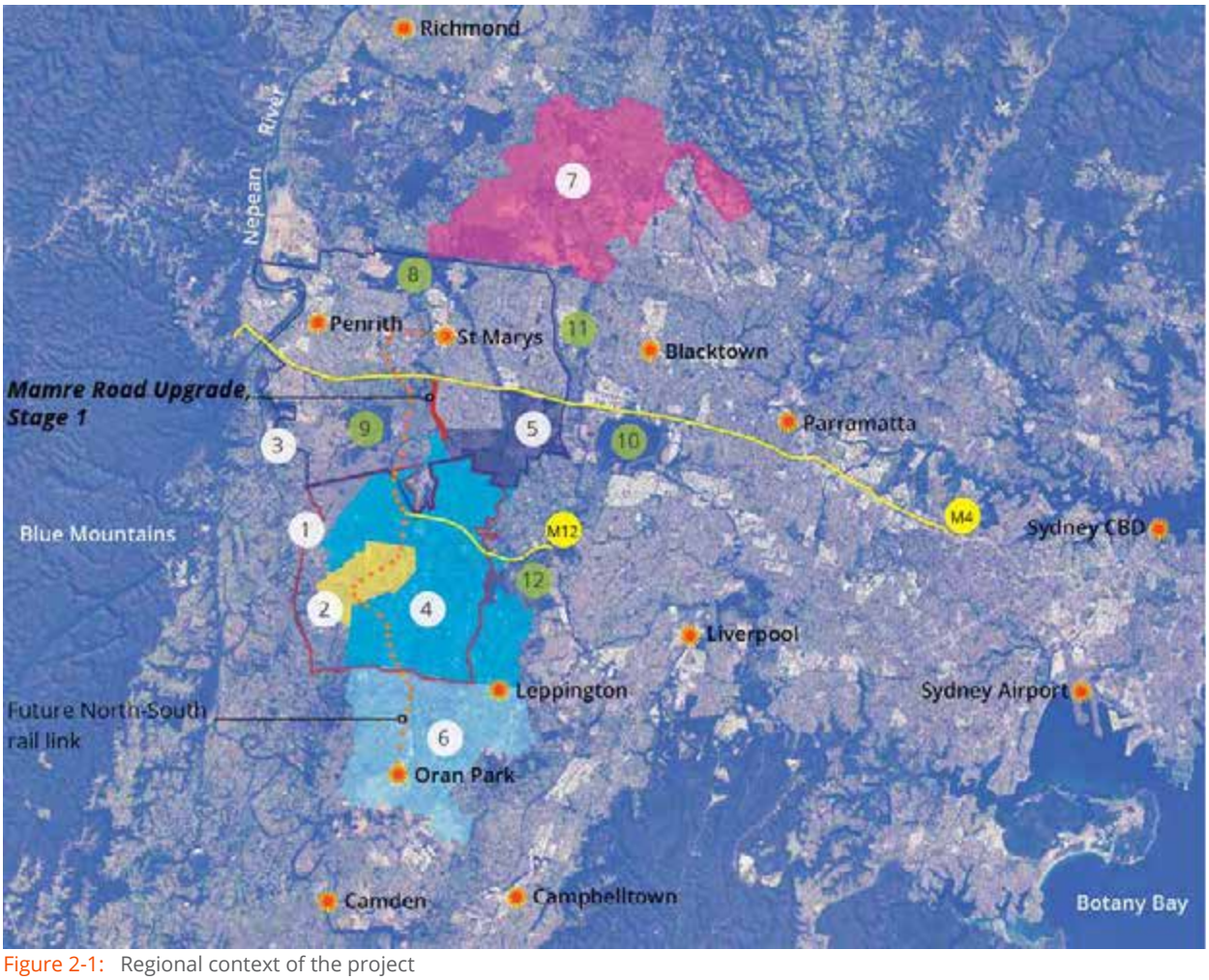


Figure 2-1: Regional context of the project

2 Existing environment

2.3 Site context

The study area illustrated in Figure 2-2 is characterised by a longitudinal spilt along Mamre Road between the urban edge of the traditional residential enclave of St Clair and industrial estates in the east and the rural, riparian areas associated with the South Creek corridor to the west.

Mamre Road is a two-lane undivided road with a posted speed limit of 80 kilometres per hour that traverses the suburbs of Orchard Hills and St Clair.

Across the study area there is a mixed use setting of semi-rural, agriculture, grazing, environmental conservation areas and corridors, large lot residential development, low density residential housing, industrial estates and public recreation.

Infrastructure within the study area includes, arterial and local road networks, water supply pipelines and high voltage power (11kV).

The Broader Western Sydney Employment Area Precinct is governed by the State Environmental Planning Policy (Western Sydney Employment Area) 2009. It is an important area for future development and is split into separate precincts that would determine future employment and growth in the area. Precincts located at the southern end of Stage 1 include:

- Mamre West Precinct
- Erskine Park Employment Lands Precinct.

Important regional landmarks in the local context of the study area include:

- Local and State and heritage-listed Mamre House (260 m west)
- Leeholme Horse Stud Rotunda (700 m south-west).

The future north-south rail link of the Sydney Metro alignment would include Metro stops at:

- St Marys
- Luddenham
- Claremont Meadows (services facility)
- Orchard Hills.

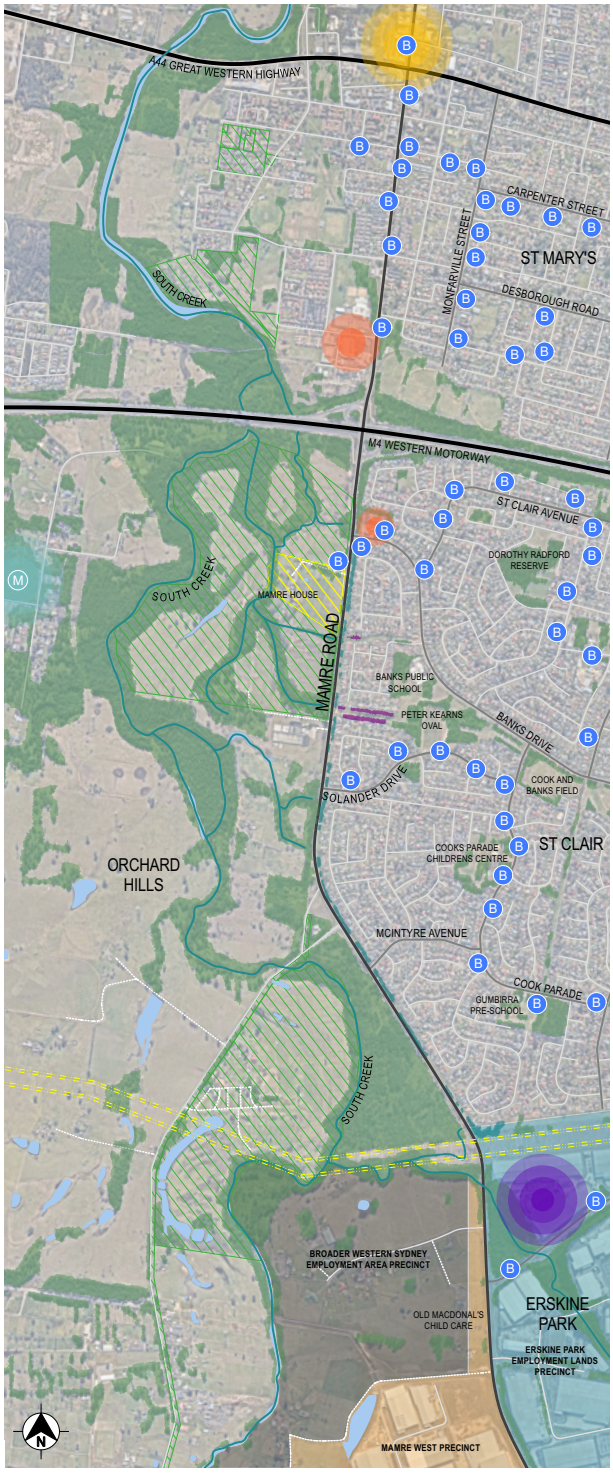


Figure 2-2: Site context

LEGEND

EXISTING FEATURES

- ARTERIAL ROAD
- SUB-ARTERIAL ROAD
- COLLECTOR ROAD
- LOCAL ROAD
- PRIVATE PROPERTY ACCESS TRACK
- OVERHEAD TRANSMISSION LINE
- WATER COURSE/BODY
- GENERAL VEGETATION
- WESTERN SYDNEY EMPLOYMENT AREA
- MAMRE WEST PRECINCT
- ERSKINE PARK EMPLOYMENT LANDS
- STRATEGIC CENTRE
- COMMERCIAL HUB
- BUSINESS PARK
- PROPOSED METRO STATION HUB
- EXISTING BUS STOP
- PROPOSED METRO STATION

HERITAGE

- STATE HERITAGE ITEMS
- LOCAL HERITAGE ITEMS

2 Existing environment

2.4 Land use

Existing urban form

Figure 2-3 illustrates the land use zones across the study area, which are regulated by Penrith City Council through the Penrith Local Environmental Plan 2010 (Penrith LEP) as well as the WSEA SEPP. The major land uses in this stage that shape the character of the area surrounding the project, and influence the experience of the area are:

- R2 Low Density Residential (Plate 2-1), which includes a mix of one and two storey detached housing typically set back from the road and surrounded by established garden vegetation
- RE1 Public Recreation, which includes:
  - Local and State heritage listed Mamre House and surrounding rural pasture land and market gardens
  - Drainage channels, which act like linear parks of open grass areas and scattered clusters of established trees. Theses areas can be access by local residents either from Mamre Road or local easement connections
- E2 Environmental Conservation, which includes the riparian corridors associated with South and its tributaries
- IN1 General Industrial (Plate 2-4), which includes large warehouse buildings, car parking, catering, logistics and freight and office spaces.
- RU2 Rural Landscape (Plate 2-2), which includes land with a rural landscape character which provides for a range of compatible land uses, including extensive agriculture
- E4 Environmental Living (Plate 2-3), which is land with special environmental or scenic values where residential development can be accommodated. Development in this zone is to give priority to preservation of the particular environmental qualities of the land. It includes 11 residential homes located on larger blocks within a more rural setting.

Future urban form

There are a number of future developments located in close proximity to the Upgrade. These are:

1. Future development by NSW Department of Planning and Environment
2. Future North-South rail link with Metro Station hub
3. Broader Western Sydney Employment Area Precinct.

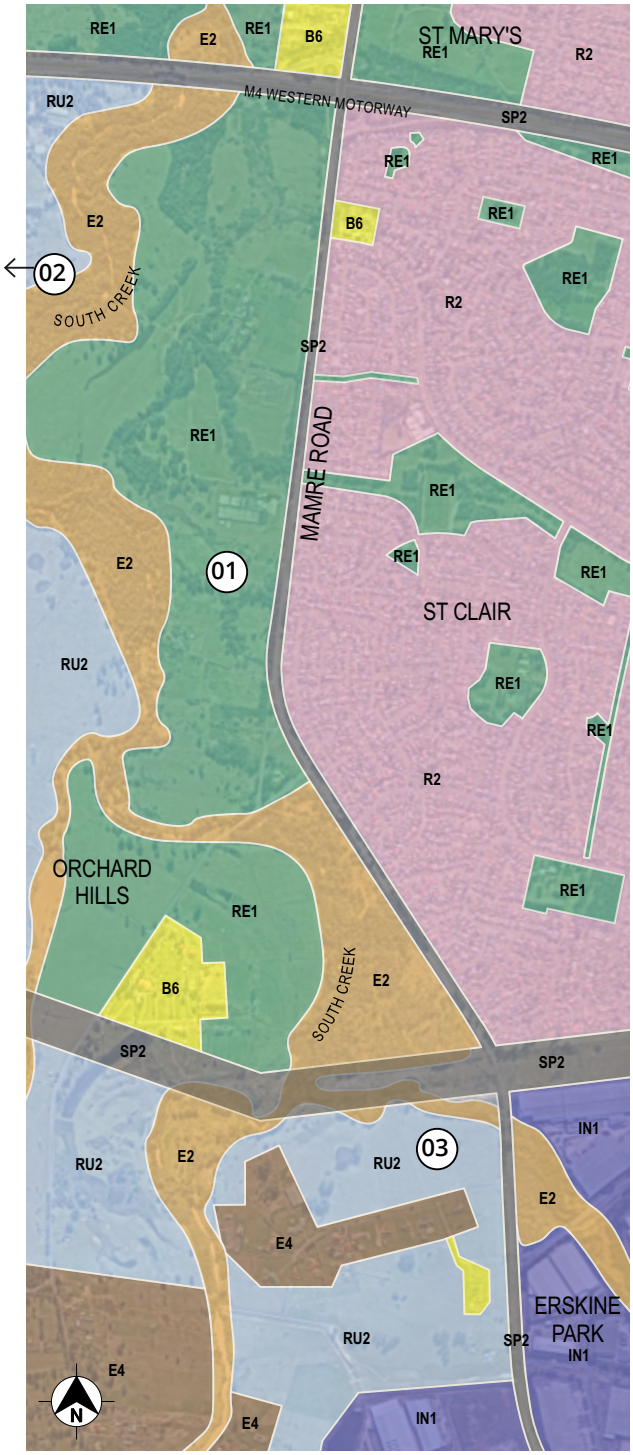


Figure 2-3: Existing land use zoning

LEGEND

LAND USE ZONING

- B6 - ENTERPRISE CORRIDOR
- E2 - ENVIRONMENTAL CONSERVATION
- E4 - ENVIRONMENTAL LIVING
- IN1 - GENERAL INDUSTRIAL
- R2 - LOW DENSITY RESIDENTIAL
- RE1 - PUBLIC RECREATION
- RU2 - RURAL LANDSCAPE
- SP2 - INFRASTRUCTURE

2 Existing environment

Stakeholders

The following stakeholders have been identified as having a potential interest in the upgrade:

- Penrith City Council
- Liverpool City Council
- NSW Department of Planning, Industry and Environment (DPIE)
- Bicycle NSW
- NSW Environmental Protection Authority
- Heritage NSW
- Penrith Valley Chamber of Commerce
- Deerubbin Local Aboriginal Land Council
- Emergency services
- Water NSW
- Utility providers
- Landowners, residents and local businesses.

Co-ordination with relevant stakeholders and the local community would be undertaken during the development of the project to ensure that the final design meets expectations and ensures that long term planning for Mamre Road is not compromised and the impacts on the surrounding community and environment are minimised as much as possible.

Considerations for the project

- The large number of future development areas that would be serviced by Mamre Road and would see a considerable increase in population and employments in the immediate vicinity and that would contribute to associated travel demand for both vehicles and pedestrians.
- Integration of the upgrade with any development proposals in adjoining development areas is important to allow for planned growth in Penrith LGA
- Providing access across the corridor will be important to align the project design with broader strategic planning aspirations, including the South Creek green corridor and to future public transport Metro stations.

Plate 2-1: R2 Low density residential zone of St Clair

Plate 2-4: IN1 General industrial zone

Plate 2-2: RU2 Rural landscape zone

Plate 2-3: E4 Environmental living zone

2 Existing environment

2.5 Landform and drainage

The study area is located on the Cumberland Plain, a low lying and gently undulating subregion of the Sydney Basin and sits at elevations ranging from 30 to 40 metres above sea level (m.a.s.l).

Figure 2-4 illustrates that the study area is characterised by the crest, flat, open depression and slope landforms, which form the interface between the South Creek/ Kemps Creek floodplain and the elevated landforms of the ridge and low lying hills.

Drainage within the study area comprises modified 1st and 2nd order drainage lines, which flow north west into South Creek or Kemps Creek. A number of large dams have been constructed throughout the area within former creek channels, altering the area's hydrology and drainage patterns. In addition, several creeks have been modified by culverts along Mamre Road.

Geology and soils

Soil landscape mapping shows that the study area traverses three soil landscapes (refer to) (Bannerman & Hazelton, 1990). The prominent soil landscape types within the road corridor are:

- South Creek soil landscape - characterised by high flood hazards, localised permanently high water tables and low fertility. General fertility is low and erodibility is high with a potentially very high to extreme erosion hazard. Active floodplain species would be more successful
- Blacktown soil landscape - characterised by localised high plasticity and expansive subsoils and soils are poorly drained with low fertility. Eucalypt woodland and tall open-forest species would be more successful.

Considerations for the project

- Plant species are to be suitable to the different soil landscapes across the region
- Plant species would be selected for South Creek landscape areas and would be suitable and tolerant of seasonal waterlogging, have permanently high watertables (localised), are a water erosion hazard (localised), and can experience localised surface movement
- Species selected for Blacktown soil landscape areas would thrive in conditions including seasonal waterlogging (localised), water erosion hazard (localised), surface movement potential (localised)
- Across the site determine the soil pH, nutrient deficiencies and apply nutrient quantities to improve the growing conditions especially for trees.

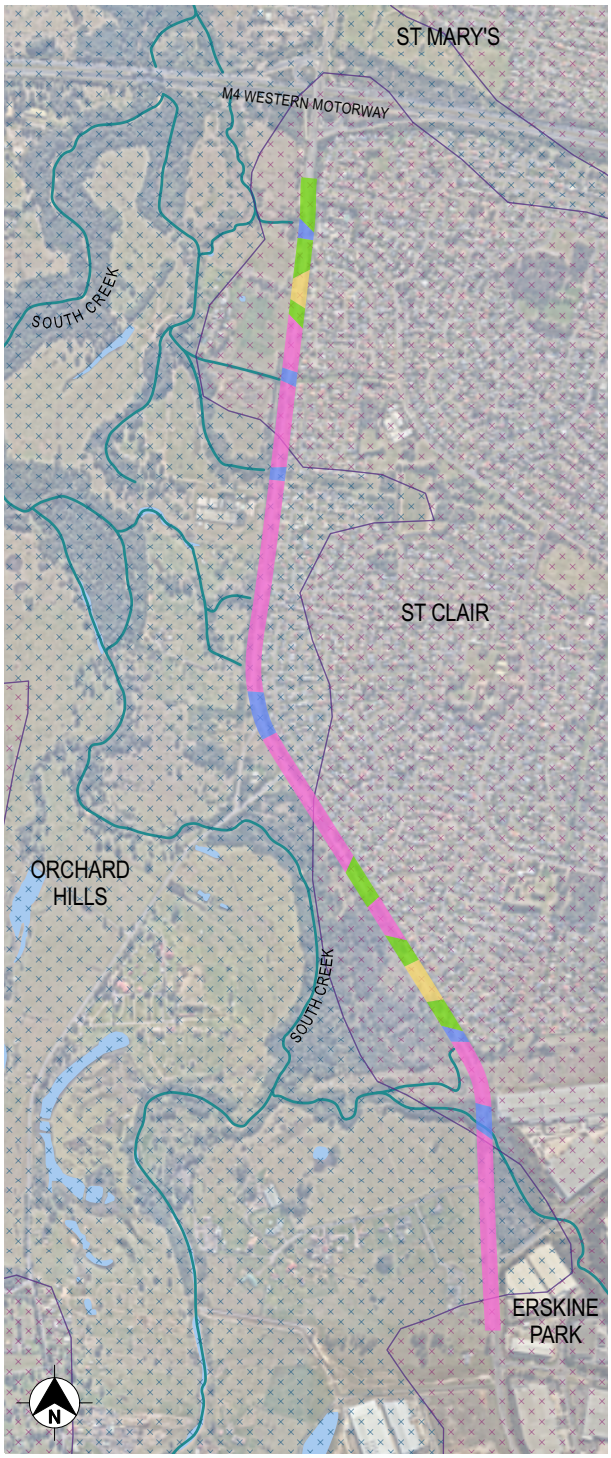


Figure 2-4: Landform and drainage

2 Existing environment

2.6 Biodiversity

Vegetation communities

Much of the study area has been cleared of native vegetation as a result of past disturbances, particularly clearing, fire and grazing. Now large parts of the study area comprises exotic grasslands, grasses and herbs, however there are three vegetation communities that have been recorded within or next to the proposal area.

These are:

- Grey Box – Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 849)
- Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin Bioregion (PCT 835)
- Swamp Oak open forest on river flats of the Cumberland Plain and Hunter valley (PCT 1800).

Threatened fauna

There are records for the following threatened fauna species within the study area. They are:

- Grey-headed Flying-fox
- Cumberland Plain Land Snail
- Little Bentwing-bat
- Yellow-bellied Sheath tail bat
- Large Bentwing-bat
- Greater Broad-Nosed bat
- Southern Myotis

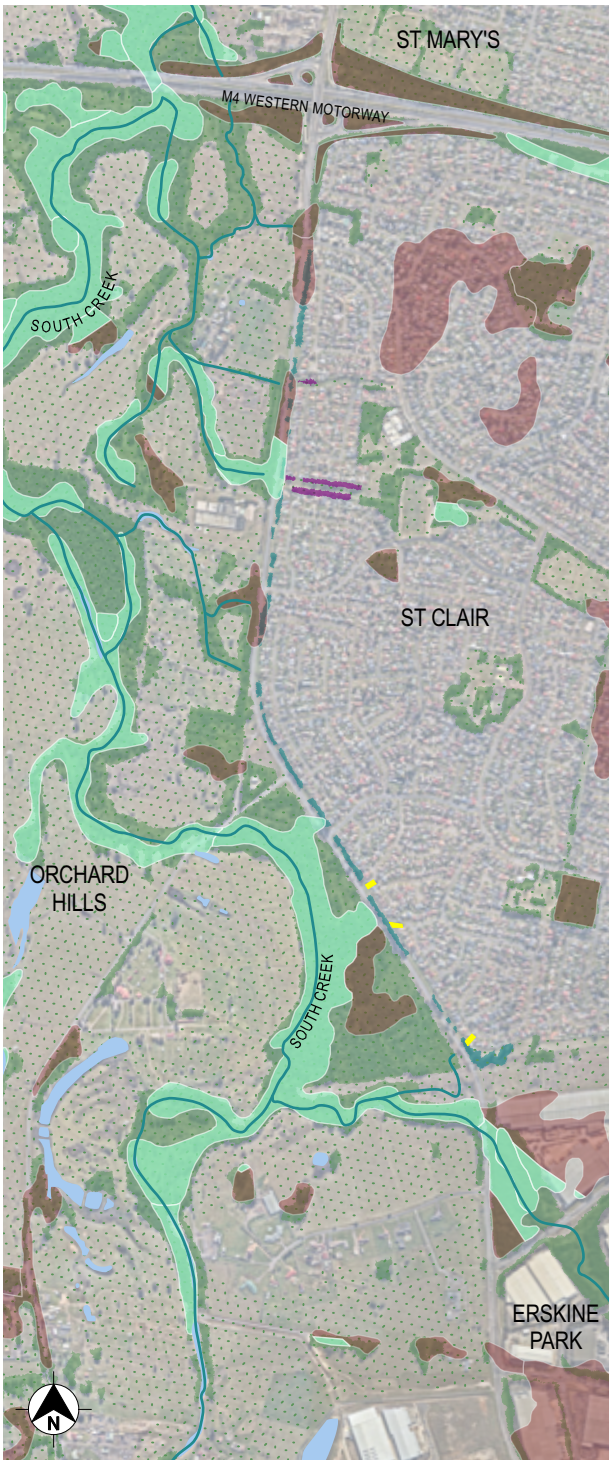


Figure 2-5: Biodiversity

2 Existing environment

Fauna habitat

The fauna habitats that occur within the proposal area consist of narrow areas of woody/forest habitat types. The habitat typically occurs close to the Mamre Road edge with limited connectivity and is subject to a high existing level of traffic noise and light pollution. Therefore, these areas are considered only suitable for urban tolerant fauna species.

Remnant patches of woodland in roadside setback (Plate 2-7) and drainage channels (Plate 2-8) would offer foraging and breeding opportunities for woodland birds, small and medium sized mammals, arboreal mammals, small reptiles and the Cumberland Plain Land Snail (Meridolum corneovirens).

Based on field observations, the existing concrete box girder bridge spanning South Creek and only one culvert appeared to have potential for roosting bats. The culvert was located next to South Creek near the Luddenham Road intersection. No suitable maternity caves/sites for Large Bentwing-bat or Little Bentwing-bat were identified within or nearby the proposal area.

Considerations for the project

- A diverse range of the plant species would be provided to ensure that fauna habitat is supplemented
- Implement water sensitive urban design (WSUD) features into the project maximising the visual and recreational amenity of the project
- Where possible restore and re-vegetate culvert curtilage areas to provide additional fauna habitat
- Consider how WSUD features and pedestrians would interact
- Median tree planting would consist of only frangible species.
- Where possible provide habitat opportunities for the endangered Cumberland Plain Land Snail
- All trees are to be co-ordinated with services prior to planting.

Plate 2-5: Areas of Shale Plains Woodland vegetation in roadside verges

Plate 2-6: Areas of Alluvial Woodland vegetation

Plate 2-7: Roadside remnant vegetation

Plate 2-8: Drainage channel vegetation

2 Existing environment

2.7 Climate

Bureau of Meteorology data from the Prospect Reservoir weather station (located approximately 10km south-west of the study area) shows the total mean annual rainfall is 873.7 millimetres (mm), with the highest mean monthly rainfall falling in the months of February and March (98.85 mm each month).

The mean maximum temperature annual temperature of 23.2 degrees Celsius (C), with the warmest months being December to February (about 28° C) and the coldest months of June to August (about 6.8°C).

Planting and revegetation would be avoided during the hottest and coldest months where possible.

Cooling the City Strategy

The Cooling the City Strategy fits under a broader integrated planning framework for the Penrith City.

Many parts of the Penrith LGA consistently experience higher temperatures and lower rainfall than more coastal parts of Sydney. The issue of heat has been recognised within the City Strategy as an area that would require attention in coming years with an adopted goal to 'increase green cover, shade and landscaping to 'cool down' Penrith' (E14).

As urban development occurs, it usually replaces natural land surfaces and vegetation with hard structures like roads, footpaths, car parks and buildings. These surfaces absorb much more heat than vegetation and encourage rainfall to run off the surface, leaving little moisture in the ground. This means there is less opportunity for evapotranspirative cooling to occur like it would in a natural landscape. This phenomenon, known as the Urban Heat Island effect (UHI), causes cities to become islands of heat.

Research set out in the Cooling the City Strategy demonstrates that there are some areas across the LGA that are substantially cooler than others and these areas have a number of features in common, including:

- Water either on the surface or stored in the soil profile
- Ground cover that is permeable and grassed
- Tree cover.

Considerations for the project

- Install dense planting to minimise the heat island effect from the road corridor (Plate 2-9)
- Increase green cover on both sides of the road corridor to protect pedestrian areas from heat (Plate 2-9)
- Preference for planted ground covers where possible
- Reinforcing and supplement existing tree cover would be important for shared use environments (Plate 2-11).

Plate 2-9: Existing west facing footpath without shade protection

Plate 2-10: Existing southbound setback shaded from trees on northbound setback of road corridor

Plate 2-11: Existing clusters of trees along Mamre Road helping to reduce heat from the road corridor

2 Existing environment

2.8 Bushfire prone land

Areas within the study area are designated bush fire prone land, which means that for the time being the land is classified as an area that can support a bush fire or is likely to be subject to bush fire attack, as designated on a bush fire prone land map (BFPL). The BFPL map has been prepared in accordance with this guide and certified by the Commissioner of the NSW RFS under section 146(2) of the Environmental Planning and Assessment Act 1979.

Figure 2-6 illustrates the existing vegetation within the study area is classified into the following categories based on vegetation types and potential risk:

Vegetation Category 1

This category is considered to be the highest risk for bush fire. It is represented as red on the bush fire prone land map and would be given a 100m buffer. This vegetation category has the highest combustibility and likelihood of forming fully developed fires including heavy ember production.

Vegetation Category 2

This category is considered to be a lower bush fire risk and would be given a 30 metre buffer. This vegetation category has lower combustibility and/or limited potential fire size due to the vegetation area shape and size, land geography and management practices.

Vegetation Buffer

Once areas of vegetation have been defined and the appropriate bush fire vegetation categories have been applied, it would be necessary to apply the buffering criteria.

The method for the determination of bush fire vegetation buffering is as follows:

- BFPV Category 1 – apply a 100 metre external buffer to each vegetation polygon.
- BFPV Category 2 – apply a 30 metre external buffer to each vegetation polygon.

Considerations for the project

- Plant species selection to include fire retardant plants where possible
- Observe guidelines for the set out of plants to ensure both the vertical and horizontal separation is maintainable
- The separation between canopy and shrub clusters would to be retained so as to reduce the potential for fire to spread
- Allow the required maintenance access to bushfire prone land within the study area
- Create necessary breaks in the continuity of vegetation.

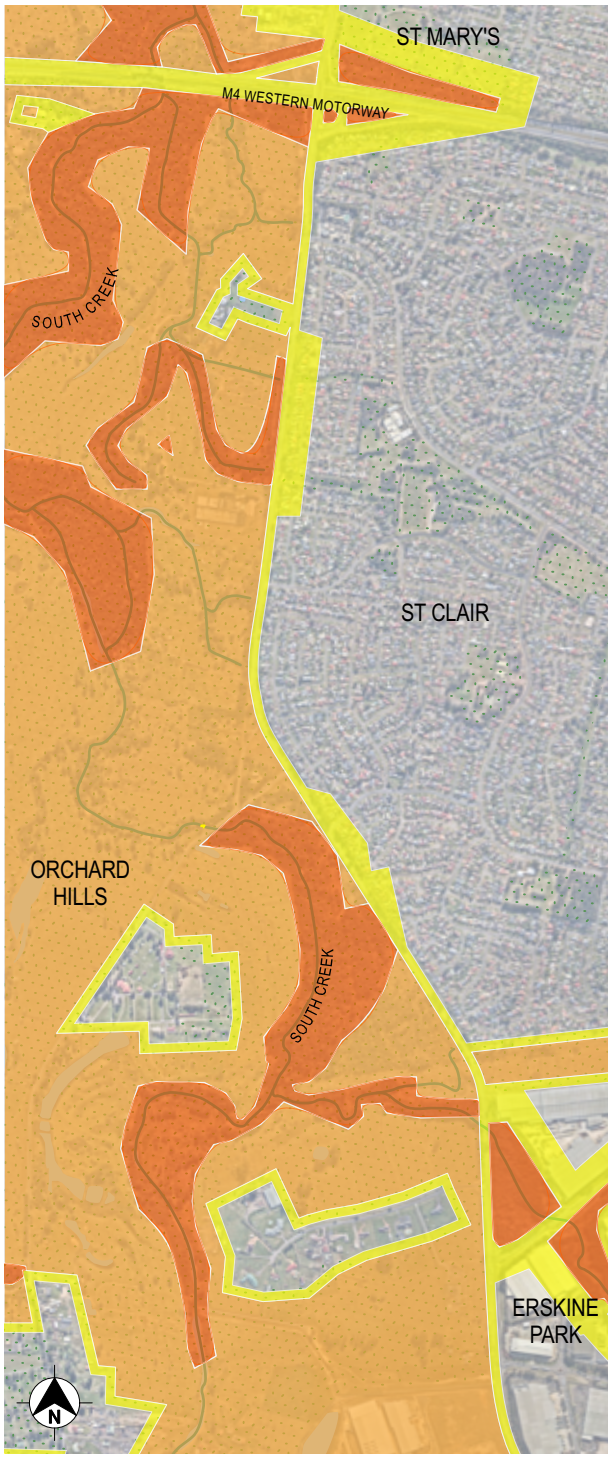


Figure 2-6: Bushfire Prone Land

2 Existing environment

2.9 Access and circulation

Pedestrian and cyclist access

Except in the northern part of the study area, there is generally no formal provision for pedestrians and cyclists. Mamre Road for the most part has no formal kerbs, which is consistent with the rural character of the area while most local streets do have kerbs.

Some on-road provision for cyclists is provided at the Mamre Road/ James Erskine Drive and Mamre Road/ Erskine Park Road intersections.

Figure 2-7 illustrates the locations of pedestrian easements at the following locations:

- Mont Place (Plate 2-12)
- South 74 Alpine Circuit (Plate 2-13)
- 29-27 Rotorua Road (Plate 2-14).

Informal pedestrian access is also possible from two wide grass drainage channels:

- North of Olympus Drive
- Peter Kearns Reserve.

In the southern portion of St Clair there are three vacant blocks, which abut the study area and can be used by pedestrians:

- 23 Dryberry Avenue
- 19 Horseshoe Crescent
- 104 Pine Creek Circuit.

There are two drainage lines that also abut the study area, which are fenced off for use as a pedestrian thoroughfare. They are:

- 83-85 Rotorua Road
- 47-49 Rotorua Road.

Erskine Park Drive to the south is an important connection of priority pathways to Lenore Drive and linking in to facilities within the City of Blacktown LGA.

There are a number of unauthorised access gates from private properties to the corridor through the rear boundary fence. These are shown in Figure 2-7.

Public transport

The community profile above indicates a relatively high level of reliance on the private motor vehicle.

St Marys Railway Station is located about two kilometres to the north of the study area. Buses service the southern and northern extents of the study area including:

- Route 801 – Badgerys Creek to Liverpool via Kemps Creek, Cecil Hills and Bonnyrigg Heights
- Route 779 – St Marys to Erskine Park Industrial Area
- Route 776 – Mt Druitt to Penrith via Erskine Park, St Clair, St Marys, UWS and Nepean Hospital
- Route 775 – Mt Druitt to Penrith via Erskine Park, St Clair, St Marys, UWS.

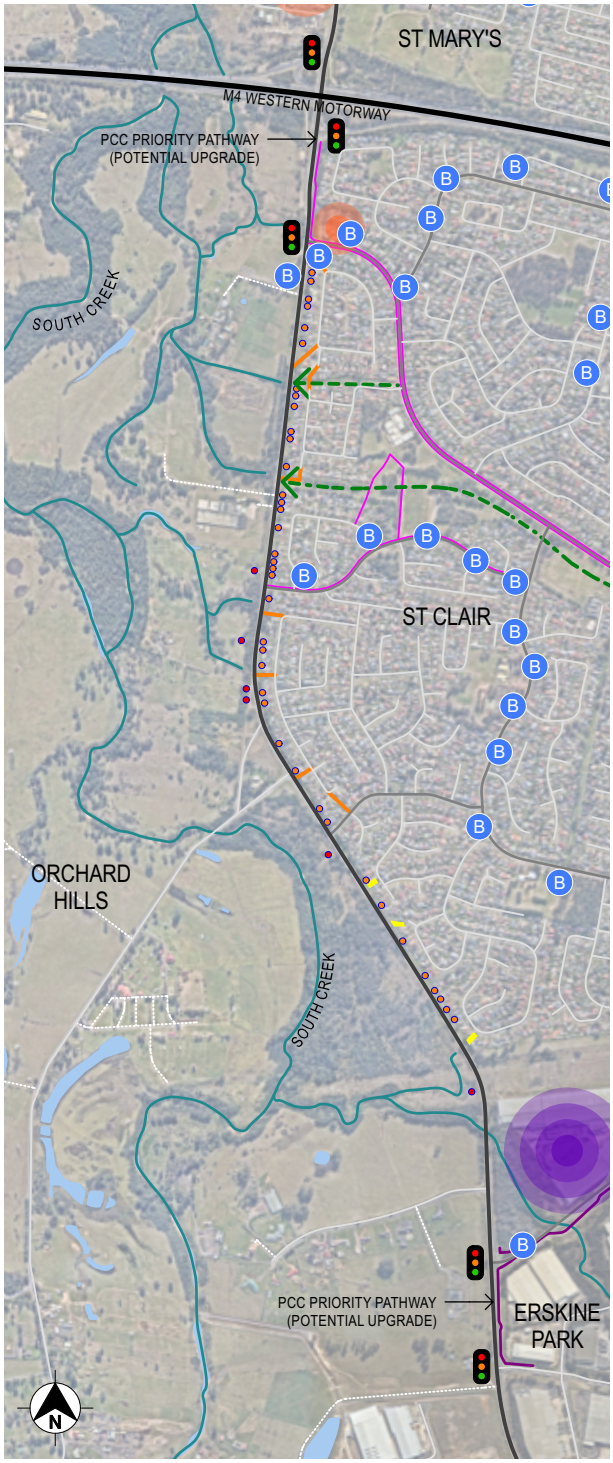


Figure 2-7: Access and circulation

LEGEND

EXISTING FEATURES

- ARTERIAL ROAD
- SUB-ARTERIAL ROAD
- COLLECTOR ROAD
- LOCAL ROAD
- PRIVATE PROPERTY ACCESS TRACK
- WATER COURSE/BODY
- VACANT LOT

ACCESS AND CIRCULATION

- EXISTING FOOTPATH
- EXISTING SHARED USER PATH
- PEDESTRIAN EASEMENTS
- GREEN GRID CONNECTION
- PRIVATE PROPERTY ACCESS POINTS
- UNAUTHORISED PROPERTY ACCESS
- TRAFFIC SIGNAL

LOCAL CONTEXT

- COMMERCIAL HUB
- BUSINESS PARK
- EXISTING BUS STOP

2 Existing environment

Vehicular access

The intersections within the study area are:

- Erskine Park Road – signalised T-intersection, with dual right-turn lanes from Mamre Road, northbound, into Erskine Park Road
- McIntyre Avenue – unsignalised T-intersection
- Luddenham Road – unsignalised seagull configuration intersection
- Mandalong Close – unsignalised T-intersection
- Solander Drive – unsignalised T-intersection
- Banks Drive – signalised T-intersection
- M4 Motorway – grade separated interchange catering for all movements. Note: M4 is outside of this project scope.

Future green infrastructure network

The South Creek corridor has been identified as having potential to become part of the Sydney Green Grid, which would in years to come become a cohesive green infrastructure network across greater Sydney.

Establishing South Creek as a green corridor and major open space destination would contribute to the development of healthy urban environments, active lifestyles and connectivity within the local and regional context.

With a balanced approach to access, biodiversity, development and recreation South Creek could present an opportunity as valuable green infrastructure that supports future growth in the district and beyond.

Future public transport

The NSW Government's Sydney Metro Authority has committed to deliver an integrated transport system for the Western Parkland City, as envisaged in the *Future Transport Strategy 2056.*

Sydney Metro Western Sydney Airport rail line is a component of the vision for a metropolis of three cities, that would link residential areas and urban areas with job hubs and the nationally-significant Western Sydney International airport. As part of the rail line a planned future metro station would be located at Orchard Hills and Luddenham, 3.5 km north-west and west of Mamre Road, these stations would service a future commercial and mixed-use precinct.

Considerations for the project

- Existing pedestrian connectivity would be maintained and or supplemented to encourage passive recreation
- Design for sight lines for pedestrians/ cyclists at non-signalised intersections where noise wall alignment may impede views of on-coming traffic
- Separation of pedestrians and cyclists from the busy road corridor would be a priority when space permits
- Bus shelter arrangements to reduce potential conflict between users (boarding or alighting the bus) and general path users
- Pavement jointing design and path surfaces at bus shelters.

Plate 2-12: Pedestrian walkway Mont Place

Plate 2-13: Pedestrian walkway Alpine Court

Plate 2-14: Pedestrian walkway at Rotorua Road

2.10 Heritage

Aboriginal cultural heritage

The AHIMS search (conducted in 2020) found 173 Aboriginal archaeological sites and six areas of potential archaeological deposit within two kilometres of the proposal, including six within the current Aboriginal heritage study area.

Non-Aboriginal cultural heritage

Within the study area, the following heritage items have been identified:

One Locally and State (SHR) listed item

- Mamre House #00264

Four locally listed items:

- Marsden Memorial Cairn (Penrith LEP #229) – located within the Mamre House State heritage area curtilage on the northern side of the entrance gates
- Blaxland Memorial Cairn (Penrith LEP #230)
- Luddenham Road Alignment (Penrith LEP #843)
- Leeholme Horse Rotunda (Penrith LEP #232)

No items listed on the National Heritage List (NHL) or Commonwealth Heritage List (CHL).

