



Attachment 14 to Item 10.1.1.

Transport Scoping Report

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Location: Council Chambers
Time: 6:30pm

The Kavanagh Family

Belmont Park Estate

Transport Scoping Report

Issue 2 | 16 August 2023

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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Executive Summary

Arup has been commissioned by The Kavanagh Family to undertake a Transport Scoping Report to support a Scoping Proposal for the Belmont Park Estate. The Scoping Proposal is to identify whether the development has strategic and site-specific merit to progress to a planning proposal and identify the necessary supporting information required for assessment, including for transport and traffic.

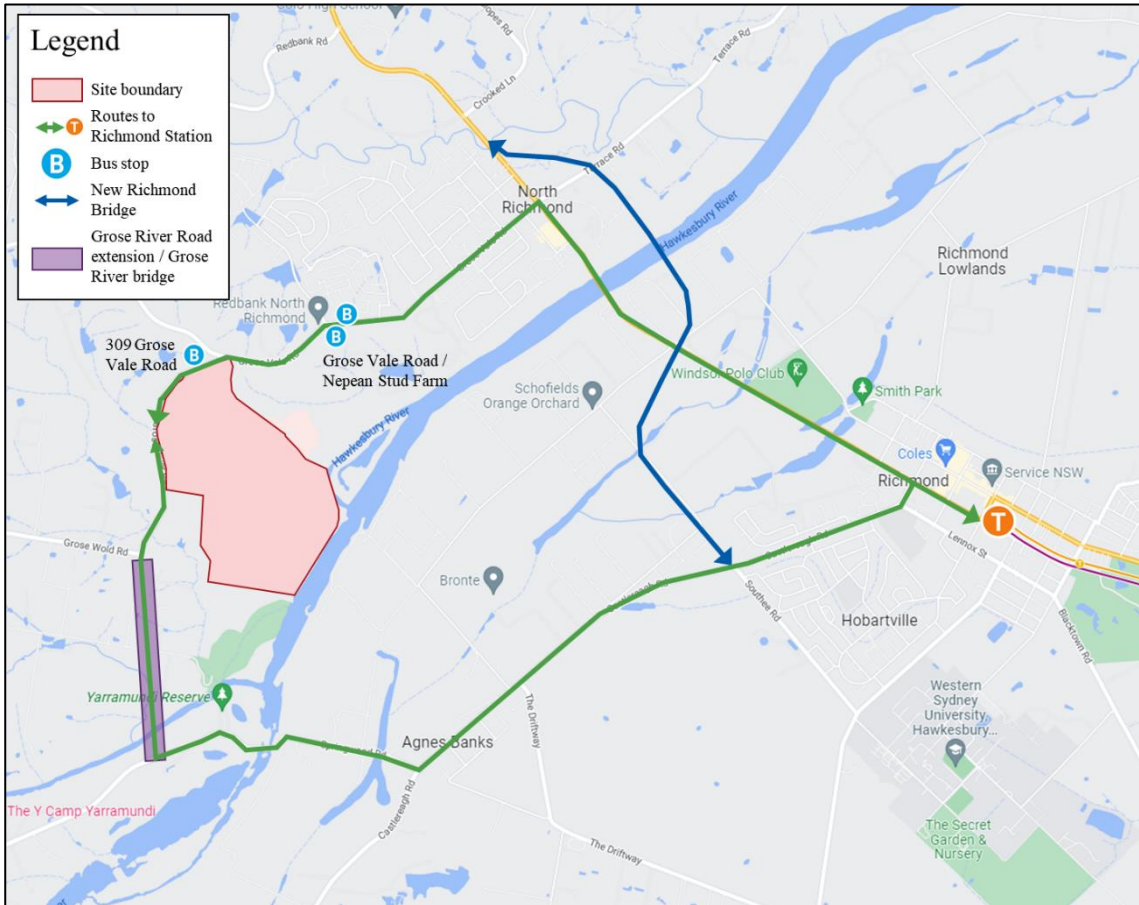
This Transport Scoping Report includes the following:

- A review of relevant planning policies to identify the priorities that the proposal will need to align with.
- A draft vision and objectives and an assessment of the existing transport services near the proposal.
- An appreciation of future transport infrastructure upgrades, land use developments and their associated timings which may influence or impact the proposal.
- An assessment of likely traffic generation, traffic distribution and road network impacts and likely pinch points/constraints within the Hawkesbury area.
- An overview of access and parking requirements for the development.
- A summary of preliminary transport considerations, opportunities and discussion points to be considered in subsequent stages of planning.

Preliminary Transport Considerations

The key preliminary transport considerations identified for the proposal include:

- The proposed development is expected to be capable of self-evacuation and would not rely on emergency services to assist in the evacuation of occupants. From the site, there is a flood-free evacuation route to extensive areas above the probable maximum flood (PMF) to the west and north-west by travelling north on Grose River Road and Grose Vale Road.
- A variety of infrastructure projects are in the planning or construction phases and would benefit the proposal. The New Richmond Bridge and Grose River Bridge are expected to provide additional capacity improvements, including at the Bells Line of Road / Grose Vale Road / Terrace Road intersection. Redbank Communities is also tendering road improvements on Grose River Road to provide greater amenity and safety for road users. The proposal should utilise these future road improvements to provide a safe and amenable environment for road users.
- Grose Vale Road (west of Bells Line of Road) is expected to reach capacity with traffic generated by the proposal (up to 1,486 vehicles per hour in each direction). Potential opportunities for additional lane capacity should be considered in subsequent stages of planning. To support road network performance, potential improvements to public and active transport facilities would shift trips to public transport, walking and cycling.
- The site is located within driving distance to Richmond Station. Richmond Station is serviced by the T1 Western and T5 Cumberland lines which provide direct connections to Blacktown and Parramatta Station, as well as to the wider Sydney Trains network. These stations are serviced by trains running every half an hour throughout the day in each direction on both weekdays and weekends. The Grose River Bridge would also provide an additional alternative route to Richmond Station via Springwood Road and Castlereagh Road.



Committed infrastructure projects and access to Richmond Station and bus stops

Opportunities

Opportunities to be considered in subsequent stages of planning to develop options for the transport network are summarised below.

No.	Opportunity type	Opportunity
1	Walking and cycling	Provide high-quality walking and cycling facilities on Grose River Road and Grose Vale Road (between Grose River Road and Yobarnie Avenue) to North Richmond.
2		If community facilities are provided, provide secure cycling parking and micromobility within the site.
3	Public transport	Improve existing bus services or provide new bus services to provide direct links to existing trunk train and bus services at Richmond and key centres (subject to consultation with TfNSW).
4		Provide high-quality bus stops near and within the site (subject to consultation with TfNSW).
5		Provide DRT services (such as on-demand buses) to connect residents with North Richmond and key locations of jobs, education and health facilities and services.
6	Traffic	Utilise road network capacity improvements from the Grose River Bridge and New Richmond Bridge projects to support new development.
7		Utilise Grose River Road improvements to provide greater amenity and safety environment for road users.
8		Provide roundabouts at the access points to the site to minimise impacts to road network performance and to improve safety of road users.
9		Consider additional lane capacity on Grose Vale Road (west of Bells Line of Road).

Discussion Points

The key discussion points to be discussed with DPE, Hawkesbury City Council, TfNSW and other authorities include:

- Agreement on the vision and objectives for how the proposal would integrate with the surrounding transport network.
- Whether there are any other nearby planned transport infrastructure projects or land use developments that may impact the proposal.
- The scope and extent of traffic modelling required to be undertaken to holistically understand the traffic impacts of the proposal.
- Flooding, bushfire and evacuation considerations and whether traffic modelling is required to quantify these impacts.
- Whether TfNSW would consider increasing the frequency of or re-routing public transport services to travel within the proposal.

1. Introduction

Arup has been commissioned by the Kavanagh Family to undertake a Transport Scoping Report to support a Scoping Proposal for the Belmont Park Estate. The Belmont Park Estate development (the proposal) seeks to rezone a large parcel of rural land at 35 Grose River Road, Grose Vale (the site) to provide approximately 1,200 residential lots in a 10-to-20-year timeframe (shown in Figure 1).

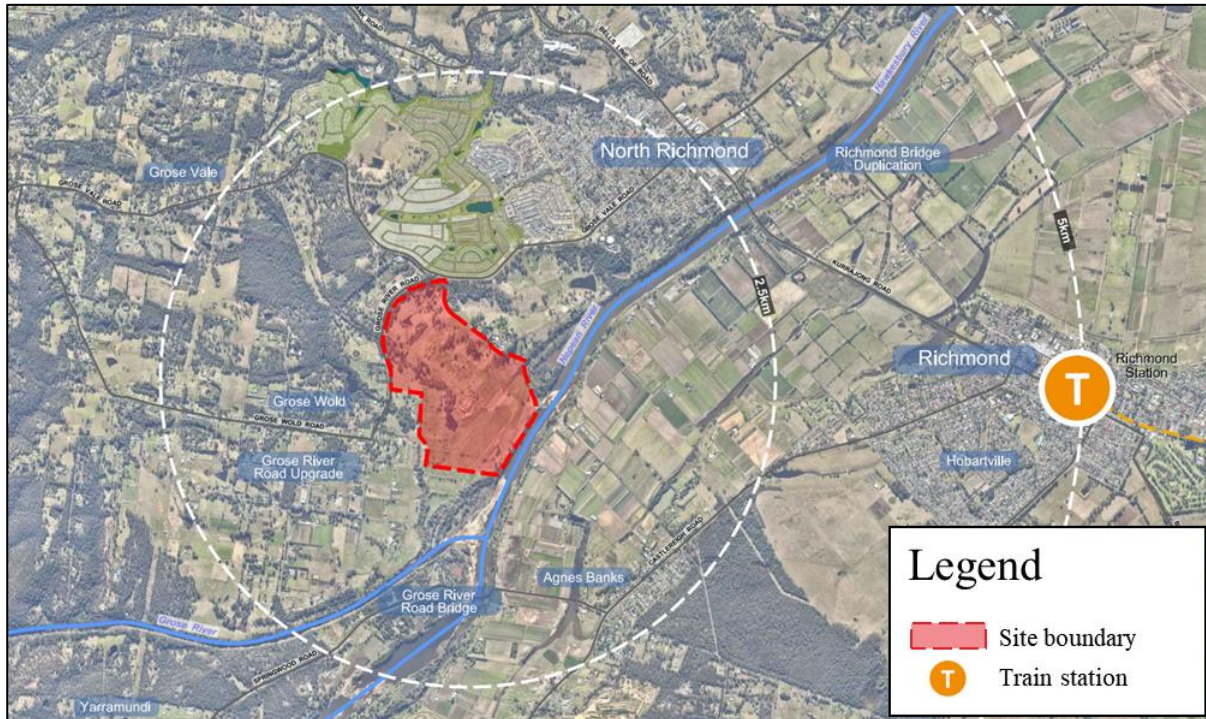


Figure 1 Belmont Park Estate site locality plan (Source: Urbanco, 2022)

Stakeholder consultation with Department of Planning and Environment (DPE) has commenced. As part of the pre-lodgement stage of the rezoning process, the Kavanagh Family is seeking to undertake a Scoping Proposal report. The Scoping Proposal will identify whether the development has strategic and site-specific merit to progress to a planning proposal and identify the necessary supporting information required for assessment, including for transport and traffic.

This Transport Scoping Report includes the following:

- A review of relevant planning policies to identify the state and local government priorities that the proposal will need to align with.
- A draft vision and objectives that outline how the proposal would integrate with the surrounding transport network.
- An assessment of the existing transport services and provisions near the proposal.
- An appreciation of future transport infrastructure upgrades, land use developments and their associated timings which may influence or impact the proposal.
- An assessment of likely traffic generation, traffic distribution, road network impacts and likely pinch points/constraints within the Hawkesbury area.
- An overview of access and parking requirements for the development based on Hawkesbury City Council development controls.
- A summary of preliminary transport considerations, opportunities and discussion points to be considered in subsequent stages of planning.

This report has been developed in alignment with the Movement and Place Framework and considers ‘Establish the project scope, vision, objectives, and evaluation criteria’ and ‘Understand Movement’ of the Movement and Place process. The remaining steps of the Movement and Place process would be considered in subsequent stages of planning.

1.1 The proposal

The proposal includes approximately 1,200 residential lots accessible via two transport access points on Grose River Road. The concept plan of the proposal is shown in Figure 2.



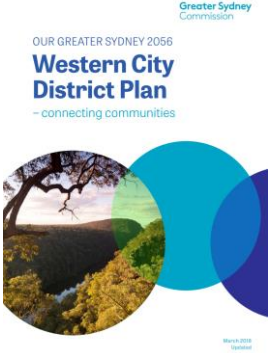

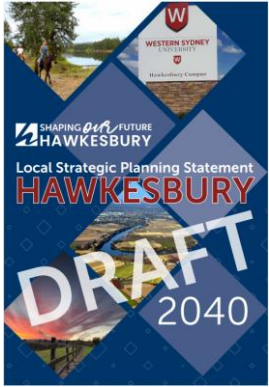
Figure 2 Concept plan (Source: Urbanco, 2023)

2. Strategic Context

A summary of the relevant state and local government plans, policies and their relation to the proposal is shown in Table 1.

