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Volume 1 - Route Options Assessment Report

Molonglo East-West Arterial Road Feasibility Study and Molonglo Strategic Traffic Study

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1 Introduction

1.1 Project Background

The three stages of Molonglo Valley development (Molonglo 1, 2 and 3) are proposed to accommodate approximately 50,000 to 55,000 people. Molonglo 2, comprises the suburb of Denman Prospect and the future suburbs of Molonglo, which is intended to include the district of Molonglo Valley's principle commercial centre. Molonglo 3 forms the third stage of urban development in Molonglo Valley and is likely to include three to four suburbs.

The Molonglo East West Arterial (EWA) road was identified as an essential part of the arterial road network for the Molonglo district in earlier traffic and road feasibility studies. The EWA was also identified in the Territory Plan's Molonglo and North Weston Structure Plan and is notionally indicated in the Territory Plan Map. It is noted that the alignment indicated in the Territory Plan Map will be superseded by the findings of this study.

The EWA road is also identified in the Molonglo 3 Planning and Design Framework (refer Figure 1-1). It is proposed to connect the future suburb of Molonglo and the wider Molonglo development area with the Tuggeranong Parkway via a bridge over the Molonglo River and a new grade-separated interchange at the Tuggeranong Parkway.

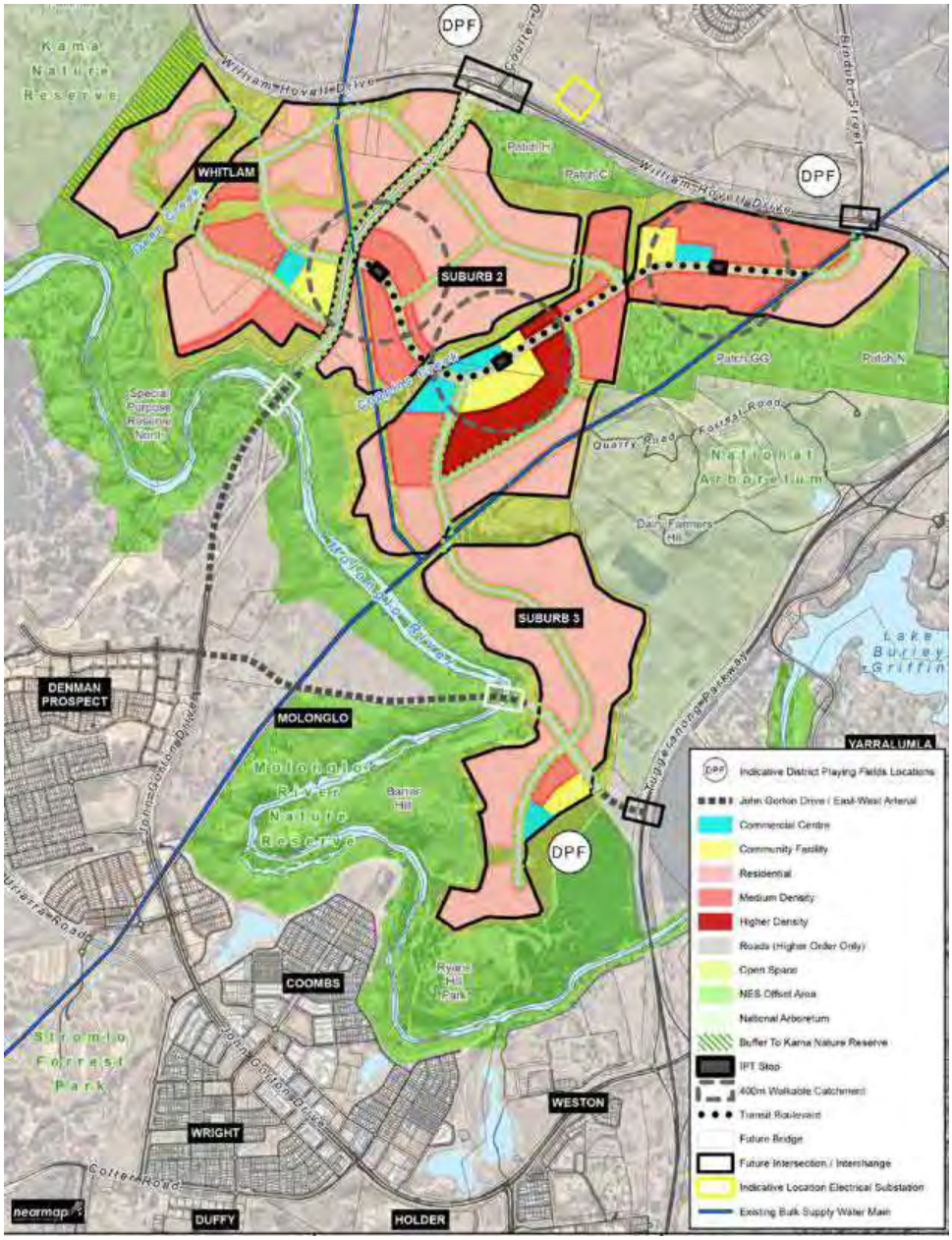

Figure 1-1 Molonglo Valley Stage 3 Framework Plan (Molonglo Valley Stage 3 Planning & Design Framework, EPSDD, 2019)

The Canberra Strategic Transport Model (CSTM) has demonstrated the need for the EWA road connection to the Tuggeranong Parkway to complement other arterial roads servicing the Molonglo area. This link will provide alternative and direct access for the suburb of Molonglo and Denman Prospect traffic to the Tuggeranong Parkway and the broader ACT trunk road network.

Furthermore, it is noted that possible development west of Molonglo (Western Edge Investigation Area) was not considered in the earlier traffic studies. The possible development of these areas is expected to have significant impacts on forecast traffic volumes for William Hovell Drive (WHD), John Gorton Drive (JGD), the EWA and the wider arterial road network and has been assessed in the transport modelling component of this study.

The Indicative Land Release Program contains significant land releases in Molonglo over the next four years and it is anticipated that substantial land release in the area will continue beyond this period. These population increases will lead to traffic demand that may exceed the combined capacity of other key access roads in the area if the EWA is not constructed. Recent traffic modelling has indicated that this growth will drive the need for an additional arterial road access for Molonglo. The likely beneficiaries of the EWA project are expected to include existing and future residents of Molonglo Valley, businesses in the area and, future residents to the west of Molonglo should development progress in the Western Edge Investigation Area.

While the completion of the EWA road to Tuggeranong Parkway may not be required in the near future (10-15 years), this study is required to confirm the road alignment reservation for gazettal, particularly through the Molonglo River Reserve and adjacent to the National Arboretum. The arterial road alignment, bridge location and associated reservations will provide surety for land use and infrastructure planning and the definition of the development boundary between Molonglo development and the National Arboretum. The road will also connect with access roads to service the suburb of Molonglo, containing the group centre and later stages of Molonglo stage 3.

1.2 Project Location

The project study area is situated in the Molonglo Valley of Canberra, ACT. The proposed EWA is to provide an arterial road link between the John Gorton Drive / Holborow Ave intersection in the west and the Tuggeranong Parkway in the east. The site is predominately rolling terrain incised by the Molonglo River, with a combination of farmland and pine plantation. To facilitate the EWA interchange with the Tuggeranong Parkway, it anticipated that upgrade works will be required on the Parkway to the Cotter Rd interchange. The location of the project site is indicated in Figure 1-2.

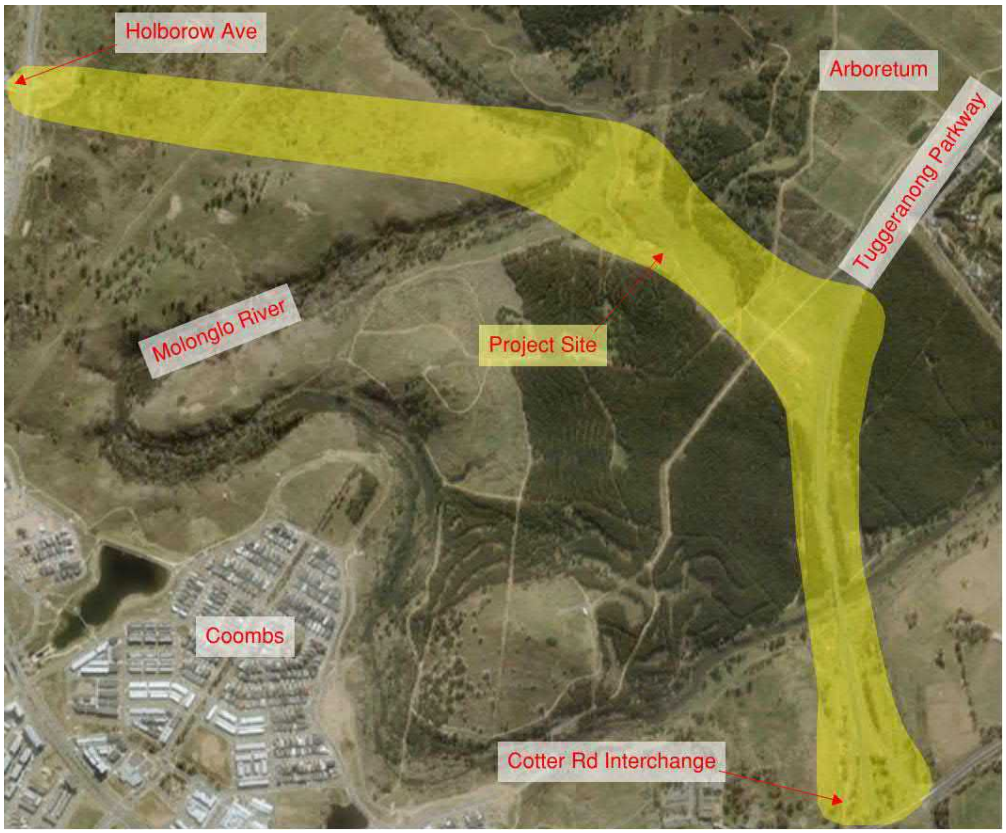

Figure 1-2 Locality Plan (Metromap, September 2020)

1.3 Project Objectives

When establishing a project brief, the Territory identified two primary objectives for the study:

1) Preparation of a strategic transport assessment using the most recent CSTM and results for 2041 development to determine the future traffic impacts of the proposed developments in Molonglo district and surrounds and proposed major new roads in particular the EWA and Bindubi Street Extension (BSE)
2) Integrate high level Molonglo 3 planning intentions as articulated in the Molonglo 3 Planning Design Framework (PDF), Molonglo 3 Stage 2 Proof of Concept (RobertsDay, 2019), Molonglo 2 Planning Design Framework and other relevant planning documents into the alignment options and concept design of the EWA road.

1.4 This Report

The ACT Environment, Planning and Sustainable Development Directorate (EPSDD) has commissioned a feasibility study of the EWA in the Molonglo Valley of Canberra. The Feasibility Study consists of three documents:

- Study Overview
- Volume 1 - Route Options Assessment Report **(this Report)**
- Volume 2 - Strategic Design Report

This Route Options Assessment Report has been prepared to document the background and outcomes of the options assessment process for the EWA. The report records the options considered, the constraints, the implications of these options, the multicriteria analysis process that was used to identify a preferred option, and provides a brief overview of the proposed way forward for the development of the strategic design for the preferred option.

2 Geotechnical Assessment

Reference should be made to the following figures when reading the geotechnical sections of this report:

- Geotechnical Figures F1 to F4, showing plan views of the site, Areas of Geotechnical Concern, and other mapping information
- Photos AGC – List and Compiled Photos and
- Geotechnical Sites – List and Compiled Photos

2.1 Site Location

The site is located between the Tuggeranong Parkway to the East and John Gorton Drive to the West. The site is roughly bisected by the Molonglo River, located approximately 1km to the west of the Tuggeranong Parkway. The Molonglo River valley is the dominant geomorphological feature of the site, being incised around 50m to 100m in vertical elevation below the surrounding low rolling hillside terrain of the Canberra district. The side slopes of the Molonglo River valley are significantly steeper than other areas of the site, with slope angles ranging between 20 to 45 degrees (with some locally steeper cliff line area) sloping downwards into the river area. Remote from the Molonglo River valley area, the terrain slopes range between about 3 and 15 degrees.

The eastern part of the site connects to the existing Tuggeranong Parkway nearby a large area of pine forest. The north-east corner of the site is limited to the southern boundary of the National Arboretum. A significant high voltage overhead power line easement and underground sewer tunnel/pipeline easement also passes through the eastern portion of the site.

The western end of the site connects to John Gorton Drive at an existing signalised intersection that is designed to tie into the western end of the future East West Arterial. The rest of the site extends eastwards from John Gorton Drive over open vegetated grassland and sparse woodland to the banks of the Molonglo River.

2.2 Soil Landscape

Based on the Soil Landscape mapping by ACT Government and the State of NSW Office of Environment and Heritage, the site soils are mapped as predominately three main soil landscapes, Williamsdale, Burra and Paddy River Variant. Williamsdale is found at the East and Western ends of the site, with the Burra soil landscape located between the Williamsdale landscape and the Molonglo River. The Paddy River Variant B soil landscape follows the banks of the Molonglo River.

Figure 2-1 Soil Landscapes at Proposed EWL Site

2.2.1 Williamsdale

This soil landscape is described as:

- Undulating rises, fans, valley flats and depressions on Silurian Volcanics of the Canberra Lowlands. Includes significant areas of pediplain. Local relief 5 - 50 m; elevation 550 - 650 m; waning foot slopes (<10%). Little or no rock outcrop.
- The original woodland has been cleared. Grassland areas have been extensively altered.
- Soils— moderately deep, moderately well-drained Yellow Chromosols (Yellow Podzolic Soils) on Red and Brown Kandosols (Red and Yellow Earths) on upper rises and fan elements. Moderately to very deep, poorly to imperfectly drained Sodosols (Solodic Soils and Solodized Solonetz Soils) on lower rises and fan elements.
- Limitations— hardsetting, erodible, dispersible soils (localised). Acidic topsoils. Seasonal waterlogging; complex terrain; flood hazard (localised); run-on; dieback.

2.2.2 Burra

This soil landscape is described as:

- Undulating to rolling low hills and alluvial fans on Silurian volcanics. Local relief <90 m; elevation 650 - 900 m; long (>300 m), waning and gently to moderately inclined hillslopes, footslopes and fans (slopes 5 - 30%). Localised terracettes are common. Almost completely cleared woodland.
- Landscape Variant baa— fans more prevalent, with less rocky and slightly deeper soils than ba.
- Soils— shallow (<60 cm), well-drained Rudosols (Lithosols) and Tenosols (Lithosols/Earthy Sands) on crests and upper slopes. Moderately deep (<90 cm), moderately well-drained Red Kurosols (Red Podzolic Soils) and Red Kandosols (Red Earths) on midslopes and most lower slopes. Moderately deep (<100 cm), slowly to moderately well-drained Brown Chromosols (Yellow Podzolic Soils) and Brown Kandosols (Yellow Earths) along minor drainage lines and on some lower slopes.
- Limitations— strongly acid soils with low fertility and low available water holding capacity. Subsoils have low permeability. Moderate mass movement hazard (terracetting); sheet erosion risk; run-on; localised shallow soils.

2.2.3 Paddys River Variant B

This soil landscape is described as:

- Stream channels and adjacent riparian features on Quaternary alluvium. Local relief is dependent on adjacent landscapes as anything outside of the low lying riparian zone is excluded from this landscape unit; streams occur at 500 - 700 m elevation. Extensively cleared riparian woodland, scrubland, grassland and sedge land
- Landscape Variant pdb— larger, higher energy watercourses with incised channels, but little or no sand bar development.
- Soils— deep (>100 cm), well-drained Stratic Rudosols (Alluvial Soils) on floodplain elements. Deep (>100 cm), imperfectly to poorly drained Stratic Rudosols (Alluvial Soils) in streambeds
- Limitations— non-cohesive soils of high permeability, high erodibility, low fertility and low available water holding capacity. Excessive drainage (localised); high run-on; gully erosion risk; wind erosion hazard (localised).

2.2.4 Geomorphic Process

Three geomorphic processes are identified in terrains onsite in Figure 2B. A description of these including their extent onsite is included below:

- Transferral
- Alluvial
- Colluvial (potential)

Of all geomorphic process areas, the main area of concern is assessed to be within the Colluvial areas. These areas are not typical of the above 3 soil landscapes but there is a potential near the banks of the Molonglo River, especially in steep slopes with steeply dipping bedrock on the western flanks of the river. In Colluvial areas, soils are not

weathered in place soils, but instead are soils transported by the action of gravity. These generally correspond with steeper areas of terrain and correspond with areas of increased landslide risk.

2.3 Geology

The general geology of the site based on mapping from the 1:50,000 Geological map by the 1970 Bureau of Mineral Resources Geology and Geophysics.

The site is underlain by two major rock types, both a part of the Laidlaw Volcanic Suite. This made up of the Laidlaw Volcanics and the Deakin Volcanics. Both rock types are dominantly pyroclastic rock, which can be described as rock formed from volcanic eruptions. The rocks are dated at around 125 million to 425 million years old.

Three major faults are mapped as outcropping on this site. One north-south trending fault is located at the south-east of the site near the Tuggeranong Parkway and the remaining two faults trend east-west. One lies parallel and beneath the floor of the Molonglo River and the second strikes along the ridgeline as the alignment travels east-west between the Molonglo River and John Gorton Drive.

