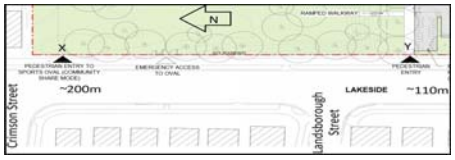
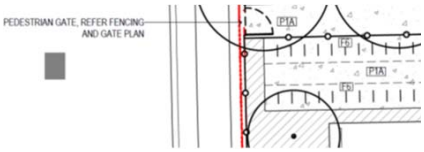
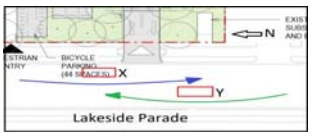
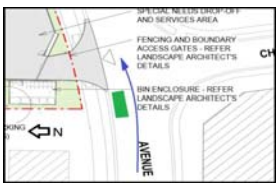
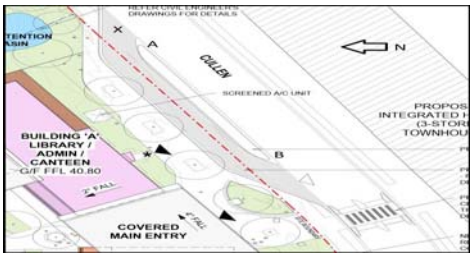
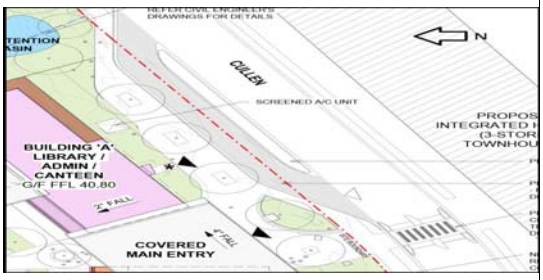
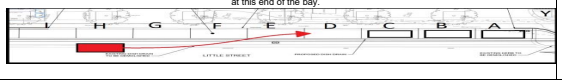
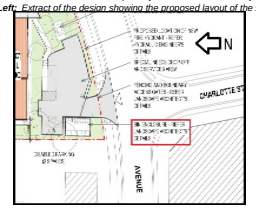
2 Safety audit findings

Table 2 Road safety audit findings.

Ref	Location	Road safety audit finding	Priority	Richard Crookes Construction Commentary
1	Pedestrian gates on Lakeside Parade.	There are two pedestrian gates proposed on the Lakeside Parade frontage to the school – labelled X and Y below. These will inevitably generate pedestrian entry/ egress movements. These are also likely to generate demands for road-crossing movements in the midblock. These would mostly be uncontrolled crossing movements requiring the pedestrian to judge and select gaps in the northbound and southbound flows on Lakeside Parade. This would generate *vehicle-pedestrian* crash conflicts, particularly if school children are involved. Children tend to have poorer peripheral awareness and vigilance when crossing the road. The audit team appreciates that as this is a significant frontage length, pedestrian access points would be a reasonable amenity. As such, to a large extent, these midblock crossing demands will be inevitable. It should be noted that gates X and Y are approximately 200m and 110m (respectively) from the signalised crossing at the Cullen Avenue/ Lakeside Parade/ Water Gum Drive intersection. These distances would impose a severe time-penalty for pedestrians, especially those heading to Crimson Street, Landsborough Street and Pitt Street, as well as the northern portions of Lakeside Parade. The school would need to manage these risks with access-egress strategies and policies. The outbound movements would be relatively easy to manage under teacher supervision. However, the inbound movements involving crossing movements from the western side to the eastern side of the road would be more difficult to prevent. Concepts such as one-way (outbound only) gates could be considered. Alternatively, the gates could simply be locked when there is no ground supervision.  ***Above:*** *Two pedestrian gates are proposed on the Lakeside Parade frontage which are likely to generate pedestrian crossing demands at these points.*	Medium	Given the inevitability of these mid block crossings and severe time penalty that would be imposed by forcing p Lakeside Parade, there is no feasible design resolution to address this issue. Accordingly, this risk will need to t
2	*Vehicle-pedestrian* conflicts at the driveways on Lakeside Parade and Cullen Avenue.	The design shows a staff car park on the eastern side of Lakeside Parade and a special needs car park and drop off area on the northern side of Cullen Avenue. Both of these facilities will have inbound-outbound driveways connecting to Lakeside Parade and Cullen Avenue respectively. As the project is still in design phase, there are several opportunities to reduce *vehicle- pedestrian* conflicts at the driveways. The audit team envisages that the Jordan Springs Town Centre will be a major attractor-generator of pedestrian trips to and from the school. Any pedestrian that emerges from the Lakeside Parade gate and heads towards the Town Centre would need to cross the staff car park driveway as shown by the blue line below. The same applies for the inbound trip in the reverse direction. This presents unnecessary conflicts with vehicles entering and egressing from the driveway. This is especially a risk when there are northbound right-turn movements into the driveway. These drivers would tend to look to the north to check for gaps in the southbound traffic stream and by doing so, may not observe pedestrians walking across the driveway. If there was also a pedestrian gate to the south of the car park driveway (eg. along line A-B-C), this could possibly eliminate such conflicts. Similarly, any pedestrians that emerge from the southern side of the school and head towards the Town Centre would tend to follow the green line. This passes through the special needs car park and driveway. There could be similar *vehicle-pedestrian* crash risks at this location as well. Similar to above, consideration could be given to providing a pedestrian access along the line A-D-E. Along the same theme of avoiding driveway conflicts, the plan below shows that the 44 bicycle parking spaces would be joined to the staff car park. As such, these cyclists would need to share the driveway with road vehicles which presents unnecessary *vehicle-bicycle* crash conflicts. Consideration should be given to linking the bicycle parking facility to the adjacent pedestrian walkway. This is indeed 	Medium	The project team has considered the pedestrian & vehicle movements along Cullen Avenue and given the loc anticipated that a majority of the pedestrian traffic wishing to access the school site will utilise this crossing wh utilising the drieway. Additionally the provision of pedestrian link A-D-E would present limited oppurtunity pedestrian traffic wishing to utilising the wombat crossing to cross the driveway, increasing the volume of pedestrian-vehicle conflict. With regards to the pedestrian movements along Lakeside Parade, the provision of pedestrian link A-B-C is i Endeavour Energy asset on Lakeside Parade. The design now incorporates access to the bike store from the pedestrian gate on Lakeside Parade to avoid the Refer to snap shot below; 
