Western Edge Investigation Area Preliminary Studies Program

Preliminary Assessment of Engineering Infrastructure Opportunities and Constraints

EPSDD Infrastructure Projects

20 January 2022

Version 6.1

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EXECUTIVE SUMMARY

This report takes an initial look at existing infrastructure in the Western Edge Investigation Area (WEIA), and any future development constraints. The aim is to identify priority areas for additional work. That additional work will look in more detail at those areas with the highest infrastructure uncertainty and risk. This additional work will ultimately determine if the infrastructure investments required to service the WEIA are warranted.

The report received input from Icon Water, Evoenergy, TransGrid and the ACT Government. The report contains structured feedback from these providers on the existing infrastructure in the area, plus constraints and opportunities with developing the area.

This work was done in parallel with other studies. The extent of development, if any, is yet to be determined, therefore sizing of infrastructure requirements for the WEIA is not possible at this stage.

The recommendations and infrastructure priorities for further investigation, are set out below.

Transport

- Determine an agreed integrated network for public transport, private vehicle use and active travel for the area and strategies to achieve this. This will be discussed as part of the ACT Transport Strategy Implementation Plan, led by the Strategic Policy team in Transport Canberra and City Services (TCCS).
- Confirm transport corridors including east-west connections and a north-south corridor. Key elements to investigate include a second Molonglo River crossing west of John Gorton Drive, Molonglo East West Arterial (EWA) connection, Uriarra Road upgrade, Cotter Road upgrade and bulk water pipeline crossings, Bulgar Creek connection via Hindmarsh Drive and Tuggeranong Parkway connection at Sulwood Drive.

Sewerage

- Due to the challenging topography of the site, early work is required to determine the most appropriate strategy for the area including; whether the site has its own sewage treatment plant, a major pump station pumping across the Molonglo to Lower Molonglo Water Quality Control Centre (LMWQCC), or a sewer bridge allowing gravity flow to LMWQCC. Each option involves a different combination of tunnels, major sewers, pump stations and potentially a major treatment plant. Early work is required to determine the most feasible system, its estimated cost, and the constraints these place on the potential development area.
- Existing sewerage infrastructure also provides constraints. Sewer odours from the Molonglo Valley Interceptor Sewer (MVIS) and LMWQCC may require treatment and are likely to place limits on the extent of development of the area in the north;
- The impact of operational noise from LMWQCC also needs to be assessed to determine how much of a constraint it will place on development of the site.

Stormwater

- Agree a range of Water Sensitive Urban Design (WSUD) and volume/flow mitigation measures specific to the needs of the area and receiving waters. Agree these with TCCS to ensure they are accepted during (possible future) construction. The scope will include concepts for the management of high urban stormwater flows down the Molonglo and Murrumbidgee escarpments;
- Clarify whether reuse of stormwater is feasible – beyond the current WSUD provisions.

Energy

- Confirm, by January 2022, whether development is to occur in the WEIA so that Evoenergy can prepare regulatory submissions to raise the required funds to build electrical infrastructure in time for development.
- Given the policy direction on natural gas use, determine revised standard energy reticulation and infrastructure requirements for the area.
- Determine the need to relocate the TransGrid transmission lines currently running through the WEIA.

Water

- Determine the water network zoning for the area, and as a result define water reservoir sites. Preserve those sites for water reservoirs.

The risk ranking summary for infrastructure in the WEIA and mitigation measures to address these risks is provided in the table at Section 12 of this report.

1 BACKGROUND

1.1 ACT Planning Strategy 2018

The ACT Planning Strategy 2018 sets out the following renewed vision for Canberra;

*To be a **sustainable, competitive** and **equitable** city that respects Canberra's unique legacy as a city in the landscape and the National Capital, while being responsive to the future and resilient to change*

Strategic Direction 1.1, within the Planning Strategy is to:

*Support sustainable urban growth by working towards **delivering up to 70% of new housing within our existing urban footprint**, and by concentrating development in areas located close to the city centre, town and group centres and along key transit corridors.*

In addition to this development within the urban footprint, Strategic Direction 1.2 says;

Investigate the potential for new residential areas to the west of the city to meet future housing need.

Meeting this Strategic Direction is the purpose for the current study. It culminates in Action 1.2.1 of the Planning Strategy for the ACT, which defines the investigations as follows;

Undertake environmental, infrastructure and planning studies for the western edge of the city to identify suitable areas for:

- *potential urban areas (excluding Central Molonglo)*
- *nature reserves*
- *environmental offset and potential environmental offset areas*
- *the consideration of cultural and heritage values*
- *other uses, for example rural, broadacre, major infrastructure, transport and services.*

The map at APPENDIX A, extracted from the ACT Planning Strategy 2018 shows the broad direction of the strategy, and identifies the Western Edge Investigation Area.

1.2 ACT Auditor-General's Report (2018)

In Report 8 of 2018 the ACT Auditor General looked at "Assembly of rural land west of Canberra". In this report the Auditor-General recommended that:

The Chief Planning Executive should undertake a planning study, to define the long-term future urban form and identify the Territory's future development fronts to guide the update of the ACT Planning Strategy (2012).

The Government's response to the recommendation was:

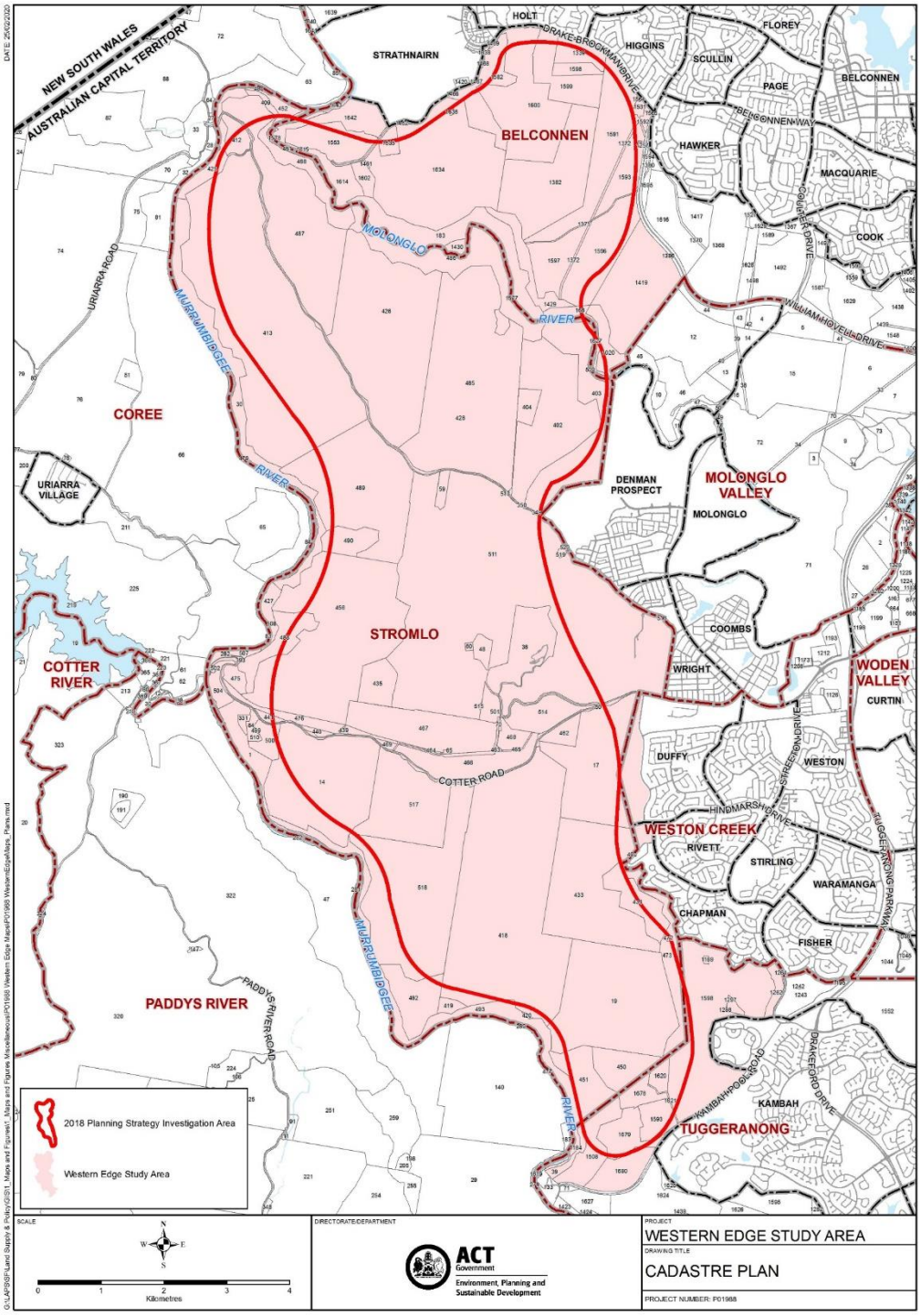
Agreed. Studies underway as part of the current Planning Strategy Refresh will be used to determine the timing of a study into the long-term future urban form.

The work of this report is part of the beginning of these studies.

1.3 Western Edge Investigation Area (WEIA)

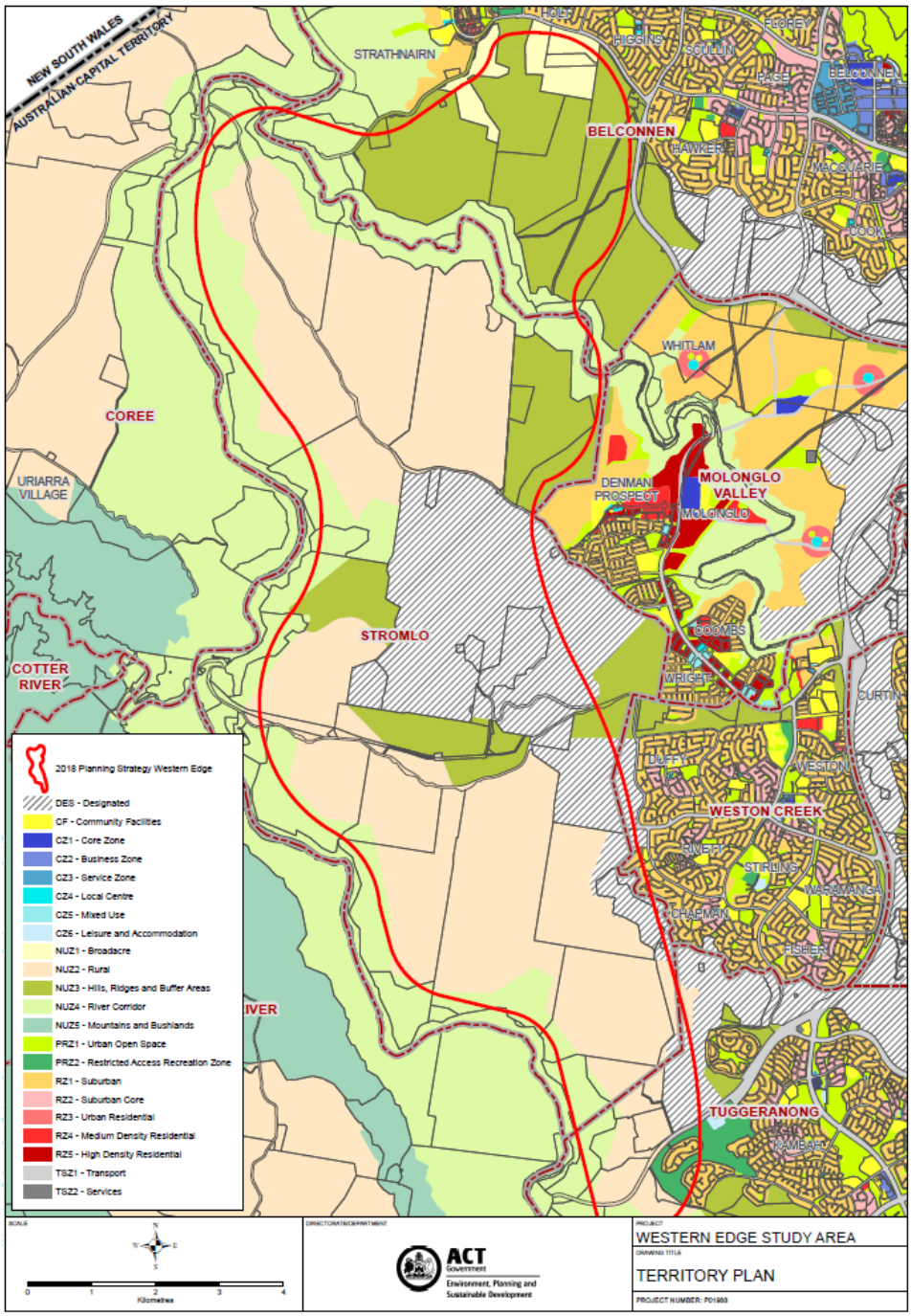
The area defined as the "Western Edge" is set out in the following plan. Note that it differs from the 2012 definition of the "Western Edge" in that it is limited in the south by the Murrumbidgee River (i.e. it does not cross the Murrumbidgee).

The study area is approximately 9,800ha, primarily within the district of Stromlo but also within limited areas of Tuggeranong, Weston Creek and Belconnen districts. It is generally bounded by the Murrumbidgee River to the west and south, and existing suburban development to the east and north.



1.4 Territory Plan land use within the study area

The map below shows the study area as overlayed on the Territory Plan. The areas under consideration as potential future urban areas are not yet decided but would primarily include those marked as "NUZ2-Rural" (beige) on this map.



