

NORTH BYRON PARKLANDS

North Byron Parklands

Traffic and Transport Assessment

NOVEMBER 2017



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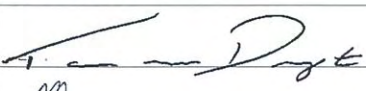
North Byron Parklands Traffic and Transport Assessment

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EXECUTIVE SUMMARY

North Byron Parklands (NBP) intends to seek development consent and associated Concept Plan Modification for the permanent use of the North Byron Parklands (Parklands) site at Yelgun. The site has been hosting major cultural events since being given approval to host trial events up to the end of 2017. This Traffic and Transport Assessment (TTA) has been prepared to assess the potential traffic and transport impacts of a range of ongoing events.

Trial events

Between 2013 and 2017, nine large and medium trial events have been held at NBP. While transport issues have occurred during some events, NBP have reacted quickly to address the issues as soon as possible to limit the impact. The 2017 editions of the Falls Festival and Splendour in the Grass (SITG) festival have demonstrated that the site can host large events with minimal impact on the surrounding road network. Data gathered from the trial events indicates the following:

- Average car occupancies: approximately 2.9 for day patrons and 2.4 to 2.8 for campers.
- A high bus mode share for day patrons of between 63% and 66% but lower for campers (2%) due to the practical requirements of carrying camping equipment.
- Departure traffic volumes from the site are constrained to avoid overloading the surrounding road network.
- The strategy of diverting off the Pacific Motorway to Cudgera Creek Interchange/Tweed Valley Way and Brunswick North Interchange/Brunswick Valley Way has been successful in reducing the pressure on the Yelgun Interchange during peak patron arrival.
- The patrons at the events held to date have been supportive of the transport initiatives adopted to increase ride sharing and bus use.

Permanent events

A number of potential event scenarios have been devised to test the impacts of different configurations. These are representative only and do not constitute the full extent of events sought under this Application. The event categories assessed in this report are shown in Table ES.1.

Table ES.1 Proposed permanent event categories, durations and days

Category	Campers	Day patrons	Total patrons	No. event days	Limit on days
Minor	Flexible mix		1,500	1	No limit
Small	Flexible mix		5,000	1	5 days per annum
Medium	-	25,000	25,000	1	3 event days per annum
	20,000 ¹	5,000	25,000	Up to 3	
100% capacity	20,000 ¹	15,000	35,000	Up to 5	2 events per year with a maximum of 5 days per event ²
	20,000 ¹	22,500	42,500		
	20,000 ¹	30,000	50,000		

(1) NBP site has approval for 25,000 campers. However, due to space constraints during larger events, this number has been limited to 20,000 campers

(2) Only one event above 35,000 patrons

This report focusses on the impacts of the 50,000 event, as it would place the largest demand on the road and transport network. However, the increase to this crowd size would be staged over several years to allow lessons learnt to be incorporated into the plans for each successive event.

Site access and layout

The NBP site was established with a view to the infrastructure requirements of a 50,000 patron event to create efficiency during construction. The infrastructure already used for the trial events is largely sufficient to accommodate the needs of future events, with minor rearrangements to the locations of certain activities. Permanent approval would enable investment in infrastructure that would better facilitate the larger crowd. It would also reduce the risk of variables such as weather impacting on the access arrangements, reducing the risk of traffic on the external road network being affected by conditions on site.

The usage of the existing gates will remain as approved. However, the types of traffic using Gates B, C and D will be managed to control traffic release onto the road network and manage delays within the site. A changed use of the Emergency Vehicle Gate – Gate E is proposed to allow access for camper and day patron parking at the northern end of the site. The anticipated number of vehicles using Gate E is small in comparison to the other gates as it would only serve the Tweed Coast catchment.

Traffic impacts

The capacity analysis of Tweed Valley Way, the Pacific Motorway and the Pacific Motorway Interchanges has been undertaken to determine the impact of the 50,000 patron Large event using forecast traffic volumes on the road network with traffic growth to 2027 and 2037. They have indicated:

- The Pacific Highway capacity would not be affected. One instance of a Level of Service D was assessed during the Monday morning camper departure in 2037. The departure rate of camping vehicles can be restricted if impacts are identified during monitoring of the Pacific Motorway.
- The Pacific Motorway ramp merge and diverge areas perform well. The southbound diverge areas at the Yelgun Interchange experience a Level of Service D. However, the impact on average speeds is small <3 km/h.
- The operation of Tweed Valley Way would change from LoS D to LoS E with the 50,000 patron event. LoS E would be experienced for three hours in the middle of the day in 2027 and four hours by 2037. Travel speeds are not expected to drop below the temporary special event speed limit of 40 km/h during this time.
- The operation of the Cudgera Creek Interchange and Brunswick North Interchange roundabouts would not be adversely affected by the event traffic.
- Queuing on the Yelgun Interchange Link Road would extend through the main Yelgun Interchange roundabout on the Friday afternoon peak in 2027 and the Friday afternoon and Sunday early afternoon peaks in 2037. However, the queues wouldn't encroach on the safe stopping sight distances for the Pacific Motorway exit ramps. Roundabout metering by traffic controllers or temporary traffic signals could be used to manage queues if they were to become excessive.

Given that this impact would be experienced for a handful of hours on a few days across the year, these impacts are considered reasonable for a state significant large special event. To recognise the special event nature and the limited times when peak impacts would be experienced, a revised set of the Key Performance Indicators are proposed.

The smaller events planned for the site would not have as significant an impact on the surrounding road network. However, depending on the nature and details of the event, some smaller events may require traffic management plans to achieve changes such as greater mode split increases to public transport.

Local access

A range of measures similar to those used for the trial events would be used for a 50,000 patron event to limit the impact on non-event road users. These include restricting access to Yelgun Road and Jones Road to residents and their guests provided with residents' permits. Residents of the surrounding villages would experience higher traffic conditions that may occasionally result in short delays. Public notices about the events would highlight this impact and suggest that trips be made during other times to avoid delays. Traffic management arrangements would seek to minimise, where possible, the impact on non-event related traffic. They have been designed to ensure that temporary and existing turning bays are of sufficient length to contain queuing, achieving uninhibited through traffic flows.

Buses

The event shuttle bus network would be expanded with higher frequency services to meet the needs of the 50,000 patron event. The infrastructure built for buses on-site has sufficient capacity to cater for the increase in buses. Stops within the surrounding towns are expected to have sufficient capacity to accommodate the increased number of buses starting/finishing at the stops. In consultation with Byron Shire Council, park-and-ride sites in key locations such as Byron Bay and Brunswick Heads could be promoted to increase bus use and reduce traffic congestion.

Event traffic management

Event speed zones of 40 km/h are proposed around the Link Road intersection and along the frontage of the site as well as at the Jones Road intersection. 60 km/h event speed zones are proposed between the 40 km/h speed zones. These speed zones are proposed to improve the safety and efficiency of traffic control locations. Also, the speed zones are used as a risk mitigation tool associated with any queuing and congestion on the public roads.

Monitoring the performance of both the Yelgun Interchange and Link Road intersection with Tweed Valley Way is required to ensure that excessive queues do not build up for the 50,000 patron event. This would enable traffic management strategies to be implemented should unexpected queuing occur. Traffic control may also be required at the site gates to improve the efficiency of the associated access intersections, depending on the size and nature of the event.

1 Introduction

Development consent and associated Concept Plan Modification are sought for the permanent use of the North Byron Parklands (Parklands) site at Yelgun. The trial use of the Parklands site has demonstrated unequivocally that this carefully selected and purpose-built venue can sustainably hold major cultural events in perpetuity.

The original proposal for North Byron Parklands (Parklands) was declared a Major Project on 23 July 2009. The Concept Approval and the Project Approval were granted on 24 April 2012 under delegated authority of the Minister for Planning by the Planning Assessment Commission.

1.1 BACKGROUND

A concurrent Concept Plan and Project Application for the NBP site was submitted in July 2009. Director General Requirements were issued on 28 August 2009, and the proposal went on exhibition between 7 October and 19 November 2010. Approval to hold trial events up to the end of 2017 was granted on 24 April 2012. The trial approval permitted:

- Use of the site for cultural, educational and outdoor events with ancillary camping and car parking
- Erection of temporary event infrastructure
- Construction of a spine road
- Implementation of storage and management of water
- Implementation of wastewater treatment.

The consent also approved:

- A cultural centre
- A conference centre and associated accommodation.

This combined State Significant Development Application and associated Concept Plan Modification seeks permanent approval for the use of Parklands as a 'Recreation Facility (Major)' with patron capacity as follows:

- Two events [i.e. the existing Splendour in the Grass (SITG) and Falls Festival Byron (FFB) catering for up to 35,000 patrons over a maximum of 5 days each;
- Three event days catering for up to 25,000 patrons (cumulative or separate); and
- Five small community event days catering for up to 5,000 patrons, and 2 minor community event days catering for up to 1,500 patrons (cumulative or separate).

Further, consent is sought to allow for the orderly growth of SITG from 35,000 to 42,500 and then 50,000 patrons, but only upon achievement of rigorous Key Performance Indicators.

Events will be managed in accordance with the Environmental Health and Safety Management Manual (EHSMM) approved with the original application. The EHSMM has been refined over the period of the trial having regard to the lessons learnt from the carrying out of events. The EHSMM ensures comprehensive management of all environmental impacts. The system guarantees that events are monitored, mitigated and managed in a sustainable manner. It also provides a transparent audit system.

1.2 SITE LOCATION

The NBP site is located north of Brunswick Heads on the North Coast of NSW in the north-east corner of Byron Shire. The NBP site is located adjacent to Tweed Valley Way and spans a section of Jones Road. A map showing the location of the site is provided in Figure 1.1. The local context of the site and lot numbers are shown in Figure 1.2.



Figure 1.1 NBP site location

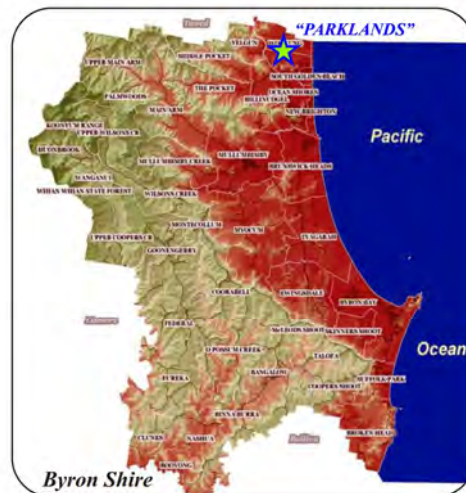
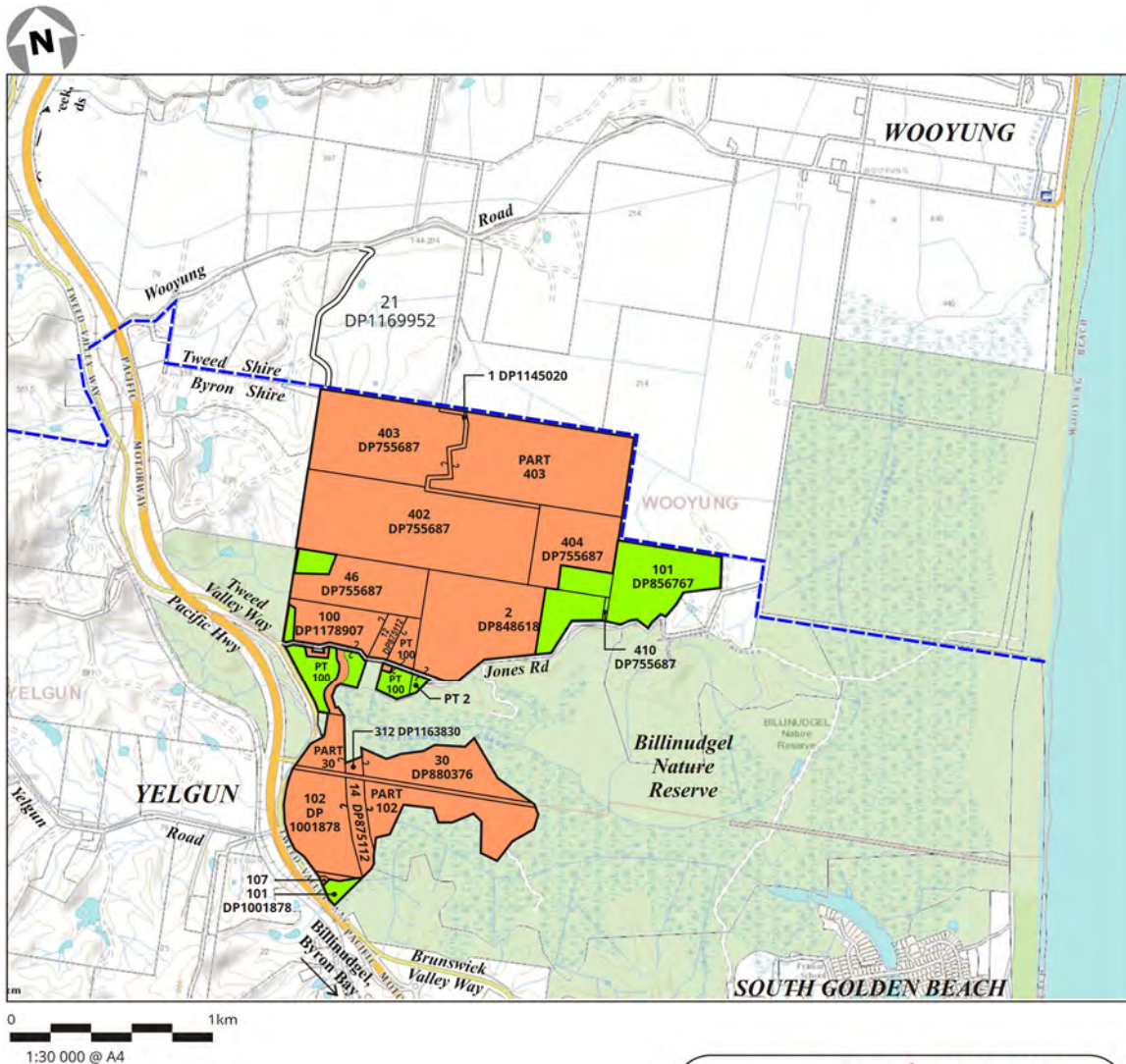


Figure 1.2 NBP site lot numbers and locality plan

1.3 STUDY CONSULTATION

As part of this assessment, consultation was undertaken with Transport for NSW and Roads and Maritime Services to identify key issues to be addressed and agree a methodology for how the assessment should be conducted. A draft methodology and background information was provided to the Development Assessment team in Roads and Maritime Services Northern Region on 28 July 2017. A teleconference meeting was held on 3 August 2017 between 1.00 pm to 2.30 pm to discuss the provided material and the study. Comments on the proposed methodology were provided by Roads and Maritime officers on 25 August 2017.

Consultation was also undertaken by phone with officers of Byron Shire Council and Tweed Shire Council, as well as local bus operators. These discussions included the organisations key issues, their feedback from the 2017 SITG event, information regarding any developments in the area to be taken into consideration and the gathering of any available data.

1.4 THIS REPORT

This Traffic and Transport Assessment (TTA) has been prepared by WSP Australia Pty Limited on behalf of Byron Venue Management Pty Ltd. The purpose of this study is to provide an assessment of the potential traffic and transport impacts for the proposed range of events.

This report is structured as follows:

- Section 2 provides a summary of experience and transport conditions at the trial *Splendour in the Grass* and *Falls Festival* events to provide the basis for evaluating the potential impacts of the proposed events.
- Section 3 details the proposed permanent event limits including the different types of events, size, duration, frequency and timing.
- Section 4 describes how the NBP site is accessed and the internal site layout that provides for patron, performer/VIP, staff and servicing movement and parking.
- Section 5 provides a summary of the transport arrangements for each type of event, including calculation of the potential traffic generation, patron arrival, mode of transport and car occupancy. It also assesses the potential impacts on the road network of the various event sizes. It discusses the impacts of the different traffic generation scenarios on the Yelgun Interchange and draws conclusions about the ability of the interchange to accommodate these traffic flows.
- Section 6 discusses potential enhancements to the current public transport to accommodate increased use of buses for the larger event size. Measures to facilitate bus movements are proposed.
- Section 7 outlines the proposed traffic management strategy based on the experience of the successful arrangements implemented at the events held to date. This section provides a schedule of the transport management measures that would be employed for the different sizes of events. The impacts of some of these measures, such as the use of multiple interchanges for patron arrival and event egress are discussed.
- Section 8 summarises the conclusions of the traffic impact assessment.

2 Trial Approval Event Summary

Since project approval was issued for NBP on 29 April 2012, the Splendour in the Grass and Falls Festival have been annually held on the NBP site, as shown in Table 2.1.

Table 2.1 Major trial events held at NBP

Year	Splendour in the Grass	Falls Festival
2013	25,000 patrons, four-day event	15,000 patrons, three-day event
2014	27,500 patrons, four-day event	17,500 patrons, three-day event
2015	30,000 patrons, four-day event	20,000 patrons, three-day event
2016	32,500 patrons, four-day event	22,500 patrons, three-day event
2017	32,500 patrons, four-day event	25,000 patrons – To be held later this year

Source: Traffic assessment reports, Greg Alderson and Associates

This chapter provides an overview of the performance of each festival. A more detailed description of each event is provided in Appendix A. A summary of data recorded during the trial events held between 2013 and the current day is provided in Table 2.3.

2.1 SPLENDOUR IN THE GRASS 2013

Held in July 2013, Splendour in the Grass 2013 was the first large trial event with an approved patronage up to 25,000 patrons. This patronage consisted of 15,000 camping patrons and 10,000 day patrons. In addition, it is understood that some 1,200 support staff personnel were on site.

- A combination of factors on Thursday and Friday afternoons and evenings resulted in significant queueing extended from the site onto Tweed Valley Way and then onto Brunswick Valley Way and both Yelgun off ramps.
- While the congestion was significant, no traffic crashes were recorded which could be attributable to these issues.
- On Wednesday, Saturday and Sunday no congestion issues were experienced.
- On Monday, the day of camper departure, departing vehicle traffic volumes were throttled back to protect the right turn off Tweed Valley Way onto the Link Road from excessive queueing.
- The emergency access to Wooyung Road was approved by NSW Police to be opened-up for departing traffic due to internal road conditions, which resulted in some queueing in Pottsville.
- A rear-end crash occurred during the short-term queueing in Pottsville on the Tweed Coast Road.

2.2 FALLS FESTIVAL 2013/14

The first medium trial event was held over the New Year holiday period of 2013/14. The annual Falls Festival is a festival that is held annually in Lorne, VIC and Marion Bay, TAS. It was first held at NBP as the first medium trial event, with an approved patronage of 15,000, of which 13,000 3-day campers and 2,000 single day and 2 day patrons.

- Site layout and operations were changed to address the issues recorded for SITG '13, resulting in a significant improvement to traffic operations.
 - All key performance indicators were complied with during patron arrival periods and the event was a success from a traffic operations perspective.
-

2.3 SPLENDOUR IN THE GRASS 2014

The second large trial event at the site was Splendour in the Grass 2014, held in July 2014. The approved patronage for this event was 27,500, comprising of 17,500 campers and 10,000 day patrons.

- An incident (not related to the event) on the road network (vehicle crash) in the northbound lane on the Pacific Motorway near Ocean Shores on the Friday afternoon resulted in delays for northbound traffic for some period. When the road was cleared, a sudden release of northbound traffic exited the Pacific Motorway using the northbound off ramp at Yelgun. To prevent any queuing on the off ramps, traffic was held back on Brunswick Valley Way for a short period of time. This allowed traffic from the northbound off ramp to travel onto Tweed Valley Way without interruption. This was the only congestion experienced on the public road during camper's arrival.
 - On the Monday, camper departure rates were restricted to ensure the vehicle density on Tweed Valley Way would be sufficiently low. Occasionally, the Level of Service KPI was exceeded, but this did not result in any significant queuing.
 - In general, the traffic operations for this festival were a success.
-

2.4 FALLS FESTIVAL 2014/15

Falls Festival 2014/15 was the second medium trial event at NBP, with an approved patronage of 17,500. The patronage was split between roughly 15,000 campers and 2,500 one or two day patrons.

- A successful trial was carried out to encourage festival patrons travelling from the North along the Pacific Motorway to exit the Pacific Motorway at the Cudgera Creek Road exit.
 - The camper departure day was on the Saturday, when the background traffic on Tweed Valley Way was relatively low.
 - Although some short-term exceedances of the Level of Service were recorded, traffic flowed with little impact on operation.
-

2.5 SPLENDOUR IN THE GRASS 2015

Splendour in the Grass 2015 was the third large trial event at NBP and was again held in July of that year. It had an approved patronage of 30,000, of which approximately 17,500 campers and 12,500 day patrons.

- The use of the Cudgera Creek off ramp diversion was used again for the SITG 2015 event.
- To further relieve pressure on the Yelgun Interchange, patrons from the South were encouraged to exit the Pacific Motorway at the Riverside Crescent exit at Brunswick Heads.

- Wet weather affected the condition of some internal roads during camper arrival. This resulted in queuing on the Spine Road that extended onto Tweed Valley Way and Brunswick Valley Way on the Thursday afternoon. On the Friday, queuing was observed on Tweed Valley Way, but only as far as the frontage to the site.
- Camper departure on the Monday was a success, with some campers departing from Gate C to the North, reducing the pressure on the Yelgun Link Road intersection.

2.6 FALLS FESTIVAL 2015/16

Falls Festival 2015/16 was the third medium trial event at NBP, with an approved patronage of 20,000, although actual tickets sold may have been less than this maximum. The patronage was split between roughly 15,000 campers and 2,500 one or two day patrons. The campgrounds opened on Wednesday 30 December 2015, although the event days did not start until the following day (Thursday 31 December 2015). Performances finished on Saturday 2 January 2016, and the site closed on Sunday 3 January 2016.

- A new 'stacked' layout for campers and their vehicles (parked alongside camping space) was trialled and appeared to work successfully.
- The arrival of campers occurred efficiently, with minimal queuing of camper's vehicles.
- VMS boards directed patron's vehicles to exit the Pacific Motorway before the Yelgun Interchange.
- Queuing at the one-lane roundabout at the intersection of Tweed Valley Way and the Yelgun Interchange Link Road was contained within the right-turn bay length.
- The Wooyung Road emergency gate was opened for camper departure by NSW Police, supported with stop signs and a 60 km/h roadworks speed limit.
- Traffic conditions on Tweed Valley Way remained at Level of Service C or better during the departure.
- Roadworks associated with the upgrade of the Pacific Motorway around the Ewingsdale Interchange resulted in some queuing. While event patrons would have been included in these queues, they were not the cause of the delays.

2.7 SPLENDOUR IN THE GRASS 2016

Splendour in the Grass 2016 was the fourth large trial event at NBP and was held in July 2016. It had an approved patronage of 32,500, of which approximately 20,000 campers and 12,500 day patrons.

- Traffic arrangements during the campers' arrival worked well with no issues observed or reported on the Wednesday and Thursday.
- On the Friday, an unexpected mode shift for day patrons to passengers being dropped off and picked up by taxi, private car or ride sharing on the Friday led to congestion within the site that extended onto Tweed Valley Way during the afternoon. This queue extended back to north of the roundabout at the Link Road at the peak. At the end of the day's performances, the return of the vehicles picking up patrons caused congestion that blocked the movement of buses and causing delays for patrons leaving the site. Some people were observed walking along Tweed Valley Way from the site, with instances of hitchhiking observed.

- In consultation between the event operators, Roads and Maritime and NSW Police, alternative arrangements were put in place to address these issues on the Saturday. This involved the relocation of the taxi stand and passenger drop-off/pick-up area to the southern parking area with adjustment to the location of parking. This had a positive impact in reducing congestion on the spine road in the northern part of the site. However, issues with the layout of the new drop-off area resulted in queuing out of the site onto Tweed Valley Way and back to the Pacific Motorway northbound off-ramp, but did not queue onto the Motorway itself. The evening departure was improved with the modified arrangements for passenger pick-up.
- Further changes were made on the Sunday to provide more queuing space for vehicles dropping-off passengers in the southern parking area. Traffic conditions on the Sunday were observed to be good without any substantial queuing on Tweed Valley Way or the surrounding roads.
- Camper departure on the Monday operated smoothly.
- The Emergency Access Road to Wooyung Road was opened by NSW Police for a short period with a restricted departure to ensure that the flow-on impact of in Pottsville was minimal.
- Traffic impacts at the Yelgun Interchange were also minimal. The newly constructed roundabout at the Tweed Valley Way/Link Road intersection was observed to be performing well.

2.8 FALLS FESTIVAL 2016/17

Falls Festival 2016/17 was the fourth medium trial event at NBP, with an approved patronage of 22,500. The patronage was split between roughly 20,000 three-day patrons, 2,250 two-day patrons and 250 one day patrons. The campgrounds opened on Friday 30 December 2016, with the event days from Saturday 31 December 2016 to Monday 2 January 2017. The site closed on Tuesday 3 January 2017. It was estimated that there was approximately 3,000 staff, stallholders, contractors and guests on site.

Campers were permitted to park alongside their camping space. Departing traffic was split into two lanes for right and left turns at Gate C. VMS boards directed patron's vehicles to exit the Pacific Motorway before the Yelgun Interchange. The results of traffic surveys indicate that they successfully influenced driver decisions, with 83% of northbound traffic and 66% of southbound traffic using an interchange before the Yelgun Interchange.

The arrival of campers occurred on the Friday, with approximately 60% of total patrons arriving. Queuing on Tweed Valley Way at Gate C into the site was minimal (approximately three vehicles) due to traffic controller direction. During the event days, exiting traffic was split into two lanes, which operated effectively. Little traffic used Wooyung Road, with most traffic staying on Tweed Valley Way to Mooball. There did not appear to be any impact on traffic conditions within Pottsville, with queues clearing before the next platoon arrived.

Automatic tube traffic surveys on Tweed Valley Way indicated it operated at Level of Service C or better during the peak Tuesday departure of campers in the southbound direction. The surveys also indicated that:

- 47% of campers arrived from the south and 53% from the north
- 54% of day guests came from the south and 46% from the north
- On Tuesday 3/1/17, 43% of campers departed to the south and 57% to the north.

Traffic surveys of the site gates indicated that the number of vehicles on site peaked at 7,600 on Saturday 31/12/2017.

Based on on-site observations, it was concluded that all Key Performance Indicators for traffic management were met during the festival.

2.9 SPLENDOUR IN THE GRASS 2017

Splendour in the Grass 2017 was the fifth large trial event at NBP and was held from 21 to 23 July 2017, with camper entry from 19 July 2017 and departure on 24 July 2017. It had an approved patronage of 35,000, of which there were 19,265 campers and 13,235 day patrons.

The successful elements of traffic management from previous events were implemented, including:

- the repositioning of the passenger drop-off/pick-up area to the southern portion of the site
- the parking of camper vehicles alongside the camp site
- the use of VMS to divert traffic off the Pacific Highway at Brunswick North and Cudgera Creek Road were employed again
- two southbound lanes were used on the Spine Road through to Gate C during camper bump-out on the Monday – left lane to Ocean Shores, Brunswick Heads, Mullumbimby, Byron Bay, Ballina, etc. right lane to Tweed Coast, Murwillumbah and Gold Coast.

The use of two departure lanes for camper bump-out resulted in increased departure rates that didn't exceed 800vph cap on Tweed Valley Way because of the split in volumes. Unlike previous years, the use of the Wooyung Road gate wasn't needed by Police.

Feedback from a number of road agencies and observers on site were that the site performed well with no repeat of the issues from the previous year. All KPIS were met and only relatively minor issues observed. Observations made during the event were that there was a general absence of congestion. Non-event through trips were only stopped by the traffic controllers for short periods of time, not by traffic congestion.

Minor issues observed include:

- Some queuing on Tweed Valley Way during the bump-out for cars and taxis/ride sharing at approximately midnight. However, the queue of vehicles was constantly moving and at this time of night, there was very little non-event traffic that would have been affected.
- Still some patrons trying to park in the Rest Area, but parking in southern car park is now more convenient. Message to be reinforced to patrons for future years.

It is anticipated that the positive transport experience in 2017 will result in less recalcitrant behaviour at future events for returning patrons (e.g. parking in unapproved areas and vehicles attempting to drop passengers on Tweed Valley Way). Patrols and enforcement will continue to be employed until it is shown that these problems are no longer occurring.

Traffic counts of vehicles entering and leaving Gates A (Jones Road), C and D were undertaken capturing traffic accessing the site. The results are summarised in Table 2.2. Detailed flow profiles, with a description of the type of movements occurring on that day are shown in Appendix B. The hourly traffic flow profile of the 2017 event is graphed by day in Appendix B.

Table 2.2 Daily traffic counts at Gates A (Jones Road), C and D at 2017 SITG

Time period	Vehicle type	Tuesday, 18 July 2017	Wednesday, 19 July 2017	Thursday, 20 July 2017	Friday, 21 July 2017	Saturday, 22 July 2017	Sunday, 23 July 2017	Monday, 24 July 2017
		In (Gates C and D)						
Day (5.00 am to 9.00 pm)	Total vehicles	1,279	3,291	7,652	6,732	6,448	6,371	1,448
	% Heavy Vehicles	22%	12%	13%	14%	15%	14%	19%
Night (9.00 pm to 5.00am)	Total vehicles	41	207	598	1,239	1,506	1,465	5
	% Heavy Vehicles	20%	18%	18%	26%	24%	23%	20%
24 hour	Total vehicles	1,320	3,498	8,250	7,971	7,954	7,836	1,453
	% Heavy Vehicles	21%	12%	13%	16%	17%	16%	19%
		Out (Gates C and D)						
Day (5.00 am to 9.00 pm)	Total vehicles	1,147	1,200	2,085	4,015	4,552	5,089	7,942
	% Heavy Vehicles	14%	13%	10%	11%	11%	9%	11%
Night (9.00 pm to 5.00 am)	Total vehicles	31	163	734	3,129	3,494	4,035	27
	% Heavy Vehicles	6%	9%	14%	11%	9%	9%	11%
24 hour	Total vehicles	1,178	1,363	2,819	7,144	8,046	9,124	7,969
	% Heavy Vehicles	13%	13%	11%	11%	10%	9%	11%

Source: Data: Greg Alderson & Associates, Analysis: WSP Australia

2.10 TRIAL EVENT SUMMARY

The method of data collection is as follows:

- Private vehicle occupancy: sample observations of number of vehicles entering site and cross-checking using number of parking tickets sold with required number of people for incentive voucher (supplied by North Byron Parklands). The sample size was 815 vehicles – or approximately 10% for the 2016 event. Samples for other years have been based on a similar percentage.
- Number of car parks: number of parking passes sold (supplied by North Byron Parklands) checked by on-site observations (Greg Alderson and Associates).
- Direction of arrival (% split): automatic tube counts on Yelgun Interchange ramps, Tweed Valley Way and Brunswick Valley Way and Site Entry/Exit gates (undertaken by Greg Alderson and Associates on behalf of North Byron Parklands).
- Peak arrival flow rate and time of day: automatic tube counts at Site Entry/Exit gates (undertaken by Greg Alderson and Associates on behalf of North Byron Parklands).
- Bus use: records of services operated and passengers on arrival/departure recorded by bus marshals.

These collection methods have a small level of error (plus or minus) but represent good data sources on which to plan future events.

Event traffic has been estimated by subtracting the volumes recorded in the two weeks preceding the event by the automatic tube counters from those recorded on the event days and in the lead-up and departure to the event. This method introduces a small error in the results but it provides sufficient confidence that the trends calculated are representative.

For all events data on bus use, surveyed traffic volumes by site gate, parking pass sales and patron/staff numbers supplied by the event promoter have been correlated and balanced to obtain a representative understanding of the event's transport patterns. This global checking has been used to 'sanity check' the individual data sources. Whilst care is used to obtain the best fit to the data available, the results are not a complete record due to the logistical difficulties associated with the magnitude of the events. To reduce the risk of inaccuracies, future transport conditions have been estimated using these transport parameters by calculating the relative increase and then factoring up the surveyed traffic volume results (which have the greatest level of accuracy). 100% of the surveyed volume has been factored to ensure no traffic is omitted.

Table 2.3 provides a comparative summary of the SITG trial events held at the NBP site between 2013 and the current day, while Table 2.4 compares the Falls Festival events.