Given the early settlement of this part of Western Sydney, there may also be some archaeological potential associated with road corridor and adjacent areas. During the site inspection, there were a number of features that were observed that contribute to the diversity of the urban fabric in the study area and may be impacted by the project. These were:

- A roadside feature (Plate 2-15) located on the western side of Mamre Road, north of Solander Drive
- Mandalong Close entry walls (Plate 2-16) that are 1.5 m tall white rendered brick walls topped with traditional Spanish curved terracotta roof tiles
- A small memorial plaque (Plate 2-17) on the rear property fence 31 Rotorua Road
- Entry sign, metal gates and memorial cairn at State heritage-listed Mamre House entry (Plate 2-18).

Considerations for the project

- Consult with PCC with regards to integration of indigenous themes into urban design
- Consult with PCC on the preferred conservation of the natural environment and the landscape treatments in these areas
- Along the Mamre House State heritage area curtilage utilities are located close to the project boundary so tree planting is limited. Consult with PCC to select low vegetation species that would maximise the views of the historic site and distinctive market gardens
- Dismantle and relocate State heritage-listed Mamre House entry signs, gates and memorial cairn in consultation with Mamre House
- Ensure commemorative plaques are protected and preserved in existing locations or reinstated in a suitable location if works require that they are moved.

Plate 2-15: Roadside feature, north of Solander Drive

Plate 2-16: Entry walls at Mandalong Close

Plate 2-17: Commemorative plaque for 'Widgey'

Plate 2-18: Entry sign, metal gates and memorial cairn

2 Existing environment

2.11 Visual setting

The relatively straight alignment of Mamre Road is lined by stands of native vegetation along many sections of the road corridor so that road user views are most often linear in nature. There are however important views that extend for some distance over the primary production lands to the South Creek corridor and further to the Blue Mountains escarpment (Figure 2-8). These views rural backdrops reinforce the relationship between the road user and the western Sydney region.

Views towards the road corridor from the various pedestrian easements are generally defined by views of existing mature vegetation, which tends to limit views of the traffic corridor instead providing a leafy and green outlook.

Views across the road corridor from the wide grassed drainage channels are mostly open with little existing vegetation. These open areas tend to be dominated by the movement of vehicles along the road corridor, which contributes to these zones feeling as though they are a part of the corridor rather than part of the open space networks.

Considerations for the project

- Conserve and enhance historic properties that illustrate early stages of economic development in Penrith and that contribute to the rural backdrops
- Maintain scenic quality and St Clair neighbourhood on the eastern side of the road corridor by retaining existing trees that are visually prominent in order to minimise impacts
- Select vegetation that would maintain filtered views towards the Blue Mountains escarpment from Mamre Road
- Create a series of open and closed views from the road corridor celebrating the riparian corridors that intersect the road corridor
- Noise walls would read as part of the thematic visual experience of the existing, varied landscape character zones
- The height and bulk of the noise walls would be reduced as much as possible and where possible transparent panels would be used to 'open up' views through the pedestrian portals
- Noise walls would to have high quality, robust finishes and portions of the noise walls would include integrated patterns/ artwork designed to respond to the local context
- Carefully locate major signage to maintain linear views and vistas.

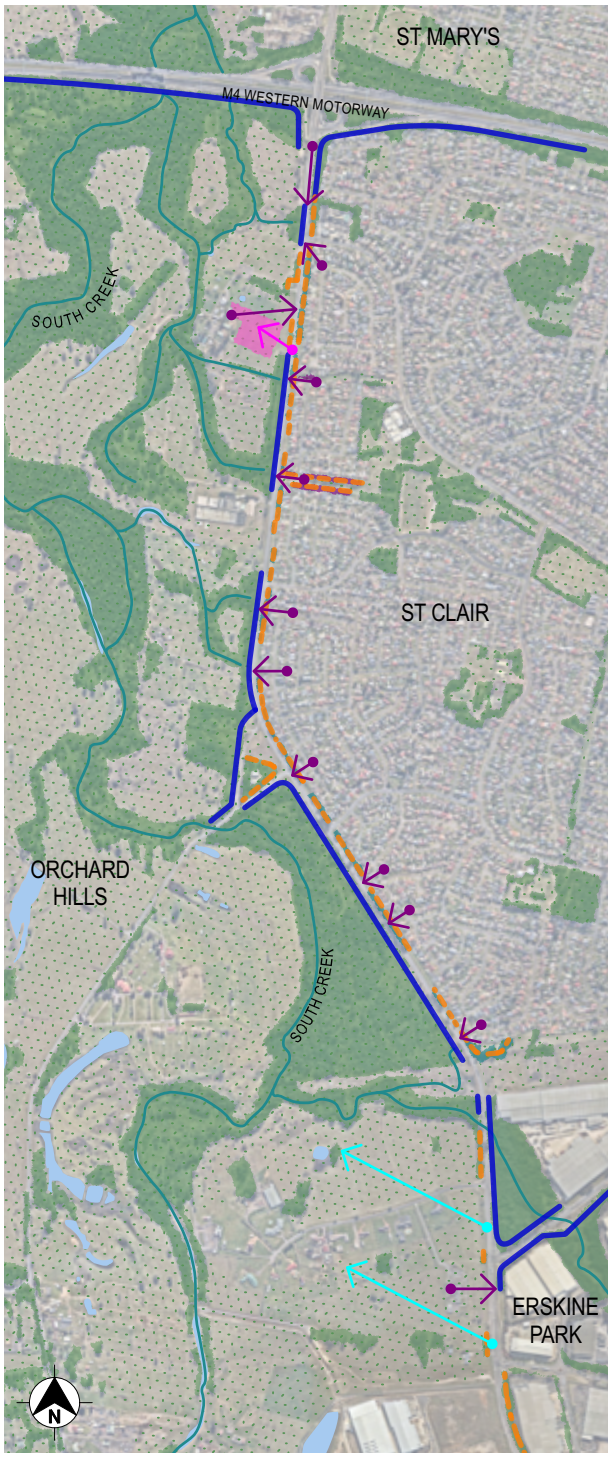


Figure 2-8: Important views and visual setting

2 Existing environment

Plate 2-19: Erskine Park Road on approach to the project

Plate 2-20: McIntyre Avenue on approach to the project

Plate 2-21: Luddenham Road on approach to the project

Plate 2-22: Solander Drive on approach to the project

Plate 2-23: Banks Drive on approach to the project

Looking east from Mamre Road across existing drainage culvert

3 Urban design vision

3.1 Chapter overview

This chapter presents the urban design strategy for the project. It is summarised in an overarching urban design vision, complemented by an explanation of the experience of travelling along the Mamre Road Upgrade would be.

Urban design objectives and principles for the project have been derived from Commonwealth, State and local government policies as well as contextual analysis in Chapter 2. These objectives guide the project and address the key areas of landscape and visual quality; design of the upgrade and its structures; cultural values and connectivity.

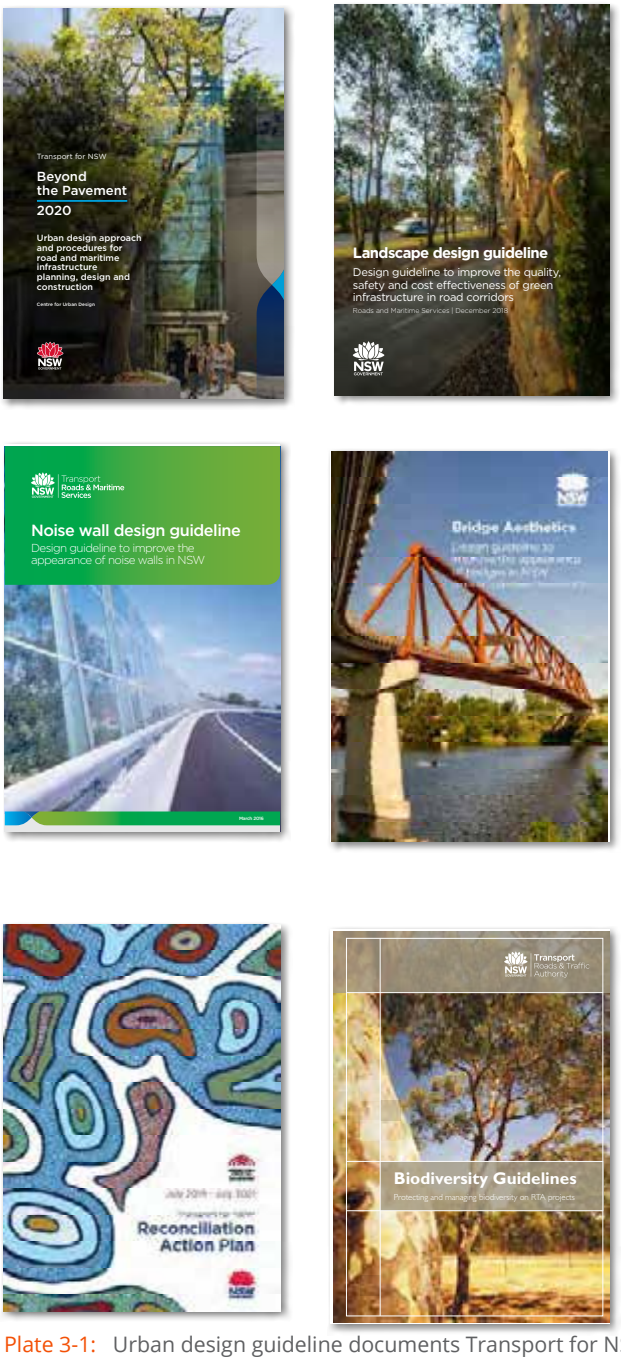


Plate 3-1: Urban design guideline documents Transport for NSW

3.2 Urban design vision

Mamre Road is an important north-south transport corridor that provides connections to the Western Sydney Employment Area and the proposed Western Sydney Aerotropolis. It will play an important role in the economic and population growth of Western Sydney over the next 20 years.

The upgrade recognises the existing adjacent landscape structure, strongly defined by the suburb of St Clair in the east, and the South Creek catchment and Mamre House to the west. The upgrade builds upon this existing character, reinforcing the landscape context and celebrating it with new landscape treatments.

High quality, integrated design along the upgrade would reflect this context, punctuating the journey a variety of visual and physical elements to provide legibility for the local and wider regional community.

3 Urban design vision

3.3 Project specific urban design objectives and principles

In order to ensure that both corridor wide and state wide expectations for the Stage 1Mamre Road Upgrade are met, a set of project specific urban design objectives and principles have been adapted from the guideline documents.

These is listed below in Table 3-1, and are based on an understanding of the unique existing landscape and urban values of the study area and the issues that affect, or are affected by, the proposal. These objectives and principles would continue to be used to guide the on-going development of the proposal in future stages.

Table 3-1: Summary of project specific urban design objectives and principles

Objectives	Principles
Objective 1 — Sense of place Recognise and enhance local places and landscape character through an appropriate landscape approach	– Reflect the distinctive landscape character along the road corridor in the design of noise wall elements and other structures and planting including Mamre House curtilage and South Creek – Ensure an integrated engineering and urban design approach that incorporates place-making and community-centred design initiatives that reflect social and cultural themes of the area taking in to account the broad actions set out in the *TfNSW Reconciliation Action Plan* – Emphasise existing views to the Blue Mountains escarpment and other landmarks to enhance how people experience the surrounding landscape – Reflect the traditional neighbourhood patterns of Saint Clair, east of the upgrade, while enhancing the informal, scenic rural quality west of the upgrade – Respect and enhance cultural heritage values identified throughout the study area
Objective 2 — Natural environment Reinforce the diversity of natural settings across the study area including waterways, bushland and remnant planting	– Emphasise connections to the wider Hawkesbury-Nepean environment and seek opportunities to celebrate local tributaries and watercourses within the road corridor – Protect and reinforce sensitive environments adjacent to the road corridor including endangered ecological communities and riverine ecology – Select plant species for the upgrade in accordance with *Bush Fire Protection* principles set out by NSW RFS and the *PCC Cooling the City Strategy*
Objective 3 — Connectivity and way-finding Create an outcome, which provides sense of place through reflecting positive aspects of the study area's physical and community cultural setting	– Reduce the opportunity for crime, maximise passive surveillance and support safe, comfortable and enjoyable places that meet *PCC Crime Prevention Through Environmental Design* (CPTED) principles – Design for universal access that would accommodate an increasing level of use by the general population and encourages physical activity, which is vital to community health and well-being – Ensure new SUPs are integrated with existing and planned path networks set out in the *Penrith City Council (PCC) Penrith Accessible Trails Hierarchy Strategy* (PATHS), in particular Potential Upgrades of Priority Pathways – Create SUP environments that address community needs and aspirational strategies set out in the *PCC Recreational and Cultural Strategy,* in particular creating pleasant footpath and cycleway infrastructure to improve passive recreation activity – Use architectural features including noise walls and lighting to accent pedestrian portals and road connections to help define the journey for pedestrians, cyclists, motorists and public transport users who travel at varying speeds – Ensure an integrated engineering and urban design approach that reduces reliance on separate signage structures and minimises visual clutter and obstructions
Objective 4 — Sustainability Strive for a sustainable design that considers connections to the wider environmental systems and 'whole of life' costs	– Investigate and mitigate the impacts caused by noise walls for residents of Saint Clair such as shadowing and access – Incorporate water sensitive design elements to enhance waterways, in accordance with principles set out in the PCC Biodiversity Strategy and TfNSW WSUD guideline – Reinforce vegetation patterns and endangered vegetation communities to ensure continuity and connectivity of natural green corridors – Select vegetation to screen and soften hard elements within the corridor, minimise visual bulk and provide a human-scale – Ensure the design considers ongoing operations and maintenance and includes sustainability sourced and robust materials

3 Urban design vision

3.4 Opportunities and constraints

Figure 3-1 on page 26 illustrates the potential opportunities and constraints across the study area, identified throughout the concept phase of the project and incorporated into the development of the urban design concept. The opportunities are:

01 Preserve and strengthen existing remnant roadside tree stands

02 Maintain clear sight lines to long range vistas

03 Introduce robust planting mixes between the residential areas and the road corridor to provide visual separation and screening

04 Introduce vegetation mixes to help create an attractive SUP environment that caters for persons of all abilities

05 Provide direct, continuous and well-lit pedestrian and bicycle routes.

06 Tree placement on the property side of the footpath, with agreement from residents, could allow for a larger and more natural canopy

07 Median planting to reinforce a well vegetated road corridor

08 Watercourses can be highlighted to contribute to journey

09 Opportunity to stagger the alignment of the SUP to maximise the retention of existing vegetation and also provide opportunity to shade SUP users from the western sun

- SUP to incorporate a light tint of oxide to minimise 'bright' appearance
- SUP to incorporate lighting to define pedestrian portals and respond to PCC CPTED guidelines

10 Define key nodes along the SUP to help with legibility and safety

- Opportunity to use the staggered alignment of the noise walls to design safe, open pleasant pedestrian portal links
- Opportunity to provide visually permeable panels in sections of the noise walls adjacent to pedestrian crossing points to improve pedestrian safety and casual surveillance
- Opportunity to use colour, art and graphics on the noise walls to help with navigation and highlight and reinforce landscape character zones

11 Opportunity to link with existing SUP and to connect with future Priority pathway future upgrades

12 Opportunity to consolidate the signage associated with the Blue Cattle Dog Hotel

13 Opportunity to provide important ecological areas with use of WSUD features

14 East-west pedestrian connectivity across the corridor providing access from St Clair and the planned Orchard Hills Metro Station.

Constraints as follows:

01 Preserving heritage items/ curtilage areas

02 Widening of road resulting in removal of existing trees

03 Proposed trees may clash with utilities

04 Existing culverts across the project that would be replaced are to consider the SUP alignment

05 Floodway openings intersecting with noise walls

06 Rear fences facing the corridor may affect scope of vegetation that can be included

07 Bushfire risk may affect scope of vegetation that can be included.

Note - For further landscape character analysis refer to the mitigation measures outlined in **section 8** of this report.

3 Urban design vision

Figure 3-1: Opportunities and constraints (Plan 01 of 02)

LEGEND

EXISTING FEATURES

- CADASTRAL BOUNDARY
- CONTOURS
- ARTERIAL ROAD
- SUB-ARTERIAL ROAD
- COLLECTOR ROAD
- LOCAL ROAD
- PRIVATE PROPERTY ACCESS TRACK
- OVERHEAD TRANSMISSION LINE
- WATER COURSE/BODY
- GENERAL VEGETATION
- ROADSIDE REMNANT BUSHLAND
- DRAINAGE CHANNEL VEGETATION
- MARKET GARDEN/ORCHARD AREA
- GREEN OPEN SPACE
- VACANT LOT

3 Urban design vision

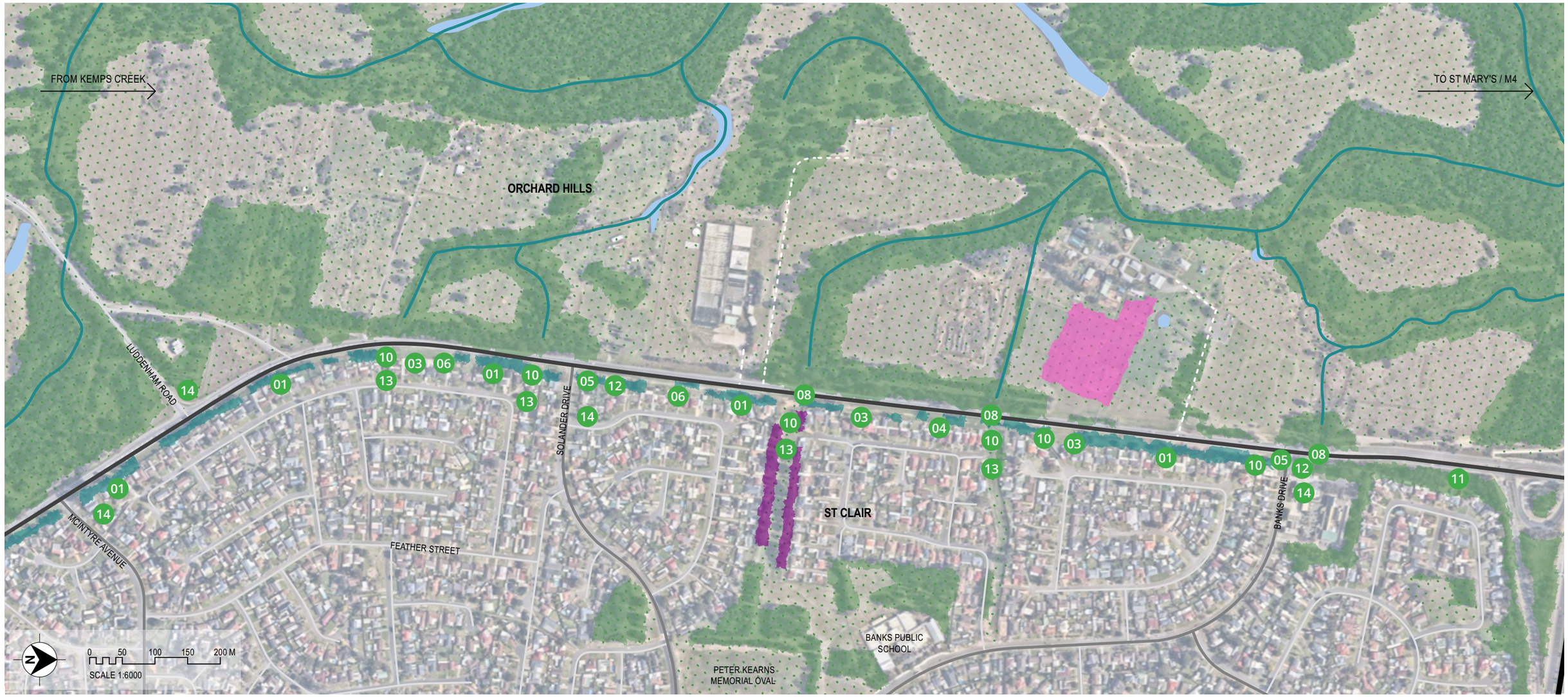


Figure 3-2: Opportunities and constraints (Plan 02 of 02)

LEGEND

EXISTING FEATURES

- CADASTRAL BOUNDARY
- CONTOURS
- ARTERIAL ROAD
- SUB-ARTERIAL ROAD
- COLLECTOR ROAD
- LOCAL ROAD
- PRIVATE PROPERTY ACCESS TRACK
- OVERHEAD TRANSMISSION LINE
- WATER COURSE/BODY
- GENERAL VEGETATION
- ROADSIDE REMNANT BUSHLAND
- DRAINAGE CHANNEL VEGETATION
- MARKET GARDEN/ORCHARD AREA
- GREEN OPEN SPACE
- VACANT LOT

4 Urban design concept

4.1 Chapter overview

This chapter describes and illustrates the design approach that responds to the urban design vision for the project.

Designed elements that were considered in order to achieve the urban design objectives include:

- Road design elements
- Structures
- Earthworks
- Drainage and water quality
- Road furniture
- Landscape treatments.

Road design elements

Shared user path

A 3.0 m wide shared user path (SUP) would be positioned within the southbound setback. The SUP would meander away from the road where possible, particularly where space permits or to avoid existing vegetation.

All SUP alignments are designed to enhance pedestrian and cyclist connectivity in the local region and to create a comfortable journey that is protected, shaded for active commuters and passive recreational activity within the community.

Design approach

- Design pedestrian and cycle connections based on *PCC CPTED* principles to ensure pedestrian and cyclist safety
- The SUP would be finished in coloured concrete (charcoal integral oxide)
- SUP would tie in with existing sections of SUP at the northern and southern ends of the project
- The alignment of the SUP would maximise the opportunity for a wide area of planting at the BOK to provide better separation between users and passing vehicles and to help vegetation thrive
- Regular 'breakout' spaces and stopping points along the SUP would be included to provide respite, shade and a place to pause and meet
- A mulch only strip would be installed at the edge of the SUP to ensure no plant overhangs onto the path to reduce the need for constant maintenance
- In locations where the SUP intersects with local street connections, the SUP would continue as standard concrete and street connections would be exposed aggregate.

Future provision of shared user path

Provision has been made for an additional future 3.0 m wide shared user path along the northbound setback, which would cater to the increasing demand for future pedestrian and cyclist volumes along the road corridor.

Design approach

- Footpaths would be finished in coloured concrete (charcoal integral oxide)
- Where future SUP pass in front of heritage curtilage areas, over riparian corridors or across pedestrian portals, a change in surface treatment could highlight these points of interest.

Medians

Mamre Road is likely to require further lane widening in the future, so an extra wide median has been designed to allow for this future expansion to take place. Rather than the road being expanded outwards to accommodate widening, it would instead go inwards and reduce the median width. The width of medians after additional lanes are harvested would be a minimum of 3 m. Surface treatments within the median would likely be as follows:

- Medians less than 3 m wide or where pedestrian access is required would have a concrete finish
- When medians are vegetated they would have 2 m strip of turf from BOK .
- Medians greater than 4 m wide would have small shrub planting and frangible trees
- Medians greater than 12 m wide would have non frangible trees where barriers are in place.

Design approach

- Where medians are to be used for pedestrians/ cyclists storage they would have a concrete surface to maximise accessibility and safety
- Sight lines would always be carefully considered within the road corridor where planting is proposed to be installed within medians
- Low maintenance vegetation that can withstand the harsh climatic conditions of Western Sydney would be selected.

4 Urban design concept

Structures

Noise walls

Due to the proximity of the road upgrade to private residences of St Clair, noise walls may be necessary along much of the southbound setback of Mamre Road. Therefore preliminary design and alignment investigations have been undertaken.

The alignment of the walls has taken into account the numerous utilities, private properties, Council boundaries, existing pedestrian easements and drainage channels. (Refer Figure 4-1 and Figure 4-2 on page 29 for detail drawings of the noise wall concept).

Design approach

- Noise walls will be robust, high quality road structures with surface treatments, including architectural detailing to help define the journey for pedestrians, cyclists, motorists and public transport users who travel at varying speeds
- Heritage interpretation is to be incorporated, including working with Indigenous artists for reflection of cultural values
- Noise walls are to have proportions of the different solid and transparent panels for each wall panel section to take advantage of views of the surrounding landscape, and reduce the bulky appearance of structures
- Noise walls are to be designed for maintenance access requirements and allow for drainage at the base of the walls
- Provide fixings that are concealed and discreet on both sides of the structures with both faces designed to the same standard of quality
- Noise walls would be responsive to the local environment and allow sunlight to waterways and ecological areas
- Where possible, vegetation would be implemented close to the wall to soften its visual appearance, particularly when used in long linear extents.

Pedestrian portals

A number of pedestrian portals are required to link existing pedestrian easements from St Clair through the noise walls to the SUP located within the southbound setback. These would be located at the following approximate locations:

- MC01 - CH2020-CH2040
- MC01 - CH2390-CH2410
- MC01 - CH2590-CH2610
- MC01 - CH3410-CH3430
- MC01 - CH3740-CH3760.

The configurations of the pedestrian portals are illustrated in the Figure 4-4 on page 30 to Figure 4-6 on page 32) . Figure 4-7 on page 33 and Figure 4-8 on page 34 explore the shade cast by varying noise wall heights.

Design approach

- Pedestrian portals are to investigate opportunities to enable future site specific art, colours, designs and finishes to be installed on the vertical surfaces of noise walls at portals to help legibility and way-finding
- Incorporate lighting to create a cohesive identity for the project and to enhance navigation and wayfinding along the project
- Implement *PCC CPTED* principles in the configuration of the pedestrian portals
- Where possible, select low vegetation species with texture and colour to accent pedestrian portals and to soften the visual appearance of these lower speed environments.

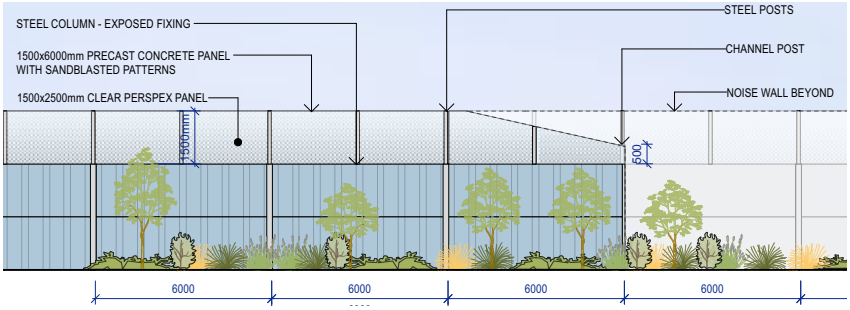


Figure 4-1: Typical elevation of noise wall overlap

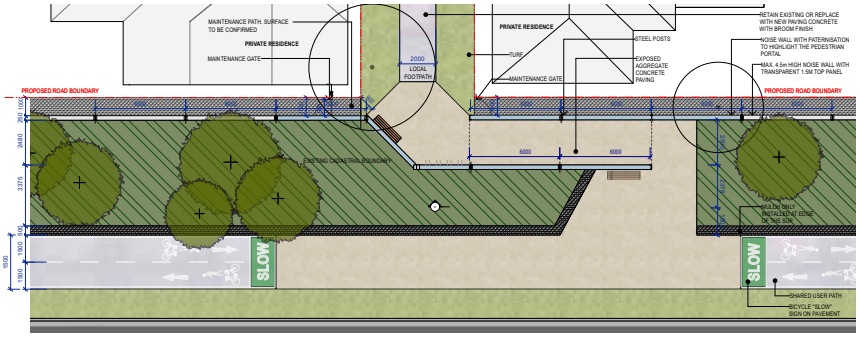


Figure 4-2: Typical detail plan of pedestrian portals

4 Urban design concept

Figure 4-3: Concept sketches of pedestrian portal configuration with yellow theme

4 Urban design concept

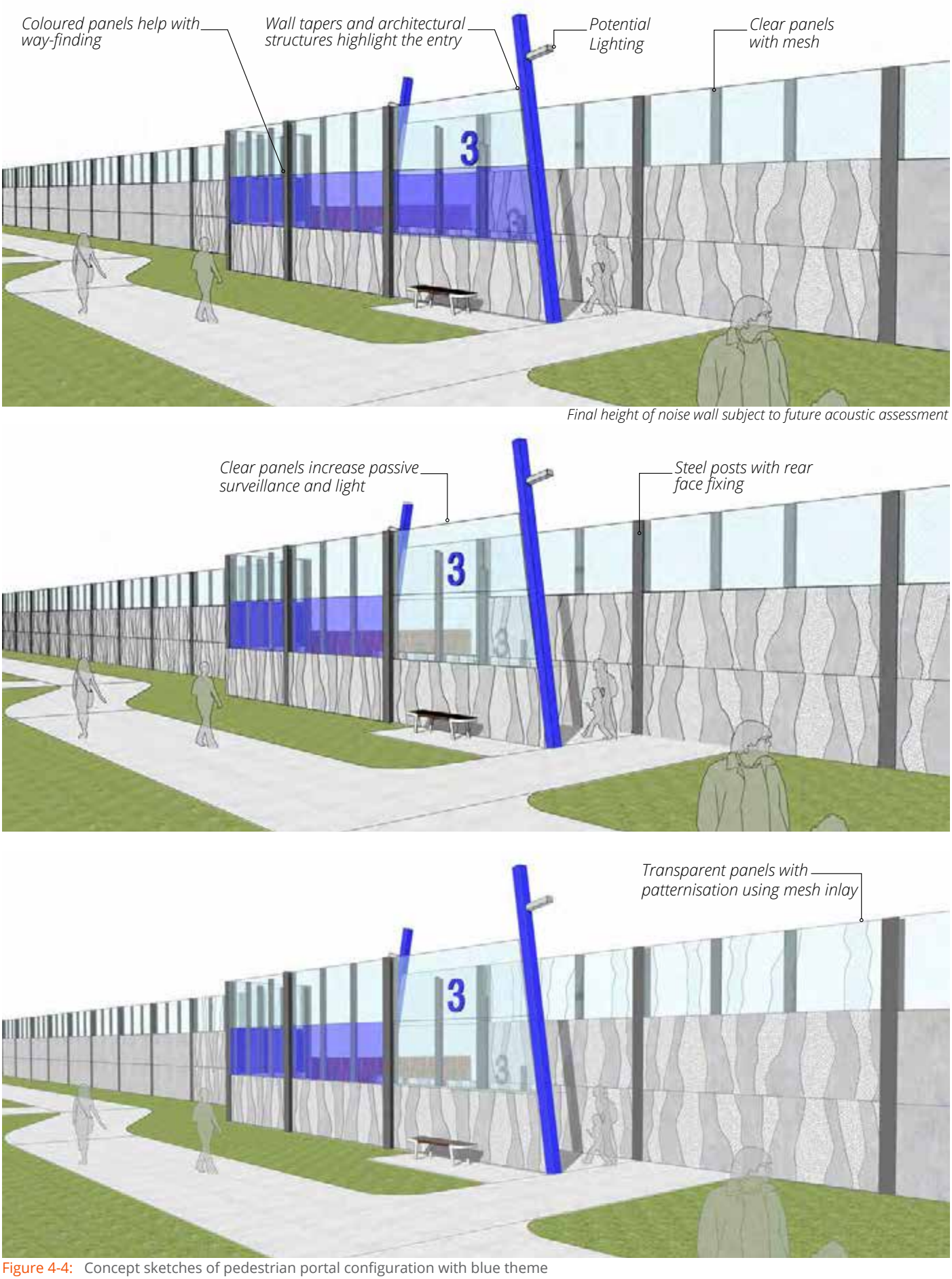


Figure 4-4: Concept sketches of pedestrian portal configuration with blue theme

4 Urban design concept

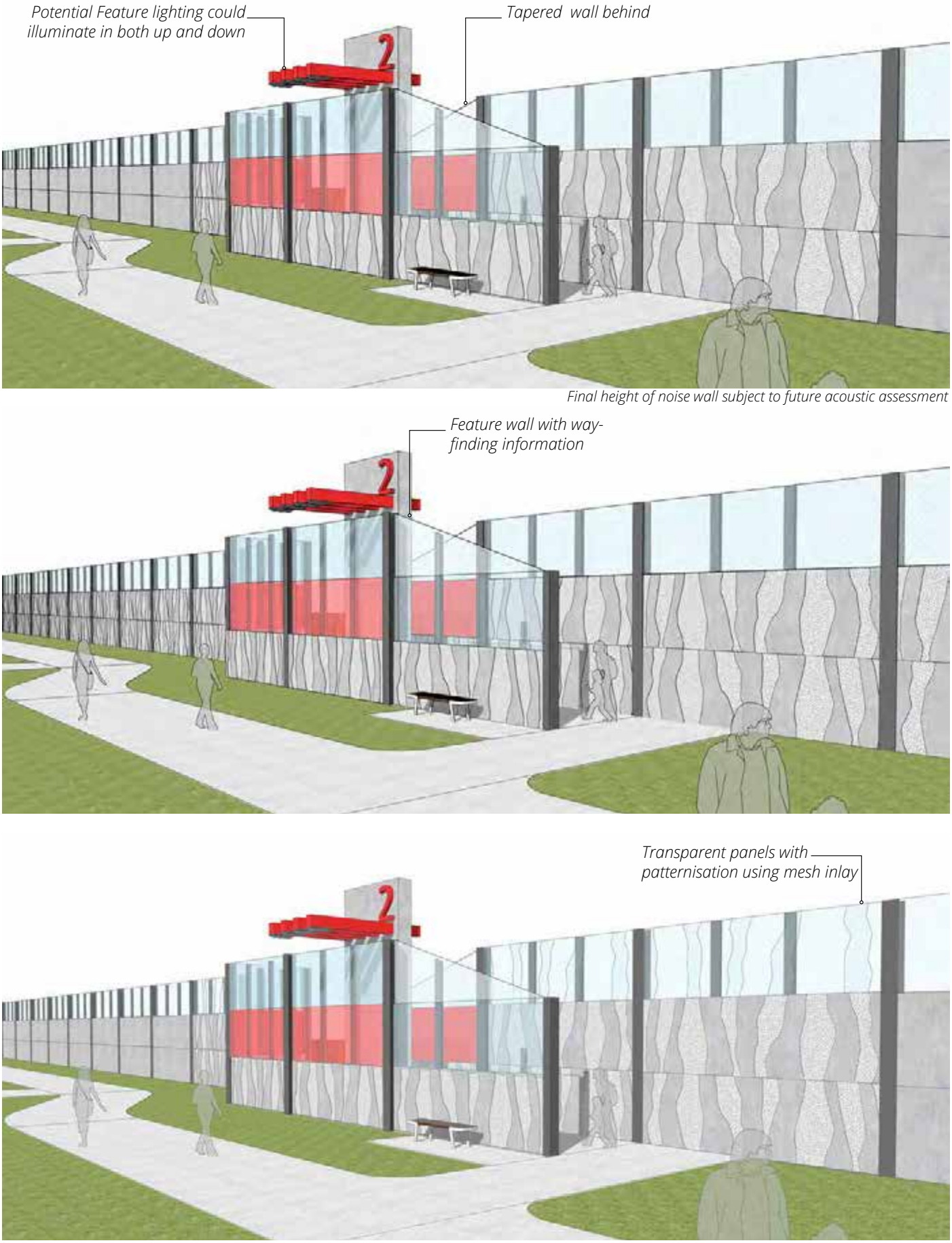
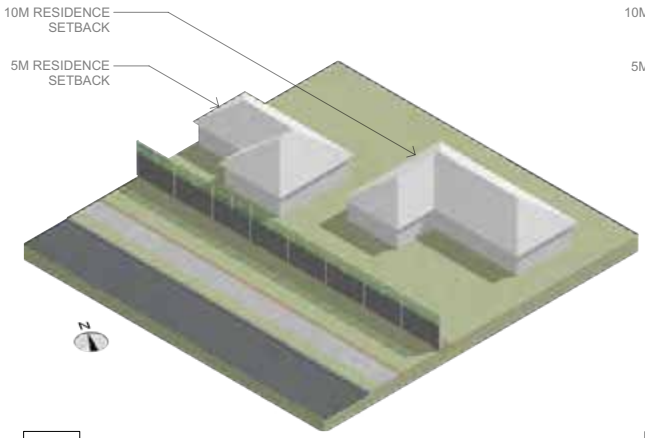
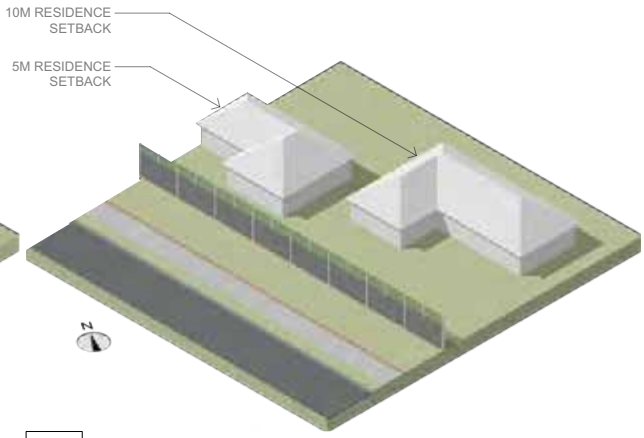


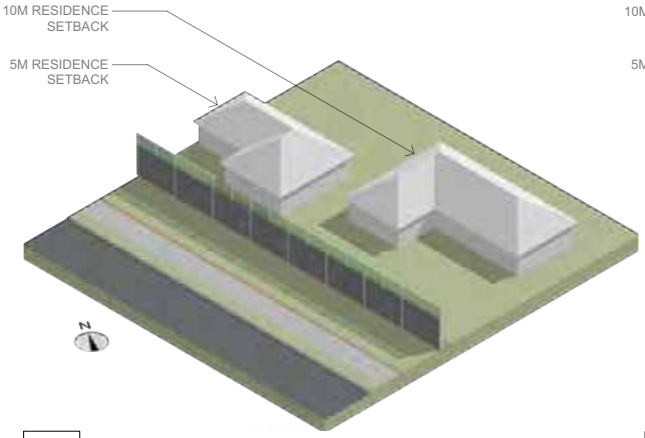
Figure 4-5: Concept sketches of pedestrian portal configuration with red theme



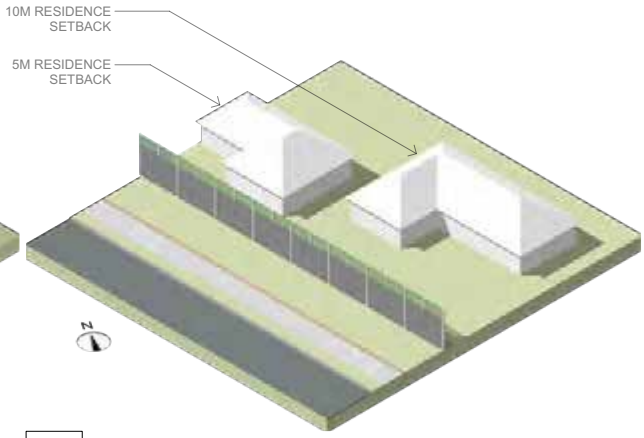
01 4.5m Noise Wall
9am 22nd December



02 4.5m Noise Wall
3pm 22nd December



05 5.5m Noise Wall
9am 22nd December



06 5.5m Noise Wall
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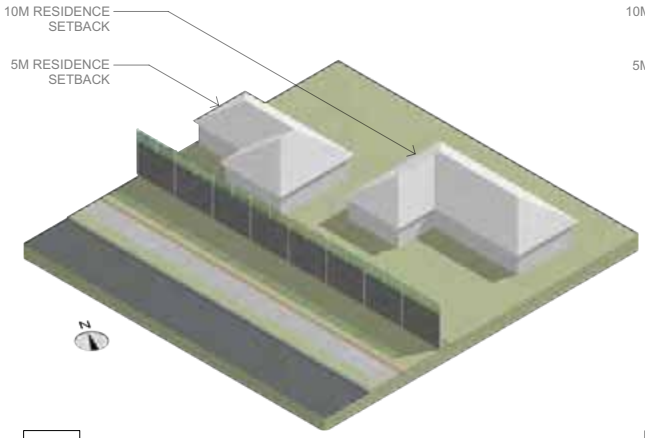
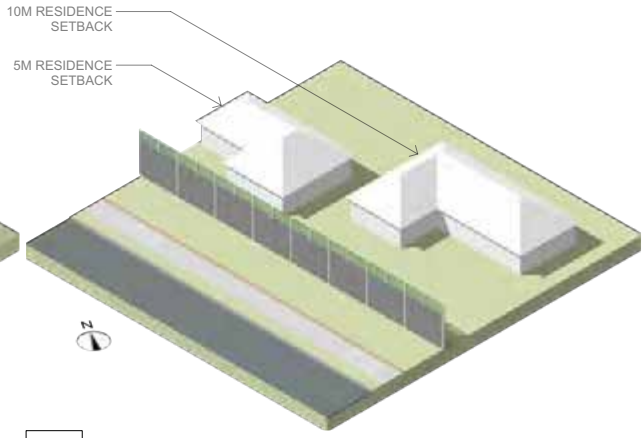
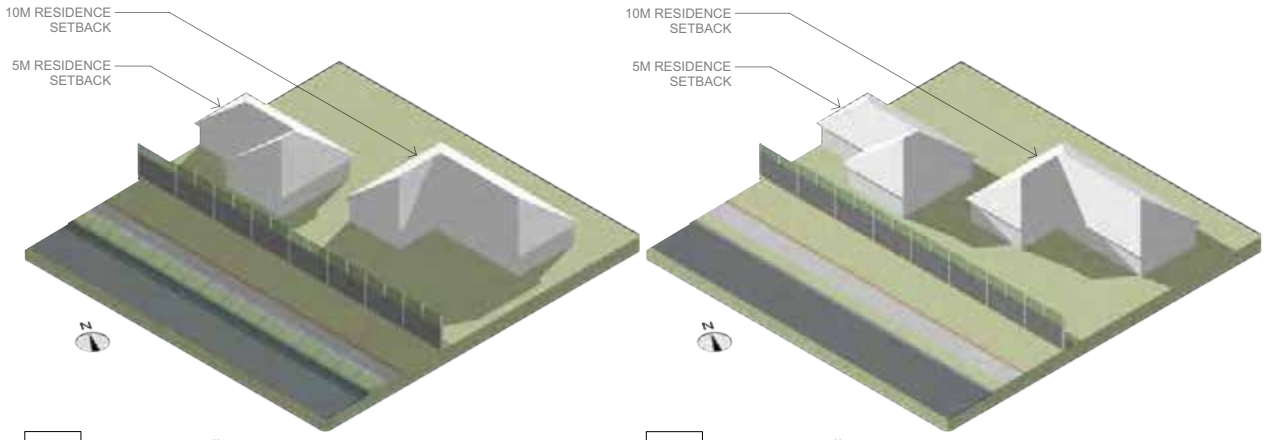


09 6m Noise Wall
9am 22nd December



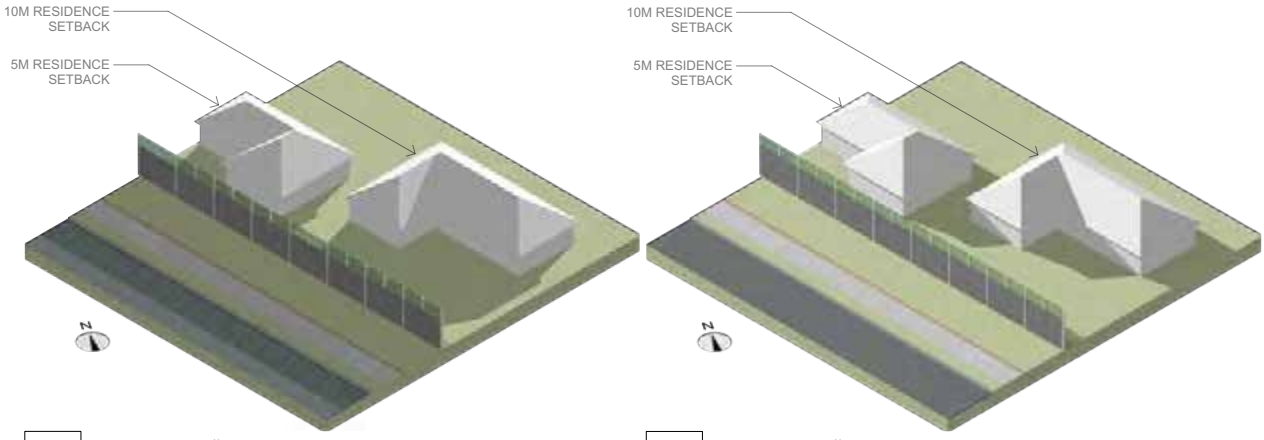
10 6m Noise Wall
3pm 22nd December

Figure 4-6: Noise wall shade studies during the Summer Solstice.



