

Traffic Impact Assessment

Mater Maria College, Warriewood

80017033

Prepared for
Avium

31 May 2019



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1 Introduction

1.1 Background

Cardno has been engaged by Avium to prepare a Traffic Impact Assessment (TIA) to accompany a development application for Mater Maria College located at 5 Forest Road, Warriewood.

1.2 Scope of Works

The purpose of this report is to assess the changes to the traffic and parking implications of the development proposal from the previously approved Development Application (DA), and the following scope of works have been undertaken as part of this study:

- > Review original DA documentation.
- > Review proposed amended plans which primarily focus on the Staff and Library Building and the Administration Building.
- > Undertake a qualitative assessment to compare on traffic generation and parking requirements from previously approved DA.

1.3 Reference Documents

The following documents have been reviewed and referenced in this report:

- > Guide to Traffic Generating Developments (RMS, 2002);
- > Guide to Traffic Generating Developments – Updated traffic surveys (RMS, TDT 2013/04a);
- > Australian / New Zealand Standards 2890: 2009 Parking Facilities Set;
- > Drawings A002, Project no. 15122, issue P1, 13/10/2016 (Avium).

The Avium plans for the proposed development are included in **Appendix A**.

2 Existing Conditions

2.1 Subject Site

The subject site is located at the end of a cul-de-sac at Forest Road, Warriewood in Sydney's north.

The subject site is an existing school with the majority of the proposed development built to the original DA plans.

The subject site and surrounding environs are shown in **Figure 2-1**.

Figure 2-1 Subject Site and Surrounding Environs



Background Image: Nearmap 2017

2.2 Existing Road Network

2.2.1 Schedule of Road Classification

Roads and Maritime Services (RMS) in partnership with local government established an administrative framework of State, Regional, and Local Road categories to help manage the extensive network of roads.

State roads are managed and financed by RMS, and Regional / Local Roads are managed and financed by councils. Notwithstanding, Regional Roads perform an intermediate function between the main arterial network of State Roads and council controlled Local Roads and therefore receives financial assistance from RMS.

Forest Road

Forest Road is a Local Road under the care and maintenance of Northern Beaches Council. Forest Road is an unmarked road with a cul-de-sac providing access to the subject site. The entirety of the road is signposted as a school zone.

Macpherson Street

Macpherson Street is a Collector Road under the care and maintenance of Northern Beaches Council

3 Development Proposal

3.1 Approved Development

Northern Beaches Council has previously approved the construction of a Library Staff Building and Administration Building (DA n1038/00). This application seeks to modify the building envelope of the approved buildings as well as modify the consent conditions relating to student numbers and associated on-site parking. More specifically, the existing consent conditions are as follows:

- > Condition D1 – *In order to provide satisfactory car parking for the total development, car parking provision shall be made for a minimum of 75 cars*
- > Condition D232 – *The capacity of the school is to be restricted to a maximum of 850 students.*

The above two consent conditions will be the focus of this traffic and parking assessment. It is acknowledged that as a result of population growth within the Sydney Metropolitan Area and the resulting increase in school placements, the school has increased to 1,026 currently. It is acknowledged that this is above current approvals and will be addressed within the Statement of Environmental Effects (SEE) to be submitted with the development application.

A more recent approval (n1038/00/S96/2) was issued on 6 December 2017 for redevelopment of part of the College. The Consent retains the above conditions, D1 & D232 in their current form.

3.2 Proposed Development

The development application seeks approval for 1,100 students and 97 on-site car parking spaces for staff (inclusive of three (3) disabled parking spaces).

Vehicular access via Forest Road is not proposed to change, nor is the internal bus zone arrangement.

4 Parking Assessment

4.1 Council Car Parking Requirement

Mater Maria College is within the Northern Beaches Local Government Area (LGA) however as a result of the recent Council amalgamations, Pittwater Council's Local Environment Plan (LEP) and Development Control Plan (DCP) remain applicable until such time as the Northern Beaches Council supersede these documents.

Therefore, referring to Pittwater Council's DCP 2014 (to be referred to as the DCP), car parking rates for a number of land uses within Chapter B6 of the DCP are provided. However, 'schools' or 'educational establishments' are not identified within the DCP, rather reference is to be made to the Roads and Maritime Services (RMS) Guide to Traffic Generating Developments 2002 (RMS Guide). Similarly, the RMS Guide does not provide parking rates for 'schools' or 'educational establishments' and as such a first principles approach is required to establish the appropriate car parking requirement, whilst also seeking to meet the objectives of Council's DCP.

Council's DCP lists the following 'outcomes' for off-street vehicle parking requirements:

- > *An adequate number of parking and service spaces that meets the demands generated by the development. Functional parking that minimises rainwater runoff and adverse visual or environmental impacts while maximising pedestrian and vehicle safety.*
- > *Safe and convenient parking.*

The above objectives have been taken into consideration as part of this assessment.

4.2 Parking Demand Analysis

4.2.1 Staff Parking

Information obtained for the Warriewood area (travel zone 2031 & 2032) indicates a car driver percentage of 82% for journeys to the identified travel zones for work (refer to **Appendix B**). Applying this outcome to the future 100 staff members on-site would result in a requirement of 82 car parking spaces to satisfy the forecast parking demand.

However, based on information provided by the school it is expected that the level of staff driving to the school is closer to 95% (i.e. 5% of staff either car pool or utilise public transport). This is a similar outcome to many other schools. Therefore, based upon a car driver rate of 95%, a requirement of 95 car spaces is required.

It is recommended that a minimum of 95 car parking spaces be provided for staff. The proposal details a total of 97 car parking spaces, including three (3) disabled car space and is therefore considered satisfactory.

4.2.2 Drop-off / Pick-up

Surveys were undertaken of the drop-off / pick-up zone on Forest Road on 7:30am to 9:30am and 2:00pm to 4:00pm on Thursday 30th March 2017, during a typical school day. The survey sheets are provided in **Appendix C** for reference.

The survey identified that the drop-off / pick-up zone (consisting of six kerbside parking spaces) is operating satisfactorily during the AM period, with minor queuing beyond the designated zone occurring.

Figure 4-1 School Drop-off / Pick-up zone



During the PM period, the operation of the drop-off / pick-up zone results in queuing which can extend to the Macpherson Street / Casuarina Drive / Forest Road roundabout. The queue occurs for approximately 10 minutes during the afternoon from 3:10pm to 3:20pm. This is largely a result of vehicles arriving and occupying the drop-off zone in advance of the school finish time and waiting until the student is present to for collection. This is typical of many schools across New South Wales (NSW) and as noted, lasts for a short amount of time in the afternoon.

Theoretically, the drop-off / pick-up zone was provided for the approved 850 students and as such, a linear increase to 1,100 students would result in 8 car spaces ($6 / 850 \times 1,100$).

The traffic surveys identified a peak of 96 cars entering Forest Road during the 3:00-4:00pm period. It assumed that all cars entering Forest Road from the roundabout are associated with the Mater Maria College. Upon further detailed investigation of the survey results, there is a clear peak of 62 cars from 3:00pm to 3:30pm.

The number of vehicles per children within Forest Road during the peak hour is equivalent to 1 vehicle per 10.7 students ($1,026 / 96$), whilst the 30 minute peak equates to 1 vehicle every 16.5 students ($1,026 / 62$).

Disregarding those parked vehicles that occupied the drop-off / pick-up zone prior to the school finish time, the average service time (i.e. time for a vehicle to stop and collect the student) is 1 minute 25 seconds (based on the survey results). However, vehicles that have arrived early and occupy the drop-off / pick-up zone disrupt the service time of all vehicles.

To reflect this operation, queuing analysis has been undertaken to replicate the drop-off / pick-up zone operation during the afternoon period. This is based on Austroads Guide to Traffic Management Part 2: Traffic Theory and queue theory. The reported queue length extending beyond the drop-off / pick-up zone was 15 vehicles. The service time (reported as 85 seconds, or 1 minute and 25 seconds) has been modified in accordance with the queuing analysis and formulas to match the maximum observed extent of queue of 15 vehicles. This resulted in a service time of 148 seconds per vehicle.

Based on the future 1,100 students it is estimated that there will be 67 vehicles during the peak 30 minute period ($1,100 / 16.5$), whilst the existing consent for 850 students would have likely seen 52 vehicles during the peak 30 minute period.

The queue length calculation is summarised in **Table4-1**. The calculation methodology and assumptions is provided in **Appendix D**.

