WESTERN SYDNEY PARKLANDS
PROPOSED FIFTEENTH AVENUE
BUSINESS HUB
Assessment of Potential Access, Traffic and Transport Implications

July 2015
(Rev E)

Reference 14160

TRANSPORT AND TRAFFIC PLANNING ASSOCIATES
Transportation, Traffic and Design Consultants
Suite 502, Level 5
282 Victoria Avenue
CHATSWOOD 2067
Telephone (02) 9411 5660
Facsimile (02) 9904 6622
Email: ross@ttpa.com.au

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EXECUTIVE SUMMARY

A Stage 1 Development Application is to be submitted to the Department of Planning and Environment for the "Fifteenth Avenue Business Hub" (FABH).

In February 2015 the Department provided Amended Secretary's Environmental Assessment Requirements for the Fifteenth Avenue Business Hub (SSD 6407). Those requirements included the following:

6. Transport and Accessibility

- *Provide a detailed traffic and transport assessment including an analysis of existing traffic conditions and estimated traffic generated by the proposed development;*
- *Assess the cumulative traffic impacts on the safety and efficiency of the local road network (consider existing and proposed development in Austral, West Hoxton and Middle Grange) and intersection capacity, with a detailed intersection performance analysis of the Fifteenth Avenue and Twenty Seventh Avenue intersection;*
- *Identify the potential need and outline any funding agreement for intersection/road improvement works to accommodate the traffic impact of the proposed development in consultation with Liverpool City Council and Roads and Maritime Services;*
- *Provide an analysis of likely pedestrian movements to and within the development including access to public transport services and measures to ensure pedestrian safety;*
- *Provide a travel plan outlining measures to promote sustainable means of transport including the provision of facilities to increase the non-car mode share for travel to and from the site;*
- *Provide details of the proposed access and parking provisions and the requirements of the relevant parking codes and Australian Standards and details of the proposed service vehicle movements (including vehicle type and the likely arrival and departure times).*

Relevant Policies and Guidelines:

- *Guide to Traffic Generating Developments (RMS);*
- *EIS Guidelines – Road and Related Facilities (DoPI); and*
- *NSW Planning Guidelines for Walking and Cycling*

The Western Sydney Parklands development site area which is subject to the SSDA is some 4.3ha (including the area which is reserved for future road widening). The overall Business Hub area (including the area to the north which is not subject to the application) is some 9.3ha. The parklands extending further to the north have the potential for intensified recreational uses.

Assessment in relation to the provision of an access road and lot layout has indicated that there will be some 33,510m^2 of developable land in the FABH. The identified land use outcome comprises:

- *Service Station*
- *Retail pad site*
- *Supermarket*
- *Large Format Retail*
- *Retail / Commercial*
- *Child Care*

This assessment has concluded that:

- *a proposed access roundabout on Fifteenth Avenue will satisfactorily accommodate the traffic demand outcome for the proposed development, at the projected design horizon of 2026 and Council have concurred to this arrangement*
- *there will not be any adverse traffic implications for the road network in the area.*
- *there will be suitable and appropriate provision for cyclists, pedestrians and public transport services relative to workers and visitors to the site*

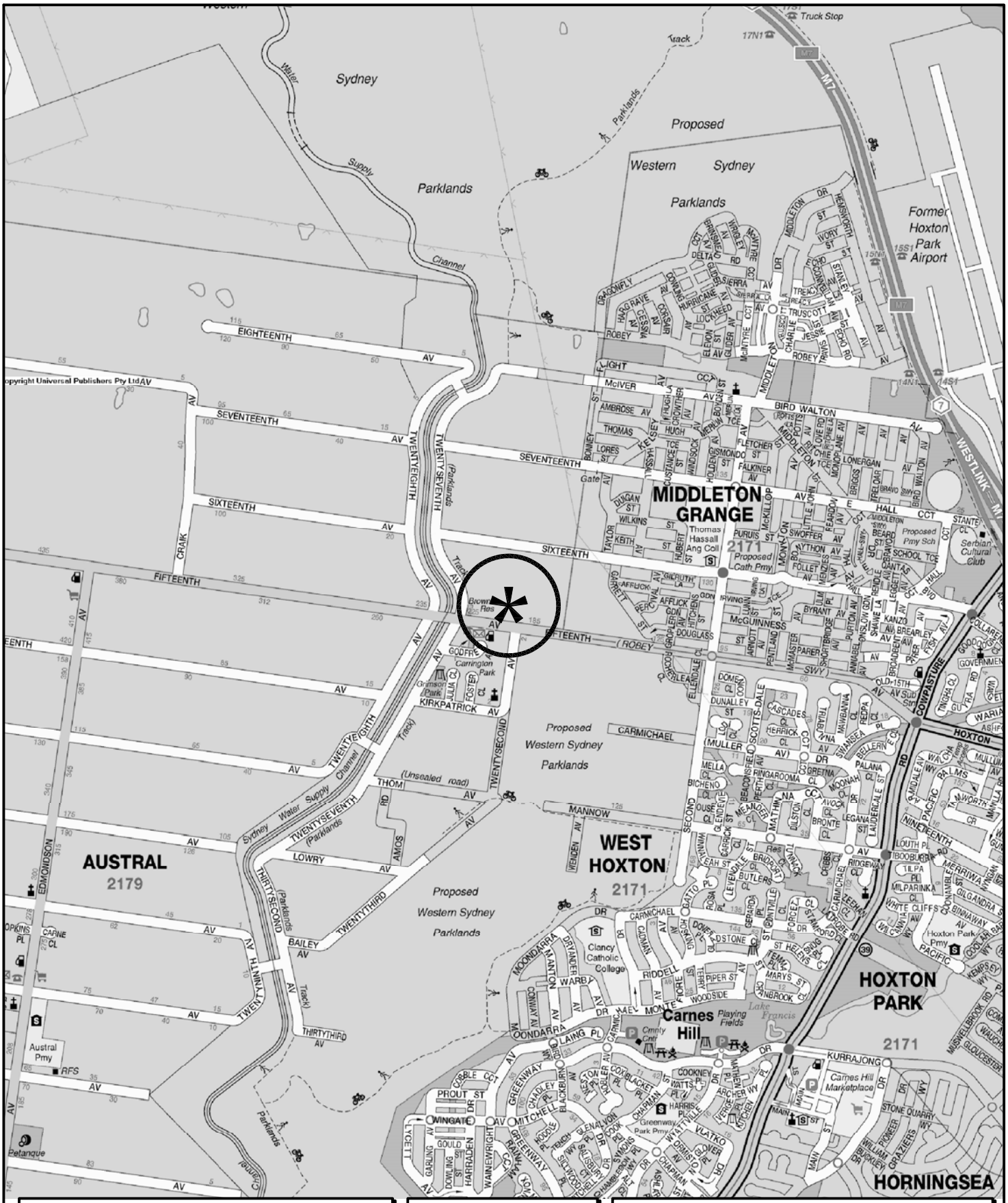
1. INTRODUCTION

This report has been prepared to accompany a State Significant Development Application to the Department of Planning for Concept Approval for development of the landholding known as the Fifteenth Avenue Business Hub (FABH) at West Hoxton (Figure 1). The site, which is owned by Western Sydney Parklands, is located to the west of Cowpasture Road and incorporates part of the envisaged road reservation required for future upgrading of Fifteenth Avenue.

It is envisaged that the Fifteenth Avenue route will become an RM State Road in the future however there are no detail plans or program for this eventuality although RMS has nominated the desirable future road reservation (40m). The proposed FABH comprises a total developable area of some 33,510m^2 and the proposed development comprises:

Service Station
Retail Padsite
Supermarket
Large Format Retail
Retail / Commercial
Child Care Centre

The potential to widen Fifteenth Avenue in conjunction with the development and provide a traffic signal controlled access intersection has been assessed however this was found to not be feasible and the development outcome adopts a roundabout control at the intersection of Fifteenth Avenue, Twentysecond Avenue and the FABH access road.



LEGEND

N

LOCATION

FIG 1

2. PROPOSED DEVELOPMENT SCHEME

2.1 SITE AND CONTEXT

The site (Figure 2) is a consolidation of 3 lots occupying a generally rectangular shaped total area of some 4.3ha which will be reduced by some 5,200m^2 by excision for the future Fifteenth Avenue road widening.

The site is located just to the east of the Sydney Water supply channel and is part of the extensive Western Sydney Parklands corridor which runs to the west of the M7 Motorway and Cowpasture Road.

The site contains a number of old industrial sheds and a former bus depot which have vehicle accesses on Fifteenth Avenue. The surrounding uses comprise:

- the rural and rural residential lands to the east and west
- the West Hoxton residential "pocket" on the southern side of Fifteenth Avenue which includes some production and commercial elements
- the new Middleton Grange and West Hoxton residential precincts extending east

2.2 PROPOSED DEVELOPMENT

The existing buildings will be demolished and the site cleared with some earthworks to provide for level building platforms, hardstand areas and the new access road. It is proposed to create 7 lots with a single access road connecting to Fifteenth Avenue.