Table 2.3 Data summary previous events – Splendour in the Grass

Parameter	SITG 2013	SITG 2014	SITG 2015	SITG 2016	SITG2017
Private vehicle occupancy	2.4–2.5 (campers) 2.7–3.2 (day patrons)	2.7 (campers) 3.0 (day patrons)	2.68 (campers)	2.63 (campers) 2.9 (day patrons)	2.74 (campers) 2.9 (day patrons) (estimated from counts)
Number of camper car parks	6,900 (incl. recreational vehicles (RV))	5,529 (excl. RV)		7,500	6,900 (parking passes)
Estimated number of day patron car parks	1,500	1,700		1,500	1,000 (parking passes)
% Patrons from south on Motorway at Yelgun	41–43% (campers) 51–53% (day patrons)	40% (campers) 42% (day patrons)	6% (campers) (directed to use BVW)	15% (Friday) 20% (Sunday) 25% (Monday)	17% (Friday) 15% (Sunday) 16% (Monday)
% Patrons from south on BVW	7–8% (campers) 7–11% (day patrons)	8% (campers) 29% (day patrons)	35% (campers)	40% (Friday) 50% (Sunday) 20% (Monday)	37% (Friday) 35% (Sunday) 36% (Monday)
% Patrons from north on Motorway at Yelgun	38–44% (campers) 32–33% (day patrons)	47% (campers) 29% (day patrons)	16% (campers) (directed to use TVW)	15% (Friday) 15% (Sunday) 35% (Monday)	23% (Friday) 30% (Sunday) 29% (Monday)
% Patrons from north on TVW	6–12% (campers) 5–7% (day patrons)	5% (campers) 6% (day patrons)	43% (campers)	30% (Friday) 15% (Sunday) 20% (Monday)	24% (Friday) 20% (Sunday) 19% (Monday)
Peak arrival flow rate	Thursday 610 vehicles per hour (vph) (restricted due to queuing), Saturday 580 vph;	768 vph	611 vph (through the gate during period of congestion, actual arrival rate may be higher)	843 vph	783 (Gates A, C and D combined)

Parameter	SITG 2013	SITG 2014	SITG 2015	SITG 2016	SITG2017
Peak arrival day and time	Thursday 4 pm–5 pm (campers); Saturday 1 pm–2 pm and Sunday 4 pm–5 pm (day patrons)	Thursday 2 pm–3 pm	Thursday 2 pm–3 pm	Sunday 2 pm–3 pm	Sunday 2 pm–3 pm

Source: Greg Alderson & Associates event transport reports

Table 2.4 Data summary previous events – Falls Festival

Parameter	Falls 2013/14	Falls 2014/15	Falls 2015/16	Falls 2016/17
Private vehicle occupancy	2.8	2.4	2.4	2.4
Number of camper car parks	5,404 (excl. RV)	5,294 (excl. RV)	5,700	-
Estimated number of day patron car parks	40	40	-	
% Patrons from south on Motorway at Yelgun	36.3%	35–56%	30%	8%
% Patrons from south on BVW	33.2%	14–26%	43%	39%
% Patrons from north on Motorway at Yelgun	28.7%	8–11%	8%	18%
% Patrons from north on TVW	1.8%	20–29%	23%	35%
Average width of cars parked	2.6 m	2.7 m	-	-
Peak arrival flow rate	460 vph	520 vph	420 vph	
Peak arrival day and time	Monday 3 pm–4 pm	Friday 1 pm–2 pm	Wednesday 4 pm–5 pm	Tuesday 11 am–12 pm

Source: Greg Alderson & Associates event transport reports

3 Proposed Events for Permanent Approval

NBP has hosted a number of trial events over several years. In general, these events have been run successfully, with any issues rectified at the time through traffic management measures, and/or addressed in the subsequent year's event plans as a continual improvement process. As the current trial approval runs out in August 2019, NBP is seeking to change this trial approval to a permanent approval. With tickets for each large trial event that has been held at the NBP site having been sold out within hours of going on sale, it is believed that there is sufficient demand to host, each year, an event of the 50,000 patron size as proposed in the original Concept Plan and Project Application. Permanency would allow investments in infrastructure improvements within the NBP site that will accommodate the increase in event capacity and allow transport to operate more efficiently.

3.1 ORIGINALLY PROPOSED SIZE AND FREQUENCY

The Environmental Assessment report, submitted in July 2010 was based on a range of event sizes. The larger events were proposed to be held less-frequently, due to their increased impact on the surrounding community, while no cap was proposed on the smallest events, as outlined in Table 3.1.

Table 3.1 2010 Environmental Assessment report event size categories and frequencies

Event	Maximum patrons	Approximate frequency	Duration
Minor	300	no daily limits are proposed	one day or one evening
Small	3,000	no more than four days per annum	one day or one evening
Moderate	10,000	no more than four event days per annum	one or two days, with or without an element of overnight camping by patrons
100% capacity	50,000	no more than 12 event days one per annum	two to four days, typically with an element of camping on-site by patrons

Source: *North Byron Parklands – Traffic Impact Assessment (July 2010, Parsons Brinckerhoff)*

The timing and arrival/departure pattern for patrons of the larger events was to be arranged to avoid the busiest times on the road network to reduce the impact on capacity for non-event traffic.

The application proposed an initial event size of 70% of the full event capacity (35,000 patrons) during the first year of operation to reduce the risk of adverse traffic conditions (compared to a 100% capacity event) and to establish and refine the on-site and external traffic management measures.

3.2 CURRENTLY PROPOSED SIZE AND FREQUENCY

The following details were considered during the preparation of this traffic assessment. Events outside the ranges indicated in this report may be considered. However these would be the subject of a separate assessment. Each future large event at the site would require a Traffic Management Plan that details how the parameters of the Traffic and Transport Assessment would be met.

3.2.1 SUMMARY OF PROPOSAL

The proposal for event size and frequency has taken into consideration a number of aspects including transport, the road network, impacts on neighbours and non-event traffic, and impacts on surrounding nature and noise. The proposal includes a limit on the number of larger-sized events that are more likely to have an impact. The increase from the currently approved event size to the ultimate goal, is proposed to occur in a stepped process from year to year, where approval to move to the next step is conditional on meeting key performance criteria agreed for the site.

The proposal is seeking the following size and frequency limits:

Permanent Approval for:

- two events per year (up to 35,000 patron and maximum of 5 days each)
- three 1 day events (up to 25,000 patrons)
- five small community/educational/sports events (up to 5,000 patrons)
- two minor community events (up to 1,500 patrons).

With a further component being:

- SITG event increasing to 42,500 (subject to meeting KPIs for 35,000 event);
- SITG event reaching 50,000 (subject to meeting KPIs for 42,500 event).

3.2.2 TYPE

The NBP site has been built with the flexibility to stage cultural events of many different types from one-off concerts to music festivals spread over several days. To date the trial events held have been music festivals with a number of stages held over more than one day.

The two large events (Splendour in the Grass and Falls Festival) held at the site during the trial would continue and grow under the proposed approval. They would continue with the current demographic and at a broadly similar time of year.

Other events, aimed at a different/older demographic would have a smaller size, offsetting the impacts of a possible higher traffic generation rate per person. This study has assessed the types of events likely to produce the largest traffic and transport impact.

3.2.3 SIZE

The range of event sizes (measured in the number of patrons) the NBP site has the capacity to accommodate has been grouped into four categories, as shown Table 3.2. The number of events shows the flexibility of the site to hold a range of events with varying levels of impact.

Table 3.2 Event size categories

Event	Type	Duration on site		Total
		Camper (Long-Stay)	Day Patron (Short-Stay)	
Minor	Patrons	Mix and duration of event to be flexible Statutory depending on details of event		1,500
	Staff/Other			225
	Total			1,725
Small	Patrons	Mix and duration of event to be flexible Statutory depending on details of event		5,000
	Staff/Other			750
	Total			5,750
Medium: One-day Concert (25,000 patrons)	Patrons	-	25,000	25,000
	Staff/Other	750	2,600	3,350
	Statutory	-	150	150
	Total	750	27,750	28,500
Medium: Multi-day Concert with Camping 25,000 patrons	Patrons	20,000	5,000	25,000
	Staff/Other	1,500	2,600	3,850
	Statutory	-	150	150
	Total	21,500	7,750	29,250
Large: 35,000 patrons Falls Festival (ultimate) or Splendour in the Grass	Patrons	20,000	15,000	35,000
	Staff/Other	1,500	3,640	5,140
	Statutory	-	150	150
	Total	21,500	18,790	40,290
Large: 2,500 patrons	Patrons	20,000	22,500	42,500
	Staff/Other	2,000	4,420	6,420
	Statutory	-	150	150
	Total	22,000	27,070	49,070
Large: 50,000 patrons	Patrons	20,000	30,000	50,000
	Staff/Other	2,500	5,200	7,700
	Statutory	-	150	150
	Total	22,500	35,350	57,850

Source: North Byron Parklands, 13 October 2017

Notes Trip generation/traffic modelling undertaken on the basis of a slightly higher estimate of staff/other people numbers. The numbers in the table above would result in a slight decrease in traffic impact at the site and at the external staff parking facility.

3.2.4 DURATION

Larger events would typically have a longer duration than smaller events. The durations envisaged include:

- smaller events could run for 1 day or one evening (see *Traffic Impact Assessment for small community events at NBP* (GAA, 5 August 2015) for further details on small event traffic planning and management
- medium sized events could run for 1 to 3 days, with or without an element of overnight camping by patrons
- larger sized events could run for 2 to 5 days, typically with an element of camping on site by patrons.

The longer events may start with a day of less intensity to spread the arrival of camper and regular day patron arrivals, reducing the peak demand on the road network. For larger events, set-up activities would commence approximately 3 weeks before the event, with the site vacated by the event approximately 1 week after the final day.

3.3 OTHER MOVEMENTS TO AND FROM THE NBP SITE

Traffic counts taken at the site as part of the monitoring commitments records all vehicles, but do not capture the purpose of the trip. Whilst patron trips can be quantified by ticket sales, parking and bus movements, other types of trips are more difficult to categorise. This section describes these types of movement and any special access arrangements that exist to assist them.

Performers, press and VIPs

Performers and VIPs arrive by a variety of means, including car, taxi, bus or Recreational Vehicle (RV). Whilst many stay on-site, some do stay in accommodation off-site. In comparison to the number of movements by patrons, the traffic associated with performers and VIPs is low.

Staff

To reduce the traffic impact of the site, staff for large events are bussed to the NBP site from a nearby staff parking area. At recent events this has been located at Mullumbimby Showground, subject to agreement with Byron Shire Council. Many staff for the large festivals that are spread over several days, camp on-site after leaving their car in the staff parking facility.

Servicing

Servicing typically involves delivery of equipment and temporary facilities during the bump-in period leading up to an event. Fresh food deliveries and removal of waste typically occur continuously throughout the event. Equipment and temporary facilities are retrieved during the bump-out period.

Emergency vehicles and security

The following provisions are in place for emergency vehicles at all events:

- Emergency vehicles would be given access to all site entrances.

- Emergency vehicles would be permitted to bypass any queue of vehicles waiting to enter the site.
- Traffic controllers would be given instructions to stop general traffic to assist emergency vehicles to pass, if required.
- Emergency staff arriving in private vehicles would be permitted to bypass any queue of vehicles waiting to enter the site.
- The site includes a helipad in the northern part of the site solely for emergency use.
- Emergency vehicles and traffic management vehicles are allocated dedicated parking spaces on-site during the event.

Resident access

Whilst not part of the NBP site, access to Jones Road and Yelgun Road needs to be maintained for local residents. During large events, Jones Road and Yelgun Road are controlled by traffic controllers and/or security guards to prevent unauthorised access to the site, and to prevent unwanted parking on Jones Road. Residents are provided with resident access passes to enable them to pass through the checkpoints on Jones Road and Yelgun Road at their Tweed Valley Way entrance.

Through traffic

Through traffic on Tweed Valley Way is generally permitted to bypass any queue of vehicles waiting to enter the site. Temporary traffic management is employed to extend the length of right-turn bays by making use of the road shoulder of Tweed Valley Way. A similar treatment is employed at the junction of Tweed Valley Way and the Yelgun Interchange Link Road during event bump-out to bypass any queue of patrons' vehicles waiting to turn right to get to the Interchange.

Other trips

Whilst the NBP site offers food stalls, bars and a general store for groceries, as well as activities other than watching/experiencing the performances, some campers and day patrons do want to leave the site during the event days while performances are underway. This can be for shopping or tourism, both of which assist the local economy of the surrounding towns. They may also want to visit friends or the surrounding countryside/beaches and return for a later performance. These general 'comings and goings' are catered for through services and facilities and have been included in traffic forecasts.

The coming and going behaviour of campers in their vehicle is not encouraged. Any campers departing the site with their own car will not be able to re-enter the northern part of the site, i.e. they will be required to park in the southern area and walk or use the on-site shuttle bus to get back to their camping area. Campers are encouraged to use the buses provided for trips outside the site.

3.4 CULTURAL CENTRE AND CONFERENCE FACILITY

The original Concept Plan Application included a cultural centre, conference centre and associated accommodation. The conference centre and associated accommodation forms part of the subject application. The cultural centre hasn't been constructed to date, however, the concept plan retains the potential inclusion of this facility (subject to separate approval).

The facilities are estimated to have the following size and staff numbers:

- Cultural centre: 110 m², two full-time equivalent and 12 part-time staff
- Conference centre: 510 m², eight full-time equivalent and 10 part-time staff
- Accommodation: 1,000 m², including 30 on-site cabins.

The conference centre would cater for up to 180 people and the cultural centre for around 50 people.

The accommodation would be associated with the conference centre and would be limited to a maximum of 120 guests.

Seventy on-site parking spaces would be provided for the conference centre and associated accommodation.

3.5 NON-EVENT ACTIVITY

The Administration centre would remain open for most of the year. During non-event times there would be a small number of permanent staff. Details of the permanent buildings are provided below.

- Administration centre: 175 m²
- Gatehouse (approved but not currently proposed): 100 m².

4 NBP Site Layout

The NBP site was planned and established considering the infrastructure requirements of a 50,000 patron event to create efficiency during construction. The infrastructure already used for the trial events is largely sufficient to accommodate the needs of future events, with minor rearrangements to the locations of certain activities. Permanent approval would enable investment in infrastructure that would facilitate the larger crowd. It would also create a more resilient site by reducing the risk of variables such as weather impacting on the access arrangements, and reducing the risk of traffic on the public road network being affected by conditions on site.

During the trial over \$25 million has been expended on physical works at the site including:

- Construction of an internal spine road
- Upgrading of local public roads, creation of site access intersections and an underpass beneath Jones Road
- Construction of event laneways, walkways, car parking areas, drainage improvements and associated works, amongst other works.

4.1 REVISED LAYOUT

The layout of the site would be amended to accommodate the larger crowd. This would include increasing the event area and camping areas, as well as expanding the car parking area in the southern portion of the site. The revised layout for the 50,000 patron event is shown in Figure 4.1 for the different land uses.

Changes to infrastructure that would occur with the permanent approval include:

- Erection of a Conference facility for 180 people and accommodation for 120 guests
- Construction of the south-east carpark
- Construction of Roundabouts
- Construction of Southern pick up and drop off zones
- Expansion of the Transport Hub
- Completion of Gate A works to improve public transport accessibility
- Construction of intersection works on Wooyung Road
- Sealing of the northern access way to Wooyung Road
- Construction of an Administration building
- Progressive implementation of further Lane rebuilding and sealing
- Progressive construction of further Spine widening and sealing
- Progressive construction of bus stops within the site.

The proposed additional facilities will be implemented in a staged way to complement the orderly and economic implementation of the development. These changes would support the permanent approval by increasing the capacity on the site and increasing the quality of the facilities, reducing the risk of queuing on-site spilling back onto the public road network.

Internal changes to the road network would include a new roundabout within the site at the southern end of the Spine Road to control the distribution of car parking, passenger drop-off and movement along the Spine Road. A second potential roundabout is shown in Figure 4.1 near Gate B, although this is not included in this assessment, and would only be implemented in the future if additional flexibility is required.

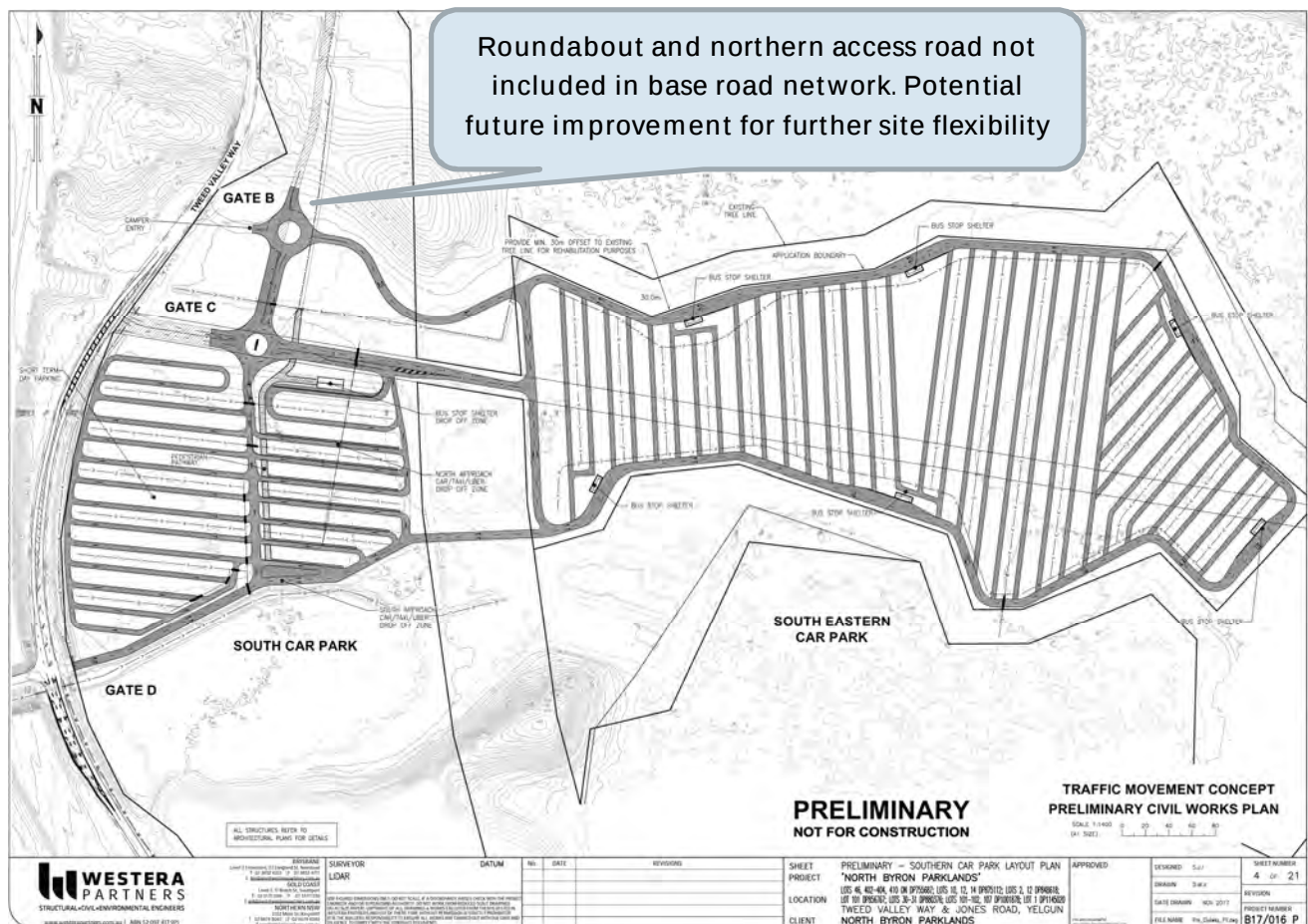


Figure 4.1 Potential future internal road structure

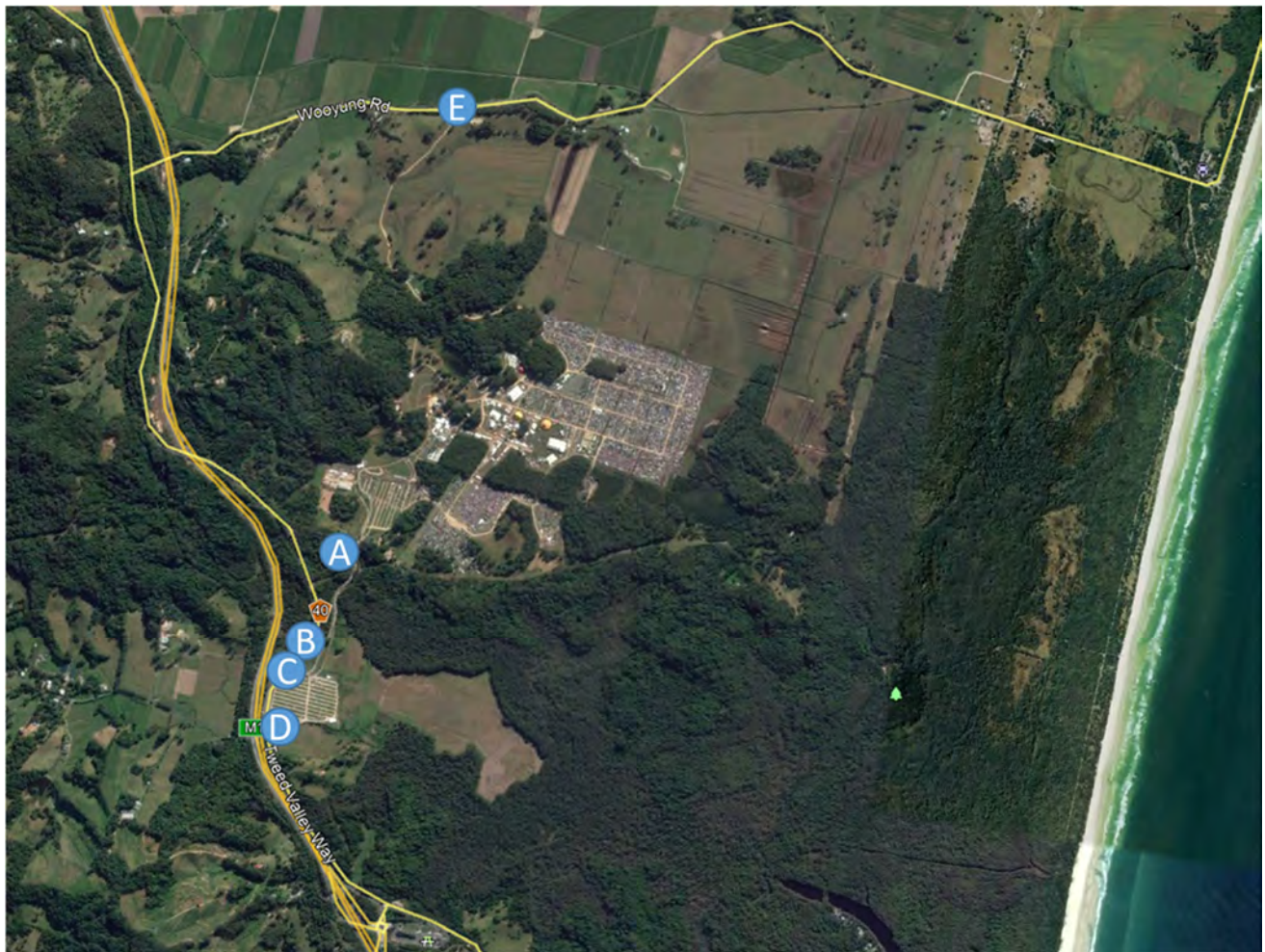
4.2 ACCESS GATES

Five gates (entrances/exits) have been used for the trial events held at the site. They include:

- A. From Jones Road: used for service vehicles, bus entry and VIP/performer entry.
- B. Bus entry: originally nominated as the bus gate. Gate B has had limited use, as buses have been brought into and out of the site through Gate C and through Gate A at peak times.
- C. Main gate: constructed as the main site gate with a constructed short channelised right hand turn into the site. The gate provides simultaneous two-way access for camper and day patron entry and exit, for both parking and drop-off/pick-up. This gate would be/is used for access to the conference centre and administration building outside of event times.

- D. Secondary gate used during peak event days only for camper and day patron entry and exit, for both parking and drop-off/pick-up. Forms a cross-intersection with Yelgun Road. During events a temporary 150 m long right turn lane on Tweed Valley Way is created.
- E. Wooyung Road: used by emergency vehicles and under direction of NSW Police to assist in getting vehicles off the site during camper bump-out. Proposed to become a camper and day patron entry and exit for parking only for vehicles arriving from the Tweed Coast Road.

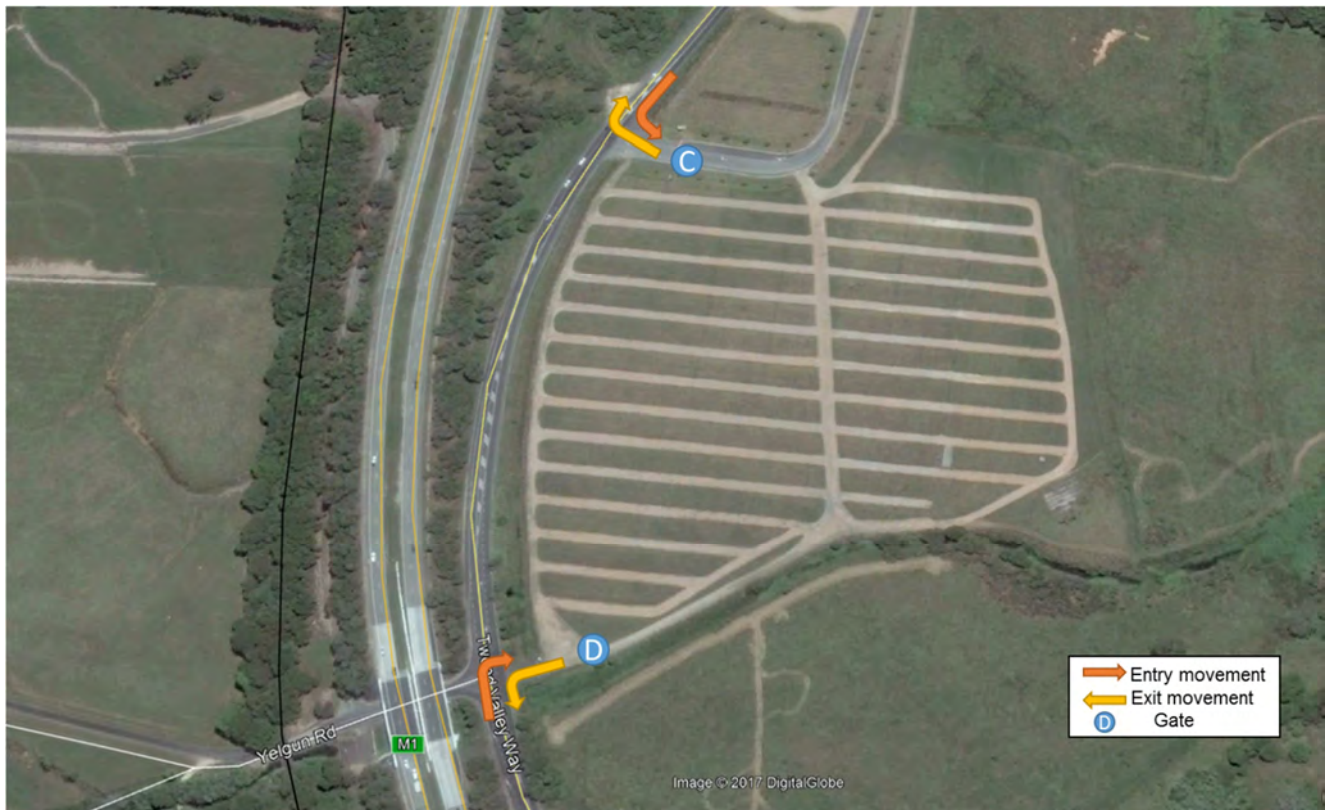
These gates are depicted in Figure 4.2.



Source: Aerial image: Google Maps 2017

Figure 4.2 Site access gates A, B, C, D and E

To avoid crossing over traffic flows from the north and south, Gates C and D are operated in combination, as shown in Figure 4.3. This improves the operation of Gate D by avoiding adding extra event traffic to the southbound through movement, which would delay the movements into and out of Gate D from/to the south. It relies on the separation of vehicle parking and drop-off movements inside the site, which simplifies the information for drivers on the public road.



Source: Aerial image: Google Maps 2017

Figure 4.3 Use of gates C and D during peak arrival and departure times

4.3 SIGHT DISTANCES AT GATES

The sight distances at the five entrances have been assessed based on the Austroads 2008 *Guide to Road Design Part 4A: Unsignalised and Signalised Intersections*. This document specifies the following (assuming a reaction time of 2.0 seconds):

- 73 m of Safe Intersection Sight Distance (SISD) and 40 m of Approach Sight Distance (ASD) are desirable for a 40 km/h design speed
- 123 m of SISD and 73 m of ASD are desirable for a 60 km/h design speed
- 181 m of SISD and 114 m of ASD are desirable for an 80 km/h design speed
- 214 m of SISD and 139 m of ASD are desirable for a 90 km/h design speed.

Gate A

Gate A on Jones Road would be used during large event days under traffic control, with a 40 km/h temporary speed limit. Under this arrangement, the traffic controller would be responsible for ensuring that traffic on Jones Road is stopped to allow a vehicle exiting the site to leave Gate A. During non-event days, the gate would be closed and site access would be via Gate C (Tweed Valley Way).

At the intersection of Jones Road and Tweed Valley Way (which provides access to Gate A for service vehicles under traffic control during large event days only), the existing sight distance is as follows:

- looking north along Tweed Valley Way – 240 m of SISD and 230 m of ASD

- looking south along Tweed Valley Way – 400 m of SISD and ASD.

The speed limit on Tweed Valley Way in the vicinity of Jones Road is 90 km/h on non-event days and would be temporarily reduced to 40 km/h under traffic control on large event days. Under these circumstances, the available sight distance at the intersection is considered to be adequate.

Gate B

The existing sight distance available at the gate location is as follows:

- looking north along Tweed Valley Way – 130 m of SISD and ASD
- looking south along Tweed Valley Way – 300 m of SISD and ASD (note that trees/shrub growth along Tweed Valley Way could obstruct view if not maintained, reducing SISD to 90 m).

The speed limit on Tweed Valley Way (in the vicinity of the exit driveway location) is 80 km/h on non-event days and would be temporarily reduced to 40 km/h on event days. Traffic controllers would be provided on event days. The available sight distance at the exit driveway location is considered adequate for event and non-event days.

Gate C

The existing sight distance available at the access location is as follows:

- looking north along Tweed Valley Way – 225 m of SISD and ASD
- looking south along Tweed Valley Way – 300 m of SISD (if shrubs along western site boundary are cleared or shortened) and 110 m of ASD.

The access comprises of two exit lanes, the above SISD would be limited if vehicles queue side by side as can be seen in the figure to the right (see Photo 4.1). The speed limit on Tweed Valley Way (in the vicinity of the access location) is 80 km/h on non-event days and would be temporarily reduced to 40 km/h during the staging of events.

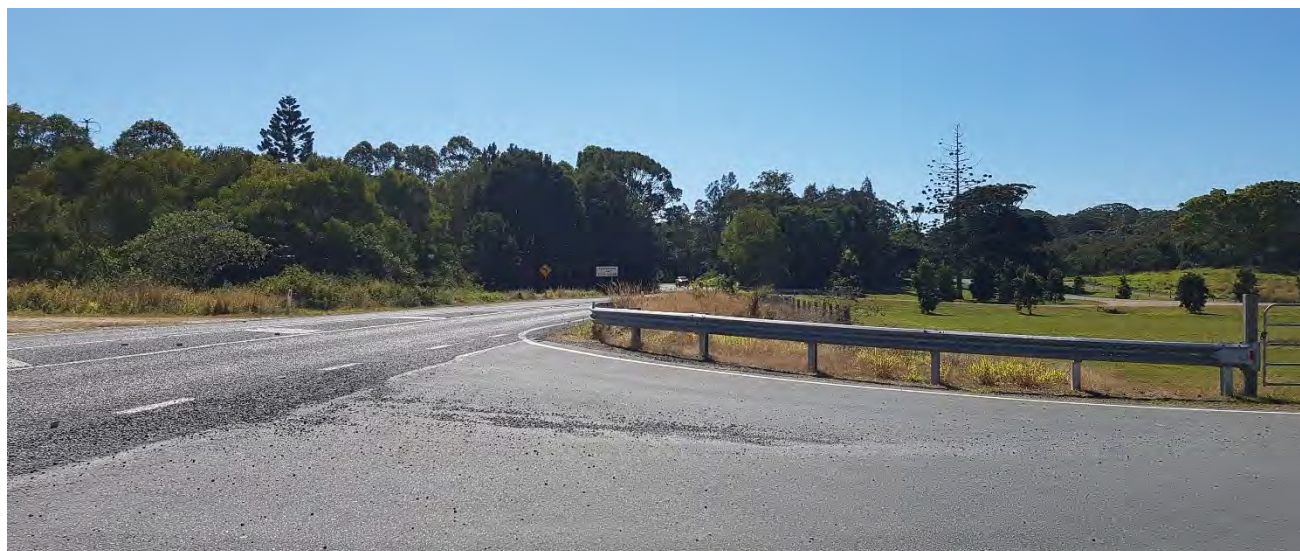


Photo 4.1 Gate C looking north along Tweed Valley Way

The available ASD to the south is expected to increase when the access is constructed and the shrubs along the western site boundary are cleared or shortened. Traffic controllers would supervise heavy vehicle movements during set up and bump-out phases. Traffic controllers would be provided on all approaches on event days. The available sight distance at the access location is considered to be sufficient for event and non-event days.

Gate D

The existing sight distance available at the access location is as follows:

- looking north along Tweed Valley Way – 80 m of SISD and ASD (200 m of SISD if shrubs along western site boundary are cleared or shortened and 100 m of ASD)
- looking south along Tweed Valley Way – 80 m of SISD and ASD.

The speed limit on Tweed Valley Way (in the vicinity of the access location) is 80 km/h on non-event days and would be temporarily reduced to 40 km/h on event days. There is no need for vehicles to enter or exit the site via this location on non-event days and this access would be gated and closed on non-event days. This gate would be used for left-turn outbound movements only, and hence the sight distance to the south is not critical. The available sight distance at the access location is considered adequate, as the access would be operating under traffic control and in a reduced speed environment of 40 km/h on event days.



Photo 4.2 Gate D looking north along Tweed Valley Way

Gate E Wooyung Road

At the intersection of the private road and Wooyung Road, the existing sight distance is as follows:

- looking east along Wooyung Road – 400 m of SISD and ASD
- looking west along Wooyung Road – 130 m of SISD and ASD.

