Feasibility Design Report

Molonglo 3 Road Access and Molonglo River Bridge, John Gorton Drive (North) and Bindubi Street Extension (West)

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Molonglo 3 Road Access and Molonglo River Bridge, John Gorton Drive (North) and Bindubi Street Extension (West)

Client: Shared Services Procurement

ABN: N/A

Prepared by

AECOM Australia Pty Ltd
Level 2, 60 Marcus Clarke Street, Canberra ACT 2600, Australia
T +61 2 6201 3000 F +61 2 6201 3099 www.aecom.com
ABN 20 093 846 925

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Prepared by	Alex Jiao, Marcus Sainsbury, and Linda Mulyadi
Reviewed by	Rod Weeks

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			Name/Position	Signature
B	20 March 2015	For information	Jane Peters Project Manager	
C	8 May 2015	Update in response to CMTEDD Comments and for Stakeholder Circulation	Jane Peters Project Manager	
D	July 2015	Updated in response to Stakeholder Circulation Comments	Jane Peters Project Manager	

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Executive Summary

In February 2014, Shared Services Procurement on behalf of Chief Minister, Treasury and Economic Development Directorate formerly known as Economic Development Directorate of the ACT Government, engaged AECOM to undertake the Molonglo 3 Road Access and Molonglo River Bridge Feasibility Study connecting Molonglo 2 at the southern end of the study area and William Hovell Drive Drive at the northern end.

The scope of this study is to identify the preferred road alignments, intersection arrangements and staging strategy for the following:

- John Gorton Drive from Molonglo Stage 2 Group Centre (John Gorton Drive Stage 2A) to the intersection with Bindubi Street Extension.
- John Gorton Drive from intersection of Bindubi Street Extension to William Hovell Drive which was formerly known as Coulter Drive Extension.
- Bindubi Street Extension stub from John Gorton Drive to the Bulk Supply Water Main.
- Intersection arrangement of John Gorton Drive with Bindubi Street Extension
- Identification of the most appropriate location for access roads westbound off John Gorton Drive into Molonglo 3 Stage 1 based on safe intersection design requirements. Development in Molonglo 3 is planned to commence in the northwest area of Molonglo 3 adjacent to William Hovell Drive. The location of the access road intersections are:
    - Northern Access Road which is located closer to William Hovell Drive to provide access to the first stage of development of Molonglo 3.
    - Emergency Access Road to provide a second access to the first stage of development of Molonglo 3 located south of the Northern Access Road pending upon the timing of the construction of the Southern Access Road.
    - Southern Access Road which is located at the intersection with Bindubi Street Extension and is proposed to extend west of John Gorton Drive to serve development in the south west of Molonglo 3
- Intersection arrangement of John Gorton Drive with William Hovell Drive Drive.

The staging of progressive improvements and new road carriageways are based on the forecast traffic volumes and the condition assessment of Coppins Crossing Road.

A review of previous studies, concurrent projects and existing constraints was undertaken and considered in the assessment of the preferred alignment of John Gorton Drive, including the following:

- Minimising impact to the existing major utilities such as 132 kV electricity transmission lines, 2550 mm diameter Molonglo Valley Interceptor Sewer and 900 mm diameter Bulk Supply Water Main to Belconnen.
- Assessing the condition of the existing Coppins Crossing Road through a Road Safety Audit and Pavement Assessment.
- Minimising impacts to the environment and heritage sensitive areas, in particular the Molonglo River areas of Pink Tail Worm Lizard, Box Gum Woodland and the Kallenia Woolshed.

The preferred ultimate option for the alignment of John Gorton Drive and bridge location was determined by the following considerations:

- Maintain 11.5 m vertical clearance to the 132 kV conductors
- Proposed finish level above the MVIS is to be similar to the existing ground level
- Retain the existing Coppins Crossing Road during the first carriageway of bridge construction.
- The full length of the bridge is located within a constant vertical radius.

- A low point is located further south or close to the southern abutment, ensuring the deck can be launched uphill.
- Minimise earthworks in the vicinity of the Bulk Supply Water Main over John Gorton Drive alignment and Bindubi Street Extension stub.
- Adopt a maximum vertical grade north of John Gorton Drive north of Bindubi Street Extension to 6% to minimise earthworks and impacts to adjacent developments. Note that in the Constraint Analysis Presentation in March 2014, Land Development Agency (LDA) indicated 6% maximum vertical grade was discussed and accepted by Territory and Municipal Services (TaMS) and could be adopted on John Gorton Drive.
- Utilise the existing Coppins Crossing Road levels as much as possible.
- Dual carriageway arrangement.
- Smooth connection with the recently completed section of John Gordon Drive at Molonglo Stage 2.
- Allowance for development access and services on the peninsula of Molonglo 2 development near John Gordon Drive on the south side of Molonglo River.

The bridge over the Molonglo River forms a key part of the project. The bridge spans approximately 230 m across the Molonglo River, passing over Coppins Crossing Road and the Molonglo River at a maximum height of approximately 25 m. Due to the scale of the structure a number of bridge options were considered feasible for the site. The following structural options were identified for consideration:

- **Option 1** – Incrementally Launched Concrete Box Girder Bridge
- **Option 2** – Continuous precast concrete supertee bridge
- **Option 3** – Simply supported precast concrete supertee bridge

Due to cost and maintenance requirements concrete was the preferred construction material as agreed with TAMS.

Evaluations of these bridge options were undertaken utilising the following assessments:

- **Structured Stakeholder Consultation (SSC)**;
- **Cost Benefit Analysis (CBA)**; and
- **Triple Bottom Line (TBL) analysis**.

Option 1, the Incrementally Launched Concrete Box Girder Bridge, performs best overall relative to the other options on the basis of safety, environmental, social and economic factors.

Other stakeholder consultations held throughout the project duration were:

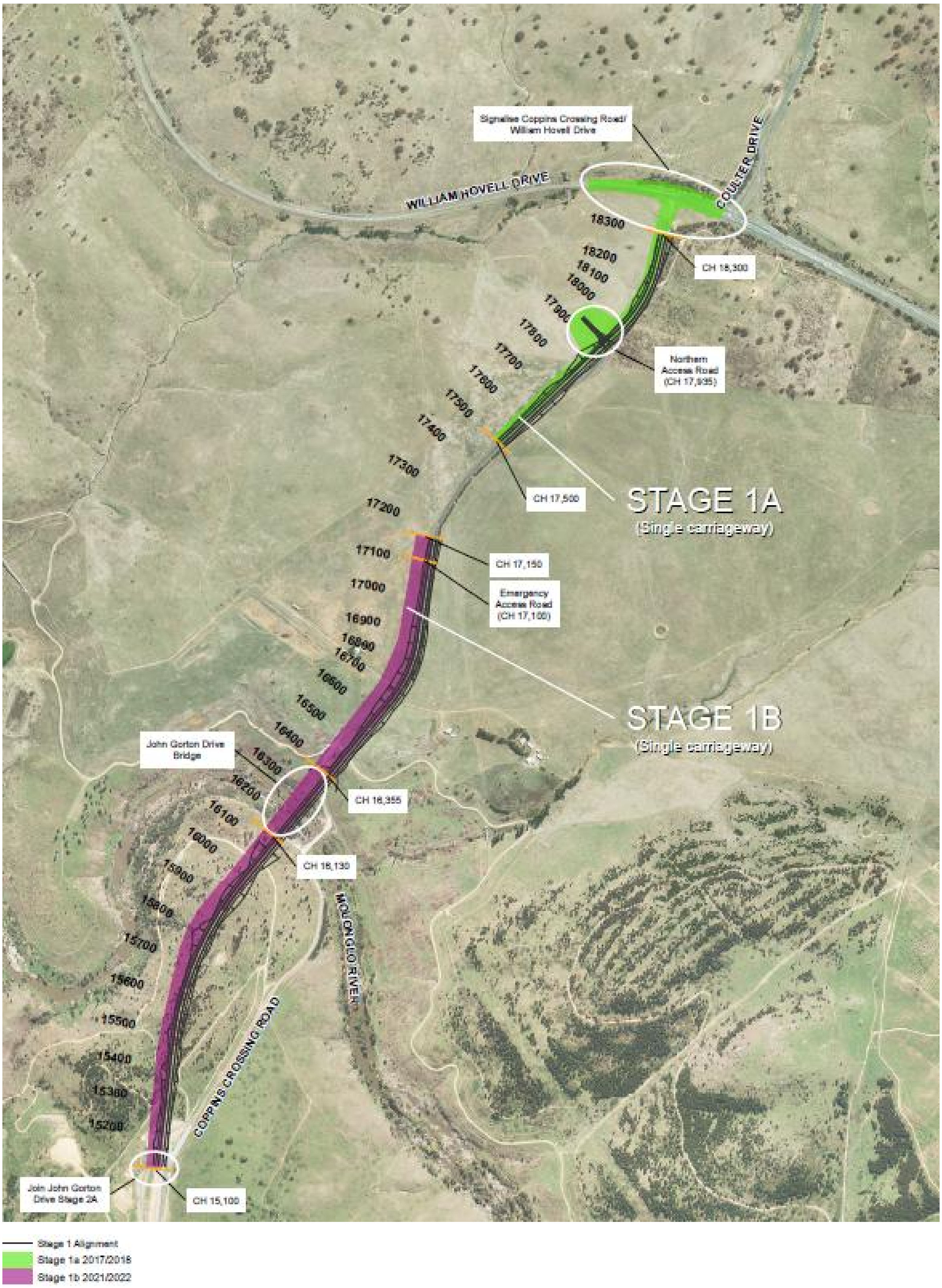
- Constraints Analysis
- Value Management Workshop (VMS) for the preferred alignment and form of bridge construction
- P50/P90 Cost Estimates and Risk Management Workshop

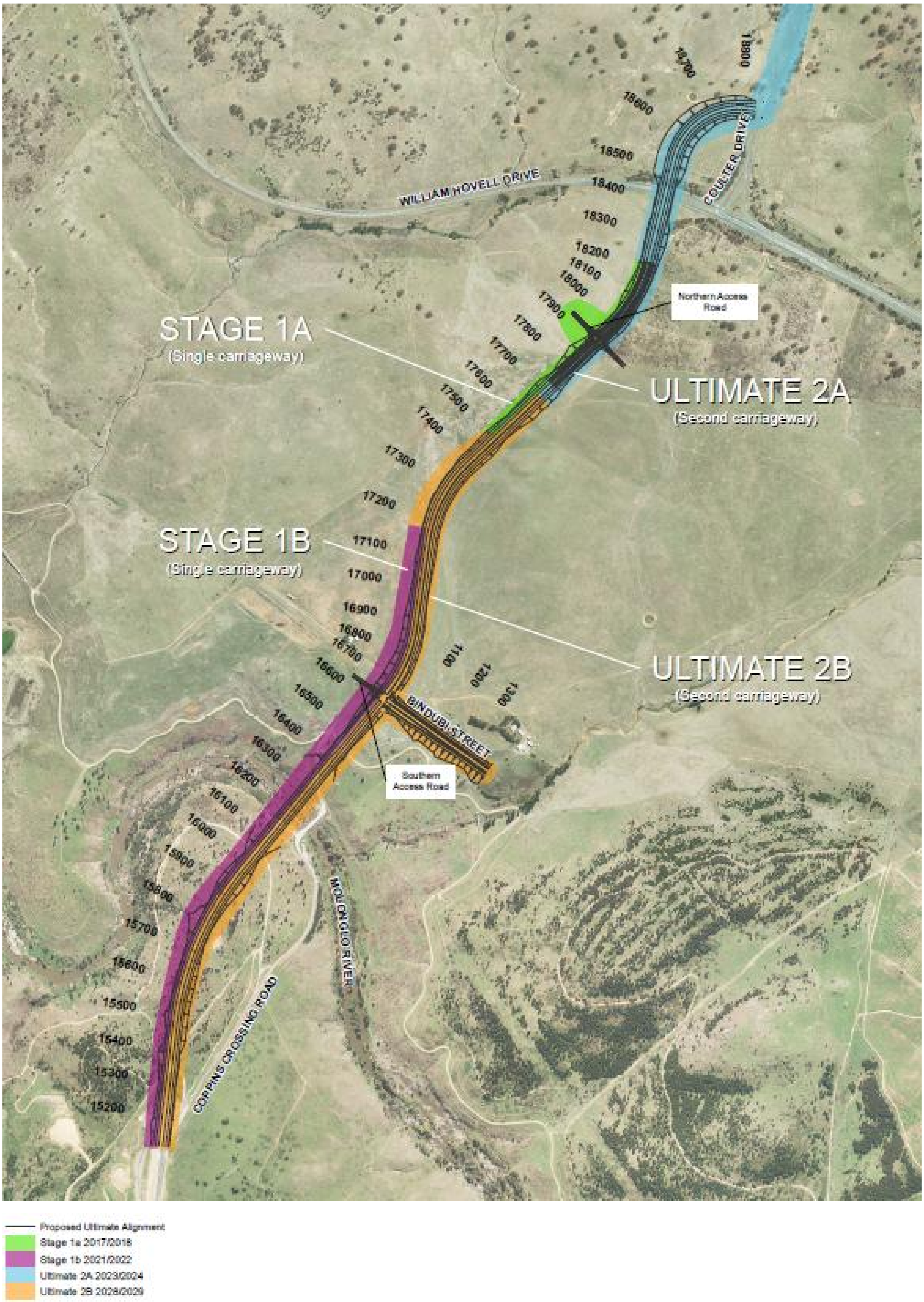
Safety during construction and operation of the bridge was one of the main considerations in discussions in the SSC and VMS and in the identification of the preferred road alignment and bridge option.

The recommended construction staging for the road works and bridge based on the findings of the traffic assessment and the existing conditions of Coppins Crossing Road are:

- **STAGE 1A – EXPECTED TO OCCUR IN 2017/2018**
  - Intersection upgrade at Coppins Crossing Road/William Hovell Drive to address safety issues and to cope with increased traffic from development in Molonglo 2 and Molonglo 3 Stage 1.
  - Construction of the Northern Access Road and Emergency Access Road to Molonglo 3 Stage 1 development off John Gordon Drive (previously called Coppins Crossing Road).
  - Single carriageway, two way traffic, construction of John Gorton Drive (future northbound carriageway) from Ch 17,500 to William Hovell Drive.
- **STAGE 1B – EXPECTED TO OCCUR BEFORE 2021/2022**
  - Single carriageway, two way traffic, construction of John Gorton Drive (future northbound carriageway) from John Gorton Drive Stage 2A works at the southern end to Ch 17,150. Works including construction of the northbound carriageway of John Gorton Drive Bridge over the Molonglo River.
- **STAGE 2A – EXPECTED TO OCCUR BEFORE 2023/2024**
  - Intersection upgrade at John Gorton Drive/William Hovell Drive to an at-grade Quadrant signalised intersection arrangement.
  - Duplication of John Gorton Drive (southbound carriageway) between the Molonglo 3 Stage 1 Northern Access Road and William Hovell Drive at Coulter Drive.
- **STAGE 2B – EXPECTED TO OCCUR BEFORE 2028/2029**
  - Duplication of John Gorton Drive (southbound carriageway) between John Gorton Drive Stage 2A works and the Northern Access Road. Works include duplication of John Gorton Drive Bridge over the Molonglo River, Bindubi Street Extension Intersection, and the Southern Access Road to Stage 1 Molonglo 3 development.

These anticipated staging requirements are based on available development timelines and traffic analysis. The actual timing of these significant civil and structural works will be dependent on actual development timings, traffic conditions and budgetary constraints.


Signalise Coppins Crossing Road/ William Hovell Drive
WILLIAM HOVELL DRIVE
COULTER DRIVE
CH 18,300
Northern Access Road (CH 17,935)
CH 17,500
STAGE 1A
(Single carriageway)
CH 17,150
Emergency Access Road (CH 17,100)
STAGE 1B
(Single carriageway)
John Gorton Drive Bridge
CH 16,355
CH 16,130
MOLONGLO RIVER
COPPINS CROSSING ROAD
Join John Gorton Drive Stage 2A
CH 15,100
Stage 1 Alignment
Stage 1a 2017/2018
Stage 1b 2021/2022


STAGE 1A
(Single carriageway)
ULTIMATE 2A
(Second carriageway)
STAGE 1B
(Single carriageway)
ULTIMATE 2B
(Second carriageway)
WILLIAM HOVELL DRIVE
COULTER DRIVE
Northern Access Road
Southern Access Road
BINDUBI STREET
COPPINS CROSSING ROAD
MOLONGLO RIVER
Proposed Ultimate Alignment
Stage 1a 2017/2018
Stage 1b 2021/2022
Ultimate 2A 2023/2024
Ultimate 2B 2028/2029

The opinion of probable costs for Stage 1 and Stage 2 are tabulated below with the assumptions, inclusions and exclusions made in developing the probable costs included in Section 11.0 of this report.

Item	Description	STAGE 1		STAGE 2	
1	Mid-blocks (South of the Bridge - Ch 15,000 To Ch16130) – Road Construction	$	9,830,000	$	7,110,000
2	Mid-blocks (North of the Bridge - Ch 17,150 To Ch17500) – Road Construction	$	1,560,000	$	3,330,000
3	Bridgeworks (Ch 16130 - 16355)	$	18,690,000	$	18,690,000
4	Bindubi Street Intersection (Ch 16,355 -17,150)	$	13,080,000	$	11,620,000
5	1st Access To M3 (Ch 17,500 – 18,300)	$	6,650,000	$	4,270,000
7	William Hovell Drive Intersection (Ch 18,300 to Coulter Drive)	$	1,810,000	$	11,470,000
8	Safety Screens On Bridge 1.8 High (Both Sides)	$	940,000	$	940,000
SUB-TOTAL		***$***	***52,560,000***	***$***	***57,430,000***
CONTINGENCY 40%		$	21,030,000	$	22,980,000
SUB-TOTAL		***$***	***73,590,000***	***$***	***80,410,000***
DESIGN AND MANAGEMENT FEES 15%		$	11,040,000	$	12,062,000
SUB-TOTAL		***$***	***84,630,000***	***$***	***92,472,000***
GST 10%		$	8,470,000	$	9,250,000
TOTAL (Including GST)		**$**	**93,100,000**	**$**	**101,722,000**
	Rounded to nearest $1M	**$**	**93,000,000**	**$**	**102,000,000**

The P50/P90 cost assessment indicated that the following major elements that are contributing to the contingency line for both stages re:

- Earthworks
- Bridge structure works
- Geotechnical risk
- Risks associated with concurrent studies
- Bitumen price

The outcomes of the P50/P90 cost assessment and the impact on the contingency are shown in the table below.

Description	Deterministic ($M)			Probabilistic ($M)		
	Stage 1	Stage 2	Total	Stage 1	Stage 2	Total
Base Estimate	**63.6**	**69.6**	**133**	**63.6**	**69.6**	**133**
Contingency	25.4	27.8	53	NA	NA	NA
Subtotal	89.0	97.4	186	63.6	69.6	133
P50 Contingency	NA	NA	NA	8.8	16.5	25
Subtotal	89.0	97.4	186	72.4	86.1	158
Extra-over for P90 Contingency	NA	NA	NA	7.2	9.6	17
Subtotal	**89.0**	**97.4**	**186**	**79.6**	**95.6**	**175**
GST	8.9	9.7	18.6	7.96	9.6	17.5
TOTAL	**98**	**107**	**205**	**88**	**105**	**193**

The limitation, risks and issues that need to be considered in the next stage of design include:

- Topography survey:
  - Majority of the study area currently utilising the contour data at 1 m intervals and a number of surveyed cross sections
- Geotechnical investigations:
  - Only desktop studies were available to assess geotechnical information within the bridge study area.
  - The design of bridge substructures is based on design parameters derived from this desktop review.
  - The preliminary geotechnical results from Molonglo Earthworks Management Strategy and Preliminary Geotechnical Investigation Study were provided in January 2015. These preliminary geotechnical results are used to confirm the assumptions on the pavement subgrade CBR.
- Coordination with Development Structure Planning for Molonglo 3.
- Environmental and development planning approvals.
- Ability to stockpile and/or dispose excess fill.
- Additional leased land withdrawal required in the vicinity of John Gorton Drive/William Hovell Drive intersection for the quadrant intersection in Stage 2A.
- Geotechnical investigation in the vicinity of John Gorton Drive Bridge (preliminary investigation in progress).

D R A F T

1.0 Introduction

1.1 Background

In February 2014, Shared Services Procurement (SSP) on behalf of Chief Minister, Treasury and Economic Development Directorate (CMTEDD) formerly known as Economic Development Directorate (EDD) of the ACT Government, engaged AECOM to undertake the Molonglo 3 Road Access and Molonglo River Bridge Feasibility Study connecting Molonglo 2 at the southern end and William Hovell Drive at the northern end.

The Molonglo Valley development is being planned to house some 55,000 people by 2041. The Molonglo Structure Plan has defined the extent of development. The planning studies to date have identified the development staging as follows (refer to Figure 1):

- **Molonglo 1** – Coombs and Wright are currently under construction;
- **Molonglo 2** – infrastructure works and first stage of land development construction has commenced,
- **Molonglo 3** – land capability assessments have commenced. Structure planning is currently progressing and the development of Molonglo 3 Stage 1 is likely to commence in the northern section adjacent to William Hovell Drive and Coppins Crossing Road in 2018.

A number of earlier studies explored preliminary options for future arterial road alignments, intersections/ interchange arrangements with existing road network and the river crossing locations and details.

The scope of this study is to identify the preferred road alignments, intersection arrangements and staging strategy for the following:

- John Gorton Drive which was formally known as John Gorton Drive Extension from John Gorton Drive Stage 2A to Bindubi Street intersection.
- John Gorton Drive from Bindubi Street intersection to William Hovell Drive which was formerly known as Coulter Drive Extension (CDE).
- Bindubi Street stub which was formally known as Bindubi Street Extension from John Gorton Drive to the Bulk Supply Water Main.
- Intersection arrangement of John Gorton Drive with Bindubi Street.
- Identification of the most appropriate location for access roads westbound off John Gorton Drive into Molonglo 3 Stage 1 (M3) based on safe intersection design requirements. Development in M3 is planned to commence in the northwest area of M3 adjacent to William Hovell Drive. The location of the access road intersections are:
  - Northern Access Road which is located closer to William Hovell Drive to provide access to the first stage of development of M3.
  - Emergency Access Road to provide a second access to the first stage of development of M3 located south of the Northern Access Road pending upon the timing of the construction of the Southern Access Road.
  - Southern Access Road which is located in the vicinity of Bindubi Street intersection.
- Intersection arrangement of John Gorton Drive with William Hovell Drive.

The staging of progressive improvements and new road carriageways are based on the forecast traffic volumes and the condition assessment of Coppins Crossing Road.

In December 2014, CMTEDD extended the feasibility study to include realignment of Bindubi Street from John Gorton Drive intersection to the proposed M3 group centre which is approximately 1.5 km from John Gorton Drive intersection. The assessment of Bindubi Street realignment is included as a separate discussions and assessment to this report.

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1.2 Study Area

The proposed arterial road of John Gorton Drive is located in the vicinity of the existing Coppins Crossing Road. It connects the John Gorton Drive Stage 2A on the southern side of the Molonglo River and William Hovell Drive on the northern end of the study area.

Bindubi Street Extension intersection with John Gorton Drive is located just north of the Molonglo River bridge crossing.

The study area is indicated in Figure 2.

1.3 Project Objective

The functional brief for the study identifies objectives of the project as follows:

- Review previous road alignment studies and validate/determine the final alignment of John Gorton Drive between John Gorton Drive Stage 2A and William Hovell Drive and intersections arrangement of John Gorton Drive with Bindubi Street and William Hovell Drive;
- Based on the recent planning studies review the existing Molonglo traffic model with consideration of the proposed West Belconnen traffic generation projections to provide input for these road/intersection feasibility considerations;
- Determine the staging of the road arrangements to connect the Molonglo Group Centre to William Hovell Drive; and
- Using a Triple Bottom Line (TBL) analysis and Cost-Benefit Analysis (CBA), determine a preferred option for the concept design of the John Gorton Drive Bridge over the Molonglo River.
- Realignment of Bindubi Street from John Gorton Drive intersection to the end of the proposed group centre which is approximately 1.5 km from John Gorton Drive intersection which is discussed and assessed separately to this report.

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Figure 1 Molonglo Valley Development

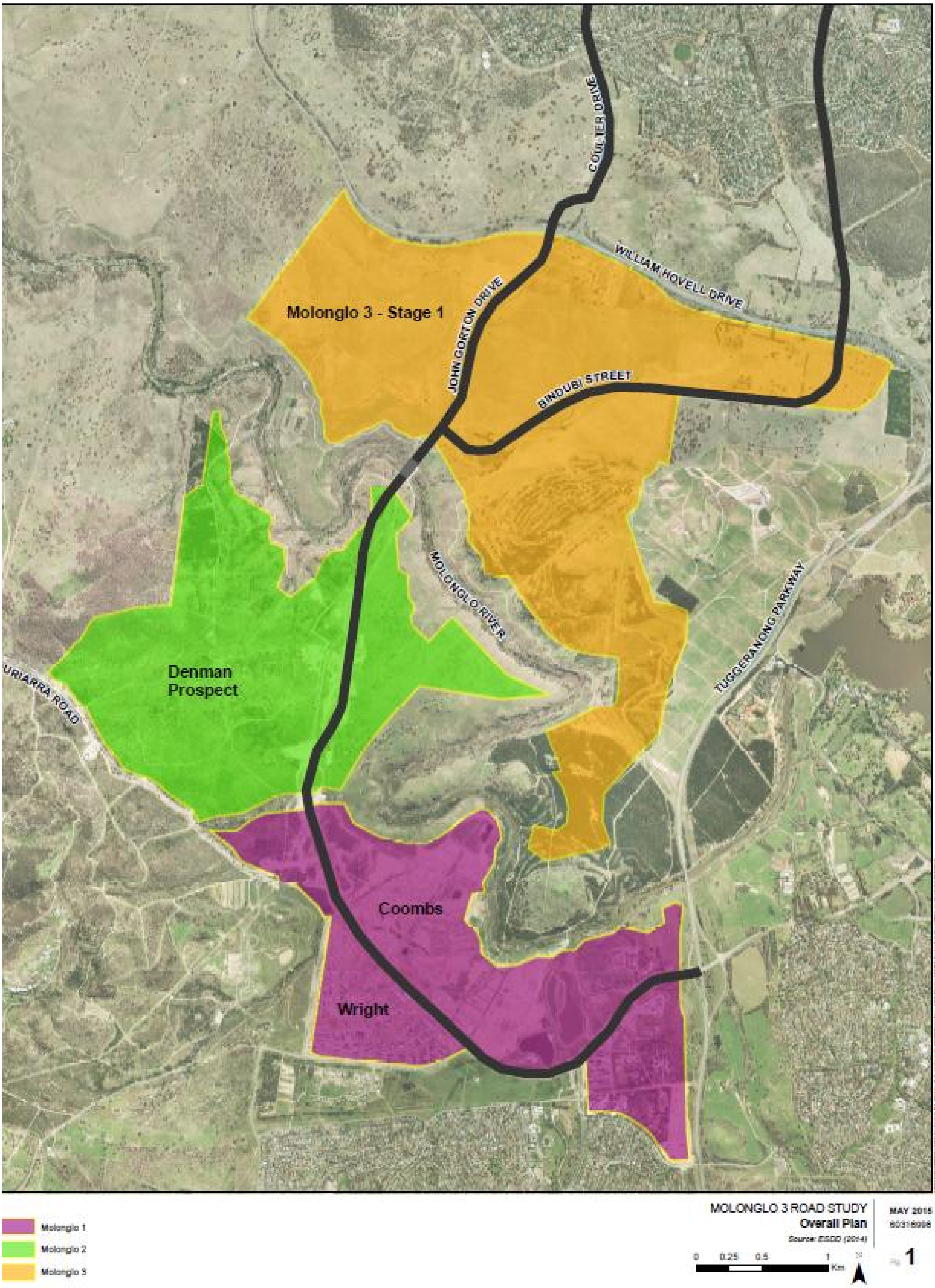

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Figure 2 Study Area

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2.0 Review of Previous Studies and Concurrent Projects

The following section provides a summary of previous studies and reports developed for the John Gorton Drive alignment and adjacent areas. The previous studies reviewed and implications to the development of design of John Gorton Drive and Bindubi Street Extension road alignments are discussed in below sections.

2.1 Molonglo 3 Master Planning

Land Development Agency (LDA) is currently in the process of preparing the structure plan for Molonglo 3. It is understood that this feasibility study will provide input into development of Molonglo 3 Structure Plan.

The latest structure plan was provided to AECOM in November 2014 and included in Figure 3. The land use assumptions were provided to AECOM as inputs for the traffic modelling.

2.2 Molonglo Arterial Roads Feasibility Study

Molonglo Arterial Roads Feasibility Study (MARFS) was undertaken by SMEC in 2013 assessing alignment options for John Gorton Drive, Coulter Drive Extension (CDE) between Bindubi Street and William Hovell Drive which is currently referred as John Gorton Drive in this report, and Bindubi Street from John Gorton Drive to William Hovell Drive.

AECOM was advised of the following outcomes of the MARFS that would be adopted for the Feasibility Study. A number of options were investigated in the MARFS and the alignment Option 6 was identified as the preferred alignment for John Gorton Drive. Refer to Section 7.2 for an overview of the previous road alignment options and outcomes of the MARFS.

The following design findings were adopted for the feasibility design of John Gorton Drive and Bindubi Street Extension alignments:

- Horizontal alignment of John Gorton Drive Bridge over the Molonglo River was agreed and is fixed.
- Horizontal alignment of John Gorton Drive between John Gorton Drive Bridge and William Hovell Drive can be slightly amended to improve construction staging.
- Location of John Gorton Drive/Bindubi Street Extension intersection is fixed.
- Vertical alignment of John Gorton Drive and Bindubi Street can be altered to minimise earthworks whilst maintaining required cover and clearances on the existing utilities and complying with relevant guidelines and design standards.
- Proposed underpass north of John Gorton Drive Bridge can be removed if required to minimise earthworks and mitigate impacts on existing utilities.

2.3 Boundary Adjustment in the vicinity of William Hovell Drive Drive

There are two areas that have been withdrawn in the vicinity of the William Hovell Drive/Coppins Crossing Road intersection in anticipation for a future intersection arrangement. The areas are shown in Figure 4. For future adjustment of the boundary, Environment Planning Directorate has advised that an application is required under the *Lands Acquisition Act 1994*. This process can take from 3 to 12 months.

2.4 Molonglo 3 Hydraulic Services Master Plans and Concept Designs

The Molonglo 3 Hydraulic Services Master Plans and Concept Designs is a concurrent project. The scope of works includes the development of sewer and stormwater (drainage and WSUD) master plans and the concept design of those elements for each service, including key water supply infrastructure, required to support initial development in Molonglo 3, including staging requirements.

No inputs from this project have been received or reviewed as part of the Molonglo 3 Access Roads and Molonglo River Bridge project.

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2.5 Molonglo 3 Major Electrical Infrastructure Relocation Feasibility Study

The Molonglo 3 Major Electrical Infrastructure Relocation Feasibility Study is a concurrent project. The infrastructure needs to be relocated to allow for the continuing development of the Molonglo Valley.

The scope of work includes the development and assessment of options and recommendation of a preferred option, for the possible relocation of existing 132kV transmission power lines to support development and major infrastructure in Molonglo 3, including staging requirements.

No inputs from this project have been received or reviewed as part of the Molonglo 3 Access Roads and Molonglo River Bridge project. The current alignment of the 132kV transmission power lines has been allowed for in the Molonglo 3 Access Roads and Molonglo River Bridge project.

2.6 Molonglo 2 Urban Edge Master Plan and Concept Design

Molonglo 2 Urban Edge Master Plan and Concept Design was undertaken by Indesco in 2014. As part of this study, a 375 mm diameter sewer crossing and an underpass were proposed under John Gorton Drive approximately 400 m south of the bridge.

The following has been agreed in a number of discussions with CMTEDD and Icon Water (formerly known as Actew Water):

- The proposed 375 mm diameter sewer crossing would have sufficient cover over John Gorton Drive.
- The proposed underpass can be lowered to suit the proposed design levels on John Gorton Drive.

