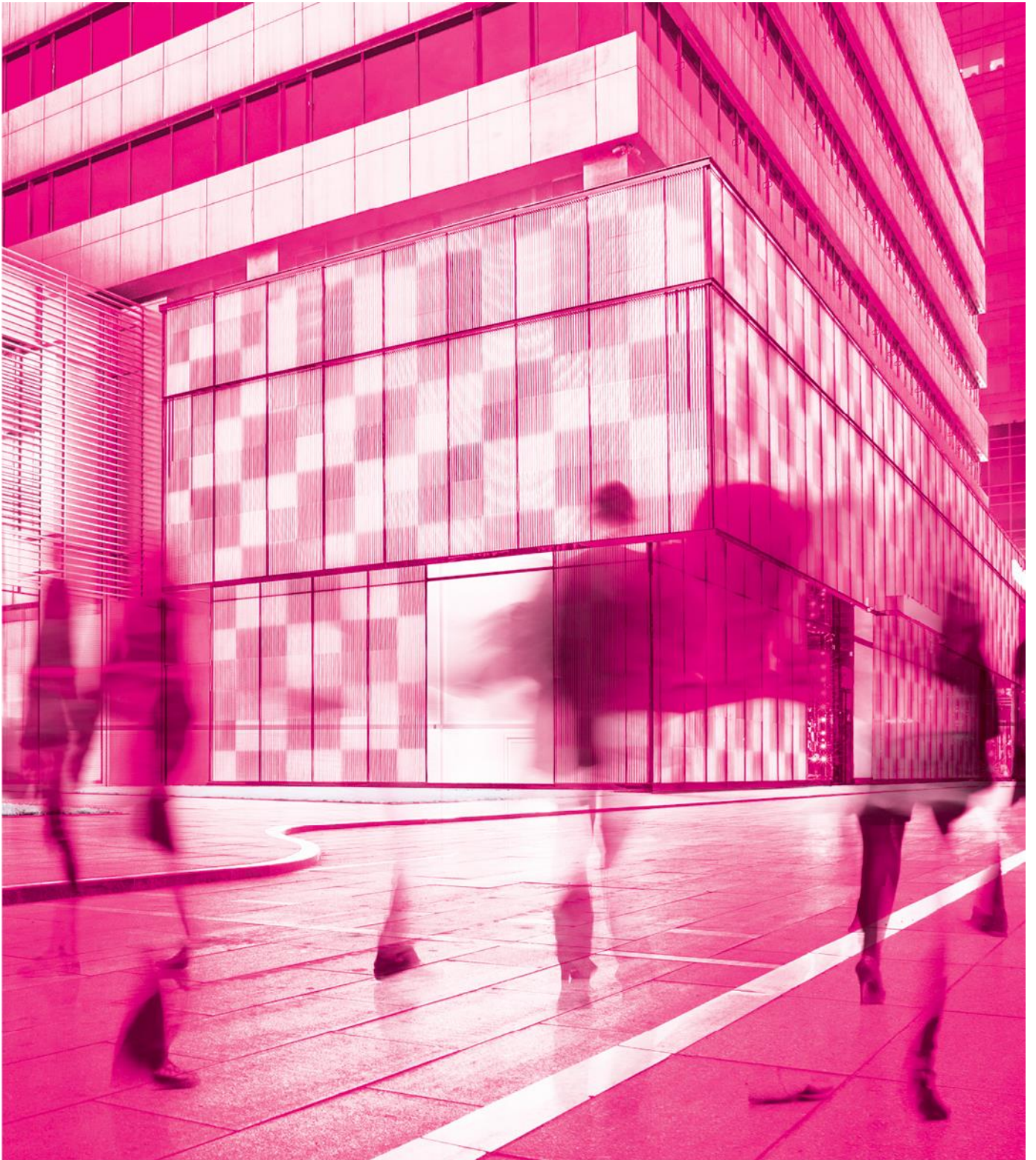




Traffic Impact Assessment;

St Lucy's School, Wahroonga

For St Lucy's School
30 November 2017

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1. Introduction

1.1 Project Summary

ptc. has been engaged by St Lucy's School to undertake a traffic impact assessment study that is intended to accompany a Development Application by the school located at 21-23 Cleveland Street and 6-8 Billyard Avenue, Wahroonga, under Ku-ring-gai Council (see Figure 1).

This report sets out the methodology and findings of the study to assess the traffic, parking and the road network related considerations associated with the following proposal:

- Intensification of use at an existing educational establishment comprising an additional 132 students (from 108 to 240) and staff increase to 104 Full Time Equivalent (from the current 45.7 FTE),
- Demolition of the existing library, after-school care facility and the vacant house and construction of two double storey buildings accommodating 16 additional classrooms with associated breakout and withdrawal areas and ancillary rooms,
- Provision of a basement level parking facility with 48 staff spaces, and
- Retention of 24 staff parking on-street, with no proposed increase in on-street parking.

This study addresses the key topics related to traffic and parking impacts typically associated with schools, being:

- Traffic activity associated with students and the impact on the road network,
- Traffic activity associated with staff and the impact on the road network,
- On-campus parking provision and demand associated with staff,
- On-street parking availability and demand associated with staff,
- On-street parking and pick-up/drop-off activity associated with students and how this is to be managed,
- The safety of pedestrians, students and other road users in the vicinity of the school,
- The warrants for providing additional traffic and/or parking facilities either within the road network or within the school.

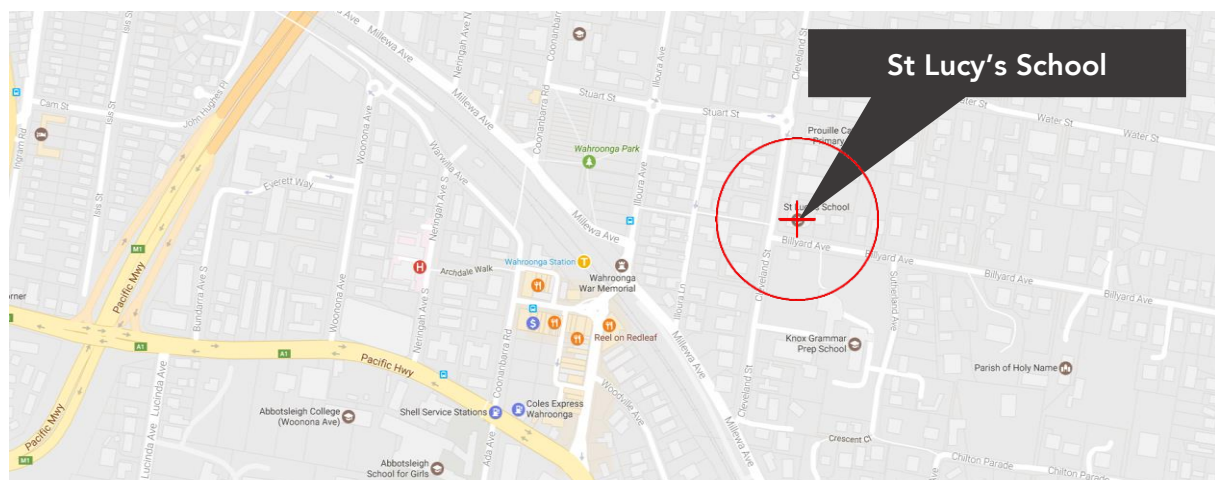


Figure 1 – Site Location

1.2 Purpose of this Report

This report presents the following considerations in relation to the Traffic and Parking assessment of the Proposal:

Section 2	A description of the project;
Section 3	A description of the road network serving the development property, and existing traffic volumes through key local intersections;
Section 4	School Travel Characteristic with a description of the survey results;
Section 5	Determination of the traffic activity associated with the development proposal, and the adequacy of the surrounding road network;
Section 6	Assessment of the proposed car park, vehicular access and internal circulation arrangements in relation to compliance with the relevant standards, and Council policies; and
Section 7	Conclusion and Recommendations.