The proposed road works along Fifteenth Avenue will comprise:

- some widening along the northern side
- a roundabout at the Twentysecond Avenue / Access Road intersection
- left turn deceleration lanes for the service station and fast food accesses and the roundabout intersection

LEGEND

SITE

FIG 2

Details of the proposed Fifteenth Avenue road arrangement for the development are provided on the diagram overleaf prepared by Costin Roe.

The proposed development outcome is as follows:

	DEVELOPMENT	**SITE AREA**	**GFA**
Lot 1	Fast Food	4,100 m^2	400 m^2
Lot 2	Large Format Retail	5,500 m^2	1,500 m^2
Lot 3	Service Station	3,100 m^2	250 m^2
Lot 4	Supermarket and Retail Commercial	12,930 m^2	2,700 m^2
Lot 5	Child Care Centre	1,900 m^2	500 m^2
Lot 6	Large Format Retail	5,980 m^2	7,000 m^2 (approx.)
Lot 7	Detention	1,200 m^2	-

Details of the proposed development are shown on the plans prepared by LFA which are reproduced overleaf. The residue land (50,000m^2) to the north has the potential to provide an additional 7,000m^2 of bulky goods/large format hardware floorspace.

ROUNDABOUT FUNCTIONAL LAYOUT PLAN
SCALE 1:250

FOR APPROVAL

AMENDMENTS	DATE	ISSUE
ISSUED FOR APPROVAL	19.06.15	F
ISSUED FOR APPROVAL	13.05.15	E
ISSUED FOR INFORMATION	11.05.15	D
ISSUED FOR INFORMATION	04.05.15	C
ISSUED FOR INFORMATION	30.04.15	B
ISSUED FOR INFORMATION	23.04.15	A

ARCHITECT: LFA (PACIFIC) PTY LIMITED

CLIENT: Western Sydney Parklands Trust
WESTERN SYDNEY PARKLANDS TRUST
LEVEL 4, 10 VALENTINE AVE
PARRAMATTA NSW 2150

PROJECT: PROPOSED DEVELOPMENT
FIFTEENTH AVENUE
WEST HOXTON NSW

SIZE: B1 | SCALE: AS SHOWN | CAD REF: Co11995.00-SK03

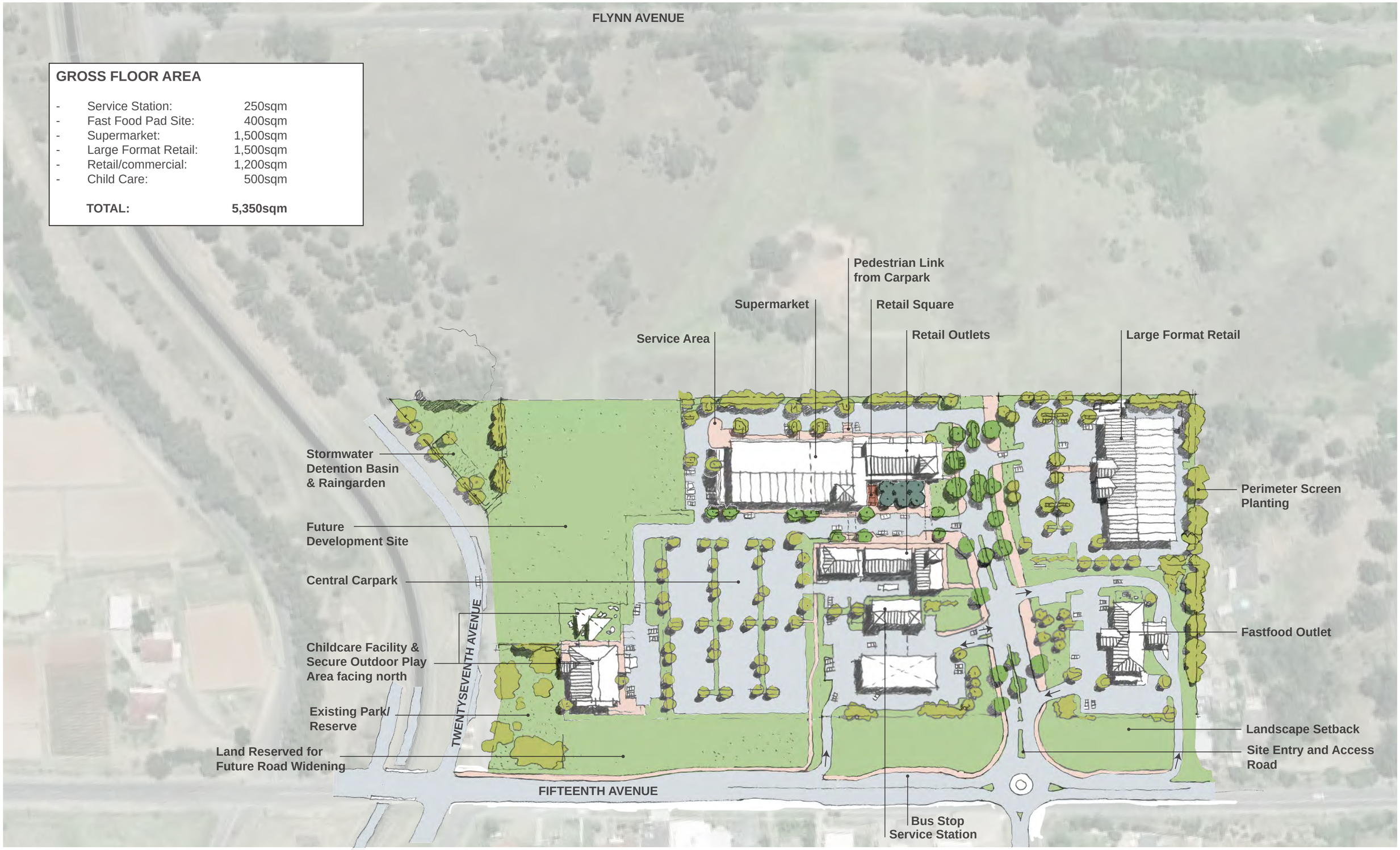
Costin Roe Consulting Pty Ltd.
Consulting Engineers
Level 1, 8 Windmill Street
Walsh Bay, Sydney NSW 2000
Tel: (02) 9251-7699 Fax: (02) 9241-3731
email: mail@costinroe.com.au ©

Costin Roe
Value in Engineering and Management

DRAWING TITLE: ROAD WORKS FUNCTIONAL LAYOUT PLAN
DRAWING No: CO11995.00- SK03
ISSUE: F

GROSS FLOOR AREA

-	Service Station:	250sqm
-	Fast Food Pad Site:	400sqm
-	Supermarket:	1,500sqm
-	Large Format Retail:	1,500sqm
-	Retail/commercial:	1,200sqm
-	Child Care:	500sqm
	TOTAL:	**5,350sqm**



LFA (PACIFIC) PTY LIMITED

MASTERPLANNING
URBAN DESIGN
ARCHITECTURE
LANDSCAPE ARCHITECTURE
INTERIORS

SUITE 4, EDGECLIFF COURT, 2 NEW McLEAN ST, EDGECLIFF NSW 2027
M PO BOX 259, EDGECLIFF NSW 2027 T 02 9327 6822 F 02 9327 5554
E lfa@lfa.com.au W www.lfa.com.au ABN 92 830 134 905 QM ISO 9001-2008

NOMINATED ARCHITECTS ALF LESTER NO.2128 STEPHEN ANDERS NO.5764

Illustrative Site Plan

2014-4330 -u/c
14 May 2015

0 10 20 50 100m

Fifteenth Avenue Commercial Precinct

FLYNN AVENUE

Pedestrian Link from Carpark

Supermarket

Retail Square

Service Area

Retail Outlets

Large Format Retail

LOT 7
1200m2

Stormwater Detention Basin & Raingarden

LOT 6
5980m2

Future Development Site

LOT 4
12930m2

Central Carpark

Road

LOT 2
5500m2

Perimeter Screen Planting

Fastfood Outlet

Childcare Facility & Secure Outdoor Play Area facing north

LOT 5
1900m2

LOT 3
3100m2

LOT 1
4100m2

TWENTYSEVENTH AVENUE

Existing Park/ Reserve

Future Road Reservation

Landscape Setback

Site Entry and Access Road

Land Reserved for Future Road Widening

FIFTEENTH AVENUE

Bus Stop

Service Station

LFA (PACIFIC) PTY LIMITED

MASTERPLANNING
URBAN DESIGN
ARCHITECTURE
LANDSCAPE ARCHITECTURE
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NOMINATED ARCHITECTS ALF LESTER NO.2128 STEPHEN ANDERS NO.5764

Illustrative Lot Pattern

2014-4330 -u/c
14 May 2015

0 10 20 50 100m

Fifteenth Avenue Commercial Precinct

3. EXISTING ROAD NETWORK AND TRAFFIC CONDITIONS

3.1 ROAD NETWORK

The existing road network serving the site (Figure 3) comprises:

