ptc.

18 June 2018

Kyle Watson
APP Corporation Pty. Ltd.
Level 1, 94 Market St.,
Wollongong, NSW 2500

Dear Kyle,

Response to Council Letter regarding development at St Lucy's School, Wahroonga (DA0583/17, dated 17 April 2018)

This letter has been prepared in response to the traffic and parking related comments raised by Ku-ring-gai Council (Section 6 and 7 of the letter dated 17 April 2018) regarding the proposed development at St Lucy's School in Wahroonga.

Each of the comments raised and ptc.'s response is provided below.

Council Comment

Section 6c: *If the pickup-drop times are not achieved will excessive queuing be a result?*

ptc. Response

If the pick-up/drop-off times are not achieved, then additional queuing may result. A sensitivity analysis is presented in the following table, illustrating the vehicle queue lengths based on varying dwell times. The calculations are based on a Poisson Queuing Analysis[1]. Note that a revisit of the car park plans has indicated that the drop-off/pick-up area for the basement car park has capacity for 6 vehicles (1 more than the original 5 spaces), see Attachment 2.

The queue length in Table 2 refers to the number of vehicles queued beyond the drop-off/pick-up area and does not include the vehicles performing pick-up/drop-off. Once the queue exceeds 17 vehicles[2] for the basement car park or 10 vehicles[3] for the Port Cochere, the queue is expected to reach the public road, i.e. Billyard Avenue and Cleveland Street, respectively.

The parameters used in the queuing model are obtained from the Traffic Impact Assessment prepared by ptc. (*PTC - St Lucy's School TIA Final 30 Nov 17*). These are presented in Table 1. Note that the drop-off window has been increased to 40 minutes (from 30 minutes in the report) to align with the afternoon pick-up duration.

[1] A mathematical model which captures the variability in vehicle arrivals and resulting queuing, provided an average arrival rate, pick-up/drop-off window, dwell time, and number of car bays.
[2] 104m / 6m per vehicle = 17 (17.33) vehicles
[3] Based on Port Cochere capacity of 15 vehicles (5 drop-off/pick-up and 10 queuing) as per original TIA

Table 1: Queuing analysis parameters

Parameter	Basement Car Park Drop-off	Basement Car Park Pick-up	Port Cochere Drop-Off/Pick-Up	Reference in TIA
Number of cars	70 (69.6)	63 (62.6)	44 (43.7)	Section 5.2.2 (pg 18)
Drop-off/pick-up window (minutes)	40	40	40	Table 4 (pg 24)
Dwell time (minutes)	2	3	3	Section 6.6.2 (pg 23)
Number of drop-off/pick-up spaces	6	6	5	Section 6.6.2 (pg 23)[4]

Table 2: Queuing sensitivity check for basement car park

Time (seconds)		Average Queue (veh)	95th Percentile Queue (veh)	Probability of queuing on external road
Drop Off				
96 seconds	20% less time per veh	0.1	0	<0.01%
108 seconds	10% less time per veh	0.1	0	<0.01%
120 seconds	original assumption	0.2	1	<0.01%
132 seconds	10% more time per veh	0.4	3	0.01%
144 seconds	20% more time per veh	0.8	4	0.05%
Pick Up				
144 seconds	20% less time per veh	0.4	2	<0.01%
162 seconds	10% less time per veh	0.8	5	0.06%
180 seconds	original assumption	1.7	8	0.58%
198 seconds	10% more time per veh	4.0	16	4.36%
216 seconds	20% more time per veh	12.9	44	26.97%

Table 3: Queuing sensitivity check for Port Cochere

Time (seconds)		Average Queue (veh)	95th Percentile Queue (veh)	Probability of queuing on external road
Pick Up/Drop Off				
144 seconds	20% less time per veh	0.2	1	0.01%
162 seconds	10% less time per veh	0.3	2	0.04%
180 seconds	original assumption	0.6	3	0.19%
198 seconds	10% more time per veh	1.1	5	0.81%
216 seconds	20% more time per veh	1.9	9	2.96%

[4] Note that the capacity of the drop-off area in the basement car park has been increased to 6 spaces following review

As indicated in the sensitivity analysis, the most critical element is the basement pick-up. For this element, if the pick-up times increase by more than 10%, then the queue is expected to not reach the public road 95% of the time. With a 20% increase in dwell time, the average queue is expected to be confined within the school, however, there will be instances where the queue is expected to grow to lengths which spill onto the public road. For the basement drop-off and Port Cochere operation, the risk of queues spilling into the main road are significantly lower.

It is noted that queuing arising from the current drop-off/pick-up arrangement extends into the Stuart Street / Cleveland Street roundabout due to proximity of the access point to the intersection (approximately 20m). Under the proposed arrangement, the car park entrance (for parent drop-off / pick-up) will be located on Billyard Avenue, approximately 90m east of the Cleveland Street / Billyard Avenue intersection. This means that in the event of queuing resulting from the basement car park, the likelihood of queues impacting the surrounding intersections is significantly reduced.

