MOTT MACDONALD

Options Identification Report

Heathcote Road Strategic Route Assessment
M5 Motorway to Junction Road

July 2021

FOR PUBLICATION

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1 Introduction

1.1 Background

The Heathcote Road corridor is approximately 24km long and connects Newbridge Road at Liverpool with the Princes Highway at Heathcote. It provides an interchange with the M5 Motorway and connectivity to the M6 corridor via New Illawarra Road. The corridor passes through Liverpool City Council and Sutherland Shire Council.

The section of Heathcote Road between Moorebank Avenue/ Newbridge Road and Infantry Parade, Holsworthy is around 3.8 kilometres long and generally a four lane partially divided road, with a 300 metre long section just north of the M5 Motorway (between Junction Road and the M5 Motorway at Moorebank) which is currently a two lane undivided road and the subject of the proposed upgrade described in this report.

Transport for NSW (TfNSW) is currently working on multiple upgrades along Heathcote Road from Moorebank to Heathcote, including a 2.2 kilometre section between Infantry Parade at Holsworthy and The Avenue at Voyager Point. This section is being upgraded to a four-lane divided road, including duplication of the bridges over Harris Creek, Williams Creek, and the T2 Airport railway line and will open to traffic in 2024. The proposed upgrade of the 300 metre section of Heathcote Road at Moorebank is intended to complement these works.

1.2 Locality

The study area is located within the Liverpool City Council local government area, approximately 25 km south-west of Sydney. A strategic route assessment is currently being developed for the upgrade of the 300 metre long two lane undivided road beginning at Junction Road and ending just north of the M5 motorway. The investigation has considered the upgrade of this section to a four lane road (two lanes in each direction) to remain consistent with the whole length of Heathcote Road. Refer to Figure 1-1 for the project study area.

Figure 1-1: Project Study Area
(Source: TfNSW PS101)

1.3 Project Objectives

The following are the overall project objectives for the Heathcote Road corridor between Junction Road and the M5 Motorway:

- The proposed upgrade will support and enhance use of public transport particularly by improving access between Liverpool and Holsworthy stations.
- Facilitate:
  - Improved movement between Holsworthy and Liverpool for general traffic, freight and bus services operating along the corridor serving adjacent catchments including Liverpool, Moorebank, Hammondville and Holsworthy.
  - A safe and efficient environment for all road users
  - Investigate opportunities to improve active transport at this section to tie-in to the remaining corridor.
- Improve road congestion due to removal of the pinch point and improve road safety by reducing current crash rates.

The proposed upgrade will complement the 2.2 kilometre upgrade of Heathcote Road between Infantry Parade at Holsworthy and The Avenue at Voyager Point, which will be open to traffic in 2024.

1.4 Current Status of Project

Transport for New South Wales (TfNSW) is preparing multi-modal road network plans for all State roads in metropolitan Sydney. In 2020 TfNSW completed Road Network Plan (RNP) for Heathcote Road. The RNP study area covered 24.3 kilometres in the north-south direction from Newbridge Road in the north to Princes Highway in the south.

The Road Network Plan (RNP) provides a framework for the development and management of the Heathcote Road network, based on the network's strategic movement and place function and customer needs. It is part of a suite of supporting plans that deliver the NSW Government's Future Transport 2056 Strategy and the Greater Sydney Region Plan – A Metropolis of Three Cities. It outlines the vision for the network, and the challenges and opportunities over the short, medium and long-term; this will enable identification of the high level corridor objectives and broader networks aims in accordance with the movement and place framework.

At the timing of this Options Identification report, Risk, Health and Safety in Design (HSiD), Value Management and Constructability workshops have been held with relevant TfNSW stakeholder representatives and formal community consultation will be completed by mid-August 2021. Key feedback from the workshops and consultation will be considered as part of the strategic assessment and will assist with the next steps of the project, which includes finalisation of the preferred option.

1.5 Scope and services required

Mott MacDonald has been engaged by Transport for NSW (TfNSW) to provide the services for a strategic route assessment for Heathcote Road upgrade between the M5 Motorway and Junction Road, at Moorebank (approximately 300m).

The scope of work includes, but is not limited to, the following:

- Review, collate and evaluate existing investigations made available by TfNSW.
- Collate and evaluate existing data within the study area available from other agencies which may include environmental, geological, digitised DBYD mapping, land use and planning details, flood maps and other relevant data as required.
- Prepare a constraints map for the study area based on the collated information.
- Highlight gaps in existing information and determine additional investigations to be undertaken that would assist in assessing feasibility of options.
- Undertake traffic assessment and traffic modelling.
- Complete hydrology assessment and undertake preliminary flood modelling.
- In consultation with TfNSW, identify up to three localised options for the proposed preferred route alignment and prepare a strategic design alignment for each.
- Assess localised option alignment against the constraint mapping that has been collated and results from the investigations.
- Facilitate a Risk and HSiD workshop.
- Facilitate a Value Management and Constructability workshop
- Prepare an Options Identification Report that provides an outline and assessment of each option identifying key issues, advantages and disadvantages, alignment against objectives as well as identify and document costs, value, constructability, benefits, and risks.

- Facilitate a Preferred Options Workshop if required, with appropriate internal TfNSW stakeholders and selected external stakeholders (as agreed with TfNSW) to review the options developed, with the aim of determining the preferred route option.
- Review and update a strategic design for preferred route.
- Prepare a Preferred Option Report.

1.6 Purpose of the Options Identification Report

The purpose of this report is to provide an outline and assessment of each of the strategic options identified. The report will present relevant design information, identify key issues, advantages and disadvantages, alignment against objectives as well as identify and document costs, value, constructability; it will also assist with the determination of the preferred option.

2 Review of Options

Before considering options, early investigations were undertaken across the study area to identify existing land use, environmental, and engineering constraints relevant to future corridor preservation, and the delivery of transport infrastructure.

Constraints mapping is an important step in the corridor planning process and has added value to the project by identifying multiple constraints and opportunities in the study area for consideration. Overlaying the different constraints and opportunities within the study area allows for corridor options to be identified and achieve a workable balance between different impacts on property, land use, identifying wetlands areas, threatened and endangered species habitats, floodplains, historical, recreational (encumbered) and contaminated properties. Wherever possible, impacts on the most sensitive constraints are avoided. For unavoidable impacts, mitigations are considered that can reduce the severity of the impact.

The constructability of future infrastructure within a corridor is also a critical consideration. The road reserve will need to be of sufficient width to accommodate space for up to four lanes of general traffic plus a wide shoulder to allow for on road cyclists. Space within the corridor is also needed to accommodate shared paths, footpaths, verges, utilities relocations and road furniture.

The following criteria have been applied to the options analysis:

- Widen the existing two-lane Heathcote Road between the M5 and Junction Road to four lanes with two lanes in each direction.
- Provide a 1.5m nearside shoulder in both directions to allow for future on road cyclists.
- Signalise the existing Heathcote Road / Junction Road intersection.

The following three options were investigated:

- **Option 1 – Widening to the West**
  - Maintain the existing kerb line on the eastern side of Heathcote Road and widen to the west (towards the existing commercial properties)
  - Maintain the existing vertical geometry where possible
  - Provide a new retaining wall on the western side to cater for the widening
  - Avoid impact to the Anzac Creek
  - Avoid impact to the shared path between Heathcote Road and Anzac Creek
  - Realign the service road between Heathcote Road and the commercial properties

- **Option 2 – Widening to the East**
  - Maintain the existing kerb line on the western side of Heathcote Road and widen to the east (towards Anzac Creek)
  - Maintain the existing vertical geometry where possible
  - Provide a new retaining wall on the eastern side to cater for the widening
  - Avoid impact to the commercial properties on the west
  - Realign the shared path between Heathcote Road and Anzac Creek where required

- **Option 3 – Widening on both sides**
  – Equal widening to both the eastern and western side of Heathcote Road where possible
  – Maintain the existing vertical geometry where possible
  – Provide a new retaining wall on both the eastern and western side of Heathcote Road to cater for the widening
  – Realign the service road between Heathcote Road and the commercial properties
  – Realign the shared path between Heathcote Road and Anzac Creek where required

2.1 Initial Assessment

The initial designs for the three options included the following:

- Two-way traffic along the service road and at the Heathcote Road / Junction Road intersection.
- 90-degree intersection angle for the service road leg of the intersection.
- Full turning radius provisions for a 19m semi-trailer to exit the service road.
- Impact to the fuel station for Options 2 and 3 due to the widening on the east of Heathcote Road.

The Constructability and Value Management workshop was held with relevant TfNSW and Mott MacDonald representatives on the 1st March 2021. The key items raised in the workshop included limiting impact to the fuel station, limiting flood impact, access to the service road and Junction Road. Exit only movement at the service road was also suggested during the workshop and was eventually implemented in the design to improve safety and reduce property impacts.

2.2 Current Options

Following the Constructability and Value Management workshop, the three options were refined to include the following:

- Exit-only movement from the existing service road (alternate route to be used to enter the service road is via Church Road – Moorebank Avenue – M5 Motorway – Heathcote Road – Left into Centenary Road).
- No impact to the fuel station for Options 2 and 3 for movements southbound, providing a smaller radius curve at the Heathcote Road / Junction Road intersection and tie into the existing nearside kerb adjacent to the fuel station.

Refer to Appendix A for the current proposed options.