Table 4-1 Queue Analysis Based on Existing and Future Inbound Traffic Volumes

	Inbound Flow (30min)	Service Bays	Service time	Probability (95%) of Queue
Existing PM	62 vehicles	6	148 seconds	15
Future PM	66 vehicles	6	148 seconds	26
850 students	52 vehicles	6	148 seconds	5

The increase of four (4) inbound vehicles is estimated to result in an additional 11 queued vehicles in the 30 minute period. This indicates how sensitive the drop-off / pick-up zone is to minor increases in traffic volume, a result of an undersupply of kerbside parking spaces and the early arrival of parents.

In order to resolve the drop-off / pick-up queuing, the following improvements should be considered:

- > The school currently does not have a formalised traffic and parking management plan in place. A management plan should be provided to all staff and parents of the school identifying the purpose and objectives of the management plan (refer to **Section 6**). As part of this management plan, a “staggering” of student departure times can provide relief from the cumulative impacts of the school pick-up/drop-off operation.
- > Consider providing additional kerbside parking for the drop-off / pick-up zone.

Table 4-2 below is based on a staggered finish time of 10 minutes for Years 7 and 8 only. This is equivalent to 37.5% of the school population. With regard to the traffic generation associated with years 7 and 8 only, whilst this represents 37.5% of the school population, it has been conservatively assumed to be 15% of the afternoon drop-off / pick-up activity. This is considered to be extremely conservative given that these school grades are likely to generate higher drop-off / pick-up activity as other grades (9 to 12) a more accustomed to using public transport.

Therefore, the inbound traffic flow for the future 1,100 students during the peak 30 minutes has been reduced by 15%, from 66 to 56 inbound vehicles.

Table 4-2 Queue Analysis Based on Staggered Finish Time

	Inbound Flor	Service Bays	Service time	95 th Percentile Queue
Future PM	56 vehicles	6	148 seconds	8

Table 4-3 is based on an increase in kerbside parking within the drop-off / pick-up zone, from the existing six (6). The inbound flow rate for the 1,100 students has been maintained.

Table 4-3 Queue Analysis Based on Additional Drop-off / Pick-up Parking

	Inbound Flor	Service Bays	Service time	95 th Percentile Queue
Future PM	66 vehicles	7	148 seconds	9
Future PM	66 vehicles	8	148 seconds	5

The provision of an additional kerbside parking space, to a total of seven (7) spaces, significantly reduces the extent of queue beyond the drop-off / pick-up zone. The extent of queuing identified in **Table 4-3** is generally consistent / closer to what would have been expected for the 850 students with the increase of 1-2 drop-off spaces. The extension of the existing drop-off/pick-up zone would likely impact street trees and be in a location where the road gradient may be unsuitable.

4.3 School Bus Requirements

Table 4-4 identifies the school bus services during the AM and PM periods. These buses are staggered to ensure on-site congestion does not occur and student safety is maintained. At any one-time, two (2) buses can be expected within the on-site bus zone.

Table 4-4 Existing School Bus Routes

Route	AM	PM
182	✓	✓
	✓	✓
	✓	✓
630		✓ ⁽¹⁾
632		✓
633		✓ ⁽¹⁾
635	✓	
636	✓	
637	✓	
641		✓
642		✓

643	✓	✓
	✓	✓
645	✓	
646	✓	
647	✓	
648	✓	✓ ⁽¹⁾
	✓	✓ ⁽¹⁾
649		✓
		✓
650		✓
651		✓
664	✓	✓
	✓	✓
742	✓	

Notes:

(1) Bus terminates at Mater Maria College in the PM

The current school bus routes are not proposed to be modified as a result of this application.

4.4 Servicing & Loading

There are no proposed changes to the schools servicing or loading arrangements.

4.5 Car Parking Layout

The site proposes 97 car parking spaces (which is a total of existing and proposed spaces, inclusive of three (3) disabled parking spaces). The new staff car park, which consists of a total capacity for 18 cars, is proposed to be located further south of the bus turning bulb of the school site. The new car park replaces the existing cricket training facilities of the college, and are considered appropriate only for staff use. Three disabled car park spaces are provided along the existing driveway with alterations to the existing carpark. The additional car parking spaces have been reviewed and are considered satisfactory in terms of compliance with relevant requirements of AS2890.1:2004 and AS2890.6:2009 where applicable.

5 Traffic Assessment

5.1 Development Traffic Generation

A significant portion of students utilise the multiple bus routes provided during the morning and afternoon periods. The resulting traffic generation associated with private car trips is reduced.

It is assumed that the level of traffic entering and exiting Forest Road during the morning and afternoon periods is associated with the school only. This is considered to be a conservative estimate as residential properties can also be access via Forest Road.

The traffic surveys are summarised in **Table 5-1** below.

Table 5-1 Surveyed Traffic Flows in Forest Road

	IN	OUT
8:00-9:00am	252	252
3:00-4:00pm	96	142

The traffic generation associated with the morning drop-off is likely to consist of 100% parent vehicles, as staff would have arrived prior to school's operational hours. During the evening peak hour, it is evident that a significant reduction occurs. This is likely to be as a result of students who have arrived via private car in the morning period, depart the school using via bus in the afternoon. As parents are likely to drop the student off on their way to work, they are not being able to collect the student in the afternoon due to school finishing circa 3:00pm whereas work will typically finish circa 5:00pm.

Additionally, the increase in outbound trips compared to inbound trips in the afternoon period is as a result of staff leaving the school during the same peak hour and/or trips to the residential properties. This would not have occurred during the morning peak hour.

The survey results are based on the current student population of 1,026. The traffic generation of the school, from the previous 850 students to the proposed 1,100 students is summarised in **Table 5-2** below. These were calculated by factoring up or down the traffic generation determined for the 1,026 students.

Table 5-2 Forecast Traffic Flow in Forest Road

	8:00-9:00AM			3:00-4:00PM		
	IN	OUT	Total	IN	OUT	Total
850 students	209	209	418	80	118	198
1,026 students	252	252	504	96	142	238
1,100 students	270	270	540	104	153	257

Based upon the linear growth outlined, the increase in student population from the approved 850 students to the proposed 1,100 students results in an additional 122 trips in the morning peak hour (540 – 418) and 59 trips in the afternoon peak hour (257 – 198).

5.2 Intersection Performance

The roundabout intersection of Macpherson Street / Casuarina Drive / Forest Road has been assessed using SIDRA 7.

The key indicator of intersection performance is typically the Level of Service (LoS), where results are placed on a scale from 'A' to 'F', outlined in **Table 5-3**.

Table 5-3 Level of Service Criteria

Level of Service	Average Delay per Vehicle (sec/veh)	Traffic Signals, Roundabout	Giveway & Stop Signs
A	< 14	Good Operation	Good Operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near Capacity & accident study required
E	57 to 70	At Capacity, at signals incidents will cause excessive delays Roundabouts require other control mode	At capacity, requires other control mode
F	> 70	Unsatisfactory and requires additional capacity.	Unsatisfactory and requires additional capacity.

The Average Vehicle Delay (AVD) provides a measure of the operational performance of an intersection and determines the LoS when applying the Roads and Maritime method. It should be noted that the AVD's should be taken as a guide only as longer delays could be tolerated in some locations (i.e. inner city conditions) and on some roads (i.e. minor side street intersecting with a major arterial route). For traffic signals, the weighted average delay over all movements should be utilised. For roundabouts and priority control intersections (sign control) the critical movement for assessing LoS should be the movement with the highest average delay.

The Degree of Saturation (DoS) is another measure of the operational performance of individual intersections. For intersections controlled by traffic signals, both queue length and delay increase rapidly as DOS approaches 1.0. It is usual to attempt to keep DOS to less than 0.9. Degrees of Saturation in the order of 0.7 generally represent satisfactory intersection operation. When DOS exceed 0.9 queues can be anticipated.

The intersection performance is summarised in **Table 5-4** below.

Table 5-4 Macpherson Street / Casuarina Drive / Forest Road Intersection Performance

	Degree of Saturation	Average Delay	Level of Service
8:00-9:00am	0.47	13.9	A
3:00-4:00pm	0.45	11.9	A

The intersection performance has been assessed as LoS A, which reflects good operation. It is relevant to note that the SIDRA model cannot adequately account for the downstream queue occurring in Forest Road from the drop-off / pick-up zone, however as this queue occurs for approximately 10 minutes, the SIDRA output is for the peak one hour period.