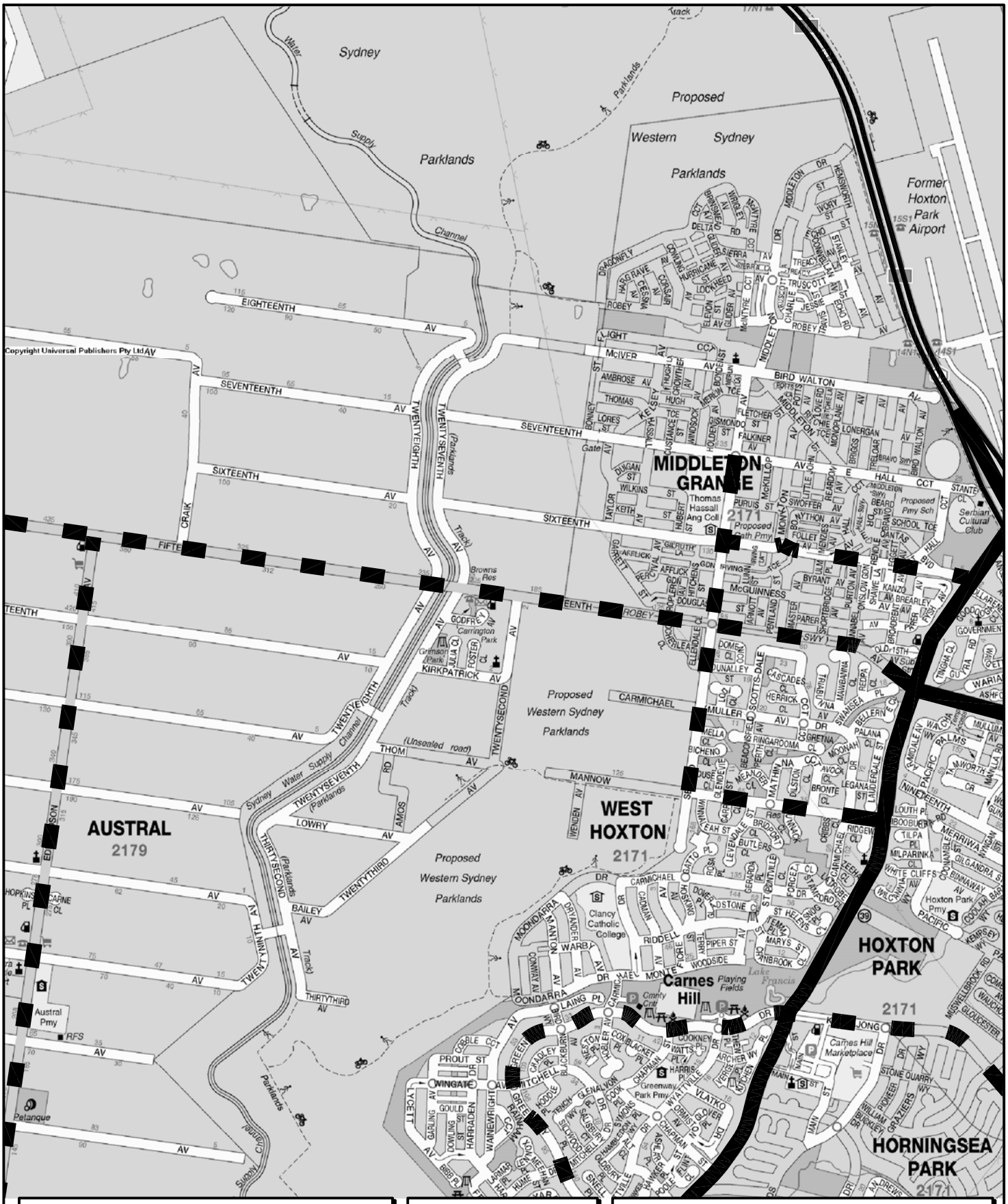
- *Westlink M7 Motorway* – a State Road and privately operated Motorway
- *Hoxton Park Road* – a State Road and arterial route which connects between Liverpool and West Hoxton
- *Cowpasture Road* – a State Road and arterial route which connects between the Horsley Drive at Bossley Park and Camden Valley Way at Horningsea Park
- *Fifteenth Avenue* – a collector route which connects between Cowpasture Road and The Northern Road at Bringelly
- *Second Avenue, Flynn Avenue and Mannow Avenue* – collector roads which serve Cowpasture Road at West Hoxton and Middleton Grange
- *Twenty second Avenue, Twenty seventh Avenue and Twenty eight Avenue* – local access roads, connecting to Fifteenth Avenue.

Fifteenth Avenue is currently a two lane 2 way sealed road generally with gravel shoulders and sections of kerb/gutter in the vicinity of the site particularly along the southern side where there is a section of indented parking.

3.2 TRAFFIC CONTROLS

The limited existing traffic controls on the road network (Figure 4) comprise:

- the 60kmph speed restriction on Fifteenth Avenue at the site frontage and 80kmph to the west