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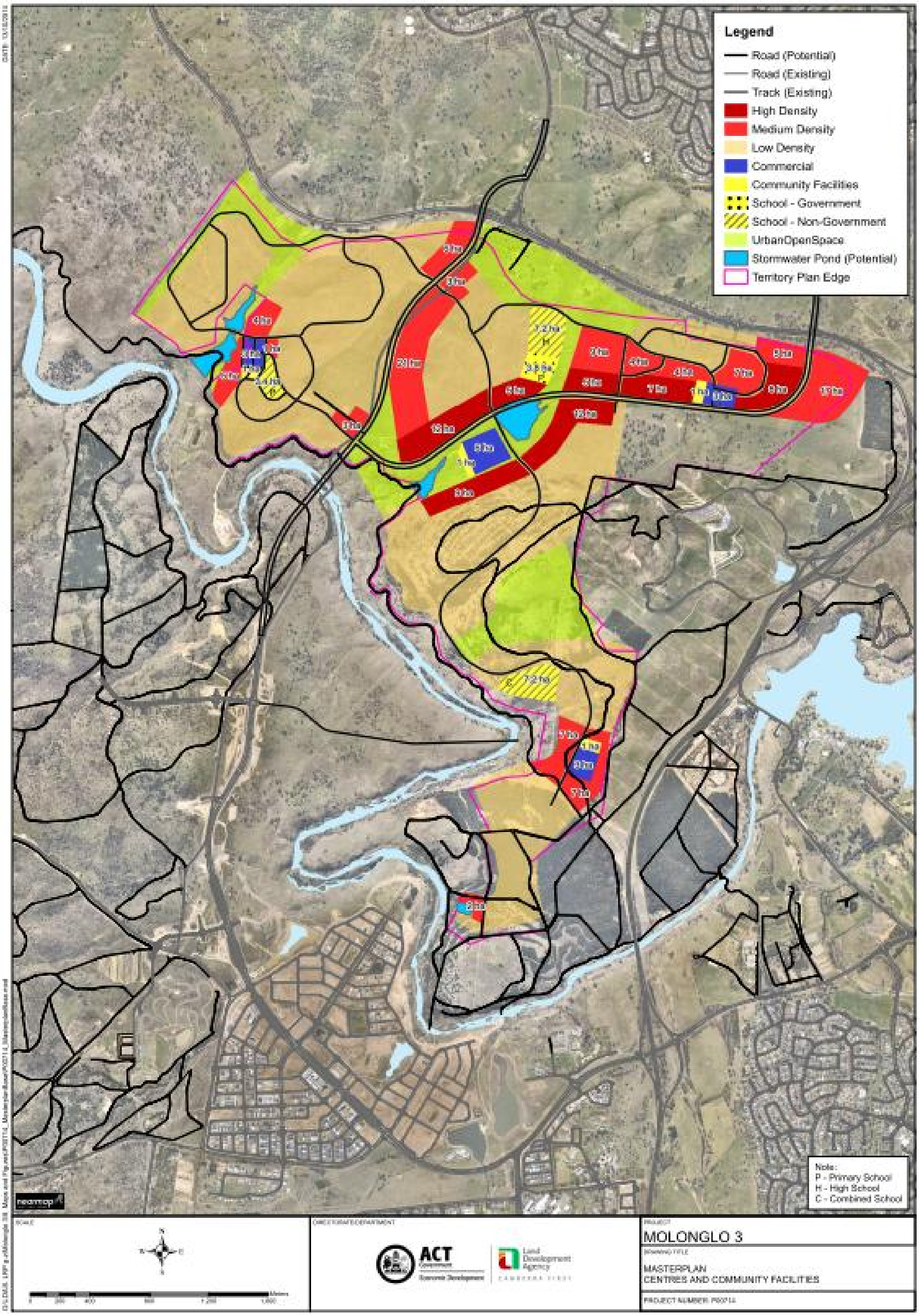
Figure 3 Molonglo Structure Plan, Centres and Community Facilities[1]



[1] Source LDA, November 2014

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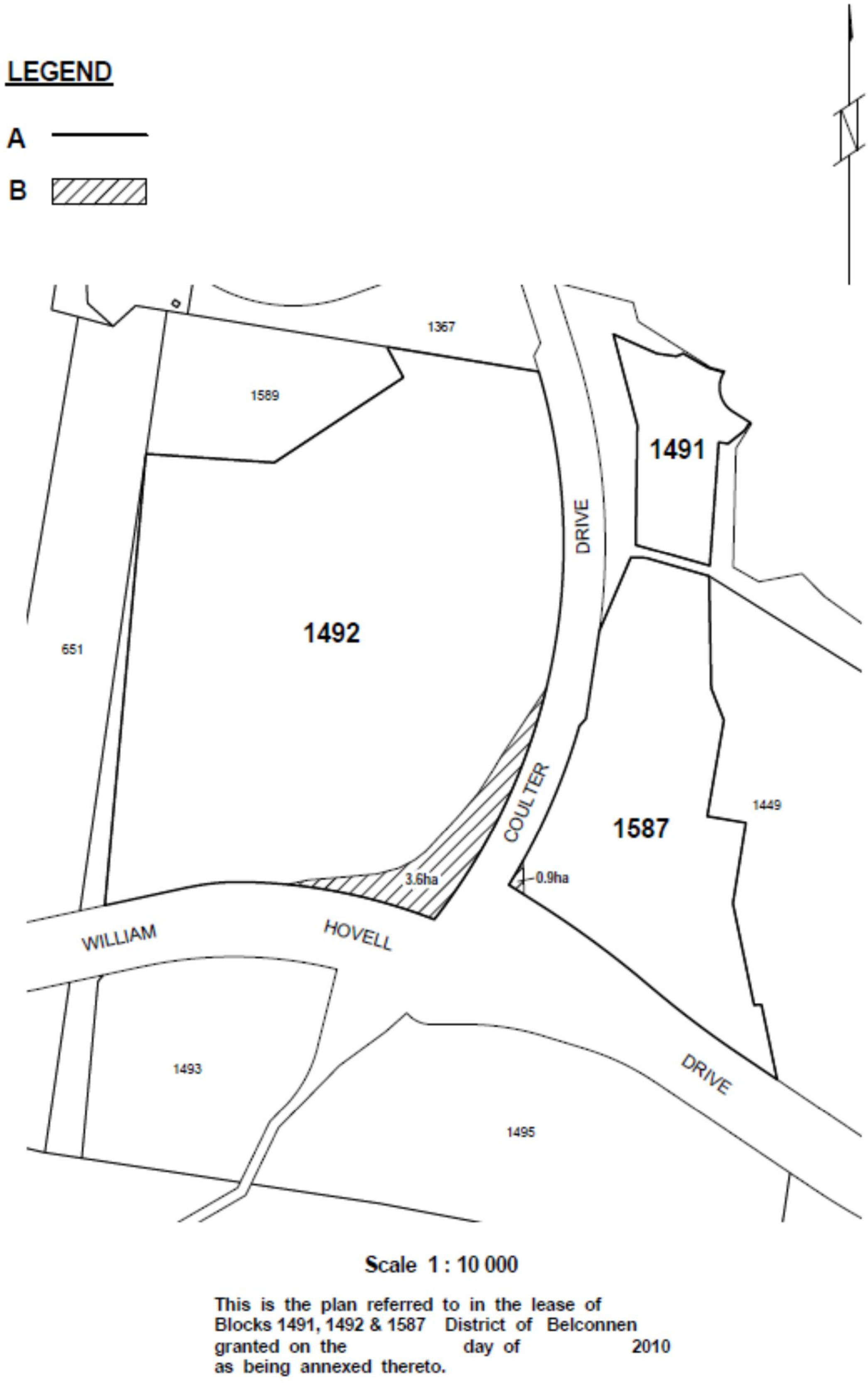
Figure 4 Withdrawn land[2]



[2] Source: Environment Planning Directorate (EPD), November 2014

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2.7 Final Design of Molonglo (Sewer) Link Bridge

The Final Design of Molonglo (Sewer) Link Bridge was undertaken by Brown Consulting in 2013.

The following facets of the Molonglo (Sewer) Link Bridge are considered in the development of feasibility design of John Gorton Drive Bridge:

- Geotechnical design parameters, as it is likely to be in similar geology to determine foundation condition for John Gorton Drive Bridge.
- Adopting similar design and features where possible in an attempt to maintain consistency between these bridges.

2.8 Molonglo Valley Interceptor Sewer – Odour Control Options

Molonglo Valley Interceptor Sewer – Odour Control Options study was undertaken by Consulting Environmental Engineers (CEE) in 2013. The study recommended a large new activated carbon scrubbing system be installed at three locations and the scrubbed gases are discharged through tall stacks (30 m to 36 m high) located within the planned reservations for future roads.

The John Gorton Drive Bridge had been identified as a possible location for a tall vent stack based on one of the earlier options of John Gorton Drive proposed in MARFS.

After a discussion with Icon Water, CMTEDD and SSP in May 2014, it was agreed that a tall vent stack on John Gorton Drive Bridge was no longer required because the preferred alignment would not provide an optimal location for a tall vent stack.

2.9 Geotechnical Investigations

Geotechnical investigations undertaken to date within Molonglo are:

- Preliminary Geotechnical and Environmental Constraints Study – Molonglo Valley in May 2005.
- Geotechnical investigation report for the Proposed Arterial Road and Ground Centre Molonglo Valley (within Molonglo 2) in June 2009.
- Molonglo 3 Earthworks Management Strategy and Preliminary Geotechnical Investigation Study commencing in 2014 and expected to complete in June 2015
- Additional geotechnical assessment in the vicinity of John Gorton Drive Bridge which will be undertaken as part of the Molonglo (Sewer) Link Bridge with timing is currently unknown.

Desk top reviews of the geotechnical investigations undertaken in 2005 and 2009 were used to understand the potential geotechnical constraints for the project.

The preliminary geotechnical results from Molonglo Earthworks Management Strategy and Preliminary Geotechnical Investigation Study were provided in January 2015. This preliminary geotechnical results are used to confirm the assumptions on the pavement subgrade CBR.

The additional geotechnical assessment in the vicinity of John Gorton Drive Bridge is not available at the time of preparing this report to confirm potential geotechnical constraints in the river corridor for the bridge substructure.

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3.0 Existing Conditions

3.1 Coppins Crossing Road

The development in Molonglo 1 is currently utilising the existing Coppins Crossing Road including the existing low level Molonglo River crossing north of John Gorton Drive Stage 2A. The development program for Molonglo indicates that the existing Coppins Crossing Road will remain in use for several years, however with the growth in Molonglo the traffic demands are forecast to increase quite significantly as Molonglo develops.

The existing Coppins Crossing Road has the following features:

- Two lane carriageway with one traffic lane in each direction;
- Posted speed of 80 km/h;
- Unsealed shoulder;
- No street lighting along the corridor;
- A number of tight curves with advisory signs;
- Low level river crossing with steep grade and tight horizontal curve at both approaches of the river crossing;
- Low level river crossing is flooded on average two to three times in a year and the average closure of about 2 days after each flood;
- Utilised by cyclists to access Stromlo Forest Park (SFP);
- Total of 49 crashes over the past 5 years at mid-block; and
- Significant number of crashes at the intersection with William Hovell Drive.

An assessment of Coppins Crossing Road, including a Road Safety Audit and a Pavement Assessment, was undertaken in June 2014. The memo outlining the outcomes of the assessment is included in Appendix A.

The findings of the assessment are:

- Based upon safety and flood immunity observations it is recommended that the process to initiate the Molonglo River bridge construction commences now.
- The completion of a new bridge crossing would also assist in providing public transport on a viable route to suit the growing demand for travel to Belconnen as Molonglo 2 develops.
- For the remainder of Coppins Crossing Road, it is considered the existing road can remain operational up to 2031 assuming:
    - The implementation of safety improvements along the existing road as recommended in the Road Safety Audit such as:
        - Sealing 1.5 m wide shoulder which is trafficable for cyclists
        - Install lighting
        - Reinstate missing RRPMs and guide posts
        - Repair damaged signs
        - Signalised Coppins Crossing Road/ William Hovell Drive intersection
    - Provide heavy patching along the road in a timely manner to ensure the longevity of the pavement.

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3.2 William Hovell Drive

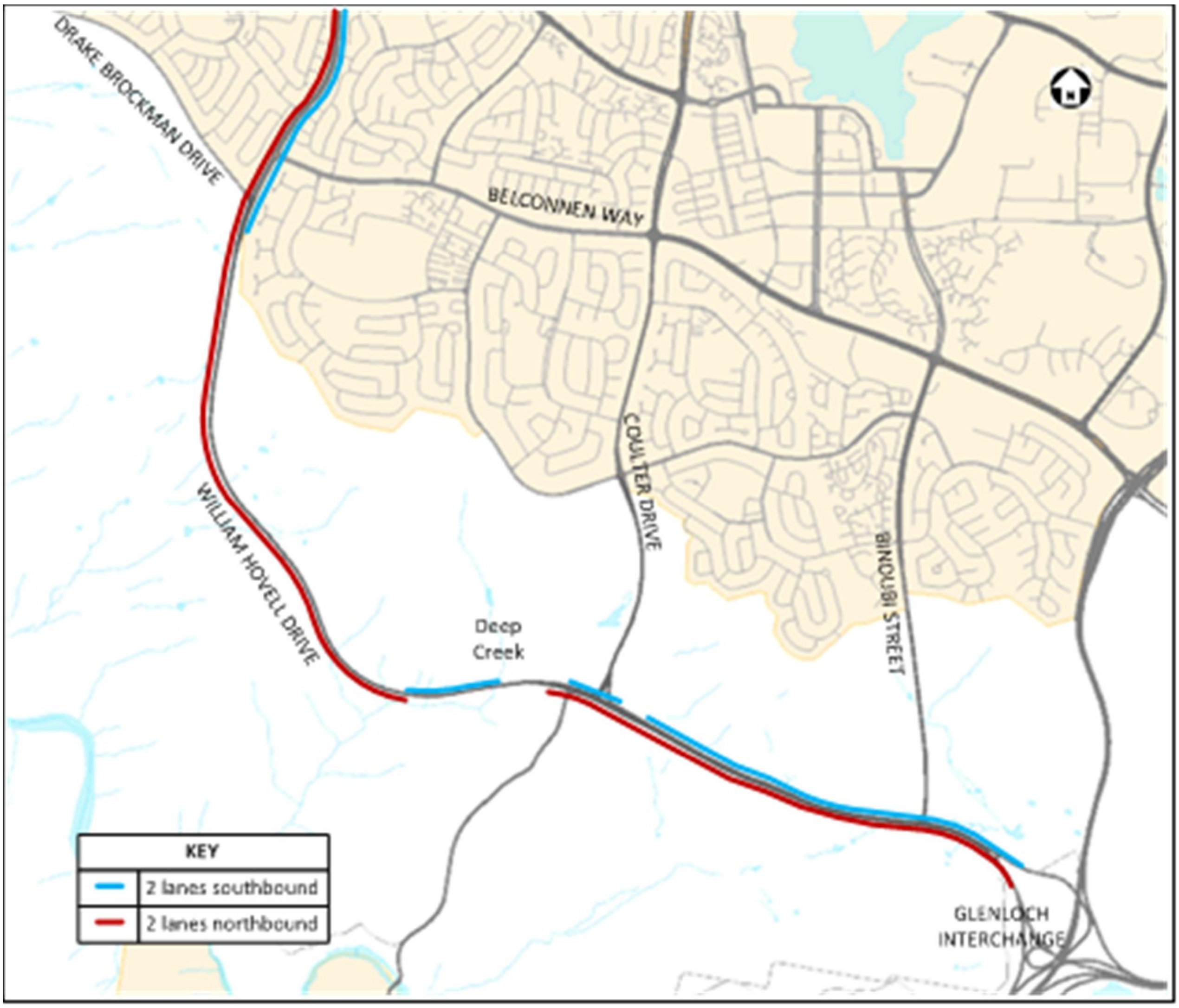
William Hovell Drive is a busy arterial road with three traffic lanes for most of its length between Drake Brockman Drive and Coppins Crossing. The speed limit is generally 90 km/h and there is no median barrier between the opposing lanes. The paved carriageway is about 15 m wide, so there is potential to utilise some of this pavement for future widening if the speed limit is reduced.

Southbound merges from two lanes to one lane about 250 m south of Drake Brockman Drive and remains as one lane until widening to two lanes in a short 600 m section just west of Coppins Crossing. Northbound is two lanes for most of its length, other than a 1 km section west of Coppins Crossing. This is illustrated in Figure 5.

The road currently carries about 15,000 veh/day between Drake Brockman Drive and Coppins Crossing. The single lane southbound currently carries about 1,400 veh/hr in the AM peak. This equates to about 74% of the theoretical capacity of this road, so it still has some spare capacity in peak periods. The real constraint is downstream signalised intersections at Coulter Drive and Bindubi Street.

The two lane section west of Coppins Crossing is largely due to the need to provide a climbing lane. The terrain is quite steep, which would make widening the road relatively difficult and costly.

Figure 5 Two Lane sections on William Hovell Drive



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3.3 Coulter Drive

Coulter Drive is a busy two-lane two-way arterial road linking William Hovell Drive to various locations in Belconnen, including the Belconnen town centre. The speed limit is 80 km/h. The section south of Springvale Drive has adjacent rural uses, whilst north of Springvale Drive passes the rear of residential properties.

3.4 Topography and Geology

The study area's topography is rolling with localised steep areas and generally sloping towards the Molonglo River.

No detailed survey of the study area and the existing Coppins Crossing Road was available for the feasibility study and design. The base information for horizontal and vertical geometry comprised 1m contours.

A survey of 13 cross sections of Coppins Crossing Road was undertaken in June 2014 to review and validate the proposed vertical alignment. The survey information is included in Appendix B. The cross sections indicated the 1 m contour information is within couple of hundred millimetres of the surveyed ground levels.

A desktop study of the previous geotechnical investigations and site geology indicated shallow rock level can be expected within the study area. No geotechnical study was undertaken as part of this feasibility study.

3.5 Environment Factors

Existing ecological constraints are shown on the Constraints Plan Figure 6 and further discussed in Section 4.2.

There are high quality Pink Tail Worm Lizard (PTWL) and Box Gum Woodland (BGW) habitat located within the study area. The environment impacts of the proposal are further discussed in Section 4.2.

3.6 Heritage Factors

Known heritage constraints are shown on the Constraints Plan on Figure 6and further discussed in Section 4.3.4.

Kallenia Woolshed was assessed as holding heritage value against the criteria of the ACT Heritage Register in 2012 which is located in close proximity to the Bindubi Street alignment. The effect of the proposals on Kallenia Woolshed is discussed in Section 4.3.4.

3.7 Conservation Management Plan for Kallenia Woolshed Molonglo Valley ACT

Biosis undertook an assessment of the Kallenia Woolshed for heritage values against the criteria of the ACT Heritage Register in 2012. The Conservation Management Plan (CMP) was prepared by Biosis to assist the short and long term ongoing management of the heritage values of Kallenia Woolshed.

The CMP indicated that infrastructure and development occurring in close proximity to the Kallenia Woolshed should not impact the defined curtilage of the site and it would require a Statement of Heritage impact to determine any impacts on heritage values.

Bindubi Street alignment at John Gorton Drive intersection end is located in close proximity and within the viewing corridor of the Kallenia Woolshed. The most recent advice from CMTEDD is that the Kallenia Woolshed currently has no heritage status and thus it is not forming a constraint in the development of Bindubi Street alignment.

D R A F T

3.8 Existing Infrastructure and Utilities

The following major infrastructure is located within the study area (refer to Figure6):

- Existing 132 kV high voltage overhead electricity.
- Existing 2550 mm diameter Molonglo Valley Interceptor Sewer (MVIS).
- Existing 900 mm diameter Bulk Supply Water Main.
- Existing low voltage power
- Existing communications

The Brief indicated the proposed road alignment is to have minimal impacts on these major utilities. The following activities were undertaken to confirm location and levels to ensure the feasibility design did not impact on the existing utilities:

- Survey of the catenary of 132 kV high voltage overhead electricity crossing Coppins Crossing Road.
- Pothole the Bulk Water Supply main and MVIS in close proximity to the proposed John Gorton Drive and Bindubi Street Extension alignment. The location of these potholes is shown in Figure 7.

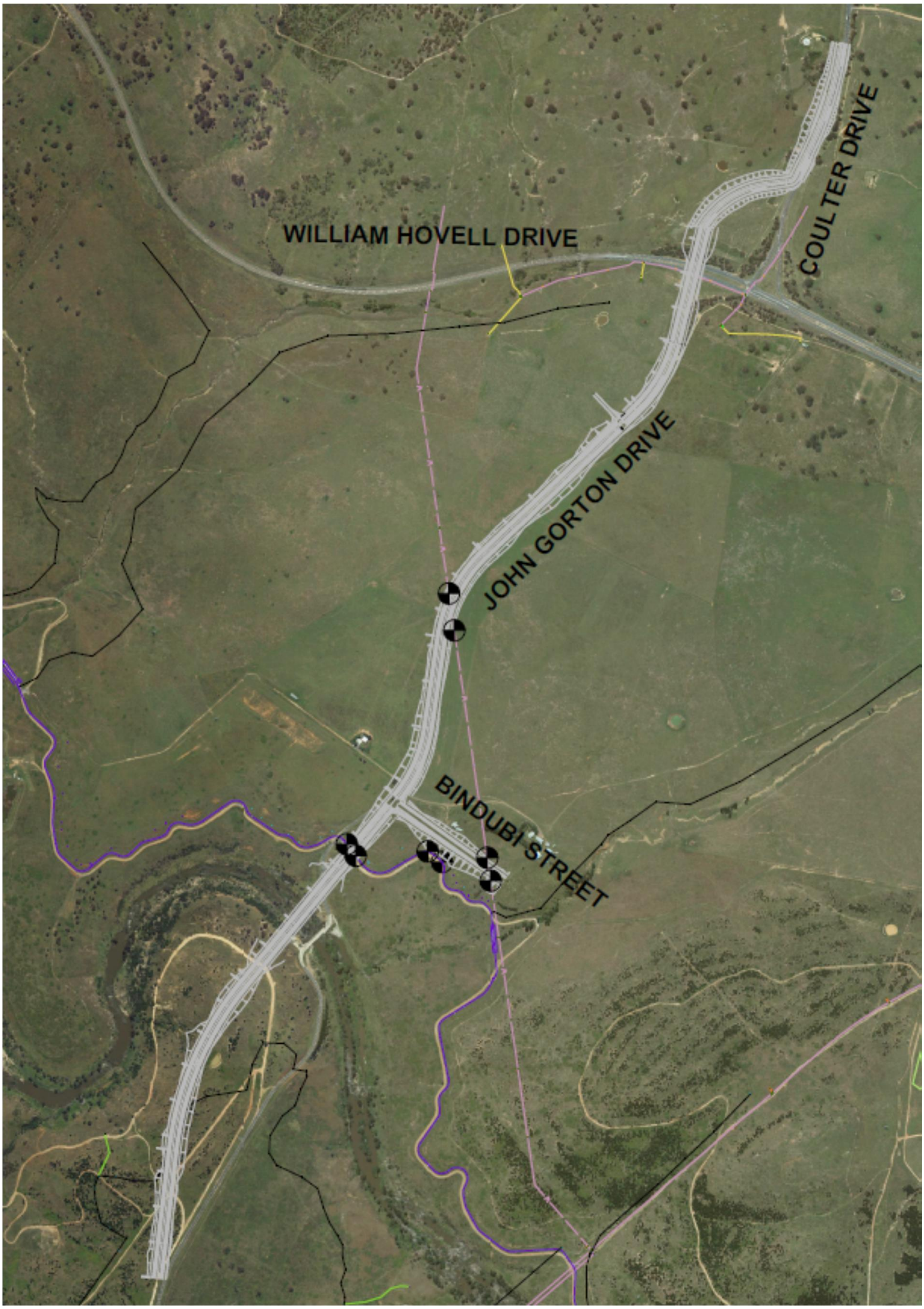
The extent of the survey of the catenary of 132 kV and pothole information is included in Appendix B.

D R A F T

Figure 6 Constraints Plan

D R A F T

Figure 7 Pothole locations on Bulk Supply Water Main and MVIS



4.0 Planning and Environmental Considerations

4.1 Introduction

The following sections detail the applicable planning and environmental considerations that would apply to the proposal to develop the extension of John Gorton Drive, including a new bridge over the Molonglo River (the proposal).

4.2 Environmental Planning Considerations

4.2.1 Planning and Development Act 2007

The commonwealth, through the *Australian Capital Territory (Planning and Land Management) Act 1998*, Requires that the Act Legislative Assembly make laws to establish a territory planning authority. The role of the authority is to prepare and administer a plan in respect to all land within the ACT other than designated areas, in a manner consistent with the National Capital Plan (NCP).

This requirement is met by the *Planning and Development Act 2007* (the Planning Act) and the ACT Planning Authority established by the Planning Act (ACT Planning and Land Authority (ACTPLA)). ACTPLA is responsible for requirements specified within the NCP.

In the case of certain non-designated areas where special requirements have been set out within the NCP, ACTPLA is responsible for approving development, provided that the proposal is consistent with the special requirements specified within the NCP.

4.2.2 Territory Plan 2008

The Territory Plan is the ACT Government's key statutory planning document, offering a policy framework for the administration of planning in the ACT. The Territory Plan is prepared and administered by the ACT Planning and Land Authority as required by Section 12 (1) (a) of the Planning and Development Act 2007 (the Act). The Territory Plan includes:

- A statement of strategic directions
- A map setting out zones and precincts in the act
- Objectives and development tables applying to each zone and a series of general
- Development and precinct codes
- Structure plans and concept plans for the development of future urban areas

The key purpose of the Territory Plan is to manage land use change and development in a manner consistent with the strategic directions set by the ACT Government, Legislative Assembly and the community. The document must also be consistent with the National Capital Plan. The Territory Plan includes broad principles and policies that guide development, through application of specific land use objectives and policies. Under the Territory Plan, land in the ACT is divided into Sections and Blocks. The Blocks are zoned and the zoning determines what kind of development is allowed on a block.

The proposal is located within land zoned as:

- NUZ4 - River Corridor
- RZ1 - Suburban
- NUZ3 - Hills, Ridges and Buffers
- Designated

In addition parts of the study area are also subject to the following Territory Plan Overlay Zones:

- FUA - Future Urban Area
- Pd - Special Purpose Reserve

4.2.3 Development Application

In accordance with the Planning Act, ACTPLA administers the Territory Plan. This is the primary statutory planning document against which development proposals are assessed. The type of the approval process depends on the nature of the project and the zoning of the land that the project will affect as prescribed by the Territory Plan. The approval process is known as a Development Application (DA).

DAs are assessed in one of three tracks identified by the Planning Act, each of which has increasing complexity reflecting the nature of the proposal. The three tracks are code, merit and impact. Table 1 provides a discussion on the tracks relevant to the development. The DA generally requires works to commence within 2 years from award and requires works to be completed within 2 years from commencement. The DA can be extended on application.

Table 1 Development Application Assessment Tracks

Development Application Assessment Track		Comment
Code track	**A code track** development involves assessment against the rules in the applicable Assessment Code of the Territory Plan. The Code track is used for minor developments; for example, a single dwelling not on new residential land, a dual occupancy proposal, or a house extension.	This track is not relevant to the development.
Merit track	**A merit track** assessment aims to provide flexibility and a performance-based assessment that enables applicants to propose an innovative design outcome, even if the development deviates from prescriptive code requirements.	This track is not relevant to the development.
Impact track	**An impact track** requires proposed developments to undergo the broadest level of assessment. They are considered against the Territory Plan and, unless exempt by the minister, are to be addressed by an EIS. Impact track assessment applies to infrastructure proposals and developments in sensitive areas, developments that have been declared impact assessable by the minister, and all other proposals not covered by the exempt, prohibited, code or merit tracks (S123 and S132). Developments which may be subject to impact track assessment include larger projects such as: constructing solar or wind farms, major dams or roads; or clearing a significant area of native vegetation (Schedule 4).	The impact track would likely apply to the development.

For each land use zone, a development table sets out the criteria to allow the assessment track for a development application for the proposal to be worked out. Under the Territory Plan, the proposal would be characterised as a “Major road” which is defined as “*a road that is an arterial road, parkway, highway, or the like and any road identified within the transport services zone*”. The following table outlines the permissibility of the proposal and potential assessment pathway under the Planning Act.

Land use zone	Permissibility of “Major Road” under the relevant zone Development Table
NUZ4 River Corridor	“Road” is identified as a merit track development, however “Major road” is not listed in the development table. Confirmation with ACTPLA as to the appropriate approval pathway would be required.
RZ1 Suburban	Prohibited Development – a Development Application cannot be made. Territory Plan Variation may be required for the proposal in this zone.
NUZ3 Hills, Ridges & Buffers	“Road” is identified as a merit track development, however “Major road” is not listed in the development table. Confirmation with ACTPLA as to the appropriate approval pathway would be required.
Designated	Subject to approval under the National Capital Plan

4.2.4 Assessment by Impact Track

In addition to the assessment requirements placed on the proposal as a result of the land zoning, the Planning Act also has specific triggers that require the preparation of an EIS for particular activities or particular areas. These triggers are considered in more detail in the following sections. In the Planning Act, Section 123, 124 and 125 state that the impact track applies to a development proposal if certain conditions are met. Table 2 provides consideration of these sections as relevant to the development.

Table 2 Development Application Assessment Tracks

Applicable Sections of the Planning Act	Comment
Section 123, impact track applies to a development proposal if -	
a) the relevant development table states that the impact track applies; or	Not expected to be applicable to the development – confirmation with ACTPLA required.
b) the proposal is of a kind mentioned in Schedule 4 (see discussion below); or	**May be applicable to the development**
c) the Minister makes a declaration under section 124 in relation to the proposal; or	Not expected to be applicable to the development.
d) section 125 (Declaration by Public Health Act Minister affects assessment track) or section 132 (Impact track applicable to development proposals not otherwise provided for) provides that the impact track applies; or	Not expected to be applicable to the development.
e) the Commonwealth Minister responsible for administering the EPBC Act advises the Minister in writing that the development proposed— i. is a controlled action under that Act, section 76; and ii. does not require assessment under that Act, part 8 (Assessing impacts of controlled actions) because a bilateral agreement between the Commonwealth and the Territory under that Act allows the proposal to be assessed under the Planning Act.	Not expected to be applicable to the development.
In the Planning Act, **Section 124** of the Planning Act states:	
1) The Minister may, in writing, declare that the impact track applies to a proposal.	Not expected to be applicable to the development.
2) However, the Minister must not make a declaration under subsection (1) in relation to a development proposal unless satisfied on reasonable grounds that there is a risk of significant adverse environmental impact from the development proposed	Not expected to be applicable to the development.

Applicable Sections of the Planning Act	
Section 124A adds clarification:	
1)	An adverse environmental impact is "significant" if— (a) the environmental function, system, value or entity that might be adversely impacted by a proposed development is significant; or (b) the cumulative or incremental effect of a proposed development might contribute to a substantial adverse impact on an environmental function, system, value or entity.
2)	In deciding whether an adverse environmental impact is "significant", the following matters must be taken into account: (a) the kind, size, frequency, intensity, scope and length of time of the impact; (b) the sensitivity, resilience and rarity of the environmental function, system, value or entity likely to be affected.
3)	In deciding whether a development proposal is likely to have a significant adverse environmental impact it does not matter whether the adverse environmental impact is likely to occur on the site of the development or elsewhere.

Schedule 4 of the Planning Act

Section 123 states that if the proposal is of a kind mentioned in Schedule 4 it requires assessment under the impact track. Schedule 4 of the Planning Act details what types of developments 'trigger' environmental assessment under the impact track through the preparation of an Environmental Impact Statement. The types of EIS triggers are divided into:

- **Activities** - lists certain types of activities which trigger the need for impact track assessment, e.g. construction of a water storage dam above a certain size
- **Areas and processes** - list certain areas or biological characteristics which trigger the need for impact track assessment e.g. an area which contains listed threatened species or communities.

An ESO can be sought for development if it triggers an EIS under the areas and processes- land reserved under s315 for the purpose of special purpose reserve (Schedule 4, Part 4.3, item 3). Development may also trigger an EIS under the areas and processes- the clearing of more than 0.5 ha of native vegetation, unless an ESO can be sought (Schedule 4, part 4.3, item 2a).

Section 138AA of the Planning Act, identifies that impact track proposals triggered by Schedule 4, part 4.3 items 3 and 2a which are not likely to have a significant adverse environmental impact can be assessed through the merit track if an ESO is provided.

In order for impact track proposals to be assessed through the merit track the proponent needs to obtain an Environmental Significance Opinion (ESO) from the relevant agency in agreement that the project will not have a significant adverse environmental impact.

The following tables outline the EIS triggers associated with activities and areas and processes along with an initial assessment as to whether the development proposed under the Master Plan is applicable to the trigger.

Table 3 Schedule 4, Part 4.2 – Relevant development proposals requiring EIS—activities

Item	Proposal	Comment
1	Proposal for construction of a transport corridor including a major road, a dedicated bus way, a railway, or a light rail corridor, on any land, other than on land designated under the Territory Plan as a future urban area or in a transport and services zone, if the proposal is likely to have a significant adverse environmental impact on— a) air quality so as to be detrimental to the health of persons in an adjoining residential, commercial or community facility zone; or b) ambient noise or vibration so as to be detrimental to the health of persons in an adjoining residential, commercial or community facility zone	Not applicable - The proposal is located within an area subject to a Future Urban Area overlay; as such this provision does not apply.

Table 4 Schedule 4, Part 4.3 - Development Proposals Requiring EIS—Areas and Processes

Item	Proposal	Comment
1	Proposal that is likely to have a significant adverse environmental impact on 1 or more of the following, unless the conservator of flora and fauna produces an environmental significance opinion that the proposal is not likely to have a significant adverse environmental impact: a) a species or ecological community that is endangered; b) a species that is vulnerable; c) a species that is protected; d) a species with special protection status; e) a species or ecological community if a threatening process has been declared under the Nature Conservation Act 1980, s38 (4) in relation to the species or community; f) a species or ecological community if the flora and fauna committee has stated criteria for assessing whether the committee should recommend the making of a declaration under the Nature Conservation Act 1980, s 38 (Declaration of species, community or process) in relation to the species or community; **g) an endangered species, an endangered population, an endangered ecological community, a critically endangered species, a critically endangered ecological community or species presumed extinct under the Threatened Species Conservation Act 1995 (NSW), if the potential impact of the proposal will be on the species or community in New South Wales**	**Potentially applicable - An ecological assessment would be required to determine this.**
2	**proposal involving—** a) the clearing of more than 0.5 ha of native vegetation other than on land that is designated as a future urban area under the territory plan unless the conservator of flora and fauna produces an environmental significance opinion that the clearing is not likely to have a significant adverse environmental impact; or **b) the clearing of more than 5.0 ha of native vegetation on land that is designated as a future urban area under the territory plan unless the conservator of flora and fauna produces an environmental significance opinion that the clearing is not likely to have a significant adverse environmental impact**	**Potentially applicable An ecological assessment is necessary to determine the extent of native vegetation to be impacted (if any).**

Item	Proposal	Comment
3	**proposal for development on land reserved under s 315 for the purpose of a wilderness area, national park, nature reserve or special purpose reserve, unless the conservator of flora and fauna produces an environmental significance opinion that the proposal is not likely to have a significant adverse environmental impact**	**Works within the area adjacent to the Molonglo River would like likely trigger this part.**
4	proposal that is likely to have a significant adverse environmental impact on— - a domestic water supply catchment; or - a water use purpose mentioned in the territory plan (water use and catchment general code); or - a prescribed environmental value mentioned in the territory plan (water use catchment general code) of a natural waterway or aquifer	Works would occur within a conservation catchment as noted in the *Water Use And Catchment General Code*, however the works are expected to not be inconsistent with these relevant provisions.
5	proposal that is likely to result in environmentally significant water extraction or consumption, other than a proposal for an urban lake, pond or retardation basin or a wastewater reuse scheme— a) in an existing urban area or on land that has been designated as a future urban area; and b) that is designed in accordance with the water sensitive urban design general code under the territory plan	Not applicable, the proposal does not involve an environmentally significant water extraction or consumption.
6	proposal that is likely to have a significant adverse impact on the heritage significance of a place or object registered under the *Heritage Act 2004*, unless the heritage council produces an environmental significance opinion that the proposal is not likely to have a significant adverse impact	Not applicable, there are no registered places adjacent to the Proposal that could be significantly impacted.
7	proposal involving land included on the register of contaminated sites under the *Environment Protection Act 1997*	Not applicable – the proposal is not located in an area where there are registered contaminated sites.
8	proposal, other than on land in an existing urban area or land that is designated under the territory plan as a future urban area, with the potential to adversely affect the integrity of a site where significant environmental or ecological scientific research is being conducted by a government entity, a university or another entity prescribed by regulation	Not applicable – there is no known relevant research that could be impacted as a result of the Proposal.