The assessed traffic flows are based on the 1,026 students. It can therefore be concluded that generally, the intersection performance is not impacted by the increase of students from 850 to 1,026 and unlikely to be impacted by the increase from 1,026 to 1,100 (difference of 74 students).

6 Traffic & Parking Management Plan

6.1 Description

A traffic and parking management plan should be formalised for the Mater Maria College, as it is understood that one does not currently exist. In principle, the management plan should be written and enforced based on the following (refer to *Renaldo Plus 3 Pty Limited v Hurstville City Council [2005] NSWLEC 315* and *Amazonia Hotels Pty Ltd v Council of the City of Sydney [2014] NSWLEC 1247*):

- 1) Do the requirements in the Management Plan relate to the proposed use and complement any conditions of approval?
- 2) Do the requirements in the Management Plan require people to act in a manner that would be unlikely or unreasonable in the circumstances of the case?
- 3) Can the source of any breaches of the Management Plan be readily identified to allow for any enforcement action?
- 4) Do the requirements in the Management Plan require absolute compliance to achieve an acceptable outcome?
- 5) Can the people the subject of the Management Plan be reasonably expected to know of its requirements?
- 6) Is the Management Plan incorporated in the conditions of consent, and to be enforced as a condition of consent?
- 7) Does the Management Plan contain complaint management procedures?
- 8) Is there a procedure for updating and changing the Management Plan, including the advertising of any changes?

Based on the outcomes of the traffic impact assessment, it is recommended that the school increase the pick-up / drop-off capacity or adopt a staggered finish time to offset the cumulative impact of school traffic in the afternoon. The management plan should be prepared irrespective of which option is adopted.

6.2 Suggested Traffic & Parking Management Plan (TPMP)

The following sub-headings are recommended inclusions within any formalised TPMP document to be prepared by the school. A detailed draft version of the TPMP is provided in **Appendix E**.

6.2.1 Introduction

This Traffic & Parking Management Plan (TPMP) has been prepared to address traffic and parking conditions within the Mater Maria College car parking areas, as well as the road network in the near vicinity of the Warriewood campus.

The purpose of this TPMP is to manage and identify objectives of the College in relation to traffic management within the school site during operating hours and ensuring that the school will function in a safe and effective manner for staff, parents, visitors and students. This TPMP is to minimise risks / conflict between pedestrians and vehicles and minimise where possible traffic and parking impacts both internal and external to the site.

This TPMP will be included to existing and future enrolled students and their families, as well as all staff of the College.

The objectives of this TPMP are to:

- 1) Acknowledge the surrounding residential neighbourhood and the need to minimise, where possible, any impact upon residential amenity
- 2) Operates with high regard to the safety of the College community and the surrounding residential neighbourhood.

6.2.2 Parking Operation

6.2.2.1 Mater Maria College Grounds

The following lists the on-site conditions:

- i. Staff will have access to the car parking spaces, as marked, at all times during the hours of operation.
- ii. A total of 97 car parking spaces (inclusive of three (3) disabled parking spaces) are provided on-site.
- iii. Staff are requested not to double park or parking in unmarked locations within the school grounds. Any incidents of unsatisfactory staff behaviour are to be reported to school management.
- iv. Parents are not permitted to utilise the Mater Maria College car parking area for the purpose of drop-off / pick-up.
- v. Staff are to be vigilant in review on-site conditions and identify and report to school management any unsatisfactory behaviour or hazards that are at risk of breaching the objectives of this TPMP.

6.2.2.2 Drop-off / Pick-up

Mater Maria College has a designated drop-off / pick-up zone within Forest Road. This zone is restricted to 2 minutes only, from 8:00am to 9:30am and 2:30pm to 4:00pm school days. The following behaviour is expected:

- i. Vehicles are not to occupy the drop-off / pick-up parking spaces for longer than what is permitted by signage.
- ii. Students are to enter the parked vehicle from the kerbside door only, wherever possible.
- iii. Students and parents are not to perform drop-off / pick-up activity within the travel lanes along Forest Road.
- iv. Vehicles are to adhere to Australian Road Rules and regulatory signage at all times.
- v. Parents are not to double park, block driveways or undertake U-turn manoeuvres.
- vi. Pedestrians are to have right of-way when crossing driveways at all times.

6.2.3 Periodic Review

School management are to review this TPMP and all other school related activity annually, or as the need arises (i.e. in response to incidents). The school is to make this document freely available to the Mater Maria College community.

6.2.4 Complaints Handling

School management are to keep a detailed history of all complaints received with regard to traffic and parking behaviour associated with the College. A complaints register is to identify the detail of the complaint, the response to the complaint and the outcome as a result. Additional detail can be included within any complaints register.

7 Conclusions

Based on the assessment and discussions presented within this TIA report, the following conclusions are made:

- > The associated increase in staff for the proposed 1,100 students equates to a total of 100 staff.
- > The proposed amendments to the previously approved development seeks to add an additional 250 students and 22 on-site car parking spaces, an increase from 850 students and 75 car parking spaces respectively. The total on-site parking proposed is 97 car parking spaces (inclusive of three-disabled parking space).
- > The additional car parking has been assessed to comply with relevant clauses of AS2890.1:2004 where applicable.
- > There is no proposed modifications to the existing school bus operations or servicing of the site.
- > The school currently has six (6) drop-off / pick-up car spaces on Forest Road. During the morning period this operates satisfactorily whilst during the afternoon pick-up time the drop-off zone is over saturated for a short period of time.
- > The school adopt a formalised Traffic and Parking Management Plan (TPMP) which details the expected behaviour and operation of the school community
- > To mitigate the queuing from the drop-off zone, it is recommended that the College implement one of the following two options:
 - Include a section within the TPMP which identifies staggering of years 7 & 8 during the afternoon finishing time and continue to monitor the utilisation of the kerbside parking in Forest Road.
 - Provide one (1) or two (2) additional pick-up car parking spaces, increasing the pick-up zone from six (6) to eight (8). This may however impact street trees and be in a location with an unsuitable gradient.
- > The roundabout intersection of Macpherson Street / Casuarina Drive / Forest Road operates satisfactorily during the morning and afternoon peak one hour period. The mitigation measures recommended for the drop-off / pick-up zone will improve the impact of queuing at this roundabout.