3 Considerations

3.1 Physical constraints

Heathcote Road between the M5 Motorway and the Junction Road intersection is constrained on both the eastern and western side due to the following:

- Property Impacts:
  - Industrial properties with major workshops / facilities west of Heathcote Road
  - Industrial properties north of Junction Road
  - 7-Eleven fuel station on the east of Heathcote Road at the corner of the Heathcote Road / Junction Road intersection
  - Residential properties on the east of the Anzac creek susceptible to potential flooding
- Retaining walls:
  - Existing retaining wall on the east of Heathcote Road – condition and durability of retaining wall to be determined in future design stages
  - Existing retaining wall on the west of Heathcote Road – condition and durability of retaining wall to be determined in future design stages
- Utilities:
  - Jemena high pressure gas mains – located at the Heathcote Road / Junction Road intersection and continues along Heathcote Road after the intersection
  - Sydney Water potable watermains – located along the service road and at the Heathcote Road / Junction Road intersection
  - Major communication utilities – located along the service road and at the Heathcote Road / Junction Road intersection
  - Telecommunication tower – located at the southern end of the service road, between the service road and Heathcote Road
  - Variable Message Sign (VMS) – Located on the corner of the Heathcote Road / Junction Road intersection
- Anzac creek:
  - Located on the east of Heathcote Road
- Service road:
  - Located on the west of Heathcote Road
- M5 Motorway:
  - Southern tie-in to project
- Flooding Risks:
  - Both Junction and Heathcote Road are considered to currently be at Medium to High Risk during the 1% AEP storm event with both roads to be cut off in events as low as the 5% AEP event

3.2 Road Design

3.2.1 Design Standards

The below standards were referenced when producing the design:

- Austroads Guides (and RMS Supplements to Austroads Guides) including but not limited to:
  - AGRD03-16 Guide to Road Design Part 3: Geometric Design
  - AGRD04-17 Guide to Road Design Part 4: Intersections and Crossings
  - AGRD04A-17 Guide to Road Design Part 4A: Unsignalised and Signalised Intersections
  - AGRD06-10 Guide to Road Design Part 6: Roadside Design Safety and Barriers
  - AGRD06A-17 Guide to Road Design Part 6A: Paths for Walking and Cycling
- AS1742 Manual of Traffic Control Devices

3.2.2 Cross Section

The following cross section was applied along Heathcote Road from the M5 Motorway to Junction Road:

Table 3-1: Cross Section

Cross Section Element	Minimum Widths (m)
Lane Width	3.5
Nearside Shoulder Width	1.5
Offside Shoulder Width	0
Median Width	4.5
Right Turn Lane Width	3.0

3.2.3 Design Criteria

The following design criteria was applied along Heathcote Road from the M5 Motorway to Junction Road:

Table 3-2: Design Criteria

Element	Design Criteria
Design Speed	70 km/h
Posted Speed	60 km/h
Crossfall	3%
Maximum Superelevation	5%
Minimum Horizontal Radius	160m
Maximum Vertical Grade	6%
Minimum Crest Curve (K Value)	19.1
Minimum Sag Curve (K Value)	13
Minimum Stopping Sight Distance	83m
Design Vehicle (Heathcote Road)	26m B-Double
Check Vehicle (Heathcote Road)	26m B-Double
Design Vehicle (Heathcote Road / Junction Road Intersection)	19m Semi-Trailer
Check Vehicle (Heathcote Road / Junction Road Intersection)	19m Semi-Trailer

3.2.4 Existing Design

The existing Heathcote Road between the M5 Motorway and the Junction Road intersection contains two 3.5m lanes, one in each direction. The shoulder width varies in both directions with a wider shoulder on the northbound nearside lane to account for sight distance, reducing to 0.5m close to the intersection with Junction Road.

This portion of road is posted at 60 km/h. The Heathcote Road bridge over the M5 includes two through lanes in each direction which continues into the study area. The northbound two lanes are dropped to one lane approximately 80m from the intersection and the southbound one lane widens to two lanes approximately 80m from the intersection. There is a dedicated right turn lane from Heathcote Road into Junction Road. The Heathcote Road / Junction Road intersection contains a priority treatment and the Heathcote Road / Centenary Avenue consisting of a left in-left out treatment.

The Heathcote Road / M5 Motorway interchange is on a crest curve with an approximately 6% downgrade towards Junction Road. There is a sag curve close to the Heathcote Road / Junction Road intersection with an approximate 1% upgrade thereafter. Junction Road contains a crest curve at the intersection with Heathcote Road, with a downgrade towards the culvert on Junction Road, approximately 130m away from the intersection. Junction Road is a two-lane road with a posted speed of 50 km/h.

An existing service road is located on the western side of Heathcote Road. There is a restricted left turn into the service road from Heathcote Road northbound. The service road provides access to the industrial properties on the western side of Heathcote Road and continues around the properties into Centenary Avenue.

Between the end of Junction Road and M5 Eastbound on-ramp, there is an existing shared pedestrian path to the east to Heathcote Road. On the western side, between Heathcote Road and the service road, there is currently no formal footpath.

3.2.5 Proposed Design

It is proposed to widen Heathcote Road from two lanes to four lanes, two lanes in each direction. This will correlate with the rest of Heathcote Road containing four lanes. The design options will tie-in to the existing four lanes just north of the M5 Motorway. A dedicated right turn lane into Junction Road will be provided. The design options will tie in to the existing four lanes on Heathcote Road after the Heathcote Road / Junction Road intersection.

The posted speed will remain at 60 km/h with a design speed of 70 km/h. It is proposed to maintain the existing vertical alignment where possible thus limiting the amount of pavement works required. Where the design options utilise the existing road, the proposed pavement is a mill and resheet with 40mm AC14 (A15E). For the widened areas and new pavement, the proposed pavement is a 180mm asphalt (40mm AC14 (A15E) and 140mm AC20 (AR450)), 200mm heavily bound base and a 300mm SMZ. Where poor ground conditions occur, an additional 300mm lower UZF layer is proposed.

The Heathcote Road / Junction Road intersection will be signalised and the results from the traffic modelling that was undertaken required a dedicated left turn lane from Junction Road to Heathcote Road to ensure an overall intersection performance with a level of service D.

A 1.5m shoulder is provided on either side of Heathcote Road to allow for future on-road cyclists. There is no provision for on-road cyclists after the Heathcote Road / Junction Road intersection, thus requiring cyclists to exit at the intersection. A formal shared path is provided on the western side of Heathcote Road and adjacent to the service road.

The key differentials between the options are:

- **Option 1:**
  - The widening on the west will require a new retaining wall to be constructed. This retaining wall will largely impact the existing service road. The service road will therefore require realignment within the current property boundary.
  - The tie-in to the existing Heathcote Road north of the Heathcote Road / Junction Road intersection on the western side will impact the current verge in this area. The property boundary is set back in this location. No additional property acquisition will be required.
  - The realigned service road will follow the existing ground alignment where possible, however batters will be required adjacent to the properties thus having additional impact to the properties.
  - Construction offset to the service road will need to be considered when acquiring property as additional building impacts will be expected.
- **Option 2:**
  - The widening on the east will require a new retaining wall to be constructed. This retaining wall can largely be constructed offline without major impacts to Heathcote Road.
  - The superelevated curve at the Heathcote Road / Junction Road intersection and the widening to the east creates a level difference between Heathcote Road and the existing ground at the intersection. A batter is therefore proposed adjacent to the shared path which will reduce the storage for flooding.
- **Option 3:**
  - The widening on the west will require a new retaining wall to be constructed. This retaining wall will impact the existing service road; however, the impact will not be as severe as Option 1. The service road will therefore require realignment within the current property boundary.
  - The widening on the east will require a new retaining wall to be constructed. This retaining wall can largely be constructed offline without major impacts to Heathcote Road.
  - The tie-in to the existing Heathcote Road, north of the Heathcote Road / Junction Road intersection on the western side will impact the current verge in this area. The property boundary is set back in this location. No additional property acquisition will be required.
  - The superelevated curve at the Heathcote Road / Junction Road intersection and the widening to the east creates a level difference between Heathcote Road and the existing ground at the intersection. A batter is therefore proposed adjacent to the shared path which will reduce the storage for flooding.

3.2.6 Constraints Analysis Considering Road Design

Whilst all options have similar design criteria and will result in a similar road design overall, Option 2 is considered the least impactful due to the overall smaller footprint. This option also has the least impact from a pavement perspective as it includes the least amount of new pavement works.

3.3 Traffic

A SIDRA network model and VISSIM microsimulation models have been developed to assess the existing traffic conditions and assess the expected traffic conditions of the proposed design options. A do-minimum scenario was assessed for the base year (2020) and future years (2026 and 2036). This includes the Heathcote Road / Junction Road intersection maintaining existing priority controls. The preferred scenario was thereafter modelled for the same years and providing the following changes to the do minimum scenario:

- Two lanes in each direction for Heathcote Road between the M5 Motorway and Junction Road
- Signalise the Heathcote Road / Junction Road intersection
- Exit only allowance from the service road

The following intersections were modelled and illustrated in the figure below:

- IC01 Heathcote Road / Seton Road
- IC02 Heathcote Road / Centenary Avenue
- IC03 Heathcote Road / Junction Road
- IC04 Heathcote Road / M5 Motorway ramps
  - IC04a M5 North ramps
  - IC04b M5 South ramps
- IC05 Heathcote Road / Nuwarra Rd – Wattle Grove Rd

