Hobart City Deal Southern Projects Sub-Project 1: Southern Outlet Transit Lane

Concept Design Report

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Revision B

Department of State Growth

Tasmanian Government

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EXECUTIVE SUMMARY

The Greater Hobart region's population and employment growth are putting increased pressure on its transport network. The growth of residential areas in Kingborough and the Huon Valley creates commuter pressures on the Southern Corridor (comprising Kingston, the Southern Outlet, and the Macquarie/Davey Street couplet) between Kingston and Hobart.

The Hobart City Deal Southern Projects seeks to encourage modal shift in favour of public transport to address congestion and accessibility issues along the Southern Corridor. The Project is comprised of five sub-projects that together provide a comprehensive, multi-faceted approach.

The subject of this report is Sub-project 1 (SP1) Southern Outlet Transit Lane.

The scope of this phase of the project includes planning investigations comprising desktop assessments of environmental & heritage, traffic investigation, and geotechnical issues, development of concept design drawings, and development of P50 / P90 cost estimates.

All concept options described within this report were developed with the following design standards:

- Austroads Guide to Road Design Part 3: Geometric Design
- Austroads Guide to Road Design Part 4A: Un-signalised and Signalised Intersections
- Austroads Guide to Road Design Part 4C: Interchanges
- Austroads Guide to Road Design Part 6: Roads Design, Safety and Barriers
- Austroads Guide to Road Design Part 5: Drainage General and Hydrology Considerations
- Austroads Guide to Road Design Part 5A: Drainage Road Surface, Networks, Basins and Subsurface
- Austroads Guide to Road Design Part 5B: Drainage Open Channels, Culverts and Floodways
- Local Government Association of Tasmania (LGAT) Standard Drawings
- AS1742-2014 Manual of Uniform Traffic Control Devices
- Department of State Growth Standard Specification for Professional Services; and
- Vicroads Traffic Engineering Manual Volume 3 Part 219 Accessibility DDA Guidelines.

The project was split into 9 sub-sections and two options were considered - widening on the east side or widening on the west side - for each sub-section.

The P50 P90 cost estimates for the preferred options are summarised below:

Southern Outlet Transit Lane

Base Estimate	P50 Total Outturn Cost	P90 Total Outturn Cost
$30,148,800	$35,798,800	$39,998,800

1. Introduction

1.1 Background

The Greater Hobart region's population and employment growth are putting increased pressure on its transport network. The growth of residential areas in Kingborough and the Huon Valley creates commuter pressures on the Southern Corridor comprising of Kingston, the Southern Outlet, and the Macquarie/Davey Street couplet.

The Hobart City Deal Southern Projects (the Project) seeks to encourage modal shift in favour of public transport to address congestion and accessibility issues along the Southern Corridor. The Project is comprised of five sub-projects that together provide a comprehensive, multi-faceted approach:

- Sub-project 1: Southern Outlet Transit Lane – Concept design for a northbound Transit lane on the Southern Outlet between Olinda Grove and Hobart/Macquarie Street. The lane will operate as a T3 lane for use by buses, private vehicles carrying three or more occupants, taxis, and emergency service vehicles
- Sub-project 2: Macquarie/Davey Bus Priority – Concept design for bus priority measures on Macquarie and Davey streets that considers how to optimise bus operations while managing impacts
- Sub-project 3: Kingborough Park-and-Ride – Concept design for park-and-ride facilities at two locations in the Kingborough municipality. The scope of work includes selecting two locations and developing any specific attributes of the facilities in collaboration with stakeholders. At the time of this report, two sites had been chosen – Browns Road, Firthside and Huntingfield terminus
- Sub-project 4: Bus service plan for Southern Corridor – Developing a park-and-ride bus service model to support the two Kingborough park-and-ride facilities (sub-project 3), the Southern Outlet transit lane (sub-project 1), and the bus priority measures proposed for Macquarie and Davey Streets (sub-project 2). The bus service model will be focused on encouraging modal shift to public transport with the potential for new buses, bus routes, and stops; and
- Sub-project 5: Southern Outlet Transit Lane – T3 Enforcement – Concept design and a concept of operations plan for the proposed T3 lane on the Southern Outlet (sub-project 1), including the recommended locations of enforcement devices, as well as technological and legal considerations.

This Concept Design Report is in relation to Sub-Project 1 Southern Outlet Transit Lane.

1.2 Location

The project is located on Southern Outlet between Olinda Grove Bridge and Davey Street intersection.

There is an existing northbound bus lane which begins approximately 400m south of Lynton Avenue and continues to south of Macquarie Street intersection. It is proposed that this existing bus lane is utilitised as the transit lane without additional works.

Figure 1 - Locality Plan

1.3 Objectives and Constraints

1.3.1 Project Objectives

The overall objectives of the Hobart City Deal – Southern Projects project are to:

- Achieve modal shift for commuters using the Southern Outlet
- Improve public transport travel reliability along the Southern Outlet corridor
- Encourage multiple occupancy of private vehicles during peak periods of travel; and
- Improve public transport and passenger experience for Kingborough and Huon residents.

The key anticipated project benefits include:

- Improved public transport passenger experience for Kingborough and Huon residents
- Improved public transport travel reliability along the Southern Outlet and Macquarie/Davey streets
- Improved bus operations along Macquarie and Davey streets
- Better utilisation of transport infrastructure to address congestion
- Increased capacity along the Southern Outlet corridor; and
- Providing long-term solutions to meet future demand and address road safety related issues.

1.3.2 Report Objectives

This report documents the design options considered in developing the functional design of the Southern Outlet additional transit lane and presents a recommended Concept Design for the State's consideration. The objectives of this report are to:

- Describe the recommended preferred Southern Outlet transit lane option
- Describe the transit lane design options that have been investigated
- Describe the advantages and constraints of the project; and
- Make reference to other investigations and activities which have been conducted as part of this project.

1.3.3 Project Constraints

The project objectives are to be delivered within the following constraints:

- Compliance with all relevant environmental, heritage and planning legislation
- Community and local government acceptance
- Deliver within the project budget; and
- Deliver within the project timeframe.

1.4 The Existing Road and Roadside Environment

1.4.1 Southern Outlet

This section of the Southern Outlet between Olinda Grove Bridge and Davey Street is posted at 80km/h and is a divided carriageway with 2-lanes in each direction. The northbound and southbound carriageway is divided by a rigid barrier which develops into retaining wall north of Cat's Eye Corner (Dynnyrne Road).

This section of Southern Outlet is highly constrained by both topography with large cut/fills and constrained property boundaries with houses very close to road carriageway. This results in an existing alignment and existing road cross section that is below current standards with departures for horizontal curves, sight distance, barrier types and offsets, lane widths and unprotected hazards in the clear zone.

The concept design is limited to widening works to create space for a transit lane in the northbound carriageway. This project is not intended as an overall upgrade project of the Southern Outlet. Therefore, these are existing issues and have not been rectified in the Concept Design. The concept design is on a like-for-like basis as these significant upgrades have significant cost implications and are outside of the scope of this concept design.

There is currently no lighting on the Southern Outlet or ITS systems.

1.5 Project Scope

The scope of this project includes:

- The development of Concept Designs for Southern Outlet transit lane
- The Concept Designs and Concept Design Reports will include the attributes of the transit lane, including cost; and
- The Concept Design Reports will describe how consideration of traffic impact including bus ingress and egress, road safety issues, land tenure/acquisition, stakeholder engagement, environmental, heritage, planning and geotechnical requirements and constraints, engineering survey including utility services location, any road upgrade requirements and cost estimates – both capex and opex - informed the Concept Designs.

2. Strategic Context

2.1 General

The Tasmanian Government has made a commitment to addressing growth through the Greater Hobart Traffic Solution (2018–2023) and Hobart City Deal (2019–2029). The Hobart City Deal is a shared 10-year vision between the Australian and Tasmanian governments and local councils, including Hobart and Kingborough councils, to guide and encourage investment to build a vibrant, liveable and connected global city.

The Hobart City Deal reflect the Tasmanian Government commitment to address the current network challenges. The Project is part of a funded program of projects including:

- $20 million for Kingborough transport infrastructure, including creating new park and ride(s) and improvements to the Kingborough bus interchange
- $35 million for a Southern Outlet transit lane, and
- $16 million for Macquarie and Davey Street bus priority.

The Tasmanian Government's Hobart Transport Vision (the "Vision") is a holistic plan that seeks to prioritise active and public transport modes to provide a reliable and cost-effective alternative transport system with a focus on prioritised rapid passenger transport as a competitive alternative to private car travel. The sub-projects are consistent with the Vision. They are also an opportunity to create synergies between Kingborough Council, the City of Hobart, the Department of State Growth, and the Royal Automobile Club of Tasmania (RACT), among other stakeholders, on a future vision for transport in Greater Hobart.

2.2 Planning Studies

The need for a Southern Outlet Transit Lane was established in the Hobart Transport Vision and Hobart City Deal, as described above.

Bus Transit Lane between Kingston and Hobart/Macquarie Street: Concept options report (Jacobs, January 2017)

The Department of State Growth engaged Jacobs to investigate options for a bus transit lane on the Southern Outlet from Kingston to Hobart. The aim of the project was to increase public transport patronage and reduce car trips during the commuter peak periods by improving the efficiency and reliability of the public transport service. Three options were considered:

- Option 1 - Northbound bus lane only;
- Option 2 - Centralised, tidal flow lane (the preferred option); and
- Option 3 - Southbound bus lane from Olinda Grove Overpass to Groningen Road Overpass.

At the conclusion of the investigation, Option 2 was identified as the preferred option because of its versatility. All options were developed so they could be funded and construction in either a staged approach or as one project. The report identified that how the project is delivered will ultimately contribute to the decision of whether to construct Option 1 or Option 2 to satisfy the project objectives.

Hobart South Bus Priority Study (WSP, September 2019)

Following the 2017 Concept Options Study outlined above, a northbound bus lane was chosen as the preferred option. Additionally, ongoing congestion incidents in the study area highlighted the need to strategically prioritise elements of the scheme so that early outcomes can be realised, without compromising future infrastructure investments.

Department of State Growth commissioned WSP to review the previous bus priority proposals and to develop a strategic options analysis that considered the suitability of the various bus priority options on the Southern Outlet, Macquarie Street and Davey Street.

A preliminary analysis of speed data indicated the two most significant issues for buses around the Southern Outlet and potential mitigations:

- AM peak northbound from Cats Eye Corner to Macquarie Street.
    - Extend existing bus lane southwards – provides a longer bypass of traffic congestion issues
    - Extend existing bus lane northwards to Davey Street intersection – bypasses more of the intersection queue and gets buses to the stopline
    - As above (2.) with a B-signal to get buses in-front of general traffic, or
    - As above (2.) with a separate bus lane between Davey Street and Macquarie Street
    - Grade separation
- PM peak outbound getting onto the Southern Outlet from Davey Street.
    - Southbound/westbound Bus Lane on Davey Street (see Davey Street analysis)
    - Southbound/westbound Transit (HOV) Lane on Davey Street (see Davey Street analysis)
    - Grade separation.

Following the strategic analysis, WSP recommended consideration of the following to provide bus priority along the Southern Outlet corridor:

- Extend bus lane northwards to Davey Street
- Widen southern Outlet to provide a replacement for the left-turn lane and enforcement bay
- Adjust triangle island to include a Bus Only Lane
- Install a B-Signal (bus queue jump) for northbound buses from Southern Outlet
- Commence concept design process
- Assess the impact of the proposal and traffic signal timings through traffic modelling.
- Consider incident management on the route including response vehicles, CCTV and VMS

3. Design Inputs

This section of Southern Outlet is highly constrained by topography with large cut/fills and property boundaries with houses very close to road carriageway. This has resulted in an existing alignment and existing road cross section that is below current standards with departures from standards for horizontal curves, sight distance, barrier types and offsets, lane widths and unprotected hazards in the clear zone.

The concept design is limited to widening works to create space for a transit lane in the northbound carriageway. This project is not intended as an overall upgrade project of the Southern Outlet. Therefore, the existing issues have not been rectified in the Concept Design. The concept design is on a like-for-like basis where possible as the significant upgrades which would be required to address many of the issues would have significant cost implications not allowed for in the project budget.

Departures are listed in Section 0 of this report

3.1 Standards and Guidelines

The concept design options are developed in accordance with the current guidelines and standards listed below.

Austroads

- Austroads Guide to Road Design Part 3: Geometric Design
- Austroads Guide to Road Design Part 4A: Un-signalised and Signalised Intersections
- Austroads Guide to Road Design Part 4C: Interchanges
- Austroads Guide to Road Design Part 6: Roads Design, Safety and Barriers
- Austroads Guide to Road Design Part 5: Drainage General and Hydrology Considerations
- Austroads Guide to Road Design Part 5A: Drainage Road Surface, Networks, Basins and Subsurface; and
- Austroads Guide to Road Design Part 5B: Drainage Open Channels, Culverts and Floodways.

Standards Australia

- AS1742-2014 Manual of Uniform Traffic Control Devices.

State Growth

- Standard Specification for Professional Services.

VicRoads

- Vicroads Traffic Engineering Manual Volume 3 Part 219 Accessibility DDA Guidelines.

3.2 Traffic Volumes

The AADT volume on the Southern Outlet (Station A0171100) in 2019 was 36,656 with 8.5% heavy vehicles

3.3 Design Vehicle

The following design and check vehicles have been adopted for these projects:

- The Design Vehicle 19m Semi Trailer; and
- The Check Vehicle 25m Semi Trailer.

Curve widening in accordance with Austroads not shown in the Concept Design but to be completed at a later stage.

3.4 Design Speed

The design speed of 80km/h has been adopted with departures where appropriate.

3.5 Typical Cross Section

The desirable values in Austroads are as follows:

Table 1 - Typical Cross Section Design Criteria

Item	Requirement	Reference	Adopted
Bus Lane Widths - 80km/h	3.5m desirable minimum width for other bus travel lanes	Table 4.22 (Preferred New Road)	3.5m Transit Lane (existing road with shoulder, match traffic lane requirement for urban freeway)
Traffic Lane Widths	3.5 m	Section 4.2.4	3.5m
Shoulder Widths and barrier offsets	3.0 m	Table 4.4	Varies. Typically like-for-like.

This section of Southern Outlet is constrained. The desirable travel lane widths are achieved where the roadway is widened; however, the desirable shoulder widths and offsets are not consistently achieved due to constraints in the existing cross section. Summary of the design:

- All lanes adopt 3.5m minimum*
- *Exception: tie into existing 3.0m bus lane at northern extent of project (retain)
- No allowance for cyclists
- No allowance for pedestrians
- Shoulder on West Side:
    - When widening on east side:
        - Retain like for like (typical 0.6m offset)
    - When Widening on west side
        - increase to 1.5m around curves so vehicles cannot stop when widening on west side
        - increase to 3.0m where space permits
- Shoulder to median barrier
    - Where barrier is being relocated
        - Increase to 0.6m offset (from 0.3 to 0.5m typical)
    - Where barrier is not being relocated
        - No works, retain like-for-like
- Shoulder on East Side
    - When widening on east side
        - increase to 1.5m (from 0.4 to 0.6 typical)
        - increase to 3.0m where space permits
    - When widening on west side
        - No works, retain like-for-like

It should be noted that many of the shoulder and offset widths are less than desirable values and require departures from standards to be approved. Additionally, the concept design does not widen the existing 3.0m bus lane on approach to Davey Street. An extract from the drawings is shown in Figure 2 below. Refer Appendix A for full set of drawings.