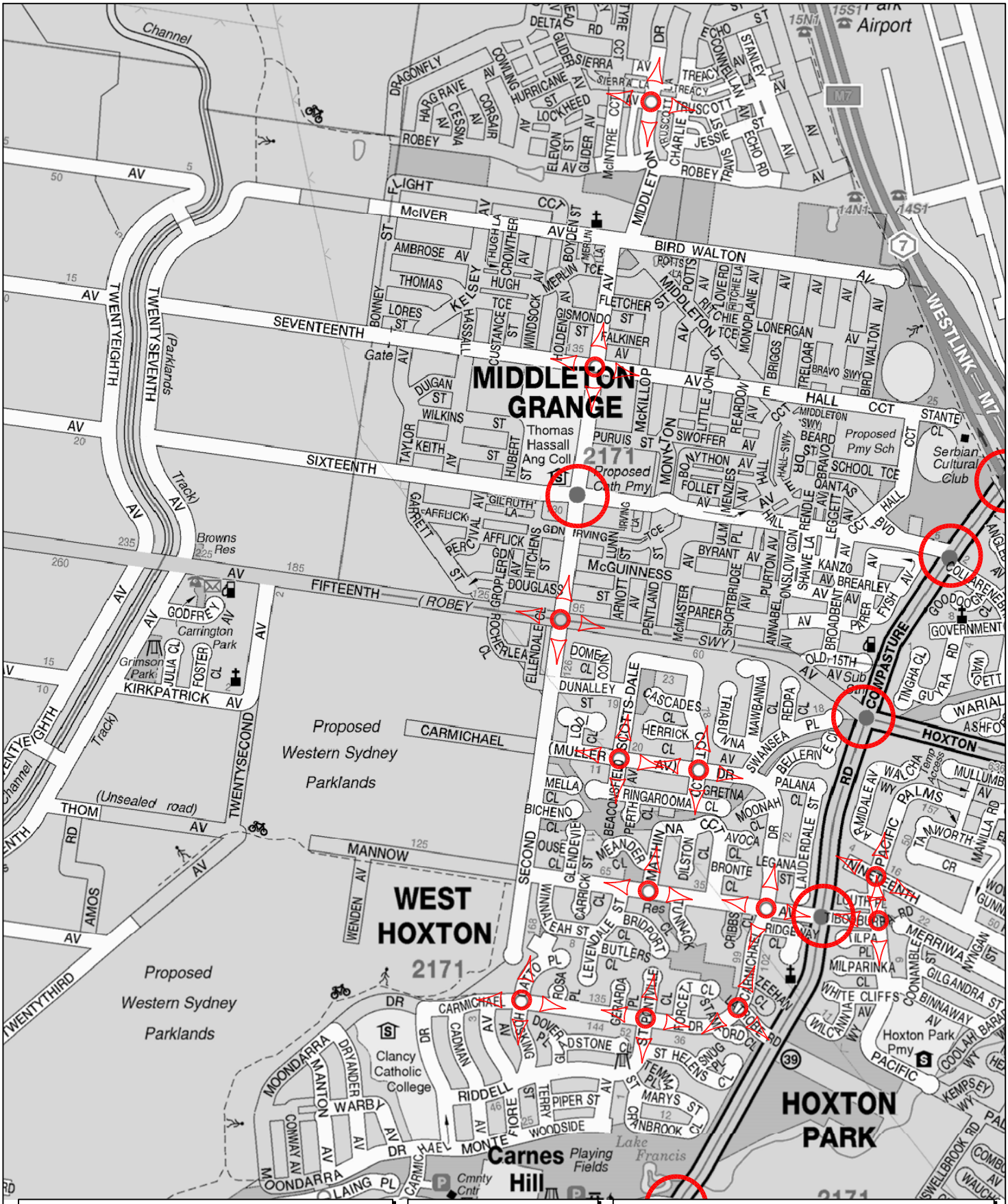
LEGEND

- ARTERIAL
- SUB-ARTERIAL
- COLLECTOR

N

ROAD NETWORK

FIG 3



LEGEND

- TRAFFIC SIGNAL CONTROL
- ROUNDABOUT
- RESTRICTED TURNING MOVEMENT

TRAFFIC CONTROLS

FIG 4

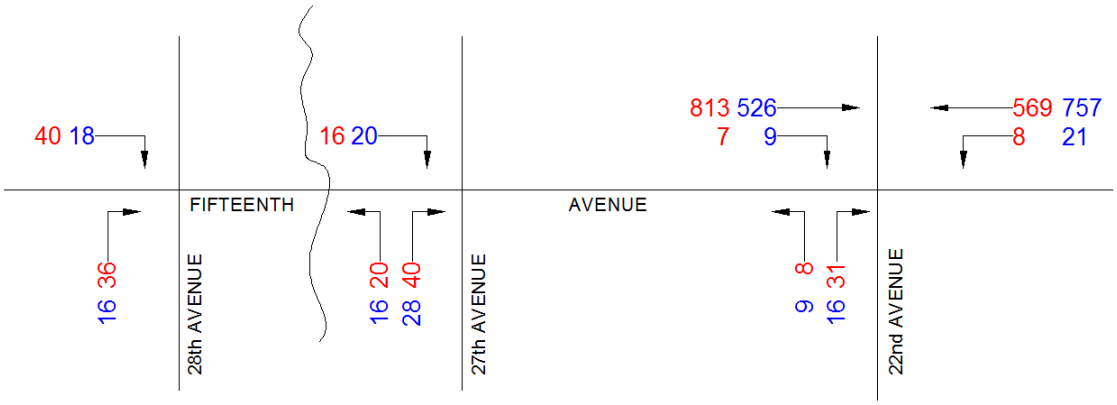
- the traffic signals on Cowpasture Road at the Fifteenth Avenue / Hoxton Park Road, Flynn Avenue, Mannow Avenue and M7 ramp intersections
- the pedestrian refuge island in Fifteenth Avenue in the western part of the site frontage
- the roundabout at the Fifteenth Avenue and Second Avenue intersection

3.3 TRAFFIC CONDITIONS

The existing 2 way traffic volumes along Fifteenth Avenue at the site frontage are as follows:

AADT	AM Peak	PM Peak
14,000	1,300	1,4500

The approximate existing intersection movement volumes are shown in the following:



- am
- pm

The operational performance of intersections in the vicinity of the site during the morning and afternoon peak periods is relative satisfactory at the present time although there is some queuing at intersections to the east. There are also significant sight distance limitations at the Twenty Second Avenue and Twenty Seventh Avenue intersections due to the crests on Fifteenth Avenue.

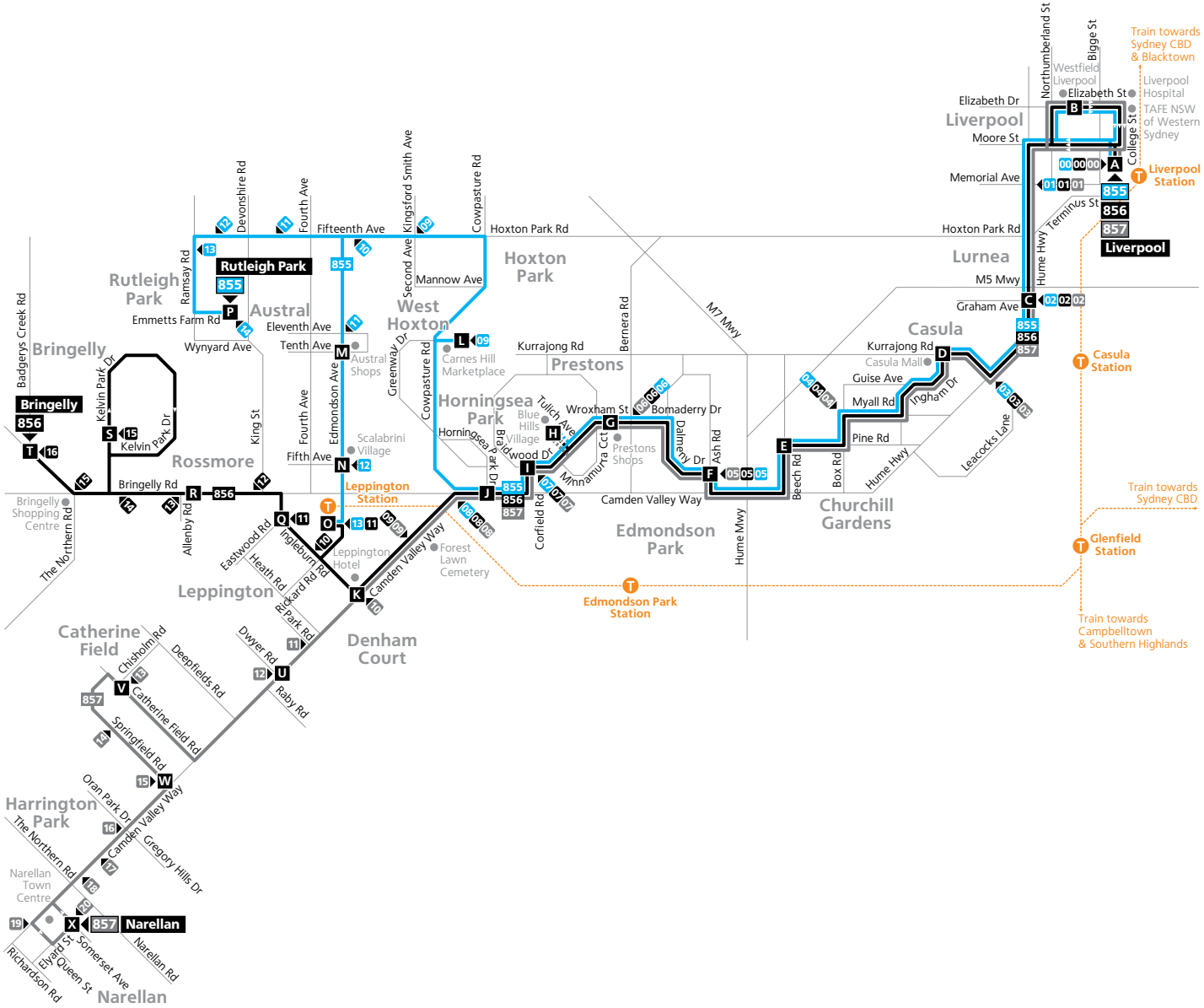
3.4 TRANSPORT SERVICES

There is currently only limited public transport provision in the vicinity of Fifteenth Avenue and there is no rail link to the suburbs immediately north or south. The nearest existing train stations are at Leppington, Glenfield and Liverpool, which are serviced by the Southwest and East Hills and the Cumberland Lines.

There is an Interline Bus Services route currently operating along section of Fifteenth Avenue. This Route 855 operates between Austral, Leppington and Liverpool, via Fifteenth Avenue, Cowpasture Road and the Hume Highway with weekday services operating hourly between 06:00-10:00 (see details overleaf).

Bus route map

855, 856, 857



Diagrammatic Map
Not to Scale
North

Legend

- Bus route
- 855 Bus route number
- A Timing point
- 00 Section point
- Train line/station

Transport

4. FUTURE ROAD NETWORK AND TRAFFIC CIRCUMSTANCES

ROAD NETWORK

Fifteenth Avenue is currently under the care and control of Liverpool City Council however it is recognised that this route will provide a principal future east-west access corridor for the developing area extending between Elizabeth Drive to the north and Bringelly Road to the south.

It is assumed that Fifteenth Avenue, as an extension of the Hoxton Park State Road, will be taken over by RMS as a State Road at some future time. However RMS has no plans or program for upgrading the road, although they have advised that it is envisaged that a 40m wide road reserve will be required.

The future upgrading will necessitate replacing the bridge crossing of the Sydney Water Supply Canal and this will quite likely require severing the existing adjacent road connections of Twenty Seventh and Twenty Eight Avenue. Due to the potential severing of the Twenty Seventh Avenue connection and the access needs for the lands south of Fifteenth Avenue it is apparent that traffic signal control will inevitably be required at the Fifteenth Avenue and Twenty Second Avenue intersection at some future time.