4.3 Environmental Issues

4.3.1 Biodiversity

The Molonglo development area contains a number of important biodiversity features, including areas of remnant woodland, and native fauna habitat. Specifically, the site contains areas of the Commonwealth *Environment Protection Biodiversity Conservation Act 1999* (EPBC Act) critically endangered Box Gum Woodland, and areas of habitat for the Commonwealth EPBC Act vulnerable Pink-tailed Worm-lizard. The area of the Coppins Crossing Road and Bridge is under the provision of the Molonglo Valley Plan for the Protection of Matters of National Significance (NES Plan).

The southern bank of the Molonglo River corridor is noted under the NES Plan as a patch of medium quality EPBC Box-Gum Woodland. A relatively small area on the southern bank of the river corridor is noted under the NES plan as high quality Pink Tailed Worm Lizard habitat. Across the length of the proposal there are small isolated patches of Pink Tailed Worm habitat, but the alignment proposed generally avoids these areas. During detailed design, there would be a need to revisit the footprints of the proposal relative to updated ecological survey of these values to understand the potential impacts. With this in mind there may be a need to prepare an ESO according to Schedule 4.3 of the Planning Act. This ensures appropriate precautions are taken and off set areas are managed correctly.

4.3.2 Effect of Molonglo River

The Molonglo River corridor is planned to be a recreational public park. The Act Government adopted the proposed Molonglo River Park Concept Plan as the guiding framework for ongoing implementation of conservation, recreation and bushfire management activities in the Molonglo River Corridor, within the area subject to the proposal. The Plan has an implementation time frame of around 30 years.

The plan is indented to guide detailed design work as the proposal progresses, to minimise any adverse impacts to the river corridor. This would include consideration of drainage, materials and various other elements of the design. The incrementally launched box girder is considered to have the least negative impacts on the Molonglo River. Material selection and finishes would be dealt with during detailed approval phase at Development Applications, although broad considerations would need to be given during an EIS process (if required).

Figure 8 Excerpt of the Molonglo River Park concept plan

4.3.3 Geology, Soils and Water

According to the Soil Landscapes of the Canberra 1:100000 Sheet (DLWC, 2000), the landscape of the study area is characterised as Burra. Typically this is undulating to rolling low hills and alluvial fans on Silurian volcanics. Localised terraces are common, almost completely cleared woodland. Silurian volcanics including the Colinton volcanics and the Cappanana Formation are found in this area. Various tuffs with minor silts on, shale, sandstone and limestone can exist in this characterisation. Bedrock tends to be highly weathered.

The soils of this landscape are shallow (<60 cm), well-drained Rudosols and Tensols on crests and upper slopes. Moderately deep (<90 cm), moderately well-drained Red Kurosols and Red Kandosols are found on the midslopes and most of the lower slopes. The minor drainage lines and some lower slopes are characterised by moderately deep (<100 cm), slowly to moderately well-drained Brown Chromosols and Brown Kandosols.

The bridge and river corridor are within the 1 in 100 year flood level (1% AEP) according to the ACT Environment and Planning mapping tool. Contours of the land suggest the surface drainage of the road flows into the Molonglo River directly.

4.3.4 Cultural Heritage

A search of the ACTMAPi tool showed there were no listed items of heritage significance within the study area. Previous heritage assessments by CHMA have identified potential heritage items within the study area; however the proposal has been specifically designed to align away from these items. The CHMA report recommended that the Kallenia Woolshed located some 500 m to the east of the proposal be nominated to the ACT Heritage Register. Discussions with the ACT Heritage Unit indicated that a nomination has not been received at this time however; this would not prevent a nomination being submitted at a future date.

4.3.5 Disruption to Air Quality, Noise and Vibration during construction

Due to the soil and geology of the area excavation for the extension is likely to require significant earthworks that would be expected to create substantial noise and vibration for surrounding sensitive receivers. At the current time there are no sensitive receivers (e.g. residential areas, childcare, schools and churches) within the study area. If the new bridge over the Molonglo River is constructed prior to or during the development of the surrounding suburban residential areas the impact to air quality, and as a result of noise and vibration would be generally be expected to be minor. However, should the Coppins Crossing Bridge be constructed following the development of the nearby residential and commercial areas the impacts to air quality, and as a result of noise and vibration impacts could be significant. These factors should be considered in the planning for the proposal, as a more involved assessment and approvals process could add significantly to the programme, and potential even result in design amendments to the proposal to address these potential impacts (e.g. shifted vertical alignments, noise walls, pavement materials etc).

4.4 Summary

The current land use zonings that the proposal is subject to pose a number of challenges to the successful implementation of the new road and bridge. It is expected that as the planning evolves for the Molonglo 3 area many of these zoning issues could be resolved. Alternatively amendments to the Territory Plan would be required. In addition, there are a number of potential triggers requiring assessment in the impact track, and the need to prepare a complete EIS.

Fundamentally though, the impact of the construction of the proposal is highly dependent on when it is carried out. The current state of East Molonglo would allow for the impacts of construction to be minimal, however should the proposal be built once the residential suburbs are constructed, the impact would likely be significant.

5.0 Traffic Assessment

Molonglo 3 Access Roads Traffic Modelling report was completed by AECOM in November 2014 with the key sections are discussed and summarised below. A copy of the report is included in Appendix C. The traffic modelling land-use, road network and mode use assumptions used for Molonglo are consistent with the traffic modelling undertaken for West Belconnen, using the latest parking cost assumptions.

5.1 Traffic Modelling

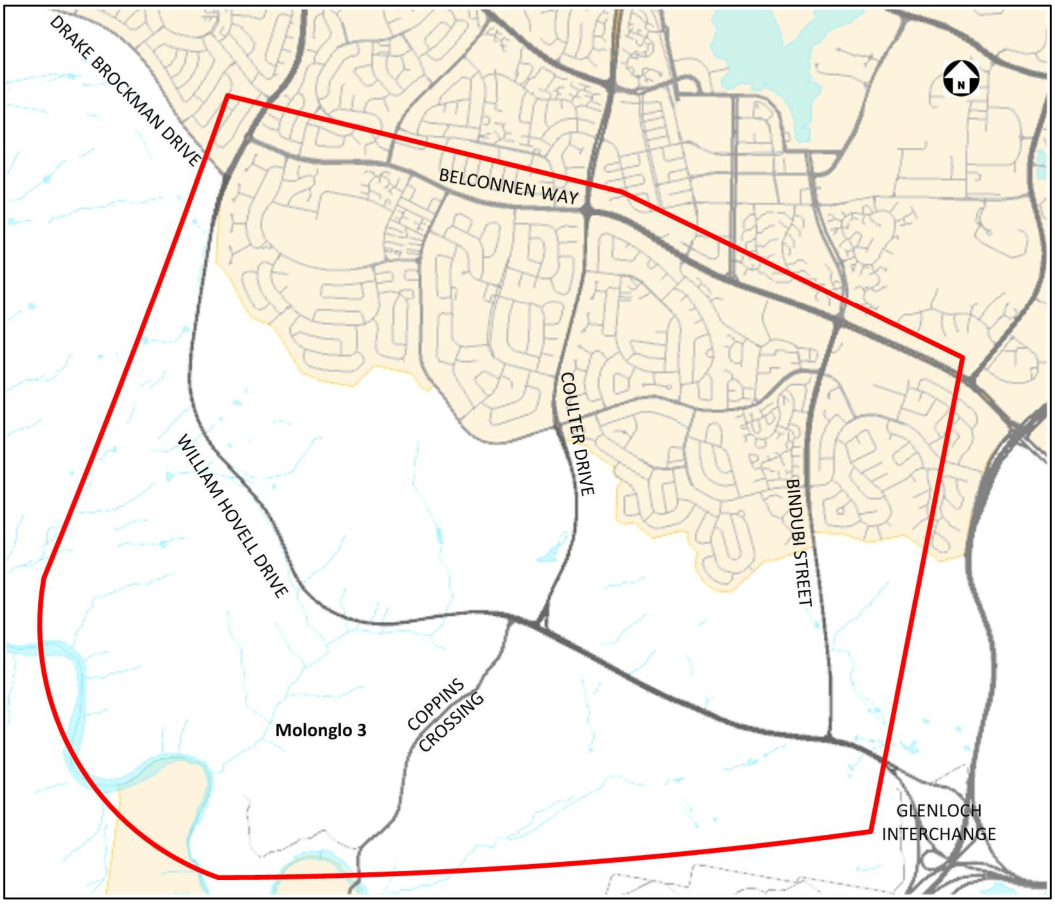
The traffic modelling provides inputs to the road design, public transport planning, staging of works and economic analyses for the John Gorton Drive Bridge. The modelling was undertaken using a three step process:

- AM peak travel demands were determined from the Canberra Strategic Transport Model (CSTM) for three future years (2021, 2031 and 2041)
- Detailed AM peak modelling of the road network was undertaken using the Commuter transport micro-simulation model to determine appropriate road and intersection arrangements
- The intersection arrangements from the AM peak micro-simulation modelling were tested for PM conditions using SIDRA.

Road upgrades were assessed based on the following assumptions:

- Commuter modelling for the AM peak only, as this was seen to be most critical in this part of the network. The extent of the micro-simulation model area is as illustrated in Figure 9.

Figure 9 Extent of micro-simulation modelled road network



- The proposed intersection configurations were checked against the likely PM peak volumes using SIDRA, for 2031 and 2041 forecast flows. Volumes and capacities for the AM derived from the Commuter Model were used in SIDRA to calibrate the results and outline the intersection parameters. Once SIDRA had a close correlation (within about 5%) the layout and assumptions were used to assess the PM peak operation.
- To derive the PM volumes, the existing SCATS volumes for the intersection of William Hovell Drive and Coulter were reviewed and the through traffic movements for the AM and PM weekday peaks were compared. The 85th percentile difference was taken over two weeks. The results showed that the PM peak was about 80% of the AM peak volumes.
- To determine the PM peak volumes for future scenarios the traffic direction was reversed and a peak reduction factor of 0.8 was applied (representing 80% of the AM peak volumes).

5.1.1 Short term road network upgrades

It is planned that an initial (northern) access for Molonglo 3 will be needed by 2018 to service the first land sales in Molonglo 3. The access is located about 500 m south of William Hovell Drive which is referred to the Northern Access Road.

It is proposed to upgrade Coppins Crossing Road in its final proposed alignment between the northern access and William Hovell Drive Drive. This should include any widening needed to provide for on-road cycling, as well as off-road facilities. It will also include new traffic signals at the current Coppins Crossing Road/William Hovell Drive Drive intersection and a signalised intersection or a roundabout at the Northern Access Road location.

Refer to Figure 44 in Section 10 for short term road network upgrades and locations of intersections.

Coppins Crossing Road/William Hovell Drive Intersection

Option 1b (refer to Figure 10 and Figure 11) is the first stage intersection improvement option at William Hovell Drive. This will include the following works:

- Signalised Coppins Crossing Road/William Hovell Drive intersection.
- Additional through lane on William Hovell Drive Eastbound or approximately 200 m.
- Additional right turn lane on Coppins Crossing Road for approximately 150 m.
- Retain existing William Hovell Drive/Coulter Drive (CD) intersection arrangement.

Table 5-1 shows a summary of 2021 intersection level of service. Some minor turn movements are level of service F, but these have very low demands so this is acceptable. The overall intersection level of service is D or less indicating that the intersections will operate satisfactorily in peak hours.

Table 5-1 Level of service summary for key intersections in 2021 AM peak

Intersection	Approach	2021 AM - Level of Service (Delay)		2021 PM - Level of Service (Delay)	
1. William Hovell Drive/Coppins Crossing Road (Figure 10)	William Hovell Drive WB	A (2.2s)	D (42.7s)	B (22.8s)	C (29.5s)
	William Hovell Drive EB	A (11.1s)		B (24.6s)	
	Coppins Crossing Road	F (72.5s)		D (46.5s)	
2. William Hovell Drive/CD (Figure 11)	CD SB (right turn)	F (78.9s)	B (22.9s)	F (79.0s)	C (39.7s)
	William Hovell Drive WB	C (29.9s)		C (30.5s)	
	William Hovell Drive EB	A (13.1s)		B (23.2s)	
	William Hovell Drive WB	C (29.9s)		C (29.8s)	
	William Hovell Drive EB	A (13.1s)		B (20.1s)	

The expected maximum queue lengths for the preferred first stage intersection design are shown in Table 5-2. These are derived from the Commuter modelling for the AM peak and SIDRA in the PM peak.

Table 5-2 2021 peak hour 95th percentile queues for analysed intersections

Intersection	Approach	AM Peak – Queue length [m]	PM Peak – Queue length [m]
1. William Hovell Drive/Coppins Crossing Road	William Hovell Drive WB	16	92
	William Hovell Drive EB	52	21
	Coppins Crossing Road	78	80
2. William Hovell Drive/CD	CD SB (right turn)	125	171
	William Hovell Drive WB	35	226
	William Hovell Drive EB	74	60

Source: AM peak based on 2021 Molonglo Commuter model; PM peak based on SIDRA analyses.
Based on the new lane arrangements at Coppins Crossing Road (see Figure 9) and current arrangement at CD.

Based on the traffic modelling undertaken for this project, this layout is expected to have a life of approximately 7 years (before 2024) assuming the installation of signalisation works would be completed by 2016 before additional works will be needed. Its life could be less if the development of Molonglo actually occurs more quickly than assumed in the modelling or William Hovell Drive is duplicated between Coppins Crossing Road and Drake Brockman Drive (DBD). This is a very real possibility, bringing forward serious consideration of early construction of medium and long-term options.

Northern Access Road

The Northern Access Road is located off John Gorton Drive closer to William Hovell Drive to provide access to the first stage of development of Molonglo 3 (M3).

Two alternative layouts (signals or roundabout) were tested at the Northern Access Road. The signals layout that was tested and shown to work satisfactorily for 2031 and 2041 flows is shown in Figure12. Similarly, the roundabout option tested for 2031 flows would not need to be modified to cater for 2041 flows. The results of the 2041 AM peak delay and level of service analyses is given in Table 5-3. The proposed roundabout layout would need to have two circulating lanes for the main movements along John Gorton Drive, but one lane for the side roads.

Figure 10 Signalised Layout for Coppins Crossing Road/William Hovell Drive intersection

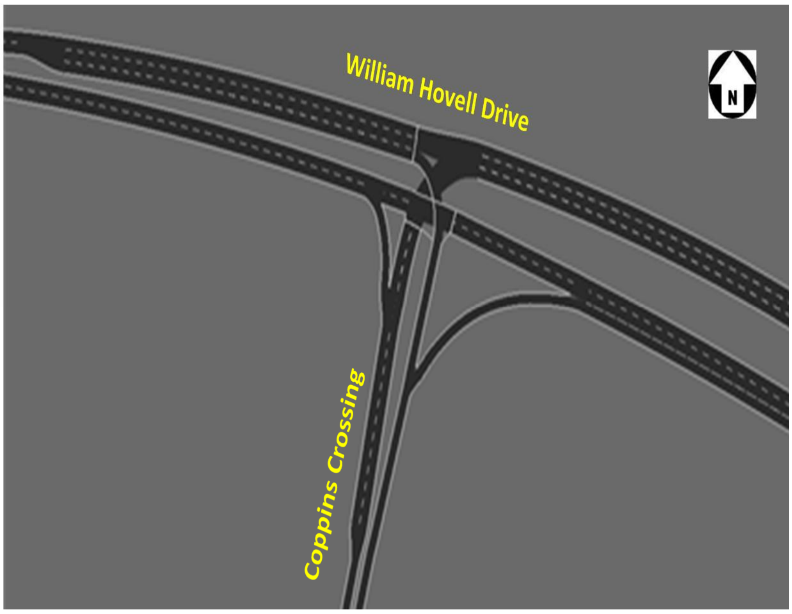


Figure 11 Current Arrangement at William Hovell Drive/CD intersection

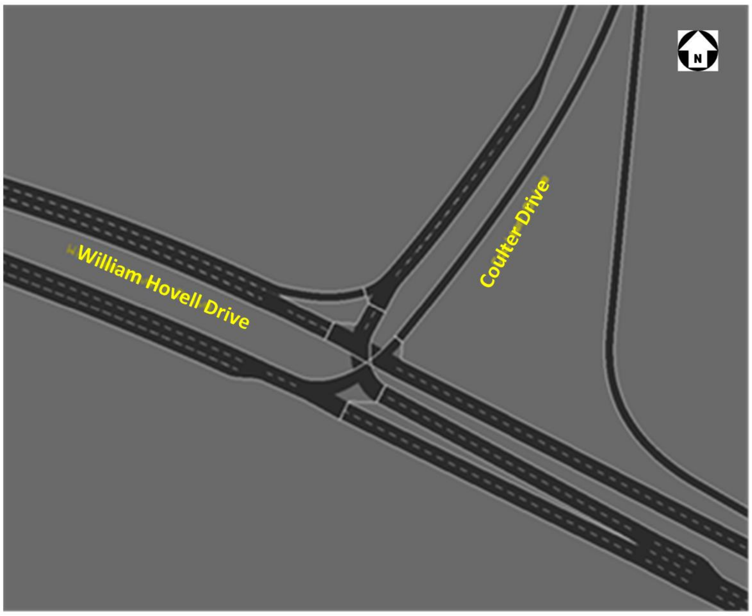
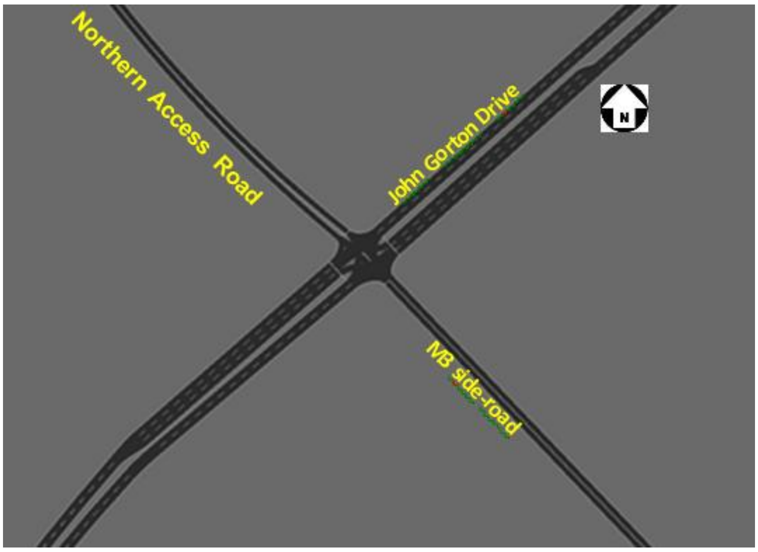


Figure 12 Initial signalised layout for John Gorton Drive intersections with Northern Access Road



The preferred layout will depend on physical constraints at the proposed location of this intersection and the relative costs for signals. Again, the roundabout will have less delay and thus is a more efficient solution here.

Table 5-3 Level of service summary for John Gorton Drive/Northern Access Road intersection – 2041 AM peak

Intersection	Approach	Level of Service (Delay)			
		Signals		Roundabout	
3. John Gorton Drive/Northern Access Road	John Gorton Drive SB	D (48.2s)	C (37.3s)	B (18.2s)	B (22.3s)
	M3 side road WB	E (58.5s)		C (31.1s)	
	John Gorton Drive NB	B (21.1s)		B (24.7s)	
	Northern Access Road EB	C (35.6s)		B (19.6s)	

Note: The signals analysis is based on the intersection layout shown in Figure 12. *The roundabout option is based on two circulating lanes for the main movements along John Gorton Drive, but one lane for the side roads.*

Molonglo River Bridge

The replacement of the existing low level crossing on Coppins Crossing Road with a new bridge across the Molonglo River should preferably occur before 2021. Only the northbound carriageway of the bridge would need to be construction by 2021. The primary reasons for the early construction of the new bridge are:

- To enable public transport connection for Molonglo 2 residents to Belconnen
- To improve road safety, as the existing road has a number of deficiencies identified in a road safety audit
- To enable safe cycle access between existing developed areas of Molonglo, M3 and Belconnen
- To provide a flood free access across Molonglo River

5.1.2 Medium to Long-term road network upgrades

Refer to Figure 45 in Section 10 for summary of medium to long term road network upgrades and locations of intersections.

John Gorton Drive/William Hovell Drive Intersection

Traffic modelling indicates that a new arrangement at John Gorton Drive/William Hovell Drive intersection will be needed here by 2024. This could either be in the form of a signalised cross-intersection or grade-separation if the function of William Hovell Drive is upgraded to a parkway.

The possible long term configurations at John Gorton Drive/William Hovell Drive intersection are:

- Single point at-grade intersection
- Quadrant Option
- Grade separated interchange

Figure 13 illustrates the intersection configuration options.

Discussions between CMPTEDD and TaMS in 2015 indicated the function of William Hovell Drive is likely to remain as an arterial road rather than a parkway. Thus, it is agreed with CMTEED and Roads ACT that the Quadrant Option is the recommended option for the feasibility design of the intersection. This could have a significant impact on land-take and any future transition to grade-separation will result in significant abortive works and some unusable left-over land slivers.

A comparison of the various intersection options (excluding grade separated interchange) was undertaken. Figure 13 and Table 5-4 provides a basic comparison of intersection options. In terms of these options, the choice is between the Quadrant and Purple 4-way intersection option. Overall, the Quadrant option provides most flexibility and longevity. It is of similar cost to the other 4-way intersection options and can be readily built under traffic with minimal impact on existing traffic operations. Readability can be addressed by signage and the peak direction flows can be coordinated adequately in SCATS.

Figure 13 Potential layout of a 4-way signalised intersection options

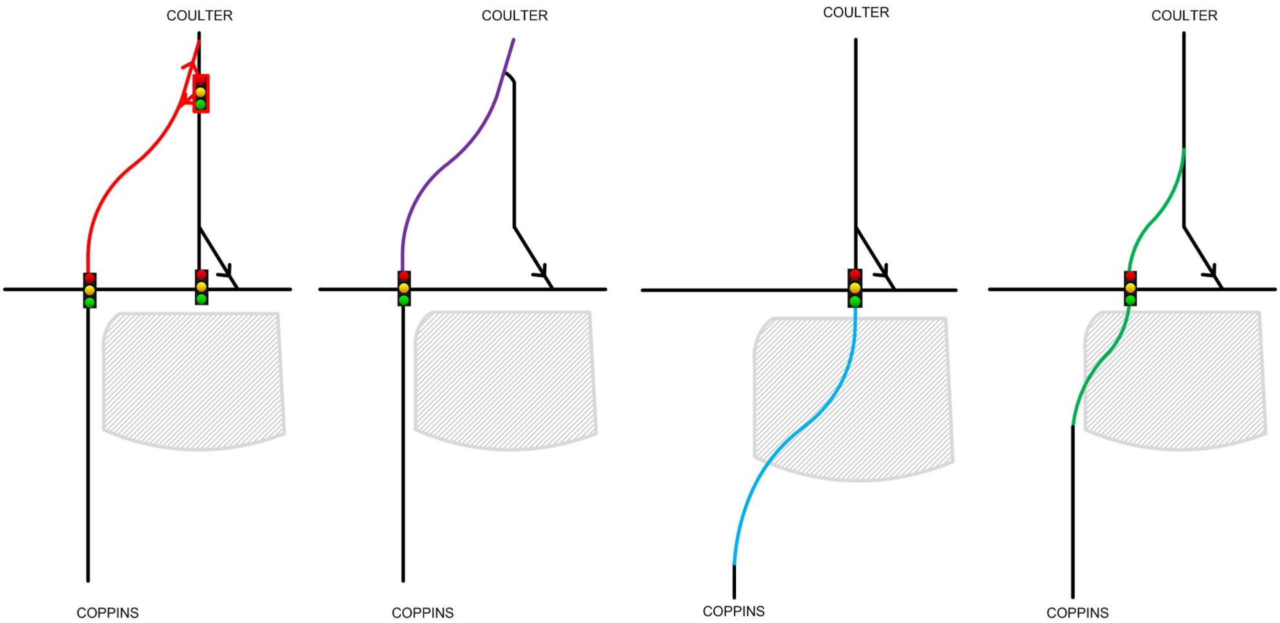


Table 5-4 Comparison of 4-way intersection options

Aspect	Quadrant (Red)	Single-point		
		Purple	Blue	Green
Probable Construction Timing	2021-2024	2021-2024	2021-2024	2021-2024
Probable life	30+ years	20+ years	20+ years	20+ years
Probable indicative cost	$21 M	$ 22 M	> $ 22 M	> $ 22 M
Compatibility with future interchange	Good	Good	OK	**Poor**
Need to bring forward Bindubi St connection	No	Likely	Likely	Likely
2031 peak hour traffic delays & queues	Moderate	High	High	High
Constructability under traffic	OK	OK	Easy	OK
Relative size of 4-way intersection	Large	Large to very large	Large to very large	Large to very large
Readability for visitors	Poor	OK	Good	OK
Compatibility with SCATS coordination	Poor	OK	OK	OK
Impact on terrain	Minimal	Minimal	**Adverse**	Some

Note: 1. Refer to Figure 13 for definition of options

2. For each option, costs assume 300m of four-lane roadways on John Gorton Drive and Coulter Drive approaches

The Quadrant option is preferable in relation to the 4-way intersection options. The layout required for the John Gorton Drive/William Hovell Drive intersection is shown in Figure 14.

The main change is the creation of a northern leg to connect with Coulter Drive north of William Hovell Drive, requiring two through lanes connecting to John Gorton Drive. This intersection will continue to operate in this form beyond 2041, without the need for grade-separation. The delays and level of service at this intersection in 2031 and 2041 are summarised in Table 5-5 and Table 5-6.

The extension of John Gorton Drive would result in the removal of left turns into and right turns from Coulter Drive. The resultant layout is shown in Figure 15 The delays and level of service at this intersection in 2031 are summarised in Table 5-7. It shows that this intersection would operate with minimal delays in both peaks.

Figure 14 2041 John Gorton Drive/William Hovell Drive (Quadrant) intersection layout

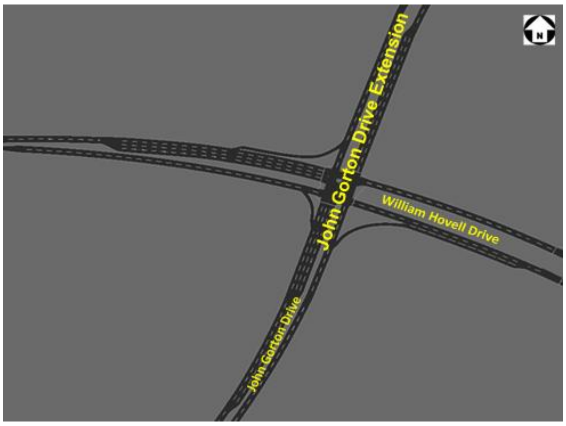


Figure 15 2031 CD/William Hovell Drive intersection layout

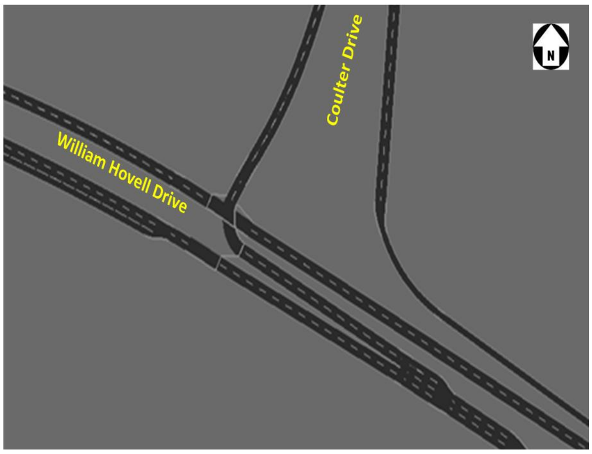


Table 5-5 2031 level of service John Gorton Drive/William Hovell Drive (Quadrant) intersection layout

Intersection	Approach	Level of Service (Delay)			
		AM Peak Hour		PM Peak Hour	
1. John Gorton Drive/William Hovell Drive	William Hovell Drive WB	C (34s)	C (38s)	B (18s)	C (30s)
	William Hovell Drive EB	C (33s)		B (27s)	
	John Gorton Drive	C (38s)		D (43s)	
	John Gorton Drive Extension	D (52s)		C (40s)	

Table 5-6 2041 level of service John Gorton Drive/William Hovell Drive (Quadrant) intersection layout

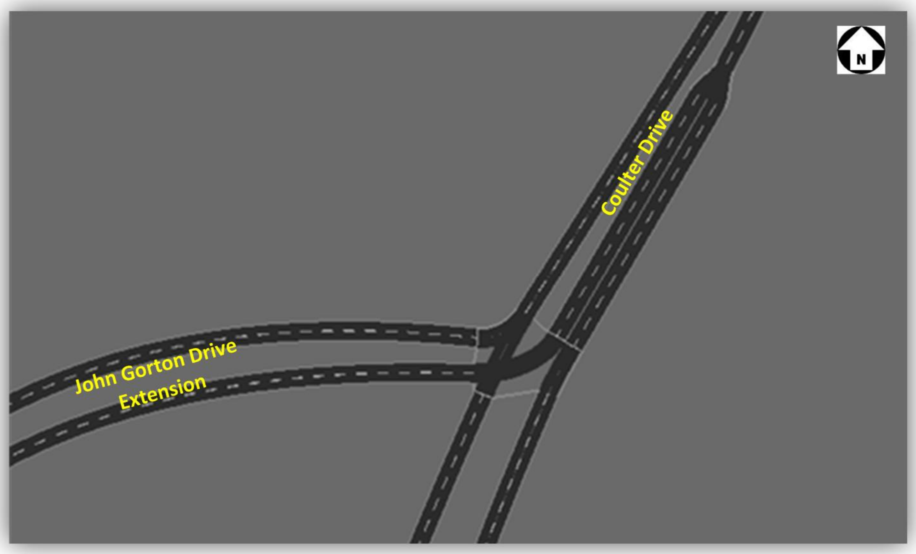
Intersection	Approach	Level of Service (Delay)			
		AM Peak Hour		PM Peak Hour	
1. John Gorton Drive/William Hovell Drive	William Hovell Drive WB	D (50s)	D (48s)	B (24s)	C (30s)
	William Hovell Drive EB	D (52s)		B (21s)	
	John Gorton Drive	C (42s)		C (36s)	
	John Gorton Drive Extension	D (46s)		C (39s)	

Table 5-7 Level of service summary for William Hovell Drive/CD intersection – 2031 AM & PM peaks

Intersection	Approach	Level of Service (Delay)			
		AM Peak Hour		PM Peak Hour	
2. William Hovell Drive/CD	CD SB	N/A	A (7s)	N/A	A (10s)
	William Hovell Drive WB	B (19s)		A (8s)	
	William Hovell Drive EB	A (3s)		B (19s)	

The layout of the proposed new intersection on Coulter Drive is shown in Figure 16.

Figure 16 John Gorton Drive Extension/CD intersection layout



The results of the analysis of 2031 and 2041 delays and level of service for the proposed new intersection on Coulter Drive is summarised in Table 5-8 and Table 5-9.

Table 5-8 Level of service summary for John Gorton Drive Extension/CD intersection – 2031 AM & PM peaks

Intersection	Approach	Level of Service (Delay)			
		AM Peak Hour		PM Peak Hour	
3. John Gorton Drive Extension/CD	CD SB	A (3s)	A (11s)	B (19s)	B (18s)
	CD NB	E (67s)		B (15s)	
	John Gorton Drive Extension	B (19s)		B (20s)	

Table 5-9 Level of service summary for John Gorton Drive Extension/CD intersection – 2041 AM & PM peaks

Intersection	Approach	Level of Service (Delay)			
		AM Peak Hour		PM Peak Hour	
3. John Gorton Drive Extension/CD	CD SB	B (26s)	A (14s)	C (30s)	B (24s)
	CD NB	D (45s)		A (14s)	
	John Gorton Drive Extension	A (3s)		B (27s)	

Southern Access Road to M3

The future Southern Access Road is located at the Bindubi Street Extension intersection and its layout is shown in Figure 17.

The results of the 2031 AM peak delay and level of service analysis for the Southern Access Road, Bindubi Street, John Gorton Drive intersection is provided in Table 5-10. It provides results for the signals layout and shows that the intersection would operate satisfactorily with relatively moderate delays.

John Gorton Drive/Bindubi Street Extension Intersection

The ultimate layout for John Gorton Drive/ Bindubi Street Extension intersection is shown in Figure 17. There will also need to be provision for IPT in the median, travelling via John Gorton Drive to the south and Bindubi Street Extension to the east.

The results of the AM peak delay and level of service analysis (refer to Table 5-10) indicated that bus priority is not needed at this intersection in the interim, as delays and queues for turning traffic will be moderate.

Figure 17 Ultimate John Gorton Drive/Bindubi Street intersection layout

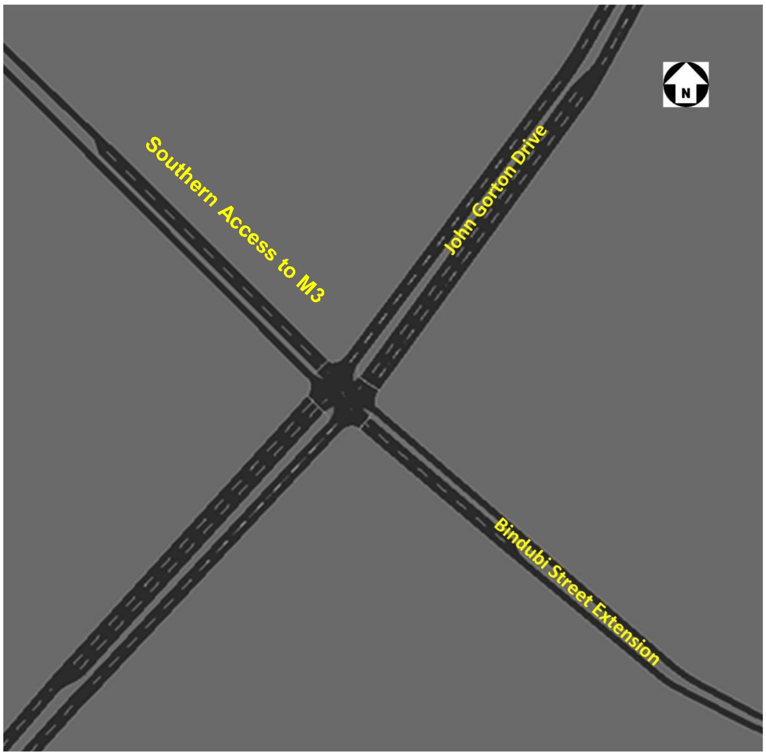


Table 5-10 Level of service summary for Southern Access Road/Bindubi Street/John Gorton Drive intersection– 2031 AM peak

Intersection	Approach	Level of Service (Delay)	
		Signals	
5. Southern Access Road/Bindubi Street Extension /John Gorton Drive intersection	John Gorton Drive SB	C (36.5s)	C (37.2s)
	BD WB	C (40.7s)	
	John Gorton Drive NB	C (33s)	
	Southern Access Road EB	D (51.2s)	

Molonglo River Bridge

The medium to long term works includes the duplication of the John Gorton Drive southbound carriageway including the John Gorton Drive Bridge over the Molonglo River. A 3-lane bridge with peak contra-flow may be an alternative option, depending on the balance of flows in the longer-term. Refer to the Staging Diagrams shown in Section 10.

