Proposed
Riverwood North Residential Renewal Project

Washington Avenue & Kentucky Road, Riverwood

TRAFFIC AND PARKING ASSESSMENT REPORT

16 November 2010

Ref 10227

VARGA TRAFFIC PLANNING Pty Ltd
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1. INTRODUCTION

This Transport and Accessibility Study has been prepared on behalf of *Housing NSW* and *Payce Communities Pty Ltd* to accompany a Concept Plan application to The Department of Planning for the proposed Riverwood North Residential Renewal Project, located in Washington Avenue & Kentucky Road, Riverwood (Figures 1 and 2).

The Concept Plan envisages the staged construction of a new and revitalised residential area, comprising a mixture of social and privately owned dwellings. The dwellings are to be in the form of modern, architecturally designed residential flat buildings.

Resident carparking for the proposed development is to be provided at the base of the respective buildings.

It is anticipated that construction of the proposed Residential Renewal Project will be undertaken in several stages, over a period of approximately nine years, with Stage 1 to comprise approximately 150 new social housing dwellings for Housing NSW.

This Transport and Accessibility Study has been prepared with reference to the *Metropolitan Transport Plan - Connecting the City of Cities*, the *NSW State Plan*, the *NSW Planning Guidelines for Walking and Cycling*, the *Integrated Land Use and Transport Policy Package*, the *NSW Bike Plan* and the RTA's *Guide to Traffic Generating Developments*.

The purpose of this report is to provide a "masterplan" assessment of the cumulative transport, traffic and parking implications of the overall development proposal, and to that end this report:

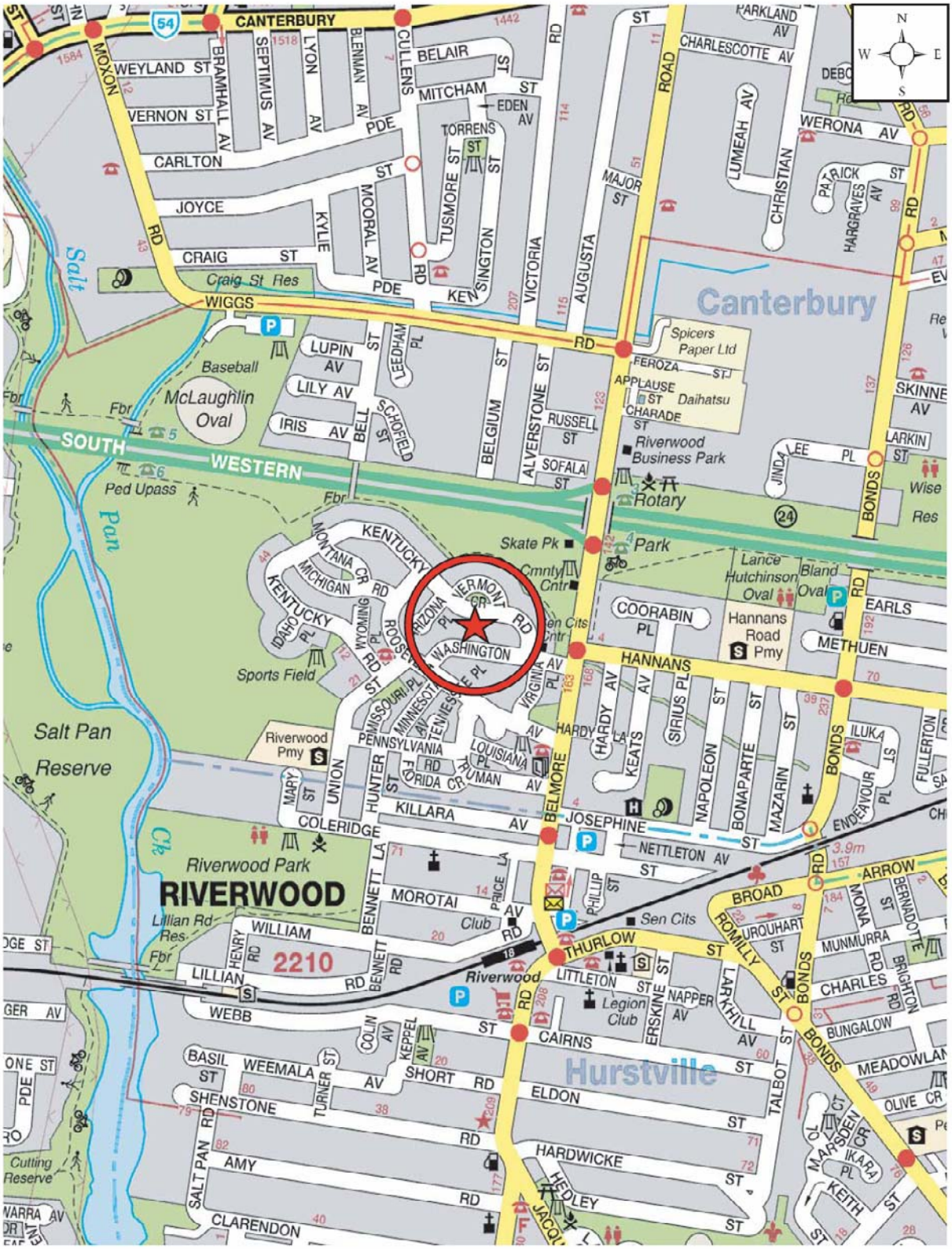
- describes the site and provides details of the development proposal

- reviews the road network in the vicinity of the site, and the traffic conditions on that road network

- identifies the opportunities for public transport, walking and cycling options which will be available to the residents of the proposed development

- assesses the traffic implications of the development proposal in terms of road network capacity

- assesses the adequacy and suitability of the off-street carparking facilities proposed on the site.



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LOCATION
FIGURE 1


N
W
E
S
SOUTH WESTERN HIGHWAY
KENTUCKY RD
MICHIGAN RD
ROOSEVELT AVE
ARIZONA PL
VERMONT CRS
KENTUCKY RD
Future Road
Future Road
BELMORE RD
WASHINGTON AVE
HANNANS RD
UNION ST
ROOSEVELT AVE
PL
HARDY AVE
MISSOURI PL
MINNESOTA AVE
TENNESSEE PL
VIRGINIA
ROOSEVELT AVE
PENNSYLVANIA RD
HUNTER ST
FLORIDA CRS
TRUMAN AVE
BELMORE RD
KEATS AVE
KILLARA AVE
JOSEPHINE ST
VARGA TRAFFIC PLANNING Pty Ltd
Traffic and Parking Consultants
SITE
FIGURE 2

2. PROPOSED DEVELOPMENT

Site

The subject site sits on both sides of Kentucky Road (and Vermont Crescent), extending west to Roosevelt Avenue, south to Washington Avenue, and north and east to the Salt Pan Creek Wetlands. The site occupies an area of approximately 3.55ha.

The subject site is currently occupied by 176 social housing dwellings comprising 12 mostly two and three-storey townhouses or "walk-up" residential flat buildings as well as several single-storey townhouses. The site also includes community areas such as a park and basketball court.

Off-street parking for the existing social housing dwellings is currently provided for approximately 130 cars at various locations throughout the site. A site inspection undertaken at 7:30am on a weekday morning found that approximately 40 of these spaces were occupied.

Proposed Development

The Concept Plan application seeks approval for the staged construction of a new revitalised residential area, comprising a mixture of public and privately owned dwellings. The proposed dwellings will comprise modern, architecturally designed residential flat buildings up to nine-storeys in height (including a parking level).

Approximately 650 residential dwellings are proposed in the new Residential Renewal Project, comprising approximately 150 social housing dwellings for Housing NSW (Stage 1) and approximately 500 privately owned dwellings.

The subject site is ideally located approximately 650m walk from Belmore Railway Station and the local shopping centre which comprises a range of shops, restaurants and services such as banks and the post office. The site is also located within 400m walking distance from Riverwood Primary School, and 500m walking distance from Hannans Road Primary School.

In addition, a number of regular bus services traverse the site or travel along Belmore Road, near the eastern perimeter of the site.

The site is located immediately adjacent to a shared pedestrian path and cycleway which traverses the Salt Pan Creek Wetlands and provides walking and cycling connections to Bankstown in the north, Padstow in the south and Kingsgrove in the east.

The site is also located immediately adjacent to the Riverwood Community Centre and within close walking distance of the new Riverwood Sport and Recreation Centre which is located on the eastern side of Belmore Road, directly opposite the Community Centre.

Associated infrastructure upgrades to be provided as part of the project will include landscaping, construction of a new garden square, new street furniture, stormwater management, site works and services, and the retention and upgrade of the existing central park.

Improvements to the existing road network will include:

- the establishment of a new "shared zone" with a 10 km/h speed limit and appropriate traffic calming and pavement treatments at the eastern end of Kentucky Road, and

- the construction of two new connecting roads between Kentucky Road and Washington Avenue which will improve through-site connections.

The construction of the new links between Kentucky Road and Washington Avenue will significantly improve the permeability of the neighbourhood for pedestrians and cyclists, particularly for those residents wishing to walk or cycle to the nearby Riverwood Public School or to Riverwood Station and the local shops.

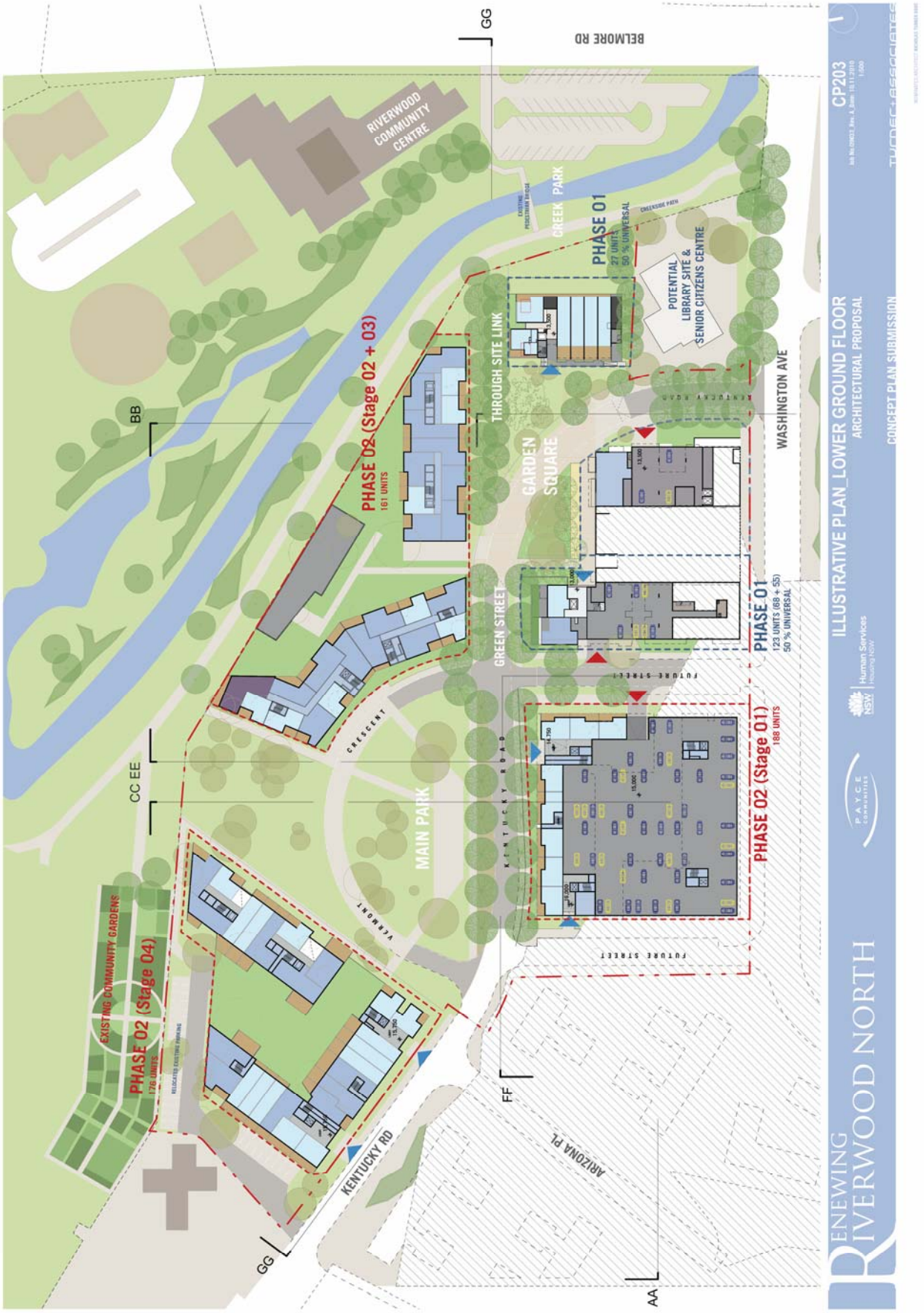
Cycling options for the residents of the proposed development will be further enhanced through the provision of bicycle storage facilities throughout the development in accordance with Council and Housing NSW requirements.

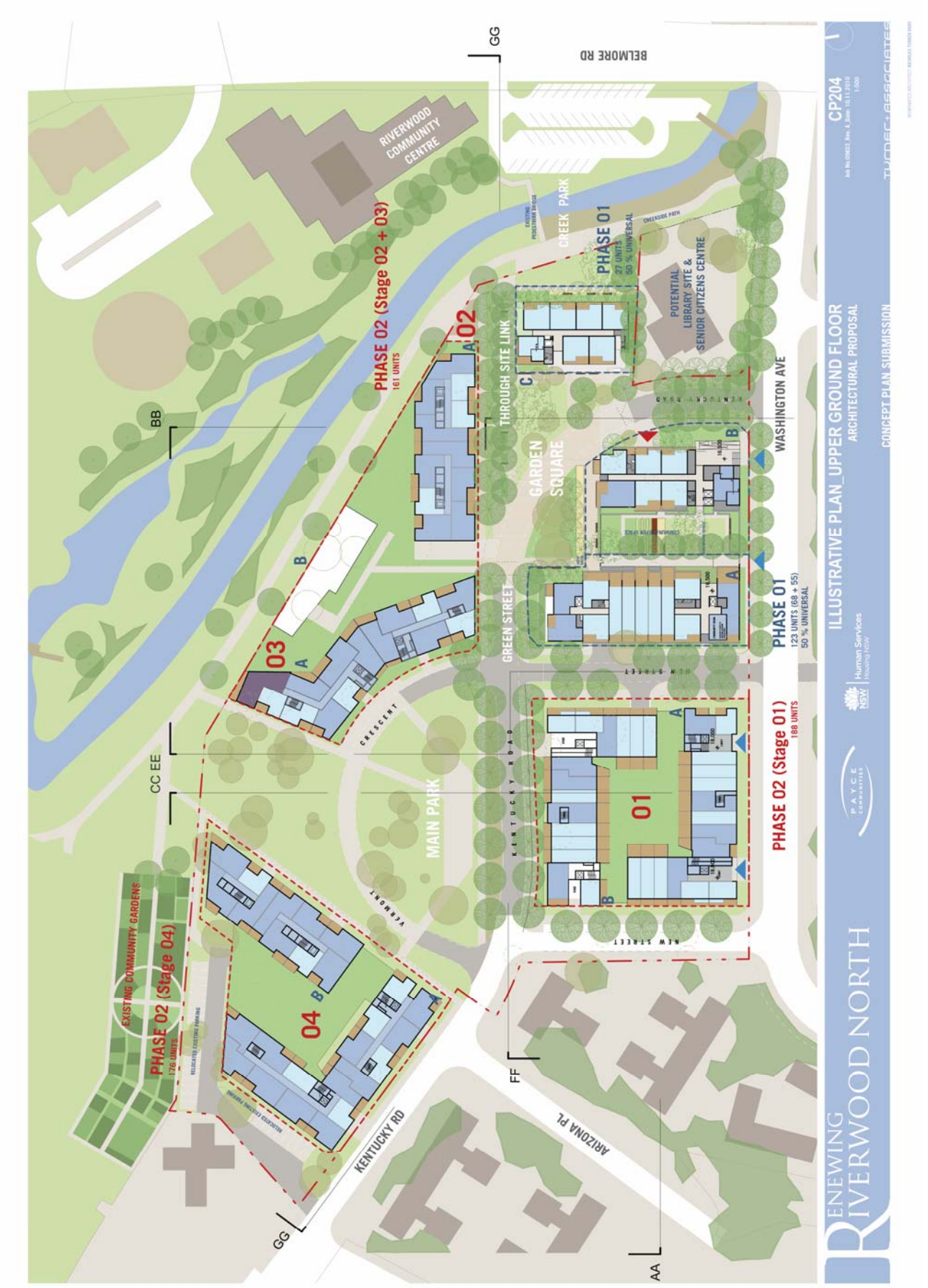
The majority of off-street car parking for the proposed Residential Renewal Project is to be provided in basement carparking areas for the respective buildings.