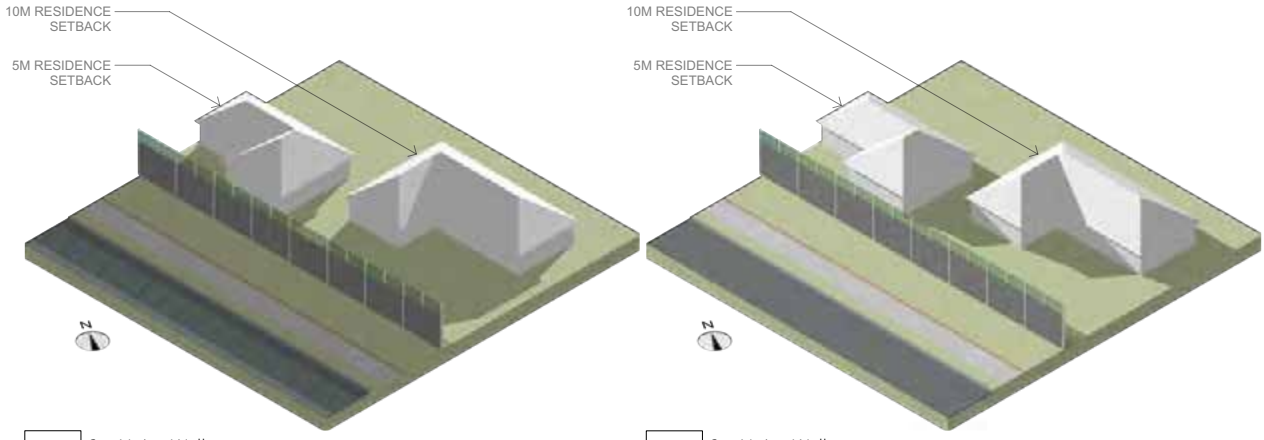
03 4.5m Noise Wall 9am 21st June

04 4.5m Noise Wall 3pm 21st June



07 5.5m Noise Wall 9am 21st June

08 5.5m Noise Wall 3pm 21st June



11 6m Noise Wall 9am 21st June

12 6m Noise Wall 3pm 21st June

Figure 4-7: Noise wall shade studies during the Winter Solstice.

4 Urban design concept

Earthworks

Cut batters

Across the proposal there are only a small number of locations with cut batters and a gradient of 4H:1V would be preferred where space allows. The current design has cut batters at the following (approximate) locations:

Northbound

- MC01 - CH1250-CH1410

Southbound

- MC01 - CH1120-CH1460
- MC01 - CH1510-CH1640
- MC01 - CH2800-CH2930.
- MC01 - CH3000-CH3350

Design approach

- Landscape treatments would be planting or turfing on the Eastern side unless for temporary erosion control measure during construction. The Western side would use predominately revegetation mixes on cut batters.
- Rounding of the top edges of the batters would help to integrate the formation with the surrounding landscape.

Fill embankments

Across the project fill embankments are generally low with a typical maximum gradient of 4H:1V, however batters with gradients of 2H:1V have been included where spatially constrained. They are located at the following approximate locations:

Northbound

- MC01 - CH240-CH1250
- MC01 - CH1410-CH2380
- MC01 - CH2630-CH4053.

Southbound

- MC01 - CH240-CH1120
- MC01 - CH1460-CH1510
- MC01 - CH1640-CH2800
- MC01 - CH2930-CH3000
- MC01 - CH3350-CH4025.

Final fill embankment would be designed to suit site constraints.

Design approach

- Road embankments on the eastern side are proposed to be planted with native grasses and shrubs to provide a robust and economical landscape treatment. On the Western side revegetation mixes would be used for batters. Where located in more visually sensitive locations, adjacent residential areas, embankments would be mass planted, potentially with advanced species.

Drainage and water quality

Culverts

Currently the proposal includes culverts at the following locations:

- MC01 - CH775
- MC01 - CH1030
- MC01 - CH1525
- MC01 - CH1830
- MC01 - CH2045
- MC01 - CH2440
- MC01 - CH2650
- MC01 - CH2675
- MC01 - CH3060
- MC01 - CH3355
- MC01 - CH3855.

Design approach

- Consider pedestrian access across the culverts especially at drainage channels
- Appropriate scour protection would be provided on both upstream and downstream ends of all structures where increased velocities have the potential to cause scour.

WSUD

Due to relatively high flood levels within existing creeks and waterways and the low lying nature of the existing landscape, drainage is an important site issue. WSUD features such as swales, ponds and operational drainage basins have been included throughout the project

Design approach

- The approach to WSUD features would be informed by TfNSW guidelines and in accordance with the PCC WSUD Technical Guidelines
- Best-practice WSUD initiatives would be implemented where feasible to increase the environmental performance of the project especially when they are linked to existing watercourses
- WSUD features would be used to enhance amenity, and improve revegetation and reduce urban heat.

Road furniture

Kerbside bus stops

The project has adopted the following bus bay/stop facilities:

- Bus priority lanes (on approach)
  - Erskine Park Road
  - Within left turn lane at Solander and Banks Drive

- Indented Bus bays on departure as Solander Drive, Banks Drive and Erskine Park Road.
- Existing kerbside bus stops
  - Mamre Road southbound CH2200
  - Erskine Park Road CH 125 east and westbound
  - Banks Drive turning left on Mamre Road southbound

Future bus shelters

Typical arrangements for the provision of future bus shelters at bus stops along the northbound carriageway, where footpath would be present, and along the southbound carriageway, where the SUP would be present have been considered for the Proposal. The SUP and footpath would be set back in these locations to allow sufficient space for bus shelters and associated facilities.

Design approach

- The SUP and footpath arrangement would be setback behind the bus shelter in order to reduce potential conflicts between all users
- Bus shelter style and configuration such as materiality and colour selections would be selected to reduce urban heat
- Additional colour and texture would be introduced through the plant selection at bus stop locations
- Ensure planting selection conforms to sight lines and clear zone requirements but provides as much shade as possible.

Safety barriers

Guardrail safety barriers would be installed on the project where batters are steeper than 4H:1V or a at culvert crossings to protect against headwalls. Lengths of barrier would also be provided along some stretches of the SUP to allow for roadside tree planting. Some lengths of barrier would be terminated to allow for property accesses on the northbound side of the carriageway.

Design approach

- Consider barrier selection and integration with other components of the SUP environment to improve amenity
- Where possible, dense shrub vegetation would be implemented to at least one side of barriers to soften the visual appearance
- Select plant species to ensure passive surveillance of pedestrians and cyclists is maintained from surrounding areas.

Pedestrian and cyclist fencing

Pedestrian and cyclist fencing has been provided in the proposal.

Design approach

- Fencing would be designed to achieve a quality urban design outcome for all users off the road corridor
- Fences would be installed as protection from hazards adjacent to SUP and footpath.
- Handrails would be required on culvert wing walls where fall heights exceed 1m and along SUP next to 2H:1V embankments
- Fences that require replacement especially those associated with private properties would be in a similar style to the existing fencing
- Where possible, vegetation would be implemented to at least one side of fencing to soften its visual appearance particularly when used in extensive linear extents along a road corridor
- Median fencing shall not obstruct the motorist's sight lines and distance requirements to users of pedestrian and cyclist facilities.

Signage

A signage strategy has been provided for the proposal.

Design approach

- Consult with PCC with regards to the soon to be published LGA wide signage strategy
- Ensure an integrated engineering and urban design approach reduces the reliance on separate signage structures and minimises visual clutter and obstructions.

Public art and interpretive signage

Public art and interpretive signage is to be included within the proposal.

Design approach

- Consult with PCC with regards to the soon to be published LGA wide signage strategy
- Investigate any opportunities to incorporate public art in pedestrian portal areas of the SUP environment
- Investigate possible ways for the application of art installations on noise wall surfaces to be developed by TfNSW in consultation with Council and Community through the detailed design phase.

Lighting

Street lighting has been provided in the proposal.

Design approach

- Lighting would be installed in accordance with the guidelines set out in the *PCC Public Domain Manual*
- Road corridor lighting would shine on pedestrian pathways and any possible entrapment spaces to minimise clutter
- Lighting in public places would be consistent in order to reduce the contrast between shadows and illuminated areas and not produce glare
- Lighting spillage onto neighbouring properties would be minimised as this can cause nuisance and reduce opportunities for natural surveillance.

4 Urban design concept

Landscape treatments

Feature planting

Feature planting is designed to highlight particular areas within the corridor. It may be used to identify an individual feature, define a node within the landscape or announce an entire area or precinct.

Feature planting also contributes to an interesting linear driving experience and helps with legibility. Feature planting would be installed at the following locations:

- Mamre House, where feature planting would reference the rural character and be sensitive to the sites heritage context.
- Pedestrian portals
- Drainage channels
- Business park and commercial areas..

Design approach

- Structure planting using contrasting species to change the visual cues along the project and contribute to the experience of the landscape along the journey
- Employ landscape sequencing techniques to improve user perception effectively promote distinctive character precincts and activity nodes along a corridor
- Install trees in setback areas to help minimise the visual scale of the road infrastructure, mitigate urban heat and enhance the amenity of both the road corridor and adjoining areas
- In bushfire prone areas of the project, feature planting is likely to include tall canopy trees with low shrub, grass and groundcover species. In these locations emphasis on colour and foliage textures would be important
- Lateral views from the road corridor across to the Blue Mountains would be accented and maintained.

Riparian planting

The riparian planting would employ species naturally associated with local creek systems and can be designed to promote awareness of watercourse crossings.

Design approach

- The selection and arrangement of species would reflect the original planting and ecological integrity of the existing watercourse systems
- Species selection would support the local ecology and biodiversity and where feasible, would be reinforced with tree, shrub and grass species selected from the relevant vegetation communities
- Appropriate aquatic (macrophyte and sedge plants) within creek channels would be selected to ensure the construction impacts of the project are minimised
- Species selection and planting layout would simulate a riparian setting and complement the character and habitat based on advise from ecologists.

Medians

Planting in median areas could adopt a formal layout and may include plant species arranged in bands or blocks with different species layered vertically. Plant species would also be selected for colour and textural qualities and may also utilise water sensitive urban design principles.

Design approach

- Where medians are greater than 3 m wide, low shrubs are to be selected and positioned to provide further greening of the corridor
- Turf would be installed in some medians to reduce the need for vegetative removal when road corridor is widened
- A 2000mm turf edge (minimum) would be installed along the edge of the kerb to prevent plant foliage spilling onto the road
- Low maintenance vegetation would be selected that has been proven to withstand the typically hot and dry climatic conditions of Western Sydney
- Sight lines would always be carefully considered within the road corridor
- Planting within the median would always avoid existing underground utilities and above ground power lines.

4 Urban design concept

Screen planting

Screen planting is designed to shape the user experience by directing or screening views as appropriate. Plants would be selected for dense foliage habit and suitable mature size to visually screen adjoining land uses and/ or structures (Figure 4-8) with the intent of reducing the visual impact of these elements.

Plants would be arranged informally in naturalistic or in a semi-natural patterns to reinforce or replicate the existing setting.

Design approach

- Screen planting in areas near noise walls using native plant species would reinforce endemic planting communities of the area
- Due to the large presence of industrial/ large scale buildings within the Erskine Business Park, it is important to provide some visual screening. Particular emphasis would be placed on creating a green corridor that reduces the apparent scale of large warehouse buildings at these locations
- Planting at the Erskine Park Road intersection to provide screening of the road from the Childcare Centre would be important
- Avoid screen vegetation that impedes the effectiveness of public lighting and long range views.

Laydown/ site compound areas

Design approach

- Planting would aim to reinstate and reinforce the existing environment prior to use during the construction of the upgrade.

WSUD planting

Planting in WSUD features is designed to support the local ecology and biodiversity, minimise negative impacts on natural water cycles and integrate water into the landscape to enhance visual, social, cultural and ecological values.

Design approach

- Support the local ecology and biodiversity and contribute to the maintenance of existing natural hydrological processes
- Appropriate aquatic (macrophyte and sedge plants) within natural creek channels would be selected to ensure the construction impacts of the project are minimised
- Species would be selected to accommodate drought and flood conditions, ensuring greater resilience and adaptability
- Planting would enhance biodiversity through developing habitat corridors and linkages to creek systems.

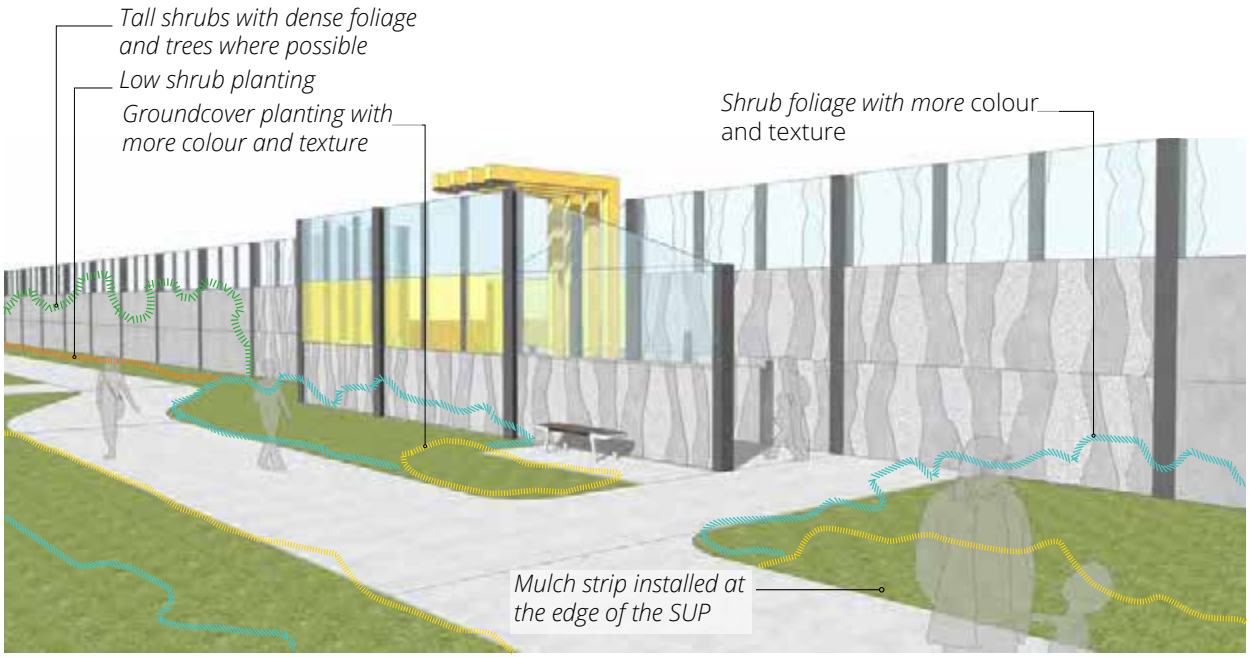


Figure 4-8: Concept sketch showing screen planting approach at pedestrian portals

4 Urban design concept

Plant species

Species selection is to be in accordance with TfNSW ***Landscape Design Guideline*** and in consultation with PCC.

Species would include low maintenance and drought tolerant plants in order to reduce maintenance requirements. The species and their location and function are outlined in Table 4-1 on page 40 to Table 9-5 on page 47.

Design approach

- Planting to incorporate both native and exotic plants to provide large amounts of shade in summer but also allow sunlight in winter
- Screening plant species would most likely be native to reinforce endemic planting communities of the areas
- At intersections and activity nodes along the SUP, there is an opportunity to provide a variety of plant species rather than using solely native grasses. This method could help provide accent and vary the experience of the journey along the road corridor.

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Table 4-1: TM1 Cumberland Native Bushland

Tree mix would be used in stands along edge of road.

Plant Species	Common Name	Height	Spread
Angophora floribunda	Rough-barked apple	20m	10m
Eucalyptus creba	Narrow leaved ironbark	30m	10m
Eucalyptus eugenioides	Thin leaved stringy bark	30m	10m
Eucalyptus moluccana	Grey box	25m	10m
Eucalyptus tereticornis	Forest red gum	30m	10m

Angophora floribunda

Eucalyptus creba

Eucalyptus eugenioides

Eucalyptus moluccana

Eucalyptus tereticornis

Table 4-2: TM2 Indigenous Screening Trees

Tree mix would be used in medians where wider than 12m with appropriate barriers.

Plant Species	Common Name	Height	Spread
Acacia implexa	Lightwood	8m	7m
Acmena smithii	Lilly pilly	8m	8m
Melaleuca decora	White feather honey myrtle	13m	8m
Tristaniopsis laurina 'Luscious'	Water gum	8m	5.5m

Acacia implexa

Acmena smithii

Melaleuca decora

Tristaniopsis laurina

Table 4-3: TM3 Riparian Trees

Tree mix would be used near culverts and drainage channels.

Plant Species	Common Name	Height	Spread
Angophora subvelutina	Broad leaved apple	20m	10m
Casuarina cunninghamiana	River she-oak	10m	7m
Casuarina glauca	She-oak	13m	5m
Eucalyptus amplifolia	Cabbage gum	25m	5m
Tristaniopsis laurina	Water gum	8m	5m

Angophora subvelutina

Casuarina cunninghamiana

Casuarina glauca

Eucalyptus amplifolia

Tristaniopsis laurina

4 Urban design concept

Table 4-4: TM4 Feature Trees

Tree mix would be used in avenue planting at intersections

Plant Species	Common Name	Height	Spread
Araucaria cunninghamii	Hoop pine	35m	6m
Corymbia eximia	Yellow bloodwood	18m	5m
Corymbia maculata	Spotted gum	30m	10m
Melaleuca linariifolia	Snow in summer	8m	2.5m

Araucaria cunninghamii

Corymbia eximia

Corymbia maculata

Melaleuca linarifolia

Table 4-5: TM5 Frangible Shrubs/Small Trees

Tree mix would be used in median where non-frangible planting is needed.

Plant Species	Common Name	Height	Spread
Callistemon citrinus 'White Anzac'	Lemon-scented bottlebrush	1m	1m
Callistemon 'King Park Special'	Bottlebrush	4m	4m

Callistemon citrinus

Callistemon 'King Park Special'

Table 4-6: TM6 Feature Shrubs

Tree mix would be used in medians on approach to intersections and to highlight some pedestrian portals.

Plant Species	Common Name	Height	Spread
Callistemon viminalis 'Little John'	Little John Bottlebrush	1m	1m
Indigofera australis	Australian Indigo	1.8m	1.8m
Melaleuca thymifolia	Thyme honey-myrtle	0.8m	0.8m

Callistemon viminalis 'Little John'

Indigofera australis

Melaleuca thymifolia

Table 4-7: TM7 Cumberland Plain Feature

Tree mix would be used in the heritage node at Mamre House

Plant Species	Common Name	Height	Spread
Angophora floribunda	Rough barked apple	10m	6m

Angophora floribunda

4 Urban design concept

Table 4-8: PM1 Feature Native Shrubs & Groundcovers

Planting mix used to highlight pedestrian portals and some intersections.

Plant Species	Common Name
Convolvulus angustissimus 'Pink Sapphire'	Pink Bindweed
Craspedia globosa	Billy buttons
Dodonaea viscosa	Sticky hop bush
Grevillea juniperina 'Cherry cluster'	Cherry cluster
Lomandra hystrix 'Katie Belles"	Mat rush
Myoporum parvifolium 'Yareena'	Creeping boobialla
Ozothamnus diosmifolius	Rice Flower
Rhagodia spinecens	Spiny saltbush


Convolvulus angustissimus


Craspedia globosa


Dodonaea viscosa


Grevillea juniperina


Lomandra hystrix


Myoporum parvifolium


Ozothamnus diosmifolius


Rhagodia spinecens

Table 4-9: PM2 Native Shrubs and Groundcovers

Planting mix used predominately to vegetate eastern side from batter to noise wall.

Plant Species	Common Name
Asperula conferta	Common woodruff
Banksia oblongifolia	Fern-leaved banksia
Banksia spinulosa	Hairpin banksia
Glycine clandestina	Twining glycine
Grevillea juniperina 'Gold Cluster'	Grevillea 'Gold Cluster'
Hardenbergia violacea	Purple coral pea
Melaleuca nodosa	Prickly leaf paperbark
Pultenaea cinerascens	Low bush pea
Westringia fruticosa 'Grey Box'	Coastal Rosemary


Asperula conferta


Banksia oblongifolia


Banksia spinulosa


Glycine clandestina


Grevillea juniperina


Hardenbergia violacea


Melaleuca nodosa


Pultenaea cinerascens


Westringia fruticosa

4 Urban design concept

Table 4-11: PM3 Feature Median Shrubs & Groundcovers

Planting mix would be used within the median to highlight pedestrian portals and intersections.

Plant Species	Common Name
Grevillea juniperina 'Molonglo'	Grevillea
Helichrysum petiolare	Licorice plant
Lomandra longifolia 'Tanika'	Spiny head mat rush
Poa labillardieri	Tussock grass
Westringia fruticosa 'Low Horizon"	Coastal rosemary

Grevillea juniperina 'Gold Cluster'

Helichrysum petiolare

Lomandra longifolia

Poa labillardieri

Westringia fruticosa

Table 4-12: PM4 Median Shrubs and Groundcovers

Planting mix would be used in median

Plant Species	Common Name
Asperula conferta	Common woodruff
Bursaria spinosa	Australian blackthorn
Daviesia ullicifolia	Gorse bitter pea
Imperata cylindrica	Blady grass
Lomandra longifolia 'Katrinus'	Katrinus mat rush
Scaevola albida 'Blue Mist'	Fan Flower

Asperula conferta

Bursaria spinosa

Daviesia ullicifolia

Imperata cylindrica

Lomandra longifolia

Scaevola albida 'Blue Mist'

4 Urban design concept

Table 4-13: PM5 Basins

Planting mix would be used in vegetated basins with plants adapted to wet conditions.

Plant Species	Common Name
Baumea rubiginosa	Soft twig rush
Carex appressa	Tall sedge
Ficinia nodosa	Knobby club rush
Juncus usitatus	Common rush
Philydrum lanuginosum	Woolly waterlily
Schoenoplectus mucronatus	Scripus club rush
Schoenoplectus validus	River club rush


Baumea rubiginosa


Carex appressa


Ficinia nodosa


Juncus usitatus


Philydrum langionosum


Schoenoplectus mucronatus


Schoenoplectus validus

Table 4-14: PM6 Creek Lines

Planting mix would be used in creek lines with plants adapted to wet conditions.

Plant Species	Common Name
Baumea rubiginosa	Twig rush
Bolboschoenus caldwellii	Marsh club-rush
Bolboschoenus fluviatilis	River bulrush
Carex appressa	Tall sedge
Ficinia nodosa	Knobby club-rush
Gahnia sieberiana	Red fruited saw sedge
Juncus usitatus	Common rush
Philydrum langinosum	Wolly waterlily


Baumea rubiginosa


Bolboschoenus caldwellii


Bolboschoenus fluviatilis


Carex appressa


Ficinia nodosa


Gahnia sieberiana


Juncus usitatus


Philydrum langinosum

4 Urban design concept

Table 4-15: PM7A Native Grasses on Fill Embankment / PM7B Native Grasses on Cut Batters

PM7A would be used on eastern side in fill embankments. PM7B would be used on cut batters and in cut swale batters.

Plant Species	Common Name
Chloris truncata	Windmill grass
Cymbopogon refractus	Barbed wire grass
Dichanthium sericeum	Queensland bluegrass
Imperata cylindrica	Blady grass
Lomandra longifolia	Spiny-headed mat-rush
Microlaena stipoides	Weeping rice grass
Themeda triandra	Kangaroo grass


Chloris truncata


Cymbopogon refractus


Dichanthium sericeum


Imperata cylindrica


Lomandra longifolia


Microlaena stipoides


Themeda triandra

Table 4-16: PM8 Verge Grasses

Planting mix would be used on verges and in planting areas along the SUP.

Plant Species	Common Name
Dianella revoluta	Blue Flax Lily
Imperata cylindrica	Blady grass
Lomandra longifolia 'Tanika'	Mat-rush
Poa labillardieri 'Eskdale'	Tussock Gras
Themeda australis	Kangaroo grass


Dianella revoluta


Imperata cylindrica


Lomandra longifolia 'Tanika'


Poa labillardieri 'Eskdale'


Themeda australis

4 Urban design concept

Table 4-17: RM1A Native Grasses on Fill Embankment/ RM1B Native Grasses on Cut Batter

Remediation mixes would be used on fill embankments and cut batters along the western side.

Plant Species	Common Name
Chloris truncata	Windmill grass
Cymbopogon refractus	Barbed wire grass
Dichanthium sericeum	Queensland bluegrass
Imperata cylindrica	Blady grass
Lomandra longifolia	Spiny-headed mat-rush
Microlaena stipoides	Weeping rice grass
Themeda triandra	Kangaroo grass


Chloris truncata


Cymbopogon refractus


Dichanthium sericeum


Imperata cylindrica


Lomandra longifolia


Microlaena stipoides


Themeda triandra

Table 4-18: RM2A Native Shrubs and Groundcovers

Remediation mix would be used on western side where denser shrubby vegetation is desired.

Plant Species	Common Name
Bursaria spinosa	Australian blackthorn
Dillwynia sieberi	Sieberi parrot pea
Gazania spp.	Treasure flower
Goodenia hederacea	Ivy Goodenia
Grevillea juniperina	Prickly Grevillea
Hakea microcarpa	Small-fruit Hakea
Hibbertia scandens	Golden guinea flower
Leucopogon muticus	Blunt beard heath
Ozothamnus diosmifolius	Rice flower
Pratia purpurascens	White root
Westringia fruticosa 'Grey Box"	Coastal rosemary


Bursaria spinosa


Dilwynia sieberi


Gazania spp.


Goodenia hederacea


Grevillea juniperina


Hakea microcarpa


Hibbertia scandens


Leucopogon muticus


Ozothamnus diosmifolius

4 Urban design concept

Table 4-19: RM4 Median Indigenous Grasses (NOT IN USE)

Planting mix would be used in medians.

Plant Species	Common Name
Aristida ramosa	Purple wire grass
Dianella caerulea	Blue flax lily
Dichelachne micrantha	Short hair plume grass
Echinopogon ovatus	Forest hedgehog grass
Lomandra hystrix	Green mat-rush
Microlaena stipoides	Weeping rice grass


Aristida ramosa


Dianella caerulea


Dichelachne micrantha


Echinopogon ovatus


Lomandra hystrix


Microlaena stipoides

Table 4-20: RM5 Batter to Boundary Indigenous Grasses

Planting mix would be used on western side between batter and boundary to tie road into the pastoral landscape.

Plant Species	Common Name
Aristida ramosa	Purple wire grass
Austrodanthonia racemosa	Slender wallaby grass
Austrostipa scabra	Corkscrew spear grass
Cymbopogon refractus	Barbed wire grass
Dianella longifolia	Blue flax lily
Dichelachne micrantha	Short hair plume grass
Dichelachne rara	Plume-grass
Echinopogon ovatus	Forest hedgehog grass
Microlaena stipoides	Weeping rice grass
Themeda triandra	Kangaroo grass


Aristida ramosa


Austrodanthonia racemosa


Austrostipa scabra


Cymbopogon refractus


Dianella longifolia


Dichelachne micrantha


Dichelachne rara


Echinopogon ovatus


Microlaena stipoides

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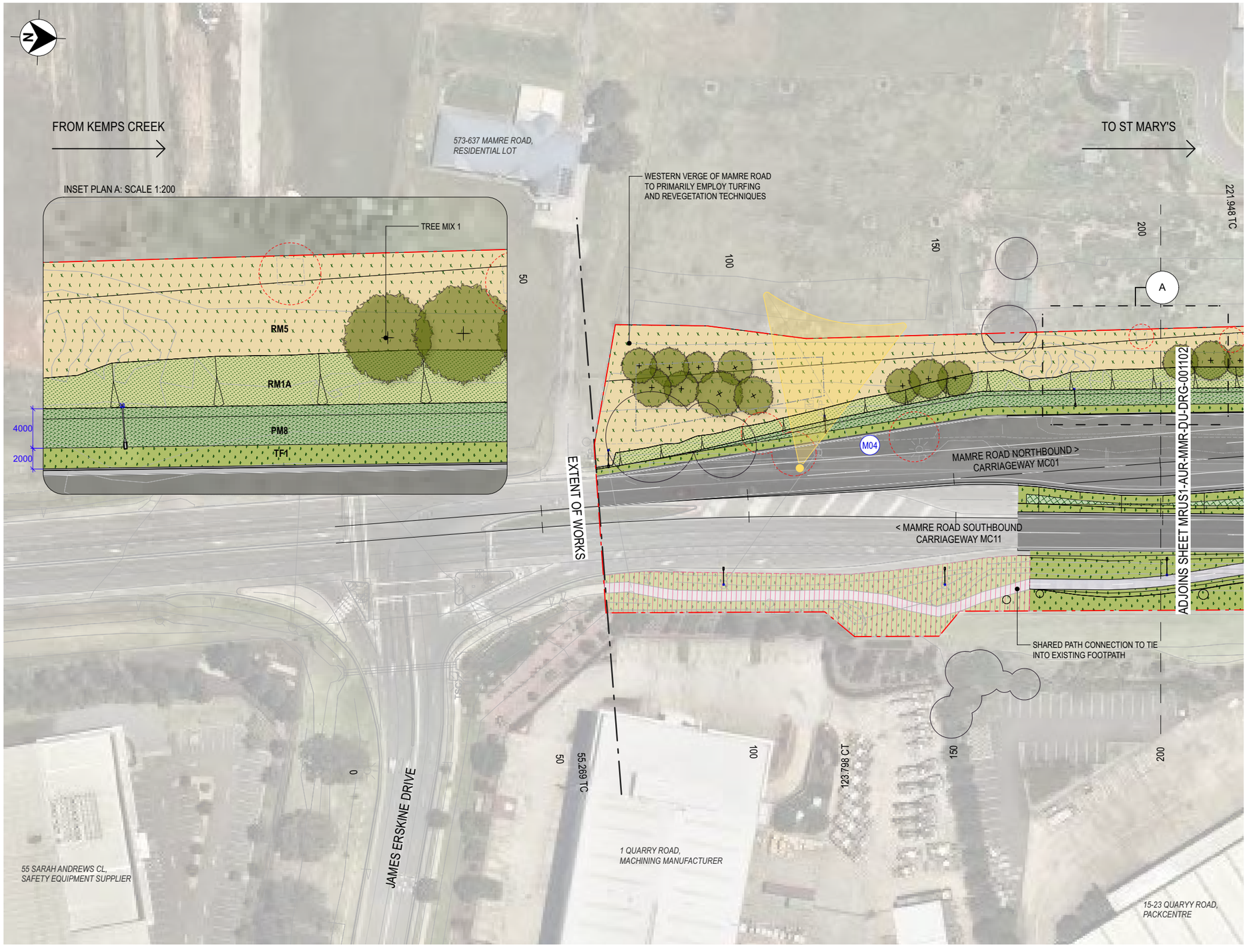

LEGEND

GENERAL
- PROPOSED ROAD BOUNDARY
- EXTENT OF WORKS
- CADASTRAL BOUNDARY
- CONTOURS (2M INTERVAL)
- EXISTING WATERCOURSE
- BUSHFIRE PRONE AREA
- OPERATIONAL BASIN LOCATION (TEMPORARY)
- EXISTING SIGNAGE TO BE RETAINED
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- CONCRETE MEDIAN (WITH INTEGRAL OXIDE)
- SHARED USEER PATH (SUP) INSITU CONCRETE

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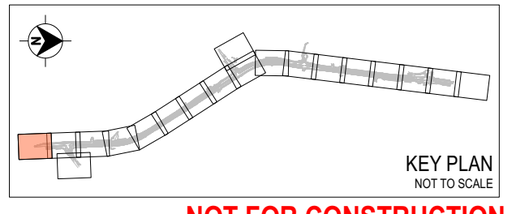

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Figure 4-9: Urban design plans (01-19)

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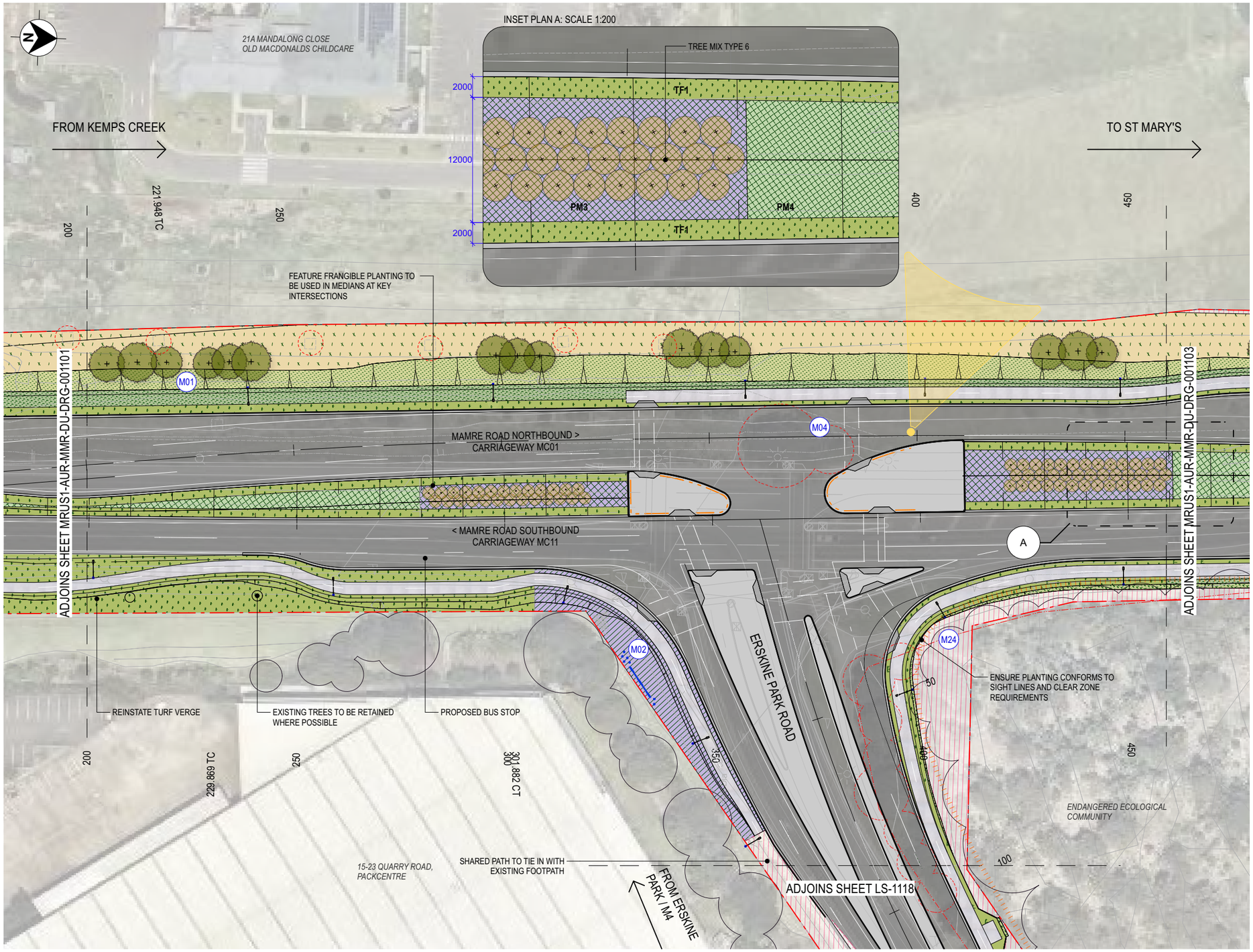

