Our Ref: 18055

27 September 2023

NSW Land and Housing Corporation
Department of Planning and Environment
Level 5
219 Cleveland Street
STRAWBERRY HILLS NSW 2010

Attention: Mr Laith Dabash

Dear Laith,

RE: RIVERWOOD MASTERPLAN PROJECT – STAGE 1 DEVELOPMENT (RESIDENTIAL UNITS AND RETAIL)
TRAFFIC IMPACT ASSESSMENT

Background

The planning pathway for Riverwood SSP Estate that consisted of 3,900 apartment units and other land uses has changed, and now the focus of the project is rezoning of the Stage 1 development that consists of approximately 420 apartment units with the potential for a small retail area.

The Riverwood Estate Planning Proposal was placed on public exhibition between 12 August and 25 September 2022.

The project has been affected by recent market changes primarily because of significant increases in construction costs impacting on the overall viability of the project.

LAHC has implemented a revised strategy that will now focus on the delivery of an exemplar first stage of the project which will deliver approximately 420 new dwellings with less impact on existing local infrastructure. This will enable the wider masterplan to be considered in the future to ensure it meets the aspirations of the local community and allow identified local infrastructure to be delivered in tandem.

Rezoning of an exemplar first stage will build on the previous renewal work at Washington Park noting that the land and proposed redevelopment in this stage mirrors the 2022 exhibited planning proposal. As the proposed first stage sits within the exhibited proposal, this means the land needed for future infrastructure such as road widening will be unaffected.

The Stage 1 development is to replace the existing 59 dwellings in Block 28.1 and 28.2, located on the west side of Belmore Road between Washington Avenue and Roosevelt Avenue, as shown in Figure 1 and Attachment One.

For analytical purposes, this assessment has allowed for 414 apartment units and a potential retail area as follows:

- 207 private units
- 83 affordable housing units, 50% of which are keyworker housing units
- 124 social units
- Potential for a small supermarket with a 1,000m^2 GFA.

In accordance with NSW Government Communities and Justice website, affordable housing is open to a broader range of household incomes than social housing and is managed more like a private rental property but there are eligibility criteria for application.

Keyworker housing units are affordable housing rented to eligible key workers such as teachers and police officers.

Figure 1: Extent of Stage 1 Development

It is proposed to provide a footpath / shared path on both sides of Virginia Place west of the development and new pedestrian crossing facilities to connect with the supermarket.

The existing footpath will remain on Belmore Road. A setback (9m) has been allowed to allow for future road widening.

This traffic letter documents the traffic and transport impacts associated with the Stage 1 development. Attachment Three shows the Jacobs traffic modelling report prepared in April 2023 to assess traffic impact in Belmore Road and the wider road network, and concluded that the Stage 1 development would not trigger any road network improvements.

Mode of Transport

Given the location of the Stage 1 site, the existing mode of transport is expected to be similar to Washington Park which consists of a mix of private and social housing units.

Table 1 provides a summary of the existing mode share by different sources, including the Washington Park survey, 2016 JTW data and 2019/2020 HTS.

Table 1: Existing Residents' Travel Mode Share

Mode of Travel	Washington Park Survey 2018			2016 JTW 11903137309 (Washington Park)	2019/2020 HTS (Hurstville S3)
	Private Housing	Social Housing	Total		
Driver	40%	23%	35%	44%	50%
Passenger	20%	0%	16%	5%	23%
Bus	9%	18%	11%	4%	2%
Train	20%	25%	25%	44%	12%
Walk	11%	32%	16%	2%	12%
Cycle	0%	1%	0%	0%	-
Other	-	-	-	1%	1%
Total	**100%**	**100%**	**100%**	**100%**	**100%**

It is anticipated the future mode share will be similar to the existing mode share of the residents in Washington Park.

Table 2 provides a summary of the future travel mode share based on existing mode share of Washington Park, with minor adjustment with consideration given to the potential traffic generation associated with the residential component of the Stage 1 development (i.e., 75 vph in private housing, affordable and keyworkers housing and 16 vph in social housing as shown in Table 4.

Table 2: Future Travel Mode Share of the Stage 1 Residential Development

Mode of Travel	Private, Affordable and Keyworker (290 dwellings)		Social (124 dwellings)		Total (414 dwellings)	
	%	Trips	%	Trips	%	Trips
Driver	40%	75	24%	16	36%	92
Passenger	20%	37	0%	0	15%	37
Bus	9%	17	18%	12	11%	29
Train	20%	37	25%	17	21%	54
Walk	11%	20	32%	21	16%	42
Cycle	0%	0	2%	1	1%	1
Total	**100%**	**187**	**100%**	**67**	**100%**	**254**

Note: It has been assumed affordable housing (including keyworkers) have similar travel characteristics with private housing as it functions like a private rental property except at a lower rent.

For the potential supermarket, the RMS (now TfNSW) Trip Generation Surveys – NSW Small Suburban Shopping Centres report (November 2018) provides the mode share for two survey sites in Canterbury and Bankstown that have a similar size to the subject development. These survey sites also consist of a supermarket but no specialty retail similar to the subject development.

The average mode share of these two survey sites is shown in Table 3 and has been used to form a starting point for setting a target mode share for the subject supermarket.

Table 3 shows the majority of trips of these two survey sites were made by cars (87%). This is because one of these survey sites is surrounded by low density dwellings, and another one is a standalone development located adjacent to Bankstown airport.

Using the TfNSW surveyed mode share as a baseline for the subject small supermarket being located within a high density residential building, it is reasonable to set the target mode share with a greater uptake of active transport and less car use compared with the baseline mode share. The subject supermarket is expected to generate walking trips, particularly for residents who live in the residential component of the Stage 1 development.

Table 3 also provides a summary of the target mode share based on 70% driving, 20% active transport and 10% public transport of the person trips that would be generated by the subject supermarket. This has also considered the potential retail traffic generation (i.e., 69 vph in the AM peak hour as discussed later in this TIA).

Table 3: Future Travel Mode Share of the Stage 1 Retail Development

Mode of Travel	TfNSW Survey Mode Share: 2 sites with similar size in Canterbury-Bankstown LGA but no high density residential developments in the vicinity	Target Mode Share: Stage 1 Development Supermarket (1,000m² GFA)	
	%	%	Trips
Driving	87%	70%	69
Public transport	3%	5%	5 (assume all bus passengers)
Active transport	10%	20%	25 (assume mostly walking trips)
Total	**100%**	**100%**	**99**

Traffic Generation

Traffic generation rates adopted in the Stage 1 development are consistent with those for the private and social housing in the TIA that was exhibited for the overall estate development. These rates have been adjusted from the Washington Park survey results and subsequently approved by TfNSW.