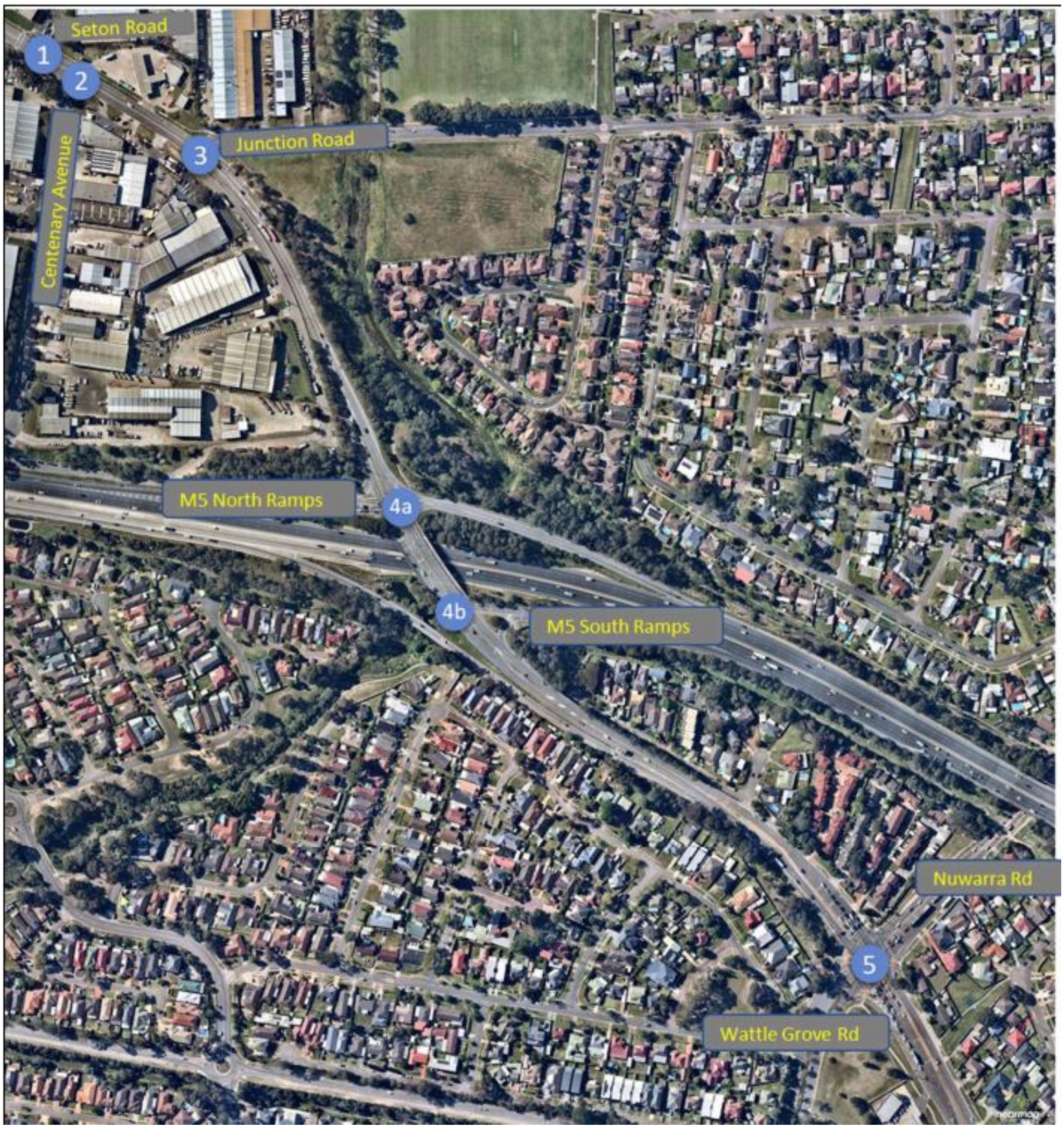


Figure 3-1: Extent of the Traffic Models

The existing Heathcote Road / Junction Road intersection currently performs at a level of service (LOS) F. The proposed works will greatly benefit this intersection as well as relieve other parts of the network.

3.4 Flooding

3.4.1 Existing Model

A review of the existing ANZAC Creek Floodplain Risk Management Study & Plan (FRMSP) as well as an existing case TUFLOW run has found the following:

Results from the existing scenario flood modelling in line with the Anzac Creek FRMSP suggest that backwater from Lake Moore (ultimately caused by Georges River) is causing inundation upstream of the Creek at Junction and Heathcote Road. Flood waters from the western portion of Heathcote Road are ponding at a sag prior to overtopping onto Junction Road. This water is attempting to drain into Anzac Creek however as the downstream tailwater level at Lake Moore is too high, the free flow of the creek is restricted.

Both Junction and Heathcote Road are considered to be at Medium to High Risk during the 1% AEP storm event with both roads to be cut off in events as low as the 5% AEP event.

3.4.2 Options Assessment

All three strategic options look at raising the intersection between Heathcote and Junction Road by either raising the southbound lane of Heathcote Road or lowering the location of the proposed service road. As a result of these changes, all three options resulted in additional pockets of flooding around the service road, creation of a new flow paths on the verge of Junction Road and an increase in flood afflux upstream within the industrial area.

Recommendations to mitigate this flood afflux is outlined in section 3.4.4 and will be investigated further in subsequent planning stages.

3.4.3 Constraints Analysis Considering Flooding Impacts

Despite all three options causing an increase in afflux, Option 1 appears to have the least impact as the road design levels in this option best replicate the existing design. Analysis of the other options show a loss in the temporary storage of flood water causing flows to be transferred to other areas of Heathcote and Junction Road.

3.4.4 Further Options Assessment

A possible solution to limit the impact of flooding on the service road (property side) will be the introduction of additional drainage pipes across the alignment to discharge to the open area on the east of Heathcote Road. This will result in additional flooding impacts on the eastern side. Additional mitigations for this are:

- Formalise a channel to Anzac Creek
- Earthworks for additional flood storage

This can be further assessed after the decision of the preferred route for Heathcote Road.

3.5 Drainage

The design of the proposed drainage system for the Heathcote Road strategic route assessment has been undertaken in accordance with the requirements of the project brief to develop a strategic concept drainage design.

This section outlines the drainage infrastructure for the proposed upgrade.

3.5.1 Design Criteria

The design of the proposed drainage system has been undertaken to meet the following design criteria:

- Design of the drainage system has been undertaken with a climate change factor of 19.7%.
- Pavement drainage pit and pipe network designed to convey the 10% AEP storm event.
- Maximum allowable flow width in the kerb of 1m in the 10% AEP storm event, into the travel lane. Where SA kerb is located on the high side of the road the maximum allowable flow width is 0.5m for full capture of runoff within the kerb.
- A desirable minimum pipe grade of 1% has been allowed. Where the longitudinal grade of the road is less than 1% and other site constraints are present an absolute minimum pipe grade of 0.5% has been adopted.
- A minimum cover is to be adopted, to allow for the design pavement thickness with 300mm clearance from the obvert of the pipe to the controlled subgrade. In areas where this cover is unable to be achieved, because of site constraints, a reduced cover will be required allowing the pipes to be located within the SMZ layer. This will need to be assessed further as the design progresses.
- Minimum pipe size of longitudinal drainage is 375mm diameter and the minimum pipe size of transverse drainage is 450mm diameter.

3.5.2 Pavement Drainage

The minor drainage reticulation system comprises of a below ground pit and pipe network which collects stormwater runoff from the proposed road alignment to control nuisance flooding and enable effective stormwater management for the proposed road alignment. The major drainage system incorporates overland flow routes through the proposed road hardstand and landscaped areas to cater for minor system failures. The major drainage system is to be designed in a manner that ensures that personal safety is not compromised. Three options have been developed, with each of the layouts summarised in the following sections.

3.5.2.1 Option 1

The following drainage works are proposed as part of Option 1, as summarised below:

- The pit inlet for the existing 1050 mm diameter transverse drainage pipe at Chainage 240 to be adjusted/reconstructed to suit the revised road alignment.
- The existing batter drains on the eastern and western kerbs at the southern end of the proposed works are to be removed/made redundant through the introduction of the Type F barrier. This results in a lager catchment being directed to the existing drainage system in Junction Road when compared to existing conditions.
- North-bound carriageway, the following works are proposed:
  - A new pit and pipe network are to be provided along the proposed Type F and SA kerbs from Chainage 290 to 360. To connect to the existing drainage pit at Chainage 390.

  - A new pit and pipe network are to be provided along the proposed SA kerb from Chainage 490 to 390. To connect to the existing drainage pit at Chainage 390.
  - The existing drainage pit at Chainage 390 is to be converted to an inspection pit and adjusted to suit the proposed surface level.
  - The existing drainage network on the existing western kerb alignment on the local service road from Chainage 220 to 390 is to be removed.
  - The existing drainage network on the existing western kerb alignment from Chainage 290 to 340 is to be removed.
- South-bound carriageway, the following works are proposed:
  - A new pit and pipe network are to be provided along the proposed Type F and SF kerbs from Chainage 170 to 370. To connect to the proposed drainage line on the north bound carriageway.
  - A new pit and pipe network are to be provided along the proposed SA and SF kerbs from Chainage 480 to 390. To connect to the existing drainage pit at the Junction Road intersection at Chainage 390.
  - The existing drainage pit at Chainage 390 is to be converted to an inspection pit and adjusted to suit the proposed surface level.
- Junction Road intersection, the following works are proposed:
  - A new pit and pipe network are to be provided to drain the new island and widened SA kerb on the southern side of the alignment. To connect to the existing drainage pit on the existing northern kerb alignment.

3.5.2.2 Option 2

The following drainage works are proposed as part of Option 2, as summarised below:

- The outlet for the existing 1050 mm diameter transverse drainage pipe at Chainage 200 to be adjusted/reconstructed to suit the revised road alignment.
- A break in the SA kerb is to be provided at Chainage 50 on the western kerb and Chainage 80 on the eastern kerb, with a batter drain provided to discharge runoff to the base of the proposed batter as per existing conditions. Erosion protection to be provided at the discharge point at the outlet.
- North-bound carriageway, the following works are proposed:
  - A new pit and pipe network are to be provided along the proposed Type F and SA kerbs from Chainage 250 to 300. A pit is to be constructed to connect to the existing drainage pipe at Chainage 300.
  - A new pit and pipe network are to be provided along the proposed SA kerb from Chainage 310 to 345. To connect to the existing drainage pit at Chainage 345.
  - A new pit and pipe network are to be provided along the proposed SA kerb from Chainage 450 to 355. To connect to the existing drainage pit at Chainage 355.
  - The existing drainage pit at Chainage 345 is to be converted to an inspection pit and adjusted to suit the proposed surface level.
  - The existing drainage pit at Chainage 355 is to be converted to an inspection pit and adjusted to suit the proposed surface level.
  - The existing drainage network on the existing western kerb alignment from Chainage 250 to 300 is to be removed.

- South-bound carriageway, the following works are proposed:
  - A new pit and pipe network are to be provided along the proposed Type F and SF kerbs from Chainage 130 to 330. To connect to the proposed drainage line on the north bound carriageway.
  - A new pit and pipe network are to be provided along the proposed SA and SF kerbs from Chainage 430 to 360. To connect to the existing drainage pit at the Junction Road intersection at Chainage 360.
  - The existing drainage pit at Chainage 360 is to be converted to an inspection pit and adjusted to suit the proposed surface level.
- Junction Road intersection, the following works are proposed:
  - A new pit and pipe network are to be provided to drain the new island and widened SA kerb on the southern side of the alignment. To connect to the existing drainage pit on the existing northern kerb alignment.