During the preparation of this report discussions were held with officers from Council's Traffic Engineering Section and the Roads and Traffic Authority's Development Assessment Unit. Both the Council and the RTA requested that a capacity analysis be undertaken at the two intersections that provide vehicular access to the precinct; that is the Belmore Road/Washington Avenue and the Belmore Road/Roosevelt Avenue intersection. The results of that analysis are discussed in Chapter 3 of this report.

Plans of the proposed Residential Renewal Project have been prepared by *Turner + Associates* and are reproduced in the following pages.


BELMORE RD
HANNANS RD
SKATE PARK
RIVERWOOD COMMUNITY CENTRE
SALT PAN CREEK RESERVE
THROUGH SITE LINK
GARDEN SQUARE
CREEK PARK
POTENTIAL LIBRARY SITE & SENIOR CITIZENS CENTRE
WASHINGTON AVE
GREEN STREET
MAIN PARK
EXISTING COMMUNITY GARDENS
KENTUCKY RD
ARIZONA PL
ROOSEVELT AVE
PROPOSED SITE CONCEPT PLAN
CONTEXT & ANALYSIS
CONCEPT PLAN SUBMISSION
CP104
RENEWING RIVERWOOD NORTH
Human Services Housing NSW
PAYCE COMMUNITIES


RIVERWOOD COMMUNITY CENTRE
BELMORE RD
GG
BB
CC
EE
FF
AA
CREEK PARK
PHASE 01
27 UNITS
50 % UNIVERSAL
POTENTIAL LIBRARY SITE & SENIOR CITIZENS CENTRE
THROUGH SITE LINK
PHASE 02 (Stage 02 + 03)
161 UNITS
GARDEN SQUARE
WASHINGTON AVE
GREEN STREET
PHASE 01
123 UNITS (68 + 55)
50 % UNIVERSAL
FUTURE STREET
CRESCENT
MAIN PARK
KENTUCKY ROAD
PHASE 02 (Stage 01)
188 UNITS
EXISTING COMMUNITY GARDENS
PHASE 02 (Stage 04)
176 UNITS
KENTUCKY RD
ARIZONA PL
RENEWING RIVERWOOD NORTH
ILLUSTRATIVE PLAN_LOWER GROUND FLOOR
ARCHITECTURAL PROPOSAL
CONCEPT PLAN SUBMISSION
CP203
PAYCE COMMUNITIES
Human Services Housing NSW


RENEWING RIVERWOOD NORTH
ILLUSTRATIVE PLAN_UPPER GROUND FLOOR
ARCHITECTURAL PROPOSAL
CONCEPT PLAN SUBMISSION
CP204
PAYCE COMMUNITIES
Human Services Housing NSW
RIVERWOOD COMMUNITY CENTRE
BELMORE RD
GG
BB
CC EE
FF
AA
PHASE 02 (Stage 02 + 03)
161 UNITS
PHASE 01
27 UNITS
50 % UNIVERSAL
CREEK PARK
POTENTIAL LIBRARY SITE & SENIOR CITIZENS CENTRE
THROUGH SITE LINK
GARDEN SQUARE
GREEN STREET
WASHINGTON AVE
PHASE 01
123 UNITS (68 + 55)
50 % UNIVERSAL
PHASE 02 (Stage 01)
188 UNITS
MAIN PARK
CRESCENT
KENTUCKY RD
NEW STREET
ARIZONA PL
EXISTING COMMUNITY GARDENS
PHASE 02 (Stage 04)
176 UNITS
01
02
03
04

3. TRAFFIC ASSESSMENT

Road Hierarchy

The road hierarchy allocated to the road network in the vicinity of the site by the Roads and Traffic Authority is illustrated on Figure 3.

The M5 Motorway is classified by the RTA as a *State Road* and provides the key east-west road link in the area, linking the City with Campbelltown and beyond. It typically carries two traffic lanes in each direction in the vicinity of the site, with opposing traffic flows separated by a centre median island. All intersections with the M5 Motorway are grade-separated. The Motorway is located approximately 350m north of the site, and intersects with Belmore Road with two west-facing ramps controlled by traffic signals. Provision has been made to allow for two east-facing ramps on the M5 Motorway to connect with Belmore Road to be constructed in the future.

Belmore Road is classified by the RTA as a *Regional Road* and provides the key north-south road link in the Riverwood area, linking Henry Lawson Drive to the south with Canterbury Road to the north. It typically carries one traffic lane in each direction in the vicinity of the site, with additional lanes/parking restrictions provided at key intersections.

Washington Avenue, Kentucky Road and Vermont Crescent are all local, unclassified roads which are primarily used to provide vehicular and pedestrian access to frontage properties. Kerbside parking is generally permitted on both sides of all three roads.

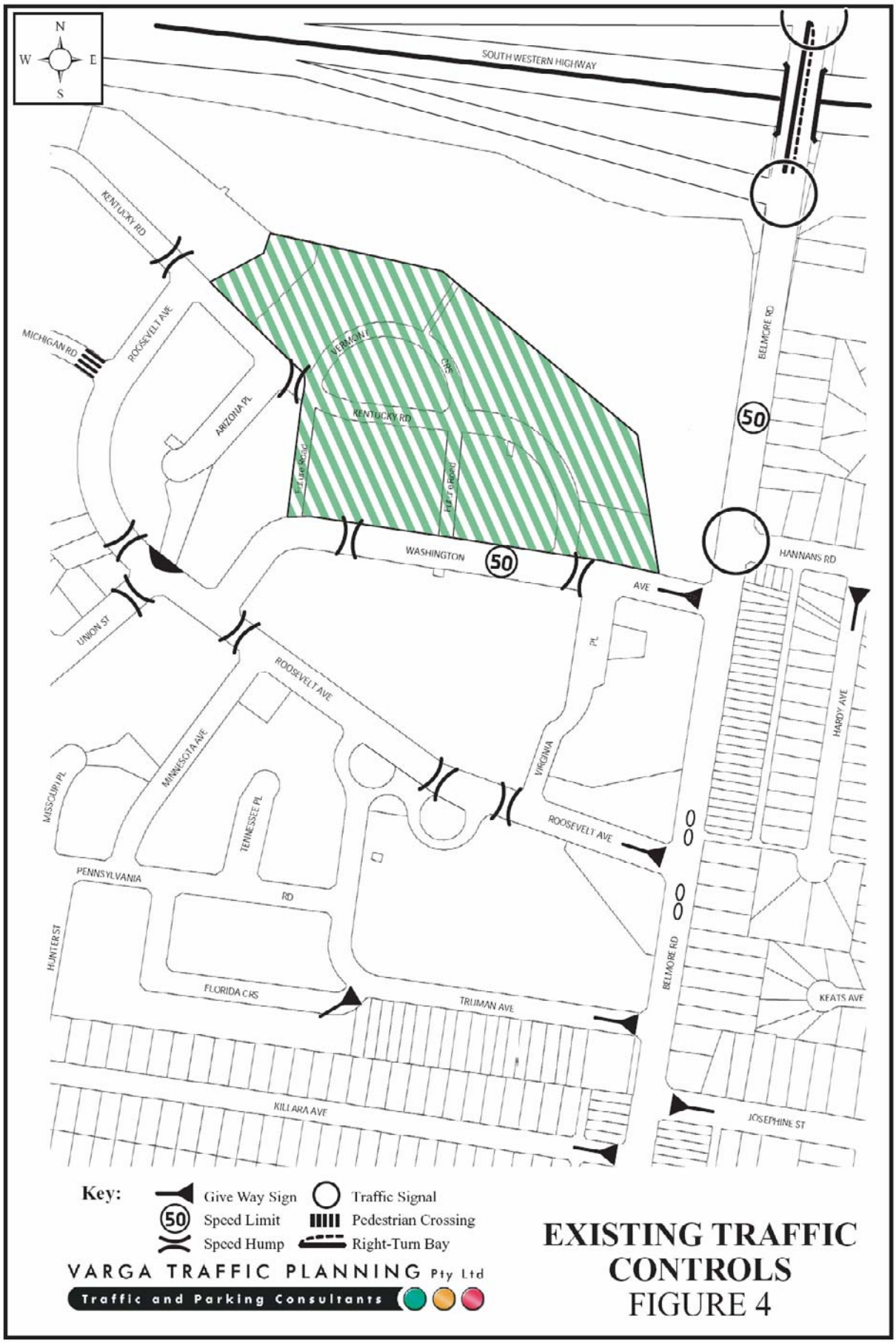
Existing Traffic Controls

The existing traffic controls which apply to the road network in the vicinity of the site are illustrated on Figure 4. Key features of those traffic controls are:

- a 50 km/h SPEED LIMIT which applies to Belmore Road and all other local roads in the area

- TRAFFIC SIGNALS in Belmore Road where it intersects with Hannans Road and also the M5 Motorway on/off ramps


CANTERBURY
WEYLAND ST
VERNON ST
CARLTON
JOYCE
CRAIG ST
Craig St Res
WIGGS
Salt Pan
Baseball
McLaughlin Oval
SOUTH WESTERN
Ped Upass
Fbr
MOXON RD
BRAMHALL AV
SEPTIMUS AV
LYON AV
BLENMAN AV
CULLENS ST
BELAIR ST
MITCHAM ST
EDEN AV
TORRENS ST
PDE
KYLIE
MOORAL AV
TUSMORE ST
KENSINGTON RD
VICTORIA RD
AUGUSTA RD
MAJOR ST
PARKLAND AV
CHARLESCOTTE AV
LUMEAH AV
CHRISTIAN
WERONA AV
PATRICK ST
HARGRAVES AV
Canterbury
Spicers Paper Ltd
FEROZA ST
APPLAUSE ST
Dalhatsu
CHARADE ST
Riverwood Business Park
SOFALA ST
RUSSELL ST
ALVERSTONE ST
BELGIUM ST
LUPIN AV
LILY AV
IRIS AV
LEEDHAM PL
SCHOFIELD ST
BELL ST
Rotary
JINDA LEE PL
BONDS RD
SKINNER AV
LARKIN ST
Wisc Res
Skate Pk
Park
Cmnty Cntr
Lance Hutchinson Oval
Bland Oval
EARLS
COORABIN PL
Hannans Road Pmy
METHUEN
HANNANS
KENTUCKY
MONTANA CR
MICHIGAN RD
IDAHO PL
WYOMING PL
ROOSEVELT RD
ARIZONA PL
VERMONT CR
WASHINGTON
Sen Cit Cntr
Sports Field
VIRGINIA AV
PENNSYLVANIA
MINNESOTA AV
TENNESSEE PL
LOUISIANA PL
FLORIDA CR
TRUMAN AV
HARDY AV
KEATS LA
SIRIUS PL
NAPOLEON ST
BONAPARTE ST
MAZARIN ST
ILUKA ST
ENDEAVOUR PL
FULLERTON
Salt Pan Reserve
Riverwood Pmy
UNION
HUNTER ST
MARY ST
KILLARA AV
COLERIDGE
JOSEPHINE ST
NETTLETON AV
Riverwood Park
RIVERWOOD
Lillian Rd Res
MOROTAI AV
BENNETT LA
PRICE LA
PHILLIP ST
Club
Sen Cits
BROAD
URQUHART ST
ROMILLY ST
MUNMURRA
BERNADOTTE
MONA
BRIGHTON RD
CHARLES
WILLIAM
HENRY RD
2210
LILLIAN RD
BENNETT RD
Riverwood
THURLOW ST
LITTLETON ST
NAPPER
LARKHILL
ERSKINE AV
Legion Club
WEBB ST
COLIN AV
KEPPEL AV
CAIRNS
BUNGALOW
MEADOWLAND
OLIVE CR
Hurstville
BASIL ST
WEEMALA AV
TURNER ST
SHORT RD
ELDON ST
SHENSTONE RD
AMY RD
HARDWICKE ST
HEDLEY ST
TALBOT ST
MARSDEN CR
IKARA PL
KEITH ST
SALT PAN RD
CLARENDON
Cutting Reserve
3.9m
Key:
State Road
Regional Road
VARGA TRAFFIC PLANNING Pty Ltd
Transport, Traffic and Parking Consultants
ROAD HIERARCHY
FIGURE 3


N
W
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S
SOUTH WESTERN HIGHWAY
KENTUCKY RD
MICHIGAN RD
ROOSEVELT AVE
ARIZONA PL
VERMONT
CRS
KENTUCKY RD
BELMORE RD
50
WASHINGTON
50
HANNANS RD
AVE
UNION ST
ROOSEVELT AVE
MINNESOTA AVE
MISSOURI PL
TENNESSEE PL
VIRGINIA
HARDY AVE
ROOSEVELT AVE
PENNSYLVANIA
RD
HUNTER ST
FLORIDA CRS
TRUMAN AVE
BELMORE RD
KEATS AVE
KILLARA AVE
JOSEPHINE ST
Key:
Give Way Sign
Speed Limit
Speed Hump
Traffic Signal
Pedestrian Crossing
Right-Turn Bay
VARGA TRAFFIC PLANNING Pty Ltd
Traffic and Parking Consultants
EXISTING TRAFFIC CONTROLS
FIGURE 4

- a GIVE-WAY SIGN in Washington Avenue at its intersection with Belmore Road

- SPEED HUMPS located at various locations throughout the area including along Washington Avenue and Kentucky Road.

Existing Traffic Conditions

An indication of the existing traffic conditions on the road network in the vicinity of the site is provided by reference to the RTA's *Annual Average Daily Traffic* data. The relevant count stations nearest to the subject site are summarised below, revealing that the annual average daily traffic along this section of Belmore Road is in the order of 16,000-20,000 axle pairs per day (northbound and southbound).