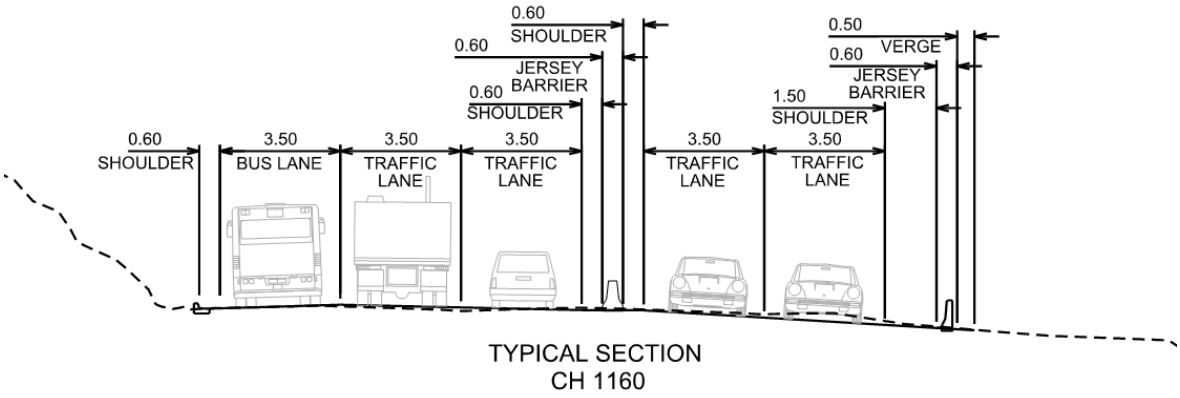

Figure 2 - Typical Cross Section

3.6 Horizontal Alignment

The desirable values for horizontal curves are determined from Equation 5 in Austroads AGRD03 Part 7.4.1. The radii were calculated and are tabulated below for various cross-falls. Minimum values (maximum friction for cars) are shaded red.

Table 2 - Horizontal Design Criteria

		Cross fall				
Design Speed	**Friction**	3%	4%	5%	6%	7%
60	0.24	105	101	98	94	91
	0.33	79	77	75	73	71
80	0.16	265	252	240	229	219
	0.26	174	168	163	157	153

This section of Southern Outlet is constrained and these minimum horizontal curves for a Design Speed of 80km/h are not always achieved in the existing alignment. This project is not intended as an overall upgrade project of the Southern Outlet and the existing horizontal curves were adopted in this Concept Design for the additional lane or improved where feasible. These existing values are less than desirable values and require approval of departures from the State. Alternatively, if the Design Speed is decreased to 60km/h, the existing horizontal curve radii will exceed these requirements.

Departures are listed in Section 6.1.1 of this report.

3.7 Vertical Alignment

This project is not intended as an overall upgrade project of the Southern Outlet and the existing vertical alignment was adopted in this Concept Design.

3.8 Stopping Sight Distance

The values for Stopping Sight Distance (SSD) are determined from Austroads AGRD03 Table 5.5 for a reaction time of 2.0s. These are tabulated below with absolute minimums in red. Corrections due to grade are required in accordance with AGRD03 Table 5.5.

Table 3 - Stopping Sight Distance Design Criteria

Design Speed	SSD (m)
60	73
	64
80	114
	99

The existing Southern Outlet has horizontal curve radii below minimum and rigid barrier/wall offsets below minimum. This has resulted in sight lines being interrupted and existing Stopping Sight Distances that are below the minimum required for an 80km/h design speed and in some instances 60km/h.

This project is not intended as an overall upgrade project of the Southern Outlet however the stopping sight distance has been improved wherever feasible through the following proposed measures:

- Increased retaining wall offset north of "Cats Eye Corner" at Chainage 1400 to desirable values
- Increased cut at curve at Chainage 600
- Increased offset to median barrier to 0.6m; and
- Increased shoulder width offset to barrier to 1.5m on east side.

These values are often less than desirable values and require approval of departures from standards. Alternatively, if the Design Speed is decreased to 70km/h, the existing horizontal curve radii will reduce the number of departures.

Departures are listed in Section 6.1.2 of this report (determined in 2D).

4. Concept Design Options

Sub Project SP01 is defined as the construction of a new transit lane in the northbound carriageway between the Olinda Grove Bridge and the Davey Street Intersection. The existing carriageway does not have enough width to accommodate this lane and therefore the road widening is required. Widening works can either occur on the western side or eastern side of the road, and this is the main consideration in the Concept Design options assessment.

It has been determined that the preferred widening solution varies across the project. There are typically two types of constraints limiting the road cross section along this project: geological constraints and project boundary constraints. The project has been subdivided into nine sections as these conditions change along the alignment and each section reviewed to determine a preferred solution.

There are many existing substandard features along this section of the Southern Outlet including but not limited to horizontal and vertical alignment, sight distance, lane and shoulder widths, barrier extent, type and offset, pull-over opportunities, lighting, drainage, slope instability and noise. Resolving all these issues is outside the scope of this project and these elements are typically replaced on a like-for-like basis or improved where practical to do so as part of these works. To resolve all these items would result in significant changes to the alignment and significantly increased cost.

The following section summarises each of these nine sections and recommends a preferred solution for the widening works.

Refer to Appendix A for a full set of drawings with details. Simplified extracts are shown in the following sections.

4.1 Section 1 – CH00 to CH350 - Olinda Grove Bridge and Intersection

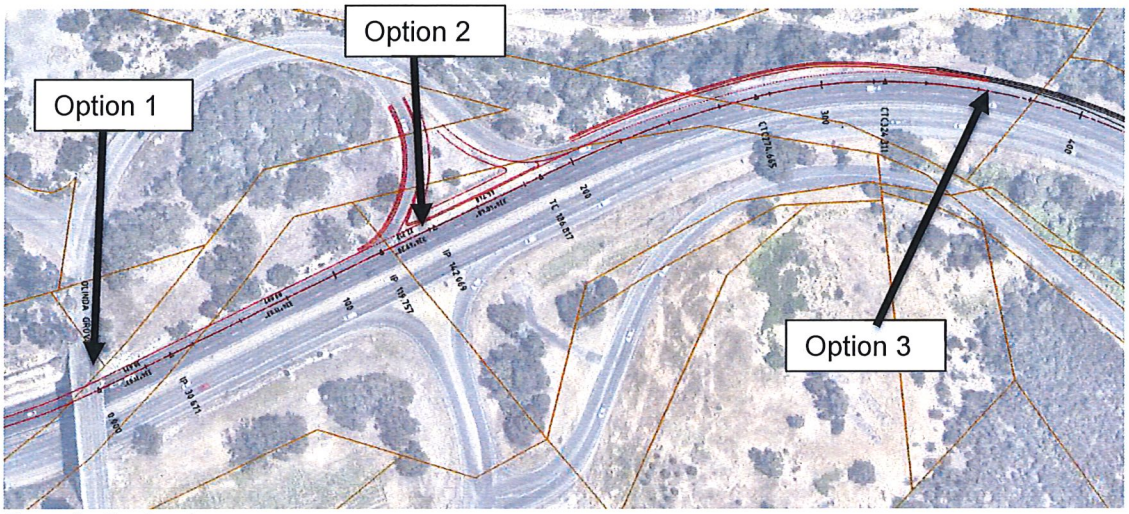

Figure 3 - Section 1 extract

Section 1 is the southern extent of the project, beginning at Olinda Grove Bridge. The key consideration at this location is determining where the proposed transit lane begins, and three options were identified:

- Option 1: Develop prior to Olinda Grove Bridge off-ramp
- Option 2: Develop after Olinda Grove Bridge prior to on-ramp; and
- Option 3: Develop after on-ramp.

The majority of the time the Southern Outlet is uncongested; however, the traffic impact assessment identified a risk that the moving traffic queue could extend past the Olinda Grove on-ramp during the peak of the AM peak period (7:45am – 8:15am). Sensitivity analyses indicated that the queue could be reduced or eliminated with modest changes in the demand profile due to mode shift and/or trip re-timing and identified opportunities to further optimise traffic operations during detailed design, such as signal timing/progression, to further reduce the risk of queuing.

The benefit of maximising the transit lane length (Option 1) is that T3 vehicles can exit the general traffic lanes as early as possible in congested conditions. However, due to site constraints and operational challenges, there are also disadvantages to developing the transit lane prior to the on-ramp. These are as follows:

- Option 1 Developing prior to Olinda Grove Bridge off-ramp by adding an additional lane will impact the bridge which will need to be reconstructed.
- Option 1 Developing prior to Olinda Grove Bridge off-ramp by having a combined left turn/transit lane is not expected to provide a performance benefit. It is expected that the Olinda Grove left-turn lane is more likely to have queuing compared to the through lanes, which are expected to be free flowing majority of the time.
- Option 1 Developing prior to Olinda Grove Bridge off-ramp adds a lane to be crossed at the Olinda Grove on-ramp. The existing on-ramp length is already substandard for an 80km/h road and adding this additional lane provides more potential conflict at this location and movement complexity; and
- Option 2 Developing after Olinda Grove Bridge prior to the on-ramp also provides more complexity and potential for conflict with little benefit. If the diverge occurs after the bridge, it is occurring within the intersection. Therefore, the vehicles using the on-ramp will be carrying out a merge movement simultaneously with other vehicles performing a merge movement. This is highly undesirable.

In consultation with the Department it was determined that Option 3 "Developing the transit lane after the on-ramp merge" provides the solution that most effectively balances benefits, costs, and safety considerations. This option has the following benefits:

- No reconstruction or modification to Olinda Grove Bridge;
- No modification to Olinda Grove Intersection;
- Diverge movement separate from merge movement.

Please note that the location of the lane start point may move to the north in future stages of design to allow for more separation between the merge and diverge movement or extension of the merge to meet current standards as identified in the Road Safety Audit. This will not have a significant impact to cost of project because it will be a line marking exercise.

There is no significant constraint on the western side, so widening in the northbound carriageway is recommended at this location.

4.2 Section 2 – CH350 to CH660 – Minor Cut Western Side

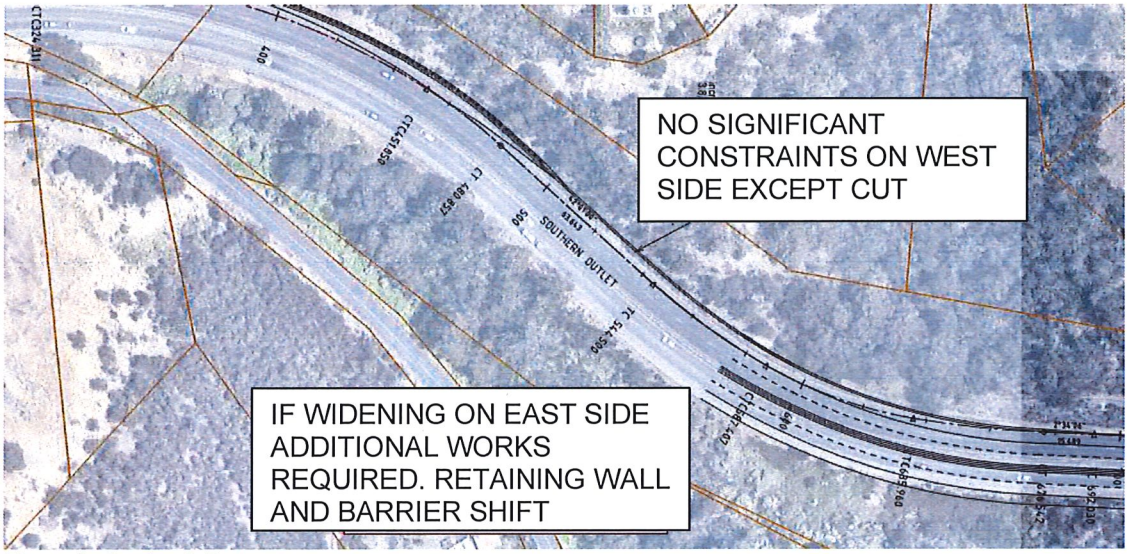

Figure 4 - Section 2 Extract

Section 2 is between Chainage 350 to 660 where the transit lane has been developed. The key decision at this location was whether to widen on the east side or west side. There is a cutting on the west side of the road and fill on the east side. The west side cutting is vegetated and is not identified as a significant constraint for the proposed scope of works; however, the east side embankment is steep and would likely require a retaining wall and modification to the median barrier. Therefore, widening on the west side is recommended at this location. *Note that in the following Section 3, widening changes to the east side was preferred therefore there is a transition from west to east side widening in this Section 2.*

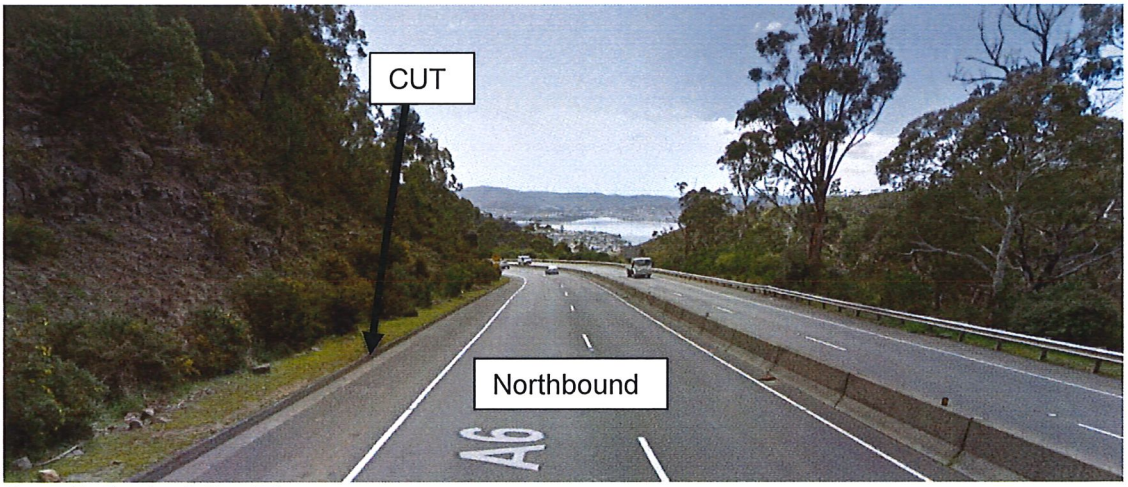

Figure 5 - Section 2 Road View

4.3 Section 3 – CH660 to CH780 – Large cutting

Figure 6 - Section 3 Extract

Section 3 is between Chainage 660 to 780. There is a cutting on both sides of the road however it is much more significant on the western side. This massive dolerite cutting is facing uphill and is protected by rockfall netting and benching. These protection works are existing and the cutting and should be avoided if possible. If widening was to occur on the west side of the road then this cutting would be impacted, and additional blasting/excavation and protection works required. The full scope of these works would be subject to additional geotechnical investigation and detailed mapping of the exposed cut, but it is assumed that significant works including rock bolting, benching and shotcrete would be required.