2. The Development

2.1 Site Content

St Lucy's School is located at 21-23 Cleveland Street and 6-8 Billyard Avenue, in the suburb in Wahroonga, approximately 22 kilometres north of Sydney CBD. It is located on the eastern side of the North Shore railway line, bounded by Cleveland Street, and Billyard Avenue.

The School is located within a predominantly residential area comprising a mixture of large established dwellings and educational institutions. Knox Grammar Prep School is located on the south-west corner of Cleveland Street and Billyard Avenue, opposite and to the south of St Lucy's School. Prouille Catholic Primary School is located north-east of St Lucy's School

The aerial photograph in Figure 2 provides an overview of the area and context in relation to the surrounding land uses.



Figure 2 – St Lucy's School Context

2.2 Development Site

The works are proposed within the following lots, which form part of St Lucy's School:

- Lot 1 DP 726090;
- Lot 1 DP715429;
- Lot A DP341153;
- Lot B DP341153;
- Lot 1 DP105255;
- Lot 2 DP105255.

St Lucy's is a school in the Dominican tradition, catering for children with disabilities and has campuses at Wahroonga, Narrabeen and Narraweena. The Wahroonga Campus (the school), the site subject to this development application, has a student population of 108 students and involves a mix of full and part time staff members, with a Full Time Equivalent (FTE) staff of 45.7.

The School accommodates a range of different types of buildings and facilities that are used for curricular and non-curricular activities and after school care. The School map presented in Figure 3 summarises the location of facilities within the School.



Figure 3 – St Lucy's School Map

2.3 The Proposal

The proposed development of the school is shown in Figure 4 and involves the following;

- Demolition of the existing school library, aftercare facility and the vacant house, fronting Billyard Avenue,
- The staged construction of the Stage 1 and Stage 3 classrooms buildings as 2 storey learning facilities, containing a total of 16 teaching spaces, breakout and withdrawal rooms, and ancillary areas, and
- The staged construction of a 48-space basement level car park for staff and associated set-down and pick-up aisle for parents.

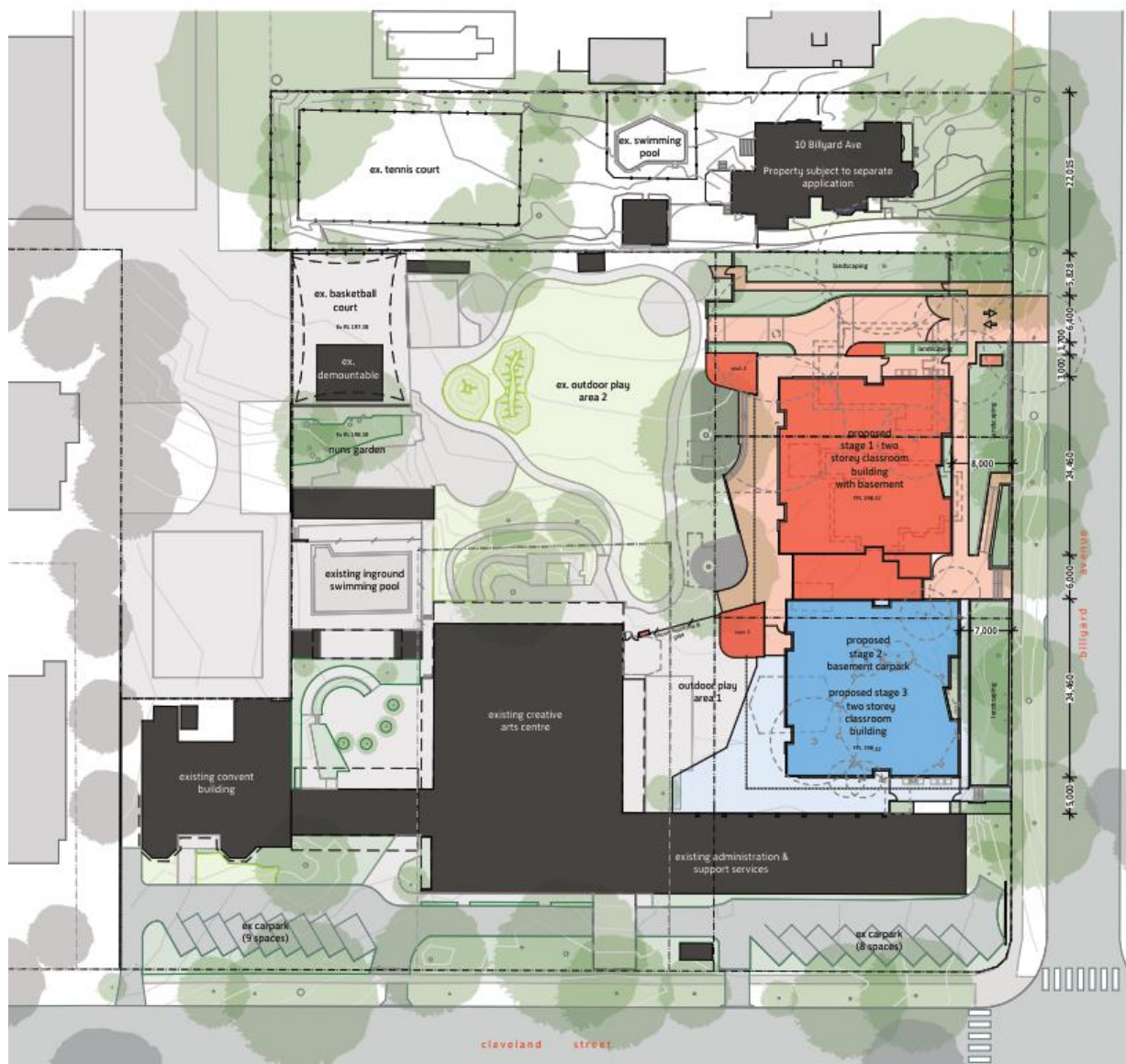


Figure 4 – Proposed Development

Associated with these works there will be an increase in the student and staff population of 132 Students and associated staff, bringing the total school population to 240 students and 104 FTE staff.

The development is proposed to be completed in three (3) stages, as follows:

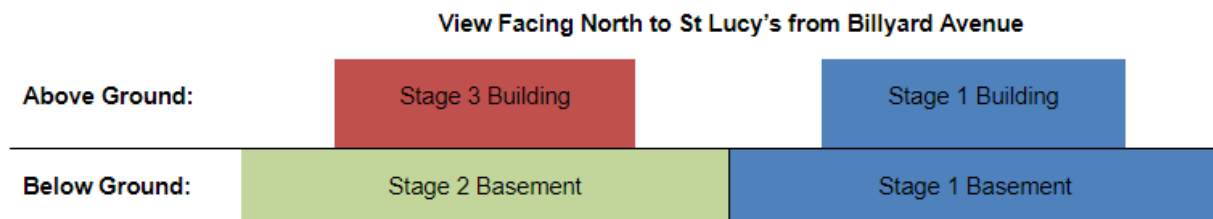


Figure 5 – Development Completion Stages

Stage 1

- Demolition of the two (2) re-purposed dwellings by retaining the existing library;
- Construction of half of the basement comprising 25 car spaces;
- Construction of the eastern-most building above Stage 1 basement; and
- Landscaping works to the extent of the Stage 1 build and play areas.

After completion of Stage 1 development, a maximum of 190 students and 80 FTE staff can be accommodated on site.

Stage 2

- Demolition of the library building;
- Construction of second half of basement comprising 23 car spaces, totalling 48 spaces in the basement; and
- Landscaping works to partial extent of the Stage 2 build and play areas

After completion of Stage 2 development, a maximum of 240 students and 104 FTE staff can be accommodated on site.

Stage 3

- Construction of the western-most building above Stage 2 basement; and
- Landscaping works to full extent of the site frontage and play areas.