Annual Average Daily Traffic Volumes
(vehicles per day)

Station No.	Location	1996	1999	2002	2005
24075	Belmore Road (north of M5 Motorway)	23,267	21,974	20,779	19,869
41150	Belmore Road (south of Morotai Avenue)	17,516	16,770	16,044	15,524

A more detailed indication of the existing traffic conditions on the road network in the vicinity of the site is provided by peak period traffic surveys undertaken as part of this traffic study. The traffic surveys were undertaken during commuter peak periods (ie. 6:30am - 7:30am and 3:30pm - 6:30pm) on Tuesday, 26 October at the following intersections:

- Belmore Road & Roosevelt Avenue
- Belmore Road & Washington Avenue
- Belmore Road & Hannans Road
- Washington Road & Virginia Place
- Washington Avenue & Kentucky Road
- Washington Road & Roosevelt Avenue
- Roosevelt Road & Virginia Place

The results of the traffic surveys are reproduced in full in Appendix A and reveal that:

- two-way traffic flows in Belmore Road are typically in the order of 1,400 vehicles per hour (vph) during peak periods

- two-way traffic flows in Washington Avenue are typically less than 200 vph during peak periods

- two-way traffic flows in Kentucky Road are typically in the order of 80 to 90 vph during peak periods

- two-way traffic flows in Roosevelt Avenue are typically in the order of 150 vph during peak periods.

Alternate Transport Options

The proposed Residential Renewal Project is fortunate to be located in an area where a variety of alternate transport options are available such as train, bus, cycling and walking, as detailed below.

Train Services

Riverwood Railway Station is located near the corner of Belmore Road and Morotai Avenue, approximately 650m south of the corner of Washington Avenue and Belmore Road. The railway station is approximately 8 to 10 minutes walk from the subject site.

The Railway Station is located on the Airport - East Hills Line, with *City Rail* services operating between Macarthur and the City Circle via Revesby and Wolli Creek, with peak hour services also operating via Sydenham.

Weekday train services operate every 5 to 10 minutes during weekday commuter peak periods, and every 10 to 15 minutes outside peak periods. Weekend services operate every 10 to 20 minutes.

Riverwood Railway Station is located six stops east of Glenfield Railway Station, a major rail interchange with connecting services to the Cumberland Line, the South Line and ultimately the South West Rail Link to Leppington.

To the east Riverwood Railway Station is also located seven stops from Wolli Creek Railway Station, a rail interchange with connecting services to the Eastern Suburbs - Illawarra Line.

Bus Services

Bus services through the Riverwood area are operated by *Punchbowl Bus Company*. Route maps are reproduced in Appendix B and summarised below:

Route No.	Nearest Bus Stop	Operating Between
940	Belmore Rd	Bankstown & Hurstville via Riverwood & Narwee
942	Belmore Rd & Josephine St	Lugarno & Campsie via Riverwood & Belmore
944	Kentucky Rd	Bankstown & Mortdale via Roselands & Riverwood
945	Belmore Rd	Bankstown & Hurstville via Riverwood & Peakhurst
N20	Belmore Rd	Rockdale to Riverwood Night Ride

All weekday services operate every 30 minutes, with additional services during commuter peak periods. All weekend services operate every 60 minutes. Bus stops are located at regular intervals along both sides of Kentucky Road and Hannans Road (for Route No. 944) and also Belmore Road (for Route No's 940, 942 and 945).

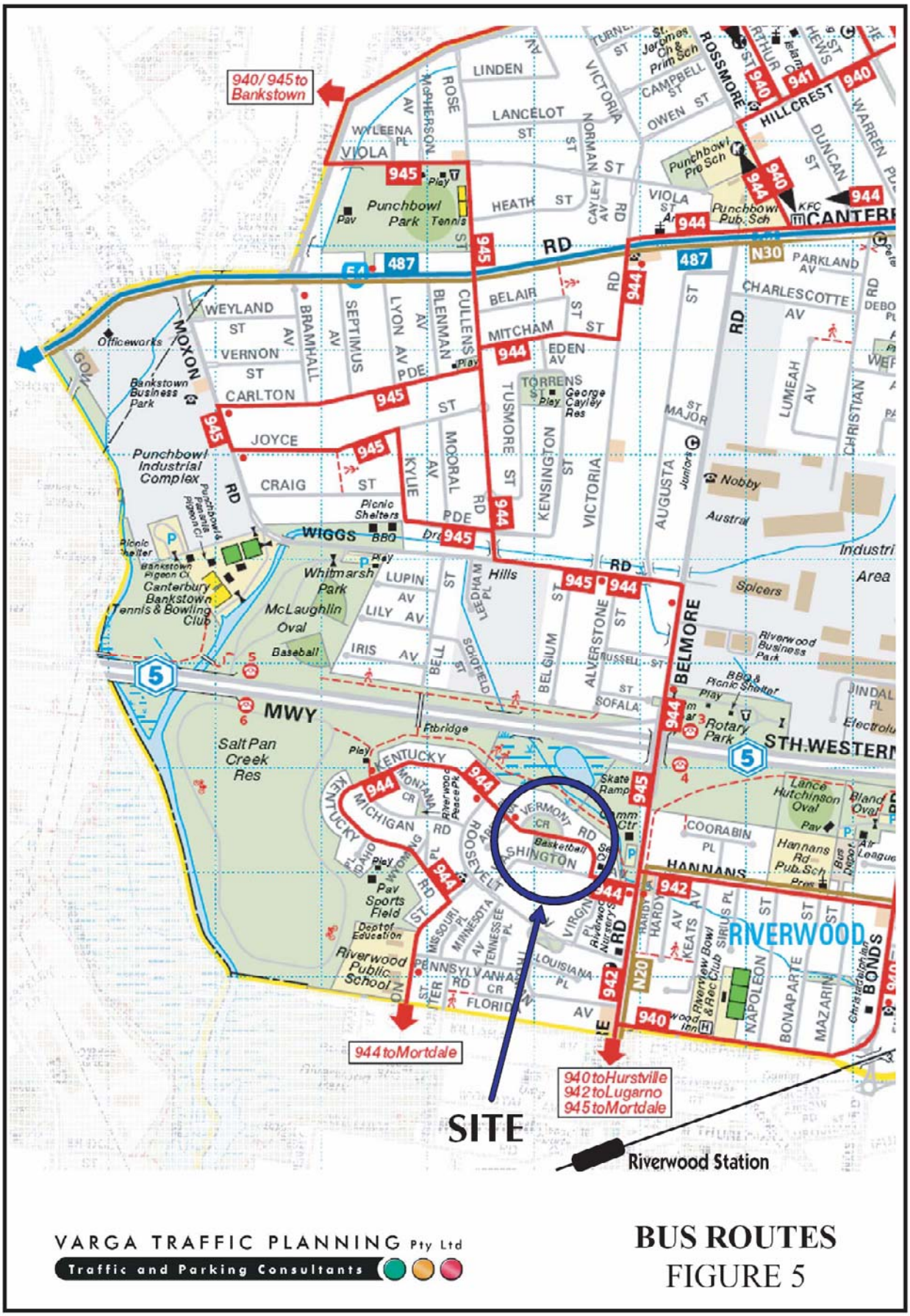
An extract from Council's Public Transport Guide illustrating the Bus Routes in the vicinity of the Riverwood site is shown on Figure 5.

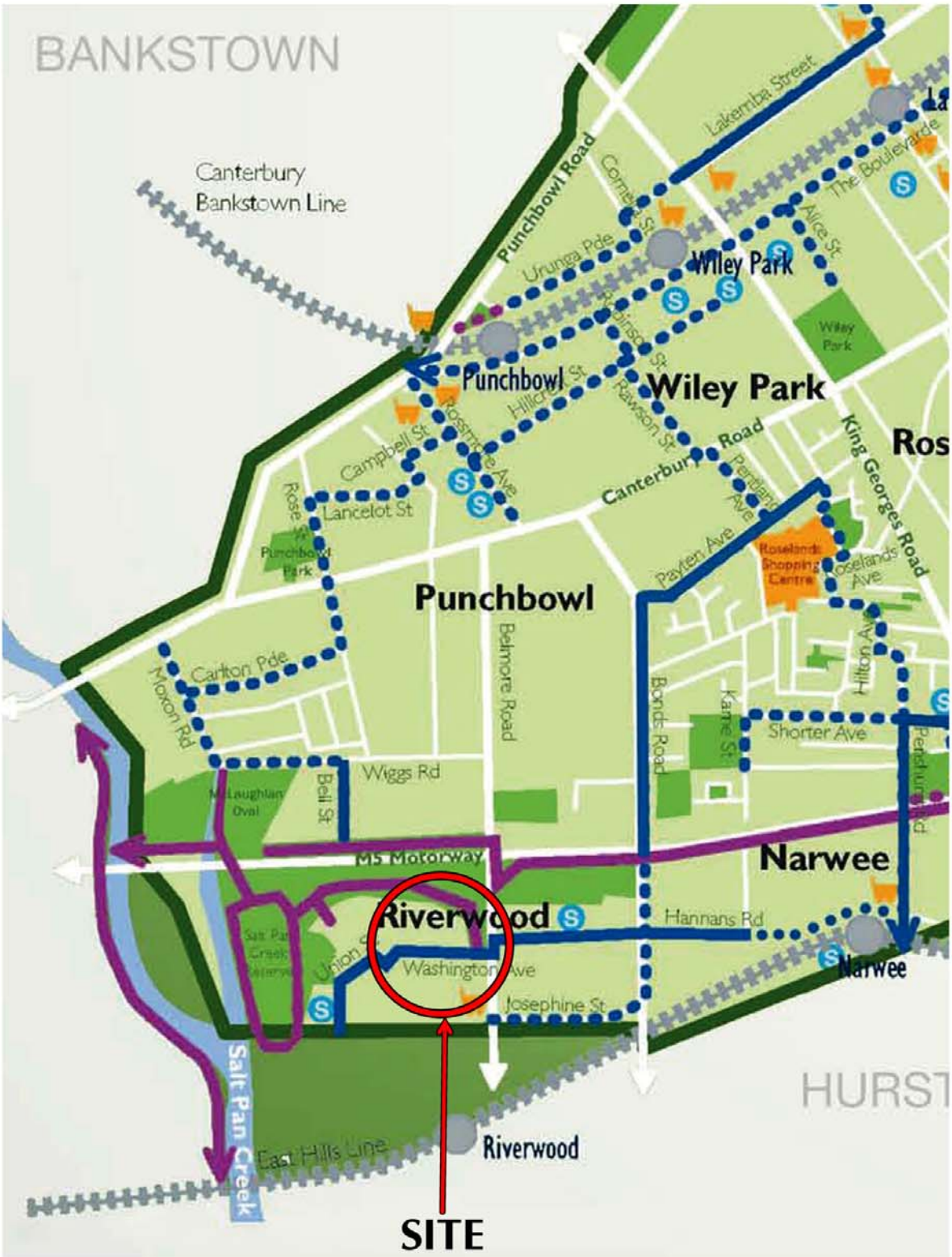
Bicycle and Pedestrian Routes

There are a number of cycleways and shared pedestrian paths providing convenient access to and from the proposed Residential Renewal Project at Riverwood for those residents who do not wish to drive or use public transport. Studies have shown that in Sydney, over 50% of trips are less than 5km; such trips are ideally suited to walking or cycling.

The nearby shared pedestrian and cycleway path which is located adjacent to Salt Pan Creek Wetlands continues approximately 4km north to Bankstown, 2km south to Padstow and 7km east to Kingsgrove.

An extract from Council's Cycleway Plan illustrating the shared cycle paths and cycle routes located in the vicinity of the site is illustrated on Figure 6.


940/945 to Bankstown
944 to Mortdale
940 to Hurstville
942 to Lugarno
945 to Mortdale
SITE
Riverwood Station
VARGA TRAFFIC PLANNING Pty Ltd
Traffic and Parking Consultants
BUS ROUTES
FIGURE 5



VARGA TRAFFIC PLANNING Pty Ltd
Traffic and Parking Consultants

COUNCIL'S CYCLEWAY PLAN
FIGURE 6

The proposed development will enhance the options available to residents for walking and cycling through the provision of 2 new links between Kentucky Road and Washington Avenue. The improved permeability for pedestrians and cyclists that will be provided by these links will provide more direct links for residents when walking or cycling to nearby facilities such as the local primary school, local shops and railway station.

The new links will also provide improved permeability for other residents living to the south of the site who may wish to access the shared pedestrian and cycleway paths traversing the Salt Pan Creek Wetlands or the nearby sports and recreation facilities using the network of local roads, without the need to travel along the busy Belmore Road.

Projected Traffic Generation

An indication of the traffic generation potential of the development proposal is provided by reference to the Roads and Traffic Authority's publication *Guide to Traffic Generating Developments, Section 3 - Landuse Traffic Generation (October 2002).*

The RTA *Guidelines* are based on extensive surveys of a wide range of land uses and nominates the following traffic generation rates which are applicable to the development proposal:

High Density Residential Flat Buildings
0.29 "peak hour" vehicle trips/dwelling
2.9 "daily" vehicle trips/dwelling (estimated)

Definition:
A *high density residential flat building* refers to a building containing 20 or more dwellings. This does not include aged or disabled persons' housing. *High density residential flat buildings* are usually more than five levels, have basement level car parking and are located in close proximity to public transport services. The building may contain a component of commercial use.

Medium Density Residential Flat Buildings
0.4 – 0.5 "peak hour" vehicle trips / 1 & 2 bedroom dwelling
4.0 – 5.0 "daily" vehicle trips / 1 & 2 bedroom dwelling

0.5 – 0.65 "peak hour" vehicle trips / 3 bedroom dwelling
5.0 – 6.5 "daily" vehicle trips / 3 bedroom dwelling

Housing for Aged and Disabled Persons

0.1 - 0.2 "peak hour" vehicle trips/dwelling

1 - 2 "daily" vehicle trips/dwelling

Factors

These figures at the lower end of the above rates are based on research conducted by the Authority. This research concentrates on *subsidised* developments (often run by religious organisations). Generation rates or *resident funded* developments are often greater, as indicated at the higher end of the range.

Application of the above traffic generation rates to the development proposal yields a projected future traffic generation potential of 160 peak hour vehicle trips as set out below, or 1600 vehicle trips per day.

Projected Development
Projected Traffic Generation Potential

Social Housing (Approx. 150 dwellings for Housing NSW):	15 peak hour vehicle trips
Residential Apartments (Approx. 500 private dwellings):	145 peak hour vehicle trips
TOTAL TRAFFIC GENERATION POTENTIAL:	**160 peak hour vehicle trips**

That projected future traffic generation potential should however, be offset or *discounted* by the volume of traffic which could be generated by the existing uses of the site. The 176 existing dwellings are characterised by 2 and 3-storey townhouses or "walk-up" residential flat buildings as well as several single storey townhouses and could be expected to generate approximately 88 peak hour vehicle trips as set out in the table below, or up to 880 vehicles per day.

Existing Development
Projected Traffic Generation Potential

Medium Density Townhouses & Apartments (176 dwellings):	88 peak hour vehicle trips

Accordingly, the nett increase in the traffic generation potential of the site as a consequence of the development proposal is estimated to be in the order 72 peak hour vehicle trips as set out in the table below, or a nett increase of 720 vehicles per day.