3.5.2.3 Option 3

The following drainage works are proposed as part of Option 3, as summarised below:

- There are no adjustments required to the existing 1050 mm diameter transverse drainage pipe at Chainage 220.
- A break in the SA kerb is to be provided at Chainage 75 on the western kerb and Chainage 120 on the eastern kerb, to direct runoff to the existing batter drains.
- North-bound carriageway, the following works are proposed:
  - A new pit and pipe network are to be provided along the proposed Type F and SA kerbs from Chainage 270 to 320. A pit is to be constructed to connect to the existing drainage pipe at Chainage 320.
  - A new pit and pipe network are to be provided along the proposed SA kerb from Chainage 325 to 360. A pit is to be constructed to connect to the existing drainage pipe at Chainage 360.
  - A new pit and pipe network are to be provided along the proposed SA kerb from Chainage 470 to 365. To connect to the existing drainage pit at Chainage 365.
  - The existing drainage pit at Chainage 365 is to be converted to an inspection pit and adjusted to suit the proposed surface level.
  - The existing drainage network on the existing western kerb alignment from Chainage 270 to 320 is to be removed.
- South-bound carriageway, the following works are proposed:
  - A new pit and pipe network are to be provided along the proposed Type F and SF kerbs from Chainage 150 to 350. To connect to the proposed drainage line on the north bound carriageway.
  - A new pit and pipe network are to be provided along the proposed SA and SF kerbs from Chainage 420 to 375. To connect to the existing drainage pit at the Junction Road intersection at Chainage 375.
  - The existing drainage pit at Chainage 375 is to be converted to an inspection pit and adjusted to suit the proposed surface level.
- Junction Road intersection, the following works are proposed:
  - A new pit and pipe network are to be provided to drain the new island and widened SA kerb on the southern side of the alignment. To connect to the existing drainage pit on the existing northern kerb alignment.

3.5.3 Constraints Analysis Considering Drainage Impacts

The amount of existing drainage removal work is similar for both Options 2 and 3 which is less than that required for Option 1. The amount of existing pit adjustments is similar for Options 2 and 3 which is less than that required for Option 1.

The existing 1050mm cross drainage pipe is unaffected by the Option 3 works. Extensions / reconstruction of either the inlet or outlet are required as a part of the Option 1 and 2 works. The amount of proposed drainage work required for all options is similar. From a hydraulic design point of view all options result in similar pipe size and pit spacing requirements. However, Option 1 results in slightly more catchment discharging to the existing drainage system in Junction Road when compared to existing conditions.

3.6 Utilities

The project study area is highly constrained by the existing utilities on both sides of Heathcote Road. There are major utilities which will be impacted by the design including high pressure gas mains, multiple telecommunication providers and large potable watermains. A summary of the impacts due to each option is described below.

3.6.1 Utilities Impact for Option 1

3.6.1.1 Junction Road Intersection

- Full relocation of the overhead electrical network to align with the new junction, overhead comms also present.
- Integrity digs and protection of the primary gas main required (70m), testing points will need relocating.
- Underground comms network will need to be relocated.
- All underground assets at the intersection of Heathcote Road and the service road to be relocated apart from the Jemena primary main.

3.6.1.2 Western Side of Heathcote Road

- Potable watermain (300mm diameter) in the service road verge will need to be relocated.
- Sewer manholes on the service road will have to be adjusted.
- All overhead and underground electrical assets on the service road will need to be relocated.

3.6.1.3 Eastern Side of Heathcote Road

No impact.

3.6.2 Utilities Impact for Option 2

3.6.2.1 Junction Road Intersection

- Full relocation of the overhead electrical network to align with the new junction, overhead comms also present.
- Integrity digs and protection of the primary gas main required (20m).
- Underground comms network will need to be relocated.
- All underground assets at the intersection of Heathcote Road and the service road to be relocated apart from the Jemena primary main.

3.6.2.2 Western Side of Heathcote Road

No impact.

3.6.2.3 Eastern Side of Heathcote Road

- Overhead Endeavour Energy to the south of the Junction Road intersection to be relocated.
- Comms underground network to the south of the Junction Road intersection to be relocated.
- Potable watermain under pavement (450mm diameter) to be protected.

3.6.3 Utilities Impact for Option 3

3.6.3.1 Junction Road Intersection

- Full relocation of the overhead electrical network to align with the new junction, overhead comms also present.
- Integrity digs and protection of the primary gas main required (30m), testing points will need relocating.
- Underground comms network will need to be relocated.
- All underground assets at the intersection of Heathcote Road and the service road to be relocated apart from the Jemena primary main.

3.6.3.2 Western Side of Heathcote Road

- Potable watermain (300mm diameter) in the service road verge will need to be relocated.
- Sewer manholes on the service road will have to be adjusted.
- All overhead and underground electrical assets on the service road will need to be relocated.

3.6.3.3 Eastern Side of Heathcote Road

- Overhead Endeavour Energy to the south of the Junction Road intersection to be relocated.
- Comms underground network to the south of the Junction Road intersection to be relocated.
- Potable watermain (450mm diameter) to be protected.

3.6.4 High-Risk Utility Identification

The following utilities have been identified as high-risk utilities.

3.6.4.1 Jemena Primary Main:

There is a Jemena primary main (3500kPa, 508mm diameter) present within the footprint of the project. Primary mains are considered major assets by Jemena.

Investigation/integrity digs and structural assessments of the pipe are required if there are any proposed changes to the ground conditions around the pipe. An example of this is building pavement over the pipe where it is currently under verge. This process may also show that an element of the pipe may need repair or replacement.

Protection slabs or encasements are generally required in these instances. The design of these slabs requires the information obtained from the integrity digs (exact RL’s and alignment of the existing pipe) and therefore can have a large impact on the delivery works program.

If relocation of the main is required, pipe materials can have a lead time of up to 12 months. Design and procurement periods can be 18-30 months.

3.6.4.2 Sydney Water Potable Watermains >300mm Diameter:

Sydney Water potable watermains of diameter greater than 300mm are considered major assets by Sydney Water Corporation.

Any cutover/isolation of mains of this size may require the works to occur during the winter months (June-September) when there is lower demand on the water system.

3.6.4.3 Multiple Telecommunications Providers:

There are multiple comms asset owners identified in the area including Telstra, Optus, NBN, PIPE Network and AARNet. Having multiple providers in the same network can have a significant impact on the works program as the pulling and cutover of the different providers cables will typically occur consecutively. Lastly, there is a telecommunications tower at the end of the Heathcote Road service road cul de sac with multiple providers leading in (Telstra, Optus, Pipe Networks and NBN), this congestion may present additional lead times for cable cutovers.

3.6.5 Constraints Analysis Considering Utility Impacts

From the perspective of utility impacts, Option 2 is the least impactful. Not only is this due to the smaller quantitative utility assets affected by this option overall (as shown in the summary table above) but also the reduced impact that Option 2 has on the two most critical assets within the project footprint which are the Jemena primary main and the Sydney Water potable mains (300mm plus diameter sizes). Option 1 has the most significant impact on the localised utilities. Despite the similarities in Options 1 and 3, Option 1 has a greater impact on the Jemena primary main and therefore presents a far greater cost and program risk.

3.7 Geotechnical

3.7.1 Available Information

No geotechnical investigation data is available in close proximity to the area of interest as noted within the TfNSW QA Specification PS101 for *Heathcote Road from Junction Road to M5 Motorway, Strategic Route Assessment* dated 30/06/2020.

Reports available in Minview maps for the surrounding areas were reviewed to deduce the geological stratigraphy and the information obtained is presented in Table 3-3 and Table 3-4.

In addition, reports available in eSPADE maps were also reviewed and this is described in Section 3.7.2.

Table 3-3: Available Geotechnical Investigations

Ref. ID	Date	Report Number	Company	Location	Investigation Type	Purpose	Offset from Site
1	13 Feb 1998	GT0001668	Geotechnical Services Group	Liverpool Public School	Borehole	New Building	2.2km NW
2	22 Nov 1990	GT0001667	Design Control Branch Public Works	Liverpool Weir	Borehole	Construction Works	2.4km NW
3	25 Feb 1977	GT0001670	NSW DPWS	Moorebank	Borehole	Lake Dredging	1.2km NW
4	28 Feb 1984	GT0000547	Douglas Partners	Moorebank	Borehole	Lake Dredging	1.4km NW
5	Aug 1999	GT0003116	NSW DPWS	Wattle-Grove Public School	Borehole	Proposed Development	2.1km SW

Table 3-4: Summary of Subsurface Conditions

Ref ID	Depth to base of layer (m bgl)				
	Silty Sand/Sand	Silty Clay/Clay-Silt	Sandy Clay/ Clay	Sand	XW[2] Shale
1	0.6	1.6 (St-VSt)			>1.6
2	6.8				>6.8
3	3.1		1.2 (VSt)	6.8-7.5	6.8-7.5
4			1.5 (St)	3.95	
5		2.6 (Fill)	6.8 (F-St)		>6.8

Notes to Table 3-4: Summary of Subsurface Conditions:

(1) (m bgl) – meters below ground level
(2) Soil consistency obtained from relevant geotechnical investigation reports as referenced. Consistency of residual soil – F-Firm, St- Stiff, and Vst-Very Stiff
(3) XW-Extremely Weathered

Review of the geotechnical reports for Lake Moore Dredging Project (report no. 3 and 4) given in Table 3-3 above indicates that this area in Moorebank is generally underlain by stiff-very stiff clay underlain by extremely weathered shale that might be encountered at a depth of 6.8-7.5m below ground surface. The lake site in Moorebank lies within similar geology which comprises of Quaternary Holocene Alluvium (*Qha*) which is relatively a more recent geological formation compared to Quaternary Pleistocene Alluvium (*Qpn*) that lies within subject site Heathcote Road. Therefore, a stiffer material is expected at Heathcote Road due to over consolidation with time. Table 3-3 shows a similar geological environment. However, these investigations were done approximately 1.4km to 2.4km away, therefore, the consistency of soil and rock depth may vary within the actual site due to changing geological conditions.