For the Port Cochere operation, there is forecast to be a very low probability of queuing onto the main road with a 0.19% chance of queuing spilling into Cleveland Street under the assumptions stated. Even with a 20% increase in dwell times to 216 seconds, the probability of queuing spilling into the external road is calculated to be 2.96%.

Council Comment

Section 6d: *Is absolute compliance required to achieve an acceptable outcome?*

ptc. Response

Following the response to Council Comment 6c, there is a small to moderate amount of leeway in regard to the capacity of the drop-off/pick-up zone. Generally, absolute compliance is not required, however, if there is a significant deviation from the assumptions, then greater queuing is expected to result during the basement car park pick-up operation. The basement car park drop-off and Port Cochere operations are less sensitive to deviations in dwell time.

Due to the nature of the school, staff, students and parents are very familiar with the need for efficient operation during pick-up and drop-off periods. Hence, it is foreseen that compliance will be much tighter and easier to achieve compared to a school with greater student numbers or without students requiring special provisions.

Council Comment

Section 7a: *Provide clarification of the exact dates and times of the traffic surveys and clarification how these times relate to the peak drop-off and pick-up times of Knox Prep School.*

ptc. Response

The survey data from the original TIA was extracted from another report. These surveys were undertaken in November 2014, which is considered outdated as survey data is generally considered valid for approximately 2 years (unless significant development has occurred).

Hence, the following four intersections have been resurveyed following Council Comment 7b (see next):

- Stuart Street / Cleveland Street
- Cleveland Street / Billyard Avenue
- Billyard Avenue / Sutherland Avenue
- Cleveland Street / Millewa Avenue

These surveys were undertaken over three days (8 May to 10 May, 2018) and were conducted from 7am-9am and from 3pm-6pm on each day. As such, surrounding peak school pick-up / drop-off activity is expected to be captured within the survey window in addition to the peak hours for general traffic.

To determine which of the three days to use for the SIDRA traffic model, the total traffic volumes for all four surveyed intersections for the survey period have been summed up for each day (i.e. 5 hours per day). The total traffic volume for each day is as follows:

- Tuesday 8 May: 13,598 vehicles
- Wednesday 9 May: 13,877 vehicles
- Thursday 10 May: 14,206 vehicles

The Thursday survey presented the greatest traffic volume; hence it is used for analysis in the updated SIDRA modelling. On this day, the peak hours are identified to be 7:30am-8:30am and 4:30-5:30pm.

Council Comment

Section 7b: *As part of the traffic assessment, traffic counts are to be undertaken for the weekday AM and PM period for at least 3 days (Tuesday to Thursday) and carried out during school days to determine the peak traffic volumes. Traffic counts to be provided to analyse the impacts through the Cleveland Street/Stuart Street intersection due to the increased movements from the site, based on peak vehicle trip generation during the AM and PM peak. The dates of the counts are to be clearly stated in the report. Both pre and post development SIDRA analyses are to be included.*

ptc. Response

Additional traffic surveys have been undertaken over 3 days. As stated in the previous section, revised SIDRA analysis for both the pre and post-development scenario has been undertaken incorporating the revised survey traffic volumes. The peak hour flows are presented in Figure 1 and Figure 2. A summary of the SIDRA modelling for the existing scenario and the development scenario is presented in Table 4.

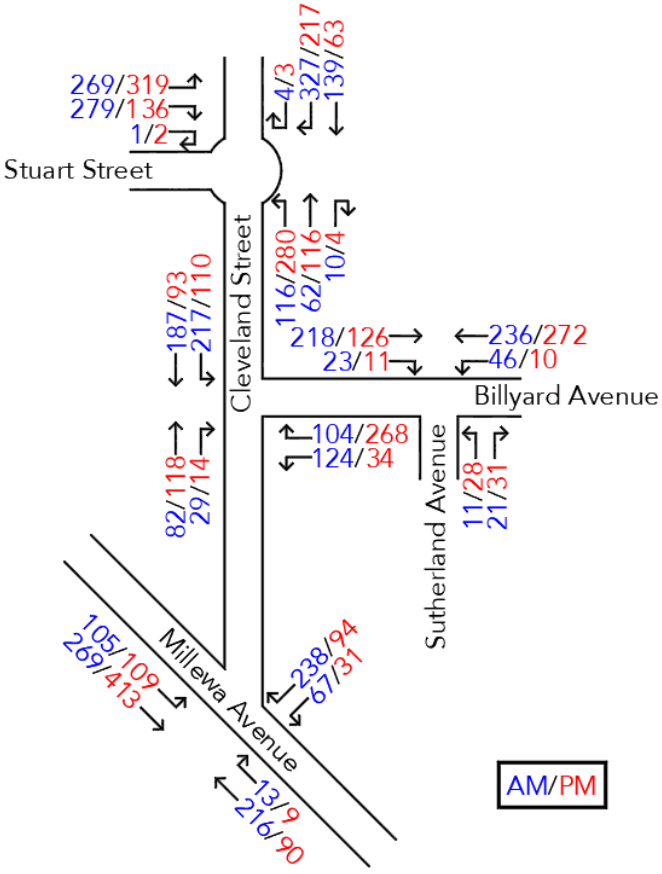


Figure 1: Existing Traffic Flows (survey date: 10/05/2018)

