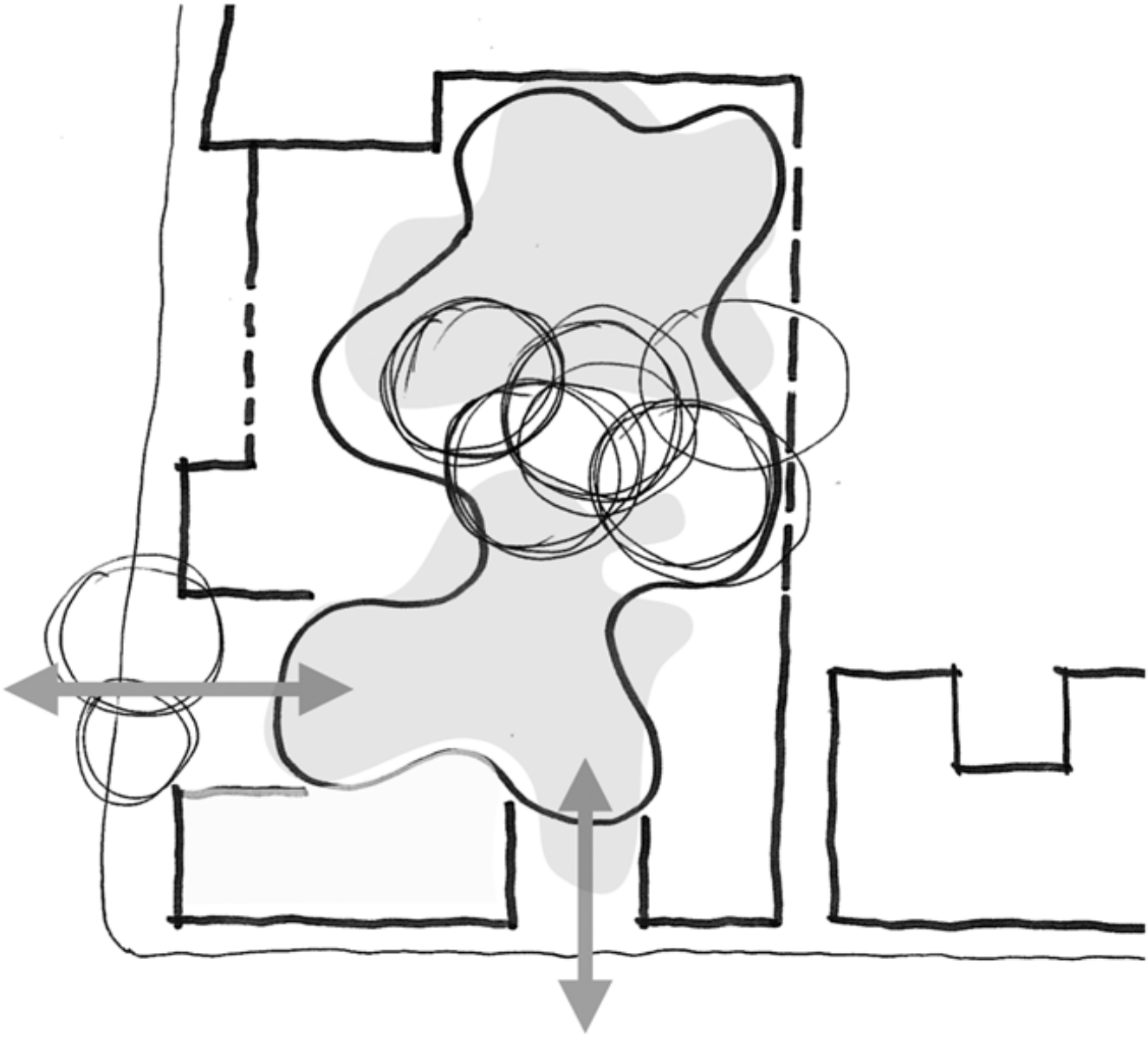
DARLINGTON PUBLIC SCHOOL REDEVELOPMENT

Appendix L — Transport Impact Assessment

SSD-9914

Prepared by TTPA

For NSW Department of Education



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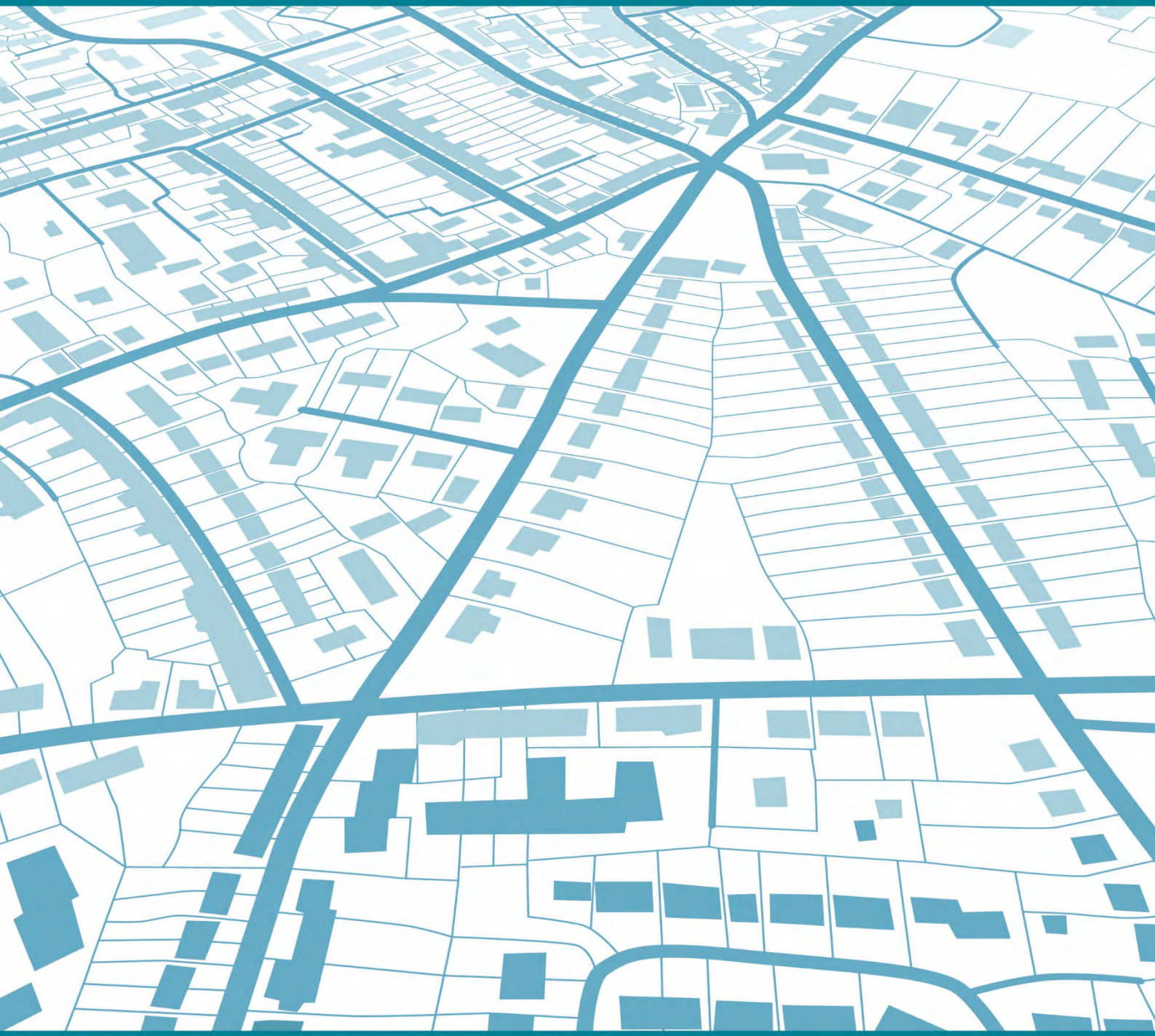

Darlington Public School
Proposed School Expansion

Transport Impact Assessment

Ref: 19043
Date: 28 May 2020
Issue: D

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1.0 Introduction

This report has been prepared to accompany an application to the Department of Planning for the proposed redevelopment of the existing Darlington Public School at Darlington (Figure 1).

Darlington Public School is an inner-city school servicing the suburbs of Chippendale, Darlington and parts of Redfern and is located at the corner of Golden Grove and Abercrombie Street in Darlington adjacent to the large Sydney University Campus.

The School accommodates some 250 students at the present time with an integrated preschool facility accommodating up to 60 children. A 'Scoping Study' has revealed that the school will not be able to accommodate the future enrolment demands arising from high density residential development in its catchment area. The proposed staged redevelopment will eventuate in a student population of 415 with associated increased staffing level from 15 to 25. The preschool will be relocated within the existing school campus.

The assessment outlined in this report addresses the Department of Planning issued SEARs in the following order:

SEARS Details	**Reference Section**
Accurate details of the current daily and peak hour vehicle, existing and future public transport networks and pedestrian and cycle movement provided on the road network located adjacent to the proposed development	Section 3.3 Section 3.4 Section 3.5
Details of estimated total daily and peak hour trips generated by the proposal, including vehicle, public transport, pedestrian and bicycle trips based on surveys of the existing and similar schools within the local area	Section 4.1 Section 4.2
The adequacy of existing public transport or any future public transport infrastructure within the vicinity of the site, pedestrian and bicycle networks and associated infrastructure to meet the likely future demand of the proposed development	Section 5.5 Section 5.6 Section 5.7

Measures to integrate the development with the existing/future public transport network	Section 5.5
The impact of trips generated by the development on nearby intersections, with consideration of the cumulative impacts from other approved developments in the vicinity, and the need/associated funding for, and details of, upgrades or road improvement works, if required (Traffic modelling is to be undertaken using SIDRA network modelling for current and future years)	Section 5.2 Section 5.3
The identification of infrastructure required to ameliorate any impacts on traffic efficiency and road safety impacts associated with the proposed development, including details on improvements required to affected intersections, additional school bus routes along bus capable roads (i.e. minimum 3.5 m wide travel lanes), additional bus stops or bus bays	Section 5.4 Section 5.6
Details of travel demand management measures to minimise the impact on general traffic and bus operations, including details of a location-specific sustainable travel plan (Green Travel Plan and specific Workplace travel plan) and the provision of facilities to increase the non-car mode share for travel to and from the site	Section 5.5 Section 9.1-9.9
The proposed walking and cycling access arrangements and connections to public transport services	Section 5.5
The proposed access arrangements, including car and bus pick-up/drop-off facilities, and measures to mitigate any associated traffic impacts and impacts on public transport, pedestrian and bicycle networks, including pedestrian crossings and refuges and speed control devices and zones	Section 7.1 Section 7.2
Proposed bicycle parking provision, including end of trip facilities, in secure, convenient, accessible areas close to main entries incorporating lighting and passive surveillance	Section 6.3 Section 7.2
Proposed number of on-site car parking spaces for teaching staff and visitors and corresponding compliance with existing parking codes and justification for the level of car parking provided on-site	Section 6.2

An assessment of the cumulative on-street parking impacts of cars and bus pick-up/drop-off, staff parking and any other parking demands associated with the development	Section 6.1
An assessment of road and pedestrian safety adjacent to the proposed development and the details of required road safety measures and personal safety in line with CPTED	Section 3.5
Emergency vehicle access, service vehicle access, delivery and loading arrangements and estimated service vehicle movements (including vehicle type and the likely arrival and departure times)	Section 7.4
The preparation of a preliminary Construction Traffic and Pedestrian Management Plan to demonstrate the proposed management of the impact in relation to construction traffic addressing the following: - assessment of cumulative impacts associated with other construction activities (if any) - an assessment of road safety at key intersection and locations subject to heavy vehicle construction traffic movements and high pedestrian activity - details of construction program detailing the anticipated construction duration and highlighting significant and milestone stages and events during the construction process - details of anticipated peak hour and daily construction vehicle movements to and from the site - details of on-site car parking and access arrangements of construction vehicles, construction workers to and from the site, emergency vehicles and service vehicle - details of temporary cycling and pedestrian access during construction.	Section 8.1-8.13

In preparing this Transport Impact Assessment, the following technical documents and guidelines are referred to and relied upon as required:

- An inspection of the site and its surrounds
- Travel mode surveys of the School's existing students/staff
- Standards Australia AS2890.1, 3 and 5
- Guide to Traffic Generating Developments (Roads and Maritime Services)
- NSW Planning Guidelines for Walking and Cycling
- Austroads Guide to Traffic Management Part 12: Traffic Impacts of Development

LEGEND

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LOCATION

FIG 1

2.0 Proposed Development

2.1 Site, Context, and Existing Use

The Darlington Public School ('School') campus is bounded by Darlington Lane to the north, Abercrombie Street to the south and Golden Grove Street to the west (Figure 2). The School is situated amongst the vast University of Sydney campus while there are small pockets of old terrace housing extending along the Abercrombie Street and Wilson Street frontages.