3.7.2 Site conditions

Topographically the site lies within gently undulating terrain with the highest elevation at the southern end of the site near M5 Motorway (about 17m AHD) and lowest elevation at the northern end of the site near junction road (about 8m AHD) with a total fall in elevation across the site to the north in the order of approximately 9-10m based on Google Earth Maps.

Reference to the factual report (No. 9030bp from eSPADE), the site is vegetated with low dense grass and some large to medium trees. There are mainly three primary vegetation associations found within the area which is based on Eucalyptus fibrosa (broad-leaved ironbark), Angophora bakeri (narrow-leaved apple) and E. sclerophylla (scribbly gum) (Murphy, 1973). Melaleuca decora and M. nodosa (paperbarks) often occur as a small tree layer (Benson, 1981).

There is an existing creek, approximately 30-60m away to the east of Heathcote Road.

3.7.3 Subsurface conditions

Reference to *Penrith 1:100,000 Geological Series Sheet 9130* (NSW Department of Mineral Resources, 1983) indicates that the site is underlain by Quaternary Pleistocene Alluvium (*Qpn*) comprising medium-grained sand, clay and silt as shown in Figure 3-2 below.

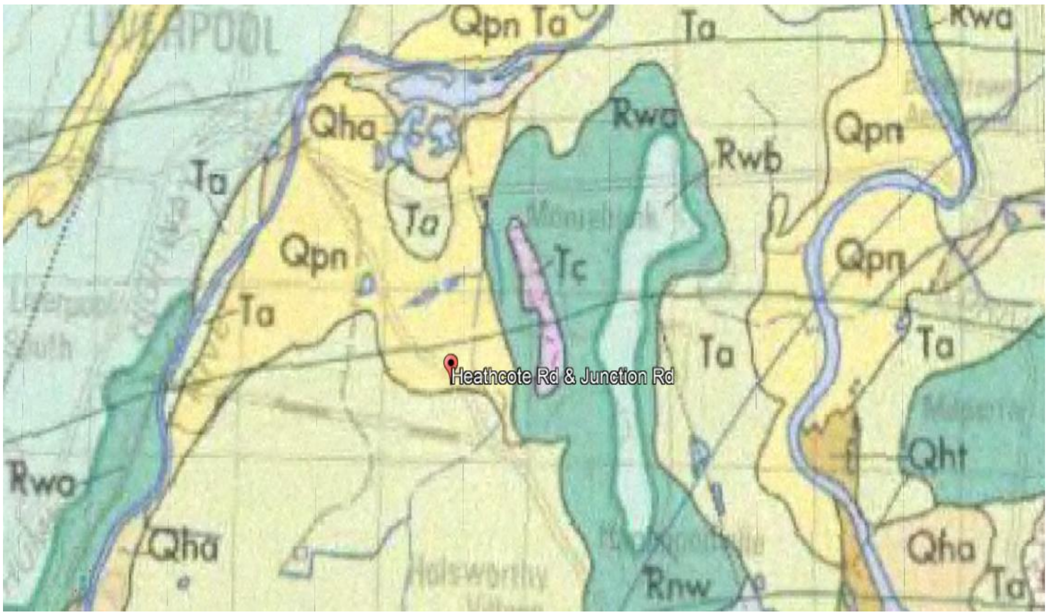


Figure 3-2: Penrith 1:100,000 Geological Map

3.7.4 Proposed Geotechnical Investigations

Geotechnical investigations are proposed to further inform the design. The key design elements considered for the geotechnical investigation are the following:

- Existing embankment fill quality.
- Potential retaining walls required on the eastern and western sides to support the widening works. These retaining walls may need to be piled.
- Existing and new pavements for the widening works.

3.7.5 Existing Retaining Walls

As-Built drawings, (DWG- F5/AB/CSB/91196| A | 24-03-92) and (DWG- F5/AB/CSB/91793| B | 27-11-91) provided by TfNSW were reviewed to get an understanding of the geometry of the existing walls and reinforced straps.

Based on the drawings, the maximum heights for retaining wall 2 (western side retaining wall) and retaining wall 3 (eastern side retaining wall) are approximately 4.9m and 4.1m respectively. The maximum heights occur at about Chainage 915 and Chainage 895 (based on control line M0G1) for retaining walls 2 and 3.

The length of reinforcement straps varies from 4.0m to 8.0m and 12.0m to 15.0m for western side and eastern side walls. The length of straps gradually increases towards the south for western side wall and towards the north for eastern side wall.

3.7.6 Proposed Retaining Walls

Retaining wall options were assessed by considering the following:

- Road alignment options, i.e. Option 1 (road widening to the west) and Option 2 (road widening to the east).
- Proposed height of the wall.
- Potential loading.
- Potential Cost and Aesthetics.
- Temporary traffic access.
- Compatibility with existing RSW walls.
- Construction Constraints.

The figures below show the potential wall type sections with approximate dimensions of existing walls, required construction zone for proposed retaining walls and temporary road footprint available for traffic during construction for Option 1 and Option 2. The retaining walls are only shown for approximate chainages that will require walls due to widening works.

3.7.6.1 Road Alignment Option 1

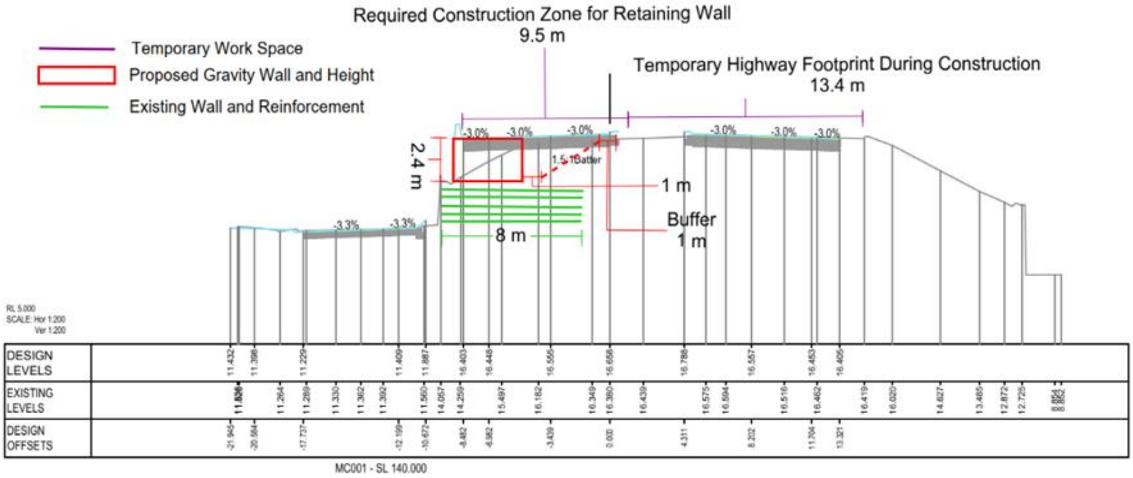


Figure 3-3: Wall Type-A (CH100-160 based on control line MC001)

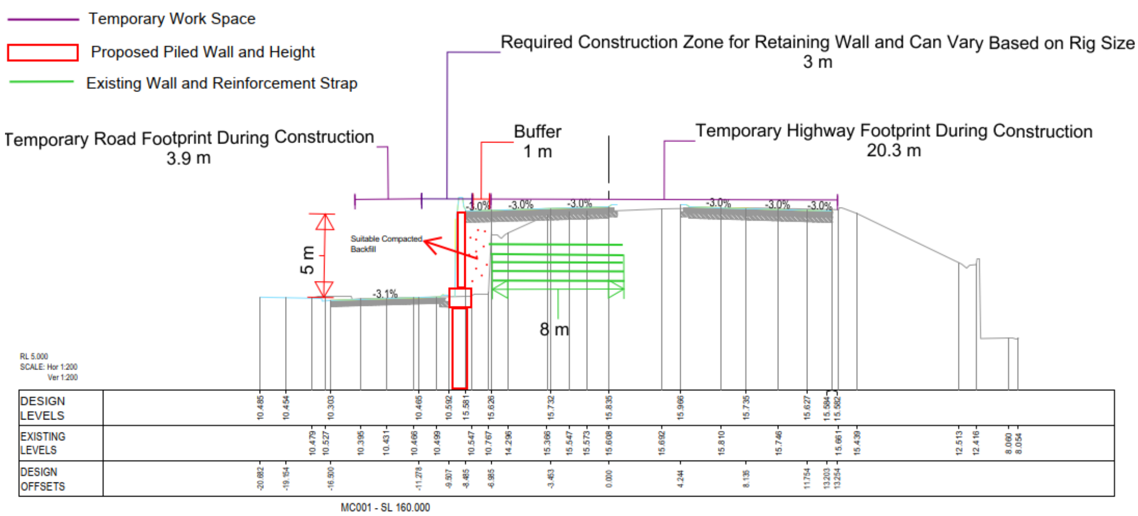


Figure 3-4: Wall Type-B (CH160-190 based on control line MC001)

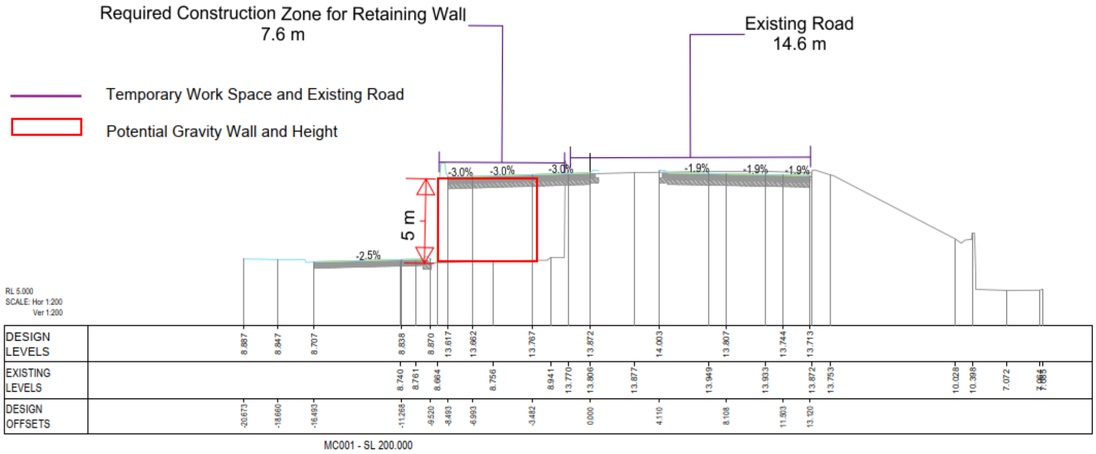


Figure 3-5: Wall Type-A (CH190-330 based on control line MC001)