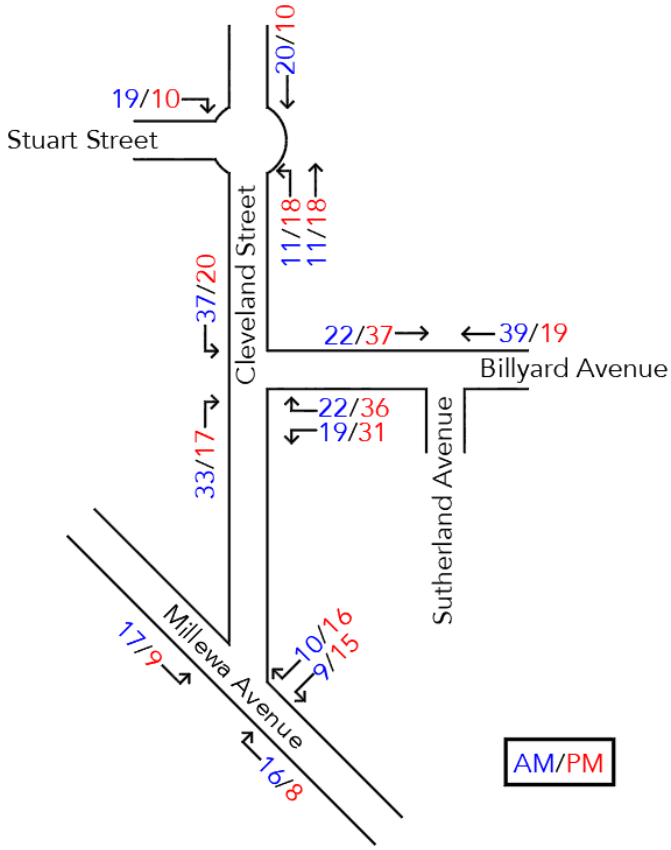


Figure 2: Development Traffic Flows

Table 4: Comparison of existing and development scenarios

Street	Period		Delay (sec)	Degree of Saturation (v/c)	Level of Service
Stuart Street / Cleveland Street	AM	Existing	7.3	0.452	A
		Development	7.4	0.481	A
	PM	Existing	6.2	0.367	A
		Development	6.2	0.397	A
Cleveland Street / Billyard Avenue	AM	Existing	4.1	0.231	A
		Development	4.6	0.282	A
	PM	Existing	4.4	0.315	A
		Development	4.9	0.384	A
Billyard Avenue / Sutherland Avenue	AM	Existing	1.2	0.157	A
		Development	1.2	0.178	A
	PM	Existing	1.2	0.156	A
		Development	1.1	0.166	A

Street	Period		Delay (sec)	Degree of Saturation (v/c)	Level of Service
Cleveland Street / Millewa Avenue	AM	Existing	3.9	0.342	A
		Development	4.2	0.366	A
	PM	Existing	2.5	0.295	A
		Development	2.9	0.298	A

As indicated by the SIDRA modelling, the proposed development is expected to have minimal impact upon the surrounding road network. All surveyed intersections are operating at a Level of Service A for both the pre- and post-development scenarios. Average delays for all intersections are minor and there is ample spare capacity in all four intersections. The busiest intersection, Stuart Street / Cleveland Street, has more than 50% spare capacity in the worse scenario (AM post-development).

Council Comment

Section 7c: *An indicative construction traffic management plan is to be submitted (required under Council's DA Guide). Plan to show the largest vehicle to be used entering and exiting the site for the demolition, excavation and construction stages, stockpiles and all necessary tree protection fencing. Consultation with the project arborist is recommended.*

ptc. Response

An indicative construction traffic management plan has been prepared and is provided as an attachment to this letter (Attachment 1). The report addresses the details outlined in Council's DA guide including:

- Commitments for minimising disruption to and maintaining the safety of residents, pedestrians and road users
- Construction vehicle routes for a 19m articulated vehicle for approach and departure to and from the site
- A site plan showing the proposed entry and exit points with swept paths of a 11m HRV showing access and egress via the provided driveway
- Details of construction employee parking and recommendations for parking restrictions if through traffic is likely to be reduced to one lane