An alternative is to widen on the eastern side. The cutting faces downhill on this side of the road and is much less significant in terms of quantities and rockfall protection/mitigation works. It is expected this cutting could be flattened to an acceptable angle where rockfall protection works may not be required; however, the

appropriate angle must be confirmed in future stages of design. For this option, the existing western kerb and lane line would be maintained from the cutting, providing a like-for-like exposure to the rock cutting on the western side.

The option to widen on the eastern side requires the central median barrier to be relocated one lane to the east to create space in the northbound carriageway. These relocation works are an additional cost item and includes modification to median drainage. On balance, it is considered that the significant protection works for a western side widening is anticipated to be less cost effective than repositioning the barrier and associated works.

This existing cutting on the west side is a hazard within the clear zone of the northbound carriageway and is currently unprotected. No widening works are proposed on this side of the road however this is an unprotected hazard and a barrier behind back of kerb should be considered in detailed design or a departure provided from the State. On the western side, works are proposed and therefore a rigid barrier is provided in the design.

Widening on the east side is the preferred option for Section 3.

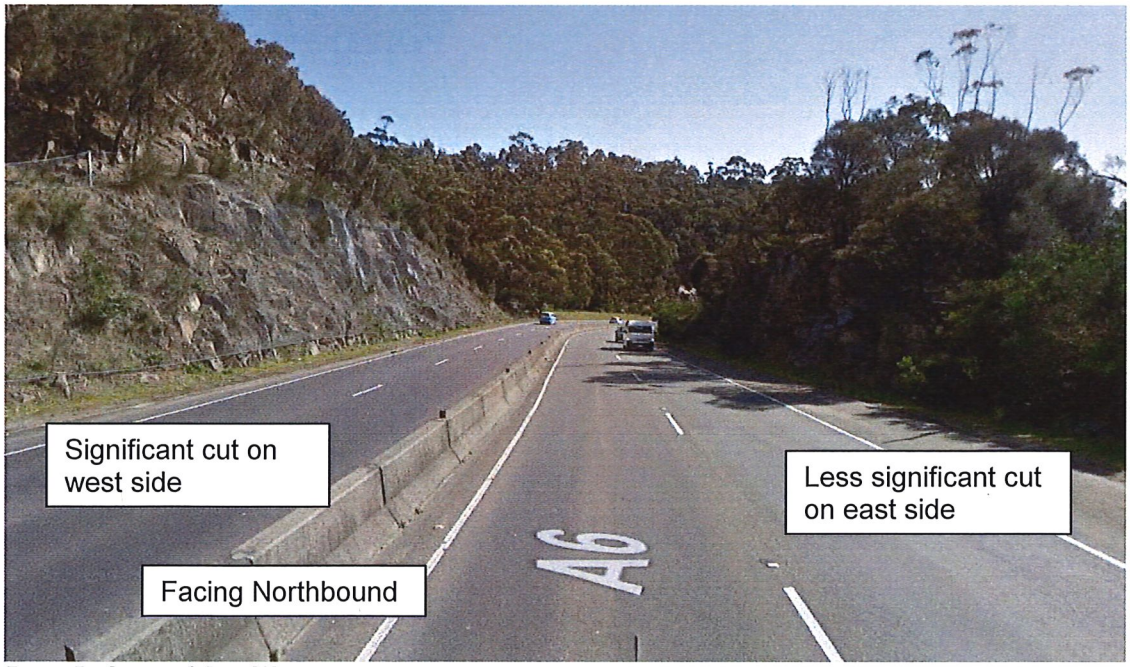

Figure 7 - Section 3 Road View

4.4 Section 4 – CH780 to 850 – No Significant Constraints

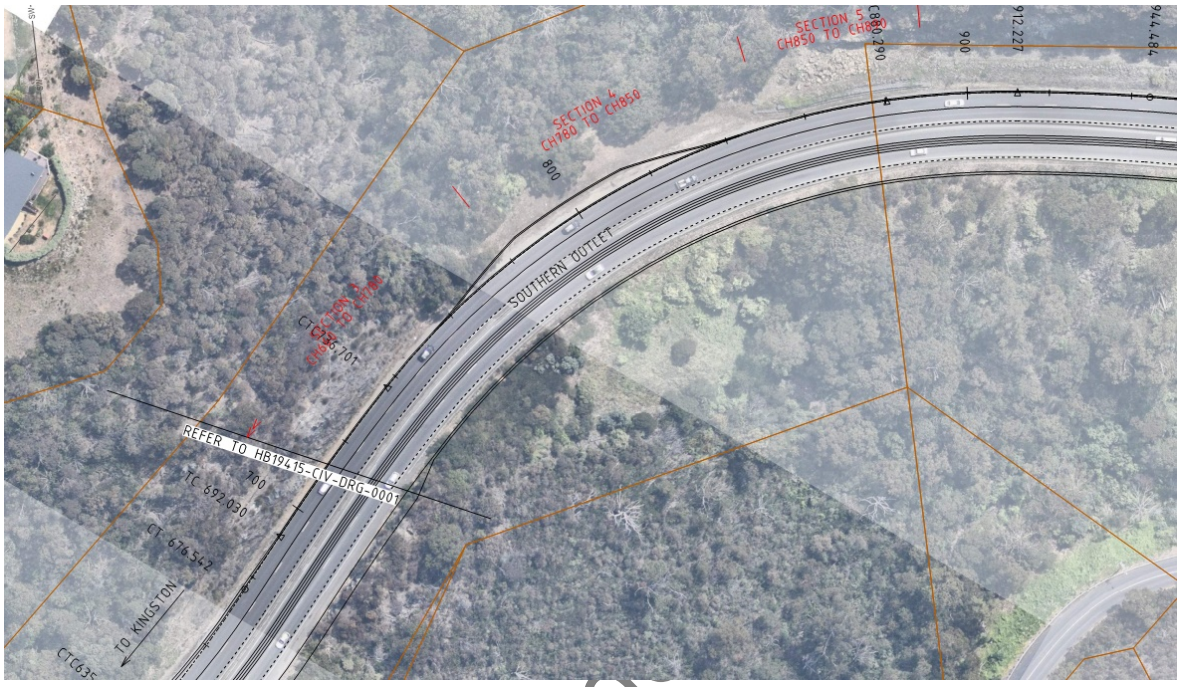

Figure 8 - Section 4 Extract

Section 4 is between Chainage 780 to 850. No significant constraints were identified at this location on the western side; however, it is proposed that the road is widened on the east side within this section for continuation between Section 3 and Section 5 which are both widened on the east side. This provides a better alignment than shifting to the east side. It is proposed to add a pull-over area at this location to make use of the available space on the west side.

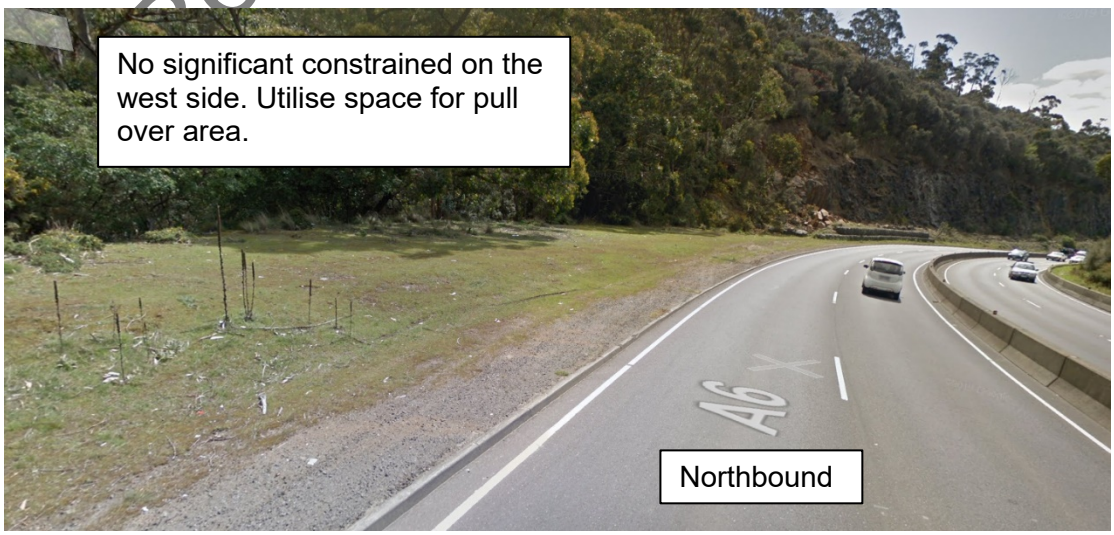

Figure 9 - Section 4 Road View

4.5 Section 5 and 6 – CH850 to CH1200 – Significant cut

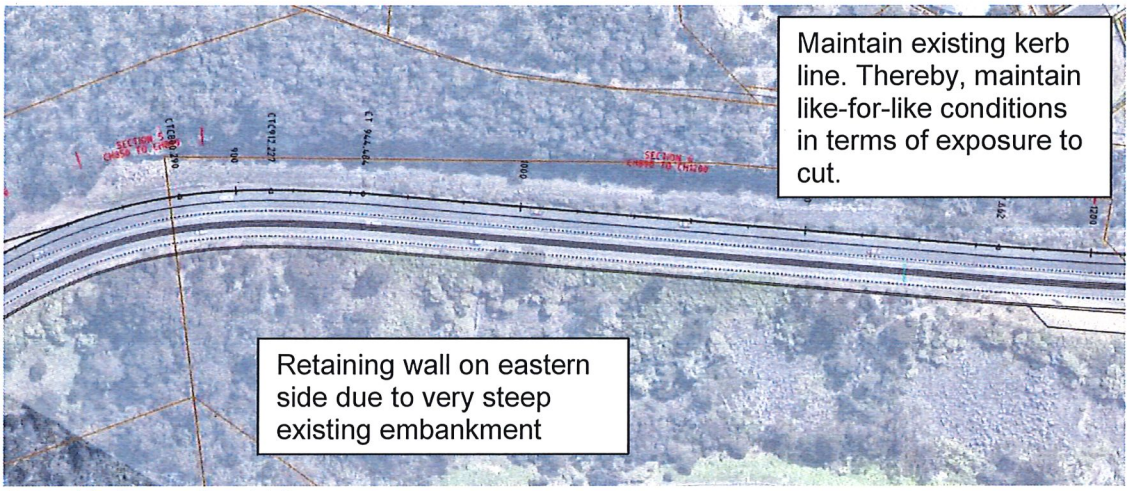

Figure 10 - Section 5 and 6 Extract

Both Section 5 and Section 6 have similar conditions with a very large dolerite cutting on the west side of the road with evidence of rock falls. This cutting is referred to as Cutting 20 in the geotechnical report and this area is of key significance to the cost of this project. Section 5 is between Chainage 850 to 890 and has an existing gabion retaining on the western side, whereas Section 6 is between Chainage 890 to 1200 and does not have a gabion wall.

Widening on the west side in this area will impact the existing cutting whereas widening on the east side will result in a retaining wall due to the high steep embankment. Both options would have significant costs and are both driven by geotechnical input. Further geotechnical investigation was undertaken at cutting 20 and a drilling investigation is ongoing on the west side embankment to confirm feasibility of wall.

The preliminary geotechnical advice on the cutting was as follows

- If excavation of this material was required, then blasting would be necessary; and
- Stabilisation of this cutting would be a very large undertaking. The joint that runs the length of the cutting would need to be stabilised, probably through extensive rock bolting; similar methods may assist near the subvertical features. Other scaling and spot bolting would be required. The face would need to be meshed or otherwise provided with surface support.

In the vicinity of Cutting 20 it is expected that widening to the downhill side may be the most cost-effective method of widening the road. The cutting as it currently stands is considered to present a level of risk to the travelling public, and movement of the traffic closer to the cutting would increase this risk, and the project would need to mitigate any increased risk. For this reason, it is considered that widening on the downhill side of the road in these sections would present the least risk to the project.

A separate item regarding the existing cutting and retaining wall on the west side is that it is a hazard within the clear zone of the northbound carriageway and is currently unprotected. No widening works are proposed on this side of the road however this is an unprotected hazard and a barrier behind back of kerb should be considered in detailed design or a departure provided from the State. On the western side, works are proposed and therefore a rigid barrier is included in the design.

Similarly, to all sections that widen on the east side, this option requires the central median barrier to be relocated one lane to the east to create space in the northbound carriageway. These relocation works are an additional cost item and includes modification to median drainage.