It has been assumed affordable and keyworkers housing would have a similar traffic generation nature with the private housing. The adopted rates are shown as follows:

- Private, Affordable and Keyworker housing to be constructed:
  - Morning peak: 0.26 vehicle trips per unit
  - Evening peak: 0.29 vehicle trips per unit
- Social housing to be constructed:
  - Morning peak: 0.13 vehicle trips per unit
  - Evening peak: 0.12 vehicle trips per unit
- Existing medium density units to be demolished:
  - Morning peak: 0.12 vehicle trips per unit, which has replaced the old rate of 0.20 as explained in Attachment Two
  - Evening peak: 0.14 vehicle trips per unit, which has replaced the old rate of 0.23 as explained in Attachment Two
- Small supermarket
  - Morning peak: 6.97 vehicle trips per 100m² GLFA during the morning peak hour (assume 70% of the evening peak based on RMS (now TfNSW) Trip Generation Surveys – NSW Small Suburban Shopping Centres report (November 2018)

- Evening peak: 15.5 vehicle trips per 100m^2 GLFA during the afternoon peak hour based on RTA (now TfNSW) Guide to Traffic Generating Developments (2002).
- It has been assumed that the GLFA is 75% of the GFA in accordance with the same RTA Guide.

Table 4 shows the traffic generation potential of the subject residential development, less the existing traffic generation which is calculated based on the old rates (0.20 and 0.23) and new rates (0.12 and 0.14) as explained above.

Table 4: Net Change in Residential Traffic Generation

Land Use Type	Residential Traffic Generation Adopted in Traffic Modelling in Attachment Two (Based on the old rates for existing housing)					Residential Traffic Generation in this TIA (based on the new rates for existing housing)				
	Yield	Traffic Generation Rate		Traffic Generation (vph)		Yield	Traffic Generation Rate		Traffic Generation (vph)	
		AM	PM	AM	PM		AM	PM	AM	PM
Private, Affordable and Keyworker dwellings to be constructed	288	0.26	0.29	75	84	290	0.26	0.29	75	84
Social dwellings to be constructed	126	0.13	0.12	16	15	124	0.13	0.12	16	15
Existing social housing to be demolished	-59	0.20	0.23	-12	-14	-59	0.12	0.14	-7	-8
NET CHANGE	**355**	**-**	**-**	**79**	**85**	**355**	**-**	**-**	**84**	**91**

Table 4 indicates that the net change based on the old rates would be 79 vph in the AM peak and 85 vph in the PM peak, whilst application of the new rates would result in a net change of 84 vph in the AM peak and 91 vph in the PM peak for the residential trips.

The use of the old and new rates would result in a difference of 5 vph and 6 vph in the AM and PM peaks respectively, which are equivalent to one vehicle every 10 to 12 minutes to be dispersed across the wider road network. Therefore, the lower traffic generation (79 vph and 85 vph) adopted in the traffic modelling for Stage 1 development (Attachment Three) would not make any material difference to the modelling results due to the small increase of 5 to 6 vph in the traffic generation. On this basis, the traffic model was not re-run with the marginally higher traffic generation.

Attachment Three documented the modelling assumptions, network performance modelling results and discussion.

The small supermarket is intended to predominantly serve the local residents. The following assumptions have been adopted for estimating traffic generation of the supermarket:

- 15% of retail trips generate by the residents in Block 28.1 and 28.2, thus no car trips.

- 35% of the retail trips come from the local catchment to the west of the development, thus no car trips would occur in Belmore Road.
- 50% of the retail trips come from a wider catchment via Belmore Road.
- 18% of the retail trips are undiverted (passer-by) drop in trips as the supermarket is less than 3,000m^2 (i.e., existing trips already in Belmore Road), based on Austroads Guide to Traffic Management Part 12: Traffic Impacts of Developments.

On this basis, the traffic generation associated with the supermarket with a 750m^2 GLFA would be 81 vph in the AM peak hour and 116 vph in the PM peak hour, based on the RTA (now TfNSW) traffic generation rates for supermarkets. Assuming 15% of trips would be reduced because residents living in the Stage 1 development do not need to drive to the supermarket, this would result in a traffic generation of 69 vph and 99 vph in the AM and PM peak hours respectively.

Based on the above assumptions, it is expected that the traffic generation that would occur in Belmore Road would be in the order of 41 vph and 58 vph in the AM and PM peak hours respectively, but 15 vph and 21 vph in the respective AM and PM peak hours would already occur in Belmore Road as passer-by trips that would drop in to the supermarket.

This means the new trips in Belmore Road that would be generated by the supermarket are in the order of 26 vph and 37 vph in the respective AM and PM peak hours. This level of traffic generation is considered low as it equates to about two vehicles every minute during the peak hours which would be distributed between the Roosevelt Avenue and Washington Avenue routes to/from Belmore Road and further dispersed in the wider road network. This low level of retail traffic volume was not deemed necessary to update the traffic modelling that was developed to assess the traffic impact associated with the residential component of the Stage 1 development on the surrounding road network.

Intersection Capacity

Performance of the key intersections in proximity of the subject site has been assessed in Aimsun modelling for year 2031. The modelling results are shown in Attachment Three and a key summary is provided in Table 5.

The majority of the intersections were assessed by Jacobs using Aimsun modelling as shown in Attachment Three. The Canterbury Road- Belmore Road and King Georges Road- Broadarrow Road intersections were assessed in SIDRA modelling by TTPP.

Table 5: Year 2031 Intersection Performance

Intersection	AM Peak				PM Peak			
	Base Case (No Development)		Stage 1 Development		Base Case (No Development)		Stage 1 Development	
	Ave Delay (s)	LoS	Ave Delay (s)	LoS	Ave Delay (s)	LoS	Ave Delay (s)	LoS
Belmore Road – Hannans Road	29	C	29	C	23	B	22	B
Belmore Road – M5 Motorway Ramps	23	B	23	B	27	B	31	C
Belmore Road – Washington Avenue	58	E	69	E	16	B	25	B
Belmore Road – Roosevelt Avenue	25	B	23	B	12	A	17	B
Belmore Road – Thurlow Street	52	D	48	D	30	C	28	B
Bonds Road – Broadarrow Road	35	C	31	C	12	A	13	A
Bonds Road – Hannans Road	38	C	38	C	36	C	40	C
Bonds Road – Romilly Street	18	B	17	B	13	A	25	B
Forest Road – Boundary Rd – Bonds Road	>70	F	>70	F	>70	F	>70	F
Henry Lawson Drive – Belmore Road	26	B	29	C	42	C	53	D
Canterbury Road – Belmore Road	23	B	24	B	27	B	27	B
King Georges Road – Broadarrow Road	72	F	72	F	108	F	108	F

Based on the above modelling results, most of the assessed key intersections would operate at LoS D or better with the Stage 1 development traffic. The background traffic growth at the Belmore Road- Washington Avenue, Forest Road- Boundary Rd- Bonds Road and King Georges Road- Broadarrow Road intersections would result in Los F, regardless of the proposed development.