The School has a current enrolment of some 250 students and some 15 full-time equivalent (FTE) staff members. Students/pedestrian accesses to the School are provided at both the Golden Grove Street and Abercrombie Street frontages.

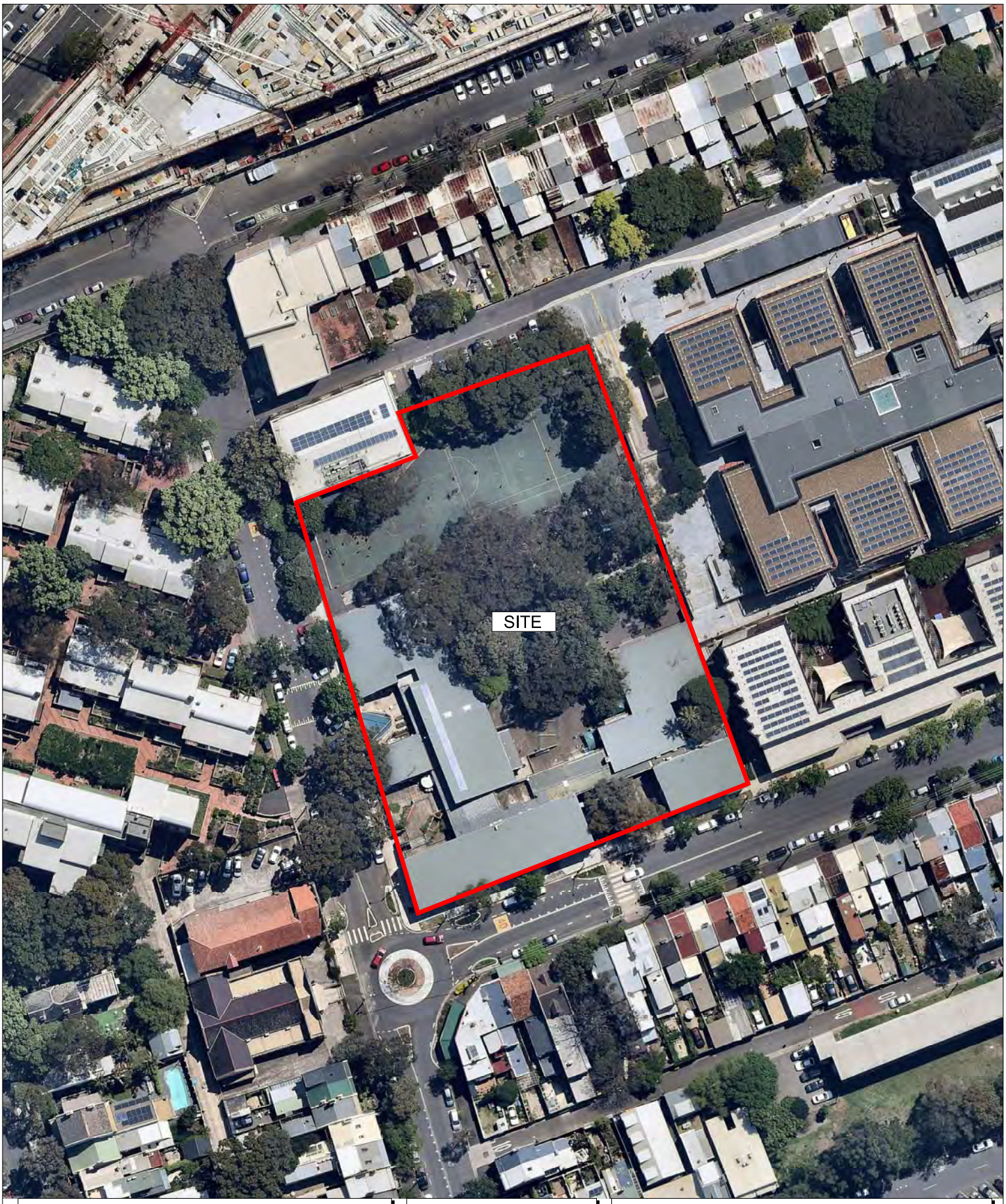
The School does not have onsite parking, however, appropriate signage (15-minute parking between 8.30am and 9.30am and 2.30pm and 4.30pm on school days) are in place to reserve for the School's use 3 set down and pick up spaces on Golden Grove Street and 2 at Abercrombie Street.

A school bus bay is also provided at the Golden Grove Street frontage with a 'No Parking (Buses Excepted 15 minutes) between 8.00am and 9.00am and 2.00pm and 4.00pm on school days' restriction.

2.2 Proposed Development

The proposal is for the demolition of the existing outmoded school buildings and construction of a suite of new and upgraded administrative and classroom facilities while the following operating parameters will be increased as follows:

- Student enrolment increased from 250 to 415 students
- FTE staff level to be increased from 15 to 25 persons
- Relocation of the existing preschool (capacity of 60 places to be retained)



LEGEND

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SITE

FIG 2

Along the road frontages, the following signage and traffic island changes are proposed to supplement the proposed upgrade:

Golden Grove Street

- 8 x Kiss and Ride only (parents remain in car) spaces between 8.30am and 9.30am and 2.30pm and 4.30pm on school days
- 3 x 15 minutes parking between 8.30am and 9.30am and 2.30pm and 4.30pm on school days
- 1 accessible x 15 minutes parking between 8.30am and 9.30am and 2.30pm and 4.30pm on school days
- 1 x Loading Bay between 9.30am and 2.30pm on school days to serve the needs of service vehicles and/or excursion buses

Abercrombie Street

- 3 x 15 minutes parking between 8.30am and 9.30am and 2.30pm and 4.30pm on school days

The School's pedestrian access locations at Golden Grove Street and Abercrombie Street will be retained. The existing service vehicle driveway on Golden Grove Street will be removed while the driveway on Abercrombie Street will be relocated further east to operate as an emergency vehicle access to the School campus.

In keeping with the City's planning principles and the Department of Education's operating principles, onsite carparking will continue to be prohibited in School campus with preference given to encouraging staff members/parents to utilise available public transport services.

Details of the proposed redevelopment outcome are shown on the master plans which are reproduced in Appendix A.

2.3 Surrounding Developments

Upon further enquiry and desktop research, a number of approved development projects which are located in close proximity of the School are incdicated as follows:

- **University of Sydney, Engineering and Technology Precinct**
  This development for which Stage 1 is currently under construction occupies a site with frontages to Shepherd Street and Maze Crescent which will be constructed in 3 stages. The Stage 1 development will comprise:

  - A new 10-level building
  - Refurbishment of the Elec. Eng. Building
  - Provision for 1,384 students and 88 staff
  - Deletion of 27 parking spaces.

- **University of Sydney, Darlington Road Terraces**
  This development which occupies a site bounded by Darlington Road and Darlington Lane has been approved and comprises:

  - 317 student accommodation rooms
  - Lecture theatre and study rooms
  - Lounge areas and recreational zones
  - Kitchen and laundries
  - No onsite parking

  In conjunction with this project, it is proposed to convert Darlington Lane into a Shared Zone with a one-way traffic movement. Separately, it is also advised that Darlington Road fronting the terraces will be closed in due course, thus restricting the terraces' access movements to the intersection of Darlington Road, Butlin Avenue and Codrington Street only. However, it is advised that these proposed traffic changes are yet to be approved.

It is pertinent to note that the above identified projects are consistent with the transport planning principles of City of Sydney i.e. minimal onsite parking provision or deletion

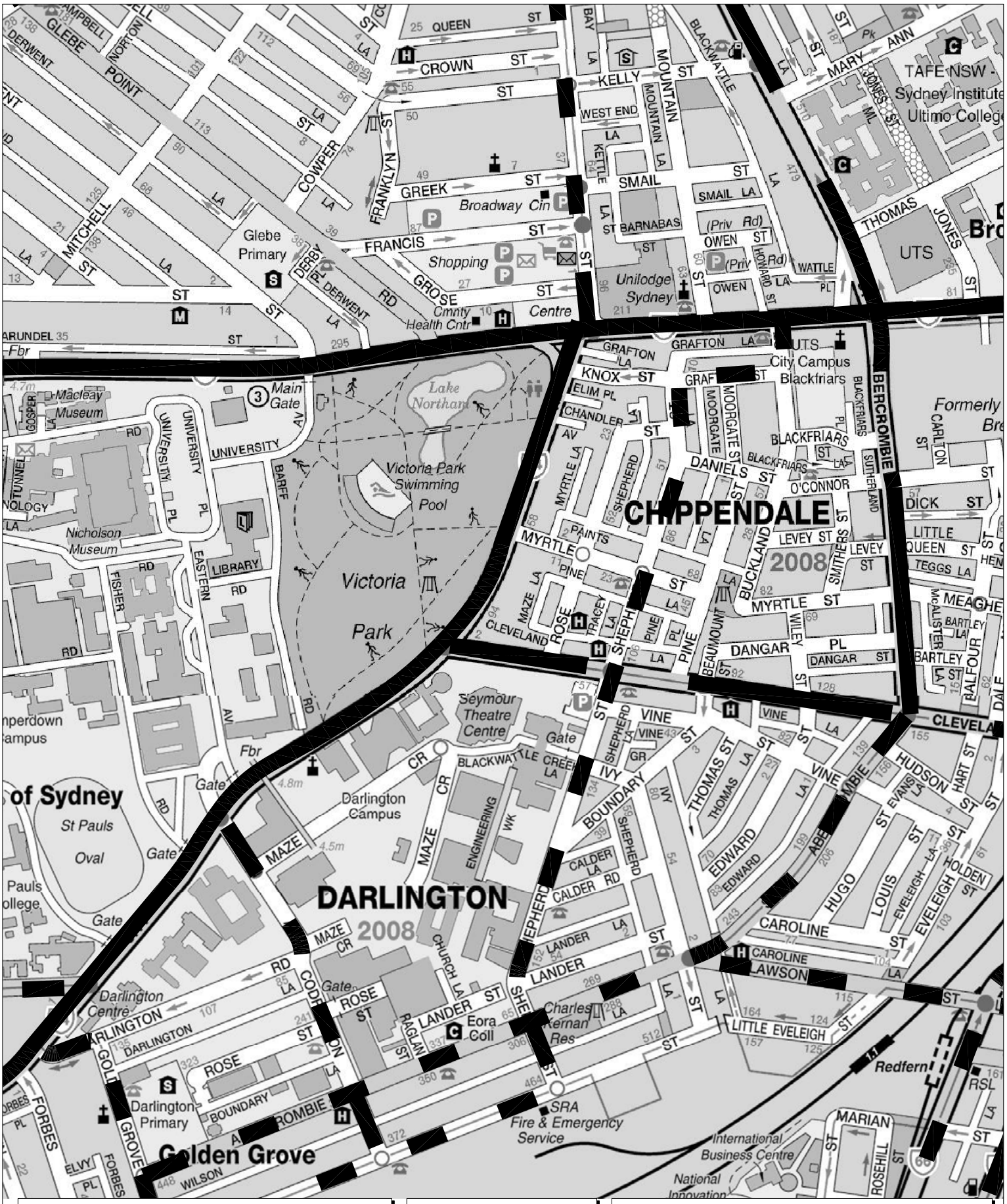
of existing parking spaces to encourage the uptake of available transport services which are already comprehensive in the University precinct.