3a	Stopping/ parking restrictions on the kerblines – Lakeside Parade at the staff car park.	The plans do not indicate whether there will be any *no stopping* zones along the Lakeside Parade and Cullen Avenue kerblines. Some critical locations were identified including the staff car park on the eastern side of Lakeside Parade, the special needs car park on the northern side of Cullen Avenue, and the pick up/ drop off bay on the northern side of Cullen Avenue. These have been discussed separately in items 3a, 3b and 3c. <u>Staff car park on the eastern side of Lakeside Parade</u> The star car park will inevitably generate southbound left-turn movements, and northbound right-turn movements by inbound traffic. Southbound left-turners would tend to slow down when approaching and turning into the car park. If the eastern kerbline allows vehicles to stop or park, then the left-turning vehicle would need to commence the turn from a more central position in the road. This offers little passing opportunity for trailing southbound vehicles. By contrast, if a short *no stopping* zone is put in place along the eastern kerbline, the left-turning vehicle (red vehicle marked X) could shift to the kerbline and allow trailing vehicles to pass around as indicated by the blue arrow. As such, a *no stopping* zone should be considered on the eastern kerbline. Similarly, if northbound right-turners (red vehicle marked Y) stop to wait for gaps, any vehicles stopped along the western kerbline would restrict any passing opportunity by other trailing northbound vehicles. If a short *no stopping* zone is put in place on the western kerbline, trailing southbound vehicles could then use this space to pass around the stopped vehicle (green arrow). The above two scenarios illustrate the value of *no stopping* zones to improve passing clearance and to reduce *rear-end* crash potential. Short lengths of *no stopping* zones either side of the car park driveway would also help to preserve sight lines from the driveway to the north and south. Students and pedestrians moving along the eastern footpath and car park driveway would be less likely to be obscured by parked cars, and hence would be more visible to any drivers turning into the driveway. **Below:** *Extract from the design showing the criticality of passing opportunities on Lakeside Parade at the staff car park. This could be improved by implementing short lengths of no stopping zones on the eastern and western kerblines.* ***Right:*** *Looking southbound along Lakeside Parade from Crimson Street. Note the kerbside parking demand under pre-existing conditions.*  	Medium	The recommended no stopping zones have been implemented in conjunction with a number of bus zones - refer
3b	Stopping/ parking restrictions on the kerblines – *Special needs* car park on the northern side of Cullen Avenue. Continued from item 3a…	Continued from item 3a… <u>*Special needs* car park on the northern side of Cullen Avenue</u> The *special needs* car park on the northern side of Cullen Avenue will inevitably generate eastbound left-turn movements into the car park. If vehicles are allowed to stop along the northern kerbline of Cullen Road, the left-turning vehicle would be forced to take a more central position in the roadway. This would limit any passing opportunity by trailing eastbound vehicles. Any passing attempt could also generate *head-on* crash risks with westbound vehicles. By contrast, if a short length of *no stopping* zone is put in place on the western side of the driveway, the left-turning vehicle could shift to the north (green vehicle in left-hand image). This would allow eastbound trailing vehicles to pass around the slowed vehicle without encroaching into the westbound lane. Also, a *no stopping* zone would also improve sightlines of drivers egressing from the driveway. This is especially since the driveway will be located midway along a horizontal curve, and on the inside of the curve. The combined effect of the horizontal curvature of the road and vehicles stopped along the northern kerbline may reduce the *minimum gap sight distance* (MGSD) from the driveway. This is the sight line needed by egressing drivers to view approaching traffic streams, judge gaps and then enter those traffic streams. The potentially restricted MGSD sight line may lead to *cross traffic* crashes. ***Below Left:*** *Extract from the design showing the proposed layout of the special needs car park on the northern side of Cullen Avenue.* ***Below Right:*** *Looking eastbound along Cullen Avenue showing the kerbside parking demands under pre-existing conditions. Note also the impact of the horizontal curve and parked cars, on the sight line between eastbound drivers and the future driveway, and vice versa.*  	Medium	The recommended no stopping zones have been implemented in conjunction with a number of bus zones - refer