Nett Increase in Traffic Generation Potential
as a Consequence of the Development Proposal

Projected Future Traffic Generation Potential:	160 peak hour vehicle trips
Projected Existing Traffic Generation Potential:	88 peak hour vehicle trips
NETT INCREASE IN TRAFFIC GENERATION POTENTIAL:	**72 peak hour vehicle trips**

However, for the purposes of this assessment, and to provide a more "rigorous" traffic assessment, it has been assumed that the private dwellings component of the development proposal will comprise "medium" density dwellings rather than "high" density dwellings which could be expected to generate up to 202 peak hour vehicle trips (or 2020 vehicle trips per day) yielding a *nett increase* in the traffic generation potential of the site as a consequence of the development proposal of 114 peak hour vehicle trips, as set out in the table below.

Projected Nett Increase in Peak Hour Traffic Generation Potential
as a Consequence of the Development Proposal
(if proposed "private dwellings are assessed using "medium" density traffic generation rates)

Projected Future Traffic Generation Potential:	202 peak hour vehicle trips
Existing Traffic Generation Potential:	88 peak hour vehicle trips
NETT INCREASE IN TRAFFIC GENERATION POTENTIAL:	**114 peak hour vehicle trips**

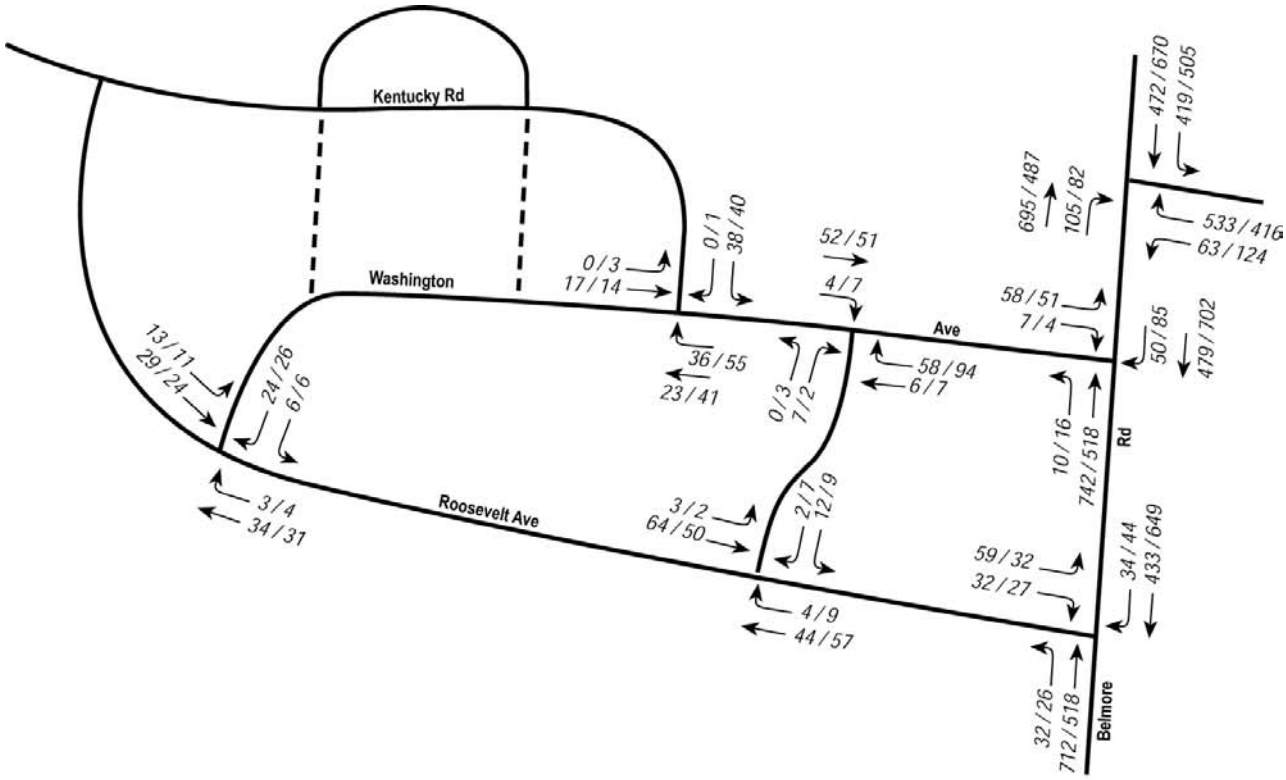
It has also been assumed that the site is currently vacant, and that all of the projected 202 peak hour vehicle trips will be new or *"additional"* to the existing traffic volumes using the nearby road network. Those projected future traffic volumes have been assigned to the surrounding road network as illustrated on Figure 7.

Traffic Implications - Road Network Capacity

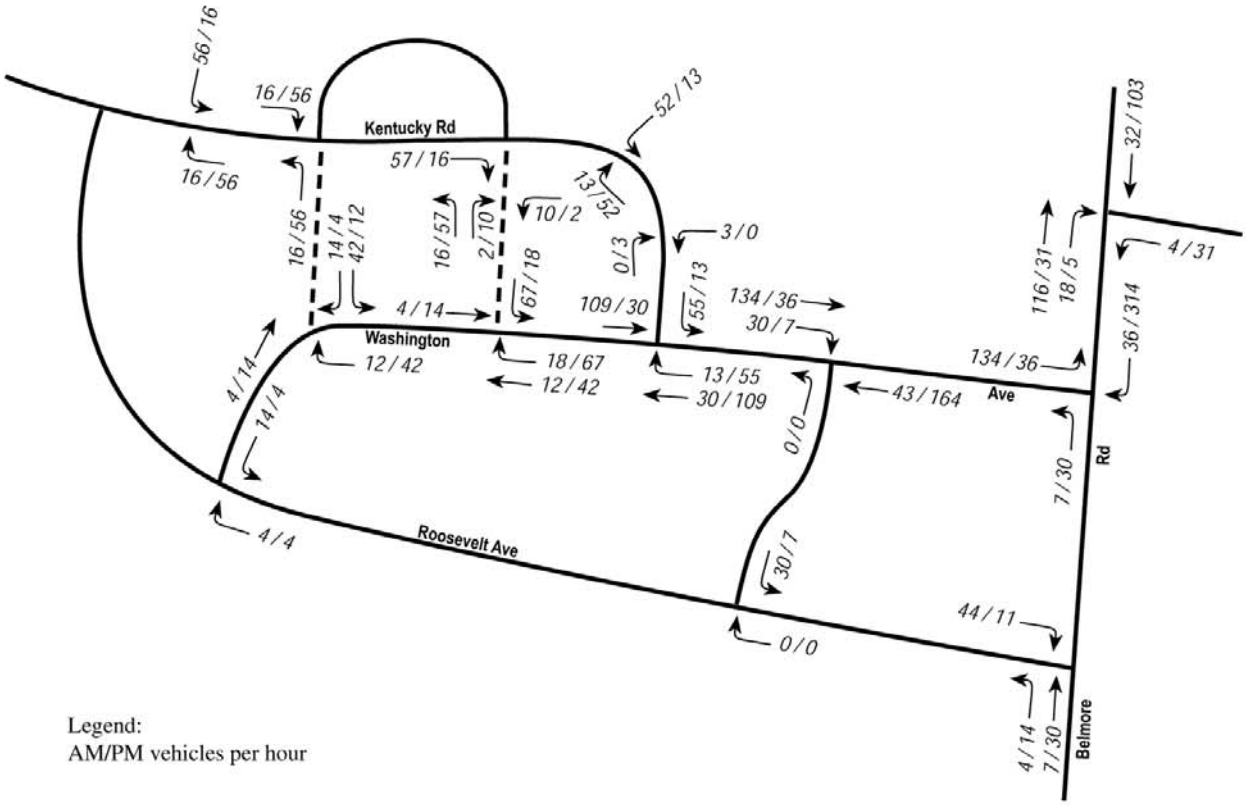
The traffic implications of development proposals primarily concern the effects that any *additional* traffic flows may have on the operational performance of the nearby road network. Those effects can be assessed using the SIDRA program which is widely used by the RTA and many LGA's for this purpose. Criteria for evaluating the results of SIDRA analysis are reproduced in the following pages.

The results of the SIDRA analysis of the Belmore Road & Roosevelt Avenue intersection are summarised on Table 3.1 below, revealing that:

- the Belmore Road & Roosevelt Avenue intersection currently operates at *Level of Service "A"* under the existing traffic demands with total average vehicle delays in the order of 2 seconds/vehicle



EXISTING TRAFFIC VOLUMES



Legend:
AM/PM vehicles per hour

TRAFFIC ASSIGNMENT

FIGURE 7

- under the projected future traffic demands expected to be generated by the development proposal, the Belmore Road & Roosevelt Avenue intersection will continue to operate at *Level of Service "A",* with increases in average vehicle delays of ***less than*** 2 seconds/vehicle.

The results of the SIDRA analysis of the Belmore Road & Washington Avenue intersection are summarised on Table 3.2 below, revealing that:

- the Belmore Road & Washington Avenue intersection currently operates at *Level of Service "A"* under the existing traffic demands with total average vehicle delays in the order of 4 seconds/vehicle

- under the projected future traffic demands expected to be generated by the development proposal, the Belmore Road & Washington Avenue intersection will continue to operate at *Level of Service "A",* with increases in average vehicle delays of 1 - 3 seconds/vehicle.

The results of the SIDRA analysis of the Belmore Road & Hannans Road intersection are summarised on Table 3.3 below, revealing that:

- the Belmore Road & Hannans Road intersection currently operates at *Level of Service "B"* under the existing traffic demands with total average vehicle delays in the order of 24 - 27 seconds/vehicle

- under the projected future traffic demands expected to be generated by the development proposal, the Belmore Road & Hannans Road intersection will continue to operate at *Level of Service "B",* with increases in average vehicle delays of ***less than*** 1 second/vehicle.

In the circumstances, it is clear that the proposed development will not have any unacceptable traffic implications in terms of road network capacity.

It is noted however, that the operation of the Belmore Road/Washington Avenue intersection is sometimes affected by queuing from the nearby Belmore Road/Hannans Road intersection. Whilst the traffic modelling indicates that the additional traffic volumes will not adversely

affect the operation performance of each intersection, it is noted that the queue of vehicles waiting to turn right into Hannans Road may sometimes delay vehicles wishing to turn left out of Washington Avenue, if the vehicle turning left out of Washington Avenue wishes to turn right into Hannans Road. This in turn restricts the ability of vehicles to turn right out of Washington Avenue to proceed towards the south in Belmore Road.

Following discussions with officers of both the RTA and Council, it is recommended that consideration be given to prohibiting the right-turn movement out of Washington Avenue during commuter peak periods, and redirecting that traffic to the Roosevelt Avenue intersection. In this regard it is noted that in practice this "prohibition" already occurs by default, as the majority of traffic departing the precinct towards the south appears to use Roosevelt Avenue in any event, with very little traffic (ie. less than 10 vph) turning right out of Washington Avenue, and is reflected in the above traffic modelling.

In summary, the foregoing analysis has found that:

- the cumulative development potential of the proposed development will not have any unacceptable traffic implications in terms of road network capacity

- the proposed development will not have any adverse impacts on the performance of nearby intersections, and will *not* require upgrading or road improvement works.

TABLE 3.1 - RESULTS OF SIDRA ANALYSIS OF BELMORE ROAD & ROOSEVELT AVENUE

Key Indicators	Existing Traffic Demand		Projected Development Traffic Demand	
	AM	PM	AM	PM
Level of Service	A	A	A	A
Degree of Saturation	0.197	0.231	0.479	0.317
Total Average Vehicle Delay (secs/veh)	1.9	1.8	3.4	2.6
	BEL_ROOX		BEL_ROOP	

TABLE 3.2 - RESULTS OF SIDRA ANALYSIS OF BELMORE ROAD & WASHINGTON AVENUE				
Key Indicators	**Existing Traffic Demand**		**Projected Development Traffic Demand**	
	AM	**PM**	**AM**	**PM**
Level of Service	A	A	A	A
Degree of Saturation	0.365	0.387	0.717	0.407
Total Average Vehicle Delay (secs/veh)	4.2	4.3	7.3	5.1
	BEL_WASX		BEL_WASP	

TABLE 3.3 - RESULTS OF SIDRA ANALYSIS OF BELMORE ROAD & HANNANS ROAD				
Key Indicators	**Existing Traffic Demand**		**Projected Development Traffic Demand**	
	AM	**PM**	**AM**	**PM**
Level of Service	B	B	B	B
Degree of Saturation	0.652	0.670	0.700	0.670
Total Average Vehicle Delay (secs/veh)	27.0	23.5	27.5	23.6
	BEL_HANX		BEL_HANP	

Criteria for Interpreting Results of SIDRA Analysis

1. Level of Service (LOS)

LOS	Traffic Signals and Roundabouts	Give Way and Stop Signs
'A'	Good operation.	Good operation.
'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, Roundabout	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.*

4. PARKING IMPLICATIONS

Existing Kerbside Parking Restrictions

The existing kerbside parking restrictions which apply to the road network in the vicinity of the site are illustrated on Figure 8 and comprise:

- NO STOPPING restrictions in Belmore Road in the vicinity of the Hannans Road and Washington Avenue intersections

- NO PARKING restrictions along both sides of Belmore Road (north of Hannans Road) during commuter peak periods

- generally UNRESTRICTED kerbside parking throughout the local area

- BUS ZONES at regular intervals along both sides of Belmore Road, Kentucky Road and also Hannans Road.