Table 1 Relevant plans and policies

Document	Overview	Relation to the proposal
 	<p><i>Future Transport Strategy</i> (TfNSW, 2022) is an update to <i>Future Transport Strategy 2056</i> (TfNSW, 2018) and outlines Transport for NSW's (TfNSW) vision and direction for the future of mobility in NSW. The vision aims to deliver safe, healthy, sustainable, accessible and integrated passenger and freight journeys.</p> <p>The Strategy works to deliver TfNSW's three high-level outcomes:</p> <ul style="list-style-type: none"> • Connecting our customer's whole lives. • Successful places for communities. • Enabling economic activity. <p>The <i>Greater Sydney Services and Infrastructure Plan</i> (TfNSW, 2018) builds on the state-wide transport outcomes identified in <i>Future Transport Strategy 2056</i> and is TfNSW's 40-year plan for transport in Sydney. The Plan establishes the specific outcomes transport customers in Greater Sydney can expect and identifies the policy, service and infrastructure initiatives to achieve these. The Plan is currently being updated to align with the updated <i>Future Transport Strategy</i>.</p>	<p>The Plan outlines several city-shaping transport initiatives that will improve the connectivity of transport networks around the site. These projects will improve connectivity between the Hawkesbury area and the Sydney CBD, Western Sydney Aerotropolis and the wider Sydney region and include:</p> <ul style="list-style-type: none"> • Outer Sydney Orbital (20-year horizon) – a motorway and freight rail bypass of Greater Sydney connecting the Illawarra, Central Coast and Sydney. This project includes a connection to Richmond Road and Windsor Road. • Bells Line of Road – Castlereagh Connection (20-year horizon) – a connection between the M7 Motorway and an upgraded Bells Line of Road at Kurrajong. This project would improve connectivity between Hawkesbury and Central New South Wales and the Sydney Motorway network. • Service Improvements on the Richmond Line (10-year horizon) – improved services on the T1 Richmond Line including potential duplication to Riverstone, Vineyard, Marsden Park and the North West Priority Growth Area. • North-south rail link in Western Parkland City: Cudgegong Road – St Marys (10-year horizon) – extension of the Sydney Metro Western Sydney Airport line from St Marys to Tallawong, including a potential interchange with the T1 Richmond Line at Schofields.
	<p>The Greater Cities Commission's <i>Greater Sydney Region Plan – A Metropolis of Three Cities</i> (Greater Sydney Commission, 2018) describes a vision of three cities where most residents live within 30 minutes of their jobs, education and health facilities, services and great places. To meet the needs of a growing and changing population, the vision seeks to transform Greater Sydney into a metropolis of three cities including the Western Parkland City, Central River City and Eastern Harbour City.</p> <p>A Region Plan for the Six Cities Region (including the above three cities and the Lower Hunter and Greater Newcastle City, Central Coast City and Illawarra-Shoalhaven City) is being developed by the Greater Cities Commission. The Region Plan will be developed by the end of 2023.</p>	<p>The site is located in the Western Parklands City. Examples of locations to be considered for 30-minute access to jobs, education, health facilities, services and great places from the site include:</p> <ul style="list-style-type: none"> • Metropolitan clusters including Greater Penrith. • Strategic centres including Richmond-Windsor and Marsden Park. • Local centres near Greater Penrith including Cranebrook, Jordan Springs and Cambridge Gardens.

Document	Overview	Relation to the proposal
	<p>The Greater Cities Commission’s District Plans are 20-year plans to manage growth in the context of economic, social and environmental matters to achieve the 40-year vision for Greater Sydney. These plans are a guide to implementing <i>Greater Sydney Region Plan – A Metropolis of Three Cities</i> at a district level and acts as a bridge between regional and local planning.</p> <p>As part of the Region Plan for the Six Cities Region, City Plans would be developed by the end of 2023 and will replace the existing District Plans.</p>	<p>The <i>Western City District Plan</i> (Greater Sydney Commission, 2018) outlines targets for population and jobs growth by 2036 as well as walkable and 30-minute cities. Several Planning Priorities would need to be considered for the proposal, including:</p> <ul style="list-style-type: none"> • W1 – Planning for a city supported by infrastructure. The proposal will need to consider the capacity of existing and planned infrastructure to accommodate additional growth. • W5 – Providing housing supply, choice and affordability, with access to jobs, services and public transport. Development in the Hawkesbury LGA will need to consider resilience of new development to flooding and recovery and the ability to evacuate.
	<p>The <i>State Infrastructure Strategy</i> (Infrastructure NSW, 2022) sets out Infrastructure NSW’s independent advice to the NSW Government on the State’s needs and strategic priorities for infrastructure over the long term.</p>	<p>The <i>State Infrastructure Strategy</i> identifies a need to integrate infrastructure, land use and service planning. Key recommendations relating to the proposal include:</p> <ul style="list-style-type: none"> • Recommendation 18 – Establish a program of prioritised resilience infrastructure and accelerate project delivery. The Strategy acknowledges flood risks in the Hawkesbury-Nepean Valley and recommends an immediate priority for local road improvements in the Hawkesbury Nepean Valley area. • Recommendation 44 – Deliver more housing, jobs, amenities and services in locations where there is spare capacity in existing and planned infrastructure. The proposal will need to consider the capacity of existing and planned infrastructure to accommodate additional growth.
	<p>The <i>Hawkesbury Local Strategic Planning Statement 2040</i> (Hawkesbury City Council, 2020) (LSPS) sets out a 20 year vision for land use in the Hawkesbury Local Government Area. The LSPS is based on the vision and values of the <i>Hawkesbury Community Strategic Plan 2017-2036</i> (Hawkesbury City Council, 2016) and how this vision gives effect to the <i>Greater Sydney Region Plan</i> and <i>Western City District Plan</i>.</p>	<p>The LSPS sets out 12 Planning Priorities and a series of relevant actions. Several Planning Priorities would need to be considered for the proposal, including:</p> <ul style="list-style-type: none"> • Planning Priority 1 – ensure infrastructure aligns with current needs and future growth. Public transport and road network infrastructure would need to accommodate population growth. • Planning Priority 3 – provide a diversity of housing types to meet the needs of the changing population. The LSPS refers to the Local Housing Strategy to align housing growth with infrastructure and services (discussed below). • Planning Priority 10 – an aware and resilient city that can adapt to natural hazards of flood, bushfire and climate change. The LSPS acknowledges flooding risks in the Hawkesbury area and recognises the use of planning controls to protect and mitigate development in areas prone to flooding where risk to life and property is high.

Document	Overview	Relation to the proposal
 <p>Hawkesbury Local Housing Strategy Prepared for Hawkesbury City Council May 2020 HillPDA</p>	<p>The <i>Hawkesbury Local Housing Strategy</i> (HillPDA, 2020) outlines how housing growth can be managed by identifying locations suitable for additional housing supply in the Hawkesbury LGA.</p> <p>The Strategy notes that additional housing opportunities outside of existing centres and greenfield urban release areas (such as Redbank, Jacaranda Ponds and Vineyard Stage 1) would need to be identified to achieve dwelling growth targets beyond 2031. The Strategy recommends additional growth by expanding existing release areas and maximising the potential of urban areas which are well-served by existing transport, health and education infrastructure.</p>	<p>The Strategy identifies a need for additional housing opportunities that maximises access to jobs, infrastructure and services while considering flooding and bushfire constraints.</p>
 <p>PRACTITIONER'S GUIDE TO MOVEMENT AND PLACE</p>	<p>The <i>Practitioner's Guide to Movement and Place</i> (Government Architect, 2020) is one component of the NSW Government's Movement and Place Framework. The guide outlines a collaborative method for practitioners, stakeholders and the community to implement the Movement and Place Approach in existing contexts and comparing future options.</p> <p>This guide should serve as a key reference for the design of new communities using the principles of place-based transport to deliver a well-designed built environment that supports communities and the needs of people.</p>	<p>This Transport Scoping Report outlines a draft vision and objectives, reviews the proposal's relationship with the surrounding transport network, assesses the impact of the development and identifies potential issues and opportunities. This analysis aligns with Step 1 (Establish the project scope, vision, objectives, and evaluation criteria) and Step 3 (Understand Movement) of the Movement and Place process.</p> <p>Further work should continue the Movement and Place approach by finalising a vision and objectives, evaluation criteria and determining a preferred option that delivers a well-designed built environment for the proposal.</p>
 <p>RTA</p> <p>Guide to Traffic Generating Developments.</p> <p>Version 2.2 October 2002</p> <p>Technical Direction For traffic, safety and transport practitioners OPERATIONAL, POLICY, GUIDANCE, ADVICE</p> <p>Transport for NSW Roads & Maritime Operations</p> <p>Guide to Traffic Generating Developments Updated traffic surveys Introduction</p> <p>04a</p>	<p>The <i>Guide to Traffic Generating Developments</i> (RTA, 2002) outlines all aspects of traffic generation considerations relating to developments. The guide provides background into the likely impacts of traffic from various types of developments.</p> <p>In 2013, technical direction <i>TDT 2013/04a</i> (RMS, 2013) was prepared to supplement the guide with updated trip and parking generation surveys.</p>	<p>The assessment and traffic generation of the Precinct was developed with consideration of best practice outlined in the <i>Guide to Traffic Generating Developments</i> and <i>TDT 2013/04a</i>.</p>

2.1 Hawkesbury Development Control Plan

Part C of the *Hawkesbury Development Control Plan 2002* (DCP) outlines car parking and access requirements for new developments. The DCP aims to:

- Ensure that adequate and convenient off-street parking facilities are provided for all vehicles generated by new development.
- Encourage the efficient flow of traffic through car parks and to minimise the potential for pedestrian/vehicle and vehicle/vehicle conflict.
- Ensure minimum interference to the flow of traffic on the street network.
- Ensure adequate traffic safety and management and to improve the amenity of car parking areas.

2.1.1 Access Considerations

The DCP outlines the following requirements for access:

- Vehicles should enter and leave the site in a forward direction for larger sites. Ingress and egress to or from a site should be located where they will cause least interference with vehicular and pedestrian movement on public roads.
- The potential for on-street queuing should be eliminated by the provision of sufficient standing area for vehicles entering the car park and loading areas.
- To encourage their utilisation, entrances to parking areas should be located to be readily visible and accessible from the frontage road.
- Service vehicle areas should be provided off-street with convenient access. Service areas should operate independently of other areas and enable vehicles to enter and leave the site in a forward direction.
- Parking areas shall incorporate rational circulation patterns. All parking bays shall be readily accessible and the provision of adequate space for the manoeuvring of vehicles, particularly rigid and articulated heavy vehicles, shall be considered.
- Car parking spaces for people with disabilities should be clearly marked and the surface should be level. A review of relevant regional and local planning policies to ensure the transport aspirations for the proposal align with these documents.

2.1.2 Car Parking Provision

The relevant residential car parking requirements outlined in the DCP are shown in Table 2.

Table 2: Hawkesbury City Council DCP car parking requirements

Item	Requirement	
Car parking provision – Dwelling House, Dual Occupancy, Villas and Townhouses and Residential Flat Buildings	Small dwelling (GFA less than 55m ²)	1 covered space
	Medium dwelling (GFA 55m ² to 85m ²)	1.5 covered spaces
	Large dwelling (GFA more than 85m ²)	2 covered spaces
	Visitor spaces	For developments containing 3 or more dwellings, 1 visitor space per 5 dwellings or part thereof

2.2 Vision and Objectives of the Proposal

Per the Movement and Place approach, a draft vision for how the proposal would integrate with the surrounding transport network is presented below and aligns with the strategic transport context outlined in Table 1.

A transport network that provides safe and reliable public and active transport facilities to connect residents to jobs and services, minimises the impacts of private vehicle travel on the limited capacity of surrounding infrastructure and is resilient to flooding and bushfire.

The vision will need to be supported by a set of objectives that will define the desired transport outcomes for the proposal. Example objectives which align with the draft vision and strategic context are presented below which have been used on other similar projects.

- A wide range of transport options are available to connect residents with local jobs and services.
- Public transport services are reliable and easily accessible by residents.
- The walking and cycling environment is high-quality, safe and supported by green spaces, tree shading and low adjacent traffic speeds.
- Transport networks are safe, equitable and cater to the needs of children, the elderly and those with accessibility needs.
- Private vehicle trips are deprioritised limited to ensure that traffic can be accommodated by surrounding infrastructure.
- Community services are provided within the site to reduce the need for external trips.

The vision and objectives would be refined in consultation with stakeholders in subsequent stages of planning.

3. Understand Movement

3.1 Road Network

3.1.1 Grose River Road

Grose River Road is a semi-rural road connecting Grose Vale Road and Grose Wold Road and provides a north-south connection between North Richmond and Grose Wold. It is a single carriageway road with one lane of traffic in each direction and is signposted at 80km/hr. The lanes and shoulders are generally narrow along the road and, as a semi-rural road, there are no sealed parking or footpath facilities.

There are currently plans for Grose River Road to be extended south to Springwood Road and act as a secondary connection for the North Richmond area and the Greater Sydney area, which are discussed further in Section 4.1.2.



Figure 3 Grose River Road near the site, facing south (Source: Google Street View, 2021)

3.1.2 Grose Vale Road

Grose Vale Road is a regional road and provides a key east-west connection between the site, North Richmond town centre to the east and Bells Line of Road to the west. It is a two-way single carriageway road with one lane in each direction. The sign posted speed limit is generally 60km/hr with limited sections of 70 km/hr remaining. As a mostly semi-rural road, most sections (outside of the urban areas) do not have sealed parking or footpath facilities.