Mater Maria College, Warriewood

APPENDIX

A

ARCHITECTURAL PLANS



PRELIMINARY
purpose of issue
21.12.18
by date
1
issue no.
architect

ALLEANZA
ARCHITECTURE

project
MATER MARIA COLLEGE

address
5 FOREST RD, WARRIEWOOD
NSW 2102

client
AVIUM

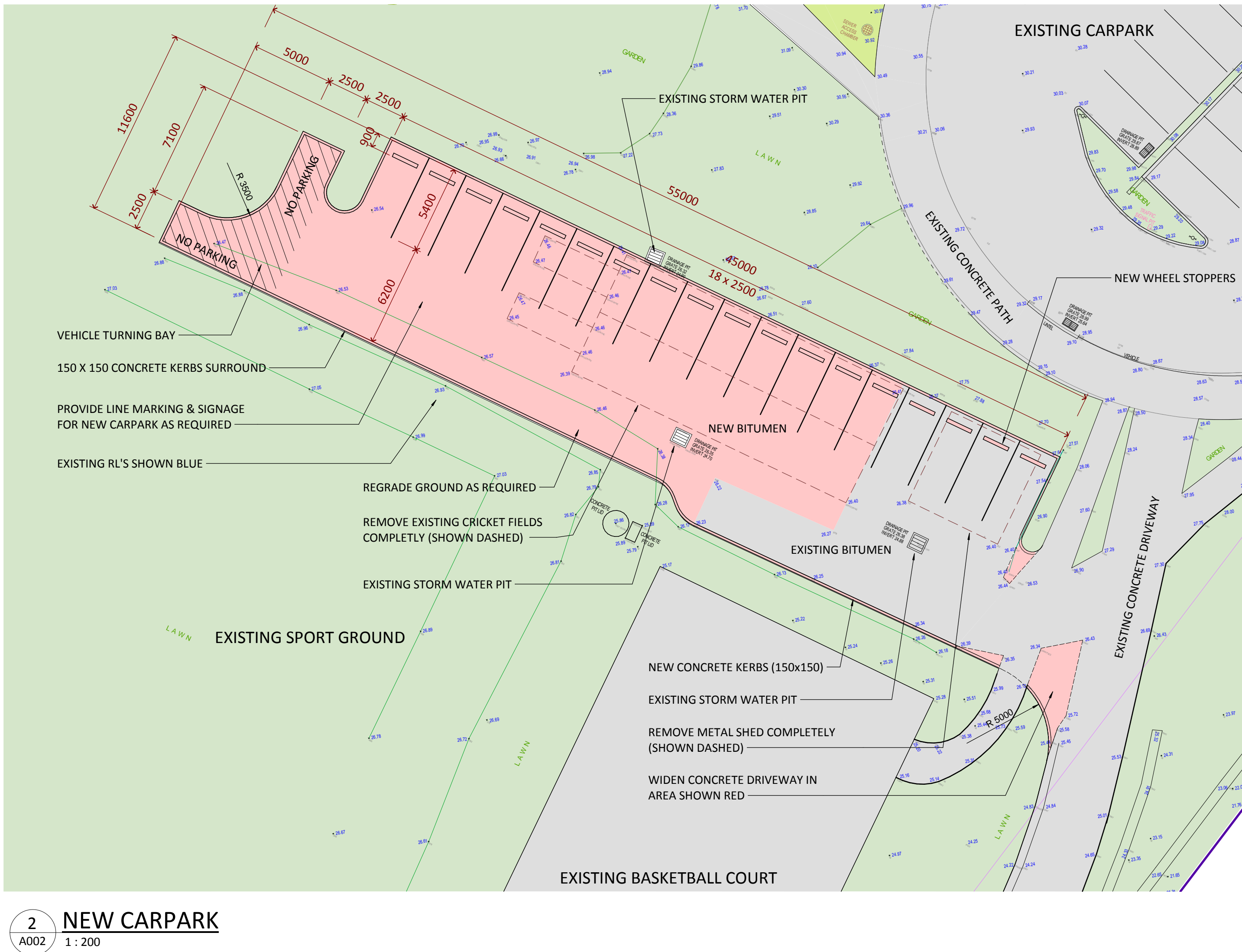
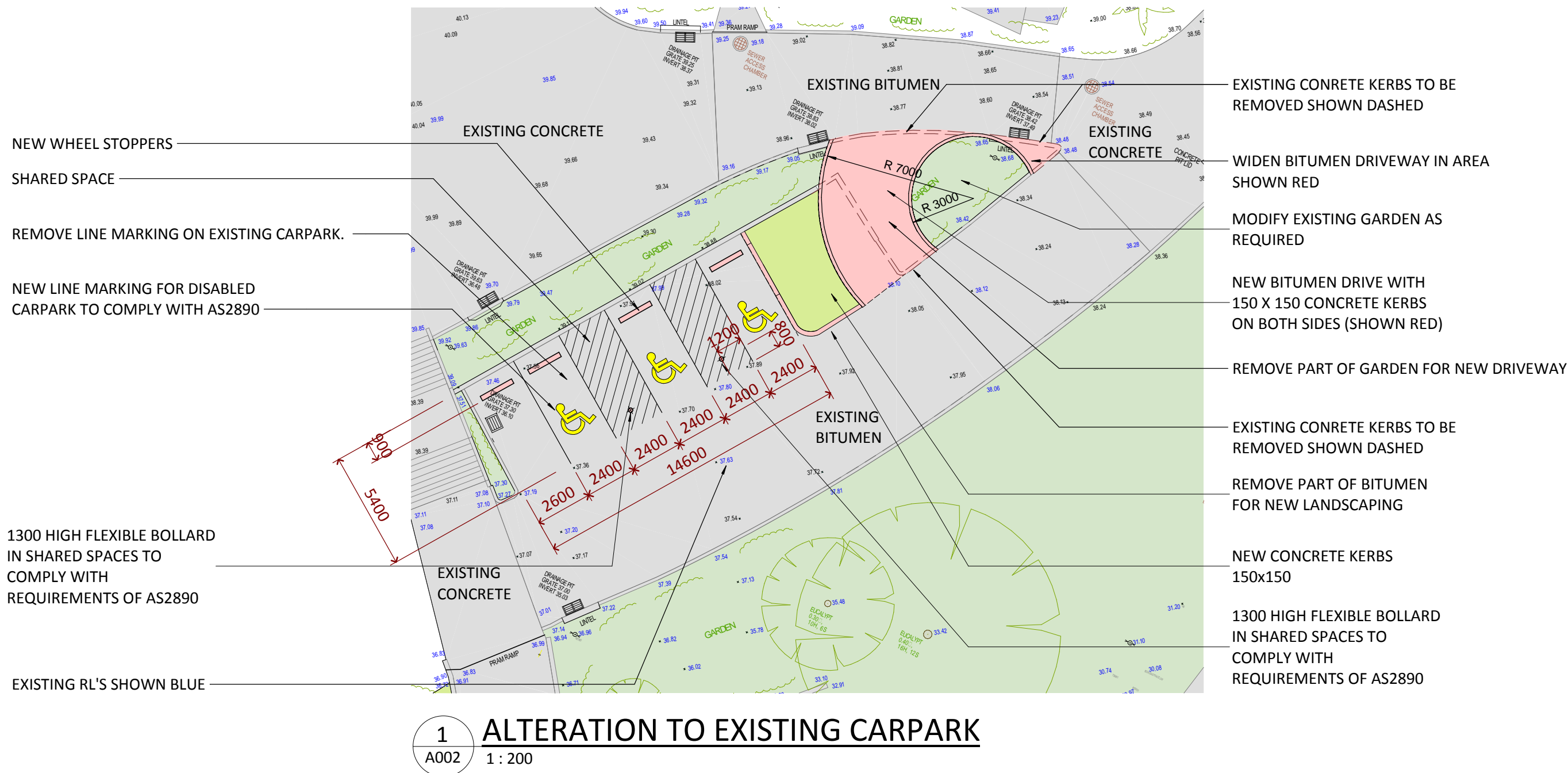
PRELIMINARY
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checked: CG
verified: CG
sheet size: A1
scale: 1 : 500
north

graphic scale

OVERALL SITE PLAN
sheet

15122
project no.
A002
sheet no.
1
issue

Original Sheet Size A1 : 841 x 594mm 21/12/2018 12:16:08 PM\\Warriewood\\15122 Mater Maria College\\B Design\\B05 CAD\\15122 Mater Maria WPD\\B219.rvt



Dimensions take precedence over scaling. Do not measure off drawings as print sizes may vary.
All 3d drawings are for viewing purposes only. 2d drawings take precedence.

PRELIMINARY 21.12.18 1
purpose of issue by date issue no.

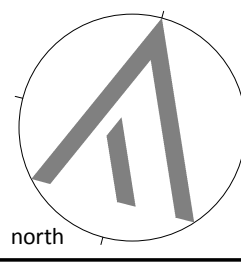
ALLEANZA
ARCHITECTURE

project
MATER MARIA COLLEGE

address
5 FOREST RD, WARRIEWOOD
NSW 2102

client
AVIUM

PRELIMINARY



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checked: CG
verified: CG
sheet size: A1
scale: 1 : 200