Figure 11 - Section 5 Road View Including Gabion and Rockfall

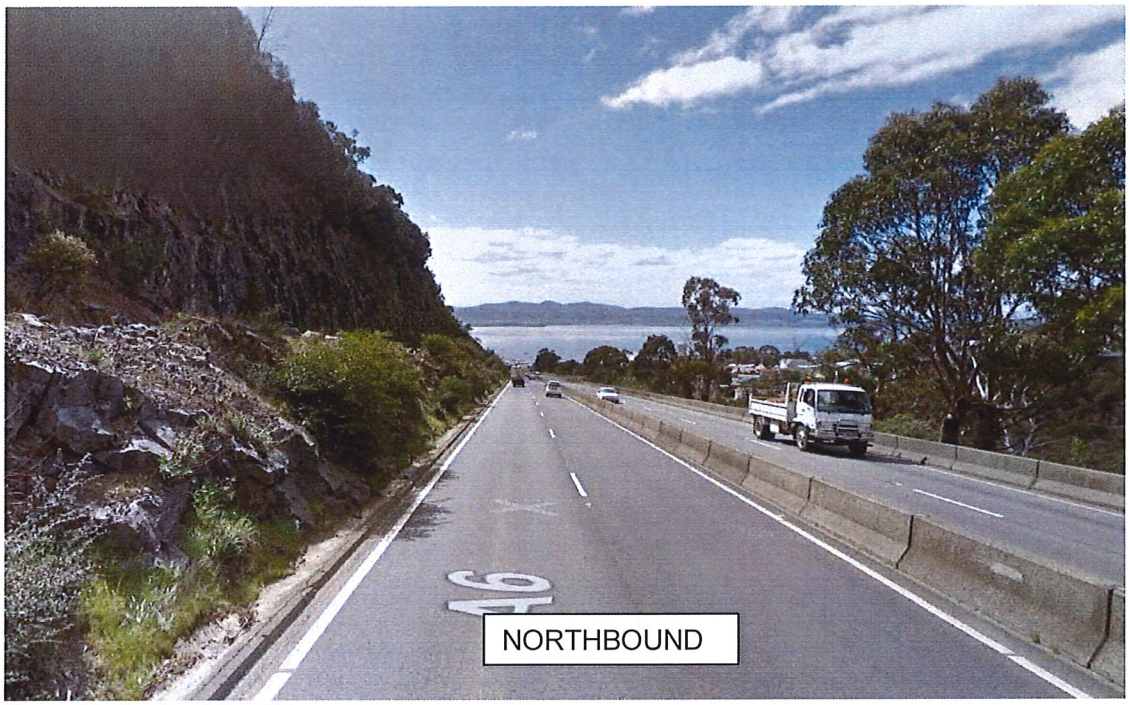

Figure 12 - Section 6 Road View

4.6 Section 7 – CH1200 to CH1370 – No Significant Constraints

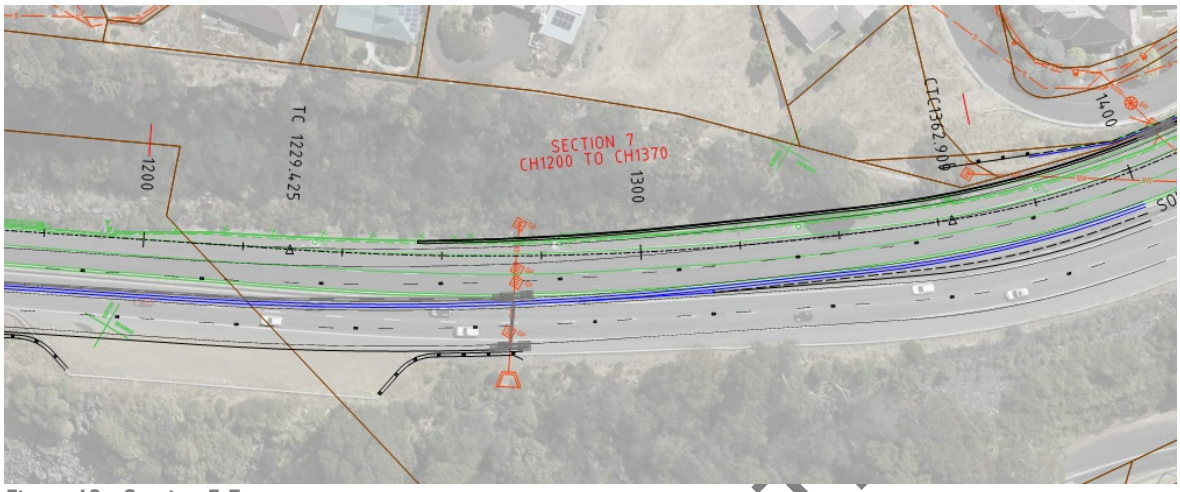

Figure 13 - Section 7 Extract

Section 7 is between Chainage 1200 to 1370. The cutting 20 in Section 6 is less significant at this location, however, it is proposed that the road is widened on the east side within this section for continuation between Section 6 and Section 8 which are both widened on the east side. The existing kerb and lane line would be retained under this option.

There may be an opportunity in future stages of design to improve the Cat's Eye Corner curve in the following Section 8 by adjusting the alignment of this section to the south. By shifting to the south, a larger radius curve and larger offset to Dynnyrne Road retaining wall may be achievable.

Figure 14 - Section 7 Road View

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Section 8 is between Chainage 1370 to 1635 and is the location on the project where property boundaries become the major constraint. This section of Southern Outlet is a small radius curve on steep topography and constrained property boundaries with houses very close to road carriageway on both sides of the road and a pinch point with Dynnyrne road on the east side. Currently these constraints are mitigated through the provision of retaining walls on the western side of the road, in the median and typically on the eastern side of the road too.

These constraints result in an existing alignment and existing road cross section that is below current standards with departures from standard for horizontal curves, sight distance, barrier types and offsets, lane widths and unprotected rock hazards in the clear zone.

This is a challenging section and two options were presented to the client's stakeholder workshop.

- Option 1 - Widen on west side
    - Land acquisition
    - Dynnyrne Road pinch point issues
    - Retaining walls on west side
    - Extend underpass structure
- Option 2 - Widen on east side by shifting alignment and removing shoulder in the northbound carriageway
    - Potentially no/reduced land acquisition
    - Central retaining wall works
    - Construction challenges in median
    - Loss of shoulder and reduce offsets to hazards; and
    - Worsen sight distance in southbound direction.

4.7.1 Option 1 – Widen on West Side

Option 1 - widening on west side is the best option from a road safety perspective and determined to be the preferred option. This option can only be achieved with significant land acquisition on the west side, upgrade works to Dynnyrne Road and retaining walls on the west side. This option will provide a significant improvement to sight distance in the southbound direction beyond the Dynnyrne Road pinch point, however, still requires sight distance departures from standards at the Dynnyrne Road pinch point for 80km/h.

Lines illustrating the compliant sight distance; achieved sight distance and existing sight distance are shown in the following figure.

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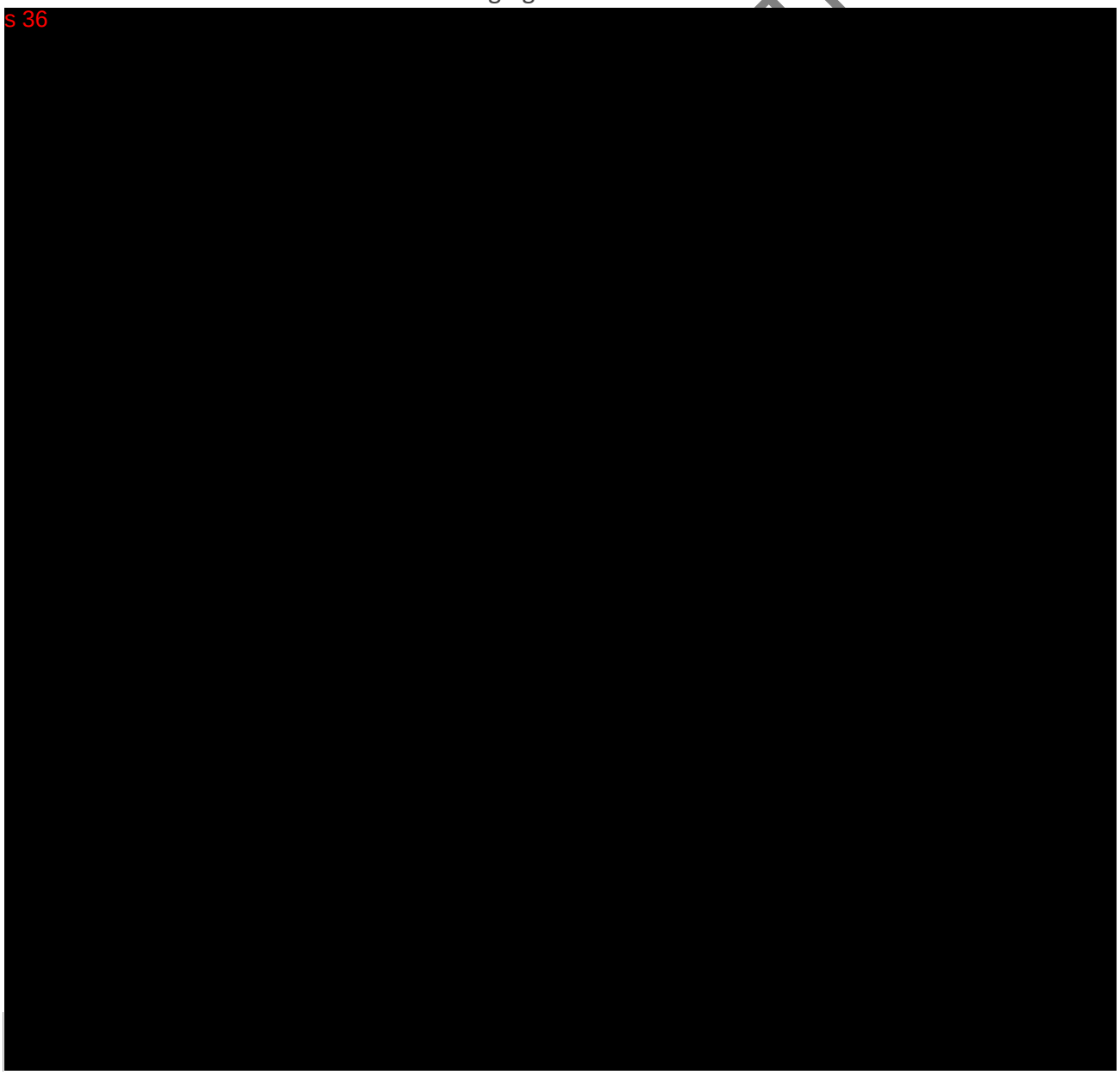


This figure illustrates that the compliant Stopping Sight Distance for 80km/h is not achievable with this alignment without removal of Dynnyrne Road. The achieved sight distance would be slightly better than existing conditions through construction of a new retaining wall and rigid barrier at Dynnyrne Road. It is expected that the Stopping Sight Distance for a reduced 60km/h design speed could be achieved in the design.

The following figure is a view of the existing stopping sight distance from a vehicle travelling northbound which illustrates how the 80km/h SSD is not achieved.

Figure 18 - Road View Existing Sight Distance Issues

The achieved Stopping Sight Distance in the proposed Concept Design may be improved through further realignment of Southern Outlet in future stages of design. Note the shoulder in the Southbound carriageway could be utilised for a larger radius however it is unlikely that a fully compliant SSD for 80km/h is possible.

These barrier upgrade works to Dynnyrne Road would provide added benefit to the Southern Outlet upgrade works. The existing conditions of Dynnyrne Road (shown in the figure below) is a small radius curve on a steep descent with only a w-beam safety barrier on the outside of the curve protecting an approximate 3m drop onto Southern Outlet. W-beam is not designed to be struck at this angle and there is a possibility that a vehicle will crash through the barrier and fall on to Southern Outlet. This residual risk of this existing condition is unacceptable and upgrading to a suitable rigid barrier is recommended.

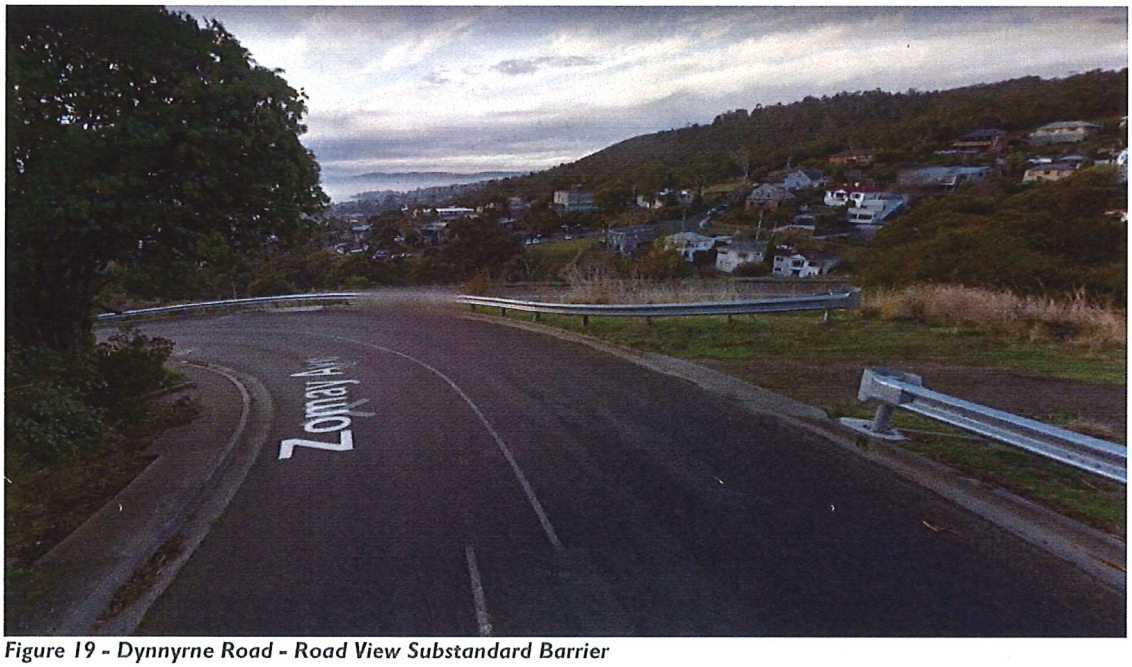
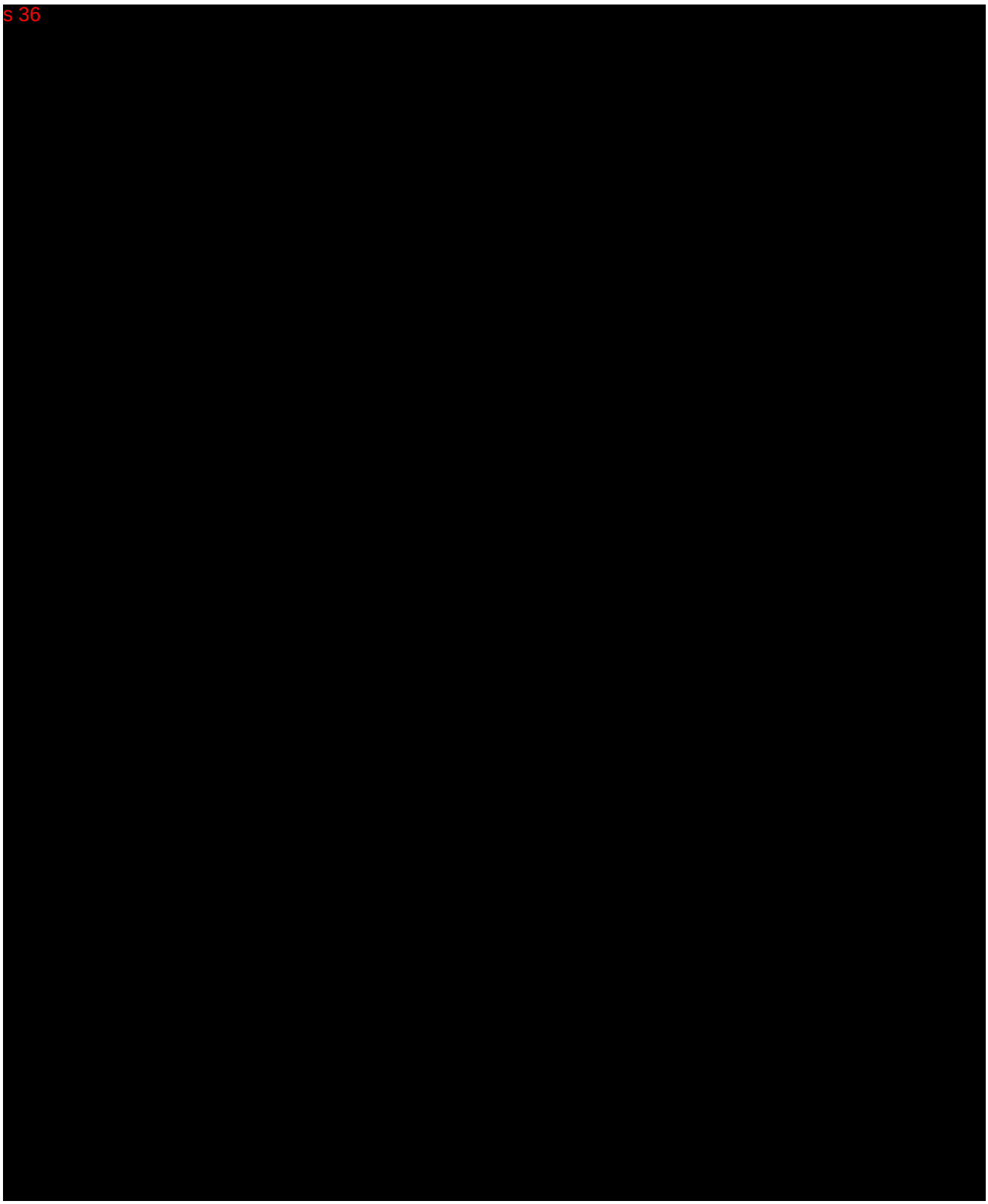


Figure 19 - Dynnyrne Road - Road View Substandard Barrier

On Southern Outlet travelling north of the curve, significant acquisition is required on the west side of the road to accommodate the new lane. The verge would be widened significantly to achieve a compliant Stopping Sight Distance and a retaining wall constructed. The shoulder is restricted to 1.5m to prevent vehicles from using the additional space as a pull-over area which is unsafe. Refer the following two figures.