To the east, Grose Vale Road continues as Terrace Road and connects to Kurmond Road, providing a key connection to centres such as Freemans Reach, Wilberforce and Windsor. To the west, Grose Vale Road continues in an east and north direction and provide connections to Kurrajong town centre and recreational facilities at Bowen Mountain.



Figure 4 Grose Vale Road east of Grose River Road, facing west (Source: Google Street View, 2021)

3.1.3 Bells Line of Road / Kurrajong Road

Bells Line of Road / Kurrajong Road is a classified state road (B59) running between Richmond and Bell. It is typically a single carriageway road with one lane of traffic in each direction. However, auxiliary lanes are provided in certain locations such as when travelling through the Richmond and North Richmond Town Centres.

The speed limit of the road varies but is generally 60km/h in suburban areas and up to 80km/h in regional areas. Footpath facilities are generally provided when the road passes through suburban areas and a shared path runs between Kurmond and North Richmond, with a key gap between North Richmond and Richmond.

To the west, Bells Line of Road continues as Chifley Road and continues to Lithgow and areas beyond such as the Central West of NSW. To the east, Bells Line of Road continues as Kurrajong Road and provides a connection to Richmond and Windsor. Kurrajong Road continues via various road names through Richmond becoming Hawkesbury Valley Way which connects to Windsor Road (A2) at Mulgrave.

A typical urban condition of Bells Line of Road is shown in Figure 5.



Figure 5: Bells Line of Road north of Grose Vale Road, facing southeast

3.2 Public Transport

Bus route 680 (Richmond to Bowen Mountain via North Richmond, Grose Wold and Grose Vale) is the only bus service which runs near the site. Route 680 is a loop service and runs adjacent to the western boundary of the site, as shown in Figure 6. The bus route generally travels between Richmond and Bowen Mountain and also travels on alternate routes at specific times, including detours towards Kurrajong.

The closest bus stops to the site (shown in Figure 7) are both outside of comfortable walking distances and are located at:

- 309 Grose Vale Road (heading west) – approximately 1 kilometre walking distance from the site.
- Grose Vale Road opposite Nepean Stud Farm (heading east) – approximately 1.5 kilometres walking distance from the site.

The stops along Grose Vale Road and towards Bowen Mountain and Kurrajong typically have a bus stop flag with no footpath, shelter or seating facilities available.

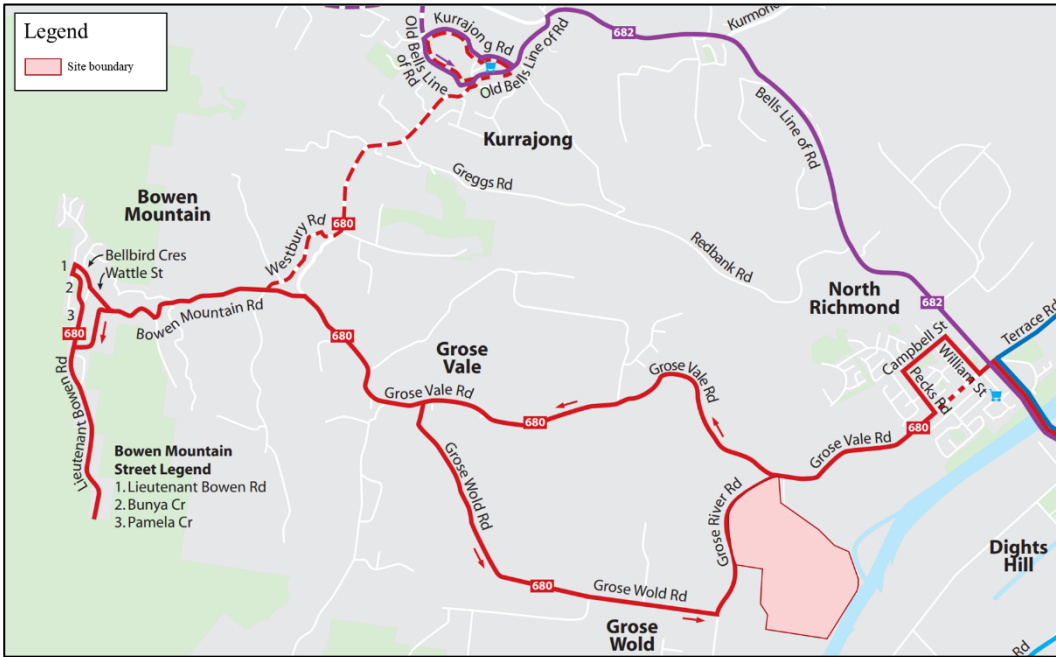


Figure 6 680 bus route (Source: Transport for NSW, 2022)

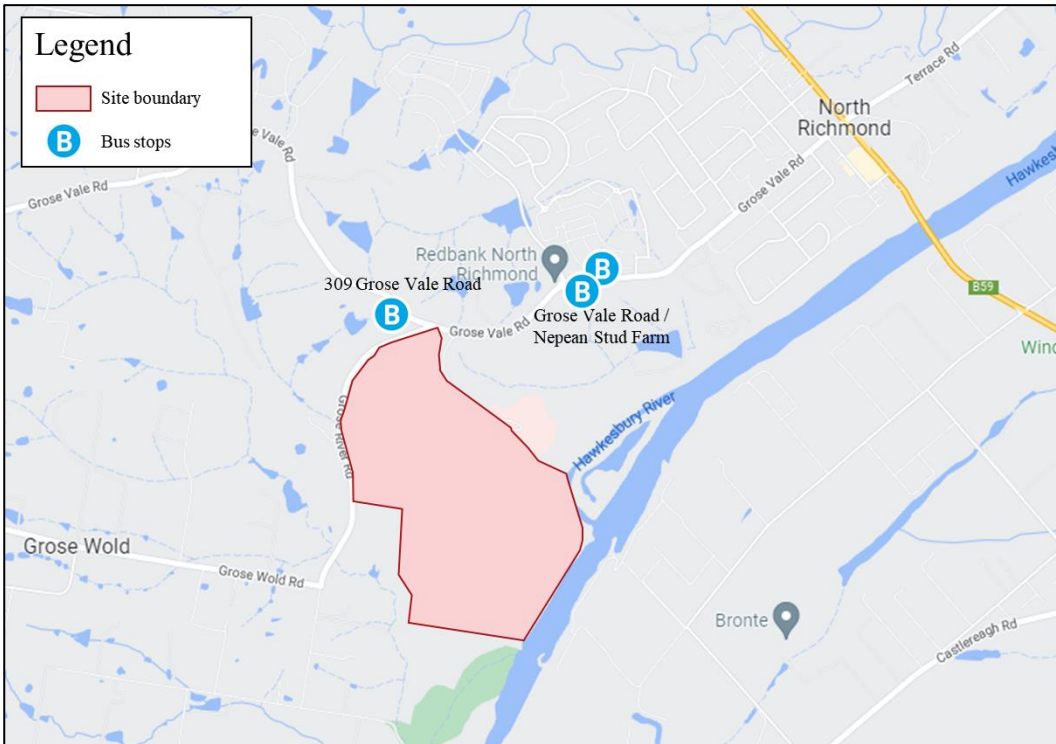


Figure 7 Bus stops within 1km of the site

During weekdays, daily services on the 680 route generally run during the AM and PM peak periods.

Table 3 Daily services (Source: Transport for NSW, 2022)

Day	Direction	Destination	Number of Daily Services
Mon-Fri	Eastbound	Richmond Station	9 services
	Westbound	Grose Vale	10 services
Sat	Loop	Richmond Station / Grose Vale	4 services
Sun & Public Holidays	Loop	Richmond Station / Grose Vale	2 services

Travel times on the 680 bus from the bus stops closest to the site are approximately:

- Richmond Station – 15-20 minutes.
- Bowen Mountain – 20 minutes.

Richmond Station is an interchange for train services and bus services to areas such as Penrith (routes 677 and 678). Train passengers may also choose to use park and ride facilities at Richmond or East Richmond Stations. The route between the site and Richmond Station is approximately 7 kilometres as shown in Figure 8.

Richmond Station is serviced by the T1 Western and T5 Cumberland lines which provide direct connections to Blacktown and Parramatta Station, as well as to the wider Sydney Trains network. These stations are serviced by trains running every half an hour throughout the day in each direction on both weekdays and weekends.

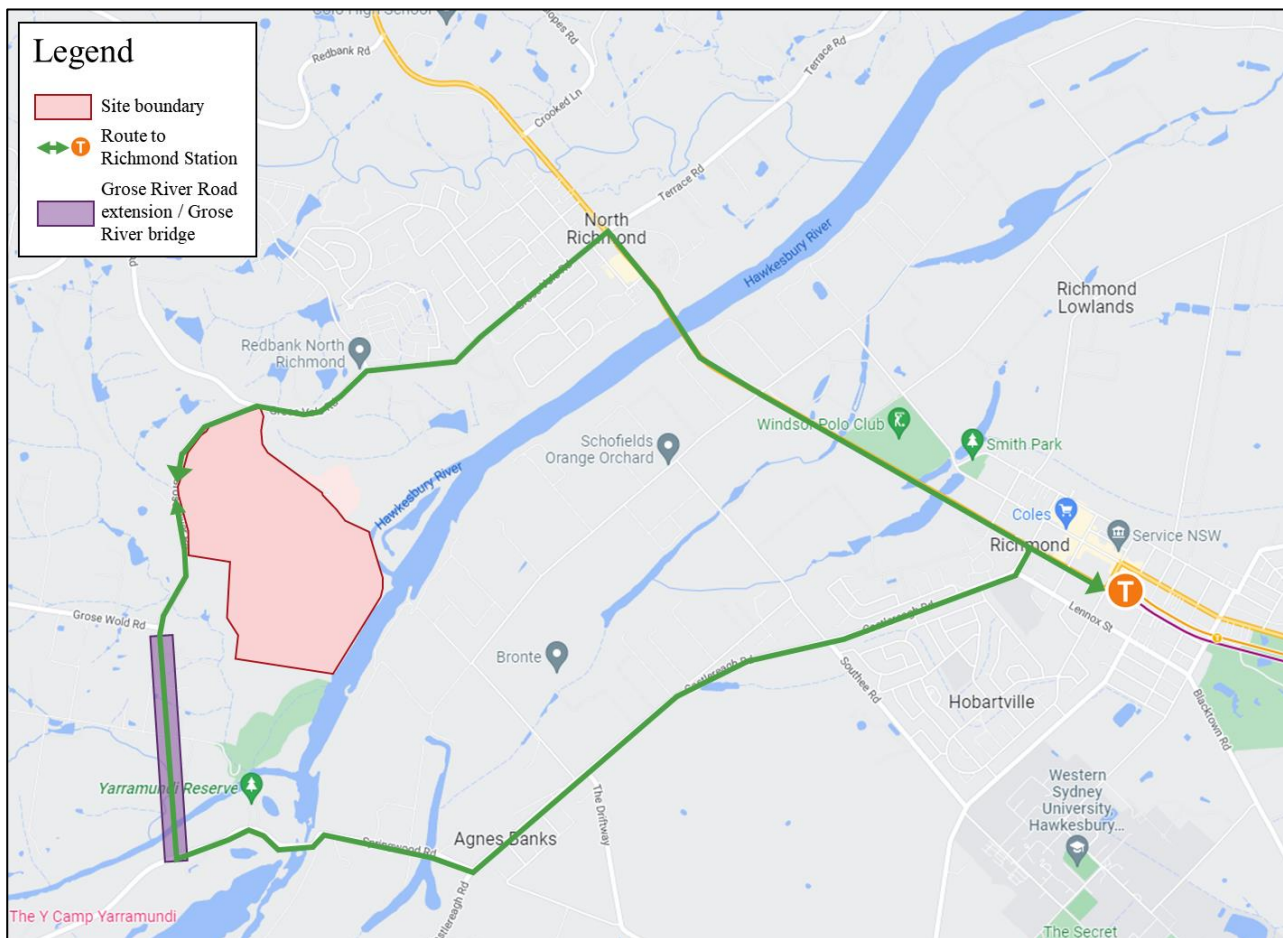


Figure 8 Access to and from Richmond Station (including access via the future Grose River Bridge)

3.3 Walking and Cycling

Due to the semi-rural nature of the site, there are very limited active transport facilities on Grose River Road. To the northeast of the site on Grose Vale Road near Redbank, paved footpaths and wider shoulders are generally provided for pedestrian access. To the west of the site, Grose Vale Road has no paved footpaths and narrow shoulders.

No cycling facilities are provided near the site.

The existing Richmond Bridge has a narrow footpath which connects to Hanna Park on the western side and Old Kurrajong Road on the eastern side. There are no footpaths that continue into Richmond from the Hawkesbury River.

3.4 Flooding and Evacuation

The *Belmont Park Estate, Grose Wold – Detailed Evacuation Capability Assessment* (Water Technology, 2023) was prepared to assess the flooding and evacuation capability of the site. The key findings of the assessment include:

- The proposed development is expected to be capable of self-evacuation and would not rely on emergency services to assist in the evacuation of occupants.
- From the site, there is a flood-free evacuation route to extensive areas above the probable maximum flood (PMF) to the west and north-west by travelling north on Grose River Road and Grose Vale Road.
- A local State Emergency Service (SES) nominated evacuation centre is Colo High School in North Richmond, which is just above the extent of the PMF. There is a flood-free route from the site to this evacuation centre via Grose Vale Road to Bells Line of Road as shown in Figure 9.