The following rock types are present, in order from youngest to oldest in terms of geological age:

- Mount Painter Porphyry (Sup): Bluish grey and greenish grey porphyritic dacite and rhyodacite
- Yarralumla Formation (Suy): calcareous shale, limestone, sandstone, tuff
- Deakin Volcanics (Sud) – East of the Molonglo River the Deakin Volcanics are described in geological mapping references as “Rhyodacitic ignimbrite and minor volcaniclastic and argillaceous sedimentary rock(s)”. The rock types described in the 1:50000 Canberra Geological Sheet are shown as:
  - Ashstone
  - Pink Rhyolite Tuff
- Deakin Volcanics (Sud) – West of the Molonglo River the Deakin Volcanics are described in geological mapping references as dark to light grey, very coarse-grained, porphyritic, rhyodacitic ignimbrite. Sporadically grades to a coarse-grained equigranular ignimbrite. Rare columnar structure”. The rock types described in the 1:50000 Canberra Geological Sheet are shown as:
  - Purple Rhyodacite.

The western 50% of the site appears mostly underlain by rock from the Deakin Volcanics (Sud) and the Mount Painter Porphyry, however some rock described as Yarralumla Formation (Suy) is present near the Molonglo River. The Deakin volcanics in this area typically have a dip angle of 25 to 53 degrees to the west. The Yarralumla Formation dips downwards to the northwest at 70 degrees.

The remaining 50% of the site to the east is underlain by the Mount Painter Porphyry and the Deakin Volcanics (with possibly some Yarralumla Formation fringing the site to the south). The Deakin Volcanics in this area typically have a dip angle of 50^{o} to the south-west.

Whilst these rocks are moderately old in terms of geological age, it would be expected that in their fresh form these rocks would be of very high or even extremely high strength due to their volcanic background.

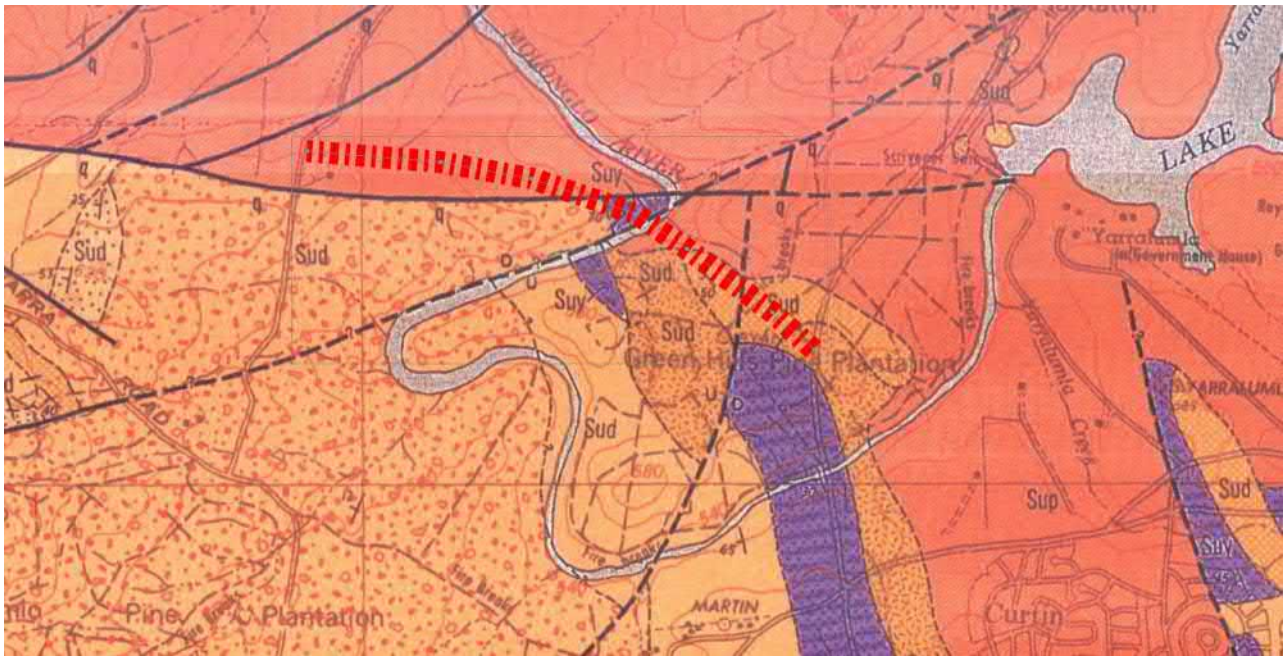

Figure 2-2 Geology at Proposed EWL Site

2.4 Salinity Hazard

The site is mapped as the Uriarra Road Hydrogeological Landscape on the Canberra 1:100 000 sheet and is noted as High Risk of salinity hazard.

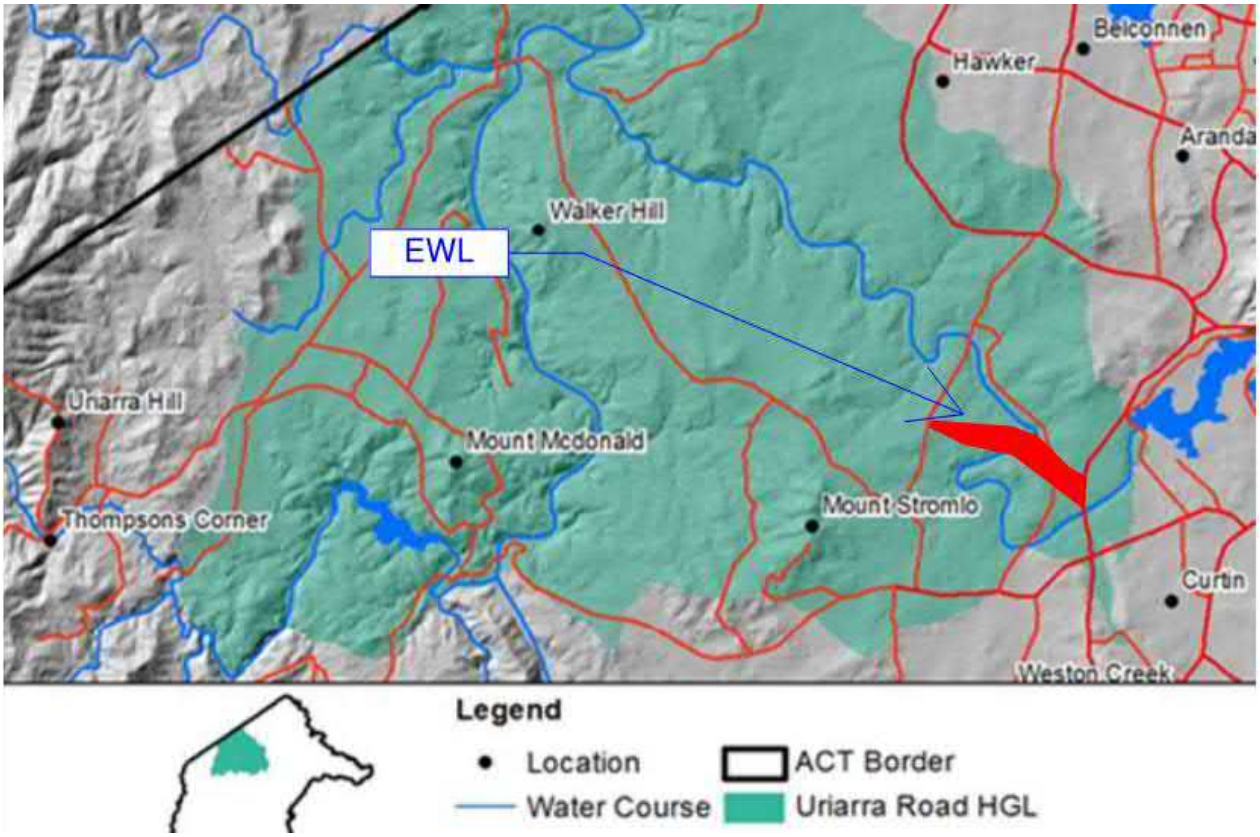

Figure 2-3 Salinity Hazard at Proposed EWL Site

2.5 Acid Sulfate Soils and Acid Sulfate Rock

A review of the NSW government eSPADE website was undertaken to assess the potential for ASS to exist on site. The NSW government eSPADE risk mapping indicates that the site is situated outside of areas of known coastal ASS risk.

The ACT is known for having Acid Sulfate Rock in some areas, and SMEC has been involved with the Majura Parkway project where ASR was identified and requirement management.

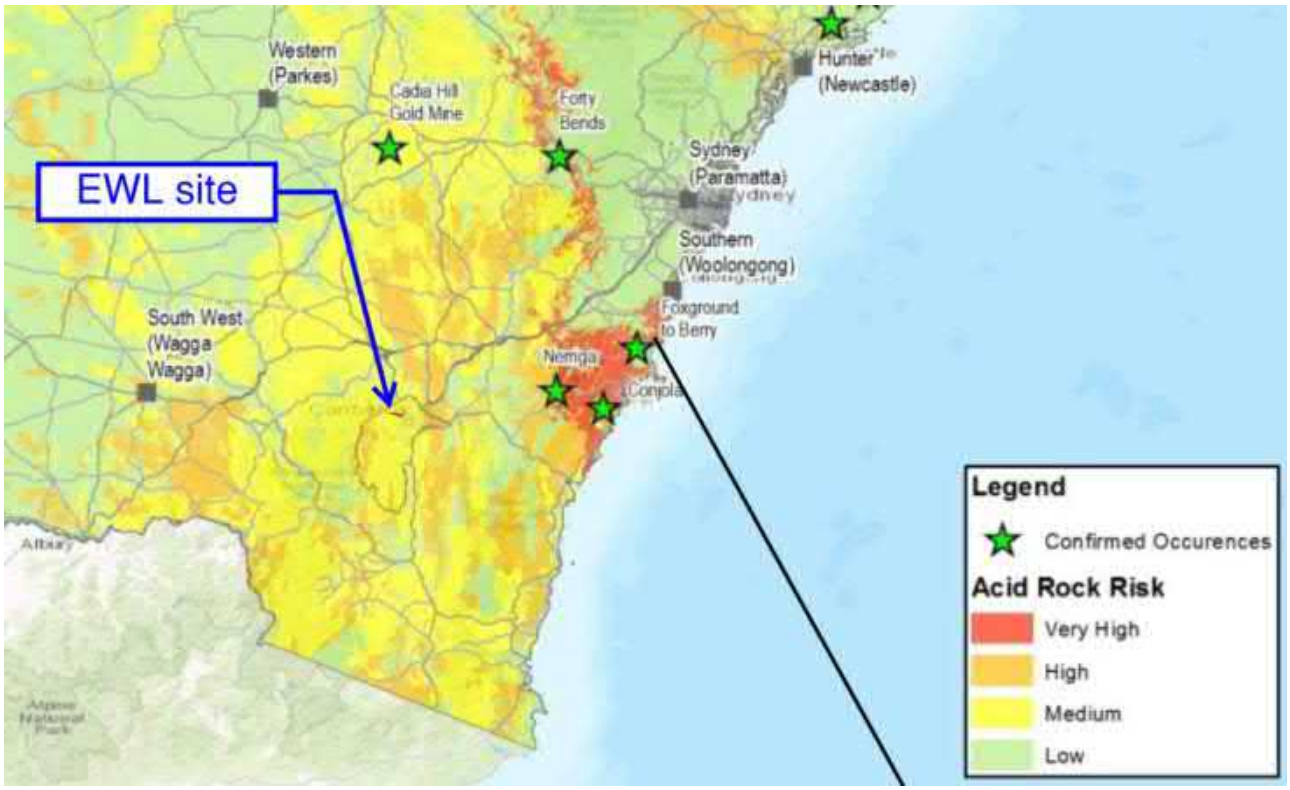

Figure 2-4 ASR Risk Map for NSW (RMS, 2017)

The East West Arterial is noted as Medium to High Risk of Acid Sulfate Rock in a recent paper (2017) by the NSW Roads and Maritime Services (RMS). This mapping provides a coarse guide of the general risk of acid sulfate rock in the area based on geological mapping.

The potential for Acid Sulfate Rock should be recognised as a potential engineering constraint. Further testing of the presence of ASR and potentially management of ASR during design and construction is recommended.

2.6 Groundwater

One groundwater well was observed within the alignment towards the western end of the project site (around 150m from John Gorton Drive). The well was constructed within a creek line area; however no water was flowing within the creek at the time of the site visit. The standing groundwater level within the well was recorded at several metres below ground level.

The lowest level for the regional groundwater table would be expected to be broadly defined by the Molonglo River level, and all groundwater should be shallower than these levels.

Most areas of the site are relatively elevated above the Molonglo River valley floor. Along areas of creek lines/gullies in most areas of the site, groundwater would be expected at around 3m to 10m below ground level. It is assessed that in areas remote from creeklines/gully areas (and in areas located away from this single well seen onsite) that groundwater would be encountered at significantly deeper depths.

During times of high rainfall, groundwater levels can rise significantly and may remain elevated for some time before dropping to a more seasonally average level.

2.7 Review of Previous Reports

2.7.1.1 Coffey Geosciences (2005)

We note that only the report text, Figure 6 and Appendix A were made available to SMEC. Figures 1 to 5B, were not available and did not inform this preliminary desktop review.

The assessment was carried out for ACT Planning and Land Authority (ACTPLA) within a parcel of land approximately 25km^2 in area, primarily to identify broad geotechnical and contamination constraints. The site of the proposed Molonglo East-West Arterial Road is part of the broad study area.

The report suggests that the majority of the study area was used for grazing purposes with mainly grassy paddocks and rocky outcrops. A preliminary assessment of potential geotechnical issues was undertaken and based on a review of information supplied by ACTPLA, and observations from a site walkover. Several areas of geotechnical concern were identified across the Coffey study area.

The report noted significant erosion potential of soils throughout the area, high to very high strength rock at or near the surface and variable depth of colluvium in gullies.

2.7.1.2 Indesco and Douglas Partners (2014)

Douglas Partners Report 2014 was included as part of an overall Indesco report. The Douglas Partners test pits indicate a depth of soil from 0.2-1.8m in the south-eastern part of the site (between the Tuggeranong Parkway and the Molonglo River) where the test pits were located.

The Indesco report also reported, potential for temporary erosion during construction due to steep grades, unsuitable soils in the form of silty sandy soils and disturbed forestry soils and very shallow very high strength bedrock.

2.8 Aerial Photos

Aerial photographs available through Google Earth Pro and ACTmapi dated 1955 and various between 2004 and 2019 were viewed for this assessment. Viewing of other older historical photos was not part of the current scope.

The photographs viewed generally indicated that the site appeared to be predominantly grassed rural land with forestry plantation in the east and bisected by the Molonglo River. Surrounding land use appeared similar to the present time.

The aerial photograph review noted some features which were then specifically checked during the site observations and described in the Section below. The only relevant feature observed in the older aerial photographs that was not captured by the site observations was the presence of a former rural residence in the western end of the site which is no longer present (refer to Figure F003C – Appendix B – Geotechnical). The residence appears to have been demolished sometime between 2012 and 2013 at the time of John Gorton Drive road construction work. The residence and nearby associated structures (sheds) appear to have been located on or on the verge of what is now John Gorton Drive. A fenced area associated with the former residence extended into the site and may have been used for some agricultural use but is not known. This former residence is shown in Figure 4 – AEC's contained in Appendix C.

2.9 Site Observations

Site observations were made by a Principal Geotechnical Engineer from SMEC on 26 February 2020 at selected areas of the site as described earlier in Section 3.4. In addition to the information provided in Section 3.4, the following is noted specifically with respect to site land use. Relevant features shown in Figure F002 and selected photographs in Appendix B - Geotechnical (Photograph locations are shown in Figure F003 A to C in Appendix B – Geotechnical):

- The site is predominantly grassed rural land with forestry plantation in the east and is bisected by the Molonglo River
- East of the Molonglo River
  - This part of the site is mostly dominated by forestry plantation with the remainder being grassed rural land
  - An area of mulch stockpiles assumed to be associated with forestry is in the south-eastern corner of the site (AGC_1.4_ATT28_Photo_1)

  - A sewer vent associated with underground sewer infrastructure was evident in this part of the site. The sewer tunnel is located underground south of the vent and two underground pipelines are noted north of the vent.
  - An area of fill material was inferred near the eastern site boundary beneath Tuggeranong Parkway (possibly up to 4m thickness) and likely to be fill for the road formation (Photo AGC _1.5_ATT13_Photo_1)
  - An area of fill material was inferred in the north-western part of this part of the site, covering an area of up to about 2.5 ha. From the geotechnical data presented earlier, this appears to be a spoil dump from sewer tunnel excavations. Some foreign materials were observed protruding from the spoil comprising coarse cobbles, boulders, some scrap metal and concrete (Photos for AGC_1.3 and Site 4, 5 and 25)
  - Several unsealed access tracks were evident in this part of the site, apparently associated with the neighbouring forestry areas.
- West of the Molonglo River
  - Most of this area comprised rural grassed areas with some unsealed access tracks
  - A square fenced zone was observed in the central part of this area. Some stone work was evident on the ground surface which appeared to potentially be associated with a former historical structure. (Geotechnical photos for AGC_2.3, 2.4 in Appendix B - Geotechnical)
  - A small dry farm dam was located north-west of the square fenced area (Geotechnical photos for AGC_2.2)
  - A disturbed area of tree planting was observed in the central southern part of this area (Geotechnical Photo no_ATT18_photo_1)
  - Disturbed ground was observed at the western end of the site, associated with previous earthworks including a mounded soil stockpile (Geotechnical Photos for AGC 1.1 and Site 9 in Appendix B-Geotechnical).