Council Comment

Section 7f: *It is proposed that private vehicles will enter the basement carpark to perform pick-up and drop-off. It is understood that children will be dropped-off/picked-up with an estimated 5 vehicles queued. Clarification is sought as to whether there would be any further queuing and significant delays within the basement carpark.*

ptc. Response

A revisit of the car park plans has identified that there will be enough space for 6 vehicles to queue for drop-off/pick-up, rather than 5 as stated in the original TIA (See Attachment 2). Under the same assumptions regarding the drop-off/pick-up window and dwell times as established in the original TIA, a Poisson Queuing Analysis indicates that the 95th percentile queue will be 1 vehicle for the basement car park drop-off and 8 vehicles for the basement car park pick-up (refer to Table 2). It is estimated that the car park can accommodate up to 17 additional vehicles in the queue (not including the 6 vehicles undertaking drop-off/pick-up), before reaching the external road network. Hence, there is expected to be sufficient

room for further queuing within the site extents without impacting the external traffic or causing undue delay.

Under the established assumptions (see Table 1), the Poisson Queuing Analysis suggests that there is less than 0.01% chance of queuing extending to the public road network (i.e. 17 vehicles queued behind the last drop-off/pick-up space) during drop-off and a 0.58% chance during pick-up (see Table 2).

If there are any further questions, please do not hesitate to contact the undersigned.

Yours sincerely,

Eric Ye
Traffic Engineer

Prepared by Eric Ye, Junior Traffic Engineer on 18/06/2018
Reviewed by Abdullah Uddin, Senior Traffic Engineer on 18/06/18

Attachment 1 – Indicative Construction Management Plan

1.1 Project Summary

ptc. has been engaged by St Lucy's School to prepare an indicative construction traffic management plan that is intended to accompany a Development Application by the school located at 21-23 Cleveland Street and 6-8 Billyard Avenue, Wahroonga. This report is to be read in conjunction with the Traffic Impact Assessment (TIA) prepared by ptc. regarding the proposal which results in:

- 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.

Note that this is an Indicative Construction Traffic Management Plan. A comprehensive Construction Traffic Management Plan is to be prepared upon engagement of a contractor and will be lodged to Council in due course.

1.2 Objective

The traffic management plan associated with the construction activity of the project aims to ensure the safety of all workers and road users within the vicinity of the construction site, with the following primary objectives:

- To minimise the impact of the construction vehicle traffic on the overall operation of the road network;
- To ensure continuous, safe and efficient movement of traffic (vehicular and pedestrian) for both the general public and construction workers;
- Installation of appropriate advance warning signs to inform users of the changed traffic conditions;
- To provide a description of the construction vehicles and the volume of these construction vehicles accessing the construction site;
- To provide information regarding the changed access arrangement and also a description of the proposed external routes for construction vehicles accessing the site;
- Establishment of a safe pedestrian environment in the vicinity of the site; and
- To minimise disturbance to the surrounding schools, construction traffic activities should be arranged to not coincide with peak school activity i.e. during drop-off and pick-up periods.

1.3 Construction Activities & Program

The proposed staging is as follows:

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.

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

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.

1.4 Construction Site Arrangement & Access

1.4.1 Site Arrangement

Figure 3: Preliminary Site Arrangement and Construction Access Driveways

Figure 3 outlines the potential site arrangement and construction vehicle access for each component of works, whilst taking into consideration the operation of existing facilities and transport infrastructure on-site. It is considered that the proposed works can be readily staged such that there will always be sufficient area within the work compounds to store all construction-related goods, equipment and facilities.

Works Zones are proposed for all stages. During Stage 1, the area in orange is proposed to be a Works Zone. For Stages 2 and 3, the area in yellow is proposed as a Works Zone. This will be subject to Council approval and a supporting construction traffic management plan shall be prepared in due course.

1.4.2 Site Access

Vehicles will access the site via Billyard Avenue using either the works zones or the construction driveway. Swept paths have been prepared illustrating access and egress for an 11m heavy rigid vehicle using the proposed construction driveways and are provided in Attachment 3. Note that Stages 2 and 3 utilise the same driveway.

It is recommended that movement of large construction vehicles be timed so as to not coincide with peak school activity, minimising disruption to surrounding schools and enhancing pedestrian safety.

1.5 Construction Traffic

1.5.1 Construction Vehicle Types

The proposed works are envisaged to be carried out using a mix of construction vehicles including:

- Low loader (up to 19m long) for delivering excavators and piling rigs at commencement and completion of excavation
- Truck and dogs (up to 19m long) during the first 80% of excavation
- Rigid trucks (up to 11m long) for the last 20% of excavation
- Semi-trailers (up to 19m long) for delivery of building materials during construction

During demolition and the first 80% of excavation, provisions will be made to allow truck and dogs to be able to turn around onsite. During the last 20% of excavation, rigid trucks will reverse into the construction access driveways provided for loading.