There is an existing pedestrian underpass (CH1580) connecting Dynnyrne Road and Richardson Avenue which is impacted by the widening works and must be extended. The existing ramps are too steep to meet current DDA requirements, and extending the

underpass requires these ramps to be reconstructed. The natural slope of the hill is steep and does not meet DDA requirements, however the underpass is human-made and therefore the connection between the underpass and the natural surface should be compliant to DDA requirements.

The Concept Design shows what a compliant solution looks like with ramps and approximately 120m of ramps and landings. A staircase is also provided to accommodate other users. While this is a future detailed design issue, a handrail or other design element must be provided at the top of the stairs to separate it from the walkway above and physically prevent users from harm.

This series of ramps is shown conceptually only and future design may seek exception from DDA standards.

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4.7.2 Option 2 – Widen on East Side

An alternative option was provided which widened on the East Side by reducing all the lane and shoulder widths and utilising the space of the existing shoulder in the Southbound carriageway and relocating the retaining wall.

This is illustrated in the section below. The space for the additional lane is achieved by the reduction of all other elements.

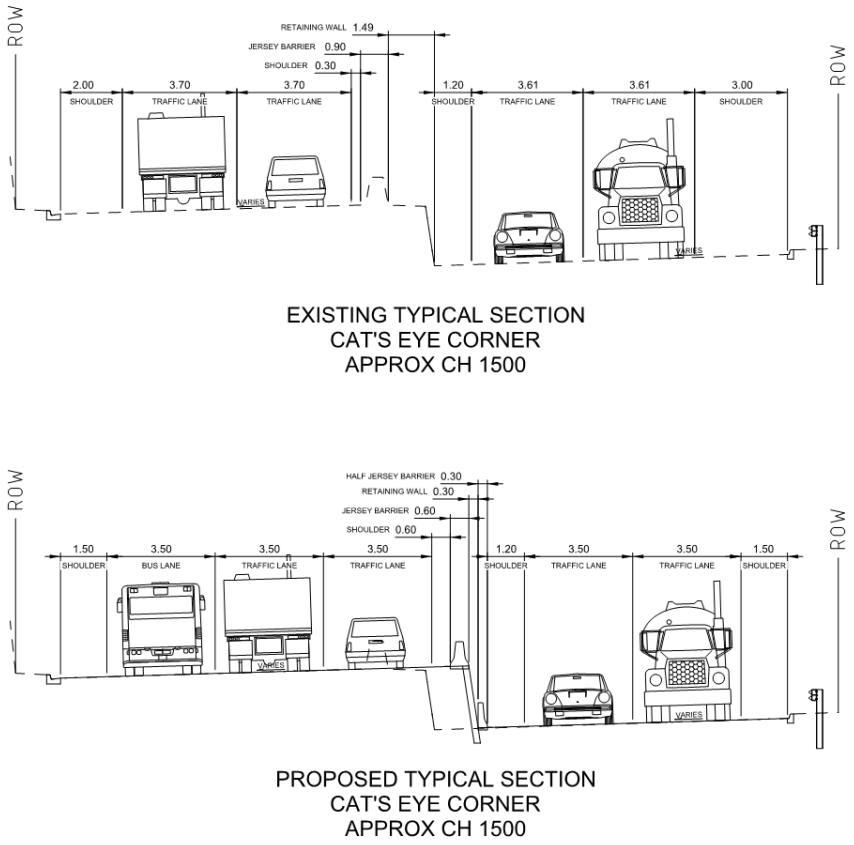

Figure 23 - Section 8 Option 2 Concept

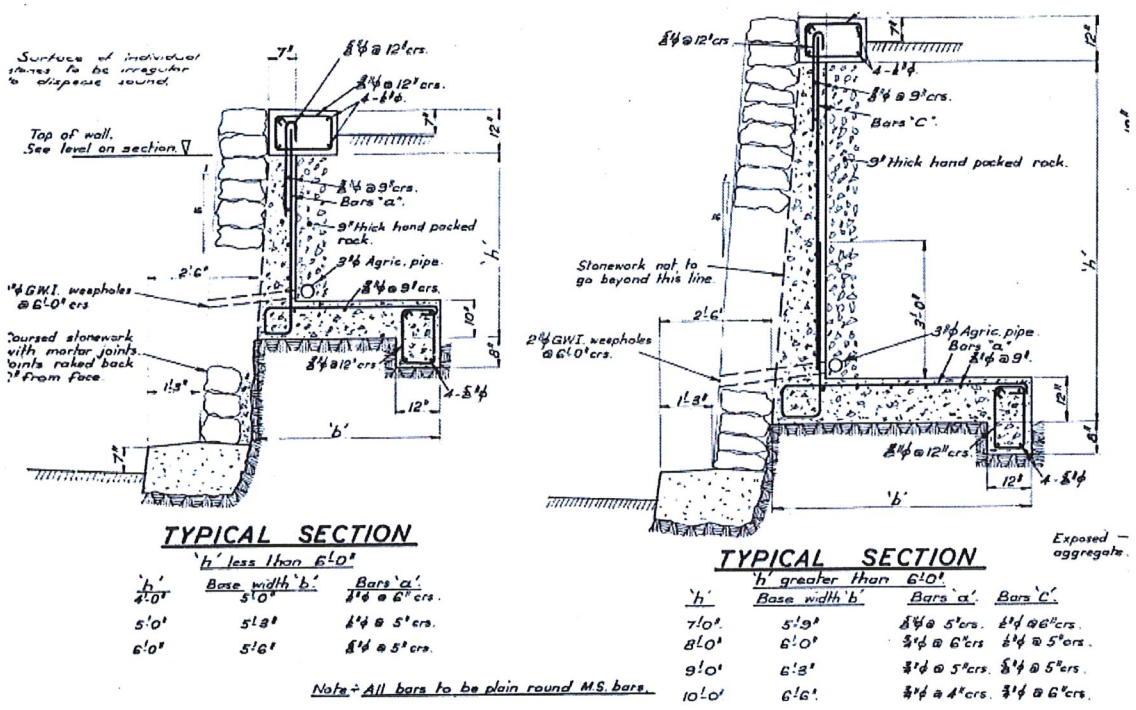

Figure 24 - Extract from As Built of Existing Median Wall

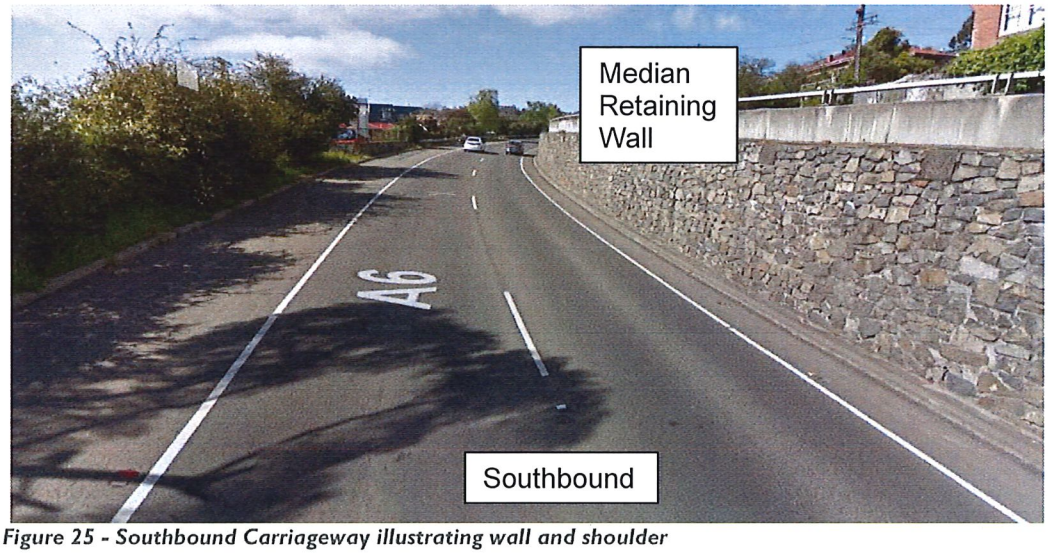

Figure 25 - Southbound Carriageway illustrating wall and shoulder

The purpose of this option is to reduce acquisition on the west side. The 2D concept suggests that there appears to be enough space in the existing cross section to fit in the 5 lanes assuming approved departures from standards. These departures include items such as further reduction in SSD, which has safety implications and does not maintain a like-for-like design to the existing conditions. It also reduces lane and shoulder widths which can have operational implications.

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The proposed reduced cross section has the following disadvantages:

- Loss of shoulder for break-down area on the southbound climb
- Reduced offsets to hazards and barrier in the southbound lane
- Reduction in Stopping Sight Distance for the Northbound and Southbound carriageways
- Reduction in lane widths for the Northbound and Southbound carriageways
- Construction challenges for median works

This option attempts to avoid acquisition by adding an additional lane into an already constrained cross section. It does not maintain like-for-like conditions and these departures can only be resolved through land acquisition. On this basis, it is not recommended that this option is pursued.

4.8 Section 9 – CH1635 to CH1810 – To match in

Section 9 is between Chainage 1635 to the match in point at Chainage 1810.

This section is a match-in to the previous Section 8 and land acquisition would be required on the western side of the road. The difference to the previous section is the road is not located on a small radius curve. Since acquisition is unavoidable in this area, and the shoulder is not on the inside of the curve, a 3.0m shoulder is proposed as a breakdown area.

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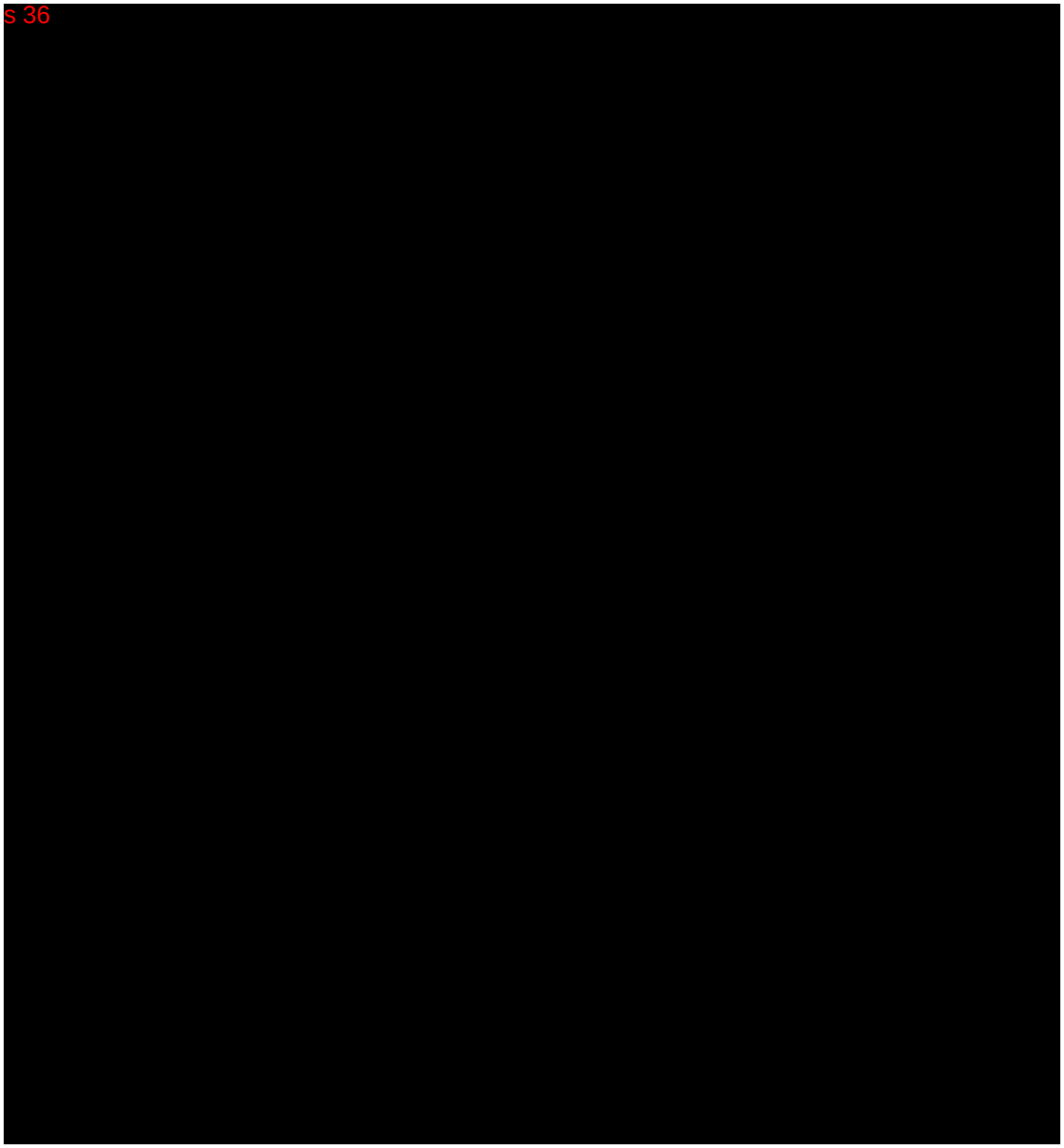


4.9 Section 10 – CH1810 to Davey/Macquarie Street

No works are proposed in this section except for a pull-over area and upgrade to Davey Street and Macquarie Street Intersection.

The existing bus lane will be used as the T3 lane and therefore the existing road cross section and all other elements that do not meet current standards are outside of the scope of this Concept Design.

The Davey Street and Macquarie Street intersection design are pending results of Traffic Analysis.