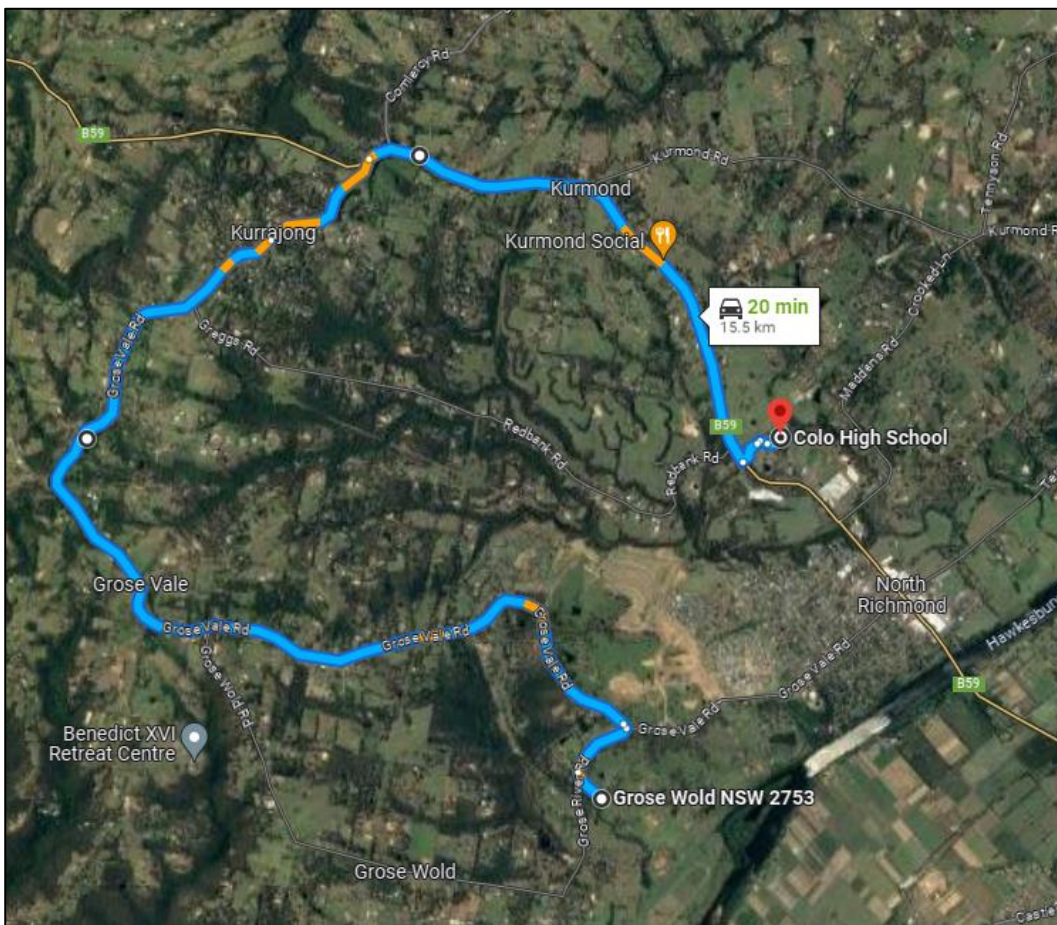


Figure 9 Flood-free evacuation route via Bells Line of Road

4. Relevant Projects

This section provides an overview of the various transport infrastructure projects and land use developments near the site that are currently in the planning or construction stages.

4.1 Transport Infrastructure Projects

4.1.1 New Richmond Bridge and Traffic Improvements

The Australian and NSW Governments have committed \$500 million to deliver traffic improvements at Richmond, including an additional bridge over the Hawkesbury River between Richmond and North Richmond. Stage 1 of the project includes improvements to The Driftway between Londonderry Road and Blacktown Road to improve road safety, road network performance and flood resilience. Stage 2 includes the construction of the New Richmond Bridge.

For Stage 1, TfNSW has determined the Review of Environmental Factors to progress into detailed design and construction. Construction is expected to commence in late 2022 and take approximately 18 months to complete.

For Stage 2, TfNSW has identified the green option as the preferred option as shown in Figure 10. The green option will provide an alternative crossing of the Hawkesbury River at North Richmond and is expected to redirect up to 40 per cent of traffic away from the existing bridge and Bells Line of Road / Grose Vale Road / Terrace Road intersection. The timeframe for completion of Stage 2 is subject to planning approval and funding release.

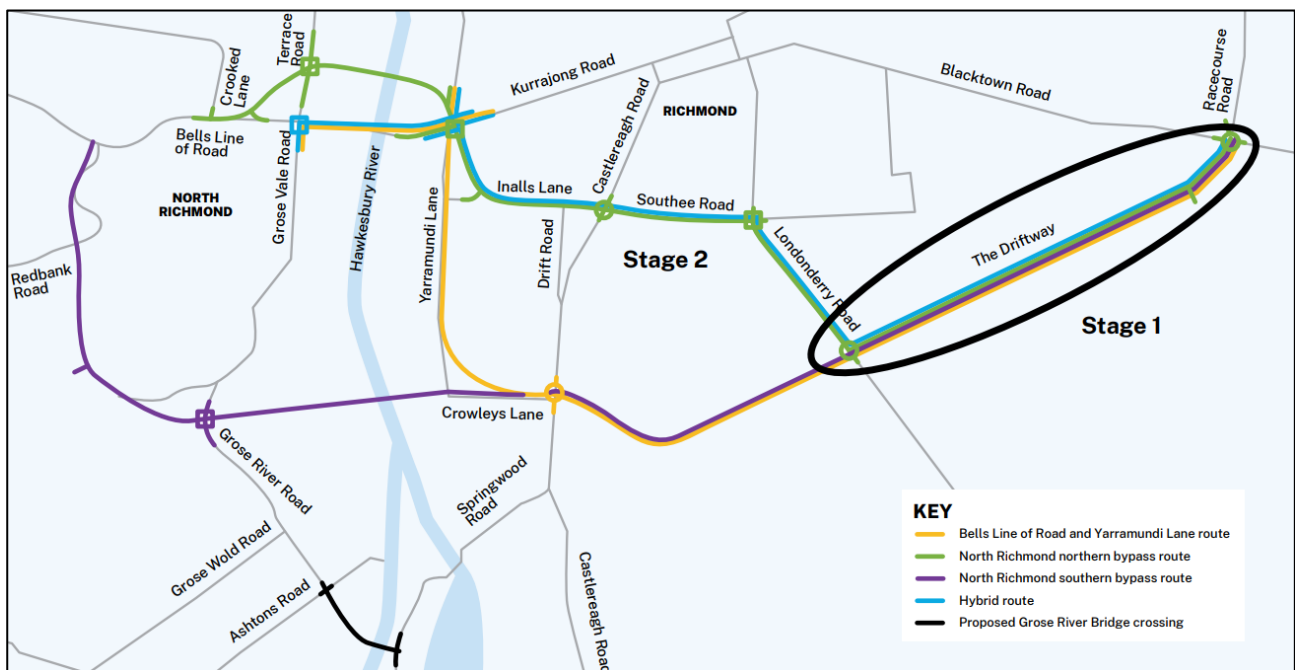


Figure 10 New Richmond Bridge and Traffic Improvements (Source: TfNSW, 2022)

4.1.2 Grose Vale Road / Grose River Road Upgrade and Grose River Bridge

As of November 2021, the Grose River Road upgrade is currently under construction and would include a roundabout upgrade to the Grose River Road / Grose Vale Road intersection from priority-controlled to a roundabout. The upgrade is expected to be completed by May 2023.

TfNSW, Hawkesbury City Council and Redbank Communities are currently in the process of extending Grose River Road, Grose Wold to Springwood Road, Yarramundi. This extension would include the Grose River Bridge over the Grose River. The Grose River Bridge aims to support planned growth in the area and help address projected future traffic congestion by providing an alternative crossing to the Richmond Bridge at Richmond. Redbank Communities expects the Grose River Bridge to reduce current and future traffic

volumes on Bells Line of Road at North Richmond by approximately 30 per cent. The Grose River Bridge also provides an opportunity to reduce the period of isolation of the North Richmond area in floods and bushfires and an alternative flood evacuation route with a higher level of flood immunity than that which currently exists.

The Review of Environmental Factors (REF) for the Grose River Bridge was publicly exhibited in 2022. The supporting *Grose River Bridge REF Addendum Traffic Impact Assessment* (SCT, 2021) assessed the traffic performance for a 2031 scenario with the Grose River Bridge and identified that the upgraded Grose Vale Road / Grose River Road and future Grose River Bridge / Springwood Road intersections would operate at Level of Service A in 2031 with significant spare capacity.

Separately, Redbank Communities is also tendering road improvements on Grose River Road to provide greater amenity and safety for road users.

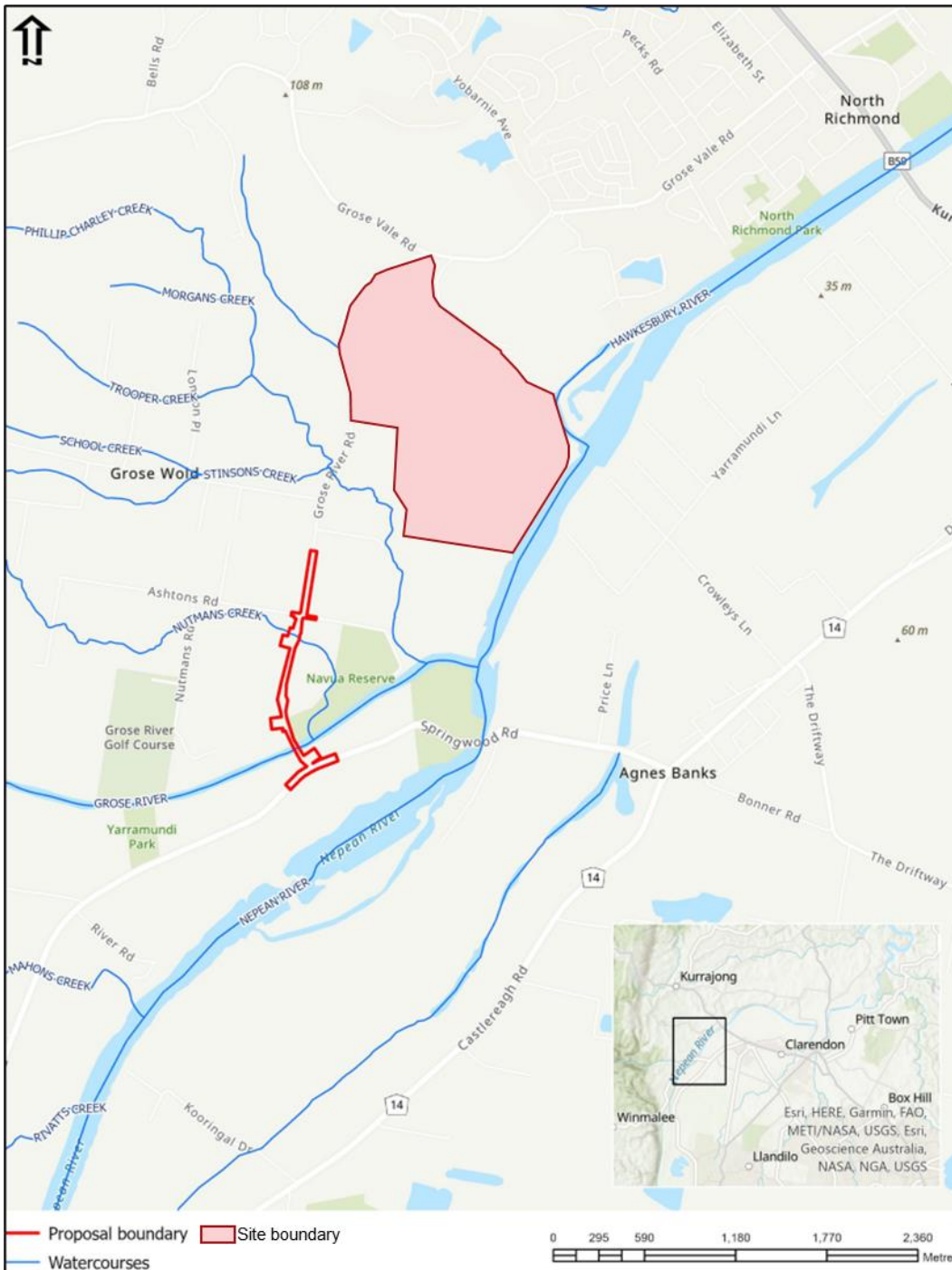


Figure 11 Grose River Road – Road Link and Bridge (Source: Arup, 2021)

4.1.3 Grose Vale Road / Sunnyside Crescent roundabout

A new roundabout is currently under construction at the Grose Vale Road / Sunnyside Crescent intersection as shown in Figure 12. The roundabout is an upgrade from the existing priority-controlled intersection and is expected to improve traffic flow at this location. The existing pedestrian crossing on the western leg is also being shifted slightly.