1.5.2 Construction Vehicle Route

An indicative construction vehicle route is outlined in Figure 4; the final route will be confirmed in the detailed CTMP in due course. This route shall be communicated to construction staff during the induction process. As a general requirement however, all drivers and associated companies are responsible for adhering to the road rules and regulations.

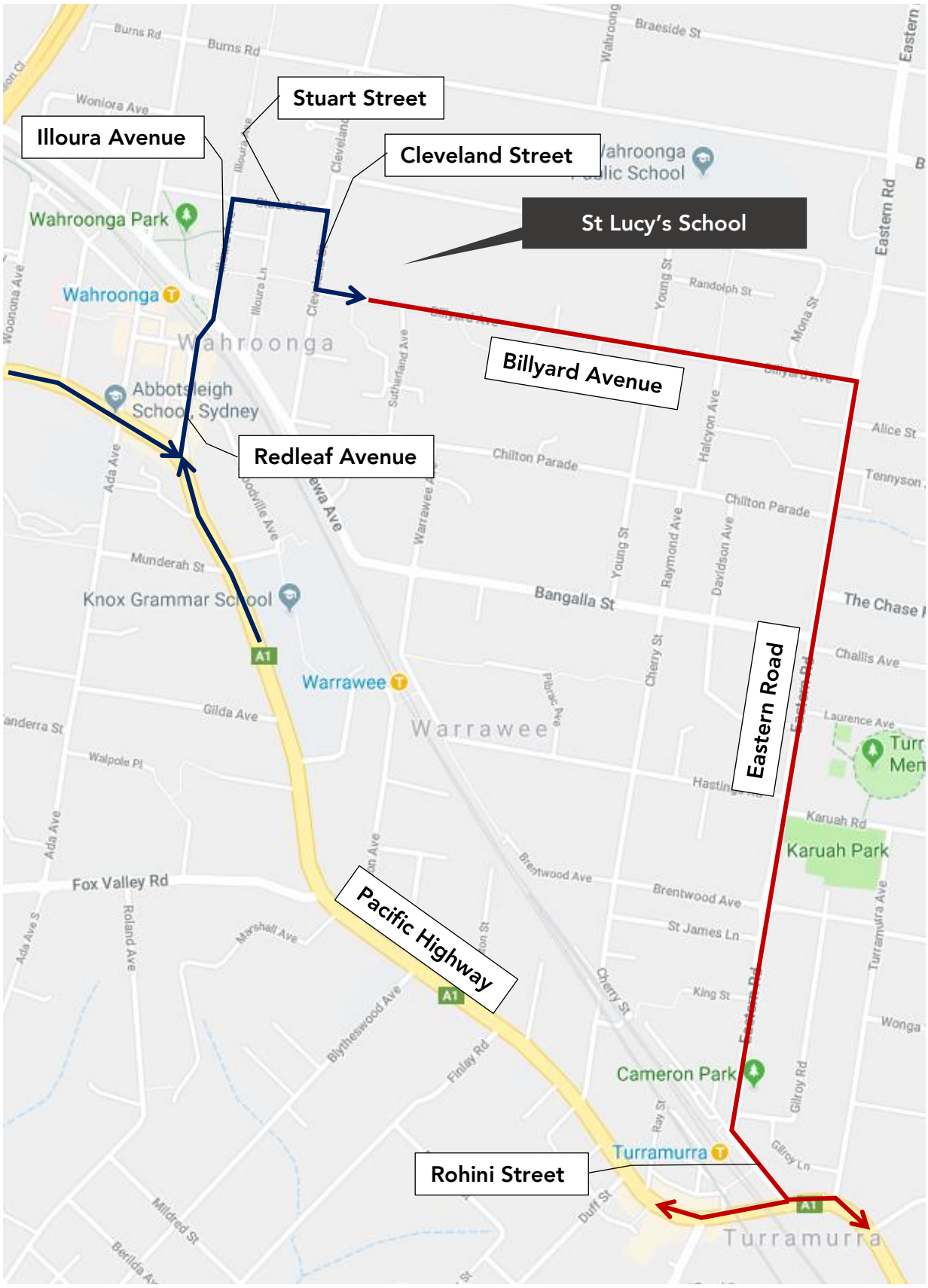


Figure 4: Indicative construction vehicle route (Access in blue, egress in red)

1.6 Contractor Parking

During demolition and excavation there will be an average 8 construction workers, parking onsite, on street and travelling via train. As the number of employees at this stage is low, the effect on on-street parking availability is anticipated to be minimal.

During construction and fitout, an average of 25 workers is expected on site. These employees are expected to park on-site, on-street, or travel via train. Once the basement car park is complete, a significant portion of these employees will be able to be accommodated within the basement parking. Hence, the effect on on-street parking availability is anticipated to be minimal.