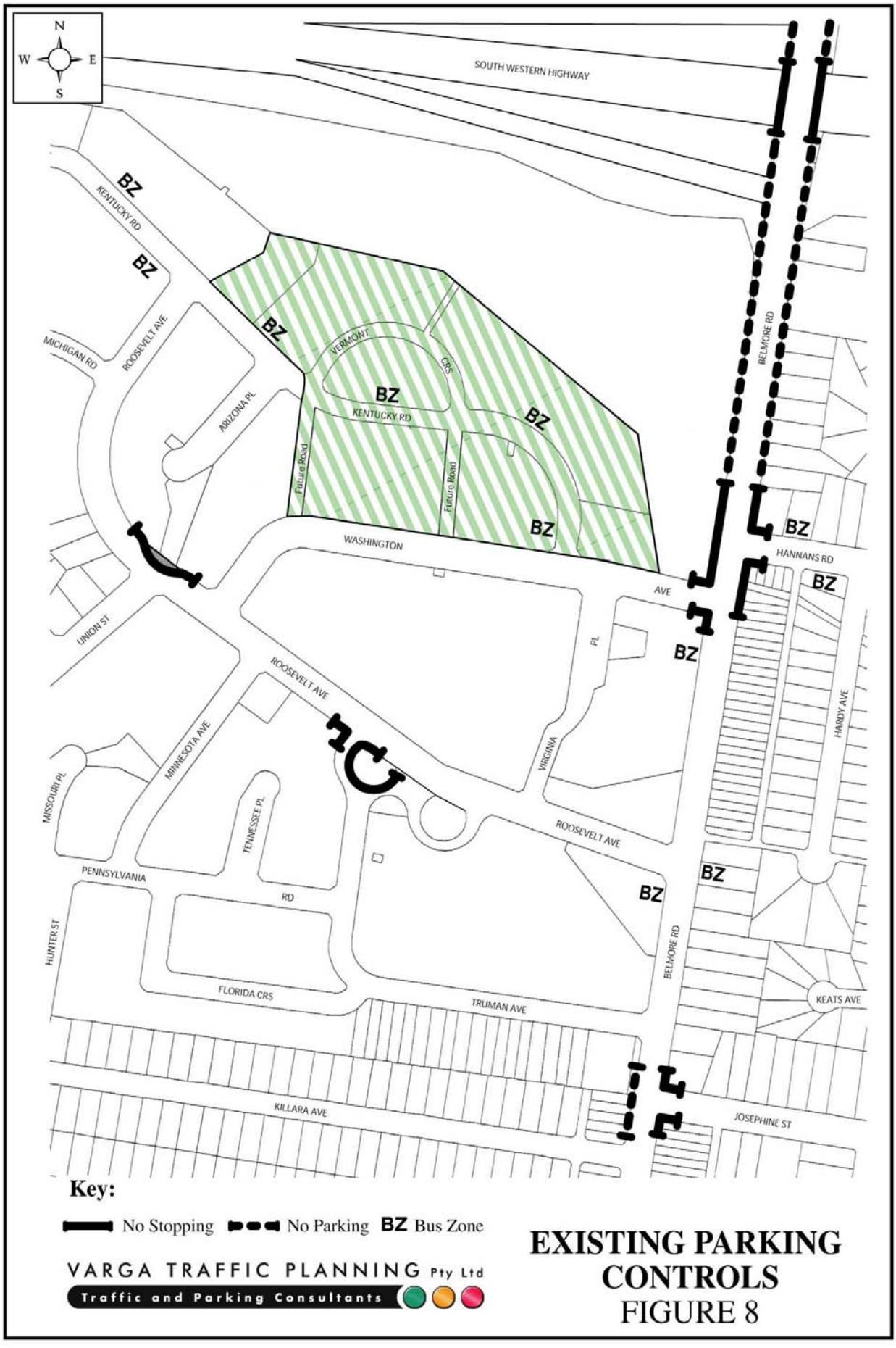
The existing on-street carparking capacity within the site is estimated to be in the order of 120 to 140 on-street carparking spaces in various kerbside carparking locations.

Off-Street Parking Provisions

The off-street parking rates applicable to the development proposal are specified in Council's *Development Control Plan No. 20 – Car Parking* document in the following terms:

Multi Unit Development	
1 bedroom unit:	1.0 space per dwelling
2 bedroom unit:	1.2 spaces per dwelling (the 0.2 space is to remain as common property)
3 bedroom unit:	2.0 spaces per dwelling
Visitors:	1.0 space per 5 dwellings

Council's *DCP No.20* does not however, nominate an off-street parking rate for social housing suitable for seniors. Reference is therefore made to the *State Environmental Planning Policy (Housing for Seniors or People with a Disability) 2004* which nominates the following:


N
W
E
S
SOUTH WESTERN HIGHWAY
BZ
KENTUCKY RD
MICHIGAN RD
ROOSEVELT AVE
ARIZONA PL
VERMONT
CRS
Future Road
BELMORE RD
WASHINGTON
AVE
HANNANS RD
UNION ST
PL
VIRGINIA
HARDY AVE
MINNESOTA AVE
MISSOURI PL
TENNESSEE PL
PENNSYLVANIA
RD
HUNTER ST
FLORIDA CRS
TRUMAN AVE
KEATS AVE
KILLARA AVE
JOSEPHINE ST
Key:
No Stopping
No Parking
BZ Bus Zone
VARGA TRAFFIC PLANNING Pty Ltd
Traffic and Parking Consultants
EXISTING PARKING CONTROLS
FIGURE 8

Division 4 Self-contained dwellings

50 Standards that cannot be used to refuse development consent for self-contained dwellings

A consent authority must not refuse consent to a development application made pursuant to this Chapter for the carrying out of development for the purpose of a self-contained dwelling (including in-fill self-care housing and serviced self-care housing) on any of the following grounds:

(h) parking: if at least the following is provided:

(ii) 1 car space for each 5 dwellings where the development application is made by, or is made by a person jointly with, a social housing provider.

By way of comparison, Housing NSW nominates an off-street carparking rate of *1 space per 5 units* for social housing.

Another indication of the off-street parking rates which could be applied to the proposed development is provided by the Roads and Traffic Authority's publication *Guide to Traffic Generating Developments, Section 5 – Parking Requirements for Specific Land Uses (October 2002).*

The RTA *Guidelines* are based on extensive surveys of a wide range of land uses and nominates the following off-street parking requirements:

High Density Residential Flat Buildings (Metropolitan Sub-Regional Centres)

1 bedroom unit:	0.6 spaces per dwelling
2 bedroom unit:	0.9 spaces per dwelling
3 bedroom unit:	1.4 spaces per dwelling
Visitors:	1.0 space per 5 dwellings

Housing for Aged and Disabled Persons (Subsidised Self-Contained Units Development)

Residents:	1.0 space per 10 dwellings
Visitors:	1.0 space per 10 dwellings

The proposed development makes provision for off-street carparking facilities to be provided for the private dwellings as follows:

1 bedroom unit:	1.0 space per dwelling
2 bedroom unit:	1.5 spaces per dwelling
3 bedroom unit:	2.0 spaces per dwelling
Visitors:	1.0 space per 6 dwellings

Carparking for the social housing dwellings component of the development proposal is proposed to be provided at the rate of 1 space per 10 dwellings.

The provision of the off-street carparking as part of the development proposal in accordance with the above parking rates will result in off-street parking provisions being provided generally in accordance with the Council's Parking Code and the RTA *Guidelines*. Whilst the provision of visitor carparking is proposed at a slightly less than the rates recommended by the Council Parking Code and the RTA *Guidelines*, that visitor parking provision is considered to be satisfactory in this instance, given the ready availability of on-street carparking within the precinct.

The geometric design layout of the proposed carparking facilities will be designed to comply with the relevant requirements specified in the Standards Australia publication *Parking Facilities Part 1 - Off-Street Carparking AS2890.1* in respect of parking bay dimensions and aisle widths.

Bicycle Provisions

The bicycle parking requirements applicable to the development proposal are also specified in Council's *Development Control Plan No. 20 – Car Parking* document in the following terms:

Multi Unit Development	
Residents:	1.0 space per 5 dwellings
Visitors:	1.0 space per 10 dwellings

It should be noted that neither Council's *DCP* nor the RTA *Guidelines* nominate a bicycle parking requirement for social housing for seniors. Application of the above bicycle rates to the 500 private housing dwellings outlined in the development proposal yields a requirement of 150 bicycle spaces as set out below:

Private Housing Residents:	100 spaces
Private Housing Visitors:	50 spaces
TOTAL:	**150 spaces**

The above requirements will be incorporated in to the detailed design plans for each stage of the development to achieve compliance with Council's Parking Code.

Loading/Servicing Provisions

The proposed Residential Renewal Project is expected to be serviced by a variety of vehicles up to and including 8.8m long rigid garbage trucks and occasionally by other trucks for furniture delivery/removalists and the like.

Garbage collection services are to be undertaken by a private contractor and the loading/servicing facilities to be provided for each of the proposed buildings is to be designed in consultation with the needs of the private contractor. These facilities may take the form of a dedicated loading dock, or an appropriate on-street loading space located in close proximity to the garbage rooms which are planned to serve each of the proposed buildings.

5. TRANSPORT PLANNING

Metropolitan Transport Plan - Connecting the City of Cities

The *Metropolitan Transport Plan - Connecting the City of Cities* sets out a 25 year vision for transport and landuse planning in the Sydney metropolitan area, including a 10-year fully funded package of transport infrastructure improvements. Those improvements include a number of measures which will increase the capacity of public transport services available to Riverwood residents, as follows:

- quadruplication of existing rail tracks between Kingsgrove and Revesby to enable express train services from south-western Sydney to operate on separate tracks, thereby allowing for improved capacity and reliability of local train services at Revesby

- implementation of the Western Express Rail Service to Western Sydney. This upgrade also provides future capacity to increase services from the south-west, including the Airport and East Hills Line

- provision for a new strategic bus corridor between Bankstown and Hurstville, with interchange between bus and rail at Narwee Station

- upgrading of Sydney's road network, including widening of the M5 Motorway.

NSW State Plan

The *NSW State Plan* identifies a number of transport planning initiatives including the upgrading the M5 Motorway and improvements to the public transport system such as the Western Express City Rail Service which will ultimately allow for increased capacity and reliability of train services to south-western Sydney, serving suburbs such as Riverwood.

Planning Guidelines for Walking and Cycling

The *Planning Guidelines for Walking and Cycling* identify a number of city-scale design principles that can assist the creation of walkable and cyclable cities and neighbourhoods.

These principles emphasise urban renewal and the creation of compact, mixed use, accessible centres around public transport stops. At the neighbourhood scale, design principles can be reinforced through the creation of local and accessible centres and neighbourhoods with connected street patterns and road design which aim to reinforce local walking and cycling networks.

In particular, the guidelines note that increased population density is an important element in creating a walkable and cyclable city. A compact development brings activities close together, making them more accessible by foot or by bicycle, without the need to use a car. Increased population density also enhances the viability of public transport services.

The Riverwood Residential Renewal Project is consistent with those objectives in that it seeks to provide increased population density in close proximity to existing public transport services which are accessible by walking or cycling. In addition, the provision of a number of new internal road links will improve the permeability of the neighbourhood for pedestrians and cyclists.

The Riverwood North Residential Renewal Project provides a number of opportunities to provide improved connections for walking and cycling using both the existing and proposed new road links to connect the existing shared pedestrian path and cycleway which traverses Salt Pan Creek Wetlands to the north of the site with the schools, shops and public transport services located to the south of the site.

Integrated Land Use and Transport Policy

The *Integrated Land Use and Transport Policy* encourages increased housing densities within an acceptable walking distance - 400 to 1,000m of major public transport land such as railway stations and high frequency bus routes to help moderate the demand for private car travel and to reduce the growth of VKT (Vehicle Kilometres Travelled).

The proposed development is consistent with those objectives in that it will result in increased population densities in an area which already has good access to public transport services as well as options for walking and cycling.

NSW Bike Plan

The *NSW Bike Plan* promotes cycling-friendly development decisions and notes that cycling is strongly influenced by the shape of our neighbourhoods. It encourages cycling-friendly developments concentrated in existing centres. Planning ahead to locate residential areas, community activities (such as schools, shops and services) close together, and next to cycleways, makes it more likely that a bicycle will be used to travel from one to the other.

The Riverwood North Residential Renewal Project is ideally placed in this regard in that it is located immediately adjacent to an established shared pedestrian/bicycle path, and is located approximately 650m from Riverwood Railway Station, shops and services such as banks, post office and the like. Careful planning of the proposed development will enable the Residential Renewal Project to further capitalise on its location by providing improve permeability through the neighbourhood, as well as improved pedestrian and bicycle pathways along the existing roads located within the neighbourhood.

Implementation of a Location Specific Sustainable Travel Plan

The proposed development provides the opportunity to provide a site specific sustainable travel plan which seeks to reduce dependence on private car travel. Key features of the sustainable travel plan could include (but are not limited to):

1. Establish high quality and efficient pedestrian and cycle links to existing routes to encourage travel by these modes
2. incorporate fibre/internet to the home for premises in an early state
3. community education to support public transport initiatives
4. provide a “How to Find Us” website facility with links to bus and train timetables etc
5. provide a “Handover Pack” to all new residents that identifies existing walking, cycling and public transport options available

6. CONCLUSION

This Transport and Accessibility Study has been prepared for *Housing NSW* and *Payce Communities Pty Ltd* to accompany a Concept Plan application to the Department of Planning for the proposed Riverwood North Residential Renewal Project which is located in Washington Avenue and Kentucky Road, Riverwood.

The Concept Plan envisages the staged construction of a new and revitalised residential area comprising a mixture of social and privately owned dwellings.

Approximately 650 dwellings are proposed, to replace the 176 existing multi-unit social housing and dwellings.

The foregoing assessment has found that:

- the site is ideally located in close proximity to a range of walking, cycling and public transport options

- the site is also located in easy walking/cycling distance of a range of shops and services, including banks, post office and primary schools

- two new road links proposed within the site will improve permeability for pedestrians and cyclists

- the site is also located immediately adjacent to a shared pedestrian and bicycle path with links to Bankstown, Padstow and Kingsgrove

- the proposed development will not have any unacceptable traffic implications in terms of road network capacity, and does not generate a need for any upgrades or road improvements, and

- the parking facilities incorporated in the development proposal will satisfactorily accommodate the needs of the proposed development

- the proposed development is consistent with the aims and objectives of the *Metropolitan Transport Plan - Connecting the City of Cities*, the *NSW State Plan*, the *NSW Planning Guidelines for Walking and Cycling*, the *Integrated Land Use and Transport Policy Package* and the *NSW Bike Plan*.

APPENDIX A

TRAFFIC SURVEY DATA

R.O.A.R. DATA

Reliable, Original & Authentic Results

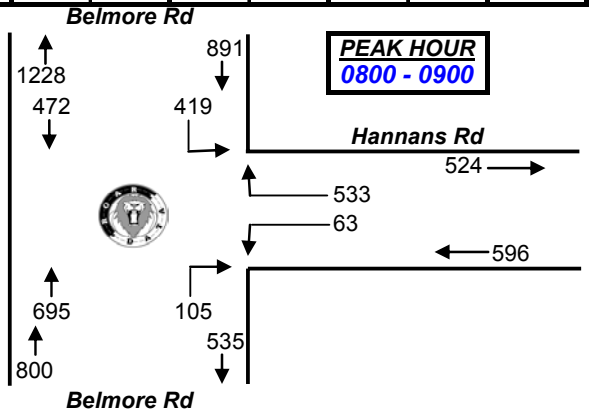
Ph.88196847, Fax 88196849, Mob.0418-239019

Client : Varga Traffic Planning
Job No/Name : 3344 RIVERWOOD Intersection Counts
Day/Date : Tuesday / 26th October 2010

All Vehicles

Time Per	NORTH Belmore Rd T	NORTH Belmore Rd L	EAST Hannans Rd R	EAST Hannans Rd L	SOUTH Belmore Rd R	SOUTH Belmore Rd T	TOTAL
0630 - 0645	81	91	86	5	12	133	**408**
0645 - 0700	96	89	85	13	26	139	**448**
0700 - 0715	59	99	103	12	19	171	**463**
0715 - 0730	98	71	114	6	19	168	**476**
0730 - 0745	70	85	132	5	18	175	**485**
0745 - 0800	80	100	150	5	21	213	**569**
0800 - 0815	99	101	126	6	27	200	**559**
0815 - 0830	107	105	141	13	29	194	**589**
0830 - 0845	120	118	132	21	28	143	**562**
0845 - 0900	146	95	134	23	21	158	**577**
0900 - 0915	106	92	80	20	17	159	**474**
0915 - 0930	94	99	87	20	17	134	**451**
Period End	**1156**	**1145**	**1370**	**149**	**254**	**1987**	**6061**