3.7.6.2 Road Alignment Option 2

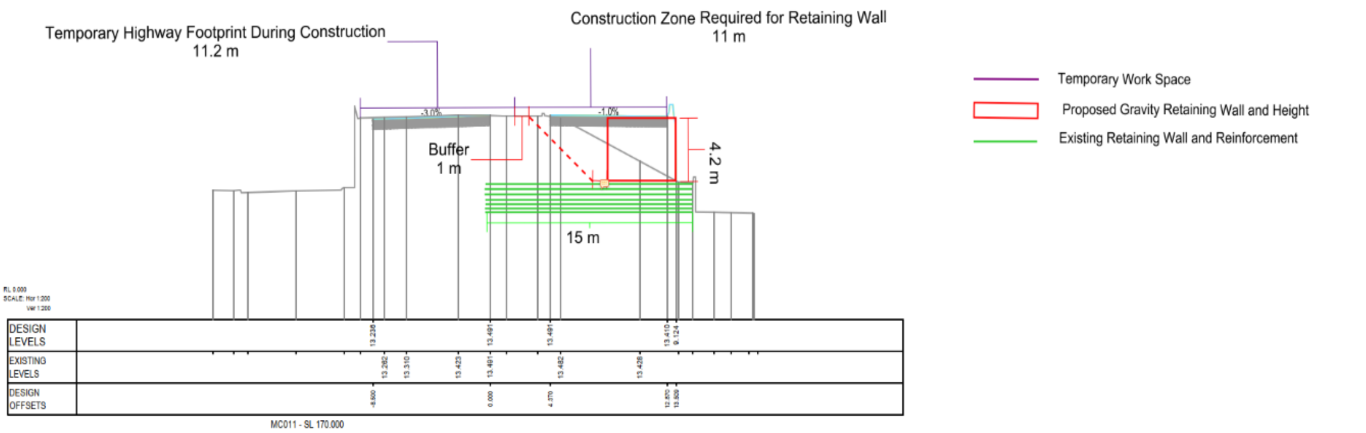


Figure 3-6: Wall Type A (CH80-270 based on control line MC011)

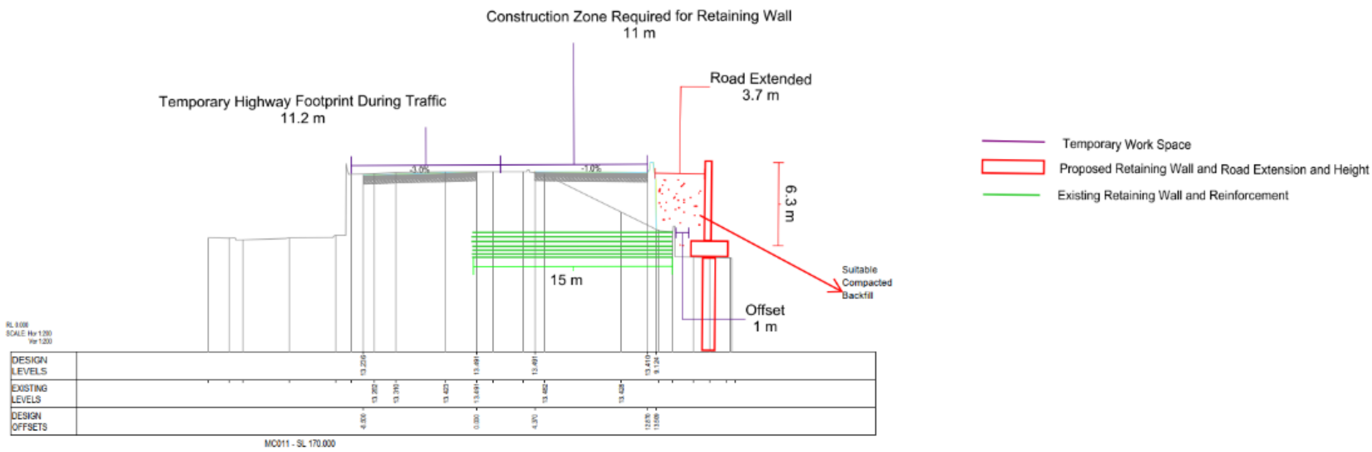


Figure 3-7: Wall Type B (CH80-270 based on control line MC011)

3.7.6.3 Discussion

Retaining walls Type A and B have been considered as potential suitable wall options for Heathcote Road Upgrade. Retaining wall Type A is a gravity wall that can be either Reinforced Soil Wall (RSW), L-shaped concrete wall or any other similar gravity wall and retaining wall Type B is a concrete piled wall.

Table 3-5: Advantages and Disadvantages of Each Wall Type

Wall Type	Advantages	Disadvantages
Type A: Gravity Wall	➢ Lower cost ➢ Simpler construction	➢ Needs to be place on top of existing RSW for certain sections of the road. Reliance on Existing Retaining Wall for Long-Term Stability attracts Project Risks. ➢ Space required for Construction may interfere with existing Heathcote Road traffic.
Type B: Concrete Piled Wall	➢ Requires less space behind wall for construction ➢ Provides greater confidence on stability of retaining live traffic on existing road. ➢ Less disruptive to Heathcote Road traffic	➢ Higher cost and more construction phases and likely to take longer. ➢ Would require road widening in certain sections of the road. For instance, needs to be widened further beyond the existing RSW wall if existing RSW is to be retained and a new concrete piled wall is to be built beside it.

Based on Table 3-5, a combination of wall Type A and Type B for Option 1 was considered due to lower construction cost with majority of the wall section (CH100-160 & CH190-330) having the wall Type A (lower cost) and only a small section of the wall (CH160-190) having wall Type B. But having combination of both wall types will require ensuring that the wall face appears similar for increased aesthetic. Also having a combination of these wall types mean that for certain sections of the road the new RSW will have to be constructed on top of existing RSW as shown in Table 3-5, which is not ideal as the existing RSW might not be designed to carry an additional load on top. Therefore, wall Type B is proposed as the preferred wall for the entire retaining wall in Option 1. Having a single wall type, viz. Type B, facilitates maintaining a similar external finish for better aesthetics.

For Option 2, wall Type A was considered for the entire retaining wall due to lower construction cost, but that means encountering the same issue as Option 1 which is for some sections of the road new RSW wall will need to be constructed on top of the existing wall as shown in Figure 3-7 and discussed in Table 3-5 It is not ideal to construct new RSW on top of existing due to existing RSW possibly not designed to support any additional load on top. Therefore, wall Type B is proposed as the preferred wall for the entire retaining wall in Option 2 which is more expensive but a more feasible option due to longer design life and more stability.

Road Alignment Option 3 will require construction of retaining walls either side on Heathcote Road and wall Type B will be the preferred solution.

3.7.7 Constraints Analysis Considering Retaining Walls

For all options, wall Type B is proposed thus the least impactful option will be Road Alignment Option 2 due to the mainly offline construction and shorter length of the retaining wall.

Road Alignment Option 3 is the most impactful option due to the complexity of construction, number of construction stages and length of retaining walls.

3.8 Environmental

A Stage 1 Preliminary Contamination Assessment was undertaken by Mott MacDonald to investigate the potential contamination risks within the study area. The Stage 1 assessment is a desktop study only, therefore Geotechnical Investigation and intrusive soil or groundwater sampling will be required in future design stages.

The findings identified in the Stage 1 Preliminary Contamination are summarised below.

- **Historic land use:** There were several key changes to the landscape within the Study area and surrounding areas between 1943 and 1965. Native vegetation was significantly cleared for agriculture purposes, there was an increase in residential properties and small to medium crop plots were developed on several large properties. The history of the Study area indicates the presence of agriculture activities, orchards and market gardening which represents a potential risk of soil and groundwater contamination from the discharge of agrochemicals and organic matter.
- **NSW EPA POEO public register**: An online search produced records to suggest the presence of contamination within the Study area. There are properties adjacent to the proposal which hold POEO licence or have surrendered licence in the past for activities to process and store waste materials. The search included two EPA breach notices issued to these sites for improper waste storage within the facility and for undertaking activity without an appropriate licence which may present a risk of contamination in the area.
- **The NSW EPA contaminated land record database**: The search identified one within one kilometre from of the proposal with active maintenance order. The site is remediating Polychlorinated Biphenyls contaminants in soil which may have potential risk of contamination in groundwater.
- **The planning certificates:** Certificates were purchased from the council to adjacent five properties along Heathcote Road is identified being potentially or actually contaminated in accordance with the relevant guidelines based on previous or current land use of the following:
  - Agricultural/ horticultural activities, Airports, Asbestos production/disposal, Batteries manufacture and recycling, Chemicals such as use or manufacture of acid/alkali products, adhesives/ resins, dyes, explosives, fertiliser, flocculants, foam production, fungicides, herbicides, paints, pesticides, pharmaceuticals, Service stations and fuel storage facilities
  - Defence work, Drum reconditioning, Dry cleaning, Electrical Engine works such as mechanics and air conditioning repairers, Foundries, Gas works, Iron and steel works, Landfill sites, Marinas Metal treatments, Mining and extractive industries Photography, rubber manufacture and solvents, Power stations, Printing shops, Railway yards, Scrap yards, Sheep and cattle dips, Smelting and refineries, Tanning and associated trades Water and sewage treatment plants, Wood preservation.
- **Site Inspection findings:** The site inspection recognised several potential sources of contamination within the proposal:
  - The property (45 Heathcote Road) was identified to be storing and repairing vehicles.
  - The property (49 Heathcote Road) was observed to be storing and sorting of unknown materials
  - The property (53 Heathcote Road) included underground refuelling tanks and oil barrels were not stored in bunded areas.
  - Uncontrolled dumping of waste material was also noted.
  - There is a service station within the Study area with ground water monitoring wells and

  - Embankment with unknown fill material from M5 construction.
- The information provided in specification PS101 (issued by TfNSW) indicated a potential risk of PFC's contamination around the proposal.