2.10 Areas of Geotechnical Concern

Based on the provided background data, site mapping and scope of work commissioned, several Areas of Geotechnical Concern (AGCs) have been identified for the site. We note that these AGCs are designed to focus the reader and designer on the more important site issues for road design. The work has been carried out for feasibility assessment of road corridor purposes, and not for other works such as for housing subdivisions or the like.

Table 2-1 below summarises our description of the relevant AGCs, and the Geotechnical Figures in Appendix B show the location of the AGCs visually. These areas of geotechnical concern have the potential to impact adversely on design and construction of the proposed road.

Table 2-1 Summary of identified Areas of Geotechnical Concern, AGCs

No.	AGC	Comments
AGC1.1	Fill mound at the western end of site boundary	Fill appears mostly reworked natural soil, gravelly clay, mound 2m high
AGC1.2	3x Fill mounds	3x Fill mounds with no obvious man-made materials – consisting primarily of dacite cobbles and boulders in a clayey sand matrix
AGC1.3	Filled Terrain – Sewer Tunnel Filled area	Fill up to 3m thick, angular gravel and cobble of dacite in a silty matrix. Sewer Tunnel spoil fill, coarse cobbles, boulders up to 0.4m diameter, with some scrap metal and concrete visible in creek gully
AGC1.4	Area of Mulch piles	Mounds of Mulch vary across AGC1.4 – the height of these mounds varies from 1.5m up to 4m in some areas. The mounds are in the Eastern Part of the site, close to the Tuggeranong Parkway and are likely associated with forestry practises.
AGC1.5	Fill area on Tuggeranong Parkway	Located on the far South-east of the Site; the Tuggeranong Parkway has a fill embankment of up to approximately 4m thick.
AGC2.1	Farm Dam	Farm Dam located on the Western side of the site near John Gorton Drive
AGC2.2	Old farm dam	Dry farm dam, depth of excavation less than 1m BGL, filled dam wall less than 1m high
AGC2.3	Fenced area, potential former historical residence location	The same as AEC 3.1; Fenced area, likely a former house block location. Several non-native trees present with old drystone blockwork of a possible house in the south-eastern corner
AGC2.4	Old House location	Location of historic house - Drystone footings observed - 70m^2 area of a house footprint
AGC2.5	Cut along Tuggeranong Parkway	Earthworks cut along the Tuggeranong Parkway alignment to 5m below natural ground level, along the far eastern boundary of the site.
AGC2.6	Disturbed terrain within Pine Forestry Area	Pine Forest: dense pine trees evident, disturbed terrain during planting and logging activities. Forestry operation and logging roads evident in this area.
AGC2.7	Disturbed terrain	Disturbed area of ground from previous earthworks and construction of John Gorton Drive
AGC2.8	Dam	Farm Dam located on the north-west site boundary. Shallow earthworks cut and fill associated with its construction.
AGC3.1	Underground Sewer Tunnel	Approximate location of Underground Sewer Tunnel and pipeline alignment, approx. Tunnel diameter 2m
AGC3.2	Underground Sewer Tunnel	Approximate location of Sewer Pipeline alignment, approx. Pipeline diameter 2m – connects to sewer tunnel of AGC3.1

No.	AGC	Comments
AGC3.3	Underground Sewer Tunnel	Approximate location of Sewer Pipeline alignment, connects to sewer tunnel of AGC3.1
AGC4.1	Steep Slopes adjacent to the Molonglo River	Steep slopes and areas located to the west and north-west of Molonglo River Valley. These steep slopes pose increased potential for landslide risk
AGC5.1	Gully erosion in the creek line	Erosion is evident in a creek line to the east of the underground sewer tunnel (AGC3.1). This creek line is south of the main access track. Some concrete was also noted within the floor of the creek
AGC5.2	Gully erosion in the creek line	Erosion is evident in a creek line near the western extent of the site.
AGC6.1	River bank alluvial deposits	Alluvial deposits, west side of Molonglo River; estimated to be several metres thick, containing rounded cobbles and boulders in a sandy clay matrix
AGC6.2	River bank alluvial deposits	Alluvial deposits, east of the Molonglo River; estimated to be several metres thick, possibly containing rounded cobbles and boulders in a sandy clay matrix

Notes:

- The location of all services such as sewer tunnels and pipelines has not been marked accurately in this desk study. These locations should be checked for accuracy based on as built data and will need ground truthing in future.

2.11 Comments on Bridge Construction over the Molonglo River

The Molonglo River bridge proposed at this site will encounter alluvial deposits, overlying weathered rock. The alluvial deposits are inferred to be about 5m to 10m thick and weathered rock is inferred to be present at relatively shallow depths on either side of the river. In many areas weathered rock was noted exposed in the river floor area. This is considered likely beneficial for bridge footings as footings will likely not be required to extend to significant depths. It is possible that pad footings may be possible on the western abutment, however extensions of footings via piles founding in weathered rock is likely on the eastern abutment.

Calcareous shale and limestone is mapped in the vicinity of the bridge footing area. The presence of solution cavities (ie. Small caves) underneath the bridge footings is possible and should be checked through cored boreholes beneath footing areas.

The bridge is also located along a mapped fault line. The fault is mapped as being translated in both the strike-slip and dip-slip orientations. Whilst rock is likely located at relatively shallow depths on both bridge abutments, the rock types, weathering and strength of the rock on the eastern and western abutments will likely vary significantly.

2.12 Conclusions

Based on the results of this assessment, 6 potential areas of general geotechnical concern were identified:

- AGC1 – Areas of general filling, containing fill of various quality with some deleterious materials particularly AGC1.3 (tunnel spoil fill) and AGC1.4 (large mulch piles)
- AGC2 – Earthwork cuts and disturbed terrain associated with human activities across the site (Dam earthworks, roadworks, forestry activities and former dwellings)
- AGC3 – Underground sewer tunnels in the middle of the site -potential shallow clearance to tunnels roof and associated instability of ground surrounding tunnels
- AGC4 – Steep slopes on the western slopes of the Molonglo River Gorge and associated increased risk of landslide and instability.
- AGC5 – Gully erosion – observed in two drainage lines indicates an increased risk of erosion in these areas.
- AGC6 – Alluvial deposits along the banks of the Molonglo river, primarily on the Eastern bank and inside bank at the tight left-hand river curve at the north of the site.

The primary areas of geotechnical concern are the underground sewer tunnel (AGC3), tunnel spoil fill (ACG1.3) and the steep slopes on the western bank of the Molonglo (AGC4). The underground sewer tunnels (AGC3) pose several geotechnical risks including potential collapse of the tunnel, ground subsidence and constraints to earthworks. It is recommended that the exact locations, depths, construction details and conditions of the tunnels be assessed prior to development of the site.

The filled terrain of ACG1.3 carries several risks including the varying condition of fill, depth, groundwater interaction and general settlement for overlying engineered structures founding on unremediated fill. Further investigations of the extent and condition of the fill is recommended. The steep slopes of the western bank of the Molonglo river (AGC4) are a geotechnical risk to the construction of the East West Arterial. These slopes have an increased risk of landslide and instability which will need to be considered in the development of the East West Arterial project.

Further assessment of the identified primary risks and the impacts of the other AGC's is highly recommended prior to development of the East West Arterial. We recommend that further site history information be reviewed, and a preliminary site investigation be undertaken to provide further details of but not limited to:

- Site History, including detailed location of services onsite
- Review of additional previous reports (if available and carried out by entities different to those provided to SMEC)
- Assessment of depth and condition of topsoil, the soil profile and rock across the site through intrusive site investigation
- Assessment of landslide risk for the Molonglo River Valley area
- Construction and condition details of the underground sewer tunnels
- Condition and extent of the Filled Terrain at AGC 1.3

- Condition and extent of Alluvial deposits along the Molonglo river bank
- Condition and properties of the disturbed terrain in and around the forestry region to the south of the site.
- Testing of rock strata for:
  - the potential of Acid Sulfate Rock, for areas of cuts onsite
  - Solution Cavities/Limestone, particularly for the Molonglo Bridge Footing area
- Specific geotechnical information for the bridge to be constructed over the Molonglo River Valley

Based on the results of the additional data, information required for a Detailed Site Investigation can then be assessed as the road design develops.

3 Planning and Environmental Assessment

3.1 Planning Considerations

A broad policy review was undertaken to understand the current statutory and strategic planning framework supporting development in the Molonglo Valley. Documents reviewed include:

- Planning and Development Act 2007
- Territory Plan 2008
- National Capital Plan
- The Molonglo Valley Plan for the Protection of Matters of National Environmental Significance (NES Plan)
- The Molonglo Draft Strategic Assessment Report and Supplementary Assessment Report
- Molonglo Valley Stage 3 Planning and Design Framework
- Section 211 EIS Exemption for Molonglo Valley Stage 3

It is understood that current land zonings under the Territory Plan will be reviewed to accommodate the residential and town centre development planned in Molonglo 3 and that this would designate a road reserve for the East West Arterial road.

As shown in Figure 3-1, current zonings within the study area are CZ1 Commercial Core, CF Community Facilities, RZ5 High Density Residential, RZ4 Medium Density Residential, TSZ1 Transport, NUZ4 River Corridor, RZ1 Suburban, RZ3 Urban Residential, CZ4 Local Centre and PRZ1 Urban Open Space. Much of the Study Area is located within the Molonglo Strategic Assessment Area under the NES Plan and is covered by the Future Urban Areas (FUA) overlay. As discussed in detail in Section 3.2 below, the NES Plan makes provision for offsetting of impacts to threatened species vegetation and habitat areas listed under the EPBC Act as a result of anticipated future infrastructure and roads.

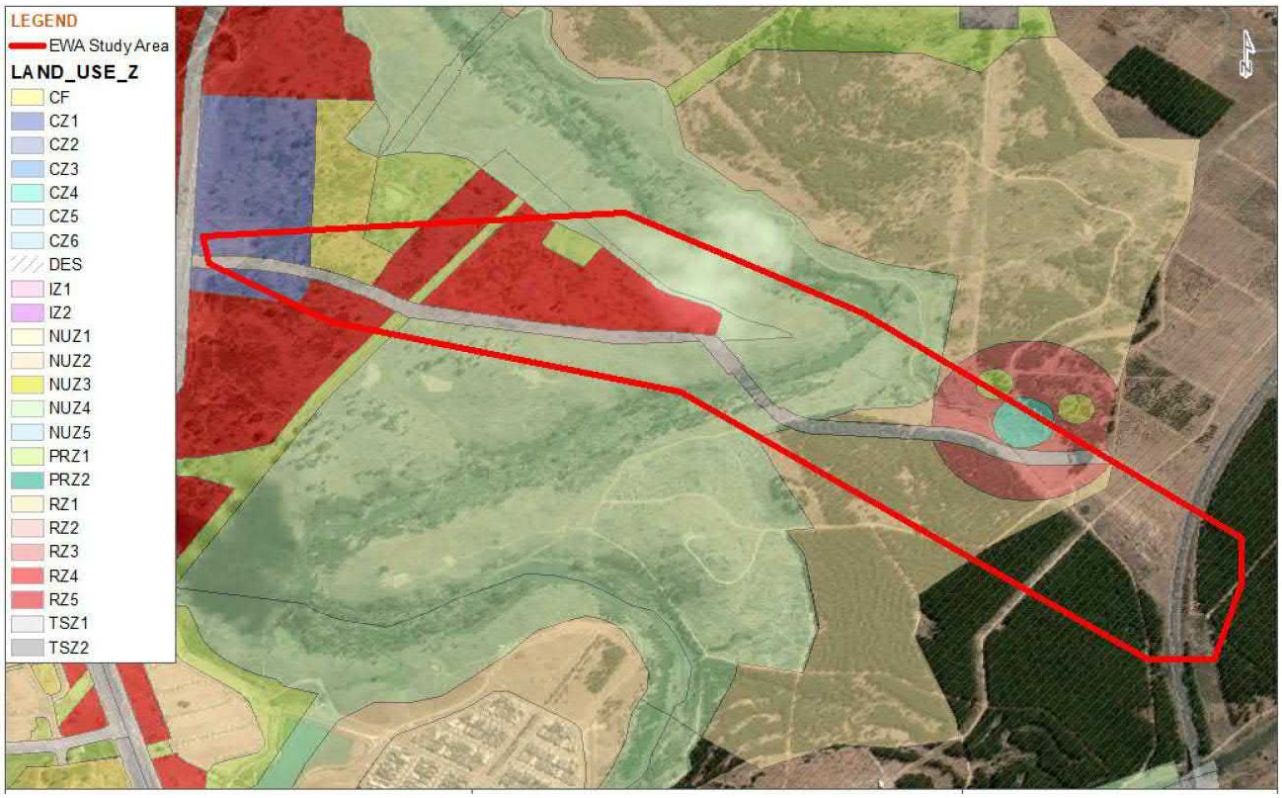

Figure 3-1 Current zoning across the study area under the Territory Plan (source: ACTmapi)

It is noted that land to the east of the Study Area comprises a Designated Area and works in this portion of the site would require NCA Approval under the National Capital Plan. This land is not within the Molonglo Strategic Assessment Area, and as such, the provisions of the EPBC Act would apply to future development. Figure 3-1 provides the extent of the Molonglo Strategic Assessment Area (covered by the NES Plan) and the area of offsets in the Molonglo River Reserve.

Figure 3-2 The Molonglo Strategic Assessment Area and Molonglo River Reserve, an offset under the NES Plan.

The EIS exemption approved for Molonglo Valley Stage 3 makes provision for the construction of a bridge over the Molonglo River. As such, it is reasonable to assume that the appropriate planning pathway for the future bridge would be a Development Application in the Impact Track, with a concurrent NCA Works Approval for development in Designated Areas.

3.2 Ecological Investigation

SMEC Ecologists undertook a desktop review of existing vegetation mapping and habitat assessment, noting considerable ecological survey work had already been undertaken in the NES Plan and more recent Audit Reports. SMEC Ecologists undertook ground truthing fieldwork on 28 February 2020 to confirm mapped communities within the Molonglo Strategic Area and to understand site conditions in the area to the east of the Study Area which is not covered by the NES Plan.

3.2.1 Study Area within the Molonglo Strategic Assessment Area

As previously discussed, most of the study area is contained within the Molonglo River Reserve (i.e. an offset area under the NES Plan) or in the Strategic Assessment Area covered by the NES Plan. The NES Plan follows the environmental planning principles of avoid, minimise, mitigate; however, does expect some degree of impact will be unavoidable in the area and sets appropriate budgets.

The portion of the study area within the Strategic Assessment Area includes threatened woodland (Blakely's Red Gum Yellow Box Grassy Woodland, a threatened ecological community (TEC) under the EPBC Act and the NC Act), areas of Natural Temperate Grasslands (also a recognised TEC), habitat for Pink Tailed worm lizard (vulnerable under EPBC and NC Act) and Perunga Grasshopper (vulnerable under NC Act). There is evidence of recent plantings in the threatened woodland area toward the southern extent of the study area, west of the river reserve.

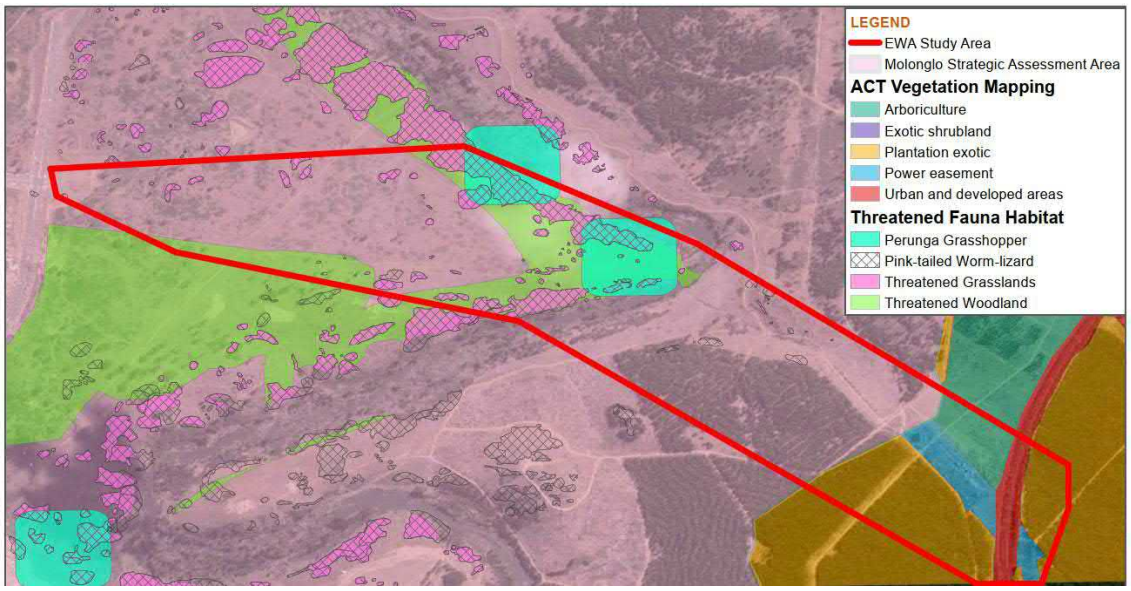

Figure 3-3 Summary of vegetation types and threatened fauna habitat identified in desktop assessment

3.2.2 Study Area east of the Strategic Assessment Area

The portion of the study area to the east of the area covered by the NES Plan predominately contains infrastructure and areas of pine forest plantation. These areas were not identified as ecologically sensitive in the desktop assessment or ground truthing exercise. A summary of the study is as follows:

- Existing vegetation mapping found to be accurate
- Further detailed vegetation plots would be required when preparing a DA to confirm the clearance footprint and contribution toward allowances made in the NES Plan
- The NES Plan covers offsetting for the following EPBC Listed species:
  - Box gum woodland
  - Natural temperate grassland
  - Pink-tailed worm lizard
  - Superb parrot
  - Swift parrot
- There were no additional ACT or EPBC listed species identified within the Strategic Assessment Area.