1.5 National Capital Plan land use within the study area

There are a number of areas of Designated Land under the National Capital Plan within the investigation area. These include the Mount Stromlo, Narrabundah Hill, Cooleman Ridge and McQuoids Hill Nature Reserves. Planning and development approval responsibility rests with the National Capital Authority for these areas.

1.6 ACT Transport Strategy 2020

The ACT Government's vision for transport is for a world class system that supports a compact, sustainable and vibrant city. This means providing flexible, reliable and sustainable options for Canberrans to make their journeys. Convenient and connected public transport; high quality environments for walking and cycling; and a road network that allows us to move people and goods safely and reliably across the city.

Canberra's future transport system will give people greater choice over how and when they travel and contribute to our city's status as one of the most liveable in the world. It will operate as one connected transport network, where people can move between transport modes seamlessly and access transport easily, regardless of where they live, disability or background. It will create a compact liveable city by supporting the delivery of new homes, jobs and services in accessible locations across the city.

The strategy comprises four main avenues to bring about the transport system of the future;

- A future-focused investment framework which supports long-term sustainable benefits of transport to the ACT. This will involve the continued rebalancing of investment towards public transport, cycling and walking while continuing to invest in the safety and maintenance of the road network.
- Refocused network planning and design which will focus on building a single transport network where movement will reflect location and better integrated with land use. Canberra's transport network will be structured through local, central, orbital and regional links. Different links will prioritise the most efficient and appropriate movement type for that link and surrounding land uses. This will encourage people to make appropriate transport choices depending on their destination, purpose and time of day.
- Optimising our infrastructure by embracing the opportunities created through new technology to better manage our network and increase capacity to accommodate future demand and emerging transport modes.
- An ACT Transport Recovery Plan will lead our efforts to set transport once again on a healthy and sustainable path as we manage the impacts of COVID-19 and transition beyond. The plan will focus on harnessing this opportunity to adapt, improve and innovate, so that we can make the most of this period, for the benefit of all Canberrans, now and in the future.

In addition, Government is implementing a Movement and Place framework that balances the dual function of streets, which is moving people and goods and enhancing the places they connect and pass through. Movement and Place supports a 30-minute city by helping to create liveable places for mixed communities with amenities close by on the one hand and identifying roads for efficient movement on the other. This means the movement function of Canberra's roads and streets will better align with the evolving place function and vice versa. At a high-level Canberra's streets will be structured around a hierarchy of local, central, orbital and regional links which will reflect the changing role of transport according to location. Transport projects will consider the needs of all transport users both on their journey and as they complete it. To facilitate this further, Government is developing a Movement and Place framework to guide design, collaboration and decision making for roads and places.

1.7 ACT Climate Change Strategy 2019-2025

Building on the successes of previous strategies and policies, the ACT Climate Change Strategy 2019–2025 outlines the next steps the community, business and Government will take to reduce emissions by 50–60% (below 1990 levels) by 2025 and establish a pathway for achieving net zero emissions by 2045. The Strategy replaces the previous ACT Climate Change Strategy and Action Plan 2 and the ACT Climate Change Adaptation Strategy. The Strategy sets out actions to reduce emissions and to build resilience to climate change impacts. From 2020, once the ACT is powered by 100% renewable electricity, the next key challenges will be reducing emissions from transport, gas and waste.

2 OBJECTIVE

The objective of the Western Edge studies program, as set out in the ACT Planning Strategy 2018, Action item 1.2.1, is to identify suitable areas for:

- potential urban areas (excluding Central Molonglo)
- nature reserves
- environmental offset and potential environmental offset areas
- the consideration of cultural and heritage values
- other uses, for example rural, broadacre, major infrastructure, transport and services.

This study looks at the existing engineering infrastructure in the area, and the opportunities and constraints associated with that infrastructure in support of potential urban areas. Opportunities and constraints are identified assuming much of the area will be developed for urban uses, predominantly residential housing. This is a necessary assumption, but it does not include assuming the development will proceed. The study is to determine what infrastructure will be required IF development proceeds.

3 SCOPE

3.1 Services to be included in this study of WEIA

The scope of this engineering infrastructure study includes;

- Transport opportunities and corridors, including
  - Road connections
  - Public transport
  - Active travel
- Urban Water supply
- Wastewater Management (including sewage collection, treatment and sewer odours)
- Stormwater management including WSUD
- Electricity – Evoenergy – ACT Electricity supply and distribution in Canberra
- Electricity – TransGrid – Operators of the 330kV transmission lines crossing the site.

The majority of these services are network services. This means there are likely to be off-site considerations that provide opportunities and constraints within the study area (e.g. traffic congestion, trunk main capacity bottlenecks). Identifying these off-site constraints and estimating the cost and the lead times involved in addressing them, is an important planning consideration.

Neither telecommunications infrastructure nor gas network infrastructure are covered in this scope. Telecommunications infrastructure is a rapidly moving area of technology and will be addressed in later infrastructure planning investigations. The ACT Government's Climate Change Strategy and policy direction of use of natural gas means that network gas supply in the WEIA is unlikely.

This investigation also excludes future health, education, emergency services and administrative services infrastructure. These will be investigated at later stages of the planning for the area.

3.2 Population Growth and the study area

The supply of utility services (e.g. water from dams, electricity from the National Grid, telecommunications capacity) generally grows with population growth. Determining if there is any impact on the bulk supply of utility services for the ACT is outside of the scope of this study. The study assumes that the population growth in the ACT, and hence the need for (say) additional water supplies or electricity supply will remain as currently projected, regardless of decisions on the location and type of development to accommodate that population growth.

4 APPROACH TO THIS STUDY

4.1 Inter-dependencies between Infrastructure sectors

The study required input from a range of Government and utility service providers. There was also considerable interconnectivity/interdependency between service providers. At this stage of the investigations these inter-dependencies are simply identified. They have implications within and extending beyond the study area, particularly in relation to transport, but also in relation to energy supplies, stormwater management, water supply, sewerage/wastewater management and telecommunications.

4.2 Inter-dependencies with other Wester Edge studies

This study relates to all other current studies of the investigation area and in-particular the;

- Water Values and Environmental Hydrology Study which links to the stormwater drainage assessment in this document as it looks at the existing drainage systems, its limitations, water values and the need to protect these. It will determine, along with the WSUD Guidelines, what the stormwater system design needs to address.
- Air Quality Study that contains information on the extent of the sewage odour constraints of the MVIS and LMWQCC. Note that this report lists odours from the MVIS and LMWQCC as a definite site constraint, the Air Quality Study looks to quantify this constraint, or at least develop a plan that will quantify the constraint.

The interdependencies between the listed infrastructure elements are addressed in the separate sections on each infrastructure type. There are also interdependencies between the infrastructure investigated and the topography, geology, soils, hydrology, groundwater, contamination, sewer odours and other issues investigated.

4.3 Use of modelling – projections, predictions and inherent errors

Modelling is a critical tool for estimating future capacity. Examples include

- Climate modelling that impacts water demands, stormwater flows, electricity demand;
- Traffic modelling for determining traffic demand, system capacities, congestion levels and mode split;
- Public Transport modelling for determining service level and capacity requirements;
- Electricity network modelling for determining demand and the network design for substations, feeders etc.

Modelling provides an estimate of future demand and use, largely based on past demand and use patterns, climate and other factors. The modelling outputs are dependent on these input assumptions. There is great uncertainty in these input assumptions, particularly if undertaken for many years in advance. The best example is climate, where future climate projections are no longer based purely on past climate. The future demand for services (transport, water, electricity etc) and hence the size of the connections to the existing networks, should be considered as projections (not predictions), and come with considerable uncertainty. Scenario Planning can assist in dealing with these and other uncertainties.

When interpreting this report, it is important to understand the sensitivity of outcomes/decisions to changes in assumptions. The benefit of debate on the detail of assumptions is limited at this stage of the planning process. Travel behaviour during COVID-19 and traffic generation models is a good example of how things may change rapidly. More people working from home would for instance change traffic generation models, congestion levels and the requirements of new roads. The rapid change in home electricity generation is changing electricity consumption from the grid and the size of network connections. Climate change is impacting water demand. The requirements for servicing the investigation area that are set out in this report are subject to these major uncertainties.

4.4 Infrastructure lead times

Major infrastructure projects generally require long lead times for planning, environmental assessments, design, procurement, approvals, construction and commissioning/handover. For regulated utilities this lead time can be even longer because of the need to have future infrastructure planned and approved as part of Economic Regulatory plans and approvals. These plans allow the price of the utility service to be set at a level that allows the utility to recoup the cost of the infrastructure.

Regulated utilities have indicated the lead times for regulatory approval in the individual responses. For example, Evoenergy's funding is regulated in 5 year periods with the next period being 2024-2029. Infrastructure studies and subsequent decisions need to be made early enough to allow utilities to include costs in their regulatory submissions. This can be up to 7 years before the work/funding is required, noting the submissions are due up to 18 months before a decision is handed down by the Regulator.

4.5 Development Staging

Infrastructure providers were asked to comment on any broad preferred development sequence from the perspective of their infrastructure networks. This means nominating any infrastructure cost reasons why, if development were to proceed, it would be beneficial to start from the north, south or central part of the investigation area.

4.6 Major risks and Uncertainties

Infrastructure providers have identified some major risks and uncertainties. These will help define the next stage of the investigations. These are summarised at the end of the report.

5 TRANSPORT – ACT GOVERNMENT

5.1 Existing Infrastructure

5.1.1 On-site – existing roads

The main existing public roads in the investigation area are Uriarra Road, Cotter Road and Kambah Pool Road.

5.1.2 Off-site network connections

Possible major transport network connections to the investigation area, from north to south, would include;

- William Hovell Drive;
- Drake Brockmann Drive;
- Stockdill Drive;
- Holborow Avenue extension;
- Uriarra Road;
- Cotter Road;
- Hindmarsh Drive;
- Tuggeranong Parkway;
- Sulwood Drive;
- Kambah Pool Road.

5.1.3 Description of existing roads and possible network connections

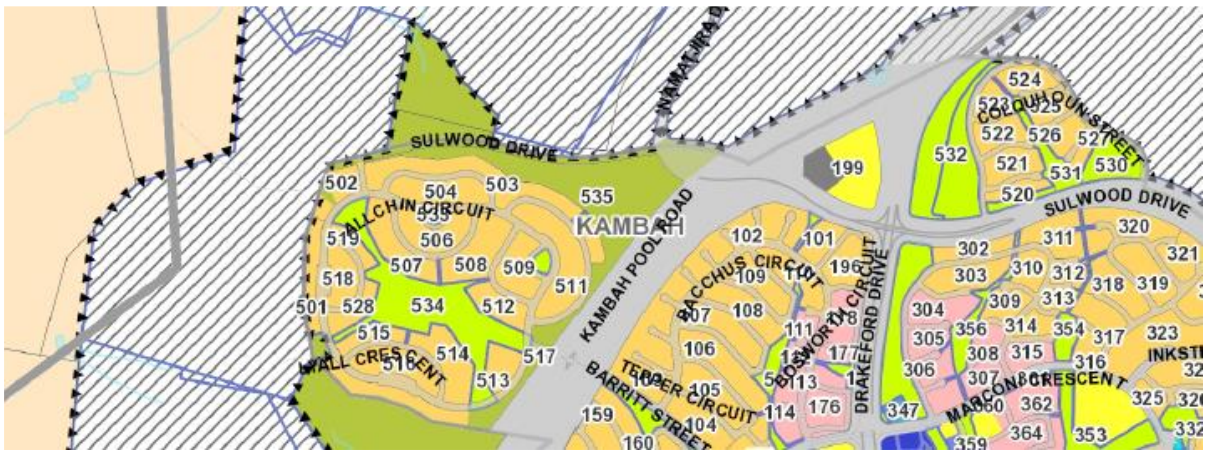
The roads currently extending in an east west direction that either currently or would lead directly into the WEIA are all two lane roads including the proposed East West Arterial (EWA) / Holborow Avenue through Denman North. All these roads are located within wide road corridors and could be duplicated / upgraded along the existing routes subject to any environmental constraints (grasslands, trees, fauna etc) and other constraints. Some sections of the roads are steep eg Kambah Pool Road and hence may not necessarily support future bus routes. With the exception of EWA / Holborow Avenue and Hindmarsh Drive to its western extremity, the roads do not appear to have been designed with the thought of them being arterial roads supporting future urban areas to the west.

The following provides an overview of the existing roads within or leading into the study area. The purpose of this overview is not to provide solutions for the transport opportunities at this stage of the study but rather to consider reserving corridors that could be used in the future, subject to urban planning outcomes and other constraints, that would provide for flexible solutions for transport infrastructure to be developed and implemented.

- William Hovell Drive – a northwest to southeast four lane arterial road (post proposed upgrade of eastern section) passing immediately to the north of the Molonglo development.
- Drake Brockman Drive – a two lane east-west arterial road (upgraded as part of the Ginninderry development) along the north-east edge of the investigation area.
- Pro Hart Avenue – new section of two lane urban road constructed as part of the Ginninderry development at the northern edge of the investigation area.
- Stockdill Drive – a two lane rural type access road along the northwestern edge of the investigation area and connecting to Pro Hart Avenue in the north.