The speed limit on Wooyung Road in the vicinity of the private road is 80 km/h. The available sight distance at the exit driveway location is considered to be adequate for vision towards the east. The sight distance to the west is limited to 130 m due to the road crest and curve. It is recommended that Wooyung Road be managed with a temporary special event speed limit and traffic controllers during events.

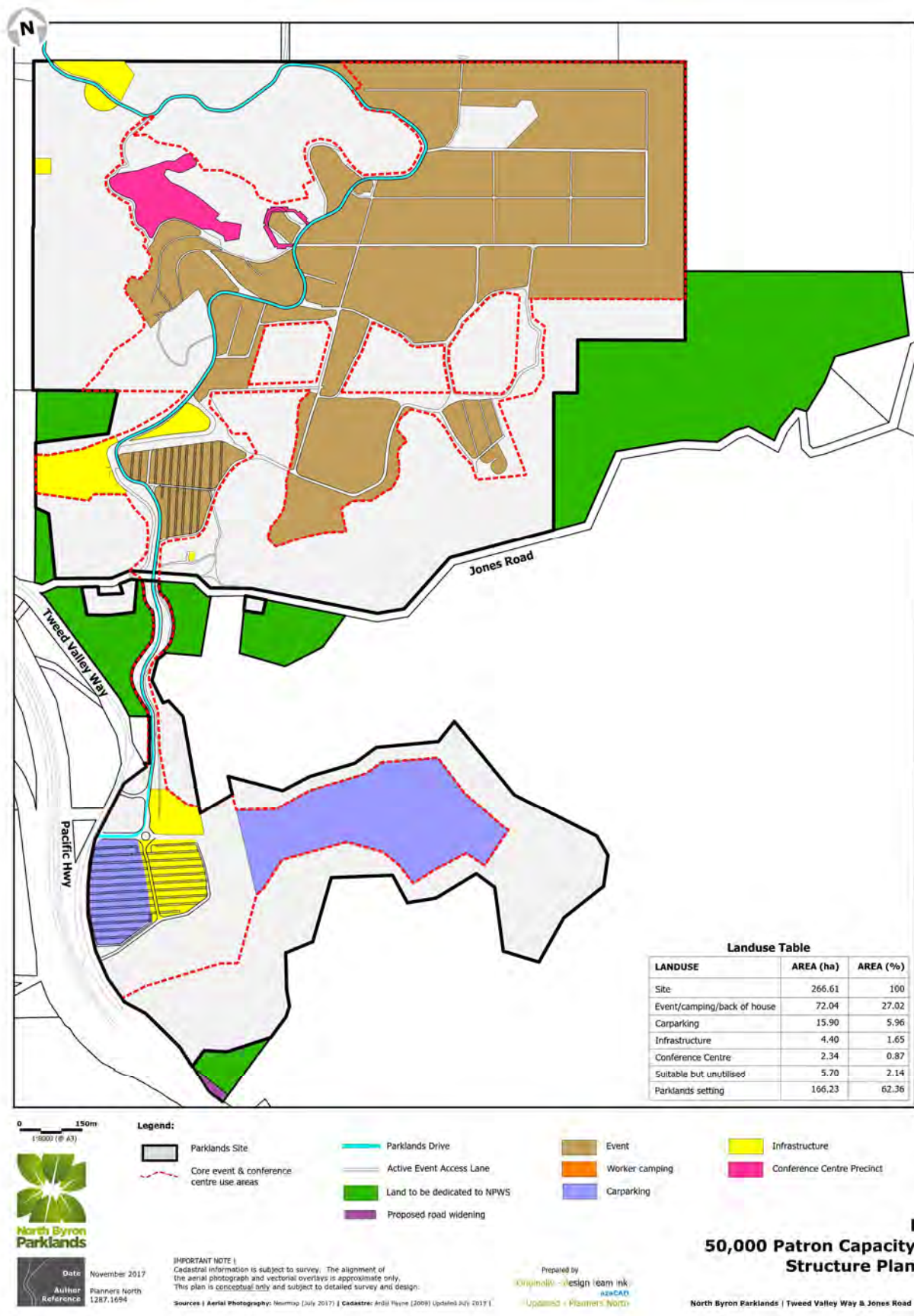
4.4 ON-SITE PARKING

Several of the recent trial events have allowed campers to park their vehicles next to their camp site, as well as a separate area for those people staying on site but requiring the use of their vehicle to come and go. This arrangement has worked well and is proposed for future events. Another area for parking is provided near the bus turn around area for VIP's, guests, emergency and traffic management operations vehicles and limited parking for staff and campers.

Figure 4.4 shows the use of an extended parking arrangement for the southern parking area. Based on these parking numbers, it is expected that there would be spare capacity in this area. Those parking in the remainder would have to be parked in the southern car parking area and transported to camping areas using shuttle buses or by foot.

It is estimated that the 2017 SITG event had approximately 7,000 long-stay parking and between 900 and 1,000 short-stay (less than one day) parking, as well as approximately 550 staff vehicles parked at Mullumbimby Showground.

For the 50,000 patron, this is proposed to increase to 7,100 long-stay parking spaces and 1,500 short-stay parking spaces (an increase of 100 and 500 respectively), as well as off-site space for another 2,500 staff vehicles (an increase of 2,000). The use of the Mullumbimby Showground would be retained, with the remaining 2,000 off-site staff parking spaces located at sites such as the BluesFest area at Tyagarah. The amount of parking is limited by the number of parking passes sold, which can be adjusted as required to suite the type and size of event.



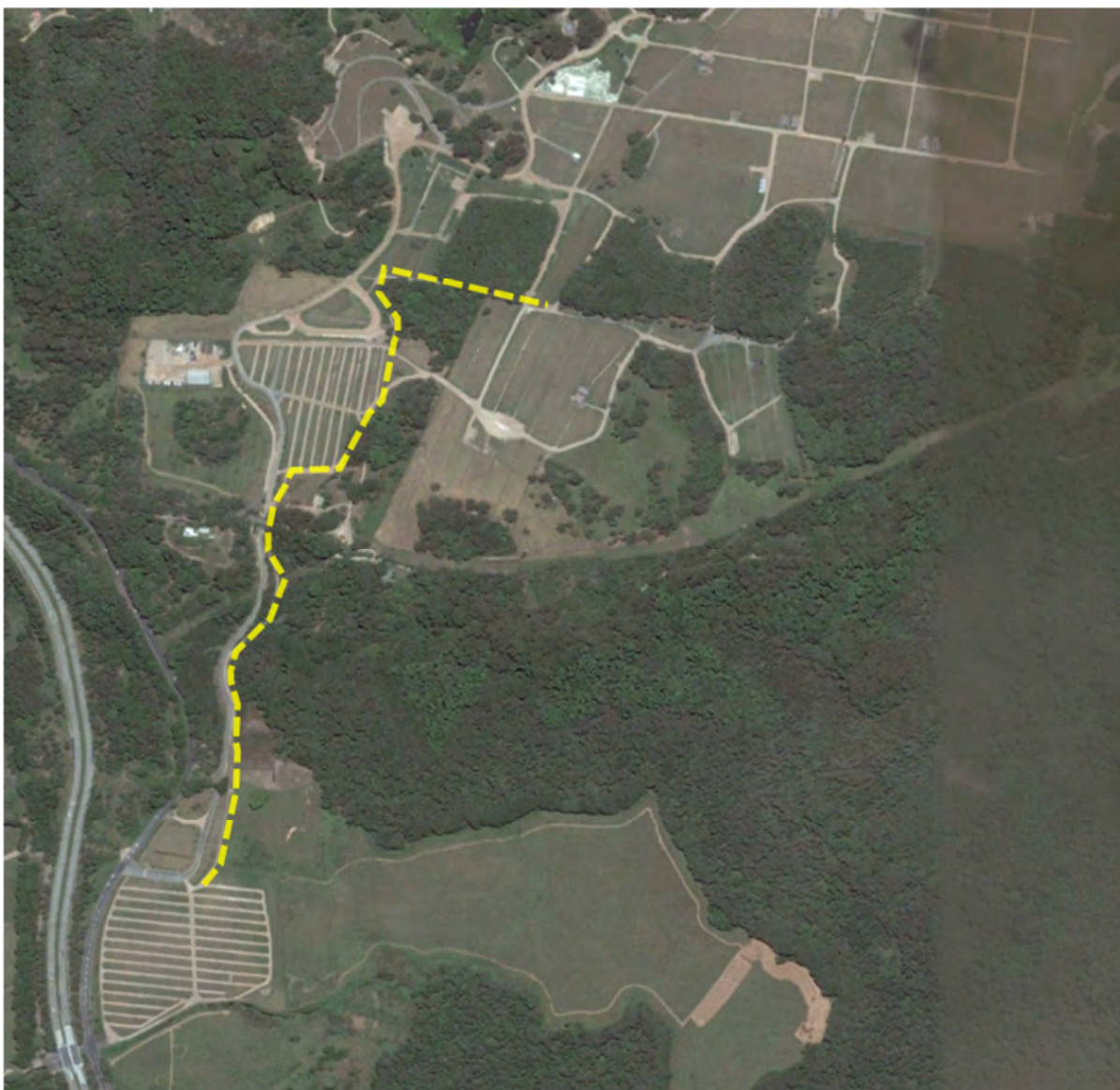
Source: Planners North

Figure 4.4 Proposed site use map

4.5 PEDESTRIAN ARRANGEMENTS

There is no formalised pedestrian access to the site and it is strongly discouraged in all community information. Pedestrian traffic on Tweed Valley Way occurs occasionally during festivals at the site. Whilst patrols by traffic controllers and NSW Police discourage this activity, it is difficult to eliminate. Based on the results of trial events, when the on-site parking and bus system operates efficiently, pedestrian traffic along Tweed Valley Way is minimal. The road works speed zones improve the safety of any pedestrians that walk along Tweed Valley Way.

The dashed yellow line in Figure 4.5 shows the existing pedestrian track from the southern car parks to the main entry (approximately 1.5 km). This path follows the Spine Road and also goes through the Jones Road tunnel. In the tunnel, the pedestrian path is separated from the Spine Road using barriers. The path is adequately lit at night and is paved with a road base material. Alternatively, a shuttle bus is operated between the southern car park and the event entry.



Source: Aerial image: Google Maps 2017

Figure 4.5 Pedestrian path from southern car park to Main Entry

4.6 ENTRY CAPACITY AND ARRIVAL PROCESSING

4.6.1 TAXI, RIDE SHARE AND DROP OFF

The relocation of the passenger drop-off and pick-up to the southern car parking area has substantially improved the operation of the site. An area for taxi and kiss-and-ride is marked yellow in Figure 4.4. The peak arrival of taxis, ride share and kiss-and-ride vehicles for the 50,000 patron event has been estimated at approximately 250 vehicles per hour during the afternoon arrival and 330 vehicles per hour during the post-event bump-out. Assuming a service time of 2 minutes per vehicle, a total of 11 car lengths is required to provide sufficient capacity. This equates to a zone of approximately 90 metres length. The new facility has a total length of 140 m.

4.6.2 CAMPERS PROCESSING

Efficient processing of vehicles is essential for the arrival of campers. The largest arrival rate measured to date (SITG 2014) at the site is 768 vph (a mixture of campers, service vehicles and vehicles coming and going). SITG'17 had a similar number of campers (19,265) compared to the estimated 20,000 campers for the 50,000 patron total event. Therefore, this number is not expected to rise appreciably.

The site has already demonstrated that it can accommodate the arrival of a 20,000 sized camping crowd. To cover a contingency for an unexpectedly high arrival of campers (e.g. due to weather), it is recommended that spare scanning equipment and staff be available to increase the capacity of camper processing, if required.

5 Road Network Assessment

This section assesses the impact of the proposed events on the road network with planned traffic management measures. Key arrival and departure periods are assessed to estimate the impact at peak times.

5.1 SURROUNDING ROAD NETWORK

The road network around the NBP site is predominantly formed around the Pacific Motorway and the recently bypassed old alignment. Figure 5.1 shows the surrounding road network.



Figure 5.1 Surrounding road network

Pacific Motorway

Pacific Motorway (M1, State Highway 10, National Highway 1) is part of the AusLink national transport network. It has a four-lane, two-way divided carriageway. The Pacific Highway connects Sydney and Brisbane via a coastal route. The posted speed limit on the Pacific Motorway is 110 km/h in the vicinity of the subject site.

Since 1996, the Pacific Highway has been undergoing an upgrade program funded by the Australian and NSW governments aimed at improving safety and transport efficiency. The upgrade mainly involves providing dual carriageways to separate opposing directions of traffic and provide overtaking opportunities, replacing winding sections with straight road, grade separating major junctions and bypassing townships. Within the vicinity of the NBP site, three projects have been completed within the past 20 years, including:

- Brunswick Heads bypass (opened 1998)
- Brunswick Heads to Yelgun (opened 2007)
- Yelgun-Chinderah Freeway (opened 2002).

These projects were built on new alignments, with the Old Pacific Highway being re-named and downgraded in terms of its position in the road hierarchy. The section between the Yelgun interchange and Chinderah was re-named as the Tweed Valley Way, and the section between Brunswick interchange and Yelgun interchange became known as the Brunswick Valley Way.

At the time of issue of this report, the final section of the upgrade (Woolgoolga to Ballina) was under construction with an expected completion date in 2020¹.

Tweed Valley Way

Tweed Valley Way (Tourist Road 40) is a two-lane, two-way road, which is a regional road under the NSW road classification, under the care of Byron Shire Council with equal funding for maintenance from Roads and Maritime and Council. Tweed Valley Road connects between Pacific Motorway at Yelgun Interchange and Pacific Motorway at Oak Avenue Interchange at Chinderah. Tweed Valley Road also provides connection to adjacent villages such as Crabbes Creek, Mooball, Burringbar, Murwillumbah, Condong and Tumbulgum.

Yelgun Interchange

Yelgun Interchange has entry and exit ramps in the northbound and southbound directions on the highway. All ramps connect to a roundabout on the eastern side of the Freeway. The roundabout is connected to Tweed Valley Way with a short Link Road. The intersection of Tweed Valley Way with the Yelgun Interchange Link Road has recently been upgraded to a two-lane roundabout.

The interchange also provides access to a truck stop/rest area, south-east of the roundabout. This area is referred to as the Yelgun Rest Area. A plan showing the Yelgun Interchange is shown in Figure 5.2.

¹ Roads and Maritime Services Pacific Highway Upgrade website, viewed 27 September 2017



Figure 5.2 Pacific Motorway – Yelgun Interchange

Brunswick Interchange

The Brunswick (north) Interchange connects the Brunswick Bypass to Riverside Crescent and the Old Pacific Highway. Due to its position on the southern bank of the Brunswick River, the interchange includes south-facing ramps only, i.e. it has a northbound off-ramp and a southbound on-ramp. The interchange includes two roundabouts on either side of the Pacific Motorway. Traffic between Brunswick Heads and the north is required to use the Yelgun Interchange or the Brunswick South Interchange. The Old Pacific Highway provides access to Brunswick Heads.

Brunswick Valley Way

Brunswick Valley Way is a two-lane, two-way road, which is a regional road under the NSW road classification. Brunswick Valley Road connects the Pacific Motorway, Wreckers Interchange south of Brunswick Heads and Pacific Motorway, Yelgun Interchange. Brunswick Valley Way also provides connection to the nearby villages of Brunswick Heads, Ocean Shores and Billinudgel.

Wooyung Road

Wooyung Road is a two-lane, two-way road. Wooyung Road connects Tweed Valley Road in the west and Tweed Coast Road in the east via overpass. Wooyung Road crosses the Yelgun to Chinderah Freeway via a recently constructed bridge. It also crosses a railway line via a single lane wooden bridge with a 14 tonne load limit. The typical speed limit on the Wooyung Road is 80 km/h.

Jones Road

Jones Road is a two-way unsealed rural road. Jones Road is separated into two parts. The southern part of Jones Road adjoins at a T-intersection with Tweed Valley Road, Yelgun. The northern part of Jones Road is connected to Wooyung Road.

Pottsville Road

Pottsville Road is a two-lane, two-way road, which connects Tweed Valley Way, Mooball in the south and Tweed Coast Road, Pottsville in the north. It is also used as a connection to the Cudgera Creek Interchange on the Pacific Motorway.

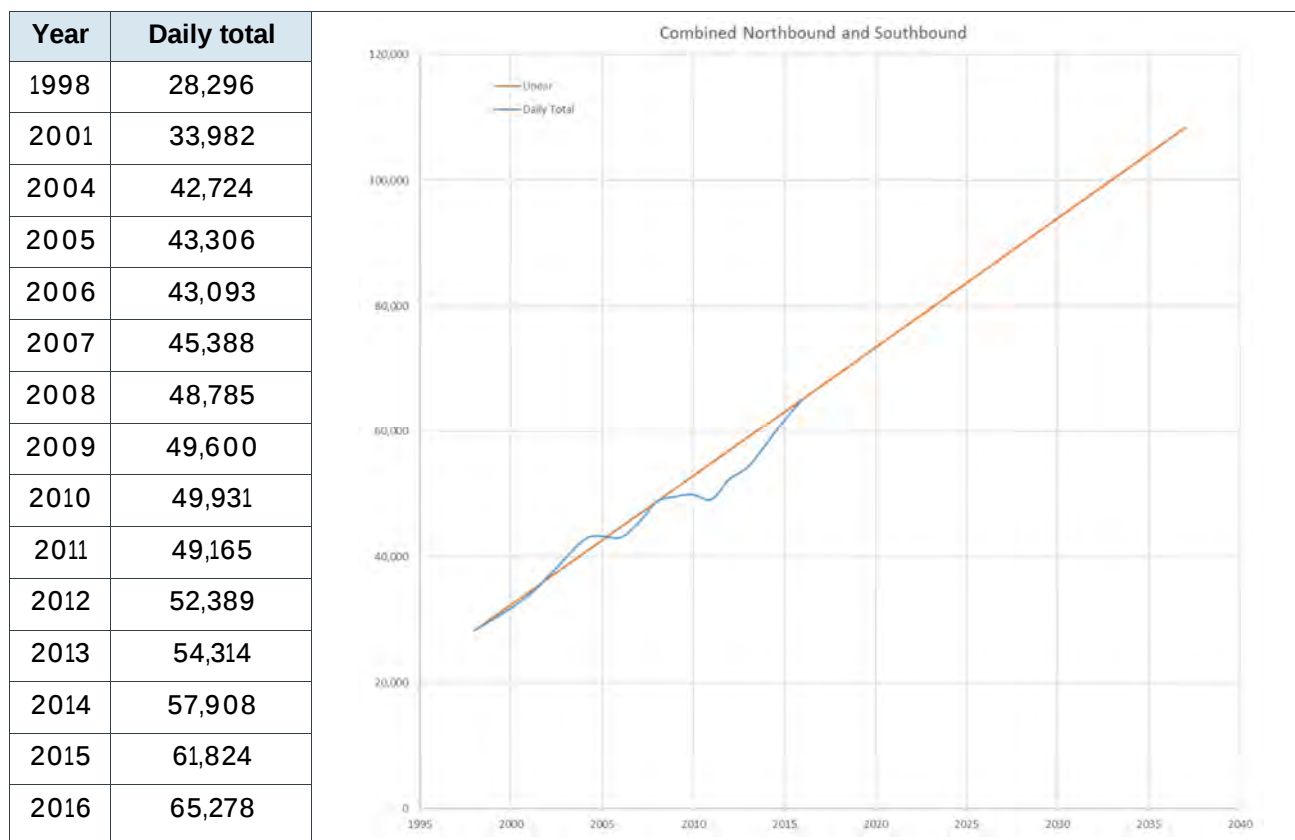
Cudgera Creek Road

Cudgera Creek Road is a two-lane, two-way road, which connects the Pacific Motorway to Tweed Coast Road at Pottsville. It also connects to Tweed Valley Way north of Burringbar. Parts of this section are narrow and winding as it passes near Burringbar Mountain.

5.2 TRAFFIC GROWTH

Traffic data from the Roads and Maritime 'Traffic Volume Viewer' has been plotted along with the older historic data for the site on the M1 Pacific Motorway at Tweed Heads South. The Average Daily Traffic volumes, shown Table 5.1, indicates that traffic growth has slowed to 3.1% per annum (between 1998 and 2016, measured as at 2016). The average increase has been approximately 2,050 vehicles per year over that time.

Table 5.1 Historic traffic growth on Pacific Motorway – 1998 to 2016



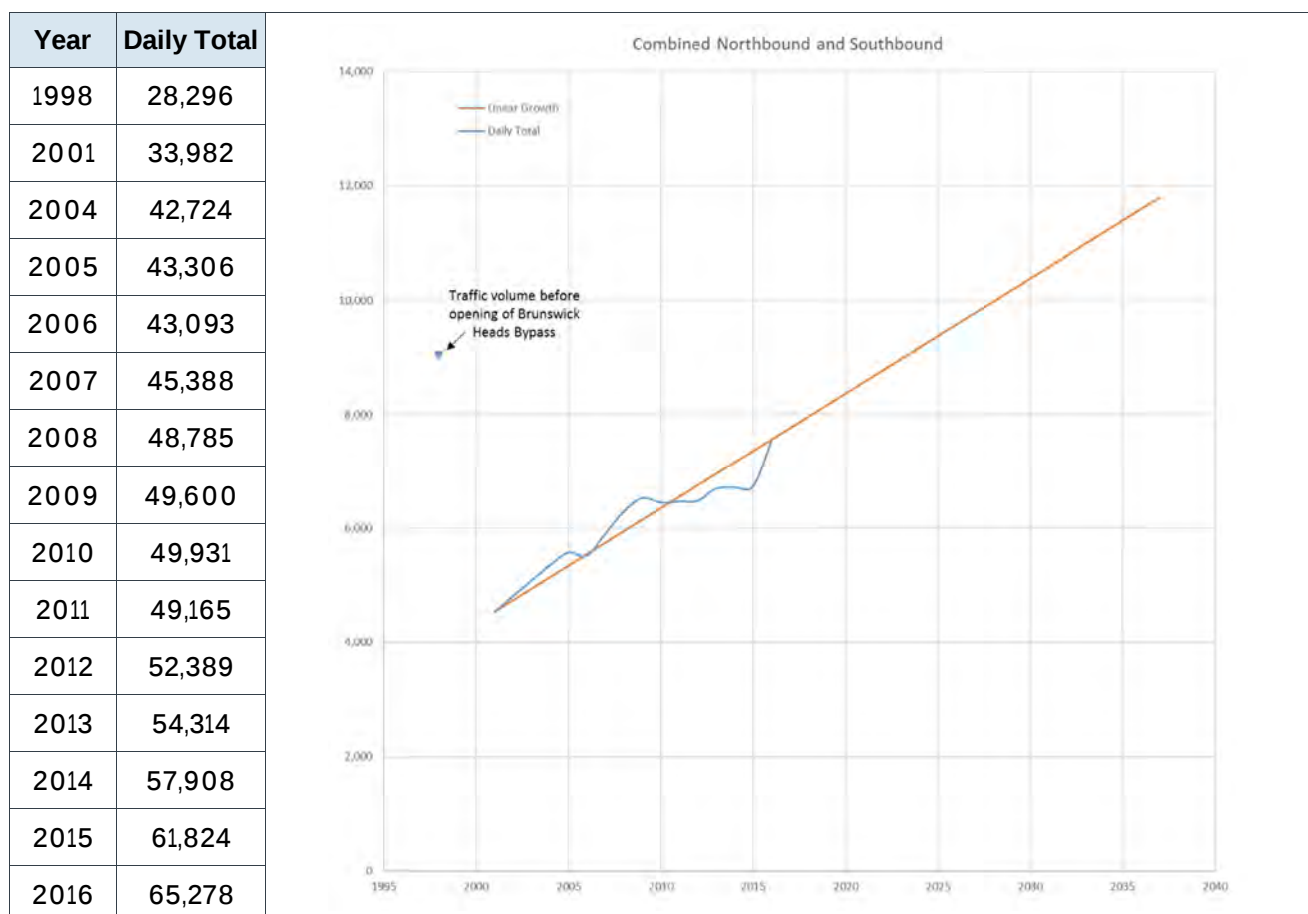
Source: Roads and Maritime Services *Traffic Volume Viewer* (2008 to 2016) and *Northern Region 2007 Annual Average Daily Traffic (AADT)* (1998 to 2007) for site 04.010 M1 Pacific Motorway 110 m south of Dry Dock Road

The nearby site THSTC – M1 Pacific Motorway, 320 m South of Heritage Street, Chinderah recorded growth in daily traffic volume of 3.7% per annum between 2015 and 2017 (35,646 vpd and 38,376 vpd respectively), equating to an increase of approximately 1,350 vpd per year.

To the south of the site, the nearest permanent count site with recent data in both directions is located on the Pacific Motorway approximately 640 m east of Teven Road, West Ballina. This site indicates a combined volume of 12,713 vpd in 2016 and is currently averaging 13,208 vpd in 2017. This increase of approximately 500vpd equates to a growth of 3.9%.

On the local road network, the Old Pacific Highway site, south of Brunswick Heads has growth of 2.7% per annum (between 2001 and 2016, measured as at 2016), as shown in Table 5.2. This equates to approximately 200vpd per year.

Table 5.2 Historic traffic growth on Old Pacific Highway – 1998 to 2016



Source: Roads and Maritime Services *Traffic Volume Viewer (2008 to 2016)* and *Northern Region 2007 Annual Average Daily Traffic (AADT) (1998 to 2007)* for site 04.270 Old Pacific Hwy, 110 m south of Access Road in Brunswick Heads

Based on these results, the following annual traffic growth rates for the +10 year and +20 year future impact assessment have been assumed:

- 3.7% p.a. (linear from 2017) be adopted for the Pacific Motorway mainline volumes and
- 2.7% p.a. (linear from 2017) be adopted for all ramp and local road volumes.

5.3 SEASONAL VARIATION

Traffic data was obtained for permanent counts sites (continuously counting) on the Pacific Motorway. The locations available with sufficient data for the years that the North Byron Parklands site has been operating were both located north of the site (Chinderah, Tweed Heads South and West Ballina). Data for permanent count sites closer to the North Byron Parklands site was not available.

The data, illustrated in Figure 5.3 to Figure 5.5, showed that at these locations, the traffic on the days that the Splendour in the Grass Festival and the Falls Festival were held was up to 15% to 20% higher than the average daily volume for that year. For the West Ballina site, the volumes are between 20% and 30% of a smaller daily volume. While the traffic increase on these days would have been contributed to by the traffic generated by the events at the NBP site, the increase may also be partially due to a general increase in traffic during the school holidays. The figures also show that:

- Traffic volumes are generally within a specific band (both above and below the average) across the year, with school holidays showing the most discernible increase in traffic
- Traffic volumes can be higher on days when the NBP site was not active.

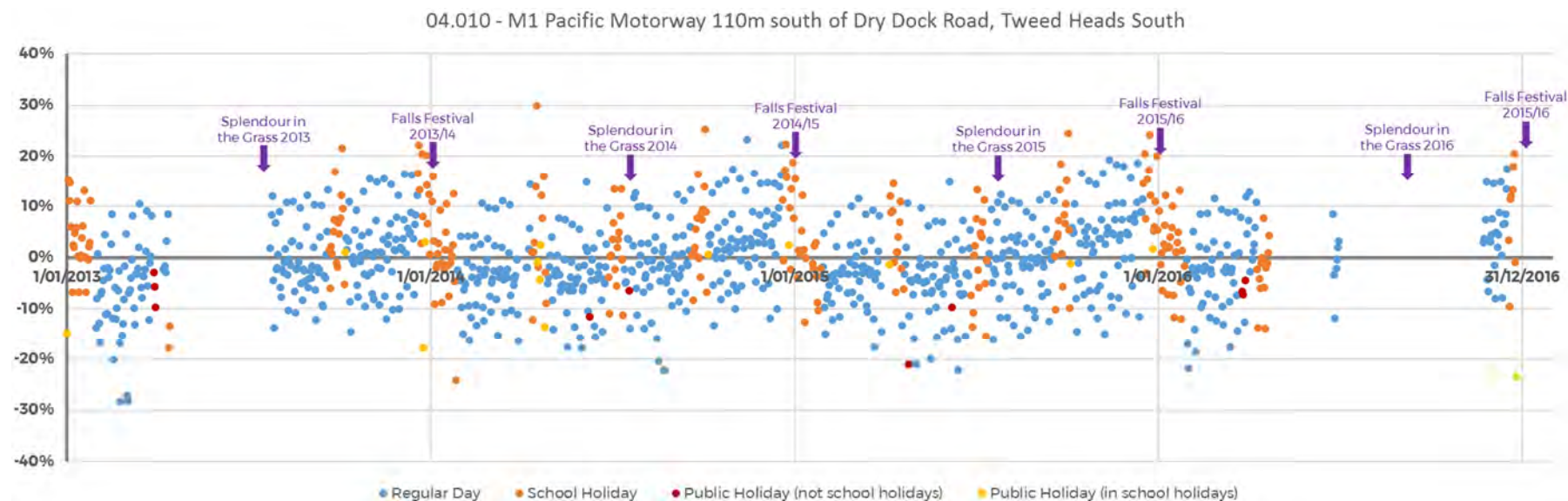


Figure 5.3 Daily traffic volumes (both directions combined) on the Pacific Motorway at Tweed Heads South as a percentage of the average daily volume for that year

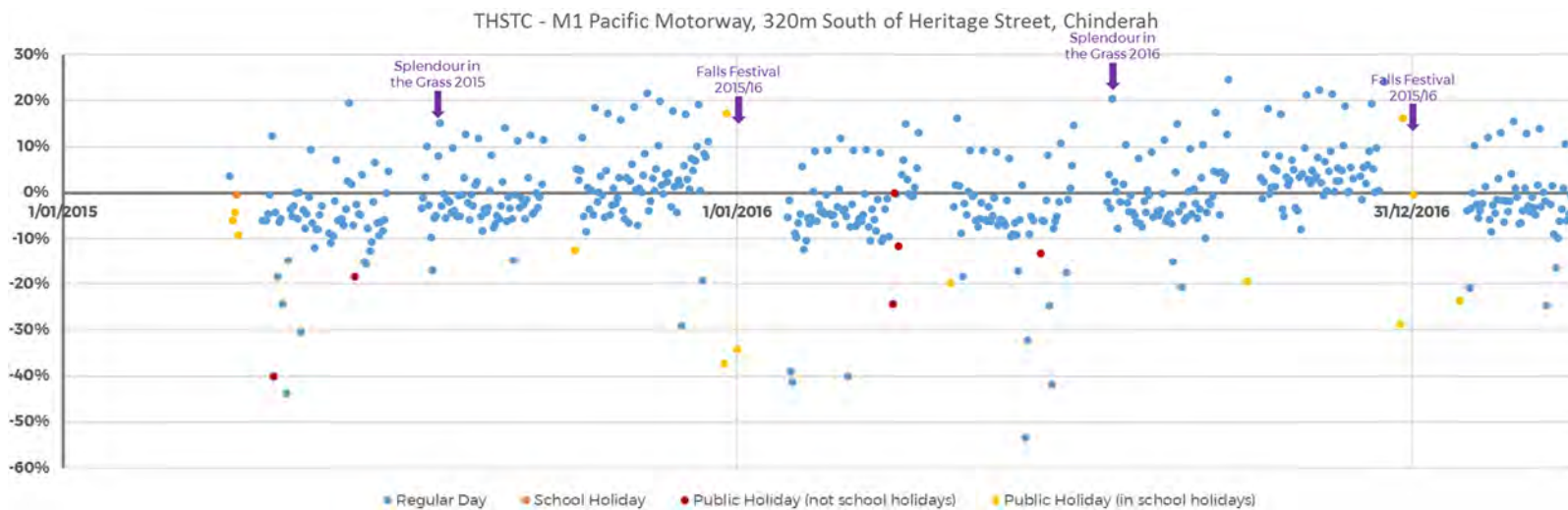


Figure 5.4 Daily traffic volumes (both directions combined) on the Pacific Motorway at Chinderah as a percentage of the average daily volume for that year

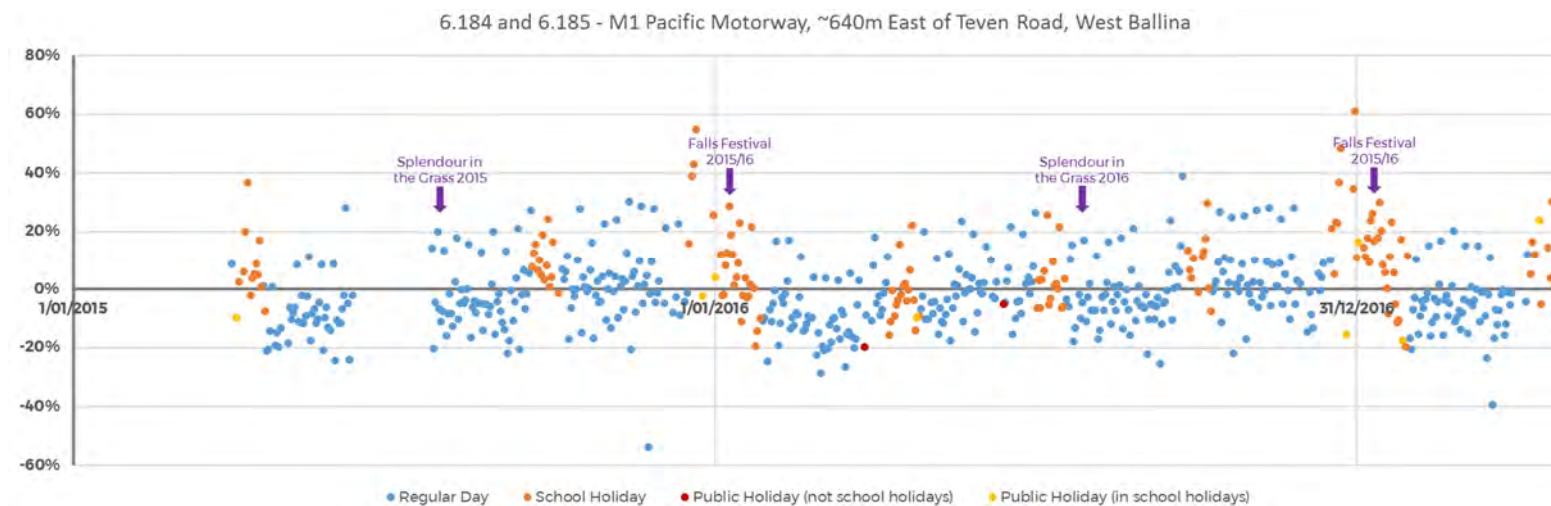


Figure 5.5 Daily traffic volumes (both directions combined) on the Pacific Motorway at West Ballina, as a percentage of the average daily volume for that year

Closer to the site, the additional volume of traffic generated by the site is likely to be higher, but well within the yearly fluctuations of traffic on the Pacific Motorway.