3c	Stopping/ parking restrictions on the kerblines –Pick up/ drop off bay on the northern side of Cullen Avenue. Continued from item 3b…	Continued from item 3b… Pick up/ drop off bay on the northern side of Cullen Avenue The kerbline adjacent to the pick up/ drop off bay (marked A-B below) would also need to be signposted as a *no stopping* zone. This is to preserve sight lines from the egress point at X to the west. That is, any vehicles stopped along this kerbline could block the *minimum gap sight distance* (MGSD) sight line from the egress point to the west. Also, if vehicles are allowed to stop along this kerbline, it may be mis-used by parents/ carers when picking up children. These drivers may consciously avoid entering the pick up bay and joining its queue. They may resort to waiting on kerbline A-B. This is especially undesirable as it would encourage students to cross the pick up bay with risks of impacts by vehicles moving along this facility. Also, the students would be forced to wait and board/ alight the vehicle from the narrow traffic island between the pick up/ drop off bay and Cullen Avenue. ***Below:*** *Extract of the design showing the proposed layout of the pick up/ drop off bay.* 	Medium	The recommended no stopping zones have been implemented in conjunction with a number of bus zones - re
4a	Operational impacts of the pick up/ drop off bay on the northern side of Cullen Avenue.	There are likely to be significant queuing and queue-related road safety impacts due to the pick up/ drop off bay. This would be especially during afternoon pick up periods following each school day. The audit team notes the following: • It is assumed that the pick up/ drop off bay will be a one-way *westbound only* traffic lane and that all entry would be via the western opening and all egress will be via the eastern opening. Signs and pavement markings should be included, as appropriate, to stipulate this one-way rule and to prohibit entry into the eastern opening. • The pick up/ drop off bay is configured as a *left-in only* access at its western end and a *left-out only* egress at its eastern opening. This is considered a reasonably safe layout assuming that all drivers comply with these turn restrictions. Signs and pavement arrows (as appropriate) should be considered to prohibit right-turns into or out of the pick up/ drop off bay. The westbound right-turn into the western opening would be a sharp hairpin turn. Some vehicles may not be able to perform this as a single manoeuvre and may need to resort to three-point turns (including a reversing adjustment with associated crash risks). The right-turn entry movement to the western opening could be a tempting movement since any vehicles that approach from the east would have very few other practical methods of turning around (see item 4b). By contrast the prohibited outbound right-turn movement (from the eastern opening) could be replaced by a left-turn out, and a u-turn at the Alinta Promenade roundabout (further east). Continued in item 4b… ***Below:*** *The proposed layout of the pick up/ drop off bay.* 	Medium	Signage & line marking has been incorporatedinto the kiss & drop as recommended by the auditor
4b	Operational impacts of the pick up/ drop off bay on the northern side of Cullen Avenue. Continued from item 4a…	Continued from item 4a… • As described in item 4a, the pick up/ drop off bay is configured as a *left-in only* access at its western end, and a *left-out only* egress at its eastern end. The inhibited right-turn entry movement at its western end may generate "q-turns" at the Cullen Avenue/ Charlotte Street intersection (ie. a westbound left-turn into Charlotte Street, followed by a u-turn, and followed by a right-turn back into Cullen Avenue such that the entire movement resembles a "q"). Typical "q-turn" movements are illustrated below – including a short "q-turn along the red path and a longer version illustrated by the yellow path. Both of these will generate right-turn movements from Charlotte Street. This would generate crash conflicts with westbound and eastbound vehicular movements on Cullen Avenue. Typically, right-turns from the minor leg of intersections are the most difficult turning manoeuvres since there are gap acceptance (and hence gap-checking) requirements in both major road flows. The short "q- turn" path illustrated by the red arrow also introduces a u-turn in the control area of the intersection which could have its own crash conflicts such as with vehicles turning into or out of Charlotte Street. Consideration may be needed for signposted time- based prohibitions (bans) on right-turns from Charlotte Street during school zone periods. ***Left:*** *With no other restrictions in place, the audit team envisages that Charlotte Street will be used by westbound drivers to perform "q-turns" to access the pick up/ drop off bay in lieu of the likely prohibited right-turn entry to the bay.