TRANSPORT SERVICES

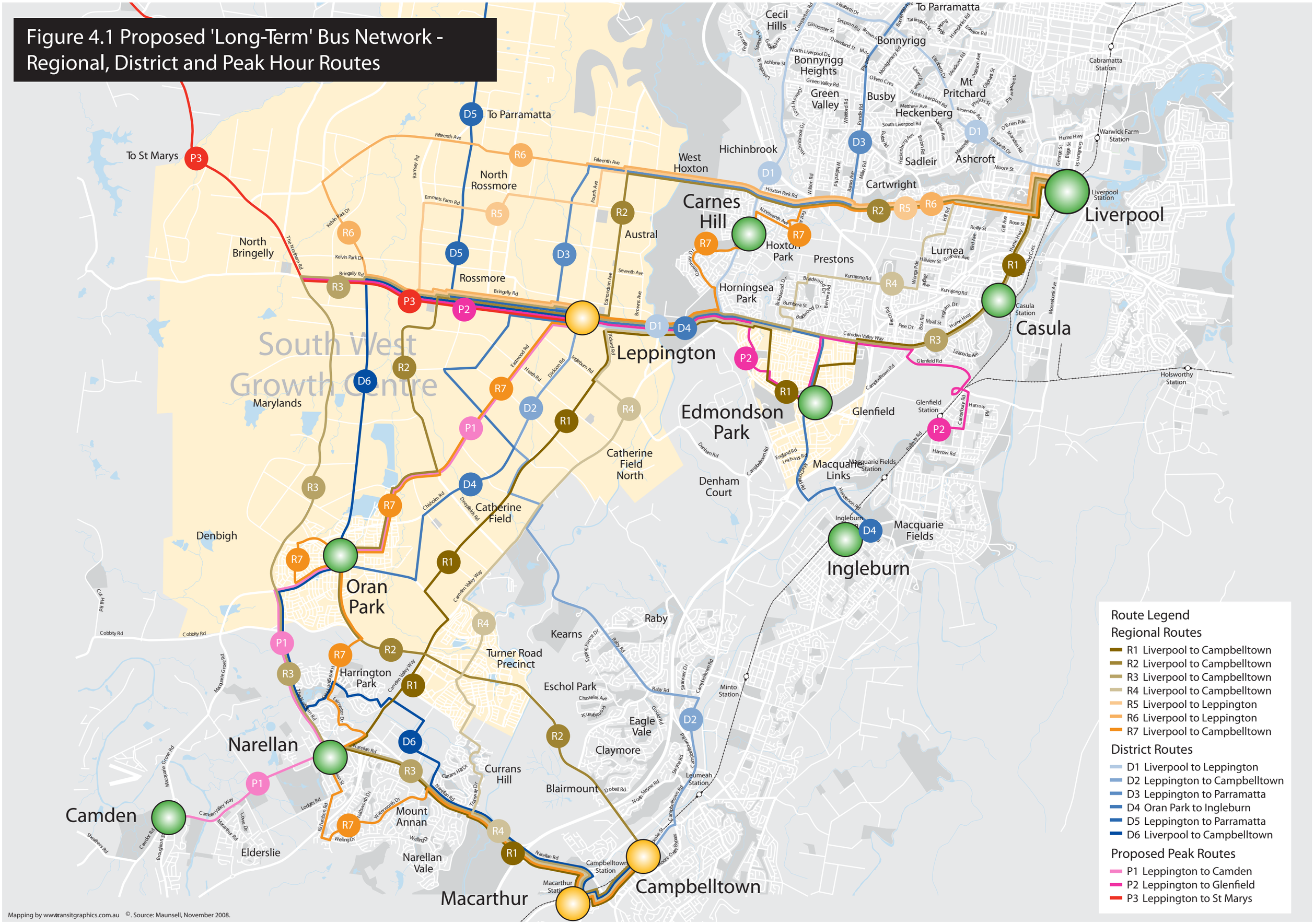
The South West Sector Bus Servicing Plan provides a long-term bus servicing strategy to cater for the future urban growth in the SWGC.

The aim of the strategy is to ensure that new residents and workers in the area have a travel choice that includes public transport and that the staging of precinct releases is consistent from a public transport efficiency perspective. The strategy focuses on the SWGC but also gives consideration to suburbs and centres which are located adjacent and beyond in order to ensure integration of the bus networks within the wider South Western Sydney area.

The ‘long-term’ bus network proposal consists of seven regional, six district and three peak hour only bus routes to provide a network that links the proposed major centres (Liverpool, Campbelltown, Parramatta, Oran Park and Leppington) and supports accessibility to each of the SWGC precincts. The ‘long-term’ bus network plan is shown on the diagram reproduced on the document overleaf.

The South West Sector Bus Servicing Plan provides a guide to the potential bus networks that would be operating along Fifteenth Avenue. Fifteenth Avenue is seen as a significant east-west bus corridor with proposed bus routes travelling on to / from Hoxton Park connecting Liverpool.

Figure 4.1 Proposed 'Long-Term' Bus Network - Regional, District and Peak Hour Routes



5. TRAFFIC

The assessed traffic generation outcome for the proposed development is as follows:

	AM	PM	WEMD
Service Station	140 vtph	100 vtph	80 vtph
Pad Site	60 vtph	80 vtph	100 vtph
Supermarket	30 vtph	70 vtph	70 vtph
Large Format Retail	16 vtph	36 vtph	36 vtph
Retail/Commercial	10 vtph	30 vtph	30 vtph
Child Care Centre	46 vtph	46 vtph	-
Total:	**302 vtph**	**362 vtph**	**316 vtph**
With 10% dual use:	272 vtph	326 vtph	285 vtph

The potential 7,000m^2 of future development on Lot 6 and the residue to the north (with bulky goods retail use @ 1.5 and 2.5 vtph/100m^2 and dual use would indicate:

	10	105 vtph	175 vtph
With 10% dual use	-	95 vtph	158 vtph
Total:	**282 vtph**	**421 vtph**	**443 vtph**

Apart from the proposed FABH SSDA development to consider there is also:

- the growth in traffic along Fifteenth Avenue as a result of urban development in the area
- the potential need to close Twentyseventh Avenue and Twentyeighth Avenue at Fifteenth Avenue or prevent right turn traffic movements due to road safety reasons and/or for the upgrading of Fifteenth Avenue (i.e. bridge over water supply channel)
- the potential additional 50,000m^2 which could be developed for 7,000m^2 on the residue land subject to separate Development Application

There are no funds available or program for the upgrading of the Fifteenth Avenue route and it could be some 10 years until this upgrade eventuates. At the same time, there is likely to be a 2 – 3 year period before the FABH development comes to fruition and the annual growth rate along Fifteenth Avenue could be 2.5% p.a. The projected traffic outcome at the Fifteenth Avenue/Twentysecond Avenue/FABH intersection in 10 years' time would be as shown on Figure 5.

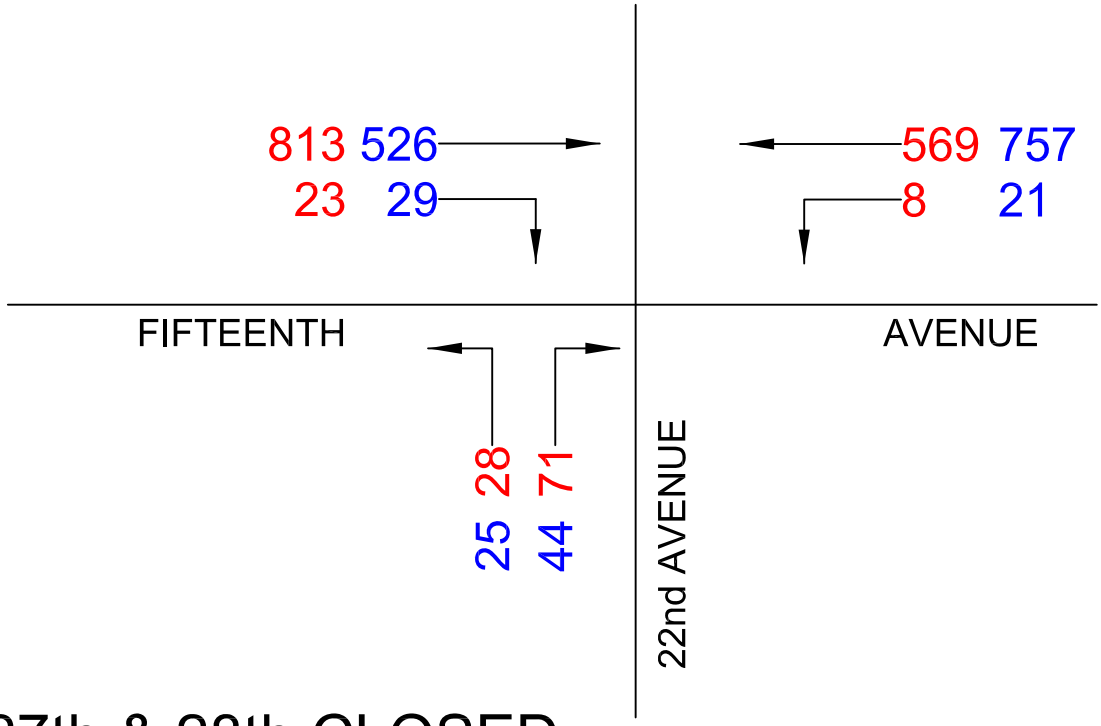
The concept road plan prepared by Costin Roe identifies the future road boundary along the northern side of Fifteenth Avenue based on:

- the RMS requirements for a 40m wide reservation
- the set-backs and cut-offs to maintain the requirements of the future FABH access (with RMS widening)