Peak Per	NORTH Belmore Rd T	NORTH Belmore Rd L	EAST Hannans Rd R	EAST Hannans Rd L	SOUTH Belmore Rd R	SOUTH Belmore Rd T	TOTAL
0630 - 0730	334	350	388	36	76	611	**1795**
0645 - 0745	323	344	434	36	82	653	**1872**
0700 - 0800	307	355	499	28	77	727	**1993**
0715 - 0815	347	357	522	22	85	756	**2089**
0730 - 0830	356	391	549	29	95	782	**2202**
0745 - 0845	406	424	549	45	105	750	**2279**
0800 - 0900	472	419	533	63	105	695	**2287**
0815 - 0915	479	410	487	77	95	654	**2202**
0830 - 0930	466	404	433	84	83	594	**2064**
PEAK HR	**472**	**419**	**533**	**63**	**105**	**695**	**2287**



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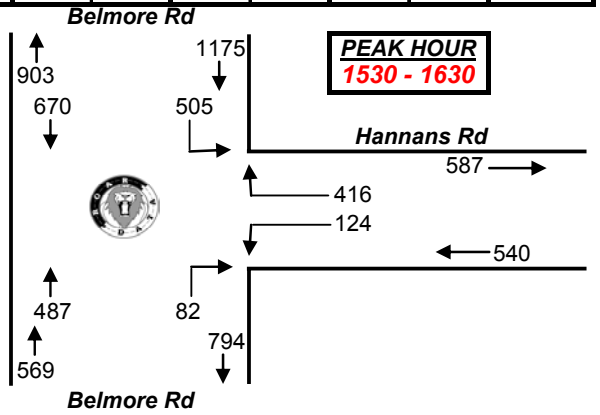
All Vehicles

Time Per	NORTH Belmore Rd T	NORTH Belmore Rd L	EAST Hannans Rd R	EAST Hannans Rd L	SOUTH Belmore Rd R	SOUTH Belmore Rd T	TOTAL
1530 - 1545	176	93	122	30	17	137	**575**
1545 - 1600	149	101	101	32	21	136	**540**
1600 - 1615	158	159	99	29	24	106	**575**
1615 - 1630	187	152	94	33	20	108	**594**
1630 - 1645	142	108	104	23	18	137	**532**
1645 - 1700	143	107	105	20	21	89	**485**
1700 - 1715	192	135	118	27	17	109	**598**
1715 - 1730	165	133	85	33	17	116	**549**
1730 - 1745	165	146	106	19	18	103	**557**
1745 - 1800	173	118	104	24	18	100	**537**
1800 - 1815	168	95	71	14	23	99	**470**
1815 - 1830	140	93	94	23	15	92	**457**
Period End	**1958**	**1440**	**1203**	**307**	**229**	**1332**	**6469**

Peak Per	NORTH Belmore Rd T	NORTH Belmore Rd L	EAST Hannans Rd R	EAST Hannans Rd L	SOUTH Belmore Rd R	SOUTH Belmore Rd T	TOTAL
1530 - 1630	670	505	416	124	82	487	**2284**
1545 - 1645	636	520	398	117	83	487	**2241**
1600 - 1700	630	526	402	105	83	440	**2186**
1615 - 1715	664	502	421	103	76	443	**2209**
1630 - 1730	642	483	412	103	73	451	**2164**
1645 - 1745	665	521	414	99	73	417	**2189**
1700 - 1800	695	532	413	103	70	428	**2241**
1715 - 1815	671	492	366	90	76	418	**2113**
1730 - 1830	646	452	375	80	74	394	**2021**
PEAK HR	**670**	**505**	**416**	**124**	**82**	**487**	**2284**



R.O.A.R. DATA

Reliable, Original & Authentic Results

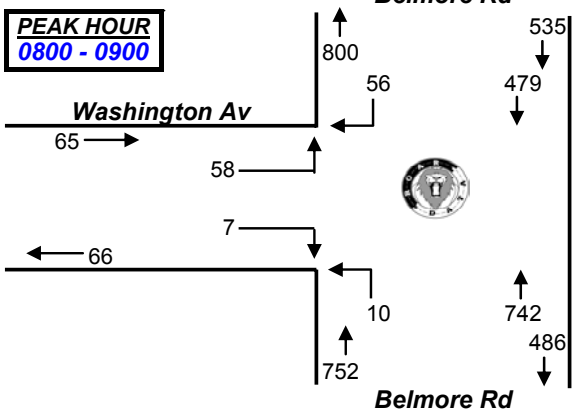
Ph.88196847, Fax 88196849, Mob.0418-239019

Client : Varga Traffic Planning
Job No/Name : 3344 RIVERWOOD Intersection Counts
Day/Date : Tuesday / 26th October 2010

All Vehicles

Time Per	NORTH Belmore Rd R	NORTH Belmore Rd T	WEST Washington Av L	WEST Washington Av R	SOUTH Belmore Rd L	SOUTH Belmore Rd T	TOTAL
0630 - 0645	0	86	10	0	0	135	**231**
0645 - 0700	2	107	5	0	0	160	**274**
0700 - 0715	3	68	7	3	1	183	**265**
0715 - 0730	9	95	8	1	0	179	**292**
0730 - 0745	2	73	8	2	1	185	**271**
0745 - 0800	5	80	11	1	0	223	**320**
0800 - 0815	8	97	12	1	1	215	**334**
0815 - 0830	12	108	20	1	2	203	**346**
0830 - 0845	21	120	14	2	2	157	**316**
0845 - 0900	15	154	12	3	5	167	**356**
0900 - 0915	9	117	20	1	4	156	**307**
0915 - 0930	14	100	13	1	3	138	**269**
Period End	**100**	**1205**	**140**	**16**	**19**	**2101**	**3581**

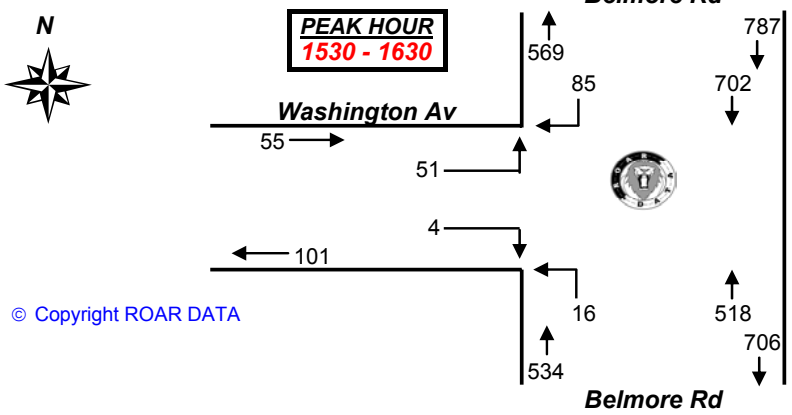
Peak Per	NORTH Belmore Rd R	NORTH Belmore Rd T	WEST Washington Av L	WEST Washington Av R	SOUTH Belmore Rd L	SOUTH Belmore Rd T	TOTAL
0630 - 0730	14	356	30	4	1	657	**1062**
0645 - 0745	16	343	28	6	2	707	**1102**
0700 - 0800	19	316	34	7	2	770	**1148**
0715 - 0815	24	345	39	5	2	802	**1217**
0730 - 0830	27	358	51	5	4	826	**1271**
0745 - 0845	46	405	57	5	5	798	**1316**
0800 - 0900	56	479	58	7	10	742	**1352**
0815 - 0915	57	499	66	7	13	683	**1325**
0830 - 0930	59	491	59	7	14	618	**1248**
PEAK HR	**56**	**479**	**58**	**7**	**10**	**742**	**1352**



All Vehicles

Time Per	NORTH Belmore Rd R	NORTH Belmore Rd T	WEST Washington Av L	WEST Washington Av R	SOUTH Belmore Rd L	SOUTH Belmore Rd T	TOTAL
1530 - 1545	24	184	8	1	2	146	**365**
1545 - 1600	20	157	17	0	4	140	**338**
1600 - 1615	18	166	13	1	5	117	**320**
1615 - 1630	23	195	13	2	5	115	**353**
1630 - 1645	21	150	18	0	2	137	**328**
1645 - 1700	14	151	5	2	1	105	**278**
1700 - 1715	15	200	8	1	3	118	**345**
1715 - 1730	21	173	16	2	1	117	**330**
1730 - 1745	19	173	14	3	2	107	**318**
1745 - 1800	14	181	14	2	2	104	**317**
1800 - 1815	13	177	14	4	1	108	**317**
1815 - 1830	6	150	9	4	3	98	**270**
Period End	**208**	**2057**	**149**	**22**	**31**	**1412**	**3879**

Peak Per	NORTH Belmore Rd R	NORTH Belmore Rd T	WEST Washington Av L	WEST Washington Av R	SOUTH Belmore Rd L	SOUTH Belmore Rd T	TOTAL
1530 - 1630	85	702	51	4	16	518	**1376**
1545 - 1645	82	668	61	3	16	509	**1339**
1600 - 1700	76	662	49	5	13	474	**1279**
1615 - 1715	73	696	44	5	11	475	**1304**
1630 - 1730	71	674	47	5	7	477	**1281**
1645 - 1745	69	697	43	8	7	447	**1271**
1700 - 1800	69	727	52	8	8	446	**1310**
1715 - 1815	67	704	58	11	6	436	**1282**
1730 - 1830	52	681	51	13	8	417	**1222**
PEAK HR	**85**	**702**	**51**	**4**	**16**	**518**	**1376**



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Job No/Name : 3344 RIVERWOOD Intersection Counts
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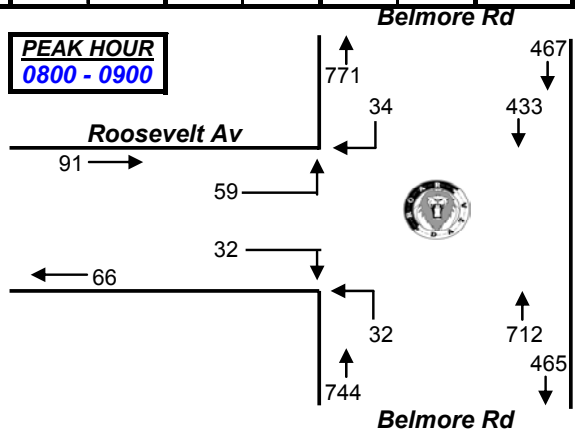
All Vehicles

Time Per	NORTH Belmore Rd R	NORTH Belmore Rd T	WEST Roosevelt Av L	WEST Roosevelt Av R	SOUTH Belmore Rd L	SOUTH Belmore Rd T	TOTAL
0630 - 0645	0	91	9	3	5	137	**245**
0645 - 0700	1	101	6	4	1	162	**275**
0700 - 0715	2	77	6	0	3	180	**268**
0715 - 0730	2	74	7	3	2	165	**253**
0730 - 0745	2	77	15	5	3	184	**286**
0745 - 0800	1	69	9	6	4	195	**284**
0800 - 0815	6	93	13	5	9	199	**325**
0815 - 0830	9	98	21	12	13	195	**348**
0830 - 0845	11	103	12	7	4	145	**282**
0845 - 0900	8	139	13	8	6	173	**347**
0900 - 0915	10	109	7	8	6	159	**299**
0915 - 0930	8	104	11	7	2	144	**276**
Period End	**60**	**1135**	**129**	**68**	**58**	**2038**	**3488**

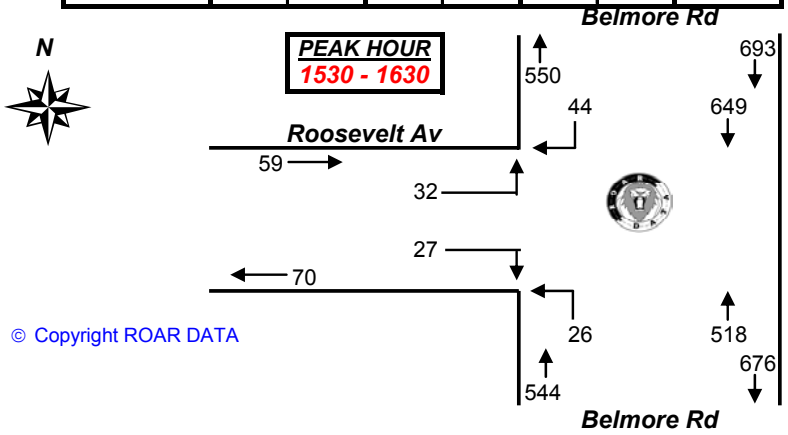
Peak Per	NORTH Belmore Rd R	NORTH Belmore Rd T	WEST Roosevelt Av L	WEST Roosevelt Av R	SOUTH Belmore Rd L	SOUTH Belmore Rd T	TOTAL
0630 - 0730	5	343	28	10	11	644	**1041**
0645 - 0745	7	329	34	12	9	691	**1082**
0700 - 0800	7	297	37	14	12	724	**1091**
0715 - 0815	11	313	44	19	18	743	**1148**
0730 - 0830	18	337	58	28	29	773	**1243**
0745 - 0845	27	363	55	30	30	734	**1239**
0800 - 0900	34	433	59	32	32	712	**1302**
0815 - 0915	38	449	53	35	29	672	**1276**
0830 - 0930	37	455	43	30	18	621	**1204**
PEAK HR	**34**	**433**	**59**	**32**	**32**	**712**	**1302**



All Vehicles

Time Per	NORTH Belmore Rd R	NORTH Belmore Rd T	WEST Roosevelt Av L	WEST Roosevelt Av R	SOUTH Belmore Rd L	SOUTH Belmore Rd T	TOTAL
1530 - 1545	7	181	4	6	8	141	**347**
1545 - 1600	11	145	13	5	7	145	**326**
1600 - 1615	9	167	8	11	5	113	**313**
1615 - 1630	17	156	7	5	6	119	**310**
1630 - 1645	10	137	9	7	12	147	**322**
1645 - 1700	11	145	6	8	5	104	**279**
1700 - 1715	9	184	14	8	6	124	**345**
1715 - 1730	12	145	10	2	9	101	**279**
1730 - 1745	13	158	7	6	14	107	**305**
1745 - 1800	5	167	6	6	2	98	**284**
1800 - 1815	5	183	12	3	5	96	**304**
1815 - 1830	2	143	2	3	4	93	**247**
Period End	**111**	**1911**	**98**	**70**	**83**	**1388**	**3661**

Peak Per	NORTH Belmore Rd R	NORTH Belmore Rd T	WEST Roosevelt Av L	WEST Roosevelt Av R	SOUTH Belmore Rd L	SOUTH Belmore Rd T	TOTAL
1530 - 1630	44	649	32	27	26	518	**1296**
1545 - 1645	47	605	37	28	30	524	**1271**
1600 - 1700	47	605	30	31	28	483	**1224**
1615 - 1715	47	622	36	28	29	494	**1256**
1630 - 1730	42	611	39	25	32	476	**1225**
1645 - 1745	45	632	37	24	34	436	**1208**
1700 - 1800	39	654	37	22	31	430	**1213**
1715 - 1815	35	653	35	17	30	402	**1172**
1730 - 1830	25	651	27	18	25	394	**1140**
PEAK HR	**44**	**649**	**32**	**27**	**26**	**518**	**1296**