- Holborow Avenue - a four lane arterial road from Denman Prospect in Molonglo Valley and connected to John Gorton Drive. The proposed EWA extends east of John Gorton Drive, across the Molonglo River and on to the Tuggeranong Parkway. Holborow Ave extension within Denman Prospect will be constructed as a two-lane road as part of the Denman Prospect 3 Estate works and will terminate at the eastern edge of the investigation area. Provision has been made within Denman Prospect for this road to be upgraded to a possible 4 lanes to the development's western boundary which aligns with the eastern edge of the investigation area.
- Uriarra Road - a two lane rural road which extends through the investigation area connecting to Opperman Avenue and John Gorton Drive in the east and extending to the Murrumbidgee River (at Uriarra Crossing) on the western edge of the investigation area. Uriarra Road would be upgraded to an arterial road to provide an east-west connection for the northern part of the investigation area. Uriarra Road would provide a major transport corridor connecting to Opperman Avenue, John Gorton Drive, Cotter Road then interchanging with the Tuggeranong Parkway and Adelaide Avenue (northern ramps).
- Cotter Road – a two lane rural road in the west and four lane arterial road in the east which extends through the investigation area after crossing the Murrumbidgee River and connecting to Adelaide Avenue to the east. Cotter Road would be upgraded (in the west) to an arterial road to provide an east-west connection for the central part of the investigation area. Cotter Road would provide a major transport corridor connecting to the Tuggeranong Parkway and Adelaide Avenue.
- Hindmarsh Drive – a two lane arterial road from the intersection of Streeton Drive to the western end of the road terminating at Eucumbene Drive near the eastern edge of the investigation area. Hindmarsh Drive could be upgraded as a four-lane arterial road to the west from Streeton Drive and extended into the Bulgar Ck central-southern portion of the investigation area. Hindmarsh Drive would then provide a major transport corridor from the investigation area to Weston Creek group centre, the Woden Town Centre and Inner South Canberra.
- Sulwood Drive – is a two-lane arterial road which could be realigned to the west of Tuggeranong Parkway to travel in a W/NW direction into the investigation area and along an existing road reservation for Sulwood Drive extension. A new intersection at Sulwood Dr / Kambah Pool Rd and Namatjira St would most likely be required. The extended Sulwood Drive would pass through a section adjacent to the Cooleman Ridge Nature Reserve.
- Kambah Pool Road – a two lane rural road along part of the southern boundary of the investigation area connecting to the intersection of Namatjira Drive and Sulwood Drive in the east. Kambah Pool Rd could be upgraded to provide the most southerly access to the investigation area;
- Tuggeranong Parkway – is a four-lane divided arterial (parkway) road connecting the Tuggeranong District to the Glenloch interchange, William Hovell Drive, Caswell Drive/Gungahlin Drive and Parkes Way to the north. The Tuggeranong Parkway changes to Drakeford Drive as it extends south to the Tuggeranong Town Centre and beyond. An upgraded intersection at Sulwood Dr/Tuggeranong Parkway/Drakeford Drive would provide a major southern transport connection and gateway into the south of the investigation area.

The plan below shows Sulwood Drive and Kambah Pool Road reservations to Tuggeranong Parkway and Drakeford Drive. The hatched area is Designated Land under the National Capital Plan.



Appendix C contains a more detailed description of road corridors to and through the WEIA.

5.2 Constraints

5.2.1 On-site

Identified likely constraints for transport connections within the investigation area include;

- A possible western crossing of the Molonglo River, downstream of Molonglo development, to provide a possible link between future urban areas and William Hovell Drive as part of a possible north/south transport corridor. The location of this link will be largely determined by an acceptable bridge crossing site that itself will be constrained by ecological values in the Molonglo River Reserve and Central Molonglo as well as cost considerations;
- The extension of Holborow Avenue to the west of Denman Prospect through a currently unnamed reserve area. Provision has been made in the design of Denman Prospect 3 for this road extension and the planning for the Molonglo East-west arterial road to Tuggeranong Parkway anticipates the possibility of this extension also;
- Crossing of Stony Creek, west of Mt Stromlo, for a north/south transport connection if required;
- Possible constraints on the upgrading, realignment and widening of Uriarra Road due to the proximity of trunk watermains from the Stromlo Water Treatment Plant and Oddie Reservoir.

5.2.2 Off-site

There are likely to be a number of constraints on the transport network across the city in ten years, when development would likely proceed in the western edge. Specific identified likely constraints at, or near, the boundary of the WEIA resulting from future development here include;

- Connection to a currently proposed upgraded (duplicated) William Hovell Drive and an acceptable alignment of a link road through Molonglo Central to a second bridge crossing of the Molonglo River. A notional connection point to William Hovell Drive has been identified immediately to the west of Kama nature reserve.
- Revisions to the design concept for Molonglo East-west arterial (EWA) connecting Tuggeranong Parkway and Denman Prospect via Molonglo group centre.
- Upgrading Uriarra Road adjacent to existing urban development to an acceptable standard to cater for significantly increased traffic compared to the current rural traffic. Intersection improvements are also likely at Denman Prospect.
- Upgrading Cotter Road adjacent to existing urban development to an acceptable standard to cater for significantly increased traffic compared to the current rural and recreational traffic. Intersection improvements are also likely at Mount Stromlo turn-off, Eucumbene Drive and other intersections adjacent to Wright. Bulk water supply mains from the Cotter are in close proximity to this road on the north side.
- Hindmarsh Drive upgrade currently constructed as an arterial road to the western edge of Weston Creek District between Rivett and Duffy. However, additional lanes and intersection upgrades would be required along Hindmarsh Drive to the west of Streeton Drive where it is currently a two-lane arterial road.
- Relocating Sulwood Drive and upgrading Kambah Pool Road to form the southerly connection points to western edge development. There are a few options to be explored here including the use of the existing gazetted reservation for Sulwood Drive extension to the west of Tuggeranong Parkway/Drakeford Drive. This would involve extensive roadworks, realignments and work through a southern portion of Cooleman Ridge nature reserve.

5.3 Opportunities

5.3.1 On-site

General Opportunities

There is an opportunity to plan for a mix of land uses in the WEIA and an integrated transport system supporting these. A range of residential densities, commercial/retail development, other local employment, education and recreation uses would be supported by an integrated transport system comprising roads, public transport and active travel paths with good connections to existing centres and transport routes.

Canberra's history of planning and development demonstrates some significant shifts in thinking about how future land use and transport will be delivered. The Burley Griffin Plan was for a much smaller city while the original "Y" plan aim of localised containment of travel between home, employment, local schools etc eroded over time. For long term sustainability it may be best to identify transport corridors, that are wide enough to allow for a range of future transport options, noting this will come at an economic cost of land.

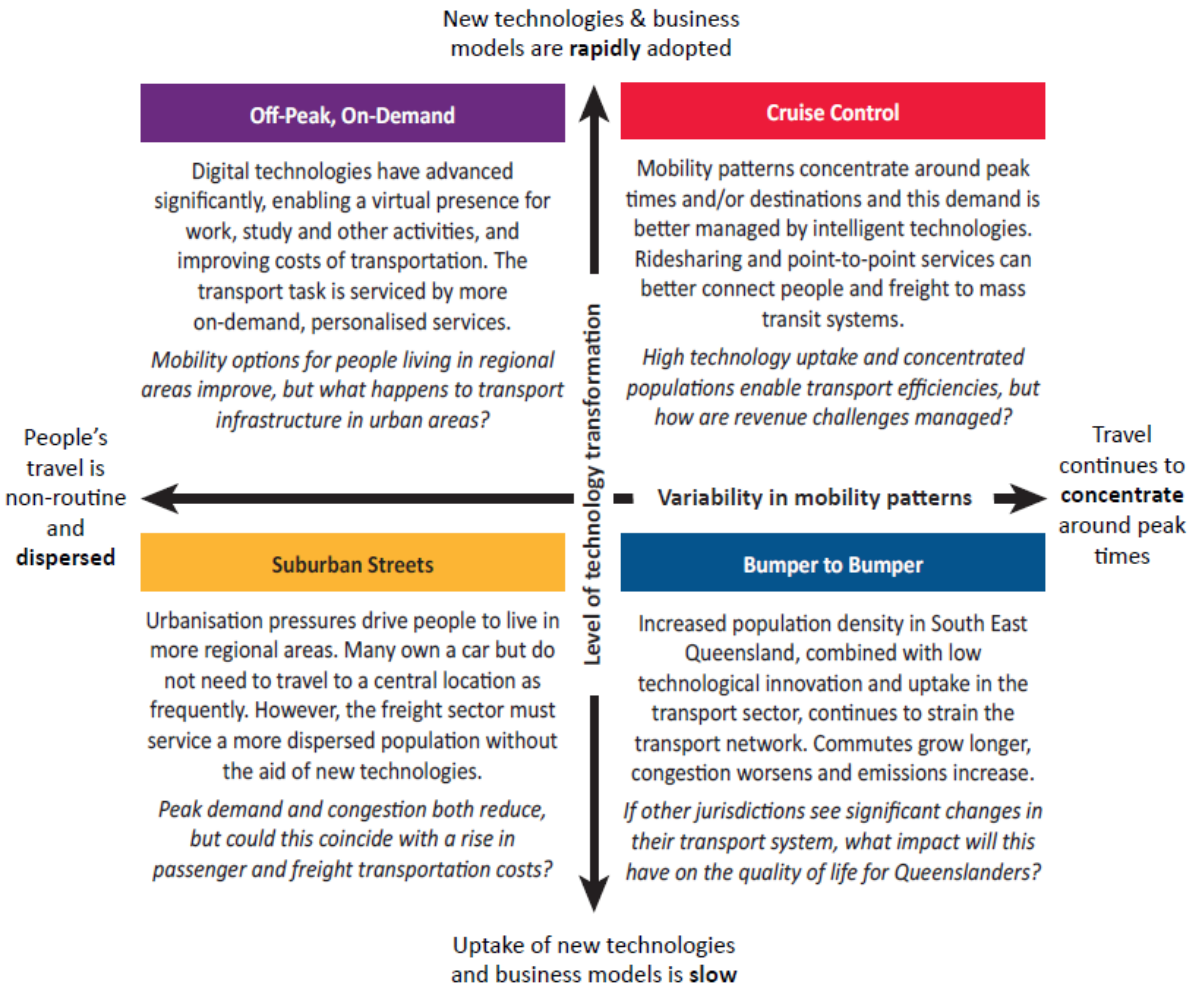
There may be an opportunity to develop a town centre within the WEIA that has a strong 'trip attraction', which could substantially pull away transport demand from the CBD/City and other existing centres.

Transport Futures

For subsequent work on transport modelling and planning (integrated with land use planning), there is the opportunity and need to explore a range of 'transport futures'. These transport futures will depend on the prevailing megatrends that might arise over the coming decades. From work undertaken by the CSIRO for Queensland Department of Transport and Main Roads, these include:

- **On the move.** Demand for transport has grown, with people travelling more and increasingly likely to consume goods and services purchased online. On the Move explores the technological, demographic and consumer shifts that will continue to drive this growth in demand.
- **Digital dividends.** Emerging technologies look to become increasingly capable, affordable and widespread. Automated vehicles, connected infrastructure, drones and big data analytics all have the potential to make the transport system more efficient, cheaper and more responsive to demand.
- **Virtually there.** Advances in technology are enabling more processes to be automated or completed online, transforming the way we work, shop and access services. This will impact how much, when and why people travel, and the infrastructure needed to support the transport task.
- **A lighter footprint.** Geopolitical pushes towards electric vehicles, shifts in consumer preferences and emerging shared mobility models offer significant opportunities to reduce the environmental and safety burden of transport.
- **Empowered consumers.** Transport users increasingly expect personalised, on-demand services that cater to their specific needs. The evolution of more individualised transport services could encourage new models of freight distribution and pay-as-you-go charging models for transport users.

Leading on from these, certain scenarios or transport futures can be suggested for analysis. Again, from the CSIRO work in Queensland, the following four scenarios have been suggested. Note that these have been tailored to South-East Queensland's strategic objectives and direction and may not suit the ACT. Scenarios or transport futures need to be developed that are in-line with the ACT's strategic directions as contained primarily in the ACT Planning Strategy, ACT Transport Strategy and Climate Change Strategy.



Source - Time travel: Megatrends and scenarios for Queensland transport out to 2048. Brisbane, Australia: CSIRO, 2018.

ACT Transport Strategy

The ACT Transport Strategy 2020, identified the following travel trends and directions for Canberra;

- Changed lifestyle and travel habits due to the COVID-19 pandemic including a reduced overall demand for travel.
- Growing demand for travel and especially by public transport, driven by population growth, congestion on roads, parking costs and other factors.
- Greater demand for travel outside peak periods and on weekends as a result of changing lifestyles and work patterns.
- Growth of car-free and car-light lifestyles.
- Older people and young families needing accessible transport options.
- Need for more transport choices.
- Emerging autonomous vehicle technologies.
- Zero emissions travel.

While the strategy does not anticipate development in the western edge investigation area specifically, there is a strong desire to continue the theme of a *compact and efficient city,* including better public transport and active travel for a more liveable city.

A key aim from investigating a range of transport futures is to future-proof the planning outcomes and transport infrastructure provided for any development area. Future-proofing can be defined as the critical process of anticipating future events, changes, needs or uses to prepare appropriately, minimize impact and capitalise on opportunities (Masood et al., 2015).

Movement and Place

There has been a growing recognition of the relative importance of movement and place in planning for new and existing urban areas. From the NSW Government Architect (https://www.governmentarchitect.nsw.gov.au/guidance/movement-and-place); *Movement and Place considers the whole street including footpaths, from property line to property line. It takes into account the needs of all users of this space including pedestrians, cyclists, deliveries, private vehicles and public transport, as well as people spending time in those places, whether moving around the place or enjoying street life including outdoor dining, waiting for a bus or watching the world go by.*

Movement and Place creates a shared language and approach to help all stakeholders achieve better place and seeks consideration of place when developing our transport systems. It is applicable at a range of scales from cities and towns to neighbourhoods and local streets.

Movement is a key enabler of places. Done well it can enhance and contribute to successful places, designed poorly movement can diminish places and contribute to their decline.