3.3 Heritage Assessment

SMEC engaged Cultural Heritage Management Australia (CHMA) to undertake a desktop review of the various heritage studies undertaken in the study area and to provide advice on the adequacy of the existing studies for use in identifying an alignment for the EWA. The following documents were considered in the desktop review:

- Molonglo River Corridor Cultural Heritage Assessment and CMP: Priority Area (CHMA, 2013)
- Molonglo River Corridor CHA and Conservation Management Plan in association with Molonglo River Corridor CHA and CMP Summary Working Document – Heritage Council Advice 2013
- Molonglo Commercial Centre Heritage PAD 1 Boundary Letter Report (CHMA, 2019)
- Molonglo 2 Commercial Centre - Heritage Council Advice Feb 2019
- Molonglo River Corridor Cultural Heritage Assessment and CMP Summary Working Document (CHMA, 2013)
- Molonglo River Corridor Heritage Advice 2013
- Molonglo Stage 3 Future Urban Release: Sub Surface testing report and further studies (Biosis, 2013)
- Molonglo Stage 3 Future Urban Release: Sub Surface testing report and further studies Heritage Council Advice 2013
- Decision not to provisionally register Coppin Homestead Site – ACT Heritage Council 2016
- Molonglo Stage 2: Detailed Heritage Assessment (Biosis, 2010)

The CHMA desktop review concluded that a number of heritage studies have been undertaken and that the whole study area for this project has been covered by survey work completed in the last ten years. Many scatters and isolated artefacts uncovered in previous survey efforts have been salvaged. Due to the artefact density of PAD 1 (located on the western bank of the Molonglo River, within the Study Area), it was recommended by the ACT Heritage Council that this area be conserved.

The following figures provide the extent of existing cultural heritage survey work, the location of previously recorded sites and the location of established PAD sites (note, the ACT Heritage Council has confirmed that this information is not suitable for public exhibition).

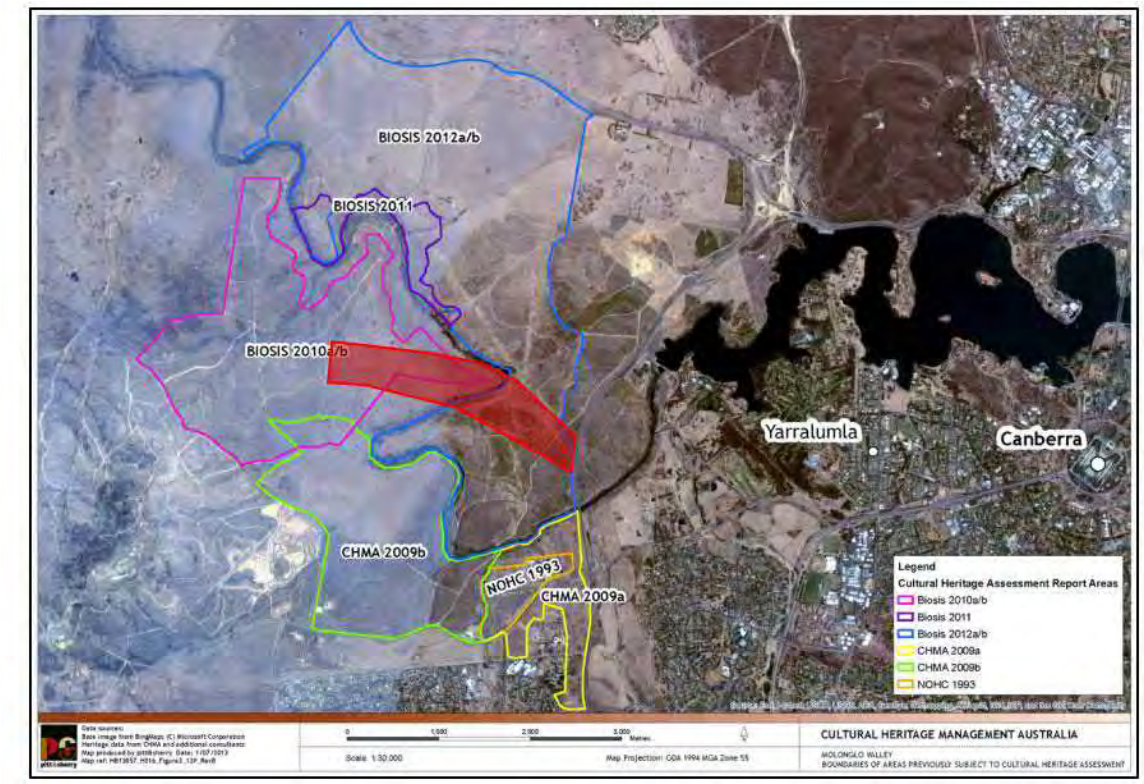

Figure 3-4 Locations and dates of previous cultural heritage investigations undertaken in the Molonglo Valley

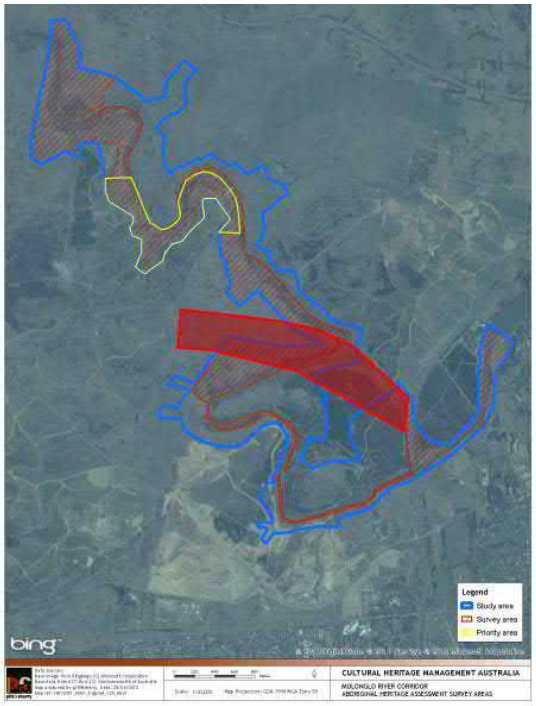

Figure 3-5 CHMA completed a gap analysis and undertook remaining survey (red hatched area) during 2013

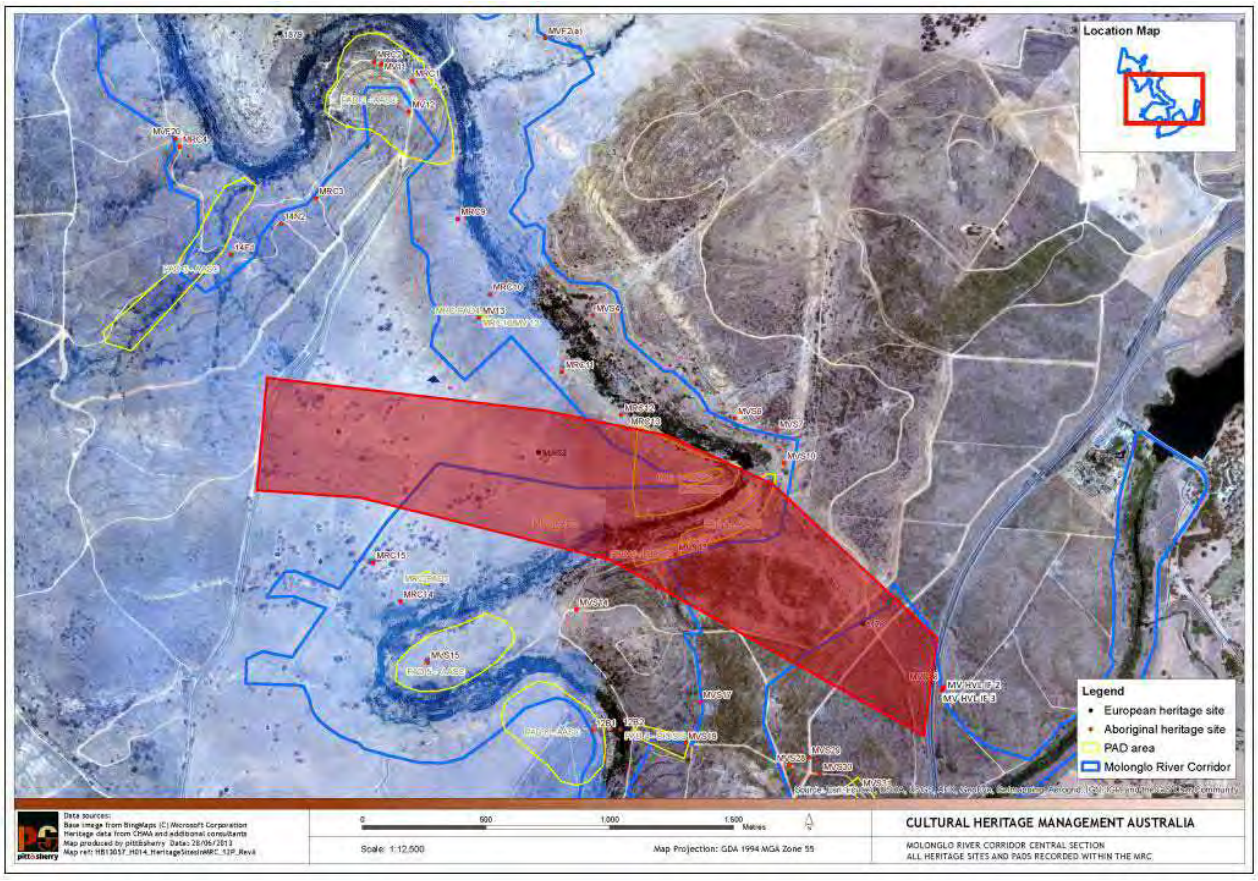

Figure 3-6 Previously recorded heritage findings within the study area and PAD sites established in previous surveys

Figure 3-7 Testpit locations within PAD 1 undertaken by CHMA in 2013. Red sites indicate where artefacts were recovered and show a greater density of finds toward the east of PAD 1.

The Site of PAD 1 was originally classified as having high archaeological potential through predicative modelling undertaken by AASC in 2006. A sub-surface testing program was undertaken by BIOSIS in 2010 however did not result in the identification of any cultural heritage material. However, when the site was revisited by CHMA in 2013, the extent of the PAD was enlarged as the modelling undertaken at the time identified "moderate to high densities of artefacts were anticipated resulting in an assessment of high archaeological sensitivity" (CHMA, 2020). A test-pitting program was subsequently undertaken, resulting in [redacted] As shown in Figure 3-7, the [redacted] on the [redacted] on the slopes of the Molonglo River. Analysis of the artefacts indicated the area was likely to have been repeatedly visited by Aboriginal people and was most likely a regular overnight camping area.

Further work was completed by CHMA in 2019, which assessed impacts associated with the proposed Molonglo 2 Commercial Centre. As part of this scope, contact was made with ACT Heritage Office and via email the following advice was provided (2 January 2019):

- *With the exception of PAD1, all Aboriginal places previously recorded within the study area have been salvaged in accordance with existing legislation and no longer have any outstanding heritage requirements.*
- *PAD1 has been subject to archaeological investigation and determined to be of high heritage significance and conservation value; requiring it to be conserved in open space indefinitely.*
- *A detailed review of the boundaries of both the PAD and the proposed area of impact for the Molonglo 2 commercial area to ensure that PAD 1 will not be impacted by any planned works.*
- *Management controls to ensure PAD1 is not inadvertently impacted by future works should also be described in the future development application for the Molonglo 2 commercial centre.*

This advice is relevant to the EWA project and the options consideration, as the bridge will likely pass through the registered PAD 1 boundary. In order to ensure the MCA process was as robust as possible, advice was sought from the ACT Heritage Office to confirm the extent of impact to PAD 1 that would be considered acceptable and an approach seeking to avoid and minimise impacts on the most-dense areas of artefacts was adopted. Figure 3-8 provides the registered extent of PAD 1 relative to the EWA Study Area.

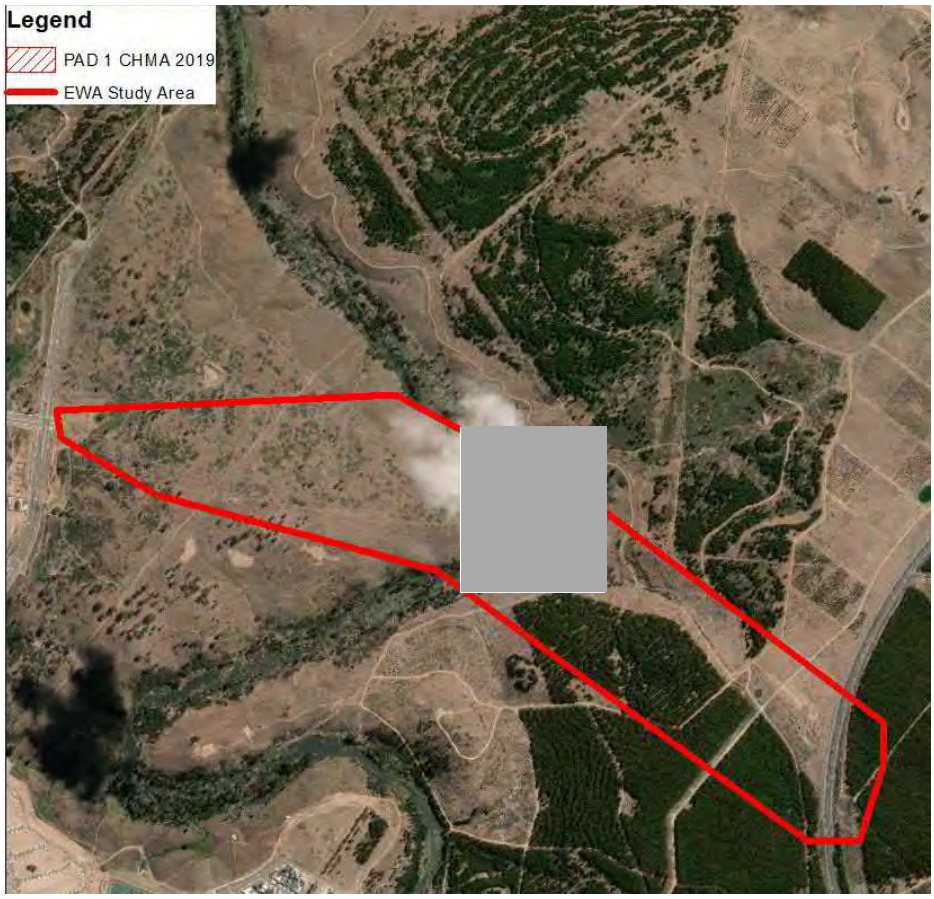

Figure 3-8 PAD 1 relative to the study area of the East West Arterial

3.4 Contamination Assessment

3.4.1 Objectives and Scope

The objectives of the contamination assessment were to:

- Assess at a preliminary level, potential contamination constraints for the site of road options based on a limited desktop review and site observations
- Provide recommendations on the need for further investigations at later stages of the project.

The scope of work carried out included:

- Review of relevant sections of previous reports made available to SMEC
- Review of aerial photographs available online (1955, 2004 to 2019)
- Site observations from selected areas of the site by an experienced Principal Engineer.

3.4.2 Site Condition and Surrounding Environment

Site conditions (geology, hydrology, hydrogeology) are discussed in Section 2.

3.4.3 Previous Reports

The following reports were made available to SMEC which had some relevance to site contamination within the study area:

- Coffey Geosciences (2005) Molonglo Valley, Preliminary Geotechnical and Contamination Constraints Study (Ref: C7742/1-AC)
- AECOM (2013) Phase 2 Environmental Site Assessment, Molonglo Stage 2, MV2-C4 (Ref: 60273858_MV2-C4_RPE_FINAL_25012013)

A summary of the relevant information from the reports is provided in the sections below.

3.4.3.1 Coffey Geosciences (2005)

We note that only the report text, Figure 6 and Appendix A were made available. Figures 1 to 5B, were not available and did not inform this preliminary desktop review.

The assessment was carried out for ACTPLA of a parcel of land approximately 25km^2 in area primarily to identify broad geotechnical and contamination constraints. The site of the proposed Molonglo East-West Arterial Road is part of the broader study area.