The evidence to date suggests there is a medium to high risk of contamination adjacent to the proposal area, however further investigation (including soil sampling) is necessary to assess the extent of soil and groundwater contamination, if present.

3.8.1 Constraints Analysis Considering Environmental Factors

From a contamination perspective, Option 2 has the least impact, as it has less risk of contamination within the properties compared to Options 1 and 3 which require a larger acquisition area and possible building impacts. However, it must be noted that overall Option 2 will require more clearance of flora.

3.9 Property Impacts

3.9.1 Constraints Analysis Considering Property Impacts

It can be determined that Option 2 has the least impact with regards to property impacts. It will require minor partial acquisition only with minimal loss to parking spaces and driveway access. Option 1 will have the largest property impacts overall including building impacts which could result in additional or full acquisition.

3.10 Road Safety

A road safety audit will be conducted after the selection of the preferred option. The existing Heathcote Road / Junction Road is unsafe as it is a priority intersection with traffic from the service road allowed to turn right and traffic from the Junction Road allowed to turn right. The intersection also includes a movement to allow traffic to turn right into the service road from Heathcote Road. These movements combined creates an unsafe intersection with a high possibility of accidents. It is therefore proposed to signalise the intersection to provide a safer environment.

3.11 Construction Staging

The construction staging for the project will be developed as the design stages progress. Due to the constrained location and highly trafficked road, construction staging is key to minimise impact to the road users, local community, and businesses. The proposed construction staging major milestones for each option is described below.

3.11.1 Option 1

1. Early works for utility relocation.
2. Construct new pavement for the new service road and thereafter switch the traffic over from the existing service road to the new service road.
3. Narrow the width on Heathcote Road to allow for one lane in each direction with minimum lane and shoulder widths. Construct the new retaining wall on the western side of Heathcote Road adjacent to the new service road. Construction of the new northbound lanes and thereafter switch traffic over from the existing Heathcote Road to the newly constructed northbound lanes.

4. Mill and resheet of the new southbound lanes and median. Allow for traffic to include the two lanes in each direction.
5. Construct left turn slip lane on Junction Road.

3.11.2 Option 2

1. Early works for utility relocation
2. Narrow the width on Heathcote Road to allow for one lane in each direction with minimum lane and shoulder widths. Construct the new retaining wall on the eastern side of Heathcote Road. Construction of the new southbound lanes and thereafter switch traffic over from the existing Heathcote Road to the newly constructed southbound lanes.
3. Mill and resheet of the new northbound lanes and median. Allow for traffic to include the two lanes in each direction.
4. Construct left turn slip lane on Junction Road.

3.11.3 Option 3

1. Early works for utility relocation
2. Construct new pavement for the new service road and thereafter switch the traffic over from the existing service road to the new service road
3. Narrow the width on Heathcote Road to allow for one lane in each direction with minimum lane and shoulder widths
4. Construct the new retaining wall on the western side of Heathcote Road adjacent to the new service road. Construction of the new pavement for the northbound lanes
5. Construct the new retaining wall on the eastern side of Heathcote Road. Construction of the new pavement for the southbound lanes
6. Move traffic to the eastern side (new pavement and existing pavement) and mill and resheet the new northbound lanes
7. Move traffic to the western side (new pavement and existing pavement) and mill and resheet the new southbound lanes and construction of the median
8. Construct left turn slip lane on Junction Road

3.11.4 Constraints Analysis Considering Construction Staging

Based on the number of construction stages and complexity of each stage, it can be determined that Option 2 is the least impactful with regards to construction staging. It includes mainly offline construction with the least impact to existing Heathcote Road traffic.

Option 3 has the most impact due to the complexity of construction, number of construction stages and close construction to live traffic.

3.12 Constructability

The constructability workshop held on 1st March 2021 allowed participants to identify the major constructability constraints and issues that could potentially arise during construction.

A summary of high priority constructability issues and recommended actions are summarised below.

Table 3-6: High Priority Constructability Issues

Project issue	Improvement Action	Responsible Party	Timetable
Commercial building Impacts	Investigate options that minimise impacts to the Western side of Heathcote Road. Investigate potential for closing off service road entrance from Heathcote Road	MM, TfNSW	Options Analysis
Option 3 proposes the road to be widened on both sides. This will impact both retaining walls as well as make it difficult for traffic staging	Pile walls seem less obstructive in comparison to RE and Gravity options. Consider Pile walls as the less obstructive methodology for widening works	MM	Options Analysis
Durability of existing walls	Determine the remaining design life of the existing retaining walls	MM	Options Analysis
Construction of retaining walls in a constrained location	Due to footprints - piling type of retaining wall may be preferred. Consider other retaining wall options in area where it may be more efficient Investigate building new retaining wall with existing retaining wall Consider impact of RE wall footings around utilities in footways and how properties are serviced	MM	Options Analysis
Potential of a retaining wall required adjacent to the petrol station	Investigate opportunities to avoid a retaining wall adjacent to the petrol station	MM	Options Analysis
All three options currently require a form of property acquisition	Consider options to limit the impact to building impact Futureproofing of the 6 lane cross sections to limit property acquisitions where it's not necessary	MM	Options Analysis
Depending on structural adjustments, additional land take could occur	Targeted survey to be done to identify critical impact areas Consider remediation strategy for properties acquired	TfNSW	Concept Design

3.13 Health and Safety in Design (HSiD) / Risks

The HSiD and Risk Workshop held on 5th March 2021 allowed participants to identify the major HSiD and risk constraints and issues that could potentially arise during construction.

A summary of high priority HSiD and risk issues listed below:

- Environmental concerns with acquisition of properties
- Hazardous material e.g. Asbestos, PFC's
- Utilities within the corridor
- Community disapproval
- Insufficient announced funds
- Budget availability
- Procurement within the required timeframes of the project
- Ultimate further acquisition may be required in the future
- Properties to go through compulsory acquisition
- Full property acquisition may be required instead of partial property acquisition
- Availability of resources to design and construct the project

3.14 Value Management

The value management workshop held on 1st March 2021 allowed participants to review the potential project options at a high level and recommend key improvements that can be achieved focusing on:

- Economy
- Efficiency
- Effectiveness

The table below includes the value improvements that were undertaken post-workshop.

Table 3-7: Value Improvements

No.	Value Improvement	Actions Resolved
1	No impact to the Fuel Station: • No impact to utilities in this area • Potential contamination within fuel station • Potential retaining wall required for Option 2 and 3 adjacent to the fuel station	Tighter curve provided resulting in no impact to the fuel station – alignment for Options 2 and 3 closer matching Option 1 after the Junction Road Intersection
2	Service Road Closure • From a constructability perspective – closing the service road could potentially make a difference western side widening impacts • Can save time for construction and therefore overall saving in project costs	Service Road access arrangements have been changed to allow for an exit only movement to the Heathcote Road / Junction Road intersection

4 Conclusion

The strategic corridor assessment undertaken for Heathcote Road between the M5 Motorway and Junction Road included the following:

- Traffic impact assessment and traffic modelling (SIDRA and VISSIM)
- Hydrology and hydraulics assessment
- Utilities management plan
- Phase 1 contamination assessment
- Geotechnical investigation proposal plan
- Minor works REF for geotechnical investigations
- Constructability workshop and related report
- Value management workshop and related report
- Risk management workshop
- HSiD workshop and related report

The above investigations determined the constraints of the project area. This was thereafter used to prepare and evaluate three options for the widening of Heathcote Road between the M5 Motorway and Junction Road from the current two lanes to four lanes.

Three options have been produced:

- Option 1 – Widening to the west
- Option 2 – Widening to the east
- Option 3 – Widening on both sides

A strategic design for each option has been produced taking into consideration:

- Road design
- Drainage design
- Utilities design
- Structural design
- Traffic conditions
- Flooding conditions
- Geotechnical conditions
- Environmental conditions
- Construction staging and overall constructability

Based on the constraint's analysis, the options have been ranked taking into consideration their respective impacts and summarised in Table 4-1 below.

Table 4-1: Summary of Constraints Analysis - Impact Level

Consideration	Option 1	Option 2	Option 3
Road Design	Moderate	Least	Most
Flooding	Least	Moderate	Most
Drainage	Most	Moderate	Least
Utilities	Most	Least	Moderate
Geotechnical	Moderate	Least	Most
Environmental	Most	Least	Moderate
Property Works	Most	Least	Moderate
Construction Staging	Moderate	Least	Most

Overall, when comparing the three options, Option 2 has the least impact overall due to the following:

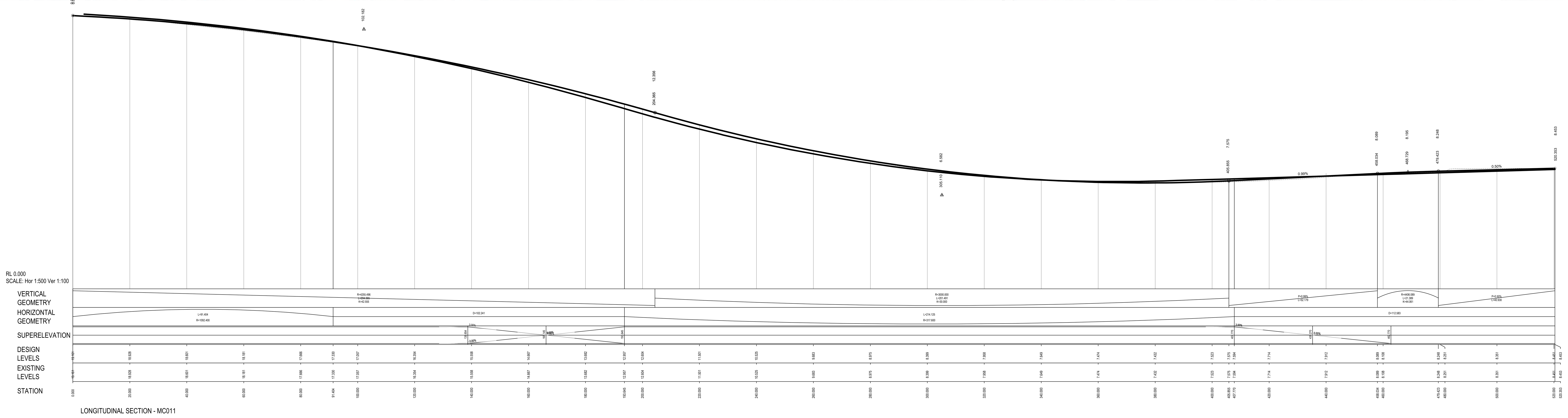
- Minor property acquisitions
- Mainly offline construction
- Least impact to utilities
- Least amount of new full depth pavement
- Similar strategy and largely within the footprint of the six-lane corridor study
- Shortest length of new retaining walls

Formal community consultation will take place in July/August 2021, following which the project team will consider all feedback received and prepare a community consultation report for publication. This report is prepared by the project team and will document and address all feedback received during consultation, as well as assist with the next steps for the project which includes finalising the preferred option.