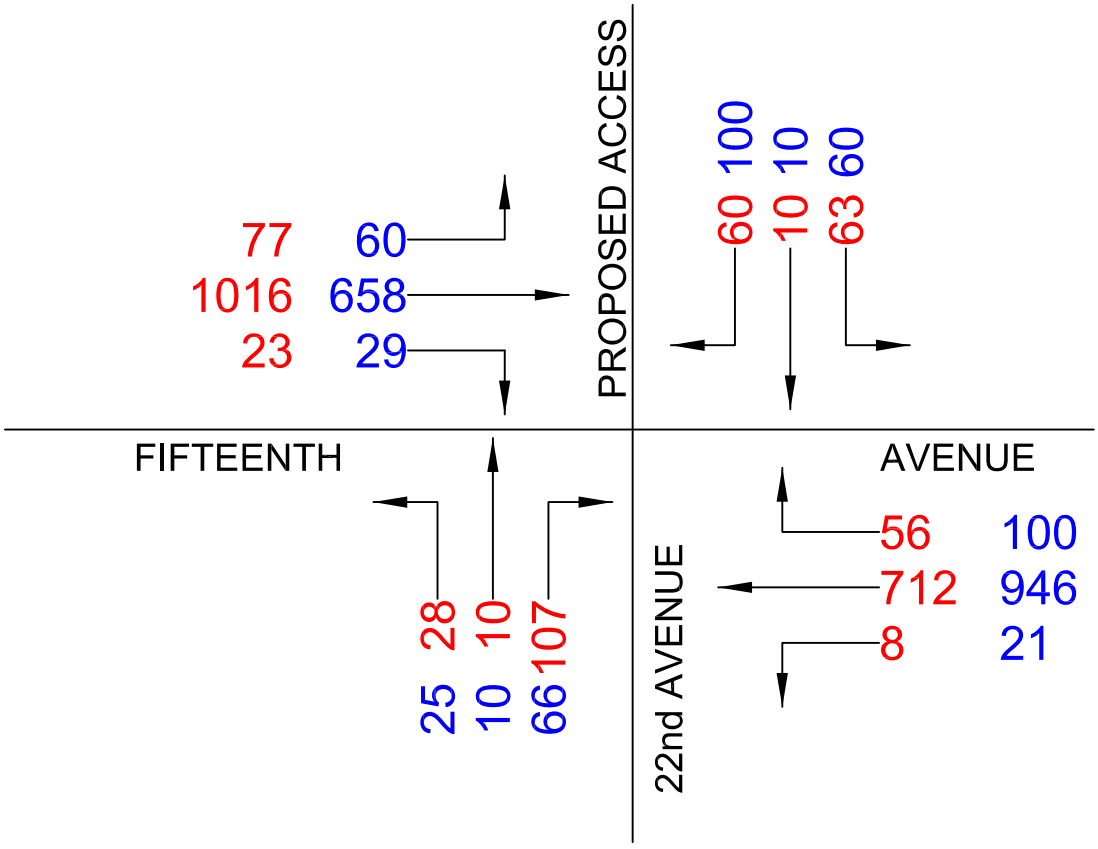
The Costin Roe concept for a roundabout represents a very suitable arrangement albeit constrained by the position of the existing roadway against the southern side of the road reserve. There is no ability to achieve splays on the south-east and south-west corners and as such a larger roundabout would result in a substantial deviation for eastbound traffic. The proposal:

- maintains one through traffic lane in each direction
- incorporates left turn deceleration lanes for the turns at the roundabout and at the service station and fast food ingresses

The operational performance of the intersection with the proposed development under the projected 10 year design horizon traffic demands has been modelled using SIDRA for the "with" and "without" roundabout scenarios.



27th & 28th CLOSED

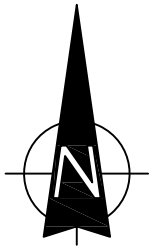


27th AND 28th CLOSED AND + 25% + DEV.

LEGEND

123 - AM

123 - PM



PROJECTED 2026 PEAK TRAFFIC FLOWS

FIG 5

The results of that analysis are provided in the following:

	AM	PM
With Roundabout		
LOS	A	A
DS	0.748	0.729
AVD	7.9	8.0
Without Roundabout		
LOS	A – E	A – F
DS	0.846	1.091
AVD	16.7	27.0 (worst 166.3)

Criteria for interpreting SIDRA results are reproduced overleaf.

The results indicate that the provision of a roundabout will be necessary to achieve an acceptable Level of Service irrespective of the road safety consideration and the potential development of the land to the north.

The factors which contribute to the justification for the provision of a roundabout at this location include:

- Spacing:
  - 800m between Cowpasture Road and Second Avenue
  - 800m between Second Avenue and Twentysecond Avenue
  - 1,700m between Twentysecond Avenue and Edmondson Avenue

- Twentyseventh Avenue and Twentyeighth Avenue connections to Fifteenth Avenue will be compromised by a bridge over the Water Supply Channel

- Lands to the east of Twentysecond Avenue (north and south of Fifteenth Avenue) are part of Western Sydney Parklands (i.e. not developable lands) and therefore there is no issue of road network continuity

- There are significant existing difficulties and hazards for drivers turning right out of Twentysecond Avenue or Twentyseventh Avenue to Fifteenth Avenue due to sight distance shortcomings

- Provision of a roundabout at the Twenty Second Avenue intersection would facilitate a safer right turn movement at the Twenty Seventh Avenue intersection

Criteria for Interpreting Results of SIDRA Analysis

1. Level of Service (LOS)

LOS	Traffic Signals and Roundabouts	Give Way and Stop Signs
'A'	Good	Good
'B'	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
'C'	Satisfactory	Satisfactory but accident study required
'D'	Operating near capacity	Near capacity and Accident Study required
'E'	At capacity; at signals incidents will cause excessive delays. Roundabouts require other control mode	At capacity and requires other control mode
'F'	Unsatisfactory and requires additional capacity	Unsatisfactory and requires other control mode

2. Average Vehicle Delay (AVD)

The AVD provides a measure of the operational performance of an intersection as indicated on the table below, which relates AVD to LOS. The AVD's listed in the table should be taken as a guide only as longer delays could be tolerated in some locations (ie inner city conditions) and on some roads (ie minor side street intersecting with a major arterial route).

Level of Service	Average Delay per Vehicle (secs/veh)	Traffic Signals, Roundabouts	Give Way and Stop Signs
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals incidents will cause excessive delays. Roundabouts require other control mode	At capacity and requires other control mode

3. Degree of Saturation (DS)

The DS is another measure of the operational performance of individual intersections.

For intersections controlled by **traffic signals**[1] both queue length and delay increase rapidly as DS approaches 1, and it is usual to attempt to keep DS to less than 0.9. Values of DS in the order of 0.7 generally represent satisfactory intersection operation. When DS exceeds 0.9 queues can be anticipated.

For intersections controlled by a **roundabout or GIVE WAY or STOP signs**, satisfactory intersection operation is indicated by a DS of 0.8 or less.

[1] *the values of DS for intersections under traffic signal control are only valid for cycle length of 120 secs*

6. ACCESS, INTERNAL CIRCULATION AND PARKING

ACCESS

The accesses for the development lots will be located along the access road except for the left turn only ingresses of Fifteenth Avenue for the service station and the fast food lots. The design of these accesses will comply with the requirements of AS2890.1 and 2 and they will accommodate all vehicles requiring to access the lots including fuel tanker and delivery/service vehicles.

Details of the development accesses will be subject to resolution with individual Development Applications.

PARKING

Details of the parking provision for each lot will be subject to resolution with the individual Development Applications although these will have regard for the relevant Development Standards as follows:

	RMS	**Council**
Bulky Goods	Not specified	1 space per 90m^2
Supermarket	1.3 spaces per 100m^2	1 space per 20m^2
Child Care	1.0 space per 300m^2	1 space per staff members and 1 space per 10 children
Fast Food	1 space per 3 seats external and internal	1 space per 6 seats + queuing for 10 cars
Service Station	5 spaces per 100m^2 convenience store 6 spaces per work bay	1 space per 20m^2 convenience store + 1 space per staff + 3 spaces per work bay

The design provisions for car parking, accessible parking, motorcycle parking and bicycle parking etc will be in accordance with Council's DCP requirements and/or other relevant standards and guidelines (e.g. AS2890.1 and 6).

The envisaged development outcome would indicate the following parking provision (without discount for dual use).

Retail	4,200m^2 @ 1 per 20m^2	210 spaces
Child Care Centre (80 kids)		15 spaces
Fast Food	90 seats @ 1 per 3 seats	30 spaces
Service Station	250m^2 @ 1 per 20m^2	13 spaces
Large Format Hardware	7,000m^2 @ 1 per 90m^2	78 spaces
	Total:	**346 spaces**

It is apparent that this quantum of car parking can be readily provided with the envisaged development.

7. RESPONSE TO SEARS

DETAILED TRAFFIC ANALYSIS

Section 5 of this report contains a detailed traffic assessment including analysis of the projected traffic generation of the proposal development and the operational performance of the access intersection.

CUMULATIVE TRAFFIC IMPACTS

The projected traffic generation of the proposed development will be quite minor. There will also be a large component of "passing trade" (i.e. vehicles already during along Fifteenth Avenue) particularly for the service station, fast food and convenience shopping elements and this factor could be some 60 to 70% of generation traffic.