3.0 Road Network, Traffic & Transport, Pedestrian Access

3.1 Road Network

The road network (Figure 2) serving the school comprises:

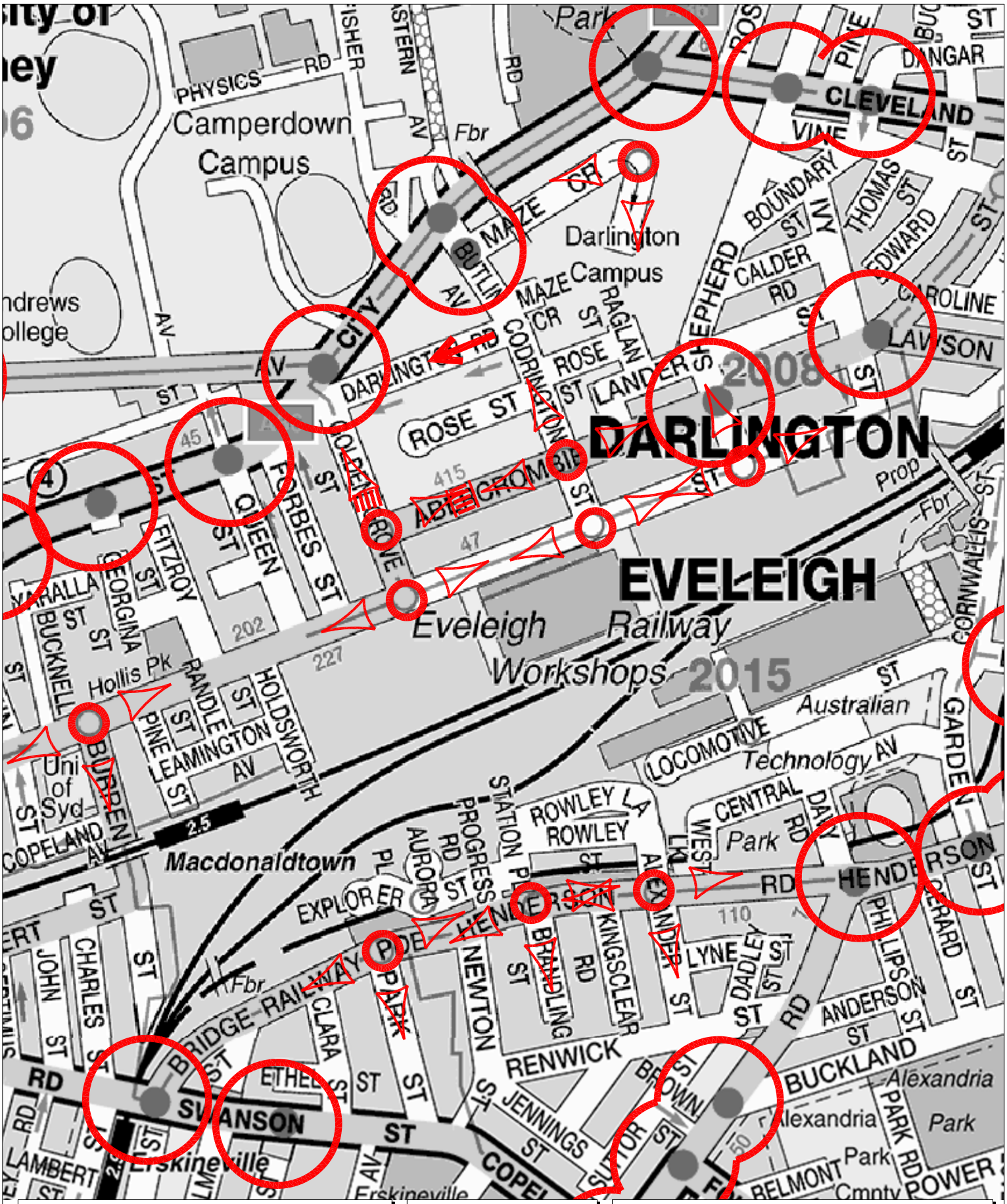
- Princes Highway (City Road/King Street) – a State Highway and north-south arterial route
- Great Western Highway (Parramatta Road/Broadway) – a State Highway and east-west arterial route
- Cleveland Street – a State Road and sub-arterial route linking between City Road and Anzac Parade
- Abercrombie Street (North of Cleveland Street) – a State Road and sub-arterial route
- Abercrombie Street (South of Cleveland Street) – a collector road route
- Wilson Street/Shepherd Street – a collector road route
- Darlington Road – a local road connecting between City Road to the west and Butlin Avenue to the east
- Golden Grove – a collector road route connecting between King Street and Wilson Street
- Codrington Street/Butlin Avenue – a collector road connecting between City Road and Wilson Street
- Darlington Lane – a service lane connecting between Codrington Street and Golden Grove


CHIPPENDALE
2008
DARLINGTON
2008
Victoria Park
Victoria Park Swimming Pool
Lake Northam
Darlington Campus
Seymour Theatre Centre
Darlington Centre
Darlington Primary
Golden Grove
Glebe Primary
Broadway Cin
Shopping Centre
Unilodge Sydney
UTS City Campus Blackfriars
TAFE NSW - Sydney Institute Ultimo College
Nicholson Museum
Macleay Museum
Main Gate
Eora Coll
Charles Kernan Res
SRA Fire & Emergency Service
International Business Centre
National Innovation
Redfern
RSL
Cmnty Health Cntr
QUEEN ST
CROWN ST
KELLY ST
GREEK ST
FRANCIS ST
GROSE ST
MITCHELL ST
COWPER ST
FRANKLYN ST
MOUNTAIN ST
BLACKWATTLE
MARY ANN ST
THOMAS JONES ST
UNIVERSITY
GRAFTON ST
KNOX ST
BERCROMBIE
MOORGATE ST
BLACKFRIARS
DANIELS ST
O'CONNOR
MYRTLE ST
LEVEY ST
BUCKLAND
BEAUMONT
DANGAR PL
CLEVELAND
VINE
IVY
BOUNDARY
THOMAS ST
EDWARD
HUGO
LOUIS
CAROLINE
LAWSON
LANDER
LITTLE EVELEIGH
MAZE
ROSE
DARLINGTON
BARTLEY
MEAGHER
DICK ST
LITTLE QUEEN ST
TEGGS LA
MARIAN
ROSEHILL
WILSON
FORBES
GROVE
ENGINEERING WK
CALDER RD
CHURCH LA
RAGLAN ST
HUDSON
HART ST
HOLDEN ST
EVELEIGH
BALFOUR
SUTHERLAND
CARLTON
SMITHERS ST
LEVEY ST
WILLEY
PAINTS
SHEPHERD
TRACEY
PINE
MAZE
BARFF
EASTERN
FISHER
LIBRARY
GOSPER
TUNNEL
NOLOGY
ARUNDEL
Fbr
Gate
St Pauls Oval
Pauls College
Sydney
Newtown Campus
Formerly Bre
Pk
ML
WEST END
SMAIL
SMAIL LA
ST BARNABAS
(Priv Rd)
OWEN ST
HOWARD ST
WATTLE PL
KETTLE
BAY LA
DERWENT RD
DERBY PL
GLEBE POINT
NORTON
CAMPBELL
ELIM PL
CHANDLER AV
MYRTLE LA
MAZE LA
ROSE LA
TRACEY LA
SHEPH LA
PINE PL
BEAUMONT ST
DANGAR ST
VINE LA
IVY LA
THOMAS LA
EDWARD LA
CALDER LA
LANDER LA
CAROLINE ST
LAWSON ST
LITTLE EVELEIGH ST
EVELEIGH LA
HUGO ST
LOUIS ST
HUDSON ST
HART ST
HOLDEN ST
BARTLEY LA
McALISTER LA
BALFOUR ST
SUTHERLAND ST
CARLTON ST
BLACKFRIARS PL
MOORGATE ST
GRAFTON LA
KNOX ST
ELIM PL
CHANDLER AV
MYRTLE LA
SHEPHERD ST
PAINTS

3.2 Traffic Controls

The traffic controls (Figure 3) on the road network in the vicinity of the school include:

- the roundabout at the intersection of Abercrombie Street and Golden Grove incorporating a pedestrian crossing across the northern arm of Golden Grove
- the “wombat” raised pedestrian crossing in Abercrombie Street in the centre of the school frontage
- the one-way south restriction on Darlington Road between Codrington Street and Golden Grove
- the raised platform on Golden Grove between Abercrombie Street and Darlington Road
- the traffic control signals (with ‘scramble” pedestrian phase) at the Abercrombie Street and Shepherd Street intersection
- the traffic control signals at the intersections of:
- City Road and Butlin Avenue
- Butlin Avenue and Maze Crescent
- Shepherd Street and Cleveland Street
- City Road and Carillon Avenue
- the roundabouts at intersections along Wilson Street
- the section of NO PARKING SCHOOL BUSES EXCEPTED 8am-9am and 2pm-4pm SCHOOL DAYS on Golden Grove along the eastern part of the school frontage
- the section of ¼P parking (60°) 8.30-9.30am and 2.30-3.30pm SCHOOL DAYS on Golden Grove along the western part of the school frontage
- the section of 1P parking and disabled parking on Abercrombie Street along the school frontage



LEGEND

- TRAFFIC SIGNAL CONTROL
- ROUNDABOUT
- RESTRICTED TURNING MOVEMENT

N

TRAFFIC CONTROLS

FIG 4

- the Light Traffic Thoroughfare restriction on all roads in the precinct including Abercrombie Street, Shepherd Street, Lawson Street and Ivy Street
- the 40 kmph School Zone speed limit restriction on both Abercrombie Street and Golden Grove Street in the vicinity of the Darlington Primary School