graphic scale 6

PART SITE PLANS

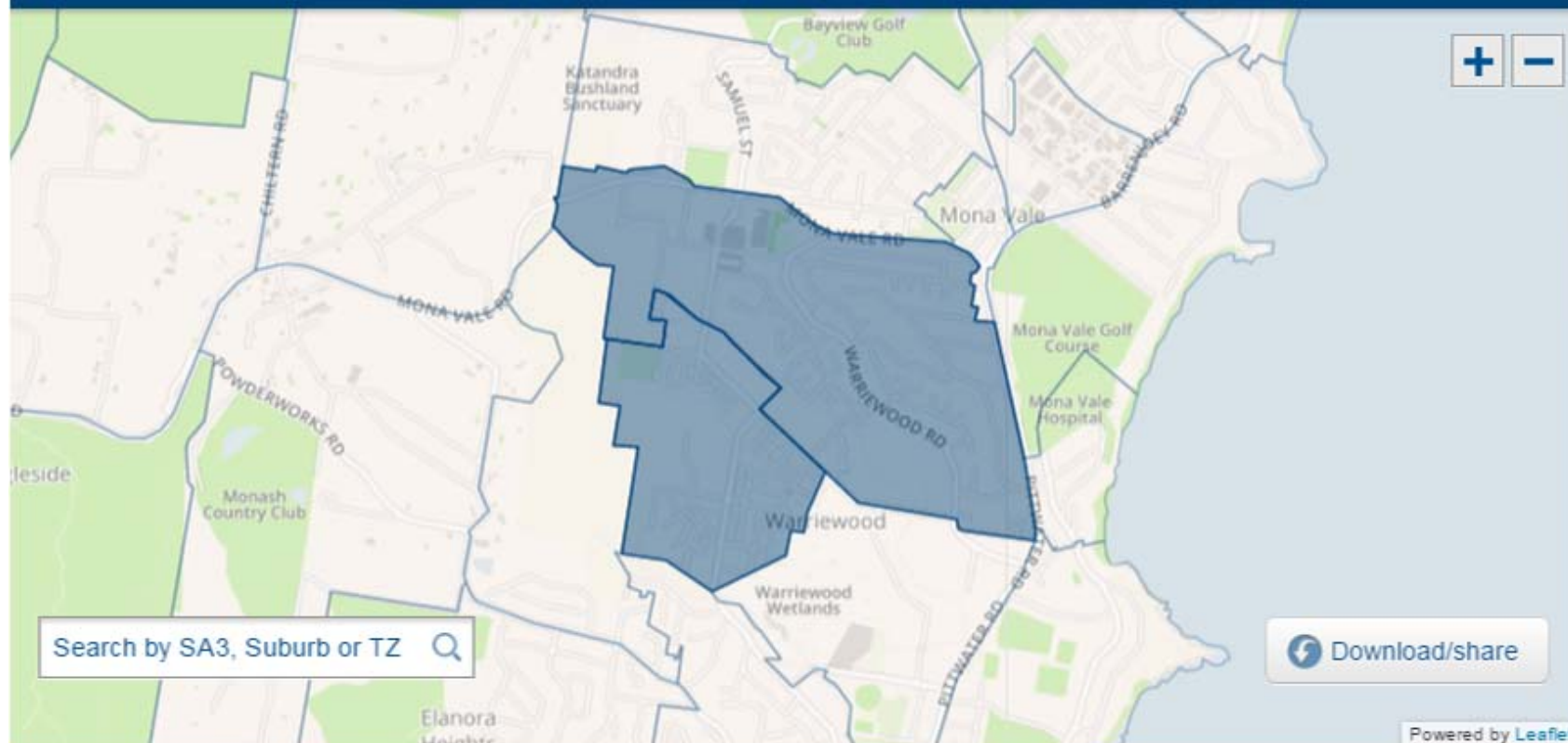
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Mater Maria College, Warriewood

APPENDIX

B

TRAVEL ZONES



TZ Selection

X clear

2031, 2032

Place of Work

Place of Residence

3,651 people work in the selected employment area from the map above

How do workers commute to the selected employment destination?

Mode Share* for all places of residence



- 82% Vehicle driver
- 6% Vehicle passenger
- 5% Bus
- 3% Walked only
- 1% Train
- 1% Other mode
- 1% Mode not stated
- 1% Ferry/Tram