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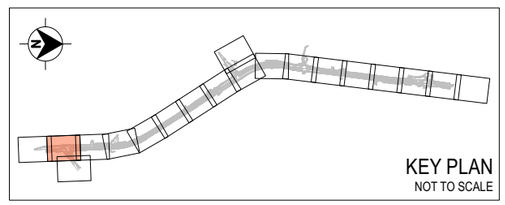

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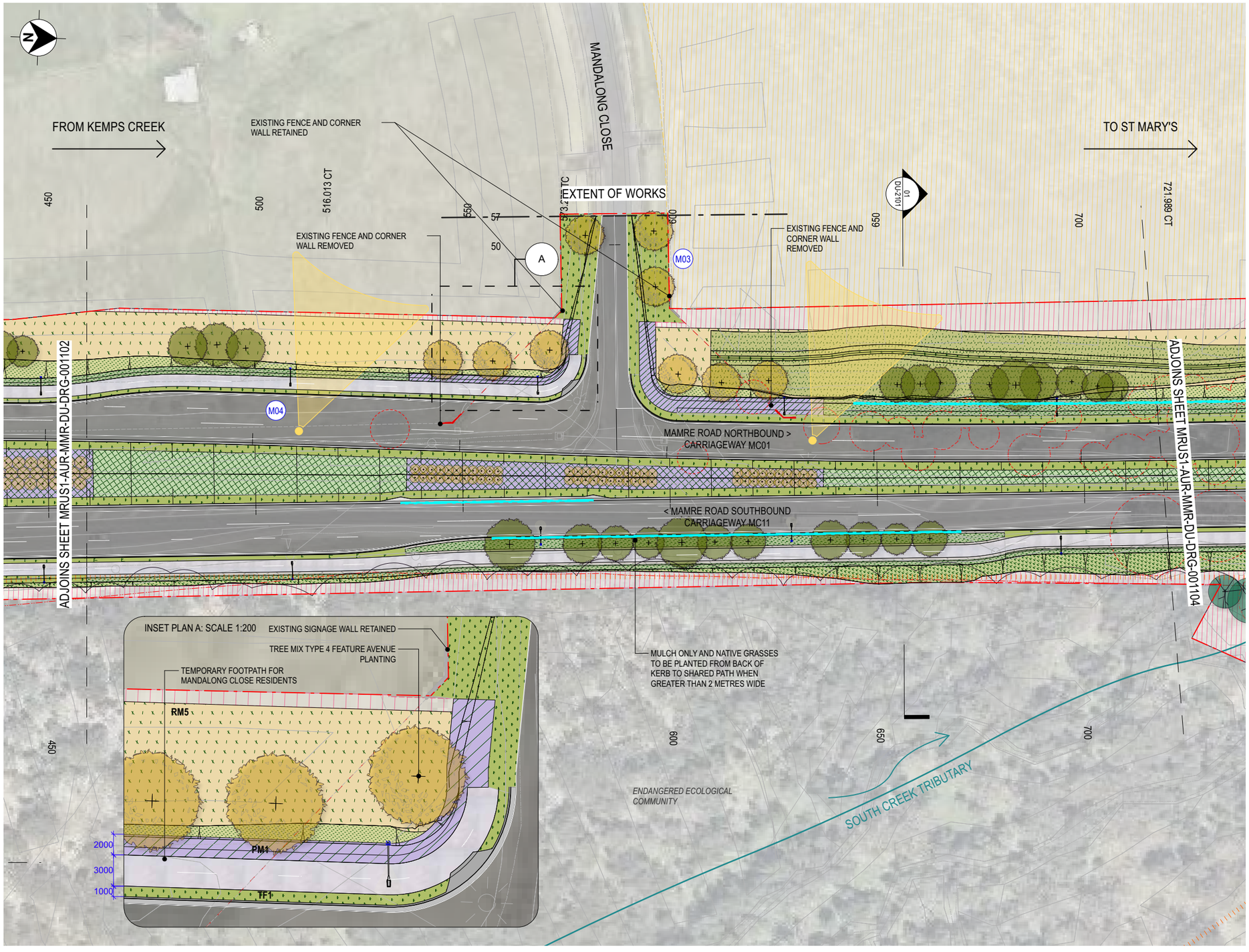

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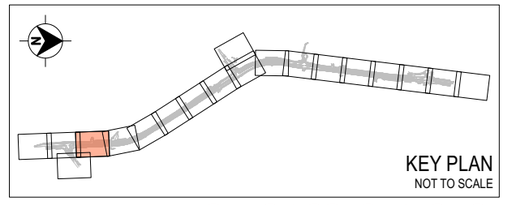

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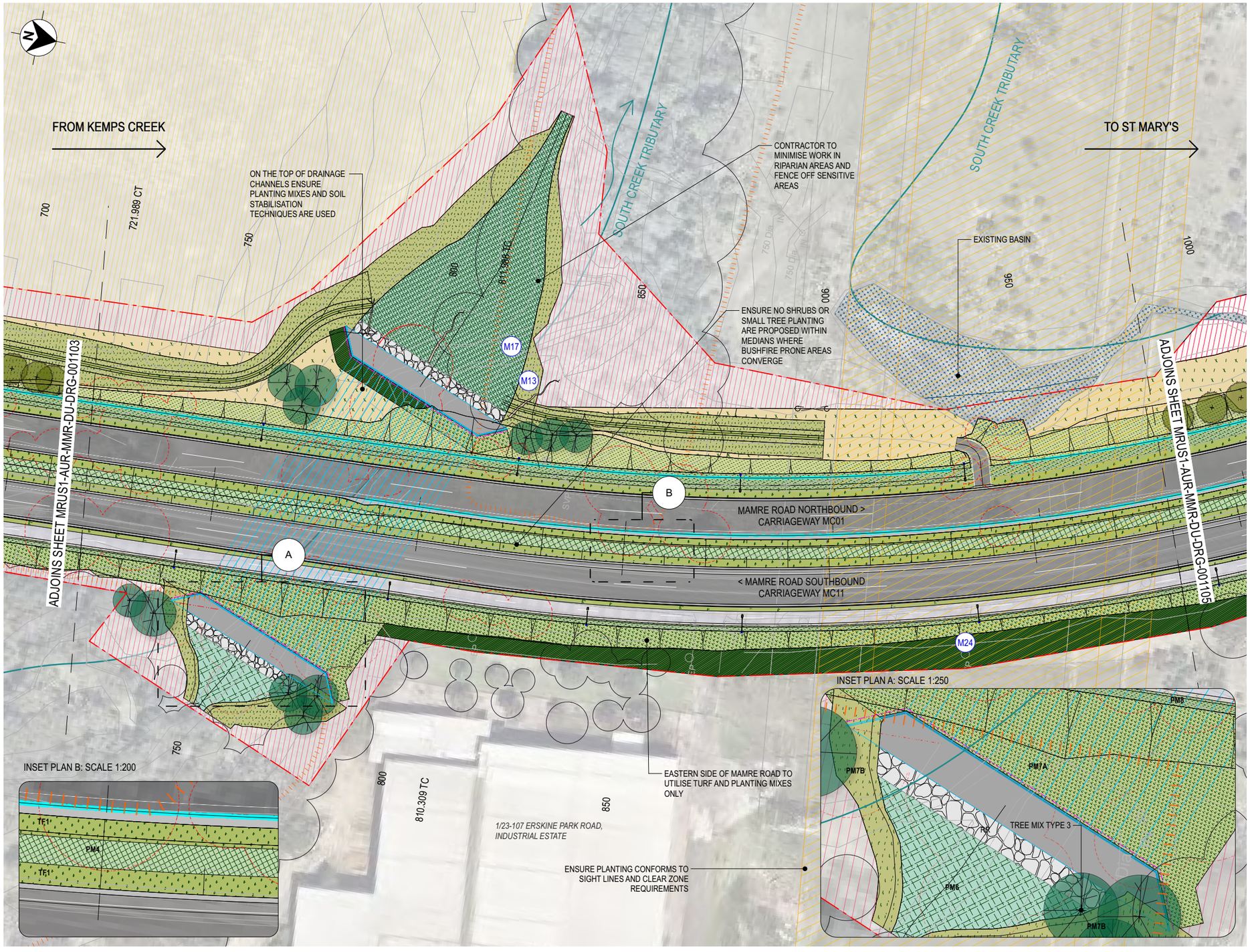

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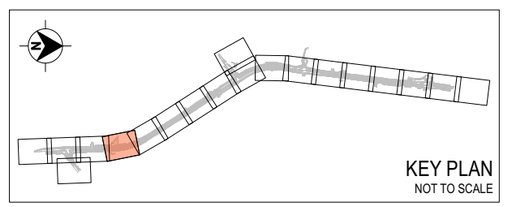

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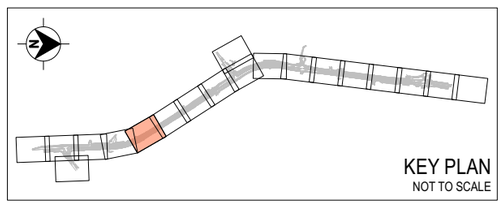

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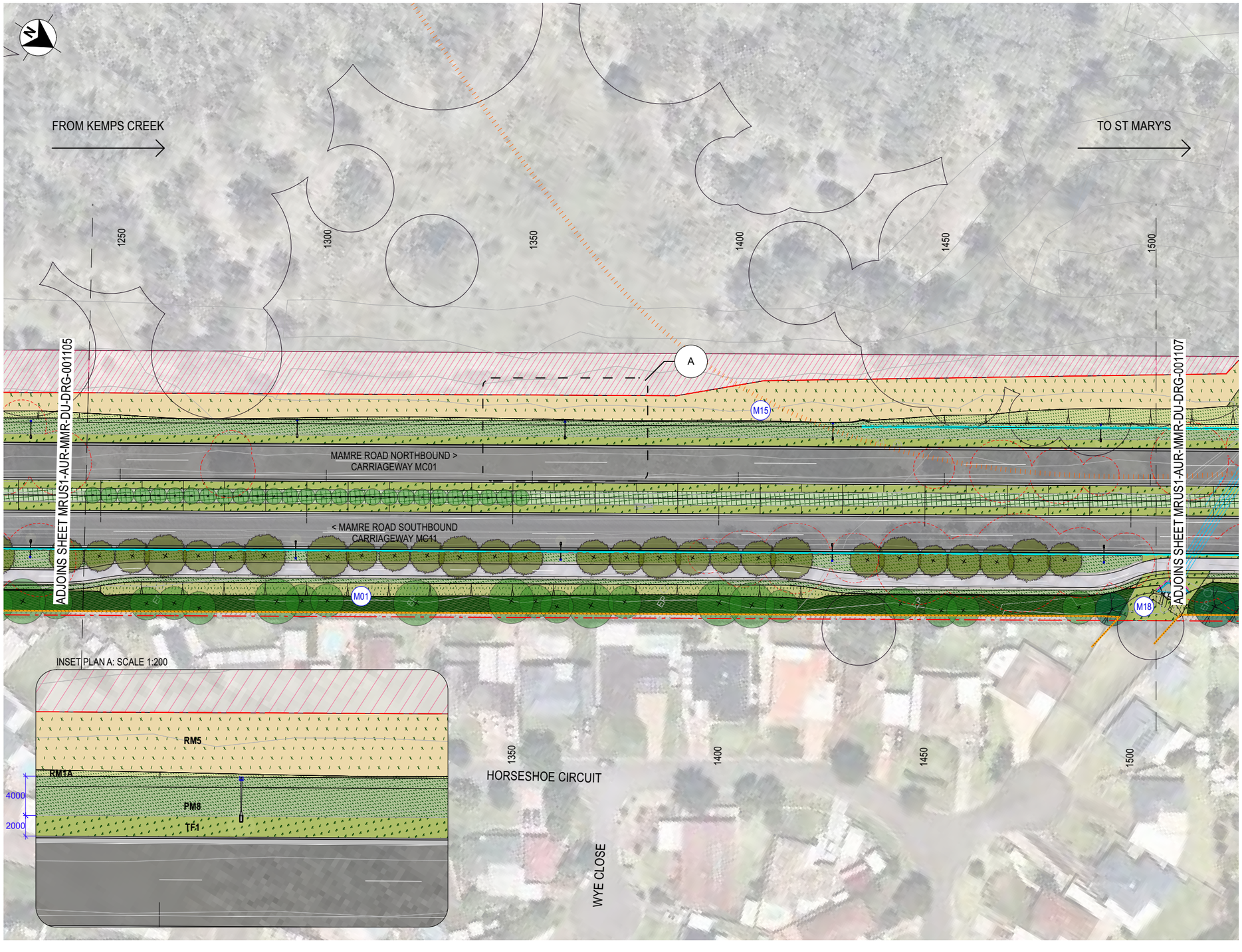

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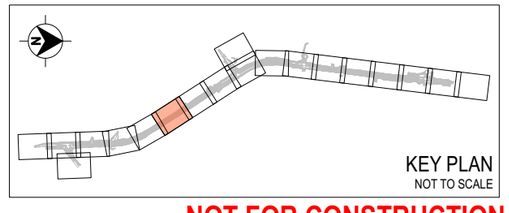

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LEGEND

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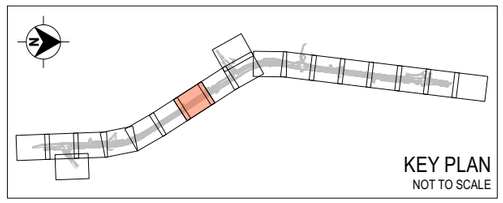

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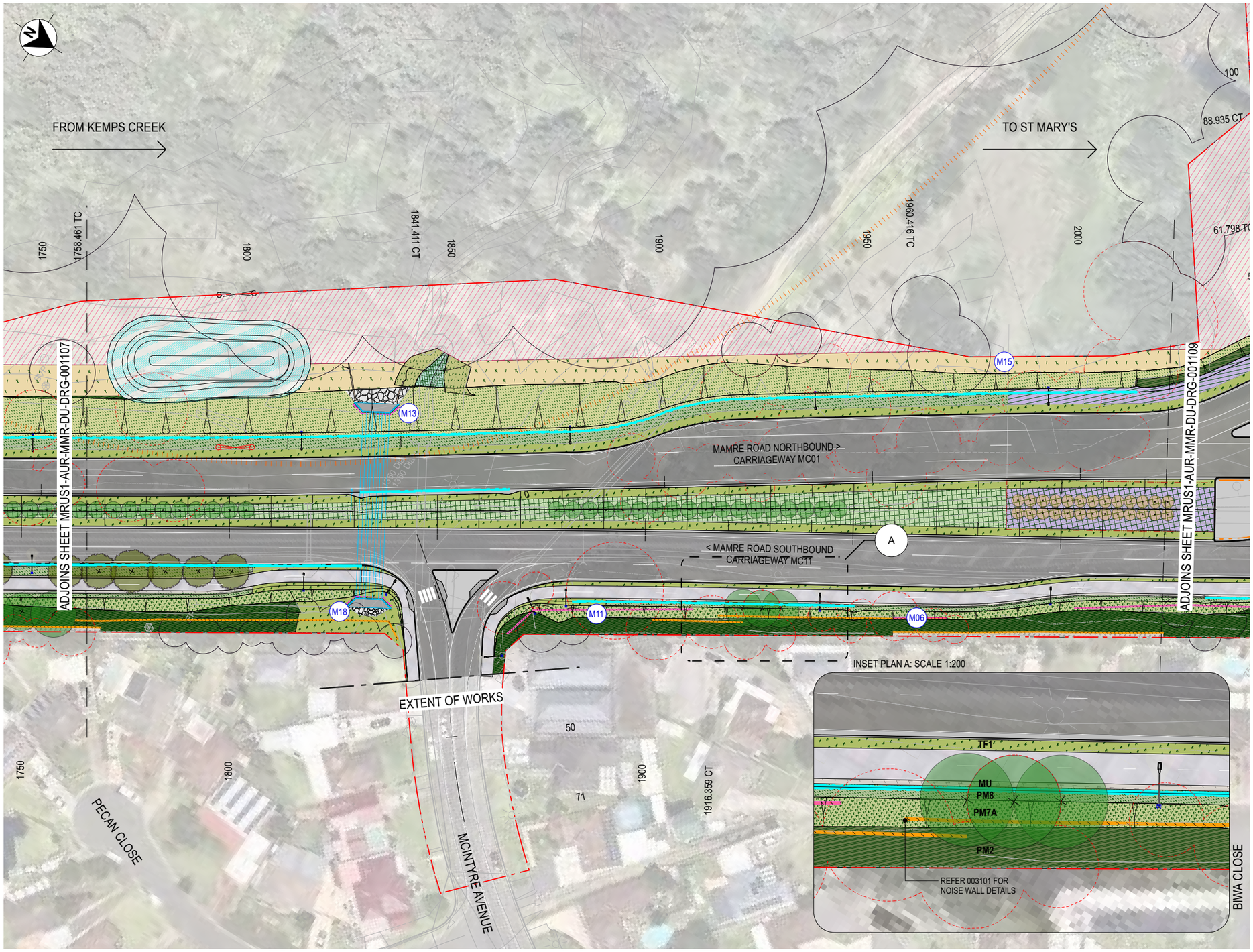

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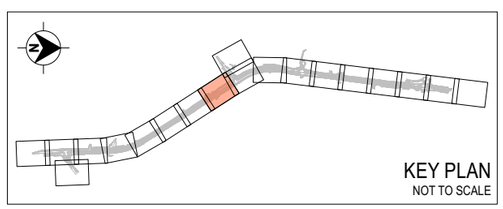

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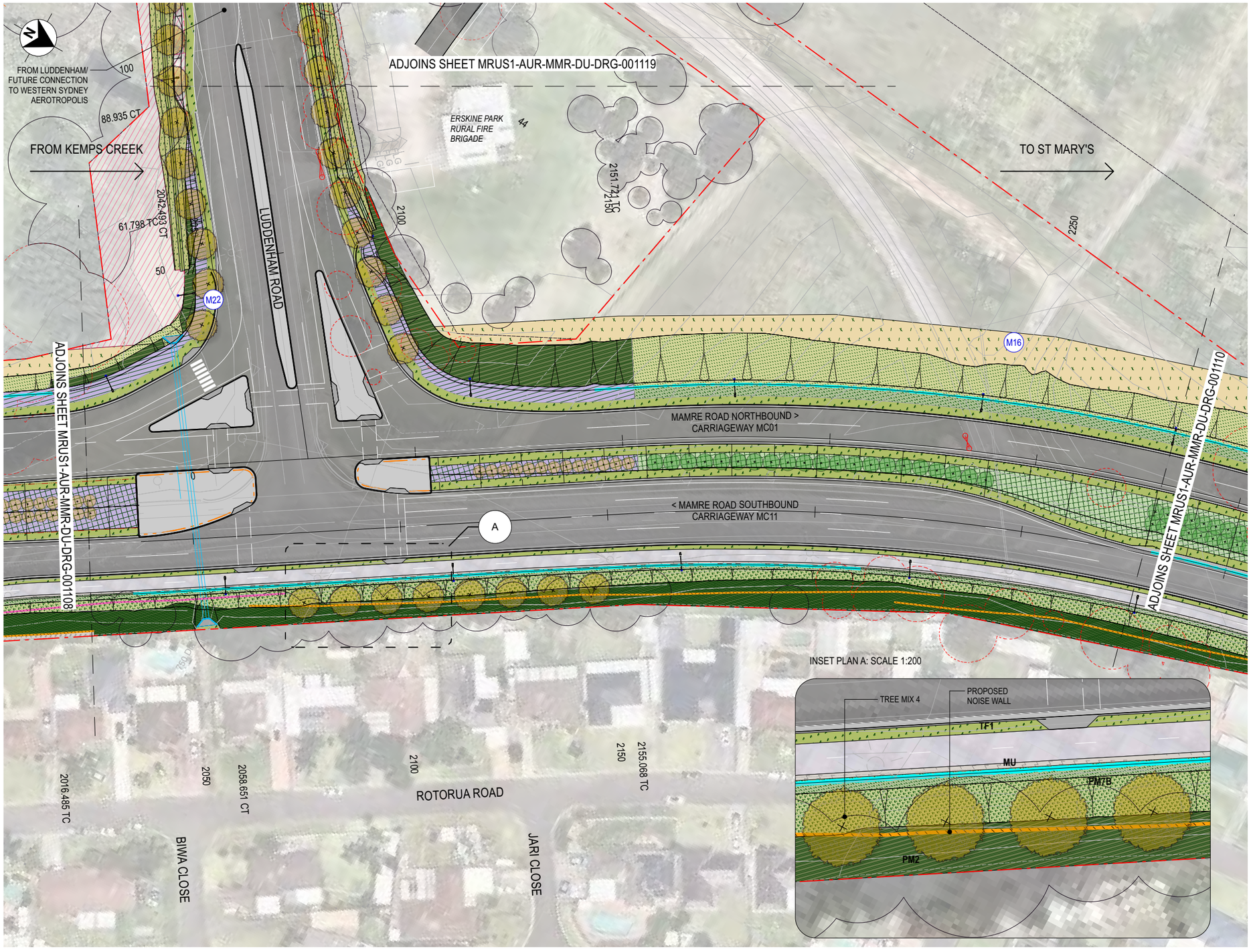

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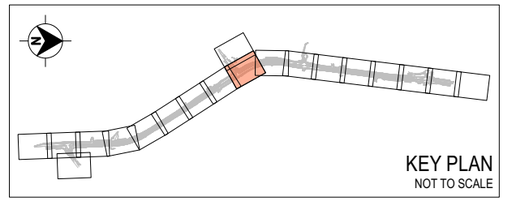

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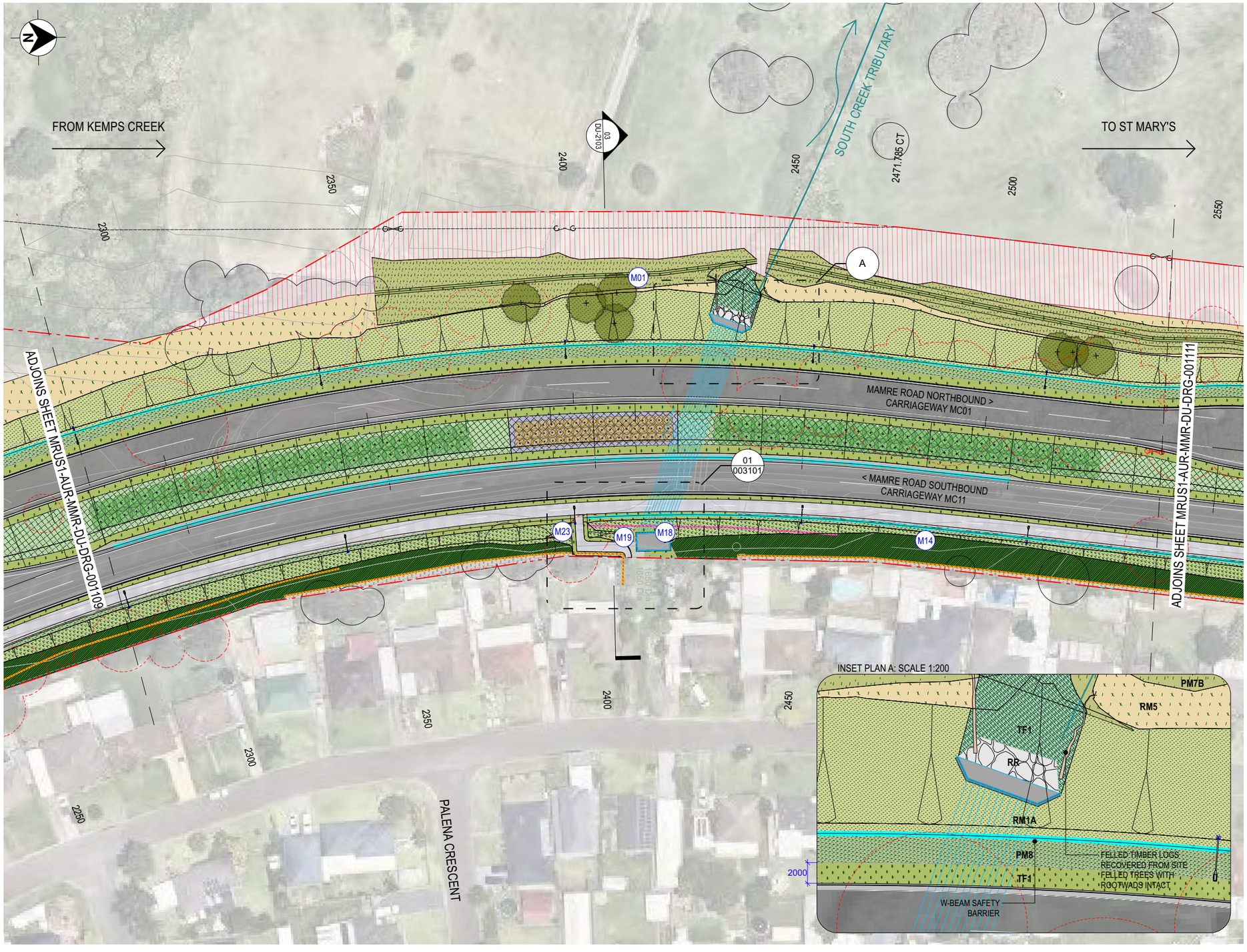

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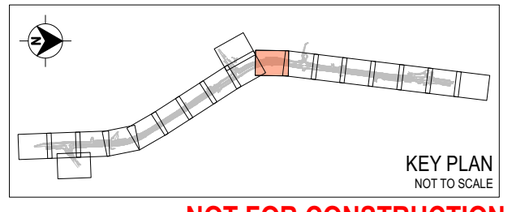

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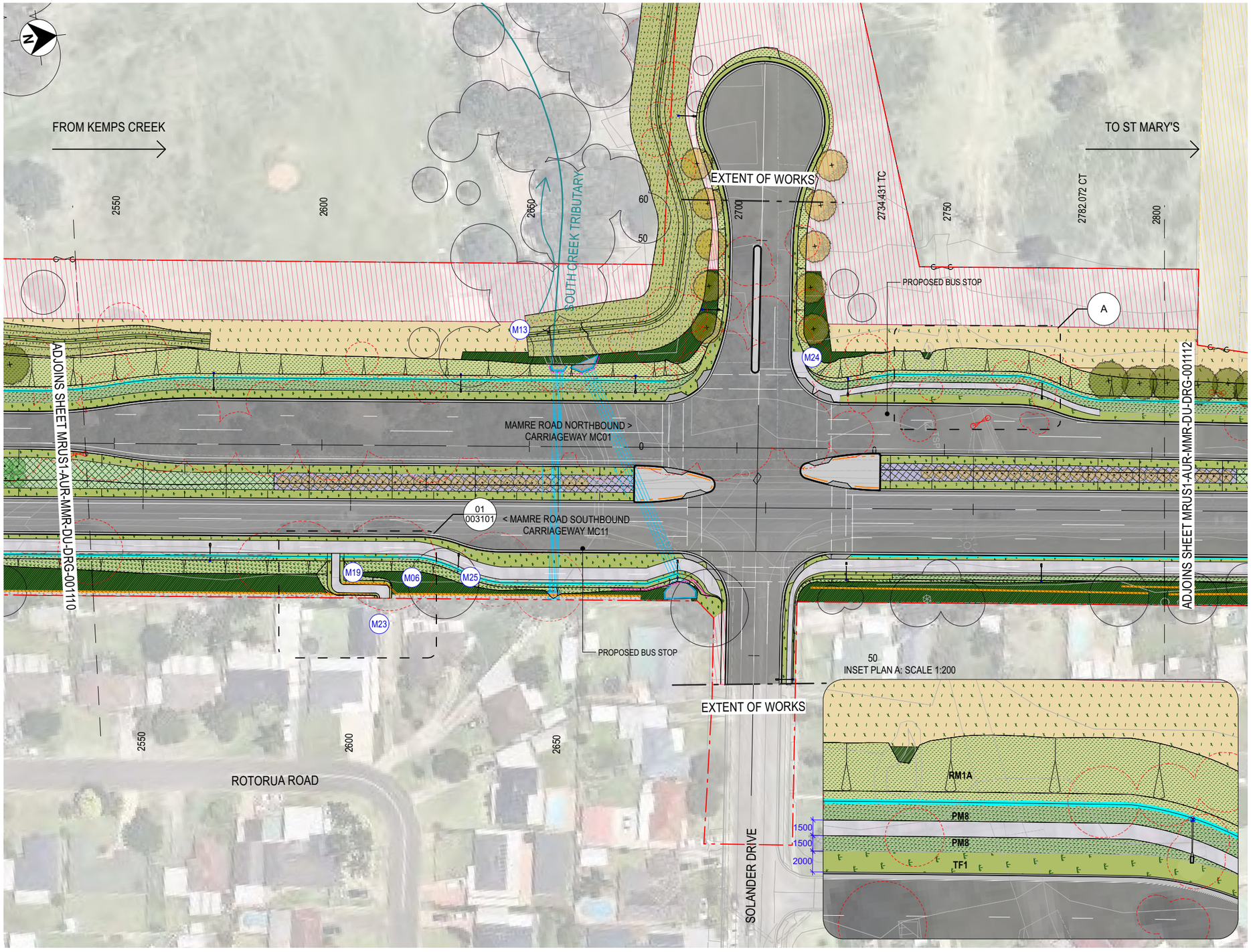

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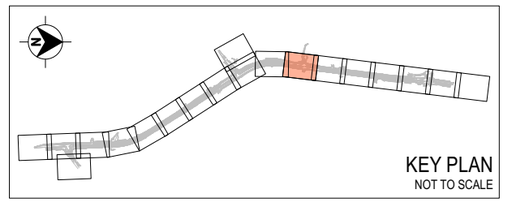

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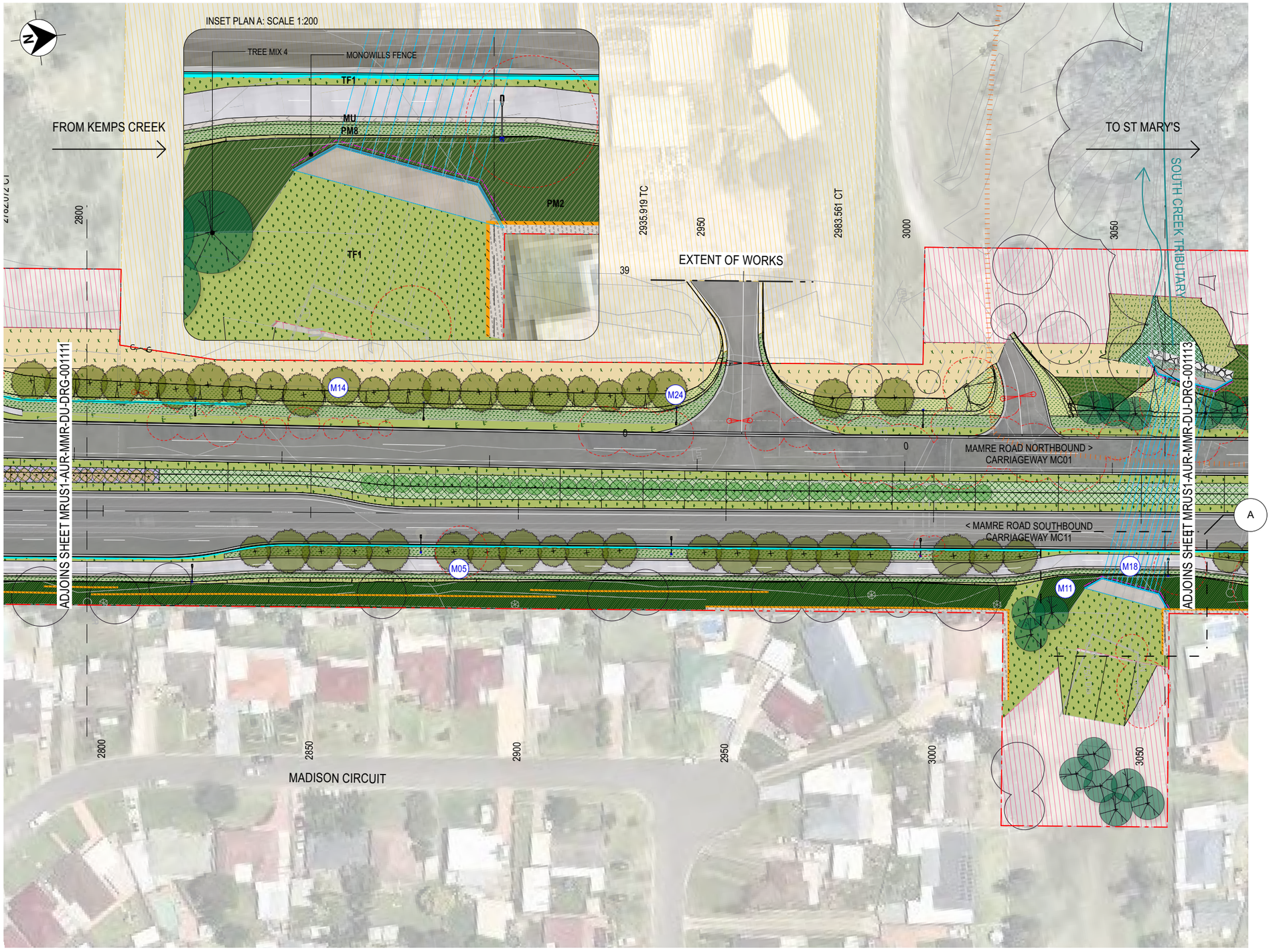

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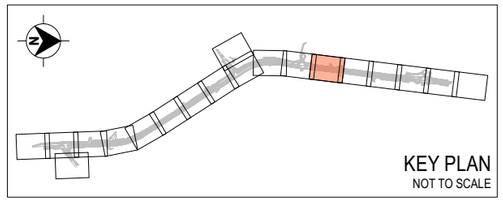

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LEGEND

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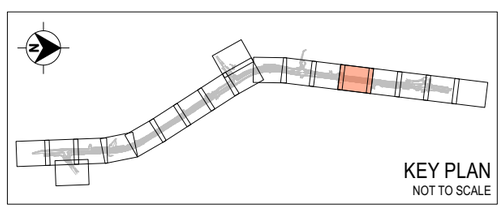

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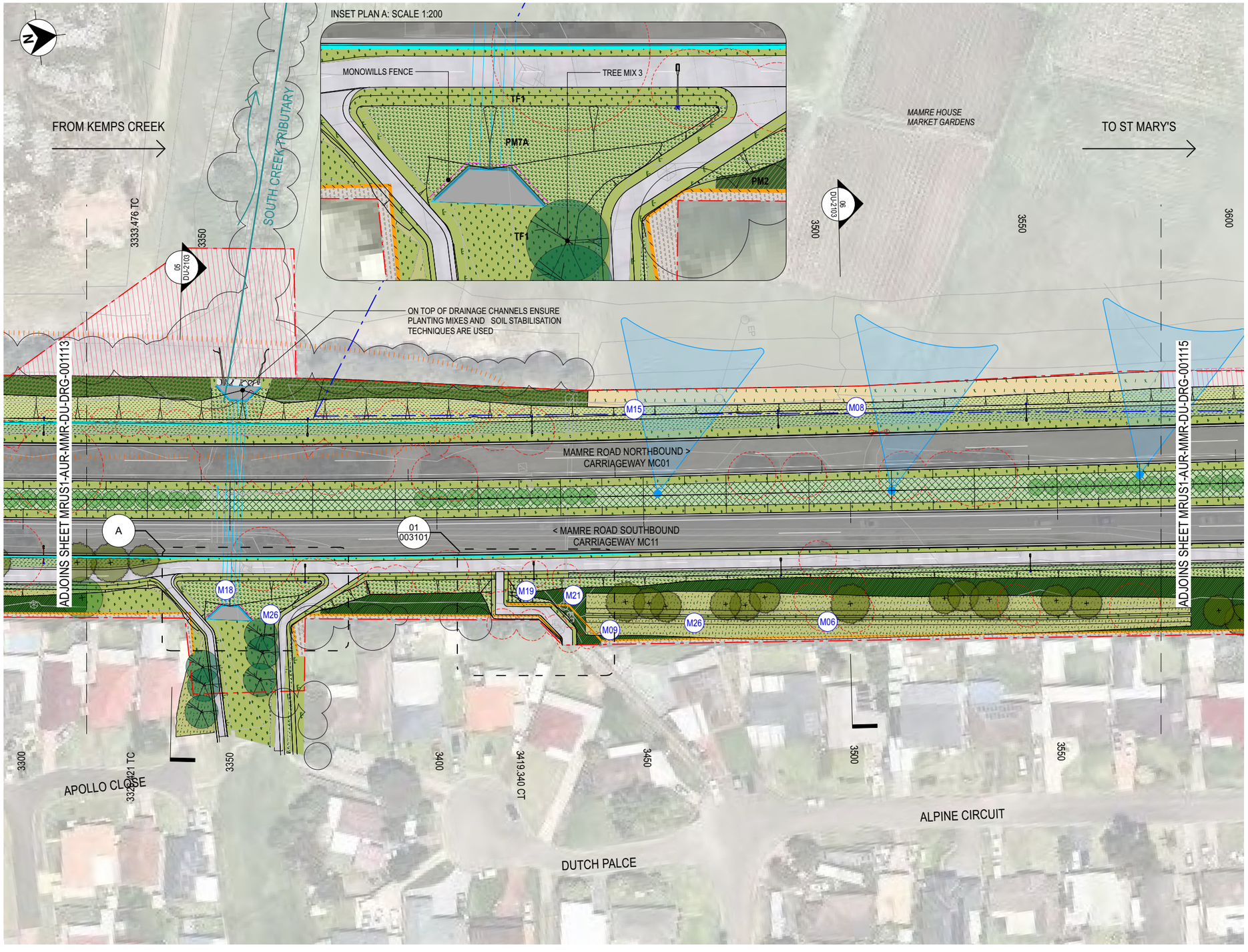

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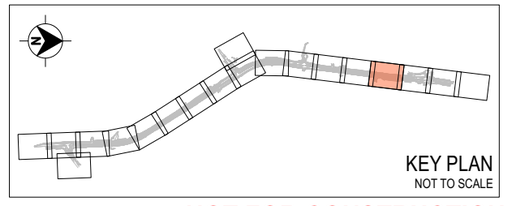