6.0 Public Transport, Cycling and Pedestrians

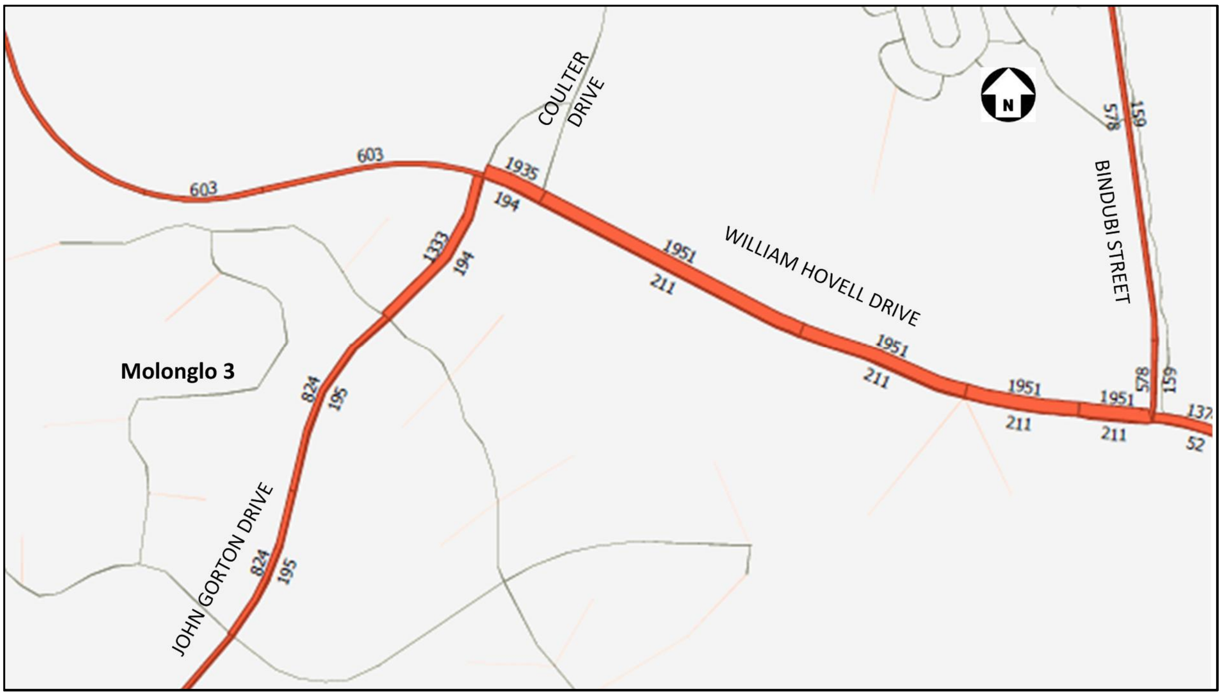
6.1 Public Transport

Future peak hour forecasts for bus passengers in 2031 and 2041 are shown in Figure 18 and Figure 19. These taken together with traffic conditions will provide guidance as to the likely need for future bus or transit lanes in the area.

In 2021 buses will need to be routed along John Gorton Drive, William Hovell Drive and Bindubi Street, prior to the completion of the Bindubi Street extension. Light rail may use the Bindubi Street route in the longer-term and this has been allowed for in the design.

In 2031, buses to Belconnen and City will need to be routed via John Gorton Drive, William Hovell Drive and Bindubi Street (Figure 18). In the City-bound direction bus passenger flows would peak at about 1,300 passengers per hour in the AM peak on John Gorton Drive. This is equivalent to about 20 buses per hour [3]. Bus priority cannot be justified here.

Figure 18 2031 peak hour bus passenger flows

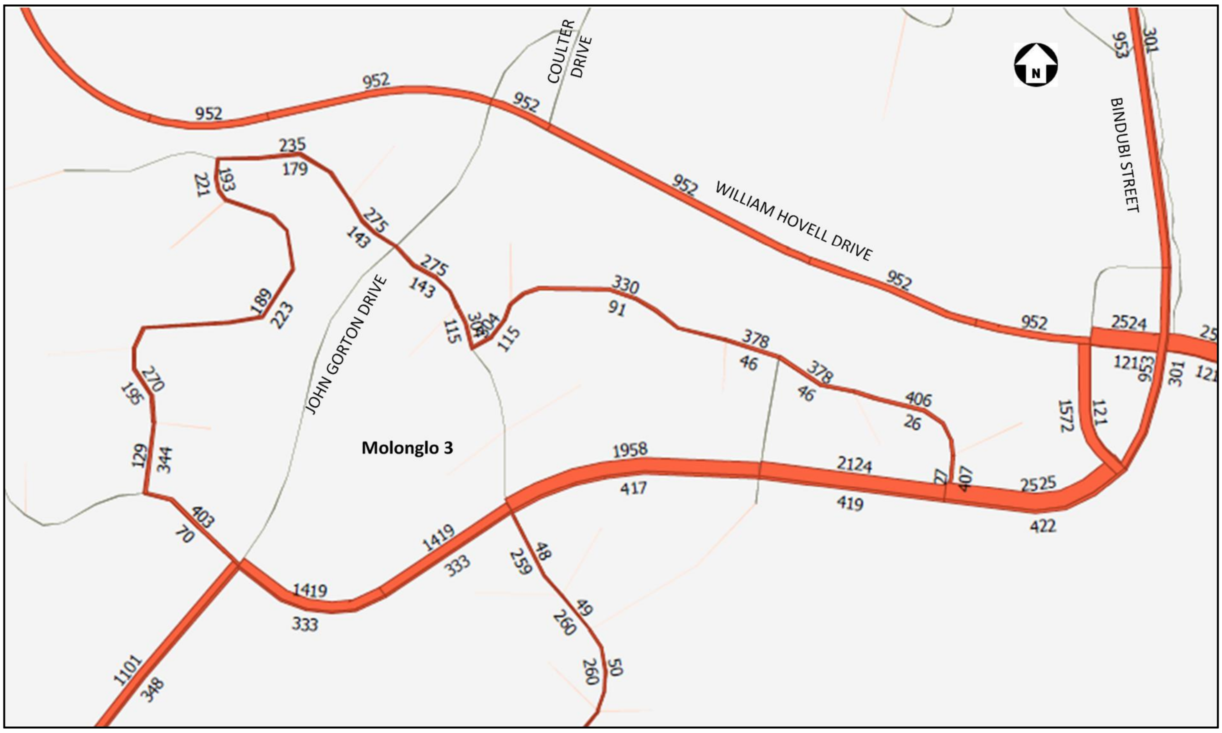


Note: The lines represent roads and the widths of the lines are proportional to the change in traffic flows; the wider the band the greater the volume. ***Source:*** *CSTM (May 2014)*

Inter-town buses will be rerouted when a new connection is made to Bindubi Street, as reflected in the 2041 plot (Figure 19). In 2041, bus passenger flows would peak at about 2,500 passengers per hour in the AM peak on Bindubi Street, south of William Hovell Drive. This is equivalent to about 35 buses per hour, which may justify consideration of bus queue jump lanes at strategic locations on approach to William Hovell Drive.

[3] This is based on an assumed average peak bus occupancy of 70 passengers. The current ACTION bus fleet varies in capacity from about 60 to 110 passengers per bus, with the larger buses plying the busy peak hour routes.

Figure 19 2041 peak hour bus passenger flows



Note: The lines represent roads and the widths of the lines are proportional to the change in traffic flows; the wider the band the greater the volume. ***Source:*** *CSTM (May 2014)*

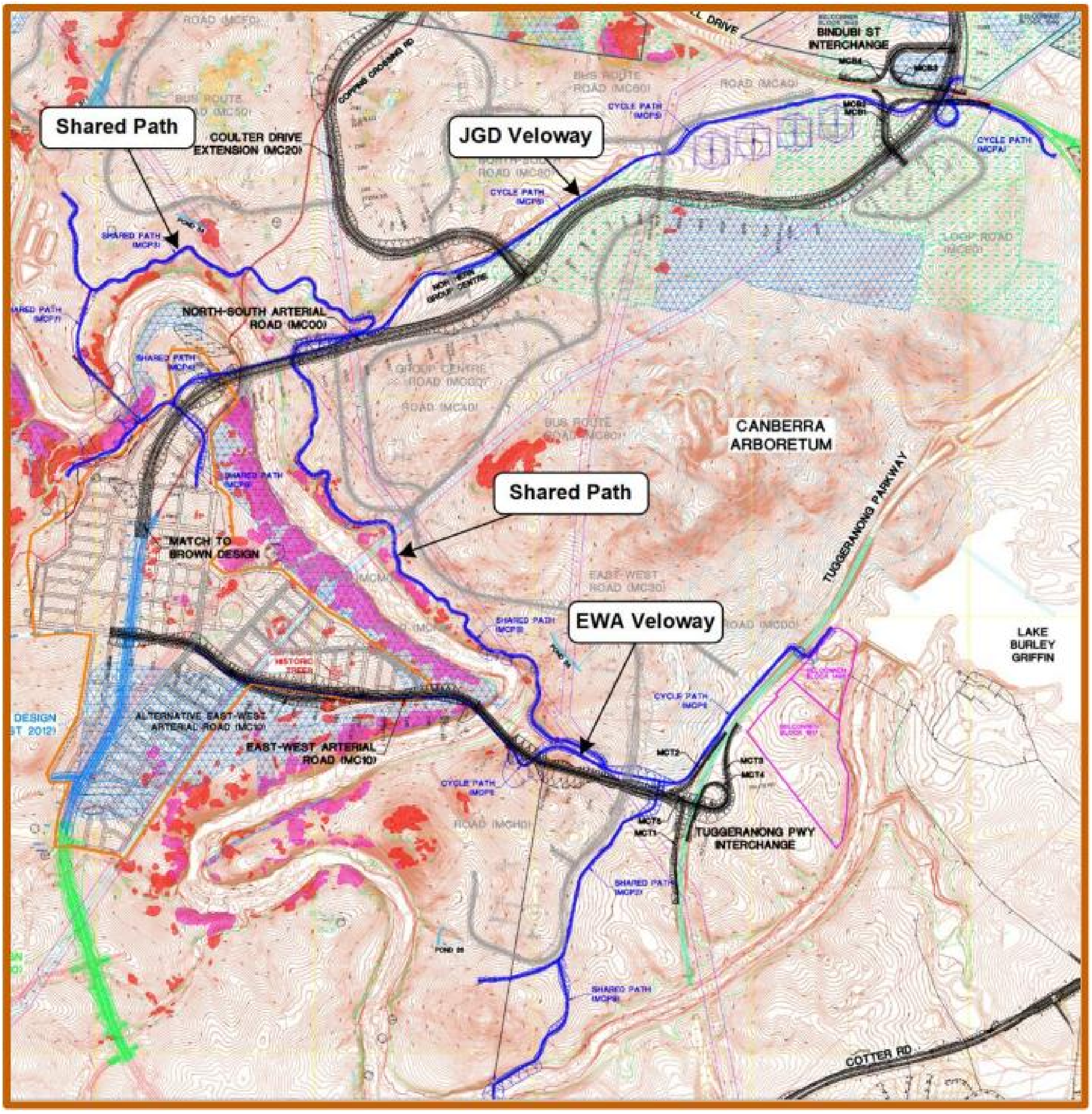
6.2 Cycling and Pedestrians

The previous MARFS undertaken by SMEC (2013), proposed a cycle highway or 'veloway' through Molonglo between Stromlo Forest Park, the Arboretum and Lake Burley Griffin, and Molonglo 2 Group Centre utilising East-West Arterial Road (refer to Figure 20).

An off-road shared path is also proposed by SMEC (2013) adjacent to the MVIS (refer to Figure 20). This off-road shared path is proposed to cross under John Gorton Drive. Due to the presence of 132 kV conductors in close proximity of the MVIS and to maintain the required minimum clearances on 132 kV conductors and the minimal cutting over the MVIS (refer to discussions in Section 7.2), CMTEDD indicated that an underpass crossing John Gorton Drive can be removed. An alternative off-road path around the northern abutment of the bridge can be explored and assessed as part of other adjacent studies.

The future cycle path or shared path to Belconnen could be accommodated in the verge of John Gorton Drive similar to recently constructed John Gorton Drive section within Molonglo 1 and 2.

Figure 20 Proposed Veloway and Shared Path[4]



Concurrent studies are being undertaken for cycle path options from Molonglo to the City. Roads ACT engaged AECOM in February 2014 to deliver a Feasibility Study on the proposed Molonglo Valley to City Trunk Cycleway.

Between the future Molonglo Commercial Centre and the Canberra City there is a range of natural and built constraints that limit and influence the possible routes. Three potential corridors were identified for the Molonglo Valley to City Cycleway and are shown on the Figure below. These corridors included:

[4] Source: Molonglo Arterial Roads Feasibility Study, SMEC, 2013

1) North South Corridor - Leaving the Molonglo Commercial Centre and heading north, following John Gorton Drive over the Molonglo River Bridge, the Cycleway proceeds north along the western boundary of the National Arboretum joining William Hovell Drive and either continuing along Parkes

Way into the City as an on-road cycle lane contained on the road shoulder or connecting to the off-road Lake Path Loop and travelling into the City

2) Segregated On-Road Corridor - Following the proposed East West Arterial from the future Molonglo Commercial Centre joining the Tuggeranong Parkway and continuing through the Glenloch Interchange onto Parkes Way and into the City via an on-road cycle lane located on the road shoulder segregated with the use of physical separation and/or barriers

3) Lake Corridor - Following the proposed East West Arterial from the future Molonglo Commercial Centre, crossing Tuggeranong Parkway via a segregated Cycleway, and following the existing Lake Path Loop into the City.

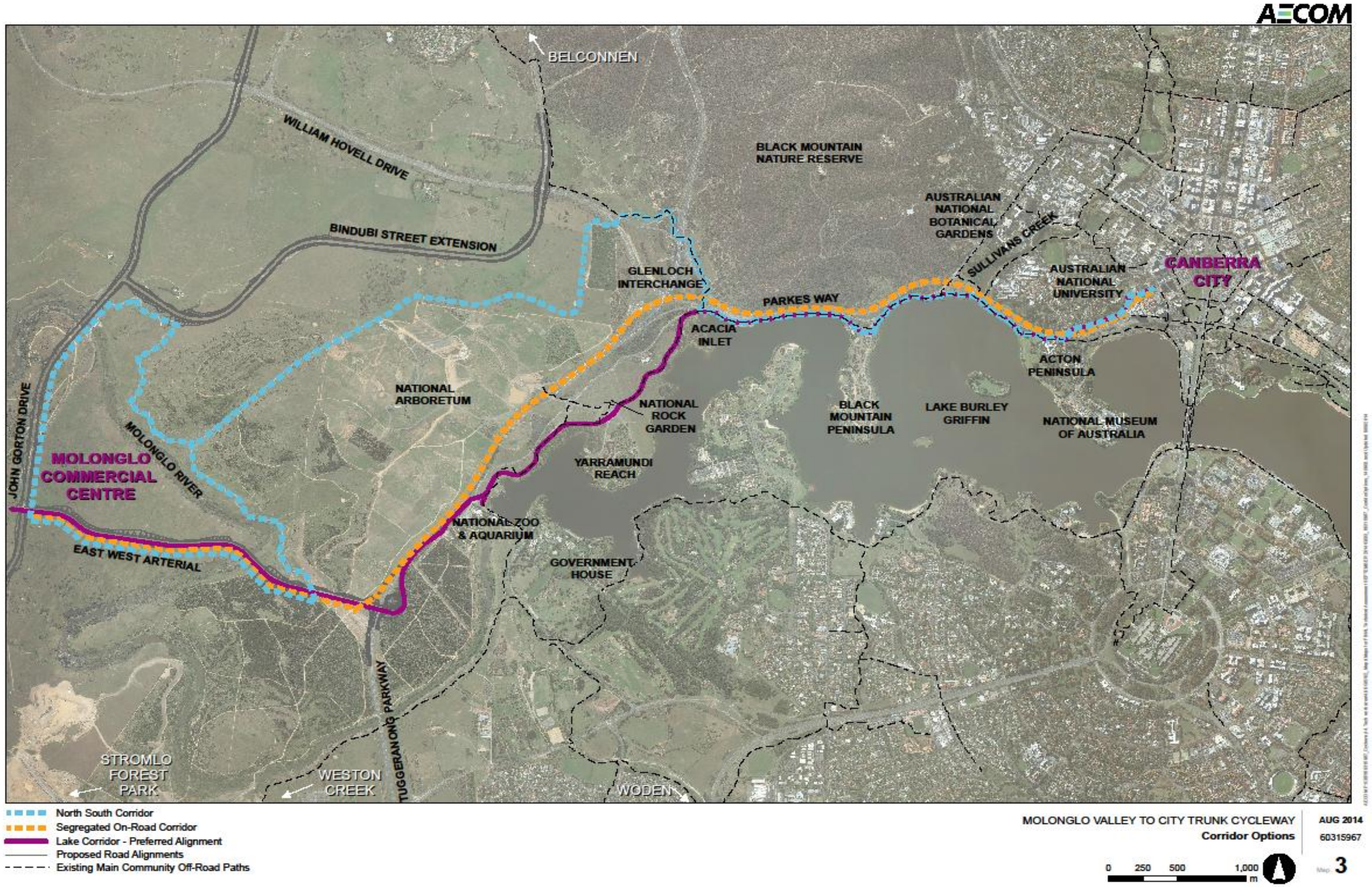
Following a review of the potential corridors it was determined that the Lake Corridor provided the most attractive route for the Molonglo Valley to City Cycleway. The Lake Corridor enables the upgrade of existing infrastructure which is already heavily used. It provides connections to the National Zoo and Aquarium, the National Arboretum, the Lindsay Prior Arboretum, the National Museum of Australia and the existing Lake Path Loop and the Woden and Belconnen Cycle path network. It is also the option most accessible and connected, enjoyable and safe.

After engaging with key stakeholders to understand objectives for developing the Cycleway, a complete investigation of different options to link Molonglo Valley and the City was undertaken. Out of this investigation, the Lake Corridor was chosen as the preferred alignment. The Lake Corridor option:

- Enables the upgrade of existing infrastructure which is already heavily used
- Provides connections to the National Zoo and Aquarium, the National Arboretum, the Lindsay Prior Arboretum, the National Museum of Australia and the existing Lake Path Loop, Woden and Belconnen Cycle path network
- Provides an improved accessible and connected, enjoyable and safe route for users between Molonglo Valley, Belconnen, Woden, Weston Creek and the City for commuters and recreational users.

The next stage of this project has received funding under the ACT Government Budget announced in June 2015.

Figure 21 Molonglo Valley to City Trunk Cycleway Corridor Options



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7.0 Road Alignment

7.1 Design Standards and Criteria

Below is a list of the guidelines and standards that have been used during the design process. Selected criteria are shown in Table 7-1.

- ACT Territory and Municipal Services – Design Standards for Urban Infrastructure
- AUSTROADS – Part 3 Geometric Design
- AUSTROADS – Part 4A Unsignalised and Signalised Intersections
- AUSTROADS – Part 6 Roadside Design, Safety and Barriers
- AUSTROADS – Part 6A Pedestrian and Cycle Paths

Table 7-1 Design Criteria for John Gorton Drive

Criterion	Value
Design vehicle	B-double
Design Speed	John Gorton Drive (south of Intersection with Bindubi Street) – 90 km/h John Gorton Drive (north of Intersection with Bindubi Street) – 90 km/h Bindubi Street Extension – 70 km/h in vicinity of Group Centre
Batter slope	4H:1V Fill 2H:1V Cut
Clear Zones	8.5 m based on: • Design Speed of 70 - 80 km/h • 4H:1V batter slope • > 6000 ADT 10 m on fill and 6.5 m on cut based on: • Design Speed of 90 km/h • 4H:1V batter slope • > 6000 ADT
Horizontal Alignment	
Desirable minimum with 3% superelevation and a maximum side friction value	400 m (desirable maximum side friction value 0.13) will be used in design for 90 km/h.
Vertical Alignment	
Minimum grade	1% (Desirable for roads with kerb and channel). Need to check drainage at superelevation transition for flat spots and conformance to Austroads Part 5.
Maximum grade	4 – 6 % (rolling terrain) Desirable maximum lengths of grades: Grade % / Length (m): 2-3 / 1800 3-4 / 900 4-5 / 600 5-6 / 450 >6 / 300

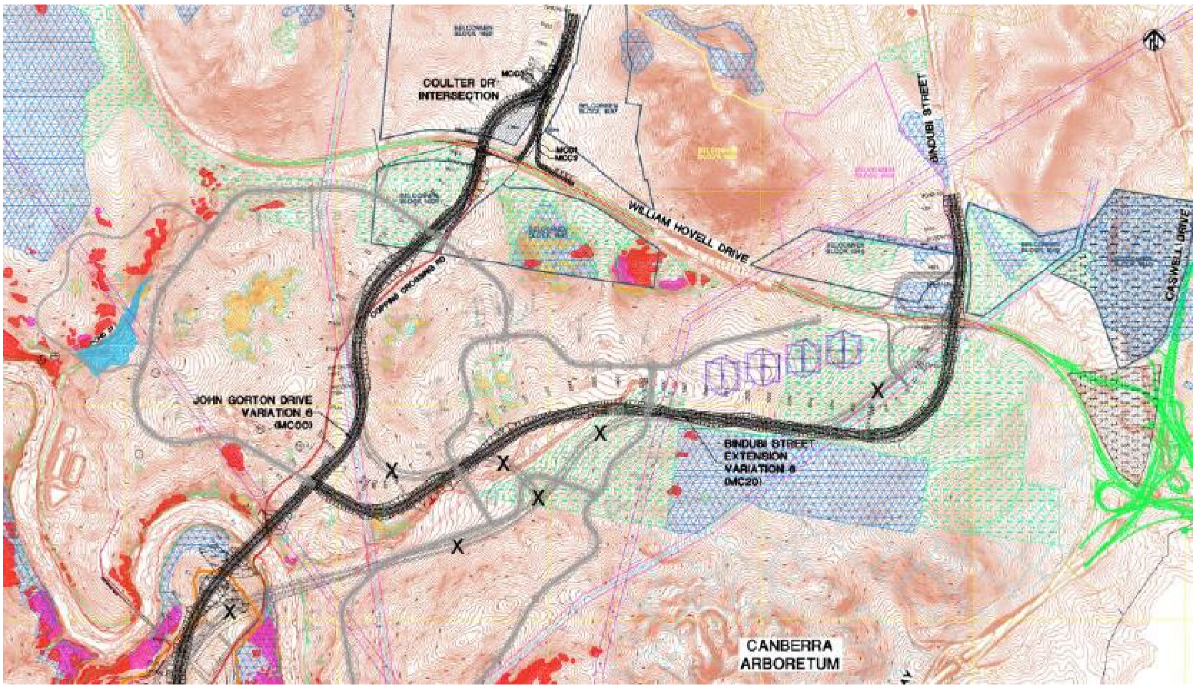
Criterion	Value
On-Road Cycle Paths	Due to the terrain and despite best efforts, there may be locations that 2.5% grade cannot be achieve at proposed bus stop locations. It is better to have a non-compliant bus stop than none at all, as the spacing between stops may become too great if only compliant stops are provided. Vertical alignment standard adopted on roads will normally be satisfactory for on-road cycle paths. Gradient steeper than 5% for on-road cycle path should not be provided for downhill travel unless it is unavoidable.
Pedestrian/Off-Road Shared Paths	Pedestrian footpaths and shared paths 3.5% to 5% - 1.2 m rests at 18m (comply with access and mobility – DDA guide)· Will need to be designed in conjunction with the estate planning.
K	42.9 Crest 13-21 Sag (90 km/h) 29.3 Crest and 10-17 Sag (80 km/h)
Intersection	
Horizontal alignment - General	As close to 90^0 All approaches are able to have straight horizontal alignment Horizontal Minimum Curve Length 230 m for 90 km/hr
Vertical alignment – John Gorton Drive/Bindubi Street Extension intersection	2% to allow for future bus station and future light rail station.
Sight Distance	SSID (R_T=2.0s) – 214 m for 90 km/h
Other Design Criteria	
Median width	12 m for future light rail or Public Transport corridor. 8.5 m at the approach to Bindubi Street intersection to accommodate right-turn lane
Coordination of vertical and horizontal geometry	Desirable for aesthetic, safety and drainage

7.2 Road Alignments

Previous Road Alignment Options for John Gorton Drive

The Molonglo Arterial Roads Feasibility Study (MARFS) was finalised in January 2013. Further investigation was undertaken for an alternative alignment that had a more direct connection between John Gorton Drive and William Hovell Drive. This work was called Variation 06 (Var 06) of the MARFS and the resulting preferred alignment is shown in Figure 22.

Figure 22 Roads Alignment Variation 06



In October 2013, further investigation was undertaken on the alignment taking into consideration the Kallenia woolshed. The alignment was required to avoid the woolshed and focus the alignment investigation around the John Gorton Drive/Bindubi Street Extension intersection.

Five alignment options were investigated:

Option 1: John Gorton Drive is aligned to the east of the trunk watermain north of the Molonglo River and Bindubi Street Extension is aligned to the south of the woolshed.

Option 2: John Gorton Drive is aligned to the east of the trunk watermain north of the Molonglo River and Bindubi Street Extension is aligned to the north of the woolshed.

Option 3: John Gorton Drive is aligned to the west of the trunk watermain north of the Molonglo River and Bindubi Street Extension is aligned to the south of the woolshed.

Option 4: John Gorton Drive is aligned to the west of the trunk watermain north of the Molonglo River and Bindubi Street Extension is aligned to the north of the woolshed.

Option 5: John Gorton Drive is aligned to provide larger radii north of the Molonglo River to reduce the curve superelevation requirements and provide a better connection for the future light rail alignment through the John Gorton Drive / Bindubi Street Extension intersection. The alignment requires a change in direction crossing the river and a more direct crossing of the trunk watermain. Bindubi Street Extension is extended to the John Gorton Drive alignment as an extension of the alignments to the south of the woolshed.

Option 6: John Gorton Drive alignment Option 5 was used as the base to review flexibility in the alignment of the western end of the Bindubi Street Extension.

Refer to Appendix D for the Technical Note prepared by SMEC which provides a detailed assessment of the previous options and the AECOM memo outlining the review of the vertical alignment for John Gorton Drive. In the previous MARFS report and AECOM memo, the proposed John Gorton Drive north of the Bindubi Street Extension was called Coulter Drive Extension (CDE).

John Gorton Drive Ultimate Alignment

An assessment of the horizontal and vertical road alignment design options was undertaken in June 2014, taking into account the factors listed below. A memo outlining the outcomes of the alignment assessment is included in Appendix D.

General parameters adopted on John Gorton Drive ultimate arrangement similar to MARFS are:

- Match with John Gorton Drive Stage 2A on the southern end.
- South of Bindubi Street Extension intersection, the horizontal alignment is to follow the MARFS Variation 6.
- Intersection with Bindubi Street Extension is located at approximately Chainage 16,640.
- Maximum vertical grade of 2% in the vicinity of future John Gorton Drive/Bindubi Street Extension intersection for future IPT station.
- Location of future Molonglo 3 Stage 1 Access Road at approximately Chainage 17,930.

In addition to the above general parameters, the following factors have been considered in the review of the horizontal and vertical alignments of the MARFS Option 6 of Variation 6 alignment:

- Lowering John Gorton Drive alignment to maintain 11.5 m vertical clearance to the 132 kV conductors based on the survey information of the catenary of these conductors.
- Proposed finish level above the MVIS is to be similar to the existing ground level with no underpass to minimise cutting in the vicinity of the MVIS.
- Retain the existing Coppins Crossing Road for access during the first carriageway of bridge construction.
- The full length of the bridge is located within a constant vertical radius.
- A low point is located further south or close to the southern abutment, ensuring the deck is launched uphill.
- Minimise cut or fill in the vicinity of the bulk water main over John Gorton Drive alignment and Bindubi Street Extension stub.
- Maximise the vertical grade north of John Gorton Drive north of Bindubi Street Extension to 6% to minimise earthworks and impacts to adjacent developments. Note that in the Constraint Analysis Presentation in March 2014, Land Development Agency (LDA) and indicated 6% maximum vertical grade was discussed and accepted by Territory and Municipal Services (TaMS) in Molonglo and could be adopted on John Gorton Drive. This position was confirmed by Economic Development Directorate representatives.
- Utilise the existing Coppins Crossing Road levels as much as possible.

Option 7 shown below is the adopted ultimate horizontal alignment north of Bindubi Street Extension intersection resulting from the review of previous alignments, with consideration of the above parameters.

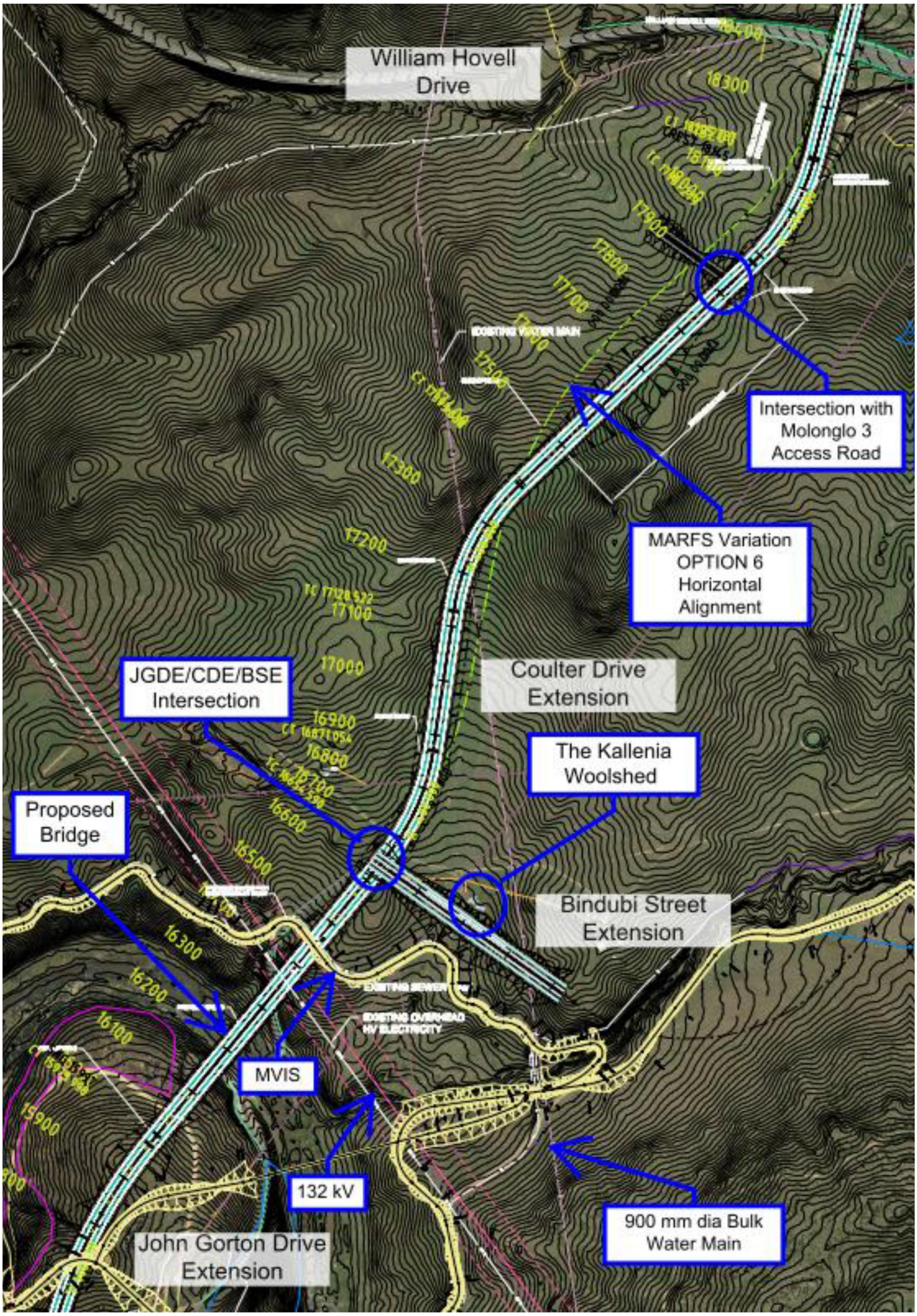


Figure 23 John Gorton Drive Ultimate Horizontal Alignment – Option 7

Two vertical alignment options, Options 13 and 14, were developed using the Option 7 horizontal alignment considering the use of an incrementally launched bridge and taking into account the constraints listed above

Option 13 is the adopted ultimate vertical alignment and is a refinement of Option 6 of MARFS Variation 6 incorporating the above factors and parameters as listed on the Figure below.