The report suggests that most of the study area was used for grazing purposes with mainly grassy paddocks and rocky outcrops. A preliminary assessment of potential contaminated land issues was undertaken and based on a review of information supplied by ACTPLA, contaminated land searches by Environment ACT and observations from a site walkover. Various areas of environmental concern were identified across the Coffey study area.

Forestry plantation areas within the Coffey study area were noted as an area of environmental concern from potential chemical sprays. Figure 6 of the Coffey report does not clearly show the location of these areas, but may fall into the site as these are known to be present in the south eastern portion of the site within historic aerial and current site observations. The contaminants of concern listed by Coffey associated with this potential contamination activity were:

- heavy metals (arsenic, cadmium, chromium, copper, lead, nickel, and zinc)
- organochlorine pesticides (OCP)
- organophosphate pesticides (OPP)
- triazine herbicides (inclusive of atrazine).

The report stated that ACT Forest indicated that herbicide triazine had been used at a rate of 10L per ha per application event. Coffey undertook limited soil sampling using composite samples from 30 locations for the above contaminants and no exceedances above the adopted (composite modified) assessment criteria were identified. The assessment Criteria were based on the version of the National Environmental Protection Measure's Health Investigation Levels and Ecological Investigation Levels.

No other areas of environmental concern were specifically shown to fall within or near the site as represented in Figure 6 of the Coffey report.

In summary, the report concluded that:

- The assessment was preliminary in nature and recommended further historical searches, along with investigation of the identified areas of environmental concern in a Phase 2 contamination assessment
- The identified areas of environmental concern should be able to be remediated if required and it was therefore assessed that they do not pose a significant constraint to development planning, although there may be moderate costs incurred for the remediation.

3.4.3.2 AECOM 2013

This assessment was carried out for Land Development Agency (LDA) for a parcel of land identified as MV2-C4 comprising 51 ha in the Molonglo Stage 2 development. This land was proposed to be developed for residential use. The western portion of the site (approximately a 150m section) formed part of the study area assessed by AECOM.

The report identified areas of environmental concern to include a farm house, shed infrastructure, septic tank and nearby 'illegal dump' which were observed on 2004 aerial photograph in the western end of the site (refer to Figure 4, Appendix C). One farm dam was listed as an area of environmental concern and was just south of the site boundary.

In 2013, targeted soil sampling appears to have been carried out by AECOM in the area of the former house and associated features from twenty-five (25) sample locations. Several soil sampling locations were relatively shallow (less than 1m) and extended into natural soils. Two boreholes in the 'illegal dump' were extended to 10m through rock. It was noted that at the time of sampling the house and structures had been removed (excluding the septic tank). Selected samples were analysed for a range of potential contaminants of concern, including:

- Total Petroleum Hydrocarbons (TPH)
- Benzene, toluene, ethylbenzene, xylene (BTEX)
- Metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc)
- Organochlorine pesticides (OPP)
- Organophosphate pesticides (OPP)
- Polycyclic aromatic hydrocarbons (PAH)
- Polychlorinated biphenyl's (PCB)
- Phenols
- Asbestos
- Nitrogen
- Faecal coliforms

Asbestos containing material was not observed during the fieldwork. Groundwater was not encountered within the depth of the investigation, up to 10m in two boreholes. Where fill materials were encountered, these predominantly comprised re-worked natural soils to an average depth of 0.2 m. The fill material was described to contain some minor amounts of brick, wood and metal.

One lead concentration in the illegal dump recorded an exceedance of the adopted sensitive residential criteria. Some metal concentrations exceeded background ranges and ecological investigation levels.

AECOM concluded the house area would be suitable for the proposed road or residential development following site remediation and validation works. Reference was made to a AECOM (2013) Remediation Works Plan, however this document has not been made available.

The report refers to an earlier AECOM Phase 1 report and sampling plan, both of which have not been made available, but are briefly summarised. Areas of environmental concern referenced in the report are difficult to relate to the site as they are not fully described and require reference to the previous reports which are not made available.

3.4.4 Aerial Photographs

Aerial photographs available through Google Earth Pro and ACTmapi dated 1955 and various between 2004 and 2019 were viewed for this assessment. Viewing of other older historical photos was not part of the current scope.

The photographs viewed generally indicated that the site appeared to be predominantly grassed rural land with forestry plantation in the east and bisected by the Molonglo River. Surrounding land use appeared similar.

The aerial photograph review noted some features which were then specifically checked during the site observations and described below. The only relevant feature observed in the older aerial photographs that was not captured by the site observations was the presence of a former rural residence in the western end of the site which is no longer present (refer to Figure 4, Appendix C). The residence appears to have been demolished sometime between 2012 and 2013 at the time of John Gorton Drive road construction work. The residence and nearby associated structures (sheds) appear to have been located on or on the verge of what is now John Gorton Drive. A fenced area associated with the former residence extended into the site and may have been used for some agricultural use but is not known. This former residence is shown in Figure 4, Appendix C.

3.4.5 Site Observations

Site observations were made by SMEC on 26 February 2020 at selected areas of the site as described earlier in Section 2.9. In addition to the information provided in Section 2.9, the following is noted specifically with respect to site land use. Relevant features shown in selected photographs in Appendix C (Photograph locations are shown in Figure 2 of Appendix C):

- The site is predominantly grassed rural land with forestry plantation in the east and bisected by the Molonglo River
- East of the Molonglo River
  - This part of the site is mostly dominated by forestry plantation with the remainder being grassed rural land
  - An area of mulch stockpiles assumed to be associated with forestry is located in the north-eastern corner of the site (Photo AGC1.4_ATT28_Photo 1 and AGC1.4_ATT31_Photo2)
  - A sewer vent associated with an underground sewer tunnel was evident in this part of the site
  - An area of fill material was inferred near the eastern site boundary beneath Tuggeranong Parkway (possibly up to 4m thickness) and likely to be construction fill (Photo AGC1.5_ATT13_ – Photo 1)
  - An area of fill material was inferred in the north-western part of this part of the site, covering an area of about 2.5 ha. From the geotechnical data presented earlier, this appears to be a spoil dump from sewer tunnel excavations. Some foreign materials were observed protruding from the spoil coarse cobbles, boulders, some scrap metal and concrete (Photos for AGC_1.3_ATT25_Photo1 and AGC1.3_ATT27_Photo8)
  - Several unsealed access tracks were evident in this part of the site, apparently associated with the neighbouring forestry areas.
- West of the Molonglo River
  - Most of this area was rural grassed areas with some unsealed access tracks
  - A fenced zone was observed in the central part of this area. Some stone work was evident on the ground surface which appeared to potentially be associated with a former historical structure. (Photo AGC2.3_ATT44_Photo2, AGC2.3_ATT16_Photo3 and AGC2.3_ATT29_Photo4)
  - A small dry farm dam was located north-west of the fenced area (Photo AGC2.2_ATT24_Photo2 andAGC2.2_ATT39_Photo1)
  - A disturbed area of tree planting was observed in the central southern part of this area (Photo no_ATT18_Photo 1)
  - Disturbed ground was observed at the western end of the site, associated with previous earthworks including a mounded soil stockpile (Photo AGC1.1_ATT14_Photo 1)
  - Some signage was observed at the site suggesting that herbicide spraying for blackberry weed has occurred.

3.4.6 Potential Contamination Sources

Areas of Environmental Concern (AEC) and Contaminants of Potential Concern (CoPC) were assessed based on the limited information available to this study. Identified AEC and CoPC are summarised in Table 3-1 below. Figure 4, Appendix C shows the approximate locations of the identified AEC.

Table 3-1 Summary of identified AEC and CoPC

No.	AEC	Likelihood of Contamination	Media Potentially Affected	COPC	Comments
AEC1	Area near former rural residence (including nearby structures, septic tank and 'illegal dump', and currently existing fill mound)	Low-Moderate	Soil	TRH, BTEX, PAH, OCP, OPP, PCB, metals, asbestos, nutrients, faecal coliforms	Whilst previous sampling generally showed low levels of contamination with respect to a proposed road end use, it is not clear if further remedial and validation work has been carried out as stated in the AECOM report. Previous reports not made available in this assessment should be reviewed to assess if this area was adequately assessed. This area was also highly disturbed from the John Gorton Drive extension. The origin of the current fill mound is unknown.
AEC2	Fill soil stockpile of unknown origin and quality in western part of site	Low	Soil	TRH, BTEX, PAH, OCP, OPP, PCB, metals, asbestos	A soil stockpile was observed in an area near John Gorton Drive which may be left over material from recent earthworks, however the origin and quality of the material is currently not known. Other soil stockpiles are possible noting the preliminary site walkover observations were made.
AEC3	Disturbed area from earthworks (near John Gorton Drive)	Low	Soil	TRH, BTEX, PAH, OCP, OPP, PCB, metals, asbestos	This area appears disturbed from earthworks. This area could contain fill or may be affected depending on how works were carried out in AEC1.
AEC4	Possible former historical residence/structure	Low	Soil	Metals, asbestos, OCP, OPP	A fenced area was observed in the central part of the site west of the Molonglo river with trees and rock features suggestive of a possible former structure. Details of this structure are not known, including time of construction or demolition.
AEC5	Former farm dams	Low	Soil / surface water / dam sediment	Metals, OCP, OPP	Two relatively small farm dams are noted on the site. Dams can sometimes be sinks for contamination if present elsewhere on the site. Previous sampling by AECOM at other dams outside the site did not show contamination, therefore the potential for contamination is regarded as low.

No.	AEC	Likelihood of Contamination	Media Potentially Affected	COPC	Comments
AEC6	Former sewer tunnel spoil dump (east of Molonglo River)	Moderate	Soil	TRH, BTEX, PAH, OCP, OPP, PCB, metals, asbestos	While the majority of the spoil is likely to comprise virgin soil/rock from the excavation of the sewer tunnel, site observations noted evidence of anthropogenic inclusions suggesting that some waste may have been intermixed with this material.
AEC7	Potential fill at the eastern end of the site from construction of Tuggeranong Parkway	Low	Soil	TRH, BTEX, PAH, OCP, OPP, PCB, metals, asbestos	The origin of the fill is not known, but likely to be construction fill
AEC8	Forestry area (including mulch stockpile area)	Low - Moderate	Soil (and mulch)	Metals, OCP, OPP, triazine herbicides (inclusive of atrazine)	As identified in a previous report, forestry areas have the potential to have been sprayed with herbicides. Previous limited testing of broader forestry areas in a previous report (Coffey 2005) did not suggest widespread contamination.
AEC9	Areas of blackberry spraying	Low	Soil	Herbicides	The exact location of past spraying is not known but could be sporadic and possibly along river banks.

Notes:

- This is our qualitative assessment of likelihood of contamination being detected (low, moderate, high) from the data reviewed, not financial or other risk associated if contamination were to be detected
- TRH (Total Recoverable Hydrocarbons), BTEX (benzene, toluene, ethylbenzene, xylene), OCP (Organochlorine pesticides) , OPP (Organophosphate pesticides), PCB (polychlorinated biphenyl's), PAH, (Polycyclic aromatic Hydrocarbons), Metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc)

The potential contamination sources identified have the potential to impact human and ecological receptors during construction of the proposed road via various exposure pathways.

3.4.7 Conclusions

Based on the results of this assessment, nine potential areas of environmental concern and associated contamination sources were identified:

- AEC1 - Area near former rural residence (including nearby structures, septic tank and 'illegal dump')
- AEC2 - Fill soil stockpile of unknown origin and quality in western part of site
- AEC3 - Disturbed area from earthworks (near John Gorton Drive)
- AEC4 - Possible former historical residence/structure
- AEC5 - Former farm dams
- AEC6 - Former sewer tunnel spoil dump (east of Molonglo River)
- AEC7 - Potential fill at the eastern end of the site from construction of Tuggeranong Parkway
- AEC8 - Forestry area (including mulch stockpile area)
- AEC9 – Areas of blackberry spraying

The former tunnel spoil (AEC6) was assessed as having a moderate likelihood of contamination due to the observed evidence of anthropogenic inclusions which can suggest waste may have been intermixed with this material. Other AECs were qualitatively assessed to have a low likelihood of contamination.

These AECs should be regarded as potential contamination constraints and considered in the context of road option route selection.

To further assess the potential for contamination at the site and within the AECs, we recommend that further site history information be reviewed compliant with a Preliminary Site Investigation as per ASC NEPM (1999, amended 2013) and relevant ACT EPA guidelines, including (but not limited to):

- Historical aerial photographs
- Review of additional previous reports
- ACT EPA contamination records
- Dangerous substance search
- Plans/records held by ACT Government or other departments
- Interviews with relevant persons with knowledge of the site (including relevant agencies).

These searches may assist with closing data gaps.

Based on the results of the additional data, the need for and scope of a Detailed Site Investigation can then be assessed that would include intrusive site investigations to check for the presence of contamination in the relevant media. Whilst further assessment is recommended to reduce the likelihood of encountering contamination during construction, some AECs may be able to be managed through an unexpected finds procedure prepared as part of the Construction Environmental Management Plan.

4 Stakeholder Engagement

4.1 Government Stakeholders

Internal Territory Government stakeholders were consulted throughout the options assessment process. This engagement included participation in project Progress Meetings, issue specific meetings and workshops. A summary of the engagement activities undertaken during the options assessment process is provided in Table 4-1.

Table 4-1 Stakeholder consultation activities during options assessment process

Engagement Activity	Participants	Date	Details of Consultation
Progress Meetings	– EPSDD – IDPG – SMEC – TCCS	Ongoing - fortnightly	TCCS attended the majority of project Progress Meetings and were kept informed of transport planning issues associated with the EWA and other considerations relevant to impacts of the EWA on road network.
Preliminary Options Preparation Session	– EPSDD – IDPG – SMEC – TCCS	26 Feb 2020	This workshop was held to provide preliminary insight to the project team and TCCS of the form of likely options and issues and design constraints that were considered likely to affect the proposed options. Details of the session are provided in Appendix D
Agency Workshop	– EPSDD – IDPG – TCCS – PCS – Heritage Unit – National Arboretum – SLA – Icon Water – ACT ESA – SMEC	8 April 2020	The agency workshop was undertaken to provide insight into the project to all stakeholders that are likely to be impacted by the EWA. The session: – Introduced the project team – Provided background and justification for the project – Outlined the planning context for the project – Discussed the constraints that the project is subject to – Outlined transport and traffic considerations – Described the Options Assessment process Details of the session are provided in Appendix E.
MCA Workshop	Details of this workshop are provided in Section 11.		

4.2 Molonglo 3 East Planning Study

In parallel to the EWA Options assessment, EPSDD have engaged a separate consultant team to undertake a master planning exercise for the Molonglo 3 East (M3E) precinct. Whilst this separate study assesses considerations for the precinct that are outside the EWA corridor, there is a degree of interdependence between the two studies. As such, ongoing consultation has been undertaken with the M3E consultant team throughout the development of the project options.

5 Design Criteria

The following summarises some key elements of the design criteria that have been adopted to develop the design options

5.1 Design Standards

Relevant design standards have been referenced to ensure that the proposed options are compliant with the latest practice. The specific standard utilised is dependent on the design component but would include the following:

- Relevant Territory standards (Trunk Road Infrastructure Standards, the Estate Development Code)
- AUSTROADS design guides
- Australian Standard 5100 (Bridge Design Code) – 2017

5.2 Road Design

5.2.1 Cross Section

The following typical road cross sections have been developed for the options assessment process. They have been developed in consultation with TCCS and are common to all options considered. These cross sections incorporate the following features:

- 3.5 m paths for active travel (cycling and pedestrians) on road edge fronting development. East of the Molonglo Town Centre these are shared paths, however in the Town Centre the paths consist of:
  - 2 m dedicated cycle zone
  - 1.5 m dedicated pedestrian zone
- 3.5 m traffic lanes
- Allowance for streetlighting and landscape planting
- A zone for underground utilities
- Allowance for a 4m wide cycle highway east of the Molonglo Town Centre

The cross section varies along the length of the EWA depending on context of the road reserve (commercial, residential etc) and the anticipated vehicle demand.