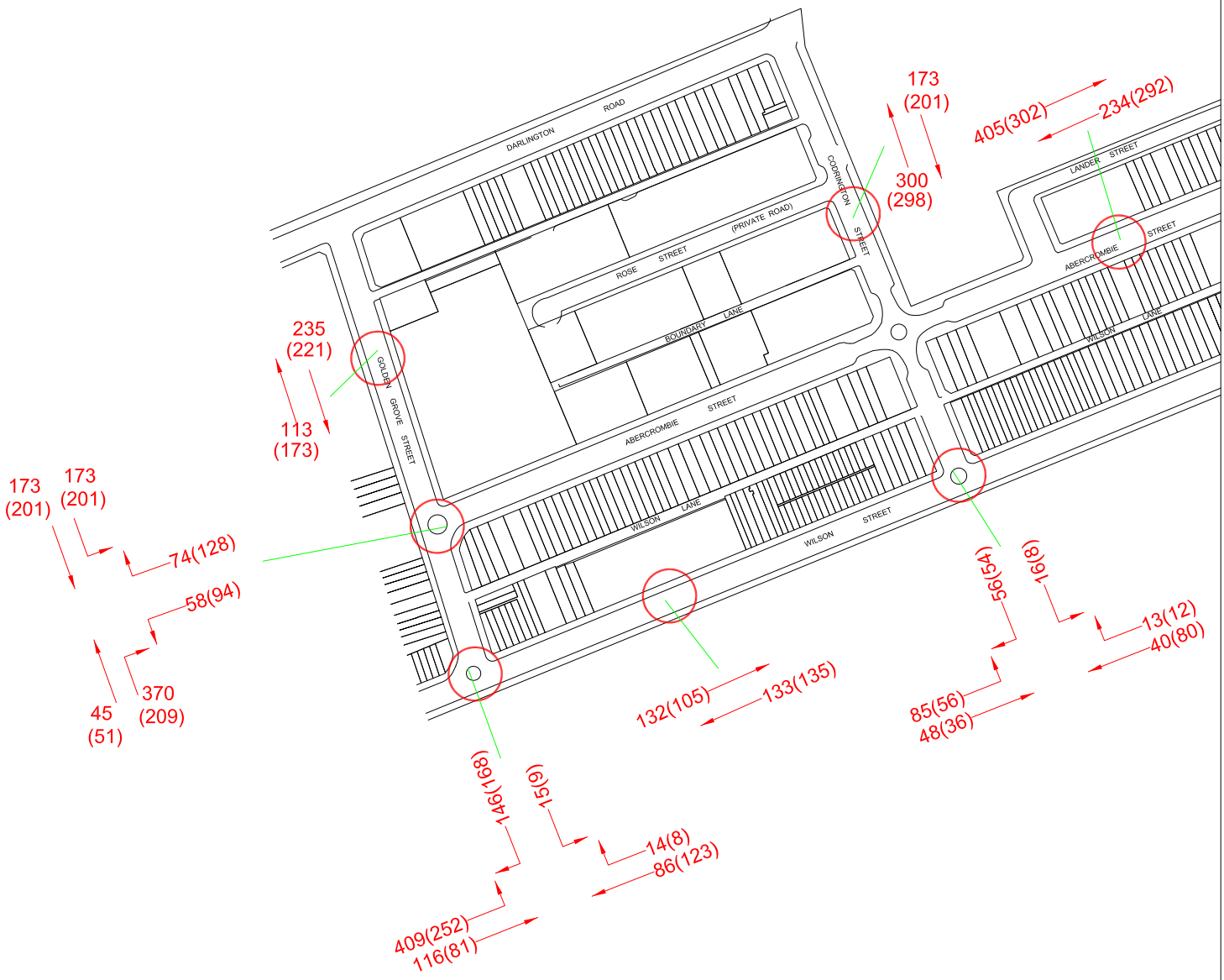
3.3 Traffic Conditions

Details of the prevailing traffic conditions on the road system serving the site are provided by data published by surveys undertaken as part of this study. The recorded peak traffic flows at the nearby intersections are indicated on Figure 5.

The operational performance of the key intersections (being King Street/Darlington Road and Golden Grove Street/Abercrombie Street intersections) have been assessed using the traffic modelling program SIDRA. The outcome of the TTPA assessment, which indicates a satisfactory level of service under prevailing peak traffic demand is provided in Appendix B and summarised as follows:

	AM Peak		**PM Peak**	
	LOS	**AVD**	**LOS**	**AVD**
King St/ Darlington Rd	A	9.5s	A	11.5s
Abercrombie St/ Golden Gr	A	8.6s	A	8.5s

The assessment indicates that the key intersections surrounding the site are currently operating with ample spare capacities. The existing levels of service (LOS) and average delays (AVD) indicate the network is currently operating with no undue constraint under peak traffic conditions.



LEGEND

123 - AM 8AM - 9AM

(123) - PM 5PM - 6PM

N

AM & PM WEEKDAY TRAFFIC VOLUMES

FIG 5

3.4 Transport Services

Bus Service

The site is advantaged by close proximity to the City Road bus route corridor which serves the needs of the University population extensively. The available bus routes at the City Road corridor are indicated in the following extract and service summary:

Source: Nearmap

Route	Details	Route	Details
352	Bondi Junction – Marrickville	M30	Sydenham – Mosman
370	Leichardt – Coogee	N10	CBD – Sutherland
422	CBD – Kogarah	N30	CBD – Macarthur
423	CBD – Kingsgrove	N40	CBD – East Hills
426	CBD – Dulwich Hill	L23	CBD – Kingsgrove
428	CBD – Dulwich Hill	L28	CBD – Canterbury

Trains

In addition to the extensive bus services, the site is located some 980m (12-15 minute walk/3-5 minute cycle) west of the Redfern Railway Station. Connection is provided via a dedicated shared path (cyclist and pedestrians along Wilson Street and Little Eveleigh Street) as shown in the following:

Source: Nearmap

A less frequently serviced railway station, Macdonaldtown station, which is also located within close proximity of the site, is situated some 800m to the west (10-12 minute walk/3-4 minute cycle). This railway station is also conveniently accessible via Golden Grove Street, Wilson Street and Burren Street as follows:

Source: Nearmap

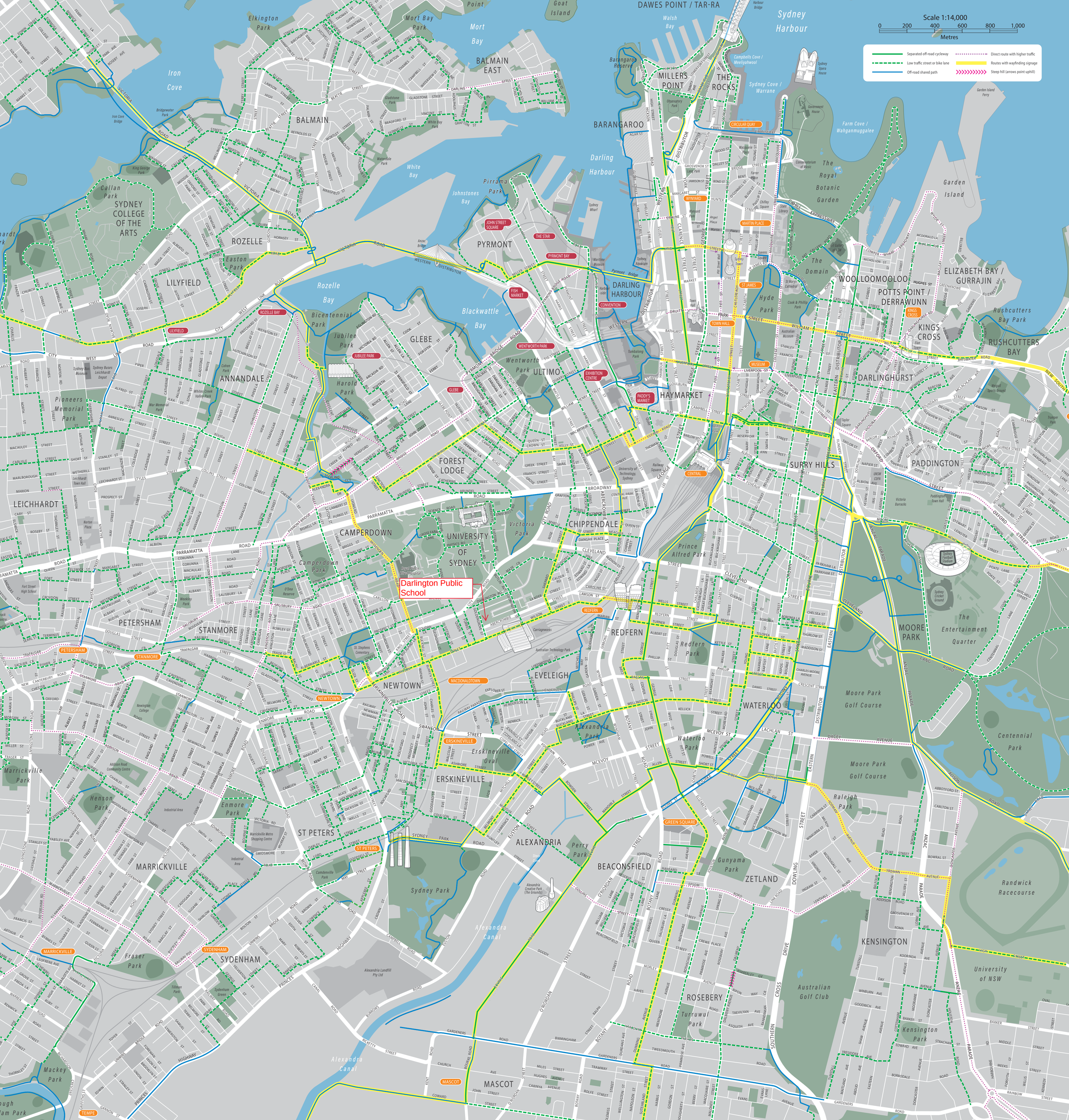
3.5 Pedestrian/Cycle Connectivity

Established footpaths are available in the surrounding street frontages providing convenient and direct connections between the School and the surrounding streets i.e. Darlington Road, Darlington Lane and Abercrombie Street further afield from the site. School students are also benefitted by the marked foot crossings available at both the Golden Grove Street and Abercrombie Street frontages (details below).

Source: Nearmap

The site is located within close proximity to both on and off-road cycling facilities. King Street, Darlington Road, Golden Grove Street and Abercrombie Street are identified in the Sydney Cycleways map as 'bicycle friendly roads'. In the immediate vicinity of the School, Wilson Street provides the added benefit of a dedicated Shared Cycleway

connecting the campus with the University, surrounding residences, as well as Macdonaldtown and Redfern Stations. Details of the comprehensive cycle paths available in the immediate and further surroundings are indicated on the City of Sydney published cycle map which is reproduced overleaf.


Scale 1:14,000
0 200 400 600 800 1,000
Metres
Separated off-road cycleway
Low traffic street or bike lane
Off-road shared path
Direct route with higher traffic
Routes with wayfinding signage
Steep hill (arrows point uphill)
Darlington Public School
Sydney Harbour
Darling Harbour
Rozelle Bay
Blackwattle Bay
White Bay
Johnstones Bay
Iron Cove
Mort Bay
Farm Cove / Wahganmuggalee
Sydney Cove / Warrane
Garden Island
Rushcutters Bay
Elizabeth Bay / Gurrajin
Darling Harbour
Millers Point
The Rocks
Barangaroo
Dawes Point / Tar-Ra
Circular Quay
Wynyard
Martin Place
St James
Town Hall
Museum
Central
Redfern
Green Square
Sydney Park
Alexandra Canal
Centennial Park
Randwick Racecourse
Moore Park Golf Course
University of NSW
Kensington Park
Bicentennial Park
Jubilee Park
Wentworth Park
Harold Park
Victoria Park
Prince Alfred Park
Redfern Park
Alexandria Park
Perry Park
Gunyama Park
Raleigh Park
Turruwul Park
Waterloo Park
Erskineville Oval
Camperdown Park
Pirrama Park
Mort Bay Park
Elkington Park
Callan Park
Easton Park
Cooper Park
Pioneers Memorial Park
Henson Park
Mackey Park
Marrickville Park
Fraser Park
Enmore Park
Tillman Park
Sydney Cricket Ground
Sydney Football Stadium
Australian Golf Club
The Entertainment Quarter
The Royal Botanic Garden
The Domain
Hyde Park
Sydney Opera House
Government House
Conservatorium of Music
Garden Island Ferry
Sydney Harbour Bridge
Sydney Buses Leichhardt Depot
Sydney Bus Museum
Sydney Fish Market
Sydney Aquarium
Sydney Tower
Sydney Wharf
Darling Harbour Convention Centre
Darling Harbour Exhibition Centre
Paddy's Market
Australian Museum
Australian Technology Park
Carriageworks
Alexandria Landfill Pty Ltd
Alexandria Creative Park (The Grounds)
Sydney Cricket Ground
Sydney Football Stadium
Sydney Buses Leichhardt Depot
Sydney Bus Museum
Sydney Central Station
Sydney Park
Sydney Cricket Ground
Sydney Football Stadium
Sydney Opera House
Sydney Harbour Bridge
Sydney Tower
Sydney Wharf
Sydney Aquarium
Sydney Fish Market

4.0 Travel Planning

4.1 Parking Demand

The School has a total of 5 set down/pick-up spaces, being 2 at the Abercrombie Street frontage and 3 at the Golden Grove Street frontage. Separately, there is a signposted school bus bay along the Golden Grove Street frontage.