R.O.A.R. DATA

Reliable, Original & Authentic Results

Ph.88196847, Fax 88196849, Mob.0418-239019

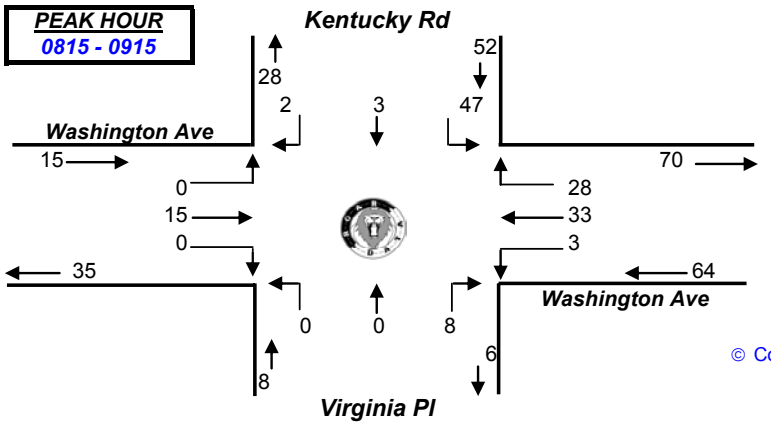
Client : Varga Traffic Planning
Job No/Name : 3344 RIVERWOOD Intersection Counts
Day/Date : Tuesday / 26th October 2010

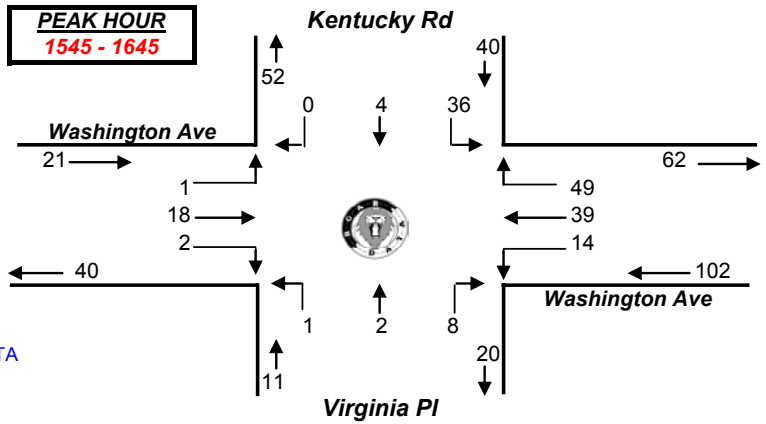
All Vehicles	NORTH Kentucky Rd			WEST Washington Ave			SOUTH Virginia Pl			EAST Washington Ave			
Time Per	L	T	R	L	T	R	L	T	R	L	T	R	TOT
0630 - 0645	5	0	0	0	3	0	0	0	1	0	1	0	**10**
0645 - 0700	5	0	0	0	1	0	0	0	0	1	0	2	**9**
0700 - 0715	8	0	0	0	2	0	0	0	0	1	1	2	**14**
0715 - 0730	6	0	0	0	1	0	0	0	1	2	3	4	**17**
0730 - 0745	6	0	1	0	3	0	0	0	2	1	2	2	**17**
0745 - 0800	8	0	0	0	4	0	0	0	0	1	2	2	**17**
0800 - 0815	6	1	0	0	5	1	0	1	1	3	4	2	**24**
0815 - 0830	14	2	0	0	3	0	0	0	3	0	8	6	**36**
0830 - 0845	7	0	0	0	3	0	0	0	3	2	14	7	**36**
0845 - 0900	7	0	2	0	6	0	0	0	1	1	9	8	**34**
0900 - 0915	19	1	0	0	3	0	0	0	1	0	2	7	**33**
0915 - 0930	5	2	0	1	6	0	0	0	3	1	11	5	**34**
Period End	**96**	**6**	**3**	**1**	**40**	**1**	**0**	**1**	**16**	**13**	**57**	**47**	**281**

All Vehicles	NORTH Kentucky Rd			WEST Washington Ave			SOUTH Virginia Pl			EAST Washington Ave			
Time Per	L	T	R	L	T	R	L	T	R	L	T	R	TOT
1530 - 1545	6	2	1	2	1	0	0	0	0	0	8	17	**37**
1545 - 1600	13	0	0	1	5	2	0	1	2	1	11	16	**52**
1600 - 1615	5	2	0	0	5	0	1	0	1	3	9	8	**34**
1615 - 1630	11	1	0	0	3	0	0	1	3	3	13	12	**47**
1630 - 1645	7	1	0	0	5	0	0	0	2	7	6	13	**41**
1645 - 1700	5	2	0	0	2	0	0	0	0	6	3	5	**23**
1700 - 1715	7	1	1	0	3	0	0	0	1	1	5	13	**32**
1715 - 1730	9	0	0	0	8	0	0	1	0	4	10	11	**43**
1730 - 1745	10	0	0	0	0	0	1	0	4	2	7	13	**37**
1745 - 1800	10	2	0	0	4	0	0	0	0	1	4	11	**32**
1800 - 1815	10	0	2	0	4	0	0	0	2	0	6	7	**31**
1815 - 1830	10	0	0	0	3	0	2	0	0	1	2	6	**24**
Period End	**103**	**11**	**4**	**3**	**43**	**2**	**4**	**3**	**15**	**29**	**84**	**132**	**433**

	NORTH Kentucky Rd			WEST Washington Ave			SOUTH Virginia Pl			EAST Washington Ave			
Peak Time	L	T	R	L	T	R	L	T	R	L	T	R	TOT
0630 - 0730	24	0	0	0	7	0	0	0	2	4	5	8	**50**
0645 - 0745	25	0	1	0	7	0	0	0	3	5	6	10	**57**
0700 - 0800	28	0	1	0	10	0	0	0	3	5	8	10	**65**
0715 - 0815	26	1	1	0	13	1	0	1	4	7	11	10	**75**
0730 - 0830	34	3	1	0	15	1	0	1	6	5	16	12	**94**
0745 - 0845	35	3	0	0	15	1	0	1	7	6	28	17	**113**
0800 - 0900	34	3	2	0	17	1	0	1	8	6	35	23	**130**
0815 - 0915	47	3	2	0	15	0	0	0	8	3	33	28	**139**
0830 - 0930	38	3	2	1	18	0	0	0	8	4	36	27	**137**
PEAK HOUR	**47**	**3**	**2**	**0**	**15**	**0**	**0**	**0**	**8**	**3**	**33**	**28**	**139**

	NORTH Kentucky Rd			WEST Washington Ave			SOUTH Virginia Pl			EAST Washington Ave			
Peak Time	L	T	R	L	T	R	L	T	R	L	T	R	TOT
1530 - 1630	35	5	1	3	14	2	1	2	6	7	41	53	**170**
1545 - 1645	36	4	0	1	18	2	1	2	8	14	39	49	**174**
1600 - 1700	28	6	0	0	15	0	1	1	6	19	31	38	**145**
1615 - 1715	30	5	1	0	13	0	0	1	6	17	27	43	**143**
1630 - 1730	28	4	1	0	18	0	0	1	3	18	24	42	**139**
1645 - 1745	31	3	1	0	13	0	1	1	5	13	25	42	**135**
1700 - 1800	36	3	1	0	15	0	1	1	5	8	26	48	**144**
1715 - 1815	39	2	2	0	16	0	1	1	6	7	27	42	**143**
1730 - 1830	40	2	2	0	11	0	3	0	6	4	19	37	**124**
PEAK HOUR	**36**	**4**	**0**	**1**	**18**	**2**	**1**	**2**	**8**	**14**	**39**	**49**	**174**





R.O.A.R. DATA

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Client : Varga Traffic Planning

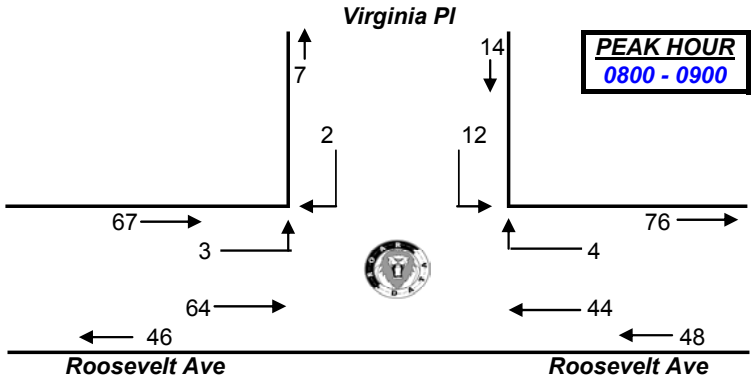
Job No/Name : 3344 RIVERWOOD Intersection Counts

Day/Date : Tuesday / 26th October 2010

All Vehicles

Time Per	WEST Roosevelt Ave L	WEST Roosevelt Ave T	NORTH Virginia Pl R	NORTH Virginia Pl L	EAST Roosevelt Ave T	EAST Roosevelt Ave R	TOTAL
0630 - 0645	0	13	0	0	5	0	**18**
0645 - 0700	0	6	0	2	2	0	**10**
0700 - 0715	0	6	1	1	3	0	**11**
0715 - 0730	0	10	0	1	1	0	**12**
0730 - 0745	0	16	0	1	4	0	**21**
0745 - 0800	0	12	0	1	2	1	**16**
0800 - 0815	0	10	2	4	9	1	**26**
0815 - 0830	1	21	0	2	12	1	**37**
0830 - 0845	1	16	0	4	14	1	**36**
0845 - 0900	1	17	0	2	9	1	**30**
0900 - 0915	0	8	1	1	9	1	**20**
0915 - 0930	1	14	0	3	8	0	**26**
Period End	**4**	**149**	**4**	**22**	**78**	**6**	**263**

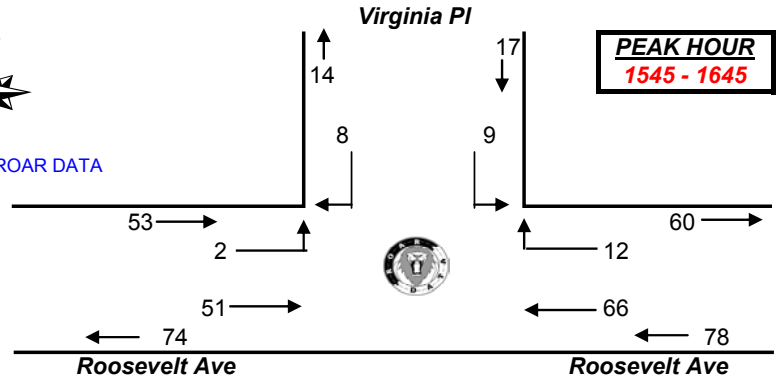
Peak Per	WEST Roosevelt Ave L	WEST Roosevelt Ave T	NORTH Virginia Pl R	NORTH Virginia Pl L	EAST Roosevelt Ave T	EAST Roosevelt Ave R	TOTAL
0630 - 0730	0	35	1	4	11	0	**51**
0645 - 0745	0	38	1	5	10	0	**54**
0700 - 0800	0	44	1	4	10	1	**60**
0715 - 0815	0	48	2	7	16	2	**75**
0730 - 0830	1	59	2	8	27	3	**100**
0745 - 0845	2	59	2	11	37	4	**115**
0800 - 0900	3	64	2	12	44	4	**129**
0815 - 0915	3	62	1	9	44	4	**123**
0830 - 0930	3	55	1	10	40	3	**112**
PEAK HR	**3**	**64**	**2**	**12**	**44**	**4**	**129**



All Vehicles

Time Per	WEST Roosevelt Ave L	WEST Roosevelt Ave T	NORTH Virginia Pl R	NORTH Virginia Pl L	EAST Roosevelt Ave T	EAST Roosevelt Ave R	TOTAL
1530 - 1545	0	7	1	3	13	1	**25**
1545 - 1600	1	15	2	1	15	4	**38**
1600 - 1615	0	16	1	3	9	1	**30**
1615 - 1630	1	12	3	2	20	3	**41**
1630 - 1645	0	8	2	3	22	4	**39**
1645 - 1700	0	9	3	5	13	1	**31**
1700 - 1715	0	13	0	3	11	2	**29**
1715 - 1730	0	9	0	3	21	1	**34**
1730 - 1745	1	13	1	1	13	1	**30**
1745 - 1800	0	7	1	2	6	1	**17**
1800 - 1815	1	12	0	1	5	2	**21**
1815 - 1830	1	6	0	0	5	1	**13**
Period End	**5**	**127**	**14**	**27**	**153**	**22**	**348**

Peak Per	WEST Roosevelt Ave L	WEST Roosevelt Ave T	NORTH Virginia Pl R	NORTH Virginia Pl L	EAST Roosevelt Ave T	EAST Roosevelt Ave R	TOTAL
1530 - 1630	2	50	7	9	57	9	**134**
1545 - 1645	2	51	8	9	66	12	**148**
1600 - 1700	1	45	9	13	64	9	**141**
1615 - 1715	1	42	8	13	66	10	**140**
1630 - 1730	0	39	5	14	67	8	**133**
1645 - 1745	1	44	4	12	58	5	**124**
1700 - 1800	1	42	2	9	51	5	**110**
1715 - 1815	2	41	2	7	45	5	**102**
1730 - 1830	3	38	2	4	29	5	**81**
PEAK HR	**2**	**51**	**8**	**9**	**66**	**12**	**148**



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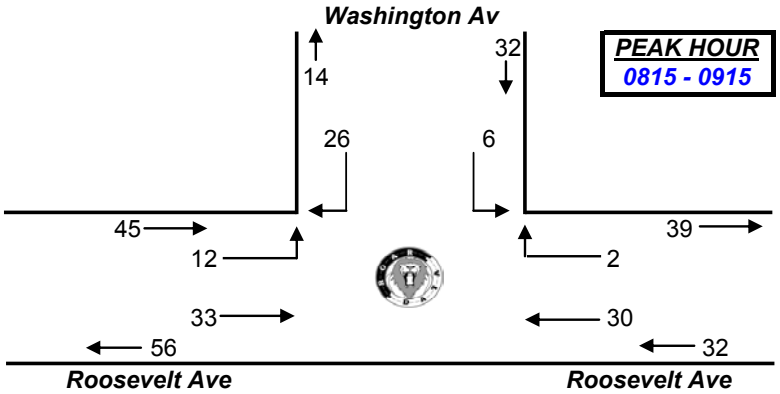
Job No/Name : 3344 RIVERWOOD Intersection Counts

Day/Date : Tuesday / 26th October 2010

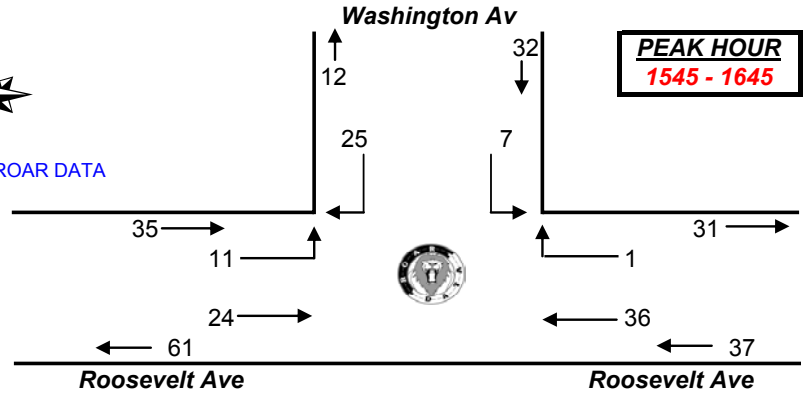
All Vehicles	WEST		NORTH		EAST		
	Roosevelt Ave		*Washington Av*		*Roosevelt Ave*		
Time Per	**L**	**T**	**R**	**L**	**T**	**R**	**TOTAL**
0630 - 0645	2	7	0	0	4	0	**13**
0645 - 0700	0	4	0	0	2	1	**7**
0700 - 0715	0	5	0	0	1	0	**6**
0715 - 0730	0	5	1	0	0	0	**6**
0730 - 0745	2	6	2	3	2	1	**16**
0745 - 0800	3	9	2	0	3	0	**17**
0800 - 0815	3	2	2	0	6	1	**14**
0815 - 0830	2	13	5	2	7	1	**30**
0830 - 0845	2	6	11	1	12	0	**32**
0845 - 0900	6	8	6	3	9	1	**33**
0900 - 0915	2	6	4	0	2	0	**14**
0915 - 0930	5	4	5	1	3	1	**19**
Period End	**27**	**75**	**38**	**10**	**51**	**6**	**207**