Where possible, construction worker vehicles should be dispersed in surrounding streets to avoid condensed parking around the school.

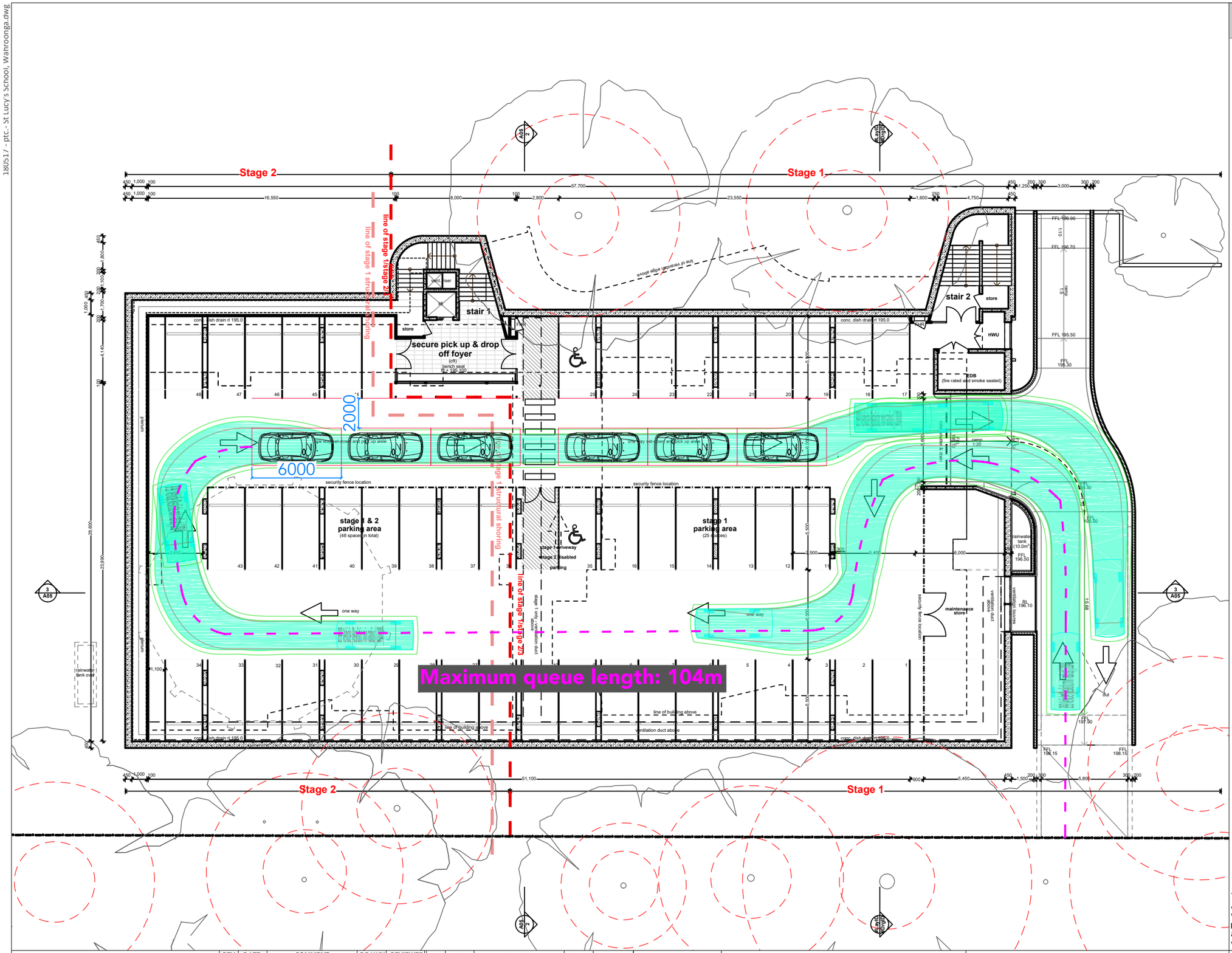
1.7 Summary

This indicative CTMP has been prepared to outline the construction traffic measures to improve site safety to the public and workers and the construction process associated with the DA application.

It is envisaged that a detailed CTMP will be prepared once the construction contractor is engaged and will be submitted to Council in due course.