Figure 12 Roundabout at the Grose Vale Road / Sunnyside Crescent intersection (Source: Site visit, November 2022)

4.2 Land Use Developments

4.2.1 Redbank

Redbank is a residential development by Redbank Communities and is located approximately 1 kilometre northeast of the site and 3 kilometres west of North Richmond town centre. Redbank will provide 1,400 dwellings, a town village, childcare centre, retirement village and various community facilities. The rezoning for Redbank was approved in 2013 and staged construction of the development is ongoing.



Figure 13 Redbank, located northeast of the site (Source: Redbank Communities, 2022)

The transport impacts of Redbank were assessed in the *North Richmond Redbank Transport Management and Accessibility Plan* (AECOM, 2013). This plan identified a package of measures to support Redbank for two infrastructure scenarios with and without the Grose River Bridge.

Following comments from TfNSW, AECOM undertook additional analysis to determine the preferred infrastructure triggers for these measures. These triggers are outlined in the *North Richmond Redbank Transport Management and Accessibility Plan Traffic Review* (GTA, 2013) and the scenario with the Grose River Bridge is shown in Table 4.

Table 4 Preferred infrastructure triggers – with Grose River Bridge

Trigger	Measure	Current status
120 lots settled	<p>Bells Line of Road / Grose Vale Road / Terrace Road</p> <ul style="list-style-type: none"> Provide a westbound egress and merge lane (west of the Grose Vale Road intersection). <p>Kurrajong Road / Old Kurrajong Road / Yarramundi Lane (short-term)</p> <ul style="list-style-type: none"> Provision of an eastbound right-turn bay. Provision of a northbound left-turn slip lane with an acceleration lane on Kurrajong Road. <p>Kurrajong Road / Bosworth Street / March Street</p> <ul style="list-style-type: none"> Parking to be banned from Chapel Street to Bosworth Street on eastbound approach (entry lane). 	Completed
400 lots settled	<p>Kurrajong Road / Bosworth Street / March Street</p> <ul style="list-style-type: none"> Parking lane shorted along March Street. Parking lane shortened from Bosworth Street to Chapel Street on eastbound approach (exit lane). 	Completed
1,000 lots settled	<ul style="list-style-type: none"> Alternative bridge crossing at Yarramundi (Grose River Bridge). Upgrade of Springwood Road / alternative bridge crossing intersection. Upgrade of Grose Vale Road / Grose River Road to a roundabout. 	Submitted to Council for approval
1,400 lots occupied	<p>Bells Line of Road / Grose Vale Road / Terrace Road</p> <ul style="list-style-type: none"> Extension of eastbound right-turn bay by 50 metres. 	Not yet completed

The remaining infrastructure projects to be completed are the Grose River Bridge and upgrade to Bells Line of Road / Grose Vale Road / Terrace Road.

4.2.2 Kurmond and Kurrajong Investigation Area

The Kurmond and Kurrajong Investigation Area is located northwest of the site and aims to provide rural living opportunities in close proximity to the Kurmond and Kurrajong neighbourhood centres. The area is still under investigation with no timeline for approval or completion.

The transport impacts of the investigation area were assessed in the *Hawkesbury Traffic Study – Stage 2 Traffic Modelling Report* (SMEC, 2019). The report undertook traffic modelling of Hawkesbury area for a 2027 scenario and assumed the inclusion of 200 dwellings as part of the investigation area as well as:

- Operation of the Grose River Bridge.
- Developments across the Hawkesbury City local government area including Redbank, Glossodia (250 dwellings), Pitt Town (150 dwellings) and Vineyard (900 dwellings).
- Recently completed TfNSW intersection upgrades approaching Richmond Bridge including Old Kurrajong Road / Kurrajong Road, Bells Line of Road / Grose Vale Road and Bosworth Street / March Street.

The report identified that the dwellings associated with the investigation area would have a minimal impact on road network performance with the above transport infrastructure upgrades.

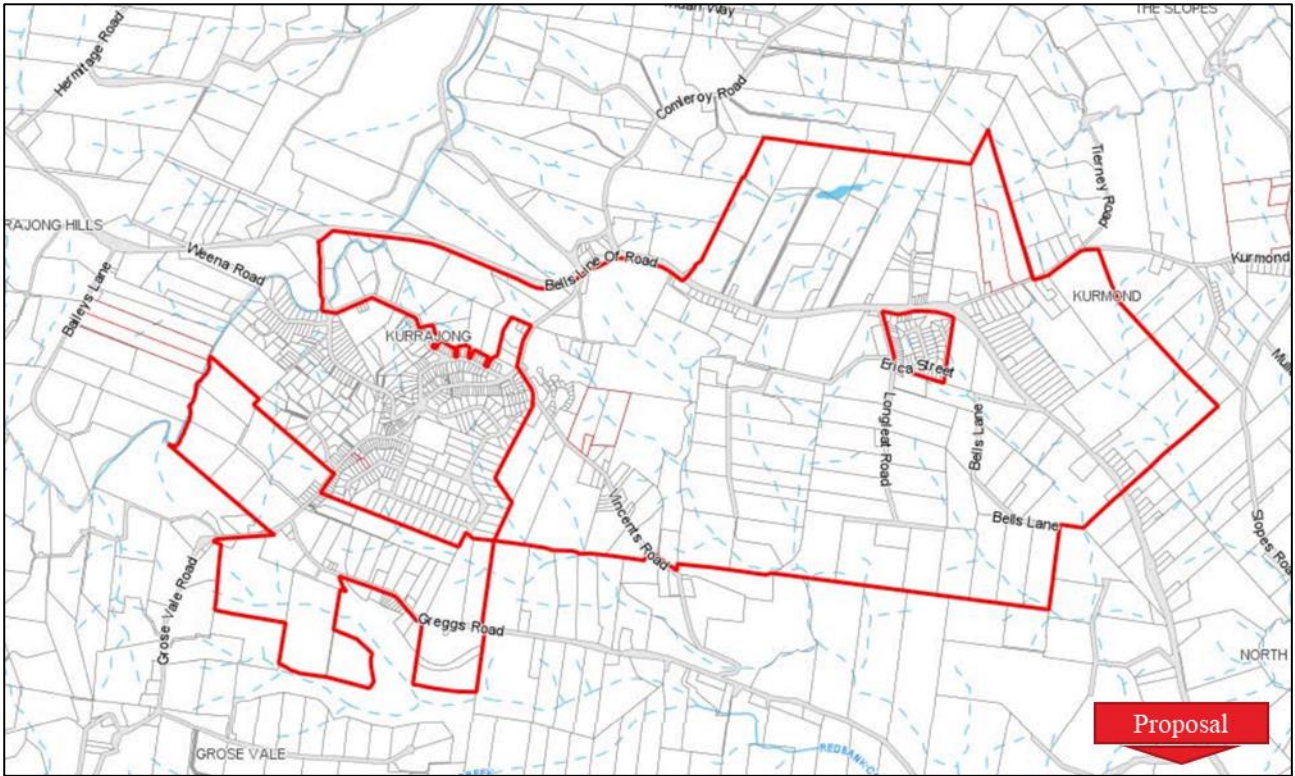


Figure 14 Kurmond and Kurrajong Investigation Area, located northwest of the site (Source: Kurmond Kurrajong Structure Plan, 2019)

5. Preliminary Transport Considerations

5.1 Mode Share

2016 Journey to Work (JTW) Census data was used to estimate baseline travel mode shares for work trips. It is noted that 2021 JTW Census data is currently available. However, 2016 JTW data has been considered for assessment as travel patterns surveyed in the 2021 JTW data is likely to be impacted by the COVID-19 pandemic.

The site is located within the Kurrajong Heights – Ebenezer Statistical Area Level 2 (SA2). However, this SA2 primarily consists of rural land uses and is not considered representative of future mode share with the proposal. Therefore, the adjacent Richmond – Clarendon SA2 was selected for analysis and is shown in Figure 15.

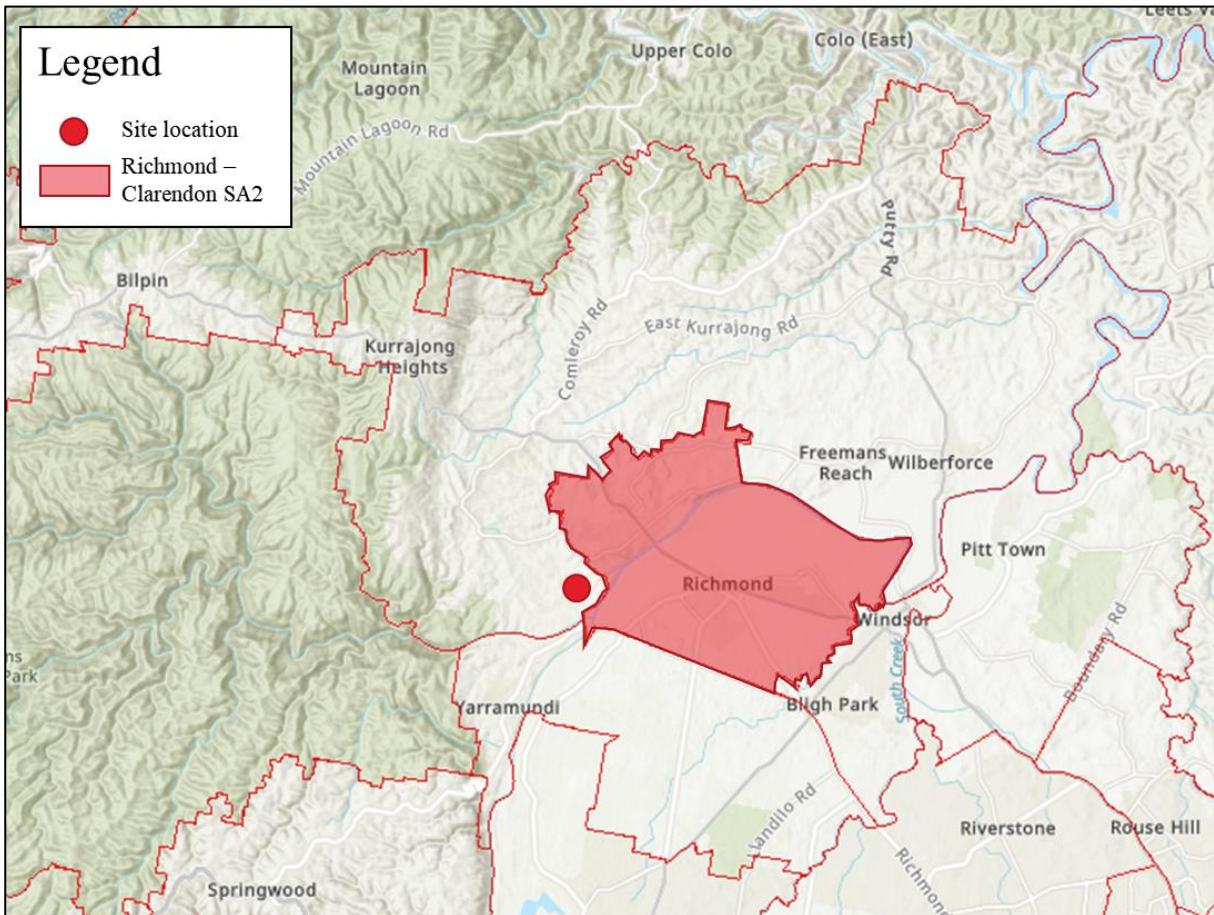


Figure 15: Richmond – Clarendon SA2 (Source: 2016 Census of Population and Housing)

The JTW data indicates there are approximately 13,855 working residents that live in the Richmond – Clarendon SA2. The vast majority of residents travel to work by private vehicle, with only 13% travelling by active or public transport modes as illustrated in Table 5. It is important to note that this SA2 includes areas that are not well-connected to public transport, and public transport trips are generally multi-modal with car trips to public transport stops.

Table 5: Mode shares – JTW (Source: Australian Bureau of Statistics, 2016)

Mode of travel	Trips	Proportion travelling to work*
Public Transport	406	8%
Private Vehicle Driver	4,440	81%
Private Vehicle Passenger	278	5%
Active Transport	291	5%
Other Mode	38	1%
Worked at home	234	-
Did not go to work	605	-
Mode not stated	55	-
Not applicable	7508	-
Total	13,855	100%

*Excluding worked at home, did not go to work, not stated and not applicable

Besides JTW, Household Travel Survey (HTS) data can also provide a useful indication of travel mode share. HTS data considers journeys of all types including non-work trips, which JTW does not consider.

The site is located within the Hawkesbury Statistical Area Level 3 (SA3). However, as with JTW, this SA3 primarily consists of rural land uses and is not considered representative of future mode share with the proposal. Therefore, the adjacent Richmond – Windsor SA3 was selected for analysis as illustrated in Figure 16.