The SITG event has always been held on a weekend in late July, outside of the school holiday period. From a seasonal traffic viewpoint, this is a favourable time to hold the event as traffic volumes are typically lower than the yearly average.

The Falls Festival occurs in the days leading up to and immediately after the New Year. This is within the summer school holidays and is close to several public holidays. The Pacific Highway sites have been analysed to determine the percentage increase in traffic experienced during the week before and after New Year. The peak traffic days are typically the days immediately after the start of the school holidays and after Christmas Day (i.e. Boxing Day) which do not coincide with the start of the Falls Festival – for example the 2017/18 event is programmed to start on 31 December 2017 and finish on 2 January 2018. However, it is noted that higher traffic days of up to +20% on Pacific Motorway at Tweed Heads South or +30% on Pacific Motorway at West Ballina.

5.4 TRIP GENERATION

Trip generation estimates, including the patron and other movements to and from the NBP Site, have been updated and quantified based on the parameters measured/estimated from the trial events held to date and the assumptions explained in this section.

Given its lower peak traffic generation and the good performance of the 2014/15 and 2015/16 Falls Festivals in terms of road network operation, the impacts of the minor and small events are considered to be less than, but in proportion with, the impacts of the 50,000 patron event. Similarly, Small and Minor events are not considered to create sufficient impact to warrant additional traffic capacity analysis. Having said this, some small events may require traffic management plans to manage their impact on the road network.

The trip generation assessment presented in this section for the various event sizes assumed a number of staff and other non-patron people slightly higher than those outlined in Table 3.2. The trip generation estimates are therefore conservatively high (by a small amount) for the number of staff/other people being dropped off at the site and parking at the external parking area.

5.4.1 *LARGE EVENT: 50,000 PATRONS*

The number of campers would remain at 20,000, in line with SITG2017, while the total number of day patrons for the 50,000 capacity event would increase to 30,000.

Mode split

The mode share for buses for the 2017 Splendour in the Grass event has been estimated by NBP using ticket data, bus records and other sources. The results indicate:

- Campers: bus use has been lower than predicted, with 2% to 3% estimated compared to the 7% to 22% estimated in the 2010 Traffic Impact Assessment. An increase in bus service provision with additional options for hiring camping equipment on the site is planned to increase the bus mode share for campers to 5%.
- Day patrons: bus use has exceeded both the low (39%) and high (56%) forecasts with an estimated mode share of between 63% and 66% across the three days.

It is believed that with the campers changing from 19,265 to 20,000 patrons (essentially no increase) versus a day patron increase from 13,235 to 30,000 (16,765 increase), the proportion of patrons who live outside the Byron area and use temporary (tourist) accommodation will increase. These people are less likely to bring a car with them and therefore, it is likely that the mode share for car driver will drop.

The use of taxi, ride share and passenger drop-off is expected to be limited by the promotion of passenger drop-off zones at bus stops away from the site as a method of avoiding the additional traffic around the site. The aim would be to provide a convenient location to the Pacific Motorway, on an existing event bus route close to its final stop, with opportunities for vehicles to turn around and lighting/nearby activity for safety. Potential locations include:

- From the North:
 - Pottsville South Bus Stop – access to Pacific Motorway via Cudgera Creek Interchange.
- From the South:
 - Shara Boulevard – Shores United Soccer Club car park.
 - North Coast Holiday Parks Ferry Reserve – access to Pacific Motorway via Brunswick Heads North Interchange.

This initiative could be reinforced by a flat fee for vehicles entering the site during peak times (12.00 pm to 5.00 pm) – payment within the site. Use of the bus service will be reinforced by the additional transport initiatives outlined in section 6.4.

Preliminary modelling indicated that the increase in day patrons based upon current transport behaviour produces an unacceptable level of performance for the road network. In order to achieve an acceptable performance, changes in mode share and/or car occupancy is required that would bring the traffic generation of the site back to that of a 42,500 patron crowd. The mode share was targeted as the best opportunity to achieve this reduction.

The proposed mode shares estimated for the 50,000 patron event are compared to the 2017 SITG estimates in Table 5.3. They involve a decrease in car mode share and an increase in bus use for both campers and day patrons. For day patron, they also require a reduction in the use of taxi/ride share/drop-off to the site (although there is capacity for drop-off at the satellite locations listed above).

Table 5.3 Proposed mode share target for Large event: 50,000 patron

Patron type	Car	Bus	Taxi/Ride Share/Drop-off	Total
2017 SITG				
Campers	93%	2%	5%	100%
Day patrons	17%	63%	20%	100%
Total	62%	27%	11%	100%
Large Event: 50,000 Patron				
Campers	90% (-3%)	5% (+3%)	5%	100%
Day patrons	13% (-4%)	73% (+10%)	14% (-6%)	100%
Total	44% (-18%)	46% (+19%)	10% (-1%)	100%

Car occupancy

Data from the trial events held to date have revealed a high average vehicle occupancy. This could be due to patrons wanting to reduce the cost of their travel and add to the enjoyment of the festival by travelling as a group with their friends. It could also be due to NBP-lead initiatives such as: parking charges, refund of some/all of these charges for vehicles with large numbers of people, and ride-sharing apps and websites promoted by the organisers.

For the purposes of this analysis, the following values have been assumed based upon most recent survey data:

- Campers: 2.74 people per vehicle
- Day patrons: 2.9 people per vehicle.

The average car occupancy for campers was not changed from the current value, as there are practical limits as to the number of people and their camping equipment that can be accommodated in a standard vehicle. No change in the current estimated average car occupancy for day patrons has been assumed for planning purposes. However, the incentives for ride sharing, as described in section 6.3 have the potential to increase this in the future.

Factoring of 2017 SITG traffic volume for 50,000 patron event

The access gate traffic surveys for the 2017 Splendour in the Grass Festival were taken as a suitable starting point from which to forecast the potential traffic associated with a 50,000 patron event. The hourly traffic flows across the set-up days prior to the event, camper arrival days, event days, camper departure and pack-up were divided up into the categories of day patrons, campers, taxi/car drop-off and pick-up, service vehicles and buses, and other comings and goings.

A preliminary analysis of traffic volumes identified that the additional volume of traffic at the Yelgun Interchange would result in queuing on the exit ramps. The proposed strategy to reduce the impact is to restrict the amount of coming and going movement between 12.00 pm and 5.00 pm. Campers will have the opportunity to use the event bus network if they must travel during this period, or time their travel before 12.00 pm or after 5.00 pm.

Testing indicated that reducing by 55%, the amount of coming and going to/from the site not associated with day patron or camper arrival, day patron drop-off, buses or servicing between 12.00 pm and 5.00 pm could improve the operation of the interchange. This will require event managers to prioritise essential movements such as buses, servicing and event management during these hours. Vehicles returning to the site between these hours would be directed into the southern carpark, which in itself is a disincentive by being further away from camping and VIP parking.

All components of the SITG 2017 traffic counts were factored by the anticipated changes, taking into account the changes in the number of people (paying patrons, workers, performers, press, VIPs, guests), mode share, car occupancy, as outlined in Table 5.4.

Table 5.4 Assumed increase in traffic components for Large event (50,000 compared to SITG 2017)

Traffic flow	Estimated increase for Large event (50,000 patrons)
Service vehicles	+59% for event lead-up days
Buses	+157% for event days
Performers, press, VIP, emergency services, security, other comings and goings	No change assumed
Long stay people, incl. campers – parking	+1%
Long stay people, incl. campers – taxi/drop-off	+8%
Short-stay people incl. day patrons, guests – parking	+41%
Short-stay people incl. day patrons, guests – taxi/drop-off	+65%
Other traffic sources	-55%

Source: WSP trip estimates

Traffic volumes

The factors shown in Table 5.4 were applied to each individual traffic flow component from the 2017 SITG event traffic counts, and outlined in Table 5.5. The results are summarised in Table 5.6, in terms of 24 hour (4.00 am to 4.00 am) total traffic volumes, the peak hour during the arrival period (4.00 am to 9.00 pm) and the peak hour during the departure period (9.00 pm to 4.00 am). The corresponding numbers for the two events are compared in Table 5.7.

Table 5.5 Surveyed traffic volumes for 2017 Splendour in the Grass

Day	24 hours (4.00 am to 4.00 am)		Arrival (4.00 am to 9.00 pm) peak hour		Departure (9.00 pm to 4.00 am) peak hour	
	In	Out	In	Out	In	Out
Tuesday	1,315	1,179	193	176	18	20
Wednesday	3,491	1,360	325	151	113	65
Thursday	8,254	2,820	717	230	255	174
Friday	7,969	7,129	711	434	302	713
Saturday	7,947	8,033	809	551	294	831
Sunday	7,826	9,067	835	565	277	832
Monday	1,480	8,057	191	1,037	3	14

Source: Data: Greg Alderson & Associates, Analysis: WSP

During the Monday departure, traffic flow is limited by traffic controllers to manage the impact on Tweed Valley Way and the Yelgun Interchange. Outbound traffic volumes onto Tweed Valley Way for the large event scenarios have been limited to approximately 800 vph based on experience regarding the practical absorption capacity gained from previous events held at the site. For this analysis, the departure rate has not been limited. However, traffic management procedures would require monitoring for the camper departure and the use of flow limiting if impacts are experienced at the Yelgun Interchange. The impact of this would be a longer exit (clearance) time for campers on the Monday departure.

Table 5.6 Forecast traffic volumes for Large event scenario

Day	24 hours (4.00 am to 4.00 am)		Arrival (4.00 am to 9.00 pm) peak hour		Departure (9.00 pm to 4.00 am) peak hour	
	In	Out	In	Out	In	Out
Tuesday	2,087	1,871	306	279	29	32
Wednesday	4,308	2,158	384	240	179	103
Thursday	10,194	4,476	845	365	405	276
Friday	12,272	10,686	931	605	646	1,180
Saturday	11,670	11,923	943	654	541	1,365
Sunday	12,087	12,959	1,132	736	699	1,267
Monday	2,349	8,906	303	1,138	5	22

Table 5.7 Large event scenario – percentage difference from 2017 SITG

Day	24 hours (4.00 am to 4.00 am)		Arrival (4.00 am to 9.00 pm) peak hour		Departure (9.00 pm to 4.00 am) peak hour	
	In	Out	In	Out	In	Out
Tuesday	59%	59%	59%	59%	59%	59%
Wednesday	23%	59%	18%	59%	59%	59%
Thursday	24%	59%	18%	59%	59%	59%
Friday	54%	50%	31%	39%	114%	65%
Saturday	47%	48%	17%	19%	84%	64%
Sunday	54%	43%	36%	30%	152%	52%
Monday	59%	11%	59%	10%	59%	59%

The traffic flow profiles of the Large event scenarios (into and out of the site by day) are shown in Appendix B2 to B4. The corresponding 2017 SITG profiles are shown in Appendix B1 for comparison.

Trip direction

The peak traffic forecast for the large event scenarios have been assigned to the road network using the direction splits shown in Table 5.8 based on the 2017 SITG traffic counts.

Table 5.8 Assumed trip directions

Direction	Friday arrival	Sunday arrival	Monday departure
Pacific Motorway from North via Yelgun Interchange	23%	30%	29%
Tweed Valley Way from north	24%	20%	19%
Pacific Motorway from south via Yelgun Interchange	17%	15%	16%
Brunswick Valley Way from south	37%	35%	36%
Total	100%	100%	100%

Source: Data: Greg Alderson & Associates, Analysis: WSP

5.4.2 LARGE EVENT: 42,500 PATRONS

To simulate the transition and gradual change in transport behaviour, the 42,500 patron event has been tested with very similar trip generation characteristics applied to the smaller number of patrons and staff. Differences to the 50,000 patron event are limited to the mode share assumptions. For the 42,500 patron event, the proposed mode share is essentially the same as the SITG '17 event with a minor (2%) change to the camper car mode share, as shown in Table 5.9.

Table 5.9 Minor changes to existing mode share for Large event: 42,500 capacity

Patron type	Car	Bus	Taxi/Ride Share/Drop-off	Total
2017 SITG				
Campers	93%	2%	5%	100%
Day patrons	17%	63%	20%	100%
Total	62%	35%	12%	100%
42,500 Event				
Campers	91% (-2%)	4% (+2%)	5%	100%
Day patrons	17%	63%	20%	100%
Total	53%	35%	12%	100%

Preliminary modelling indicated that the 42,500 event with these travel characteristics similar to the existing (SITG '17) event is about the limit the road network can accommodate. To achieve the 50,000 event, existing travel behaviour needs to change, as outlined in section 5.4.1.

The 42,500 patron event is also likely to require a reduction in the amount of coming and going to/from the site. not associated with day patron or camper arrival, day patron drop-off, buses or servicing. The 42,500 patron event has been assessed with a 25% reduction in the coming and going traffic.

5.4.3 LARGE EVENT: 35,000 PATRONS

The 35,000 patron event would be similar in magnitude and behaviour to the 32,500 event held at SITG '17. As for the 42,500 patron event, the changes in travel behaviour would only represent a minor departure from the SITG '17 event. The small 1% change in car mode share has been applied to encourage a gradual change in camper mode share, as shown in Table 5.10.

Table 5.10 Minor changes to existing mode share for Large event: 35,000 capacity

Patron type	Car	Bus	Taxi/Ride Share/Drop-off	Total
2017 SITG				
Campers	93%	2%	5%	100%
Day patrons	17%	63%	20%	100%
Total	53%	35%	12%	100%
35,000 Event				
Campers	92% (-1%)	3% (+1%)	5%	100%
Day patrons	17%	63%	20%	100%
Total	53%	35%	12%	100%

The reduction in the amount of coming and going to/from the site not associated with day patron or camper arrival, day patron drop-off, buses or servicing is not required for the 35,000 event, although if it could be achieved, this would reduce the peak impact on the road network.

5.4.4 MEDIUM EVENT: MULTI-DAY CONCERT WITH CAMPING (25,000 PATRONS)

The multi-day concert with camping is similar to the current Falls Festival in terms of number and mix of patrons. Its trip generation has been estimated assuming the same travel behaviours with a minor change to camping. The mode share is outlined in Table 2.1.

Table 5.11 Minor changes to existing mode share for multi-day 25,000 capacity event

Patron type	Car	Bus	Taxi/Ride Share/Drop-off	Total
2017 Falls Festival				
Campers	93%	2%	5%	100%
Day patrons	35%	40%	25%	100%
Total	53%	35%	12%	100%
25,000 Event				
Campers	92% (-1%)	3% (+1%)	5%	100%
Day patrons	35%	40%	25%	100%
Total	53%	35%	12%	100%

5.4.5 MEDIUM EVENT: ONE-DAY CONCERT (25,000 PATRONS)

The one day festival is different to the multi-day events that have been trialled at the site so far. These concerts are generally high-profile performers, with patrons preferring to stay at nearby accommodation and leave their car behind to allow them to drink/avoid traffic and parking issues.

The travel behaviours for the one day concert have been assumed to be similar to that of the day patron component of the SITG'17 event. The mode share is summarised in Table 5.12.

Table 5.12 Minor changes to existing mode share for one day 25,000 capacity event

Patron type	Car	Bus	Taxi/Ride Share/Drop-off	Total
Day patrons	17%	63%	20%	100%

The event would rely upon the bus network established for the SITG concerts, although this could be tailored for a particular event if needed. The supply of buses would need to be confirmed as, due to international concert commitments, these events are typically held mid-week. Timing of the concert may allow buses needed for school and commuter peaks to be redeployed during the middle of the day for bump-in and after the peak for bump-out.

5.4.6 SMALL EVENT

NBP lodged an application for modification of their existing consent (i.e. MOD 3), requesting approval for small cultural events at the site. As part of this application, a Traffic Impact Assessment was prepared by Greg Alderson and Associates. In this assessment, it was found that traffic generation profiles depend on the type of event to be held. It was concluded that some types of events may require traffic management for patron volumes between 1,500 and 3,000 patrons, whilst others with up to 3,000 patrons, but less intense arrival/departure peaks could operate satisfactorily with existing road infrastructure.

For the currently proposed 5,000 patron event, the travel behaviour will be more focussed on car travel with smaller amounts of taxi and bus travel. Without incentives for higher occupancy vehicles, car occupancy could be less than for the large events. A critical element of the Small event impact is the amount of time for arrival and departure. If these periods are short, the impact could be akin to that of a large event, but for a much shorter duration. For these reasons, traffic management is proposed for small events.

5.4.7 MINOR EVENT

Assuming a conservatively low average car occupancy of 2.5 and 100% arrival by car or taxi, it is estimated that the Minor event would generate approximately 2% of the total number of cars generated by the 2017 *Splendour in the Grass* Festival. This volume of traffic could easily be accommodated within the existing road infrastructure without the need for additional traffic management.

5.4.8 SUMMARY

The range and magnitude of events can create very different types and durations of impacts on the surrounding road network. Figure 5.6 illustrates the relative magnitudes of people and vehicle movements estimated for each event size. Added to this is the temporal, spatial and duration variations for the event type.

It is recommended that the events of Small size or more should have a traffic management plan produced during the approvals process to detail the type, location and magnitude of impact.

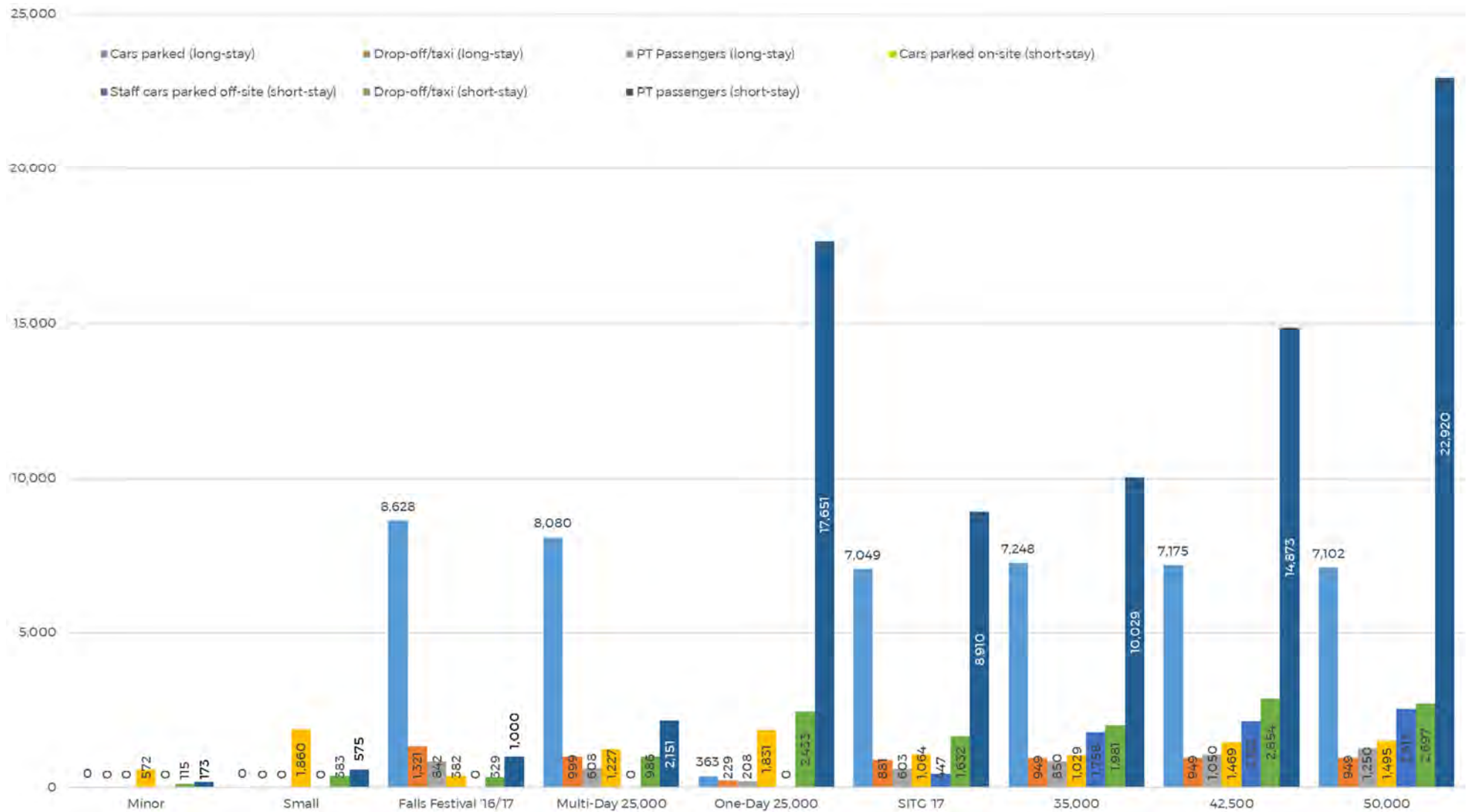


Figure 5.6 Comparison of relative trip generation for different event sizes and comparison to 2017 Falls Festival and SITG

5.5 EVENT TIMING

Events would be planned to occur throughout the year. The analysis in section 5.4 of this study is based on base traffic estimated volumes for 2037 for a non-school holiday day, when volumes are likely to be close to the average.

However, the Falls Festival is held during the New Year period. The analysis shown in section 5.3 showed that while none of the Falls Festival days have coincided with the peak traffic days, days within this period have up to 30% extra vehicles. While background traffic could be higher during the Falls Festival, the size of the Event would be approximately 30% smaller (35,000 patrons versus 50,000).

To test the counter-acting impact of the smaller event at a higher traffic time, traffic volumes were factored based on the estimated demand for the 50,000 patron event. The results are shown in Figure 5.7, Figure 5.8 and Figure 5.9.

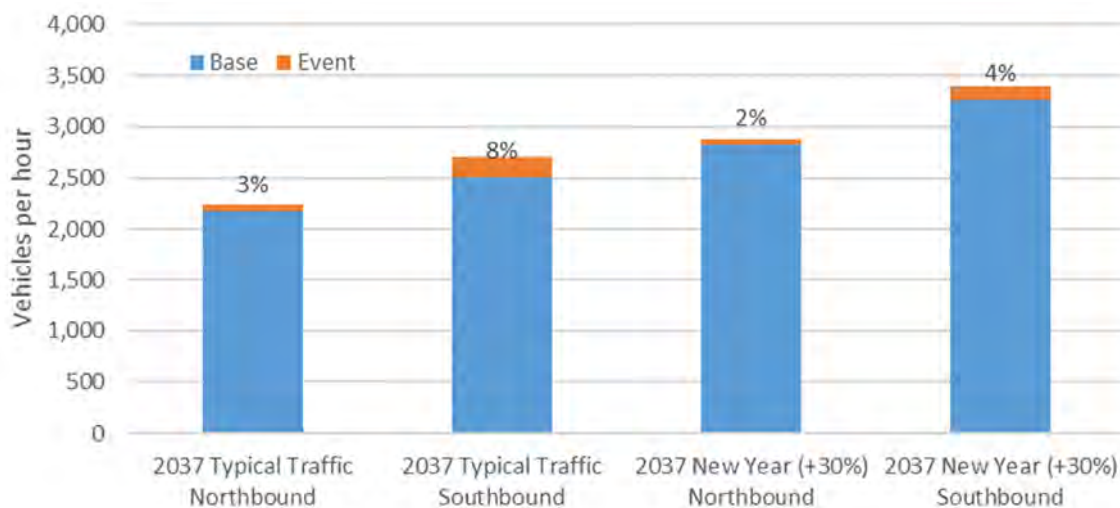


Figure 5.7 Pacific Motorway, north of Yelgun 2037 Friday peak – comparison of typical with 50,000 patron event and New Year (+30%) with 35,000 event

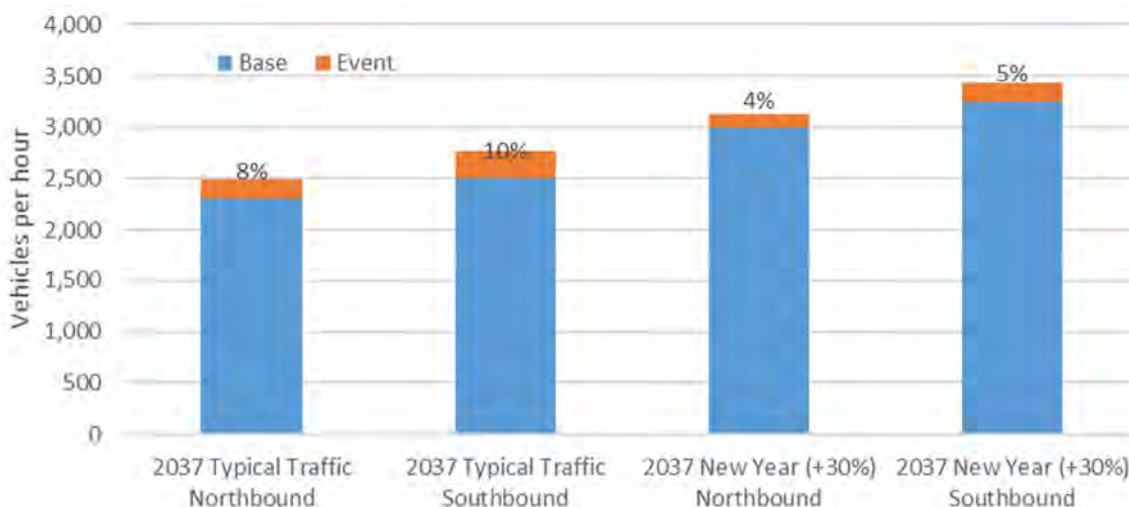


Figure 5.8 Pacific Motorway, south of Yelgun 2037 Friday peak – comparison of typical with 50,000 patron event and New Year (+30%) with 35,000 event

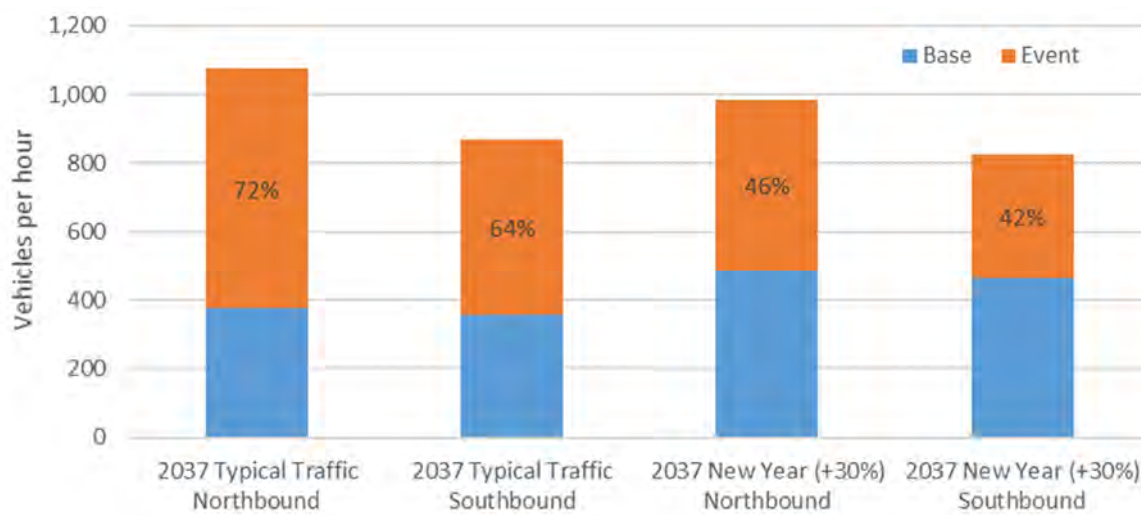


Figure 5.9 Tweed Valley Way, north of Yelgun Interchange 2037 Friday peak – comparison of typical with 50,000 patron event and New Year (+30%) with 35,000 event

The results show that on the Pacific Motorway, the variation in the background traffic volume has a much larger impact than that of the additional traffic generated by the NBP event. Even though the Background + 30% plus 35,000 patron scenario is higher, the percentage contribution of the event traffic drops to a small percentage (2% to 5%). This would not be discernible from the daily variation in traffic volumes.

On the Tweed Valley Way between the site and the Yelgun Interchange, the impact of the event traffic has a larger percentage of the total traffic volume. However, the reduction in event size results in a lower total traffic volume for the Background + 30% plus 35,000 patron scenario compared to the Background plus 50,000 patron scenario.

5.6 SPINE ROAD CAPACITY²

In accordance with the *Austrroads Guide to Traffic Management Part 3*, the transition of the LoS from D to E for multilane highways occurs at a vehicle density of 22 vehicles per kilometre per lane. Although the Spine Road is not a multilane highway, the relationship between Level of Service and density provides a good indication.

Using traffic data from Falls Festival 2014/15 for cars (without trailers), the 85th percentile (free-flow) speed for the Spine Road has been estimated at 37.4 km/h and 39.6 km/h for the northbound and southbound directions respectively. Using these values, the threshold traffic volume for transition from LoS D to E is estimated at 822 vehicles per hour northbound and 871 vehicles per hour southbound.

The above numbers were confirmed by observations during SITG 2017. On the campers' departure day on Monday, the largest traffic volume exiting the site measured over a one hour period (Gates C and D combined) was 849 vehicles per hour. The traffic flow on the Spine Road during this period was saturated and vehicle speed was similar to jogging pace.

² Surveys and analysis undertaken by Greg Alderson Associates, 2016

With the re-organisation of the site, by having passenger drop-off and day patron parking in the southern portion of the site, the greatest demand for the Spine Road is during camper arrival and departure.

Surveys on the Spine Road during the 2017 SITG (using an automatic tube counter) shows a maximum traffic volume of:

- 542 vph northbound on the Thursday camper arrival
- 312 vph northbound during the event Friday, Saturday and Sunday
- 320 vph southbound during the event Friday, Saturday and Sunday
- 635 vph southbound on the Monday camper departure.

All of these volumes are well below the previously surveyed capacity of the Spine Road.

The proposed 50,000 event maintains the same number of campers (20,000), meaning that the Thursday camper arrival and Monday camper departure numbers are unlikely to change significantly and will remain within the capacity of the single lane.

For the main event days of Friday, Saturday and Sunday:

- Day patron parking and drop-off has been relocated to the south of the site avoiding placing pressure on the Spine Road
- Bus volumes will increase by approximately 65 trips in each direction
- Service traffic may increase by 60% to accommodate the increased crowd size
- General coming and going, which uses the Spine Road, is proposed to be cut by 55%.

It is therefore expected that the volume on the Spine Road would only change slightly, and would remain well within its capacity.

5.7 ROAD NETWORK CAPACITY

The key locations have been assessed for the following scenarios:

- 2017 Base plus SITG '17
- 2027 Base plus 50,000 patron event
- 2037 Base plus 50,000 patron event.

The road network capacity has been checked at key locations, including:

- Tweed Valley Way, between the site and the Yelgun Interchange
- Pacific Motorway, Yelgun Interchange on-ramps
- Pacific Motorway, between Yelgun Interchange and Brunswick North Interchange.

The analysis was completed using the method specified by the Transport Research Board 2010, *Highway Capacity Manual 2010*, (and the HCS software). The results are provided in Appendix D and are summarised in this section.

The abovementioned locations have been assessed for the three identified peak periods – Friday afternoon, Sunday afternoon and Monday morning. To apply a conservative assessment and introduce a margin of safety, the peak surveyed traffic volume (between 1.00 pm and 5.00 pm on a Friday, between 12.00 pm and 4.00 pm on a Sunday and between 7.00 am and 11.00 am on a Monday) has been added to the peak event traffic over a similar period, regardless of whether they coincide or not.

With background traffic volumes varying between 10% and 50% and event traffic varying between 10% and 25%, it is estimated that this represents a factor of safety of 5% on Friday, 2% on Sunday and 10% on Monday.

5.7.1 PACIFIC MOTORWAY

The peak traffic impacts on the Pacific Motorway are anticipated during the arrival of day-patrons for the 50,000 patron event scenario when volumes on the Pacific Motorway would also be high.

The capacity of the Pacific Motorway was completed using the method specified by the Transport Research Board 2010, *Highway Capacity Manual 2010*, and the *HCS software*. The results shown in Table 5.13 and Table 5.14 for the northbound and southbound directions respectively, indicate that the Pacific Motorway, north of the Yelgun Interchange, would operate at LoS C for Base and with 50,000 patron event scenarios in 2037.