To establish the existing traffic demand associated with the School, a survey of the set down and pick up spaces was commissioned in April 2019 which reveal the following 'turnover' during the School's morning and afternoon peaks:

AM	55 vehicles
PM	40 vehicles

4.2 Travel Mode Survey

To supplement the survey, a separate questionnaire was undertaken of the School's students and staff to identify their current mode of travel, i.e., by car, foot or public and active transport. Details of the survey outcome are provided in Appendix C and a summary of the current mode shares for students and staff shown are as follows:

	AM	**PM**
Walk	44.6%	41.2%
Bicycle/Scooter	28.5%	29.4%
Car	26.9%	20.6%
Bus	-	8.8%

The survey outcome indicates, quite clearly in the context of this School, that reliance on using vehicles to set down and pick up students is already lower than that typically observed in a suburban school. This is likely due to the locality of the School within a highly accessible area.

5.0 Traffic Impact Assessment

5.1 Traffic Generation

Traffic circumstances for schools in the metropolitan areas are generally dictated by the parents' mode of travel and set down/pick-up characteristics.

Based on the survey findings detailed in the preceding section, the School's traffic generation can be deduced as 0.27 vehicle movements per student in the AM peak and 0.21 vehicle movements per student in the PM peak.

Application of the above rates to the envisaged population of 415 students would therefore indicate the following potential traffic generation outcome:

AM 112 vehicle trips per hour
PM 87 vehicle trips per hour

And by comparison with the existing School:

	AM	**PM**
Existing	55	40
Post-Dev	112	87
Net Increase	**57**	**47**

Therefore, in the event that staff and parents' travel behaviour continue to occur in the existing manner, the post-development circumstance would likely result in additional traffic generation of up to 57 vtph during the School's peak periods.

5.2 Cumulative Traffic Impact

As detailed previously in Section 2.3 of this report, the key new land uses that will be within proximity of the School are:

- the Engineering and Technology Precinct building, University of Sydney
- the Darlington Terraces, University of Sydney

The new and upgraded Engineering and Technology building will have a reduction of 27 spaces while the student accommodation i.e. Darlington Terraces will have no onsite parking.

These developments having constrained onsite parking, coupled with limited unrestricted parking spaces in the immediate surroundings, will discourage vehicle ownership amongst residents. It follows that there will be limited vehicular traffic generation outcome associated with these developments. As such, the identified surrounding developments will not be expected to occasion an adverse cumulative traffic impact on the surrounding road network.

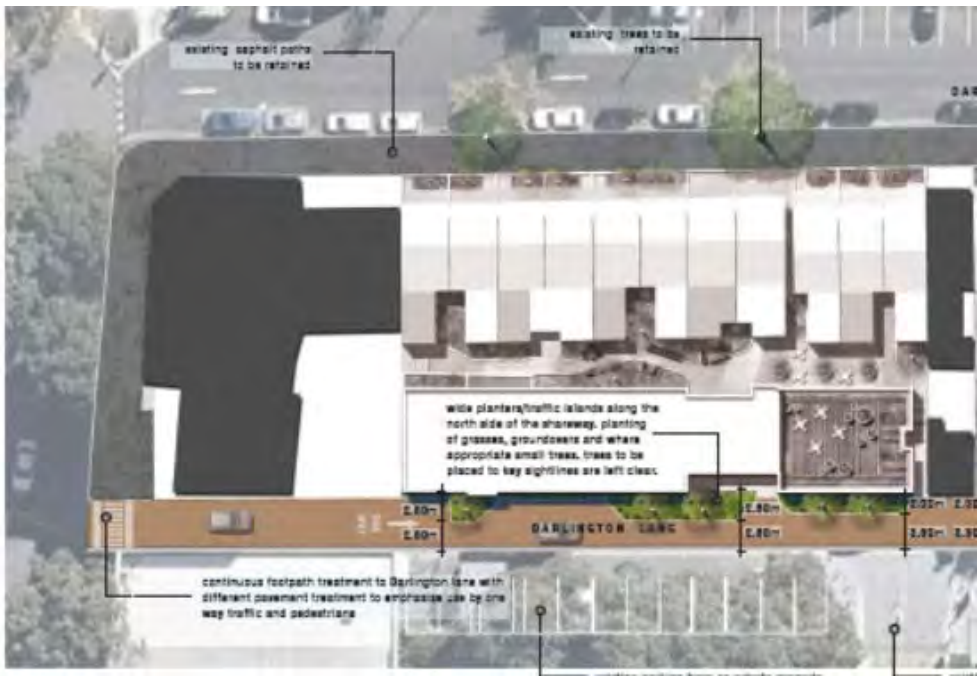
5.3 Traffic Impact due to Surrounding Changes

There are two proposals which will potentially alter the road and traffic operations in the vicinity of the site namely:

Darlington Lane Shared Zone

It is proposed to introduce a Shared Zone restriction with a one-way north traffic flow along Darlington Lane in conjunction with the proposed Darlington Terraces development (see details below).

Whilst it is subsequently advised that the proposed change is not yet formally approved by Council/TfNSW, it is nevertheless not anticipated that the conversion of this laneway to a Shared Zone will have any discernible adverse effect to the School's operation. On the contrary, if approved, the conversion to Shared Zone, i.e. a roadway where pedestrians have right of way over vehicles, will be seen as a positive outcome as the School will now be bounded by a pedestrian friendly laneway.



Source: SMEC Darlington Road Terraces TIA, April 2018

Construction Impact

Similarly, if approved, it is expected that the Darlington Road closure would restrict the School's construction vehicles to approach and depart from the site via the King Street – Darlington Road – Golden Grove Street route only. It is noted that Darlington Road is restricted for heavy vehicle access, however, dispensation could be sought from Council to gain access to the site on the basis that:

- the nominated route presents as a route of minimal impact to the surrounding residential dwellings;
- the nominated route presents as a route which is most directly connected to the arterial and sub-arterial network.

It is recommended that the principle agreement is sought from Council's Construction Regulations Team prior to construction.

5.4 Traffic Impact – Vehicular

To assess the potential traffic implications resulting from the School's redevelopment, the local road network is assessed using lane-based traffic modelling program SIDRA.

An even directional distribution between King Street and Abercrombie Street is adopted for the purpose of this assessment. On this basis, the existing and post-development outcome (Appendix B) are summarised in the following:

	AM		PM	
	LOS	**AVD**	**LOS**	**AVD**
Existing				
King St/Darlington Rd	A	9.5s	A	11.5s
Golden Gr/Abercrombie	A	8.6s	A	8.5s
Post-development				
King St/Darlington Rd	A	11.6s	A	13.0s
Golden Gr/Abercrombie	A	8.6s	A	8.4s

The assessment outcome indicates that the additional traffic movements resulting from the School expansion will maintain the existing network at LOS A. As such, it is assessed that the existing road network can accommodate the anticipated additional traffic demand with no undue capacity issue, thus there will be no additional road/traffic upgrade necessary to accommodate this development.

5.5 Traffic Impact – Bicycle and Pedestrian Facilities

The questionnaire survey reveals some 45% of school children walked to and from the School while some 30% rode a bicycle/scooter. If these rates of uptake are maintained in the upgraded School, then the additional pedestrians/cyclists will likely be:

Bicycle	+ 74 students
Foot	+ 50 students

To the extent that there are excellent foot path and cycle facilities available in the surrounding road network, the School does not currently have provision for onsite storage for bicycles/scooters for students/staff. It is understood that some parents ‘push’ their children’s bicycles/scooters to/from the School. In view of the above, it would be

prudent for the proposal to incorporate onsite storage for students/staff, noting that staff members will be further benefitted by onsite End of Trip facilities. The uptake of these facilities, including the ready public transport services that already exist in the vicinity of the School, can be collectively encouraged by the appropriate implementation of a Green Travel Plan, which includes a suitable Transport Access Guide. Section 9 of this assessment outlines such a document on a conceptual level.

5.6 Traffic Impact – Public Transport Facilities

The questionnaire survey reveals some 8.8% of school children travelled to/from the School using the available bus services. None was recorded to have arrived/departed by train. This is due to the factor of 'local school catchment' where students and their families are typically local residents who are within reasonable walking distances of the School. Nevertheless, observations made in the local bus/train services during the School's peak hours indicate that the services via Redfern Station are generally closer to capacity during the morning peak while the Macdonaldtown Station route was observed to operate with higher level of spare capacities. Buses are generally observed to be 'crowded' during the morning peak periods, however, the high frequency of those services (along City Road/King Street) appear to be capable of accommodating the peak demands with no undue difficulty. These public transport services are generally operating with ample spare capacities during the School's afternoon peak. It is expected that there will some level of uptake in terms of these available public transport services following the School's expansion, however, it is not anticipated this increment would be significant due to the location of the School (i.e. largely by staff members only). On this basis, it can be expected that the available public transport services will continue to serve the needs of the School adequately.

5.7 Safety Impact – Vehicle, Bicycles and Pedestrians

The proposal will result in additional traffic, pedestrians as well as bicycle/scooter riders. The traffic modelling assessment indicates the immediately surrounding intersection will continue to operate with level of service A following the School's expansion. Because there are generally quite limited increments to the respective intersections' average delays (i.e. the additional average delays experienced by road users), it is not expected

that driver behaviour will change drastically following the development. As the proposal seeks to discourage parents from travelling to/from the School using private vehicles, it is anticipated that the additional 'load' on the traffic network will be somewhat less than that which is assessed in Section 5.4. The additional children activities either in form of pedestrians or bicycles/scooters will be readily accommodated by the existing road traffic/crossing devices that exist in the surrounds of the School campus. On this basis, it is assessed that the proposal will not be expected to result in undue safety issue on the local road network for the 3 user groups.

6.0 Proposed Parking Arrangement

6.1 Capacity of Set Down and Pick Up Area

There are currently 5 set down and pick up spaces available for the School's use. Thus, the surveyed peak movements of 55 trips would indicate a 'service rate' of these spaces of some 11 cars per hour per space.

Because the proposed expansion is expected to result in an addition of up to 57 vehicles per hour, application of the calculated service rate would indicate an additional requirement of 5-6 spaces, thus a potential total demand of 13 set down and pick up spaces.

6.2 Car Parking

The Sydney LEP specifies a maximum permissible parking provision of 1 space plus 1 space per 100m^2 GFA of a building used for the purpose of accommodating childcare centre/preschool. As the proposed area for this purpose is 616m^2 GFA, the applicable maximum parking permissible to the preschool will be 7 spaces. Accordingly, provision is made on Golden Grove Street for 3 x 15-minute parking spaces and on Abercrombie Street for 3 x 15-minute parking spaces (including one accessible) for the School and preschool's use.

The Department of Education's policy is to not provide onsite parking for parents/carers, rather accommodating students' demands by appropriate provision of set down and pick up areas. It is understood, based on observations made in the vicinity of the School and advice from the School's management, that some parents tend to overstay the 15-minute parking spaces that are reserved for set down and pick up, thus occasionally result in constrained capacity during the School peak periods. To overcome this 'misuse', it is proposed that a majority of the existing 15-minute parking is further restricted to be signposted as 'Kiss and Ride' during the relevant school peak periods. When in operation, it is expected that the Kiss and Ride area will be supervised by a School staff

member and parents will not be permitted to leave their vehicles when setting down or picking up their children.