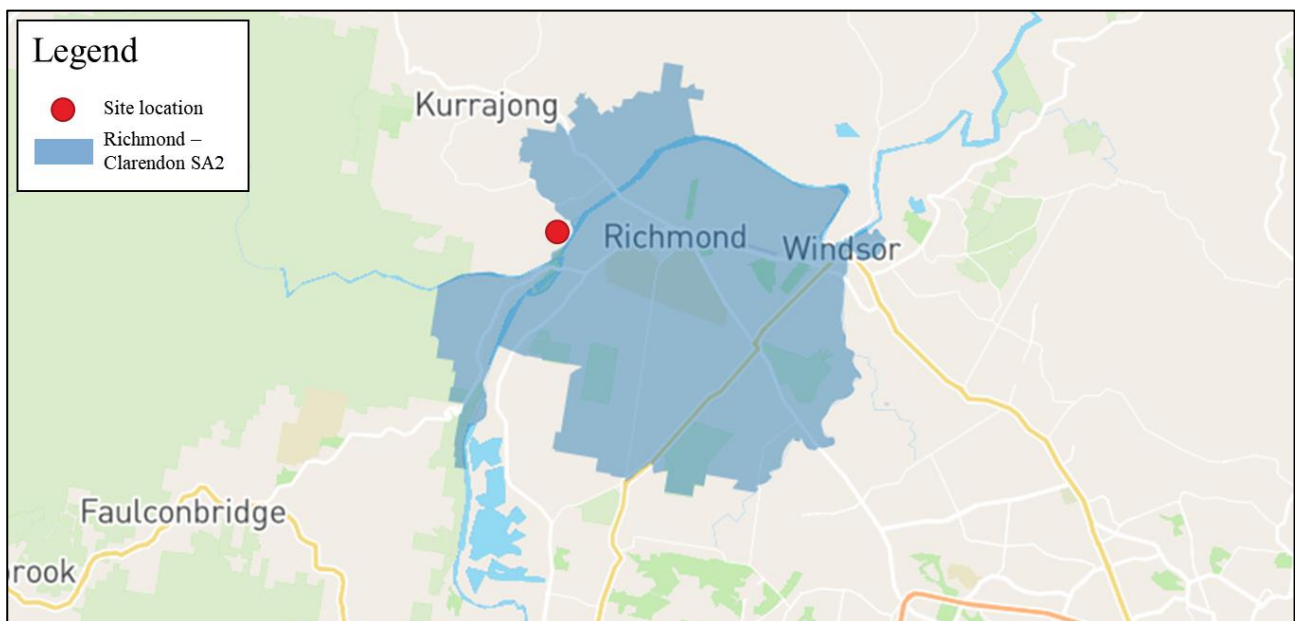


Figure 16: Richmond – Windsor SA3 (Source: HTS – Data by SA3 2009/10-2019/20)

The most recent mode shares for 2019/20 are shown in Table 6. Similar to the JTW data, 83% of residents in the Richmond – Windsor SA3 travel using private vehicles, with public transport and active travel representing only 16%.

Table 6: Mode shares – HTS

Mode of travel	Trips	Proportion
Vehicle Driver	76,000	62%
Vehicle Passenger	26,000	21%
Train	6,000	5%
Bus	< 1,000	1%
Walk only	5,000	4%
Walk linked	8,000	6%
Other	1,000	1%
Total	122,000	100%

5.2 Traffic Generation

The *Guide to Traffic Generating Developments 2002* provides traffic generation rates for dwellings based on surveys conducted in areas where new residential subdivisions are being built. It recommends an average trip rate of 0.85 vehicle trips per dwelling in the weekday peak hour.

This is in line with the traffic generation rate used in the *North Richmond Redbank Transport Management and Accessibility Plan, Hawkesbury Traffic Study – Stage 2 Traffic Modelling Report* and other studies in the area, including the *Jacaranda Ponds Glossodia Traffic and Transport Assessment* (Arup, 2013). The *North Richmond Redbank Transport Management and Accessibility Plan* also applied the same traffic generation rate for the weekend peak hour.

It is noted that the TDT 2013/04a outlines a trip rate of 0.71 and 0.78 vehicle trips per dwelling in the morning and evening peak hours respectively. However, the trip rate of 0.85 is still within the range of trip rates suggested by the TDT 2013/04a.

For the proposed 1,200 dwellings, this equates to 1,020 peak hour vehicle trips.

Furthermore, the following standard incoming and outgoing trip ratios have been assumed. The highest number of vehicle trips in each direction is expected to be in the AM outbound and PM inbound in line with typical commuting patterns.

- 20% incoming, 80% outgoing in the weekday AM peak hour.
- 80% incoming, 20% outgoing in the weekday PM peak hour.
- 50% incoming, 50% outgoing in the Saturday peak hour.

The full breakdown of traffic generation for each peak hour is detailed in Table 7.

Table 7: Traffic generation and direction

Mode	AM Peak			PM Peak			Saturday Peak		
	In	Out	Total two-way	In	Out	Total two-way	In	Out	Total two-way
Private Vehicle	204	816	1020	816	204	1020	510	510	1020

It should be noted that the current concept plan for the proposal does not include land uses that employ people. Therefore, no trip containment has been assumed and residents of the proposed development are assumed to travel to external locations for work.

5.3 Traffic Distribution

The distribution of traffic generated by the proposal was estimated using JTW origin and destination data. Table 8 outlines the areas which residents within the Richmond – Clarendon SA2 travelled to for work.

Table 8: JTW travel distribution

Route	Statistical Area	% of JTW Travel
Towards Richmond and Windsor	Richmond – Clarendon	29%
	Windsor – Bligh Park	9%
	Rouse Hill – McGraths Hill	5%
	Yarramundi – Londonderry	2%
	Dural – Wisemans Ferry	1%
Towards Penrith	Penrith	11%
	Blue Mountains	5%
	St Marys	1%
Towards Hawkesbury	Hawkesbury	4%
Towards Central Sydney	Blacktown	11%
	Parramatta	7%
	Baulkham Hills	4%
	City and Inner South	3%
	North Sydney and Hornsby	2%
	South West	2%
	Ryde	1%
	Inner South West	1%
	Outer South West	1%
	Inner West	1%
Total		100%

The majority of residents work locally in the Richmond and Windsor area with residents also working in the Hawkesbury/Baulkham Hills, Penrith, Blacktown and Parramatta areas.

Based on the JTW distribution, trips to each destination were assigned to the assumed shortest route to estimate the distribution of traffic generated by the proposal. The assumed routes were:

- Northeast towards Richmond and Windsor – Grose River Road > Grose Vale Road > Bells Line of Road (towards Richmond).

- North towards Hawkesbury – Grose River Road > Grose Vale Road > Bells Line of Road (towards Kurmond).
- South towards Penrith and Central Sydney – assumed to be distributed between the two routes:
 - Grose River Road > Grose Vale Road > Bells Line of Road (towards Richmond) – **33%**
 - Grose River Road > Grose River Bridge > Springwood Road > Castlereagh Road (and The Driftway) – **66%**

The resulting trip distribution of traffic generated by the proposal is shown in Table 9 and Figure 17.

Table 9: Assumed vehicle trip routes to and from the site

Route Name	Destinations	Route	Trip Distribution
Northeast towards Richmond and Windsor	<ul style="list-style-type: none"> • Richmond – Clarendon • Windsor – Bligh Park • Rouse Hill – McGraths Hill • Dural – Wisemans Ferry 	Grose River Road > Grose Vale Road > Bells Line of Road (towards Richmond)	44%
North towards the Hawkesbury SA3 (north of Richmond)	<ul style="list-style-type: none"> • Hawkesbury 	Grose River Road > Grose Vale Road > Bells Line of Road (towards Kurmond)	4%
South towards Penrith and Central Sydney	<ul style="list-style-type: none"> • Yarramundi – Londonderry • Baulkham Hills • Penrith • Blue Mountains • St Marys • Blacktown • Parramatta • City and Inner South • North Sydney and Hornsby • Ryde • South West • Inner South West • Outer South West • Inner West 	Grose River Road > Grose Vale Road > Bells Line of Road (towards Richmond)	17%
		Grose River Road > Grose River Bridge > Springwood Road > Castlereagh Road (towards Penrith)	35%

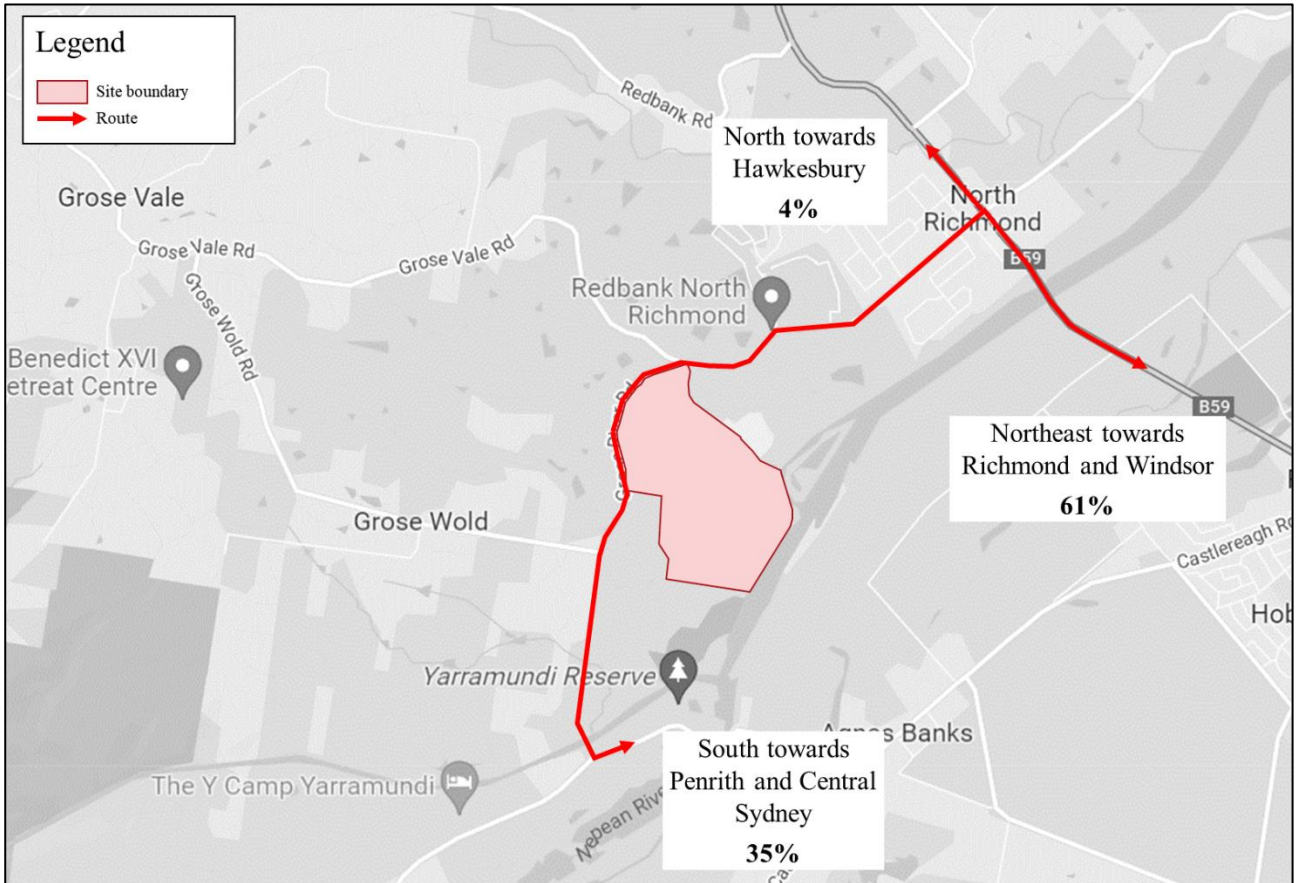


Figure 17: Assumed vehicle trip distribution

Applying these trip distributions results in the following vehicle trips outlined in Table 10.

Table 10: Vehicle Trip Distribution

Mode	AM Peak			PM Peak			Saturday Peak		
	In	Out	Total two-way	In	Out	Total two-way	In	Out	Total two-way
Northeast towards Richmond and Windsor	124	498	622	498	124	622	311	311	622
North towards Hawkesbury	8	32	40	32	8	40	20	20	40
South towards Penrith and Central Sydney	72	286	358	286	72	358	179	179	358
Total	204	816	1020	816	204	1020	510	510	1020

5.4 Midblock Capacity Assessment

This section provides an overview of the midblock capacity assessment. It is noted that this is high level assessment being undertaken using publicly available data. A further assessment including more detailed traffic modelling in consultation with TfNSW should be considered in subsequent stages of planning.

5.4.1 Methodology

A high-level midblock capacity assessment was carried out to assess the impact of the proposed development on the surrounding road network. The assessed roads are outlined in Table 11.

Table 11 Roads assessed in the midblock capacity assessment

Road	Data source
Grose River Road (near the site)	<i>Grose River Bridge REF Addendum Traffic Impact Assessment</i>
Grose Vale Road (east of Grose River Road)	
Grose River Bridge	
Springwood Road (west of Castlereagh Road)	
Grose Vale Road (west of Bells Line of Road)	<i>Hawkesbury Traffic Study – Stage 2 Traffic Modelling Report</i>

The following scenarios were considered:

- 2031 Base Scenario (**without** the proposal and with the Grose River Bridge)
- 2031 Development Scenario (**with** the proposal and with the Grose River Bridge)

2031 Base Scenario traffic volumes without the proposal and with the Grose River Bridge were estimated in the *Grose River Bridge REF Addendum Traffic Impact Assessment* as shown in Figure 17.

For Grose Vale Road (west of Bells Line of Road), 2027 weekday traffic volumes without the proposal and with the Grose River Bridge were estimated using Scenario 2 modelling from the *Hawkesbury Traffic Study – Stage 2 Traffic Modelling Report*.