The most notable increase in intersection delay would occur at the Belmore Road- Washington Avenue intersection being the key access location to the subject development. An increase of 9 to 11 second delay is anticipated in the AM and PM peak hours, albeit the same LoS would remain as compared with the base case.

Another key access location to the subject development is the Belmore Road- Roosevelt Avenue intersection, where an increase of 5 second delay is anticipated albeit LoS B would remain as per the base case.

Further discussion is provided in Attachment Three for the performance of the surrounding road network and traffic queues along Belmore Road.

Jacobs recommended to locate the site access of the Stage 1 development closer to Roosevelt Avenue so that more traffic would utilise Roosevelt Avenue when egressing to Belmore Road and Hannans Road, as a way to reduce the use of Washington Avenue to access Hannans Road.

TTPP agree with this recommendation as it would reduce the "dog-leg" movements between Washington Avenue and Hannans Road, considering the short distance available for queueing and lane changing in Belmore Road between these intersections.

Overall, the modelling results indicate that the additional traffic associated with the Stage 1 development would not impose any adverse impact on the surrounding road network.

It is concluded that the low traffic generating nature of the proposed development would not require improvements to the assessed intersections.

Impact on Public Transport

There are three existing bus routes serving Belmore Road including 940 (Hurstville to Bankstown), 944 (Bankstown to Mortdale) and 945 (Hurstville to Bankstown) with a frequency between 15 and 30 minutes. The closest bus stops are located on Belmore Road (south of Washington Avenue) and Washington Avenue (east of Virginia Place) which are immediately adjacent to the subject site.

Riverwood Station is served by T8 Airport and South Line which provides frequent services between Sydney CBD, Macarthur and International and Domestic Airports. Frequency of the train services vary between 3 and 12 minutes during the peak periods, with up to seven trains per hour during the morning peak period. The northern end of the subject site is about a 650m radial distance (or 8-minute walk) from Riverwood Station.

The Stage 1 development is anticipated to generate in the order of 88 trips using public transport, involving 34 bus trips and 54 train trips in the peak hour, as shown in Table 2 and Table 3.

Given the low magnitude additional trips, it is expected there will be no adverse impacts on the existing public transport network.

Impact on Active Transport

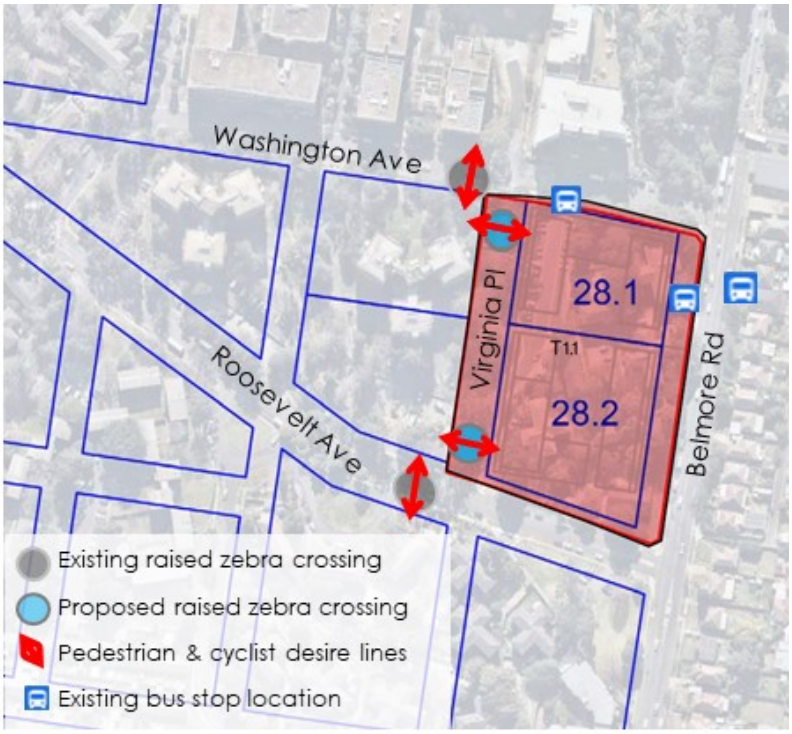
The design plan indicates a shared path would be provided on both sides of Virginia Place west of the Stage 1 development. Walking routes would be available on Virginia Place and the existing footpaths on Washington Avenue, Roosevelt Avenue and Belmore Road.

Given there are no existing bicycle facilities on Washington Avenue and Roosevelt Avenue to connect with the proposed cycling facility in Virginia Place, it is envisaged that a 3m footpath

could be provided on both sides of the road in the early stage which can subsequently be converted to a shared path when/if the Riverwood SPP is further developed in due course.

It is recommended to provide pedestrian crossing facilities to better connect the supermarket to the surrounding road network. This may involve two new raised pedestrian crossing in both ends of Virginia Place. These crossings are to be setback by minimum 5m (one car length) from the nearby intersection as shown in Figure 2 to minimise vehicle/pedestrian conflicts.

Figure 2: Pedestrian Crossing Facilities



Parking Requirements

Car Parking

Parking requirements for the Stage 1 development have been assessed based on the rates set out in Canterbury-Bankstown Development Control Plan (DCP) 2023, TfNSW Guide to Traffic Generating Developments (GTTGD) 2002, Apartment Design Guide (ADG) 2015, and State Environmental Planning Policy – Housing (SEPP) 2021.

The subject site is located entirely within an 800m catchment from Riverwood Station, therefore the ADG parking rates would be applicable to the private units.

The parking rates applied to the social and affordable units (including keyworker units) were based on the SEPP for affordable housing provided by LAHC.

The retail parking rate is based on the DCP for retail developments with a GFA between 120m^2 to 1,000m^2.

Table 6 shows the statutory requirements on car parking for the Stage 1 development.

Table 6: Car Parking Requirement

Land Use	Yield	Source	Parking Rate	Car Parking Requirement
Private				
Studio / 1-bedroom	52 units	ADG (lesser of GTTGD as a metropolitan sub-regional centres and DCP)	0.6 spaces per unit	31.1
2-bedroom	135 units		0.9 spaces per unit	121.5
3-bedroom	20 units		1.4 spaces per unit	28.4
Visitor	207 units		1 space per 5 units	41.4
Keyworkers, Social and Affordable Housing				
Studio	12 units	SEPP	0.4 spaces per unit	5.0
1-bedroom	70 units		0.4 spaces per unit	28.2
2-bedroom	110 units		0.5 spaces per unit	55.0
3-bedroom	14 units		1 space per unit	14.2
Retail				
Supermarket	1,000m^2 GFA	DCP	1 space per 30m^2 GFA	33.3
TOTAL				**358**

Table 6 shows that the indicative minimum parking requirement for the Stage 1 development is approximately 358 car parking spaces.