Accordingly, provision for parking/set down and pick up for the School and Preschool is made in the following

Golden Grove Street

- 8 x Kiss and Ride only (parents remain in car) spaces between 8.30am and 9.30am and 2.30pm and 4.30pm on school days
- 3 x 15 minutes parking between 8.30am and 9.30am and 2.30pm and 4.30pm on school days
- 1 accessible x 15 minutes parking between 8.30am and 9.30am and 2.30pm and 4.30pm on school days
- 1 x Loading Bay between 9.30am and 2.30pm on school days to serve the needs of service vehicles and/or excursion buses

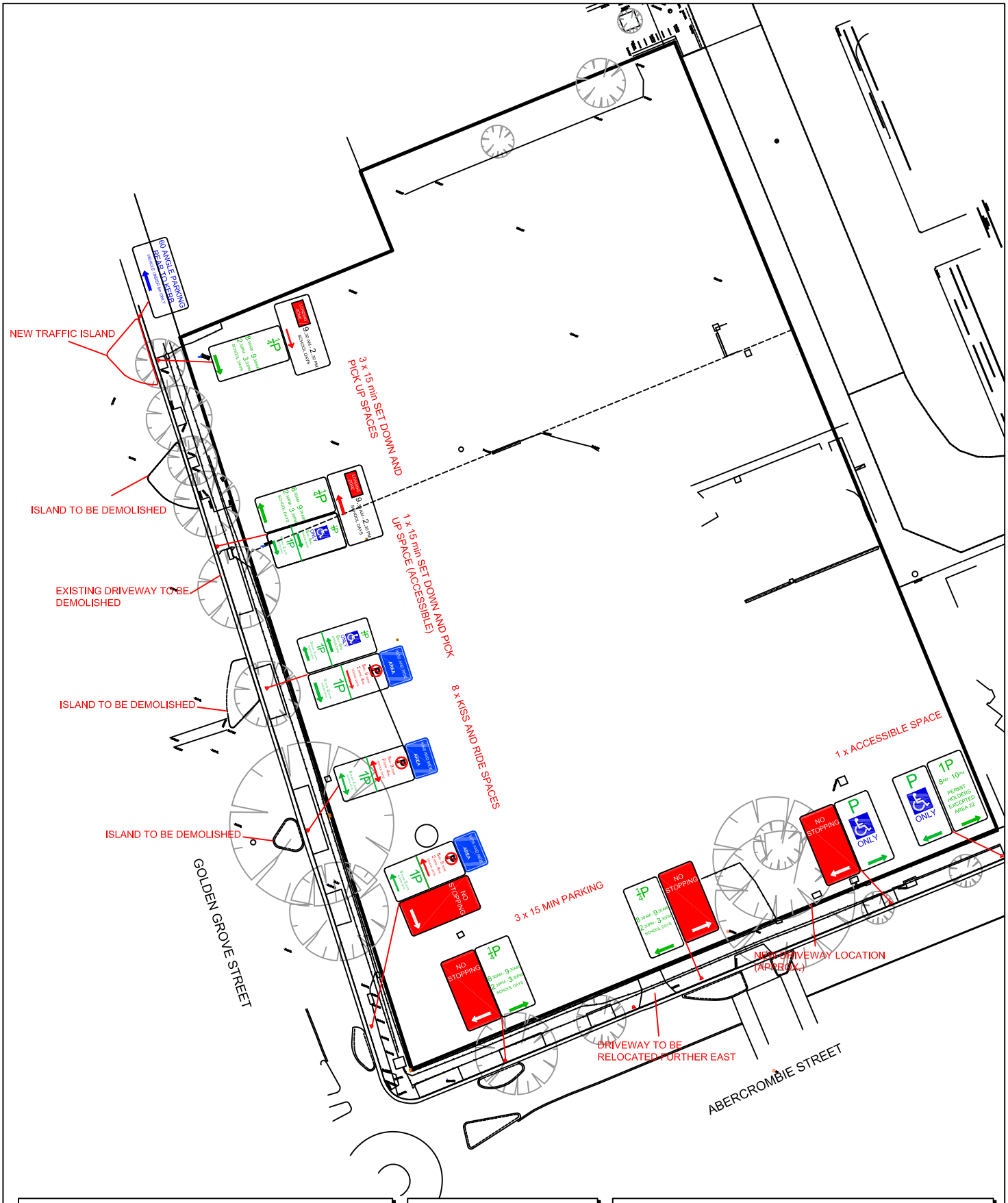
Abercrombie Street

- 3 x 15 minutes parking between 8.30am and 9.30am and 2.30pm and 4.30pm on school days

It is acknowledged that the proposed arrangements will necessitate changes to existing parking signage, including modification to existing traffic island/kerb, which are the subject of a separate assessment by the Council's traffic committee.

Details of the proposed set down and pick up arrangements are shown in Figure 6 overleaf.

Consistent with the City's and the Department of Education's planning policies, onsite carparking will not be provided and staff members will be encouraged to use the existing ready transport services guided by a Transport Access Guide (TAG)/Green Travel Plan which informs users of available transport options to/from the School, details of timetabling and coverage, as well as the implementation of ridesharing/carpooling program.



LEGEND

PROPOSED SIGNAGE

Fig 6

6.3 Bicycle Parking & End of Trip Facilities

In line with the assessment made in Section 5.5 of this report, it is acknowledged that the School is likely to experience an increased uptake of bicycles/scooters by students and staff alike. The most recent surveys reveal up to 58 students travel to/from the School using the bicycles/scooters. It is understood that a large proportion (more than 50%) of these students are currently accompanied by their parents/carers when travelling to/from the School. When the School is expanded, the same rate of uptake would indicate some 116 students using the same mode of transport to/from the School. As it is not expected that all students would 'park' their bicycles at School, the proposal of 68 bicycle/scooter racks/storage within the School campus will be pragmatic and adequately provide for the students/staff who desire to park onsite.

In addition to the generous provision of bicycle storage, the School will also provide an onsite End of Trip facility which incorporates the following:

- 1 x accessible male bathroom with change room with shower
- 1 x accessible female bathroom with change room with shower
- staff dedicated bicycle racks

7.0 Access, Internal Circulation and Servicing

7.1 Access

The existing vehicular access (for servicing purposes only) at the Golden Grove Street frontage will be demolished and kerb/gutter reinstated while the existing driveway at the Abercrombie Street frontage will be relocated further east to align with a new School gate. This access will only be reserved for use by emergency vehicles.

7.2 Pedestrian & Bicycle Facilities

The existing marked foot crossings in the immediate surrounding of the School campus operate satisfactorily. It is intended that these infrastructures will be retained following the development.

It is understood that an additional marked footcrossing has been proposed (separate to this proposal) at Golden Grove Street north of the School, however, it is advised that this facility is not yet formally approved by the Council's traffic committee. If approved, it is expected that this device would provide an earlier opportunity for pedestrians to cross Golden Grove Street, thus improving connectivity between the School and the City Road bus stops.

The onsite bicycle parking/storage will enable students/staff to secure their bicycles in an undercover area in a well-lit section of the School campus.

7.3 Servicing

The existing servicing arrangement involves a truck reversing from Golden Grove Street towards the loading area. This is not considered to be a suitable arrangement given that there are high pedestrian activity and young children along the road frontages. The School's loading area/Waste Bin collection area will be relocated further north to be adjacent to the onstreet Loading Zone. Thus, all garbage collection and loading activities related to deliveries, maintenance, etc. will be expected to occur

via Golden Grove Street. Trucks/service vehicles will no longer be allowed to reverse onto the site; rather, they will be expected to undertake their activities across the footpath to minimise traffic conflict with pedestrians and general traffic. As the Loading Zone will only be operational between 9.30am and 2.30pm (outside of school peak periods) the servicing activities will need to be managed to occur within this window of period in order to minimise disruption and maximise students' safety.

7.4 Emergency Vehicles

The fire and rescue NSW and ambulance can access the School at all times via the Abercrombie Street driveway. Emergency protocols for the proposed School would include a requirement for the on-site staff to assist with emergency access from these roads. Any vehicles impeding the emergency vehicle access should be cleared, and any planned vehicle movements should be suspended.

8.0 Construction Traffic Management Plan

The preparation of a more detailed construction traffic management plan is recommended during the construction documentation process. It is advised that the development scheme would involve 2 stages, being:

- Stage 1 – Building works to the north
- Stage 2 – Demolition of existing school buildings and construction of hall/play space

8.1 Construction Process

It is anticipated that construction traffic access provision for the main contract works will occur via a temporary construction access at Golden Grove Crescent. The typical trucks expected of a development scheme of this nature will involve:

- up to 8.8m medium rigid trucks, i.e., mobile concrete pump, Hymix concrete mixer during the concrete pumping phases; and
- up to 12.5m heavy rigid trucks for the transport of construction waste materials.

All workers will be encouraged to not park in the surrounding streets and instead use the available public transport to access the site given the site's proximity to high-frequency public transport services or to carpool wherever possible.

A tool drop-off and storage facility will be provided within the site. This would allow tradespeople to drop-off and store their tools and machinery, allowing them to use public transport to travel to/ from the site on a daily basis.

Workers will also be informed of with appropriate tool/ equipment drop-off and storage arrangements made within site sheds and amenities provided on site.

8.2 Spoil Management

It is proposed to minimise the need for removal of spoil from the site by endeavouring to balance cut and fill to create the ground platform. Truck shaker grids and wheel wash stations shall be positioned at all entry/exit points. Machine operated street sweepers will be utilised whenever spoil is tracked onto local or state roads, and at the direction of Council.

8.3 Construction Vehicle Route

Truck movements associated with the proposed works will approach and depart the site via the following routes:

1. King Street, Butlin Avenue, Darlington Road and Golden Grove Street; and/or
2. King Street, Darlington Road, and Golden Grove Street (truck sizes may be limited on this route subject to detailed turning path assessment at the intersection of King Street and Darlington Road).

Details of the routes shall form part of the contract and distributed to all drivers.

8.4 Construction related Vehicle Movements

For a development of this nature, it is anticipated that there will be an average of 2 trucks per day with a maximum of 8 trucks per day during peak construction (16 movements per day). Heavy vehicle movements are likely to be spread through the day. Traffic demand of this order of magnitude is not significant and can be accommodated by the available and ample spare capacity that currently exists in the local road network.

Queuing or marshalling of construction vehicles must not be permitted on the road network and call-up procedures must be put in place to manage arrivals.

Workers typically begin and end their workday outside of network peak periods (i.e., 6.30am – 3.30pm) and as such is unlikely to adversely impact the surrounding road network.

If essential, the restriction of works may be imposed during the peak school set down and pick up periods.

8.5 Bus Movements

The movements of buses/pedestrians and construction vehicles/workers in the surroundings of the work sites shall be closely monitored by RMS accredited Traffic Controllers. Under all circumstances, the movements of buses shall have the right of way over construction vehicles to maintain the efficiency of bus services in the local road network.

8.6 Pedestrian Movements

Pedestrian movements shall be separated from the site by through the provision of Class A hoarding/ fencing along the perimeter of the site and B class hoarding where applicable.

To maintain the safety of young pedestrians, RMS accredited traffic controllers will be present at the site access to manage pedestrian movements when construction vehicles are entering the site.

8.7 Cyclist Movements

During the construction period, cyclist movements in the vicinity of the School must remain unaffected.

8.8 Works Zone/Road Closure

If a Works Zone is required for the construction process, this Zone must not impede the existing set down and pick up operation at the School. This may be in the form of restriction from works/deliveries during the associated School set down and pick up periods.

8.9 Cranage and Materials Handling

Mobile cranes will be used to lift materials to/from trucks standing in the site compound while all delivered materials will be stored in designated secured facilities within the bounds of the site.

Should it be that a mobile crane is required to occupy any part of State Roads/Council's roads or footpaths during the construction process, a separate permit either in the form of Works Zone or temporary Road Occupancy License will need to be issued to the Council and approved prior to the planned event.

8.10 Site Induction

All workers and visitors employed on the site by the appointed contractor (including sub-contractors) will be required to undergo a formal 'site induction' process and all the inductions will be performed specific to each trade according to Workcover OH & S requirements.

The induction will include details of approved access routes to and from the construction site for site staff and delivery vehicles, parking arrangements, as well as standard environmental, WHS, driver protocols and emergency procedures. The agreed work hours must be included as part of this induction.