There will not be any additional student or staff member after Stage 3. Hence, the net maximum student and FTE staff will remain as 240 and 104 respectively.

3. Existing Transport Facilities

3.1 Road Hierarchy

The School is located in Wahroonga to the east of the northern line railway and the Pacific Highway and in this regard, has reasonably good connections to the north shore arterial road network. However, connections to the west are somewhat limited by the North Shore Railway line, which acts as a barrier through the area.

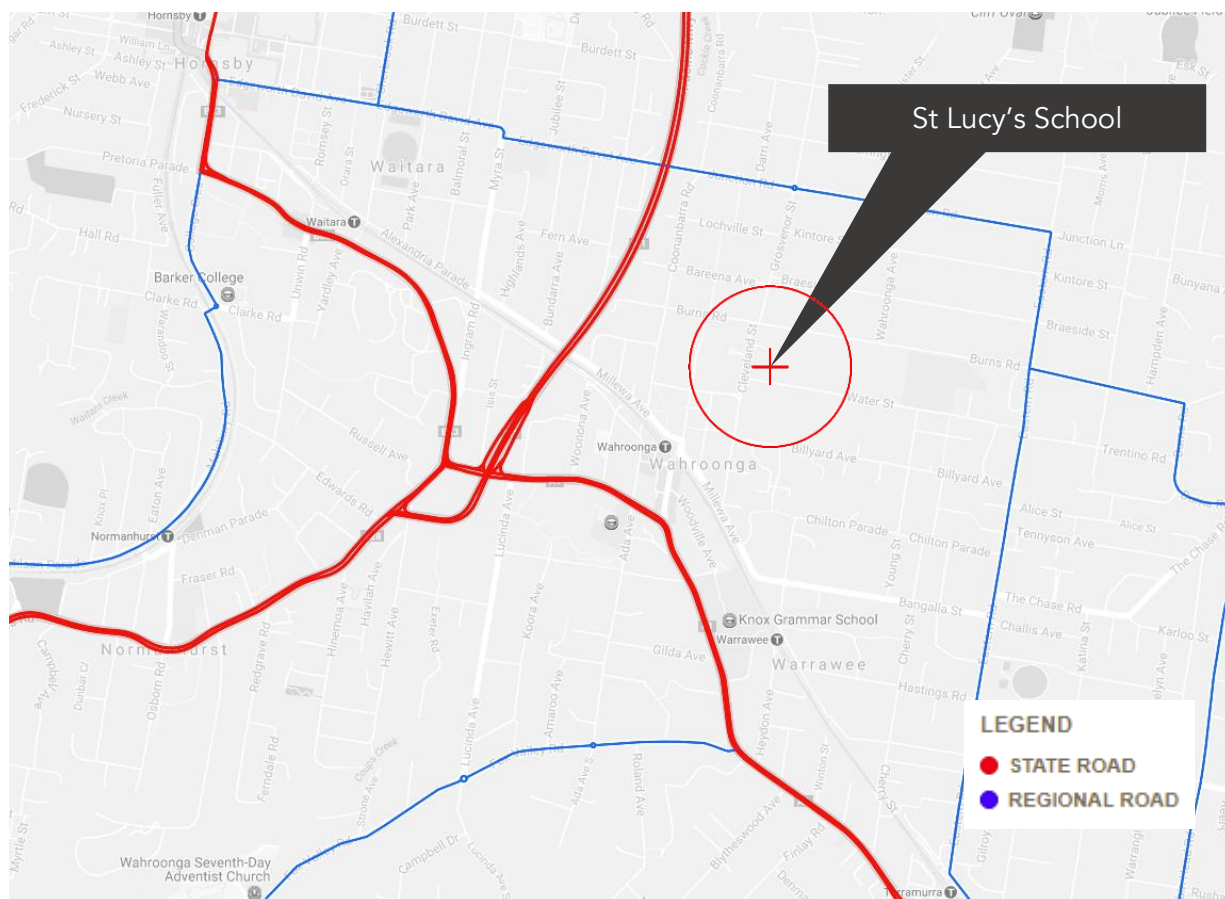


Figure 6 – Road Hierarchy

The NSW administrative road hierarchy comprises the following road classifications, which align with the generic road hierarchy as follows:

- | | |
|----------------|--|
| State Roads | - Freeways and Primary Arterials (RMS Managed) |
| Regional Roads | - Secondary or Sub Arterials (Council Managed, partly funded by the State) |
| Local Roads | - Collector and Local Access Roads (Council Managed) |

The road network servicing the School includes:

The Pacific Highway, which is classified as a State Road and follows a north–south alignment. Within the suburb of Wahroonga, the carriageway accommodates three (3) traffic lanes in each direction with auxiliary turning lanes at major intersections. During peak periods, clearway restrictions are implemented and a 40Kph School Zone is applied in addition to the normal 60Kph speed limit.

Eastern Road, which is classified as a Regional Road and provides a connection to the East Wahroonga Area and Junction Road, which provides an important alternative connection to Hornsby.

Cleveland Street, which is a Local Road providing access between Millewa Avenue (along the northern side of the railway) and Burns Road. Cleveland Street provides strategic access to the school frontage and connects with the expansive residential area to the north of the school, as well as providing the most convenient crossing over the railway, via Millewa Avenue. In the vicinity of the school the carriageway accommodates parking along both sides, with an undivided roadway able to accommodate two-way vehicles at low speed.

Billyard Avenue, which is a Local Road providing access between Eastern Road and Cleveland Street. Billyard Avenue is also a strategic access road to the School as it connects directly with the Eastern Road, Burns Road and Junction Road regional route from the south (which is an alternative to the Pacific Highway). In the vicinity of the School the carriageway accommodates two marked traffic lanes in each direction, with parking along both sides.

3.2 Surrounding Traffic Controls

The traffic controls in the vicinity of the school comprise a general 50kph speed limit and a 40kph school zone applicable to Cleveland Street and Billyard Avenue. Other controls include two pedestrian crossings located on the northern and eastern approaches to the Cleveland Street and Billyard Avenue intersection. The intersection is not subject to any STOP or GIVE WAY control, although it is clear to the motorists that Cleveland Street has priority over traffic on Billyard Avenue.

3.3 School Traffic and Parking Arrangements

The school benefits from two road frontages comprising Cleveland Street and Billyard Avenue. Vehicular access is currently available via three (3) driveways off Cleveland Street and two (2) driveways off Billyard Street. Both of these roads are classified as “local roads” according to the RMS Road Classification map and are residential in character (refer to Section 3.1 for further details).

The primary on-street drop-off and pick-up area is provided along the Billyard Avenue and Cleveland Street frontages (by way of ‘No Parking’ signage).

The majority of the private vehicle drop-off and pick-up parking is located along Billyard Street, with the students collected from the school entrance indicated in Figure 7, with some additional student drop-off, by private vehicle, undertaken in the ‘Port Cochere’ off Cleveland Street.

The drop-off and pick-up operation undertaken by Government taxis, also utilises the ‘Port Cochere’ off Cleveland Street. These two operations are further discussed in Section 3.3.1.

All roads in the vicinity of the School are subject to the School Zone 40kph speed limit controls associated with St Lucy’s School, Prouille Catholic Primary School, and the Knox Grammar Prep School. Marked pedestrian crossings are located at the intersection of Cleveland Street and Billyard Avenue.