	WEST		NORTH		EAST		
	Roosevelt Ave		*Washington Av*		*Roosevelt Ave*		
Peak Per	**L**	**T**	**R**	**L**	**T**	**R**	**TOTAL**
0630 - 0730	2	21	1	0	7	1	**32**
0645 - 0745	2	20	3	3	5	2	**35**
0700 - 0800	5	25	5	3	6	1	**45**
0715 - 0815	8	22	7	3	11	2	**53**
0730 - 0830	10	30	11	5	18	3	**77**
0745 - 0845	10	30	20	3	28	2	**93**
0800 - 0900	13	29	24	6	34	3	**109**
0815 - 0915	12	33	26	6	30	2	**109**
0830 - 0930	15	24	26	5	26	2	**98**
PEAK HR	**12**	**33**	**26**	**6**	**30**	**2**	**109**



All Vehicles	WEST		NORTH		EAST		
	Roosevelt Ave		*Washington Av*		*Roosevelt Ave*		
Time Per	**L**	**T**	**R**	**L**	**T**	**R**	**TOTAL**
1530 - 1545	1	4	5	2	8	3	**23**
1545 - 1600	4	8	8	1	7	1	**29**
1600 - 1615	2	4	5	2	9	0	**22**
1615 - 1630	4	8	8	1	7	0	**28**
1630 - 1645	1	4	4	3	13	0	**25**
1645 - 1700	0	1	1	1	10	1	**14**
1700 - 1715	0	8	3	1	14	3	**29**
1715 - 1730	2	5	6	0	9	1	**23**
1730 - 1745	0	6	5	1	13	1	**26**
1745 - 1800	0	5	3	1	3	0	**12**
1800 - 1815	4	5	5	1	4	1	**20**
1815 - 1830	0	6	3	4	4	1	**18**
Period End	**18**	**64**	**56**	**18**	**101**	**12**	**269**

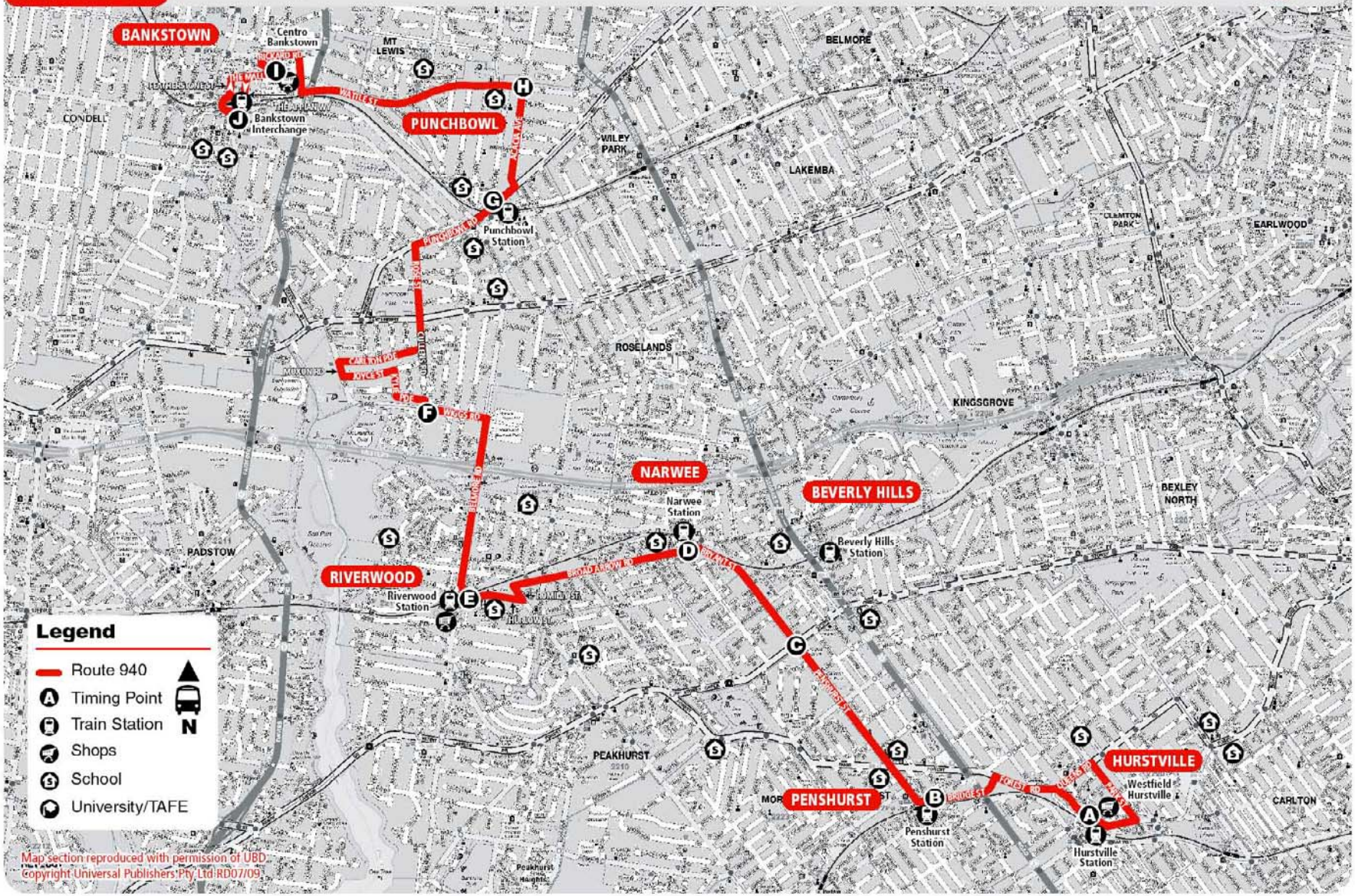
	WEST		NORTH		EAST		
	Roosevelt Ave		*Washington Av*		*Roosevelt Ave*		
Peak Per	**L**	**T**	**R**	**L**	**T**	**R**	**TOTAL**
1530 - 1630	11	24	26	6	31	4	**102**
1545 - 1645	11	24	25	7	36	1	**104**
1600 - 1700	7	17	18	7	39	1	**89**
1615 - 1715	5	21	16	6	44	4	**96**
1630 - 1730	3	18	14	5	46	5	**91**
1645 - 1745	2	20	15	3	46	6	**92**
1700 - 1800	2	24	17	3	39	5	**90**
1715 - 1815	6	21	19	3	29	3	**81**
1730 - 1830	4	22	16	7	24	3	**76**
PEAK HR	**11**	**24**	**25**	**7**	**36**	**1**	**104**



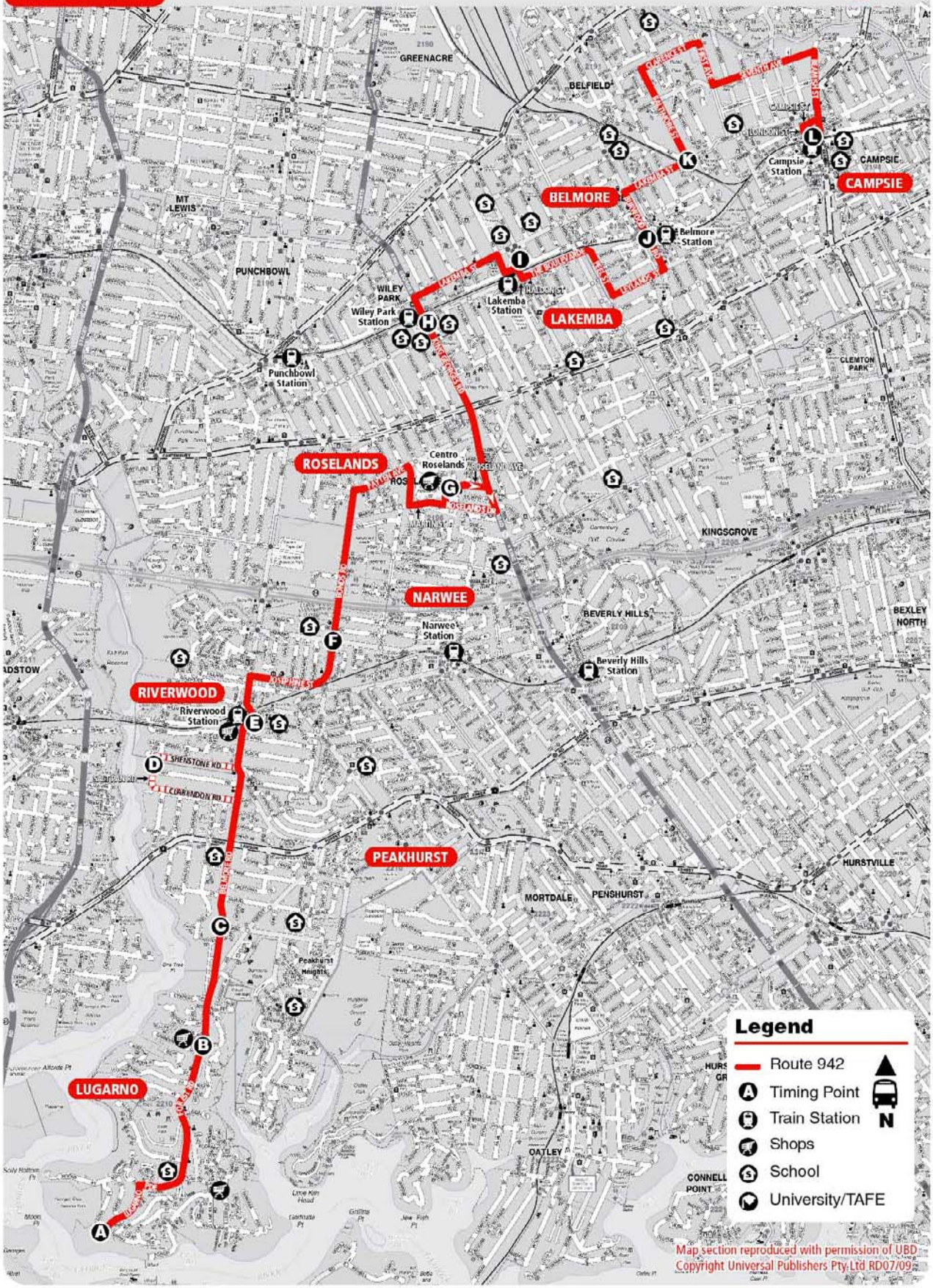
APPENDIX B

BUS ROUTE MAPS

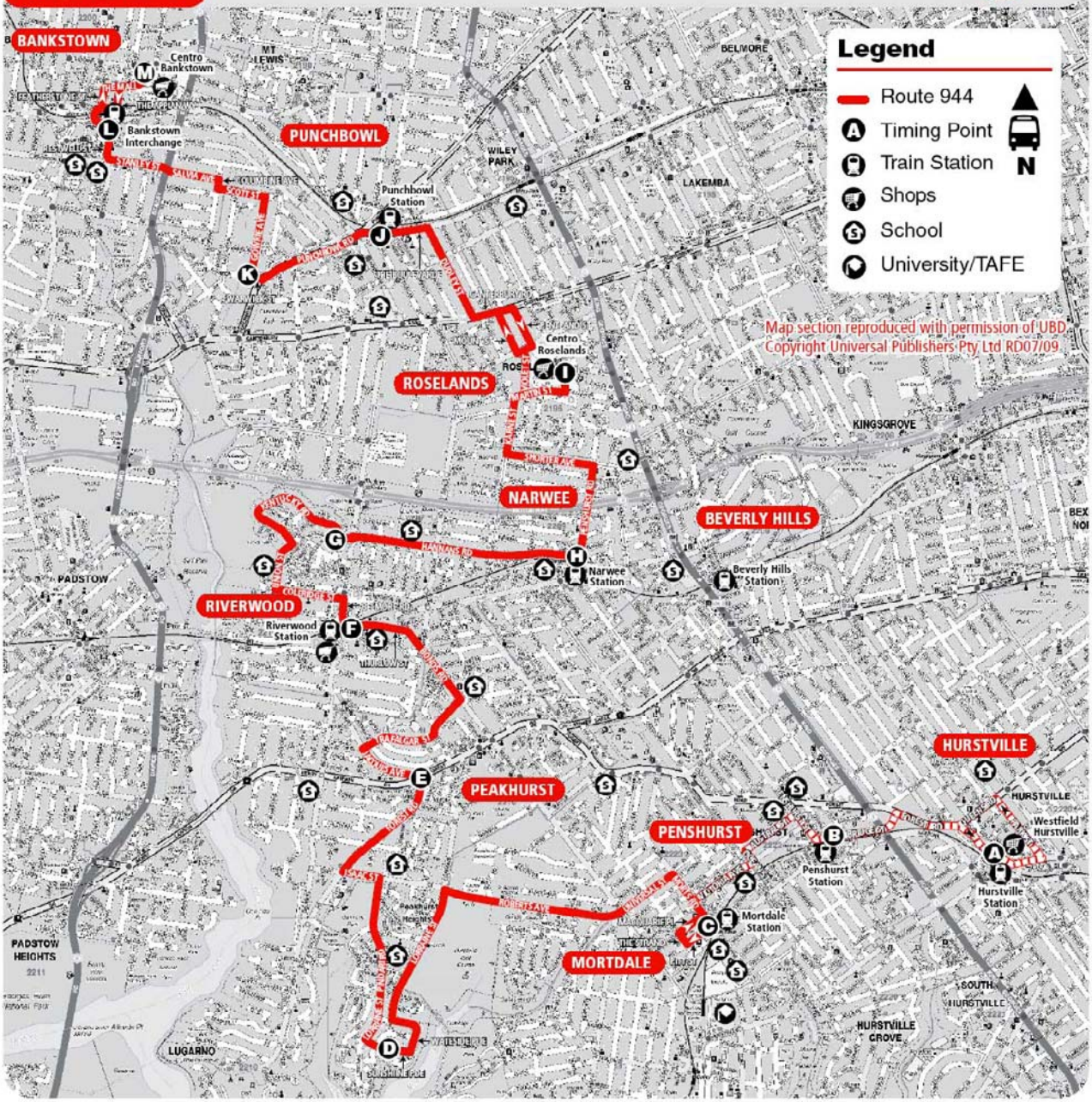
Route
940
Bus Route Map



Route
942
Bus Route Map



Route 944 Bus Route Map



Route 945 Bus Route Map