* 	Medium	Additional signage and line marking will be installed at the intersection of Cullen Avenue & Charolette Stree way (Cullen Avuenue)
4c	Operational impacts of the pick up/ drop off bay on the northern side of Cullen Avenue. Continued from item 4b…	Continued from item 4b… Queue management is especially critical to the road safety performance of the pick up/ drop off bay, especially during afternoon pick up periods. If the pick up operations are untidy and cause queuing, these queues could easily spill back out of the pick up bay and into Cullen Avenue, where the back of queue would be exposed to*rear-end* crashes. The queue may also spill back to and across the zebra crossing. This is largely a traffic management issue during the operational phase. However, there are some design measures that could be used to mitigate these risks. Simple linemarking solutions in the pick up bay could be used to guide drivers where to queue and where to stop to pick up students. This would also create a wide residual space for other vehicles (that have completed their pick up "transactions") to pass around other vehicles that are still loading. The audit team notes that the long pick-up rank and kerbline must be managed diligently to operate efficiently. Firstly, in order for the pick up zone to be used efficiently, the student would need to predict which part of the pick up bay their parent/ carer will arrive at. Unless this can happen, there will always be several pick up spaces that students will take substantially longer to reach from their dispatch point. Using the left image, if the student dispatch point is at Y, then the student will take longer to reach their parent/ carer's car in spaces G, H and I and hence these cars will be delayed much more than those in the leading spaces. Similarly, if the student dispatch point is midway along the bay, then cars in spaces A, B and C would experience more delays compared with the trailing bays. The differential waiting times across the pick up rank would lead to different "transaction" times which means the fully occupied rank cannot move off in a single platoon. Rather, cars will leave the rank as they complete their transaction, not when ALL other cars in the rank have completed their transactions. There would be a mixture of occupied spaces and vacant spaces since the spaces will not all vacate at the same time. The top image also shows what would happen when cars in spaces A, B and C are still completing pick up operations and another car (red vehicle) arrives at the rank, this vehicle would enter bay D instead of waiting until A, B and C become vacant. The bottom image shows what happens next after vehicles A, B and C vacate the rank. The next vehicle that arrives would typically enter space E rather than cutting in front of car D to access A, B or C. Hence the storage capacity of the rank diminishes due to the inefficient loading and transactions. Alternatively, if the green vehicle does head towards A, B or C they could generate a*cross over* crash conflict with the red vehicle as it pulls out. In the audit team's experience with other schools, a long-rank style pick up zone works best if the pick up operations are confined to the first few spaces (say A to C), and the remaining spaces are only used as a lead-up queue. The children would be dispatched from point Y which therefore limits the longest walk-distance to the Y-C distance. Although this is a traffic management decision, the design could assist by creating more road-side waiting space, and perhaps shelter at the leading portion of the bay to encourage all loading to occur at this end of the bay. 	Medium	The school operations team will actiovely manage the operation of the kiss &