5.2.1.1 Molonglo Town Centre (CH 0000 – 0700)

It is proposed to provide a low speed dual carriageway environment around the Town Centre at the western extent of the EWA (the proposed cross section in Figure 5-1). This approach has been adopted to:

- Cater for a higher volume of vehicle movements anticipated around the town centre
- Provide intersection capacity at the John Gorton Drive intersection signalised intersection
- Provide consistency with Holborow Ave (EWA west of John Gorton Drive)
- Provide a consistent cross section throughout the town centre
- Support the place function of the Molonglo Town Centre
- Enhance safety in the Town Centre (eliminate cross movements of the arterial and provide two stage crossings of the arterial road)

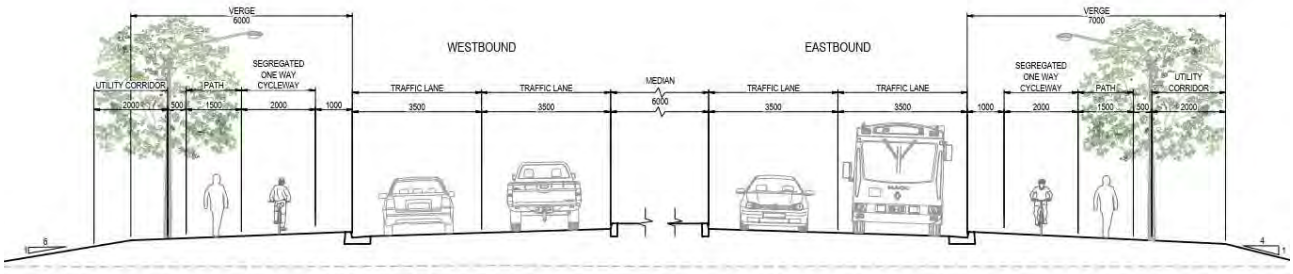

Figure 5-1 Typical cross section – Molonglo Town Centre

5.2.1.2 Molonglo Town Centre to Molonglo 3 East Connector Road (CH 0700 – CH2300)

East of the Molonglo Town Centre it is proposed to rationalise the cross section down to a two-way single carriageway. The rationale for this approach includes:

- Forecast traffic volumes indicate that a single lane in each direction provides sufficient capacity
- Whole of life cost reduction (reduced pavement, earthworks and drainage costs)
- Consistency with the proposed Molonglo River Bridge cross section

The proposed cross section (indicated in Figure 5-2) make allowance for the future provision of a second carriageway should growth in demand necessitate an increase in corridor capacity.

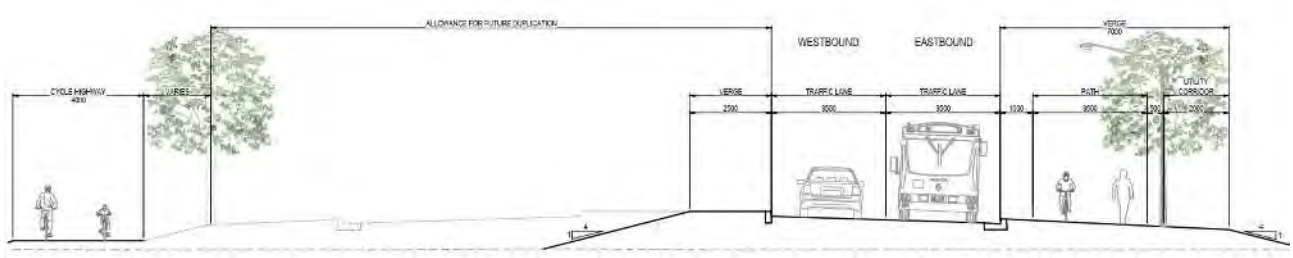

Figure 5-2 Typical cross section – Molonglo Town Centre to Molonglo 3 East Connector Road

5.2.1.3 Molonglo 3 East Connector Road to Tuggeranong Parkway (CH CH2300 – 3000)

The northern leg of the Molonglo 3 East (M3E) connector road is expected to introduce a significant amount of traffic onto the EWA. As such, the intersection of the EWA and the M3E Connector Rd, and the EWA to the east of the intersection will require significant capacity to convey the forecast traffic. As such it is proposed to provide a dual carriageway on the EWA on the eastbound approach to the M3E intersection. This approach has been adopted as:

- Traffic modelling indicates that two lanes in each direction is required for the predicted traffic volumes
- Traffic modelling indicates that several through and turn lanes are required at the M3E intersection

The proposed cross section east of the M3E intersection is provided in Figure 5-3.

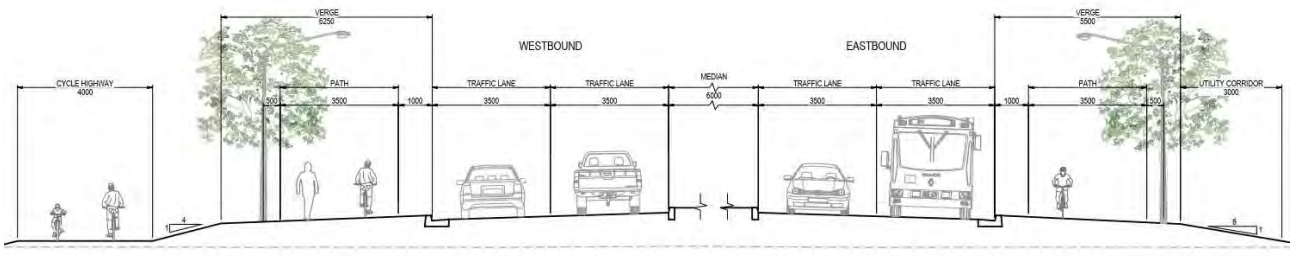

Figure 5-3 Typical cross section – Molonglo 3 East Connector Road to Tuggeranong Parkway

5.2.2 Earthworks

Earthworks and batter slope requirements will be subject to geotechnical investigation during future design stages. Typically, the following has been assumed in the preparation of the options development:

- 6:1 max – Road formation fill batters with no barrier;
- 2:1 max – Road formation fill batters with barrier; and
- 2:1 max – Road formation cut batters

5.2.3 Design Speed

Given the variable nature of the land uses adjacent to the EWA, and in the context of the arterial function of the road, two posted speed zones have been proposed in the options assessment:

- Molonglo Town Centre: 50 km/h – the Molonglo Town Centre will have a strong place function with high pedestrian movements and vehicular friction. Maintaining low vehicle speeds on this part of the EWA will be important in this urban context.
- East of the Molonglo Town Centre: 70 km/h – Between the Town Centre and the Tuggeranong Parkway the primary function of the EWA will be to provide an arterial link between the Molonglo Valley and the motorway corridor. That is, the EWA will primarily serve a movement function through a suburban area. As such it is considered important to convey traffic at higher travel speeds in order to reduce travel times and increase the capacity of the corridor.

As such, and in accordance with the standard Austroads GRD design approach, a design speed of 60 km/h has been adopted in the Town Centre, and 80 km/ has been adopted outside the Town Centre on the EWA.

5.2.4 Design Criteria Table

Table 5-1 below provides a summary of the design criteria that has been adopted for the development of the route options and will be used in the development of the strategic design.

Table 5-1 Road design criteria summary table

Criteria	Requirement	Reference
General		
Road Classification	Arterial Road	AUSTROADS - Guide to Road Design Part 2: Design Considerations (2019) - Section 2.4.1
Posted Speed Limit	50km/h	Molonglo Town Centre
	70km/h	Molonglo Town Centre (eastern extent) to Tuggeranong Parkway
Design Speed	60km/h	Molonglo Town Centre (AUSTROADS - Guide to Road Design Part 3: Geometric Design (2016) - Section 3.5.2)
	80km/h	East of Molonglo Town Centre (AUSTROADS - Guide to Road Design Part 3: Geometric Design (2016) - Section 3.5.2)
Design Life (Road)	30 years	AUSTROADS - Guide to Road Design Part 3: Geometric Design (2016) - Table 4.1
Design Life (Bridge)	100 years	AUSTROADS - Guide to Road Design Part 3: Geometric Design (2016) - Table 4.1
Design and Check Vehicles		
Design Vehicle	Single unit truck/bus (12.5 m) Radius 12.5 m	AUSTROADS - Guide to Road Design Part 4: Intersections and Crossings (2017) - Section 5.2
Check Vehicle	Single articulated (19.0 m) Radius 15 m	AUSTROADS - Guide to Road Design Part 4: Intersections and Crossings (2017) - Section 5.2

Criteria	Requirement	Reference
Lane, Shoulder, Verge, and Batters		
Traffic Lane Width	3.5m	AUSTROADS - Guide to Road Design Part 3: Geometric Design (2016) - Section 4.2.5
Path	3.5m	Shared and dedicated path widths as agreed with TCCS in session of 20 May 2020
Typical Maximum Design Batter Slopes	1V:4H grassed 1V:2H low maintenance treatment	AUSTROADS - Guide to Road Design Part 3: Geometric Design (2016) – Table 4.11
Median		
Width	6.0m	Typical (less at intersections)
Cross fall & Grading		
Pavement Cross fall on Straights	3%	AUSTROADS - Guide to Road Design Part 3: Geometric Design (2016) - Section 4.2.2
Cross fall on footpath	2.5%	Australian Standards AS1428
Vertical Alignment		
Minimum desirable longitudinal grade	0.5%	AUSTROADS - Guide to Road Design Part 3: Geometric Design (2016) - Table 8.5
Maximum desirable longitudinal grades	 6-8 % 4-6 %	AUSTROADS - Guide to Road Design Part 3: Geometric Design (2016) - Table 8.3 60 km/h 80 km/h
Maximum desirable longitudinal grade for footpaths	5%	Australian Standards AS1428
Sight Distances		
Sight Distance Parameters	Varies	AUSTROADS - Guide to Road Design Part 3: Geometric Design (2016) - Section 5.2.1
Driver Reaction Time	2.0 sec	AUSTROADS - Guide to Road Design Part 3: Geometric Design (2016) -Table 5.2
Stopping Sight Distance (SSD) Minimum size crest VC (K value)	 K=19.1 (SSD=73m) K=29.3 (SSD=114m)	AUSTROADS - Guide to Road Design Part 3: Geometric Design (2016) -Table 5.5 and Table 8.7 60 km/h 80 km/h
Safe Intersection Sight Distance (SISD)	 K=19.1 (SSD=73m) K=29.3 (SSD=114m)	AUSTROADS - Guide to Road Design Part 4A: Unsignalised and Signalised Intersections - Table 3.2 60 km/h 80 km/h
Curves		
Minimum radii of horizontal curves based on superelevation and side friction at maximum values	161m desirable 107m absolute minimum	AUSTROADS - Guide to Road Design Part 3: Geometric Design (2016) - Section 7.6.1

Criteria	Requirement	Reference
Maximum superelevation	5%	AUSTROADS - Guide to Road Design Part 3: Geometric Design (2016) - Section 7.7.3
Minimum Sag Vertical Curve K Value	13	AUSTROADS - Guide to Road Design Part 3: Geometric Design (2016) - Figure 8.9
Minimum radii with adverse cross fall	400m	AUSTROADS - Guide to Road Design Part 3: Geometric Design (2016) - Table 7.12

5.3 Bridge Design

The project includes three bridges which are:

- EWA bridge over Molonglo River
- EWA interchange bridge over Tuggeranong Parkway
- An additional bridge on the Tuggeranong Parkway over the Molonglo River will be required to facilitate the project, however is expected to be undertaken as part of other works prior to the construction of the EWA.

5.3.1 Bridge over Molonglo River

5.3.1.1 Bridge Form

The bridge over Molonglo River spans approximately 236 metres across the Molonglo River, passing over the Molonglo River at a maximum height of approximately 30 metres. ACT Government's view for the new bridge is that the appearance and proximity of other bridges across the Molonglo River is an important contextual factor. The new bridge is located upstream of the proposed 3-span, steel trough girder bridge on John Gorton Drive (JGD) over Molonglo River. Hence, the similar form of steel trough girder bridge for the new Molonglo Bridge is proposed. The proposed bridge will have a span configuration from of 75 metres, 85 metres and 75 metres for an overall bridge length of 236 metres as shown in Figure 5-4.

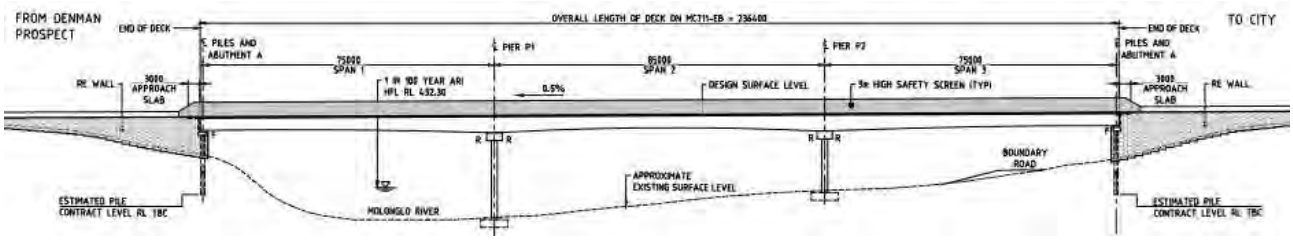

Figure 5-4 Typical cross section – Molonglo River Bridge

5.3.1.2 Cross Section

The bridge cross section allows for a two-way single carriageway with 1.2m shoulders, road barriers, a shared path and the cycle highway. The proposed cross section is indicated in Figure 5-5, noting that the number of required girders is to be confirmed as part of the strategic design exercise.

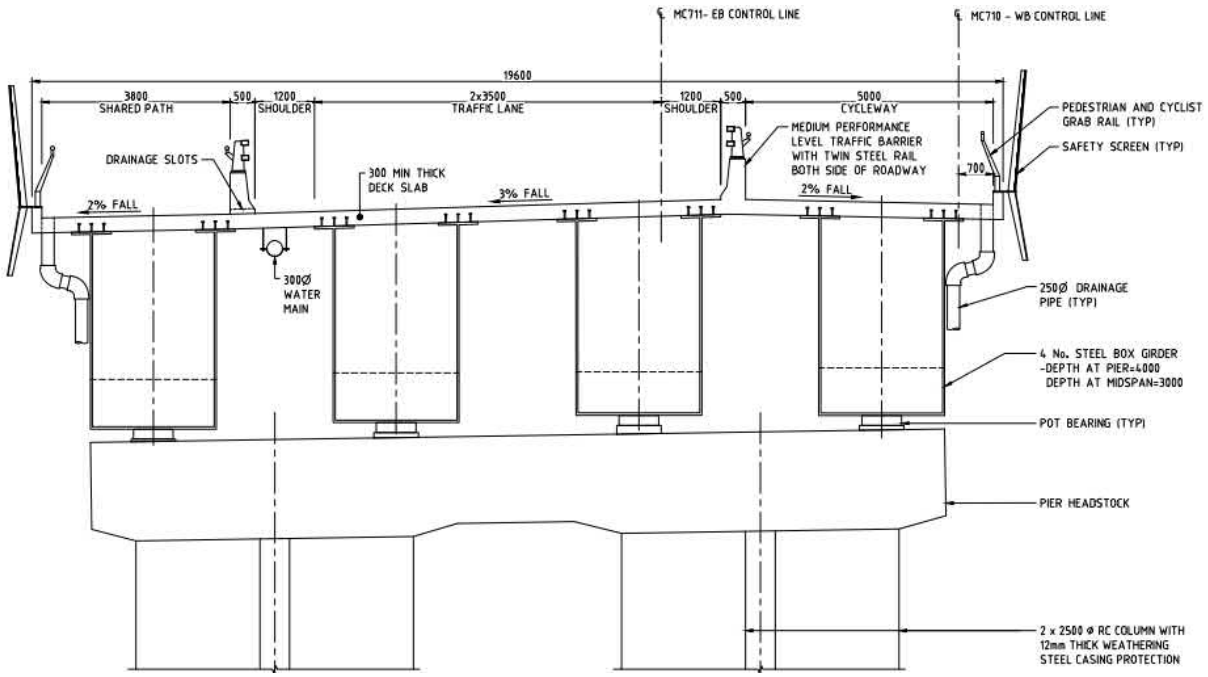

Figure 5-5 Typical cross section – Molonglo River Bridge

5.3.2 Bridge over Tuggeranong Parkway River

5.3.2.1 Bridge Form

The proposed bridge over Tuggeranong Parkway spans approximately 34.6 metres with vertical clearance of minimum 5.4 metres. The new bridge is located north of existing Cotter Road bridge over Tuggeranong Parkway. The Cotter Road bridge is a single span bridge supported on abutments with reinforced earth walls around the abutments. Hence, the similar form of precast girder bridge with reinforced earth wall around the abutment is proposed for the bridge. The proposed bridge is as shown in Figure 5-6.

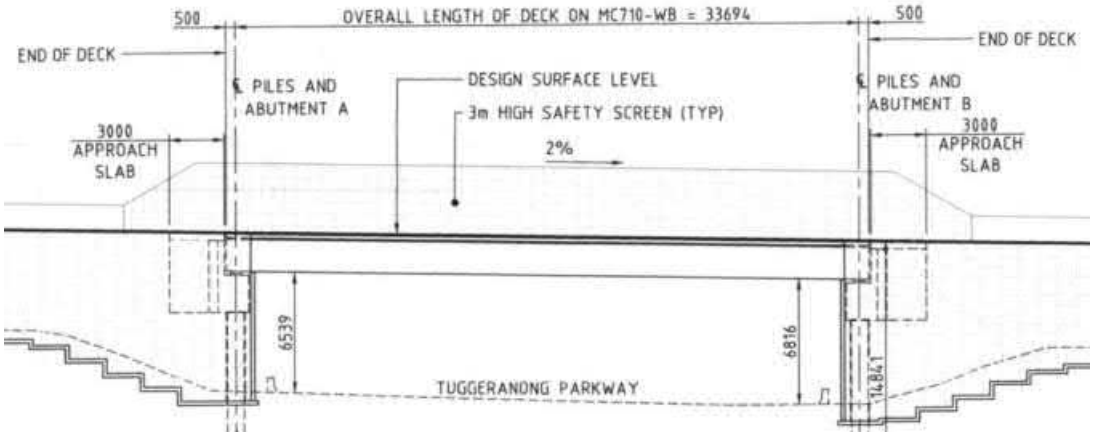

Figure 5-6 Typical cross section –Bridge over Tuggeranong Parkway

5.3.2.2 Cross Section

The bridge cross section allows for a two-way single carriageway with 1.2m shoulders, road barriers, a shared path and the cycle highway. The proposed cross section is indicated in Figure 5-7, noting that the number of required girders is to be confirmed as part of the development of the strategic design for the preferred option (refer Volume 2 of the Feasibility Study.