5. Intelligent Transport System

Intelligent Transport System (ITS) concept designs have been developed to include T3 enforcement sites (primary and secondary), Variable Speed Limit Sign (VSLS), Vehicle detecting devices, and CCTV. The ITS concept design has been developed with sufficient detail for a high-level cost estimate.

Additional scope beyond the minimum required to support a T3 lane (such as southbound devices and VSLS) have been included at the direction of the Department of State Growth.

The ITS Concept Drawings can be found in Appendix A. Additional technical details of the ITS concept design can be found in Appendix D ITS Design Memo.

6. Safety

A Road Safety Audit (RSA) has been carried out and is included in Appendix I of this report including the Designer's response. Most of the items identified in the RSA are existing non-compliances along the Southern Outlet and are typically driven by the topographic and land boundary constraints. The scope of the Concept Design is limited to widening works to create space for a transit lane in the northbound carriageway and is not intended as an overall upgrade project of the Southern Outlet. These significant upgrades have significant cost implications and are outside of the scope of this concept design.

The following issues and recommendations highlighted in the RSA should be further addressed during detailed design:

- Item 1.3/1.4 – Consider reduction of the speed limit on the Southern Outlet
- Item 2.1/2.2 - Further safety improvements and signal timing adjustments at the intersection of the Southern Outlet and Davey Street
- Item 3.1/5.1 - Extension of the Olinda Grove on-ramp and adjustment to the start of the Transit Lane
- Item 3.14 – Additional roadway signage
- Item 4.2/5.4 - Lane widening around bends
- Item 5.3 – Mountable barrier kerb type
- Item 5.6 - Extend the central median on Davey St across the front of the modified slip lane alignment to enforce the left turn movement.

Additionally, the RSA identified some existing maintenance issues that should be addressed during construction or outside of this project:

- Items 2.7/2.12/3.4/3.12 - Vegetation trimming
- Item 3.5 - Distracting TasWater signage

It is important to note that a Safety in Design workshop has not been held within the Concept Design phase; however, it has been necessary to use a number of "Departures from Standards" in order to meet over-riding objectives within the overall constraints of the projects, as noted above. Understanding the risks associated with these Departures is very important from an operational safety perspective and for future design.

Any changes to the criteria for design, design assumptions, and the listed Departures would have a significant impact to the scope of works. Some of the Departures included in the Concept Design, such as reduced design speed, may be best addressed by implementing a reduced speed limit and this should be considered in future phases of design. These items are of high importance and should be included in the project brief and other contract documents to ensure that they are defined and understood by all parties. We recommend the following is carried over from our Concept Design report:

- Project specific requirements including but not limited to a scope of works and design/posted speeds;
- A hierarchy or design standards and guidelines to be adopted;
- An approved departure register to these standards and project specific requirements.

The Design Criteria adopted in the design is outlined in Section 3 of this report and the following sections list the main departures. Refer the RSA for specific items.

6.1 Horizontal Alignment

The below figure outlines the major curves along the Southern Outlet alignment. The key design criteria associated with Horizontal Alignment are curve radius and Stopping Sight Distance (SSD) and these departures are listed in the following sections.

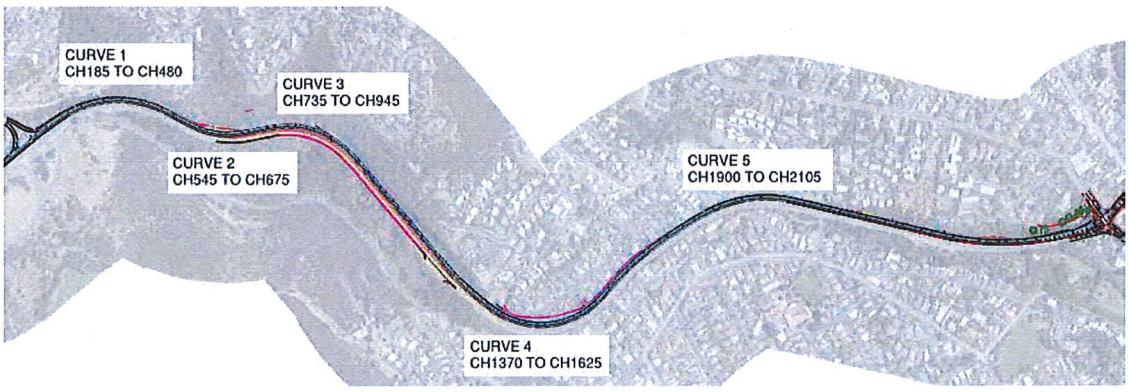


Figure 30 - Major Curve Numbers

6.1.1 Curve Radii

The below Table 4 shows the radius of each major curve (as shown in Figure 30) and compares it with the requirements in Austroads Part 3.

Four of the Five curves do not meet the requirements for 80km/h Design Speed for the desirable car side friction factors, however they all exceed the requirements for absolute minimum side friction factors. These values will be further developed in Detailed Design however departures are unavoidable without significant changes to the alignment.

All curve radii meet the desirable values for 60km/h Design Speed, however the road is currently posted at 80km/h.

Table 4 - Curve Radii

Curve number	Radius (m)	Crossfall	Radius Requirement (80km/h)		Radius Requirement (60km/h)	
			f=0.16	f=0.26 (min)	f=0.24	f=0.33 (min)
Curve 1	206	7.5%	214	**150**	90	70
Curve 2	194	7.7%	213	**150**	89	70
Curve 3	177	8.9%	202	**144**	86	68
Curve 4	173	7.5%	214	**150**	90	70
Curve 5	270	6.8%	**221**	154	92	71

6.1.2 Stopping Sight Distance

The below Table 5 shows the Stopping Sight Distance of each major curve (as shown in Figure 30) and compares it with the requirements in Austroads Part 3.

This value is corrected for grade and calculated in the northbound (Downhill) and southbound (uphill). The existing Southern Outlet has horizontal curve radii below minimum and rigid barrier/wall offsets below minimum. This has resulted in sight lines being interrupted and existing Stopping Sight Distances that are below the minimum required for an 80km/h design speed.

The approximate SSD achieved in the northbound carriageway design are detailed in Table 5 below. These curves do not meet desirable values for 80km/h design speed. Three of the five curves do not meet minimum values for 60km/h design speed.

Table 5 – Stopping Sight Distance Northbound

Curve number	Long. Grade NB	Approximate SSD Achieved (m)	SSD Requirements (m)(80km/h)		SSD Requirements (m)(60km/h)	
			Desirable	Minimum	Desirable	Minimum
Curve 1	-1.9%	63	118	102	75	**65**
Curve 2	-11.1%	128	146	**117**	90	74
Curve 3	-9.2%	57	138	113	86	**72**
Curve 4	-9.4%	94	139	113	**87**	72
Curve 5	-7.4%	65	133	110	83	**70**

The approximate SSD achieved in the southbound carriageway design are detailed in Table 6 below. The southbound is an uphill section so the required SSD is less than the northbound direction, however only one of the five curves meets the desirable value for 80km/h. Three of the curves do not meet minimum values for 80km/h however meets the desirable value for 60km/h.

Table 6 – Stopping Sight Distance Southbound

Curve number	Long. Grade SB	Approximate SSD Achieved (m)	SSD Requirements (m)(80km/h)		SSD Requirements (m)(60km/h)	
			Desirable	Minimum	Desirable	Minimum
Curve 1	7.6%	93	102	**91**	66	60
Curve 2	10.6%	63	99	89	**64**	58
Curve 3	9.0%	65	100	90	**65**	59
Curve 4	8.7%	60	101	91	**65**	59
Curve 5	8.1%	105	**102**	91	65	60

6.2 Cross Sections

The desirable values for shoulder widths, barrier offsets and lane widths (when utilising existing lanes) are not achieved due to topographical and land boundary constraints. There is not one location on this project where there is a strictly conforming cross section due to the median barrier offset always being less than desirable.

An optimised cross-section has been provided in the Concept Design which follows a hierarchal approach and like-for-like. Details of the design criteria adopted in this project for each section is provided in Section 3.5 of this report and on the drawings.

6.3 Roadside Barrier

Barrier is proposed to be replaced on a like-for-like basis on both sides of the road and in the median. Where it is impacted by the works or where a new hazard is introduced, barrier is being replaced with F-type rigid barrier.

The section of Southern Outlet between Olinda Grove Intersection (CH200) and "Cats Eye Corner" (CH1400) does not typically have barrier on the western side of the road where there are large exposed cuts. Under current standards, these cuts would be defined as a hazard and barrier provided. In the current Concept Design, widening works are occurring on the eastern side of the road and no changes to the road in front of the Cutting 20. This is an exposed hazard and requires an approved departure from standards and was determined to be an unacceptable risk considering works were occurring adjacent to the cutting. Therefore, rigid barrier with reduced offset was added.

Also, in areas where works are not proposed (north of the tie-in to existing bus lane, and in the eastern carriageway for example) the existing barrier system does not meet current standards including barrier types and connection types. It is not proposed as part of the Concept Design to upgrade these barriers as they are not impacted by the works. However, this was identified as an item in the RSA.

Note this includes the Lynton Avenue bridge which may not meet current standards. If this was to be upgraded it would likely require strengthening works to the bridge.

6.4 Lighting

Lighting is not currently provided along this section of Southern Outlet and is not included as a scope item in the Concept Design. Lighting is outside of scope for this project as it is not an overall upgrade project however was identified as an item in the RSA.

7. Design Implications

7.1 Land Use Planning

A Planning and Environment Report was undertaken and included a review of land ownership and planning requirements. This report is located in Appendix F of this report including plans and summarised below.

Undeveloped land adjoining the Southern Outlet is predominantly owned by the Crown with some adjacent areas owned by local government. It is not currently used for any agricultural production and is not managed by Sustainable Timbers Tasmania for forestry. Residential areas adjacent the road are privately owned. The northwest of the Olinda Grove Rd junction there are two areas of local government open space reserve. These are unlikely to be impacted due to the availability of reserved road.

In the Concept Design property acquisition is required on the west side of the road beyond Cat's Eye Corner (Dynnyrne Road). Refer to the Planning Report for details.

7.2 Local Road and Private Access

The Southern Outlet is the primary connection between Hobart CBD, Kingston and the southern communities in the Channel and Huon Valley.

Within the location of Sub-Project 1 (between Olinda Grove interchange and Macquarie Street), the Southern Outlet is a Category 1 State Road which functions as a primary freight and passenger road. It is a dual carriage highway, typically with two lanes in each direction, that is separated by a rigid concrete barrier. The posted speed limit is 80 km/h. However, this limit is reduced to 50 km/h on the approach to Davey Street, as it transitions to an urban environment of Hobart CBD.

In the northbound direction, an additional bus lane (third lane) starts approximately 1 km south of Davey Street. The bus lane on Southern Outlet ends approximately 150 metres south of its intersection with Davey Street where all three lanes become available for use by general traffic.

7.3 Stormwater

7.3.1 Stormwater

A Concept drainage design is shown on the drawings in Appendix A. The existing road drainage system is a pit and pipe system which collects water from the kerb and rigid barriers and discharges down the embankment or into pipe systems. The Concept Design matches this design with the following modifications:

- It is proposed that the wearing course is changed to Open Graded Asphalt to reduce risk aquaplaning
- Additional pits are proposed at closer intervals to reduce flow widths against the kerbs and barriers
- Double pits are proposed to increase the capture efficiency at steep grade sections
- Where the barrier or kerb moves, it is proposed to relocate these pits to the new location outside of the lane.

7.3.2 Water Sensitive Urban Design Requirements

Stormwater management must satisfy the requirements of the Planning Scheme and the State Policy on Water Quality Management 1997. The state policy establishes the water quality parameters to be obtained.

The Planning Scheme requires that stormwater from new impervious surfaces must be disposed of by gravity to public stormwater infrastructure. The acceptable solutions are outlined in Table 7. If these cannot be met the works will rely on Performance Criteria – this will trigger a Discretionary level of assessment.

Table 7 Stormwater standards

Acceptable Solution	Performance Criteria
A1 Stormwater from new impervious surfaces must be disposed of by gravity to public stormwater infrastructure	**P1** Stormwater from new impervious surfaces must be managed by any of the following: (a) Disposed of on-site with soakage devices having regard to the suitability of the site, the system design and water sensitive urban design principles (b) Collected for re-use on the site; and (c) Disposal to public stormwater infrastructure via a pump system which is designed, maintained and managed to minimise the risk of failure to the satisfaction of the Council.

Acceptable Solution	Performance Criteria
A2 A stormwater system for a new development must incorporate water sensitive urban design principles for the treatment and disposal of stormwater if any of the following apply: (a) The size of new impervious area is more than 600 m2 (b) New car parking is provided for more than 6 cars; and (c) A subdivision is for more than 5 lots.	**P2** A stormwater system for a new development must incorporate a stormwater drainage system of a size and design sufficient to achieve the stormwater quality and quantity targets in accordance with the State Stormwater Strategy 2010, as detailed in Table E7.1 unless it is not feasible to do so.

As the proposed transit lane will be larger than 600 m2 in area the WSUD principles apply – these are outlined in Table 8 and should be incorporated into any future design.

Table 8 Stormwater targets

Acceptable Stormwater Quality and Quantity Targets
80% reduction in the average annual load of total suspended solids (TSS) based on typical urban stormwater TSS concentrations.
45% reduction in the average annual load of total phosphorus (TP) based on typical urban stormwater TP concentrations.
45% reduction in the average annual load of total nitrogen (TN) based on typical urban stormwater TN concentrations.
Stormwater quantity requirements must always comply with requirements of the local authority including catchment-specific standards. All stormwater flow management estimates should be prepared according to methodologies described in Australian Rainfall and Runoff (Engineering Australia 2004) or through catchment modelling completed by a suitably qualified person

7.3.3 Hydrology

The project area is within the Derwent Estuary-Bruny catchment and is within the Hobart-Sandy Bay-Lamberts sub-catchment. The road passes through the Proctors and Sandy Bay areas of the Hobart stormwater catchment.

Proctors Creek and two of its tributaries pass under the Southern Outlet in a west to east direction. The creek is channelised when it reaches Sandy Bay and enters the general stormwater system, ultimately discharging to the River Derwent. The Sandy Bay Rivulet passes under the Southern Outlet near Lynton Avenue and is highly modified at that point.

7.4 Utilities

A Dial Before You Dig request was conducted, along with review of available Utility GIS information, and the data was digitised into a CAD format and shown on the drawings. A preliminary assessment of utility impact was carried out for the extents of SP1.

7.4.1 Olinda Grove to Davey Street

Water

At approximate chainage 1490 a DN200 cast iron water main and DN50 galvanised water main crosses the southern outlet, running within an area of road widening and a new retaining wall. This service is owned and maintained by TasWater. The location and impact of the new retaining wall should be assessed with regards structural and operational compromise of the water mains, and relocation of the pipes is recommended.

Between chainages 1950 and 1970 a DN600 mild steel cement lined water main and DN150 cast iron water main crosses the southern outlet. These services are owned and maintained by TasWater. As there are no widening works in this vicinity, there are no impacts on the pipe.