5	Shared path designation on Cullen Avenue and Lakeside Parade.	The pre-existing footpaths surrounding the school site are not well defined with respects to their status as shared paths or common footpaths. On Cullen Avenue, to the east of the school site, the footpath is a designated shared path (see signage in image below). This legally allows usage by pedestrians and cyclists. However, aside from this sign, there are no other signs to confirm or terminate the shared path status. The northern footpath of Cullen Avenue has the appearance and width of a shared path. As such, with no other reassurance signage, this could be a lost opportunity for improving bicycle safety. If cyclists simply believe that the paths are common footpaths, then they would tend ride on the roadways (unless they are eligible to cycle on the footpath under NSW Road Rule 250). By riding on the roadway, this could increase exposure to *vehicle-bicycle* crashes. The audit team acknowledges that there are 44 bicycle spaces are proposed in the staff car park, and hence there is a predicted demand for bicycle travel to and from Jordan Springs Public School. Similarly, the footpath on Lakeside Parade is not defined as a shared path although it appears wide and flat enough to operate as one. This is also a lost opportunity, especially since this footpath would be directly accessible from the bicycle parking area. Consideration could be given to formalising the status of these footpaths and if appropriate, signposting these as shared paths. ***Left:*** *Pre-existing signs on the northern path of Cullen Avenue indicate that this is a designated shared path. This sign is along the northern footpath to the east of the school site.* 	Low	
6	*Special needs* car park on the northern side of Cullen Avenue.	The plan indicates that a bin enclosure area will be provided in the *special needs* car park on the northern side of Cullen Avenue. This implies that garbage collection will take place at this location. If these are dumplex bins, then typically the waste collection truck would need to enter the premises, lift and empty the bins and then egress. If so, this car park area does not seem large enough for a truck to perform a u-turn in a single manoeuvre. This would inevitably require a three-point turn including a reversing movement. This could increase the risk of impacts with other parked cars, structures or pedestrians. If these bins are wheeled sulo bins, then consideration could be given to providing a separate paved path for these to be wheeled to the kerbline. Otherwise the bins would need to be wheeled to the street via the driveway. The audit team were also uncertain whether the disabled parking spaces are intended for (i) drivers to drop off and pick up disabled students, or (ii) for use by disabled drivers (staff or visitors), or (iii) both. If intended to be used by disabled drivers, these parking spaces will be difficult to use. If the vehicles are parked *front-in* , then the driver would inevitably need to perform a difficult reverse weaving movement to egress from the parking space. This would also require sight line checks at various angles to check for other vehicular or pedestrian movements. Drivers with neck mobility limitations may not be able to achieve these visibility checks. The bin enclosure area could also block driver visibility. If drivers park *rear-in* , they would need to perform an awkward reverse weaving manoeuvre into the spaces. This could also prove difficult for disabled drivers, especially those with neck mobility limitations. ***Left:*** *Extract of the design showing the proposed layout of the special needs parking area, on the northern side of Cullen Avenue.* 	Low	It is anticipated that the waste collection activities will take place outside of the hours that it is anticipated tha unlikely that conflict between waste collection vehicles and disabled parking bay users will occur.
7	Maintenance access gate at the eastern end of the property – on the northern side of Cullen Avenue.	The design indicates that a maintenance gate will be provided on the northern side of Cullen Avenue at the eastern end of the property. This is presumably so that vehicles can access the bioretention basin and other landscaped areas on the eastern side of the school buildings. Overall, this gate would have low-volume usage. However, it still creates an unnecessary driveway conflict point into Cullen Avenue. There is an opportunity to relocate this gate to the pick up/ drop off bay and hence rationalise the number of conflict points that would have a direct connection to Cullen Avenue. By relocating the gate accordingly, this may also improve access by maintenance vehicles. By contrast, the currently proposed maintenance gate appears to lead vehicles directly towards a steep embankment and towards the basin. ***Below:*** *Proposed layout of the maintenance gate (circled in blue) and its close proximity to the pick up/ drop off bay.* 	Low	this access point has only been incorporated into the desin to provide access to the bio treatment basin for the place on a bi-annual basis. As suchthere wiolI be very little oppurtunity for conflict along Cullen Avenue to o bay would create connflict between heavu vihicles accesing the basin for maintenance and pedestrians & veh integration of the bio treatment basin access and the kiss & drop day is considered likely to increase the risk