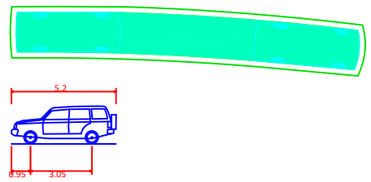
Attachment 2 – Car Park Diagram

18051/ - ptc.- St Lucy's School, Wahroonga.dwg



COMMENTS

A3



B99 Vehicle (Realistic min radius) (2004)

Overall Length	5.200m
Overall Width	1.940m
Overall Body Height	1.878m
Min Body Ground Clearance	0.272m
Track Width	1.840m
Lock-to-lock time	4.00s
Curb to Curb Turning Radius	6.250m

The turning paths illustrated in this drawing have been prepared using the Autotrack vehicle modelling software in conjunction with AutoCAD. The vehicle model was prepared by Analytico Pty Ltd based upon vehicle data provided by Austroads. While this modelling represents a conservative assessment of the vehicles ability, it is not possible to account for all vehicle types/characteristics or driver ability.

ptc.

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REV	DATE	COMMENT	DRAWN	REVIEWED	REV	DATE	COMMENT	DRAWN	REVIEWED
1	18/05/18	For information	EY	AU					

PROJECT:

St Lucy's School, Wahroonga

DRAWING TITLE:

Queuing and B99 Swept Path

CLIENT:	**St Lucy's School**
DRG. #:	**PTC-001**
PROJECT #:	**T2-2210**
SCALE:	**1:250**

REV: 1

Attachment 3 – 11m HRV Swept Path Site Entry/Exit

180517 - ptc. - St Lucy's School, Wahroonga.dwg

12 Billyard Ave
–
single storey residence

two storey residence

pool (estimated)

ex. swimming pool

10 Billyard Ave

Property subject to separate application

13,030

22,015

15,608

landscaping

stage 1 construction area

driveway

RIGID MIN RADIUS WITH 3X6M LOAD

landscaping

4,700

stair 2

ex. outdoor play area 2

proposed stage 1 - two storey classroom building with basement carpark

FFL 198.32

8,000

demolish existing buildings and trees (shown dashed)

3,000

1,170

landscaping

awning

29,460

secure fence line

existing sandpit

stair 1

secure fence line & gate

brick paving

existing shade sail

existing library building

existing creative arts centre

existing concrete playground

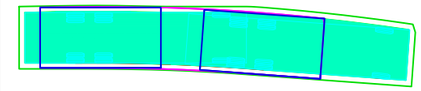
Billyard Avenue

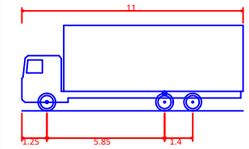
Refer to the arborist report for details of tree protection

Proposed Works Zone (Indicative)

COMMENTS

A3





11 RIGID MIN RADIUS WITH 3X6M LOAD	
Overall Length	11.000m
Overall Width	2.500m
Overall Body Height	4.250m
Min Body Ground Clearance	0.427m
Track Width	2.500m
Lock-to-lock time	6.00s
Wall to Wall Turning Radius	12.500m

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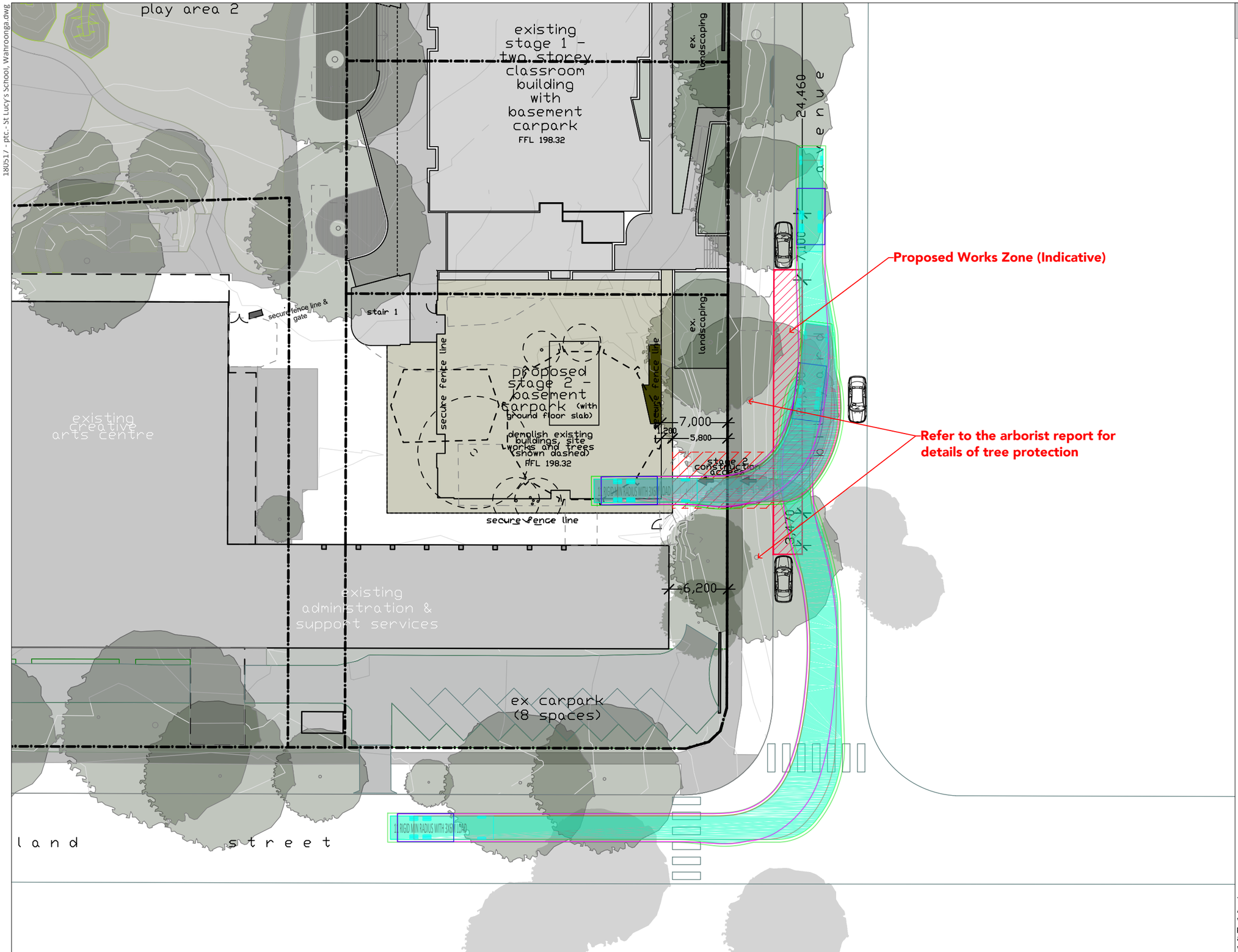
REV	DATE	COMMENT	DRAWN	REVIEWED
1	18/05/18	For information	EY	AU