Table 5.13 Comparison of HCS analysis for Pacific Motorway north of Yelgun Interchange - Northbound

Day	Level of Service		
	2017	2027	2037
	Base – No Event		
Friday	B	B	C
Sunday	B	B	C
Monday	B	B	C
	With Event at NBP – SITG'17 in 2017, 50,000 patron event in 2027 and 2037		
Friday	B	B	C
Sunday	B	B	C
Monday	B	C	C

Source: HCS analysis, WSP 2017

Table 5.14 Comparison of HCS analysis for Pacific Motorway north of Yelgun Interchange - Southbound

Day	Level of Service		
	2017	2027	2037
	Base – No Event		
Friday	B	B	C
Sunday	B	B	C
Monday	B	B	C

Day	Level of Service		
	2017	2027	2037
	With Event at NBP – SITG'17 in 2017, 50,000 patron event in 2027 and 2037		
Friday	B	B	C
Sunday	B	B	C
Monday	B	C	C

Source: HCS analysis, WSP 2017

The results for the Pacific Motorway, south of the Yelgun Interchange are shown in Table 5.15 and Table 5.16 for the northbound and southbound directions respectively. They indicate that, the motorway would operate at LoS C for Base and with 50,000 patron event scenarios in 2037. The one exception is the southbound direction on Monday morning for the 2037 with 50,000 event scenario, which would operate with LoS D. It is noted that the average speed for this link is still above 100 km/h, which indicates that traffic is moving relatively freely.

Table 5.15 Comparison of HCS analysis for Pacific Motorway south of Yelgun Interchange - Northbound

Day	Level of Service		
	2017	2027	2037
	Base – No Event		
Friday	B	B	C
Sunday	B	B	C
Monday	B	B	C
	With Event at NBP – SITG'17 in 2017, 50,000 patron event in 2027 and 2037		
Friday	B	C	C
Sunday	B	B	C
Monday	B	B	C

Source: HCS analysis, WSP 2017

Table 5.16 Comparison of HCS analysis for Pacific Motorway south of Yelgun Interchange - Southbound

Day	Level of Service		
	2017	2027	2037
	Base – No Event		
Friday	B	C	C
Sunday	B	B	C
Monday	B	C	C
	With Event at NBP – SITG'17 in 2017, 50,000 patron event in 2027 and 2037		
Friday	B	C	C
Sunday	B	C	C
Monday	C	C	D

Source: HCS analysis, WSP 2017

5.7.2 PACIFIC MOTORWAY ON-RAMPS

During bump-out of day patrons and campers, the event-generated traffic would need to merge into the traffic on the Pacific Motorway. The bump-out of the day-patrons at the end of each day's performance would occur late in the evening (before and after midnight), when volumes on the Pacific Motorway are at their lowest. The bump-out of the campers would occur during the morning of the day after the event, when volumes on the Pacific Motorway are much higher.

An assessment of the absorption capacity of the Pacific Motorway at the Yelgun Interchange ramps was completed using the method specified by the Transport Research Board 2010, *Highway Capacity Manual 2010*, and *HCS*. While event traffic volumes are higher after midnight during day patron bump-out, the Friday afternoon, Sunday early afternoon and Monday morning periods were taken as the worst case for analysis as non-event traffic volumes will be higher during these periods. The results are shown in Table 5.17 and Table 5.18 for the northbound and southbound ramps respectively.

Table 5.17 Comparison of HCS analysis for Pacific Highway Yelgun Interchange Northbound Ramps

Day	Intersection	Year		
		2017	2027	2037
	Base			
Friday	Diverge	B	B	C
	Merge	B	B	B
Sunday	Diverge	B	B	C
	Merge	B	B	C
Monday	Diverge	B	B	C
	Merge	B	B	C
	With Event at NBP – SITG'17 in 2017, 50,000 patron event in 2027 and 2037			
Friday	Diverge	B	C	C
	Merge	B	B	C
Sunday	Diverge	B	C	C
	Merge	B	B	C
Monday	Diverge	B	B	C
	Merge	B	B	C

Source: HCS analysis, WSP 2017

The results indicate that, in general, the merge areas would operate with a LoS B or LoS C for the base and with event scenarios. The two exceptions are Friday and Sunday southbound exit ramp diverge in 2037 with the 50,000 patron event scenario. While they dip to Level of Service D, it is noted that the average speeds are less than 3 km/h slower than the posted speed limit and the volume to capacity ratio is very low.

Table 5.18 Comparison of HCS analysis for Pacific Highway Yelgun Interchange Southbound Ramps

Day	Intersection	Year		
		2017	2027	2037
	Base			
Friday	Diverge	B	C	C
	Merge	B	B	C
Sunday	Diverge	B	C	C
	Merge	B	B	C
Monday	Diverge	B	C	C
	Merge	B	C	C
	With Event at NBP – SITG'17 in 2017, 50,000 patron event in 2027 and 2037			
Friday	Diverge	B	C	D
	Merge	B	C	C
Sunday	Diverge	B	C	D
	Merge	B	C	C
Monday	Diverge	B	C	C
	Merge	B	C	C

Source: HCS analysis, WSP 2017

5.7.3 TWEED VALLEY WAY

Tweed Valley Way is a one-lane each way road, and therefore, the capacity of the lane is the limiting factor for traffic and leaving the site.

An assessment of the capacity of the road was completed using the method specified by the Transport Research Board, 2010, *Highway Capacity Manual (Using HCS software)*. This method is also specified by Austroads 2013, *Guide to Traffic Management Part 3: Traffic Studies and Analysis*. The Austroads description of the Level of Service for roads is provided in Appendix C. Output pages from the analysis are summarised in Table 5.19.

Table 5.19 Comparison of HCS analysis for Tweed Valley Way south of Gate D

Day	Level of Service		
	2017	2027	2037
	Base – No Event		
Friday	B	B	B
Sunday	B	B	B
Monday	B	B	B

Day	Level of Service		
	2017	2027	2037
	With Event at NBP – SITG'17 in 2017, 50,000 patron event in 2027 and 2037		
Friday	D	E	E
Sunday	C	D	D
Monday	C	D	D

Source: HCS analysis, WSP 2017

While Tweed Valley Way has a posted speed limit of 80 km/h – during event times, a 40 km/h temporary special event speed limit is applied as per the Traffic Management Plan.

It can be seen from Table 5.19 that Tweed Valley Way between the site and the Yelgun Interchange experiences a significant increase in traffic and decrease in performance during the Large event. It is noted that the 2017 SITG event has already reached a Level of Service D during the peak on the Friday.

The Level of Service E result for 2027 and 2037 on Friday with the 50,000 event is a factor of both the increase in event size and the increase in background traffic. Analysis indicates that if the 2017 SITG event were to be held in 2027 or 2037, the LoS would still be LoS D. However, there would be little margin for increasing the event size beyond 35,000 patrons.

The Level of Service E result is estimated to occur for:

- Three hours in 2027 on the Friday afternoon (between 12.00 pm and 3.00 pm), and
- Four hours in 2037 on the Friday afternoon between 12.00 pm and 4.00 pm.

While this result exceeds the criteria proposed by Roads and Maritime Services, it should be considered that:

- 1 People travelling near a large event expect that there may be some impact to traffic conditions;
- 2 The average speeds of between 48 km/h and 50 km/h is representative of a moving stream of traffic – i.e. some restriction of freedom for the driver to select their desired speed, but not bumper-to bumper conditions.
- 3 These speeds are higher than the 40 km/h special event temporary speed limit – i.e. drivers wouldn't be disadvantaged any further.
- 4 This would occur for three/four hours on one day out of the whole year.

It is proposed that the results outlined for the 50,000 patron event represent an acceptable solution for an infrequent special event.

For events which are temporary in nature, there is a certain expectation of people attending the event that, for the benefit of attending the event, they are willing to put up with a certain restriction in freedom of movement (same as for sporting, entertainment and cultural events). Other road-users not associated with the event may not be willing to put up with the same restriction of freedom of movement. However, if they are informed of the reason for the delay and given guidance on alternative routes to avoid the congestion, they would, in general, be more understanding if any delays are only of short duration.

If the monitoring for future events identifies that the capacity of Tweed Valley Way cannot be addressed through behaviour change, an upgrade to Tweed Valley Way may need to be considered to address the issue. The widening of Tweed Valley Way northbound between the Link Road Roundabout and Gate D to two lanes would result in a Level of Service B.

5.8 INTERCHANGE OPERATION

The Splendour in the Grass event has employed a strategy of splitting demand for arrival to multiple interchanges (Cudgera Creek Road and Brunswick Heads). This traffic management strategy is considered important to spread the additional demand, reducing the impact on the Yelgun Interchange and creating redundancy in the event of an incident on one of the routes.

The strategy has been successful to date with the majority of traffic arriving on the event days using the Cudgera Creek Road and Brunswick Heads interchanges and Tweed Valley Way and Brunswick Valley Way. The amount of traffic using the Yelgun Interchange versus the other interchanges will be monitored for each large event, and additional VMS signs can be deployed if required.

The forecast traffic volumes for the event scenarios were assessed using the SIDRA 7.0 Intersection modelling software. This version enables the interaction of queuing between closely spaced intersections to be modelled. The results were evaluated against the performance criteria set out in Appendix C2. The models have been run as linked networks for the two connected roundabouts at each interchange. The results are summarised in this section and are provided with more detail in Appendix E.

A summary of the results for the Friday arrival peak, Sunday arrival peak and Monday departure peak is provided in Table 5.1 for 2017, 2027 and 2037 for the baseline and Large event (50,000 patron) scenarios.

The results indicate that the success of the strategy of diverting some of the event traffic at the Cudgera Creek Road and Brunswick Heads Interchanges and the new roundabout at the Tweed Valley Way/Link Road intersection has improved the performance of these intersections substantially compared to previous modelling undertaken for the 2010 *North Byron Parklands – Traffic Impact Assessment*.

5.8.1 CUDGERA CREEK INTERCHANGE

The layout of the interchange modelled is shown in Figure 5.10.

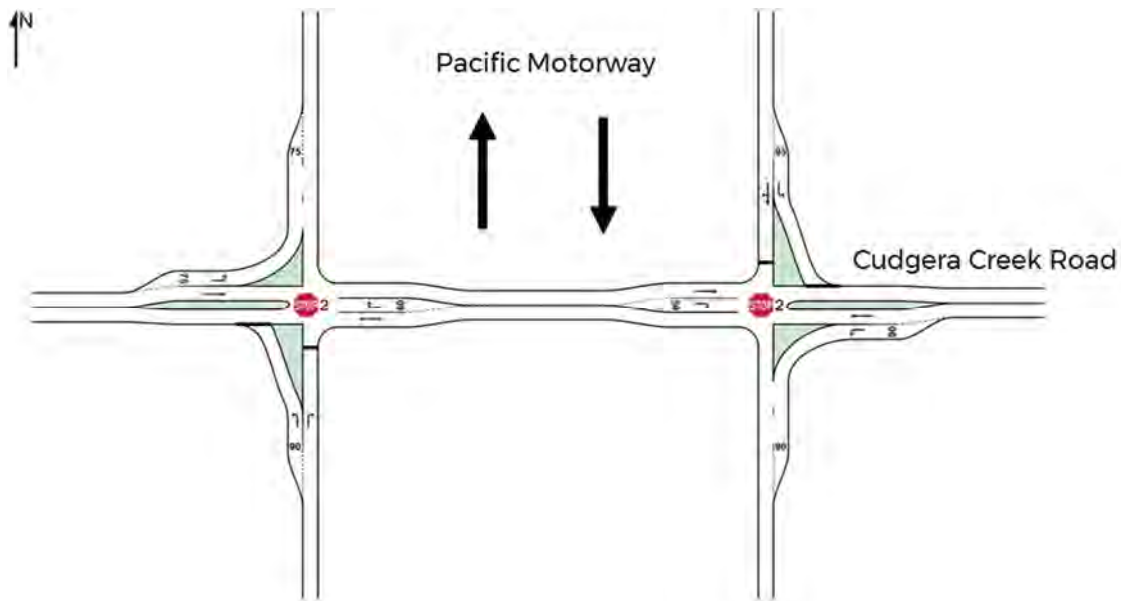


Figure 5.10 Layout of Cudgera Creek Interchange

Results are provided in Table 5.20 and are provided in more detail in Table E.1.

Base:

- All scenarios operate at Level of Service A or B for all movements
- Average delays generally less than 20 seconds
- Maximum queue of 22 m for Friday afternoon peak in 2037 on the southbound exit ramp.

With Event (2017 SITG, 2027 50,000 patron, 2037 50,000 patron):

- All scenarios operate at Level of Service A or B for all movements
- Average delays generally less than 20 seconds
- Maximum queue of 46 m for Friday afternoon peak in 2037 on the southbound exit ramp.

Table 5.20 Cudgera Creek Interchange SIDRA Intersection analysis result summary

Day	Intersection	Year		
		2017	2027	2037
	Base			
Friday	East (1A)	— LoS A	— LoS A	— LoS A
	West (1B)	— LoS A	— LoS A	— LoS A
Sunday	East (1A)	— LoS A	— LoS A	— LoS B
	West (1B)	— LoS A	— LoS A	— LoS A
Monday	East (1A)	— LoS A	— LoS B	— LoS B
	West (1B)	— LoS A	— LoS B	— LoS B

Day	Intersection	Year		
		2017	2027	2037
	With Event at NBP – SITG'17 in 2017, 50,000 patron event in 2027 and 2037			
Friday	East (1A)	— LoS A	— LoS A	— LoS A
	West (1B)	— LoS A	— LoS A	— LoS A
Sunday	East (1A)	— LoS A	— LoS A	— LoS B
	West (1B)	— LoS A	— LoS A	— LoS A
Monday	East (1A)	— LoS A	— LoS B	— LoS B
	West (1B)	— LoS A	— LoS B	— LoS B

Source: SIDRA Analysis, WSP 2017

5.8.2 YELGUN INTERCHANGE

The layout of the interchange modelled is shown in Figure 5.11.

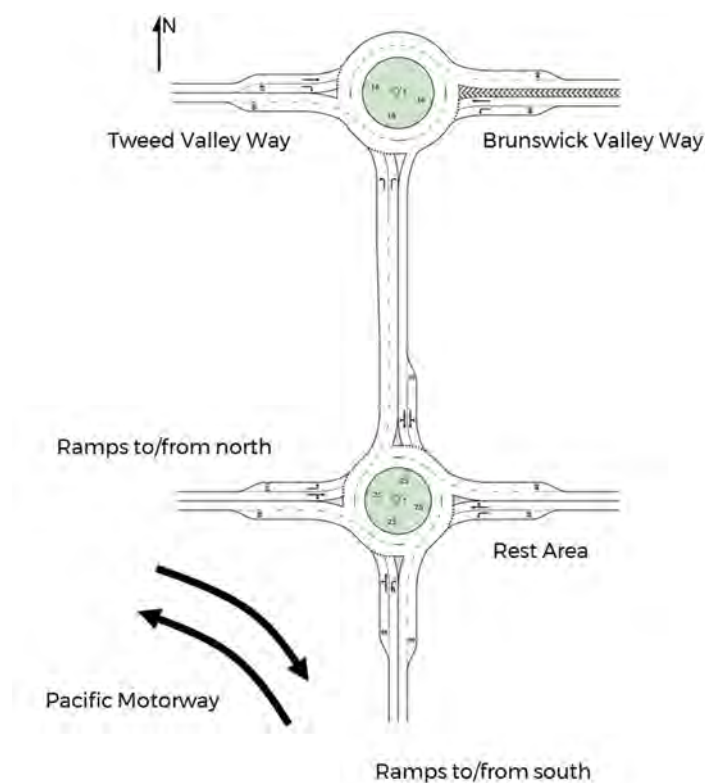


Figure 5.11 Layout of Yelgun Interchange

Results are provided in Table 5.21 and are provided in more detail in Table E.2.

Base:

- All scenarios operate at Level of Service A for all movements
- Average delays generally less than 13 seconds
- Maximum queue of 13 m for Monday morning peak in 2037 at the Link Road intersection on the Brunswick Valley Way approach.

With Event (2017 SITG, 2027 50,000 patron, 2037 50,000 patron):

- All scenarios operate at Level of Service A or B for all movements.
- Average delays generally less than 20 seconds, although the maximum delay of 27 seconds occurs for Monday morning peak in 2037 at the Link Road intersection on the Brunswick Valley Way approach.
- Queuing occurs on the Link Road left turn onto Tweed Valley Way in 2027 and 2037 with the 50,000 patron event on the Friday afternoon. In 2027 it is 87 m long and 118 m long in 2037. On the Sunday early afternoon it is 62 m in 2037 with the 50,000 patron event.
- While these queues reach through the main Yelgun Interchange roundabout, the results for the main roundabout indicate that queuing is within acceptable limits: 26 m, 42 m and 27 m respectively for the three scenarios mentioned on the critical southbound off-ramp.

Table 5.21 Yelgun Interchange SIDRA Intersection analysis result summary

Day	Intersection	Year		
		2017	2027	2037
	Base			
Friday	North (2A)	— LoS A	— LoS A	— LoS A
	South (2B)	— LoS A	— LoS A	— LoS A
Sunday	North (2A)	— LoS A	— LoS A	— LoS A
	South (2B)	— LoS A	— LoS A	— LoS A
Monday	North (2A)	— LoS A	— LoS A	— LoS A
	South (2B)	— LoS A	— LoS A	— LoS A
	With Event at NBP – SITG'17 in 2017, 50,000 patron event in 2027 and 2037			
Friday	North (2A)	— LoS A	— LoS A — Queue of 86 m on Link Road left turn	— LoS B — Queue of 118 m on Link Road left turn
	South (2B)	— LoS A	— LoS A — Queue of 26 m on southbound off-ramp	— LoS A — Queue of 42 m on southbound off-ramp
Sunday	North (2A)	— LoS A	— LoS A	— LoS B — Queue of 61 m on Link Road left turn
	South (2B)	— LoS A	— LoS A	— LoS A — Queue of 27m on southbound off-ramp
Monday	North (2A)	— LoS A	— LoS B	— LoS B
	South (2B)	— LoS A	— LoS A	— LoS A

Source: SIDRA Analysis, WSP 2017

Interchange queuing space

The critical issue for the impact on the Yelgun Interchange is the length of queuing:

- on the Link Road between Tweed Valley Way and the Yelgun Interchange roundabout
- on the southbound off-ramp
- on the northbound off-ramp.

The available queuing distance on the Link Road between Tweed Valley Way and the roundabout is approximately 53 metres. The SIDRA model results indicate that the Friday afternoon time period for the 50,000 patron event scenario in 2027 and 2037 could result in 95th percentile queues on the Link Road of 118 metres despite operating with Level of service B and a low average delay of 11 seconds per vehicle. This means it would add to the queues on the northbound and southbound off-ramps.

For the Pacific Motorway off-ramps, provided the queue stays within the distance that provides sufficient Stopping Sight Distance for vehicles exiting the Motorway, the operation of the Motorway at the ramps should not be affected. An explanation of the calculation of Stopping Sight Distances for the Yelgun Interchange off-ramps is included in Appendix F. The forecast queue of 42 metres on the Pacific Motorway southbound off-ramp is outside the Stopping Sight Distance (SSD) requirement.

It is recommended that the performance of the roundabout continue to be monitored during the peak times (between 12.00 pm and 6.00 pm on large event days) to ensure that performance is within the acceptable levels. If adverse queuing is observed, the proposed traffic management measure to have on standby and be enacted would be to have traffic controllers or temporary traffic signals to meter the following approaches:

- Brunswick Valley Way northbound
- northbound off-ramp.

The arrangements could be applied independently or in combination. The locations of the temporary traffic controller are shown in Figure 5.12. This measure could be switched off when the intersection returns normal operation.

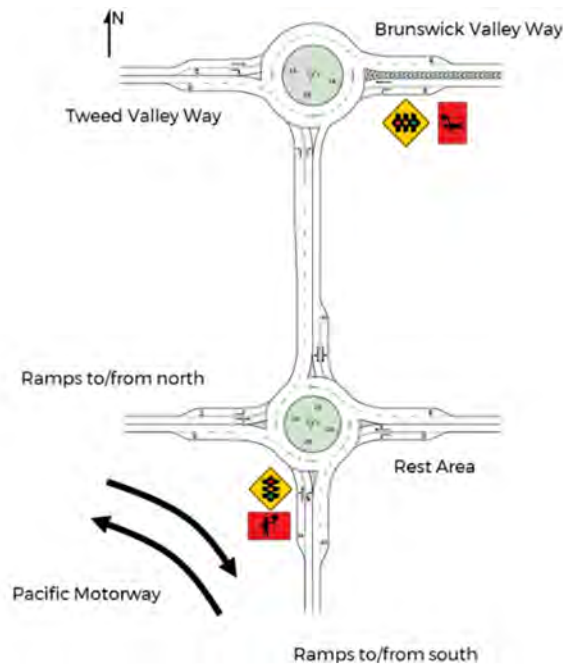


Figure 5.12 Potential locations for roundabout metering

SIDRA Intersection 7.0 results indicate that both measures could provide reductions in the critical queue lengths:

- Brunswick Valley Way northbound: short phasing reduced the queue length to approximately 60 m. Brunswick Valley Way delays increase to 90 seconds per vehicle with a queue length of 300 m – however, queueing in this location does not affect safety on the Pacific Motorway.
- northbound off-ramp: reduces the queue on the southbound exit ramp to 20 m, but increases the queue on the northbound exit ramp to 130 m. This is outside of the SSD for the ramp – i.e. it would not adversely affect safety. The results shown in Appendix F indicate that this ramp has space for a queue of up to 247 m before the margin of safety is affected.

5.8.3 BRUNSWICK NORTH INTERCHANGE

The layout of the interchange modelled is shown in Figure 5.13.

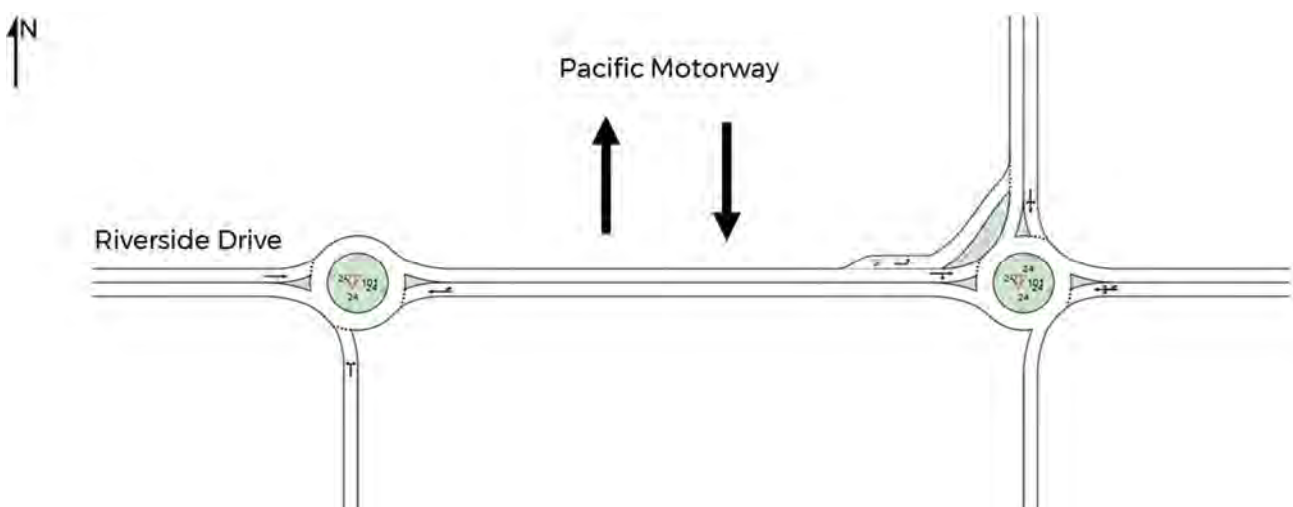


Figure 5.13 Layout of Brunswick North Interchange

Results are provided in Table 5.22 and are provided in more detail in Table E.3.

Base:

- All scenarios operate at Level of Service A for all movements
- Average delays generally less than 14 seconds
- Maximum queue southbound on Brunswick Valley Way of 12 m to 55 m for Monday morning peak in 2037.

With Event (2017 SITG, 2027 50,000 patron, 2037 50,000 patron):

- All scenarios operate at Level of Service A for all movements apart from the eastern roundabout on Monday morning in the 2037 with 50,000 event scenario, which operates with a LoS B
- Average delays generally less than 15 seconds
- Maximum queue southbound on Brunswick Valley Way of 14 m to 66 m for Monday morning peak in 2037.

Table 5.22 Brunswick North Interchange SIDRA Intersection analysis result summary

Day	Intersection	Year		
		2017	2027	2037
	Base			
Friday	East (3A)	— LoS A	— LoS A	— LoS A
	West (3B)	— LoS A	— LoS A	— LoS A
Sunday	East (3A)	— LoS A	— LoS A	— LoS A
	West (3B)	— LoS A	— LoS A	— LoS A
Monday	East (3A)	— LoS A	— LoS A	— LoS A
	West (3B)	— LoS A	— LoS A	— LoS A
	With Event at NBP - SITG'17 in 2017, 50,000 patron event in 2027 and 2037			
Friday	East (3A)	— LoS A	— LoS A	— LoS A
	West (3B)	— LoS A	— LoS A	— LoS A
Sunday	East (3A)	— LoS A	— LoS A	— LoS A
	West (3B)	— LoS A	— LoS A	— LoS A
Monday	East (3A)	— LoS A	— LoS A	— LoS B
	West (3B)	— LoS A	— LoS A	— LoS A

Source: SIDRA Analysis, WSP 2017

5.9 NBP SITE ACCESS OPERATION

The performance of Tweed Valley Way along the frontage of the subject site has been assessed for the Friday and Sunday scenarios, as they represent peak times for vehicle entry. A SIDRA 7.0 model of the intersections of Tweed Valley Way with Jones Road, Gates C and D, including Yelgun Road, as well as a model of the intersection of Wooyung Road and Gate E, has been established to carry out the analysis. A 150 m temporary right turn lane into Gate D has been incorporated in the model, as this right turn lane has been effective during previous events in allowing through traffic to bypass right turn queues. The results are summarised in Table 5.23.

The modelling shows that:

- The use of the Wooyung Road exit for patron bump-out performs well, and takes pressure of the other gates. It operates with low levels of delay and queuing in all scenarios tested.
- The Jones Road intersection experiences delay for the right turn movement in 2037 with the 50,000 patron event. Traffic control could be on hand to allow vehicles out of Jones Road if delays become excessive.
- Gate C experiences delays for the right turn out of the site. The Monday camper departure in 2037 experiences the longest delays of approximately three minutes with a queue of 400 m. However, for a large festival the delays are reasonable. During this time, the traffic management procedures convert the Spine Road to two southbound lanes, allowing the queues of vehicles turning north and south to operate independently.
- Gate D operates well for all movements except for the right-turn out of Yelgun Road. However, the volumes on Yelgun Road are very low. Traffic controllers would be on hand to assist vehicles turning out of Yelgun Road if delays become excessive.

Table 5.23 SIDRA intersection results for Jones Road, Gates C, D and E

	2017 SITG	2027 with 50,000 Patron Event	2037 with 50,000 Patron Event
	Gate E, Wooyung Road		
Friday	— LoS A	— LoS A	— LoS B
Sunday	— LoS A	— LoS A	— LoS A
Monday	— LoS A	— LoS B	— LoS B
	Jones Road, Tweed Valley Way		
Friday	— LoS A	— LoS C — 40 seconds delay for the right-turn movement out of Jones Road — Queue of approximately 16 m	— LoS D — 52 seconds delay for the right-turn movement out of Jones Road — Queue of approximately 18 m

	2017 SITG	2027 with 50,000 Patron Event	2037 with 50,000 Patron Event
Sunday	— LoS B	— LoS C — 33 seconds delay for the right-turn movement out of Jones Road — Queue of approximately 15 m	— LoS D — 43 seconds delay for the right-turn movement out of Jones Road — Queue of approximately 17 m
Monday	— LoS C	— LoS E — 67 seconds delay for the right-turn movement out of Jones Road — Queue of approximately 20 m	— LoS F — 74 seconds delay for the right-turn movement out of Jones Road — Queue of approximately 21 m
	Gate C, Tweed Valley Way		
Friday	— LoS A	— LoS B — 20 seconds delay for the right turn into Gate C — Queue of approximately 21 m	— LoS B — 23 seconds delay for the right turn into Gate C — Queue of approximately 25 m
Sunday	— LoS A	— LoS B — 15 seconds delay for the right turn into Gate C — Queue of approximately 17 m	— LoS B — 18 seconds delay for the right turn into Gate C — Queue of approximately 20 m
Monday	— LoS A	— LoS B — 27 seconds delay for the right turn out of Gate C — Queue of approximately 88 m inside site	— LoS F — 177seconds delay for the right turn out of Gate C — Queue of approximately 407 m inside site
	Gate D, Tweed Valley Way and Yelgun Road		
Friday	— LoS A	— LoS A/F — Traffic control required to assist Yelgun Road traffic — Queue to turn right into site of 32 m	— LoS A/F — Traffic control required to assist Yelgun Road traffic — Queue to turn right into site of 37 m
Sunday	— LoS A	— LoS A/F — Traffic control required to assist Yelgun Road traffic — Queue to turn right into site of 30 m	— LoS A/F — Traffic control required to assist Yelgun Road traffic — Queue to turn right into site of 33 m

	2017 SITG	2027 with 50,000 Patron Event	2037 with 50,000 Patron Event
Monday	— LoS B	— LoS A/F — Traffic control required to assist Yelgun Road traffic	— LoS B/F — Traffic control required to assist Yelgun Road traffic

Source: SIDRA Analysis, WSP 2017

5.10 INTERNAL INTERSECTIONS

The internal road layout, including the two-lane roundabout at the intersection of the Gate C entry and the Spine Road (shown in Figure 4.1), and a give-way sign controlled intersection at the Gate B connection has been assessed in SIDRA for the Thursday peak camper arrival, Friday camper and day patron arrival and Sunday day patron arrival.

Traffic management procedures within the site would seek to minimise the amount of crossing traffic, reducing opposing volumes at the roundabout. This avoids delays for the movement of vehicles on site, as shown in the good intersection performance levels shown in Table 5.24.

Table 5.24 SIDRA intersection results for internal intersections

	50,000 Patron Event
	Gate B, Spine Road (Give-Way controlled)
Thursday	Not used
Friday	— LoS A, 7 seconds per vehicle and less than one vehicle queue for the worst-performing movement
Sunday	Not used
	Gate C, Spine Road (two-lane roundabout)
Thursday	— LoS A, 10 seconds per vehicle and 20 metre queue for the worst-performing movements
Friday	— LoS A, 10 seconds per vehicle and less than two vehicle queue for the worst-performing movements
Sunday	— LoS A, 10 seconds per vehicle and 20 metre queue for the worst-performing movements

To confirm that the intersections have sufficient capacity to cope with unexpected arrival of vehicles, a sensitivity test was run with no reduction in the amount of coming and going traffic and all volumes increased by 50%. The results indicate continued low levels of delay (less than 12 seconds per vehicle) and queues contained within the site – increasing to 42 m on Thursday, 28 m on Friday and 100 m on Sunday on the southern approach (however, queue towards Tweed Valley Way still less than two vehicles). These results indicate that the roundabout and traffic management procedures can accommodate the anticipated traffic within the site boundary.

5.11 IMPACT ON OTHER ROAD USERS

During events, the road network would be in demand from both event and non-event related traffic. The events would use traffic management measures to limit the impact on local residents and other road users similar to those for the trial events, as follows:

- Long-term notification of other road users of the event and likely traffic impacts through newspaper advertisements, and notices on Byron Shire Council and Roads and Maritime websites.
- Real-time notification to drivers. Variable Message Signs would be placed on the Pacific Motorway north and south of the Yelgun Interchange, and on Tweed Valley Way and Brunswick Valley Way.
- Bypass queues for non-event vehicles at the NBP site entries
- Traffic management of queues at the Yelgun Interchange off-ramps (if required), on the Link Road and Tweed Valley Way using traffic controllers. See section 7 for details. Application of a 40 km/h special event speed limit to protect traffic controller safety.
- Security checkpoints would be established at the entrances to Jones Road and Yelgun Road off Tweed Valley Way. Residents and their guests would be issued passes to allow them to pass through the checkpoint.
- Property entrances would not be obstructed. Parking patrols would be regularly undertaken to remove/infringe illegally parked vehicles.

Residents

Residents of Jones Road and Yelgun Road would need to pass through the area affected by the event traffic. At the Yelgun Interchange they would be included in the queue of event traffic, which based upon SIDRA modelling, would experience delays of up to 20 seconds for some movements. They would be protected from additional delay from any queues at the site entrance gates by the provision of permanent and temporary right-turn bays which would enable through traffic to bypass.

As implemented for the trial events, Jones Road and Yelgun Road would be closed to all but authorised and resident traffic. The residents would be given resident passes to enable them to pass through the traffic control points. Traffic controllers would assist vehicles leaving Jones Road and Yelgun Road onto Tweed Valley Way if delays become excessive.

Tweed Valley Way road users

- The special event speed limit would increase travel times along Tweed Valley Way, but is necessary to slow traffic during a period of non-standard traffic conditions, and to improve the safety of traffic controllers and event patrons.
- Non-event through traffic would be provided with a bypass lane at the NBP site gates to avoid the queue of traffic arriving at or leaving the site.
- Sections of Tweed Valley Way would be temporarily signposted as 'No Stopping' to maintain traffic flow.