Accessible Parking Requirement

It is proposed to provide 25 adaptable units which is around 20% of the total social units. The adaptable units would mostly be 2-bedroom units.

Canterbury-Bankstown DCP does not have any specific parking requirements for adaptable units and visitors.

Australian Standard for Adaptable Housing (AS4299) requires at least one accessible car parking space to be provided for each adaptable apartment. Therefore, the 25 proposed adaptable units would require 25 accessible spaces to be provided in the basement car park.

For the supermarket, the following accessible parking rates are applicable for developments containing 10 or more spaces:

- staff: 1 accessible space per 50 parking spaces
- visitors: 1 space per 50 parking spaces (less than 500 car parking spaces)

Based on 33 retail parking spaces, the proposed supermarket would require a total of two accessible parking spaces, comprising one accessible space for staff use and one accessible spaces for visitor use.

Parking facilities for the disabled should be provided in accordance with AS2890.6:2023 Parking Facilities: Off-street Parking for People with Disabilities and relevant DCP design requirements.

Bicycle Parking

Bicycle parking requirement for the Stage 1 development has been assessed using the minimum parking rates set out in the Canterbury-Bankstown DCP. The required bicycle parking provision for residential visitors and retail use is summarised in Table 7, noting that there is no residential bicycle parking rate in the DCP.

Table 7: Bicycle Parking Requirement

Bicycle Parking Type	DCP Parking Rate	Bicycle Parking Requirement
Residential		
• Visitor	1 space per 10 dwellings	41
Retail		
• Staff	1 space per 300 m² GFA	3
• Visitor	1 space per 500m² GFA over 1,000m²	Nil

It is required to provide a minimum of 44 bicycle parking spaces to meet the DCP requirement.

Motorcycle Parking

Canterbury-Bankstown DCP does not require the provision of motorcycle parking spaces in residential developments nor retail area.

Site Access

A basement car park will be provided to accommodate parking for residential tenants and visitors, as well as retail staff and visitors.

Driveway access to basement car park and waste collection will be located on the western frontage to minimise conflicts between road users. As discussed earlier, it is recommended to provide the driveway access on the southern end of western frontage road to direct more traffic to use Roosevelt Avenue instead of Washington Avenue.

Driveway, parking bays, parking aisles and ramps will be designed in accordance with AS2890.1:2004 at a later stage.

Loading Bay

This mixed use development will provide loading/unloading or furniture pickup spaces. In accord with the Canterbury-Bankstown DCP (2023), at least one off-street parking space for delivery/service vehicles.

The DCP requires loading docks to be separated from parking circulation or exit lanes to ensure safe pedestrian movement and uninterrupted flow of other vehicles in the circulation roadways. Service vehicles are to enter and leave the site in a forward direction.

Loading and servicing facilities and driveways will be designed in accordance with AS2890.2:2018 at a later stage.

Sight Distance

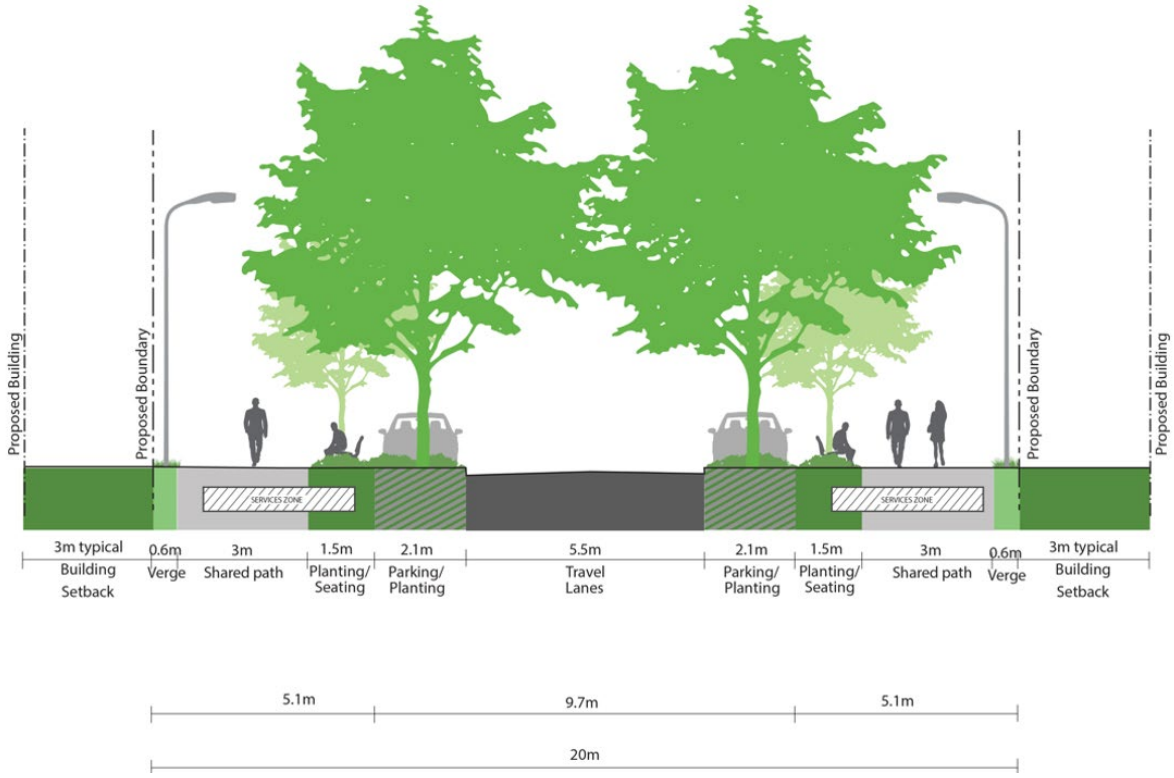
The minimum sight distance is required to be 55m at the site access, based on a desirable give second gap in accordance with AS2890.1:2004 and AS2890.2:2018. No permanent objects are to be located within the sight triangle. This would enable a vehicle to find a safe gap in oncoming traffic when leaving the driveway.

Frontage Roads

Virginia Place as the site's western frontage road will be realigned to provide a straight alignment and will provide vehicle connections between the apartment buildings and Washington Avenue and Roosevelt Avenue as shown in Figure 3.