* Excludes those who did not go to work

Mater Maria College, Warriewood

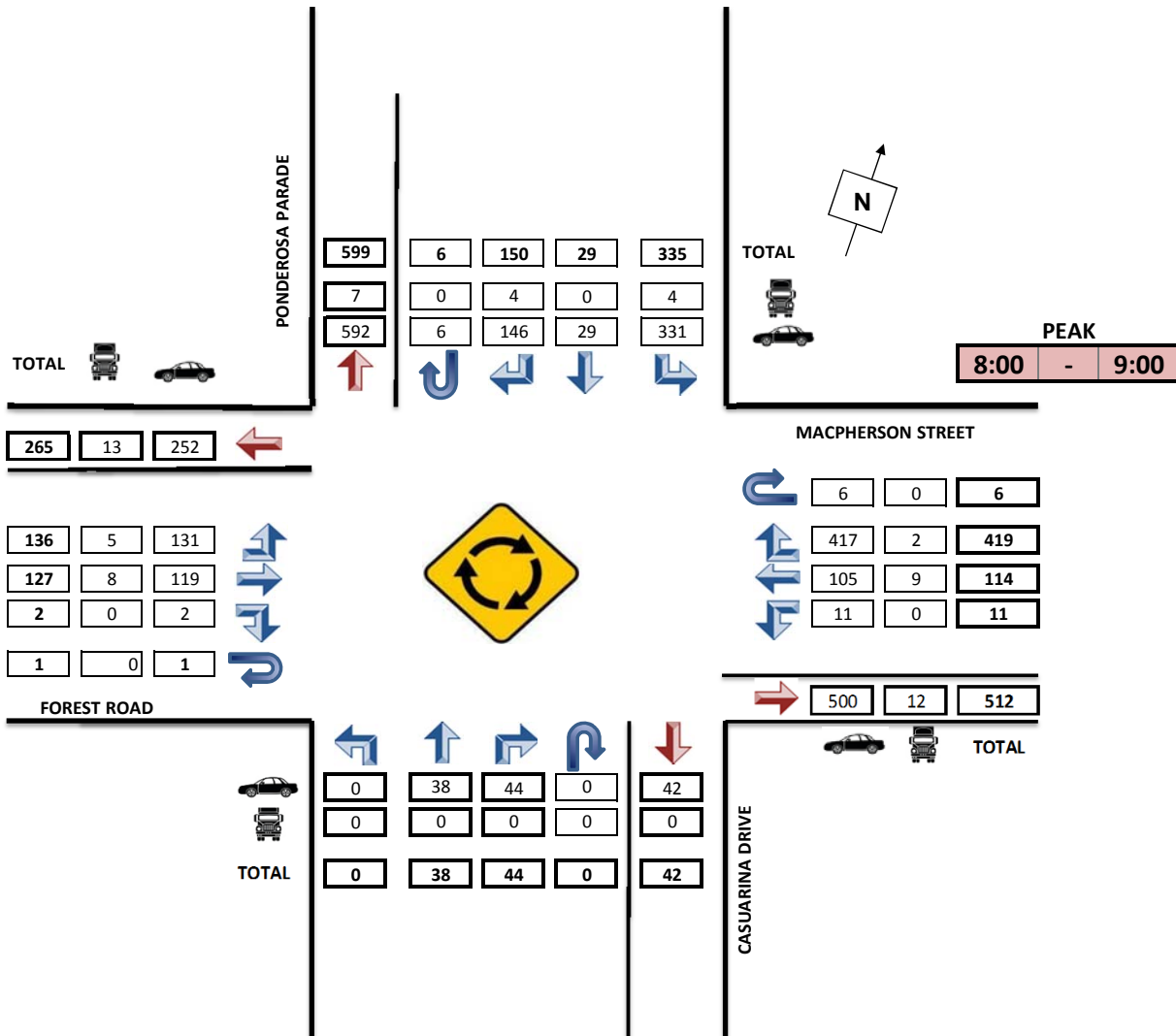
APPENDIX

C

TRAFFIC SURVEYS

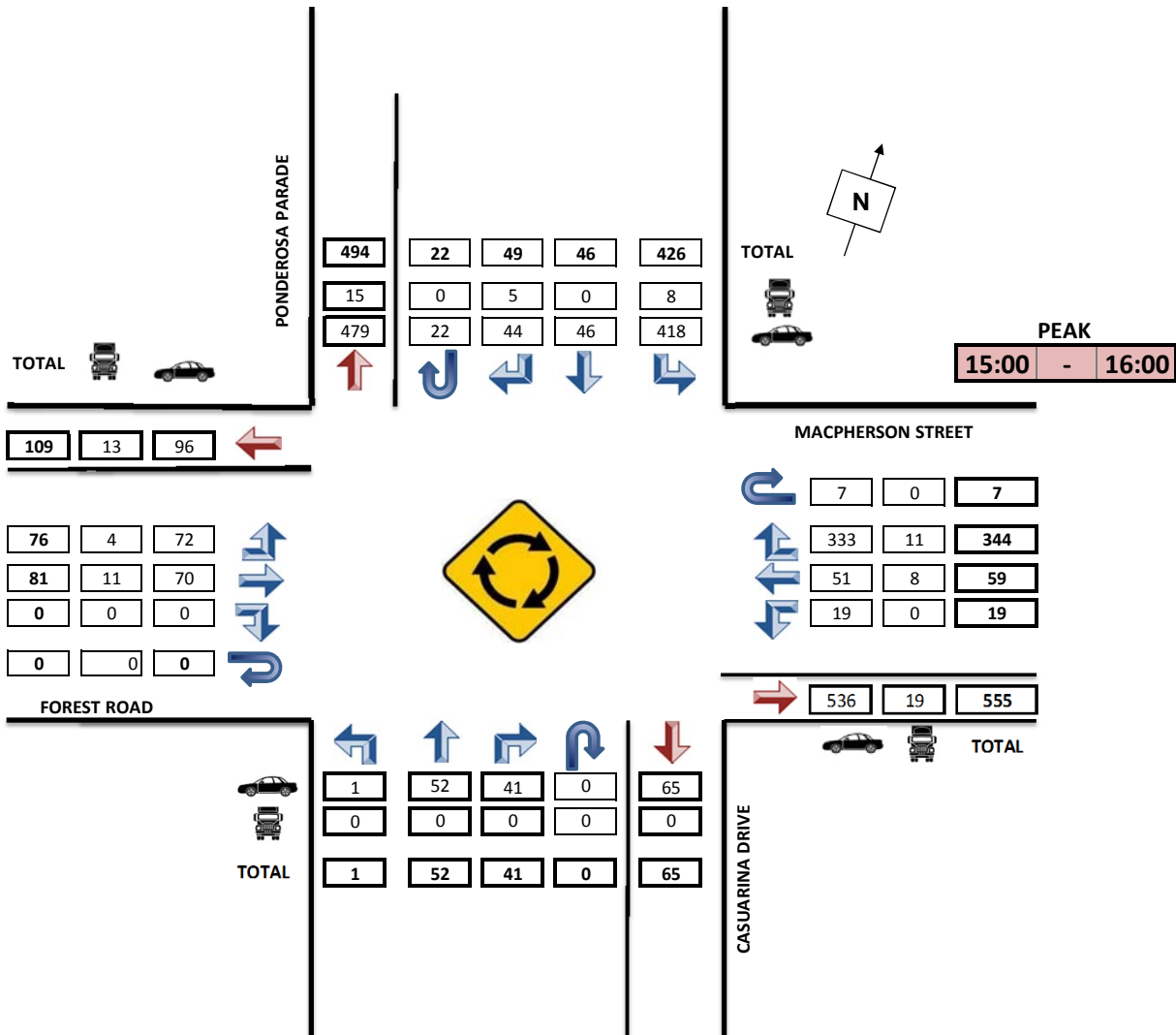
Location PONDEROSA PARADE
MACPHERSON STREET
CASUARINA DRIVE
FOREST ROAD
 Suburb WARRIEWOOD

Duration 0730 - 0930
1400 - 1600
0
 Day/Date Thursday, 30 March 2017
 Weather 0



Location PONDEROSA PARADE
MACPHERSON STREET
CASUARINA DRIVE
FOREST ROAD
 Suburb WARRIEWOOD

Duration 0730 - 0930
1400 - 1600
0
 Day/Date Thursday, 30 March 2017
 Weather 0



Mater Maria College, Warriewood

APPENDIX

D

QUEUE ANALYSIS

Queue Analysis

Document Reference: **Austroads Guide to Traffic Management Part 2 – Traffic Theory (2008), Section 4**

- **The state of a queuing system.** A queuing system is in state n if it contains exactly n queue members, including those in line and those in service.
- **Utilisation factor.** The utilisation factor, ρ , is the ratio of the average arrival rate, r , to the average service rate, s , that is:

$$\rho = \frac{r}{s} \quad 4.1$$

(In the technical literature on queuing, some authors refer to ρ as the *intensity* of the queuing system.)

If ρ is less than one, queue length may vary over time due to random fluctuations but the queuing system is stable and it is possible to calculate a time-independent probability of the queue being in a particular state. If ρ is greater than or equal to one, however, the queue length will increase with time.

4.4 Steady State Queues with Random Arrivals and Service

4.4.1 Queue Lengths

This subsection provides the key formulae related to queue lengths in an [M/M/1] queuing system. The derivations of these formulae are provided in Commentary 3.

The key formulae are as follows.

The probability of the queue being empty – that is, having no units in service and no units waiting in a queue to be serviced – is:

$$P_0 = 1 - \rho \quad 4.2$$

And the probability that there are n units in the system, $n \geq 0$, including the unit in service (if any), is:

$$P_n = (1 - \rho) \rho^n \quad 4.3$$

The expected number in the system is:

$$E(n) = \frac{\rho}{1 - \rho} = \frac{r}{s - r} \quad 4.4$$

The probability of there being more than N items in the system is:

$$\Pr(n > N) = \rho^{N+1} \quad 4.5$$

The mean queue length, excluding the unit being serviced, is:

$$E(m) = \frac{\rho^2}{1 - \rho} = \frac{\rho}{1 - \rho} - \rho \quad 4.6$$

Thus,

$$E(m) = E(n) - \rho = E(n) - \rho \quad 4.7$$

Given that $\rho < 1$, $E(m)$ is not (as might be expected) equal to $E(n) - 1$. This is because there is a finite probability that the system is empty, in which case $n = m = 0$.

Finally, the variance of the number of units in the system is:

$$\sigma^2(n) = \sum_{n=0}^{\infty} n^2 P_n - [E(n)]^2 = \frac{\rho}{(1-\rho)^2} \quad 4.8$$

The kerbside pick-up / drop-off on Forest Road were observed to operate both independently of each other and in some cases in pairings (single file) existing six (6) parking spaces. The following diagram explains this movement.



Assumptions

Existing inbound peak flow is 62 vehicles over the 30 minute period = 2.07 vehicle per minute
Proposed (no management plan) inbound peak flow is 66 vehicles = 2.2 vehicles per minute
Proposed (with management plan) inbound peak flow is 56 vehicles = 1.87 vehicles per minute

Service rate = 6 kerbside parking spaces operating at a service time of 148 seconds, providing capacity for 0.406 vehicles per minute (i.e. 2.46 minutes per vehicle)

ρ (existing) = 0.004

ρ (proposal with no management plan) = 0.002

ρ (with management plan) = 0.012

95% back of queue has been established to be the design criteria for the extent of queue from the kerbside parking zone. The probability of a queue longer than the 95% is the summation of queue lengths up to the 95% probability.

Existing

Number of Queued Vehicles	Probability of this Queue Length, or less
0-13	93.8% ⁽¹⁾
14	94.7%
15	95.5%
16	96.2%

Notes: (1) this is a summation of the probabilities up to and including this queue length

Future (no management plan)

Number of Queued Vehicles	Probability of this Queue Length, or less
0-24	94.1% ⁽¹⁾
25	94.7%
26	95.2%
327	95.7%

Notes: (1) this is a summation of the probabilities up to and including this queue length

Future (with management plan)

Number of Queued Vehicles	Probability of this Queue Length, or less
0-5	90.9% ⁽¹⁾
6	93.0%
7	94.6%
8	95.9%

Notes: (1) this is a summation of the probabilities up to and including this queue length

Mater Maria College, Warriewood

APPENDIX

E

DRAFT TPMP

Traffic and Parking Management Plan

Mater Maria College, Warriewood

80017033



Prepared for
Avium

4 February 2019

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1 Introduction

School's congestion and parking issues are mostly in the morning and afternoon peaks. By managing traffic and parking movements around schools, and reducing the number of cars travelling to these facilities, these problems can be significantly reduced.

The Traffic and Parking Management Plan (TPMP) has been developed to improve safety for students, parents, staff, residents, and other people who drive or walk to Mater Maria College, located in Warriewood. It provides practical guidelines on how traffic and parking is managed at and around the College. The effectiveness of the plan ultimately depends on the communication to, and the cooperation of, parents and students, particularly in the periods immediately prior to and after each school day.

The objectives of the TPMP are to:

- > Acknowledge the surrounding residential neighbourhood and the need to minimise, where possible, any impact upon residential amenity
- > Operates with high regard to the safety of the College community and the surrounding residential neighbourhood.
- > Promote improved utilisation of public transport by students and staff
- > To minimise adverse impacts on users of the road and adjacent properties and facilities.

The location of the college is shown in **Figure 1-1**



Figure 1-1 Location of the College

. In principle, the management plan should be written and enforced based on the following (refer to *Renaldo Plus 3 Pty Limited v Hurstville City Council [2005] NSWLEC 315* and *Amazonia Hotels Pty Ltd v Council of the City of Sydney [2014] NSWLEC 1247*):

- 1) Do the requirements in the Management Plan relate to the proposed use and complement any conditions of approval?