In the context of planning for the possibility of urban development in the Western Edge, the location and type of transport mode and infrastructure should be guided not just by concerns around connectivity, capacity and safety but also by the importance of places and how the transport systems can enhance these into the future. In particular, public space is where people can socialise and add vitality to their neighbourhoods, and streets and roads have an important role in that vitality. Aligning movement functions with the places they serve can make transport networks and public spaces better contribute to the liveability of communities.

Specific Opportunities

Five to six road connections to the investigation area from the east have been identified. However, there is no existing north-south connection to or through the area. The need for a north-south transport connection for all modes needs to be investigated as a priority in the next phase of studies for the area. Depending on the outcomes of this work and subsequent work on planning and transport modelling, two broad access strategies for the investigation area have been identified so far;

- Transport connections to the east only, including Holborow Avenue extension, Uriarra Road, Cotter Road, Hindmarsh Drive and Sulwood Drive;

- Easterly transport connections (above) and a north-south trunk route linking all western edge investigation area precincts and connecting to William Hovell Drive to the north and Tuggeranong Parkway in the south.

These strategies, while 'broad', need to be developed through an Integrated Transport and Land Use Planning (ITLUP) approach.

Internal suburban road typology and land use to promote more active travel could be achieved in part by:

- Localised schools, shops, childcare and work opportunities promoting walking and cycling and reducing the need for cars
- Pedestrian paths separated from cycle paths
- On road cycling lanes
- Off road dedicated cycle paths or shared paths
- Priority for pedestrians and cyclists over vehicles
- Appropriate sizing of road infrastructure so that design speed reflects intended posted speed to avoid excessive land take for road corridors.
- Integrated transport network that reflects Movement and Place framework and design principles.

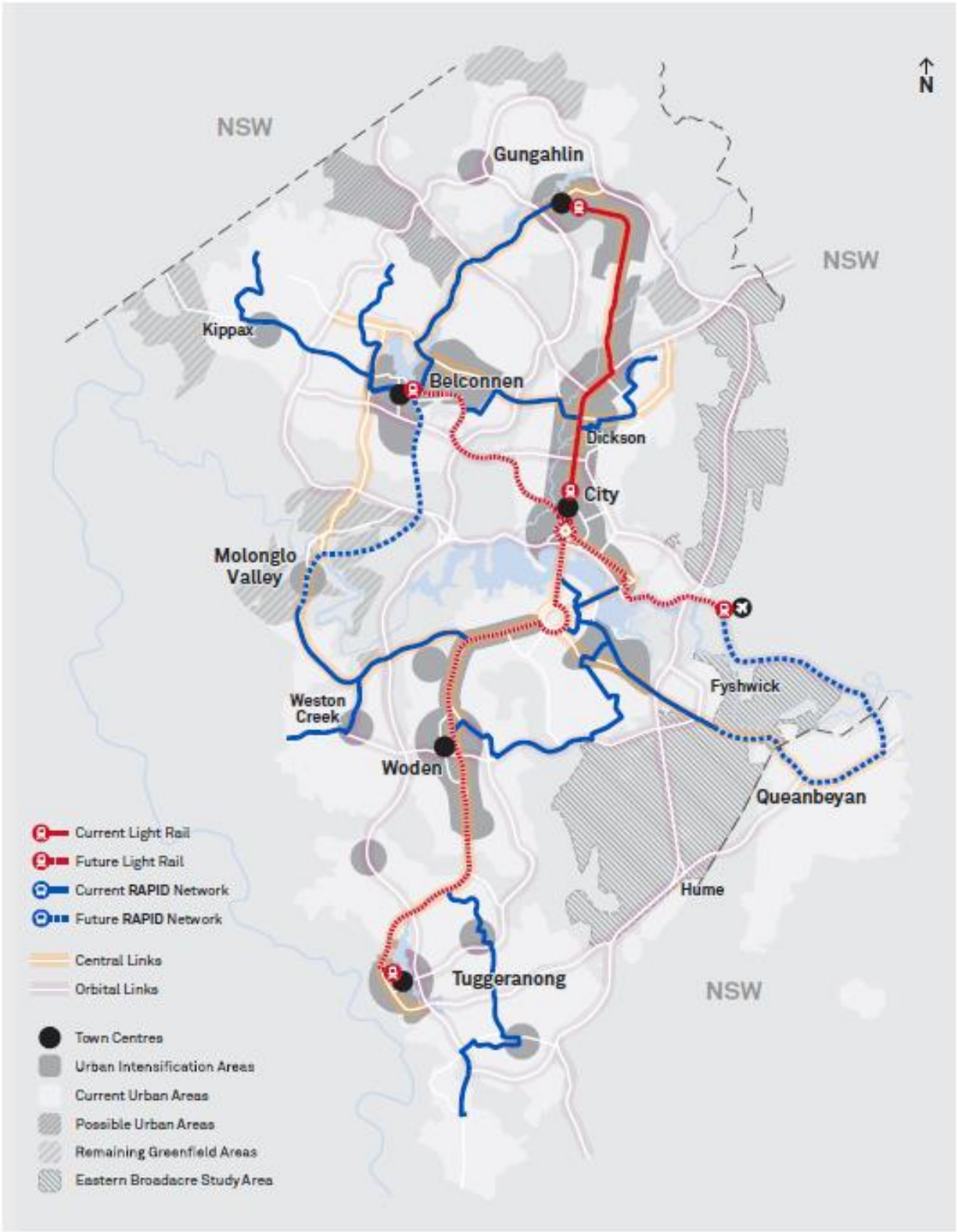
These could all be developed as part of the ITLUP approach.

5.3.2 Off-site

Public Transport

The ACT Transport Strategy provides for future network improvements that any development within the WEIA could build on. Map 2 (below) from the strategy shows the key links throughout Canberra.

MAP 2 **ACT Transport Strategy – Central links and public transport network**



Potential exists for public transport connections to expand westwards from those shown for West Belconnen, Molonglo, Weston Creek and Tuggeranong. In addition, the creation of a north-south arterial road link would provide improved public transport connectivity within

the WEIA, to existing urban areas and potentially between existing urban areas on the western side of Canberra.

Opportunities exist for frequent, reliable and direct public transport links from the WEIA via Hindmarsh Drive to Woden and the new public transport interchange and via John Gorton Drive/William Hovell Drive / Coulter Drive to Belconnen and the (future) light rail / bus interchange. These would, in turn, provide links to the Tuggeranong Town Centre and the City from Woden and to the Gungahlin Town Centre and Dickson from Belconnen. With the rapid advance of transport technologies, future public transport could include systems that are not yet used today (e.g. automated shuttle buses).

Further opportunities exist to expand the light rail network to connect WEIA to other major town centres, creating an orbital network around Canberra to cater for population growth. However, light rail will require two carriages on each service to cater for the increased patronage.

The determination of transport corridors and the associated infrastructure requirements would depend on a few factors, including:

- Land Use Planning: Is City/Civic still going to be the central area of commercial activity (CBD), or is the ACT going to be more decentralised in the future? What is the land use composition of the WEIA and the rest of the ACT in the long term (2051+). This will impact decisions relating to the infrastructure requirements of the southwest corridor, Glenloch Interchange, Parkes Way, etc. It is important to integrate transport and land use in the planning process.
- Future Transport Directions: The level of adoption of emerging transport technologies (e.g. CAVs, EVs, drones, etc) and mobility services (e.g. Movement as a Service, ridesharing, etc) would also need to be considered in determining future transport infrastructure needs. Scenario planning could be considered to determine and assess likely/plausible transport futures.
- Alignment with the ACT's Strategic Objectives: Transport plans for the WEIA will need to be closely coordinated with the ACT Transport Strategy Implementation Plan (see preceding comment) and consistent with the Movement and Place planning approach.

5.4 Lead time

A lead time of about 10 years is anticipated for the delivery of key transport infrastructure in support of urban development. This includes the need for a clear policy and implementation plan for transport for the WEIA, integrated with the structure and other planning for the area and based on thorough feasibility and options assessments. Approximately 5-8 years lead time is expected for the planning, design, approvals and construction of major road and other transport elements.

5.5 Inter-dependencies

The key interdependency for transport planning and design is the structure planning for the Western Edge, including land use designations and population/employment/enrolement projections. Public Transport network plans, active travel plans, future light rail plans, future

transport / emerging technologies and other innovations in mobility services will also have an influence on the nature and timing of transport infrastructure required for the area.

5.6 Preferred development sequence

The presence of a number of road connections from the east may allow a degree of flexibility in the sequencing of development for sub-areas within the WEIA. However, the contiguous development of various stages of WEIA is likely to be preferred so that better linkages can be drawn between development stages and existing districts and centres. The investigation of a strong north-south transport connection would also form part of the considerations here. Development radiating away from existing roads could reduce the initial infrastructure costs and make best use of existing assets.

5.7 Risk Ranking – Roads and Traffic

HIGH – early planning and investigation of land use and infrastructure options required in preparing an integrated network solution

The determination of Transport Corridors and Traffic risk is rated as **HIGH** due to:

- The many interdependencies and the uncertainty associated with these
- Integrate transport and land use planning (ITLUP)
- Alignment with ACT Transport Strategy
- Topography of the site
- The cost of infrastructure, and
- The overall approach to planning for the WEIA.

6 WATER SUPPLY – ICON WATER

6.1 Existing Infrastructure

6.1.1 On-site – existing Infrastructure

Three major bulk supply pipelines, 600mm, 900/1050mm and 1350mm diameter run from or past the Cotter Pump Station (CPS) to Stromlo Water Treatment Plant (SWTP), roughly along the alignment of the Cotter Road. They are critical watermains as they connect both the CPS and Bendora dam to SWTP. They are Canberra's main water supply lines. An additional rising main from Cotter River to Mount Stromlo is included in the water supply masterplan to be constructed in around 2040. A corridor/easement will need to be set aside for this future main.

6.1.2 Off-site network connections

The investigation area is close to SWTP and the Stromlo-Higgins Bulk Supply Main in the north, the Stromlo-Red Hill mains in the Weston Creek area and is close to the water supply network in Tuggeranong. All these sites are potential connection points to the existing water network.

6.2 Constraints

6.2.1 On-site

The existing CPS to SWTP watermains are a constraint to future development, roads and other infrastructure. Relocating them is unlikely to be feasible. They are also very high-pressure mains (2500kPa+/ 250m+ head) that will require significant easement corridors. It may be feasible to lower the one above-ground main in selected areas to allow for road crossings.

Road crossings will need to be designed to prevent damage to the pipelines, and maintenance access to and along these watermains will need to be maintained.

The investigation area is undulating and extends a long distance from north to south, meaning the water supply zoning, and the availability of water reservoir sites, will be critical to providing an adequate water network. While not particularly complicated, the identification and designation of sites for service reservoirs will need to be an early action to reserve the sites for urban water supply.

The presence of the watermains may impact on Cotter Road upgrades and will also limit major urban development earthworks in the immediately surrounding terrain.

6.2.2 Off-site

The water network is designed to allow supply from either Stromlo or Googong water treatment plants in the case of one of these two sources being unavailable. In the case where supply is only from Googong treatment plant, it's likely that off-site upgrades to the bulk supply network will be required to serve the WEIA. Actual requirements will be dependent on the final development areas and loadings.

It is unlikely there will be a need for a new Murrumbidgee River or Molonglo River water main crossing to serve the area, however this cannot be completely ruled out until the extent and nature of development is known.

6.3 Opportunities

6.3.1 On-site

There is an opportunity to upgrade Cotter Road or construct a major new road adjacent to the existing watermains.

Water supply could come from a connection to the existing Stromlo-Higgins bulk supply main, which runs through the north-east corner of the site.

Consideration of non-potable supply sources is an opportunity. Options for use of LMWQCC treated effluent for reticulated irrigation, or reuse of stormwater, have been considered in the past for Molonglo and Canberra as a whole. Studies to date in the ACT have shown the cost of such schemes outweigh the benefits. Important issues include public health, regulation of the Icon Water network and water pricing. In water accounting terms, the LMWQCC effluent discharge is part of the ACT's Sustainable Diversion Limit (SDL) calculation. Given the proximity of the northern part of the WEIA to LMWQCC, consideration might be given to re-examination of re-use of effluent for irrigation in this area. Consideration of whether to pursue a water supply strategy that follows the current scheme or whether to use alternative sources needs to be undertaken early as approvals for alternatives will have long lead times. Any decision on current or "alternative" water options should also be made early as the integration or exclusion of these options into the planning and design of the area will also have a long lead time.

6.3.2 Off-site

The existing bulk water supply network (Stromlo and Googong plants suppling to district reservoirs) was designed at a time when peak water demand per capita was much greater than the current level. This has resulted in a situation where the bulk supply network remains over-designed for current peak demand. There is, therefore, an opportunity to use the existing reserve capacity in the network of pipes and reservoirs to service new demand. Whilst some of this current excess capacity has already been taken up with recent development, it may be feasible to extend the Tuggeranong and Weston Creek water supply service areas to include parts of the investigation area. This approach would be less feasible in the northern part of the investigation area which is adjacent to Molonglo and Belconnen districts that have limited, if any, reserve capacity. It is also dependant on the level of extra load that would occur from new development in the WEIA.

6.4 Infrastructure Delivery Lead Times

Water infrastructure lead times are driven largely by ICRC and other Regulatory processes as well as planning and environmental approvals. Expenditure on detailed investigations, design, environmental assessments and construction need to be identified years ahead of any work commencing. The current Icon Water Regulatory Determination expires in 2023. The next submission will be due in 2022. Preparation for that submission will begin in 2021. Therefore, opportunities to place projects in the price path exist in 2021, 2026 and nominally every 5 years after that. Also note that inclusion in a submission developed in (say) 2021 will not allow expenditure until 2023 at the earliest.