8.11 Traffic Control Plans

Any required Traffic Control Plans will be prepared by the Builder's appointed Traffic Control Contractor and submitted to the Council for approval.

8.12 Road Serviceability

The contractor shall be responsible for ensuring that the roads and footpaths along Abercrombie Street and Golden Grove Street remain in a serviceable state during the course of the construction. Under the direction of Council, the contractor will make good any roadside facilities affected by the construction works, being footpaths, road pavement, etc. to the Council's satisfaction, at no cost to Council.

8.13 Emergency Vehicle Access

Emergency protocols on the site would include a requirement for an accredited traffic controller to assist with emergency access, and as such, access to the School by emergency vehicles will not be affected.

Ongoing liaison will be maintained with the police and emergency services agencies throughout the construction period and a site contact will be made available for out-of-hours emergencies and access.

9.0 Green Travel Plan

Transport is a necessary part of life which has effects that can be managed. There is a current major focus on improving transport services as well as cycling facilities and provisions for pedestrians in major priority precincts. As well as delivering better environmental outcomes, providing a range of travel choices with a focus on walking, cycling, and public transport will have major public health benefits and will ensure a prosperous urban and economic outcome for cities.

9.1 Objectives

A Travel Plan (TP) is a package of measures aimed at promoting and encouraging sustainable travel and reducing reliance on private vehicle usage, and is prepared with an ambition to over a progressive period:

- reduce dependence on private cars
- improve pedestrian and cycling facilities
- promote public transport and car sharing
- reduce congestion in the local area

Travel Plans have proven to be a successful way of changing travel behaviour for school developments throughout Australia and overseas. A Travel Plan is a way in which a development manages the transport needs of parents, carers, school community members, staff and visitors. The plan aims to reduce the environmental impact of travel to and from a given site and in association with its operation. In essence, the plans encourage a more efficient use of motor vehicles as well as alternatives to single occupant car usage.

9.2 Process

The preparation of a TP is a considered process which occurs under the leadership and guidance of an established TP Coordinator and involves the following:

- securing ownership via the establishment of a TP Coordinator
- providing a clear context of existing transport circumstances via site audit
- developing and implementing a travel plan via identification of contextual incentive schemes and the establishment of mode share targets
- monitoring the effectiveness of the plan via a formal evaluation process, i.e., travel surveys, etc.

9.3 Management Team

A TP Coordinator for the development will be nominated by the School Infrastructure NSW (SINSW)'s representative prior to occupation and this coordinator will have responsibility for developing, implementing and monitoring the effectiveness of the TP. The coordinator will be appointed when the occupation commences.

9.4 Existing Travel Circumstance

A summary of the current mode shares for students and staff are shown as follows:

	AM	PM
Walk	44.6%	41.2%
Bicycle/Scooter	28.5%	29.4%
Car	26.9%	20.6%
Bus	-	8.8%

9.5 Targets

Assessment of the transport circumstances for the School indicate the following desirable Mode Share targets:

	AM	PM
Walk	45%	45%
Bicycle/Scooter	35%	35%
Car	10%	10%
Bus	10%	10%

Surveys undertaken within 6 months of completion of the redevelopment of the School will be able to assess whether these targets have been met. While these targets have been set, and a range of measures have been provided in the travel plan to persuade staff and visitors to participate in sustainable travel, it is not possible to guarantee that these modal split targets will be achieved.

The measures proposed within the TP will be taken up by the staff/visitors as a matter of free choice, and this mode choice is beyond the control of the TP Coordinator. The survey results will, however, indicate the more popular measures which can then be focused upon in future updated TPs.

9.6 Supplementary Transport Programs

Once the new buildings are occupied the TP Coordinator may implement a number of initiatives to further enhance the effectiveness of the travel plan. Having regard for the School's operating nature, it is recommended that the following initiatives are considered and incorporated into the travel plan:

Increase walking, running and cycling to work and other destinations by staff

Common and effective measures that are event based including a Ride to Work/School Day raises awareness amongst teachers, parents, students and visitors alike. Likewise, the following initiatives prove to be highly effective amongst staff and potentially students:

Pedometer-based walking program

Walk/Bike buddy scheme

Provision of the end of trip facilities such as shower and change cubicle

Convenience and Increase staff and parent awareness and knowledge of available transport options

New pamphlets and leaflets detailing these programs incorporating a TAG can be distributed to all who need to travel to and from the School. They should also be provided with an induction package for new staff and incorporates the TAG while ongoing initiatives may be circulated in the form of email newsletters.

Other initiatives may include:

- Provide interactive timetables on-site to promote public transport usage.
- Allow for access to umbrellas and ponchos in case of wet weather.
- Provision of good quality, accurate and useful directional signage to promote walking and cycling.
- Provide real-time information on public transport arrival/departure times with information screens/monitors.

Incentive Scheme for Staff Members

For staff members, additional incentive programs may be established by SINSW to encourage the uptake of active transport. This can be delivered in the form of:

- Active carpooling program (with the benefit of knowledge of staff members' place of residence) with guaranteed ride share and car parking space within the School's compound
- Implementation of a ride share system, which could include encouraging staff to participate in a peak-hour car-pooling club to drive to a nearby station (with higher train frequencies) or common work location during the peak hours. This may be coordinated by the formally appointed Travel Coordinator.

9.7 Monitoring & Management of Travel Plan

It will be important to monitor the TP to ensure that travel mode targets are met, and the maximum benefits are being gained.

A TP Coordinator for the School will be appointed to ensure the successful development, implementation and monitoring of the effectiveness of the TP. The TP Coordinator will be appointed prior to the operation once the redevelopment is complete.

Travel surveys can be undertaken where the main focus will be to establish parents'/carers'/school community members', staff's and visitors' travel patterns including the mode share of trips to and from the School. This information will also help inform TPs for subsequent changes and upgrading.

It will be important to understand people's reasons for travelling the way they do, any barriers to changing their behavior and their propensity to change. This will enable the most effective initiatives to be identified, and conversely less effective initiatives can be modified or replaced to ensure the best outcomes are achieved.

It will also be necessary to provide feedback to parents, carers, school community members, staff and visitors to ensure that they can see the benefits of sustainable transport.

There are several key elements to the development and implementation of a successful TP. These include:

Communications – Good communications are an essential part of the TP. It will be necessary to explain the reason for adopting the plan, promote the benefits available and provide information about the alternatives to reliance on private car travel.

Commitment – TPs involve changing established habits and providing the impetus for parents, carers, school community members, staff and visitors for new

developments to choose a travel mode other than private car use. To achieve co-operation, it is essential to promote positively the wider objectives and benefits of the Plan. This commitment includes the provision of the necessary resources to implement the Plan, beginning with the introduction of encouragement for changing travel modes upon operation.

Consensus – It will be necessary to obtain broad support for the introduction of the TP.

Once the TP has been adopted, it will be essential to maintain interest in the scheme and any new initiative in the Plan will need to be publicised and marketed. Accordingly, it is proposed to produce a half-yearly leaflet for parents, carers, school community members, staff and visitors to inform them of sustainable travel initiatives.

9.8 Monitoring Milestones

Monitoring of the plan will be an essential process in consolidating the travel patterns and publicising the positive outcomes of the plan.

It is therefore proposed that within 3 months of occupation of the new facilities, a travel survey will be conducted. The results of the travel survey will indicate the desirable travel mode outcome. In this way, the Coordinator will be able to examine the success of the TP and make appropriate recommendations.

9.9 Evaluation of Targets

A travel questionnaire (example below) can be conducted with parents, carers, school community members, staff and visitors.
The first study provides a baseline for travel planning while subsequent travel surveys would be reported annually to SINSW to inform any weakness or strength in the current travel plan. Based on the review the travel plan should be refined to reflect changing circumstances.

Sample Survey

1. What is the postcode of your place of residence? _____

2. How do you travel to school?
   a) Walk/run
   b) Bicycle
   c) Bus
   d) Train
   e) Combination of bus and train
   f) Drive a car
   g) A passenger in a car
   h) Others _____

3. What time do you usually leave and arrive at school in the morning? _____

4. What time do you usually leave and arrive home in the afternoon? _____

5. Do you use your car for school trips during the day?
   a) Yes
   b) No

6. To facilitate walk/cycle groups and/or carpooling may we share your contact details with a colleague that live/work near you?
   a) Yes – walking group (Email:_____)
   b) Yes – cycling group (Email:_____)
   c) Yes – carpool driver (Email:_____)
   d) Yes – carpool passenger (Email:_____)

Whilst these targets have been set and though limited parking supply is available, and a range of measures have been provided in the travel plan to persuade parents, carers, school community members, staff and visitors to participate in sustainable travel, it is not possible to guarantee that these modal split targets will be achieved.

10.0 Conclusion

The proposed Darlington Public School redevelopment project involves the demolition of existing outmoded buildings and construction of new administrative and classroom facilities and provision of additional set down and pick up area to accommodate the envisaged student population growth from the current level of 250 students to 415 students.

Assessment of the proposal has established that:

- the existing local road network adjacent to the School operates with a satisfactory level of service
- the School is suitably located within close proximity of excellent transport services in the local area
- the existing proportion of vehicle set down and pick up reliant students are 27% and 21% during the AM and PM respectively
- there will be additional provision made for active transport infrastructures i.e. bicycles storage and EOT facilities
- the projected traffic generation resulting from the expansion will have no adverse implications on the adjacent road network, and the existing network level of service will be maintained
- the travel planning for staff is to be complemented by sustainable transport planning initiatives, i.e. the publication and distribution of a TAG, the promotion and information of available transport services and timetabling details, as well as the provision of active transport infrastructures
- the existing vehicle access, internal circulation and servicing will be retained
- the provision of extended set down and pick up spaces will be adequate to the anticipated School demand.

- It is anticipated that the impact of the school traffic would be further reduced with the provision of other measures such as a travel plan and traffic management plan.

- the planning and management of construction vehicles will have regard for the anticipated peak traffic operations in the vicinity of the School and accord with the Council requirements

- the anticipated construction traffic demand will be adequately accommodated by the ample spare capacities that exist within the local road network.

Appendix A

Architectural Plans

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1 PLAN Ground Floor B0A3 - S2 General Arrangement Plan
1:200

GENERAL NOTES

- ALL DIMENSIONS AND EXISTING CONDITIONS SHALL BE CHECKED AND VERIFIED BY THE CONTRACTOR BEFORE PROCEEDING WITH THE WORK.
- ALL LEVELS RELATIVE TO 'AUSTRALIAN HEIGHT DATUM'.
- DO NOT SCALE DRAWINGS. USE FIGURED DIMENSIONS ONLY.

legend

- PS401 Homebase Unit
- PS501 Library Unit
- PS502 Special Programs Unit
- PS503 Communal Hall Unit
- PS504 COLA
- PS601 Administration Unit
- PS602 Staff Unit
- PS604 Canteen
- PS613 OSHC
- PS605 Storage Unit
- Pre-School Unit
- Wet Areas
- Circulation
- External Circulation
- Services

rev	date	name	by	chk
03	28/4/20	SSDA Submission	CD	
02	17/4/20	SSDA Submission	CD	
01	9/4/20	For 70% Schematic Design	IL	
A	1/4/20	For 70% Schematic Design	CD	

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project
Darlington Public School
Golden Grove Street
Darlington NSW 2008

title
General Arrangement Plans
Upper Ground Plan - S2

scale	first issued
1:200 @ A1 - 1:400 @ A3	1/4/20

project code	sheet no.	revision
DTPS	2051	03

Appendix B

SIDRA Model Results

MOVEMENT SUMMARY

Site: 1 [King St / Darlington Rd AM]