- 2) Do the requirements in the Management Plan require people to act in a manner that would be unlikely or unreasonable in the circumstances of the case?
- 3) Can the source of any breaches of the Management Plan be readily identified to allow for any enforcement action?
- 4) Do the requirements in the Management Plan require absolute compliance to achieve an acceptable outcome?
- 5) Can the people the subject of the Management Plan be reasonably expected to know of its requirements?
- 6) Is the Management Plan incorporated in the conditions of consent, and to be enforced as a condition of consent?
- 7) Does the Management Plan contain complaint management procedures?
- 8) Is there a procedure for updating and changing the Management Plan, including the advertising of any changes?

2 School Drop-off / Pick-up zone

Mater Maria College has six (6) designated drop-off / pick-up zone within Forest Road. these zones are intended to act like a flowing taxi rank. This zone is restricted to 2 minutes only, from 8:00am to 9:30am and 2:30pm to 4:00pm school days. It should be noted that drop off zones/pick up zones are not for parking. If a child is not waiting ready to be picked up, parents should move on and park in the car park and walk back to find children. Also, if they arrive and the school drop off/ pick up zone is full they must continue on and return at a later time.

Figure 2-1, shows the location and number of drop off and pick up zones along Forest Road.



Figure 2-1 School Drop off/Pick up Parking Arrangement

The following rules and regulations should be communicated to new and existing parents:

- > A Kiss and Ride or School Drop-off Pick-up Zone operates as a “No Parking” location in accordance with Australian Road Rules
- > Vehicles are not to occupy the drop-off / pick-up parking spaces for longer than what is permitted by signage.
- > Stopping for more than 2 minutes is prohibited in a “No Parking” restricted area
- > You must stay within 3 metres of your vehicle at all times.
- > Students are to enter the parked vehicle from the kerbside door only, wherever possible.
- > Students and parents are not to perform drop-off / pick-up activity within the travel lanes along Forest Road.
- > Never call out the children from across the road - it is very dangerous
- > Parents are not to double park, block driveways or undertake U-turn manoeuvres.
- > Children should be capable of getting into the car unassisted in order to be picked up; parents must remain in the vehicle.
- > Parking inspectors may impose penalties for illegal parking practices
- > Make sure the hand brake is applied when the vehicle is stationary.
- > Vehicles are to adhere to Australian Road Rules and regulatory signage at all times.

Safety tips for students

- > Student should stay buckled up until the vehicle has stopped in the 'Drop-off and Pick-up' area.
- > Student should make sure the school bag and other items are in a safe position, for example on the floor.
- > Students should be ready to get out of the car with their belongings when the car has stopped and they have unbuckled the seatbelt.
- > Students should always get in and out of the backseat of the vehicle through the kerbside door – the rear footpath-side door.

Recommendations:

- > If the school's drop –off/pick-up zone is causing traffic congestion problems due to the large number of motorists wishing to access it at the same time, the school may consider staggering pick-up and drop-off times. For example, letting different grades start and finish at different times, also encouraging parents and carers to drop off older grades slightly earlier and pick them up later than others. These simple strategies can have a positive impact on road safety and traffic congestion.
- > Implement a car pooling register and identify incentives amongst the parents and students to encourage carpooling and reduce private vehicle dependency. The schools P&C could manage this process and develop a school portal (e.g. intranet) or make use of mobile phone apps to adequately inform parents/students of carpooling options. Contact protocols for parents and students (e.g. SMS, email) can be used to organise carpooling and drop-off / pick-up times. The school's P&C / management should regularly monitor parents involvement in carpooling to ensure that the needs of the multiple family groups can be achieved and does not "fall down" due to one person's non-involvement / commitment.
- >

3 Staff Parking

Parking is provided on site at Mater Maria College for staff and they will have access to the car parking spaces, as marked, at all times during the hours of operation. A total of 97 (inclusive of three (3) disabled parking spaces) are provided on-site.

Figure 3-1, shows the location of the onsite parking in Mater Mara College.



Figure 3-1 School Parking Layout Arrangement

The following are guidelines that apply to staff parking conditions:

- > Staff are requested not to double park or parking in unmarked locations within the school grounds.
- > Parents are not permitted to utilise the Mater Maria College car parking area for the purpose of drop-off / pick-up.
- > Any incidents of unsatisfactory staff behaviour are to be reported to school management.
- > All staff should provide details of their vehicle registration number with contact numbers to the school management so that they may be contacted in case of emergency. This is regardless of whether the car is parked on or off campus.
- > Staff are to be vigilant in review on-site conditions and identify and report to school management any unsatisfactory behaviour or hazards that are at risk of breaching the objectives of this TPMP.

Recommendations

- > To minimise illegal parking by others, parking cards are recommended to be issued by the college and should be displayed on the windscreen of the car by the staff. Vehicles within the school grounds that do not display this information may be at risk of being towed away.
- > Implement a car pooling register and identify incentives amongst the staff to encourage car pooling and reduce private vehicle dependency.

4 Active Travel

Australian physical activity guidelines recommends that children get at least 60 minutes of moderate to vigorous activity each day. Cycling and walking to and from school is an easy way to help kids achieve this. Active travel not only combats increasing levels of obesity and Type II diabetes but also improves bone strength and mental health.

Figure 4-1 and Figure 4-2 shows map of walking and cycling route around the college.

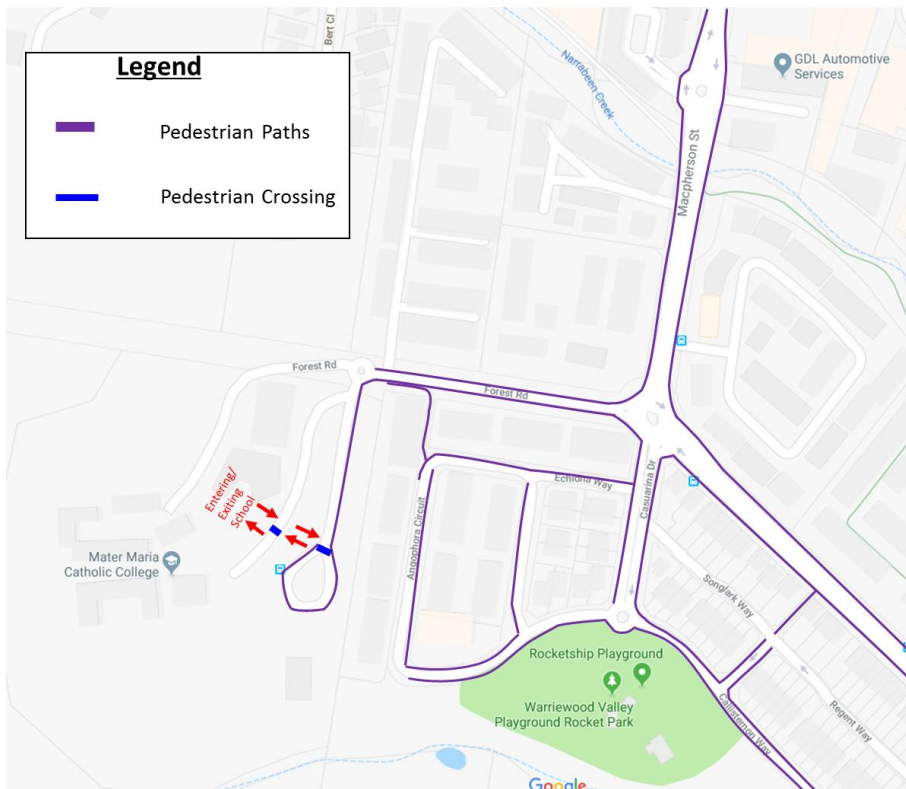


Figure 4-1 Pedestrian Footpath Network



Figure 4-2 Cycleway Routes

Source: RMS Cycleway Finder (viewed: 17/01/2019)

The following are some general tips that should be followed by the Active Transport Users

- > Use the school pedestrian crossings rather than randomly crossing the access road.
- > Bicycle riders must obey the road rules.
- > Bicycle rider on roads and road-related areas must wear an approved bicycle helmet securely fitted and fastened
- > When riding on a footpath, riders must keep left and give way to pedestrians.
- > Students, parents and carers are asked to cross roads at designated crossing points.
- > When crossing at traffic lights, only commence crossing when the green pedestrian signal is displayed and traffic has come to a complete stop.
- > When crossing at children's crossings, only commence crossing the road when directed by the crossing supervisor.
- > When crossing at pedestrian refuges and signalised intersections, only commence crossing when there is a suitable gap in traffic. Inexperienced pedestrians should be accompanied by an adult when crossing at these locations.
- > Students should be remember the 'Stop, Look, Listen, Think' approach when crossing the road
 - 'Stop' clear of the kerb
 - 'Look' for traffic to the left and to the right
 - 'Listen' for cars approaching
 - 'Think' whether it is safe to cross
 - To always look and listen whilst crossing the road

Recommendations

- > The college surrounding streets have cycleway network along with footpath network. Activities such as Walk Safely to School Day , Ride2School as well as 'walking school buses' are activities where all user groups can be involved in should be promoted. The college can also increase these types of activities to further promote active transport use and provide healthy and sustainable mode choice.
- > Walking and cycling routes should be reviewed annually to ensure any changes or additions to routes in the local area are reflected.
- > The school should consider providing active travel education to all students annually an identify key walking / cycling routes that are used by students to ensure they are adequately capturing the local student population and have appropriate safety facilities and wayfinding to assist in student travel.