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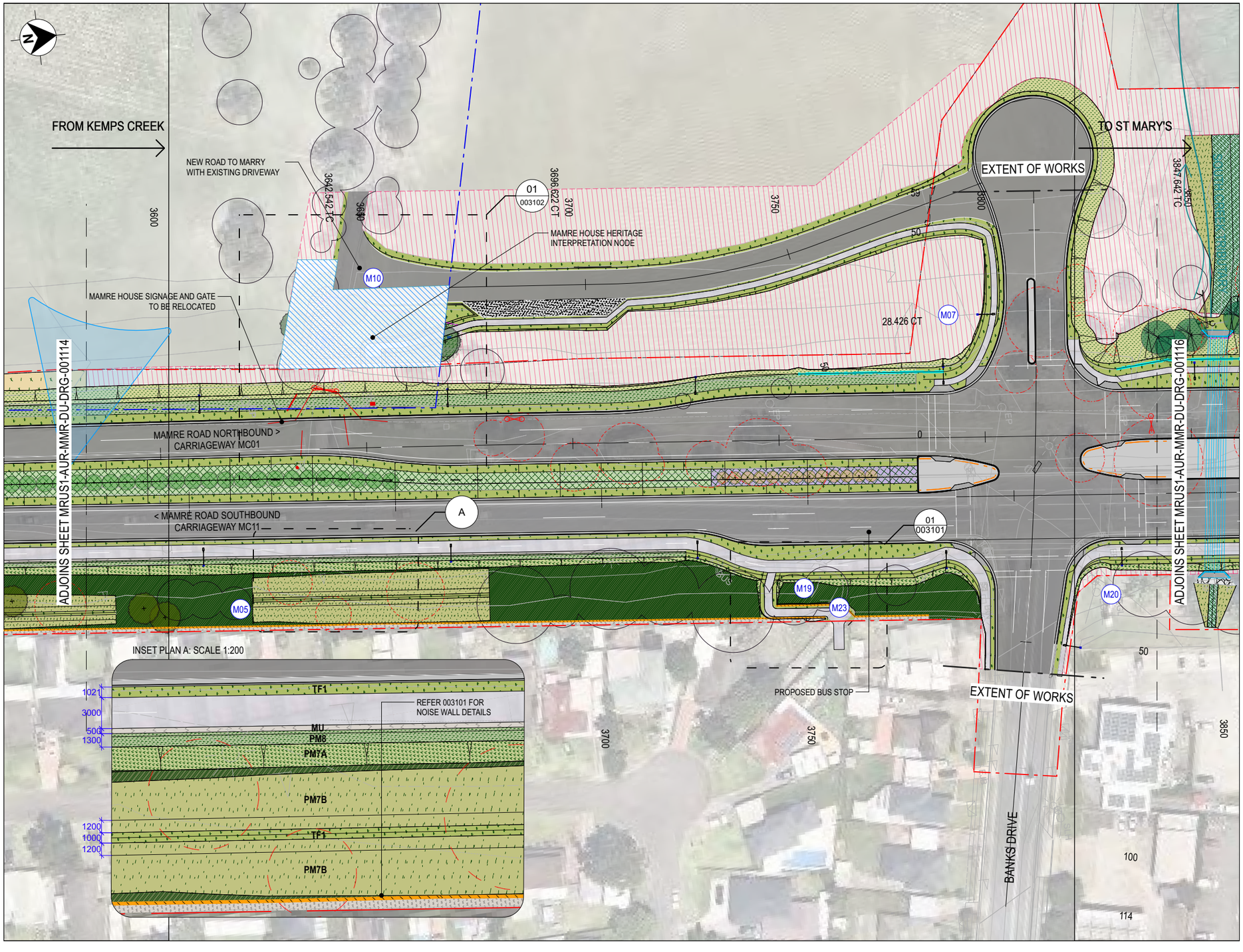

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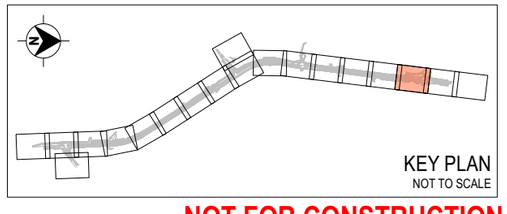

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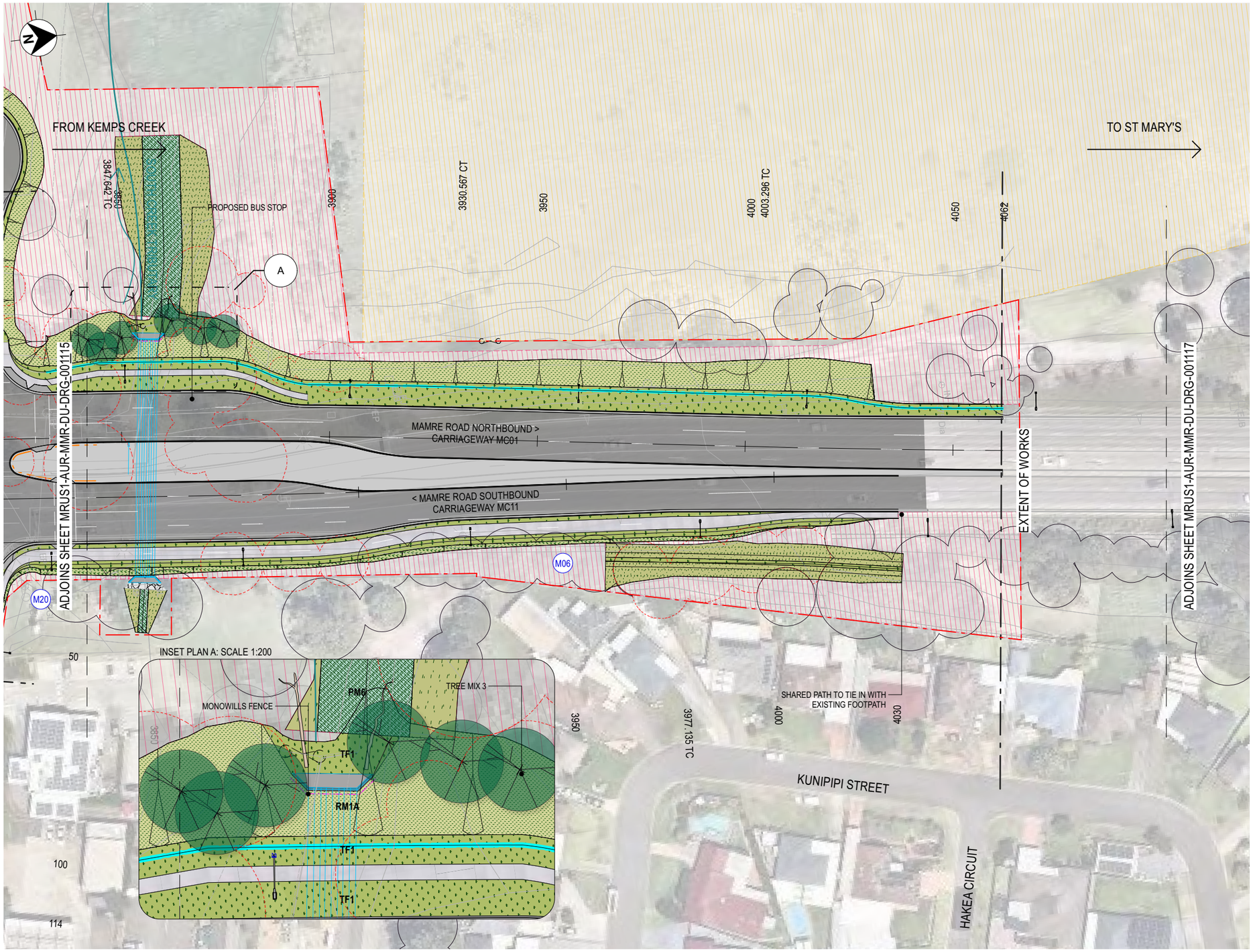

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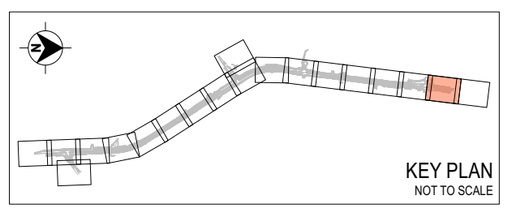

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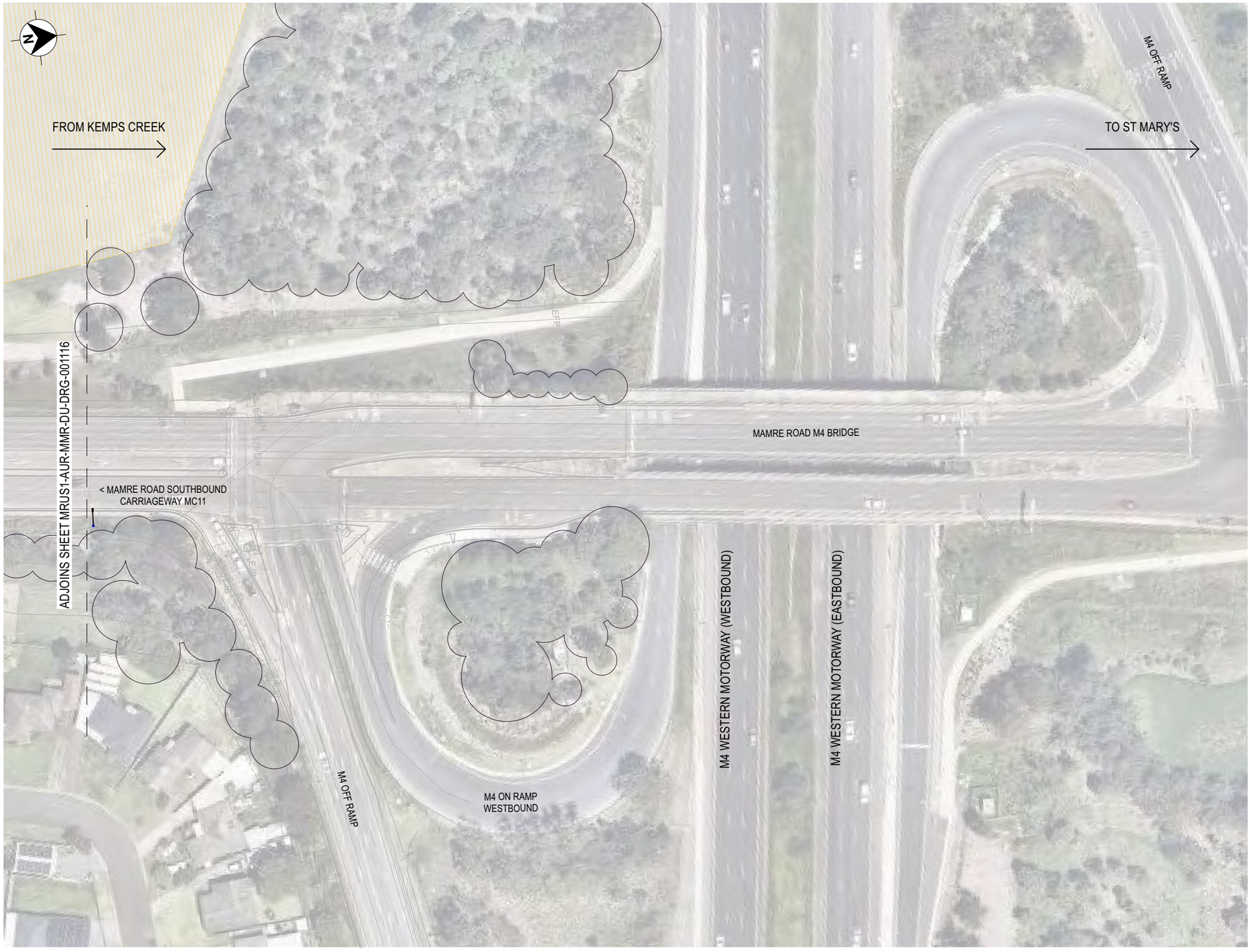

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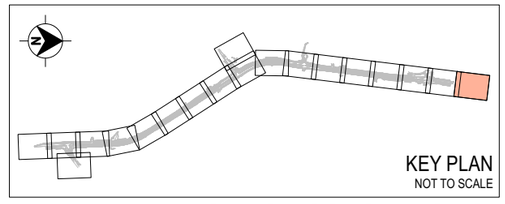

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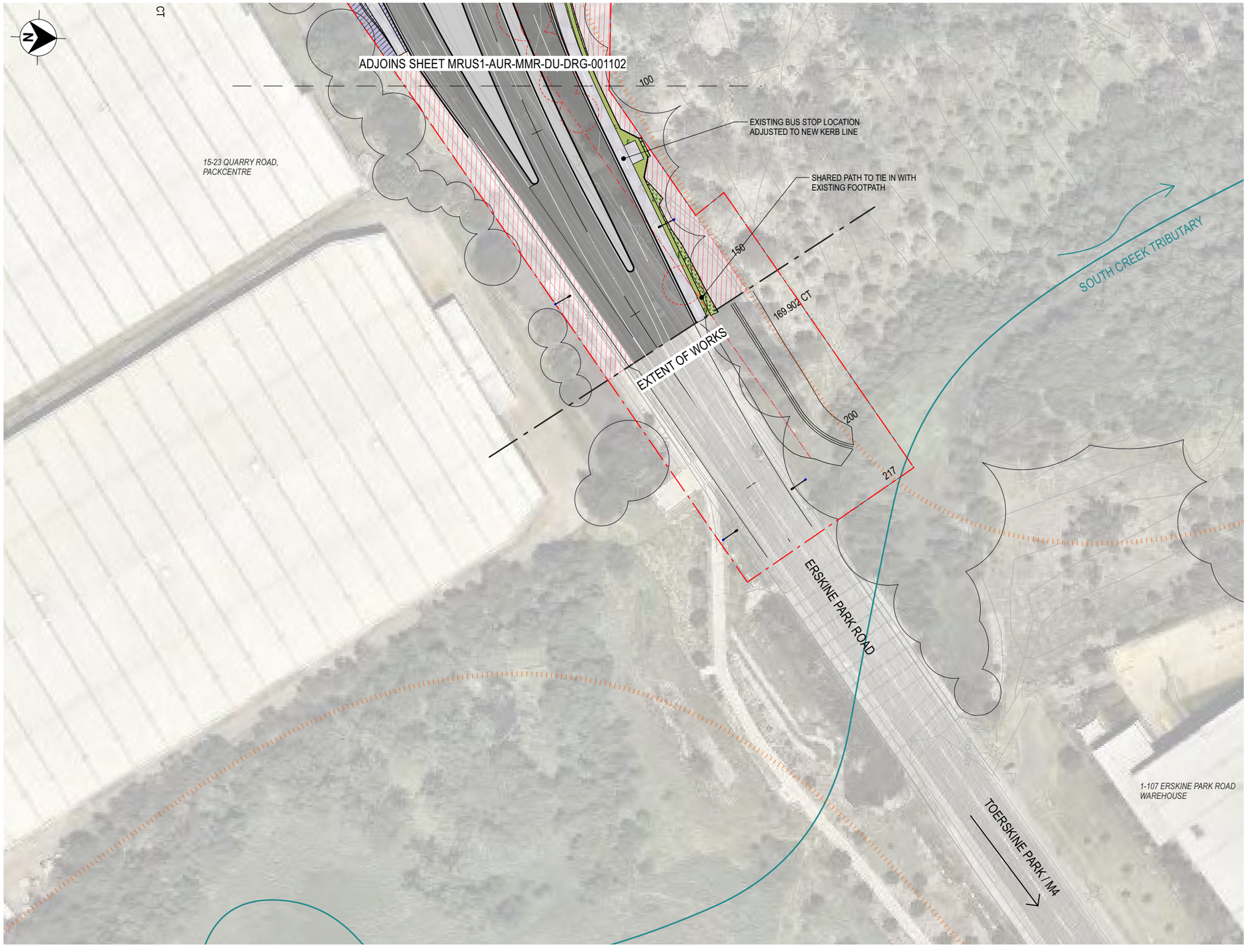

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- COMPOUND SITES (AREA TO BE REVEGETATED ON COMPLETION)
- ELECTRICAL EASEMENT

VIEWS AND VISTAS
- LONG RANGE VIEWS TOWARDS BLUE MOUNTAIN ESCARPMENT
- IMPORTANT VIEWS FROM MAMRE ROAD

UPGRADE FEATURES
- W-BEAM SAFETY BARRIER
- PEDESTRIAN SAFETY FENCE
- MONOWILLS FENCE
- GATE
- GATE REMOVED
- SA-TYPE KERB
- SF-TYPE KERB
- SM-TYPE KERB
- PROPOSED LIGHTING
- NOISE WALL A
- NOISE WALL B

FOR NOISE WALL HEIGHTS REFER TO ACOUSTIC REPORTS

MITIGATION MEASURES
- M01 REFER TO 000005 GENERAL NOTES FOR MORE INFORMATION

EXISTING TREES
- EXISTING TREE RETAINED
- EXISTING TREE REMOVED

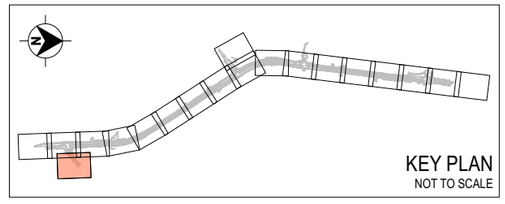
EXISTING TREES HAVE BEEN SHOWN INDICATIVELY - DETAILED ARBORIST REPORT IS REQUIRED TO DETERMINE CANOPY AND EXTENT OF TREES AFFECTED

PROPOSED TREES
- TREE MIX TYPE 1 CUMBERLAND NATIVE BUSHLAND
- TREE MIX TYPE 2 INDIGENOUS SCREENING
- TREE MIX TYPE 3 RIPARIAN TREES
- TREE MIX TYPE 4 FEATURE TREES
- TREE MIX TYPE 5 MEDIAN SHRUBS
- TREE MIX TYPE 6 MEDIAN FEATURE SHRUBS

LANDSCAPE TREATMENTS
- PM1 PLANTING MIX PM1 FEATURE NATIVE SHRUBS AND GROUNDCOVERS
- PM2 PLANTING MIX PM2 NATIVE SHRUBS AND GROUNDCOVERS
- PM3 PLANTING MIX PM3 MEDIAN FEATURE SHRUBS AND GROUNDCOVERS
- PM4 PLANTING MIX PM4 MEDIAN HEADLIGHT GLARE SHRUBS AND GROUNDCOVERS
- PM5 PLANTING MIX PM5 BASINS NOT IN USE
- PM6 PLANTING MIX PM6 CREEK LINES
- PM7A PLANTING MIX 7A NATIVE GRASSES ON FILL EMBANKMENT
- PM7B PLANTING MIX 7B NATIVE GRASSES ON CUT BATTERS
- PM8 PLANTING MIX 8 VERGE INDIGENOUS GRASSES AND GROUNDCOVERS
- RM1A REVEGETATION MIX 1A NATIVE GRASSES ON FILL EMBANKMENT
- RM2A REVEGETATION MIX 2A NATIVE SHRUBS AND GROUNDCOVERS ON FILL EMBANKMENTS
- RM4 REVEGETATION MIX 4 MEDIAN INDIGENOUS GRASSES NOT IN USE
- RM5 REVEGETATION MIX 5 BATTER TO BOUNDARY INDIGENOUS GRASSES
- RM6 REVEGETATION MIX 6 DRAINAGE SWALE
- TF1 TURF TYPE 1 GENERAL TURF
- MU MULCH TYPE MULCH ONLY
- ROCK SCOURING ROCK SCOUR PROTECTION

HARDSCAPE TREATMENTS
- ASPHALTIC CONCRETE
- CONCRETE MEDIAN (WITH INTEGRAL OXIDE)
- SHARED USEER PATH (SUP) INSITU CONCRETE

NOTES:
1. THE SURVEY SHOWN IN THESE DRAWINGS WAS PROVIDED BY TRANSPORT FOR NSW
2. ALL LEVELS ARE TO AUSTRALIAN HEIGHT DATUM (AHD) UNLESS STATED OTHERWISE
3. NOISE WALL REQUIREMENT SUBJECT TO VERIFICATION TO ACOUSTIC MODELLING



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SCALE 1:500

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4 Urban design concept

LEGEND

GENERAL
- PROPOSED ROAD BOUNDARY
- EXTENT OF WORKS
- CADASTRAL BOUNDARY
- CONTOURS (2M INTERVAL)
- EXISTING WATERCOURSE
- BUSHFIRE PRONE AREA
- OPERATIONAL BASIN LOCATION (TEMPORARY)
- EXISTING SIGNAGE TO BE RETAINED
- EXISTING SIGNAGE TO BE REMOVED
- CONSTRUCTION SITES (AREA TO BE MADE GOOD ON COMPLETION)
- COMPOUND SITES (AREA TO BE REVEGETATED ON COMPLETION)
- ELECTRICAL EASEMENT

VIEWS AND VISTAS
- LONG RANGE VIEWS TOWARDS BLUE MOUNTAIN ESCARPMENT
- IMPORTANT VIEWS FROM MAMRE ROAD

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- PEDESTRIAN SAFETY FENCE
- MONOWILLS FENCE
- GATE
- GATE REMOVED
- SA-TYPE KERB
- SF-TYPE KERB
- SM-TYPE KERB
- PROPOSED LIGHTING
- NOISE WALL A
- NOISE WALL B
- FOR NOISE WALL HEIGHTS REFER TO ACOUSTIC REPORTS

MITIGATION MEASURES
- M01 REFER TO 000005 GENERAL NOTES FOR MORE INFORMATION

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- EXISTING TREE REMOVED
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- TREE MIX TYPE 4 FEATURE TREES
- TREE MIX TYPE 5 MEDIAN SHRUBS
- TREE MIX TYPE 6 MEDIAN FEATURE SHRUBS

LANDSCAPE TREATMENTS
- PM1 PLANTING MIX PM1 FEATURE NATIVE SHRUBS AND GROUNDCOVERS
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- PM3 PLANTING MIX PM3 MEDIAN FEATURE SHRUBS AND GROUNDCOVERS
- PM4 PLANTING MIX PM4 MEDIAN HEADLIGHT GLARE SHRUBS AND GROUNDCOVERS
- PM5 PLANTING MIX PM5 BASINS NOT IN USE
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- ROCK SCOURING ROCK SCOUR PROTECTION

HARDSCAPE TREATMENTS
- ASPHALTIC CONCRETE
- CONCRETE MEDIAN (WITH INTEGRAL OXIDE)
- SHARED USEER PATH (SUP) INSITU CONCRETE

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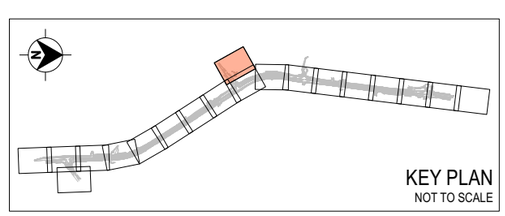

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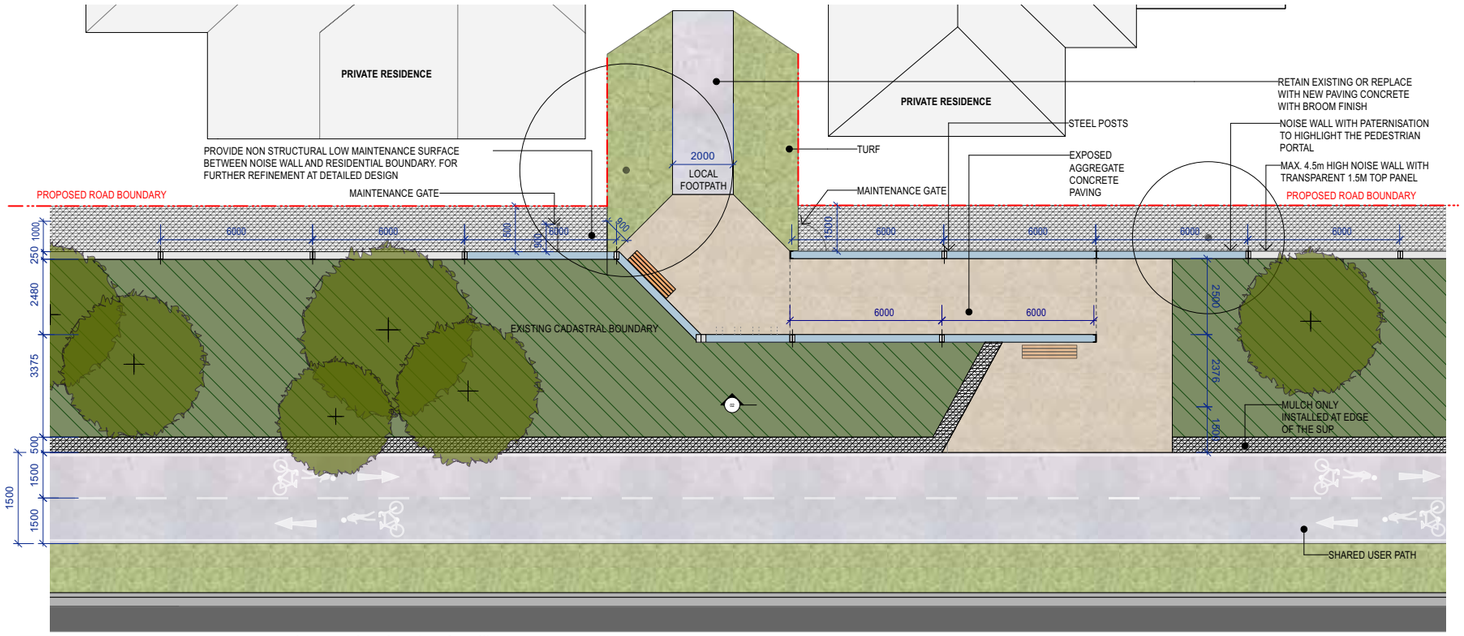
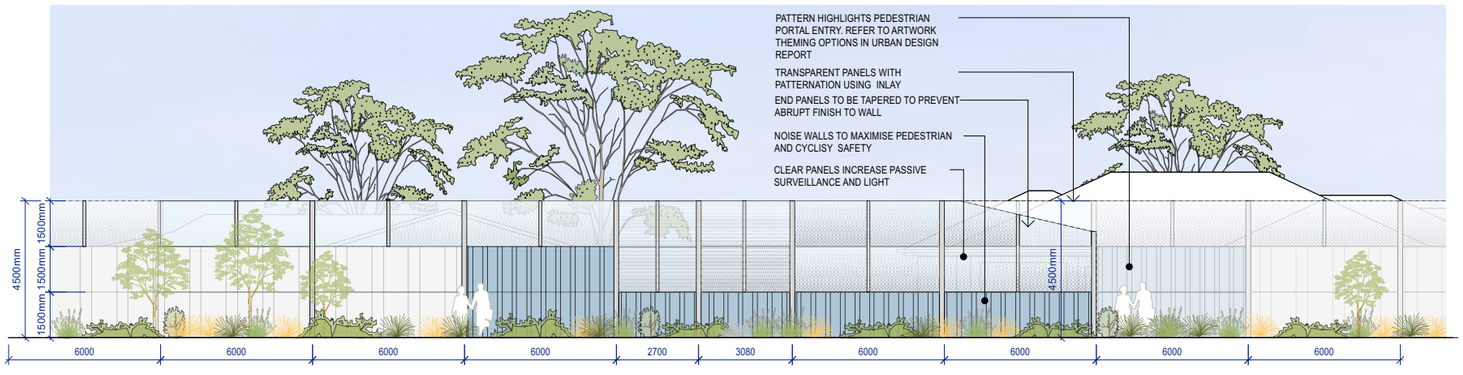
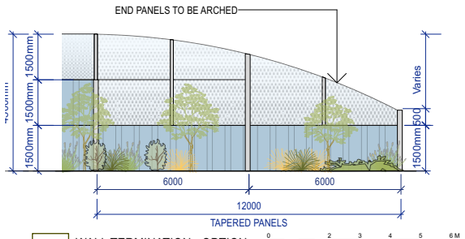


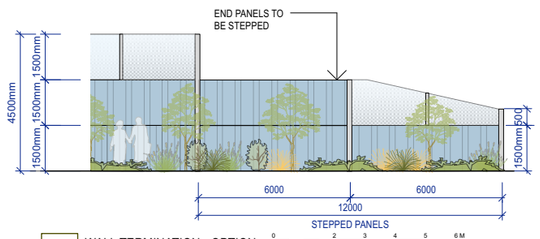
01 PEDESTRIAN PORTAL TYPE - TYPICAL
PLAN - SCALE 1:100



02 PEDESTRIAN PORTAL - TYPICAL
ELEVATION - SCALE 1:100



03 WALL TERMINATION - OPTION
ELEVATION - SCALE 1:100



04 WALL TERMINATION - OPTION
ELEVATION - SCALE 1:100

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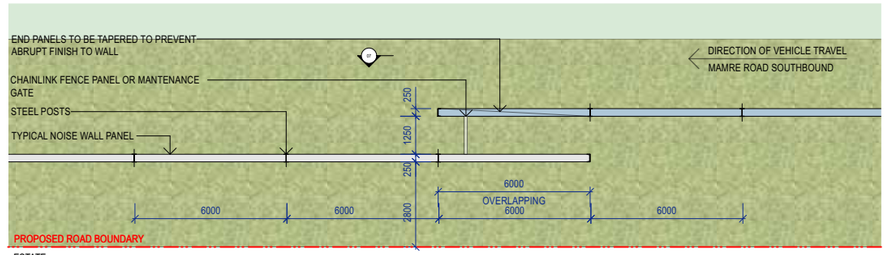
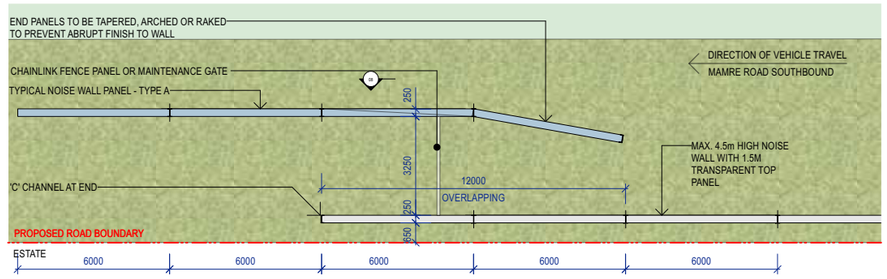
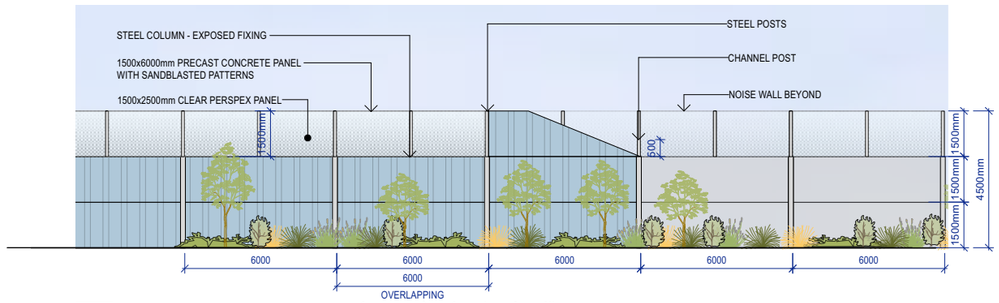


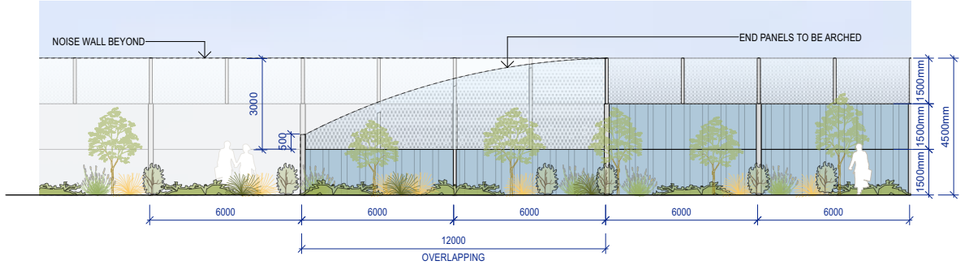
05 OVERLAPPING NOISE WALL TYPICAL
PLAN - SCALE 1:100



06 OVERLAPPING NOISE WALLS - OPTION
PLAN - SCALE: 1:100



07 OVERLAPPING NOISE WALLS TYPICAL
ELEVATION - SCALE: 1:100



08 OVERLAPPING NOISE WALLS OPTION
ELEVATION - SCALE: 1:100

NOTES
1. REFER TO URBAND DESIGN REPORT XXX FOR FURTHER DETAIL REGARDING NOISE WALL ART, MATERIALS AND FIXINGS
2. REFER TO STRUCTURAL ENGINEERS DRAWINGS XXX FOR STRCTURAL DESIGN

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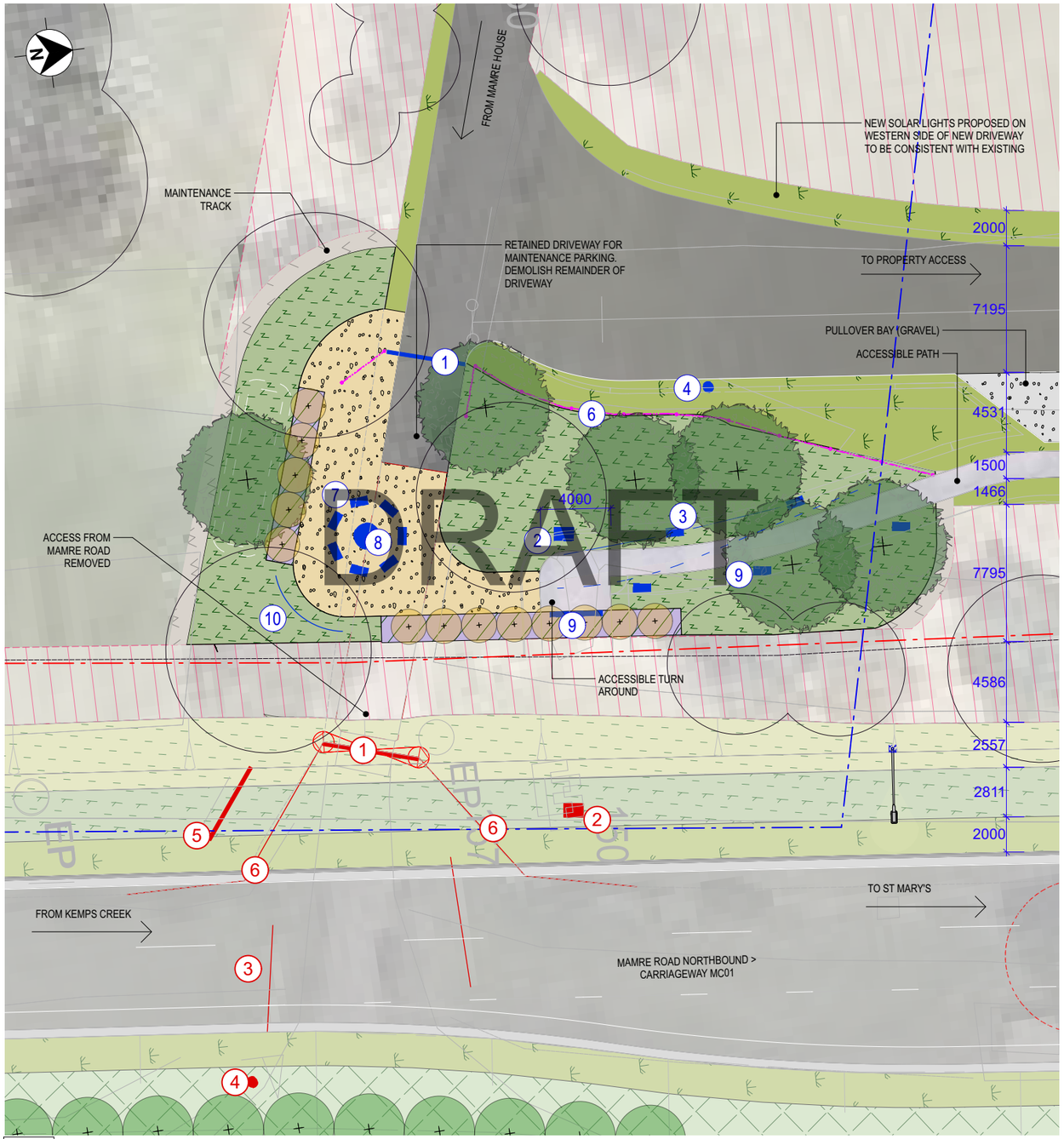

01 MAMRE HOUSE - HERITAGE SPACE
DETAIL PLAN - SCALE 1:150

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LEGEND

GENERAL
- PROJECT BOUNDARY
- MAMRE HOUSE HERTIAGE CURTILAGE BOUNDARY
- EXTENT OF WORKS
- RELOCATED SIGNAGE / NEW HERITAGE ELEMENTS
- EXISTING SIGNAGE TO BE RELOCATED OR REMOVED
- COMPOUND SITES (AREA TO BE REVEGETATED ON COMPLETION)
- CONSTRUCTION SITES (AREA TO BE MADE GOOD ON COMPLETION)

UPGRADE FEATURES
- PROPOSED FENCE
- W-BEAM SAFETY BARRIER
- PEDESTRIAN SAFETY FENCE
- SA-TYPE KERB
- PROPOSED LIGHTING

EXISTING TREES
- EXISTING TREE RETAINED
- EXISTING TREE REMOVED
- EXISTING TREES HAVE BEEN SHOWN INDICATIVELY - DETAILED ARBORIST REPORT IS REQUIRED TO DETERMINE CANOPY AND EXTENT OF TREES AFFECTED

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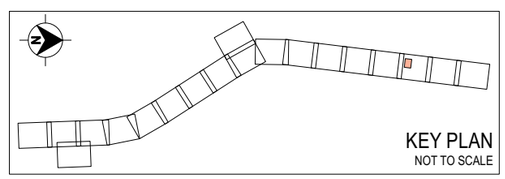
- TREE MIX TYPE 1 CUMBERLAND NATIVE BUSHLAND
- TREE MIX TYPE 2 INDIGENOUS SCREENING
- TREE MIX TYPE 3 RIPARIAN TREES
- TREE MIX TYPE 4 FEATURE TREES
- TREE MIX TYPE 5 FRANGIBLE SHRUBS/SMALL TREES
- TREE MIX TYPE 6 FEATURE FRANGIBLE SHRUBS
- TREE MIX TYPE 7 HERITAGE FEATURE TREES

LANDSCAPE TREATMENTS
- PM1 PLANTING MIX PM1 FEATURE NATIVE SHRUBS AND GROUNDCOVERS
- PM9 PLANTING MIX 9 CUMBERLAND PLAIN WOODPLAIN
- TF1 TURF TYPE 1 GENERAL TURF

HARDSCAPE TREATMENTS
- ASPHALTIC CONCRETE
- CONCRETE MEDIAN (WITH INTEGRAL OXIDE)
- SHARED USEER PATH (SUP) INSITU CONCRETE
- GRAVEL
- DECO