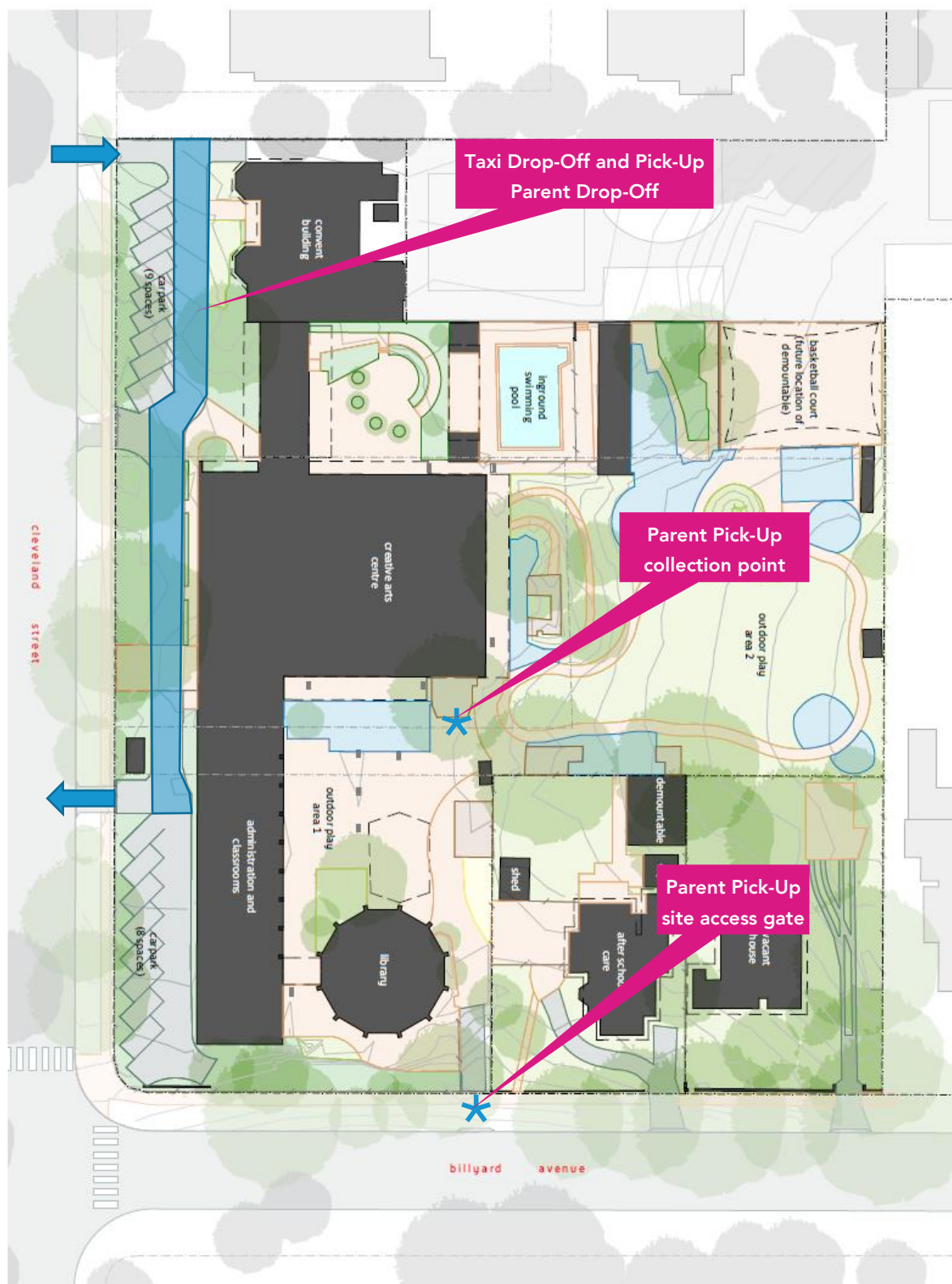


Figure 7 – Existing Drop-off and Pick-up Facilities

3.3.1 School Drop-Off and Pick-Up

Observations were made on Monday 20th February and Tuesday 21st February 2017 to assess the operation and dwell time (the time vehicles are stationary when dropping off and picking up students). Both days were typical of the school's operations and did not include any special events, sporting carnivals or adjoin a public holiday (which would otherwise impact the observations).

Drop-Off

The drop-off activity by both Government taxis and parents (private vehicles) is undertaken in the Port Cochere off Cleveland Street. The access (northern) and egress (southern) gates are opened at 8.30am and a total of 28 vehicles were observed being processed before the gates closed at 8.50am.

A member of staff escorts each student from the vehicle to the main school entrance.

On average, each vehicle took between 2 and 4 minutes to drop off the students (This being the time taken from the member to open the vehicle door, escort the student into the school and the vehicle to leave the Port Cochere). The exact time is dependent on the number of students in the vehicle and the level of disability of the students.

Parents, not using the Port Cochere, parked their vehicles on Cleveland Street and Billyard Avenue and escorted their child to the school. The average time undertaken from parking to exiting the space was approximately 5 minutes.

Pick-Up

The pick-up activity operated by the Government taxis, is undertaken in the Port Cochere off Cleveland Street. The northern gate is opened at 2.30pm and the taxis enter and queue in the Port Cochere. The Port Cochere can accommodate up to 15 vehicles and the drivers are instructed not to queue on the public roads.

Pick-up commences at approximately 2.40pm and each vehicle is allocated up to 4 students, with the students' name indicated in the vehicle windscreen. A member of staff escorts the children to the waiting vehicles.

The dwell time from the allocated students exiting the school to the vehicle exiting the Port Cochere averages 3 to 5 minutes. The exact dwell time is dependent on the number of children per vehicle and the level of disability of the students. The taxi pick-up operation was completed by 3.00pm.

The pick-up activity undertaken by parents (private vehicles) is in two stages. Parents park on Billyard Avenue and Cleveland Street and then proceed to the parent pick-up point, as indicated on Figure 7.

A member of staff then escorts the student to the pickup point for them to be collected by their parents. The parents then proceed back to their parked vehicle.

The dwell time from the parent exiting and re-entering their car is between 6 to 8 minutes dependant on the students' level of disability.

The parents arrive from 2.30pm and the pick-up activity is completed by 2.50pm.

3.3.2 On-Street Parking Controls

The School has two (2) road frontages; Cleveland Street and Billyard Avenue, each providing some areas of on-street parking. The on-street parking provision is subject to time restrictions and 'No Stopping'

restrictions. The various parking controls are presented in Figure 8 which comprise either unrestricted parking, 'No Parking', or 'No Parking during student drop-off and pick-up periods' ('No Parking' permits a driver to stop for up to two (2) minutes, however, they must remain within three (3) metres of the vehicle).



Figure 8 – Existing On-Street Parking Controls

3.3.3 On-Site Parking Supply

The current parking provision within the school comprises 17 spaces accessed via the Cleveland Street driveways. There are currently no parking spaces or pick-up/drop-off areas for parents within the school.

3.4 Public Transport

The school is well served by both train and bus services operating on the North Shore line and the 576 bus route along Cleveland Street.



Figure 9 – Surrounding Public Transport (Bus and Train Services)

3.4.1 Rail

Wahroonga Station is located approximately 400m walking distance from the Billyard Avenue entrance to the School and is situated on the North Shore Line, providing access to the School from Northern, Southern and Western suburbs (via interchange at Sydney CBD stations).

Table 1 – Rail Services

Rail Route	From	To	Frequency on Weekdays (approx..)
Northern Line (Southbound)	Berowra/Hornsby	Parramatta (via Central)	Arrive every 15 minutes (morning peak and afternoon school peak)
Northern Line (Northbound)	Parramatta (via Central)	Hornsby/Berowra	Arrive every 6-9 minutes (morning peak) Depart Every 6-9 minutes (afternoon school peak)

Services via the North Shore/Northern Line are frequent and provide excellent availability throughout the day, especially during peak hours.

3.4.2 Bus

A bus stop is located approximately a 3 min walk (280m) from the school near the Cleveland Street / Clwydon Place intersection. This bus stop services one (1) bus route, the 576 Wahoonga to North Wahoonga (Loop Service).

This service operates only from Monday to Friday in the morning prior to school hours and in the evening following school hours. The timetable is provided in Figure 10 below.