Icon Water suggest around 5-10 years lead time for planning, design, approvals and construction of reservoirs and large mains. Another important issue for Icon Water is the efficient sequencing of this infrastructure with land development, so that the infrastructure can be delivered on-time but not too early.

6.5 Inter-dependencies

The urban water network is not designed with enough capacity to fight bushfires. It is designed to fight building fires. Increasing infrastructure size (pipes and reservoirs) to account for bushfire fighting is a very major change to the intent of the water supply network. For example, one risk is that larger pipes, normally dormant, are likely to cause ongoing water quality problems in the normal operation of the urban water supply. Such a system is likely to require a dedicated "bushfire network" and come at very significant cost. This change would require regulatory approval, new network standards and designs for this separate network. If it is being contemplated work needs to begin now.

6.6 Preferred Development Sequence

Water supply to the area is not highly sensitive to the development sequence but some existing infrastructure around Mount Stromlo and Weston Creek could more readily supply early stages of the western edge area.

6.7 Risk Ranking - Water

LOW

The ability to supply potable water to the investigation area is considered a low risk. The major issues will be:

- allowing sufficient lead time to meet the Regulatory processes required of Icon Water, planning and environmental approvals,
- location and 'protection' of future reservoir sites
- resolution of the role of the urban water network in firefighting, and
- protection of the existing Cotter to Stromlo watermains, the main supply to the city.

7 SEWERAGE AND WASTEWATER MANAGEMENT– ICON WATER

7.1 Existing Infrastructure

7.1.1 On-site – existing Infrastructure

The Molonglo Valley Interceptor Sewer (MVIS) passes through the study area on the north side of the Molonglo River. Other than this major sewer, the WEIA has no sewerage infrastructure within the study boundary.

7.1.2 Off-site network connections

The area could be served by a connection to the MVIS at the northern part of the study area. The southern area could be served by the existing Tuggeranong sewerage network, which also flows to the MVIS, via the Tuggeranong Sewer Tunnel beneath Weston Creek. However, the local topography will make this option difficult and expensive and may require one or more sewer pump stations.

All sewage from the northern part of the WEIA will need to either end up at the existing LMWQCC treatment plant, or a new sewage treatment plant built south of the Molonglo River and discharging somewhere along the Murrumbidgee River. Based on the current strategy, LMWQCC will expand its operations over the current site of the plant within the next 50 years. Due to the steep topography of the site, to upgrade further would require major earthworks and infrastructure that would be very expensive. Icon Water is considering how best to utilise that spare capacity and whether (and where) a new treatment plant might be possible.

Whilst the most likely option is to drain the WEIA sewage to LMWQCC, the next stage of investigations should consider the pros and cons of a new sewage treatment plant for the WEIA, among other options.

7.2 Constraints

7.2.1 On-site

Implementing a gravity sewage collection system that services the entire investigation area will require a crossing the Molonglo River and connection to LMWQCC or the MVIS. At this stage of investigations it appears that the most feasible option is connecting to the MVIS downstream of the Molonglo development.

Development of the northern part of the WEIA will be somewhat constrained by the buffer zone required around the existing LMWQCC. The buffer zone is primarily for noise and odour, and will need to be defined, but can be assumed to be of the order of a 1.5km distance from the plant in all directions. This will be a constraint, and work is underway to quantify it. Reference is made to the Western Edge Investigation Area Preliminary Air Quality Assessment (AECOM 2020).

The ability to connect to the sewerage system will define the lower- level bound of any proposed urban development. Development could be extended to lower levels by pumping sewage up into the adjacent network. However, the best design approach is to minimise the number of pump stations, due to WH&S and environmental risks, cost and energy consumption. The majority of the site should be served by a gravity sewerage system.

The general topography of the investigation area, with deep ravines, will make the construction of a gravity sewage network, that connects to the existing network,

challenging. It is possible but will produce development constraints and will involve bridging and possibly also significant tunnelling in some areas.

7.2.2 Off-site

Neither the MVIS nor LMWQCC have capacity constraints related to receiving flows from the development of the investigation area. The need to upgrade the LMWQCC capacity will be driven by population growth, wherever it occurs, and hence is out of the scope of this study. The MVIS has significant capacity thanks to the foresight of the original planners and designers.

7.3 Opportunities

7.3.1 On-site

On-site treatment and reuse of effluent for irrigation is an option that has arisen in studies of Greenfields developments in the ACT in the past. It has yet to be implemented, as studies have consistently shown that the costs outweigh the benefits. The costs include the public health risk, operational costs, cost of the infrastructure for a distribution network, infrastructure for the measurement, billing, maintenance etc of such a network and the fact that discharge from LMWQCC is counted as part of the ACT's sustainable diversion limit (SDL) from the Murray-Darling Basin. The regulation of Icon Water pricing would also mean there would likely be no savings to water customers. An early decision on whether to keep this option under consideration, or not, is required as there would be many time-consuming issues to resolve to design, plan, approve, regulate, and implement such a scheme.

7.3.2 Off-site

Using the reserve capacity of existing infrastructure, particularly the trunk sewage collection system, to collect sewage by gravity from the development areas offers a number of advantages.

There is an opportunity to co-locate any proposed Molonglo River gravity sewer crossing with a traffic or pedestrian bridge. Siting of the bridge over the Molonglo River and connecting to the MVIS is critical for the sewerage system, but there are likely to be co-location opportunities as was shown with the Butters Bridge serving the Molonglo Valley development.

7.4 Lead times

Crossing of the Molonglo River to connect to the MVIS would be a key project in sewer servicing of development in the investigation area. Early planning, design and environmental approvals of the infrastructure and its location would be critical to the timely delivery of a sewerage system to serve the WEIA.

Designing the sewerage system will be complicated and take considerable time. Tunnelling is also likely, and sourcing and procuring appropriate tunnelling expertise will also require long lead time.

Lead times are also heavily dependent on the regulatory processes. Expenditure on detailed investigation, design and construction will need to be identified years ahead of any work commencing. The current Icon Water Regulatory Determination expires in 2023. The next submission will be due in 2022. Preparation for that submission will begin in 2021. Hence opportunities to place projects in the price path exist in 2021, 2026 and nominally every 5

years after that. Also note that inclusion in a submission developed in (say) 2021 will not allow expenditure until 2023.

7.5 Inter-dependencies

There are no major inter-dependencies other than the opportunity mentioned above for joint use of a bridge across the Molonglo River.

7.6 Preferred development sequence

The preferred sequence, from the perspective of trunk sewer construction, would be for development to occur from the north to the south. A temporary Sewage Pump Station could also be constructed for the Molonglo River Crossing to help delay the bridge construction, although this could be difficult due to Geotechnical issues and the ability to locate an acceptable rising main within the river reserve.

There is some limited potential for smaller temporary pump stations in the southern areas to pump to the existing networks around Weston and Kambah. These would have some capacity limitations and operational difficulties due to the length of rising mains required.

Sequencing of sewer construction will be critical. This will require more detailed examination when there is a better idea of development extents, layouts and population.

7.7 Risk Ranking - Sewerage

HIGH – early agreement on planning, staging, design and investment required

While it will be possible to sewer the site, the sewerage system has potential to limit the extent of development of the investigation area and there are interdependencies that will impact on staging. The sewerage risk is rated as HIGH due to;

- Long lead time, including Icon Water Regulatory processes and planning and environmental approvals;
- Topography of the site – a number of design solutions may exist, and these will generally set the limit of development;
- The need for a trunk sewer to cross the Molonglo River to connect to the MVIS, and/or the need for connection to the Tuggeranong Sewer Tunnel in the south and;
- Potential need for a significant tunnel beneath the Uriarra Road ‘peninsula’, its lead time and cost.

More studies are required as a priority to better understand the details and the viability and cost of various options.

8 STORMWATER DRAINAGE – ACT GOVERNMENT

8.1 Existing Infrastructure

8.1.1 On-site – existing Infrastructure

There is little or no man- made stormwater drainage infrastructure within the study area.

There are existing natural drainage channels (creeks, gullies etc) on the site that would ultimately be part of any urban stormwater system draining the site if urbanised. The natural values of these are the subject of an accompanying study; Water Values and Environmental Hydrology Assessment (Alluvium 2020).

8.1.2 Off-site network connections

Stormwater systems on the site would be connected to the Molonglo River or the Murrumbidgee River, via existing natural drainage channels.

8.2 Constraints

8.2.1 On-site

There are significant slopes and elevation differences within the investigation area and especially from the various hills and ridges to the Molonglo and Murrumbidgee Rivers below. Assuming urban ponds/wetlands are used to help manage stormwater quality and flow, these would most likely be placed above the Murrumbidgee Corridor and Molonglo River reserves and below the future urban areas that they would serve. Piping large flows from these ponds down to the river system will produce concentrated flows with high velocity/momentum. Slowing the flow into natural water courses and at river level, to prevent erosion, will be a significant engineering challenge, and likely to be costly. Stormwater reuse or piping of flows to the receiving waters are some of the alternatives.

Integration of Water Sensitive Urban Design (WSUD) solutions, at a local and catchment level (i.e. within a subdivision) has proven a challenge, as highlighted by the Auditor General's report (No. 1/ 2018) into the Acceptance of Stormwater Assets. This challenge remains.

There is also significant uncertainty in designing drainage systems for climate changed conditions.

8.2.2 Off-site

The need to protect the downstream water quality is the primary off-site constraint and requirement. The current WSUD Guidelines are designed to ensure such protection but are yet to achieve an integrated treatment train for Stormwater, partly for reasons set out in the Auditor General's report.

A related issue is the significant increase in volume and peak flows of stormwater that occur with urban development. A fourfold increase in the volume of runoff is possible with urban development and similar increases in peak flows are also possible if mitigation measures are not undertaken. These flow volume and rates are related to water quality issues and especially erosion and sedimentation.

Another off-site/network connection constraint is the ability of the ACT Government to operate and maintain any stormwater assets. Many stormwater water quality protection options require significant maintenance, and all require some maintenance (i.e. regular

cleaning of gross pollutant traps). If this maintenance is not undertaken then that element of the treatment train will generally not work.

8.3 Opportunities

8.3.1 On-site

Development of the investigation area provides an opportunity for early engagement of all stakeholders in the treatment train required to protect the water quality in the Molonglo and Murrumbidgee Rivers. The opportunity is to develop an integrated "all of catchment" approach to the management of urban stormwater. A process is required to ensure works on leases, in streets, in neighbourhoods and sub-catchments are integrated into agreed stormwater treatment train options for the entire site. Collaboration within EPSDD (Planning and Urban Policy, Development and Implementation, Environment Division) and relevant areas of TCCS will be necessary.

There is also an opportunity to begin focussed water quality and flow modelling at key points on the site to ensure the existing conditions are well known, and any point sources or catchments of concern are identified.

8.3.2 Off-site

Integrating on-site and off-site water quality monitoring would help to better understand long term water quality and flow trends, and the effectiveness of WSUD interventions. In order to gather sufficient information to design appropriate WSUD infrastructure, preliminary on-site water quality monitoring is required

8.4 Lead time

Early development and agreement of a stormwater strategy for the entire site area will be critical to an effective staged implementation of WSUD measures over the area. Determining a process for this catchment wide approach can start now, as can identification of key stakeholders and the monitoring of water quality and quantity. The ultimate outcome may include changes to regulations and/or design standards that may be specific to this site.

8.5 Inter-dependencies

The stormwater strategy for the area will have strong links to the urban design including road locations and design, to the environmental outcomes for the site, and to the land value creation for any future suburbs (i.e. pond size, location and design features).

8.6 Preferred development sequence

The existence of a number of small to medium sized catchments over the WEIA site allows for a staged implementation on a catchment-by-catchment basis. At this stage, a preferred development sequence is not identified. However, the establishment of stormwater management measures (WSUD and flow management) for each catchment should occur before development proceeds.

8.7 Risk Ranking - Stormwater

MEDIUM

The stormwater risk is rated as MEDIUM due to:

- Topography of the site and existence of many small to medium sized catchments discharging to the Molonglo and Murrumbidgee Rivers
- Need for early development of an integrated stormwater management strategy, from block to river, and the process and time needed to develop and agree this approach
- Potential need for site specific design criteria and other requirements that may differ from existing guidelines, standards and codes, and
- The need for early and long-term water quality and flow monitoring.

9 ELECTRICITY - EVOENERGY

9.1 Existing Infrastructure

This assessment focuses on very high voltage networks including transmission lines and other lines above 11 kV. Existing 11 kV HV lines and smaller distribution lines to individual properties are not covered here and do not represent a significant constraint to development.

9.1.1 On-site – existing Infrastructure

There are two high priority 22kV Distribution overhead lines to Cotter Pumping Station and Tidbinbilla tracking station that traverse the area. There are no Evoenergy 132 kV transmission lines through the area. There is a TransGrid 330 kV transmission line through the area from north to south as described in Section 11.

9.1.2 Off-site network connections

The on-site electricity network will need to connect to the existing network and is subject to the existing network requirements. **Error! Reference source not found.** shows the Evoenergy Transmission network and a conceptual plan prepared by Evoenergy for the expansion of the 132 kV network, including a new zone substation, to serve the investigation area.

9.2 Constraints

9.2.1 On-site

The two high priority 22kV Distribution overhead lines to Cotter Pumping Station and Tidbinbilla tracking station will need to be retained through the area.

9.2.2 Off-site

Woden Zone Substation (see **Error! Reference source not found.**) is close to full capacity, so would not be able to supply any new suburbs in the southern part of the western edge investigation area.