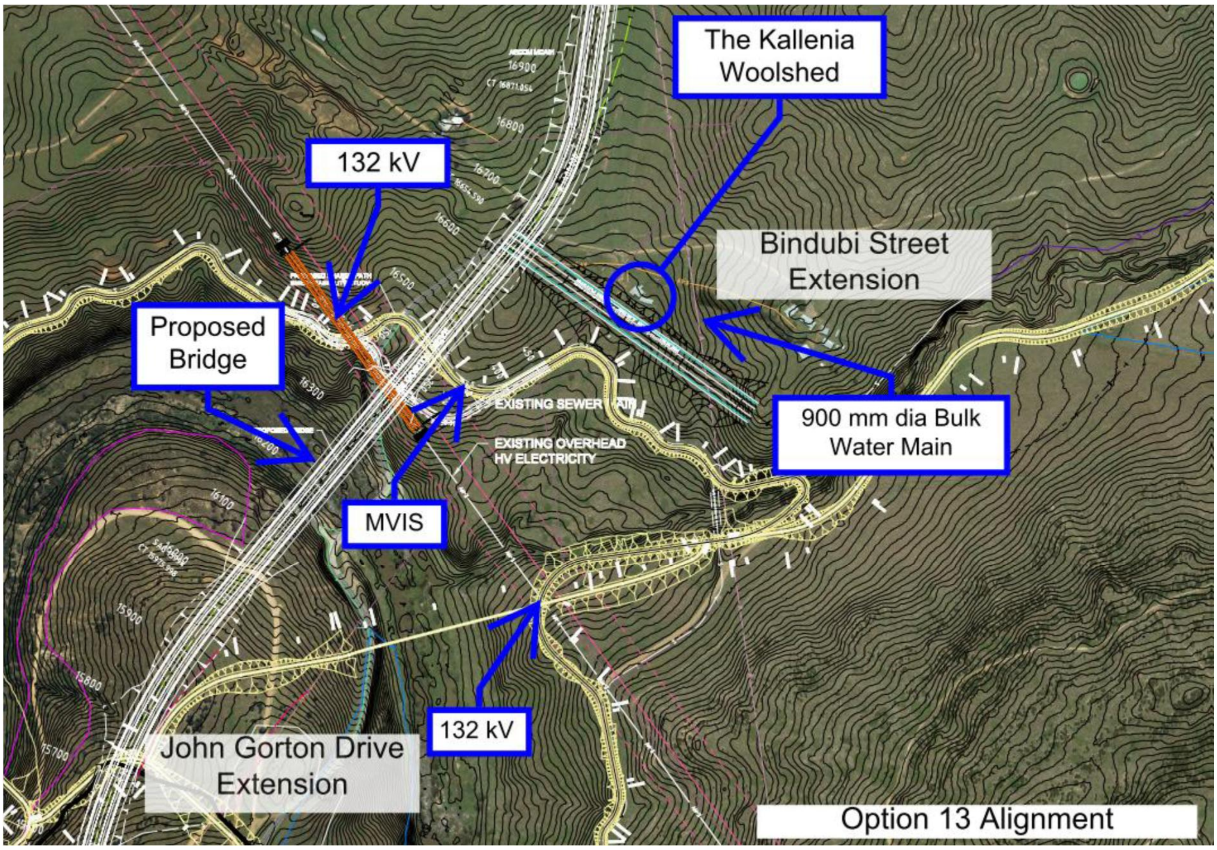


Figure 24 John Gorton Drive Ultimate Vertical Alignment Considerations

Vertical alignment Option 13 on John Gorton Drive is indicated to be the optimum option based on less excavation on the southern side of the bridge abutment. The advantages of less excavation are:

- reduces the volume of disposal of spoil material off site
- reduces impact of cut batter to the adjacent developments
- reduces the potential excavation into rock

The detailed review discussion and plans and profiles for Options 7 and 13 are included in the memo in Appendix D.

The vertical alignment Option 13 was further refined in July 2014 incorporating design levels of the Bulk Supply Water Main and the MVIS. The main amendments to the vertical alignment compared to the recommended in the memo were:

- Raising the design level on John Gorton Drive in the vicinity of the Bulk Supply Water Main crossing to provide approximately 1 m cover over the main.
- Reducing the length of vertical curve located in the vicinity of John Gorton Drive/Bindubi Street intersection

The adopted concept design showing ultimate horizontal and vertical alignments for John Gorton Drive, including at the intersection with William Hovell Drive and Coulter Drive, are shown in Figure 25, Figure 26 and Figure 27.

High level assessment of a split-level carriageway was undertaken in an attempt to minimise the cut volume and the cut batters at the interface with the future residential development. The preliminary findings of the assessment are as follows:

- The possible area to be explored would be limited to the section between Bindubi Street Extension intersection and the first access to Molonglo 3 Stage 1 development which is approximately 1.3 km.
- The longitudinal grade in this vicinity is at its maximum grade of 6%.
- The design levels and longitudinal grade at John Gorton Drive/Bindubi Street Extension intersection are set due to possible location of Intertown Public Transport (IPT) platform along John Gorton Drive.
- The length of vertical curve located in the vicinity of John Gorton Drive/Bindubi Street Extension intersection is at its minimum.
- The possible outcomes of a split-level in this vicinity are:
  - The possible future intersection layout located in this vicinity would be left-in/left-out arrangement.
  - The possible way to create a split-level carriageway would be to increase the longitudinal grade steeper than the maximum acceptable grade of 6%.
  - Longitudinal grade steeper than 6% may not be acceptable by TaMS. Thus, a split-carriageway is considered to be not viable.

Increasing the longitudinal grade between the bridge and John Gorton Drive/Bindubi Street Extension intersection could be viable in attempt to minimise the cut volume provided the future IPT platform is not located along John Gorton Drive. It is recommended for this option to be explored in the next stage of design once the IPT route and its possible platform locations have been developed further.

Figure 25 John Gorton Drive Ultimate Plan and Profile Southern Section

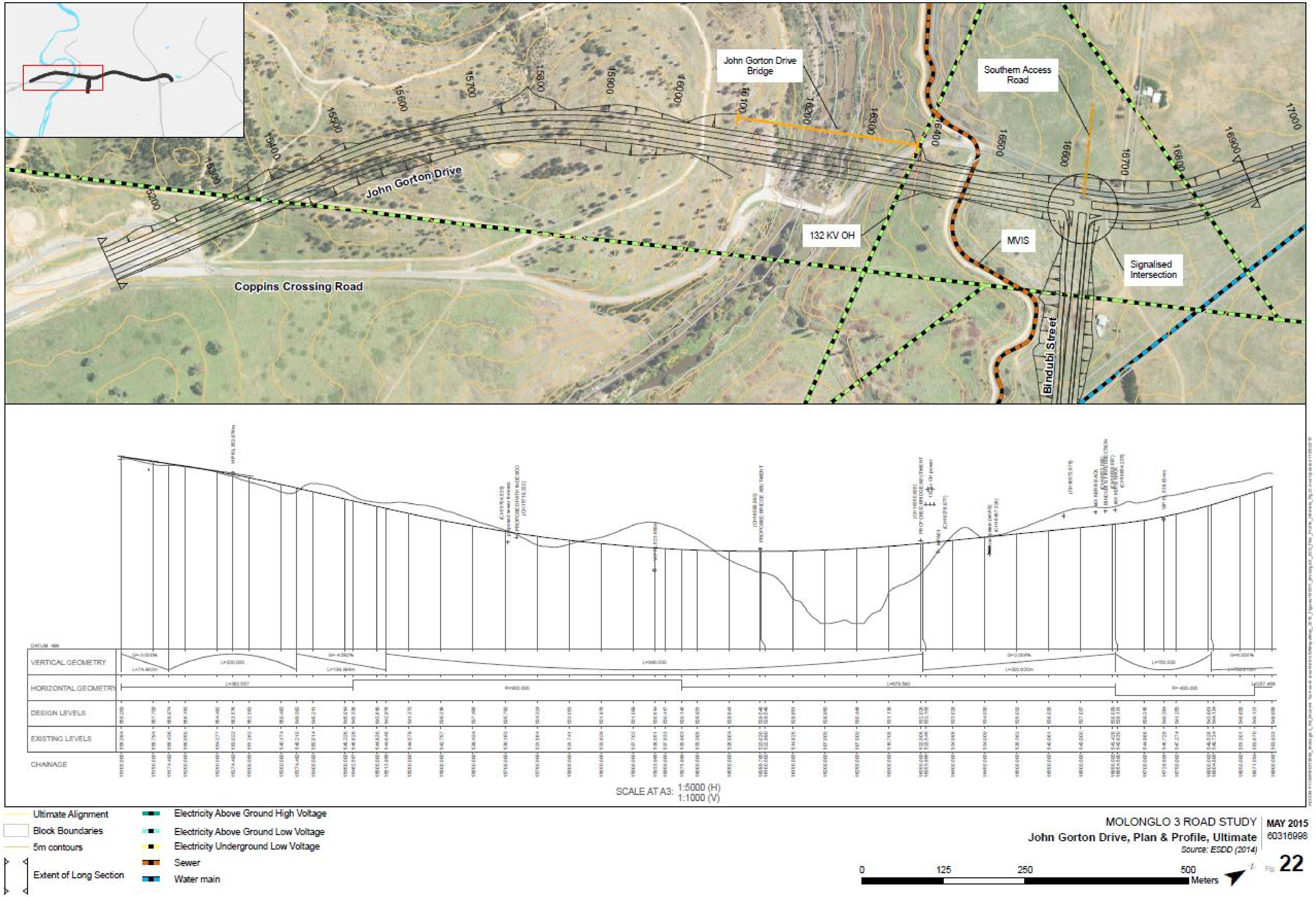


Figure 26 John Gorton Drive Ultimate Plan and Profile Mid Section

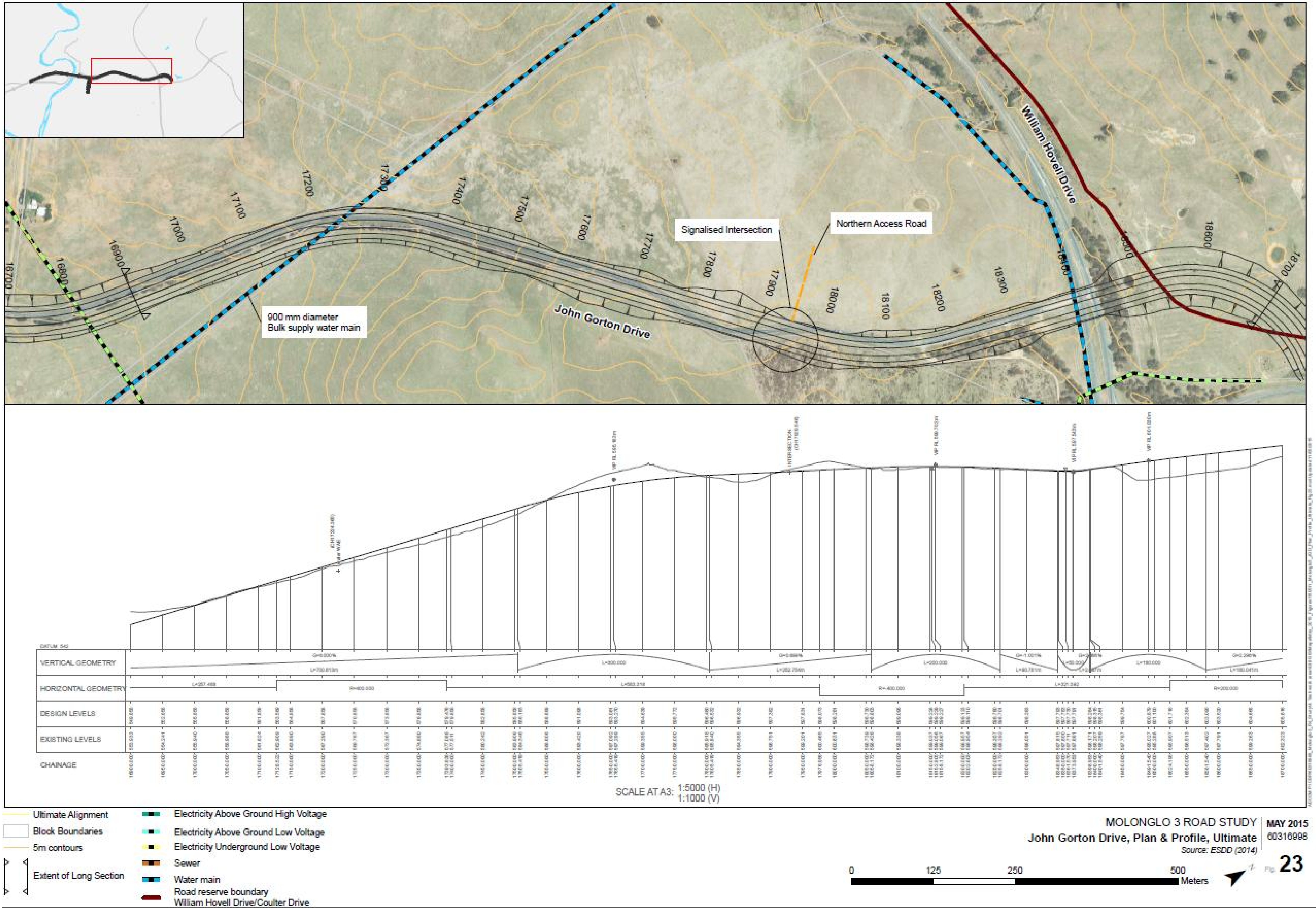
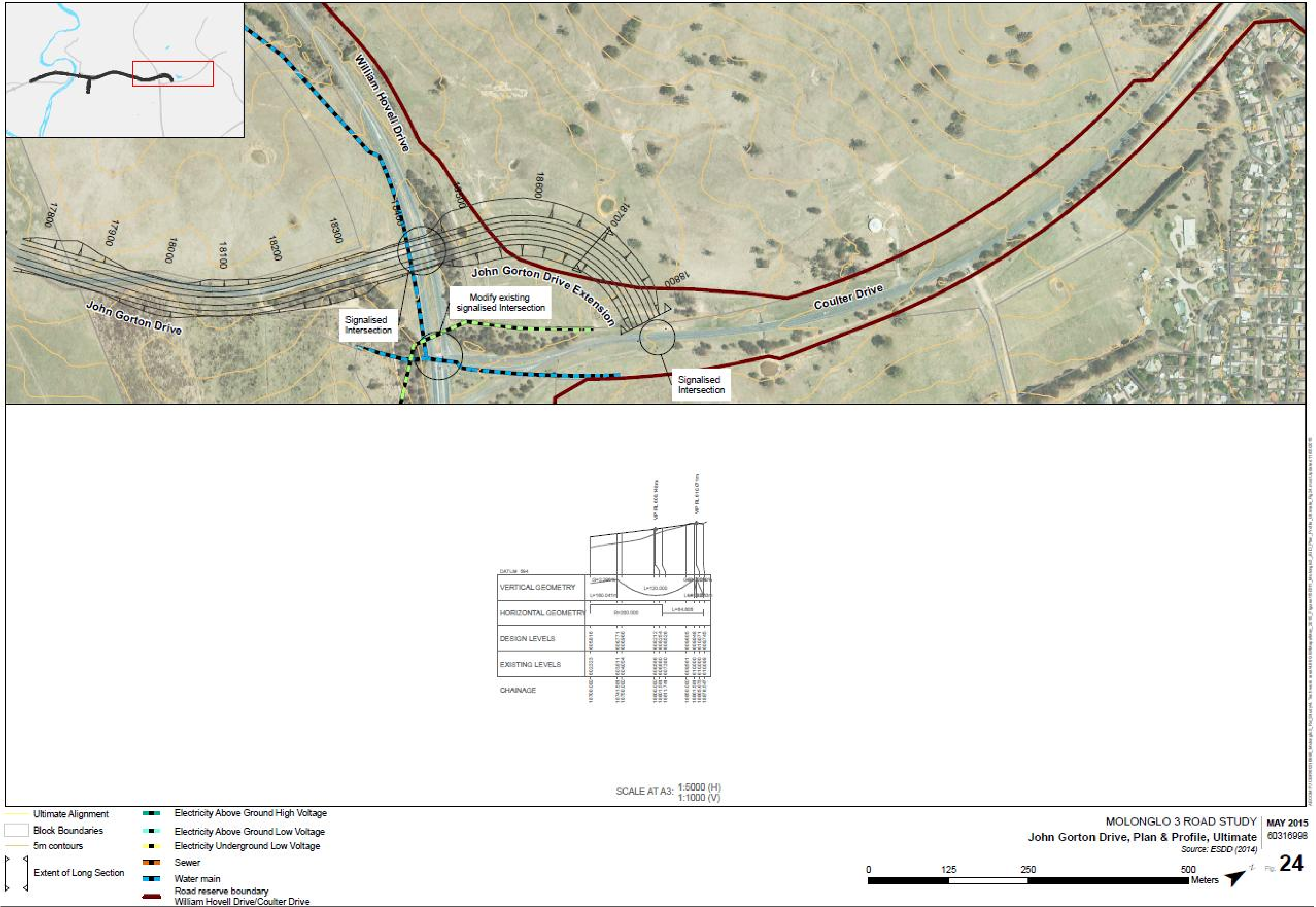


Figure 27 John Gorton Drive Ultimate Plan and Profile Northern Section



John Gorton Drive Stage 1 Alignment

As discussed in Section 5.1.1, the works required in the first stage of road network upgrades are:

- The section between the Northern Access Road and William Hovell Drive
- Coppins Crossing Road crossing over the Molonglo River (new Molonglo River Bridge)

In addition to the above identified upgrades, an assessment of the geometry of existing Coppins Crossing Road was also undertaken highlighting sections requiring upgrade to comply with the design guidelines.

The summary preliminary findings of assessment of the existing Coppins Crossing Road are as follows (Refer Figure 28 and Figure 29).

- The design speed for the section in the vicinity of John Gorton Drive/Bindubi Street Extension intersection is between 50 km/h to 70 km/h
- The design speed for the section in the vicinity of John Gorton Drive/Northern Access Road intersection is between 50 km/h to 70 km/h

Based on the above assessments, the following are proposed:

- Ultimate vertical and horizontal alignments from the southern end of John Gorton Drive at Ch 15,100 (matching with John Gorton Drive Stage 2A) to approximately Ch 17,150.
- Existing vertical and horizontal alignments from Ch 17,150 to Ch 17,500
- Ultimate vertical and horizontal alignments from Ch 17,500 to John Gorton Drive/William Hovell Drive intersection.

Bindubi Street Extension Alignment

The section of Bindubi Street Extension alignment included as part of this study was originally limited up to the crossing over the Bulk Supply Water Main.

Towards the end of the Study, CMTEDD requested an alignment review of Bindubi Street Extension to the future Molonglo 3 Group Centre location to assess the integration of the future road and the Group Centre location. The results are discussed in a separate memo included in Appendix F.

The horizontal alignment of the Bindubi Street Extension is to follow Option 6 of MARFS Variation 6 which considered the impacts to the Kallenia Woolshed, the MVIS and the Bulk Supply Water Main. This section of road is generally located on straight section.

The vertical alignment of the Bindubi Street Extension was a refinement of Option 6 of MARFS Variation 6 to include the following features (refer to Figure 30):

- Lower the alignment at John Gorton Drive intersection to provide the required vertical clearance to the 132 kV conductors on John Gorton Drive.
- Raise the alignment in the vicinity of the Bulk Supply Water Main to minimise cut over the main.

Figure 28 John Gorton Drive Stage 1 Vertical Alignment Southern

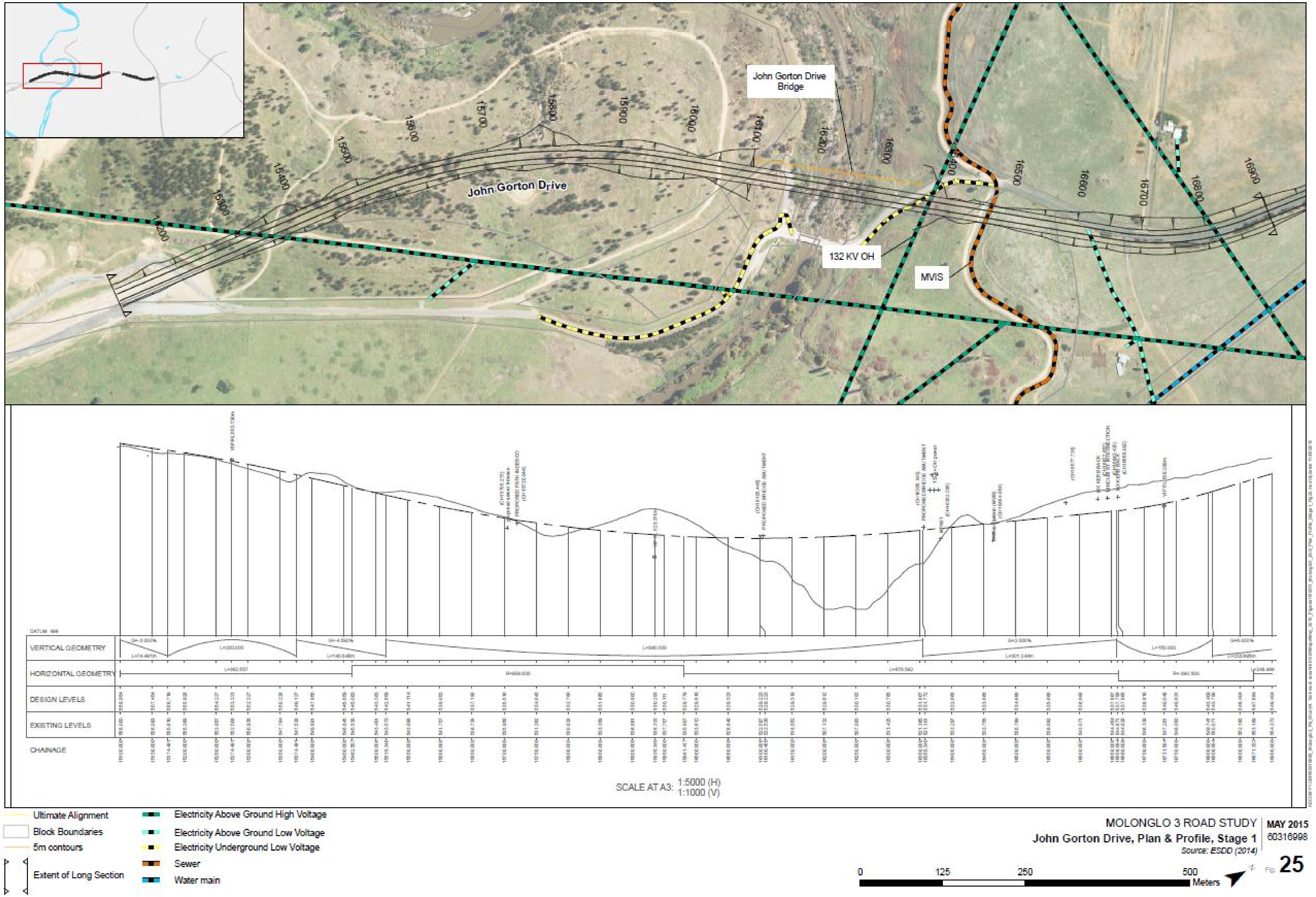


Figure 29 John Gorton Drive Stage 1 Vertical Alignment Northern

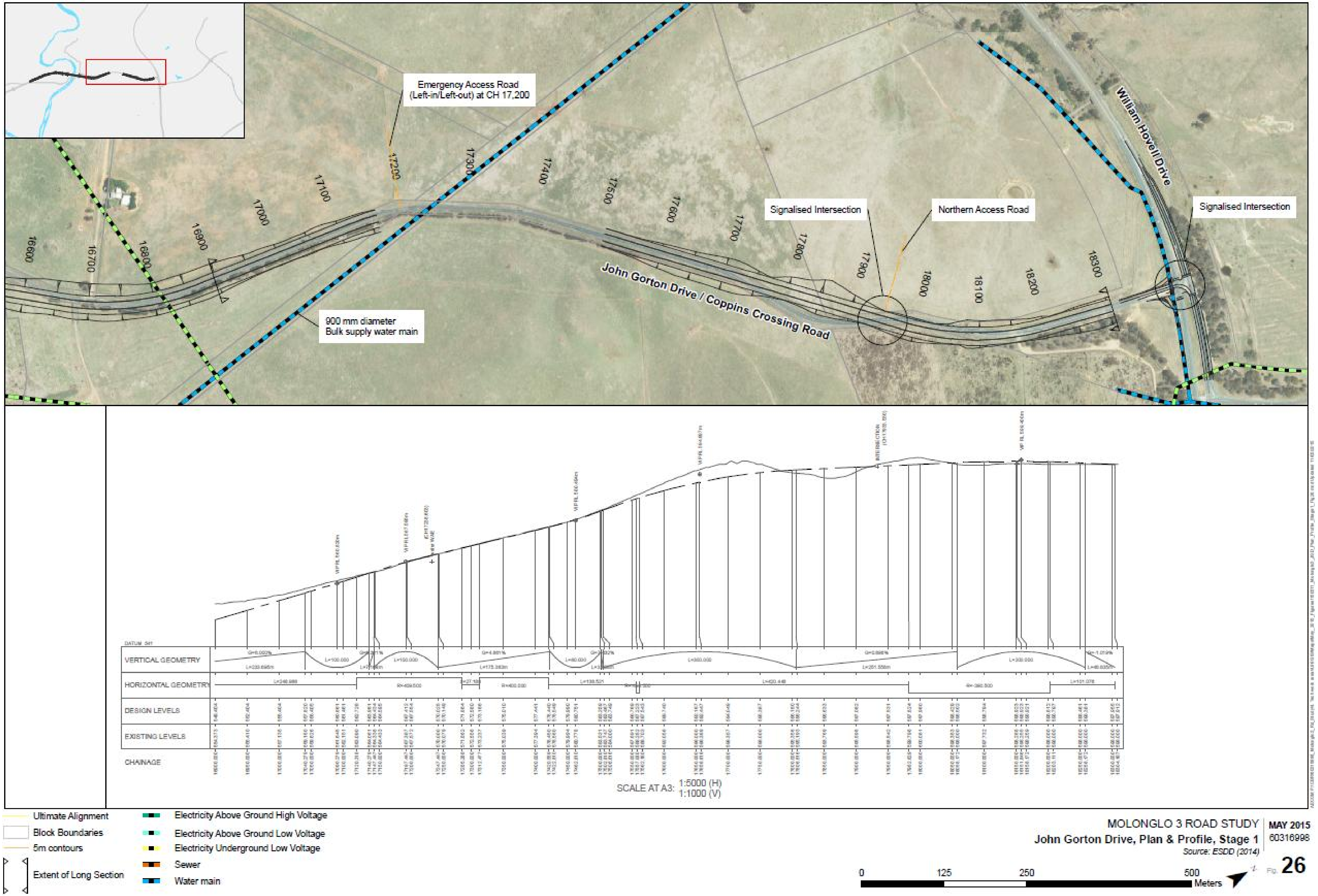
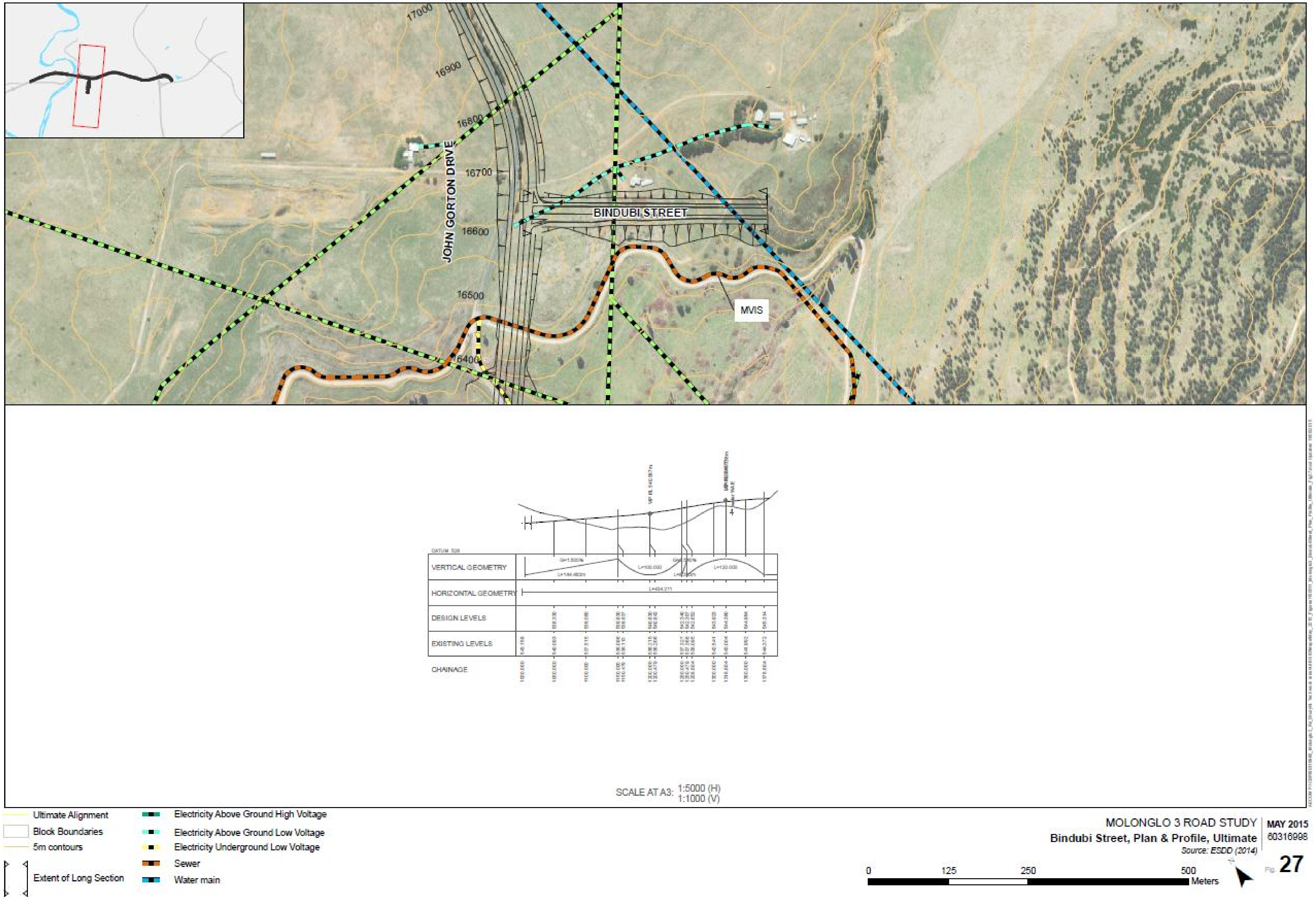


Figure 30 Bindubi Street Extension Ultimate Plan and Profile



7.3 Typical Sections

The typical cross sections adopted for John Gorton Drive and Bindubi Street Extension alignments are:

Road type	Lane widths per carriageway	Median (for IPT)	Verge	Total Road Corridor width	Batter Slopes
John Gorton Drive					
Single Carriageway (Stage 1) **(refer to Figure 31)**	2 x 3.5 m traffic lanes 1 x 3.5 m at intersections 2 x 2.0 m on-road cycle lane	-	8.0 m	27 m mid-block 30.5 m at intersections	4H:1V in fill 2H:1V in cut
Dual Carriageway **(refer to Figure 32)**	2 x 3.5 m traffic lanes 1 x 3.5 m at intersections 1 x 2.0 m on-road cycle lane	12.0 m mid-block 8.5 m at intersection	8.0 m	46 m	4H:1V in fill 2H:1V in cut
Bindubi Street					
Dual Carriageway **(refer to Figure 33)**	1 x 3.5 m traffic lanes 1 x 3.5 m at intersections 1 x 2.0 m on-road cycle lane	12.0 m mid-block 8.5 m at intersection	8.0 m	39 m	4H:1V in fill 3H:1V in fill adjacent to the MVIS 2H:1V in cut

A verge width of 8 m has been provided along John Gorton Drive and Bindubi Street Extension alignment mainly due to the following reasons:

- To comply with clear zone requirements in the area where the design speed of the alignment is 90 km/h;
- To provide allowance for utilities, footpath, trees and other road furniture in the areas where the design speed of the alignment is less than 90 km/h

The typical sections below illustrate the arrangement of carriageways, median and on road cycling for the future road within the road reserve and have provided a template for the modelling of the road alignment and investigation of the cut and fill batters. The Structure Planning was not at a stage to be able to coordinate the integration of the arterial road corridor and the future urban development.

Figure 31 John Gorton Drive Typical Section – Stage 1

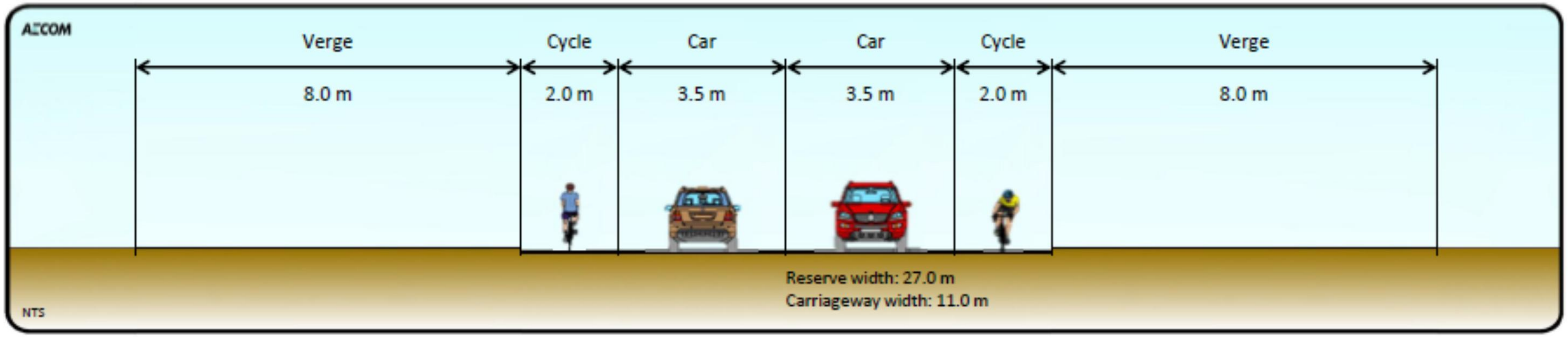


Figure 32 John Gorton Drive Typical Section – Dual Carriageway

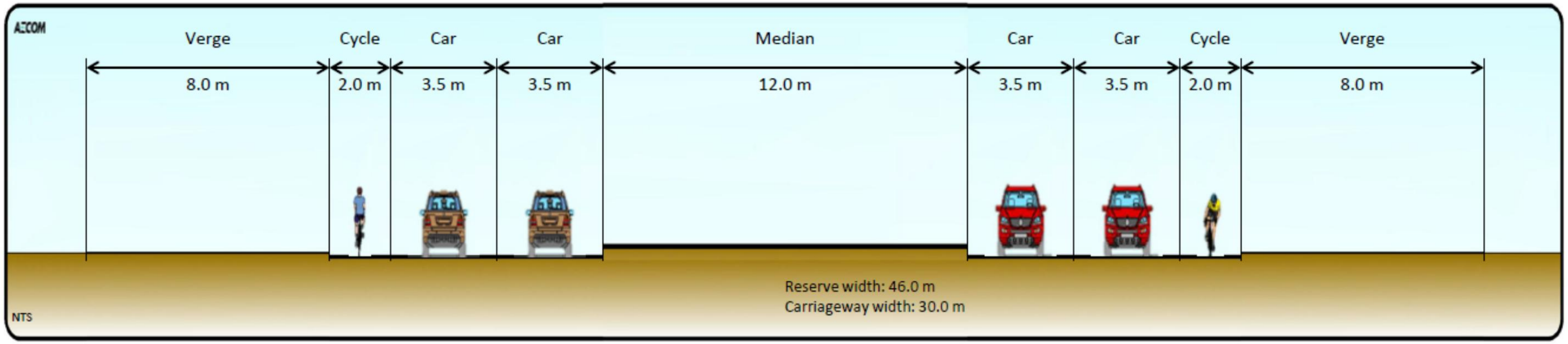
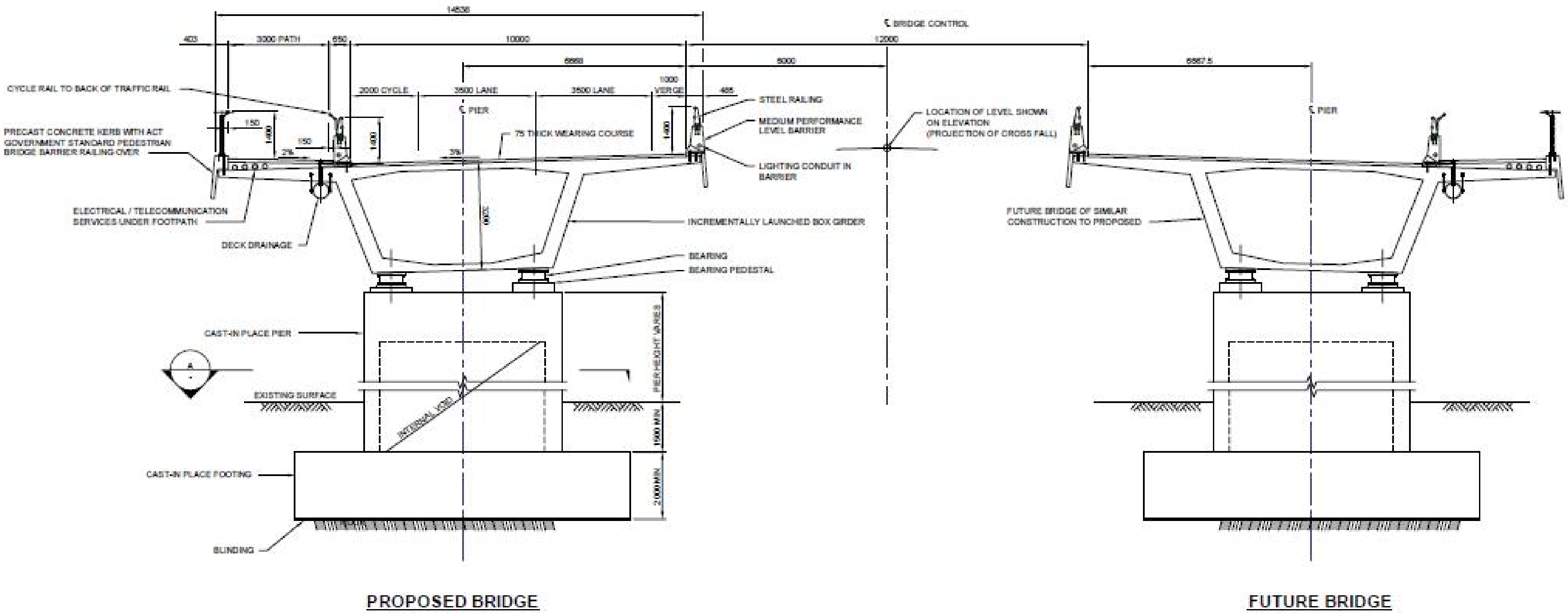


Figure 33 Bindubi Street Typical Section – Single Carriageway

Figure 34 Molonglo Bridge Cross Section



The integration of the arterial road corridor and the future residential and urban development was raised as an issue during the stakeholder consultation. Due to the topography there are some large cut and fill batters along the alignment. The verge width of 8m has been allowed for this study to provide a cross section template to model and assess the earthworks volumes and impacts of cut and fill batters.