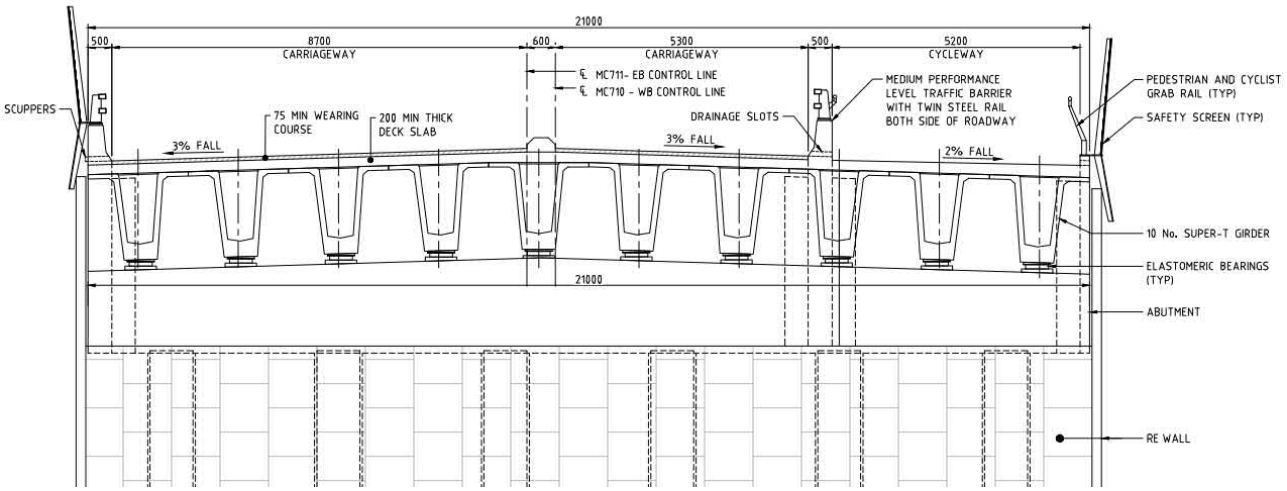

Figure 5-7 Typical cross section –Bridge over Tuggeranong Parkway

5.3.3 Bridge Design Criteria Table

Table 5-2 provides a summary of the design criteria that has been adopted for the development of the route options and will be used in the development of the strategic design.

Table 5-2 Bridge design criteria summary table

Criteria	Requirement	Reference
Live load	• SM1600 • HLP400 • W80 Wheel Load • Non-concurrent Pedestrian loading (**p**) as per Figure 8.1 of AS5100.2 which is based on loaded area (A) o A < 10m^2, **p** = 5kPa o A>100m^2, **p** = 2kPa **p** linearly varies for 10m^2 < A < 100m^2	Clauses 7 and 8 of AS5100.2
Flood parameters	• Flood immunity – 100 years • Service design flood – 100 years • Ultimate design flood – 2000 years	Clause 11.1 of AS5100.1 and clause 16 of AS5100.2
Temperature Parameters	• Mean Temperature 25°C • Average bridge temperature - -5°C to 60°C for steel bridge • Average bridge temperature - 0°C to 50°C for concrete bridge	Clause 18 of AS5100.2
Wind parameters	Regional Wind Speed • V_{20}= 37m/s • V_{2000}= 48m/s	Clause 17 of AS5100.2 and clause 3.2 of AS1170.2
Settlement	• 20mm substructure settlement • 10mm differential settlement between adjacent substructures	The settlement value to be confirmed based on geotechnical investigation

Criteria	Requirement	Reference
Traffic Barriers and Pedestrian Railings	Medium performance traffic barriers Outside footpath: Pedestrian railing	Medium performance barrier is proposed in accordance with clause 14.5.4 of AS 5100.1.
Construction Load	• Construction live load – 0.5kPa, • Differential Temperature – 90% of Clause 18.3 of AS5100.2 • Wind Load – 200yr return Period: Regional Wind Speed V_R = 43m/s	Clause 22 of AS5100.2

6 Route Alignment Options - East West Arterial

6.1 Option Development

6.1.1 Relationship between Options

Following development of two early options (identified as Options 1 & 2) to inform initial consultation with key stakeholders (namely TCCS and EPSDD), three route alignment options were developed for the EWA. Option 3 was an evolution of the approach adopted for the original Option 2 and similarly Option 4 was an evolution of Option 1. An additional option – Option 5 – was also developed in effort to maximise developable area. The purpose of this option development was to assess various design approaches to the EWA alignment and present them in an MCA process to identify a preferred option for the EWA to develop a strategic design.

The three design alternatives developed as part of the options assessment process plus an additional hybrid option developed following the MCA process (Option 6) are provided in Appendix A and are discussed below. All options connect to the existing Holborow Ave intersection stub in the west and the Tuggeranong Parkway to the east. Following is a summary of the options considered as part of the assessment process:

- Option 1 – early design concept for Collector-Distributer interchange arrangement
- Option 2 – early design concept for free-flow loop ramp interchange arrangement
- Option 3 – Free-flow loop ramp interchange arrangement
- Option 4 – Collector-Distributer interchange arrangement
- Option 5 – Compact EWA footprint
- Option 6 – Hybrid (Option 3 / 5) – developed following the MCA workshop

All options are generally aligned along the southern edge of the proposed developable area to the west of the Molonglo River to maximise developable area. Whilst a more central route was considered early in the options development process, it was considered by key stakeholders that this approach was less aligned with the land development objectives for the area. Generally, most of the variance between options takes place to the east of the Woodland boundary (CH 1400m).

The option design was developed to a high level for the purpose of comparison between alternatives and will necessarily require refinement and more rigorous interrogation as part of the strategic design process. Optimisation of the vertical road alignment to minimise material handling requirements will also be necessary in future stages of the design process.

6.1.2 Related Projects

6.1.2.1 Tuggeranong Parkway Upgrade

It is understood that the Tuggeranong Parkway is scheduled for upgrade in the next 10 years. Advice from TCCS indicated that an additional (third) northbound lane will be constructed from the Cotter Rd interchange to the Glenloch interchange. This third northbound lane has been incorporated into the design of all the considered options.

Furthermore, this upgrade will have implications for the Tuggeranong Parkway bridge crossing of the Molonglo River, although at the time of writing it is unclear what these implications are. As a minimum the current bridge will need to be widened to accommodate this third lane, however given challenges with existing structure it may be more appropriate to construct a new northbound bridge. It is noted that all the assessed options require a new northbound bridge and as such there appear to be synergies between the EWA project and the required Tuggeranong Parkway upgrade.

6.1.2.2 Molonglo High Voltage Relocations

The Suburban Land Agency (SLA) is delivering a project to relocate an underground the 132 kV power lines that are in the project site. The project is currently in the detailed design stage, and designs provided by the SLA team have informed the options development. All assessed options cross the proposed 132 kV alignment in the same location, and as such HV relocation project is not expected to have implications for the options assessment process.

6.1.2.3 Molonglo Valley Interceptor Sewer Odour Control Facility

Upgrades to the existing Molonglo Valley Interceptor Sewer (MVIS) infrastructure on the project site are also under development by the SLA. The project is currently in the design development phase, and designs provided by the SLA team have informed the options development and have varying implications for the EWA options considered.

6.2 Option 3

6.2.1 Option Description

The western part of the Option 3 alignment is relatively north, crossing the Molonglo River valley near the peninsula. The proposed Molonglo River bridge is straight and has the shortest overall span of the considered options at 260m. The eastern abutment of the bridge appears likely to land on a poorly compacted and potentially contaminated fill area near the MIVIS tunnel portal that was used to spoil material from the tunnel excavation. Additionally, the alignment is relatively close to the proposed MVIS odour control facility.

To the east, the EWA Tuggeranong Parkway interchange provides free flow ramps for all movements, with the southbound entry ramp being a minimum radius loop ramp. Being relatively close to the Cotter Rd interchange, Option 3 provides minimal weave distances (approximately 400-450m) between the interchanges.

The Option 3 arrangement will require a new Tuggeranong Parkway bridge crossing of the Molonglo River. The existing Molonglo river bridge would be reconfigured to accommodate three southbound mainline Parkway lanes. The new bridge would consist of three northbound Parkway lanes. Whilst this component of Option 3 is not depicted in the design sketches contained in Appendix A, the design sketches provided for Option 6 indicate the expected necessary treatment for the Tuggeranong Parkway bridge over the Molonglo River. The proposed layout of Option 3 is indicated in Figure 6-1.

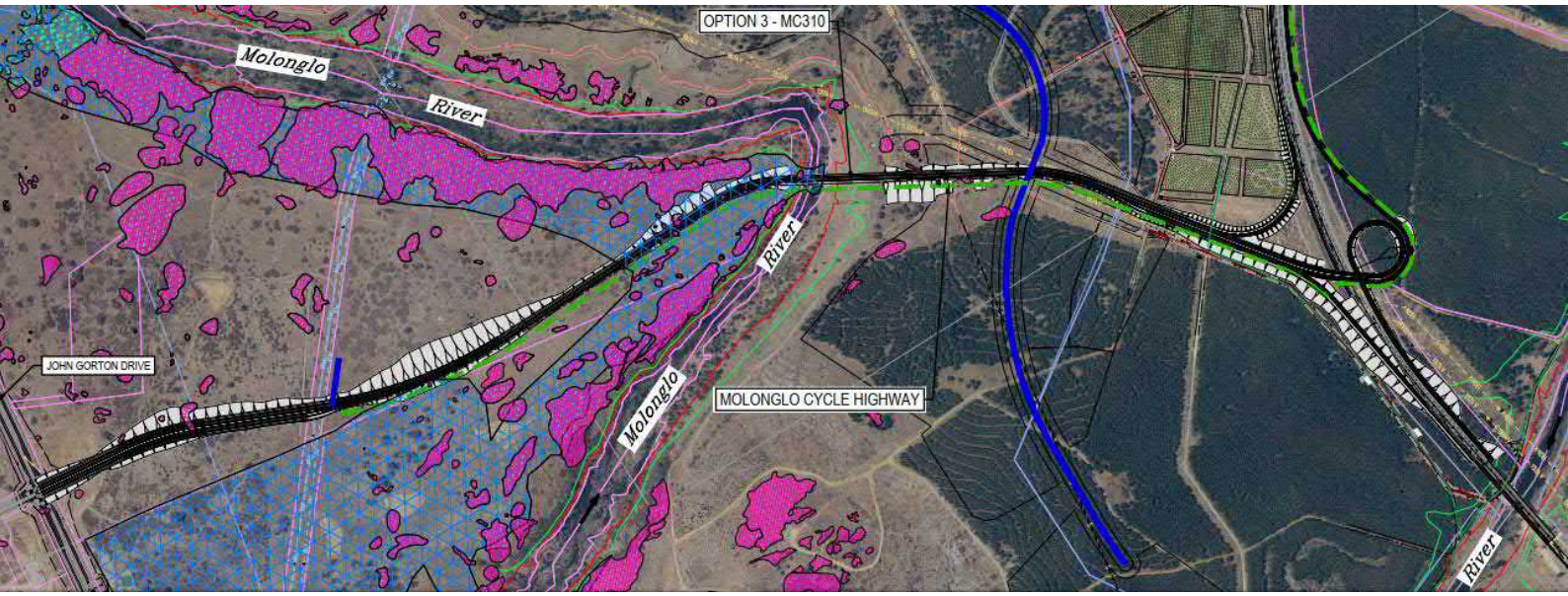

Figure 6-1 EWA Option 3 alignment

6.2.2 Option Rationale

The alignment of the Molonglo River crossing attempts to thread through identified Pink Tail Worm Lizard habitat and minimise the bridge length across the Molonglo River corridor. Furthermore, the provision of straight bridge is intended to reduce construction costs.

The Option 3 interface with the Tuggeranong Parkway most closely resembles the feasibility concept design developed as part of the Molonglo Roads Feasibility Study undertaken in 2013. It provides a free-flow Parkway interchange with a loop ramp arrangement for the southbound entry ramp to the Tuggeranong Parkway in effort provide the most efficient interchange possible, minimising network travel times. The EWA alignment and interchange location has been adjusted from the 2013 study to make allowance for the revised extent of the Arboretum plantings.

6.3 Option 4

6.3.1 Option Description

Option 4 is the northernmost of the three alignment options. The primary intent of the western part of this option is to cross the Molonglo River near the point of the peninsula, providing a relatively perpendicular crossing of the Molonglo River valley. It is noted however that the Molonglo River Bridge is curved both horizontally and vertically and approximately 300m long.

To the east, Option 4 has a substantially different approach to the interface with the Tuggeranong Parkway compared to other options. In Option 4, the EWA interchange and Cotter Rd interchange to the south are not treated as discrete interchanges, but rather are linked by a Connector-Distributer (CD) road arrangement. This CD approach means that the south facing EWA interchange ramps do not directly link onto the Tuggeranong Parkway, but rather route through the Cotter Rd interchange.

Whilst this arrangement has potential safety benefits, three of the four ramps are not free flow and are subject to signal control (two sets of signals in the case of the southbound entry ramp). Also, the two-phase signalised intersection between the two southbound ramps is at a high skew and will likely require refinement if further developed.

The CD arrangement will require a new Tuggeranong Parkway bridge crossing of the Molonglo River. The existing Molonglo river bridge would be reconfigured to accommodate two southbound mainline Parkway lanes plus a segregated single lane southbound CD road. The new bridge would consist of three northbound lanes plus a segregated northbound single lane CD road. This new Option 4 Tuggeranong Parkway bridge would be larger than required in other options. The proposed layout of Option 4 is indicated in Figure 6-2.

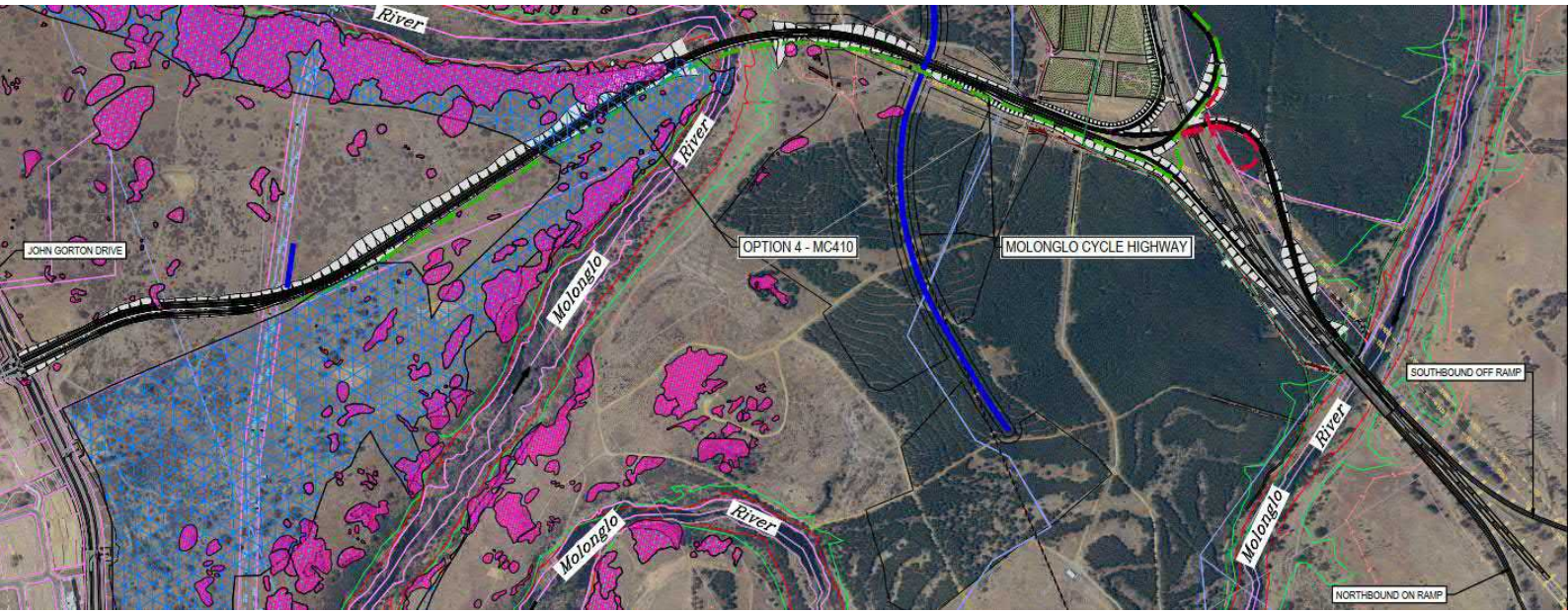

Figure 6-2 EWA Option 4 alignment

6.3.2 Option Rationale

West of the M3E intersection, the intention of the Option 4 alignment is to keep the road corridor as far north as possible. This approach provides uninterrupted view corridors along the Molonglo River corridor in both directions from the peninsula; provides substantial clearance to the proposed MVIS odour control facility; and avoids the poorly compacted and potentially contaminated fill area near the MIVIS tunnel portal that was used to spoil material from the tunnel excavation.