HERITAGE ELEMENTS

	EXISTING ELEMENT	DESCRIPTION	IMAGE
1	EXISTING GATE (TO BE RELOCATED)	DECORATIVE GATE WITH 'MAMRE' SIGNAGE	
2	MEMORIAL CAIRN (TO BE RELOCATED)	MEMORIAL CAIRN WITH FIXED SIGNAGE PLATE	
3	EXISTING LOGS (TO BE RELOCATED)	PAINTED LOGS SET EITHER SIDE OF EXISTING DRIVEWAY ENTRANCE	
4	EXISTING SIGN (TO BE RELOCATED)	DECORTIVE SIGNPOST WITH HANGING SIGN	 
5	CATHOLIC CARE SIGN (TO BE RELOCATED)	NOT HEITAGE ITEM. SMALL BILLBOARD TYPE SIGN FOR CATHOLIC CARE, WITH ADDRESS AND 'VEGETABLES AND PLANTS SOLD HERE'.	
6	POST AND RAIL FENCE (TO BE RELOCATED)	PAINTED LOG POST AND RAIL FENCE	
	PROPOSED ELEMENT		
7	INTERPRETIVE SANDSTONE BLOCKS	SANDSTONE BLOCKS WITH INTERPRETIVE SIGNAGE REGARDING THE INDIGENOUS HISTORY OF THE SITE. ALSO SANDSTONE BLOCKS FORM A MEETING PLACE TO SIT AT.	
8	INDIGENOUS ARTWORK	FOCAL ARTWORK IN MEETING PLACE TO BE DONE BY LOCAL INDIGENOUS ARTIST	
9	MAMRE HOUSE SIGNAGE	INTERPRETIVE SIGNAGE RELAYING THE CULTURAL AND HISTORICAL SIGNIFICANCE OF MAMRE HOUSE.	
10	MULLIONS	RECYCLED HARDWOOD MULLIONS REFERING TO MAMRE HOUSE MATERILITY	



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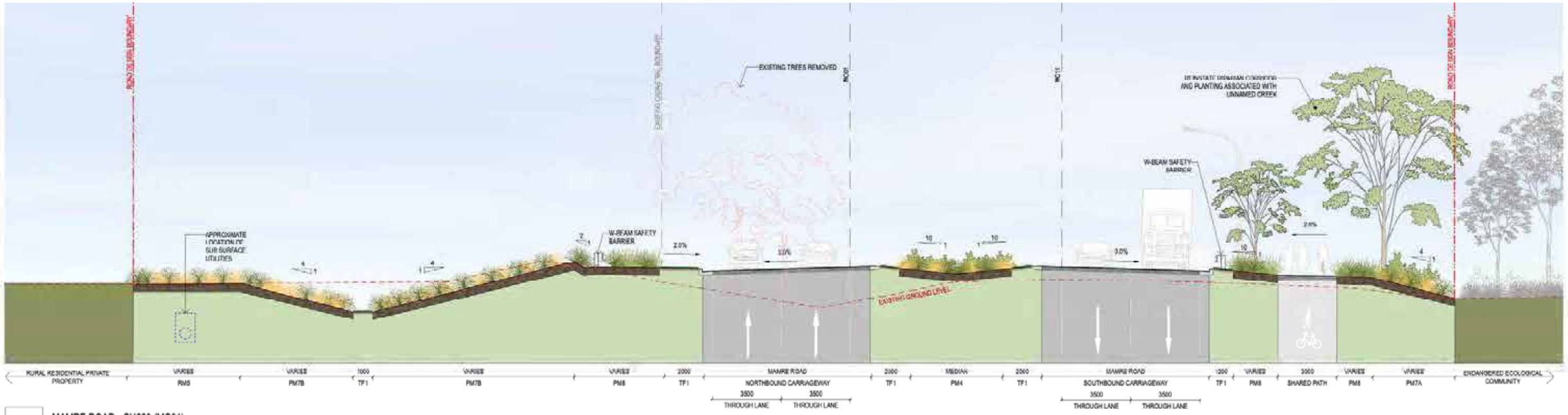

01 MAMRE ROAD - CH660 (MC01)
TYPICAL CROSS SECTION - SCALE 1:100

02 MAMRE ROAD - CH1540 (MC01)
TYPICAL CROSS SECTION - SCALE 1:100

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SCALE 1:100

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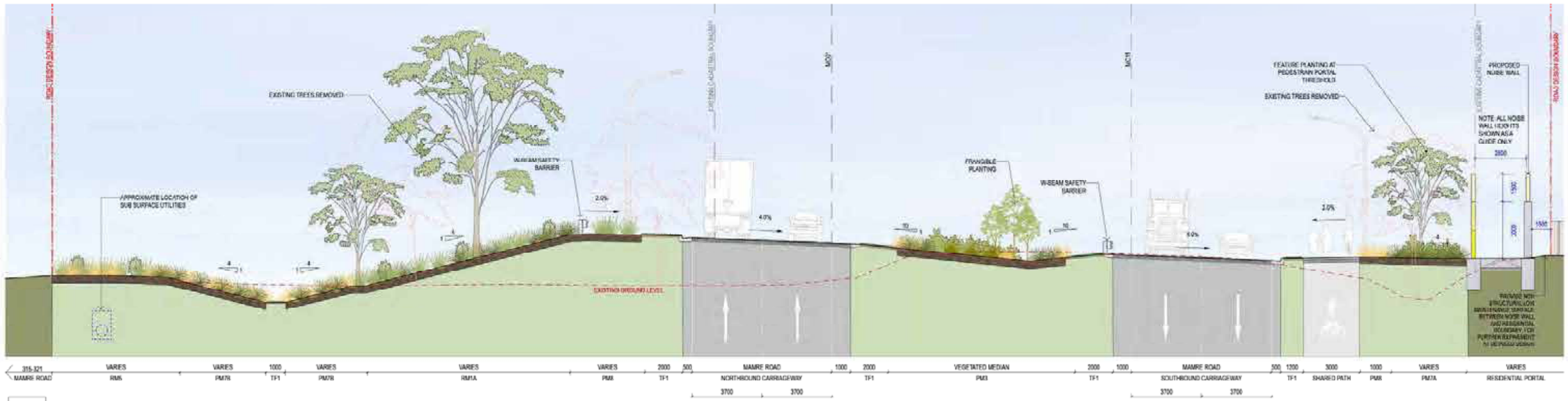
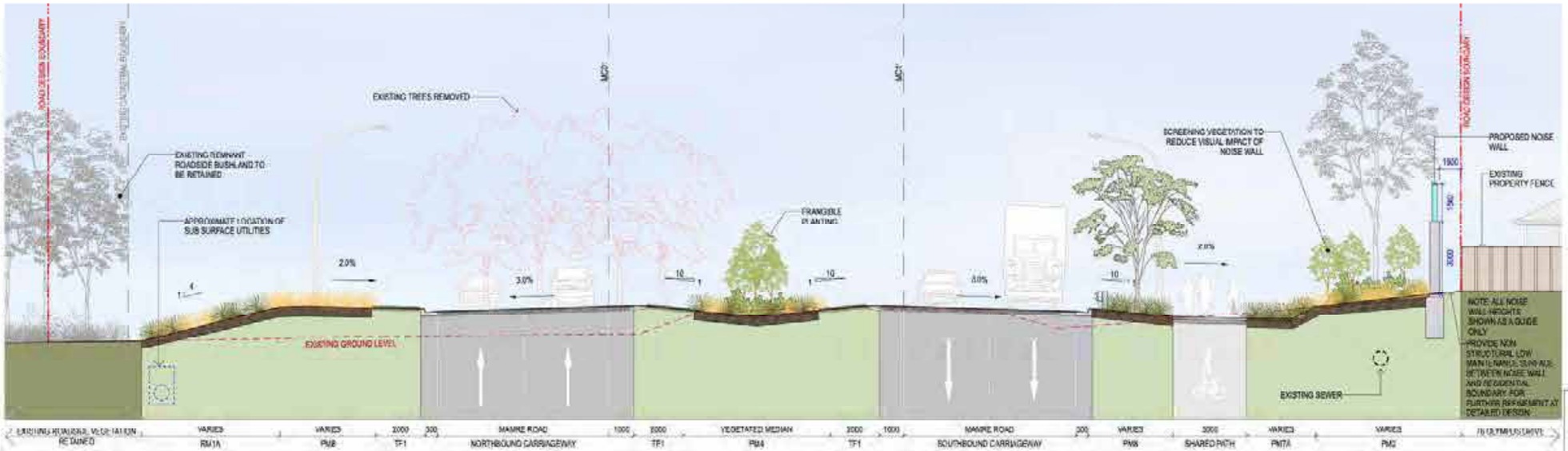
Figure 4-10: Urban design sections (01-06)



03 MAMRE ROAD - CH2400 (MC01)
TYPICAL CROSS SECTION - SCALE 1:100



04 MAMRE ROAD - CH3200 (MC01)
TYPICAL CROSS SECTION - SCALE 1:100

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SCALE 1:100

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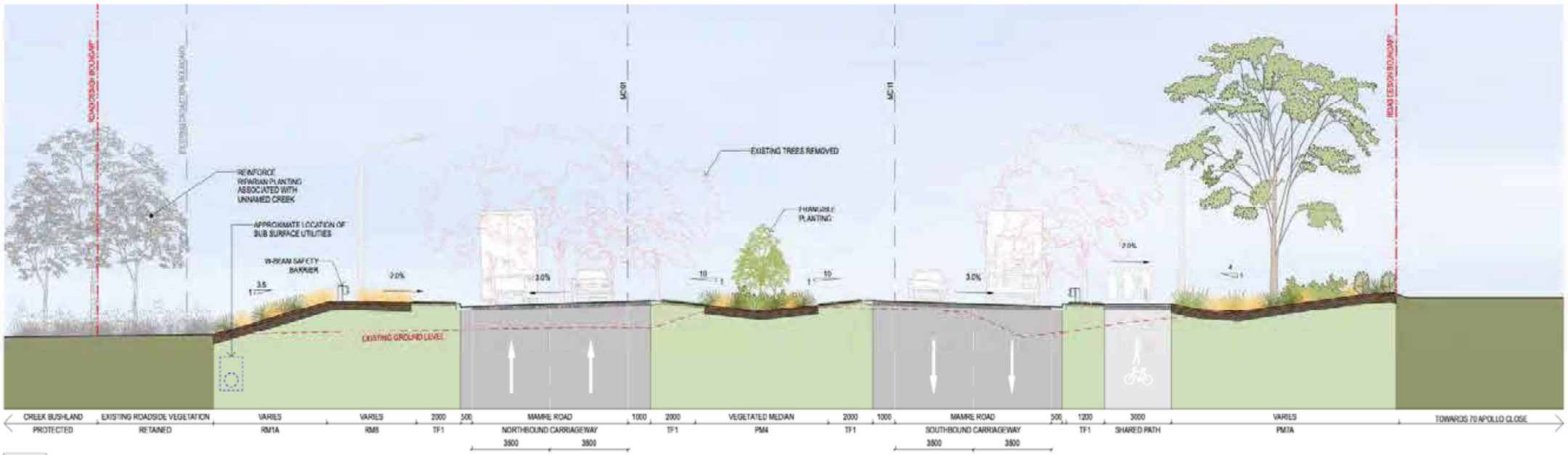
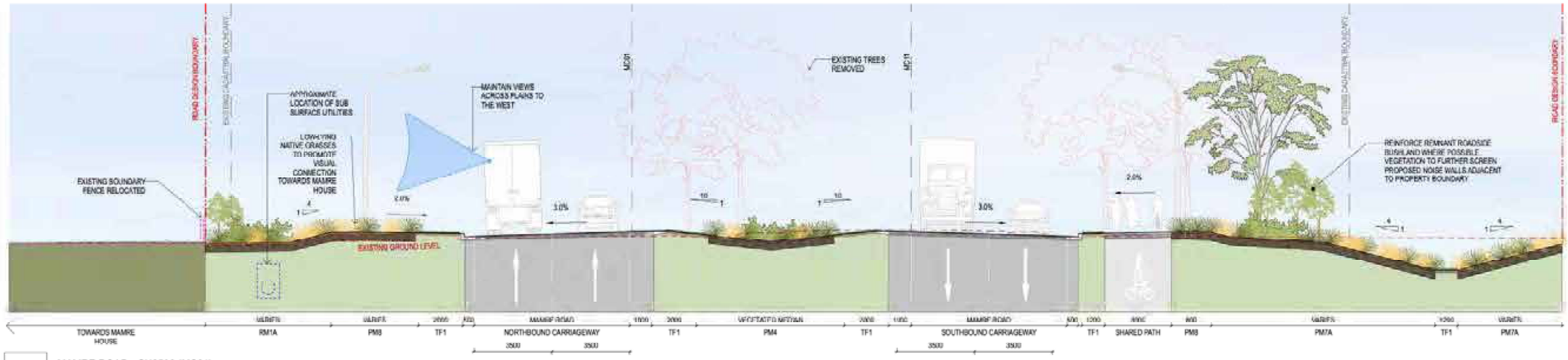
NOT FOR CONSTRUCTION

4 Urban design concept



05 MAMRE ROAD - CH3340 (MC01)
TYPICAL CROSS SECTION - SCALE 1:100



06 MAMRE ROAD - CH3500 (MC01)
TYPICAL CROSS SECTION - SCALE 1:100

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SCALE 1:100

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Stands of remnant roadside vegetation

5 Landscape character impact assessment

5.1 Chapter overview

To enable the assessment of impacts from the project on the surrounding landscape, the study area has been classified into distinct character areas or landscape character zones (LCZ). These zones are defined as having a distinct, recognisable and consistent pattern of elements, be it natural (soil, vegetation, landform) and/ or human built form, distinguishing one zone as different from another.

5.2 Methodology

TfNSW, Guideline for landscape character and visual impact assessment, *Environmental impact assessment practice note EIA-N04* provides the following definition of landscape character:

> ***Landscape character is the aggregate of built, natural and cultural aspects that make up an area and provide its unique sense of place. Landscape in this context is taken to include all aspects of a tract of land - the built, planted and natural topographical and ecological features.***

In applying this definition to the specific conditions within the study area and the features of the proposal, the landscape character assessment also considers how the Project would be used and how it would function as a part of the region. The assessment has considered both existing landscape character and desired future character (where relevant).

Landscape character zones

To enable the assessment of impacts on the landscape character of each assessment zone, key landscape elements including landform, hydrology, vegetation, land use and built form were identified during site visits.

Two primary factors are used to determine impacts:

- **sensitivity** of the character within the zone
- **magnitude** of the project in that zone.

Refer to Figure 5-1 on page 75 for landscape character zone identification.

Sensitivity

The degree to which a particular landscape type can absorb and accommodate change arising from a project. Sensitivity refers to how sensitive the character of the setting is to the proposed change, which may also include the sensitivity of regular users and viewers of the zone. For example a pristine natural environment would be more likely to be sensitive to change than an industrial area.

It considers the perceived cultural, natural and heritage values of the visual environment and the elements within it.

Magnitude

Magnitude is a study of the bulk scale and form. It reflects the degree of physical change between the proposal and the landscape setting. In the case where future development is already approved, for example rezoning, this context is used in the assessment. Consideration is given to existing built form in the landscape and how closely the proposal matches this in bulk, scale and form. This is categorised as follows:

- The proposal would be the dominant feature in the landscape and would affect and change its character
- The proposal would form a readily visible and new feature in the landscape that changes its character
- The proposal would constitute a minor feature in the landscape with minor changes.

Refer to Figure 5-1 on page 75 for landscape character zone identification.

Table 5-1: Landscape character impact rating matrix Source: TfNSW EIA-N04

		Magnitude			
		High	Moderate	Low	Negligible
Sensitivity	High	High	High-Moderate	Moderate	Negligible
	Moderate	High-Moderate	Moderate	Moderate-Low	Negligible
	Low	Moderate	Moderate-Low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

5 Landscape character impact assessment

5.3 Character zones

Eight character zones were identified during desktop studies and confirmed during the site visit where they were recorded and photographed. Each is represented below in Plate 5-1 to Plate 5-8 and include:

- LCZ 1: Residential estate
- LCZ 2: Light commercial
- LCZ 3: Existing road corridor
- LCZ 4: Heritage/ pastoral
- LCZ 5: Riparian bushland
- LCZ 6: Rural residential
- LCZ 7: Business Park
- LCZ 8: Service corridor.

Each character zone across the study area is summarised in Table 5-2 on page 76 in the following pages in terms of the existing physical attributes as well as proposal elements, which are likely to impact the zone.

Plate 5-1: Residential estate

Plate 5-2: Light commercial

Plate 5-3: Existing road corridor

Plate 5-4: Heritage/ pastoral

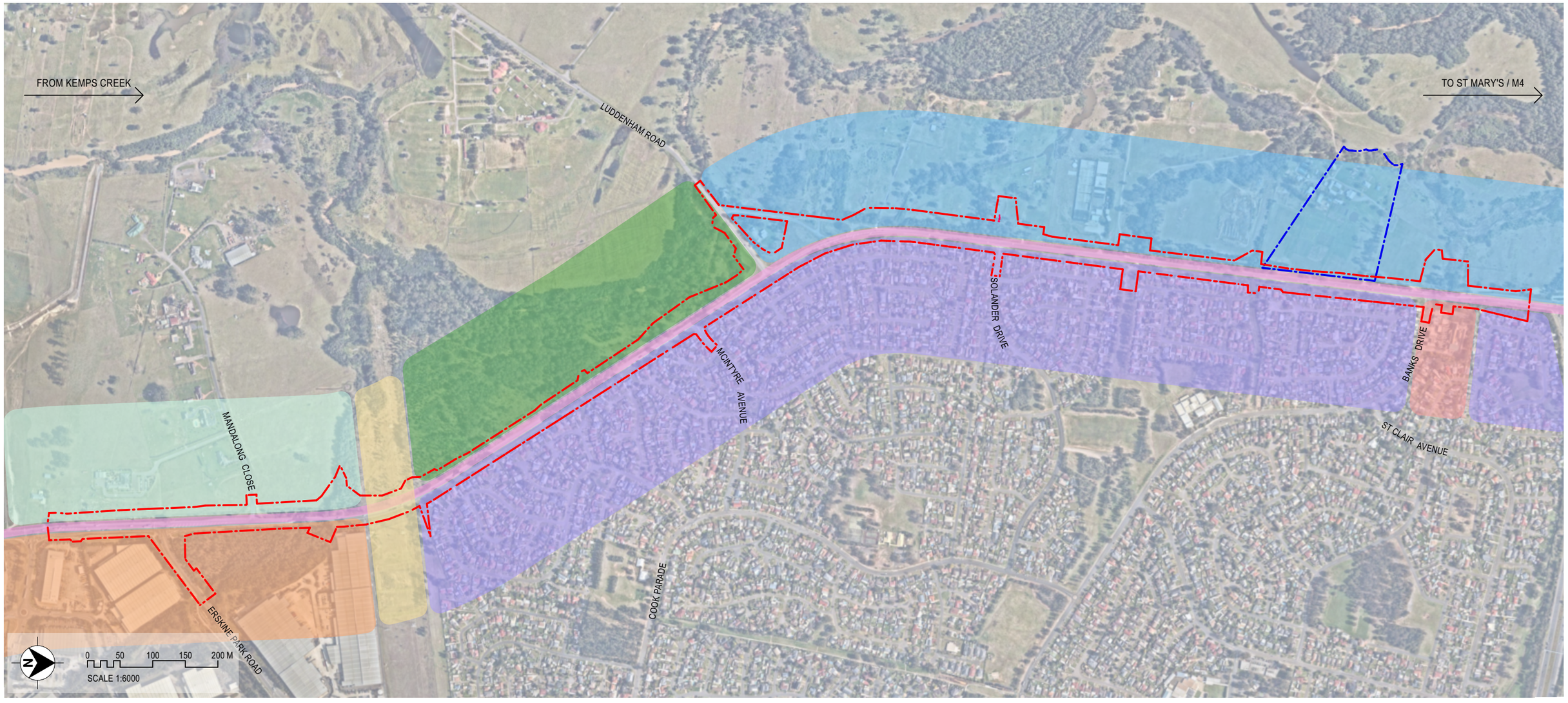
Plate 5-5: Riparian bushland

Plate 5-6: Rural residential

Plate 5-7: Business Park

Plate 5-8: Service corridor

5 Landscape character impact assessment



LEGEND

PROPOSED FEATURES

- PROJECT BOUNDARY
- MAMRE HOUSE HERITAGE CURTILAGE BOUNDARY

LANDSCAPE CHARACTER ZONES

- LCZ 1 - RESIDENTIAL ESTATE
- LCZ 2 - COMMERCIAL
- LCZ 3 - EXISTING ROAD CORRIDOR
- LCZ 4 - HERITAGE/PASTORAL
- LCZ 5 - RIPARIAN BUSHLAND
- LCZ 6 - RURAL RESIDENTIAL
- LCZ 7 - BUSINESS PARK
- LCZ 8 - SERVICE INFRASTRUCTURE CORRIDOR

5 Landscape character impact assessment

Table 5-2: Landscape character zones summary

LCZ		Summary of landscape setting	Project elements causing change
1	Residential estate	This zone comprises low density residential estate of St Clair and extends from the service corridor north to Banks Drive east of the Mamre Road. Part of the visual fabric of the suburb are two wide drainage channels, which as well as controlling runoff that originates from within the estate, are used for passive recreation and links to other open spaces within the suburb. These channels and that are intermittently lined with stands of established remnant trees and a number of pedestrian paths and bridge crossings.	The project would include: – A new SUP along the eastern side of Mamre Road that would include noise walls with pedestrian portals, drainage and flooding infrastructure upgrades and the removal of some roadside trees – New road furniture including signage and lighting
2	Light commercial	This zone is defined by a mix of commercial premises and extends approximately 100 m along the eastern side of the proposal north from Banks Drive. Commercial signage structures as well as the KFC building facade and are prominent visual elements in this character area. Vegetation through this zone is almost completely absent.	The project would include: – An upgrade to the existing signalised intersection at Banks Drive including a new western stub to cater for future development and minor earth work adjustments – Removal of roadside trees
3	Existing road corridor	The existing road corridor is a state arterial road asset, which comprises a two-lane undivided road with a posted speed limit of 80 kilometres per hour and runs in a north-south direction. The eastern verge of the road, along the St Clair residential estate, is a wide area of turf and scattered stands of large, established roadside trees, including occasional resident plants.	The project would include: – An upgrade of Mamre Road to a four-lane divided road with a wide central median with minor earth work adjustments, new traffic control facilities including electronic traffic signage – Changes to intersections with Mamre Road including Banks Drive, Solander Drive, Luddenham Road, Erskine Park Road, McIntyre Avenue and Mandalong Close – New bus bays, reinstatement of existing bus stops and provision for future bus stops – New road furniture including signage and lighting – New shared user path
4	Heritage/ pastoral	This zone comprises the Mamre House estate, which is a colonial Georgian homestead in its farm setting, surrounded by farmland and market gardens with distant views to South Creek and the Blue Mountains. Areas of primary production (south-west) are open with a mix of grassland and grazing land. The majority of the landscape has been cleared for rural use while the western boundary is defined by the densely vegetated South Creek tributary. Scattered remnant vegetation and farm outbuildings are also dotted across the area with most set back from the road corridor.	The project would include: – An upgrade to the existing signalised intersection at Banks Drive including a new western stub to cater for future development – New gravel driveway connection and U-Turn facility for access from Banks Drive to the existing access driveway and new heritage interpretation node located at the original driveway connection with Mamre Road – Minor earth work adjustments
5	Riparian bushland	This zone comprises heavily vegetated floodplain areas of the Cumberland Plain and is associated with the riparian corridor and tributaries of South Creek. Established native vegetation communities of Alluvial Woodland and Shale Plains Woodland species create a vegetative gateway along Mamre Road (south of Luddenham Road) with the watercourse not visible from the road corridor.	The project would include: – An upgrade of Mamre Road to a four-lane divided road and minor earth work adjustments – Drainage and flooding infrastructure including basins and culverts
6	Rural residential	This zone comprises semi-rural landscape with large lot residential properties aligned along the southern side of Mandalong Close, a local access road, with no through access. The majority of the landscape is not associated with intensive agriculture but some areas, especially west of the road is used for low intensity grazing. A long day care facility for 131 children also has access via Mandalong Close.	The project would include: – An upgrade of Mamre Road to a four-lane divided road with minor earth work adjustments – Provision for a future shared path on the western side
7	Business Park	This zone comprises a range of large warehouse buildings, manufacturing, factory suppliers, car and truck parking areas, logistics, freight and office spaces and cafe catering. Warehouses are generally surrounded by a mix of mown grass, manicured garden beds, heavily vegetated earth mounds with mature trees and palisade/ chain mesh fences.	The project would include: – An upgrade of Mamre Road to a four-lane divided road with minor earth work adjustments
8	Services corridor	This zone comprises a 135 m wide electricity transmission easement that runs perpendicular to Mamre Road. Two high voltage networks run along the easement including a 330kV single circuit steel towers and 330kV double circuit steel towers. East of Mamre Road the corridor is mostly open grassland with a fringe of native trees along the northern edge while to the west the corridor is mostly scattered bushland.	The project would include: – An upgrade of Mamre Road to a four-lane divided road with minor earth work adjustments

5 Landscape character impact assessment

LCZ 1: Residential estate

Existing landscape character

This zone comprises the residential suburb of St Clair. This zone has a generally flat landform, that is characterised by modestly-scaled detached, brick dwellings typically built in the 1970s. Most are separated from their street frontages and neighbouring properties by leafy private gardens some with tall shade trees and established gardens. Occasional modern two-storey duplex style homes are currently being developed throughout the estate. Fence lines of properties that back onto the Mamre Road corridor are typically 1800 mm high metal or timber fences and many properties have gates that open onto the road corridor.

The vegetation of this zone is consistent with the suburban nature of the area and comprise of a mix of exotic trees, shrubs and turf as well as some native tree and shrub species.

Interspersed throughout the estate are pockets of open space, passive recreation areas and some formal sports facilities. A number of primary and secondary educational institutions are dotted across the estate as well as a childcare centre and retirement living community.

Two 40 m wide grassed floodways, which divert runoff that originates from within the residential estate, intersect with the Mamre Road on the western edge of the estate.

Refer to Plate 5-9 to Plate 2-11 for existing character images.

Landscape character changes

Changes to this landscape setting would be restricted to the eastern fringe of the zone. At the interface between the residential property boundaries and the possibility of new noise wall structures that would include pedestrian portals.

Landscape character impact assessment

The exact alignment of the new noise wall structures and the configuration of the pedestrian portals and floodways is not yet determined. However, it appears that the almost continuous nature of the new structures would constitute major new built form along the edge of this character zone.

It would be noted that the impact of the structures is expected to reduce over time as vegetation establishes and matures. As well, the possible addition of patterns, texture and/ or transparent panels to the structures may also help to screen and soften these large vertical elements and minimise the visual scale and bulk.

The impact on landscape character is summarised in Table 5-3.

Plate 5-9: Banks Drive interface between commercial zone and residential homes of St Clair

5 Landscape character impact assessment

Plate 5-10: View of typical style of residential homes on Solander Drive

Plate 5-11: View of open grassed drainage channel within the residential zone

Table 5-3: LCZ 1 'residential estate' impact rating summary

Sensitivity	Magnitude	Impact
Moderate – The character of this zone is predominantly residential and includes some attractive open spaces, which contribute to the character and amenity of the area. The zone can accommodate some change without impacting its character and is described as having a moderate sensitivity.	Moderate – Considering the proposal is essentially a widening of an existing arterial road within an existing road reserve outside of this zone, the magnitude is considered to be limited to a moderate level of change	Moderate
Summary		
The expected impact on this zone has been rated Moderate. The proposal would have some impact on the western fringe of the St Clair residential area, with the introduction of new noise walls with pedestrian portals likely to be the most noticeable elements. The vast majority of the suburb would be unaffected.		

LCZ 2: Light commercial

Existing landscape character

This zone is comprised of a cluster of different commercial premises relying on patrons moving through the zone in their vehicles or parking on site in one of four car park areas. Access to take-away food with a drive-through facility, a service station with a Coles Express, an auto service centre and a hotel with overnight accommodation and bottle shop is provided via a common driveway on Banks Drive.

A wide road reserve along Mamre Road is dotted with mature eucalypts while the Banks Drive frontage comprises a mix of mown grass and manicured garden beds with clipped shrubs. Individual mature trees are located within the hotel carpark with others dotted across the wide turf area surrounding the hotel. The hotel is a two storey open, gable roofed building with cantilevered second story balconies for guests. Tall signage structures as well as temporary canvas strung signs dominate the intersection of Banks Drive and Mamre Road with tall native trees along Mamre Road screening of most of the hotel.

Refer to Plate 5-12 to Plate 5-14 for existing character images.

Landscape character changes

Changes to this landscape setting would be confined to the western boundary of the zone with noticeable change restricted to minor clearing of existing vegetation and the re-configuration and rationalisation of signage structures. The creation of more travel lanes, road batters and the introduction of safety barriers and pedestrian crossings would be less noticeable changes to the commercial premises.

Landscape character impact assessment

Although the exact extent of tree removal is not yet determined, it appears that the magnitude of impact on the vegetation is low. The magnitude of impact on other landscape features and the landscape character as a whole would be low, owing largely to the fact that the proposal is an upgrade of an existing road within the road reserve and that the landscape character zone has a limited number of aesthetically prominent features.

The impact on landscape character is summarised in Table 5-11 on page 93.

Plate 5-12: Looking east from the Mamre Road northbound setback

5 Landscape character impact assessment

Plate 5-13: Looking east towards the hotel from Mamre Road

Plate 5-14: Signage structures on the southbound setback of Mamre Road

Table 5-4: LCZ 2 'light commercial' impact rating summary

Sensitivity	Magnitude	Impact
Low – This zone comprises a high level of commercial development with numerous large buildings with varying scales and styles. This landscape character has few sensitive receptors and a high ability to absorb change, leading to a low sensitivity to change.	Low – The magnitude of impact of the proposal on the commercial area is likely to be low. Whilst there would be some property adjustments to cater to the widening of the corridor, the physical setting and appearance of the commercial precinct would not be substantially impacted.	Low
Summary		
Overall, a Low impact would be expected on this character zone, limited to perimeter boundaries.		

LCZ 3: Existing road corridor

Existing landscape character

This zone has been assessed as possessing strong definition and sense of separation from the adjoining areas. It has a gently undulating landform with several tributaries that flow under the road and link to the South Creek and Kemps Creek catchments to the west of the corridor.

A 20 m wide road reserve comprising mown turf, stands of mature remnant native trees and occasional areas of resident planting and shrub/ screening vegetation runs along the southbound setback of the corridor with it's eastern edge bordered by the rear fences of the residential dwellings of St Clair.

Two wide, open grass drainage floodways open onto the setback and together with a series of transverse drainage structures, function as part of the drainage network from the residential estate.

Residential dwellings in St Clair frame the eastern side of the corridor and much of the motorist's experience relies on this 'borrowed' landscape outside the road corridor. Orchard Hills on the western side of the road corridor retains its rural, scenic character. This is characterised by open pastoral and native grassland areas that terminate at dense vegetation associated with either South Creek or the Blue Mountains escarpment further afield. At the same time, dense, intermittent roadside vegetation stretches along the corridor and creates a sense of momentary enclosure.

Refer to Plate 5-15 to Plate 5-17 for existing character images.

Landscape character changes

Changes to this landscape setting would include the creation of new travel lanes and medians as well as the introduction of new noise walls and safety barriers within the remaining road reserve. Overall there would be an increase in the scale of the road as well as an increase in the concentration of the associated infrastructure elements.

Landscape character impact assessment

Although the proposal is an upgrade of an existing road the almost continuous nature and large scale of the new vertical elements such as noise walls would constitute major new built form. In conjunction with intersection upgrades the creation of additional travel lanes and medians as well as vegetation clearing would likely result in a more dominant road corridor.

The impact on landscape character is summarised in Table 5-11.

Plate 5-15: Looking south along Mamre Road from Banks Drive

5 Landscape character impact assessment

Plate 5-16: Looking south along Mamre Road from close to McIntyre Avenue

Plate 5-17: Looking south-west from the northbound setback of Mamre Road

Table 5-5: LCZ 3 'existing road corridor' impact rating summary

Sensitivity	Magnitude	Impact
Low – The character of this zone is defined by road infrastructure and as motorists are transitory, change may or may not be noticed. Consequently sensitivity has been assessed as low	High – The character is currently defined by road infrastructure however the proposal requires road widening, which would ultimately increase the bulk and scale of road	Moderate
Summary		
The qualitative assessment indicates that the landscape character impact of the proposal in this zone is likely to be Moderate. A higher level of sensitivity would be associated with changes to road reserve areas as the proposal would require a full redevelopment of the corridor with more concentrated road infrastructure elements.		

LCZ 4: Heritage/ pastoral

Existing landscape character

The visual character of this zone is characterised by a scenic pastoral/ agricultural landscape that is part of the Mamre House property, which is a state listed heritage item. The property is encroached upon to the north by the M4 Motorway and by the adjoining residential subdivision and Mamre Road to the east. It comprises areas of flat, open land, characteristic of Cumberland Plain colonial landscapes, which are interspersed with scattered remnant vegetation and bordered by South Creek in the west.

Set back from the Mamre Road, behind rural post and wire fencing, is the historic Mamre farmhouse, which is a notable built feature within the St Marys region and western Sydney. The farmhouse faces South Creek (west) and is surrounded by a number of small cottages, large commercial sheds and farm outbuildings that are generally timber framed structures with corrugated iron roofing. The current driveway approach has shifted approximately 130 m north of the original approach route, and is no longer an extension of the main axis from the building. It is lined by informally and formally planted indigenous Eucalypts planted over three decades ago, which contrast to the dominant character of the surrounding open grasses and market gardens. This zone provides for a visually pleasant driving experience from Mamre Road, across the scenic rural homestead and farm.

Refer to Plate 5-18 to Plate 5-20 for existing character images.

Landscape character changes

The curtilage of the property is vital to the significance and integrity of the character zone and anticipated impacts from the proposal are limited to a shift in the approach route to the homestead, which as a result of the proposal would be accessed via the four way signalised intersection at Banks Drive. A heritage interpretation node is proposed to be included (with bus pullover bay) at the old driveway connection with Mamre Road with the existing sign, metal gates and memorial cairn relocated outside of the proposed Mamre House grounds.

Landscape character impact assessment

Although the proposal is an upgrade of the existing road corridor it would almost double its width and slightly widen towards the heritage curtilage boundary. As well as a new signalised intersection, road furniture and vegetation clearing, the proposal would also require realignment of the driveway. These changes would be somewhat discernible from the homestead and more clearly discernible from the surrounding pastoral/ market garden landscape. The *2003 CMP for Mamre Homestead prepared by Graham Brooks and Associates* suggests reinstating the driveway to the original entrance, which aligns with the homestead, however due to road safety issues this is not possible and the driveway would join the western stub at Banks Drive.

The impact on landscape character is summarised in Table 5-11.

Plate 5-18: Looking west from Mamre Road towards Mamre

5 Landscape character impact assessment

Plate 5-19: Mamre House - heritage-listed former farm homestead complex

Plate 5-20: Interface between Mamre Road and the Mamre House fence

Table 5-6: LCZ 4 'heritage/ pastoral' impact rating summary

Sensitivity	Magnitude	Impact
High – This zone possesses scenic and heritage values, indicating that the sensitivity to changes in the landscape character would be high.	Moderate – The proposal would be larger in scale and bulk than the existing road corridor and although physical changes within the zone are limited, the magnitude of the proposed works would be moderate. This may reduce depending the outcome of the driveway realignment and whether the previous heritage recommendations can be implemented.	High-Moderate
Summary		
Overall, a High-Moderate impact would be expected on this character zone. The proposal may alter the pastoral outlook from the heritage buildings and gardens, increasing the level of infrastructure development in close proximity of the working landscape. The greatest impacts are likely to be experienced by the visitors and staff arriving at the property along the re-arranged driveway.		

LCZ 5: Riparian bushland

Existing landscape character

The character of this zone consists of a vegetated riparian zone associated with South Creek/ Kemps Creek catchment, which is part of the greater Hawkesbury-Nepean system. The road corridor crosses over seven tributaries all of which link with the two main creeks.

South Creek meanders east and west along the western edge of the study area through areas of River-flat Forests, wetlands and riparian habitats, which are among the most threatened natural landscapes in Western Sydney. The banks of the creek are vegetated with clusters of indigenous trees, shrubs and grasses. The eastern edge of this zone, closest to the existing road corridor, is dominated by a number of weed species along an approximately 40 m wide fringe.

The riparian environment creates a regionally significant biodiversity link along its length forming a linear vegetated buffer across the otherwise open, pastoral landscape.

Refer to Plate 5-21 to Plate 5-23 for existing character images.

Landscape character changes

The most noticeable changes to this landscape setting would be restricted to the eastern boundary of the zone. Changes would include clearing of vegetation to allow for the creation of more travel lanes, medians and road fill batters as well as the implementation of new drainage basins and culverts. Due to the poorer quality of the vegetation along the eastern fringe removal of vegetation would be less noticeable.

Landscape character impact assessment

Although the exact extent of tree removal is not yet determined, it appears that the magnitude of impact on vegetation is low. The magnitude of impact on other landscape features and the landscape character as a whole would be low, owing largely to the fact that the proposal is an upgrade of an existing road within an area that is dominated by dense woody weeds and younger exotic growth.

The impact on landscape character is summarised in Table 5-11.

Plate 5-21: Looking south along Mamre Road from McIntyre Avenue

5 Landscape character impact assessment

Plate 5-22: View south-east from Luddenham Road across South Creek riparian corridor

Plate 5-23: Looking east towards Mamre Road from South Creek riparian corridor

Table 5-7: LCZ 5 'riparian bushland' impact rating summary

Sensitivity	Magnitude	Impact
Moderate – This *character of this zone is reas*onably inconsistent especially along road corridor fringe. Some areas are dominated by attractive remnant riparian vegetation while others (typically closer to the existing road corridor) tend to be dominated by weed species and as such is not particularly sensitive to change is these areas.	Moderate – The proposal has the potential to impact small areas of remnant vegetation on both sides of the road corridor. Some clearing of areas along the existing road corridor are expected but the loss would not be substantial in terms of overall character. A moderate magnitude rating has been recorded.	Moderate
Summary		
Overall, a Moderate impact rating has been recorded on this character zone. The proposal would require the clearance of a small portion of vegetation along the existing road corridor. Reduction in batter widths and tree protective fencing would assist in limiting the impacts on this zone further.		

LCZ 6: Rural residential

Existing landscape character

This character zone comprises a rural-residential enclave with 0.5-1.0 hectare rural residential lots of a generally open landscape character. The flat terrain of the area is considered to be an important rural backdrop that influences the scenic quality of Penrith and contributes to the environmental identity and landscape values of Western Sydney.

Mid-distance views south from the dwellings look across fields of pastoral land and grassland with scattered remnant trees to the large warehouses within the First Estate Industrial Estate, while shorter range views to the north look towards vegetation. Further afield, transmission towers and power lines are visible.

Single storey residential homesteads are typically set back from Mandalong Close by approximately 20 to 40 m with dwellings enveloped by manicured turf with sparse, scattered exotic feature plants and hedges along the project boundary fences. Homesteads are often accompanied by one or more large metal storage sheds, gazebos, water fountains and sealed driveways.

Refer to Plate 5-24 to Plate 5-26 for existing character images.

Landscape character changes

Changes to this landscape setting would be confined to the western boundary of the zone with noticeable change from within the zone restricted to a small area of existing roadside vegetation removed (north and south of Mandalong Close), the removal of earth mounds along the northbound boundary of Mamre Road and the re-configuration of the intersection of Mandalong Close with Mamre Road. The creation of more travel lanes, medians, minor road fill batters and the introduction of safety barriers would be less noticeable from within the zone.

Landscape character impact assessment

The magnitude of impact on landscape features and the landscape character as a whole would be low, owing largely to the fact that the proposal is an upgrade of an existing road corridor within the road reserve and that the noticeable changes would be limited to the eastern edge and depending on the extent of removal of the existing earth mound.

The impact on landscape character is summarised in Table 5-11.