Between chainages 2780 and 2820 (crossing of Davey Street) there are four (4) significant water mains which are crossed. These services are owned and maintained by TasWater. The location and impact of the new roadworks (alignment and depth of cover to pipes) should be assessed with regards structural and operational compromise of the water mains and appurtenances.

Sewer

At approximate chainage 110 a DN225 cast iron gravity sewer runs across the southern outlet. This service is owned and maintained by TasWater. As there are no widening works in this vicinity, there are no impacts on the pipe.

Between approximate chainages 1515 and 1830 a DN150 RC gravity sewer runs along the rear of properties to be acquired due to road widening and new retaining wall. This service is owned and maintained by TasWater. The location and impact of the new retaining wall and removal of properties being serviced makes removal and/or decommissioning of this pipe recommended.

Between approximate chainages 1950 and 1970 a DN150 RC gravity sewer runs across the southern outlet. This service is owned and maintained by TasWater. As there are no widening works in this vicinity, only line marking changes, there are no impacts on the pipe.

Between approximate chainages 2000 and 2020 a DN150 RC gravity sewer runs across the southern outlet. This service is owned and maintained by TasWater. As there are no widening works in this vicinity, only line marking changes, there are no impacts on the pipe.

Power

At this stage no power services identified are identified as being impacted by the works. This should be confirmed in future stages.

Gas

There are no gas services in the vicinity of these proposed works.

Telecommunications

There are no telecommunications services that were identified as impacted by these proposed works.

Table 10: Public Utilities within Project Site

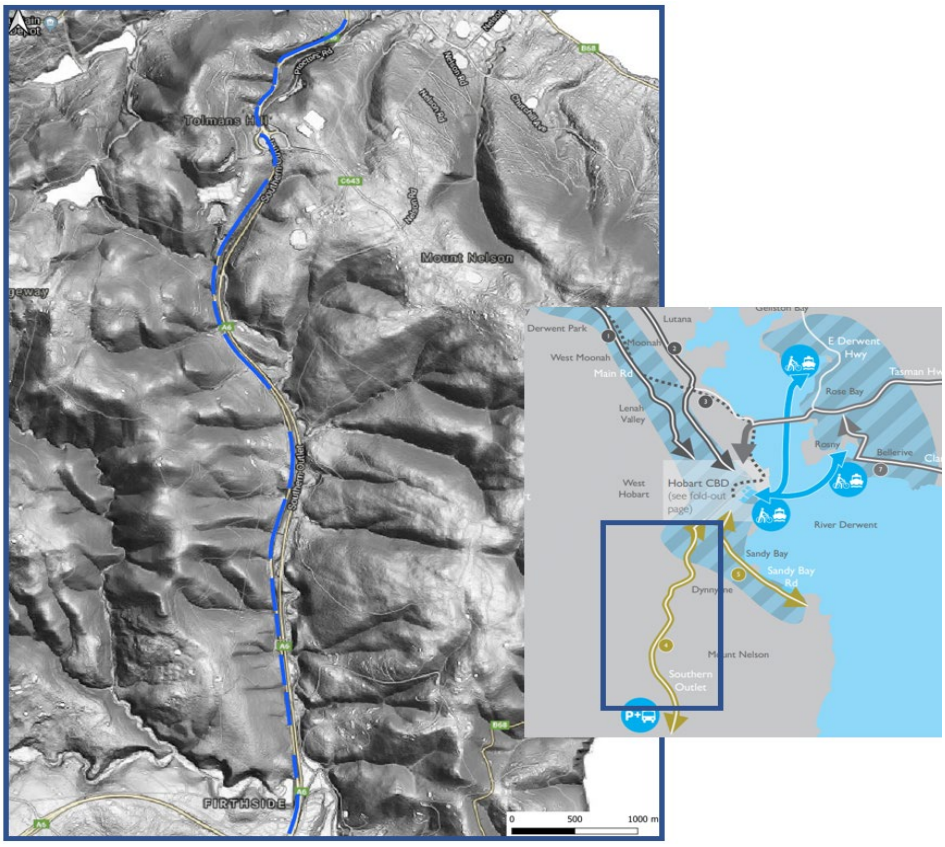
Utility	Description of Assets	Estimate of Works Required
TasWater	Gravity Sewer crossing at chainage 110	No impact
Taswater	Water Mains crossing at chainage 1490	Relocate clear of retaining wall
TasWater	Gravity Sewer between 1515 and 1830	Remove or decommission
TasWater	Water Mains crossing between chainages 1950 and 1970	No impact
TasWater	Gravity Sewer crossing between chainages 1950 and 1970	No impact
TasWater	Gravity Sewer crossing between chainages 2000 and 2020	No impact
Taswater	Water Mains crossing between chainages 2780 and 2820	Assess impact

7.5 Geotechnical

7.5.1 Geotechnical Investigation

A Geotechnical Report was prepared and is attached in Appendix G of this report.

The Geotechnical Report presents the findings of the geotechnical assessments of the proposed road cuttings along the route; and the potential slope downhill of the northernmost cutting. Twenty cuttings along the western side of the northbound carriageway of the Southern Outlet were inspected; see Figure 31 below. They total over



5.4km in length.

Figure 31 - Location of Cuttings

It was determined that Cutting 20 is clearly the most difficult area to deal with from a geotechnical perspective. All other areas are likely to be able to be excavated or sufficient room found without major issues.

In the vicinity of Cutting 20 it is considered that widening to the downhill side may be the safest and most cost-effective method of widening the road. This cutting is already considered to present a level of risk to the travelling public and movement of the traffic closer to the cutting would increase that risk and would require mitigation. For this reason, widening on the downhill side of the road in this area is recommended.

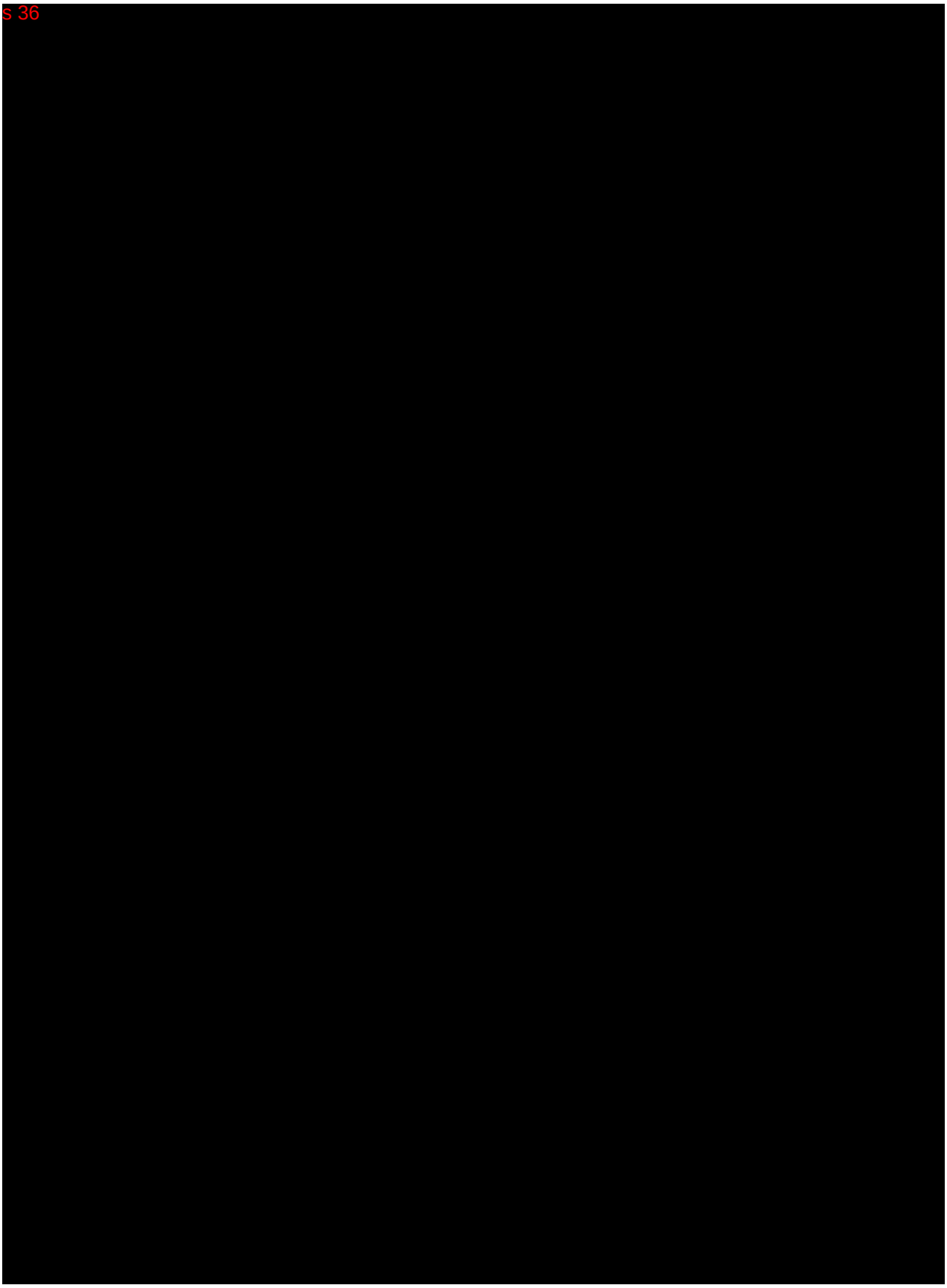
- Widening on the downhill side of the road is also suggested from approximate chainages 600m to 1180m. Within this overall section there is currently narrow verge from CH800 to CH835, and CH940 to CH1110. Further penetrative testing was carried out between 7th and 9th of July 2020 and the Geotechnical Addendum is included in Appendix H.

7.5.2 Natural Values

The Tasmanian Geoconservation Database lists geodiversity features, systems and processes of conservation significance. It includes features identified in scientific publications and through geoconservation assessments. Management Goals and Notes are provided for each feature which aim to protect the feature and its relevant values. Features are identified on the Natural Values Atlas and while not regulated under specific legislation, the management of these features fall under the Objectives of the Resource Management and Planning System of Tasmania. Some features are protected by specific codes under the relevant planning scheme (e.g. karst systems).

One listed Geoconservation site, the Mt Nelson Dolerite Intrusion exposure, is located either side of the Southern Outlet just north of Olinda Grove Rd. This feature is of national significance (being rare or not occurring outside Tasmania), is a notable example of this type of formation and is representative of the key features of Jurassic dolerite intrusions in Tasmania. Further assessment of the extent of this formation and protective measures in place should be undertaken as part of the design development process.

The Management Goals for this feature are to maintain exposure. Management Notes for the feature state that maintaining clear exposures in road cuttings is the key to maintaining the values of this site and should be considered in any future roadworks. The proposal will be consistent with the recommended management.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7.7 Stakeholder Implications

Initial stakeholder consultation for the Southern Outlet Transit Lane has been conducted as part of the overarching engagement for the Hobart City Deal Southern Projects.

On 6 November 2019 and 18 November 2019, the Department of State Growth held a Focus Group with key external stakeholders in Kingborough and Hobart, respectively, to discuss local issues and obtain feedback to contribute to the planning and design processes of the Hobart City Deal. During the Focus Group, stakeholders expressed support for aspects of the Southern Projects, including the proposed park and ride sites and bus priority on Macquarie/Davey Street. No specific comments on the proposed Southern Outlet T3 Lane were raised.

The key stakeholders identified during the concept design phase are summarised below:

- Department of State Growth
- Tasmanian Government
- Australian Government
- Department of Police, Fire & Emergency Management
- Department of Primary Industries, Parks, Water and Environment
- Department of Premier and Cabinet
- City of Hobart
- Adjacent landowners on Dynnyrne Road
- Bus operators

7.8 Environmental issues

7.8.1 Environment - Flora and Fauna

A Planning and Environment Report was undertaken. This report is in Appendix F of this report for details however is summarised below.

Regarding Commonwealth protected values, the search identified 32 listed threatened species and 12 migratory species which are known or have the potential to occur in the search area. Nine are plants and the remainder are predominantly avian species. There is an area of Commonwealth threatened ecological communities (TEC) south east of the alignment near Olinda Grove Rd, but this is unlikely to be impacted.

Regarding State protected values, a search of the Natural Values Atlas was undertaken and a number of species, additional to the federally listed species mentioned above, were identified as occurring within 500 m of the current road alignment. Seven plant species listed in the act have been previously recorded within 500 m of the road.

Regarding Weeds, the Natural Values Atlas Search indicated that the 15 listed weeds declared under the Tasmanian Weed Management Act 1999 have been recorded within 500 m of the Southern Outlet. Gorse is the only one recorded close to the road (one record 50 m to the east).

7.8.2 Historic Heritage

A Heritage Management Strategy was prepared by Praxis and is provided in Appendix F. The strategy identified potential heritage issues arising from the proposed Southern Projects, including widening/reconfiguration of the Southern Outlet. The report identified each section of the project area and discussed applicable statutory heritage requirements which may be applicable.

There are several Heritage listed properties adjoining the northern end of the Southern Outlet, mostly in the section between Davey and Macquarie Streets, and just to the south of that section. The findings are summarised below:

- **Properties listed on the Tasmanian Heritage Register** – none are included in the survey corridor
- **Properties listed in the Planning Scheme heritage schedule –** none are included in the survey corridor
- **Heritage Precincts identified under the Planning Scheme** - parts of the survey corridor overlap with the Heritage Precinct H4 (Davey Street from Antill Street to the Southern Outlet) and Precinct SH2 (from 353 -357 Macquarie Street). Any major works may require a development application
- **Places of Archaeological Potential identified under the Planning Scheme** – part of the survey corridor overlaps with a Place of Archaeological Potential. There are exemptions available for some works, however, depending on the extent an application, an archaeological impact assessment may be required; and
- **Trees included on the significant trees list** – the proximity of works and the potential for impacts on the English Oak at The Hermitage (251 Davey Street) will need to be considered.

There are not considered to be any critical heritage issues on the portion of the survey corridor from Fitzroy Gardens to Olinda Grove.

A Heritage Impact Assessment (Appendix J) was prepared by Praxis on the preferred concept design against any statutory heritage requirements and the conservation policies.

The assessment found that whilst a Development Application may be likely to be required for these works in order to address Clause E.13.8. (Heritage Precinct provision) in the scheme, it is considered unlikely that the realignment of modern rear retaining walls would result in unreasonable impact upon the heritage values of the precinct. However, this would need to be considered in more detail and on a case by case basis via a discretionary DA if required.

7.8.3 Aboriginal Heritage

Aboriginal cultural heritage is managed by Aboriginal Heritage Tasmania (AHT) under the Aboriginal Heritage Act 1975. The Department of State Growth has undertaken an AHT desktop review. There are no recorded Aboriginal Heritage sites within the project footprint. Works may proceed under the condition of an unanticipated discovery plan.