- Tweed Valley Way would experience some congestion with slow-moving traffic. However, speeds would not be lower than the temporary special event speed limit of 40 km/h.

Pacific Motorway road users

- Pacific Motorway road users would experience higher traffic volumes during the arrival and departure times of the events. However, the Motorway is forecast to have sufficient capacity to accommodate the increased flow.
- Motorway road users would be warned in advance of potential delays around the Yelgun Interchange.

Wooyung Road Gate – Tweed Coast Road

The release of vehicles from the Emergency Vehicle Gate (Gate E) in the trial events has been limited to reduce the risk of queuing at the roundabout at the intersection of Tweed Coast Road and Coronation Avenue. The proposed use of Gate E would be for vehicles travelling to/from the Tweed Coast towns (Pottsville, Hastings Point, Cabarita Beach, Bogangar, Casurina and Kingscliff) and the Site. Based on the analysis of postcode data and accommodation, the volume is expected to be less than the amounts of traffic released from this gate during the recent trial events under NSW Police direction. It is therefore not expected to contribute to an increase in roundabout delays or queuing.

Local town roads

The patrons may increase traffic within local towns such as Brunswick Heads, Ocean Shores and South Golden Beach. It is understood that the area experiences increased levels of holiday-makers during the summer school holidays, with traffic inside the towns and parking demand along beach-side roads increasing. Based on SIDRA modelling, residents and visitors of these areas may experience delays of up to 14 seconds for some movements at the Yelgun Interchange. However, it is noted that some of the event patrons are likely to choose to stay in these locations.

5.12 KEY PERFORMANCE INDICATORS

Based on the results of the traffic analysis in this study and discussions with Roads and Maritime Services, Byron Shire Council and Tweed Shire Council, a revised set of Key Performance Indicators (KPIs) associated with traffic management and car parking are proposed for the future events:

- 1 all movements at the Yelgun Interchange including merges and diverges need to operate at Level of Service C or better for delay
- 2 the level of service for local traffic and through traffic on the Tweed Valley Way should not fall below Level of Service D in general across the day
- 3 the level of service for local traffic and through traffic on the Tweed Valley Way should not fall below Level of Service E for more than four hours during the day

- 4 queue lengths on the link road between Tweed Valley Way and the Yelgun Interchange must be limited to a maximum of 60 metres³
- 5 queue length (95% back of queue in metres) of no more than 210 metres from the Give Way yield line on the northbound off-ramp of the Yelgun Interchange
- 6 on site queuing is not to extend onto the Pacific Motorway or the Tweed Valley Way
- 7 no appreciable impact on through traffic travel times of the Pacific Motorway.

These KPIs are considered realistic and appropriate for a special event size with a small number of peak event days across the year. They are proposed for further discussion with Roads and Maritime Services.

³ Was 70 m before the upgrading of the intersection of Tweed Valley Way, Brunswick Valley Way and the Link Road to roundabout control

6 Alternative transport

The NBP site management have taken a proactive approach to reducing the impact of the event on the road network in all the trial events held to date through the implementation of sustainable transport initiatives. This has assisted in achieving the traffic management and car parking performance criteria issues with the trial project approval. Initial forecasts that the demographic of the event patrons at NBP would be receptive to the sustainable transport initiatives originally proposed have proved correct, with a higher bus mode share for day patrons than originally envisaged.

6.1 BUSES

A network of event bus services to surrounding towns and accommodation centres was proposed in the original Concept Plan and Project Application. This network has been refined through experience from each successive large event held. For the proposed Medium and Large events, use of this event bus network will be increased with increased promotion, to reduce the demand for parking and car drop-off/pick-up within the site.

6.1.1 EVENT BUS NETWORK

The bus network for each event is tailored to the demographic of that event, with the number of bus services assigned based on information on ticket sales and accommodation. Information from the 2017 *Splendour in the Grass* event⁴, indicates that the event bus network catered for between 8,150 and 12,150 patrons in each direction with a 63% bus mode share. The 2017 bus network is summarised in Table 6.1.

Table 6.1 2017 Splendour in the Grass bus service provision

Bus service to/from	Day Arrival (Approx 11.00 am to 8.00 pm)	Night/Morning Departure (Approx 8.00 pm to 11.00 am)	Total across day
Brunswick Heads	56	53	109
Ocean Shores/South Golden Beach	21	15	36
Mullumbimby	10	13	23
Byron Bay (Suffolk) ¹	123	95	219
Kingscliff/Casuarina/Cabarita/ Hastings Point/Pottsville	36	25	61
Ballina/Lennox Head	8	10	18
Crabbes Creek	2	3	5
Lismore/Bangalow	4	5	9
Day total	260	220	479

Source: North Byron Parklands, 2017

⁴ Bus information provided by North Byron Parklands

The passenger numbers for 2017 and bus service numbers equate to an average of approximately 33 bus patrons per bus entering the site and 50 passengers per bus exiting the site. These numbers are averages, with the arrival rate of passengers peaking across the period when the majority of stages are active with well-known performers (typically between 12.00 pm and 4.00 pm). A higher bus load is experienced on departure as demand spikes following the end of performances and some patrons arriving by taxi switch to bus. Typically, the buses shuttle between the NBP site and their destination leave with full loads until demand starts to fall.

6.1.2 LARGE EVENT

Day patrons

As outlined in section 5.4.1, the mode share for day patrons has been considered for the event bus network to serve the full 50,000 event (with 30,000 day patrons). Total bus patronage is expected to rise from approximately 9,500 for SITG 2017 (campers, staff and day patrons) to 24,200 for the 50,000 patron event.

Converting these bus passenger numbers into a number of bus trips (services), and applying them to the current event bus network, the estimated numbers are shown in Table 6.2. For planning purposes, a higher number of passengers per bus has been assumed, i.e. a higher occupancy in non-peak times. The number and distribution of buses would be determined based on demand for each area served.

Table 6.2 Forecast 50,000 patron event bus service provision

Bus service to/From	Day Arrival (Approx 11.00 am to 8.00 pm)	Night/Morning Departure (Approx 8.00 pm to 11.00 am)	Total across day
Brunswick Heads	82	68	150
Ocean Shores/South Golden Beach	50	40	91
Mullumbimby	28	23	51
Byron Bay (Suffolk) ¹	303	212	515
Kingscliff/Casuarina/Cabarita/Hastings Point/ Pottsville	94	76	170
Ballina/Lennox Head	28	23	51
Crabbes Creek	1	1	2
Lismore/Bangalow	8	6	14
Day total	596	449	1,045

Source: WSP, 2017

Table 6.3 and Table 6.4 show a summary of the arrival and departure bus services needed to service a 50,000 patron event. These details are for planning purposes only, to demonstrate the implications of the larger crowd and the practicality of the network.

Table 6.3 Forecast 50,000 patron event bus service provision – Arrival

Bus service to/From	Estimated percentage of passengers	Estimated number of day patron passengers daily	Average passengers per bus	Estimated number of bus services	Estimated Peak number of services per hour	Estimated Peak Headway (min)	Length (km)	Estimated one-way travel time (minutes)
Brunswick Heads	13%	2,870	35	82	15	4	10	15
Ocean Shores/South Golden Beach	9%	2,017	40	50	10	6	15	30
Mullumbimby	5%	1,138	40	28	10	6	13	25
Byron Bay (Suffolk) ¹	48%	10,601	35	303	50	1.2	27	35
Kingscliff/Casuarina/Cabarita/Hastings Point/Pottsville	17%	3,777	40	94	30	2	34	60
Ballina/Lennox Head	5%	1,132	40	28	8	7.5	66	60
Crabbes Creek	0%	44	40	1	1	60	11	11
Lismore/Bangalow	1%	321	40	8	4	15	59	59
Day total	100%	21,900		596	128			

Source: WSP, 2017

Table 6.4 Forecast 50,000 patron event bus service provision – Departure

Bus service to/From	Estimated percentage of passengers	Estimated number of day patron passengers daily	Average passengers per bus	Estimated number of bus services	Estimated Peak number of services per hour	Estimated Peak Headway (min)	Length (km)	Estimated one-way travel time (minutes)
Brunswick Heads	12%	3,410	50	68	16	3.75	10	15
Ocean Shores/South Golden Beach	9%	2,587	50	40	10	6	15	30
Mullumbimby	6%	1,734	50	23	10	6	13	25
Byron Bay (Suffolk) ¹	46%	13,203	50	212	50	1.200	27	35
Kingscliff/Casuarina/Cabarita/Hastings Point/Pottsville	18%	5,198	50	76	20	3	34	60
Ballina/Lennox Head	6%	1,701	50	23	12	5	66	60
Crabbes Creek	1%	274	40	1	1	60	11	11
Lismore/Bangalow	2%	469	50	6	3	20	59	59
Day total	100%	28574		449	122			

Source: WSP, 2017

The bus services outlined in Table 6.3 and Table 6.4 would be spread out over a period starting from 7.00 am and finishing when the last patrons have left the NBP site – at around 3.00 am. Whilst the numbers of services are large compared to regular bus levels in the surrounding area, they are consistent with major sporting and cultural events in larger cities, and hence are considered feasible.

Critical points in the bus network will include the capacity of the bus interchange, bus access and priority between Tweed Valley Way and the Spine Road and the reduction in certain movements on and off the site (miscellaneous coming and going) to maintain the performance of Tweed Valley Way.

Campers

For campers, the amount of equipment that they require limits their potential use of the bus service. It also limits the number of passengers that can be carried. If initiatives can overcome this issue, such as on-site rental of camping equipment, the 2% transport mode share estimated from 2017 *Splendour in the Grass* data could increase to 5% for the 50,000 patron event. With the number of campers proposed to stay at 20,000, bus passengers would increase.

The number of bus services during the day on the Thursday of the event compared to the 2% bus passenger mode share indicates a low average patronage per bus. Therefore there is ample spare capacity in the current bus network during camper arrival and departure to accommodate the demand from the 50,000 patron event.

Bus fleet

It is estimated that the number of buses required to service these routes with the frequencies listed in Table 6.4 is approximately 164 during the day-time peak and 147 during the night-time departure. These represent a 150% and a 100% increase respectively over those estimated for the 2017 SITG event. This number of buses is likely to require the bus fleet to be chartered not only from the surrounding area but also from bus companies located on the Gold Coast.

6.1.3 ON-SITE BUS TERMINUS CAPACITY

A bus and coach terminus was built on the NBP site to provide a high-quality facility and ensure a smooth operation. The terminus has the following features:

- one-way clockwise loop travel to reduce conflicts between vehicles and improve pedestrian safety
- bus hub on the outside with 10 bus bays parallel to enable quicker operation for internal shuttle buses and day-patron buses
- charter coach area in the centre for coaches with longer dwell times
- pedestrians follow the yellow paths to get from the bus area to the event entry
- located closer to the event entry than car parking to give priority to public transport passengers
- designed to accommodate the turning and manoeuvring requirements of buses and coaches.

To date, this loop has been working successfully for the trial events, and was designed with spare capacity to accommodate the bus patron demands of the 50,000 patron event.

The current peak arrival rate for buses is on the Friday, Saturday and Sunday between 1.00 pm and 2.00 pm, where it accommodates approximately 38 buses per hour (measured during the 2017 SITG). The departure peak is typically the most intense time for the bus terminus, with 49 buses leaving between 11.00 pm and midnight.

Based on the increased size of day patrons, this could increase to 122 buses per hour. The capacity of the existing terminus has been checked assuming four minutes per bus and 11 bus stands (with some sharing of stands for low frequency services). The results indicate that it has capacity to serve 165 buses per hour. This capacity is considered to be sufficient for the future scenario.

The potential layout of the bus interchange for this configuration is shown in Figure 6.1.



Source: Aerial image: Google Maps 2017

Figure 6.1 Proposed layout of bus interchange (placement of bus stands indicative only)

6.1.4 TOWNSHIP BUS STOPS

Bus stops within surrounding townships have been used for the trial events, as they provide the benefit of enabling patrons to walk from their accommodation to the stop. This has proved popular for those who want to consume alcohol while at the event as it is a convenient 'Plan B Option' to avoid the temptation to 'drink and drive'. For many other patrons, it bypasses the congestion on the road network and at the gates. For visitors to the area, they can fly/bus to their accommodation in the area and avoid the expense of hiring a car.

In addition to walk-up passengers, these stops are also used for 'kiss-and-ride' that does not require the person dropping-off to drive all the way to the NBP site. It can also be cheaper than catching a taxi all the way to the site.

Byron Bay

The current major stop in Byron Bay is located outside the Tourist Information Centre, which is easy for visiting patrons to find. It is expected that up to three bus spaces could be required to load passengers quickly enough to keep up with demand for travel to the NBP site. The current stop has approximately 50 metres of kerbspace which is sufficient to fit three buses if they load simultaneously and depart in order. Assuming three minutes per bus (not loading to full) and a daytime peak requirement of 50 buses per hour, there is expected to be sufficient capacity. Bus marshals will be required to maintain the efficient loading and dispatch of buses to maintain this peak capacity.

Other stops

The other bus stops along the routes are estimated to manage with one dedicated pick-up space.

Layover space

In addition to the bus stop space, some locations may require additional space for bus layover (time between finish of one trip and start of the next to give the driver time to rest or go to the bathroom). In general this can be accommodated within the NBP site around the inner part of the bus terminus. However, on some of the longer or more frequent routes, space may be needed within the towns. An indication of the number of spaces is seven spaces at Byron Bay and ten at Chinderah (for Kingscliff route). Ideally this space is located close to the first stop, and near publicly accessible toilet facilities.

6.1.5 KISS-AND-RIDE

One method of avoiding congestion getting to/from the NBP site for people dropping-off passengers is to use a convenient bus stop along one of the routes. This has likely occurred to some extent during the trial events, and will be promoted as a method of reducing the number of vehicles accessing the NBP site.

To reduce the number of taxis and vehicles dropping off passengers, convenient locations to connect to the bus services would improve the kiss-and-ride options. The aim would be to provide a convenient location to the Pacific Motorway, on an existing event bus route close to its final stop, with opportunities for vehicles to turn around and lighting/nearby activity for safety. Potential locations include:

- From the North:
 - Pottsville South Bus Stop, space for drop-off on Philip Street near the intersection with Coronation Avenue – access to Pacific Motorway via Cudgera Creek Interchange.
- From the South:
 - Shara Boulevard, space for drop-off in the car park on Shara Boulevard – Shores United Soccer Club car park.
 - North Coast Holiday Parks Ferry Reserve, space for drop-off on Old Pacific Highway between roundabouts – access to Pacific Motorway via Brunswick Heads North Interchange.

The cost of the bus ticket could be saved in reduced taxi fares waiting in traffic to get into and out of the site. These sites have capacity for passenger drop-off for multiple vehicles. Their use would be explored further in consultation with Byron Shire or Tweed Shire Councils and Roads and Maritime.

6.1.6 PARK-AND-RIDE

While the majority of bus passengers walk or catch taxis to and from the bus stops (to allow them the opportunity to drink alcohol and avoid driving), a small number may choose to drive to the bus. No accurate data is currently known about the percentage of people who choose this option. However, anecdotally it is low.

Assuming 5% car drivers, the number of parked vehicles along the entire routes are approximately:

- | | |
|---|-----|
| — Byron Bay (Suffolk) | 660 |
| — Kingscliff/Casuarina/Cabarita/Hastings Point/Pottsville | 260 |
| — Brunswick Heads | 170 |

— Ocean Shores/South Golden Beach	130
— Mullumbimby	90
— Ballina/Lennox Head	90
— Crabbes Creek	10
— Lismore/Bangalow	20

The smaller numbers can be accommodated on-street with little disruption. The parking number along the Kingscliff/Casuarina/Cabarita/Hastings Point/Pottsville route would be spread between the towns and stops, reducing the impact in any one location. The arrangement would be similar for Ocean Shores/Golden Beach with multiple stops along the route.

Park-and-ride sites in key locations such as Byron Bay and Brunswick Heads could be promoted to increase bus use and reduce traffic congestion in consultation with Byron Shire Council. Such sites could reduce pressure on stops within Brunswick Heads and Byron Bay.

6.1.7 *BUS PRIORITY*

With the increase in bus numbers, the need to keep the bus system moving, and protect it from congestion on the road network becomes more important. The NBP site has been planned with a separate bus access from Tweed Valley Way that is separate from general traffic. This removes them from the queues to enter the NBP site. From the event traffic reports, it is understood that it is not always used for bus access. However, it is an important contingency measure in the event of congestion at Gates C and D and maintain bus movement.

6.1.8 *OTHER EVENTS*

Bus services are expected to be organised for Medium and Large events. However, routes, duration of operation and frequency would be varied to suit the needs of the individual event. Due to the smaller size of the event, dedicated shuttle buses may or may not be provided for Small and Minor events. If they are provided, they would be in the form of charter services to the main centres such as Byron Bay and Brunswick Heads.

6.2 PEDESTRIANS

Due to the distance from large towns and safety concerns for pedestrians walking close to the large volumes of traffic during the pre and post-event period (and night-time event finishes), walking to the NBP site will continue to be discouraged. This also assists in discouraging un-controlled parking in the surrounding roads.

During the trial events, instances have been observed of passengers being let out on Tweed Valley Way and even the Pacific Motorway shoulder. This creates safety hazards for the passenger/pedestrian and the vehicle as it re-joins the traffic stream. With improvements to the management of on-site traffic movement, it is anticipated that these occurrences will diminish.

For Large events (when the desire to use this behaviour is greatest), the event organiser has organised roving patrols to check for passenger drop-offs on the road network, as well as to move on vehicles that look like they are parking in an inappropriate place. It is recommended that these patrols continue until a pattern of positive behaviour is achieved.

6.3 BICYCLES

The 2010 Traffic Impact Assessment described provisions for cycle use to the NBP site as an enjoyable and healthy mode of transport that reduced the number of cars coming to the site. During the trial events, this mode of transport has not been as popular as expected. The NBP site remains supportive of this mode should the future event promoters wish to encourage its use.

6.4 TRANSPORT INCENTIVES

A range of transport initiatives have been tested and successfully implemented during the trial events. These are listed in Table 6.5. New measures that could be implemented to reduce the use of private car (as driver) are also proposed.

Table 6.5 Transport incentives

Method	Details	Used to date	Purpose
Paid parking charges	Parking pass pre-purchased with tickets. Passes are not available at the gate/on the day.	Yes	Financial penalty to encourage use of other modes that have less impact on the road network. Assists in managing traffic coming to site.
Reimbursement of parking charges for vehicles with multiple passengers	Cost of parking pass (partially) refunded for: — Campers' vehicles with three or more people. — Day patrons' vehicles with four or more people.	Yes	Reduces the number of vehicles by providing a financial reward for choosing car passenger as a mode of transport. Reinforces car pooling and ride sharing messages.
Enforcement of on-street parking bans	Special Event Parking Restrictions used for large events. Enforced by local council parking inspectors with back-up from NSW Police if required.	Yes	Has largely eliminated uncontrolled (feral) parking to reduce the impact of the events on surrounding properties.
Event bus with priority	Gate B used for buses entering NBP to avoid queues of cars. Gate A also used at peak times as required) Much cheaper than parking charges. Terminus located the closest to the ticket gates (minimises walking).	Yes	Front-door service in the NBP site with priority that provides a convenient link to the major towns and accommodation locations. Plays a large role in reducing traffic volumes accessing the NBP site.

Method	Details	Used to date	Purpose
Bicycle parking provided	Cycle parking provided within the northern car parking area with close pedestrian access to the ticket gates.	Yes	Whilst the take-up of this option has not been extensive, it is still offered.
Ride sharing (car-pooling)	Ride sharing website provided by event organisers (splendour.lamule.com.au). Website also available to residents of Byron Shire Council (www.nrcarpool.org). Locally run mobile app available (www.miler.me).	Yes	Saves money from travel costs and parking charge reimbursement. Reduces traffic volumes and vehicle emissions.
Kiss-and-ride using event buses	Potential to promote as travel option on event website.	Yes (informal)	Easier passenger drop-off for drivers. Reduces taxi fares.
Park-and-ride using event buses	Potential for designated park-and-ride stops along the event bus routes. Subject to arrangement with Byron Shire Council and Tweed Shire Council or individual land owners.	Not actively promoted or organised	Increases the attractiveness of the event bus network. Avoids NBP site parking charges (may involve smaller fee, TBA). Reduces drive distances after the day's activities when drivers are tired.
Food/drink voucher for vehicles with large numbers of passengers	Rewards for five or more people in a vehicle	No	Increase average people per vehicle over 2.9 for the event as a whole.
Event bus service to Coolangatta	Additional route to the current bus network.	No	Increases the flexibility of the bus network. Accesses large numbers of accommodation rooms and types. Can be express to the Yelgun Interchange.

Some of these measures, such as the cost of parking or number of people per vehicle required to achieve, have the ability to be fine-tuned (within reasonable parameters) to achieve the transport outcomes desired. Parking fee reimbursement and food/drink vouchers for ride sharing need to be priced such that the event bus service is always the cheapest option.

7 Event traffic management

Traffic control has been used in previous events and will be required again in the future. This chapter will outline the traffic control requirements and methodology.

7.1 REGULATORY SIGNAGE AND TRAFFIC CONTROL PLANS

Appendix G provides typical traffic control plans that are to be implemented for festivals at the subject site. However, each festival would need to review, update and issue event specific traffic control plans.

Intersections

For a Large event, Jones Road, Gates C, D and E would have temporary traffic management to guide non-event traffic around queues of event traffic.

The Yelgun Interchange should have traffic controllers or temporary traffic signals in place ready to be activated if monitoring of the Interchange Performance identifies an issue. This would involve holding the northbound Brunswick Valley Way movement and/or northbound exit ramp movement to allow temporary congestion to be relieved.

Monitoring

Monitoring of traffic conditions at Yelgun Interchange traffic movement are recommended at peak times to allow traffic management interventions to be implemented in a timely manner should they be required.

Monitoring is also required of illegal parking on the road network and in the Yelgun Rest Area, passenger drop-off on the road network and traffic conditions on Tweed Valley Way between the Yelgun Interchange and Jones Road, and the operation of the Pacific Motorway.

If any queuing or congestion occurs on Tweed Valley Way, Brunswick Valley Way, Pacific Motorway off ramps, and/or Pacific Motorway, back of queue warning vehicles are to be deployed to warn oncoming traffic of impending queues. On Tweed Valley Way and Brunswick Valley Way this can be done with traffic control vehicles with vehicle mounted warning signs.

The traffic control company that is engaged for an event, would need to have sufficient staff and equipment on standby to be able to enact back of queue protection within an acceptable time frame.

If any queuing is extending beyond the length of the Link Road, then traffic controllers are required on the Yelgun off ramps, to manage queue growth on these off ramps efficiently.

Speed limits

It is proposed to introduce 40 km/h roadworks speed zones on the Pacific Motorway off ramps at Yelgun, on the Link Road and at traffic control locations along Tweed Valley Way. These 40 km/h zones are required to improve the safety of traffic controllers on the roads.

Parking restrictions

A 'No Stopping' zone is proposed from the Shara Boulevard intersection on Brunswick Valley Way and along Tweed Valley Way up to Wooyung Road. 'No Stopping' zones are also proposed for shorter distances along Yelgun Road and Billinudgel Road off Tweed Valley Way.

The 'No Stopping' zones are proposed to limit on-street parking and to enable rangers to issue infringement notices to the owners of illegally parked vehicles. The 'No Stopping' zone along Wooyung Road is also intended as a measure to reduce potential trespassing from Wooyung Road to the festival site through private lands.

Event traffic diversions

The success of the external traffic arrangements hinges strongly on the effectiveness of the patron detours at the southbound Cudgera Creek Road off ramp and the northbound off ramp at Brunswick Heads onto Brunswick Valley Way. At each off ramp, a total of three VMS boards is required to direct patrons to exit the Pacific Motorway at these locations. The VMS boards are to be spaced two kilometres apart, with the third VMS located at the start of the diverge of each off ramp.

One VMS board is proposed at each Yelgun off ramp. Additional VMS boards will be required on Brunswick Valley Way and Tweed Valley Way to enable warning through traffic for potential queueing.

Diversion routes should be inspected in the days leading up to the event to confirm that the route remains suitable as a diversion route.

Directional signage

Sufficient directional signage is also required to be installed, with an emphasis on critical intersections. This will improve the efficiency of these intersections as it will be made clear to patrons which direction to take. Directional signage is to be included in each set of event specific traffic control plans.

7.2 EXTERNAL TRAFFIC MANAGEMENT

- The purpose of traffic control at the Link Road intersection is to improve its efficiency and minimize queuing during events at the site. Traffic controllers are required on all inbound traffic lanes to ensure the safety of the traffic controllers.
- Traffic controllers are also required at the site gates that are in operation during peak arrival times, in order to improve the efficiency of the site gates.
- All traffic controllers external to the site are to be Roads and Maritime certified traffic controllers.

7.3 INTERNAL TRAFFIC MANAGEMENT

Roads and Maritime certified traffic controllers are required on site at critical intersections where interaction of large traffic volumes (including pedestrians) is anticipated. All other on-site traffic controllers are not required to have Roads and Maritime certification.

It is typical for events at the site, that various components of the traffic flow are managed by different teams. Roads and Maritime certified traffic controllers manage external traffic, volunteers direct traffic through the site and there is a team for parking vehicles (consisting of a mix of volunteers and paid staff for ticketing purposes). For the efficient management of traffic, it is essential that an experienced traffic manager is present, who oversees the traffic management from the Motorway to the car parks. This traffic manager liaises with all relevant teams as well as with festival management, local Councils and Roads and Maritime.

All traffic related incidences or congestion would need to be processed through the traffic manager. However, the traffic manager must always delegate the solving of individual problems to others and continue to inspect the entire traffic management envelope at all times to identify any other issues as they may occur simultaneously.

7.4 COMMUNICATION

All events of a size Small to Large will have a Traffic Management Plan prepared and approved prior to implementation.

Communications are to be provided to patrons and drivers dropping off or collecting passengers, as well as the general public. All communications should be provided to the NSW Police, Roads and Maritime and Byron Shire Council and Tweed Shire Council representatives, in advance of being sent if possible.

Information will be provided in a manner appropriate to the level of urgency:

- Long-term notification of other road users of the event and likely traffic impacts through newspaper advertisements, and notices on Byron Shire Council and Roads and Maritime websites.
- Medium-term notification and publishing of information via the event internet site to include travel arrangements, bus times and network information, park-and-ride and kiss-and-ride options, maps with preferred routes by mode and notifications of any restrictions – e.g. no dropping passengers on the side of a road outside the site, re-entry restrictions for vehicles leaving the site between 11.00 am and 6.00 pm, etc.
- Real-time notification of drivers. Variable Message Signs would be placed on the Pacific Motorway north and south of the Yelgun Interchange, prior to the Cudgera Creek Interchange and Brunswick North Interchange, and on Tweed Valley Way and Brunswick Valley Way.
- Short-term notifications using text messages to pre-registered patrons, social media postings, push notifications via the Event's App, etc. to transmit any urgent information regarding incidents

7.5 CONTINGENCIES

The following contingency measures are proposed for the site should unpredicted traffic conditions occur:

- If adverse queuing is observed at the Yelgun Interchange, roundabout metering should be applied to hold the northbound movement on Brunswick Valley Way and/or the northbound exit ramp movement until queuing is back to appropriate levels. The conditions that may trigger this action are most likely to occur on the Friday, Saturday and Sunday between the hours of 12.00 pm and 5.00 pm.
- If the operation of Tweed Valley Way, the Yelgun Interchange or the Pacific Motorway are being compromised during the Monday camper departure, the rate of camper vehicles leaving the site to the south (Gate D) should be restricted until appropriate performance is achieved. This is likely to increase the clearance time for the site, increasing delays for departing patrons. Notifications should be made using the short-term communications methods if this is put in place.
- At a more strategic level, if the site is unable to achieve the changes in travel behaviour necessary to achieve the proposed KPIs, consideration should be given to the upgrading of infrastructure, such as the widening of Tweed Valley Way in the northbound direction between the Yelgun Interchange Link Road and Gate D.

8 Conclusions

NBP is seeking development consent and associated Concept Plan Modification for the permanent use of the North Byron Parklands (Parklands) site at Yelgun. The site has been hosting large cultural events at the site since being given approval in April 2012. With continual refinement, the site has demonstrated that it can successfully host large events for a limited number of days per year.

Trial events

Nine large and medium trial events have been held to date at NBP between 2013 and 2017. Data gathered from these events indicates some consistent transport parameters for the site which were considered with some uncertainty in the assessments of the original application, including:

- Average car occupancies have been approximately equal to the maximum rates anticipated during the 2010 TTA – i.e. around 2.9 for day patrons and 2.74 for campers.
- Bus mode share has been higher than anticipated for day patrons (63% versus between 39% and 56%), but lower for campers (2% versus 7% to 22%), due to the practical requirements of camping equipment.
- At times of large-scale departure of patrons from the site, the road network has a threshold of how much outbound traffic it can accommodate.
- The strategy of diverting off the Pacific Motorway to Tweed Valley Way and Brunswick Valley Way at the preceding interchange has been successful in reducing the pressure on the Yelgun Interchange during peak patron arrival.

The patrons at the events held to date have been supportive of the transport initiatives used to increase ride sharing and bus use. This combined with adaptable traffic management that has applied lessons learnt from previous events, has meant that each of the events has been run relatively smoothly with few adverse impacts on the road network. When impacts have occurred, the event promoters and NBP site management team have reacted in a short period of time to correct the issue at the time or by the next day's peak period. These trials have established that the site can host large events. They also provide data from which to plan the 50,000 patron permanent events.

Travel behaviour

NBP is proposing a broad range of event sizes and durations, which will have different transport behaviours. Preliminary modelling indicated that the 42,500 patron event size could occur in the future (up to 2037) using the existing established travel parameters without having an impact on achieving the KPIs. However, the 50,000 patron event would require a mode share change of an additional 10% to buses to achieve a similar level of impact to the 42,500 patron event, i.e.:

- 73% bus mode share and an average car occupancy of 2.9 persons per car for day patrons
- 5% bus mode share and an average car occupancy of 2.74 persons per car for campers.

In addition, the amount of traffic coming and going at the site gates (not associated with patron arrival or departure, site servicing, buses, statutory management vehicles, etc.) is proposed to be restricted during the hours of 11:00am to 6:00pm to reduce the peak impact of the site. The restriction would have a target of reducing this amount of traffic by 55% by 2037.

Site access and layout

The usage of the existing gates will remain as approved. However, the types of traffic using Gates B, C and D will be managed to control traffic release onto the road network and manage delays within the site.

A changed use of the Emergency Vehicle Gate – Gate E is proposed to allow access for camper and day patron parking at the northern end of the site. The anticipated number of vehicles using Gate E is small in comparison to the other gates as it would only serve the Tweed Coast catchment.

Improved surfaces and drainage on key internal roads are planned to improve their traffic carrying capacity. The Spine Road is expected to have sufficient capacity to accommodate peak north-south traffic within the site at a LoS D. A roundabout is planned within the site to control vehicle distribution in the southern portion of the site.

Traffic impacts

The capacity analysis of Tweed Valley Way, the Pacific Motorway and the Pacific Motorway Yelgun Ramp merges has been undertaken to determine the impact of the 50,000 patron Large event using forecast traffic volumes on the road network with traffic growth to 2027 and 2037. They have indicated:

- The Pacific Highway capacity would not be affected. One instance of a Level of Service D was assessed during the Monday morning camper departure in 2037. Traffic monitoring of Pacific Highway conditions would allow the departure rate of campers to be reduced if congestion issues are experienced.
- The Pacific Motorway ramp merge and diverge areas perform well. The southbound diverge areas at the Yelgun Interchange experience a Level of Service D. However, the impact on average speeds is small – 3 km/h.
- The operation of Tweed Valley Way would change from LoS D to LoS E with the 50,000 patron event. LoS E would be experienced for three hours in the middle of the day in 2027 and four hours by 2037. Travel speeds are not expected to drop below the temporary special event speed limit of 40 km/h during this time. The impact would therefore be constrained travel for the section between the Link Road roundabout and Gate D. Given that this impact would be experienced for a handful of hours across the year, it is considered reasonable for a state significant large special event. If issues with the capacity of Tweed Valley Way persist and cannot be addressed by changes in the travel behaviour of event patrons, then options such as the widening of Tweed Valley Way to two lanes northbound on this section would be considered.
- The operation of the Cudgera Creek Interchange and Brunswick North Interchange roundabouts would not be adversely affected by the event traffic.
- Queuing on the Yelgun Interchange Link Road would extend through the main Yelgun Interchange roundabout on the Friday afternoon peak in 2027 and the Friday afternoon and Sunday early afternoon peaks in 2037. However, the queues wouldn't encroach on the safe stopping sight distances for the Pacific Motorway exit ramps. Roundabout metering by traffic controllers or temporary traffic signals could be used to manage queues if they become excessive.

While some impacts are higher than usually accepted for a continuously used permanent development, it should be acknowledged that the times of greatest impact would only be experienced for a few hours/days per year. During these special events it is not unreasonable to experience some small deterioration in conditions below the standard/ideal levels, as would be experiences at a major sporting/cultural event facility elsewhere in the State.

To recognise the special event nature and the limited times when peak impacts would be experiences, a revised set of the Key Performance Indicators are proposed.

The conclusions regarding the 50,000 patron event to meet the Key Performance Indicators approved for the trial events are outlined in Table 8.1.