Plate 5-24: View north-west over grazing fields to rural residential properties on Mandalong Close

5 Landscape character impact assessment

Plate 5-25: View of typical rural residential homes on Mandalong Close (approximately 500m west of the upgrade)

Plate 5-26: Grazing sheep at rear of Mandalong Close rural properties

Table 5-8: LCZ 6 'rural residential' impact rating summary

Sensitivity	Magnitude	Impact
Moderate – This zone consists of heritage and scenic landscape values.	Low – The proposal comprises road widening into this zone and the removal of strips of pastureland and a visual mound.	Moderate-Low
Summary		
Overall, a Moderate-Low impact would be expected on this character zone as minor changes would be limited to the eastern boundary. Reinstating the earth mounds or limiting the construction footprint would assist in limiting the impacts on this zone further.		

LCZ 7: Business Park

Existing landscape character

This zone comprises Erskine Business Park and is located in an area zoned as part of the Western Sydney Employment Area (WSEA). The visual character of the area is dominated by industrial and utilitarian features with many sites occupied by bulky, high-bay warehouses clad in metal sheeting and surrounded by large concrete parking areas. Larger lots within this zone are occupied by the headquarters of large companies, such as DHL Supply Chain and CEVA Logistics, which operate on a 24/7 basis. Warehouses tend to be set back from the road corridor behind substantial areas of landscaping that includes open mown grass areas and manicured garden beds with shrubs and mature trees. Some lots are more visually exposed to Mamre Road.

North of the Erskine Park Road intersection, the landscape character varies from the industrial built form within the Business Park. Dense Alluvial Woodland (EEC) vegetation creates a green, vegetated east-west threshold across Mamre Road. Runoff from the Ropes Creek catchment passes through the Business Park to a detention basin facility on the southern side of Erskine Park Road before being released into South Creek, west of the Mamre Road corridor.

Refer to Plate 5-27 to Plate 5-29 for existing character images.

Landscape character changes

Changes to this landscape setting would include the creation of new travel lanes and medians as well as the introduction of new raised medians and pedestrian crossings, safety barriers and a more formalised southbound road reserve environment with SUP. Overall there would be an increase in the scale of the road and the scale and concentration of the associated road infrastructure elements.

Landscape character impact assessment

Although the proposal is an upgrade of an existing road, the almost continuous nature and larger scale of the new elements such as wider overall road corridor with intersection upgrades, the creation of additional travel lanes, split lanes and medians as well as vegetation clearing would likely result in a more dominant road corridor.

The impact on landscape character is summarised in Table 5-11.

Plate 5-27: View south-east towards the Erskine Business Park

5 Landscape character impact assessment

Plate 5-28: Existing feature entry planting for Erskine Business Park

Plate 5-29: Existing paths and planting associated with Erskine Business Park

Table 5-9: LCZ 7 'Business Park' impact rating summary

Sensitivity	Magnitude	Impact
Low – Industrial areas consisting of numerous large commercial and industrial buildings. This LCZ has a high ability to absorb change, leading to a low sensitivity.	Low – An increase in the extent of road pavement and formalising road infrastructure elements with little impact on vegetation or other landscape features within this zone, is considered to result in a low magnitude of change.	Low
Summary		
Overall, a **Low** impact would be expected on this character zone, limited to the western boundary.		

LCZ 8: Service corridor

Existing landscape character

The landform along the service corridor undulates and gently slopes down from east to west across the road corridor towards South Creek. East of Mamre Road the transmission corridor is mostly open with long range views over grassland and a fringe of remnant trees stretching along the western edge of the southern extent of the St Clair residential estate. West of Mamre Road the corridor has scattered areas of bushland within the corridor and riparian bushland vegetation associated with the South Creek tributaries limits views in this direction. Along either side of the road corridor rural post and wire fence fencing is visible with an additional chain mesh fence visible along the eastern verge. Utility poles and electrical transmission towers dominate the skyline within this zone.

Refer to Plate 5-30 to Plate 5-32 for existing character images.

Landscape character changes

Changes to this landscape setting would include widening for additional travel lanes, medians, minor road fill batters and the introduction of safety barriers. The introduction of new SUP within a more formalised southbound road reserve would also be a noticeable change. Overall there would be an increase in the scale of the road and associated infrastructure elements.

Landscape character impact assessment

Although the proposal would result in a wider overall road corridor, with additional travel lanes and medians, there would be little impact on vegetation or other landscape features within this LCZ owing largely to the fact that the proposal is an upgrade of the road within the existing road reserve.

The impact on landscape character is summarised in Table 5-11.

Plate 5-30: Looking east along electricity transmission corridor

5 Landscape character impact assessment

Plate 5-31: View south from Blackwell Avenue

Plate 5-32: Looking west along electricity transmission line easement

Table 5-10: LCZ 8 'service corridor' impact rating summary

Sensitivity	Magnitude	Impact
Low – This character of this zone is largely defined by services infrastructure. The proposal would be of similar nature to the existing road corridor, which reduces the zone's sensitivity to the proposal.	Low – An increase in the extent of road pavement and formalising road infrastructure elements with little impact on vegetation or other landscape features within this zone, is considered to result in a low magnitude of change.	Low
Summary		
The expected impact on this zone has been rated Low with the vast majority of the zone remaining unaffected by the upgrade.		

5 Landscape character impact assessment

5.4 Summary of landscape character impact assessment

The proposal has been identified as having some impacts across all of the nine character zones and these have been ranked and the cumulative impact on sensitivity and magnitude has been assessed. The landscape character assessment is summarised in Table 5-11 below.

Mamre Road traverses a number of landscape characters zones, from the built up areas of St Clair and Erskine Business Park in the east to scenic pastoral and productive landscapes associated with Mamre and the South Creek corridor to the west. The proposed upgrade is essentially a widening of an existing arterial road into the associated road reserve area that results in many of the adjoining characters zones being better able to absorb the increase in the scale and bulk of the proposal.

The proposal is shown to have the greatest impact on the heritage/ pastoral zone where the sensitivity is highest across the regionally significant landscape. The preservation of the curtilage areas of this zone is vital to its integrity and while the anticipated impacts from the proposal are limited to a shift in the approach route to the farmstead, this change would constitute a high-moderate overall impact. The urban design and landscaping impacts would be minimised by taking into consideration heritage advice and incorporating opportunities for heritage interpretation.

The proposal is likely to have moderate overall impacts on residential and riparian bushland zones. Both of these zones have a large overall scale and changes would be limited to a narrow linear fringe so that the overall landscape integrity is not expected to be affected. A moderate impact also occurs where the existing infrastructure environment is considered to be better able to absorb the changes resulting from the proposed upgrade.

Zones where moderate-low and low impacts are foreseen, generally relate to zones where the land-use of the character zone is relatively immune from the changes in road form such as the industrial land-use and commercial areas.

Table 5-11: Landscape character impact rating summary

Landscape Character Zone		Sensitivity	Magnitude	Impact
1	Residential estate	Moderate	Moderate	Moderate
2	Light commercial	Low	Low	Low
3	Existing road corridor	Low	High	Moderate
4	Heritage/ pastoral	High	Moderate	High-Moderate
5	Riparian bushland	Moderate	Moderate	Moderate
6	Rural residential	Moderate	Low	Moderate-Low
7	Business Park	Low	Low	Low
9	Service corridor	Low	Low	Low

South Creek riparian vegetation

6 Visibility of the project

6.1 Chapter overview

This chapter identifies the areas where the proposal would be visible, in order to determine representative viewpoints that cover a range of different land uses and viewers surrounding the project.

6.2 Visual envelope

A visual envelope is a theoretical assessment of visibility to or from the proposal. Figure 6-1 on page 96 illustrates the visual envelope, which was generated manually during desktop analysis and verified in the field, taking in to account such factors as built structure, intervening vegetation and topography.

Viewpoints for assessment

Table 6-1 lists viewpoints that have been selected to assess potential visual impacts including:

- Publicly accessible locations that are representative of residential properties and businesses
- Heritage items and precincts
- Public domain, including parks, footpaths, shared user paths and lookouts
- Popular destinations and tourist attractions
- Road user views from the existing road.

The locations and directions of selected viewpoints are representative of the range of locations both within and beyond the road corridor and are shown in Figure 6-2 on page 97.

This list does not represent the entire number of receptors likely to be visually impacted by the proposal, but rather, represents the range of viewers potentially impacted by some part of the project across each LCZ. These viewpoints are assessed further in Section 7 on page 99.

Table 6-1: Viewpoint summary

VP	Location	LCZ	Viewpoint visited	Distance to proposal	Artist's impression
Stage 1					
1	Banks Drive intersection looking south	**LCZ 1**	•	0 m	
2	Mamre House looking east towards the upgrade	**LCZ 4**	•	210 m	•
3	Pedestrian portal at Alpine Court looking south	**LCZ 1**	•	0 m	
4	Drainage channel and culvert looking west towards the upgrade	**LCZ 1**	•	50 m	•
5	Solander intersection looking north along the upgrade	**LCZ 3**	•	0 m	•
6	Luddenham Road looking east towards the upgrade	**LCZ 4**	•	0 m	
7	McIntyre intersection looking south	**LCZ 1**	•	0 m	
8	Mandalong intersection looking south-east	**LCZ 3**	•	10 m	•
9	Mandalong Close property looking towards the upgrade	**LCZ 6**	•	110 m	
10	Erskine Park Road intersection looking towards entry feature	**LCZ 3**	•	0 m	

6 Visual impact assessment

Figure 6-1: Visual envelope mapping

LEGEND

EXISTING FEATURES

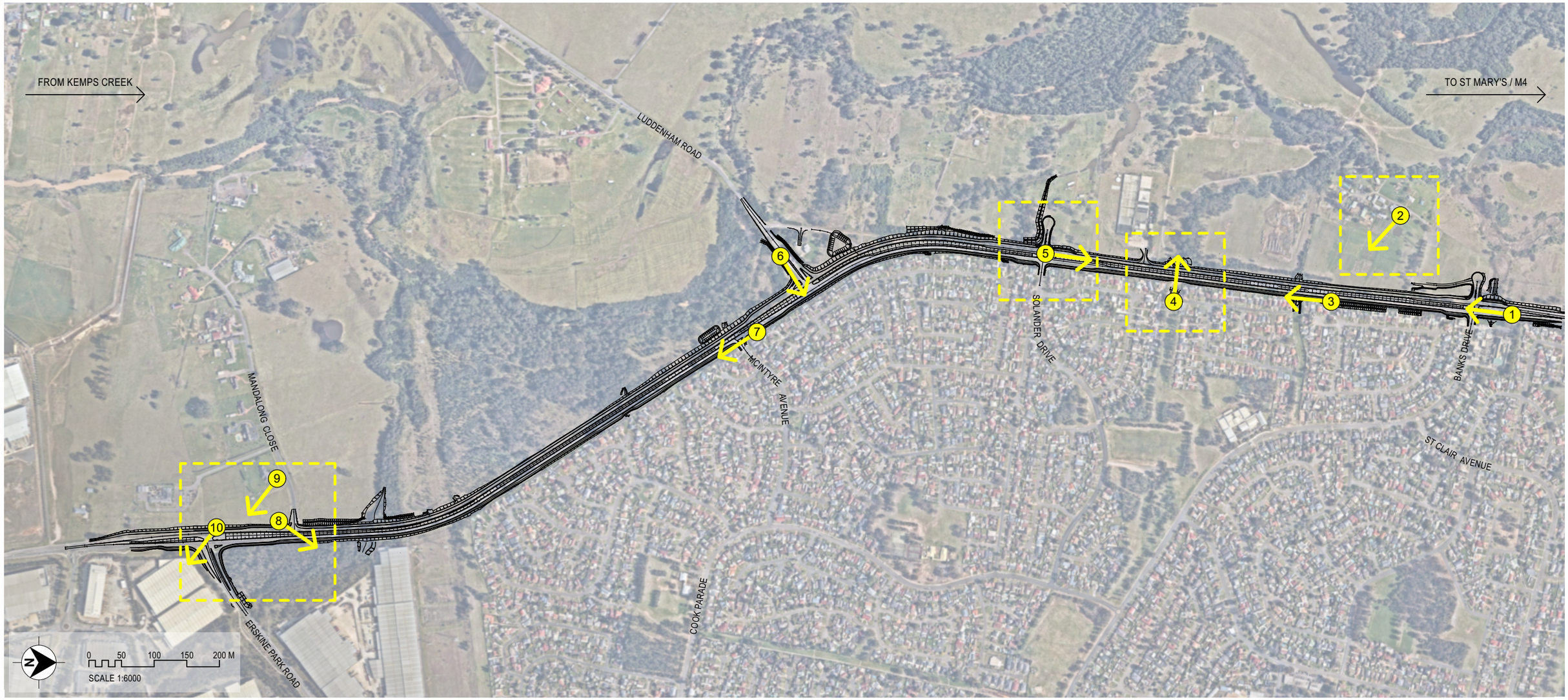
CADASTRAL BOUNDARY

CONTOURS (2M INTERVAL)

VISUAL ENVELOPE

APPROXIMATE EXTENT OF VISUAL ENVELOPE

6 Visual impact assessment



LEGEND

VIEWPOINT LOCATIONS

- 3D VISUALISATION LOCATION (AS SUPPLEMENTARY TO VIEWPOINT ASSESSMENT MATERIAL)
- 1 VIEWPOINT 1 - BANKS DRIVE INTERSECTION, MAMRE CURTILAGE AND COMMERCIAL AREA
- 2 VIEWPOINT 2 - MAMRE HOUSE
- 3 VIEWPOINT 3 - PEDESTRIAN PORTAL (ALPINE CIRCUIT)
- 4 VIEWPOINT 4 - FLOODWAY AND DRAINAGE CULVERT
- 5 VIEWPOINT 5 - SOLANDER INTERSECTION AND SENSITIVE RECEIVER
- 6 VIEWPOINT 6 - RFS
- 7 VIEWPOINT 7 - MCINTYRE INTERSECTION AND SENSITIVE RECEIVER
- 8 VIEWPOINT 8 - MANDALONG INTERSECTION, SPANISH WALL AND BUSHLAND BEHIND
- 9 VIEWPOINT 9 - MANDALONG SENSITIVE RECEIVER TO NEW ROAD
- 10 VIEWPOINT 10 - ERSKINE PARK ENTRY STATEMENT AND COMMERCIAL BACKDROP

Remnant roadside vegetation on Luddenham Road

7 Visual impact assessment

7.1 Chapter overview

This chapter assesses the visual impact at each of the selected viewpoints based on the established visual envelope.

7.2 Methodology

Impact assessments are based on a qualitative assessment of the sensitivity of the view and magnitude of the proposal potentially visible in that view. This enables the development of a mitigation strategy to address the impacts identified.

Sensitivity

Sensitivity is the measure of the 'completeness' and the perceived 'value' of the existing view. An assessment is made as to the quality of the landscape, its cultural and historical importance to the community, scenic value and overall composition of the place.

The following sensitivity parameters have been used as the basis for this assessment:

- The category of view such as residential, tourism or commercial and frequency at which the scene is viewed
- The elements of the project that are visible
- Importance of the view. Places with high social, recreational, and historical significance to local residents have higher sensitivity, as do areas of unique scenic quality
- Generally, views with the highest sensitivity include:
  - residential views that would be affected by the project and the context of this view i.e. kitchen window, balcony, bedroom, living room
  - public open space with a notable visual landscape, for example, lookouts or other scenic natural areas
  - views with high cultural and historical significance on the visual landscape
- Views with the lowest sensitivity are most likely to be:
  - Commercial areas with enclosed workplaces
  - Road user views where the road corridor signifiers take precedence – however it is important to provide a stimulating motorist experience, particularly for tourists.

Magnitude

The 'magnitude of visual change' describes the contrast or type of change resulting from the project or project, the extent of change and also the proximity of the viewer. Changes are categorised as follows:

- A high magnitude of change would result if the project is of a major scale and considered out of scale or uncharacteristic of the existing view, or if there is considerable modification to the existing built fabric or landscape
- A moderate magnitude of change would result if the project is prominent but not considered to be substantially different from the existing character
- A low magnitude of change would result if there is minimal alteration to the existing view and the project is of a scale and nature that is consistent with the existing landscape.

Table 7-1: Visual impact rating matrix, Source: TfNSW EIA-N04

		Magnitude			
		High	Moderate	Low	Negligible
Sensitivity	High	High	High-Moderate	Moderate	Negligible
	Moderate	High-Moderate	Moderate	Moderate-Low	Negligible
	Low	Moderate	Moderate-Low	Low	Negligible
	Negligible	Negligible	Negligible	Negligible	Negligible

7 Visual impact assessment

Assessment tools

In order to assess the potential impacts of the project across the variable landscape features of the study area, it was necessary to investigate the potential visual impacts using different tools.

Viewing .KMZ files in Google Earth from a 'Ground Level view' with the terrain on was used to obtain a comprehensive understanding of the extent of the project from various viewpoints that were not accessible. Views were assessed in conjunction with plans and site photography taken during the site visit.

TfNSW EIA-N04 defines the methodology was used to assess the likely changes to landscape composition. Elements of the view include dominance of form, lines, colours and textures. The qualitative sensitivity of potential viewers was combined with objective measurement to form assessment conclusions.

Artist's impressions

Artist impressions and computer generated images (3D) are for illustrative purposes only. Each view was generated in software from 3D Max (or similar) digital models built up using aerial photography, existing site contours and CAD generated 3D concept road design inputs.

These artist impressions are indicative of the final road design, seen at each location only and may not always reflect the most current design depending on when they were prepared.

Notated photographs

.KMZ files modelled by the road designers. The files were imported in to Google Earth™ software and basic terrain data was turned on to enable 3D views of the project to be generated from each specific viewpoint location shown in Figure 7-2. These images were then overlaid onto the site photographs (Figure 7-1), scaled and positioned so that they matched existing features.

Each photograph was then marked up a to illustrate the proposed change as a result of the project. These broad illustrations portrayed a more flexible appearance allowing changes to occur throughout the development of the road design. Each .KMZ based image provides an approximation of the design in its setting rather than a fully resolved representation of the design and graphically present the following design elements:

Approximate extent of road corridor
Project boundary extent
Extent of batters
Approximate noise wall alignment
Extent of existing vegetation
Extent of vegetation to be removed

The photographic illustrations are indicative only.

3D model views

These images were captured as screen shots during a fly-through animation of the computer generate 3D model. Each one is located close to the determined viewpoints.

They are indicative of the final design seen at each location only (or immediate surrounding area) and do not always reflect the most current design.

Figure 7-1: Example of existing viewpoint in Google Earth™

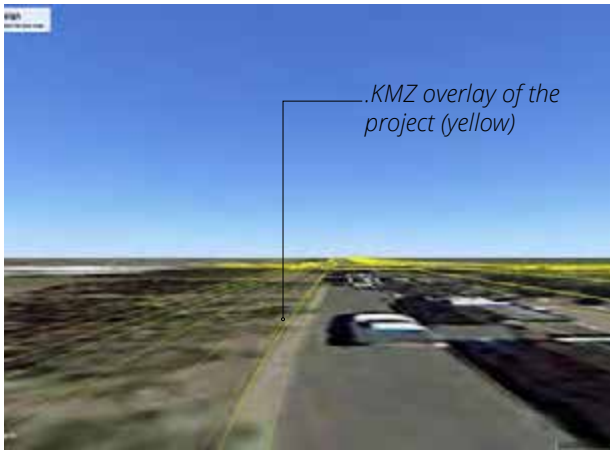


Figure 7-2: Example of .KMZ model view in Google Earth™ at the same viewpoint

7 Visual impact assessment

Viewpoint 1

Location and description

This viewpoint is located on in the middle of the eastern carriageway (Figure 7-3). The commercial hub, located in the north of St Clair, is partially visible through Casuarina trees while more distant views along the road corridor are intermittently framed by stands of roadside Eucalypts. Power lines and poles with light fixtures as well as traffic poles with outreach arms are visible above the road carriageway.

Visible elements of the project

At this location the road corridor would be widened to accommodate additional travel lanes, turning lanes, raised medians with pedestrian crossings and a new four way signalised intersection at Banks Drive with new driveway to Mamre House. Refer Section 1.2 on page 1 for a full description of the features of the proposal.

Affected viewers:

- Motorists, cyclists and pedestrians travelling on Mamre Road and setback
- Employers and employees arriving and departing Mamre House
- Staff and customers of the nearby commercial hub on Banks Drive
- Local residents.

Description of impacts

The proposal would be visible at this location. Existing vegetation provides a semi-enclosed driving experience, which gives way to open pastureland to the west and residential properties of St Clair to the east. The existing semi-restricted views out to the west would be slightly increased by removal of vegetation along western margins seen on the right of Plate 7-1 on page 102. Refer Figure 7-4 and Figure 7-5 on page 103.

The proposal would increase the prominence of road related infrastructure within the view and while areas of existing vegetation would be required to be removed, road user views at this location have a lower sensitivity due to the inherent expectation of intermittent changes along the road journey. The presence of existing road infrastructure within the viewframe ensures that only a moderate impact on visual amenity is expected.

The visual impact on these viewpoints is summarised in Table 7-12 on page 131. For mitigation measures relating to these views refer to Section 8 on page 133 of this report.

Figure 7-3: Viewpoint 1 location map

7 Visual impact assessment

Plate 7-1: Looking south towards the Banks Drive intersection from the southbound setback

7 Visual impact assessment

Figure 7-4: Viewpoint 1 - existing view looking south in the southbound travel lane

Figure 7-5: Viewpoint 1 - proposed view looking south in the southbound travel lane

Table 7-2: Visual impact summary viewpoint 1

Sensitivity	Magnitude	Impact
Moderate – A large compositional element in the view is the intermittent tree cover on both sides of the corridor, while another dominant element of the view is the road corridor itself. The sensitivity to change is therefore considered to be moderate.	Moderate – The width of the road would increase with the requirement for tree removal. The proposal results in increased road infrastructure.	Moderate

7 Visual impact assessment

Viewpoint 2

Location and description

This viewpoint is located about 210 m north-west of the main alignment at the edge of the existing formal bitumen driveway that runs to the east of Mamre House (Figure 7-6). Orientated south-east along an original approach route, the foreground is now dominated by a mix of lawn areas, pastoral grassland, market gardens, a dam and scattered remnant Eucalypts. Longer range views are comprised of the housing in St Clair and traffic moving along Mamre Road. Visitor parking close to the driveway is currently haphazard with large buses often parked directly in front of Mamre House with vehicles scattered over the lawns (Plate 7-2).

Visible elements of the proposal

As the direction of the view is perpendicular to the proposed upgrade and at a similar elevation, this results in a relatively high capacity to absorb changes such as widening. The proposal would introduce a new driveway and utility work along with new embankments, associated with a slightly higher vertical alignment. Existing rural post and wire fencing would be reinstated where any sections are temporarily removed for access. New road furniture may also be visually intrusive from areas within the rural curtilage of the homestead.

Affected viewers:

- Employers, employees and visitors to Mamre House
- Pedestrians and road users on Mamre Road.

Description of impacts

Impacts from the proposal at this location would be mostly experienced at a distance of over 200 m with changes mostly perceptible when entering and existing the site via the re-alignment of the proposed approach route. Refer Figure 7-7 and Figure 7-8 on page 106.

Carefully arranged screening shrubs and grassland vegetation along the fence line and new approach route would assist in retaining the open character of the homestead whilst providing some buffer for the sight of vehicles. Maintaining the visibility and recognition of the rural homestead and farm from the road would also be important for the preservation of character and integrity within the region. The alteration of minor aspects along the fringe of the curtilage is not considered to have negative impacts and results in an overall moderate impact rating.

The visual impact on these viewpoints is summarised in Table 7-3. For mitigation measures relating to these views refer to Section 8 on page 133 of this report.

Figure 7-6: Viewpoint 2 location map

7 Visual impact assessment

Plate 7-2: Looking across the circular driveway in front of Mamre House

7 Visual impact assessment

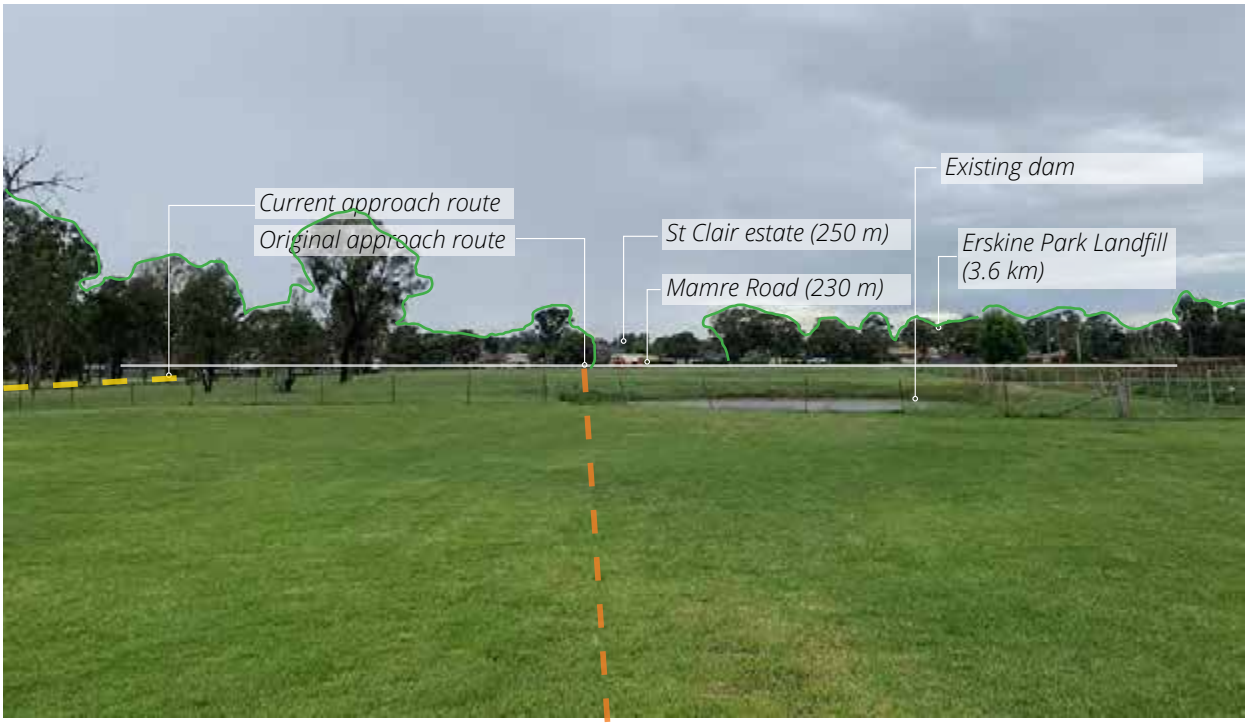


Figure 7-7: Viewpoint 2 - existing view looking SSE from Mamre Homestead (approx. 230 m west of Mamre Road)

Figure 7-8: Viewpoint 2 - proposed view looking SSE from Mamre Homestead

Table 7-3: Visual impact summary viewpoint 2

Sensitivity	Magnitude	Impact
High – Views experienced by people working at and visiting the homestead are considered to be particularly sensitive to change due to the unique type of amenity and existing heritage qualities experienced and valued by these receptors.	Low – The magnitude of change resulting from the proposal would consist of an extension to an existing driveway.	Moderate

Plate 7-3: Aerial view looking SSE from above Mamre Homestead

7 Visual impact assessment

Viewpoint 3

Location and description

This viewpoint is located within the existing southbound road reserve, north of the existing pedestrian connection to St Clair (Figure 7-9). The setback area comprises a 20 m wide linear mown turf area with stands of mature remnant native trees. Screening shrub vegetation is dotted along the eastern edge of the setback against the rear fences of the residential dwellings. An easement entry links to the setback though it is not obvious with the only visual indication of the connection from the residential estate being a blue metal bollard. A power pole is located close to the entry with power lines running across the road carriageway. Views out to the west are enclosed by dense bushland associated with one of the tributaries that travels under Mamre Road.

Visible elements of the project

At this location the road corridor would be raised above the existing ground level, and the carriageway would be widened to accommodate additional travel lanes and a depressed median. The southbound setback environment would include safety barriers, SUP, noise walls and a pedestrian portal that links to Alpine Circuit.

Affected viewers:

- Residents of St Clair
- Pedestrians and cyclists using the Mamre Road setback environment
- Motorists travelling along Mamre Road.

Description of impacts

The new road corridor would be wider and would be elevated above the existing ground. While the majority of the existing vegetation within the southbound setback would be retained, additional road furniture, noise walls with pedestrian portal and a SUP would increase the prominence of the infrastructure within the view. The proposal would be highly visible at this location. Along the northbound setback, existing vegetation would largely be retained so that views would remain much the same. Refer Figure 7-10 and Figure 7-11 on page 109.

Road users at this location have a lower sensitivity due to their inherent expectation of intermittent changes along their road journey, however the increase of road infrastructure with new vertical built features would be highly visible to slower moving pedestrians and cyclists within the viewframe resulting in a high-moderate impact rating.

The visual impact on these viewpoints is summarised in Table 7-4. For mitigation measures relating to these views refer to Section 8 on page 133 of this report.

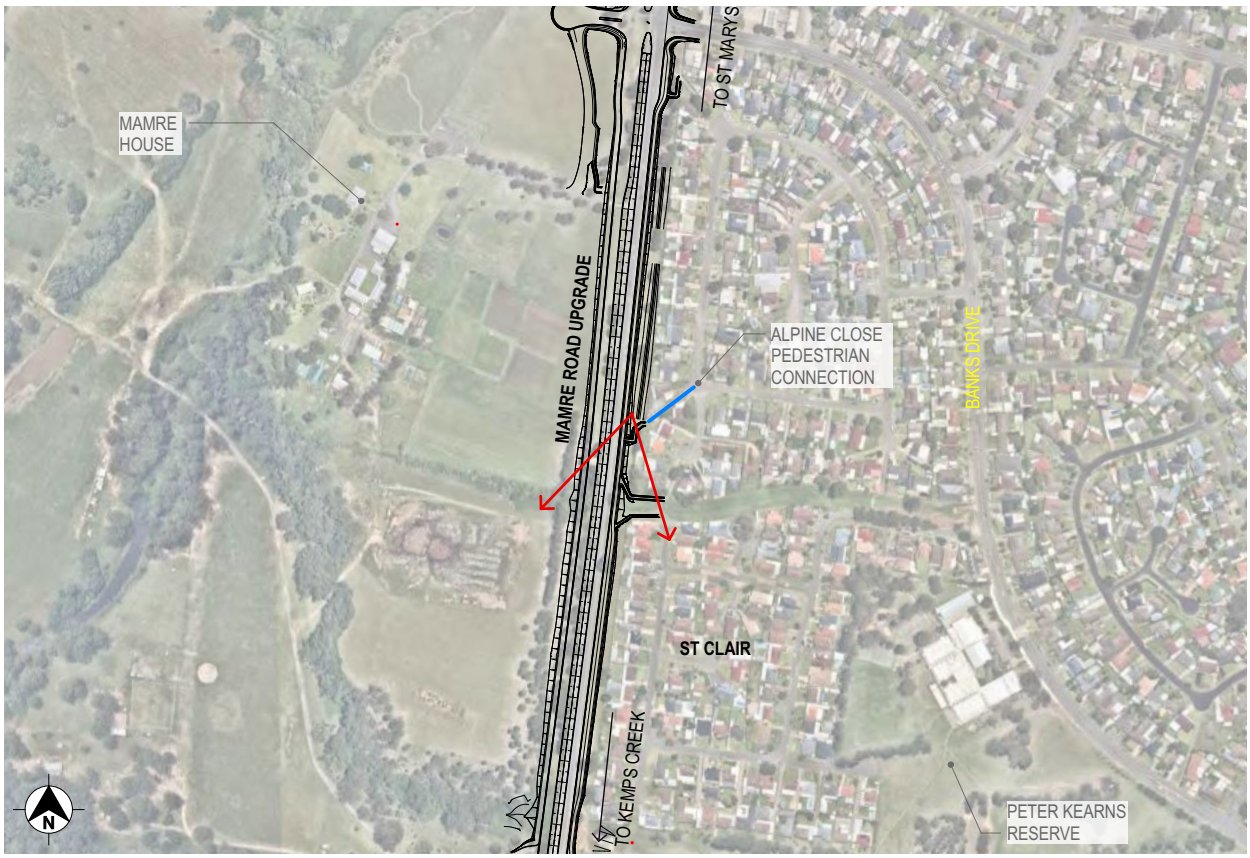


Figure 7-9: Viewpoint 3 location map

7 Visual impact assessment

Figure 7-10: Viewpoint 3 - existing view looking towards the pedestrian portal at Alpine Close

Figure 7-11: Viewpoint 3 - proposed view looking towards the pedestrian portal at Alpine Close

Table 7-4: Visual impact summary viewpoint 3

Sensitivity	Magnitude	Impact
High – Views of the landscaped setback experienced by local residents are typically valued are generally considered to be highly sensitive to change	Moderate – The width of the road would almost double including changes to the landscaped setback. The proposal constitutes an increase in the dominance of road infrastructure, therefore the magnitude of the change to the view is moderate.	High-Moderate

7 Visual impact assessment

Viewpoint 4

Location and description

This viewpoint is located within the existing open drainage channel and is part of the wider drainage network linking through Peter Kearns Reserve in St Clair with South Creek in the west (Figure 7-12). The grass channel is approximately 40 m wide and is sunken from the existing road carriageway. As well as operating as a drainage easement during flood events, it is also used as open space for passive recreation and as a pedestrian link. Views are limited by riparian bushland along the northbound verge of Mamre Road and along the sides of the floodway by 1.8 m high residential fencing along both sides. Established eucalypt trees situated close to the property boundaries, provide a softened green edge to the space. A 18 m wide concrete drainage culvert in the foreground has a ball fence handrail across the top of it.

Visible elements of the project

The direction of the view is perpendicular to the proposed upgrade means that is has a relatively high capacity to absorb changes such as widening. The proposed works would introduce would new fill embankments, associated with a vertical road alignment that is higher than the existing ground. The proposed southbound setback would include new noise walls (that may wrap into the drainage channel), modifications to the culvert with fencing, safety barriers, a SUP and informal paths connecting into the drainage easement.

Affected viewers:

- Residents of St Clair
- Pedestrians and cyclists using the drainage easement as a link to the Mamre Road setback.

Description of impacts

From this location the widened road carriageway would not be a more dominant feature within the view however the introduction of noise walls, a SUP and informal paths into the drainage channel would increase the prominence of infrastructure within the view and does constitute a major change within the view. There would be some loss of bushland vegetation within the northbound setback but this would not constitute a major change. Refer Figure 7-13 and Figure 7-14 on page 111.

The introduction of vertical built features would be highly visible to slower moving pedestrians and cyclists and results in a high impact rating.

The visual impact on these viewpoints is summarised in Table 7-5. For mitigation measures relating to these views refer to Section 8 on page 133 of this report.

Figure 7-12: Viewpoint 4 location map

7 Visual impact assessment

Figure 7-13: Viewpoint 4 - existing view looking west towards the upgrade from drainage channel (62 m from Mamre Road)

Figure 7-14: Viewpoint 4 - proposed view looking west towards the upgrade from drainage channel

Table 7-5: Visual impact summary viewpoint 4

Sensitivity	Magnitude	Impact
High – Views experienced by residents and outdoor recreation users within the open space environment would typically be sensitive to change due to the unique type of amenity experienced by and valued by these receptors.	High – Substantial changes within the setback and the introduction of noise walls and a shared user path on top of the drainage channel constitutes an increase in the dominance of infrastructure and therefore the magnitude of the change to the view is high.	High

7 Visual impact assessment

Plate 7-4: Proposed view looking west towards drainage channel

7 Visual impact assessment

Viewpoint 5

Location and description

This viewpoint is located south of the future four-way intersection at Mamre Road and Solander Drive (Figure 7-15). It looks north along the Mamre Road corridor, which stretches to the horizon of the view. The existing road corridor is a major compositional element in the view and includes a raised concrete median that splits the travel on Solander Drive. An existing 1.2 m wide concrete footpath runs along the northern verge of Solander Drive and ends abruptly at the T-intersection. Light poles with arms over the road corridors and regulatory road signage is also visible. The other prominent feature within the view is the low density residential dwellings of St Clair with rear property fences that form a distinct, linear edge along the 20 m wide mown turf setback. This setback area is dotted with stands of mature remnant native trees as well as a clump of Casuarinas.

Visible elements of the project

At this location the road corridor would be widened to accommodate more travel lanes, turning lanes, raised medians with pedestrian crossings and a new four way signalised intersection at Solander Drive that would provide a new connection to future development areas within the recreation zone west of the corridor.

Affected viewers:

- Pedestrians and cyclists using the Mamre Road setback environment
- Motorists travelling on Mamre Road.

Description of impacts

The proposal would be highly visible at this location. The new road corridor would be substantially wider and would be elevated above the existing ground and existing foreground vegetation within the northbound verge, would be removed opening up views to the west of the corridor. The majority of the existing vegetation within the southbound setback would be retained however, additional road furniture, noise walls and a SUP would increase the prominence of the infrastructure within the view. Refer Figure 7-16 and Figure 7-17 on page 114.

Motorists at this location have a lower sensitivity due to their inherent expectation of intermittent changes along their road journey, however the increase of road infrastructure with new vertical built features would be highly visible to slower moving pedestrians and cyclists within the view, resulting in a high-moderate impact rating. The visual impact on these viewpoints is summarised in Table 7-6. For mitigation measures relating to these views refer to Section 8 on page 133 of this report.

Figure 7-15: Viewpoint 5 location map

7 Visual impact assessment

Figure 7-16: Viewpoint 5 - existing view looking east from the Solander Drive intersection

Figure 7-17: Viewpoint 5 - proposed view looking north from the central median at Solander Drive

Table 7-6: Visual impact summary viewpoint 5

Sensitivity	Magnitude	Impact
Moderate – The view is a mix of existing bushland, road carriageway, setback and residential dwellings. It would have a moderate capacity to absorb the proposed changes.	High – The footprint of the proposed upgrade would increase, resulting in increased road infrastructure. The magnitude would be considered high.	High-Moderate

7 Visual impact assessment

Plate 7-5: Proposed view looking north from the Solander Drive intersection

7 Visual impact assessment

Viewpoint 6

Location and description

This viewpoint is located in the southern verge of the westbound travel lane close to the intersection of Mamre Road and Luddenham Road (Figure 7-18). It looks north-east along Luddenham Road, across the Mamre Road corridor towards the residential estate of St Clair. The existing road corridor as well as roadside vegetation on both corridors are the major compositional elements in the view. Secondary elements include steel sheds, concrete driveway and parking areas associated with the Erskine Park Rural Fire Brigade, galvanised chain mesh fencing with barb wire, regulatory road signage, light poles with outreach arms over the road corridors. Fences of the residential dwellings of St Clair are just visible in the distance (Plate 7-6).

Visible elements of the project

At this location the road footprint of the intersection would increase as a result of the upgrade and some areas of existing vegetation would be cleared. The prominence of road infrastructure elements such as traffic lights, light poles, raised pedestrian islands, with safety fencing, signage and noise walls along the southbound setback of the main alignment would also be introduced. The road carriageway would also sit higher than the existing ground level.

Affected viewers:

- Motorists travelling along Luddenham Road
- Pedestrians utilising the signalised intersection at Mamre Road and Luddenham Road.
- Erskine Park Rural Fire Station (RFS)

Description of impacts

Although there would be a loss of vegetation within the westbound verge of Luddenham Road as well as some roadside vegetation removal within the eastbound verge this would not constitute a major change in the view. Mid-range views, north-east from the Luddenham Road carriageway, to the southbound setback of Mamre Road would be impacted by an increase in the compositional elements as a result of new noise walls, a SUP environment and more road furniture. Refer Figure 7-19 and Figure 7-20 on page 118.