The future land use and transport infrastructure assumptions in the Addendum and study are consistent with the *North Richmond Redbank Transport Management and Accessibility Plan*, and include:

- Completion of the Redbank development
- Completion of the Grose River Bridge
- Completion of intersection upgrades as specified in Table 4.

These volumes were used to assess the expected future volume/capacity ratio without and with the proposal.

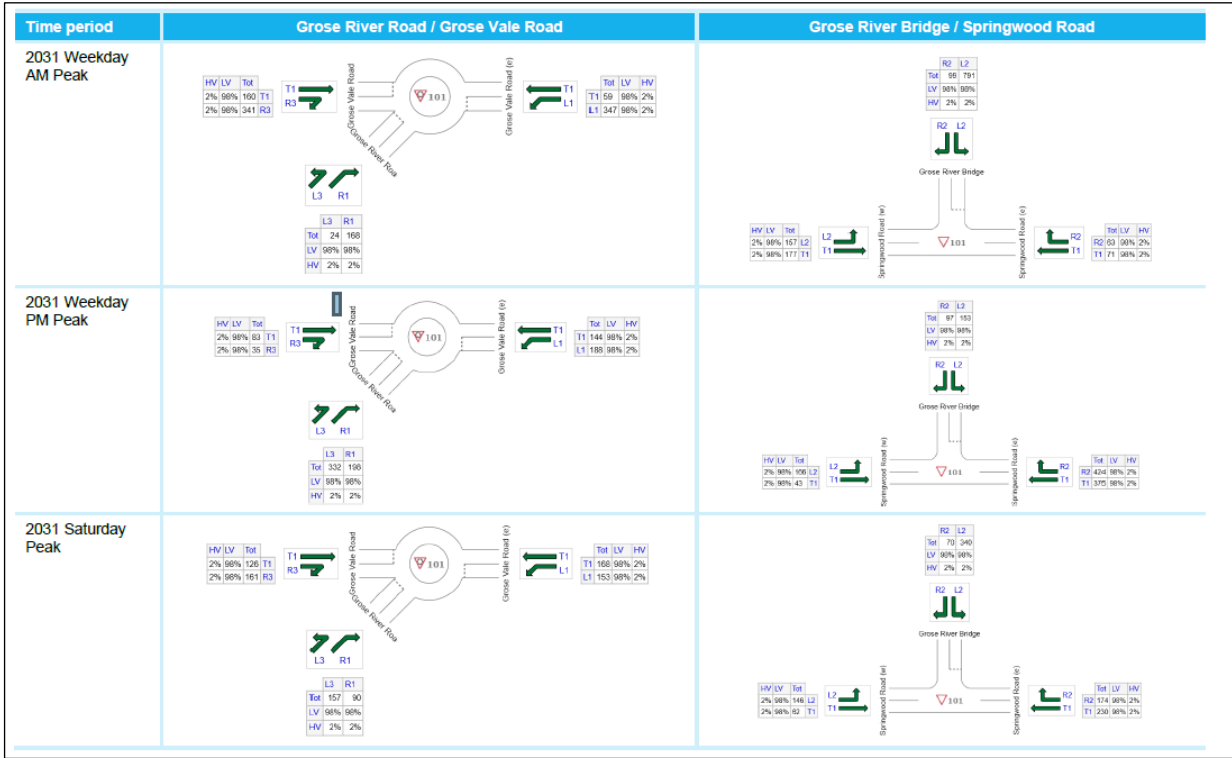


Figure 18: 2031 traffic volume forecasts at the Grose River Road / Grose Vale Road and Grose River Bridge / Springwood Road intersections with the Grose River Bridge (Source: Grose River Bridge REF Addendum Traffic Impact Assessment, 2022)

To scale up the 2027 traffic volumes from the *Hawkesbury Traffic Study – Stage 2 Traffic Modelling Report* to a 2031 Base Scenario, Richmond and North Richmond network traffic growth from the *Richmond Bridge duplication and traffic improvements Preferred Option Report* (TfNSW, 2021) was considered. The projected network traffic growth from the report is shown in Table 12.

Table 12 Projected network growth (Source: Richmond Bridge duplication and traffic improvements Preferred Option Report, 2021)

Year	2019	2026	2036	2046
Peak period demands	44,190	50,590	54,560	63,550

Between 2026 and 2036, the compound annual growth rate is approximately 0.76 per cent. This growth rate has been applied to scale up the 2027 traffic volumes to a 2031 forecast.

5.4.2 Midblock Capacity

The capacity of a significant length of a single traffic lane for the prevailing roadway and traffic conditions can be calculated using the following equation, sourced from the *Guide to Traffic Management Part 3: Traffic Studies and Analysis* (Austroads, 2013):

$$C = 1800f_w f_{HV}$$

Where:

C = capacity in vehicles per hour under prevailing roadway and traffic conditions

f_w = adjustment factor for narrow lanes and lateral clearances

f_{HV} = adjustment factor for heavy vehicles ($1/[1 + P_{HV}(E_{HV} - 1)]$)

P_{HV} = the proportion of heavy vehicles in the traffic stream, expressed as a decimal

E_{HV} = the average passenger car equivalents for heavy vehicles

This method of road capacity was used as opposed to the urban road capacities which are based on interrupted flow (from intersections). It is considered appropriate given the largely rural road typologies throughout the area and minimal intersection controls.

A summary of the assumed midblock capacities for the study roads is shown in Table 13.

Table 13 Assumed midblock capacities

Road	f_w	P_{HV}	E_{HV}	f_{HV}	C
Grose River Road	0.80	0.02	4.0	0.94	1,358
Grose Vale Road (east of Grose River Road)	0.90	0.02	4.0	0.94	1,528
Grose River Bridge (near the site)	0.80	0.02	2.0	0.98	1,412
Springwood Road (west of Castlereagh Road)	0.80	0.02	2.0	0.98	1,412
Grose Vale Road (west of Bells Line of Road)	0.8	0.02	2.0	0.98	1,412

5.4.3 Assessment Results

The midblock capacity assessment results are shown in Table 14 and Table 15.

Table 14: 2031 Base Scenario (without the proposal and with the Grose River Bridge)

Road	Capacity	AM peak				PM peak				Weekend peak			
		NB / EB		SB / WB		NB / EB		SB / WB		NB / EB		SB / WB	
		Volume	V/C	Volume	V/C	Volume	V/C	Volume	V/C	Volume	V/C	Volume	V/C
Grose River Road	1,358	192	0.14	688	0.51	530	0.39	223	0.16	247	0.18	314	0.23
Grose Vale Road (east of Grose River Road)	1,528	328	0.21	83	0.05	281	0.18	476	0.31	216	0.14	325	0.21
Grose River Bridge (near the site)	1,412	220	0.16	890	0.63	590	0.42	250	0.18	320	0.23	410	0.29
Springwood Road (west of Castlereagh Road)	1,412	968	0.69	134	0.09	196	0.14	799	0.57	402	0.28	404	0.29
Grose Vale Road (west of Bells Line of Road)	1,412	918	0.65	228	0.16	550	0.39	956	0.68	-*	-	-*	-

Table 15: 2031 Development Scenario (with the proposal and with the Grose River Bridge)

Road	Capacity	AM peak				PM peak				Weekend peak			
		NB / EB		SB / WB		NB / EB		SB / WB		NB / EB		SB / WB	
		Volume	V/C	Volume	V/C	Volume	V/C	Volume	V/C	Volume	V/C	Volume	V/C
Grose River Road	1,358	722	0.53	821	0.60	663	0.49	753	0.55	579	0.43	646	0.48
Grose Vale Road (east of Grose River Road)	1,528	858	0.56	83	0.05	414	0.27	476	0.31	548	0.36	325	0.21
Grose River Bridge (near the site)	1,412	291	0.21	1,176	0.83	876	0.62	321	0.23	499	0.35	589	0.42
Springwood Road (west of Castlereagh Road)	1,412	1,254	0.89	205	0.15	267	0.19	1,085	0.77	581	0.41	583	0.41
Grose Vale Road (west of Bells Line of Road)	1,412	1448	1.03	361	0.26	683	0.48	1486	1.05	-*	-	-*	-

*Data not available for weekend peak

In the 2031 Base Scenario, the roads near the site are expected to operate with spare capacity with a volume / capacity ratio of 0.8 or under. The roads with the highest volume / capacity ratio are Springwood Road eastbound in the AM peak hour and Grose Vale Road (west of Bells Line of Road) eastbound in the AM peak hour and westbound in the PM peak hour. This reflects traffic travelling to work towards Penrith and Central Sydney.

In the 2031 Development Scenario, the addition of traffic generated by the proposal will increase traffic volumes on all roads near the site. In particular, the volume / capacity ratio of Grose Vale Road (west of Bells Line of Road) is expected to increase to 1.05. Potential opportunities for additional lane capacity should be considered in subsequent stages of planning.

It should be noted that potential improvements to public and active transport facilities are expected to reduce private vehicle mode share and shift trips to public transport, walking and cycling, which would reduce the impact on these roads.

5.5 Site Access

The concept plan currently proposes two vehicular access points, which are both to the west of the site onto Grose River Road. The vehicular access points are shown on Figure 19.

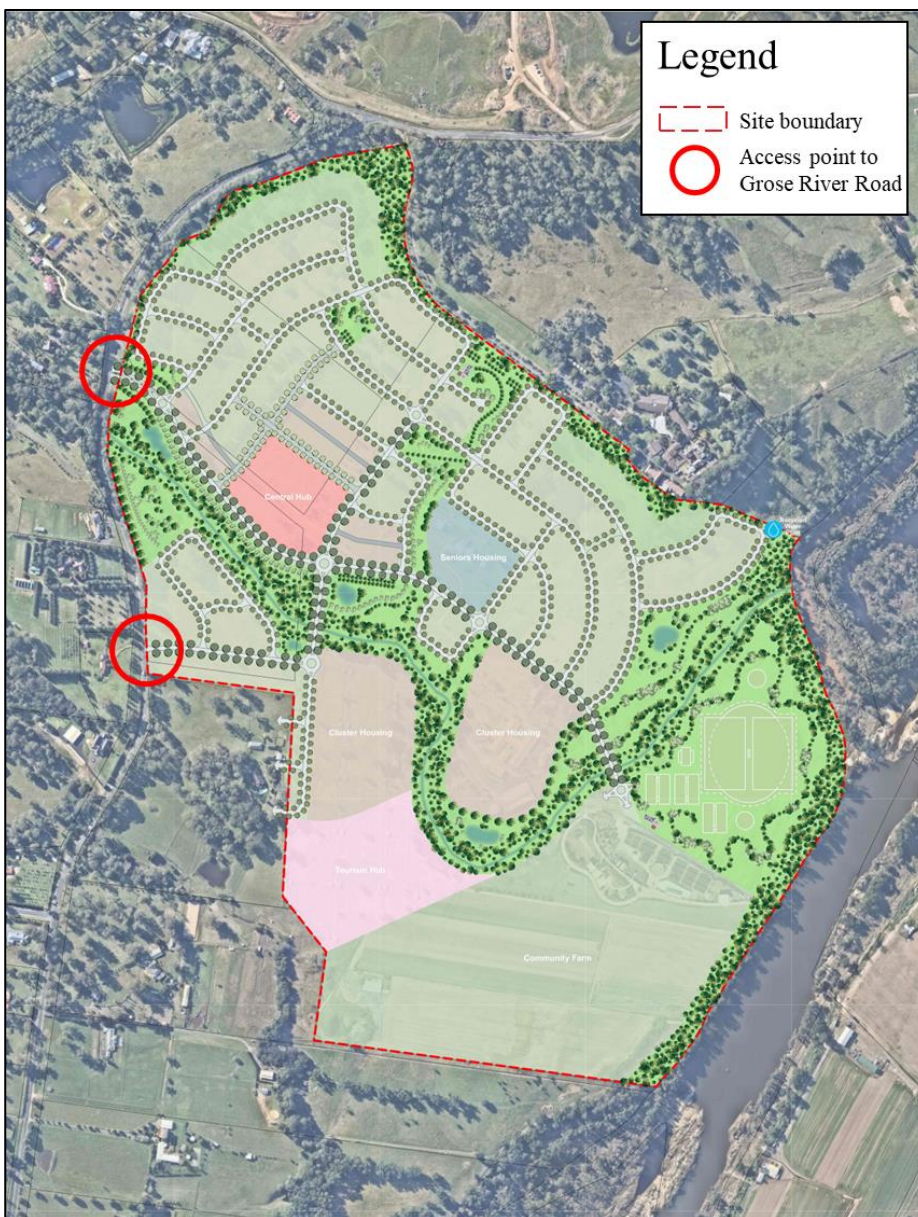


Figure 19: Site vehicular access points

Assuming a 50 per cent split between both access points onto Grose River Road, the proposal is expected to generate 510 two-way vehicle trips at each access during each peak hour. When considering that vehicles would also be performing right-in or right-out movements to and from the site, priority-controlled intersections are not considered appropriate.

Therefore, it is recommended that roundabouts be implemented at the access locations given the semi-rural nature of the roads serving the development. Intersection modelling should be carried out to determine the details of the roundabout design, such as number of circulating lanes and slip lane arrangements. Wayfinding and appropriate signage may also be considered to distribute traffic to minimise impacts to road network performance, if required.

The recommendations above are subject to consideration of seasonality and detailed traffic analysis which should be considered in subsequent stages of planning.