PROJECT:
St Lucy's School, Wahroonga

DRAWING TITLE:
Stage 1 - 11m HRV entry and exit

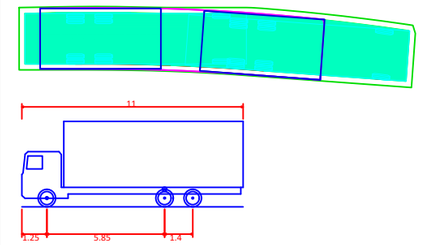
CLIENT:	**St Lucy's School**
DRG. #:	**PTC-002**
PROJECT #:	**T2-2210**
SCALE:	**1:400**

REV: 1



COMMENTS

A3



11 RIGID MIN RADIUS WITH 3X6M LOAD

Overall Length	11.000m
Overall Width	2.500m
Overall Body Height	4.250m
Min Body Ground Clearance	0.427m
Track Width	2.500m
Lock-to-lock time	6.00s
Wall to Wall Turning Radius	12.500m

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1	18/05/18	For information	EY	AU					

PROJECT:
St Lucy's School, Wahroonga

DRAWING TITLE:
Stage 2 - 11m HRV entry and exit

CLIENT:	**St Lucy's School**
DRG. #:	**PTC-003**
PROJECT #:	**T2-2210**
SCALE:	**1:400**

REV: 1

180517 - ptc. - St Lucy's School, Wahroonga.dwg

play area 2

existing stage 1 - two storey classroom building with basement carpark
FFL 198.32

ex. landscaping

8,000

24,460

avenue

6,000

Proposed Works Zone (Indicative)

Refer to the arborist report for details of tree protection

secure fence line & gate

stair 1

proposed stage 3 - two storey classroom building over existing stage 2 basement
FFL 198.32

outdoor play area 1

existing creative arts centre

7,000

stage 3 construction access

11 RIGID MIN RADIUS WITH 3X6M LOAD

5,000

6,200

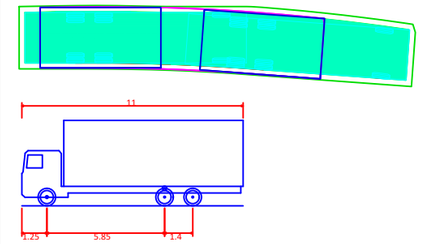
existing administration & support services

ex carpark (8 spaces)

land street

COMMENTS

A3



11 RIGID MIN RADIUS WITH 3X6M LOAD

Overall Length	11.000m
Overall Width	2.500m
Overall Body Height	4.250m
Min Body Ground Clearance	0.427m
Track Width	2.500m
Lock-to-lock time	6.00s
Wall to Wall Turning Radius	12.500m

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1	18/05/18	For information	EY	AU					

PROJECT:
St Lucy's School, Wahroonga

DRAWING TITLE:
Stage 3 - 11m HRV entry and exit

CLIENT: **St Lucy's School**
DRG. #: **PTC-004**
PROJECT #: **T2-2210**
SCALE: **1:400**

REV: **1**