Monday to Friday												
Service Information												
Wahroonga Station	-	07:00	07:31	-	-	08:37	15:35	15:55	16:36	17:07	17:22	
Boundary Rd opp Daly Ave, Wahroonga	-	07:07	07:36	07:46	08:15	08:42	-	-	-	-	-	
Curtin Ave opp Page Ave, North Wahroonga	06:39	07:15	07:44	07:54	08:24	08:49	15:43	16:05	16:45	17:15	17:30	
Grosvenor St at Barton Cres, North Wahroonga	06:44	07:19	07:48	07:58	08:28	08:52	15:46	16:07	16:47	17:16	17:31	
Boundary Rd at Daly Ave, Wahroonga	-	-	-	-	-	-	15:49A	16:09	16:49	-	-	
Wahroonga Station	06:53	07:26	07:55	08:06	08:37	08:58	-	-	16:57	17:19	17:34	
Clissold Rd after Kokoda Ave, Wahroonga	-	-	-	-	-	-	15:59	-	-	-	-	
Turramurra Station	-	-	-	-	-	-	16:03	16:16	-	-	-	
Monday to Friday												
Wahroonga Station	17:52	18:08	18:37	18:52	19:20	19:52						
Curtin Ave opp Page Ave, North Wahroonga	18:00	18:16	18:45	18:56	19:24	19:56						
Grosvenor St at Barton Cres, North Wahroonga	18:01	18:17	18:46	18:57	19:25	19:57						
Wahroonga Station	18:04	18:20	18:49	-	-	-						

Figure 10 – Bus Route 576 Timetable

4. School Travel Characteristics

In order to assess the current and projected traffic activity associated with the School, it is important to understand the current travel characteristics, such as the transport mode split, car occupancy rates, locations of drop-off or parking etc.

Surveys were undertaken of both the students and staff and the results of these surveys are set out in Sections 4.1 and 4.2.

4.1 Student Drop-Off and Pick-Up Survey and Results

Given that the school caters for children with disabilities, the mode of travel to school differs from that of a traditional school and therefore the questions within the survey have been tailored to the school's specific mode of student travel.

The outcome of the survey was as follows:

- Government Taxis
 - 20 taxis dropping off and picking up a total of 77 students
- Parent/Guardian Drop-off
 - 8 vehicles dropping off 8 students within the existing driveway
 - 23 vehicles dropping off 23 students on street.
- Parent/Guardian Pick-Up
 - 8 vehicles picking up 8 students within the existing driveway
 - 23 vehicles picking up 23 students on street.

Total Students = 108

It was also noted that between 10 and 15 students attended on site After School Care, with the actual number being dependant on the activity being undertaken.

From this data it can be ascertained that:

- 71% of students are dropped off and picked up by Government Taxis with an average vehicle occupancy of 3.9 students per taxi
- 29% of students are dropped off and picked up by parents or guardian, with vehicle occupancy of 1 student per vehicle.
- Approximately 10% of the students attend after school car and therefore are picked up outside the school peak period.

4.2 Staff Parking Survey and Results

Of the 57 members of staff (at the Wahrooga Campus), 44 replied to the questionnaire and the results of this are outlined as follows:

- 36 members of staff travelled to and from school by car, in 35 vehicles.

Of these 35 vehicles:

- 15 have allocated parking spaces within the school
- 12 parked on Cleveland Street
- 5 parked on other streets in the vicinity of the school, and
- 3 parked at 8 Billyard Avenue.
- 8 members of staff travelled to and from school by public transport.

The staff arrival times were as follows:

- 23 arrived before 8.00am
- 10 arrived between 8.00am and 8.30am, and
- 3 arrived after 8.30am.

Staff departure times were as follows:

- 3 members of staff departed before 2.50pm
- 10 departed between 2.50pm and 3.30pm
- 18 departed between 3.30pm and 5.00pm, and
- 5 departed after 5.00pm

From this data it can be ascertained that:

- 82% (36/44) of staff travelled to and from school by car, with a vehicle occupancy of approximately 1 person per car.
- 18% of staff travelled to and from school by public transport.
- 17 members of staff have allocated parking spaces on site, this is assumed as there are 17 spaces available on site.
- Approximately 24 members of staff park on-street in the vicinity of the school, calculation as follows:
 - $57 \text{ staff} \times 81.8\% \text{ travelling by car} - 17 \text{ with allocated spaces} \times (45.7 \text{ FTE} \div 57 \text{ staff}) \approx 23.8$
 - This on-street staff parking demand is extrapolated from surveyed results assuming that the surveyed cohort 's (77% of all staff) mode split is representative of the entire staff
 - Note the $(45.7 \text{ FTE} \div 57 \text{ staff})$ is to adjust for the fact that the survey did not separate respondents into full-time and part-time staff, hence the need to reduce estimated on-street parking

5. Traffic Assessment

5.1 Existing Traffic Conditions

In order to determine the existing traffic conditions within the road network serving the school, traffic count surveys were undertaken at the following intersections:

- Cleveland Street and Billyard Avenue
- Cleveland Street and Millewa Avenue
- Billyard Avenue and Sutherland Avenue

The results of the intersection surveys are illustrated in the following figures:

Weekday Morning Peak

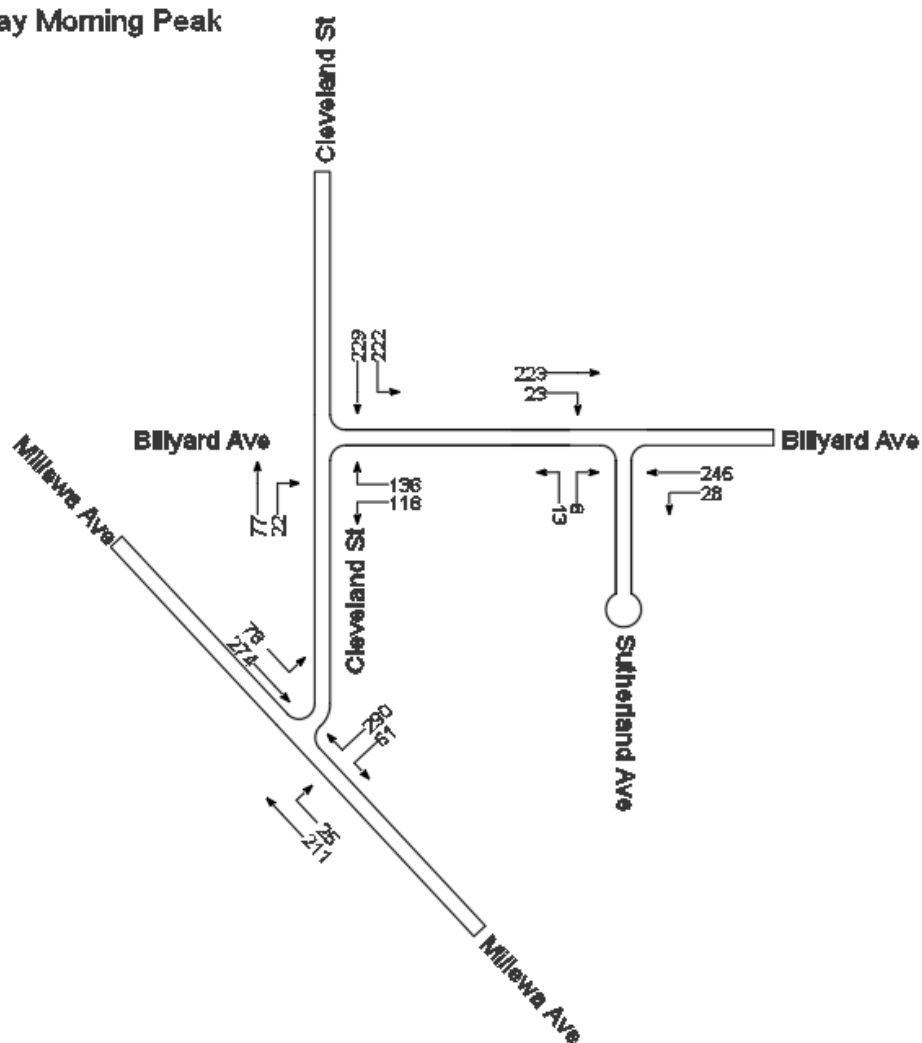


Figure 11 – Existing Morning Peak Traffic Volumes

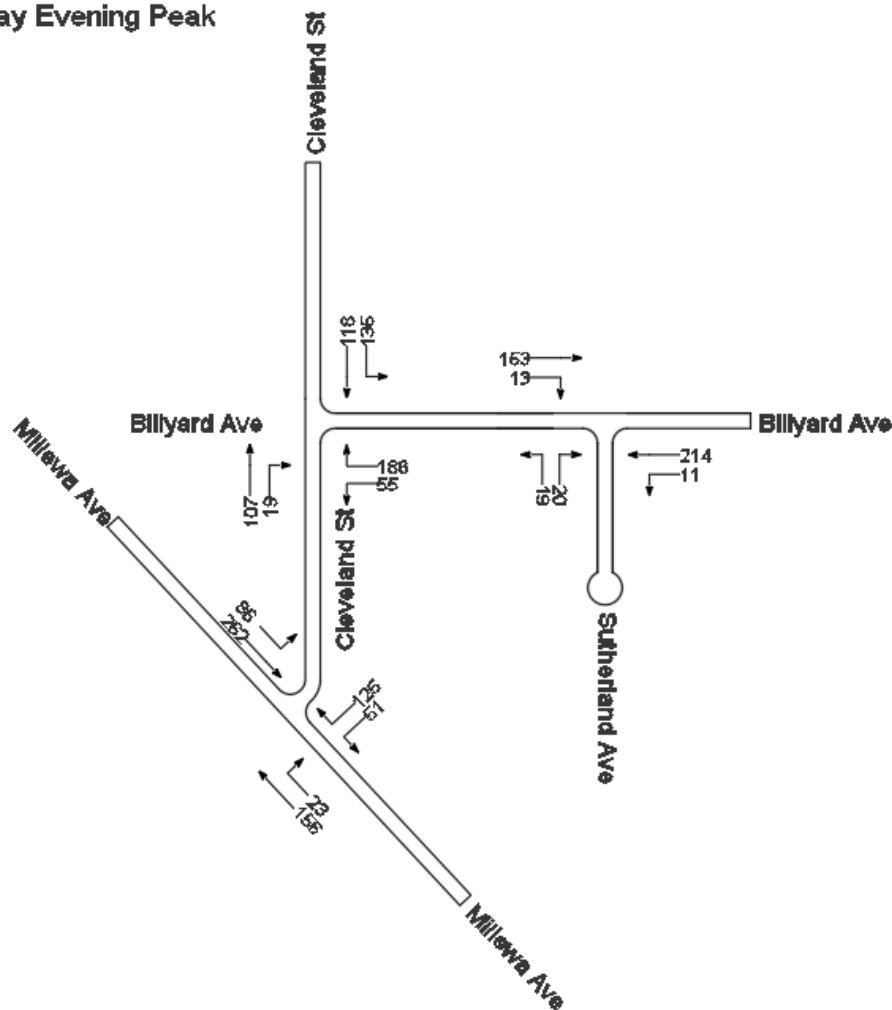
Weekday Evening Peak

Figure 12 – Existing Evening Peak Traffic Volumes

5.2 Development Traffic

The development traffic is calculated based upon comparison of existing vehicle generation and the expected post-development traffic generation. The calculations are split into the vehicle trips generated by taxis, private vehicles for parents, and teachers.

5.2.1 Government Taxis

Currently there are 20 taxis operating (see Section 4.1). Under the assumption that mode split will remain unchanged from the existing scenario, 71% of the new total of 240 students will arrive via Government taxis. The number of taxis required is calculated as follows:

- $240 \text{ students in total} \times 71\% \text{ of students in taxis} \div 3.9 \text{ students per taxi} = 43.7 \text{ taxis} \approx 44 \text{ taxis}$

Post-development, there is an expected number of 44 taxis required, resulting in a net increase of 24 vehicle trips in and 24 vehicle trips out from the school in each the peak hour.

5.2.2 Private Vehicles – Parents

Currently there are 31 vehicles as a result of parents dropping off and picking up children (see Section 4.1).

The number of vehicles for drop-off and pick-up post development for each period is forecasted using the existing modal split:

- Morning drop-off:
 - $29\% \text{ of students travelling by car} \times 240 \text{ students} \div 1 \text{ student per car} = 69.6 \approx 70 \text{ vehicles}$
- Afternoon pick-up:
 - $29\% \times 240 \div 1 \times 90\% \text{ (factoring that 10\% of students attend after-school care)} = 62.6 \approx 63 \text{ vehicles}$

Post-development, there is an expected number of 70 vehicles in the AM peak and 63 vehicles in the PM peak. This results in a net increase of 39 vehicle trips in the AM peak and 32 vehicle trips in the PM peak. Due to the short dwell times of vehicles operated by parents, this equates to 39 vehicle movements in and 39 vehicle movements out for the AM, and 32 vehicle movements in and 32 vehicle movements out for the PM.

5.2.3 Private Vehicles – Teachers

Post-development, there will be an increase in staff numbers from 45.7 FTE to 104 FTE, i.e. a 58.3 increase in FTE. Using the assumption that 81.8% travel by car (see Section 4.2), this results in 48 vehicle trips ($58.3 \times 81.8\%$). As teachers will enter the school during the AM peak and exit during the PM peak, the overall contribution is 48 vehicle movements in for the AM peak, and 48 vehicle movements out for the PM peak.

It should be noted that the actual PM peak traffic in the road network is typically between 5-6pm on weekdays. Although the road network is not saturated during the afternoon school peak, traffic modelling is undertaken considering the actual PM peak as a conservative approach.

5.3 Trip Assignment

The following trip assignment is proposed for all vehicles which is considered to be reasonable.

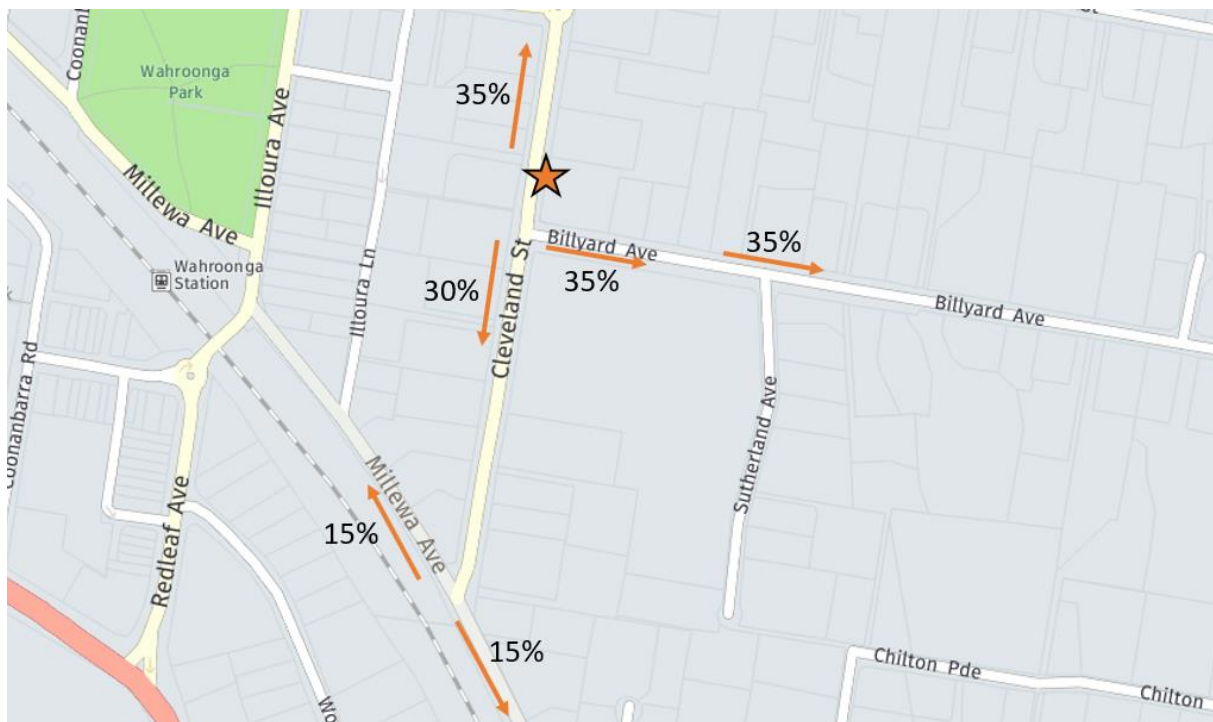


Figure 13 – Trip Assignment

5.4 Intersection Modelling

In order to confirm the current operation of the intersection, an assessment has been undertaken using the SIDRA modelling software, which presents a range of performance indicators (Level of Service, Average Delay, etc.).