With the possibility of no natural gas in new developments and with the increasing popularity of instantaneous electric or electric assisted solar hot water in many developments, Evoenergy are expecting a 50% to 80% increase in peak electricity demand when compared with suburbs with natural gas connections. Further work is being undertaken on the actual impact of these policy positions. Early indications are that the increase in peak electricity demand will occur but that the increase may not be as significant as indicated above.

9.3 Opportunities

9.3.1 On-site

Assuming additional electricity supply would be required for approximately 50,000-100,000 residents (20,000-50,000 residential customers) and with no natural gas supply, Evoenergy expects that between 1 and 2 new zone substations would be required for the entire area. The options detailed in **Error! Reference source not found.** show a single new zone substation in the middle of the investigation area. This location is indicative only and the number of zone substations as well as their location are to be confirmed in later stages of investigation work.

Distributed energy generation and storage offers opportunities to minimise peak demands and hence the extent of network capacity upgrades required. Work is currently underway by the ACT Government and separately by Evoenergy looking at 'big battery' opportunities across the Territory.

9.3.2 Off-site

At this stage the proposed new Molonglo Zone substation (see **Error! Reference source not found.**) is expected to require 2 permanent transformers by 2030 to supply planned developments in the Molonglo Valley. This zone substation will be able to accommodate a third transformer which is expected to be able to supply any initial stages of western edge development in the northern part of the study area.

Wanniassa Zone Substation has some capacity to supply initial stages of the most southern part of the western edge investigation area.

A future zone substation is also planned for the West Belconnen area at Strathnairn within Ginninderry development, to the north of the investigation area. This has the potential to also supply load to the northern parts of the investigation area as a possible supplementary supply to the planned Molonglo zone substation. Technical and environmental constraints may exist in extending 11 kV feeder cables from this planned Strathnairn zone substation to the investigation area including a crossing of the Molonglo River Reserve.

9.4 Lead time

Evoenergy is governed by the National Electricity Rules (NER) which is governed by the Australian Energy Regulator (AER). As part of Evoenergy's regulatory requirements the business must work in 5 year regulatory periods. Prior to these regulatory periods Evoenergy is required to submit details on proposed expenditure which then must be approved by the AER. Any expenditure which is not approved as part of this process cannot be recovered from electricity customers through the regulated business.

Evoenergy is currently in the July 2019 to June 2024 regulatory period. The preparation for a new regulatory period is approximately 2.5 years before the start of the period. For this reason, Evoenergy would need to be advised of any major development occurring within the July 2024 to June 2029 period by January 2022.

Evoenergy also requires annual land release program updates in order to update forecasting information.

For each major greenfield development Evoenergy requires 12 months' notice to enable the best planning outcomes.

9.5 Inter-dependencies

1. Gas reticulation – Evoenergy's GN21 Gas Access Arrangement submission has identified that the gas network will not be reticulated into new greenfields unless this is supported by the developer, however the following items will need to be considered and confirmed for broader network planning of both the electricity and gas network:
    - The requirement for gas in commercial developments such as commercial kitchens and pools.

- If electricity is incentivised over gas in established suburbs, this will place additional load on the existing electricity network leaving less existing capacity to support this development.

2. Residential solar panel & battery penetration – Network augmentation requirements will be significantly impacted by the penetration of residential solar panels and battery storage. This will be partly driven by government policies and incentives.
3. Electric vehicle uptake – Electric vehicles are yet to contribute significantly to electrical load in the ACT, however this is expected to change in the coming years.
4. Appliance trends and/or incentives e.g. type of hot water systems
5. Microgrid opportunities with local generation and battery support
6. Development model – government development or private developers?
7. What will distribution be of residential and commercial developments as this diversity impacts modelling
8. Housing density – The density of the housing will impact the extent and timeline of the required augmentation.
9. Development sequence – As Evoenergy has varying levels of existing capacity across the network the required augmentation timeline will depend on the development sequence. See section 11.6 for additional detail.

9.6 Preferred development sequence

Evoenergy has a preference to stage from north to south, as they expect to be able to provide a significant amount of new load from the proposed Molonglo Zone Substation that in-turn receives power from the new Stockdill substation at West Belconnen. This would minimise costs for ACT electricity customers due to greatest efficiencies of supply.

Evoenergy's second preference would be to begin staging from the south, as Wanniassa Zone Substation is expected to be able to supply some initial stages of development.

The central part of the proposed investigation area has the least available capacity from existing infrastructure (from Woden zone substation) and would require the construction of a new Zone Substation so Evoenergy would prefer it to be later in any land release plans.

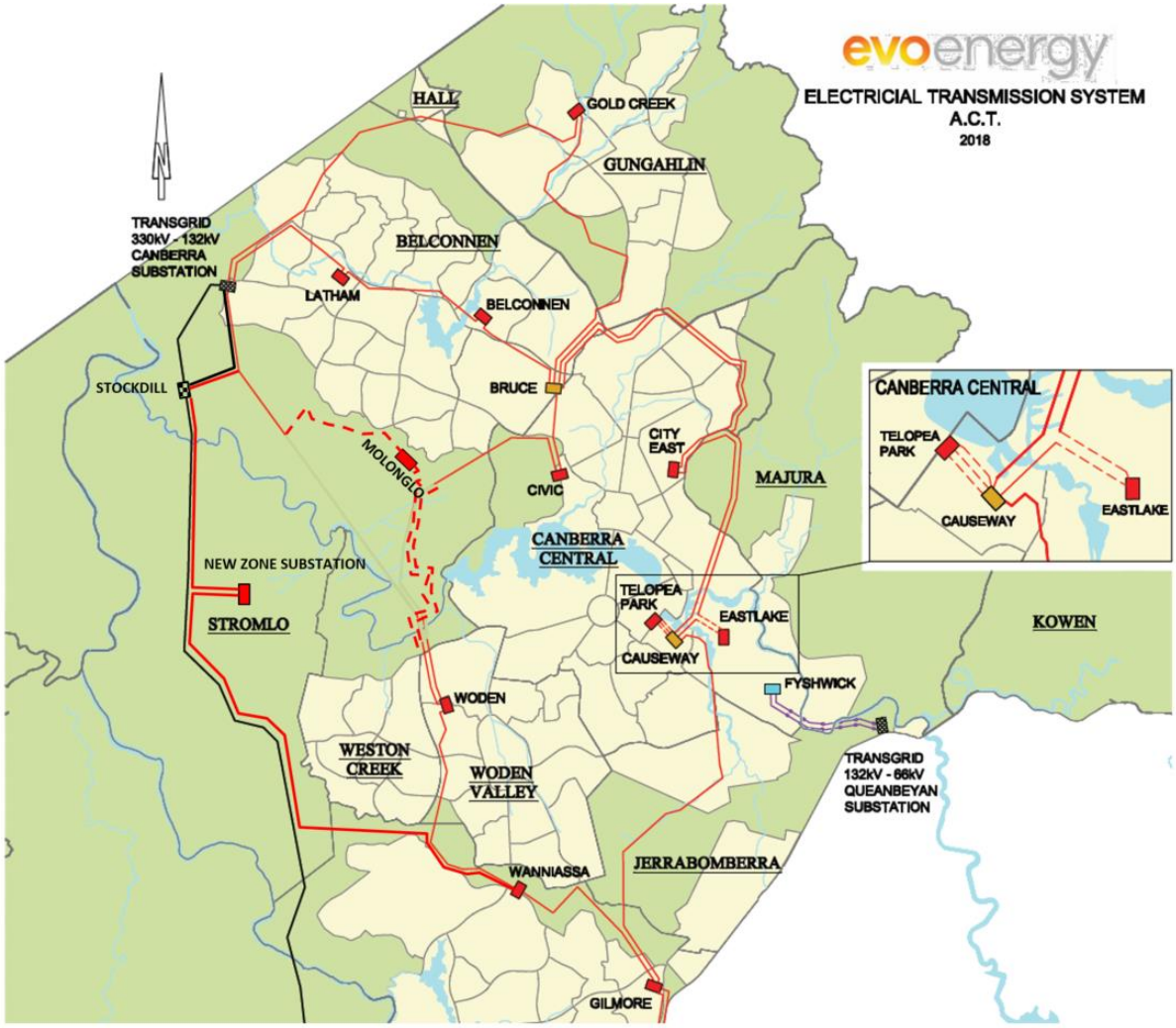
9.7 Risk Ranking – Electricity - Evoenergy

MEDIUM

This risk has been determined to be medium due to uncertain demand projections primarily due to the new policies on natural gas phase-out and difficulties projecting take-up of distributed energy generation and storage resources. Regardless of these factors, an energy network will be required including one or two new zone substations and associated transmission lines, hence sites and easements will be required with location and easement options needing investigation and confirmation early in the planning for the development.

Figure 1 – Evoenergy's electrical transmission network plan – conceptual plan with potential future substation

(Thin red lines represent existing 132 kV transmission lines, dashed red are planned network modifications and bold red lines show possible future transmission line to a new Stromlo zone substation. Black lines are TransGrid 330 kV transmission lines)



10 ELECTRICITY – TRANSGRID

10.1 Existing Infrastructure

10.1.1 On-site – existing Infrastructure

TransGrid is the manager and operator of the very high voltage electricity transmission network in New South Wales and the Australian Capital Territory and is part of the National Electricity Market. As such TransGrid operate a significant part of Australia's national grid.

A TransGrid 330kV transmission line runs from north to south across the site on steel lattice towers and within a 60m wide reservation/easement. This is shown on Figure 1 as a black solid line from the new TransGrid Stockdill substation in Belconnen to TransGrid's Williamsdale substation to the south of Canberra.

10.1.2 Off-site network connections

The 330kV lines form part of the National Electricity Grid and are essential to the distribution of power in our region. The Canberra TransGrid substation, located to the north of the investigation area and north of the new Stockdill substation distributes power from the national grid into the ACT from five 330 kV transmission lines including the Canberra-Williamsdale line described above. Other lines come from Upper and Lower Tumut, Yass and Capital Windfarm.

10.2 Constraints

10.2.1 On-site

Development and activities on and in the immediate vicinity of TransGrid transmission are restricted to ensure safety of landowners and the public. Details on the key constraints around transmission lines can be found on TransGrid's website at

https://www.transgrid.com.au/being-responsible/public-safety/Living-and-working-with-electricity-transmission-lines/Pages/default.aspx

An indicative relocation cost of $1-3M per km (not including any property or easement costs) depending on site conditions should be considered a typical figure. Easements for single 330 kV transmission lines are typically 60m wide.

10.2.2 Off-site

Network modifications follow the process as described in the following link https://www.transgrid.com.au/what-we-do/our-network/connections-and-modifications/network-modifications/Pages/default.aspx . A timeframe of 2-3 years should be allowed as construction outages can be difficult to obtain for critical lines.

10.3 Opportunities

10.3.1 On-site

Options for transmission lines include:

- leaving them where they are and manage the adjacent land use
- relocating them elsewhere within an equivalent 60m wide easement and,
- placing the lines underground – subject to technical and cost considerations.

Undergrounding has significant cost and reliability implications and is not always considered feasible or desirable. Undergrounding high voltage cables are typically in the range of 5-10 times the cost of an overhead line of the same capacity.

At this time, the likely best options appear to be to relocate the lines or manage the land use around the existing lines.

10.4 Lead time

As mentioned above, the lead time for a relocation (if/when agreed the best option) is 2-3 years minimum. Given the need to integrate any planning of development with existing line locations or relocated lines, a further period of years is required – possibly extending the above timeframe to 5 years or more. As an indication, the ACT second electricity supply project, involving a new substation, new and relocated transmission lines took 7 years from options assessment to final project delivery.

10.5 Inter-dependencies

None?

10.6 Preferred development sequence

There is no preferred development sequence from the perspective of TransGrid's infrastructure in the area.

10.7 Risk Ranking – Electricity - TransGrid

MEDIUM – long lead time for any relocation of transmission lines

11 RISK RANKING SUMMARY

Ranking	Service	reason	Mitigation
HIGH	**Transport**	• The many interdependencies and the uncertainty associated with these • Integrate transport and land use planning (ITLUP) • Alignment with ACT Transport Strategy • Topography of the site • The cost of infrastructure, and • The overall approach to planning for the WEIA.	1. Ensure integrated land use and transport planning process for the area. This will be undertaken as part of further investigation phases.
HIGH	**Sewerage**	• Long lead time, including matching Icon Water Regulatory process • Topography of the site - design solutions will be difficult to determine, and will also set the limit of development • Need to cross the Molonglo River and; Potential need for significant tunnelling, and its lead time and cost.	1. Early decision on effluent reuse 2. Develop a concept design for the sewerage network and identify the Molonglo River crossing point. 3. Gain Government/Icon wide agreement to the concept design, especially the Molonglo crossing point and the location and extent of tunnelling that may be required.
MEDIUM	**Electricity** **Evoenergy**	This risk has been determined to be medium due to: • uncertain demand projections primarily due to the new policies on natural gas phase-out and difficulties projecting take-up of distributed energy generation resources. • Early identification of sites for one or two new zone substations and associated transmission lines easement options.	1. Identification of appropriate zone substation sites. 2. Determine new transmission line routes. 3. Determine whether the existing 330 kV TransGrid transmission lines requires relocation.

MEDIUM	**Electricity** **TransGrid**	• Any relocation of the Transgrid Transmission line will require a long lead time.	1. Early identification of the need, if any, to relocate the existing Transgrid transmission line.
MEDIUM	**Stormwater**	The stormwater risk is rated as MEDIUM due to: • Topography of the site and existence of many small to medium sized catchments discharging to the Molonglo and Murrumbidgee Rivers; • Need for early development of an integrated stormwater management strategy, from block to river, and the process and time needed to develop and agree this approach; • Potential need for site specific design criteria and other requirements that may differ from existing guidelines, standards and codes, and • The need for early and long term water quality and flow monitoring.	1. Implement a water quality and flow monitoring regime in the WEIA 2. Early work to agree an integrated stormwater management strategy within Government (EPSDD and TCCS).
LOW	**Water**	• Allowing sufficient lead time to meet the Regulatory processes required of Icon Water, planning and environmental approvals, • Location and 'protection' of future reservoir sites • Resolution of the role of the urban water network in firefighting, and • Protection of the existing Cotter to Stromlo watermains, the main supply to the city.	1. Early identification of water system zoning, and hence identification of reservoir sites. 2. Early clarification of firefighting requirements to ensure adequate water network design.