5.6 Parking

Parking within the proposal would be provided as required in the DCP. As the breakdown of dwelling types is not yet available, the car parking provision of the proposal has been estimated using an assumed 1,200 large dwellings as shown in Table 16.

Table 16: Hawkesbury City Council DCP car parking requirements

Item	Requirement		Car parking requirement
Car parking provision – Dwelling House, Dual Occupancy, Villas and Townhouses and Residential Flat Buildings	Small dwelling (GFA less than 55m ²)	1 covered space	-
	Medium dwelling (GFA 55m ² to 85m ²)	1.5 covered spaces	-
	Large dwelling (GFA more than 85m ²)	2 covered spaces	2,400 covered spaces
	Visitor spaces	For developments containing 3 or more dwellings, 1 visitor space per 5 dwellings or part thereof	240 spaces

The site would need to provide at least 2,400 covered parking spaces and 240 visitor spaces (based on a yield of 1,200 large dwellings).

6. Opportunities

6.1 Environmental Capacity Upgrades

Besides midblock capacity, the capacity of roads can also be measured by ‘environmental capacity’, which is the capacity of a street or area to accommodate moving and parked vehicles having regard to the need to maintain environmental and safety standards.

While key roads are expected to operate with sufficient midblock capacity, Grose River Road and Grose Vale Road (west of Yobarnie Avenue) have inconsistent treatments or show minor deterioration and could be improved to provide greater amenity and safety for road users.

Figure 20 shows a section from Grose River Road, south of Grose Vale Road. The carriageway is relatively narrow, is not of a uniform seal width, linemarking is faded and the shoulders are not sealed.



Figure 20 Grose River Road south of the site, facing south (Source: Google Street View, 2021)

While roads near the site provide sufficient theoretical lane capacity, the amenity and environmental standard of these roads would be significantly enhanced by upgrading to a consistent standard. A recommended standard would include a sealed carriageway of 10 metres width (including sealed shoulders).

As discussed in Section 4.1.2, Redbank Communities is also tendering road improvements on Grose River Road to provide greater amenity and safety for road users. The proposal should utilise these future road improvements to provide a safe and amenable environment for road users.

6.2 Intersection Capacity

While this assessment has not considered intersection performance via traffic modelling, previous studies have been reviewed to determine if there are risks to intersection performance. Intersection modelling should be carried out in subsequent planning to assess and confirm the impact of development traffic at key intersections. As estimated in Table 10, additional traffic volumes at key intersections in the peak hours are as follows:

- Grose Vale Road / Grose River Road and Bells Line of Road / Grose Vale Road / Terrace Road – 662 additional vehicles
- Grose River Bridge / Springwood Road – 358 additional vehicles

Given the quantum of traffic generated by the proposal, impacts may potentially be more far reaching beyond the above intersections. The scope of traffic assessment and modelling should be confirmed with authorities in the subsequent stages of planning.

The *Grose River Bridge REF Addendum Traffic Impact Assessment and Hawkesbury Traffic Study – Stage 2 Traffic Modelling Report* undertook traffic modelling for the above intersections. As discussed in Section 5.4.1, the Addendum undertook traffic modelling for a 2031 scenario and included consideration of the Grose River Bridge and Redbank development. Scenario 2 of the Stage 2 Traffic Modelling Report undertook traffic modelling for a 2027 scenario and included consideration of the Grose River Bridge, Kurmond and Kurrajong Investigation Area, Redbank and Jacaranda Ponds developments.

The traffic modelling results from the Addendum and Stage 2 Traffic Modelling Report are summarised in Table 17.

Table 17 Traffic modelling undertaken in the *Hawkesbury Traffic Study – Stage 2 Traffic Modelling Report*

Intersection	Peak hour	Degree of saturation	Delay	Level of service
Grose Vale Road / Grose River Road	AM	0.46	9	A
	PM	0.44	11	A
Grose River Bridge / Springwood Road	AM	0.83	12	A
	PM	0.78	11	A
Bells Line of Road / Grose Vale Road / Terrace Road	AM	0.95	51	D
	PM	0.97	43	C

The traffic modelling identified that the Bells Line of Road / Grose Vale Road / Terrace Road intersection is expected to operate very close to capacity and the Grose River Bridge / Springwood Road is expected to begin approaching capacity during peak hours.

However, this study did not consider the benefits of the New Richmond Bridge, which is expected to redirect up to 40 per cent of traffic away from the existing bridge and Bells Line of Road / Grose Vale Road / Terrace Road intersection. The proposal should utilise the capacity improvements as a result of the New Richmond Bridge. Intersection modelling will determine the full extent of the impacts of the proposed development at these intersections, as well as to determine whether mitigation measures, such as additional lanes, would be required ensure adequate performance.

6.3 Walking and Cycling Improvements

As discussed in Section 3.3, there are very limited walking and cycling facilities near the site. Walking and cycling could be improved by providing dedicated infrastructure such as footpaths or shared paths along Grose River Road and Grose Vale Road (between Grose River Road and Yobarnie Avenue) to connect to North Richmond via existing footpaths on Grose Vale Road (east of Yobarnie Avenue).

Within the proposal, shared paths and footpaths should be provided on internal roads. Traffic calming should also be implemented to reduce vehicle speeds and improve walking and cycling amenity. If community facilities are proposed within the site, secure cycling parking should be provided. Emerging active travel trends, such as increased usage of micromobility products like e-scooters and e-bikes, should also be encouraged in the design of the area. For example, dedicated e-bike and e-scooter charging stations at community facilities should be provided. Implementation of shared bikes could also be considered to encourage active travel in the area.

6.4 Public Transport Improvements

A key challenge will be providing services that encourage active and public transport-only trips to and from the proposal. The site is located within driving distance to Richmond Station. The Grose River Bridge would also provide an additional alternative route to Richmond Station via Springwood Road and Castlereagh Road. However, private vehicle access to public transport would generally be more attractive than active and public transport-only trips as Richmond Station and bus stops are outside of comfortable walking distances.

Public transport improvements could be considered to improve its attractiveness as travel mode. Improvements could include modifications to the existing route 680 service or new, direct bus connections to North Richmond, as well as Richmond and Windsor. Buses should focus on easy and regular interchange opportunities with the Sydney Trains and regional bus network. Additionally, more direct bus services to key centres located further away could also be considered, such as to Rouse Hill, Penrith, Parramatta, Blacktown or Western Sydney Aerotropolis.

Bus services could also travel within the proposal, with bus stops located within 400 metres walking distance from any dwelling to provide suitable access.

Measures to achieve good public transport outcomes could include:

- Integrated planning of land use and public transport facilities, such as dedicated bus facilities within the site.
- High quality bus stops.
- High frequency services at peak hours.
- Timetable integration with the Sydney Trains network at Richmond and Windsor Stations, as well as other bus services.
- Implementation of bus routes at inception of the development to instil sustainable travel behaviours, even if funded by the developer initially.

6.5 Demand Responsive Transport

An alternative to typical bus services is Demand Responsive Transport (DRT). DRT is a form of public transport that provides on-demand services and is flexible with passenger destinations. DRT is particularly useful in rural areas where infrequent public transport demand makes typical fixed-route public transport services unfeasible. DRT could present a suitable service for the proposed development to connect to North Richmond, Richmond and Windsor. In Sydney, on-demand buses are currently being trialled in a variety of locations including at The Ponds and Norwest (shown in Figure 21).



Figure 21 On-demand buses in Sydney

7. Summary

Arup has been commissioned by the Kavanagh Family to undertake a Transport Scoping Report to support a Scoping Proposal for the Belmont Park Estate. The Scoping Proposal would identify whether the development has strategic and site-specific merit to progress to a planning proposal and identify the necessary supporting information required for assessment, including for transport and traffic.

7.1 Preliminary Transport Considerations

The key preliminary transport considerations identified for the proposal include:

- The proposed development is expected to be capable of self-evacuation and would not rely on emergency services to assist in the evacuation of occupants. From the site, there is a flood-free evacuation route to extensive areas above the probable maximum flood (PMF) to the west and north-west by travelling north on Grose River Road and Grose Vale Road.
- A variety of infrastructure projects are in the planning or construction phases and would benefit the proposal. The New Richmond Bridge and Grose River Bridge are expected to provide additional capacity improvements, including at the Bells Line of Road / Grose Vale Road / Terrace Road intersection. Redbank Communities is also tendering road improvements on Grose River Road to provide greater amenity and safety for road users. The proposal should utilise these future road improvements to provide a safe and amenable environment for road users.
- Grose Vale Road (west of Bells Line of Road) is expected to reach capacity with traffic generated by the proposal (up to 1,486 vehicles per hour in each direction). Potential opportunities for additional lane capacity should be considered in subsequent stages of planning. To support road network performance, potential improvements to public and active transport facilities would shift trips to public transport, walking and cycling.
- The site is located within driving distance to Richmond Station. Richmond Station is serviced by the T1 Western and T5 Cumberland lines which provide direct connections to Blacktown and Parramatta Station, as well as to the wider Sydney Trains network. These stations are serviced by trains running every half an hour throughout the day in each direction on both weekdays and weekends. The Grose River Bridge would also provide an additional alternative route to Richmond Station via Springwood Road and Castlereagh Road.

7.2 Opportunities

Opportunities to be considered in subsequent stages of planning are summarised in Table 18 and Figure 22.

Table 18 Opportunities

No.	Opportunity type	Opportunity
1	Walking and cycling	Provide high-quality walking and cycling facilities on Grose River Road and Grose Vale Road (between Grose River Road and Yobarnie Avenue) to North Richmond.
2		If community facilities are provided, provide secure cycling parking and micromobility within the site.
3	Public transport	Improve existing bus services or provide new bus services to provide direct links to existing trunk train and bus services at Richmond and key centres (subject to consultation with TfNSW).
4		Provide high-quality bus stops near and within the site (subject to consultation with TfNSW).
5		Provide DRT services (such as on-demand buses) to connect residents with North Richmond and key locations of jobs, education and health facilities and services.
6	Traffic	Utilise road network capacity improvements from the Grose River Bridge and New Richmond Bridge projects to support new development.

No.	Opportunity type	Opportunity
7		Utilise Grose River Road improvements to provide greater amenity and safety environment for road users.
8		Provide roundabouts at the access points to the site to minimise impacts to road network performance and to improve safety of road users.
9		Consider additional lane capacity on Grose Vale Road (west of Bells Line of Road).

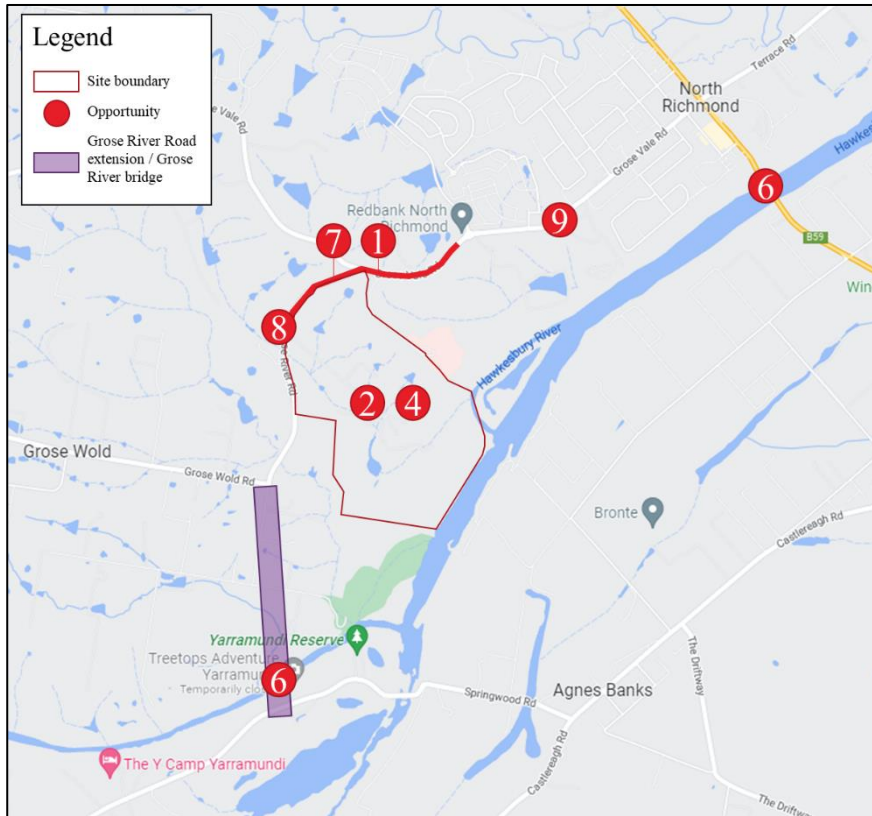


Figure 22 Opportunities

7.3 Discussion Points

The key discussion points to be discussed with DPE, Hawkesbury City Council, TfNSW and other authorities include:

- Agreement on the vision and objectives for how the proposal would integrate with the surrounding transport network.
- Whether there are any other nearby planned transport infrastructure projects or land use developments that may impact the proposal.
- The scope and extent of traffic modelling required to be undertaken to holistically understand the traffic impacts of the proposal.
- Flooding, bushfire and evacuation considerations and whether traffic modelling is required to quantify these impacts.
- Whether TfNSW would consider increasing the frequency of or re-routing public transport services to travel within the proposal.