The two cross sections below illustrate the extent of cut and fill batters on John Gorton Drive using the adopted vertical alignment. At chainage 17450 there is a fill batter 3m high and at chainage 17700 there is a cut batter 7m high. The adopted vertical alignment is significantly constrained by existing trunk infrastructure, bridge location and connection to William Hovell Drive, as well as the staging objectives and maximising the life of the existing Coppins Crossing Road.

A high level assessment of a possible split carriageway was assessed to reduce the impact of cut and fill batters on adjacent residential areas and reduce earthworks volumes. The only area where this could be achieved is between the bridge and John Gorton Drive/Bindubi Street Extension intersection provided the future IPT platform is not located along John Gorton Drive. Other sections of the alignment are constrained by maximum gradient requirements and proximity to intersections.

A larger verge width maybe required subject to trunk utility requirements and noise attenuation requirements with consideration of location of noise walls and integration of landscaping and any WSUD treatments required. The outcomes of this study and concept design for the future arterial road can be used in the design for the residential development to provide an integrated design outcome.

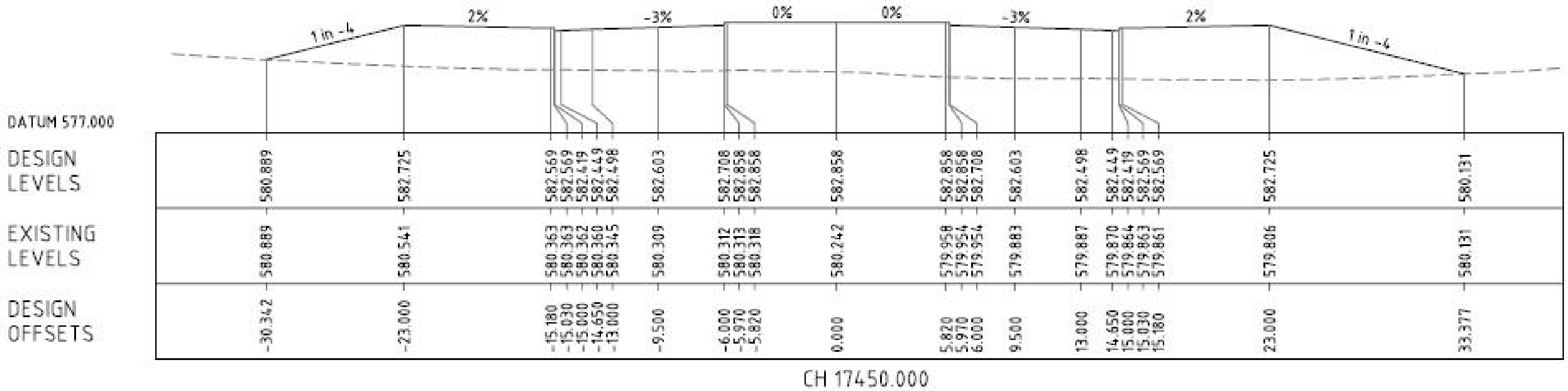


Figure 35 John Gorton Drive Cross Section in Fill

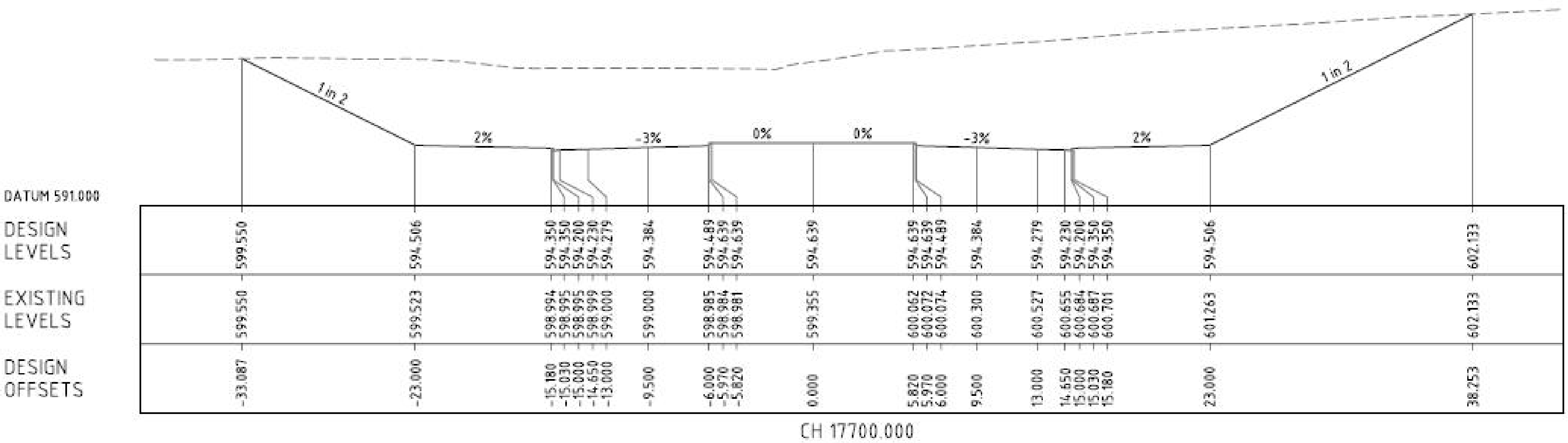


Figure 36 John Gorton Drive Cross Section in Cut

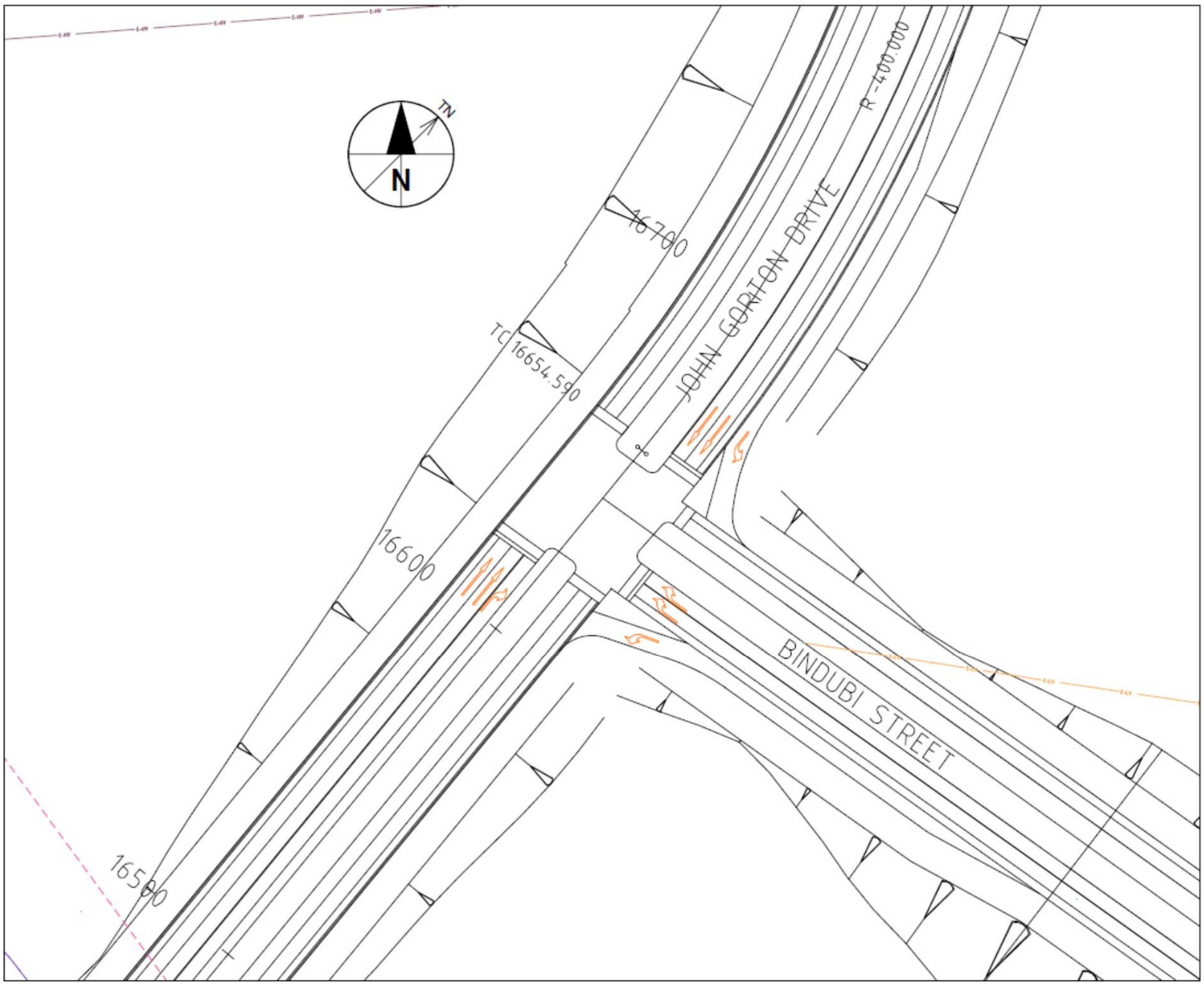
7.4 Intersections

7.4.1 John Gorton Drive/Bindubi Street Extension Intersection

A three way signalised intersection is proposed at John Gorton Drive/Bindubi Street Extension intersection (refer to Figure 37). As discussed and indicated in Section 5.1 the ultimate intersection will have the Southern Access Road as a fourth leg in the year 2031. This Feasibility Study has only looked at the concept design of the intersection with the Bindubi Street Extension.

The IPT route is expected to turn right from John Gorton Drive to Bindubi Street Extension at this intersection. The location of the station/platform on John Gorton Drive or Bindubi Street Extension is currently unknown and subject to future planning.

Figure 37 John Gorton Drive/Bindubi Street Intersection Layout



7.4.2 John Gorton Drive/William Hovell Drive Intersection

Stage 1 Works

As discussed in Section 3.1 and Section 5.1 this intersection was identified to require upgrading in Stage 1 works to address current safety concerns and to assist with M3 Stage 1 development.

The intersection improvement works at this intersection in Stage 1 works include: (refer Figure 38)

- Signalised Coppins Crossing Road/William Hovell Drive intersection.
- Additional through lane on William Hovell Drive Eastbound or approximately 200 m.
- Additional right turn lane on Coppins Crossing Road for approximately 150 m.
- Retain existing William Hovell Drive/Coulter Drive (CD) intersection arrangement

Ultimate Works

The recommended ultimate arrangement of John Gorton Drive/William Hovell Drive intersection is the Quadrant Option (refer to discussions in Section 5.1.2).

The Quadrant Option has considered the intersection improvement works proposed in Stage 1 works to minimise redundant works between the two stages of works.

The following assumptions have been adopted in the production of 2D intersection layout of the Quadrant Option (refer to Figure 39, Figure 40, and Figure 41):

- William Hovell Drive will be duplicated with typically 7.5 m wide median at mid-block.
- John Gorton Drive Extension will be duplicated with typically 12 m wide median at mid-block.
- Posted speed along John Gorton Drive Extension is 60 km/h due to the following:
    - To match with the location of the intersection proposed by Option 6 of MARFS Variation 6.
    - To minimise encroachment to north western block.
- Coulter Drive will be duplicated with typically 7.5 m wide median at mid-block.
- No right turn from Coulter Drive into William Hovell Drive at the existing William Hovell Drive/Coulter Drive intersection.
- No left turn from William Hovell Drive into Coulter Drive at the existing William Hovell Drive/Coulter Drive intersection.

Two options explored for the vertical alignment of John Gorton Drive Extension are shown in Figure 42:

- Option 1 - A climbing grade between William Hovell Drive and Coulter Drive intersections.
    - This is the preferred alignment as it provides line of sight for a posted speed higher than 60 km/h.
    - May be able to utilise the excess cut material from the woks south of the intersection.
- Option 2 - A crest which follows with a sag curve to minimise earthworks.
    - This alignment provides limited line of sight for a posted speed of 60 km/h
    - This alignment minimises the earthworks.

There will be additional area required to be withdrawn due to the Quadrant arrangement compared to the area that has been withdrawn previously (refer to Section 2.3.) The withdrawal of additional land is to be considered in the next stage of design.

Figure 38 Coppins Crossing Road/William Hovell Drive Intersection Layout – Stage 1

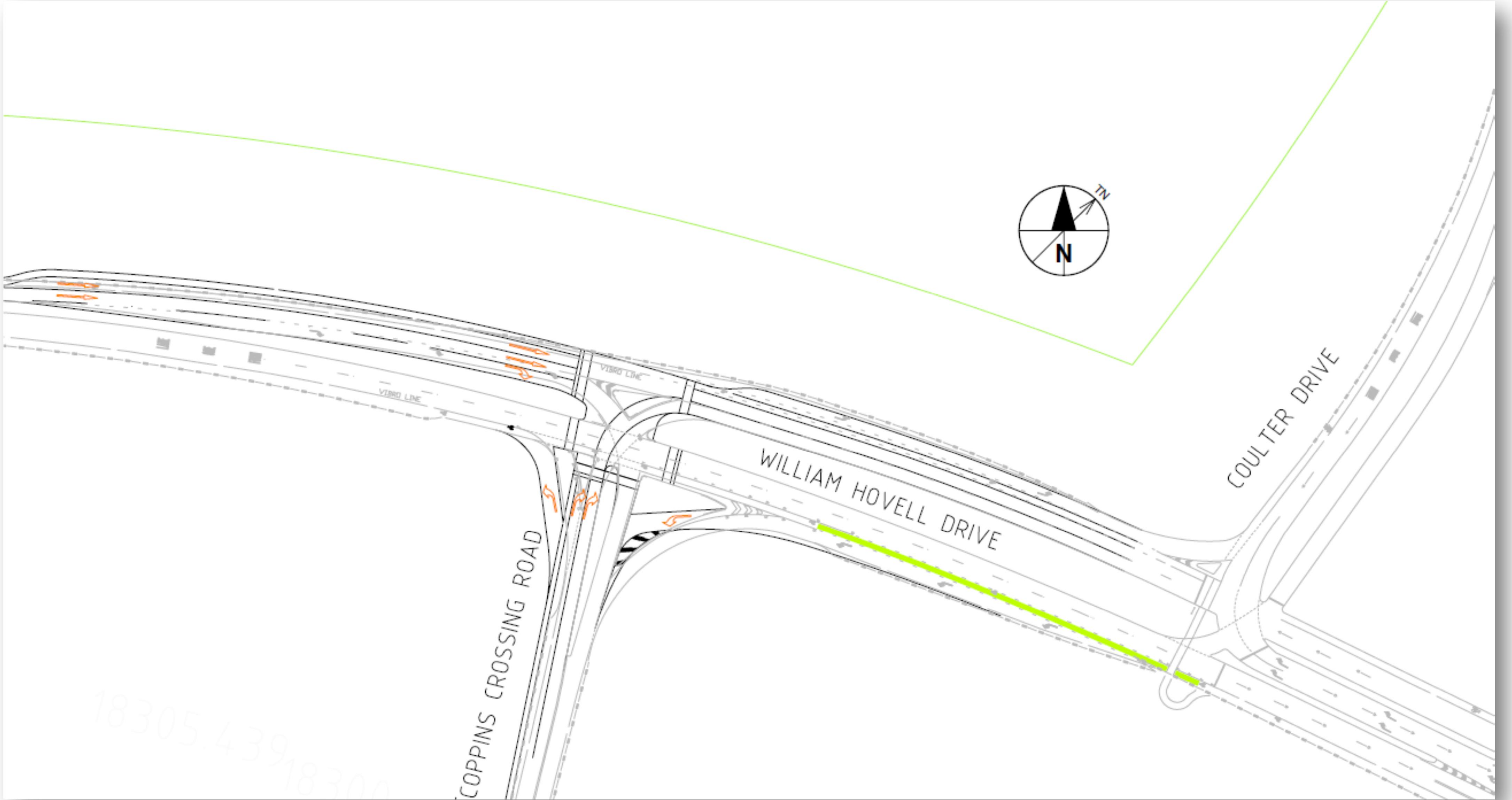


Figure 39 John Gorton Drive/William Hovell Drive Intersection Overall Layout – Ultimate

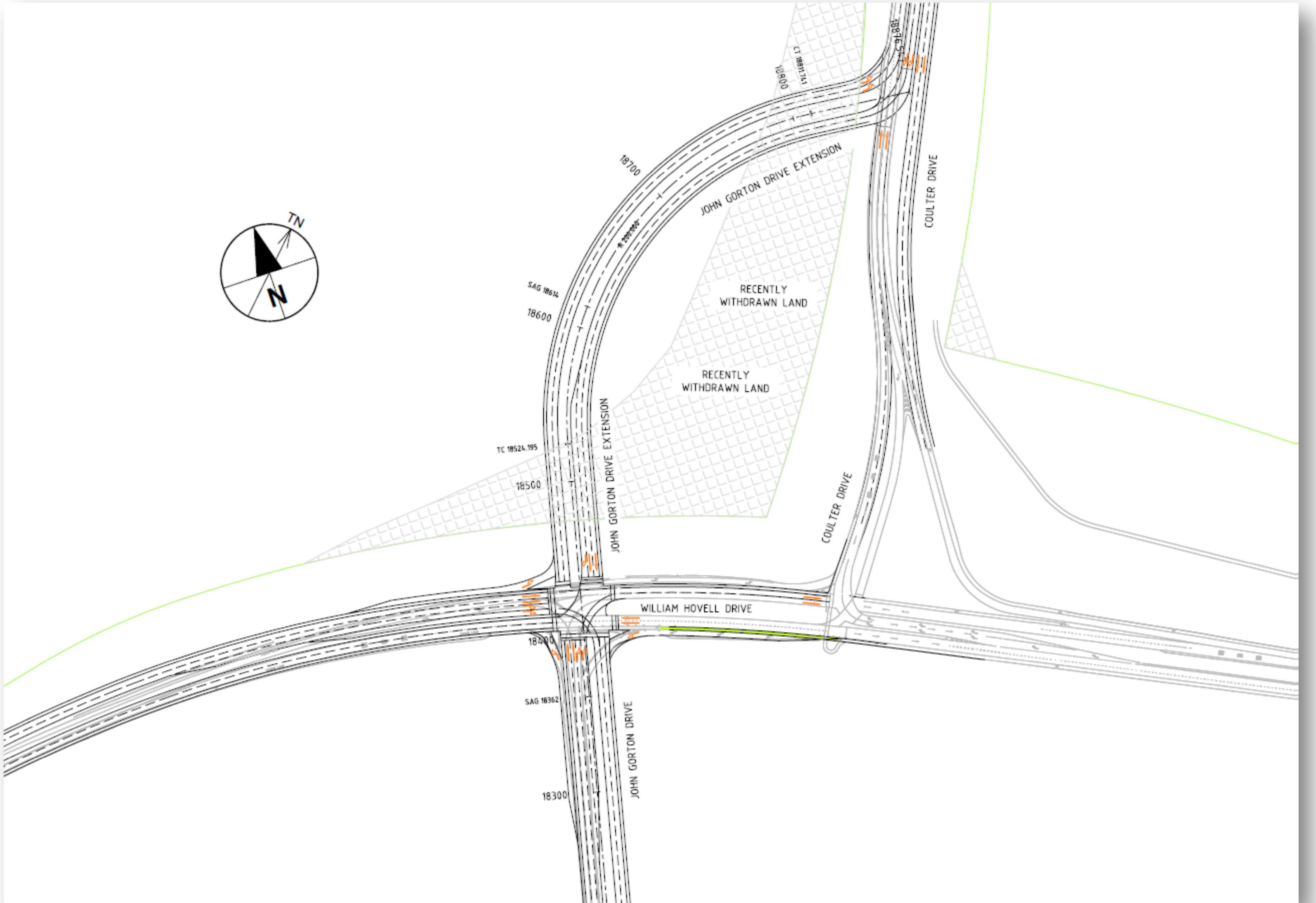


Figure 40 John Gorton Drive/William Hovell Drive/CD Intersection Layout– Ultimate

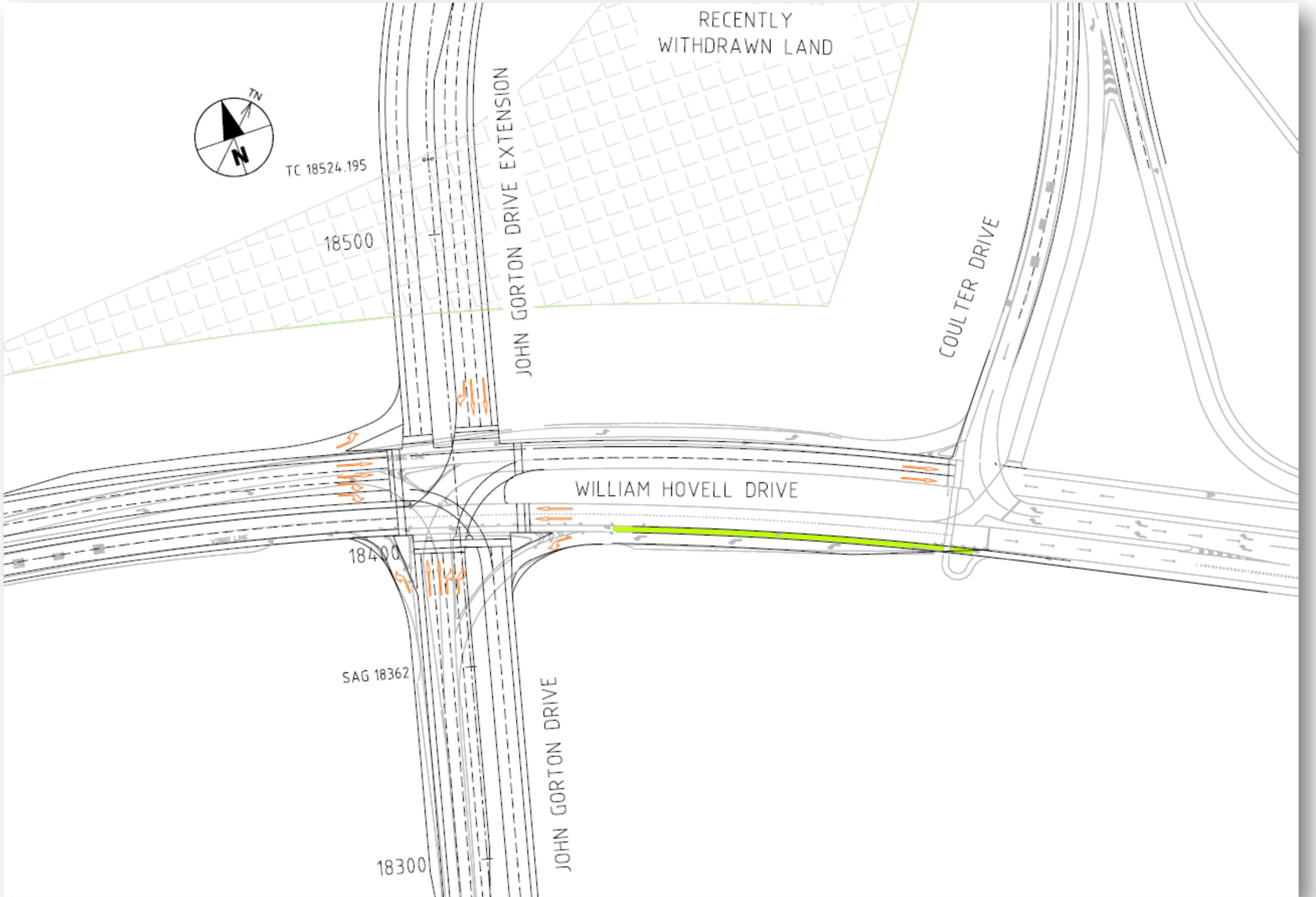


Figure 41 John Gorton Drive Extension/ CD Intersection Layout– Ultimate

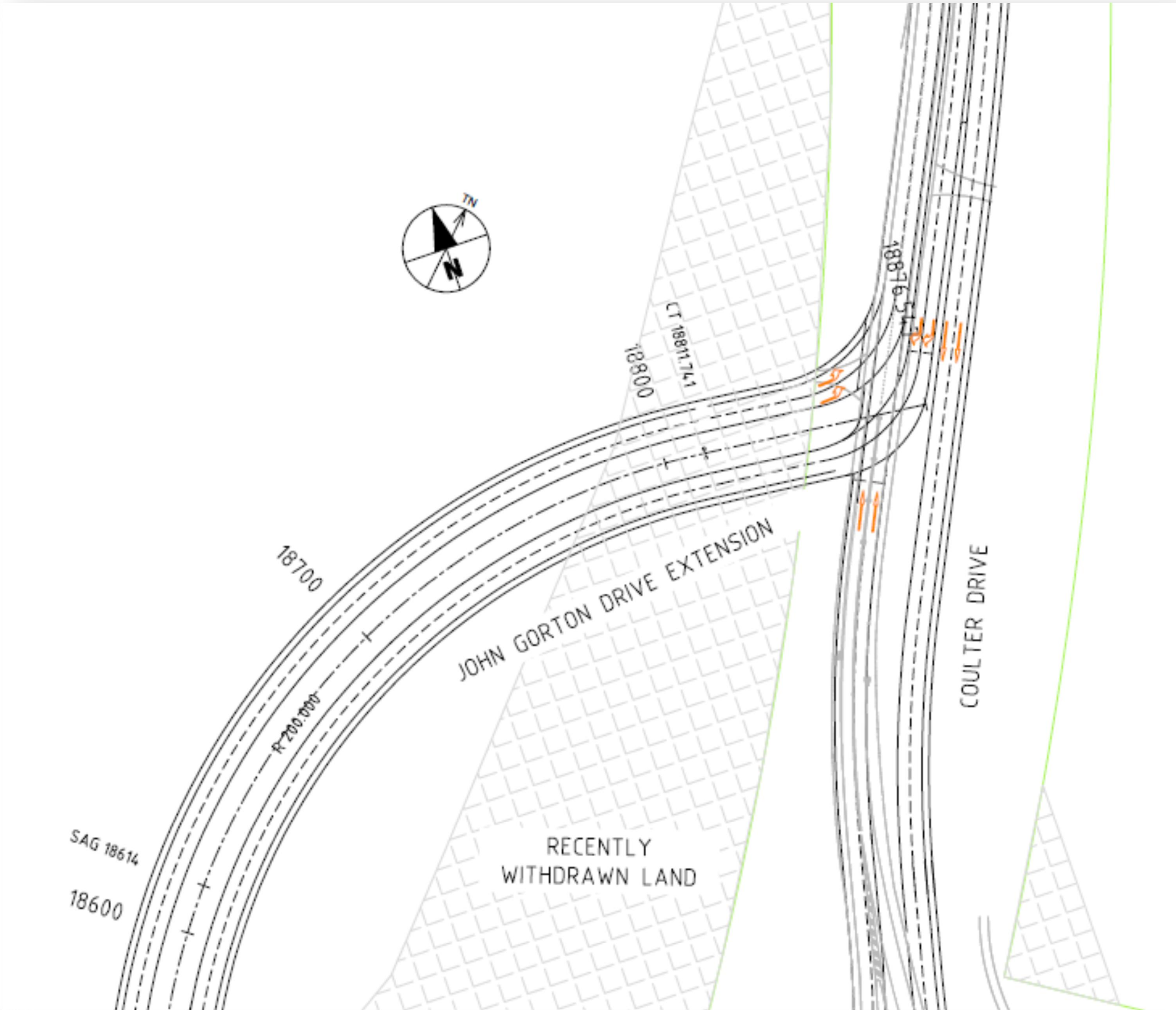
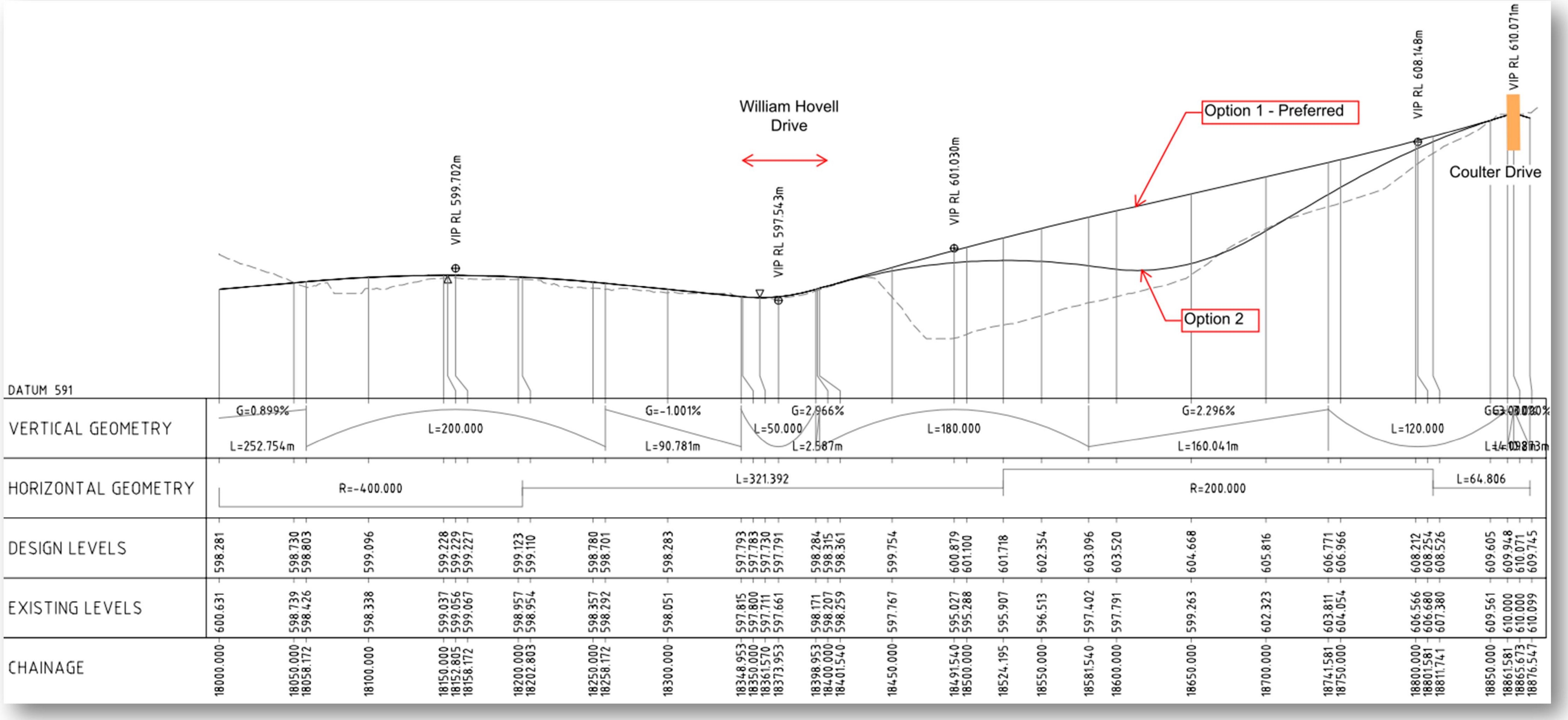


Figure 42 John Gorton Drive Extension Vertical Alignment Options



7.4.3 Access to M3 Development

There are three access roads proposed off John Gorton Drive to access M3 Stage 1 development west of John Gorton Drive. According to the Brief, the extent of assessments of these intersections is limited to identifying the most appropriate location for these intersections based on sight distance requirements.