Appendices

A. Current Strategic Corridor Assessment Options

A. Current Strategic Corridor Assessment Options



LEGEND

- EXISTING DP PROPERTY BOUNDARY
- EXISTING ROAD
- ROAD CONTROL LINE
- SIX LANE ROAD CORRIDOR STUDY BOUNDARY
- NEW ROAD DESIGN
- PROPERTY ACQUISITION BOUNDARY
- NEW RETAINING WALL
- NEW DRAINAGE PIPE
- NEW DRAINAGE PIT LABEL
- NEW DRAINAGE PITS
- EXISTING DRAINAGE PITS/ PIPES TO BE REMOVED AND/OR REDUNDANT
- EXISTING PAVEMENT
- NEW PAVEMENT
- NEW CONCRETE MEDIAN
- SHARED PATH
- VERGE

NOTES:

1. FROM SPECIFICATION PS101 ISSUED BY TfNSW, THERE ARE PFC (PERFLUORINATED COMPOUNDS) ISSUES AROUND THE AREA WHICH HAS BEEN IDENTIFIED IN THE PAST AND THIS INDICATED THERE IS A POTENTIAL RISK OF PFC'S CONTAMINATION AROUND THE PROPOSAL

Date	Drawn	Description	Ch'k'd	App'd
14/05/2021	DK	ISSUED FOR REVIEW	VS	AK
01/04/2021	DK	ISSUED FOR REVIEW	VS	AK
26/02/2021	DK	ISSUED FOR REVIEW	VS	AK
10/02/2021	DK	ISSUED FOR REVIEW	VS	AK

Status Stamp: REVIEW

Client: Transport Roads & Maritime Services

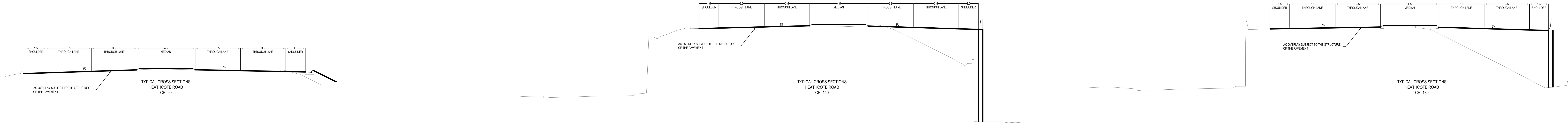
HEATHCOTE ROAD
STRATEGIC ROUTE ASSESSMENT
GENERAL ARRANGEMENT - OPTION 1
WIDENING WEST

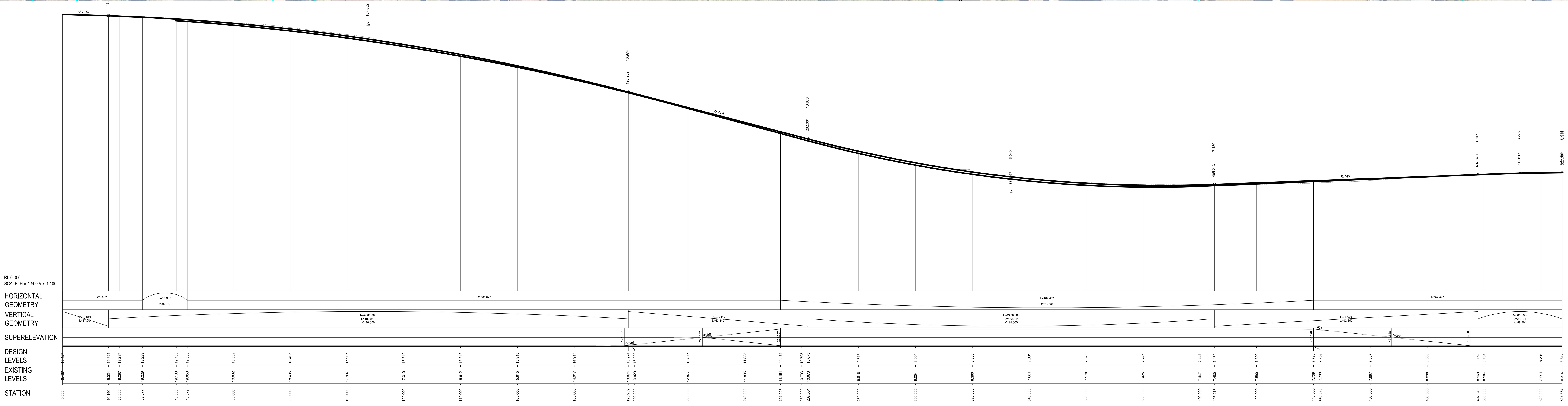
Designed	V.GOPALAN	MM	Eng check		
Drawn	D.KUMAR	MM	Coordination		
Dwg check			Approved	A.AKOOJEE	MM

MMD Project Number	Scale at A0	Security
421292	1:500	STD

Suitability Description	Suit. Code
Work In Progress	S0

Drawing Number	Revision
421292-MMD-SKT-RD-001001	3





LONGITUDINAL SECTION - MC00I

LEGEND

- EXISTING DP PROPERTY BOUNDARY
- EXISTING ROAD
- ROAD CONTROL LINE
- SIX LANE ROAD CORRIDOR STUDY BOUNDARY
- NEW ROAD DESIGN
- PROPERTY ACQUISITION BOUNDARY
- NEW RETAINING WALL
- NEW DRAINAGE PIPE
- NEW DRAINAGE PITS
- EXISTING DRAINAGE PITS/ PIPES TO BE REMOVED AND/OR REDUNDANT
- EXISTING PAVEMENT
- NEW PAVEMENT
- NEW CONCRETE MEDIAN
- SHARED PATH

NOTES:

1. FROM SPECIFICATION PS101 ISSUED BY TfNSW, THERE ARE PFC (PERFLUORINATED COMPOUNDS) ISSUES AROUND THE AREA WHICH HAS BEEN IDENTIFIED IN THE PAST AND THIS INDICATED THERE IS A POTENTIAL RISK OF PFC'S CONTAMINATION AROUND THE PROPOSAL

Date	Drawn	Description	Ch'k'd	App'd
14/05/2021	DK	ISSUED FOR REVIEW	VS	AK
22/04/2021	DK	ISSUED FOR REVIEW	VS	AK
26/02/2021	DK	ISSUED FOR REVIEW	VS	AK
10/02/2021	DK	ISSUED FOR REVIEW	VS	AK

Status Stamp: REVIEW

Client: Transport Roads & Maritime Services (NSW Government)

HEATHCOTE ROAD
STRATEGIC ROUTE ASSESSMENT
GENERAL ARRANGEMENT - OPTION 2
WIDENING EAST

Designed	V.GOPALAN	MM	Eng check		
Drawn	D.KUMAR	MM	Coordination		
Dwg check			Approved	A.AKOOJEE	MM

MMD Project Number	Scale at A0	Security
421292	1:500	STD

Suitability Description	Suit. Code
Work In Progress	S0

Drawing Number	Revision
421292-MMD-SKT-RD-002001	3

LEGEND

- EXISTING DP PROPERTY BOUNDARY
- EXISTING ROAD
- ROAD CONTROL LINE
- SIX LANE ROAD CORRIDOR STUDY BOUNDARY
- NEW ROAD DESIGN
- PROPERTY ACQUISITION BOUNDARY
- NEW RETAINING WALL
- NEW DRAINAGE PIPE
- NEW DRAINAGE PIT LABEL
- NEW DRAINAGE PITS
- EXISTING DRAINAGE PITS/ PIPES TO BE REMOVED AND/OR REDUNDANT
- EXISTING PAVEMENT
- NEW PAVEMENT
- NEW CONCRETE MEDIAN
- SHARED PATH
- VERGE

NOTES:

1. FROM SPECIFICATION PS101 ISSUED BY TfNSW, THERE ARE PFC (PERFLUORINATED COMPOUNDS) ISSUES AROUND THE AREA WHICH HAS BEEN IDENTIFIED IN THE PAST AND THIS INDICATED THERE IS A POTENTIAL RISK OF PFC'S CONTAMINATION AROUND THE PROPOSAL

Date	Drawn	Description	Ch'k'd	App'd

Status Stamp

REVIEW

Client

NSW GOVERNMENT | Transport Roads & Maritime Services

HEATHCOTE ROAD
STRATEGIC ROUTE ASSESSMENT
GENERAL ARRANGEMENT - OPTION 3
WIDENING CENTER

Designed	V.GOPALAN	MM	Eng check		
Drawn	D.KUMAR	MM	Coordination		
Dwg check			Approved	A.AKOOJEE	MM

MMD Project Number	Scale at A0	Security
421292	1:500	STD

Suitability Description	Suit. Code
Work In Progress	S0

Drawing Number	Revision
421292-MMD-SKT-RD-003001	2

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