12 OPPORTUNITIES

Development site opportunities, from an infrastructure and servicing perspective, are identified at the following broad locations. Some of these

would require comparatively lower investment in infrastructure to enable urban development. These areas take advantage of existing infrastructure nearby. However, these areas should be developed in a way that does not preclude their integration into a larger cohesive and integrated development including efficient infrastructure networks.

Bulgar Creek – to the west of Chapman, Rivett and Duffy

This area has adjacent water, electricity and road connectivity. Development would be limited by the ability to sewer the area as the existing Weston Creek urban boundary is coincident with the edge of the Weston Creek catchment boundary. Development could be served by a sewage pump station, but the size of this development would be limited by the trunk sewer capacities within Weston Creek district that are likely to require upgrading. This constraint is yet to be quantified.

Huntly area – along Uriarra Road to the west of Molonglo Valley district

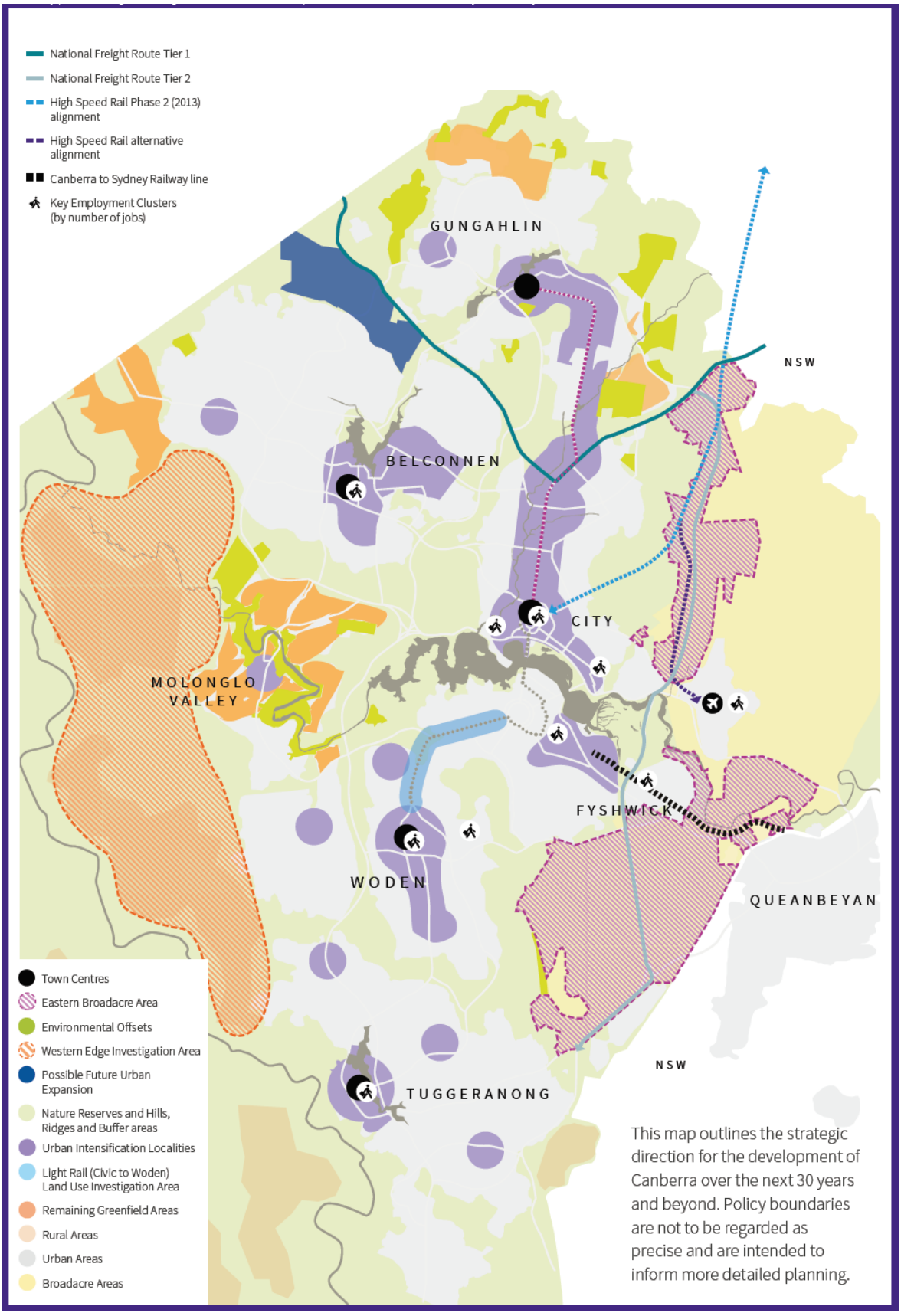
This area is located on a long broad ridge that slopes to the Molonglo River to the north and to Stoney Creek and the Murrumbidgee River to the south and west. Access would be available from Uriarra Road and from an extension of Holborow Avenue in Denman Prospect – subject to environmental considerations. Services including water supply and sewerage would need to be extended to this area.

North of Kambah Pool Road

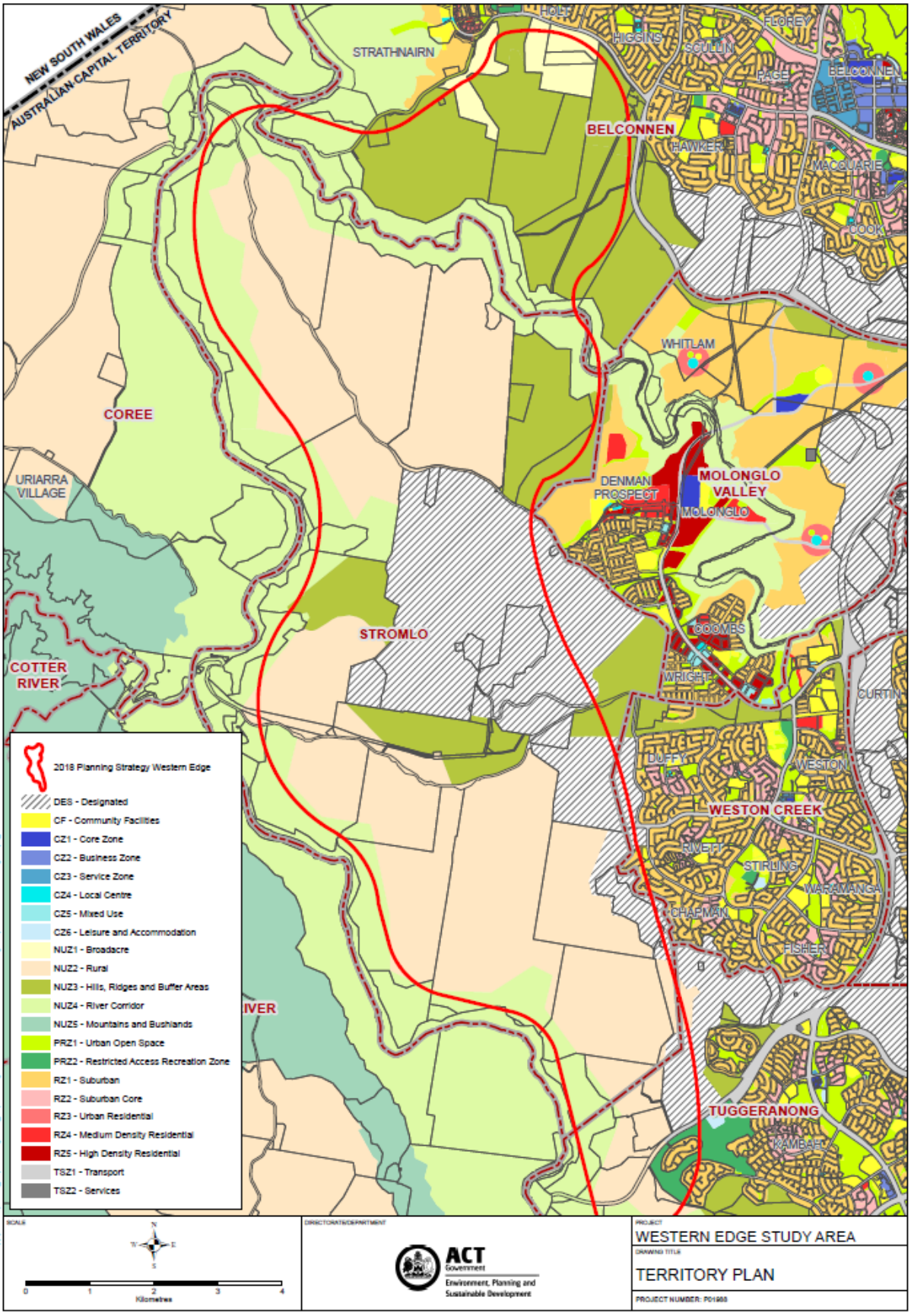
A narrow corridor of potential development is identified north of Kambah between Cooleman Ridge and the Murrumbidgee River. This area would have access from Kambah Pool Road and an extension of Sulwood Drive within an existing easement. This area could also interconnect with roads in the Bulgar Creek development area. Services including water supply and sewerage would need to be extended to this area.

Central Molonglo, between the western Belconnen suburbs of Higgins and Holt and the Molonglo Valley suburb of Whitlam was considered in the initial structure planning for the Molonglo Valley district in 2006 but has subsequently been removed from further consideration by Government. If reconsidered for urban development, the area would have good transport access off William Hovell Drive and Drake Brochman Drive. Sewer servicing to the existing MVIS and nearby connections to trunk water supply and electricity also exist.

APPENDIX A – MAP FROM THE ACT PLANNING STRATEGY 2018



APPENDIX B – STUDY AREA OVERLAYED ON THE TERRITORY PLAN



APPENDIX C - EXISTING TRANSPORT INFRASTRUCTURE IN AND AROUND THE WEIA

As noted in section 6 of this report, the transport network connection opportunities for the WEIA area are likely to include;

- William Hovell Drive
- Drake Brockman Drive
- Stockdill Drive
- Holborow Avenue
- Uriarra Road
- Cotter Road
- Hindmarsh Drive
- Tuggeranong Parkway
- Sulwood Drive
- Kambah Pool Road

The road locations are identified on Figure 1 below.

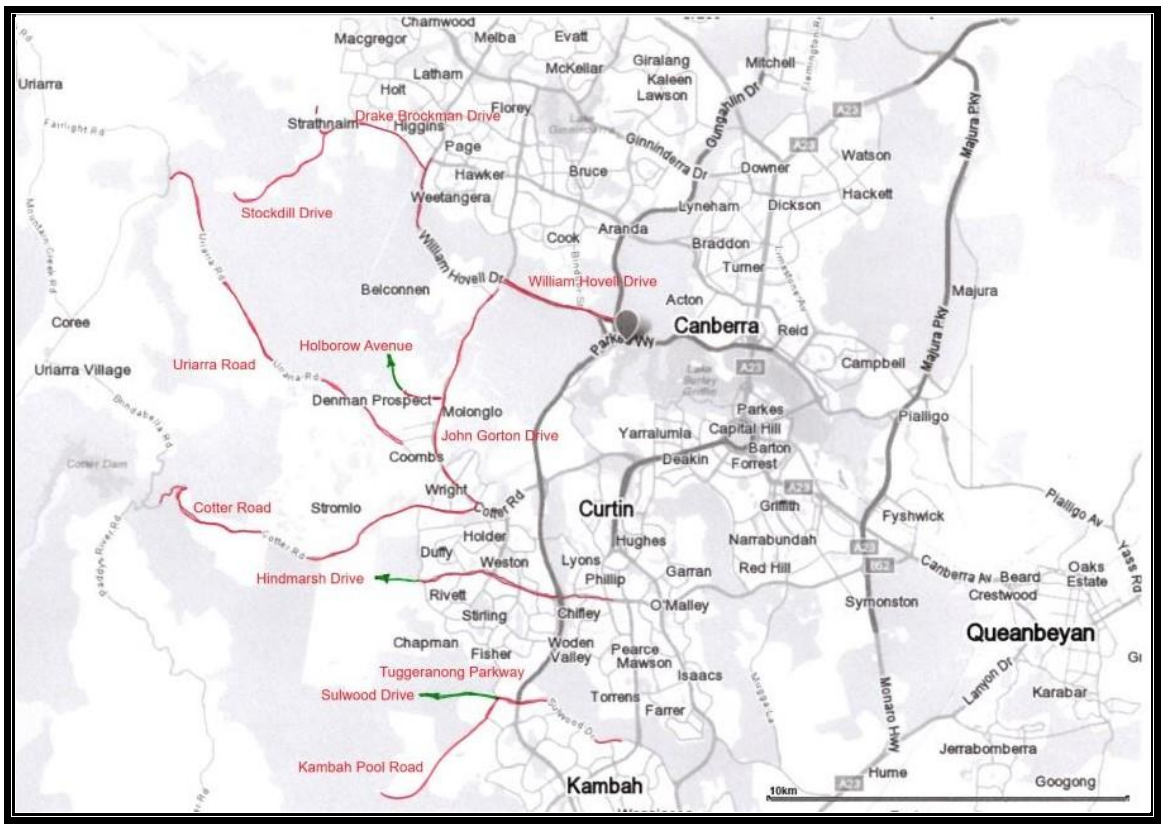


Figure 2: Possible road connections to the WIEA (source: whereis maps)

The following describes the roads within the WEIA and their characteristics in more detail.