Values used in determining the most appropriate location for the access road intersections into M3 Stage 1 are tabulated below.

Table 7-2 Sight Distance Requirements

Criterion	Value	Comments
Design Speed	Access Road = 70 km/h John Gorton Drive (north of Bindubi Street) = 90 km/h	
Approach Sight Distance (ASD)	92 m (with K = 38.9)	R_T = 2.0 s Design Speed = 70 km/h
Safe Intersection Sight Distance (SISD)	214 m (K = 49)	R_T = 2.0 s Design Speed = 90 km/h
Minimum Gap Sight Distance (MGSD)	125 m	Critical acceptance time (ta) = 5 seconds Design Speed = 90 km/h
Stopping Sight Distance (SSD)	139 m	R_T = 2.0 s Design Speed = 90 km/h

There are two access roads that have been identified in the structure plan to access M3 Stage 1 development. The first access road referred to as the Northern Access Road is located at Ch 17,935, approximately 500m south of William Hovell Drive. The construction of this access road has been identified to be included as part of first stage road network upgrade. The location of this access was identified in Option 6 of MARFS Variation 6 and has been assessed to meet the sight distance requirements outlined in Table 7-2.

The second access road referred to as the Southern Access Road is located at John Gorton Drive/Bindubi Street Extension intersection. This access has been identified to be included as part of medium and long term road network upgrade.

Due to the timing of the construction of the Southern Access Road, M3 Stage 1 development would only have one access (Northern Access Road) to the development. CMTEDD requested an assessment of the most appropriate location for a second access to M3 Stage 1 development prior to the construction of the Southern Access Road. This second access is intended to be temporary and function as an emergency access by left-in/left-out arrangement only. Based on the sight distance requirements outlined in Table 7-2, it is recommended for the emergency access to be located approximately at Ch 17,200.

7.5 Drainage/Flooding and Stormwater Management

7.5.1 Molonglo River

John Gorton Drive crosses the Molonglo River, south of John Gorton Drive/Bindubi Street intersection. At the bridge crossing over the Molonglo River, the following flood levels have been adopted based on Option 6 of MARFS Variation 6:

- 10 year flood level is RL509.82.
- 100 year flood level is RL513.33.
- Dam break flood level is RL522.05.

The level of the new bridge over the Molonglo River will be above the Dam Break Level.

7.5.2 Stormwater Management

John Gorton Drive and Bindubi Street are expected to increase the degree of imperviousness in the study area. This increase in impervious area will be marginal compared to the increase in impervious area of the adjoining urban development.

It is assumed that the impacts of adjoining development will have to be managed through appropriate drainage design, including:

- Peak stormwater flow attenuation; and
- Stormwater quality control (WSUD).

The requirements for the roads would be best managed by integrating with the equivalent requirements for the adjoining urban development area.

7.6 Street lighting

The lighting for the new section of John Gorton Drive continues the lighting style of the recently installed section near Wright.

For the preliminary design and calculation, Sylvania Roadsters were chosen to match with the existing John Gorton Drive Stage 2A road luminaires and for TaMS compliance. The Aeroscreen lens was incorporated for the environmental reason of reducing upward waste light which is a consideration within the Mount Stromlo vicinity. High pressure 250W sodium lamps were found to be the most energy efficient solution for a Category V lighting arrangement on 12m poles with 4.5m outreach.

The location of the poles is 1.7m behind the back of kerb as per TaMS requirements. This position is to match an arrangement of dual opposite at the time that a secondary carriageway is installed. The dual opposite arrangement allows for a reduced amount of road furniture.

The lighting design proposed is compliant with Category V3 of the Australian Standard 1158.1.1-2005. A footpath within the road reserve area would be compliant with a Category P4 of the Australian Standard 1158.3.1-2005.

8.0 Bridge over the Molonglo River

8.1 Options Development

The bridge over the Molonglo River forms a key part of the project. The bridge spans approximately 230 m across the Molonglo River, passing over Coppins Crossing Road and the Molonglo River at a maximum height of approximately 25m. Due to the scale of the structure a number of bridge options were considered feasible for the site. The following structural options were identified for consideration:

- **Option 1** – Incrementally Launched Box Girder Bridge (ILBG)
- **Option 2** – Continuous supertee bridge
- **Option 3** – Simply supported supertee bridge

Whilst the method of construction for Option 1 is pre-defined, Options 2 and 3 required consideration of two construction methodologies. The two methodologies differ in the manner in which the precast girders are placed, either by:

- Launching truss construction
- Crane erection construction

Descriptions of the options considered are provided in sections 8.1.2 to 8.1.4 below. Sketches of the proposed options are included in Appendix J.

The above options were qualitatively compared under a number of criteria, including whole of life costs, constructability, program, safety, logistics, aesthetics, environment, existing road user amenity and provision for future light rail. An assessment of opinion of probable costs was also undertaken to aid option comparison. A summary of these considerations is provided in section 8.1.6.

8.1.1 Carriageway Construction Staging

The final road alignment for this project calls for a four lane dual carriageway road with shared paths and provision for future light rail in the median. In addition, traffic forecasts are such that it is expected that a single carriageway (future northbound carriageway) will be built first, with the second (future southbound carriageway) to be built at a later date. Currently the estimated dates that the first and second carriageways will be required are 2021 and 2028 respectively.

As such, the most appropriate bridge solution is two independent structures. This allows for independent construction of the carriageways, as well as providing unobstructed space between the carriageways for future light rail options. In addition, if requirements were to change by the time the second carriageway is required, individual structures allow the second structure to be modified to meet the needs at the time.

There are options to build portions of the second carriageway, such as pier foundations, at the same time as the first. This will reduce the options available to the second carriageway, but may reduce overall construction costs and impacts on future urban development depending on the expected duration between builds. One of the constraints for the bridge construction is that Coppins Crossing Road remain open to traffic during construction of the first carriageway.

Based on the above considerations, the designs have been developed for the ultimate two carriageway arrangement. However, the opinion of probable costs has only included the construction of a single structure in each stage.

The northern abutment and pier have been located with regard to the existing Coppins Crossing Road to best facilitate construction whist minimising effects on traffic. It is noted that this has been undertaken within the confines of the level of design completed at feasibility stage and the reliance on aerial imagery to discern the location of the road. The proposed abutment is to be of Reinforced Soil Wall construction with minimal excavation expected as the load carrying components of the bridge abutment headstock is to be supported on bored piles. It is expected that at the pinch point adjacent to Coppins Crossing Road that only a minimal area in front of the wall can achieved for the construction for the reinforced soil wall.

Positioning the abutment corner close to Coppins Crossing Road maximises the offset to Pier 4 construction, which will require additional area to facilitate and stabilise the pad footing excavation. It is intended that this layout will allow construction to be undertaken with minimal construction impact and no permanent effect to existing alignment. It is expected a construction zone speed limit will be in place during the construction period due to proximity of the construction activities adjacent to Coppins Crossing Road. Part or full road closures will be required to facilitate particular construction operations (such as lifting in supertee girders), however these would be programed to avoid peak periods. The design and location of these elements, staging of construction and impact on Coppins Crossing Road are expected to be refined during the concept and detailed design phases.

8.1.2 Incrementally Launched Box Girder

The Incrementally Launched Box Girder (ILBG) bridge is 225m long overall, consisting of three 50m long main spans and two 37.5 m long backspans. This length and span arrangement was chosen to best suit the Incremental Lunch Method (ILM) construction process and will result in less piers impacting the river corridor. The cross section is a continuous post tensioned 3.2 m deep single cell reinforced concrete box girder. Including cantilevers, the section is approximately 14.5 m wide, carrying two traffic lanes, a shared path, on-road cycling and shoulders. The box girder with wide cantilevers is an efficient structural shape and provides advantageous shadow lines which reduce the apparent depth of the structure. The bridge is launched across, and will ultimately rest on, pot bearings.

The abutments of the bridge will be cast in-situ reinforced concrete headstock beams supported on short bored concrete piles. The abutment will be higher than the surrounding natural surface and will be at the top of a reinforced soil wall. This will reduce the volume of material needed to form the abutment earthworks.

The piers are rectangular hollow reinforced concrete, 5.9 m x 3.0 m in cross section. The width of the pier will match the width of the bottom flange of the box girder, avoiding the need for a pier headstock. This will aid in the aesthetic appearance of the bridge. The depth of the pier is greater than other options, as it must be built to withstand the forces generated by the superstructure launching process. It is proposed that the pier columns will be constructed using jump form methodology. Due to the shallow depth to rock on the site, the pier foundations are proposed to be spread footings. This will disturb more land than a piled foundation but will likely result in a lower construction cost, reduced complexity and lower risk.

The superstructure is constructed using the Incremental Launch construction method. This involves the creation of a temporary casting bed behind the southern abutment. The box girder is constructed at the casting bed in 25 m long segments, connecting to the segments already cast. The superstructure segments are then launched uphill from the southern abutment, over the piers, without the need for temporary supports. The bridge is launched with the precast parapets, steel railings and screens already installed on the segments, with the exception of the first two leading span segments. This reduces the required work at heights and reduces construction time. A temporary steel launching nose must be constructed and fitted to the leading superstructure segment to facilitate this type of construction.

8.1.3 Continuous Supertee Bridge

The Continuous Supertee Bridge is 230 m long overall, consisting of four 41 m long main spans and two 33 m long backspans. This length and span arrangement was chosen to best suit the continuous nature of the superstructure and results in longer spans through the middle of the river corridor. The cross section is comprised of seven 1800 mm deep precast concrete supertee girders with an in-situ concrete deck, giving an overall structural depth of 2 m. The deck is approximately 14.5 m wide, carrying two traffic lanes, a shared path, on-road cycling and shoulders. The supertee girders are of industry standard form and are precast in specialty fabrication yards.

This bridge option uses a continuous superstructure to achieve longer main spans. In order to achieve this, the precast girders must be erected onto temporary supports at the top of the pier. A full depth in-situ diaphragm is then cast to provide continuity between the girders. Once complete, the bridge is lowered onto pot bearings under the continuity diaphragm and the temporary supports are removed. Following this, typical supertee bridge construction continues, with the casting of the in-situ concrete deck, placement of parapets and installation of deck furniture.

The abutments of the bridge will be cast in-situ reinforced concrete headstock beams supported on short bored concrete piles. The abutment will be higher than the surrounding natural surface and will be at the top of a reinforced soil wall. This wall will be slightly shorter than the ILM option as the longer overall length allows the abutment to be placed further up the valley slope. This will further reduce the volume of material needed to form the abutment earthworks.

The piers are rectangular solid reinforced concrete, 8.5 m x 1.5 m in cross section. The width of the pier is the greatest of all bridge options, in order to support the bridge bearings and negate the need for a pier headstock. It is proposed that the pier column will be constructed using jump form methodology. Once the piers are complete temporary falsework will need to be affixed to facilitate temporary support of the girders, before the continuity diaphragm is poured. This will increase the complexity of construction and the extent of works required at height. Due to the shallow depth to rock on the site, the pier foundations are proposed to be spread footings. This will disturb more land than a piled foundation but will result in lower construction cost, risk and complexity.

The precast superstructure girders can be placed using one of two methodologies, the first of which is the use of a launching truss. This methodology uses a custom launching gantry extended over the span under construction. Girders are brought out along the bridge to the launching truss. Here they are connected and then slid out over the span and lowered into position. This methodology negates the need for large disturbance of the valley floor for crane pads, but does increase the number of operations undertaken at height.

In order to move the launching truss into the necessary position, the in-situ concrete deck of the proceeding span must first be completed. This stringently dictates the construction program, reducing flexibility and extending program duration. Whilst the use of launching truss methodology exists in the industry, the launching of girders to form a continuous structure is rarely undertaken and will limit the number of capable contractors with recent experience.

The second erection option is the more traditional crane erection method. As per standard construction techniques this method involves the creation of a crane hardstand below each span. Girders are transported to below the span by truck and lifted into place using a crane. The access to the river corridor and considerable height of the lift are likely to complicate this operation and increase construction costs. In addition, the construction of hardstands and access roads for oversized loads will significantly increase the area of disturbance in the river corridor.

As this method does not rely on the proceeding span, flexibility of the construction program is achieved in the order of erection. Additionally, the construction program is reduced as erection of subsequent spans can continue concurrently with in-situ deck pours.

8.1.4 Simply Supported Supertee Bridge

The Simply Supported Supertee bridge is 230 m long overall, consisting of six 38.3 m long spans. This length and span arrangement was chosen to best suit the nature of the superstructure. The cross section is comprised of seven 1800 mm deep precast concrete supertee girders with an in-situ concrete deck, giving an overall structural depth of 2m. The deck is approximately 14.5 m wide, carrying two traffic lanes, a shared path, on-road cycling and shoulders. The supertee girders are of industry standard form and are precast in specialty fabrication yards.

Each supertee girder is independently supported by an elastomeric bearing at each end. Unlike the continuous bridge, the girders remain independent and continuity of the bridge is achieved through the deck only. Once the girders are in place, construction is by industry standard methods, with the casting of a half-height diaphragm between the girders, casting of the in-situ concrete deck, placement of parapets and installation of deck furniture.

The abutments of the bridge will be cast in-situ reinforced concrete headstock beams supported on short bored concrete piles. The abutment will be higher than the surrounding natural surface and will be at the top of a reinforced soil wall. This wall will be slightly shorter than the ILM option as the longer overall length allows the abutment to be placed further up the valley slope. This will further reduce the volume of material needed to form the abutment earthworks.

The piers are rectangular solid reinforced concrete, 7 m x 1.5 m in cross section. The pier is the smallest overall cross section of the options considered. However, a cast in-situ reinforced concrete headstock is required to support the individual supertees. It is proposed that the pier column will be constructed using jump form methodology. The headstock is expected to be cast using traditional formwork methods, supported off falsework fixed to the top of the pier column. This will increase the extent of works required at height. Due to the shallow depth to rock on the site the pier foundations are proposed to be spread footings. This will disturb more land than a piled foundation but will likely result in a lower construction cost, risk and complexity.

As with the continuous supertee option, the precast superstructure girders can be placed using one of two methodologies, the first of which is the use of a launching truss. This methodology uses a custom launching gantry extended over the span under construction. Girders are brought out along the bridge to the launching truss. Here they are connected and then slid out over the span and lowered into position. This methodology negates the need for large disturbance of the river corridor for crane pads but does increase the number of operations undertaken at height.

In order to move the launching truss into the necessary position, the in-situ concrete deck of the proceeding span must first be completed. This stringently dictates the construction program, reducing flexibility and extending program duration. Whilst the use of launching truss methodology exists in the industry, the launching of simply supported girders is not common and will limit the number of capable contractors.

The second erection option is the more traditional crane erection method. As per standard construction techniques this method involves the creation of a crane hardstand below each span. Girders are transported to below the span by truck and lifted into place using a crane. The access to the river corridor and considerable height of the lift are likely to complicate this operation and increase construction costs. In addition, the construction of hardstands and access roads for oversized loads will significantly increase the area of disturbance in the river corridor.

As this method does not rely on the proceeding span flexibility of the construction program is achieved in the order of erection. Additionally the construction program is reduced as erection of subsequent spans can continue concurrently with in-situ deck pours.

8.1.5 Bridge Delivery options

There are two main delivery models for the bridge design and construction[5]:

- Design, Document and then Construct
- Design and Construct

Design, Document and then Construct Delivery Model

The “Design and then Construct Delivery Model” is often referred to as Traditional Contracts and is the most common delivery model used by the ACT Government for infrastructure construction projects.

In a Design and then Construct Delivery Model, the design is completed and fully documented by a consultant on behalf of the Principal. The contractor is engaged to undertake the construction phase of a project. The method of payment is usually schedule of rates but lump sum can also be used.

The Principal (ACT Government) will have a prepared design brief, a detailed design and the tender documentation. Contractors are invited to submit competitive tenders for the work. The contractor, once selected, assumes no risk for design or deficiencies in the design documentation.

One of the attractions of a Design and then Construct Delivery Model is that there is generally low risk as the contractor bears the construction risks, however the documentation and design risk remains with the Principal.

The disadvantage of the delivery model is that there is limited opportunity for the contractor to provide the Principal with the benefit of previous construction experience to provide innovation with regard to constructability.

[5] Transport Infrastructure Project Delivery System, State of Queensland (Department of Transport and Main Roads) February 2014

Design and Construct Delivery Model

Under a Design and Construct Delivery Model, the Principal enters into a contract with a single entity that is responsible for both design and construction of the project. This is usually a contractor who then engages the designer through external consultants.

In a Design and Construct Delivery model both the design and the construction risk are shifted to the Contractor.

The advantages of the Design and Construct delivery model are:

- Increased opportunity for innovation by tenderers preparing a design solution that provides the most efficient method of construction in respect of both time and cost
- Early contractor involvement provides the Principal with constructability experience that can provide time and cost savings in the overall delivery
- Reduced risk of variations by having the Contractor prepare and take responsibility for its own quantities, rates and lump sums;
- Reduced risk of claims and disputes by having a single entity responsible for both design and construction

The disadvantages of the Design and Construct delivery model are:

- The specifications in the design brief and performance outcomes must be clearly documented to avoid dispute regarding the achievement of the outcomes
- The role of the Principal in monitoring the design and quality of the work must not be done in way that shifts the design risk back to the Principal
- Due to the high cost to industry in preparing tenders for Design and Construct, there is an expectation the tenderers are paid to submit Design and Construct tenders
- The comparative assessment of tender proposals can be difficult given that tender proposals may differ significantly

8.1.6 Criteria Comparison

Each of the options has been considered against a number of criteria. A summary of these considerations is below.

BRIDGE OPTIONS	INCREMENTALLY LAUNCHED BOX GIRDER	CONTINUOUS SUPERTEE		SIMPLY SUPPORTED SUPERTEE	
		Launching Truss	Crane Erection	Launching Truss	Crane Erection
STRUCTURE DETAILS					
Layout	225m overall. 5 spans (37.5m, 3x50m, 37.5m)	230m overall. 6 Spans (33m, 4x41m, 33m)		230m overall. 6 Spans (6 x 38.3m)	
Structural Depth	3.2m	2m (made up 1.8m supertee girder plus 0.2m thick insitu deck)		2m (made up 1.8m supertee girder plus 0.2m thick insitu deck)	
Probable Costs[6]	$33.5 million	$29 million		$31 million	
CONSTRUCTION CONSIDERATIONS					
Temporary Works	Casting bed required at southern abutment (within road corridor footprint) for construction and launching of the box segments. Temporary steel launching nose required for launching.	Custom self launching girder erection gantry required. Falsework attached to the top of the piers required to temporarily support the girders until the continuity diaphragm is completed.	Construction of crane pads in valley floor for girder erection. Falsework attached to the top of the piers required to temporarily support the girders until the continuity diaphragm is completed.	Custom self launching girder erection gantry required. Falsework to facilitate pier headstock construction. Pier headstock to be sized to support launching gantry legs.	Construction of crane pads in valley floor for girder erection. Falsework to facilitate pier headstock construction.

[6] Refer to Section 11.1.1 for discussions and assumptions of the Opinion of Probable of Costs

BRIDGE OPTIONS	INCREMENTALLY LAUNCHED BOX GIRDER	CONTINUOUS SUPERTEE		SIMPLY SUPPORTED SUPERTEE	
		Launching Truss	Crane Erection	Launching Truss	Crane Erection
CONSIDERATIONS					
Whole of Life Cost	Site intensive construction, increases overall costs.	Modified Supertee girders, manufactured off site in specialist precasting facility, reducing site construction activities and costs		Standard Supertee girders, manufactured off site in specialist precasting facility, reducing site construction activities and costs	
	Lower Maintenance Cost Superstructure - Fewer bearings, least exposed concrete surface area.	Higher Maintenance Cost than ILB for superstructure due to more bearings and larger exposed concrete surface area of superstructure options.		Highest Maintenance Cost due to largest number of bearings and larger exposed concrete surface area of superstructure compared to ILB option.	
	Lower maintenance cost substructure - Least number of piers, least exposed concrete surface area of piers.	Higher Maintenance Cost than ILB for substructure due to more piers and larger exposed concrete surface area		Similar maintenance cost to continuous supertee option. Higher Maintenance Cost than ILB for substructure due to more piers and larger exposed concrete surface area.	
	Low Maintenance Frequency.	Low maintenance Frequency.		Low Maintenance Frequency.	
Constructability	Repetitive Construction process - Standard industry technique although not commonly used.	More complex than simply supported supertee due to need for temporary falsework. Maximises the use of precast concrete girders fabricated in specialist facilities. Use of launching truss in combination with continuity diaphragms is rarely undertaken in the industry.	More complex than simply supported supertee due to need for temporary falsework. Maximises the use of precast concrete girders fabricated in specialist facilities. Continuous supertee uncommon in industry.	Industry standard design. Limited number of contractors have access to launching trusses, only two or three trusses in eastern Australia.	Industry standard design and construction, majority of contractors familiar with this method of construction.

BRIDGE OPTIONS	INCREMENTALLY LAUNCHED BOX GIRDER	CONTINUOUS SUPERTEE		SIMPLY SUPPORTED SUPERTEE	
		Launching Truss	Crane Erection	Launching Truss	Crane Erection
	Superstructure construction activities concentrated at the casting yard increasing quality but reducing construction flexibility.	Use of launching truss requires insitu deck to be cast before launching traveller to next span, reducing construction flexibility.	Crane erection provides flexibility in construction program.	Use of launching truss requires insitu deck to be cast before launching traveller to next span, reducing construction flexibility.	Efficient construction method providing the shortest onsite construction period. Crane erection provides flexibility in construction program.
Program	Longest construction program due to staged casting and launching operations.	Slower than crane erected continuous supertees, slower than simply supported supertee options.	Faster than continuous supertee option using launching truss erection method, slower than simply supported supertee options.	Slower than crane erected simply supported option.	Shortest onsite construction period.
Safety	Limited work at heights as deck can be launched with the majority of the bridge furniture (barriers, railing and protection screens) already installed, with the exception of the leading segments.	Significant work at heights, including; – launching truss operation – continuity diaphragm – insitu deck – barrier and protection screen erection Girders are temporarily supported on falsework and load transfer to permanent bearings is required.	Significant work at heights, including; – heavy girder crane lift – continuity diaphragm – insitu deck – barrier and protection screen erection Girders are temporarily supported on falsework and load transfer to permanent bearings is required.	Significant work at heights, including; – launching truss operation – insitu diaphragm – insitu deck – barrier and protection screen erection	Significant work at heights, including; – heavy girder crane lifts – insitu diaphragm – insitu deck – barrier and protection screen erection
Logistics	On site construction, no large elements requiring significant transport or craneage.	Heavy, long girders, difficult to handle and transport.		Heavy, long girders, difficult to handle and transport.	

BRIDGE OPTIONS	INCREMENTALLY LAUNCHED BOX GIRDER	CONTINUOUS SUPERTEE		SIMPLY SUPPORTED SUPERTEE	
		Launching Truss	Crane Erection	Launching Truss	Crane Erection
Visual Impact	Large cantilevers provide good shadow lines, reducing apparent depth.	Short supertee cantilevers limit shadow lines.		Short supertee cantilevers limits shadow lines.	
	Span to depth ratio 16.	Slender Structure, span to depth ratio 21. Best of all options.		Reasonably slender structure, span to depth ratio 19.	
	Long spans, least piers.	Shorter spans require additional pier to option 1.		Shorter spans require additional pier to option 1.	
	No pier headstocks.	No pier headstocks.		Cantilever pier headstocks.	
	Minimised pier width matches bottom flange width of box girder. Thicker piers to accommodate launching forces.	Wide piers to limit diaphragm cantilever. Minimal pier thickness due to single line of bearings.		Thick piers and headstock to accommodate two lines of bearings.	
Environmental	Minimal clearing of valley floor vegetation. Casting yard aligned on final road alignment.	Minimal clearing of valley floor vegetation due to overhead girder erection.	Increased clearing of valley floor vegetation due to crane pad locations.	Minimal clearing of valley floor vegetation due to overhead girder erection.	Increased clearing of valley floor vegetation due to crane pad locations.
	Minimum number of piers and associated disturbed zone around the piers.	One extra pier compared to ILB option, increases disturbed area around the piers.		One extra pier compared to ILB option, increases disturbed area around the piers.	
	Longer spans provide larger offset of piers from low flow waterway.	Longer span than simply supported supertee girder provides larger offset of piers from low flow waterway. 6 span arrangement places pier closer to low flow waterway than ILB 5 span option.		Shortest span places piers closer to low flow waterway. 6 span arrangement places pier closer to low flow waterway than ILB 5 span option.	

BRIDGE OPTIONS	INCREMENTALLY LAUNCHED BOX GIRDER	CONTINUOUS SUPERTEE		SIMPLY SUPPORTED SUPERTEE	
		Launching Truss	Crane Erection	Launching Truss	Crane Erection
Coppins Crossing Road	Can operate under stage 1. Stage 2 pier location impacts on current alignment.	Can operate under stage 1. Stage 2 pier location impacts on current alignment.		Can operate under stage 1. Stage 2 pier location impacts on current alignment.	
	Can launch superstructure over live traffic. Short road closures required to install bridge furniture on the leading segments only.	Road closures required during girder erection, precast parapet, railing and screen erection.		Road closures required during girder erection, precast parapet, railing and screen erection.	
Provisions for future light rail	Design allows for the future provision of a bridge for light rail between carriageways.	Design allows for the future provision of a bridge for light rail between carriageways.	Design allows for the future provision of a bridge for light rail between carriageways.		

8.2 Bridge Urban Design

8.2.1 Site analysis

Whilst the site is currently open space, the proposed developments in M2 and M3 will connect Belconnen with Weston Creek and Molonglo. What is now open bushland with an isolated low level bridge crossing has the potential to be a natural corridor that takes people from Scrivener Dam to the Molonglo Nature Reserve.

As part of the site analysis a photo montage was prepared to show the proposed bridge in place at the site.

Figure 43 Bridge Elevation

8.2.2 Design Precedents

The proximity to the Molonglo 2 Link Bridge has the potential to influence the design of the new Molonglo 3 John Gorton Drive Bridge. The project Brief requires the consideration of a “family” of bridges across the Molonglo River that includes the Link Bridge and the East West Arterial bridge. Whilst this project recognises that the bridges are quite separate in location and different entities, it is important to create some dialogues and links to the design language.

8.2.3 Design Overview

The main findings of the design overview from an urban design perspective are (refer to Figure 43, Figure 44 and Figure 45 for the general bridge elevation and section):

- A similar construction methodology to the Link Bridge (box girder) for uniformity and a cleaner under bridge experience.
- An ‘entry bookend’ to announce the start and finish of the bridge (refer to Figure 46).
- Galvanised steel balustrades (refer to Figure 47 and Figure 48).
- Grey concrete for the girder and precast parapets.
- An exaggerated parapet splay details to catch the light and lighten the edge of the deck.

Figure 44 Bridge Elevation

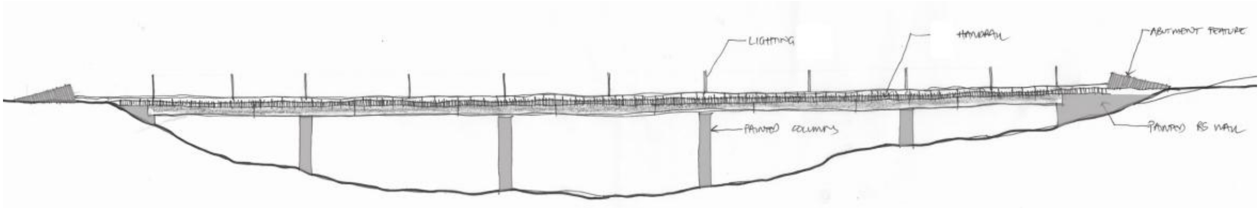


Figure 45 Bridge Section

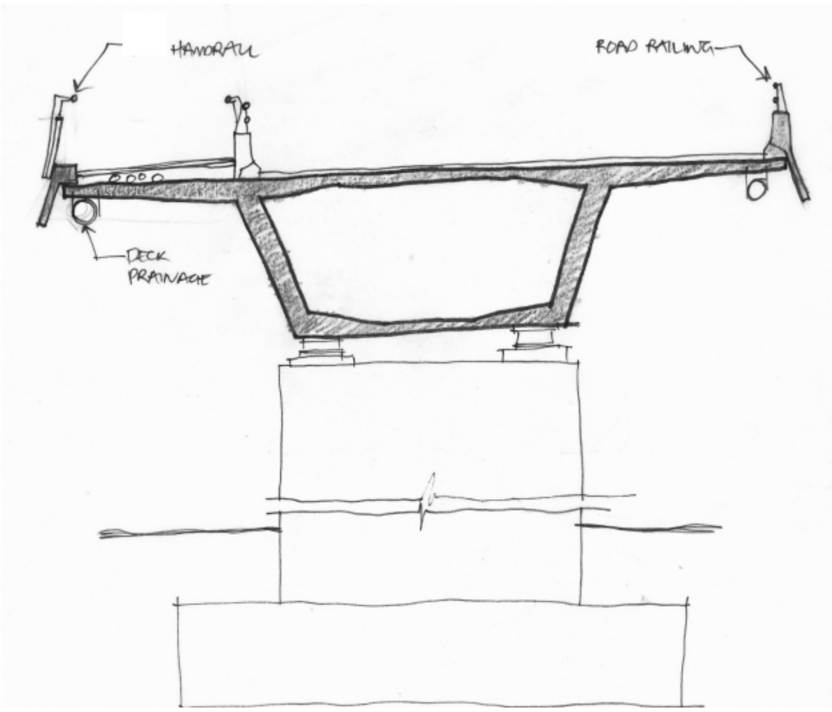


Figure 46 Possible 'Entry Bookend' details

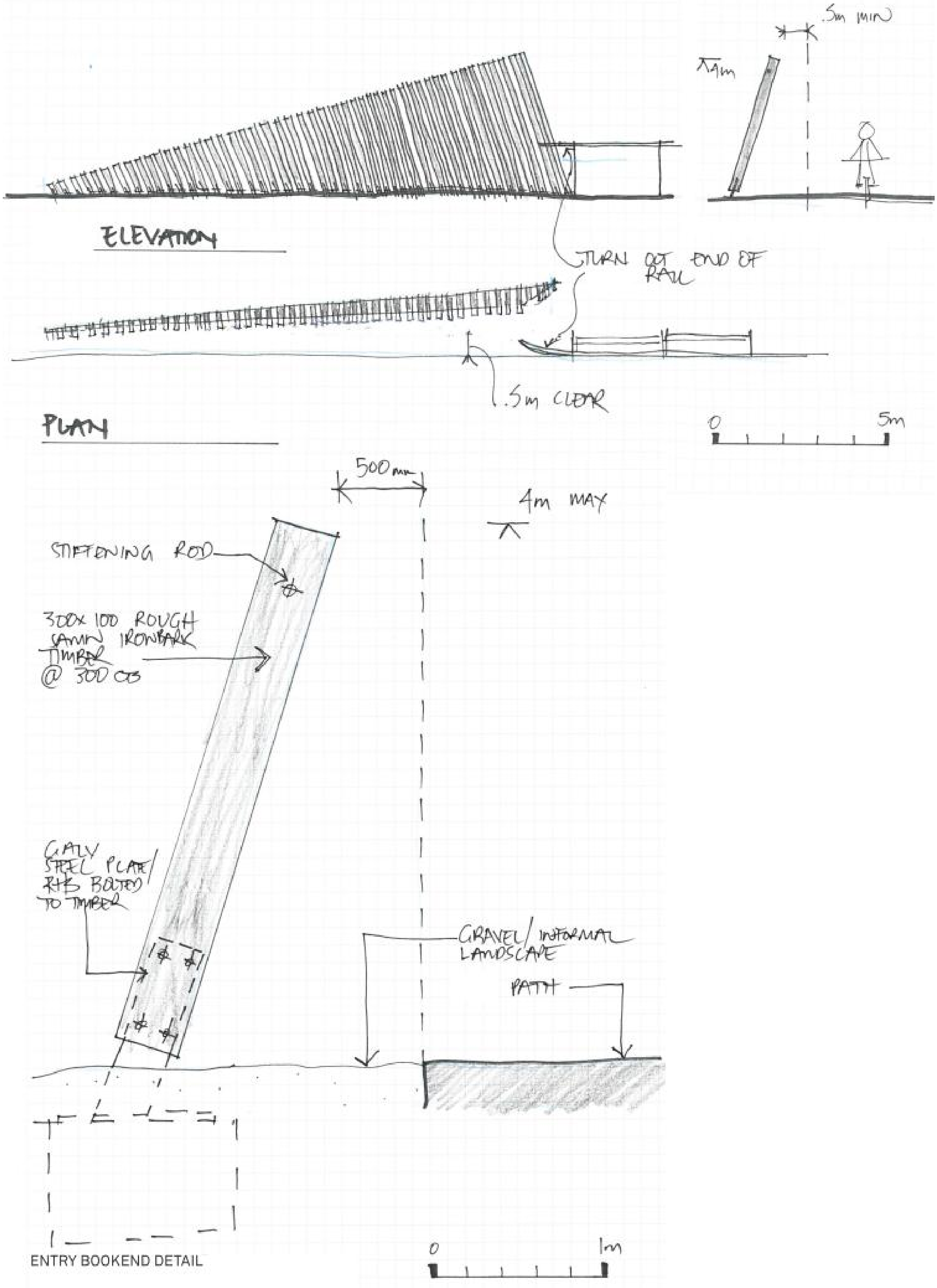
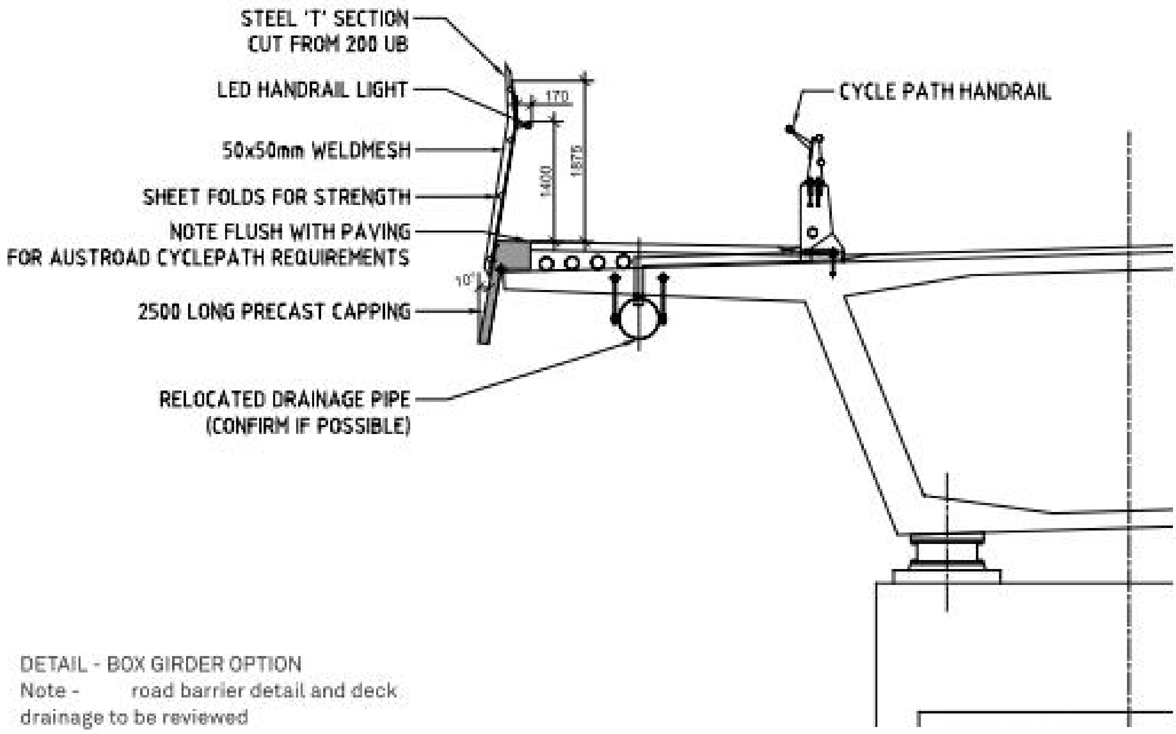