Table 8.1 Ability to meet Key Performance Indicators

Key Performance Indicator	Conclusion for 50,000 patron event	Location in report
1 All movements at the Yelgun interchange including merges and diverges need to operate at Level of Service C or better for delay;	SIDRA intersection modelling and HCM capacity calculations indicates that all movements within the Yelgun Interchange would operate at LoS C or better apart for some occurrences of LoS D at the southbound diverge on the Pacific Motorway at Yelgun Interchange. However, the speed drop is only minor.	Sections 5.7.2 and 5.8
2 The level of service for local traffic and through traffic on the Tweed Valley should not fall below Level of Service D; (800 vph at 40 km/h, 1260 vph at 60 km/s);	The HCM capacity calculations indicates that Tweed Valley Way would operate at LoS C to LoS E at peak times. However, traffic could continue to move at a reasonable speed no less than the temporary special event speed limit.	Section 5.7.3
3 Queue lengths on the link road between Tweed Valley Way and the Yelgun interchange must be limited to a maximum of 70 m (reduced to 60 m by the upgrade of the intersection to roundabout control);	The maximum queue length on the Link Road would exceed this length at peak times. However, the resulting queues on the exit ramps would remain within safe distances. With the application of roundabout metering, this could be reduced to 55 m.	Section 5.8
4 Results in a Queue Length (95% back of queue in metres) of no more than 210 metres from the Give Way yield line on the northbound off-ramp;	Queues on the Pacific Motorway Northbound off-ramp at the Yelgun Interchange are forecast at less than 210 m, with or without the use of roundabout metering on this ramp.	Section 5.8
5 On site queuing is not to extend onto the Pacific Motorway or the Tweed Valley Way;	Experience has been used from previous trial events to improve on-site traffic management. Changes made to increase the capacity of the Spine Road and reduce traffic crossing from the southern	Sections 4 and 7

Key Performance Indicator	Conclusion for 50,000 patron event	Location in report
	to the northern part of the NBP site have been successful.	
6 There is to be no impact on through traffic travel times of the Pacific Motorway:	HCM capacity calculations indicates that the Pacific Motorway would operate at LoS C with or without the 50,000 patron event at the times modelled. The one exception is southbound, south of the Yelgun Interchange which would dip to LoS D. However, the average speed would remain above 100 km/h indicating a moving stream of traffic.	Section 5.7.1

An assessment of the trip generation of the development has shown that the smaller events planned for the site would not have a significant impact on the surrounding road network.

Impact on other road users

A range of measures similar to those used for the trial events would be used for a 50,000 patron event to limit the impact on non-event road users. Restricted access to Yelgun Road and Jones Road should prevent event patrons using these roads for parking. Residents and their guests would be provided with permits to allow them to enter. Traffic controllers would assist the small number of vehicles turning out of Yelgun Road and Jones Road if their delay becomes excessive.

Residents of the surrounding villages would experience some traffic delays during peak event times. However, public notices about the events would highlight this impact and suggest that trips be made during other times to avoid delays where possible. The largest impacts would only be experienced for a few days per year. The peak times are likely to occur at different times to the regular traffic peaks, and are unlikely to have a significant impact during before and after school times. Traffic management arrangements would seek to minimise the impact on non-event related traffic by allowing it to bypass the traffic queues.

Buses

The event shuttle bus network has been an essential component of the NBP sites strategy to minimise its traffic impact since the first trial event in 2013. This bus network can be expanded with higher frequency to meet the needs of the 50,000 patron event.

The existing infrastructure built for buses on-site has sufficient capacity to cater for the increase in buses. Stops within the surrounding towns are likely to have sufficient capacity to accommodate the increase number of buses starting/finishing at the stops.

Transport initiatives

- Tried and tested:
 - paid parking charges
 - reimbursement of parking charges for vehicles with multiple passengers
 - enforcement of on-street parking bans
 - event bus with priority

- bicycle parking provided
- ride sharing (car-pooling)
- May be occurring, but could be actively promoted:
 - park-and-ride using event buses
- Could be implemented:
 - food/drink voucher for vehicles with large numbers of passengers
 - event bus service to Coolangatta.

Event traffic management

Traffic control would be required at Jones Road and on Gates C and D during the 50,000 patron event in order to manage delays for Yelgun Road residents and for traffic exiting Gate C. Modelling shows that these delays can be managed in a satisfactory manner.

Monitoring of the performance of the Yelgun Interchange and Link Road intersection with Tweed Valley Way are required to ensure that excessive queues do not build up for the 50,000 patron event.

Roads and Maritime certified traffic controllers are required at critical intersections in the southern car parking area, to ensure efficient management of internal traffic conflicts and thus minimize any risks of on-site queuing extending onto Tweed Valley Way.

8.1 REVISED KEY PERFORMANCE INDICATORS

Based on the results of the traffic analysis in this study and discussions with Roads and Maritime Services, Byron Shire Council and Tweed Shire Council, the following revised set of Key Performance Indicators (KPIs) associated with traffic management and car parking are proposed for the future events:

- 1 all movements at the Yelgun Interchange including merges and diverges need to operate at Level of Service C or better for delay
- 2 the level of service for local traffic and through traffic on the Tweed Valley Way should not fall below Level of Service D in general across the day
- 3 the level of service for local traffic and through traffic on the Tweed Valley Way should not fall below Level of Service E for more than four hours during the day
- 4 queue lengths on the link road between Tweed Valley Way and the Yelgun Interchange must be limited to a maximum of 60 metres
- 5 queue length (95% back of queue in metres) of no more than 210 metres from the Give Way yield line on the northbound off-ramp of the Yelgun Interchange
- 6 on site queuing is not to extend onto the Pacific Motorway or the Tweed Valley Way
- 7 no appreciable impact on through traffic travel times of the Pacific Motorway.

These KPIs are considered realistic and appropriate for a special event size with a small number of peak event days across the year. They are proposed for further discussion with Roads and Maritime Services.

8.2 LIST OF RECOMMENDATIONS

Events and timing:

- The 50,000 patron event can operate successfully provided the following steps are taken to:
 - Reduce the amount of traffic generated by the site during peak times by restricting the amount of coming and going movement from the site between 11.00 am and 6.00 pm.
 - Reducing the mode share of day patrons arriving by car (for parking) and drop-off by a combined 10%.
- The Medium, Small and Minor events are forecast to have lower traffic generation rates than existing trial events (which are performing satisfactorily) and are therefore not considered to require additional traffic modelling.
- It is recommended that no restriction be placed on the dates for Medium Small and Minor events.

Intersection operation:

- Use traffic control during Large events to manage the left-turn queue on the Yelgun Interchange Link Road onto Tweed Valley Way by temporarily stopping the northbound movement on Brunswick Valley Way.
- Monitor the performance of the Yelgun Interchange and intersection of the Link Road with Tweed Valley Way during peak times for large events and one-day medium events.
- Improve sight distance at Gates C and D by trimming vegetation.

Bus network:

- Increased bus frequency is needed to accommodate the increased demand for the 50,000 patron event. Increased bus servicing to be considered for Medium and Small events if appropriate.
- Park-and-ride sites at Byron Bay and Brunswick Heads be investigated in consultation with Byron Shire Council or Tweed Shire Council.
- An additional route to Coolangatta be considered if demand is anticipated from patrons staying in the area for a 50,000 patron event.

Transport initiatives

- A range of transport initiatives are proposed as outlined in Table 6.5.

Event traffic management:

- During peak arrival periods, all patron traffic (day patrons) arriving through Gate D are to be parked in the southern car parks for large events.
- Each small sized or larger (i.e. over 1,500 patrons) event held at the site would require a Traffic Management Plan that details how the parameters of the Traffic and Transport Assessment would be met.

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APPENDIX A

SUMMARY OF TRIAL EVENT OPERATION



This appendix presents summaries of the following trial events held at the NBP site:

- 1 SPLENDOUR IN THE GRASS 2013
 - 2 FALLS FESTIVAL 2013/14
 - 3 SPLENDOUR IN THE GRASS 2014
 - 4 FALLS FESTIVAL 2014/15
 - 5 SPLENDOUR IN THE GRASS 2015
 - 6 FALLS FESTIVAL 2015/16
 - 7 SPLENDOUR IN THE GRASS 2016
 - 8 FALLS FESTIVAL 2016/17
 - 9 SPLENDOUR IN THE GRASS 2017
-

A1 SPLENDOUR IN THE GRASS 2013

Held in July 2013, Splendour in the Grass 2013 was the first large trial event with an approved patronage up to 25,000 patrons. This patronage consisted of 15,000 camping patrons and 10,000 day patrons. In addition, it is understood that some 1,200 support staff personnel was on site.

A1.1 TRAFFIC PLANNING AND SETUP

In preparation of this event, traffic planning was carried out based on the *North Byron Parklands Traffic Impact Assessment* by Parsons Brinckerhoff, which was published in July 2010. Combined with local experience with similar events in this region and previous Splendour in the Grass festivals, a set of parameters was established. These parameters included modal splits, vehicle occupancy and origin distribution. These parameters were used to estimate peak traffic flows, in particular on the Yelgun Interchange and Link Road intersection.

In order to increase the capacity of the Yelgun Interchange to cope with peak traffic loads during patron arrival, a system of water filled barriers was designed and installed, that delayed the merging of traffic from both Yelgun off ramps to a point close to the Billinudgel Road underpass on Tweed Valley Way. This enabled control of any queuing due to arrival peaks and increased queuing capacity for the southbound off ramp by several hundred metres.

Additionally, a 150 m long right turn lane was created using water filled barriers in the northbound lane of Tweed Valley Way for the right turn into Gate D. Due to limited length of the Gate C CHR(S) turn, this additional right turn lane was deemed necessary to limit queuing on Tweed Valley Way.

A 40 km/h roadworks speed zone was introduced from Brunswick Valley Way at the Link Road on Tweed Valley Way to Gate B, in order to reduce risks associated with queuing and provide a safe working environment for traffic controllers.

As festival management had proposed to check camper vehicles prior to admitting these into the camping area, several checking stations were set up to ensure sufficient capacity to prevent any queuing from these stations. Campers were not allowed to park their cars at their tents and were required to park in a separate car parking area.

A1.2 FESTIVAL PERFORMANCE

Due to a combination of factors, such as limited capacity of the camping area to cope with arriving traffic flows and drug dog operations at the car checking stations, the inaugural site layout design for this festival was not able to cope with the magnitude of arriving traffic flows. As a result, on Thursday and Friday afternoons and evenings, significant queueing extended from the site onto Tweed Valley Way and then onto Brunswick Valley Way and both Yelgun off ramps. This congestion was significant, but no traffic accidents were recorded as a result of these issues. On Wednesday, Saturday and Sunday no congestion issues were experienced.

On Monday, the day of camper departure, departing vehicle traffic volumes were throttled back to protect the right turn off Tweed Valley Way onto the Link Road from excessive queueing. Some queueing was experienced on Tweed Valley Way but this was limited to short duration queues. As the Spine Road on the site was in poor conditions in some locations, the emergency access to Wooyung Road was opened up for departing traffic as well. This resulted in congestion in Pottsville. We understand also that a rear-ender accident occurred as a result of the short-term queueing into Pottsville, along Tweed Coast Road.

A2 FALLS FESTIVAL 2013/14

The first medium trial event was held over the New Year holiday period of 2013/14. The annual Falls Festival is a festival that is held annually in Lorne, VIC and Marion Bay, TAS. It was first held at NBP as the first medium trial event, with an approved patronage of 15,000, of which 13,000 3-day campers and 2,000 single day and 2 day patrons.

A2.1 TRAFFIC PLANNING AND SETUP

Following the traffic congestion experience during SITG 2013, the site layout and operations were radically changed for the 2013/2014 Falls Festival. Campers were not allowed to park their cars at their tents and were required to park in a separate car parking area. A new site planning philosophy was also introduced, that arriving patrons should not be interrupted and queried by staff until they had parked their cars. The checking of parking passes and luggage would be carried out in the car park, after parking the cars.

A configuration of water filled barriers was installed at the Yelgun Interchange, similar to the SITG 2013 event. However, a combination of large and small barriers was used, in order to improve driver sight distance and visibility. Also improved directional signage was installed on the off ramps to advise local traffic of the changed traffic conditions in operation.

A2.2 FESTIVAL PERFORMANCE

A significant improvement was achieved on site with respect to traffic operations during SITG 2013. Although some 'conversation points' were maintained (some by volunteers, others by staff), which limited on-site through flow capacity to approximately 400 vehicles per hour, this limitation did not result in any queueing on the public road network. As a result, all key performance indicators were complied with during patron arrival periods and the event was a success from a traffic operations perspective.

It was found however, that some vehicle processing did occur on the internal primary access road to the parking areas. Also service vehicles caused delays on the main car parking roads, in particular next to amenity blocks where waste trucks would be present to pump out liquid waste.

Camper departure was on Friday. This was managed in a similar fashion as per the SITG 2013 event. After some adjustments, it was found that the critical departure rate through Gate C was 700 to 750 vehicles per hour. Flows higher than this would cause queuing on Tweed Valley Way and associated short term exceedances for the Level of Service and queuing KPI's for Tweed Valley Way. As it was a particular hot day, the delayed departure of campers resulted in annoyance and discomfort amongst festival patrons on Friday.

A3 SPLENDOUR IN THE GRASS 2014

The second large trial event at the site was Splendour in the Grass 2014, held in July 2014. The approved patronage for this event was 27,500, comprising of 17,500 campers and 10,000 day patrons.

A3.1 TRAFFIC PLANNING AND SETUP

Continuing on from the progress made between SITG 2013 and Falls Festival 2013/14, a similar site layout was adopted to the Falls Festival 2013/14, such that camper parking was separate from camping. The barrier configuration was adopted for the Yelgun Interchange as well as at Gate D, similarly to previous festivals.

A3.2 FESTIVAL PERFORMANCE

Some queuing on the internal Spine Road back to the tunnel was observed as a result of limited capacity in the car park area to park camping vehicles. This capacity limitation was due to a combination of issues with the mobile ticketing system and insufficient staff. This issue was corrected and the queue did not grow onto the public road network.

There was a car accident in the northbound lane on the Pacific Motorway at Ocean Shores on the Friday afternoon. This resulted in delays for northbound traffic for some period of time. When the road was cleared and northbound traffic could continue as normal, a large amount of traffic exited the Pacific Motorway using the northbound off ramp at Yelgun as a result of this sudden release of traffic. In order to prevent any queuing on the off ramps, traffic was held back on Brunswick Valley Way for a short period of time. This allowed traffic from the northbound off ramp to travel onto Tweed Valley Way without interruption. This was the only congestion experienced on the public road during camper's arrival.

On the Monday, camper departure rates were restricted to ensure the vehicle density on Tweed Valley Way would be sufficiently low. Occasionally, the Level of Service KPI was exceeded, but this did not result in any significant queuing. It was found that the departing traffic flow needed to be restrained to approximately 800 vehicles per hour in order to ensure acceptable Level of Service on Tweed Valley Way.

In general, the traffic operations for this festival were a success, although further improvements were identified that could be implemented for future on-site traffic operations.

A4 FALLS FESTIVAL 2014/15

Falls Festival 2014/15 was the second medium trial event at NBP, with an approved patronage of 17,500. The patronage was split between roughly 15,000 campers and 2,500 one or two day patrons.

A4.1 TRAFFIC PLANNING AND SETUP

Due to the relatively low traffic volumes during the previous medium trial event, it was concluded that the barriers at the Yelgun Interchange and Link Road intersection would not be required. Also, a trial was carried out whereby festival patrons travelling from the North along the Pacific Motorway were encouraged to exit the Pacific Motorway at the Cudgera Creek Road exit. Three Variable Message Signs (VMS) were placed on the Pacific Motorway to the North of the Cudgera Creek Road exit to convey the message to patrons to use this alternative route.

A4.2 FESTIVAL PERFORMANCE

No congestion issues were experienced on the public road network during the arrival periods of the festival. The trial of incorporating the Cudgera Creek Road exit was a success. Approximately two-thirds of patrons from the North exited the Pacific Motorway at that location.

A reduction in private vehicle occupancy was measured as is outlined in Table 2.1.

The camper departure day was on the Saturday. The background traffic on Tweed Valley Way was relatively low. As a result, no restrictions needed to be in place for the exiting traffic through Gate C and Gate D. Also, a significant percentage of traffic turned right out of Gate C as they had arrived on site using that same route. Also signage was in place to encourage this behaviour.

The 15 minute average vehicle speed on Tweed Valley Way remained above 54 km/h at all times. Although some short term exceedances of the Level of Service were recorded, the additional delay calculated as a result was approximately 8 seconds.

A5 SPLENDOUR IN THE GRASS 2015

Splendour in the Grass 2015 was the third large trial event at NBP and was held in July 2015. It had an approved patronage of 30,000, of which approximately 17,500 campers and 12,500 day patrons.

A5.1 TRAFFIC PLANNING AND SETUP

Due to the success of the use of the Cudgera Creek off ramp during Falls Festival 2014/15, this arrangement was incorporated for SITG 2015 event. In order to further relieve pressure on the Yelgun Interchange, patrons from the South were encouraged to exit the Pacific Motorway at the Riverside Crescent exit at Brunswick Heads. As a result, it was decided to not install the water filled barriers at the Yelgun Interchange.

A5.2 FESTIVAL PERFORMANCE

There was wet weather in the local area leading up to the event. Although the majority of the internal roads held up well, some sections of the internal roads suffered under the traffic load during camper arrival. Also the car parking areas were wet and their capacity to cope with a large influx of vehicles was limited. Camping car parking occurred at a reduced rate, resulting in queuing on the Spine Road. This queue grew onto the public road network and extended on Tweed Valley Way and Brunswick Valley Way on the Thursday afternoon. On the Friday, queuing was observed on Tweed Valley Way at the frontage to the site due to the high traffic volumes exiting through Gate C and all inbound traffic being directed to Gate D only.

It was also found that at night time on event days, the Spine Road was saturated with traffic. This traffic was associated with vehicles (buses, taxis and private cars) picking up departing patrons.

During campers' arrival, the use of the Cudgera Creek Road Pacific Motorway exit and the Brunswick Heads Pacific Motorway exit was a success. Of camping patrons arriving from the Pacific Motorway from the South on Wednesday and Thursday, 88% used the Brunswick Heads off ramp and only 12% continued to the Yelgun northbound off ramp. Less than a quarter of patrons arriving from the North used the Yelgun southbound off ramp.

It was found however that the use of the Yelgun Interchange by day patrons coming from the north increased over Friday, Saturday and Sunday, indicating that the repeatability of these detours is somewhat limited. An increasing portion of returning patrons found that the route to the Yelgun Interchange exits would be quicker than the detours, and therefore ignored the VMS messages at the detour exit locations.

Camper departure on the Monday was a success. A relatively large component of campers departed Gate C to the North, reducing the pressure on the Link Road intersection. The throttling back of traffic departing through gates C and D was not required.

The car occupancy of campers was surveyed by NBP staff during campers' departure on the Monday. With a sample size of 2,300 vehicles, an average car occupancy of 2.68 people per vehicle was calculated.

Traffic counts of vehicles entering and leaving Gates C and D were taken capturing the vast majority of traffic (did not capture bus and service vehicle entry via Jones Road or Gate B, or entry via the emergency gate). The results are shown in Table A.1.

Table A.1 Daily traffic counts at Gates C and D at 2015 SITG

Day	In (Gates C and D)				Out (Gates C and D)			
	Cars	Rigid truck/ bus	Articulated truck	Total	Cars	Rigid truck/ bus	Articulated truck	Total
Tuesday, 21 July 2015	1,010	199	19	1,228	871	220	9	1,100
Wednesday, 22 July 2015	2,952	259	29	3,240	1,047	209	14	1,270
Thursday, 23 July 2015	6,400	334	26	6,760	1,700	345	14	2,059
Friday, 24 July 2015	6,470	268	13	6,751	4,251	746	13	5,010
Saturday, 25 July 2015	5,768	480	20	6,268	5,413	721	19	6,153

Day	In (Gates C and D)				Out (Gates C and D)			
	Cars	Rigid truck/ bus	Articulated truck	Total	Cars	Rigid truck/ bus	Articulated truck	Total
Sunday, 26 July 2015	6,003	440	16	6,459	7,437	809	29	8,275
Monday, 27 July 2015	1,494	171	18	1,683	7,931	782	55	8,768

Source: Data: Greg Alderson & Associates, Analysis: WSP Australia

Traffic flow changes across each day, with different peaks corresponding to different types of trips.

A6 FALLS FESTIVAL 2015/16

Falls Festival 2015/16 was the third medium trial event at NBP, with an approved patronage of 20,000. The campgrounds opened on Wednesday 30 December 2015, although the event days did not start to the following day (Thursday 31 December 2015). Performances finished on Saturday 2 January 2016, and the site closed on Sunday 3 January 2016.

A6.1 TRAFFIC PLANNING AND SETUP

A new 'stacked' layout for campers and their vehicles (parked alongside camping space) was trialled and appeared to work successfully. The arrival of campers occurred efficiently, with sufficient staffing to ensure minimal queuing of camper's vehicles. The results indicate that the arrangement could be scaled up to a larger crowd size with appropriate staffing.

VMS boards directed patron's vehicles to exit the Pacific Motorway before the Yelgun Interchange. The results of traffic surveys indicate that they successfully influenced driver decisions, with 68% of northbound traffic and 76% of southbound traffic using an interchange before the Yelgun Interchange.

A6.2 FESTIVAL PERFORMANCE

The arrival of patrons occurred without significant delays or queuing. The combination of slightly lower camper numbers than expected and the departure on a Sunday resulted in minimal traffic issues on departure. The Wooyung Road emergency gate was opened for camper departure by NSW Police, supported with stop signs and a 60 km/h roadworks speed limit. Traffic data from Gate C indicates that approximately a quarter of traffic turned right (northbound) and three quarters turned left (southbound). Gate D was opened at around midday for a short period to increase the departure rate of vehicles from the site. Queuing at the one-lane roundabout at the intersection of Tweed Valley Way and the Yelgun Interchange Link Road was contained within the right-turn bay length.

Private vehicle occupancy remained at approximately 2.4 people per vehicle, the same as the previous years' festival.

Traffic conditions on Tweed Valley Way remained at Level of Service C or better during the departure. Roadworks associated with the upgrade of the Pacific Motorway around the Ewingsdale Interchange resulted in some queuing. While event patrons would have been included in these queues, they were not the cause of the delays.

A7 SPLENDOUR IN THE GRASS 2016

Splendour in the Grass 2016 was the fourth large trial event at NBP and was held in July 2016. It had an approved patronage of 32,500, of which approximately 20,000 campers and 12,500 day patrons.

A7.1 TRAFFIC PLANNING AND SETUP

The plan to divert event traffic (arriving from the north and south) off the Pacific Motorway before it arrives at the Yelgun Interchange was continued from previous years, which took pressure off the Yelgun Interchange.

A new layout for campers within the site was trialled, with parking for approved campers' vehicles adjacent to their camping space rather than in a separate parking area. This changed their path within the site, which required a different location for vehicle processing and inspection. These new arrangements worked well.

During the event (between performance days), a change to the location of taxi, ride-share and private vehicle passenger drop-off and pick-up from the northern part of the site to the southern was required to respond to an unexpected increase in use of this mode of transport. These changes reduced congestion around the bus station and event entry, which addressed the traffic issues experienced on the Friday (see below for details).

A7.2 FESTIVAL PERFORMANCE

Traffic arrangements during the campers' arrival worked well with no issues observed or reported on the Wednesday and Thursday.

On the Friday, small occurrences of patrons being dropped off in the Yelgun Rest Area and along Tweed Valley Way were observed.

An unexpected mode shift for day patrons to passengers being dropped off and picked up on the Friday led to congestion within the site at the end of the day. The arrangement for vehicles dropping off and picking up patrons was that they entered the site from Gate C and travelled up the spine road to a dedicated area south of the bus stops before returning south along the spine road and out Gate C (same as previous years). However, increased numbers of patrons using this option via taxi, private car and an increase in the popularity of ride-sharing services were observed during the afternoon on the Friday (after about 2.00 pm). Additional congestion at the north end of the site resulted in increased queuing on Tweed Valley Way for the turns into the site during the afternoon (at around 3.30 pm). At the peak, the northbound queue extended to north of the roundabout at the Link Road.

At the end of the day's performances, the return of the vehicles picking up patrons caused congestion at the Gate C exit, which extended along the Spine Road, blocking the movement of buses and causing delays and frustration for patrons trying to leave the site. Some people were observed walking along Tweed Valley Way from the site, with some hitchhiking observed.

Arrangements that had originally been planned for the 100% capacity (50,000 patrons) site were put in place to address these issues on the Saturday. This involved relocating the taxi stand and passenger drop-off/pick-up area to the southern parking area with adjustment to the location of parking.

This had a positive impact in reducing congestion on the spine road in the northern part of the site, but the configuration of the drop-off area resulted in queuing out of the site onto Tweed Valley Way from 3.30 pm. At its peak, the queue extended back along Tweed Valley Way, the Link Road and reached the Pacific Motorway northbound off-ramp, but did not queue onto the Motorway itself. Roads and Maritime Services placed a vehicle with a warning message on the Motorway prior to the northbound off-ramp. A traffic controller was deployed to the Tweed Valley Way/ Brunswick Valley Way/Link Road roundabout to hold the northbound traffic on Brunswick Valley Way to allow the queue to dissipate. By 5.00 pm, the queue has dissipated sufficiently to no longer affect the Yelgun Interchange or Link Road. The evening departure was improved with the modified arrangements for passenger pick-up.

Further changes were made on the Sunday to provide more queuing space for vehicles dropping-off passengers in the southern parking area. Traffic conditions on the Sunday were observed to be good without any substantial queuing on Tweed Valley Way or the surrounding roads.

Camper departure on the Monday operated smoothly. The Emergency Access Road to Wooyung Road was opened by NSW Police for a short period around 10.30 am to assist camper departure at a controlled rate (approximately 40 vehicles per 5 minutes) to ensure that the flow-on impact of event-related traffic in Pottsville was minimal.

Traffic impacts at the Yelgun Interchange were also minimal, with traffic moving well throughout the day. The newly constructed roundabout at the Tweed Valley Way/Link Road intersection performing well. The traffic flow out of the site was predominately limited by the rate at which vehicles exited the site itself. Both Gates C and D were used.

The car occupancy of campers was surveyed by NBP staff during campers' departure on the Monday. With a sample size of 815 vehicles, an average car occupancy of 2.63 people per vehicle was calculated.

Traffic counts of vehicles entering and leaving Gates C and D were undertaken capturing the vast majority of traffic (did not capture bus and service vehicle entry via Jones Road or Gate B, or entry via the emergency gate). The automatic traffic counter tubes at Gate C were damaged on Saturday 23 July 2016. The traffic volumes during the period where the tubes were damaged has been estimated from the surrounding traffic counts and data from previous years. The results are shown in Table A.2.

Table A.2 Daily traffic counts at Gates C and D at 2016 SITG

Date	In (Gates C and D)			Out (Gates C and D)		
	Day (5am to 9pm)	Night (9pm to 5am)	Total	Day (5am to 9pm)	Night (9pm to 5am)	Total
Tuesday, 19 July 2016 ¹	1,381	26	1,407	1,200	58	1,258
Wednesday, 20 July 2016 ¹	3,430	298	3,728	1,302	189	1,490
Thursday, 21 July 2016 ¹	7,112	691	7,803	1,915	699	2,615
Friday, 22 July 2016 ¹	6,929	1,136	8,065	3,842	3,344	7,186
Saturday, 23 July 2016 ¹	5,776	1,505	7,281	4,111	3,847	7,958
Sunday, 24 July 2016	6,604	1,700	8,304	4,721	3,923	8,644
Monday, 25 July 2016	1,390	0	1,390	7,775	0	7,775 ²

Source: Data: Greg Alderson & Associates, Analysis: WSP Australia

- (1) 2016 SITG data for inbound Tuesday to Friday and outbound Tuesday to Saturday affected by counter malfunction. Data for 2015 SITG used and factored up based on increased number of people on site
- (2) Includes approximately 200 vehicles directed to exit through the Emergency Exit by NSW Police

A8 FALLS FESTIVAL 2016/17

Falls Festival 2016/17 was the fourth medium trial event at NBP, with an approved patronage of 22,500. The patronage was split between roughly 20,000 three-day patrons, 2,250 two-day patrons and 250 one day patrons.

The campgrounds opened on Friday 30 December 2016, with the event days from Saturday 31 December 2016 to Monday 2 January 2017. The site closed on Tuesday 3 January 2017. It was estimated that there was approximately 3,000 staff, stallholders, contractors and guests on site.

A8.1 TRAFFIC PLANNING AND SETUP

Campers were once again allowed to park alongside their camping space. Departing traffic was split into two lanes for right and left turns at Gate C. VMS boards directed patron's vehicles to exit the Pacific Motorway before the Yelgun Interchange. The results of traffic surveys indicate that they successfully influenced driver decisions, with 83% of northbound traffic and 66% of southbound traffic using an interchange before the Yelgun Interchange.

A8.2 FESTIVAL PERFORMANCE

The arrival of campers occurred on the Friday, with approximately 60% of patrons arriving. Queuing on Tweed Valley Way at Gate C into the site was minimal (approximately three vehicles) due to traffic controller direction. During the event days, exiting traffic was split into two lanes, which operated effectively. Little traffic used Wooyung Road, with most traffic staying on Tweed Valley Way to Mooball. There did not appear to be any impact on traffic conditions within Pottsville, with queues clearing before the next platoon arrived.

Traffic surveys on Tweed Valley Way indicated it operated at Level of Service C or better during the peak Tuesday departure of campers in the southbound direction. The surveys also indicated that:

- 47% of campers arrived from the South and 53% from the North
- 54% of day guests came from the South and 46% from the North
- On Tuesday 3/1/17, 43% of campers departed to the South and 57% to the North.

Traffic surveys of the site gates indicated that the number of vehicles on site peaked at 7,600 on Saturday 31/12/2017.

Based on on-site observations, it was concluded that all Key Performance Indicators for traffic management were met during the festival.

A9 SPLENDOUR IN THE GRASS 2017

Splendour in the Grass 2017 was the fifth large trial event at NBP and was held from 21 to 23 July 2017, with camper entry from 19 July 2017 and departure on 24 July 2017. It had an approved patronage of 35,000, of which included 19,265 campers and 13,235 day patrons.

A9.1 TRAFFIC PLANNING AND SETUP

The successful elements of traffic management from previous events including:

- the repositioning of the passenger drop-off/pick-up area to the southern portion of the site;
- the parking of camper vehicles alongside the camp site;
- the use of VMS to divert traffic off the Pacific Highway at Brunswick North and Cudgera Creek Road were employed again; and
- two southbound lanes were used on the Spine Road through to Gate C during camper bump-out on the Monday – left lane to Ocean Shores, Brunswick Heads, Mullumbimby, Byron Bay, Ballina, etc. right lane to Tweed Coast, Murwillumbah and Gold Coast.

The use of two departure lanes for camper bump-out resulted in increased departure rates that didn't exceed 800vph cap on Tweed Valley Way because volumes are split. The use of the Wooyung Road gate wasn't needed by Police, as it had in previous years.

A9.2 FESTIVAL PERFORMANCE

Feedback from a number of road agencies and observers on site were that the site performed well with no repeat of the issues from the previous year, all KPIS being met and only relatively minor issues observed. Observations made during the event were that there was a general absence of congestion. Non-event through trips were only stopped by the traffic controllers for short periods of time, not by traffic congestion.

Minor issues observed include:

- Some queuing on Tweed Valley Way during the bump-out for cars and taxis/ride sharing at approximately midnight. However, the queue of vehicles was constantly moving and at this time of night there was very little non-event traffic that would have been affected.

- Still some patrons trying to park in the Rest Area, but parking in southern car park is now more convenient. Message to be reinforced to patrons for future years.

It is anticipated that the positive transport experience in 2017 will result in less recalcitrant behaviour at future events for returning patrons (e.g. parking in unapproved areas and vehicles attempting to drop passengers on Tweed Valley Way). Patrols and enforcement will continue to be employed until it is shown that these problems are no longer occurring.

The car occupancy of campers was surveyed by NBP staff during campers' departure on the Monday. With a sample size of 815 vehicles, an average car occupancy of 2.63 people per vehicle was calculated.

Traffic counts of vehicles entering and leaving Gates C and D were undertaken capturing the vast majority of traffic (did not capture bus and service vehicle entry via Jones Road or Gate B, or entry via the emergency gate). The automatic traffic counter tubes at Gate C were damaged on Saturday 23 July 2016. The traffic volumes during the period where the tubes were damaged has been estimated from the surrounding traffic counts and data from previous years. The results are shown in Table A.2.