William Hovell Drive is a four lane divided arterial road east of Coulter Drive and a three lane undivided arterial road to the west of Coulter Drive. William Hovell Drive connects to the Glenloch interchange to the east and connects to Drake Brockman Drive and Kingsford Smith Drive to the west. William Hovell Drive provides a significant east-west road corridor between the Glenloch Interchange, Molonglo Valley development and Belconnen. The road reserve width varies from about 150m at Coulter Drive to about 75m closer to Drake Brockman Drive. This section of William Hovell Drive is planned for widening to two lanes in each direction in the next few years. Existing lane widths are a minimum of 3.5 metres and there are shoulders to each carriageway that also serve as on road wide cycle lanes of approximately 2m width.

Figure 3: William Hovell Drive looking east from Coulter Drive (source: Google Earth)

Figure 4: William Hovell Drive looking west from Coulter Drive (source: Google Earth)

Drake Brockman Drive is a two lane east-west arterial road with a wide painted median and auxiliary lanes at intersections. Drake Brockman Drive connects to William Hovell Drive in the east and terminates at Spofforth Street in the west where it extends as the recently named Pro Hart Avenue into the Ginninderry Development suburb of Strathnairn. Drake Brockman Drive / Pro Hart Avenue and Stockdill Drive are located along the northern extent of the investigation area. The Drake Brockman Drive road reserve width varies from one section about 40m wide but most sections are about 60m wide. The lane widths are a minimum of 4 metres and the median is a minimum width of 3.5metres. There are cycle symbols painted at intervals along the road however cycle lanes are only marked through intersections.

Drake Brockman Drive is a bus route and is to be upgraded as part of the Ginninderry residential estate development.

Pro Hart Avenue continues as a two lane road with a narrow shoulder on the southern side of the road, the lane widths are a minimum of 3.5 metres and no on-road cycling. Within the Ginninderry residential estate, Pro Hart Avenue becomes a divided road with off road shared paths and a reserve width of approx. 50 m.

Figure 5: Drake Brockman Drive looking west from William Hovell Drive (source: Google Earth)

Figure 6: Drake Brockman Drive looking east (source: Google Earth)

Figure 7: Pro Hart Ave near Ginninderry estate entrance looking west (source: Google Earth)

Stockdill Drive is a two lane rural type access road along the northern extent of the investigation area and connecting to Pro Hart Avenue. The lane widths are a

minimum of 3metres and there are limited shoulders. The road reserve width varies with a minimum width of approx. 45metres. This road provides access to the Lower Molonglo Water Quality Control Centre (LMWQCC), the recently completed TransGrid Stockdill substation and a number of rural properties.

Figure 8: Stockdill Drive looking North-west (source: Google Earth)

Holborow Avenue, as currently constructed, is a short 1 km section of four lane divided arterial road connecting to John Gorton Drive to the east and a Bebo arch crossing of Cravens Creek to the west. This road is intended to extend further west and north through later development stages of Denman Prospect to the eastern edge of the investigation area. The possibility of this road extending to and through the un-named nature reserve to rural properties owned by the ANU, Yass Plains and the SLA (Huntly) exists but would be subject to planning and environmental assessments and approvals. A conceptual plan of this road extension is provided below at Figure 8A.

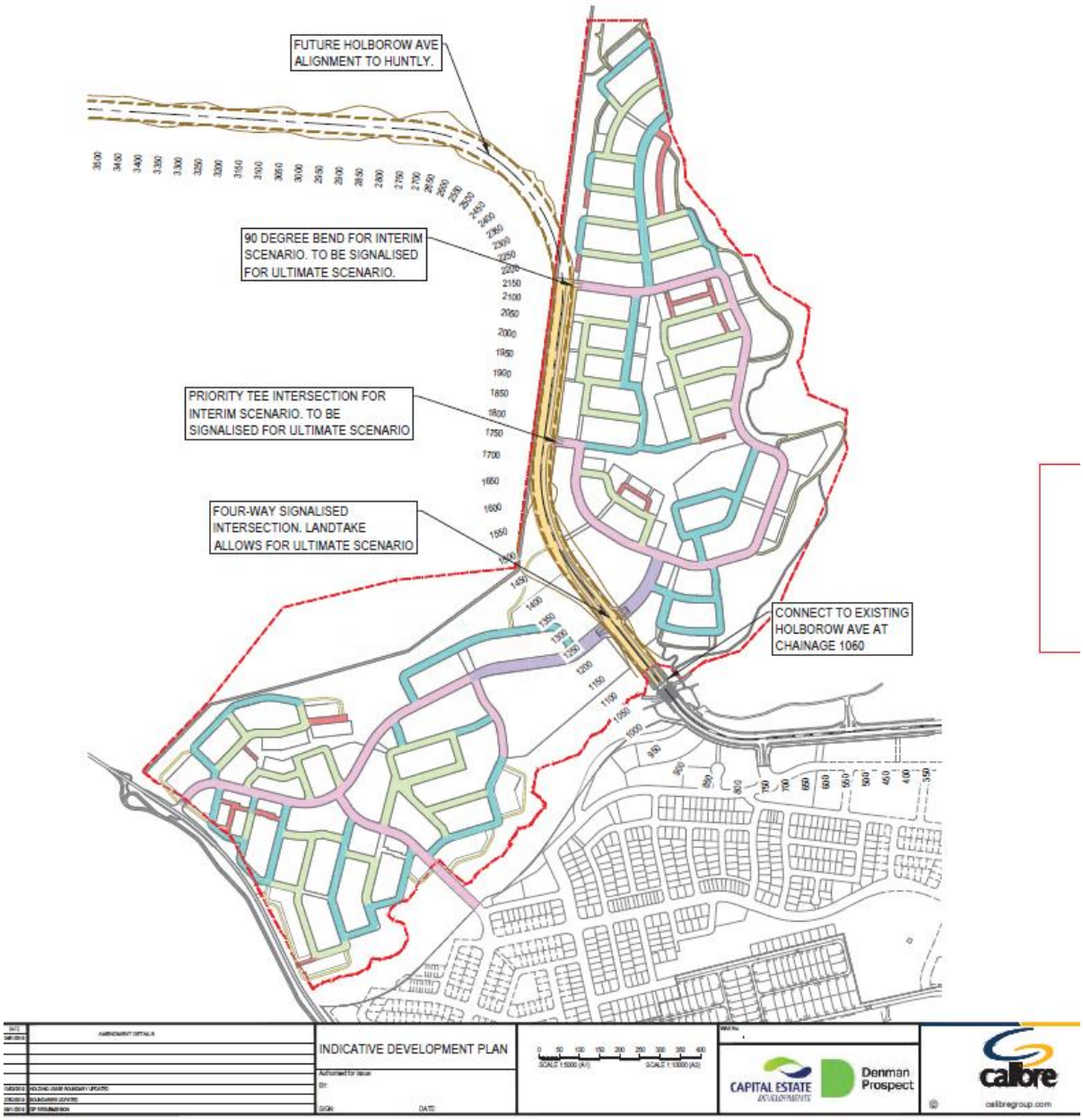


Figure 8A: Indicative extension of Holborrow Avenue to West of Denman Prospect

The road reserve width varies with a minimum width of approx. 45 metres. The lane widths are a minimum of 3.5 metres, there is a median of varying width allowing for the provision of right turn lanes at intersections, and the provision of 2 metre wide on

road cycle lanes in each carriage way and 2 metre wide paths in each verge. Holborow Ave has been designed to carry 16,000vpd in the Traffic Report prepared for Denman Prospect.

Figure 9B: Holborow Ave looking west across Cravens Creek bridge

John Gorton Drive connects to Cotter Road to the southeast which in turn connects to the Tuggeranong Parkway and Adelaide Avenue. John Gorton Drive is undergoing staged construction and connects to William Hovell Drive near Coulter Drive. The existing Coppins Crossing Road is being progressively de-gazzetted. The last and largest stage of John Gorton Drive (Stage 3C) is to be constructed in the near future with the provision of a new dual bridge crossing of the Molonglo River.

Uriarra Road is a two lane rural road which passes through the investigation area and connects to Opperman Avenue and then John Gorton Drive and Cotter Road in the east. The road reserve width varies with a minimum width of approx. 30 metres and allows for duplication of the road, subject to any environmental constraints (grasslands, trees, fauna et al), if required. The lane widths are a minimum of 3 metres and there are no shoulders or cycle lanes.

In certain locations, the Uriarra Road reserve abuts the major water supply mains from the Stromlo Water Treatment Plant and Oddie Reservoir hence creating possible additional constraints to realigning, widening or upgrading the road.

Figure 10: Uriarra Road (source: Google Earth)

Cotter Road is a two lane rural road to the west of Eucumbene Drive and an arterial road to the east of here. Cotter Road extends into the investigation area from the west, after crossing the Murrumbidgee River, and connects to Adelaide Avenue to the east. The road reserve width varies with a minimum width of approx. 30 metres. This width of reservation to the west of Eucumbene Drive would allow for some improvements but not duplication – due to the narrow reserve width and central location of the road within the reservation. The lane widths are a minimum of 3 metres and there are no shoulders or cycle lanes. Cotter Road interchanges with the Tuggeranong Parkway and then terminates at Adelaide Avenue (these roads providing two of the three major north south road corridors through Canberra.)

Figure 11: Cotter Road (source: Google Earth)

Hindmarsh Drive is a two lane arterial road to the west of the intersection with Streeton Drive to the western end of the road at Eucumbene Drive. East of Streeton Drive, Hindmarsh Drive is a four to six lane divided arterial road which extends to Fyshwick in the east, intersecting/interchanging with Tuggeranong Parkway, Melrose Drive, Athllon Drive, Yamba Drive, Monaro Highway and Canberra Avenue along the way.

West of Streeton Drive, the road reserve width varies with an approximate width of 64 m but which also includes a service road on the southern side for much of its length. About two thirds of the road reservation would be available for Hindmarsh Drive road improvements which would allow for duplication of the road if required, subject to any environmental constraints (grasslands, trees, fauna et al). The lane widths are a minimum of 3.5metres and there are 2 metre approx. wide on road cycle lanes in each carriageway.

Figure 12: Hindmarsh Drive looking east from the western end of the road

Tuggeranong Parkway is a four lane divided arterial (parkway) road connecting the Tuggeranong District to the Glenloch interchange to the north. The Tuggeranong Parkway changes to Drakeford Drive as it extends south to the Tuggeranong Town Centre and beyond. From the Glenloch interchange, traffic can proceed to the City via Parkes Way, Belconnen via William Hovell Drive and north Canberra via Caswell Drive/ Gungahlin Drive. The Tuggeranong Parkway also crosses Cotter Road and Hindmarsh Drive at grade separated interchanges, both of these roads being potential major traffic corridors into the investigation area.

The Tuggeranong Parkway road reserve width varies with a minimum width of approx. 130 metres. The lane widths are a minimum of 3.5 metres, there is a median of varying width ranging from 0metres where concrete barriers are installed to more than 30metres in some locations. There are 2 metre approx. wide shoulders to both carriageways except at some bridge locations which present a safety risk for cyclists.

It is considered that cycling should not be encouraged on the parkway due to the speed differential and the lack of adequate lane widths or no lanes at many locations (eg most bridges).

Figure 13: Tuggeranong Parkway looking north near Weston (source: Google Earth)

Figure 14: Tuggeranong Parkway looking south from Sulwood Drive (source: Google Earth)

Kambah Pool Road is a two lane rural road which connects to the intersection of Namatjira Drive and Sulwood Drive (Sulwood Drive in turn connects to the Tuggeranong Parkway) and terminates at a picnic area called Kambah Pool on the Murrumbidgee River. Kambah Pool Road defines part of the southern boundary of the investigation area. The road reserve width varies from up to 200m in the east to about 70m adjacent to the Murrumbidgee Country Club to about 50m west of the urban areas of Kambah. These widths allow for duplication or widening of the road if required, subject to any environmental constraints (grasslands, trees, fauna et al). The lane widths are a minimum of 3.0metres, there are limited shoulders and no provision of cycle lanes.

Figure 15: Kambah Pool Road looking east (source: Google Earth)

Sulwood Drive is a two lane arterial road connecting Namatjira Drive in the west to Erindale Drive in the east. Sulwood Drive intersects with the Tuggeranong Parkway, Athllon Drive and Erindale Drive to the east. The road reserve width varies significantly along its length with a minimum width of approx. 60 metres and a maximum of about 110m. Duplication of the road to Tuggeranong Parkway appears technically feasible with a minimum reserve width of 65m, subject to any environmental constraints (grasslands, trees, fauna et al). The lane widths are a minimum of 3.5 metres and there are narrow cycle lanes on both sides of the carriageway for part of its length. The road widens at intersections to provide turning / storage lanes and near the Tuggeranong Parkway the road widens to four lanes and has a median of varying width.

Extending Sulwood Drive into the investigation area appears to have been envisaged in early planning for the Tuggeranong area as a road reservation is shown on survey and cadastral plans. However, this extension would require the road to pass through the southern portion of the Cooleman Ridge Nature Reserve shown on other plans. The unutilised road reservation for Sulwood Drive passes between the Kambah north residential precinct and the Kambah Pony Club property. The road reservation, nature park boundary and other features of this area are shown in Figure 16.

Figure 16: Sulwood Drive looking west and at the intersection with Namatjira Drive (source: Google Earth)

Figure 16: Sulwood Drive road reservation to WEIA near Kambah