Virginia Place would be upgraded to a 20m wide major road as part of the Stage 1 development. The road will be 5.5m wide to accommodate two travel lanes. Parking will be permitted on both sides of the road, with a 1.5m wide area for planting/ seating on the kerbside.

Figure 3: Virginia Place Cross Section



Key features include:

- 20m wide road reserve between property boundaries
- 5.5m wide roadway for two travel lanes
- 2.1m wide parking lane on both sides of the street
- 1.5m wide planting on both sides of the street
- 3.0m wide shared path on both sides of the street
- 0.6m wide verge on both sides of the street.

The design plan shows a 3m wide shared path will be provided on both sides of Virginia Place and connect with Washington Avenue and Roosevelt Avenue to enable a walking route to Belmore Road, bus stops and train station. The 3m width is complaint to Austroads as it falls in the upper end of the required width of 2m to 3m for local access shared paths.

Notwithstanding this, given there are no existing bicycle facilities on Washington Avenue and Roosevelt Avenue to connect with the proposed cycling facility in Virginia Place, it is envisaged that a 3m footpath would be provided on both sides of the road in the early stage which can subsequently be converted to a shared path when/if the Riverwood SPP is further developed in due course.

The layout of Belmore Road, Washington Avenue and Roosevelt Avenue will remain as per the existing conditions due to the low traffic generating nature of the Stage 1 development. However, a setback (9m) has been allowed in the Stage 1 development to allow for future road widening.

Summary and Conclusion

Key findings of this traffic impact assessment are shown as follows:

- The Stage 1 development consisting of approximately 420 apartment units. The reduced scheme is now the focus of the Riverwood SSP development.
- The development is to provide 325 parking spaces including 25 accessible parking spaces and 41 parking spaces in the basement car park.
- The residential development is estimated to generate a net increase of 84 vph in the AM peak hour and 91 vph in the PM peak hour. This presents a small increase of 5 to 6 vph from the lower traffic generation that was adopted in the Stage 1 traffic modelling (Attachment Three), but is not envisaged to make any material difference to the modelling results. On this basis, the traffic model was not re-run with the marginally higher traffic generation.
- The retail development is estimated to generate 69 vph in the AM peak hour and 99 vph in the PM peak hour. Of which, the new trips that would occur in Belmore Road would be in the order of 26 vph and 37 vph in the respective AM and PM peak hours. This low level of retail traffic volume was not deemed necessary to update the traffic modelling that was developed to assess the traffic impact associated with the residential component of the Stage 1 development on the surrounding road network.
- The development is not anticipated to impose any traffic and transport impacts on the adjacent networks. Traffic modelling results indicate that the Stage 1 development would not trigger any road network improvements.
- Virginia Place would be upgraded to provide a straight road alignment with a 20m road reserve to provide one travel lane and one parking lane in each direction. A 3m wide footpath would be provided on both sides of the road in the early stage which can subsequently be converted to a shared path when/if the Riverwood SPP is further developed in due course.
- The existing footpath will remain on Belmore Road. A setback (9m) has been allowed to allow for future road widening.

Overall, it is concluded that the Stage 1 development can be accommodated with the existing road network, public and active transport networks and do not require any infrastructure works (beyond those proposed to Virginia Place).

We trust the above is to your satisfaction. Should you have any queries regarding the above or require further information, please do not hesitate to contact the undersigned on 8437 7800.

Yours sincerely,

Ken Hollyoak
Director

Attachment One

Stage 1 Development Design

Stage 1 - Revised Boundary

Revised Site Boundary - Stage 01

Revised boundary

= 16,265m^2

Virginia Place road shift and alignment

= 2,816m^2

Block 28.1

= 4,669m^2

Block 28.2

= 6,882m^2

Belmore Road Reserve and set backs

= 1,898m^2

Legend

Stage 1

Lot outlines

Proposed lot boundaries from 2022 exhibition

Height change

FSR change

Project Name

Client Name

Stage 1 - Revised FSR Boundary

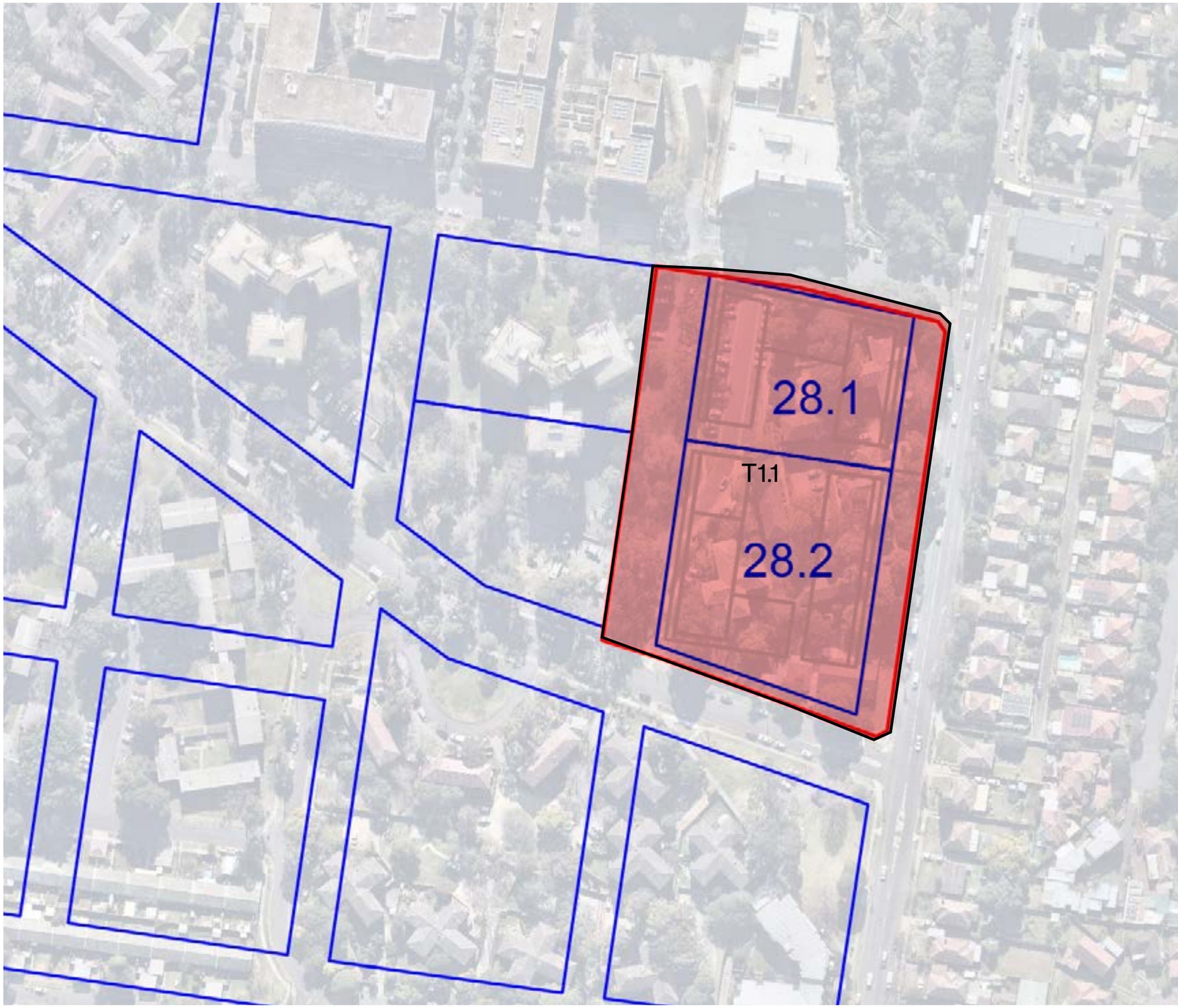
Revised Site Boundary and FSR - Stage 01