7.8.4 Noise

A noise assessment will be required to determine the need for noise mitigation and to confirm compliance with the planning scheme and the Tasmanian State Road Traffic Noise Management Guidelines (Department of State Growth, 2015). This should be commenced once the concept alignment is finalised and proposed land acquisitions are confirmed.

The Planning Scheme requirements are associated with the Utility zone provisions and relate to noise generated by the use. These are outlined in Table 9.

Table 9 Planning Scheme noise requirements

Acceptable Solutions	Performance Criteria
A1 Noise emissions measured at the boundary of a residential zone must not exceed the following: (a) 55 dB(A) (LAeq) between the hours of 7.00 am to 7.00 pm; (b) 5dB(A) above the background (LA90) level or 40dB(A) (LAeq), whichever is the lower, between the hours of 7.00 pm to 7.00 am; and (c) 65dB(A) (LAmax) at any time. Measurement of noise levels must be in accordance with the methods in the Tasmanian Noise Measurement Procedures Manual, issued by the Director of Environmental Management, including adjustment of noise levels for tonality and impulsiveness. Noise levels are to be averaged over a 15 minute time interval.	**P1** Noise emissions measured at the boundary of a residential zone must not cause environmental harm within the residential zone.

The acceptable solution 'A1', has been formulated primarily to address noise emitted industrial or commercial developments and is not well suited to evaluating the impact of traffic noise, however the methodology provided in the traffic noise guidelines is directly applicable to addressing the performance criterium 'P1'.

At the northern (urban) end of the project, the existing road alignment brings large traffic volumes very close to adjoining residences, with no noise migration measures currently in place. It can be reasonably expected that the existing noise levels at most houses will be above 68 dB(A) and that noise mitigation measures will be recommended upon application of the guidelines throughout this part of the project.

Noise walls may need to be considered, although residents on the "uphill" side of the road may find these undesirable as, depending on the height required, they may obstruct existing views. These mitigation actions would be subject an assessment of reasonableness, practicality and cost-effectiveness as outlined above.

Other mitigation measures such as Open Graded Asphalt may be considered.

The southern end of the project is unlikely to need noise mitigation.

7.8.5 Development Application (DA)

It is expected that a Development Application will be required for this project. Items to be addressed within the application are listed below:

- There is an area of Commonwealth TEC south east of the alignment near Olinda Grove Rd, but this is unlikely to be impacted
- State listed threatened native vegetation communities are unlikely to be impacted
- Threatened flora species have not been recorded within 200 m of the current road alignment north of the Olinda Grove Rd intersection, but a flora and fauna survey will confirm the presence of any or suitable habitat
- The flora and fauna survey will also confirm the presence of any trees suitable for potential nesting habitat for threatened bird species such as swift parrot and masked owl (among others)
- Weeds will be identified during the flora and fauna survey, which will target the road corridor and a suitable buffer. Appropriate weed management actions and timeframes will be required for implementation prior to and during construction.
- A site of geoconservation significance is present on both sides of the road (dolerite outcrop) and will require consideration in the design – maintenance of clear exposures in road cuttings is the preferred management of this feature
- The road passes through areas of medium risk landslide hazard which will require consideration

- The area of land available for construction of the road is highly constrained at the northern end where it passes between residential properties
- Several utilities are located within the corridor and will require consideration in the design (potentially requiring relocation)
- The heritage report prepared by Praxis recommended that no works should be undertaken on any State listed place of heritage significance or any places of archaeological sensitivity unless there is no viable alternative. The Heritage Impact Assessment of the concept design determined that it is unlikely that the realignment of modern rear retaining walls would result in unreasonable impact upon the heritage values of the precinct; however, this would need to be considered in more detail and on a case by case basis via a discretionary DA if required.
- Works beyond resurfacing or lane reconfiguration (e.g. like-for-like works) within any Place of Archaeological Potential are to be preceded by a statement of archaeological potential, and if necessary, an archaeological impact assessment and archaeological method statement
- Works should seek to avoid impact to significant trees/plantings. If any impact is proposed, then a rigorous assessment will be required to demonstrate there are no alternative
- The use is permissible in the Utilities zone – permit requirements will need to be confirmed with Council, but a permit is likely to be required
- Stormwater not being discharged to the Council system will be required to meet state water policy standards, and
- A noise assessment will be required to determine the need for noise mitigation and to confirm compliance with the planning scheme. This should be commenced once the concept alignment is finalised and proposed land acquisitions are confirmed.

8. Cost Estimates

8.1 General

WT Partnerships were engaged as a sub-consultant to carry out a Concept cost estimate for the Southern Outlet. The cost estimate is included in Appendix B.

The basis for the estimate was a set of the Concept Design Drawings, Estimate Advice Notice, and risk register prepared by pitt&sherry, as well as the ITS Design Memo prepared by WSP.

The summary of the cost estimate is provided in subsequent sections.

8.2 Base Estimate

The total base estimate for construction cost is $30,148,800. s 38 [redacted]

s 38 [redacted]

[redacted]

8.3 Contingency

Contingent risks have been included in the cost estimates for the Southern Outlet Transit Lane based on the risk register in Appendix C.

Based on the probabilistic cost estimate, there is a 50 per cent chance that the final project cost will be below $35,798,800 and a 90 per cent chance that the final project cost will be below $39,998,800. The estimates are summarised in the following table.

Table 10 – Contingent cost estimate summary

	P50 ($m AUD)	P90 ($m AUD)
Base Cost Estimate	30.15	30.15
Contingency	5.65	9.85
Total Project Cost Estimate	35.8	40.0

8.4 Cost Escalation

Cost escalation has been excluded from this cost estimate.

8.5 Cost Summary

Refer to Appendix B for a detailed breakdown of costs and contingencies.

9. Risk Assessment

9.1 General

A risk register has been developed for the project and is included in Appendix C. The register was developed and updated throughout the concept design process and included input from the Design Workshops with the Department's Internal Working Group on 3 February 2020 and 30 April 2020. The risks included in the register have been used to inform the inherent and contingent risk components of the cost estimate.

Figure 32: Risk Likelihood Evaluation Criteria

Risk Likelihood Evaluation Criteria

The likelihood that a risk event will occur is based on the following contributing factors:

- Complexity – evaluated in the context of the complexity of a process or activity
- Susceptibility – evaluated in the context of people, processes, stakeholders involved or the rate of change within industry.
- History – evaluated in the context of the history of previous incidents directly within the organisation, industry or more broadly.

Some events happen once in a lifetime. Other cans happen almost every day. Analysing risk requires an assessment of their frequency of occurrence. This following table provides broad descriptions used to support likelihood ratings. The occurrence will be evaluated without reference to known management practices since these are at a later stage of the risk assessment process.

RISK ASSESSMENT MATRIX		LIKELIHOOD (Refer to Definitions right)				
		A. Rare	B. Unlikely	C. Possible	D. Likely	E. Almost Certain
CONSEQUENCES (Refer to Definitions Overleaf)	5 - Catastrophic	M	H	H	VH	VH
	4 – Major	M	M	H	H	VH
	3 – Moderate	L	M	M	H	H
	2 – Minor	L	L	M	M	H
	1 - Notable	L	L	L	M	M

	Risk Action Levels
VH - Very High	▪ Minister/Secretary decision/direction may be required ▪ Provide memorandum to Manager Project Services ▪ Include in Project Monthly Report
H – High	▪ Take immediate action to further control the risk ▪ Include in Project Monthly Report ▪ Consider providing supplementary advice to Manager Project Services
M – Medium	▪ Proactively manage risks ▪ Report to Project Steering Committee through risk register ▪ Review for improvement opportunities
L – Low	▪ Monitor risk, reduce if practicable

Likelihood Definitions
What is the likelihood of the selected consequences occurring?

Likelihood Rating	Description
5 - Almost Certain	▪ Over 90% probability; or ▪ "Happens Often"; or ▪ "Unlikely that it won't happen"
4 - Likely	▪ Greater than 50% probability; or ▪ "Could easily happen"
3 - Possible	▪ Greater than 10% probability; or ▪ "Could happen, has occurred before".
2 - Unlikely	▪ Greater than 1% probability; or ▪ "Hasn't happened yet but could".
1 - Rare	▪ Less than 1% probability; or ▪ Conceivable, but only as a result of combination of unusual events.

Figure 33: Risk Consequence Evaluation Criteria

Risk Consequence Evaluation Criteria

In the context of the risk assessment, risks are assessed in terms of their impact on the achievement of business strategies and operational outcomes. Risk evaluation criteria may be based on operational, technical, financial, legal, social, environmental or other criteria. Each consequence can be rated, in terms of its severity, from notable to catastrophic as follows:

Consequence Definitions What is the likely consequences in the event of a failure?

Rating	Community	Environment & Heritage	Legal & Compliance	Reputation	Management Impact	Financial Impact	Program Impact
5 – Catastrophic	• Complete loss of trust by affected community leading to social unrest & outrage.	• Unacceptable impact on environmental values with high significance. • Unacceptable impact on heritage values with high significance.	• Major litigation with significant damages costs • Potential Prosecution by authorities. • Court or Non-Government Organisation (NGO) imposed fine	• Reputation and standing of DIER affected locally, national and internationally • Catastrophic loss of confidence by key stakeholders.	• Requires management at Ministerial Level • Requires new or amended legislation	• Project unable to proceed • Loss of Federal funding • Election commitment projects cancelled or deferred to balance budget	• Project is never able to proceed
4 – Major	• Prolonged community outrage	• Serious long term environmental impact • Partial loss of significant heritage values	• Major Litigation • Class action • Possibility of custodial sentence for Senior Management	• Major embarrassment for DIER locally and nationally. • Significant loss of confidence of key stakeholders	• Critical event that requires considerable Secretarial and General Manager time to manage over many months	• Additional Federal Government funding required at project level • Additional State funding required to program budget	• Project is delayed indefinitely
3 – Moderate	• Sustained community disruption leading to actions requiring continual management attention	• Moderate impact but not affecting ecosystem function • Moderate impact on heritage values	• Major breach of regulation with punitive fine • Significant litigation involving many weeks of senior management time	• Community and stakeholder concern on a number of issues suggesting an inability to deliver results.	• Significant event that can be managed with careful management attention • Will take some branch-level Management time over several weeks	• Other projects cancelled or deferred (internal budget reallocation) • Scope reduced on other projects in the program	• Critical timeframe for delivery cannot be met
2 – Minor	• Short-term community outrage or sustained but localised community disruption	• Minor impacts on environmental values • Minor impact on heritage values	• Serious breach of regulation with investigation or report to authority with prosecution and/or moderate fine possible	• Issues raised by community and stakeholders • Negative perception of DIER in parts of the community or with key stakeholders.	• Will require Group Manager attention over several days	• Scope reduced on other projects in program • Internal budget reallocation	• Moderate delay against non-critical timeframe for delivery
1 – Notable	• Insignificant localised community disruption	• No impact values	• Minor breach of regulation	• Some isolated impact on DIER reputation at any level.	• Impact of event absorbed in normal management activity.	• Use of contingency funds is required	• Minor delay to program

9.2 Options

As described in Chapters 4 and 5 of this report, various configuration options were considered along the 9 segments of the Southern Outlet, which were assessed against project objectives and risks.

9.3 Discussion and Analysis

9.3.1 Risk Implications and Mitigation Factors.

Throughout the concept design process and during the design workshop, risks associated with the Implementation, Scope, Stakeholder, Design, Approvals, and Construction were discussed and recorded.

The likelihood and consequence of the risks identified for the above criteria was discussed taking into account general project management treatments, with a resultant risk level identified. The same procedure was again undertaken taking into account project specific treatment that can be introduced to reduce the identified risk level to a more manageable or acceptable level. The residual risk of a number of items remained high following this process

Table 10 sets out these high-risk items, the full risk assessment is included in Appendix C.

Table 11 – High Risk Level Residual Risks

Risk Category	Risk
Implementation	• Complexity of process to acquire land results in delays to commencement of construction
Scope	• Extent of pavement rehabilitation on existing carriageway • Barrier not provided in front of existing Cutting 20 is required resulting in scope increase of rigid barrier • Existing sightline issues and horizontal curve issues must be upgraded resulting in significant scope increase and acquisition.
Stakeholder	• Project is poorly received by the community. Negative press. • Stakeholders and public not engaged in project • Dissatisfied stakeholders' results in media attention • Project land acquisition difficult to obtain and poorly received by the community. Negative press.
Construction	• Complexity of structural activities (i.e. retaining walls) results in increased costs

9.3.2 Environmental and Statutory Risks

A few project risks were identified by the project team that have the potential to dictate aspects of the final design and project delivery timeframe, such as environmental, heritage, stakeholder and statutory risks. Investigation of the potential impacts of these constraints was not included in the project scope.

Table 12 – Environmental & Statutory Risks

Environmental and Statutory Risks	Mitigation
Environmental risk	• Conduct a flora and fauna survey to confirm the presence of any trees suitable for potential nesting habitat for threatened bird species and identify any threatened flora species or weeds. • Weeds will be identified during the flora and fauna survey, which will target the road corridor and a suitable buffer. Appropriate weed management actions and timeframes will be required for implementation prior to and during construction.
Heritage risk	• If any works are required on any State listed place of heritage significance or any places of archaeological sensitivity, a rigorous heritage impact assessment must be undertaken • Works beyond resurfacing or lane reconfiguration (e.g. like-for-like works) within any Place of Archaeological Potential are to be preceded by a statement of archaeological potential, and if necessary, an archaeological impact assessment and archaeological method statement • A search of the Aboriginal Heritage Register should be undertaken to determine if any sites are present. If sites are present an assessment may be required. If none are recorded an Unanticipated Discovery Plan may need to be implemented
Geotechnical risk	• A site of geoconservation significance is present on both sides of the road (dolerite outcrop) and will require consideration in the design – maintenance of clear exposures in road cuttings is the preferred management of this feature. The road passes through areas of medium risk landslide hazard which will require consideration.
Noise	• A noise assessment will be required to determine the need for noise mitigation and to confirm compliance with the planning scheme. This should be commenced once the concept alignment is finalised and proposed land acquisitions are confirmed.

Environmental and Statutory Risks	Mitigation
Public and stakeholder engagement risk	• Public and stakeholder consultation will be undertaken prior to further design work being undertaken.
Land acquisition risk	• Further refinement of land acquisition risk early in the development Phase is required.

9.4 Summary

A preliminary risk assessment has been undertaken and has identified major risks to the project. Several risks were identified, with the likelihood and consequence of these risks determined and outlined in the Risk Register (Appendix C). A few of these risks remain in the high-risk category following consideration of perceived project management and project specific treatment. It is recommended that these high category risks are quantified further in the delivery phase of the project, with mitigation measures introduced in the detailed design phase to continue to reduce these risks.

10. Program – Development and Delivery Phases

10.1 General

The project program is developed for each stage of the project, including scoping, development and delivery phase.

10.2 Program

A high-level summary of the project timeframes is shown in Table 13 below.

Table 13 Proposed timeframe

Milestone	Date
Concept design complete	2020
Detailed design commences	2021
Construction commences	Late 2022