King Street and Darlington Road
Site Category: 19043
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: Darlington Road												
4	L2	117	5.0	0.094	6.3	LOS A	0.6	4.2	0.46	0.53	0.46	41.4
6	R2	12	5.0	0.114	42.4	LOS C	0.3	2.5	0.91	1.00	0.91	21.0
Approach		128	5.0	0.114	9.5	LOS A	0.6	4.2	0.50	0.57	0.50	38.3
NorthEast: King Street												
7	L2	40	5.0	0.247	4.6	LOS A	0.0	0.0	0.00	0.05	0.00	48.0
8	T1	893	5.0	0.247	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	49.2
Approach		933	5.0	0.247	0.2	NA	0.0	0.0	0.00	0.02	0.00	49.1
SouthWest: King Street												
2	T1	1800	5.0	0.319	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.9
3	R2	208	5.0	0.288	9.3	LOS A	1.3	9.4	0.57	0.77	0.59	37.8
Approach		2008	5.0	0.319	1.0	NA	1.3	9.4	0.06	0.08	0.06	46.6
All Vehicles		3069	5.0	0.319	1.1	NA	1.3	9.4	0.06	0.08	0.06	46.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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 is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [King St / Darlington Rd PM]

King Street and Darlington Road
Site Category: 19043
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: Darlington Road												
4	L2	181	5.0	0.180	8.1	LOS A	1.1	8.3	0.62	0.64	0.62	40.0
6	R2	18	5.0	0.177	46.0	LOS D	0.6	4.1	0.91	1.01	0.94	20.0
Approach		199	5.0	0.180	11.5	LOS A	1.1	8.3	0.64	0.68	0.64	36.8
NorthEast: King Street												
7	L2	87	5.0	0.405	4.6	LOS A	0.0	0.0	0.00	0.06	0.00	47.8
8	T1	1439	5.0	0.405	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	49.0
Approach		1526	5.0	0.405	0.3	NA	0.0	0.0	0.00	0.03	0.00	48.8
SouthWest: King Street												
2	T1	1333	5.0	0.237	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
3	R2	144	5.0	0.347	15.6	LOS B	1.4	10.4	0.78	0.94	0.89	32.8
Approach		1477	5.0	0.347	1.5	NA	1.4	10.4	0.08	0.09	0.09	45.0
All Vehicles		3202	5.0	0.405	1.5	NA	1.4	10.4	0.08	0.10	0.08	45.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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 is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2 [Abercrombie St / Golden Gr AM]

Abercrombie Street and Golden Grove
Site Category: 19043
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Golden Grove												
2	T1	47	5.0	0.318	4.4	LOS A	2.1	15.6	0.29	0.59	0.29	40.4
3	R2	389	5.0	0.318	9.1	LOS A	2.1	15.6	0.29	0.59	0.29	43.3
Approach		437	5.0	0.318	8.6	LOS A	2.1	15.6	0.29	0.59	0.29	43.1
East: Ambercrombie Street												
4	L2	61	5.0	0.122	4.8	LOS A	0.7	5.1	0.40	0.59	0.40	42.3
6	R2	78	5.0	0.122	9.7	LOS A	0.7	5.1	0.40	0.59	0.40	47.0
Approach		139	5.0	0.122	7.6	LOS A	0.7	5.1	0.40	0.59	0.40	45.0
North: Golden Grove												
7	L2	182	5.0	0.371	6.5	LOS A	2.4	17.6	0.63	0.68	0.63	45.6
8	T1	182	5.0	0.371	6.8	LOS A	2.4	17.6	0.63	0.68	0.63	40.1
Approach		364	5.0	0.371	6.7	LOS A	2.4	17.6	0.63	0.68	0.63	43.3
All Vehicles		940	5.0	0.371	7.7	LOS A	2.4	17.6	0.44	0.62	0.44	43.5

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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 is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2 [Abercrombie St / Golden Gr PM]

Abercrombie Street and Golden Grove
Site Category: 19043
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Golden Grove												
2	T1	54	5.0	0.221	4.7	LOS A	1.3	9.7	0.35	0.60	0.35	40.5
3	R2	220	5.0	0.221	9.4	LOS A	1.3	9.7	0.35	0.60	0.35	43.4
Approach		274	5.0	0.221	8.5	LOS A	1.3	9.7	0.35	0.60	0.35	43.0
East: Ambercrombie Street												
4	L2	99	5.0	0.209	5.1	LOS A	1.2	9.1	0.44	0.62	0.44	42.0
6	R2	135	5.0	0.209	10.0	LOS A	1.2	9.1	0.44	0.62	0.44	46.7
Approach		234	5.0	0.209	7.9	LOS A	1.2	9.1	0.44	0.62	0.44	44.8
North: Golden Grove												
7	L2	212	5.0	0.368	5.4	LOS A	2.5	18.0	0.50	0.56	0.50	46.4
8	T1	212	5.0	0.368	5.6	LOS A	2.5	18.0	0.50	0.56	0.50	41.1
Approach		423	5.0	0.368	5.5	LOS A	2.5	18.0	0.50	0.56	0.50	44.3
All Vehicles		931	5.0	0.368	7.0	LOS A	2.5	18.0	0.44	0.59	0.44	44.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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 is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [King St / Darlington Rd AM - DEV]

King Street and Darlington Road
Site Category: 19043
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: Darlington Road												
4	L2	125	5.0	0.101	6.3	LOS A	0.6	4.5	0.46	0.53	0.46	41.4
6	R2	20	5.0	0.198	45.3	LOS D	0.6	4.5	0.92	1.01	0.96	20.2
Approach		145	5.0	0.198	11.6	LOS A	0.6	4.5	0.52	0.60	0.53	36.4
NorthEast: King Street												
7	L2	48	5.0	0.250	4.6	LOS A	0.0	0.0	0.00	0.06	0.00	47.9
8	T1	893	5.0	0.250	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	49.1
Approach		941	5.0	0.250	0.2	NA	0.0	0.0	0.00	0.03	0.00	49.0
SouthWest: King Street												
2	T1	1800	5.0	0.319	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.9
3	R2	217	5.0	0.302	9.5	LOS A	1.4	10.1	0.58	0.78	0.61	37.6
Approach		2017	5.0	0.319	1.0	NA	1.4	10.1	0.06	0.08	0.07	46.5
All Vehicles		3103	5.0	0.319	1.3	NA	1.4	10.1	0.06	0.09	0.07	45.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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 is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [King St / Darlington Rd PM - DEV]

King Street and Darlington Road
Site Category: 19043
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: Darlington Road												
4	L2	188	5.0	0.187	8.0	LOS A	1.2	8.7	0.62	0.65	0.62	40.0
6	R2	25	5.0	0.250	49.6	LOS D	0.8	6.1	0.92	1.03	1.01	19.1
Approach		214	5.0	0.250	13.0	LOS A	1.2	8.7	0.65	0.69	0.66	35.6
NorthEast: King Street												
7	L2	95	5.0	0.407	4.6	LOS A	0.0	0.0	0.00	0.07	0.00	47.7
8	T1	1439	5.0	0.407	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	48.9
Approach		1534	5.0	0.407	0.3	NA	0.0	0.0	0.00	0.03	0.00	48.8
SouthWest: King Street												
2	T1	1333	5.0	0.237	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
3	R2	151	5.0	0.365	15.9	LOS B	1.5	11.1	0.79	0.94	0.91	32.6
Approach		1483	5.0	0.365	1.6	NA	1.5	11.1	0.08	0.10	0.09	44.8
All Vehicles		3231	5.0	0.407	1.7	NA	1.5	11.1	0.08	0.11	0.09	44.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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 is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2 [Abercrombie St / Golden Gr AM - DEV]

Abercrombie Street and Golden Grove
Site Category: 19043
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Golden Grove												
2	T1	56	5.0	0.328	4.4	LOS A	2.2	16.3	0.31	0.59	0.31	40.4
3	R2	389	5.0	0.328	9.2	LOS A	2.2	16.3	0.31	0.59	0.31	43.3
Approach		445	5.0	0.328	8.6	LOS A	2.2	16.3	0.31	0.59	0.31	43.0
East: Ambercrombie Street												
4	L2	61	5.0	0.130	4.9	LOS A	0.7	5.5	0.41	0.60	0.41	42.1
6	R2	86	5.0	0.130	9.8	LOS A	0.7	5.5	0.41	0.60	0.41	46.8
Approach		147	5.0	0.130	7.7	LOS A	0.7	5.5	0.41	0.60	0.41	44.9
North: Golden Grove												
7	L2	191	5.0	0.388	6.6	LOS A	2.6	18.8	0.64	0.68	0.64	45.5
8	T1	191	5.0	0.388	6.8	LOS A	2.6	18.8	0.64	0.68	0.64	40.0
Approach		381	5.0	0.388	6.7	LOS A	2.6	18.8	0.64	0.68	0.64	43.2
All Vehicles		974	5.0	0.388	7.7	LOS A	2.6	18.8	0.45	0.63	0.45	43.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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 is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 2 [Abercrombie St / Golden Gr PM - DEV]

Abercrombie Street and Golden Grove
Site Category: 19043
Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Golden Grove												
2	T1	61	5.0	0.229	4.7	LOS A	1.4	10.2	0.37	0.60	0.37	40.6
3	R2	220	5.0	0.229	9.5	LOS A	1.4	10.2	0.37	0.60	0.37	43.5
Approach		281	5.0	0.229	8.4	LOS A	1.4	10.2	0.37	0.60	0.37	43.0
East: Ambercrombie Street												
4	L2	99	5.0	0.217	5.2	LOS A	1.3	9.5	0.45	0.63	0.45	41.8
6	R2	142	5.0	0.217	10.0	LOS A	1.3	9.5	0.45	0.63	0.45	46.5
Approach		241	5.0	0.217	8.0	LOS A	1.3	9.5	0.45	0.63	0.45	44.7
North: Golden Grove												
7	L2	219	5.0	0.380	5.4	LOS A	2.6	18.9	0.51	0.57	0.51	46.4
8	T1	219	5.0	0.380	5.6	LOS A	2.6	18.9	0.51	0.57	0.51	41.1
Approach		438	5.0	0.380	5.5	LOS A	2.6	18.9	0.51	0.57	0.51	44.2
All Vehicles		960	5.0	0.380	7.0	LOS A	2.6	18.9	0.45	0.59	0.45	44.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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 is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix C

Travel Mode Survey

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LOCATION	NORTH	Golden Grove Street	TIME PERIOD	0800 - 0900
	EAST	Abercrombie Street		1430 - 1530
	SOUTH	Golden Grove Street		-
	WEST	Abercrombie Street	DATE	Tuesday, April 9, 2019
SUBURB		DARLINGTON	WEATHER	FINE

Number of Children Time Per 15 Mins	1 Walking	2 Bike/Scooter	3 Car	4 Bus/Van	
8:00 - 8:15	8	1	3	0	12
8:15 - 8:30	13	23	7	0	43
8:30 - 8:45	26	15	24	0	65
8:45 - 9:00	44	19	21	0	84
Period End	91	58	55	0	204
14:30 - 14:45	0	0	2	0	2
14:45 - 15:00	5	2	8	0	15
15:00 - 15:15	73	53	30	17	173
15:15 - 15:30	2	2	0	0	4
Period End	80	57	40	17	194

Traffic Information Specialists
ABN: 42 613 389 923
Email info@trafficinfospecialist.com.au

LOCATION	NORTH	Golden Grove Street	TIME PERIOD	0800 - 0900
	EAST	Abercrombie Street		1430 - 1530
	SOUTH	Golden Grove Street		-
	WEST	Abercrombie Street	DATE	Tuesday, April 9, 2019
SUBURB		DARLINGTON	WEATHER	FINE

Number of Children	1	2	3	4	
Time Per Hour	Walking	Bike/Scooter	Car	Bus/Van	
8:00 - 9:00	91	58	55	0	204
Period End	91	58	55	0	204
14:30 - 15:30	80	57	40	17	194
Period End	80	57	40	17	194

Traffic Information Specialists
ABN: 42 613 389 923
Email info@trafficinfospecialist.com.au