Figure 47 Galvanised steel balustrade details



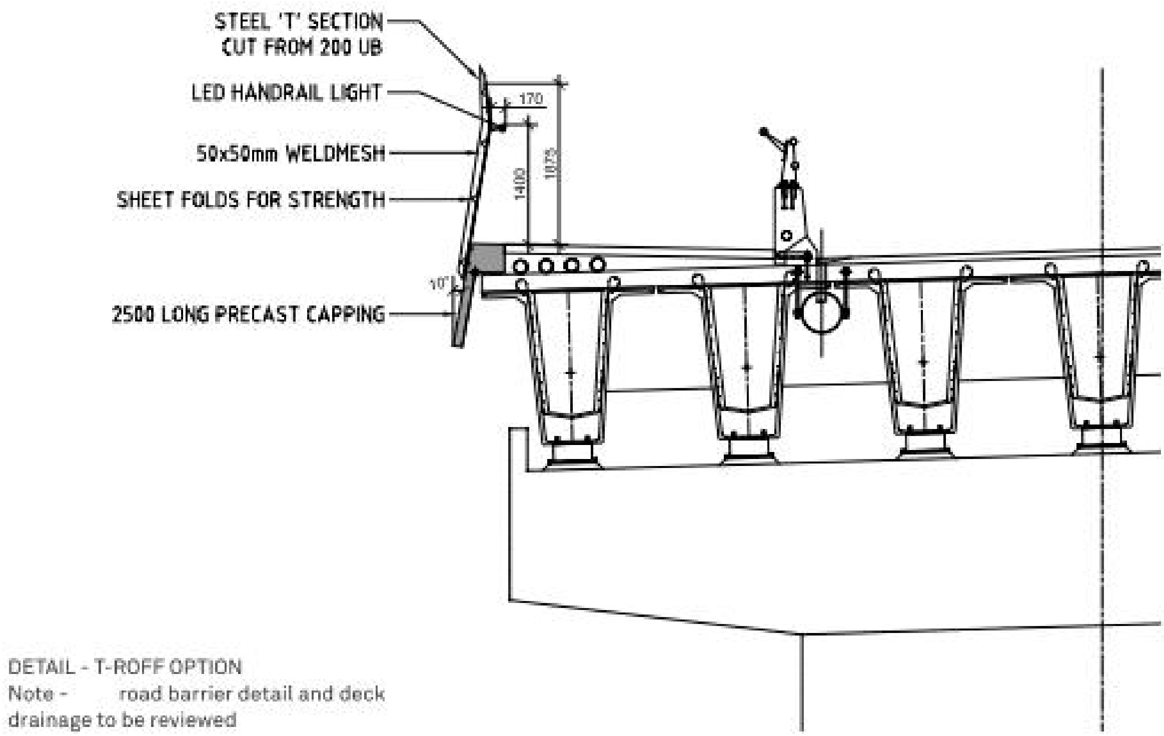
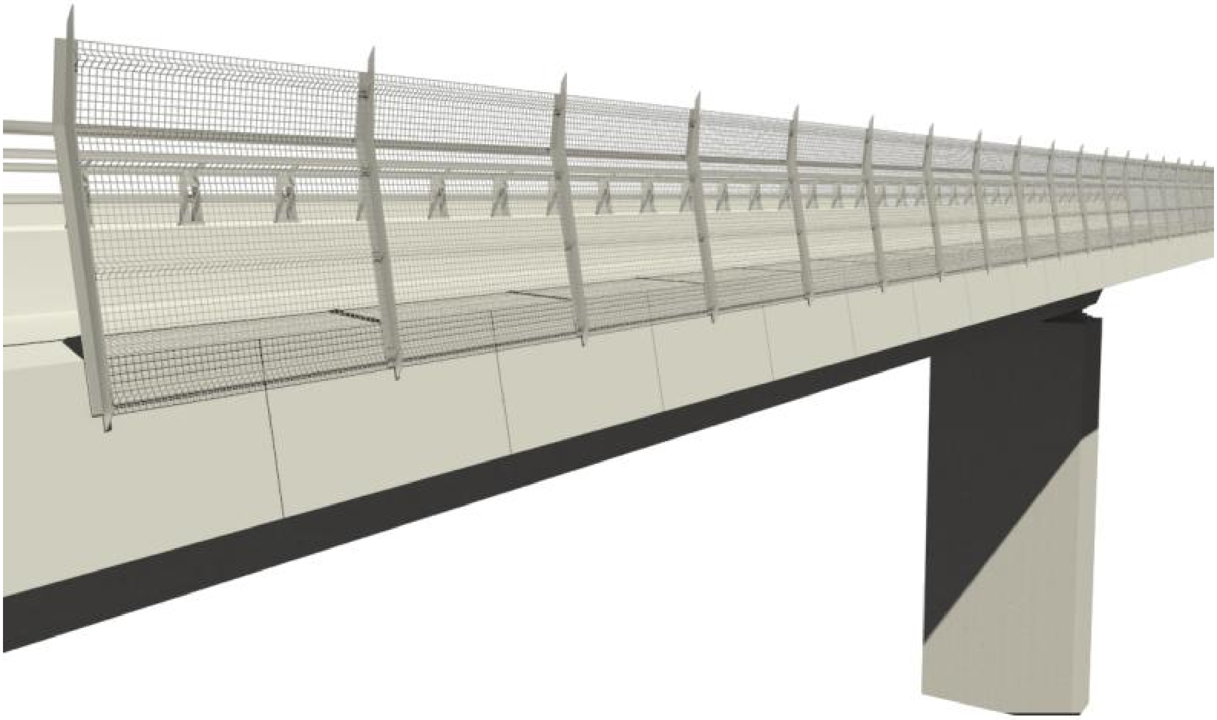


Figure 48 Perspective view of galvanised steel balustrade



8.3 Bridge Lighting

The lighting for the new bridge over the Molonglo River has been designed with consideration of the aesthetics of the new bridge.

The luminaire design has taken into account the aesthetics of the bridge and aligning the poles with the bridge piers. For the design and calculation, Rexel Optispans were chosen for their sleek aesthetics and for TaMS compliance. The Aeroscreen lens was incorporated for the environmental reason of reducing the upward waste light given the proximity to Mount Stromlo. The 400W metal halide luminaires were chosen for their improved colour rendering and to increase the pole spacing to line up with the bridge piers.

The location of the poles is co-located with the crash barrier between the road and the footpath with protective plate coverings. The access hatch is to be located on the pedestrian path side for safe access. Co-locating the pole with the crash barrier will reduce the road furniture and increase safety.

The lighting design proposed is compliant with Category V3 of the Australian Standard 1158.1.1-2005. The footpath is compliant with a Category P2 of the Australian Standard 1158.3.1-2005.

8.4 Triple Bottom Line Analysis

The Triple Bottom Line Assessment (TBL) is designed to identify and integrate social, environmental and economic factors into the decision making process of selecting the preferred bridge option. The TBL has been prepared in accordance with the *Triple Bottom Line Assessment for the Act Government- Framework and Templates July 2012.*

The TBL evaluates the bridge options against selected social, environmental and economic criteria to identify which bridge option is the preferred design. The table below shows the criteria addressed.

Criteria	Option 1- Incrementally Launched Box Girder	Option 2- Continuous Supertee		Option 3- Simply Supported Supertee	
		Launching Truss	Crane lift	Launching Truss	Crane Lift
Social					
Community and Individual Health	✓				
Economic					
ACT Government Budget				✓	✓
Skills and Education	✓		✓		✓
Environmental					
Biodiversity	✓				
Landscape & Visual quality	✓				
Heritage	✓				
Water	✓				
Waste		✓		✓	
Preferred Option	✓				

The ILBG performs best overall relative to the other four options. This is mostly attributed to this option performing significantly better than the other options against the environmental criteria. Although the ILBG is more expensive to build, the benefit cost ratio is only marginally lower than the other options.

The ILBG as the preferred option is consistent with the outcomes of the stakeholder consultation, receiving only positive responses.

With the least number of piers of all the options, the ILBG creates the least disturbance in the river corridor of all the options. The casting yard is aligned on the final road alignment causing no additional disturbance to the vegetation and ecology of the area.

The key social benefit of the ILBG is that there is limited work at heights. This is because the deck can be launched with the majority of barriers, railing and protection screens in place.

Economically the ILBG is the most expensive to install however, having the fewest piers and least amount of exposed concrete surface area the maintenance costs are decreased significantly.

In summary, the TBL assessment has identified that the ILBG option would be the best option to take forward on the basis of environmental, social and economic factors.

A copy of the TBL assessment report is included in Appendix G.

9.0 Stakeholder Consultations

Stakeholder consultations held throughout the project duration were:

- Constraints Analysis Presentation
- Structured Stakeholder Consultation (SSC) for the bridge options
- Value Management Workshop (VMS) for the preferred alignment.
- P50/P90 Risk management Workshop.

9.1 Structured Stakeholder Consultation (SSC) for the Bridge Options

There was an information session undertaken as part of SSC process which was held on the 15th of September 2014 with key stakeholders. The purpose of this session was to:

- Provide an overview of the project.
- Explain the process of weighting and evaluation for assessment of the bridge options
- Detail the specifics of each bridge option, from a construction and operation perspective.

Each attendee was given a package including detailed specifications of each bridge option and the background and objectives of the project.

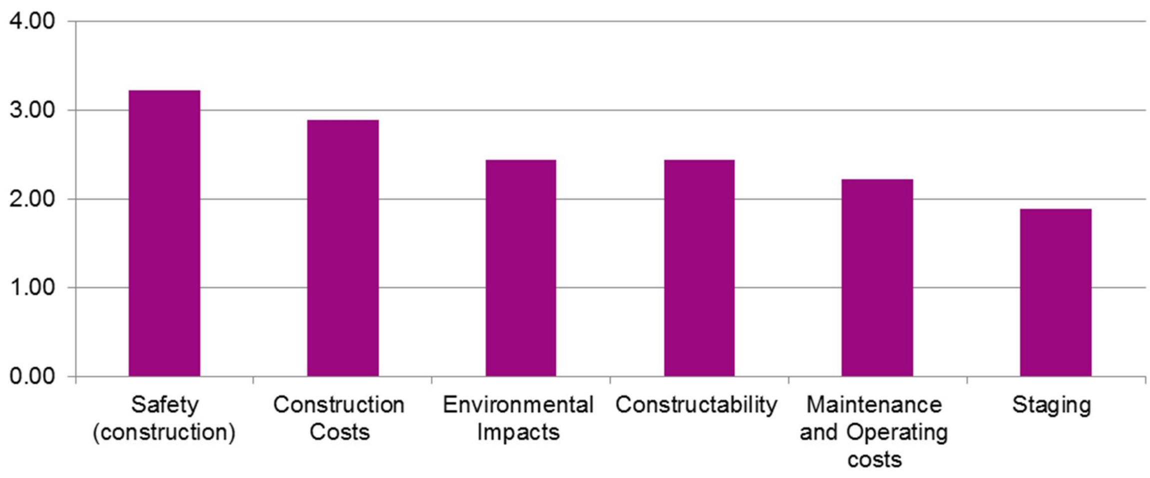
The process asked respondents to complete two key tasks:

- Rate the relative importance of each criterion (used to weight the evaluation)
- Evaluate each option against the criteria

For each option being evaluated respondents were asked to allocate a relative score for the perceived performance of that option relative to the criteria. The scoring process was conducted via an online platform that aggregated and stored each stakeholder's feedback, for later analysis.

The following graph illustrates how the stakeholders viewed the importance of each of the criteria. Construction safety was deemed to be the most important criteria, with staging considerations being the least important.

Figure 49 Relative importance of the criteria being used to evaluate the different bridge options



In summary:

- The ILBG received only positive responses, scoring particularly highly from a construction safety and environmental impact perspective.
- The Continuous Supertee option using an overhead gantry received low positive responses for most of the criteria but scored negatively for construction safety. The same design using the crane lift received negative scores for construction safety, environmental impacts and constructability. The remaining criteria received low positive scores.
- The Simply Supported Supertee option using an overhead gantry received positive results for construction costs, constructability and staging however were rated negatively on construction safety, environmental impacts and maintenance and operating costs. The same design using a crane lift received negative scores for construction safety, environmental impacts, constructability and maintenance and operating costs.

Option	Average score
ILBG	1.04
Continuous Supertee (overhead gantry)	0.17
Continuous Supertee (crane lift)	-0.17
Simply Supported Supertee (overhead gantry)	0.17
Simply Supported Supertee (crane lift)	-0.12

The results of this consultation exercise show a clear preference for the ILBG.

A copy of the report is included as one of the appendices in the TBL Analysis Report discussed in Section 8.4.

9.2 Value Management Workshop

A Value Management Workshop (VMW) was held on the 26th November 2014 for the project. The purposes of the VMW are:

- To identify the optimum approach that delivers the best value proposition.
- To ensure all agencies have the opportunity to review the project and add value to the proposals

The process adopted ensured all the relevant agencies were engaged and given the opportunity to understand and discuss project issues in an open non-critical environment. Issues were debated and ideas generated both by individuals and groups with a view to adding value.

The consideration of safety for the construction and operation of the bridge, roads and intersections was an important aspect of the workshop.

The outputs included priority ideas as well as a collection of ideas from the individuals. The priority actions that all agreed on was the need for "**Integration of John Gorton Drive design and adjacent land use planning" and "addressing the surplus material coming out of the cuts**"

A copy of the VM report is included in Appendix H.

9.3 P50/P90 Cost and Risk Management Workshop

The Brief indicated all cost estimates are to be formulated as P50 and P90 confidence level estimates in accordance with the Department of Infrastructure and Planning 'Best Practice Cost Estimation Standard for Publically Funded Road and Rail Construction' updated in May 2011.

As part of the P50 and P90 cost estimates process, a risk assessment workshop was held on the 4th of February 2015 with the ACT Government representatives. The outputs of the workshop were used in developing the probabilistic cost estimates for Stage 1 and Stage 2 (ultimate) works which is further discussed in Section 11.2.

9.4 Safety in Design (SiD)

The consideration of safety for the construction and operation of the bridge, roads and intersections was an important aspect of the feasibility design and was discussed during the SSC and VM workshops with stakeholders.

All discussions relating to safety were included in the relevant stakeholders' consultation report.

10.0 Construction Staging

The construction staging strategy has been developed based on the following aspects:

- Existing condition of road network and traffic conditions (refer to Section 3.1.
- The findings of the traffic assessment (refer to Section 4.0).

There are two stages of works recommended for the project based on the above:

- Stage 1 Works which is expected to occur between 2016 to 2021
- Stage 2 (Ultimate) Works which is expected to occur between 2021 to 2031

Each of the two stages is broken down into sub-stages to reflect the interim time frames.

10.1 Stage 1 Works

Works that have been identified to be required in Stage 1 Works are as follows (refer to Figure 50):

- **STAGE 1A – EXPECTED TO OCCUR IN 2017/2018**
  - Intersection upgrade at Coppins Crossing Road/William Hovell Drive to address safety issues and to cope with increase traffic from development in M3 Stage 1.
  - Construction of the Northern Access Road and Emergency Access Road to M3 Stage 1 development.
  - Single carriageway construction of John Gorton Drive (future northbound carriageway) from Ch 17,500 to William Hovell Drive.
- **STAGE 1B – EXPECTED TO OCCUR BEFORE 2021**
  - Single carriageway construction of John Gorton Drive (future northbound carriageway) from John Gorton Drive Stage 2A works at the southern end to Ch 17,150. Works include construction of John Gorton Drive Bridge over the Molonglo River.

10.2 Stage 2 (Ultimate works)

Works that have been identified to be required in the Stage 2 (Ultimate) Works are as follows (refer to Figure 50):

- **STAGE 2A – EXPECTED TO OCCUR BEFORE 2023/2024**
  - Intersection upgrade at John Gorton Drive/William Hovell Drive to a Quadrant intersection arrangement.
  - Duplication of John Gorton Drive (southbound carriageway) between the Northern Access Road and CD.
- **STAGE 2B – EXPECTED TO OCCUR BEFORE 2028/2029**
  - Duplication of John Gorton Drive (southbound carriageway) between John Gorton Drive Stage 2A works and the Northern Access Road. Works include duplication of John Gorton Drive Bridge over the Molonglo River, Bindubi Street Intersection, and the Southern Access Road to Stage 1 M3 development.

CMTEDD indicated later in the design process that Coppins Crossing Road is to be retained as a low speed, local access road and retaining Coppins Crossing Road during the Stage 2B construction of future southbound John Gorton Drive Bridge is not required.

Preliminary assessment indicated retaining Coppins Crossing Road in the vicinity of the northern abutment ultimately is possible. Widening of existing pavement between the two bridge piers would be required and the operating speed of Coppins Crossing Road in this section of road would be less than 40 km/h.

Figure 50 Stage 1 (Single Carriageway) Works

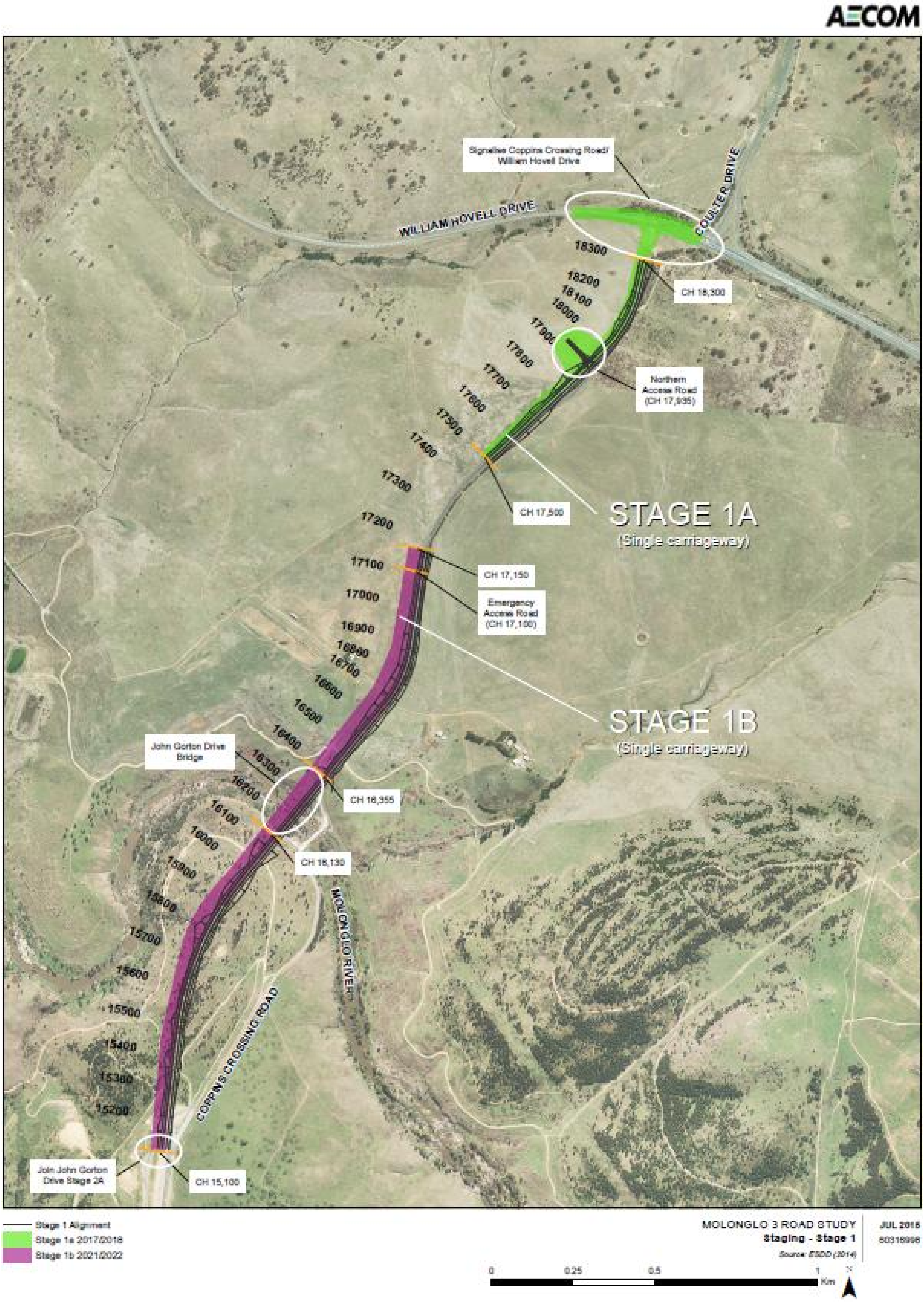
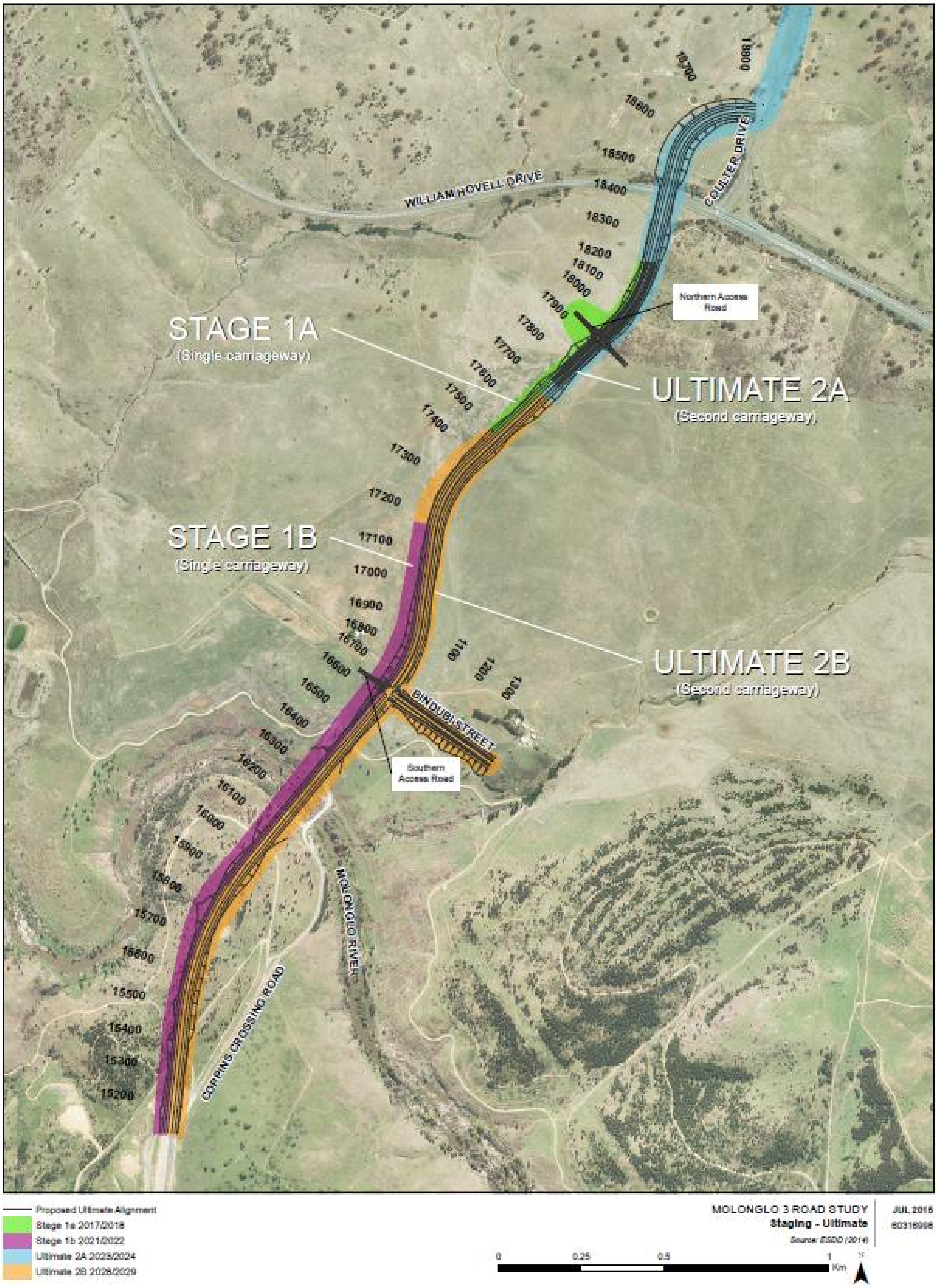


Figure 51 Ultimate (Dual Carriageway) Works

AECOM



11.0 Opinion of Probable Costs

11.1 Assessment of Opinion of Probable Costs

11.1.1 Bridge Options

The following section contains a detailed assessment of opinion of probable costs or the bridge options including the assumptions, inclusions and exclusions.

ITEM	Description		Incrementally launched box girder		38 m Simply Supertee		41 m Supertee	
1	Earthworks		$	789,000	$	693,000	$	696,000
2	Piles		$	710,000	$	828,000	$	828,000
3	Piers		$	2,132,000	$	2,906,000	$	2,993,000
4	Bearing and joints		$	347,000	$	193,000	$	430,000
5	Bridge deck		$	11,614,000	$	8,855,000	$	9,463,000
6	Miscellaneous		$	650,000	$	650,000	$	650,000
Subtotal			$	16,250,000	$	14,130,000	$	15,060,000
Preliminaries		15%	$	2,440,000	$	2,120,000	$	2,260,000
Subtotal			$	18,690,000	$	16,250,000	$	17,320,000
Contingency		40%	$	7,480,000	$	6,500,000	$	6,930,000
Subtotal			$	26,170,000	$	22,750,000	$	24,250,000
Design and management fee		15%	$	3,930,000	$	3,420,000	$	3,640,000
Subtotal			$	30,100,000	$	26,170,000	$	27,890,000
GST		10%	$	3,010,000	$	2,620,000	$	2,790,000
Total			$	33,110,000	$	28,790,000	$	30,680,000
Say			**$**	**33,500,000**	**$**	**29,000,000**	**$**	**31,000,000**

Assumptions, Inclusions and Allowances

- The following allowance have been included in the opinion of probable costs:
  - 15% for preliminaries
  - 40% for contingency
  - 15% for design and management fee
  - 10% for GST
- The opinion of probable cost is based on current industry rates (2014) with no escalation.
- The estimation of quantities has been developed based on the feasibility arrangement of the structures given in the drawings.
- The estimation of quantities is for the northbound carriageway structure only i.e. no provision for future carriageway.
- No allowance for any works in addition to the main structure other than the construction of the reinforced soil walls to the underside of pavement level
- Allowance for 1m over-excavation in plan for pad footing construction, no allowance for benching or shoring measures.

- Excavation rate is assumed to be in all type of materials.
- The following items are NOT included in the probable cost:
  - Relocation of utilities.
  - Provision of proposed utilities.
  - Treatment or removal of contaminated material.
  - Land withdrawal costs.

11.1.2 Road

The following section contains a detailed assessment of opinion of probable costs for the road and intersection works including assumptions, inclusions and exclusions.

Item	Description		STAGE 1		STAGE 2
1	Mid-blocks (South of the Bridge - Ch 15000 To Ch16130) – Road Construction	$	9,830,000	$	7,110,000
2	Mid-blocks (North of the Bridge - Ch 17150 To Ch17500) – Road Construction	$	1,560,000	$	3,330,000
3	Bridgeworks (Ch 16130 - 16355)	$	18,690,000	$	18,690,000
4	Bindubi Street Intersection (Ch 16355 -17150)	$	13,080,000	$	11,620,000
5	1st Access To M3 (Ch 17500 - 18300)	$	6,650,000	$	4,270,000
7	William Hovell Drive Intersection (Ch. 18300 to Coulter Drive)	$	1,810,000	$	11,470,000
8	Safety Screens On Bridge 1.8 High (Both Sides)	$	940,000	. $	940,000

SUB-TOTAL		***$***	***52,560,000***	***$***	***57,430,000***
CONTINGENCY	40%	$	21,030,000	$	22,980,000
SUB-TOTAL		***$***	***73,590,000***	***$***	***80,410,000***
DESIGN AND MANAGEMENT FEES	15%	$	11,040,000	$	12,062,000
SUB-TOTAL		***$***	***84,630,000***	***$***	***92,472,000***
GST	10%	$	8,470,000	$	9,250,000
TOTAL (Including GST)		**$**	**93,100,000**	**$**	**101,722,000**
Rounded to nearest $1M			**$93M**		**$102M**

Assumptions, Inclusions and Allowances

Assumptions:

- The following allowance have been included in the probable costs:
  - Removal of 100 mm of topsoil.
  - 15% for Preliminaries.
  - 40% for contingency.
  - 15% for design and management fee.
  - 10% for GST.
- The opinion of probable cost is based on current industry rates (2014) with no escalation.
- William Hovell Drive Stage 2 intersection layout is assumed to be quadrant arrangement.
- Incrementally launched box girder type of bridge option is included in the assessment of probable of costs.
- Excavation rate is assumed to be in all type of materials.

- The assumed pavement profile is a flexible granular pavement with thin asphalt wearing course with subgrade CBR 5%.
- Allowance of 550mm for boxing
- Excavation is limited to the proposed stage of works i.e. no provision for future works except clearing and grubbing activities.
- Excess material can be transported between sections in a particular staging of works e.g. excess material from Stage 2B can be utilised in Stage 2A works.
- Earthworks quantities:

Stage 1	- Total cut – 195,000 m^3
	- Total fill – 70,000 m^3
	- Excess material – 125,000 m^3
Ultimate Stage	- Total cut – 320,000 m^3
	- Total fill – 165,000 m^3
	- Excess material – 165,000 m^3

- The following items are NOT included in the probable cost:
  - No new utilities infrastructure such as sewer main.
  - Relocation of existing utilities.
  - Treatment or removal of contaminated material.
  - Land withdrawal costs.

11.2 P50/P90 Cost and Risk Management Workshop

The Probabilistic Cost Estimate report was prepared to provide conversion of the conventional deterministic estimate into a probabilistic estimate to provide review and rigour to the percentage of contingency allowed for in the budget cost estimates.

The report provides outputs for Stage 1 and Stage 2 works which are separately modelled using the @Risk add-on to Microsoft Excel. These provide separate risk allowances for P50 and P90 confidence levels for each of the two stages. The total is expressed as an arithmetic sum of the two stages. A copy of the report is included in Appendix I.

The outputs from the model can be summarised as follows:

Description	Deterministic ($M)			Probabilistic ($M)		
	Stage 1	Stage 2	Total	Stage 1	Stage 2	Total
Base Estimate	**63.6**	**69.6**	**133**	**63.6**	**69.6**	**133**
Contingency	25.4	27.8	53	NA	NA	NA
Subtotal	89.0	97.4	186	63.6	69.6	133
P50 Contingency	NA	NA	NA	8.8	16.5	25
Subtotal	89.0	97.4	186	72.4	86.1	158
Extra-over for P90 Contingency	NA	NA	NA	7.2	9.6	17
Subtotal	**89.0**	**97.4**	**186**	**79.6**	**95.6**	**175**
GST	8.9	9.7	18.6	7.96	9.6	17.5
TOTAL	**98**	**107**	**205**	**88**	**105**	**193**

The P50/P90 assessment indicated that the following major elements that are contributing to the contingency line for both stages re:

- Earthworks
- Bridge structure works
- Geotechnical risk
- Risks associated with concurrent studies.
- Bitumen price.

It is recommended that the following actions be undertaken to progress the cost management of the project:

- Critically analyse the contingent risk matrix, especially with respect to Stage 2 to ascertain if the risks are applicable and reasonable in their application to the model.
- Compare the report outputs to other benchmarks.
- Undertake a reasonableness test against recent projects of a similar scope.
- Include the ACT government’s direct costs for the project including the project management and supervision personnel.
- Repeat this process at the pre-tender stage of the project.

Repeat this process at the delivery stage of the project.

12.0 Limitations and Project Risks

12.1 Limitation

12.1.1 Topography

The study has used available topographical data. For the majority of the study area, the available information took the form of contour data at 1 m intervals and surveyed cross sections discussed in Section 3.4.

12.1.2 Geotechnical Information

Only desktop studies have been undertaken to assess geotechnical information within the study area, and hence no intrusive investigations have been undertaken. The design of bridge substructures is based on design parameters derived from this desktop review.

The preliminary geotechnical results from Molonglo Earthworks Management Strategy and Preliminary Geotechnical Investigation Study were provided in January 2015. This preliminary geotechnical results are used to confirm the assumptions on the pavement subgrade CBR.

12.2 Risk

The risks and issues that need to be considered in the next stage of planning and design include:

- Coordination with Structure Planning for Molonglo 3.
- Environmental and planning approvals.
- Ability to stockpile and dispose excess fill.
- Additional land withdrawal in the vicinity of John Gorton Drive/William Hovell Drive intersection.

Geotechnical investigation in the vicinity of John Gorton Drive Bridge

Appendix A

Assessment of Coppins Crossing Road

Appendix B

Survey

Appendix C

Traffic Modelling Report

Appendix D

Road Alignment Design Options

Appendix E

Discussions with TaMS, Actew Water, ActewAGL and Utilities

Appendix F

Bindubi Street Extension

Appendix G

Triple Bottom Line Report

Appendix H

Value Management Workshop

Appendix I

P50/P90 Cost Estimate Report

Appendix J

Bridge Options

Appendix J Bridge Options

Appendix K

Stakeholder Circulation Comments and Responses