Revised boundary = 16,265m^2

= T1 . 1

16,265m^2

2.2 : 1



Legend

Stage 1

Proposed lot boundaries from 2022 exhibition

FSR change

Project Name

Client Name

Stage 1 - Revised HOB Boundary

Revised Site Boundary and HOB - Stage 01

Revised boundary = 16,265m^2

= T4

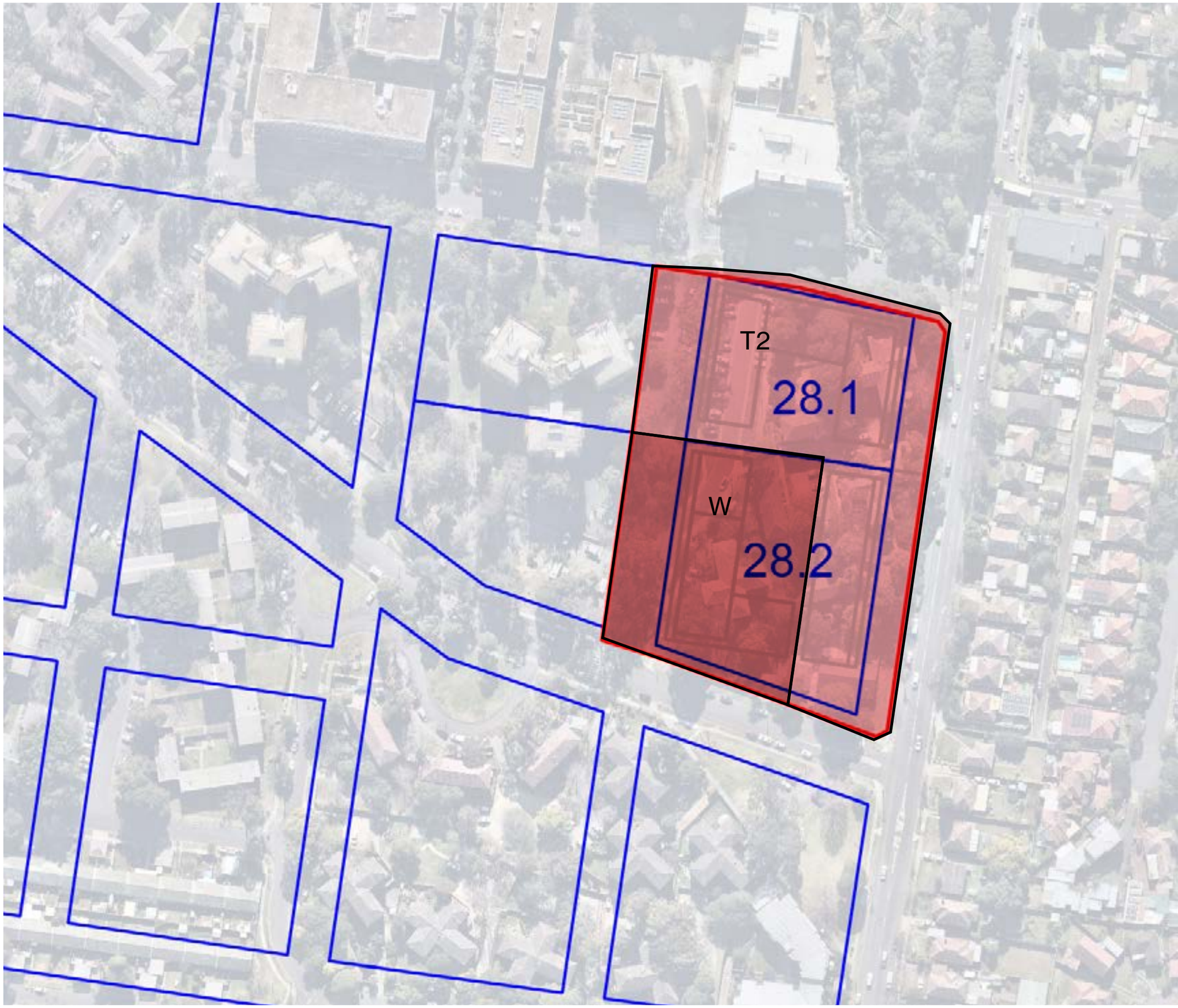
8 storeys

29m

= W

12 storeys

41m



Legend

Stage 1

Proposed lot boundaries from 2022 exhibition

Height change

Project Name

Client Name

Attachment Two

Update of the Traffic Generation Rates for the Existing Medium Density Housing

This is an update of the traffic generation of the existing medium density dwellings presented in Section 5.9.1 in Riverwood Estate State Significant Precinct Traffic and Transport Assessment (18055_r02v13_220616_Traffic Report).

The existing site traffic generation has been estimated based on traffic movements recorded at the Belmore Road intersections with Washington Avenue and Roosevelt Avenue, based on the surveys undertaken on Thursday 9 February 2017 on Saturday 11 February 2017 presented in Figure 5.5.

Table 5.11: Existing Site Traffic Generation

Peak Hour	Traffic Volumes (vehicle/hour)			Distribution (%)		Trip Rate (veh/unit)
	In	Out	Two-Way	In	Out	
Weekday AM peak	114	205	319	36%	64%	0.12
Weekday PM peak	218	165	383	57%	43%	0.14
Saturday peak	154	191	345	45%	55%	0.13

The AM and PM traffic generation rates derived in Table 5.11 were adopted in the traffic generation for the existing 59 medium density units that will be demolished as part of the Stage 1 development as follows:

- Morning peak: 0.12 vehicle trips per unit, which has replaced the old rate of 0.20
- Evening peak: 0.14 vehicle trips per unit, which has replaced the old rate of 0.23.