The rationale for the CD road interchange arrangement is focussed on catering for the EWA – Tuggeranong Parkway – Cotter Road movement which is forecast to be the heaviest movement south from the EWA. It facilitates this movement by segregating from the mainline Parkway flows, avoiding the need for weave movements on the Parkway, improving efficiency for this movement and reducing the risk of accident between weaving vehicles. Conversely,

Parkway vehicles originating from / heading to south of the Cotter Rd interchange need to route through the Cotter Rd interchange, which introduces inefficiencies for these movements.

6.4 Option 5

6.4.1 Option Description

Option 5 is the southernmost of the assessed options, providing the shortest path across the designated woodlands on the Molonglo River peninsula. The proposed Molonglo River bridge is approximately 280m long and contains reverse horizontal curves. East of the river, the Option 5 alignment is near the proposed MVIS odour control facility and is likely to require retaining walls.

To the east, the EWA Tuggeranong Parkway interchange is configured with compact diamond formation with signal control at the ramp terminals. Being relatively close to the Cotter Rd interchange, Option 5 provides minimal weave distances (approximately 400-m) between the interchanges.

The Option 5 arrangement will require a new Tuggeranong Parkway bridge crossing of the Molonglo River. The existing Molonglo river bridge would be reconfigured to accommodate three southbound mainline Parkway lanes. The new bridge would consist of three northbound Parkway lanes. The proposed layout of Option 3 is indicated in Figure 6-3.

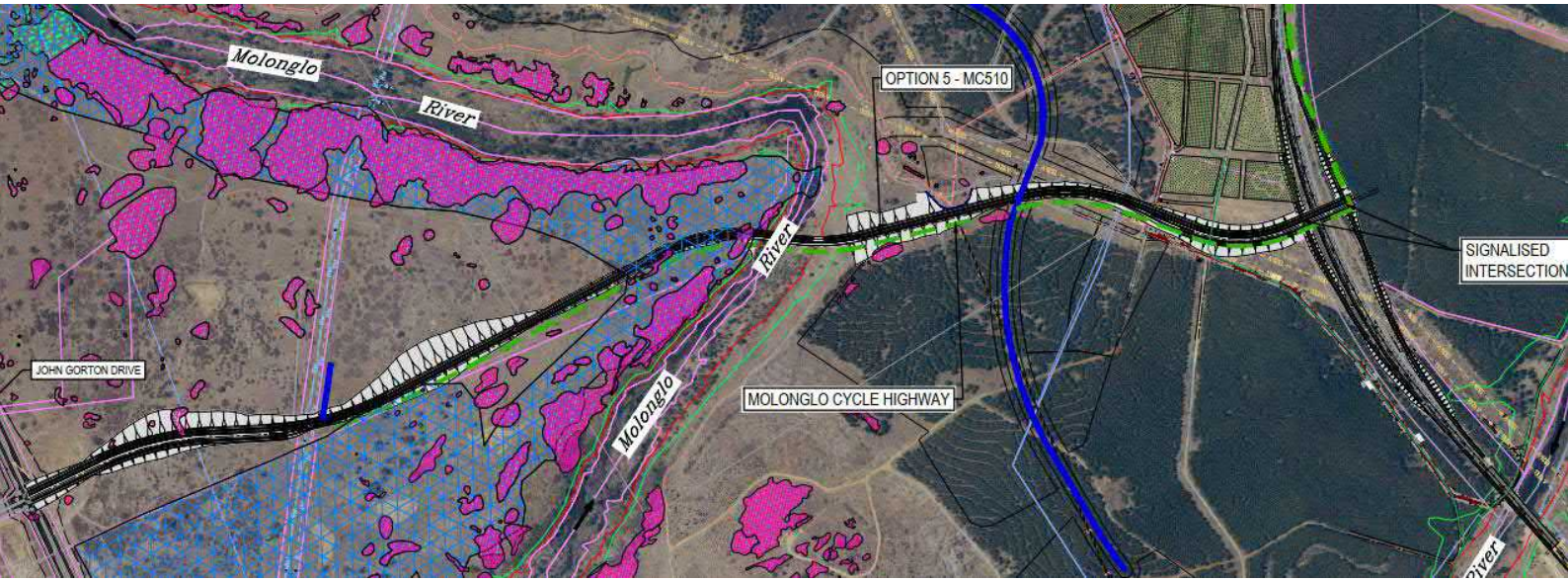

Figure 6-3 EWA Option 5 alignment

6.4.2 Option Rationale

The primary objective of Option 5 is to minimise project footprint and by extension maximise developable area. It achieves this aim to the west of the Molonglo River by hugging the box gum woodland boundary (which results in a southern crossing of the river) and maximising the area that can be developed on the peninsula. To the east, Option 5 minimises the footprint of the Tuggeranong Parkway interchange by utilising a conventional compact diamond arrangement. Whilst this interchange option offers poorer performance than the free flow arrangement proposed in Option 3, the reduced footprint of the interchange will allow more developable area to the east of the Tuggeranong Parkway, in addition to facilitating better access to a precinct here in the future.

6.5 Option 6

Option 6 was developed as a hybrid of Options 3 and 5 in response to the outcomes of the MCA process. It splices together the western part of Option 5 (CH 0 to CH 2550) with the eastern part of Option 3 (from CH 2550 east), combining the strongest performing features of both options into a single option. The rationale for this approach is discussed in further detail in Section 9. The proposed layout of Option 6 is indicated in Figure 6-4.

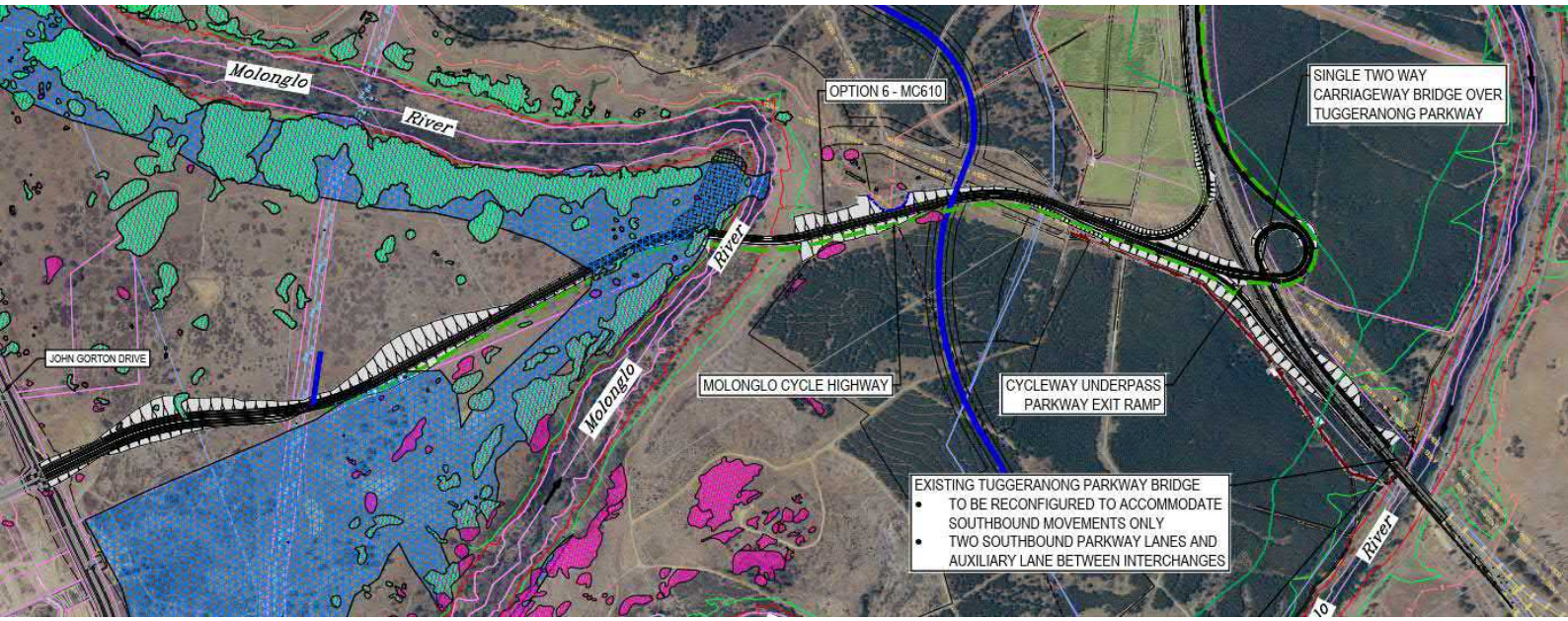

Figure 6-4 EWA Option 6 alignment

6.6 M3E Connector Road Intersection Configuration

6.6.1 Intersection considerations

A key consideration of the EWA design is the signalised intersection with the proposed Molonglo 3 East connector road. The M3E connector road provides access to the residential precinct to the south of the EWA and links the EWA to the large residential, commercial and education zones to the north ultimately connecting to the Bindubi St extension.

The proposed intersection will convey large through traffic volumes on the EWA in addition to a significant north to east left turn movement in the AM peak (reversed right turn movement in the PM peak). As such, this intersection requires a large capacity and thus will have a large footprint. Key considerations of the intersection include:

- Capacity – the intersection is forecast to convey large traffic volumes and as such will need to have a number of through and turn lanes to operate at an acceptable level of service.
- Urban design – give the large footprint of the intersection it will have significant urban design implications for the area. Large intersections can act as a barrier to movement and in this case has the potential to create severance between north and south areas of the M3E precinct. Feedback from the consultant team for the M3E study on the urban design implications of this intersection has informed the optioneering assessment.
- Proximity to the Tuggeranong Parkway interchange – a significant traffic performance and safety concern is the operation of the westbound weave movement between the Tuggeranong Parkway and the M3E intersection. The need for this weave creates the requirement for a minimum distance between the M3E intersection and the interchange.
- Active travel amenity – large intersections make for a less attractive environment for active travel as they increase crossing distances and wait times, creating a barrier to pedestrian and cyclist movements. The implications for active travel are exacerbated by the need to accommodate the proposed cycle highway
- Landform – the alignment of the EWA navigates through some relatively steep terrain. The location of the proposed M3E is constrained by local topography.

In the context of these considerations, two options were considered for this signalised intersection configuration:

1) 4-way cross road intersection
2) Staggered T intersection

The features of these intersection options are discussed below. An analysis of the traffic performance for both these options has been undertaken in both SIDRA Network and AIMSUN (microsimulation). This modelling is discussed in Section 9.

6.6.2 Four-way cross road intersection

The crossroad arrangement facilitates all movements in the one location including a single north-south crossing movement of the EWA. A proposed layout of the 4-way crossroad intersection is provided in Figure 6-5

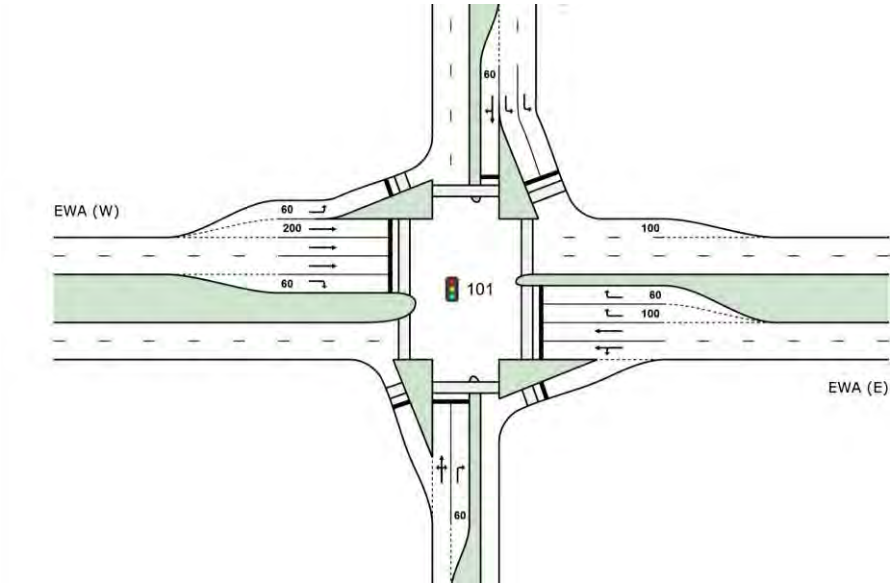

Figure 6-5 Four-way cross road intersection layout (SIDRA Network schematic)

As the crossroad option is facilitating all movements in the one location it requires longer turn lanes to ensure the required intersection capacity is achieved. This has implications for the size and cost of the intersection and weaving lengths. The topography of the site will require the southern leg of the intersection to be in significant cut.

6.6.3 Staggered T intersection

The staggered T arrangement facilitates provides two discrete but coordinated sets of signalised T intersections with a spacing of approximately 130 m. Traffic signals on the EWA will be coordinated for the through movement to maximise efficiency across both intersections. The north-south movement on the M3E connector road will need to be staged between the two intersections. A proposed layout of the staggered T intersection is provided in Figure 6-6.

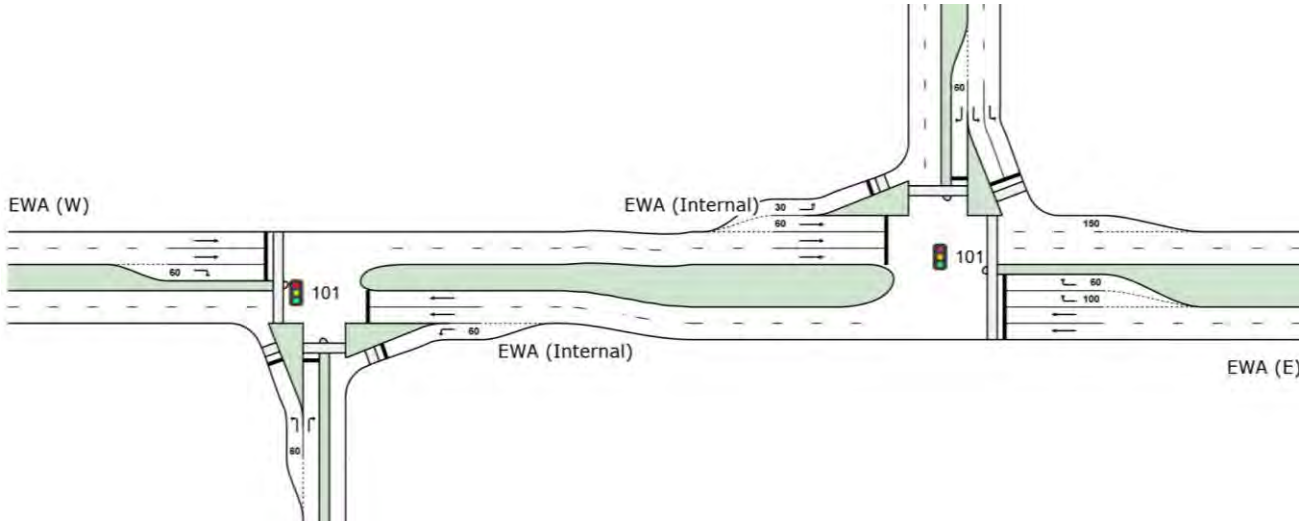

Figure 6-6 Staggered T intersection layout (SIDRA Network schematic)

As movements are separated across the two intersections, turn lane lengths can be shortened relative to the crossroad arrangement. Additionally, the local topography is more suited to the staggered T arrangement. Austroads Guide to Road Design Part 4 provides guidance on the selection of staggered T intersection intersections, noting that they are not preferred if high through volumes are anticipated. However, the north-south movement is not considered likely to be large in the case of this intersection. Furthermore, as the intersection is a Right-Left stagger it

reduces the spatial requirements for the intersection. The fact that the intersection is signalised mitigates safety concerns associated with right turning vehicles having to negotiate both traffic streams on the EWA.

6.6.4 Preferred intersection arrangement

6.6.4.1 Urban design

The two intersection options have different urban design implications. Advice from the M3E consultant team indicated that the staggered T arrangement was preferred from an urban design perspective. This advice was primarily based on the reduced footprint of the staggered T arrangement, and the associated improved pedestrian amenity this provides.

6.6.4.2 Operational Performance

The traffic operational performance of both intersection options was modelled. Initial assessment using SIDRA Network indicated that staggered T performed better and hence should be preferred from an operational perspective. However, subsequent more detailed microsimulation analysis indicated that there was minimal performance difference between the two intersection options. Detailed traffic modelling results are provided in Section 9.

6.6.4.3 Access considerations

During design development it was initially considered that a secondary access to the southern M3E precinct would take the form of a riverside edge road (refer Section 7). However, as the design of such an edge road was investigated it became apparent this it would necessarily incur into the Molonglo River Corridor. This was regarded as an undesirable outcome by key stakeholders and as such development of an alternate access arrangement was pursued.

In response to the need for a second access point to the southern precinct, a hybrid intersection arrangement was investigated for the EWA. This arrangement consisted of adoption of a crossroad intersection arrangement combined with a Left in – Left out arrangement approximately 200m to the west.

This arrangement was considered to address the requirement for a second access to the southern precinct (right turn movements can be facilitated under traffic control in emergency situations) and performs similar to the staggered T from an operational perspective. It is noted that this option is less desirable from an urban design perspective, however on the balance of considerations, the hybrid intersection arrangement was considered the preferred approach.