5 Public Transport

Public transport helps to reduce traffic congestion and improve air quality around schools. Students who learn to use public transport also gain valuable skills for travelling to work and higher education institutions after leaving school. Hence the College should actively encourages all students to catch a bus to and from the College. At the beginning of the new College year, students should be informed of any changes to bus routes.

The primary bus stop is serving the college is mater Marina College School ground bus stop (Stop ID 210221). Also there are three other bus stops nearby the College:

- > Stop ID 210388, Ponderosa Pde before Macpherson St
- > Stop ID 210222, Macpherson St before Casuarina Dr
- > Stop ID 210223, Macpherson St opp Lomandra Way

Figure 5-1 identifies the relative locations of the bus stops around the college.

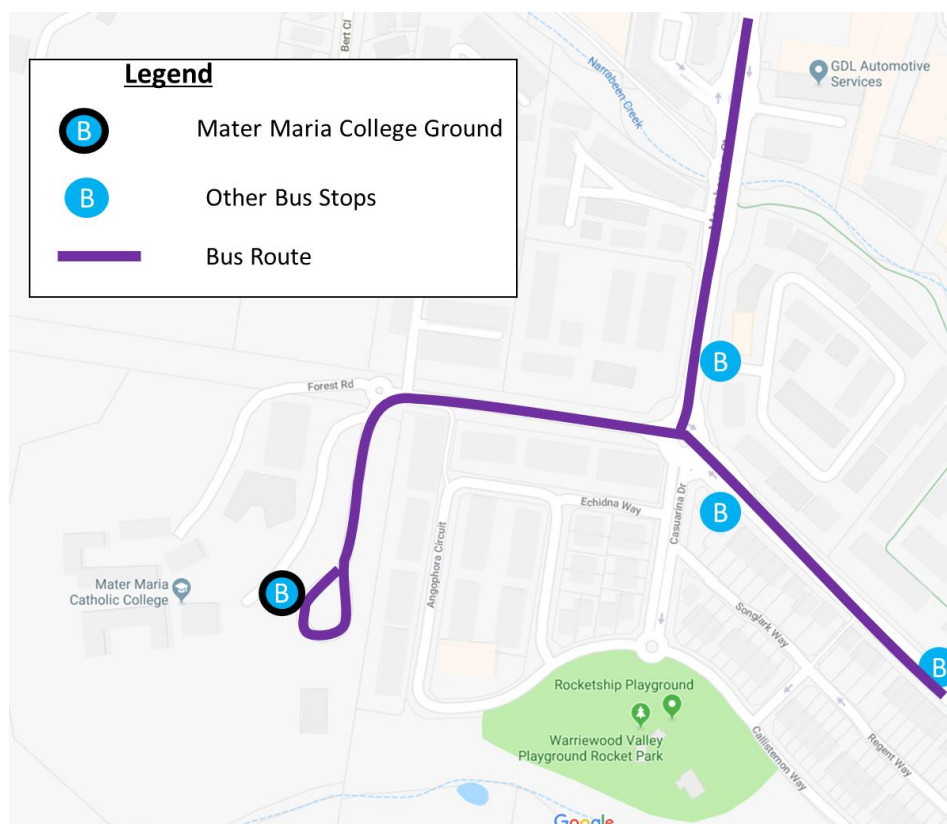


Figure 5-1 Bus stops and Routes

Table 5-1 identifies the school bus services during the AM and PM periods. Students and parents can see the detailed route of the various school public transport options available to them by visiting the website and entering the bus number: <https://transportnsw.info/routes/bus>

Table 5-1 Existing School Bus Route

Route	AM	PM
182	✓	✓
	✓	✓
	✓	✓

630		✓ ⁽¹⁾
632		✓
633		✓ ⁽¹⁾
635	✓	
636	✓	
637	✓	
641		✓
642		✓
643	✓	✓
	✓	✓
645	✓	
646	✓	
647	✓	
648	✓	✓ ⁽¹⁾
	✓	✓ ⁽¹⁾
649		✓
		✓
650		✓
651		✓
664	✓	✓
	✓	✓
742	✓	

Notes:

(1) Bus terminates at Mater Maria College in the PM

It should be noted that these buses are staggered to ensure on-site congestion does not occur and student safety is maintained. At any one-time, two (2) buses can be expected within the on-site bus zone.

The following are the guidelines that apply to the Bus Users:

- > Students arriving on public buses alighting at the on-site bus stop located at Mater Maria College School Grounds. Students should enter the college using the pedestrian paths/access points to facilitate safe entry to the school.
- > Students are to move in an orderly manner onto the designated bus under staff supervision.
- > Staff members should be rostered to supervise student departures at the mater Maria College Ground bus stop when the bus arrives.
- > When getting off the bus, students should wait on the footpath until the bus has been driven away. Then together should choose the safest place to cross the road. They should remember the 'Stop! Look! Listen! Think!' routine they cross.

- > While waiting at the bus stop, should stand as far away from the passing traffic as possible. They should never wait right at the kerb.
- > Students should discuss with your parents what they should do if they accidentally get on the wrong bus or miss their regular bus stop.

6 Sports and Special Events

The College may conduct several special events during the academic year. Many of these events are small (e.g. a meeting of parents of a particular Year or Class group).

The following regulations should be considered for management of parking during special sports and special events:

- > Where possible, the College should provide off street parking for parents in the main car park, which accommodates 97 cars or a shuttle bus could be provided to bring attendees to the school site. Else, On-street car parking is also available in surrounding areas.
- > Parents should be notified before major events of the availability of parking.
- > Parking attendants in high visibility gear should be present on site to regulate traffic movements into and out of the college and to manage on-site parking, to ensure that no vehicles are illegally parked and are not obstructing driveways or pedestrian paths.
- > Parking attendants should monitor and assess the overall event traffic and car parking plan and should make adjustments as required. As part of this process, the attendants should monitor car parking during events to check that people have parked responsibly.
- > The registration and description of any cars parked that may cause disruption should be noted and communicated and should take immediate action to remove those cars immediately.
- > The college should also consider utilising radios for efficient communication among staff during events, to ensure any issues can be attended to quickly and effectively.

Recommendations

The college should encourage attendees to:

- > Car pool to reduce the car parking demand;
- > Be aware of local public transport options including the local bus stops;
- > Utilise any 'park and ride' options made available;
- > Be mindful of the surrounding residential area when arriving and departing from the property.

7 Residential Neighbours

As a part of giving consideration to the residential neighbours of the school the following tips should be followed:

- > The school should actively review its procedures and behaviour of staff / parents / carers / students and effectively communicate to these groups. The review and communication should take place during staff meetings, class rooms and through newsletters.
- > Feedback should also be encouraged from the various school groups with action plans formulated to adjust and improve road safety.
- > The school should encourage input and feedback from the surrounding residential neighbourhood. If any complaint is made, the school should log and respond to the resident concern and the steps taken to rectify the issue.

8 Administrative Process

8.1 Periodic Review

- > College management are to review this Traffic and Parking Management Plan (TPMP) and all other college related activity annually, or as the need arises (i.e. in response to incidents). The college is to make this document freely available to the Mater Maria College community. Any updates to the plan should be communicated to staff, parents, all students (as relevant), visitors; and companies servicing the College (deliveries etc.).
- > It is recommended to maintain a feedback register for all other transport related items (whereby staff, students, parents and carers are able to provide suggestions that can be incorporated during the periodic review.

8.2 Management of Complains

- > College management should keep a detailed history of all complaints received with regard to traffic and parking behaviour associated with the College. A complaints register is to identify the detail of the complaint, the response to the complaint and the outcome as a result.
- > The College should always contact the complaintive and address the particular issue of concern.
- > If the College Principal receives an update of any complaints and the College should keep a record of each on the file.