RFS would be impacted by the new driveway alignment, which would cause a possible loss of vegetation.

Motorists at this location have a lower sensitivity due to their inherent expectation of intermittent changes along their road journey and shorter viewing times and combined with the presence of existing road infrastructure within the viewframe ensures that only a moderate-low impact on visual amenity is expected.

The visual impact on these viewpoints is summarised in Table 7-7. For mitigation measures relating to these views refer to Section 8 on page 133 of this report.

Figure 7-18: Viewpoint 6 location map

7 Visual impact assessment

Plate 7-6: South Creek environment looking east towards Mamre Road from Luddenham Road

7 Visual impact assessment

Figure 7-19: Viewpoint 6 - existing view looking east towards the main alignment

Figure 7-20: Viewpoint 6 - proposed view looking east towards Mamre Road

Table 7-7: Visual impact summary viewpoint 6

Sensitivity	Magnitude	Impact
Low – Major compositional elements in the view are the existing road corridor together with roadside vegetation. Overall, the sensitivity of the view is considered low.	Moderate The footprint of the intersection would increase, resulting in increased road infrastructure. The magnitude would be considered moderate.	Moderate-Low

7 Visual impact assessment

Viewpoint 7

Location and description

This viewpoint is located within the existing southbound setback, north of the intersection of Mamre Road and McIntyre Avenue (Figure 7-21). Major compositional elements in the view include mature remnant native trees located within the 20 m wide mown turf southbound setback area, roadside vegetation along the western verge as well as the existing Mamre Road corridor. The intersection environment is highlighted by metal safety barriers, power poles and light poles with outreach arms. Secondary features within this view are pockets of screening shrub vegetation dotted along the rear fences of the residential dwellings of St Clair (Plate 7-7).

Views out to the west are enclosed by dense riparian bushland associated with one of the tributaries that travels under Mamre Road at this location.

Visible elements of the project

At this location the road corridor would be raised above the existing ground level, and the carriageway would be widened to accommodate more travel lanes, turning lanes and a wide depressed median and a raised pedestrian traffic island. The southbound setback would include safety barriers, a SUP with bicycle crossing at McIntyre Avenue and noise walls.

Affected viewers:

- Pedestrians and cyclists using the Mamre Road setback
- Motorists travelling along Mamre Road and McIntyre Avenue.

Description of impacts

The new road corridor would be substantially wider and would be elevated above the existing ground. Scattered patches of the existing vegetation within the southbound setback would be removed to accommodate road furniture, noise walls and a SUP, increasing the prominence of infrastructure within the view. Along the northbound setback, existing vegetation would also be removed impacting the sense of enclosure currently experienced along this section of the road corridor. Refer Figure 7-22 and Figure 7-23 on page 121.

Road users at this location have a lower sensitivity due to their inherent expectation of intermittent changes along their road journey, however the increase of road infrastructure with new vertical built features would be highly visible to slower moving pedestrians and cyclists within the viewframe resulting in a high impact rating.

The visual impact on these viewpoints is summarised in Table 7-8. For mitigation measures relating to these views refer to Section 8 on page 133 of this report.

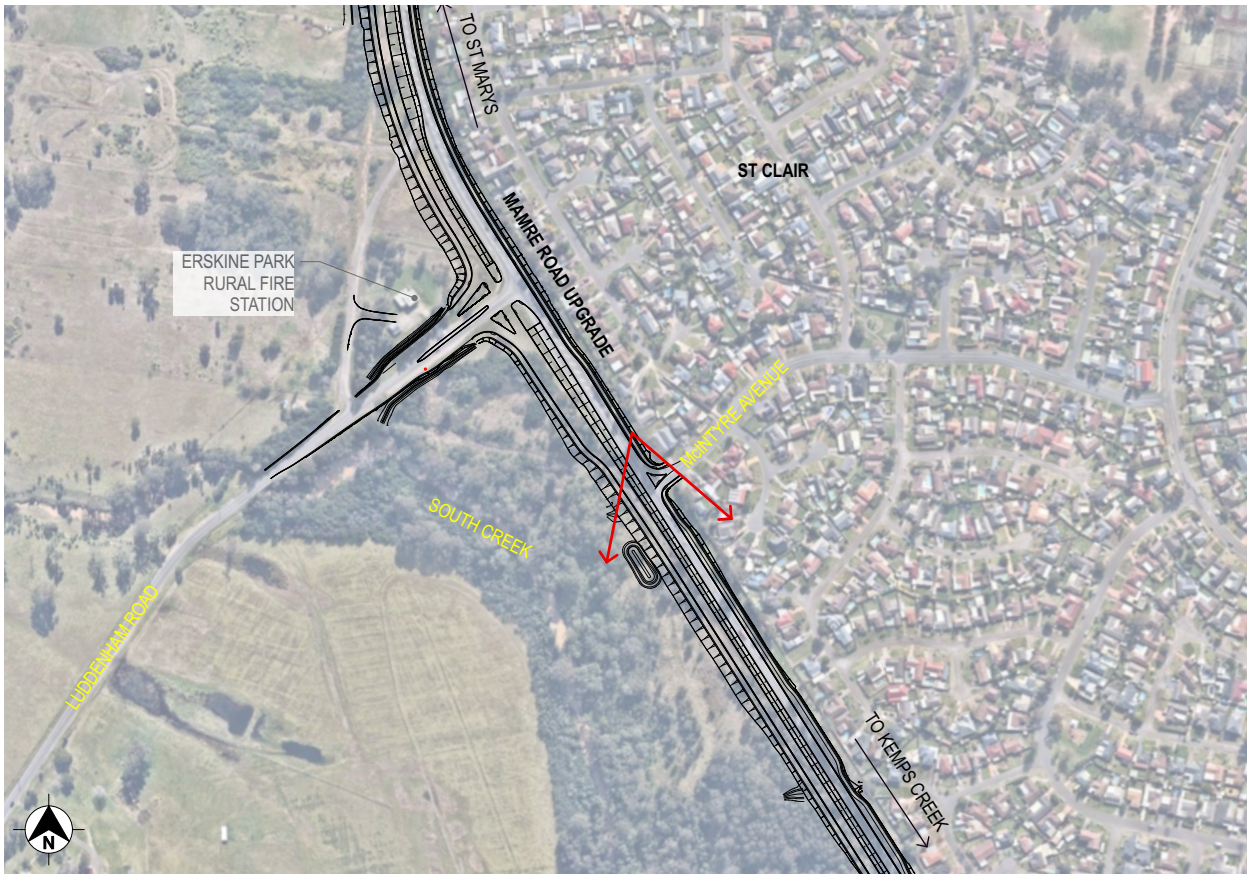


Figure 7-21: Viewpoint 7 location map

7 Visual impact assessment

Plate 7-7: Looking south along the existing southbound setback

7 Visual impact assessment

Figure 7-22: Viewpoint 7 - existing view looking south along Mamre Road

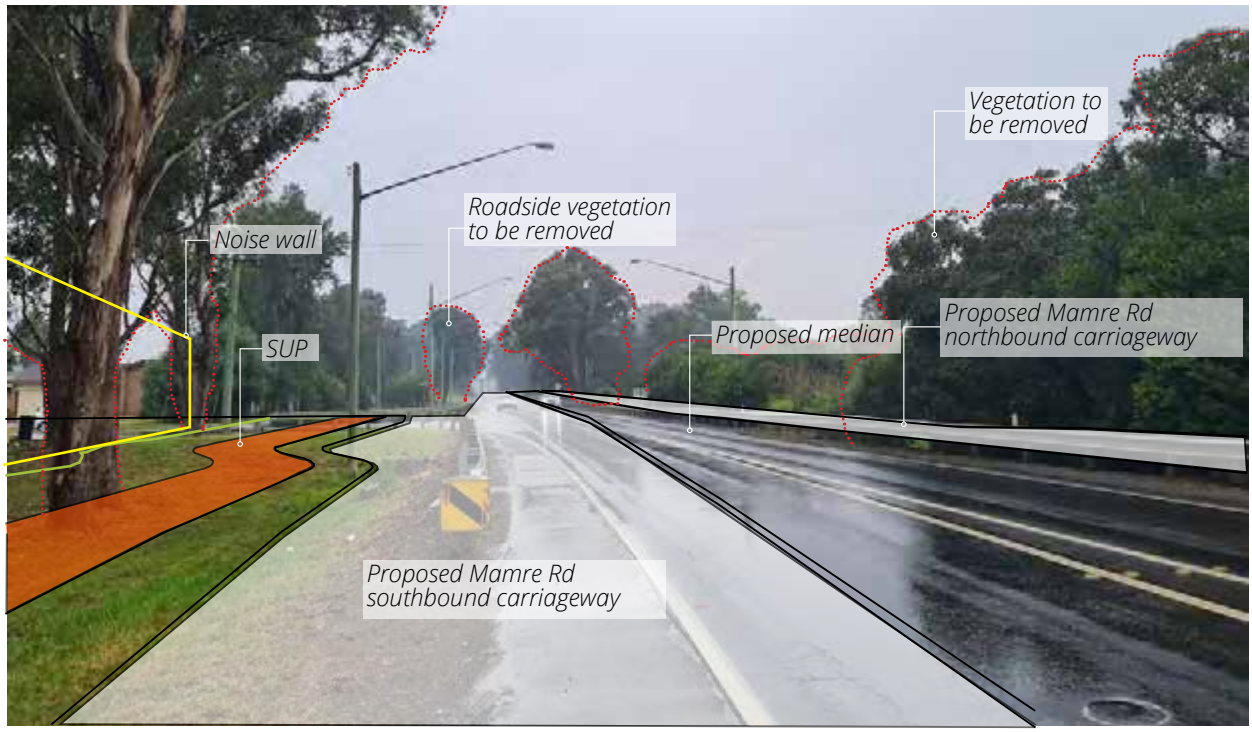


Figure 7-23: Viewpoint 7 - proposed view looking south along Mamre Road

Table 7-8: Visual impact summary viewpoint 7

Sensitivity	Magnitude	Impact
High – Views of the landscaped setback experienced by local residents are typically valued are generally considered to be highly sensitive to change.	High – The width of the road would almost double with substantial changes to the setback zones. The proposal constitutes an increase in the dominance of road infrastructure and loss of vegetation. The magnitude of the change to the view would therefore be considered high.	High

7 Visual impact assessment

Viewpoint 8

Location and description

This viewpoint is located in the northbound carriageway just south of the proposed intersection upgrade at Mandalong Close. (Figure 7-24). It looks north up Mamre Road corridor. The existing road corridor forms a major compositional element in the view, which includes two travel lanes, turning lanes and a painted median. On the right the eastern verge is dense with Alluvial Woodland (EEC) vegetation that creates a green east-west threshold across Mamre Road north of this viewpoint.

The entry to Mandalong Close is defined by white rendered brick walls topped with rustic Spanish style roof tiles and timber sleeper fencing. Running north and south of the intersection beyond the southern entry wall is a 1.5 m high earth mound that provides a visual barrier to the Mamre Road corridor. Larger vehicles moving along the Mamre Road are visible above the mound from this location. The western verge of Mamre Road affords open views across grazing land.

Visible elements of the project

At this location the road corridor would be raised above the existing ground level and the carriageway would be widened to accommodate additional travel lanes, turning lanes, a depressed median and light poles either side of the carriageway. The northbound setback would include road safety barriers while the southbound setback environment would include a SUP.

Affected viewers:

- Residents of Mandalong Close
- Staff, parents and children arriving and departing the Old MacDonald's Child Care.

Description of impacts

Although the new road corridor is elevated above the existing ground and would be wider at this location, it also includes a 20 m wide depressed median, which is likely to lessen the impact from the widened road corridor. The majority of the existing vegetation within the southbound setback would be retained and additional road furniture and a SUP are unlikely to the noticeably contribute to the prominence of the infrastructure within the view. Refer Figure 7-25 and Figure 7-26 on page 123.

Motorists at this location have a moderate sensitivity due to typically slower travel speeds resulting in a Moderate impact rating.

The visual impact on these viewpoints is summarised in Table 7-9. For mitigation measures relating to these views refer to Section 8 on page 133 of this report.

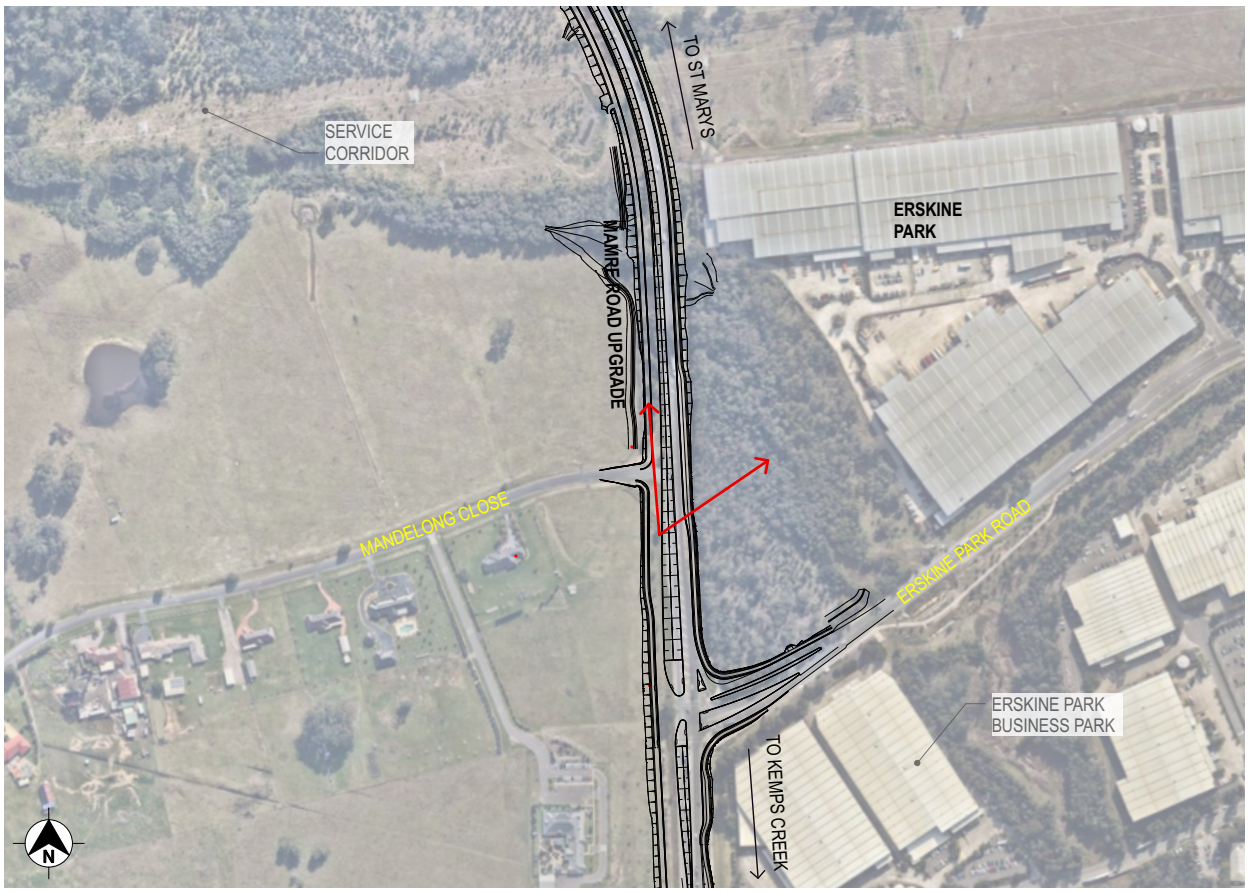


Figure 7-24: Viewpoint 8 location map

7 Visual impact assessment

Figure 7-25: Viewpoint 8 - existing view looking north-east across Mandalong Close intersection

Figure 7-26: Viewpoint 8 - proposed view looking north-east across the intersection

Table 7-9: Visual impact summary viewpoint 8

Sensitivity	Magnitude	Impact
Moderate – The rustic architectural features and pastoral setting of this view makes it visually sensitive. The visual sensitivity is considered moderate.	Moderate – The footprint of the road carriageway would increase, resulting in a larger portion of the view being comprised of road infrastructure. The magnitude would be considered moderate.	Moderate

Viewpoint 9

Location and description

This viewpoint is located at eastern property boundary of a rural-residential lot on Mandalong Close looking east towards Mamre Road (Figure 7-27). Grazing land dominates the foreground of the view and beyond this field a 1.5 m high earth mound that provides a visual barrier to the Mamre Road corridor. Larger vehicles moving along the Mamre Road corridor are visible above the mound although from this location to road carriageway can not be seen. Beyond the earth mounds, the major compositional element in the view is dense *Alluvial Woodland (EEC)* vegetation that stretches across the entire view (Plate 7-8).

Visible elements of the project

As the direction of the view is perpendicular to the proposed upgrade and at a similar elevation, this results in a relatively high capacity to absorb changes such as widening. While the proposed works are almost 110 m to the east, the proposal would remove the existing earth mounds, located in the northbound setback and would expose more of the upgrade from this location. Existing rural post and wire fencing would be reinstated where any sections are temporarily removed for access. New road furniture may also be visible from areas within the grazing land.

Affected viewers:

- Residents of Mandalong Close properties
- Indicative of staff, parents and children arriving and departing the Old MacDonald's Child Care.

Description of impacts

From this location the widened road carriageway is unlikely to be a more dominant feature within the view, however there would be an increase in the prominence of some road infrastructure elements and vehicles moving across the view as a result of the removal of exiting earth mounds. Refer Figure 7-28 and Figure 7-29 on page 126.

The introduction of more vertical features within this view would be noticeable to residents but the distance of the works from the viewpoint reduces the visual impact and results in a high-moderate impact rating.

The visual impact on these viewpoints is summarised in Table 7-10. For mitigation measures relating to these views refer to Section 8 on page 133 of this report.

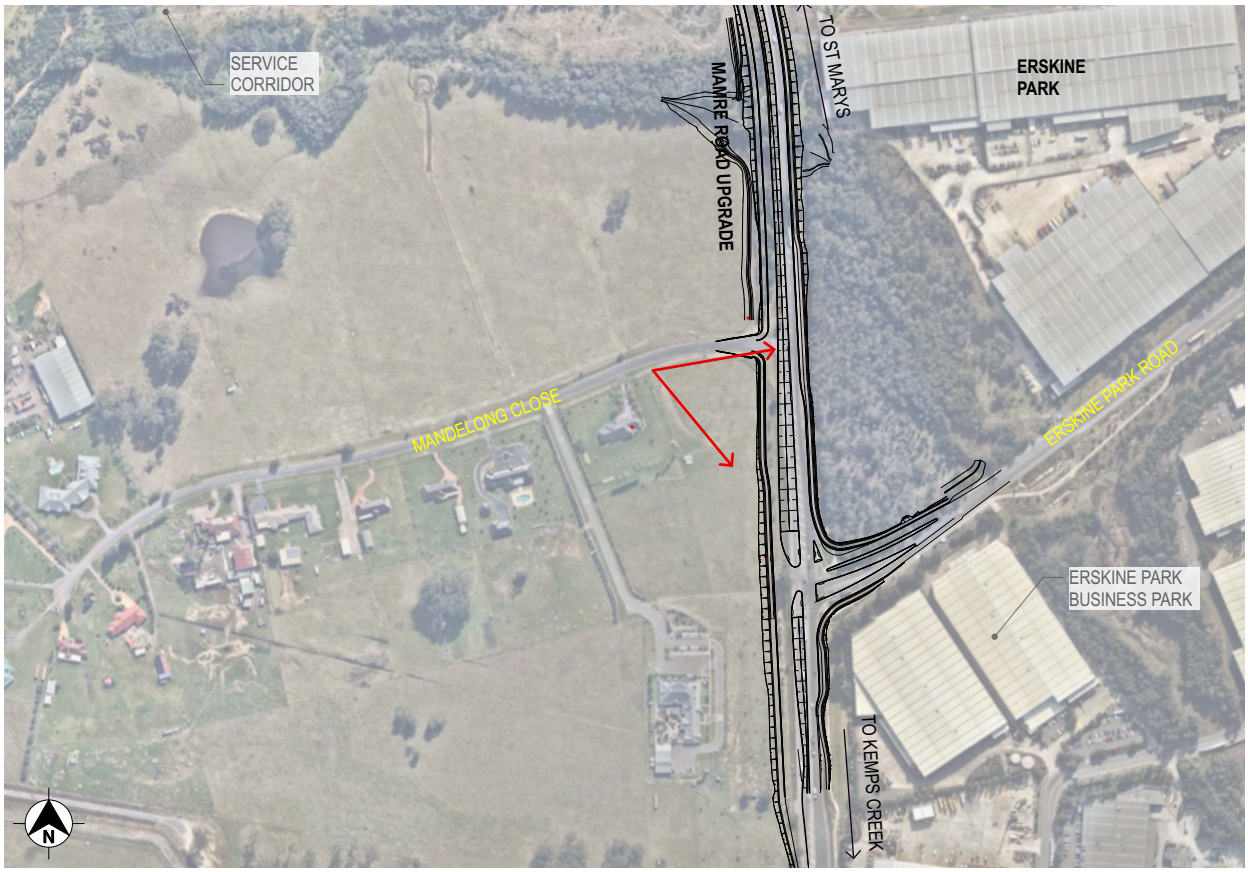


Figure 7-27: Viewpoint 9 location map

7 Visual impact assessment

Plate 7-8: Looking south-east from Mandalong Close towards the Mamre Road

7 Visual impact assessment

Figure 7-28: Viewpoint 9 - existing view looking east towards the upgrade (115 m from Mamre Road)

Figure 7-29: Viewpoint 9 - proposed view looking east towards the upgrade (90 m west of the proposal)

Table 7-10: Visual impact summary viewpoint 9

Sensitivity	Magnitude	Impact
High – Despite the viewpoint being located 90m from the proposal the pastoral setting of this view makes it highly sensitive to changes resulting from built infrastructure. The visual sensitivity is considered high.	Moderate – The proposal would require the removal of a visual mound and result in increased road pavement. The magnitude would be considered moderate.	High-Moderate

7 Visual impact assessment

Viewpoint 10

Location and description

This viewpoint is located in the north-western corner of the proposed intersection upgrade at Mamre Road and Erskine Park Road (Figure 7-30). It looks south-east across the Mamre Road corridor towards the Erskine Business Park. The existing road corridors form a major compositional element in the view and includes travel lanes, slip lanes, turning lanes as well as raised medians. To the left of the view, the eastern verge of the road corridor is dense Alluvial Woodland (EEC) vegetation that creates a green east-west threshold across Mamre Road north of this viewpoint.

The southern verge of Erskine Park Road is defined by large warehouses set behind landscaping that includes planted roadside verge areas, mown grass, concrete edged garden beds and mature trees. A rendered block work entry wall with a sculptural installation defines the precinct and a SUP runs along an open drainage culvert within the southbound verge of Mamre Road and the westbound verge of Erskine Park Road (Plate 7-9).

Visible elements of the project

At this location the road corridor would be widened to accommodate and upgraded T-intersection more travel lanes, slip lanes, bus stops, raised medians with safety barriers and pedestrian crossings.

Affected viewers:

- Motorists travelling on Mamre Road and Erskine Park Road.

Description of impacts

The new road corridor would be wider and would be elevated above the existing ground. While the majority of the existing vegetation within the southbound setback of Mamre road would be retained, additional road elements such as medians and bus stops would increase the prominence of the infrastructure within the view. The proposal would be highly visible at this location. Refer Figure 7-31 and Figure 7-32 on page 129.

Road users at this location have a lower sensitivity due to their inherent expectation of intermittent changes of the scale of the road along their journey, however the increase of road infrastructure would be noticeable and results in a moderate impact rating.

The visual impact on these viewpoints is summarised in Table 7-11. For mitigation measures relating to these views refer to Section 8 on page 133 of this report.

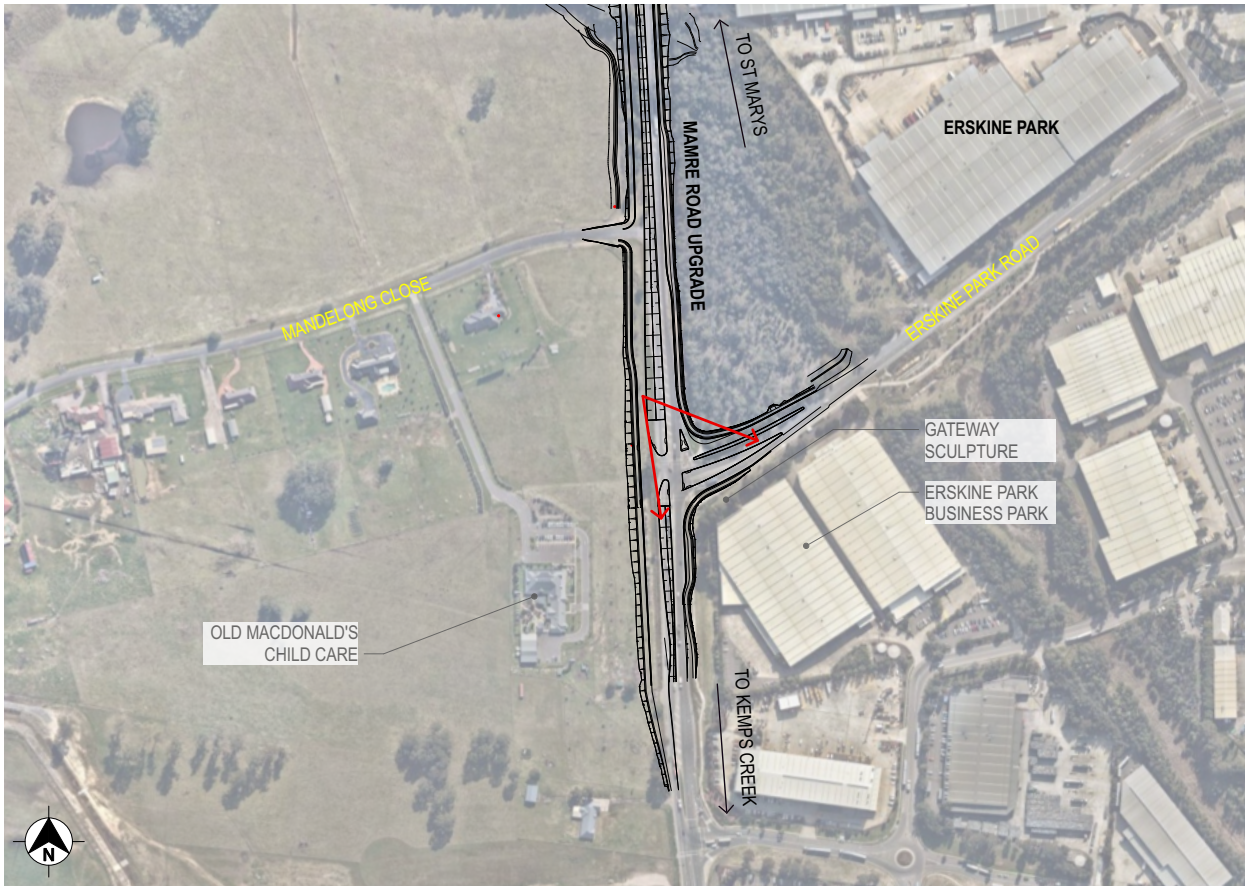


Figure 7-30: Viewpoint 10 location map

7 Visual impact assessment

Plate 7-9: Looking south-east towards Erskine Business Park

7 Visual impact assessment

Figure 7-31: Viewpoint 10 - existing view looking south-east towards the Erskine Business Park

Figure 7-32: Viewpoint 10 - proposed view looking south-east towards the Erskine Business Park

Table 7-11: Visual impact summary viewpoint 10

Sensitivity	Magnitude	Impact
Low – Major compositional elements in the view are the existing road corridor and vegetation associated with the business park. Overall, the sensitivity of the view is considered low.	Moderate – The footprint of the road corridor would increase. The magnitude would be considered moderate.	Moderate - Low

Plate 7-10: Aerial view looking south-east towards the Erskine Business Park

7 Visual impact assessment

7.3 Summary of visual impact assessment

The visual impact assessment has identified ten viewpoints, from which visual impacts resulting from the proposal can be demonstrated. Generally the proposal is an upgrade of the existing road corridor, with provision of western stubs for future access to residential development areas. The upgrade would be lifted from the existing Mamre Road for the majority of the alignment and widens the corridor to four lanes with a wide central median. The future design allows for sufficient width in the median for the ultimate six-lane design, which would include an additional lane in each direction.

Impacts are greatest where open recreational landscape and/ or vegetation is the dominant element in the view, which results in a high level of sensitivity to change especially where the upgraded road infrastructure would be more extensively observed. This includes potentially high impacts for viewpoints four and seven.

Viewpoints three, five, eight and nine are likely to experience high-moderate impacts as a result of degradation in the quality of the view caused by the increase in the dominance of road infrastructure as well as small losses of vegetation.

Viewpoints one and ten experience moderate impacts reflecting lower sensitivity as a result of the more highly modified existing environment including existing infrastructure that currently dominates the visual setting. Viewpoint two has a high level of sensitivity to change but impacts would be experienced at a distance of over 200 m, which results in a moderate impact.

Viewpoint six experiences a moderate-low rating due to an existing setting where infrastructure is already the predominant visual element.

The visual impact of the proposal across the study area is summarised in Table 7-12 below. Based on this assessment, a series of mitigation measures would be required to address the identified visual impacts and these are discussed further in Section 8 on page 133.

Table 7-12: Viewpoint assessment summary

VP	Location	Sensitivity	Magnitude	Impact
Stage 1				
1	Banks Drive intersection looking south	Moderate	Moderate	Moderate
2	Mamre House looking east towards the upgrade	High	Low	Moderate
3	Pedestrian portal at Alpine Court looking south	High	Moderate	High-Moderate
4	Drainage channel and culvert looking west towards the upgrade	High	High	High
5	Solander intersection looking north	Moderate	High	High-Moderate
6	Luddenham Road looking east towards the upgrade	Low	Moderate	Moderate-Low
7	McIntyre intersection looking south	High	High	High
8	Mandalong intersection looking north-east	Moderate	Moderate	Moderate
9	Mandalong Close property looking towards the upgrade	High	Moderate	High-Moderate
10	Erskine Park Road intersection looking towards entry feature	Low	Moderate	Moderate-Low

View south along Mamre Road from close to McIntyre Avenue

8 Mitigation strategy

8.1 Chapter overview

This section provides a summary of the mitigation measures that have been included as part of the concept design for the proposal. These mitigation measures have been developed in order to address the impacts identified in the visual analysis section of the report and would continue to be considered during the detailed design and construction phases of the proposal.

8.2 Mitigation incorporated in the concept design

The landscape and urban concept design responds to the overall proposal objectives and is underpinned by a set of specific landscape and urban design principles, which are set out in Section 4.

Mitigation measures are illustrated in detail in the Urban Design Concept Plans (01-19) Figure 4-9 on page 48 and a summary of these measures is listed below in Table 8-1.

Table 8-1: Mitigation measures

Mitigation #	Description of mitigation	Reason
Sense of place		
M01	Trees and tall shrubs have been arranged in clumps to represent a more natural character	To provide screen planting to childcare centre
M02	The design has protected existing sculptural art and preserved it in existing locations or reinstated it in a suitable location if works require that they are moved	Sculptural art signifies the gateway of the Erskine Park Employment Lands Precinct, which is an important precinct within the region
M03	Trees have been shown at regular intervals to provide an informal 'boulevard' treatment either side of the road upgrade.	A boulevard treatment helps to enhance the entry to the rural residential areas. Species are to be selected to preserve views across the scenic rural landscape
M04	Long vistas to the Blue Mountains escarpment have been maintained with any proposed planting framing these vistas	Selection of appropriate plant species, which are arranged with consideration of long range vistas of the Blue Mountains escarpment ensures that views remain the visual focus along this section of the road journey
M05	Diverse and varied planting species have been combined along the length of the road corridor	Varied plant species along the road journey would help to reinforce the different landscape character areas including the neighbourhood of St Clair and scenic rural areas to the west
M06	Removal of existing roadside remnant vegetation has been minimised	Avoiding the removal of existing vegetation would ensure that residential areas continue to be screened from the road and SUP environments are protected
M07	New driveway link from Banks Drive to Mamre House remains visually open	Maintaining the open quality of the heritage curtilage areas surrounding Mamre House ensures that views across the pastoral landscape are preserved
M08	Appropriate landscape treatments and suitable plant species have been used along the Mamre House curtilage area	Use of low plant species would ensure that views across to the historic Mamre House and the market gardens are preserved
M09	Potential noise wall surfaces have been designed to reflect the distinctive landscape character zones along the road corridor in consultation with specialist heritage advice.	Reinforcing the landscape character areas along the road corridor would contribute to a better experience of the journey as well as way-finding
M10	Heritage nodes are to associate with the road corridors historical features including bespoke treatments and interpretive nodes for Local and State Heritage listed Mamre House	Interpretive heritage items provide public interest and connection with country

8 Mitigation strategy

Mitigation #	Description of mitigation	Reason
M11	Plant species have been selected to screen and soften hard elements within the corridor	Vegetation can minimise visual bulk and provide a human-scale to built elements
Natural environment		
M12	All proposed laydown areas of the proposal disturbed by major work have been identified and are to be restored with appropriate native vegetation	To minimise the footprint of the road corridor especially for sensitive receptors
M13	Appropriate vegetation has been selected to be reinstated in riparian corridors associated with South Creek and tributaries	Appropriate selection of species mixes would ensure vegetation thrives and visual impacts of new works are minimised
M14	New planting areas are varied in selection of species, types and scale, as well as the density of spacing	Varied planting areas would help to distinguish separate zones along the journey experience
M15	Different landscape character areas have been represented through the selection of appropriate species	Maintaining and supplementing existing vegetation patterns ensures that the road corridor better integrates with the landscape
M16	Shallow gradients on batters have been utilised where possible	Shallow grades would aid plant establishment, reduce slope erosion and reduce future maintenance costs
M17	Landscape treatments adhere to the guidelines for designated Bush Fire Prone Land	Careful selection of plant species that include fire retardant plants that would maintain both the vertical and horizontal separation is maintainable would reduce the potential for fire to spread
Connectivity and way-finding		
M18	Specific requirements of drainage culverts in terms of pedestrian access have been allowed for and considered	Consideration of user behaviour and their requirements
M19	Pedestrian portals are to utilise architectural elements including colour, art, texture, lighting and signage, allowing for heritage interpretation opportunities	Use of architectural elements would help to define the journey for pedestrians, cyclists, motorists and public transport users
M20	Signage structures are to be consolidated and minimised	Reducing visual clutter and obstructions improves road user safety
M21	The alignment of the SUP has been staggered to cater for universal access that would accommodate an increasing level of use by the community	Maximising connectivity with the wider region would ensure that the SUP would become an integral part of the community and encourages physical activity
		Servicing the needs of (future) longer distance commuters that would connect with the Sydney Metro and/ or Green Grids
M22	Trees have been shown at regular intervals to provide feature 'boulevard' treatment at the Luddenham Road intersection	Trees planted would create a distinctive marker along the road journey and signal the intersection of the Luddenham Road regional link
M23	Pedestrian portals are configured to maximise pedestrian and cyclist safety and connections from St Clair residences	Utilising CPTED principles ensures that the pedestrian portals are a safe and well utilised link within the local area
M24	All planting conforms to sight lines and clear zone requirements.	Conforming to sight lines and clear zones increases road user safety
Sustainability		
M25	Existing roadside remnant vegetation has been supplemented.	Supplementing the roadside vegetation would increases shade within the SUP environment reducing temperatures and reinforcing endangered vegetation communities

8 Mitigation strategy

8.3 Mitigation to be incorporated in detailed design

Table 8-2 below lists recommendations and issues to be reduced during the detailed design phase.

Table 8-2: Detailed design recommendations

Design element	Detailed design stage recommendation/ comment
Road design:	
– SUP	– Provide a shared user path (SUP) along the entirety of the road corridors eastern verge
– Footpaths	– Provide footpath connections from the SUP to existing pedestrian networks along the entire road corridor
Structures:	
– Noise walls	– Design noise walls surfaces to reflect the distinctive landscape character zones along the road corridor
– Pedestrian portals	– Define portals to help contribute to a better experience as well as way-finding opportunities
Earthworks:	
– Cut batters	– Planting or turfing on the Eastern side of road corridor would be used unless for temporary erosion control measures during construction. The Western side of the road corridor would use predominately revegetation mixes.
– Fill embankments	– The eastern side of the road corridor would be planted with native grasses and shrubs to provide a robust and economical landscape treatment. The western side of the road corridor may include revegetation mixes unless located in visually sensitive locations. For example adjacent to residential areas.
Drainage and water quality	
– WSUD features	– Best-practice WSUD initiatives would be implemented where feasible to increase the environmental performance of the project especially when they
Road furniture:	
– Fences and barriers	– Adjust fence lines where property acquisition and adjustments are required – Where safety barriers are installed consider non frangible planting
– Signage	– Consolidate signage structures and minimises visual clutter and obstructions
– Lighting	– Ensure lighting is coordinated with tree planting both above and below ground to avoid clashes and any future maintenance requirements
Landscape treatments:	
– Feature planting	– Employ landscape sequencing techniques to improve user perception effectively promote distinctive character precincts and activity nodes along a corridor
– Riparian planting	– Species selection and planting layout would simulate a riparian setting and complement the character and habitat based on advise from ecologists
– Median planting	– Medians greater than 3 m wide to include low shrubs and positioned to provide further greening of the corridor – Tree planting within medians with safety barrier to be further considered and explored during detailed design – Turf would be installed along the edge of the kerb to prevent plant foliage
– Screen planting	– Particular emphasis is to be placed on creating a green corridor that reduces the apparent scale of large infrastructure interventions and structures
– Off-site mitigation	– Vegetation outside the road corridor boundary may assist in visually screening the upgrade
– Species	– Maintain and supplement the existing vegetation patterns to ensure that the road corridor better integrates with the landscape – Vary plant species along the road journey to reinforce the different landscape characters and areas

View west towards the Blue Mountains escarpment

9 Summary of Urban Design findings

Overview

Following an analysis of landscape context, the development of objectives, principles, strategies and mitigation measures, an assessment of landscape character and visual impact has been undertaken in accordance with TfNSW guidelines.

The results of this assessment have been incorporated into the concept urban design drawings and are to be further refined during detailed design.

The landscape character and visual impact assessment of the project represents a qualitative assessment based on the landscape character zones and selected representative viewpoints, which have been determined based on an investigation of landscape and cultural context as well as an analysis of land use, vegetation, topography and scenic values. This analysis then proposes a series of mitigation measures that are to be utilised to address the project impacts to landscape character.

Findings

Although a busy arterial road in its existing form, the proposal would see the upgrade of the road to a dual carriageway, with an accompanying substantial increase in road-related infrastructure. This related infrastructure includes pavement, earthworks, retaining walls, fences and barriers, drainage facilities including swales, basins and culverts, as well as the potential for noise walls in close proximity to existing residences. The proposal also includes the removal of a substantial number of existing trees.

In addition to the magnitude of physical change, many viewpoint locations, which are representative of views that are experienced by local residents, workers, tourists and road users would exhibit varying degrees of visual impacts, as would the identified character zones, which include a heritage site of state significance within a pastoral landscape and the natural woodlands associated with the surrounding creek lines.

Given these potential impacts, a series of measures have been developed, which must be implemented in order to mitigate these outcomes. These measures include planting and revegetation including the planting of a substantial number of trees, the design of a heritage interpretation node, the design and specification of high quality finishes in accordance with beyond the pavement guidelines, integration of earthworks forms and other measures that aim to minimise impacts of the proposal.


scape DESIGN