It is not realistic to incorporate an assessment of the cumulative impact with that of major urban precinct development in the area. This is particularly the case when it is recognized that Fifteenth Avenue will be upgraded to a major access route for the area.

FUNDING ARRANGEMENT

It is understood that the SEARS' reference to funding agreement for any intersection/road improvement works to accommodate the traffic impact consequent to the proposed development. Accordingly WSP will bear the costs of the provision of a roundabout control at the access intersection. It should be acknowledged that the proposed upgrade would not only be of benefit to the subject development but also to traffic movements associated with the adjoining communities.

PEDESTRIAN TRAVEL AND PUBLIC TRANSPORT

A pedestrian pathway will be provided along the site frontage linking with the pedestrian refuge on Fifteenth Avenue, the bus stop, the pedestrian refuge on the access road and the development elements. There will be a network of pedestrian paths through the hub linking the various elements and providing access for the parklands to the north.

A bus bay will be provided near the existing pedestrian refuge and this will be supplemented with a bus shelter seating and lighting. Bicycle facilities will be provided in each development element in compliance with the requirements of Council's DCP.

TRAVEL PLAN

A Draft Travel Plan is provided in Appendix B and an example Transport Access Guide is provided in Appendix C.

ACCESS AND PARKING PROVISIONS

These are detailed in Section 6.

8. CONCLUSION

This report provides a detailed assessment of the potential access, traffic and transport implications of the proposed Fifteenth Avenue Business Hub.

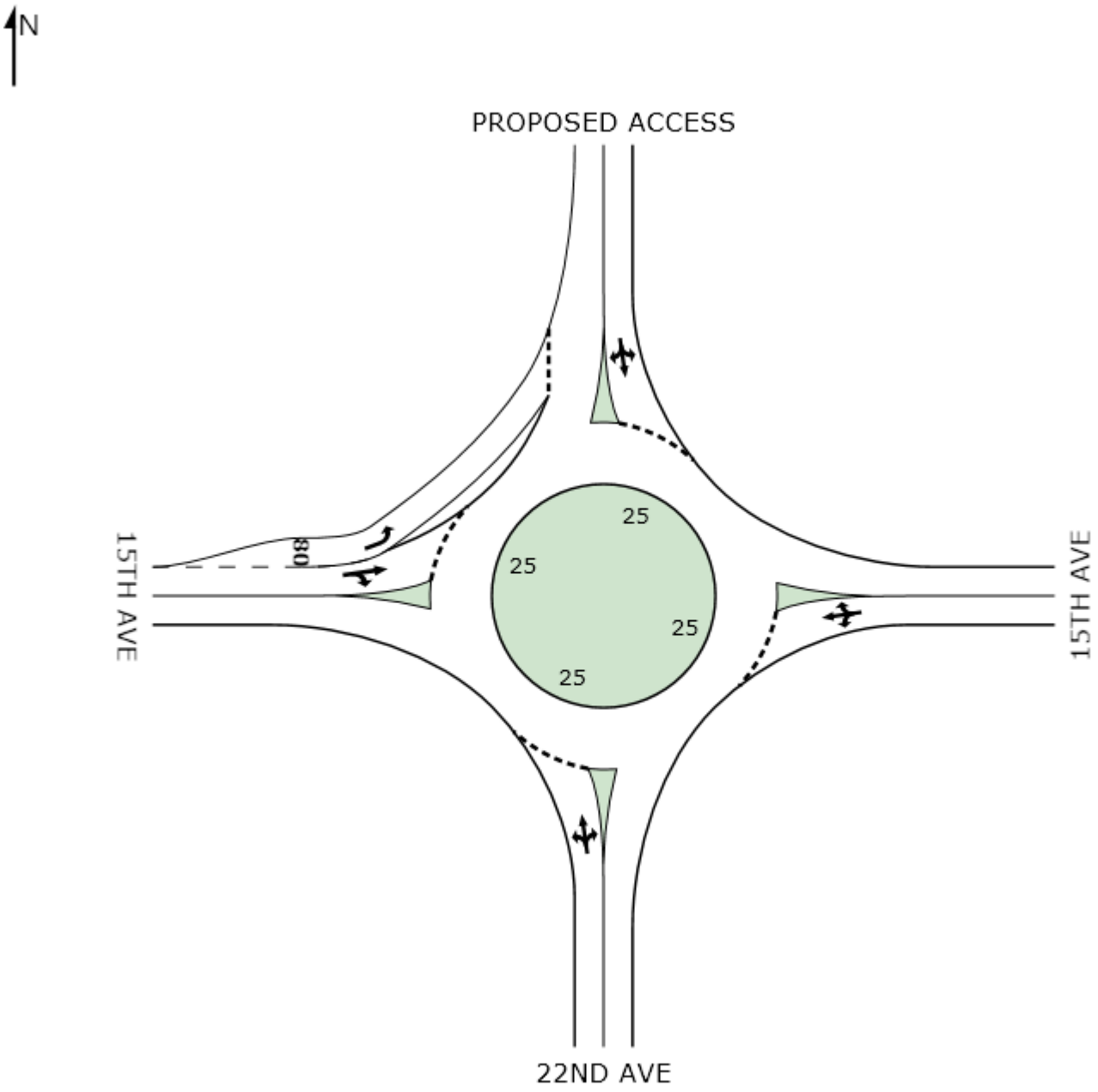
The assessment has had particular regard for the SEARS for State Significant Development (SSD6407).

The assessment demonstrates that:

- the proposed access intersection on Fifteenth Avenue will satisfactorily accommodate the projected traffic demand outcome for development for the circumstances of the projected 2026 traffic volumes
- there will not be any adverse traffic implications for the road system servicing the site
- there will be suitable and appropriate provisions for cyclists, pedestrians and public transport services

APPENDIX A

SIDRA RESULTS


N
PROPOSED ACCESS
15TH AVE
80
25
25
25
25
15TH AVE
22ND AVE

MOVEMENT SUMMARY

Site: 27th AVE RBT AM

Roundabout

Movement Performance - Vehicles											
Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: 22ND AVE											
1	L	28	2.0	0.232	12.6	LOS A	1.6	11.3	0.85	0.83	44.0
2	T	10	2.0	0.232	11.5	LOS A	1.6	11.3	0.85	0.82	44.2
3	R	107	2.0	0.232	17.8	LOS B	1.6	11.3	0.85	0.88	41.3
Approach		145	2.0	0.232	16.4	LOS B	1.6	11.3	0.85	0.87	42.0
East: 15TH AVE											
4	L	8	2.0	0.009	6.8	LOS A	0.0	0.3	0.31	0.48	49.4
5	T	712	2.0	0.513	5.4	LOS A	4.8	34.4	0.41	0.45	49.8
6	R	56	2.0	0.513	11.8	LOS A	4.8	34.4	0.41	0.77	46.5
Approach		776	2.0	0.513	5.9	LOS A	4.8	34.4	0.41	0.47	49.5
North: PROPOSED ACCESS											
7	L	63	2.0	0.364	19.4	LOS B	2.9	20.3	1.00	0.99	38.8
8	T	10	2.0	0.364	18.3	LOS B	2.9	20.3	1.00	0.99	38.9
9	R	60	2.0	0.364	24.7	LOS B	2.9	20.3	1.00	0.99	37.1
Approach		133	2.0	0.364	21.7	LOS B	2.9	20.3	1.00	0.99	38.0
West: 15TH AVE											
10	L	77	2.0	0.056	5.7	LOS A	0.3	2.1	0.21	0.45	50.7
11	T	1016	2.0	0.748	6.5	LOS A	8.8	62.4	0.71	0.56	47.9
12	R	23	2.0	0.748	12.8	LOS A	8.8	62.4	0.71	0.73	46.5
Approach		1116	2.0	0.748	6.5	LOS A	8.8	62.4	0.67	0.56	48.0
All Vehicles		2170	2.0	0.748	7.9	LOS A	8.8	62.4	0.61	0.57	47.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