The following discussion is to update the remaining of Section 5.9.1 of the exhibited traffic and transport assessment, but not necessarily applied in the assessment of the Stage 1 development.

To determine the net impact of the proposed development, the existing traffic volumes generated by the dwellings to be demolished are to be deducted sequentially as the development progresses throughout the stages. The trip rates shown in Table 5.11 have been applied to the number of dwellings that will be demolished in the Riverwood SSP.

A summary of the traffic volumes to be deducted is presented in Table 5.12. Demolition of 1,081 dwellings would ultimately deduct 128 trips in the AM peak, 153 trips in the PM peak and 138 trips in the Saturday peak.

Table 5.12: Traffic Generation Deduction during Peak Hours

Ultimate Number of Dwellings to be Demolished	Traffic Volumes to be Deducted (vehicle/hour)		
	AM	PM	Saturday
1,081	128	153	138

The traffic volumes shown in Table 5.12 have been deducted based on the existing directional distribution.

A sanity check was undertaken to compare the traffic deduction with the remaining traffic generation that must be retained in relation to Washington Park and Riverwood Public School.

Table 5.13: Traffic Generation Deduction during Peak Hours

Peak Hour	Surveyed Traffic Volume at These Two Intersections (vph)	Traffic Generation of 1,081 Medium Density Housing (vph)	Traffic to be Removed from Intersections (vph)	Remaining Traffic (vph)	Traffic Generation of Washington Park and Riverwood Public School (vph)
AM	319	128	40%	191	Washington Park: 126 vph (refer to Table 5.14) School: 70 vehicle trips (based on a rate of 0.67 trips/student and enrolment of 110 students in 2017) Total: 200 vph
PM	383	153	40%	230	Washington Park: 155 vph (refer to Table 5.14) School: 55 vehicle trips (based on a rate of 0.53 trips/student and enrolment of 110 students in 2017) Total: 213 vph

The remaining traffic volumes at the Belmore Road intersections with Washington Avenue and Roosevelt Avenue would be sufficient to cover the traffic generation associated with Washington Park and Riverwood Public School as shown in Table 5.13:

- AM peak hour: the remaining 191 vehicle trips are very similar to the traffic generation of 200 vehicle trips which to be retained, including Washington Park 126 vehicle trips and school 70 vehicle trips. The minor difference of nine vehicles is negligible, noting Section 6.9.3.5 shows that the revised design yield of the master plan reduces the original traffic generation thus creating a contingency of 53 vph in the AM peak hour which can offset this minor difference.
- PM peak hour: the remaining 230 vehicle trips which could cover traffic generation of 213 vehicle trips to be retained including Washington Park 155 vehicle trips and school 55 vehicle trips.
- Saturday peak hour: survey was not undertaken on Saturday at Washington Park for this traffic assessment.

This is considered conservative because the existing traffic volume at the Belmore Road and Truman Avenue intersection was not reduced in the traffic assessment but in reality Truman Avenue is a travel route to Riverwood Public School. Subsequent calculation in the traffic and transport assessment would not be affected by this amendment.

Attachment Three

Traffic Modelling (Jacobs)

Transport and Traffic Assessment

Date:	26 April 2023
Project name:	Riverwood Renewal (Exemplar Stage 1)
Project no:	IA195800
Attention:	Gerald Walker (LAHC)
Company:	Jacobs
Prepared by:	Mathew Brooks/Miliss Mansour
Copies to:	Doris Lee (TTPP)

Jacobs Group (Australia) Pty Limited
Level 7, 177 Pacific Highway
North Sydney, NSW 2060
PO Box 632
North Sydney, NSW 2059
Australia
T +61 2 9928 2100
F +61 2 9928 2444
www.jacobs.com

Background

Jacobs has been requested by the Land and Housing Commission (LAHC) to assess the network impacts of providing 414 units as part of stage 1 of the Riverwood estate renewal project. Stage 1 is considered as an exemplar phase to enable an early phase of development to occur. This is due to recent increases in construction build prices that are affecting the viability of many projects in NSW.

The following details the results of the assessment of the road network performance due to the proposed stage 1 development of Riverwood Estate.

Proposal

The proposal is for the demolition of 59 existing units, adjacent to Belmore Road / Washington Avenue to be replaced with 414 units (288 private residential and 126 social housing), as shown in Figure 1.

Existing Yield	Proposed Yield	Uplift
59	414	355

Figure 1. Proposed Development

Trip Generation

Table 1 provides the trip generation rates adopted for this study. Using the traffic generation rates an additional 79 vehicle movements an hour in the AM peak and 85 in the PM peak would be generated.

Table 1. Traffic Generation Calculation

Land Use Type	Yield	Trip Rate		Traffic Generation	
		AM	PM	AM	PM
Residential - Private	288	0.26	0.29	75	84
Social Housing	126	0.13	0.12	16	15
Existing Social Housing to be demolished	-59	0.2	0.23	-12	14
Total				79	85

Trip Distribution

Assuming a distribution of 20% in and 80% out in the AM peak and 80% in and 20% in the PM peak, the distribution of traffic is estimated as shown in Table 2.

Table 2. Traffic Distribution

AM Peak		PM Peak	
IN	OUT	IN	OUT
16	63	68	17

Trip Assignment

The demand detailed in Table 2 has been applied to the Riverwood Aimsun Traffic model, layered over the 2031 do minimal scenario, and distributed across the 4-hour demand proportionally to the peak hour.

A do minimum scenario considers no road network improvements are included with the modelled road network, adopting the same network configuration that currently exists.

The intersection results from the assignment of these trips to the road network using the traffic model are shown in Table 3. Table 4 provides a description of Level of Service (LOS) and performance criteria for signalised and unsignalised intersections.

It should be noted that these results represent the worst hour of performance for each intersection, and as such represent slightly different results than the modelling report for the full development, which detailed the LOS for a common peak hour 8-9AM and 5-6PM across all intersections for the purpose of that assessment.