Typically, there are three performance indicators used to summarise the performance of an intersection, being:

- **Average Delay**- The average delay encountered by all vehicles passing through the intersection. It is often important to review the average delay of each approach as a side road could have a long delay time, while the large free flowing major traffic will provide an overall low average delay.
- **95% Queue lengths (Q95)** - is defined to be the queue length in metres that has only a 5-percent probability of being exceeded during the analysis time period. It transforms the average delay into measurable distance units.
- **Level of Service (LoS)** – This is a categorization of average delay, intended for simple reference. The RMS adopts the following bands:

Table 2 – Level of Service Criteria

Level of Service	Average Delay (secs/veh)	Traffic Signals, Roundabout	Give Way & Stop Signs
A	<14	Good operation	
B	15 to 28	Good with acceptable delays & spare capacity	Acceptable delays & spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity & accident study required
E	57 to 70	At capacity. At signals, incidents would cause excessive delays. Roundabouts require other control mode	At capacity, requires other control mode
F	>70	Extra capacity required	Extreme delay, major treatment required

The modelling includes the existing intersections of:

- Cleveland Street / Millewa Avenue;
- Cleveland Street / Billyard Avenue;
- Sutherland Avenue / Billyard Avenue.

A summary of the modelling results is presented in the following table:

Table 3 – SIDRA Modelling Results for pre and post-development (Stage 2)

Intersection	Time	Period	Level of Service	Average Delay (s)	Degree of Saturation (%)	95% Queue Length (veh)
Cleveland Street / Millewa Avenue	AM Peak	Existing	B	4.5	0.463	2.6
		Development	B	4.9	0.497	2.9
	PM Peak	Existing	A	3.0	0.208	0.8
		Development	A	3.4	0.244	0.9
Cleveland Street / Billyard Avenue	AM Peak	Existing	A	4.1	0.265	1.1
		Development	A	4.6	0.320	1.4
	PM Peak	Existing	A	4.1	0.243	0.9
		Development	A	4.5	0.311	1.3
Sutherland Avenue / Billyard Avenue	AM Peak	Existing	A	0.9	0.149	0.2
		Development	A	0.8	0.170	0.2
	PM Peak	Existing	A	1.0	0.122	0.1
		Development	A	0.9	0.132	0.1

Sidra results in the above table show that the net traffic impact at the three (3) analysed intersection is minor. Following the Stage 2 development, all the intersections will continue to operate LOS A or B with significant spare capacity to accommodate additional traffic. The average vehicular delay and queuing will also be reasonable without affecting the non-development traffic.

6. Proposed Improvements

6.1 Planning Policy Requirements

The relevant planning policy applicable to the development is the Ku-ring-gai DCP 2015, and Part 23 which stipulates the following parking provisions for schools:

- 1 space per full time equivalent (FTE) employee;
- Provision for on-site set down / pick-up of students and a set down / pick-up management plan is required.

It is evident that the DCP makes the assumption that all staff drive to work at a car usage ratio of 1:1, whereas the survey results (discussed at Section 4.2) indicate that only 82% of staff drive to the School and therefore the actual parking demand is in fact less than that contemplated by the DCP.

It should also be noted that the existing site accommodates 17 parking spaces and the remaining staff park in the vicinity of the school in available on-street unrestricted parking spaces.

6.2 Proposed Parking Provision

As stated earlier, the development application proposes 25 basement parking spaces for Stage 1 and an additional 23 spaces for Stage 2, totalling net increase of onsite parking to 48 spaces within the basement car park.

The school currently has on-site parking for 17 vehicles, with an estimated 24 members of staff utilising the available on-street parking (see Section 4.2). The increase in staff parking demand will be accommodated within the basement car park. Staff who currently park on-street are expected to continue to park on-street, post-development.

The additional parking requirements are calculated as follows, assuming modal split is unchanged:

- $(104 - 45.7) \text{ increase in FTE} \times 82\% \text{ travelling by car} = 47.7 \approx 48 \text{ spaces}$

The proposed car park provides 48 spaces, which results in no requirement of additional on-street spaces following the completion of Stage 2. As such, the on-street staff parking demand of 24 (refer to Section 4.2) is expected to remain unchanged.

6.3 Accessible parking

The proposal also provides two (2) accessible spaces in the basement level car park with the required dimensions of 2.4m x 5.4m, and adjacent shared spaces of equal dimensions as part of Stage 1. Shared bays and accessible spaces shall be installed in accordance with AS2890.6:2009, including the installation of bollards and relevant pavement markings.

6.4 Vehicular Access

The new vehicular access to the site is proposed via a new 2-way driveway off Billyard Avenue towards the south-eastern corner of the site.

The proposed driveway is 5.8m wide and will facilitate simultaneous entry and exit into the site. A downward ramp will provide access into the basement level of the car park, and has a width of 5.8m

between kerbs to accommodate two-way movement. The ramp has been designed in accordance with AS2890.1:2004 requirements, whereby:

- Maximum grades do not exceed 25%;
- Transition grades do not exceed 12.5% and run for 2m;

6.5 Car Parking Arrangement

The existing car parking arrangement of the 17 car spaces within the site along Cleveland Street will remain in place.

The car park access and parking arrangements of the basement car park have been assessed against the requirements of AS2890.1:2004, with reference to Class 1A (employee) facilities. In addition to the typical requirements of AS2890.1, Class 1A facilities are to provide the following dimensions (90° angle parking):

- Car Spaces: 2.4m x 5.4m
- Aisle Width: 5.8m

All parking spaces have been individually assessed, and found to be 2.5m x 5.5m, with a minimum aisle width of 6.0m. All spaces meet the clearance requirements (door opening, entry flanges, column locations) of the parking space envelope requirements provided in Figure 5.2 of AS2890.1.

Regarding headroom clearance, the proposal provides a minimum height clearance of 2.2m. All overhead obstructions (ceiling-mounted services) shall allow for a minimum of 2.2m height clearance, or 2.5m immediately above any accessible and shared spaces.

The circulation within the car park occurs via a one-way path which starts and finishes with the ramp. Detailed plans on the car park with circulation and the flow direction can be found in the architectural plans in **Attachment 1**.

It is assumed that teachers will access the car park outside the pick-up and drop-off hours and the School will manage staff access accordingly so as to avoid conflicts with student drop-off / pick-up.

It should be noted that the development proposes to minimise the drop-off and pick-up activity from the road network and undertake this within the site, which will reduce the impact on the existing road network. Further, it is understood that, Knox Prep School has an approved DA to provide on-site parking for its staff and drop-off and pick-up activity. When completed, this will further reduce the on-street parking demand.