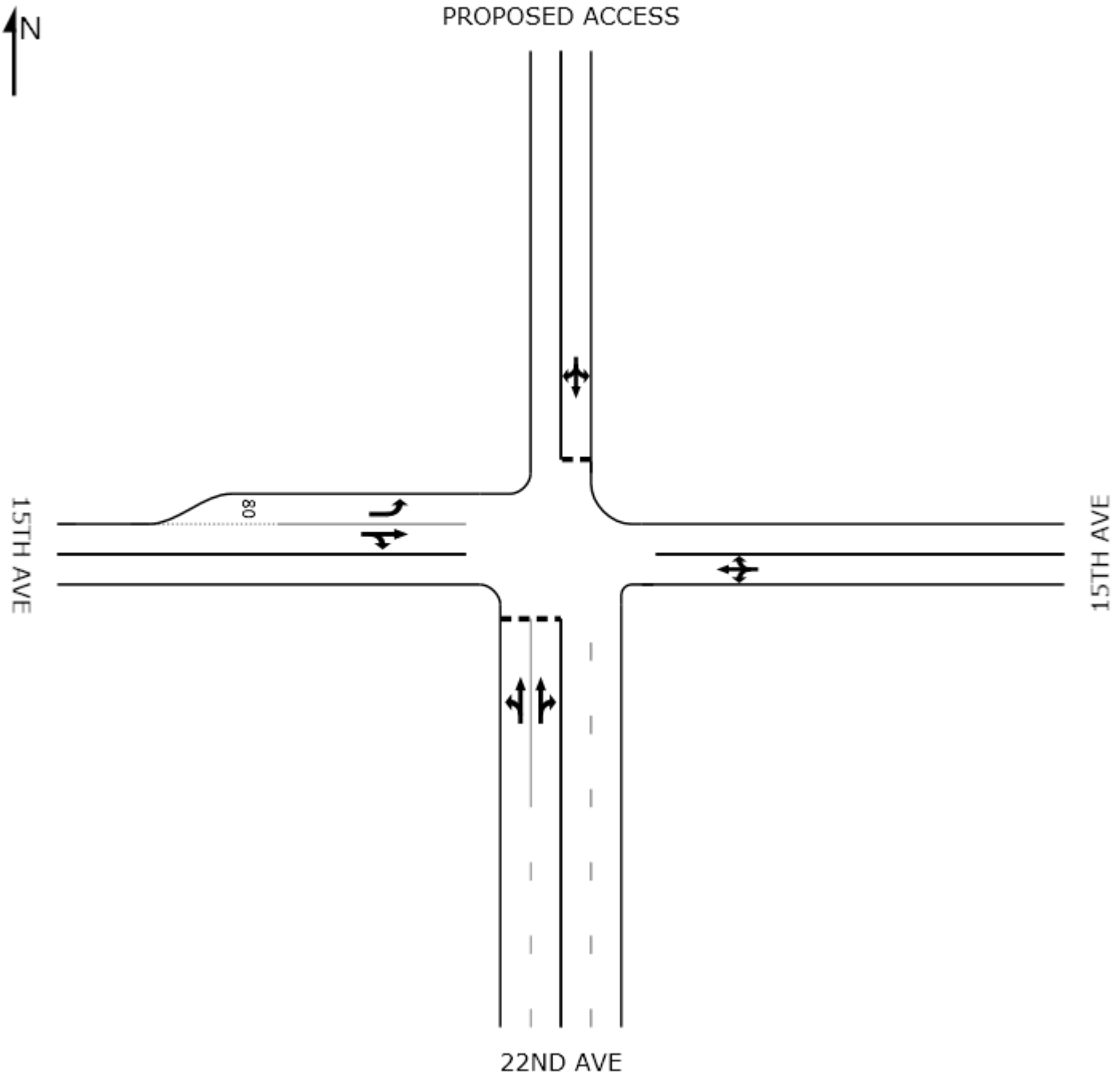
Site: 27th AVE RBT PM

Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: 22ND AVE											
1	L	25	2.0	0.268	18.7	LOS B	2.0	14.5	1.00	0.96	39.2
2	T	10	2.0	0.268	17.6	LOS B	2.0	14.5	1.00	0.96	39.3
3	R	66	2.0	0.268	24.0	LOS B	2.0	14.5	1.00	0.96	37.4
Approach		101	2.0	0.268	22.0	LOS B	2.0	14.5	1.00	0.96	38.0
East: 15TH AVE											
4	L	21	2.0	0.025	7.2	LOS A	0.1	0.9	0.38	0.51	49.0
5	T	946	2.0	0.729	6.1	LOS A	8.7	62.1	0.64	0.52	48.2
6	R	100	2.0	0.729	12.5	LOS A	8.7	62.1	0.64	0.71	46.3
Approach		1067	2.0	0.729	6.7	LOS A	8.7	62.1	0.64	0.54	48.0
North: PROPOSED ACCESS											
7	L	60	2.0	0.257	11.7	LOS A	1.8	12.7	0.83	0.83	44.9
8	T	10	2.0	0.257	10.6	LOS A	1.8	12.7	0.83	0.81	45.2
9	R	100	2.0	0.257	17.0	LOS B	1.8	12.7	0.83	0.87	42.1
Approach		170	2.0	0.257	14.8	LOS B	1.8	12.7	0.83	0.85	43.2
West: 15TH AVE											
10	L	60	2.0	0.044	5.9	LOS A	0.2	1.7	0.29	0.46	50.2
11	T	658	2.0	0.498	6.0	LOS A	4.1	29.4	0.52	0.52	49.1
12	R	29	2.0	0.498	12.3	LOS A	4.1	29.4	0.52	0.79	46.5
Approach		747	2.0	0.498	6.2	LOS A	4.1	29.4	0.50	0.52	49.1
All Vehicles		2085	2.0	0.729	7.9	LOS A	8.7	62.1	0.62	0.58	47.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.


N
PROPOSED ACCESS
15TH AVE
80
15TH AVE
22ND AVE

MOVEMENT SUMMARY

Site: 27th AVE GIVEWAY AM

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: 22ND AVE											
1	L	28	2.0	0.072	13.1	LOS A	0.2	1.7	0.58	0.85	44.2
2	T	10	2.0	0.072	11.9	LOS A	0.2	1.7	0.58	0.82	44.9
3	R	71	2.0	0.696	63.0	LOS E	2.4	17.2	0.96	1.12	21.9
Approach		109	2.0	0.696	45.5	LOS D	2.4	17.2	0.83	1.02	26.6
East: 15TH AVE											
4	L	8	2.0	0.444	21.5	LOS B	9.0	64.1	1.00	0.00	40.4
5	T	626	2.0	0.444	13.3	LOS A	9.0	64.1	1.00	0.00	40.7
6	R	56	2.0	0.444	21.8	LOS B	9.0	64.1	1.00	1.16	40.5
Approach		690	2.0	0.444	14.0	NA	9.0	64.1	1.00	0.09	40.6
North: PROPOSED ACCESS											
7	L	63	2.0	0.846	62.5	LOS E	4.5	32.1	0.95	1.38	22.0
8	T	10	2.0	0.846	61.3	LOS E	4.5	32.1	0.95	1.31	22.1
9	R	60	2.0	0.846	62.6	LOS E	4.5	32.1	0.95	1.30	22.0
Approach		133	2.0	0.846	62.5	LOS E	4.5	32.1	0.95	1.34	22.0
West: 15TH AVE											
10	L	77	2.0	0.042	8.3	LOS A	0.0	0.0	0.00	0.67	49.0
11	T	855	2.0	0.478	8.9	LOS A	10.5	75.1	1.00	0.00	44.6
12	R	23	2.0	0.478	17.2	LOS B	10.5	75.1	1.00	1.16	44.4
Approach		955	2.0	0.478	9.0	NA	10.5	75.1	0.92	0.08	44.9
All Vehicles		1887	2.0	0.846	16.7	NA	10.5	75.1	0.95	0.23	39.0

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: 27th AVE GIVEWAY PM

Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: 22ND AVE											
1	L	25	2.0	0.095	17.3	LOS B	0.3	2.1	0.74	0.92	40.8
2	T	10	2.0	0.476	26.2	LOS B	1.4	10.3	0.80	0.93	34.5
3	R	44	2.0	0.476	52.7	LOS D	1.4	10.3	0.94	1.04	24.4
Approach		79	2.0	0.476	38.2	LOS C	1.4	10.3	0.86	0.99	29.2
East: 15TH AVE											
4	L	21	2.0	0.585	18.7	LOS B	13.0	92.9	1.00	0.00	42.5
5	T	839	2.0	0.585	10.5	LOS A	13.0	92.9	1.00	0.00	42.7
6	R	100	2.0	0.585	19.0	LOS B	13.0	92.9	1.00	1.24	42.6
Approach		960	2.0	0.585	11.5	NA	13.0	92.9	1.00	0.13	42.7
North: PROPOSED ACCESS											
7	L	60	2.0	1.091	166.3	LOS F	16.2	115.1	1.00	2.65	10.7
8	T	10	2.0	1.091	165.0	LOS F	16.2	115.1	1.00	2.17	10.7
9	R	100	2.0	1.091	166.4	LOS F	16.2	115.1	1.00	2.14	10.7
Approach		170	2.0	1.091	166.3	LOS F	16.2	115.1	1.00	2.32	10.7
West: 15TH AVE											
10	L	60	2.0	0.033	8.3	LOS A	0.0	0.0	0.00	0.67	49.0
11	T	580	2.0	0.366	12.4	LOS A	7.5	53.3	1.00	0.00	41.5
12	R	29	2.0	0.366	20.8	LOS B	7.5	53.3	1.00	1.11	41.3
Approach		669	2.0	0.366	12.4	NA	7.5	53.3	0.91	0.11	42.0
All Vehicles		1878	2.0	1.091	27.0	NA	16.2	115.1	0.96	0.36	33.0

Level of Service (LOS) Method: Delay (RTA NSW).

Vehicle movement LOS values are based on average delay per movement

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model used.

SIDRA INTERSECTION

APPENDIX B

DRAFT WORKPLACE TRAVEL PLAN

APPENDIX C

EXAMPLE TRANSPORT ACCESS GUIDE