Table 3. Simulated LOS Levels – 2031 background growth

	AM Peak				PM Peak			
	Base Case		Project Case		Base Case		Project Case	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Belmore Road/Hannans Road	29	C	29	C	23	B	22	B
Belmore Road/M5 motorway ramps	23	B	23	B	27	B	31	C
Belmore Road/ Washington Avenue	58	E	69	E	16	B	25	B

	AM Peak				PM Peak			
	Base Case		Project Case		Base Case		Project Case	
	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Belmore Road/Roosevelt Avenue	25	B	23	B	12	A	17	B
Belmore Road/Thurlow Street	52	D	48	D	30	C	28	B
Bonds Road/Broad Arrow Road	35	C	31	C	12	A	13	A
Bonds Road/Hannans Road	38	C	38	C	36	C	40	C
Bonds Road/Romilly Street	18	B	17	B	13	A	25	B
Forest Road/Boundary Road/Bonds Road	>70	F	>70	F	>70	F	>70	F
Henry Lawson Drive/Belmore Road	26	B	29	C	42	C	53	D

Table 4. Level of Service (LoS) criteria for intersections

LoS	Average delay per vehicle (seconds/vehicle)	Traffic signals and roundabouts
A	Less than 15	Good operation
B	15 to 28	Good with acceptable delays and spare capacity
C	29 to 42	Satisfactory
D	43 to 56	Operating near capacity
E	57 to 70	At capacity at signals, incidents will cause delays Roundabouts require other control mode
	Over 70	Extra capacity required

Source: Roads and Traffic Authority (2002) Guide to Traffic Generating Developments

From Table 3 the intersections of Belmore Road/Hannans Road intersection, Belmore Road/M5 intersections and Belmore Road/Roosevelt Avenue perform adequately with the increased demand from the development. In the PM peak delay at Belmore Road/Roosevelt Avenue delay increases from 12 to 17 seconds and a change in LoS with the project included. The increase is due to the intersection being unsignalised with the highest delay experienced by the right turning traffic from Roosevelt Avenue to Belmore Road who need to give way to two-way traffic.

The intersection of Belmore Road/Thurlow Street and Belmore Road/ Washington Avenue currently perform at LOS D and E respectively in the AM peak and remain at this level with proposed development traffic. For the intersection of Belmore Road/ Washington Avenue, the level of delay increases by 11 seconds in the project case. The delay is primarily experienced by the left turning traffic in Washington Ave attempting to enter Belmore Road which is blocked by northbound queues from the Hannans Road signalised intersection. This is due to the close distance between the two intersections with little queuing space available in Belmore Road before reaching Washington Ave as shown in Figure 2.

Considering that Stage 1 of LAHC development is to be located within the block flanked by Washington Ave/ Roosevelt Avenue/Belmore Road, it is likely that some of the development traffic would utilise Roosevelt Avenue instead to avoid the long delay in merging with Belmore Road from Washington Avenue as the model is assuming.

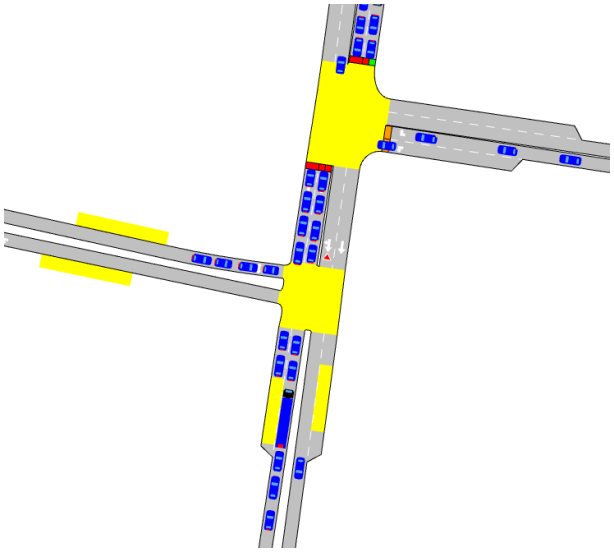


Figure 2. Queues at Washington Ave/Belmore Rd/Hannans Road Intersections

The intersection of Forest Road/Boundary Road/Bonds Road operates at LOS F in all scenarios and is a point of volatility in the model. As the model is dynamic in nature each model run introduces minor differences in the number of vehicles and the time those vehicles enter the model. This can result in the number of vehicles able to traverse the Forest Road/Boundary Road/Bonds Road intersection varying between scenarios thus impacting downstream intersection performance such as at Broad Arrow Road and Thurlow Street.

The results also show only one intersection has its performance worsen to LOD D during the project case (apart from Forest Road/Boundary Road/Bonds Road intersection, Belmore Road/Thurlow Street intersection, and Belmore Road/ Washington Avenue intersection, which are already at that level or worse), that being the Henry Lawson Drive/Belmore Road intersection in the PM peak. This is not associated with the development as in the PM peak very few vehicles associated with this development traverse this intersection as shown in Figure 5 and Figure 6. This change in delay is considered due to the volatility in the model in particular due to the operation of the Forest Road/Boundary Road/Bonds Road intersection.

The primary routes between the development area are shown in Figure 3 to Figure 6. They represent total vehicle trips across the AM and PM periods (4 hours) respectively. The figures show total trips greater than 100 vehicles (25 veh/hr), as any value less than this is not considered large enough to have a discernible impact on the network. The figures show that the development traffic travels to/from the M5 in the north.

Conclusion

On the basis of this assessment, the volume of trips generated by the proposed stage 1 (exemplar) involving 355 additional units is generally considered low (i.e. 79 and 85 vph two-way in the AM and PM peak hours respectively). This is due to the low traffic generation characteristics of residential and social units.

When the additional traffic is distributed to the surrounding roads, the network impacts are generally most evident closer to the development where flows from the development are highest. The nearest intersections to the stage 1 development are the intersections of Belmore Road/Hannans Road, Belmore Road/ Washington Avenue and Belmore Road/Roosevelt Avenue.

The intersection of Washington Ave/Belmore Road shows an increase in average delay in both AM and PM peaks increasing from 58 to 69 seconds and 16 to 25 seconds respectively. This is partly due to model over-assigning trips from the developments on the western side of the estate to Washington Avenue caused by the shorter travel distance to Hannans Road and M5, where majority of traffic in the morning heads to. The delays and level of service in the AM peak is already at capacity and with the additional traffic it increases further due to the left turn traffic from Washington Avenue unable to enter Belmore Road as a result of queues that extend back from Hannans Road.

To facilitate the entry of vehicles from stage 1 development, it is recommended to locate the entry and exit points closer to Roosevelt Avenue where some of this traffic would utilise Roosevelt Avenue when egressing

to Belmore Road and Hannans Road thus reducing the use of Washington Ave as the model is predicting.

Other intersections assessed are too far from the development to be directly affected considering the low volume of trips generation from stage 1 of the development. The variation in performances of these intersections including some reductions in delays with the Project case are due to modelling related variabilities explained earlier and unrelated to additional traffic and impacts from stage 1.

In view of the low trip generation and network impacts of stage 1, no associated network improvements are deemed necessary as part of its development.

Figure 3. AM Peak – Total Traffic To Development (6AM-10AM)

Figure 4. AM Peak – Total Traffic from Development (6AM-10AM)

Figure 5. PM Peak – Total Traffic to Development (3PM-7PM)

Figure 6. PM Peak – Total Traffic from Development (3PM-7PM)