6.6 Pick-Up/Drop-Off Analysis

Student transport to and from the school is via two main modes of transport, government taxis and private vehicles. For both these modes, pick-up/drop-off facilities are provided to facilitate safe and efficient movement from vehicle to school and vice-versa.

Future operation will be largely unchanged from the existing operation at the school, however the pick-up/drop-off time may need to be extended to 5 to 20 minutes depending on the situation.

Staff entry and exit from the car park is proposed to take place outside of these time periods, and hence will not conflict with the movement of vehicles dropping off and picking up students.

6.6.1 Government Taxis

Operation

Government taxis will be able to access the school via the existing Cleveland Street 'Port Cochere'. Taxis enter the site and pull forward into the 'Pick-Up/Drop-Off' zone which can accommodate 5 vehicles simultaneously.

Currently, a proportion of private vehicles (parents) also utilise the Port Cochere for drop-off and pick-up of students (see Section 3.3.1). Within the proposal is the alternative arrangement to enable private vehicles to utilise the basement car park for student pick-up/drop-off (see following section). This will result in less traffic on the Port Cochere and smoother operation for the government taxis.

In the afternoon, pick-up from the Cleveland Street 'Port Cochere' will occur in a similar manner to the morning drop-off.

Calculation

With each taxi having an average dwell time of 3 minutes (see Section 3.3.1), the number of taxis accommodated by the Cleveland Street 'Port Cochere' is calculated as follows (drop-off period has a shorter time frame, and therefore is more critical):

- $20 \text{ min pick-up/drop-off period} \div 3 \text{ min dwell time} \times 5 \text{ vehicles at once} = 33.3 \approx 33 \text{ taxis}$

With 44 taxis dropping off children (see section 5.2.1), the existing Port Cochere facility off Cleveland Street is forecast to have insufficient pick-up/drop-off capacity. Therefore, the 20 min pick-up/ drop-off will need to be increased once student enrolments exceed the values provided in Table 4.

6.6.2 Private Vehicles - Parents

Operation

Currently parents pick-up and drop-off students via the Port Cochere or by parking their vehicle on Cleveland Street / Billyard Avenue, walking into the school, and collecting their child. Within the proposal is the arrangement for private vehicles to enter the basement car park to perform pick-up and drop-off.

To maximise efficiency and emphasise student safety, it is proposed for the operation to be as follows:

- Vehicles enter the basement car park and follow the one-way flow, moving through the car park, and begin queuing from the pedestrian crossing
- The queue will build up towards the western end of the car park (estimated 5 vehicles queue)
- Children will be dropped off/picked up from these 5 vehicles
- Once all 5 vehicles have completed their operations the marshal will direct them towards the exit and allow the queue to progress forwards
- This process is repeated

Calculation

Assuming a 6m length for queueing (i.e. 6m from car to car), the car park pick-up/drop-off aisle can accommodate a maximum of 5 vehicles. Assuming 2 minutes for drop-off and 3 minutes for pick-up, the existing 20 minute drop-off and pick up time will need to be increased subject to the number of students being dropped off / picked up. As estimated maximum number of student for various drop-off and pick-up

periods are provided in the table below. The student capacity calculation considers student drop-off and pick-up in both the basement parking and the Port Cochere.

Time	Activity	Maximum number of Students that can be accommodated
20	Drop-off	172
	Pick-up	127
25	Drop-off	215
	Pick-up	159
30	Drop-off	Sufficient for max. 240 students
	Pick-up	191
35	Drop-off	Sufficient for max. 240 students
	Pick-up	223
40	Drop-off	Sufficient for max. 240 students
	Pick-up	Sufficient for max. 240 students

Table 4 – Drop-off & Pick-up calculation

The above table shows that to accommodate maximum 240 students, 30 minute drop-off time and 40 minute pick-up (for both the basement car park and the Port Cochere) will be required once student enrolments reach 240.

It should be noted that the above calculations have assumed that all parents use the basement car park to pick-up/drop-off children. In reality, a proportion of parents may choose to park in the nearby on-street parking spaces to perform pick-up/drop-off (see Section 3.3.1). This will reduce the forecast number of private vehicles in the basement car park. In addition, the dwell times are very conservative with the afternoon pick-up dwell time for a single student in a private vehicle being the same as for government taxis with, on average, 3.9 students. Thus, the capacity calculations are very conservative and actual operation is likely to have more spare capacity.

7. Access and Car Park Assessment

The following section presents an assessment of the proposed development with reference to the requirements of AS2890.1:2004 (*Off-street car parking*) and AS2890.6:2009 (*Off-street parking for people with disabilities*). This section is to be read in conjunction with the architectural drawings in Attachment 1.

7.1 Vehicular Access

Access to the basement car park is via a ramp off Billyard Avenue. The two-way ramp is 6.4m wide with 300mm kerbs on both sides (5.8m kerb-to-kerb) which satisfies the minimum 5.5m width of two-way ramps as per AS2890.1 Section 2.5.2.

The ramp presents an initial 2m long transition with grade 1:8 before steepening to 1:5.68 for approximately 13.7m, followed by a 1:10 grade for approximately 2.2m (inside edge of ramp), and a 1:20 for approximately 4.2m. These grades are appropriate for the proposed use of light vehicles as per AS2890.1 Section 2.5.3.

7.2 Car Park Layout and Circulation

Table 1.1 of AS2890.1 presents a number of car park classifications applicable to different land-uses. The basement car parking is provided only for teachers, with parents accessing the car park during drop-off / pick-up periods (however, not parking). As such the car park is classified as a Class 1 facility.

The parking space dimensions and associated aisle width requirements for a Class 1 facility are as follows:

- Space: 2.4m x 5.4m
- Aisle width: 5.8m

The spaces provided are 2.5m x 5.5m which are wider and longer than required, increasing amenity and improving access. The aisle widths are 5.9m and 6.0m which meets the requirements of AS2890.1.

Circulation within the car park is one-way and at the narrowest aisle, is 5m which provides sufficient manoeuvring room. Swept path analysis has been performed to demonstrate the ability for two-way flow with a B99 vehicle entering the car park and a B85 vehicle exiting simultaneously (this is the critical case with the larger vehicle occupying the smaller radius turn).

8. Conclusion & Recommendations

The development proposes to increase the student and teacher (FTE) population at St Lucy's School (Wahroonga Campus) to 240 and 104 respectively at the site.

The assessment of the traffic activity has established that the development is likely to have a minor increase in traffic activity and will have minimal impact on the surrounding road network.

The development proposes to maintain the existing taxi drop-off and pick-up facility on the Cleveland Street frontage and provide a private vehicle (parent) drop-off and pick-up facility, by means of a set-down and pick-up zone within the basement car park. These facilities have been assessed and deemed to be adequate for the schools proposed demands.

The proposed additional 48 parking spaces, in conjunction with the existing 17 on-site parking spaces and the available and currently used on-street parking, is considered suitable for the proposed development.

The demand for on-street parking as a result of this development is expected to remain unchanged with an expected 24 staff continuing to park on-street.

Attachment 1 Architectural Drawings

All dimensions to be verified on site and any discrepancies referred to architect for determination. figured dimensions to take precedence over scaled dimensions.

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Rev	Issue	Date
P1	Client issue	13/06/2017
P2	Client issue	08/08/2017
P3	Client & Consultant issue	11/08/2017
P4	Council issue	21/08/2017
P5	Consultant issue	21/09/2017
P6	Consultant issue	09/10/2017
P7	Consultant issue	23/10/2017
P8	Consultant issue	25/10/2017
P9	Consultant issue	02/11/2017
P10	Consultant issue	08/11/2017

Architecture
Project management
Access consulting
Interior design



stanton dahl
architects

St Lucy's School

Masterplan 2.0

21 Cleveland Street,
Wahroonga, NSW

Drawn; ke
Checked; cjh
Plot date; 8/11/17

Scale: 1:100 as noted @ A1

Project No;
2061.16

Drawing No; **DA02** Amendment#;
/P10

basement plan