Table A.3 Daily traffic counts at Gates C and D at 2016 SITG

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Source: Data: Greg Alderson & Associates, Analysis: WSP Australia

- (3) 2016 SITG data for inbound Tuesday to Friday and outbound Tuesday to Saturday affected by counter malfunction. Data for 2015 SITG used and factored up based on increased number of people on site
- (4) Includes approximately 200 vehicles directed to exit through the Emergency Exit by NSW Police

APPENDIX B

TRAFFIC GENERATION FORECASTS – HOURLY FLOWS



B1 2017 SPLENDOUR IN THE GRASS

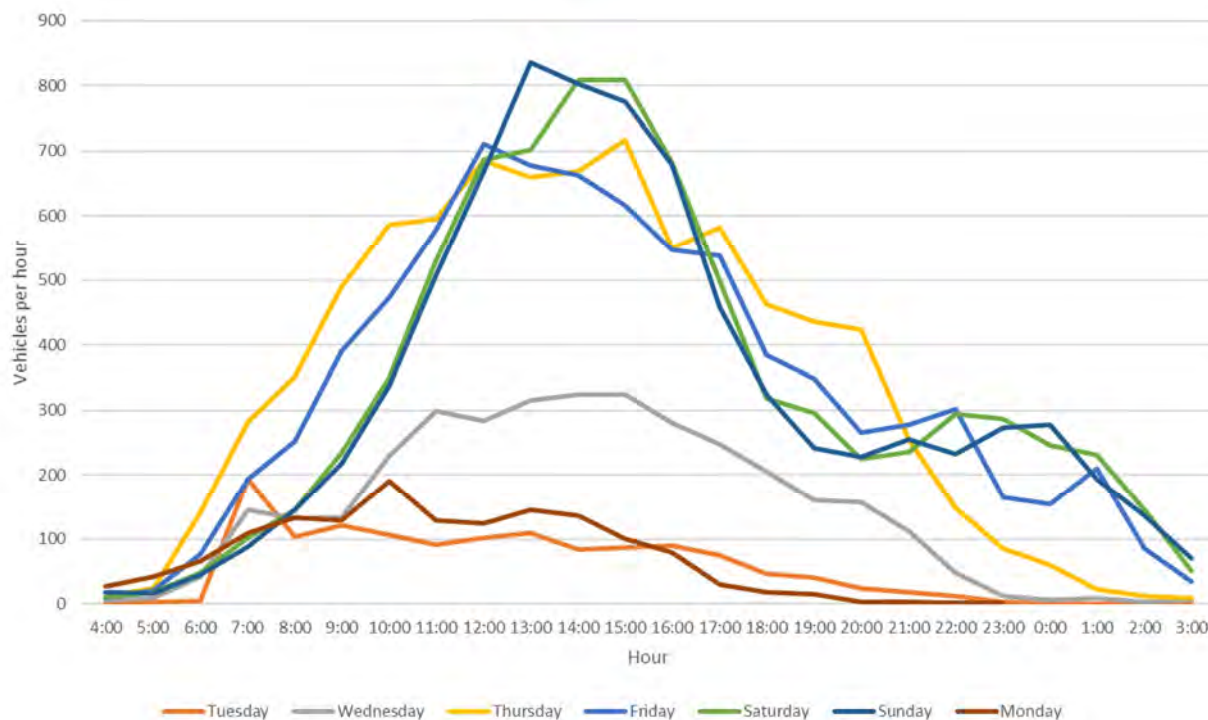


Figure B.1 2017 Splendour in the Grass – profile of vehicles entering Gate A, C and D

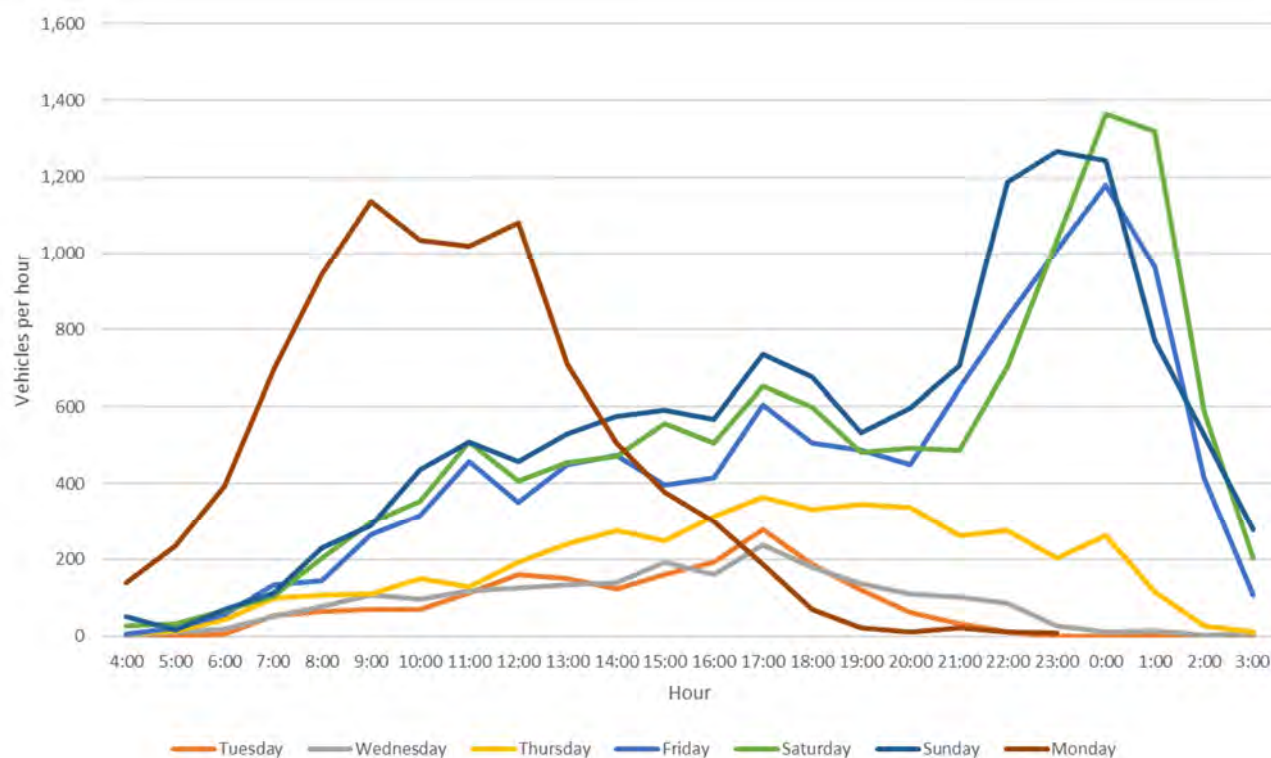


Figure B.2 2017 Splendour in the Grass – profile of vehicles exiting Gate A, C and D

B2 50,000 PATRON LARGE EVENT

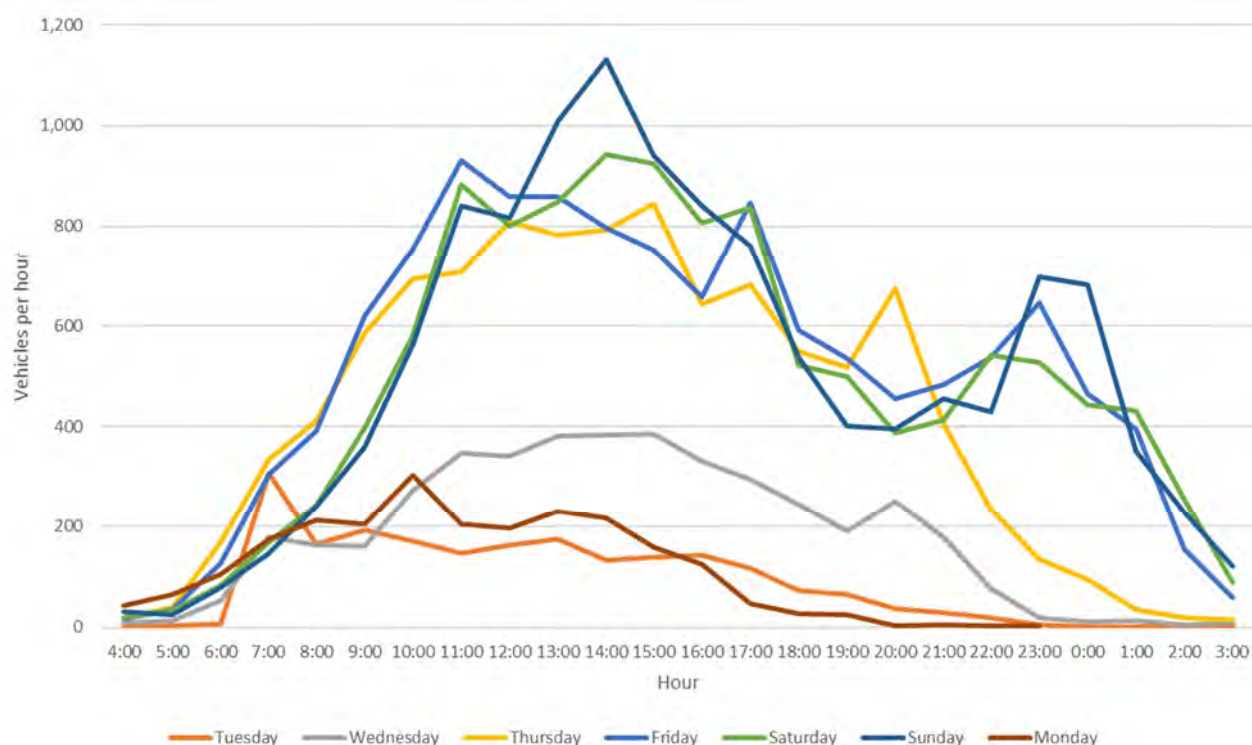


Figure B.3 50,000 Patron Large Event – profile of vehicles entering Gate A, C, D and E

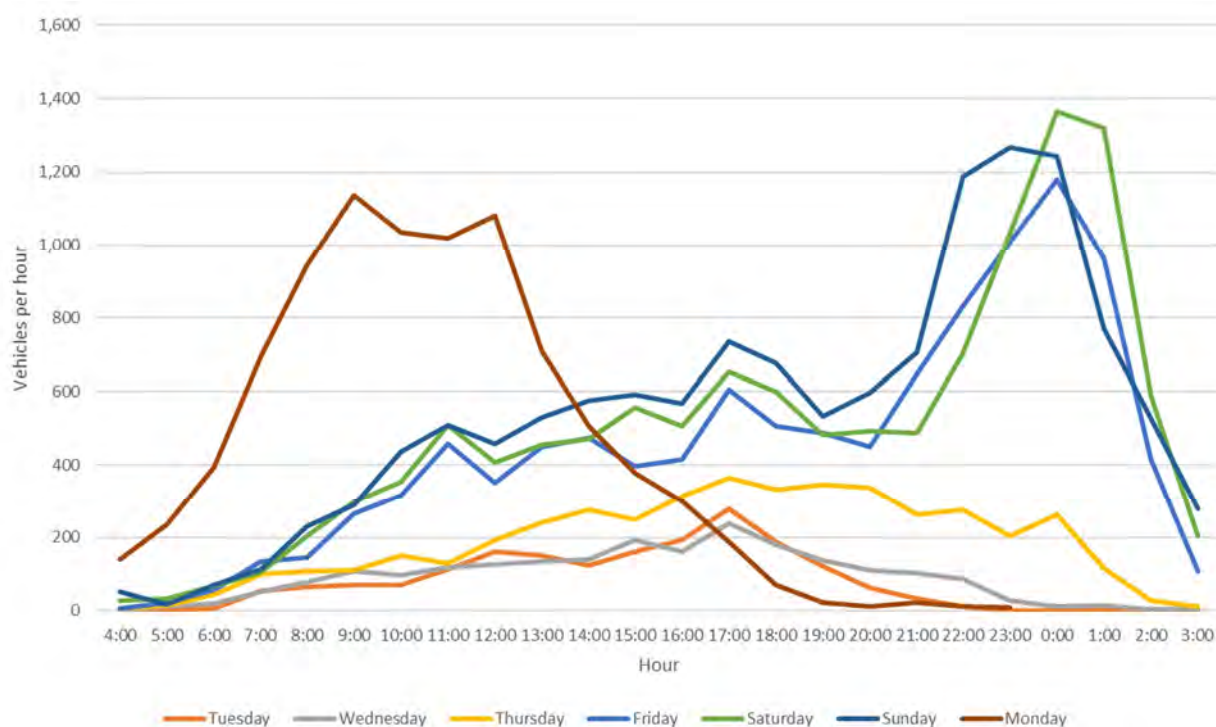


Figure B.4 50,000 Patron Large Event – profile of vehicles exiting Gate A, C, D and E

APPENDIX C

LEVEL OF SERVICE CRITERIA



C1 ROAD CAPACITY

Level of Service is a qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers. A level of service definition generally describes these conditions in terms of factors such as speed and travel time, freedom to manoeuvre, traffic interruptions, comfort and convenience, and safety.

In general, there are six levels of service, designated A to F, with Level of Service A representing the best operating condition (i.e. free flow) and Level of Service F the worst (i.e. forced or breakdown flow). Descriptions of each are included in Table C.1.

Table C.1 Levels of Service descriptions for roads

Level of Service	Description
A	A condition of free flow in which individual drivers are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream is extremely high, and the general level of comfort and convenience provided is excellent.
B	In the zone of stable flow where drivers still have reasonable freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is a little less than with Level of Service A.
C	Also in the zone of stable flow, but most drivers are restricted to some extent in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience declines noticeably at this level.
D	Close to the limit of stable flow and approaching unstable flow. All drivers are severely restricted in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is poor, and small increases in traffic flow will generally cause operational problems.
E	Traffic volumes are at or close to capacity, and there is virtually no freedom to select desired speeds or to manoeuvre within the traffic stream. Flow is unstable and minor disturbances within the traffic stream will cause breakdown.
F	In the zone of forced flow, where the amount of traffic approaching the point under consideration exceeds that which can pass it. Flow breakdown occurs, and queuing and delays result.

Source: Austroads 2013, *Guide to Traffic Management Part 3: Traffic Studies and Analysis*

C2 INTERSECTIONS

The performance of the intersections was simulated using the SIDRA intersection analysis computer program. SIDRA calculates intersection performance using measures such as:

- Level of Service (LoS)
- Degree of Saturation (DoS)
- Average Intersection Delay
- Queue length.

Level of Service

Level of Service (LoS) is one of the basic performance parameters used to describe the operation of an intersection. The levels of service range from A (indicating good intersection operation) to F (indicating over saturated conditions with long delays and queues). At signalised and roundabout intersections, the LoS criteria are related to average intersection delay (seconds per vehicle). At priority-controlled intersections, the LoS is based on the average delay (seconds per vehicle) for the worst movement. The results from SIDRA can be compared to performance criteria set out in Table C.2.

Table C.2 Level of Service criteria for intersections

Level of Service	Average delay (seconds per vehicle)	Interpretation	
		Traffic Signals, Roundabout	Give Way and Stop Signs
A	Less than 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 and 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	Greater than 71	Unsatisfactory with excessive queuing	Unsatisfactory with excessive queuing; requires other control mode

Source: Roads and Maritime Services 2002, Guide to Traffic Generating Developments, Version 2

Degree of saturation

Degree of saturation (DoS) is defined as the ratio of demand flow to capacity, and therefore has no unit. As it approaches 1.0, extensive queues and delays could be expected. For a satisfactory situation, DoS should be less than the nominated practical degree of saturation, usually 0.9. The intersection DoS is based on the movement with the highest ratio for all types of intersection.

Delay

Delay is the difference between interrupted and uninterrupted travel times through the intersection and is measured in seconds per vehicle. The delays include queued vehicles decelerating and accelerating to and/or from stop, as well as delays experienced by all vehicles negotiating the intersection. At signalised and roundabout intersections, the average intersection delay is usually reported and is taken as the weighted average delay by summing the product of the individual movement traffic volume and its corresponding calculated delays and dividing by the total traffic volume at the intersection. At priority controlled intersections, the average delay for the worse movement is usually reported.

Queue length

Queue length reflects the number of vehicles waiting at the stop line and is usually quoted as the 95th percentile back of queue, which is the value below which 95% of all observed queue lengths fall. It is measured as the number of vehicles per traffic lane at the start of the green period, when traffic starts moving again after a red signal. The intersection queue length is usually taken from the movement with the longest queue length.

APPENDIX D

HIGHWAY CAPACITY ANALYSIS SUMMARY



D1 PACIFIC MOTORWAY

Table D.1 Comparison of HCS analysis for Pacific Motorway north of Yelgun Interchange – Northbound

Day	Demand [Freeway] (veh/h)			Density (pc/km/in)			Average Travel Speed (km/h)			Level of Service		
	2017	2027	2037	2017	2027	2037	2017	2027	2037	2017	2027	2037
	Base – No Event											
Friday	1412	1793	2174	7.64	9.69	11.81	106.1	106.1	106.1	B	B	C
Sunday	1427	1812	2198	7.71	9.82	11.93	106.1	106.1	106.1	B	B	C
Monday	1434	1821	2208	7.83	9.94	12.05	106.1	106.1	106.1	B	B	C
	With Event at NBP – SITG'17 in 2017, 50,000 patron event in 2027 and 2037											
Friday	1482	1861	2243	8.0	10.2	12.2	106.1	106.1	106.1	B	B	C
Sunday	1511	1919	2305	8.3	10.6	12.7	106.1	106.1	106.1	B	B	C
Monday	1698	2063	2451	9.2	11.2	13.4	106.1	106.1	106.1	B	C	C

Source: HCS analysis, WSP 2017

Table D.2 Comparison of HCS analysis for Pacific Motorway north of Yelgun Interchange – Southbound

Day	Demand [Freeway] (veh/h)			Density (pc/km/in)			Average Travel Speed (km/h)			Level of Service		
	2017	2027	2037	2017	2027	2037	2017	2027	2037	2017	2027	2037
	Base – No Event											
Friday	1627	2066	2506	8.89	11.31	13.73	106.1	106.1	105.9	B	C	C
Sunday	1612	2047	2482	8.82	11.18	13.61	106.1	106.1	105.9	B	B	C
Monday	1575	2000	2426	8.70	11.06	13.36	106.1	106.1	106.1	B	B	C
	With Event at NBP – SITG'17 in 2017, 50,000 patron event in 2027 and 2037											
Friday	1767	2277	2717	9.8	12.9	15.3	106.1	106.1	104.8	B	C	C
Sunday	1840	2347	2782	10.1	13.3	15.9	106.1	106.1	104.1	B	C	C
Monday	1588	2021	2446	8.8	11.1	13.5	106.1	106.1	105.9	B	B	C

Source: HCS analysis, WSP 2017

Table D.3 Comparison of HCS analysis for Pacific Motorway south of Yelgun Interchange – Northbound

Day	Demand [Freeway] (veh/h)			Density (pc/km/in)			Average Travel Speed (km/h)			Level of Service		
	2017	2027	2037	2017	2027	2037	2017	2027	2037	2017	2027	2037
	Base – No Event											
Friday	1496	1900	2304	8.20	10.38	12.61	106.1	106.1	106.1	B	B	C
Sunday	1455	1848	2241	7.89	10.00	12.12	106.1	106.1	106.1	B	B	C
Monday	1436	1824	2211	7.83	10.00	12.12	106.1	106.1	106.1	B	B	C
	With Event at NBP – SITG'17 in 2017, 50,000 patron event in 2027 and 2037											
Friday	1678	2109	2513	9.2	11.6	13.9	106.1	106.1	105.7	B	C	C
Sunday	1573	1973	2366	8.5	10.7	12.8	106.1	106.1	106.1	B	B	C
Monday	1440	1830	2218	7.9	10.0	12.1	106.1	106.1	106.1	B	B	C

Source: HCS analysis, WSP 2017

Table D.4 Comparison of HCS analysis for Pacific Motorway south of Yelgun Interchange – Southbound

Day	Demand [Freeway] (veh/h)			Density (pc/km/in)			Average Travel Speed (km/h)			Level of Service		
	2017	2027	2037	2017	2027	2037	2017	2027	2037	2017	2027	2037
	Base – No Event											
Friday	1625	2064	2503	8.95	11.37	13.79	106.1	106.1	105.9	B	C	C
Sunday	1604	2037	2471	8.76	11.12	13.55	106.1	106.1	105.9	B	B	C
Monday	1777	2257	2737	9.69	12.37	15.16	106.1	106.1	104.9	B	C	C
	With Event at NBP – SITG'17 in 2017, 50,000 patron event in 2027 and 2037											
Friday	1847	2335	2773	10.3	13.2	16.0	106.1	106.1	104.1	B	C	C
Sunday	1753	2219	2652	9.7	12.5	15.0	106.1	106.1	105.1	B	C	C
Monday	2147	2613	3093	11.7	14.5	17.8	106.1	105.4	101.7	C	C	D

Source: HCS analysis, WSP 2017

D2 PACIFIC MOTORWAY ON RAMPS

Table D.5 Comparison of HCS analysis for Pacific Highway Yelgun Interchange Northbound Ramps

Day	Ramp	Analysis Volume/ Opposing Volume (veh/h)			Volume/Capacity Ratio			Average Travel Speed (km/h)			Level of Service		
		2017	2027	2037	2017	2027	2037	2017	2027	2037	2017	2027	2037
	Base – No Event												
Friday	Diverge	1496/186	1900/236	2304/286	9.8	11.1	14.7	98.8	98.7	98.5	B	B	C
	Merge	1310/102	1664/130	2017/157	8.3	10.4	12.4	98.3	98.0	97.2	B	B	B
Sunday	Diverge	1455/145	1848/184	2241/223	9.4	10.6	14.2	99.1	99.0	98.8	B	B	C
	Merge	1310/117	1664/149	2017/180	8.3	10.6	12.6	98.3	97.8	98.8	B	B	C
Monday	Diverge	1436/126	1824/160	2211/194	9.4	10.6	14.1	99.1	99.0	98.8	B	B	C
	Merge	1310/124	1664/157	2017/191	8.4	10.6	12.6	98.3	97.8	97.2	B	B	C
	With Event at NBP – SITG17 in 2017, 50,000 patron event in 2027 and 2037												
Friday	Diverge	1678/368	2109/445	2513/495	9.8	12.5	14.9	98.2	97.7	97.5	B	C	C
	Merge	1310/172	1664/198	2017/225	8.6	10.9	13.2	98.3	97.8	97.0	B	B	C
Sunday	Diverge	1573/263	1973/309	2366/348	9.1	11.4	13.7	98.7	98.5	98.3	B	C	C
	Merge	1310/201	1664/256	2017/287	8.8	11.4	13.8	98.3	97.7	96.9	B	B	C
Monday	Diverge	1440/130	1830/166	2218/200	8.3	10.6	12.9	99.1	99.0	98.8	B	B	C
	Merge	1310/388	1664/400	2017/433	9.8	12.1	14.5	98.2	97.5	96.6	B	B	C

Source: HCS analysis, WSP 2017

Table D.6 Comparison of HCS analysis for Pacific Highway Yelgun Interchange Southbound Ramps

Day	Ramp	Analysis Volume/ Opposing Volume (veh/h)			Volume/Capacity Ratio			Average Travel Speed (km/h)			Level of Service		
		2017	2027	2037	2017	2027	2037	2017	2027	2037	2017	2027	2037
	Base – No Event												
Friday	Diverge	1627/145	2066/184	2506/223	10.4	12.0	15.8	99.1	99.0	98.8	B	C	C
	Merge	1482/143	1882/182	2282/220	9.2	12.2	14.1	98.5	97.7	96.6	B	B	C
Sunday	Diverge	1612/130	2047/165	2482/200	10.4	11.9	15.8	99.1	99.0	98.8	B	C	C
	Merge	1482/122	1882/155	2282/188	9.1	12.0	13.9	98.5	97.8	96.7	B	B	C
Monday	Diverge	1575/93	2000/118	2426/143	10.2	11.7	15.5	99.3	99.1	99.1	B	C	C
	Merge	1482/295	1882/375	2282/454	9.9	13.3	15.2	98.3	97.4	95.8	B	C	C
	With Event at NBP – SITG'17 in 2017, 50,000 patron event in 2027 and 2037												
Friday	Diverge	1767/285	2277/395	2717/434	10.5	13.9	16.6	98.3	97.7	97.5	B	C	D
	Merge	1482/365	1882/453	2282/491	11.0	14.4	17.3	98.2	96.9	95.1	B	C	C
Sunday	Diverge	1840/358	2347/465	2782/500	10.9	14.4	16.8	98.2	97.4	97.4	B	C	D
	Merge	1482/271	1882/337	2282/370	10.3	13.4	16.2	98.3	97.4	95.9	B	C	C
Monday	Diverge	1588/106	2021/139	2446/164	9.3	11.8	14.3	99.3	99.1	99.0	B	C	C
	Merge	1482/665	1882/731	2282/811	12.7	15.8	19.1	97.5	96.1	93.7	B	C	C

Source: HCS analysis, WSP 2017

D3 TWEED VALLEY WAY

Table D.7 Comparison of HCS analysis for Tweed Valley Way south of Gate D

Day	Analysis Volume/ Opposing Volume (veh/h)			Volume/Capacity Ratio			Average Travel Speed (km/h)			Level of Service		
	2017	2027	2037	2017	2027	2037	2017	2027	2037	2017	2027	2037
	Base – No Event											
Friday	244/232	310/295	376/357	0.15	0.19	0.24	68.6	66.8	65.2	B	B	B
Sunday	219/210	286/274	337/323	0.14	0.17	0.21	69.4	67.9	66.3	B	B	B
Monday	177/236	225/300	273/363	0.11	0.14	0.17	69.4	67.9	66.5	B	B	B
	With Event at NBP – SITG'17 in 2017, 50,000 patron event in 2027 and 2037											
Friday	842/668	1049/820	1115/883	0.55	0.72	0.76	55.4	50.1	48.3	D	E	E
Sunday	789/569	966/721	1025/777	0.50	0.65	0.68	57.6	52.8	51.3	C	D	D
Monday	293/1049	409/1099	457/1163	0.18	0.26	0.29	58.3	56.2	54.6	C	D	D

Source: HCS analysis, WSP 2017

APPENDIX E

SIDRA INTERSECTION MODEL RESULTS



E1 CUDGERA CREEK INTERCHANGE

Table E.1 Cudgera Creek Interchange

Day	Intersection	Volume (veh/h)			Worst Delay (s)			95% Queue (m)			Worst LoS (delay based)		
		2017	2027	2037	2017	2027	2037	2017	2027	2037	2017	2027	2037
	Base – No Event												
Friday	East (1A)	675	858	1040	11.1	12.3	14.2	9.4 (N)	13.5 (N)	22.0 (N)	A	A	A
	West (1B)	336	428	516	10.0	11.0	12.4	4.6 (S)	6.6 (S)	9.6 (S)	A	A	A
Sunday	East (1A)	526	668	811	11.6	13.3	15.4	2.6 (N)	3.5 (N)	4.4 (N)	A	A	B
	West (1B)	369	469	569	10.5	11.8	13.8	4.4 (S)	6.5 (S)	10.0 (S)	A	A	A
Monday	East (1A)	665	844	1023	14.1	17.5	22.4	2.7 (N)	3.6 (N)	4.5 (N)	A	B	B
	West (1B)	451	575	694	13.6	16.7	20.3	8.4 (E)	11.4 (E)	14.8 (E)	A	B	B
	With Event at NBP – SITG'17 in 2017, 50,000 patron event in 2027 and 2037												
Friday	East (1A)	817	1003	1185	11.1	12.3	14.2	15.9 (N)	25.9 (N)	46.0 (N)	A	A	A
	West (1B)	336	428	516	10.0	11.0	12.4	4.6 (S)	6.6 (S)	9.6 (S)	A	A	A
Sunday	East (1A)	642	789	932	11.6	13.3	15.4	6.0 (N)	7.4 (N)	8.7 (N)	A	A	B
	West (1B)	369	469	569	10.5	11.8	13.8	4.4 (S)	6.5 (S)	10.0 (S)	A	A	A
Monday	East (1A)	711	916	1095	14.1	17.5	22.4	3.9 (N)	5.7 (N)	6.7 (N)	A	B	B
	West (1B)	451	575	694	13.6	16.7	20.3	8.4 (E)	11.4 (E)	14.8 (E)	A	B	B

E2 YELGUN INTERCHANGE

Table E.2 Yelgun Interchange – Base Scenarios

Day	Intersection	Volume (veh/h)			Worst Delay (s)			95% Queue (m)			Worst LoS (delay based)		
		2017	2027	2037	2017	2027	2037	2017	2027	2037	2017	2027	2037
	Base – No Event												
Friday	North (2A)	779	989	1201	9.4	9.6	9.9	4.1 (W)	5.6 (W)	7.4 (W)	A	A	A
	South (2B)	604	767	934	12.7	13.0	13.2	4.4 (S)	5.9 (S)	7.7 (S)	A	A	A
Sunday	North (2A)	709	900	1094	11.1	11.2	11.4	3.7 (E)	5.0 (E)	6.4 (E)	A	A	A
	South (2B)	546	694	841	12.3	10.5	12.7	3.6 (N)	4.8 (N)	6.0 (N)	A	A	A
Monday	North (2A)	764	974	1173	11.7	12.0	9.3	6.9 (E)	9.7 (E)	13.0 (E)	A	A	A
	South (2B)	667	847	1021	12.4	12.6	12.8	6.6 (N)	9.0 (N)	11.8 (N)	A	A	A
	With Event at NBP – SITG'17 in 2017, 50,000 patron event in 2027 and 2037												
Friday	East (1A)	1864	2313	2522	9.5	10.9	14.9	29.0 (S)	86.5 (S)	117.9 (S)	A	A	B
	West (1B)	1279	1568	1731	13.3	13.6	13.8	14.2 (W)	25.6 (W)	41.7 (W)	A	A	A
Sunday	East (1A)	1625	2012	2202	9.3	13.9	14.8	22.2 (S)	50.7 (S)	61.6 (S)	A	A	B
	West (1B)	1156	1443	1591	12.8	13.3	13.5	13.4 (W)	23.1 (W)	27.0 (W)	A	A	A
Monday	East (1A)	1694	1933	2142	11.3	21.0	26.6	40.0 (W)	47.5 (W)	55.9 (W)	A	B	B
	West (1B)	1353	1508	1688	14.0	14.2	14.5	26.5 (N)	31.8 (N)	38.3 (N)	A	A	A

E3 BRUNSWICK NORTH INTERCHANGE

Table E.3 Brunswick North Interchange – Base Scenarios

Day	Intersection	Volume (veh/h)			Worst Delay (s)			95% Queue (m)			Worst LoS (delay based)		
		2017	2027	2037	2017	2027	2037	2017	2027	2037	2017	2027	2037
	Base – No Event												
Friday	East (3A)	1113	1414	1714	12.2	12.7	13.4	15.6 (E)	23.1 (E)	34.0 (E)	A	A	A
	West (3B)	292	371	451	11.1	11.1	11.1	5.5 (S)	7.3 (S)	9.4 (S)	A	A	A
Sunday	East (3A)	958	1216	1477	12.1	12.5	12.9	12.5 (N)	17.8 (N)	24.5 (N)	A	A	A
	West (3B)	199	253	306	11.1	11.1	11.1	3.1 (S)	4.1 (S)	5.1 (S)	A	A	A
Monday	East (3A)	998	1266	1539	13.0	13.8	14.7	23.1 (N)	35.6 (N)	55.1 (N)	A	A	A
	West (3B)	165	209	255	11.1	11.1	11.1	2.6 (S)	3.4 (S)	4.2 (S)	A	A	A
	With Event at NBP – SITG'17 in 2017, 50,000 patron event in 2027 and 2037												
Friday	East (1A)	1416	1774	2074	12.2	12.8	14.1	18.2 (E, W)	27.8 (W)	55.3 (W)	A	A	A
	West (1B)	476	584	664	11.1	11.1	11.1	11.2 (S)	14.5 (S)	18.9 (S)	A	A	A
Sunday	East (1A)	1183	1478	1738	12.3	12.7	13.2	14.1 (N)	20.3 (N)	27.7 (N)	A	A	A
	West (1B)	349	429	482	11.1	11.1	11.1	7.3 (S)	10.0 (S)	11.4 (S)	A	A	A
Monday	East (1A)	1115	1409	1682	13.1	14.0	15.4	27.6 (N)	42.7 (N)	66.2 (N)	A	A	B
	West (1B)	165	209	255	11.1	11.1	11.1	2.6 (S)	3.4 (S)	4.2 (S)	A	A	A

E4 SITE GATES

Table E.4 SIDRA results – Site Gates

Day	Intersection	Volume (veh/h)			Worst Delay (s)			95% Queue (m)			Worst LoS (Delay based)		
		2017 SITG	2027 FF	2037 FF	2017 SITG	2027 FF	2037 FF	2017 SITG	2027 FF	2037 FF	2017 SITG	2027 FF	2037 FF
Friday	Jones Road	800	1028	1164	22.7	40.2	51.9	7.8 (S)	16.2 (S)	17.8 (S)	B	C	D
	Gate C	904	1313	1448	12.0	19.4	23.1	5.9 (E)	21.0 (E)	25.1 (E)	A	B	B
	Gate D	1508	1889	2024	9.6	11.9	13.7	60.7 (S)	32.3 (S)	37.4 (S)	A	A/F*	A/F*
	Wooyung	595	751	886	7.8	8.8	10.0	0.4 (S)	0.4(S)	0.4 (S)	A	A	B
Sunday	Jones Road	731	961	1083	19.4	33.2	43.1	6.9 (S)	14.9 (S)	17.4 (S)	B	C	D
	Gate C	798	1151	1273	10.5	15.1	18.1	5.3 (E)	16.8 (E)	20.0 (E)	A	B	B
	Gate D	1435	1759	1899	27.7	10.8	12.0	16.4 (S)	29.7 (S)	33.2 (S)	B	A/F*	A/F*
	Wooyung	522	665	787	7.4	8.6	9.6	0.4 (S)	0.5 (S)	0.5 (S)	A	A	A
Monday	Jones Road	1072	1297	1415	37.3	67.1	73.9	10.1 (S)	19.8 (S)	21.4 (S)	C	E	F
	Gate C	1159	1741	1929	12.1	26.9	177.4	32.6 (E)	88.1 (E)	407.2 (E)	A	B	F
	Gate D	1161	1472	1588	8.1	14.3	16.4	16.4 (E)	7.4 (S)	8.7 (S)	A	A/F*	B/F*
	Wooyung	473	604	722	9.0	11.0	12.8	1.0 (S)	1.8 (S)	2.1 (S)	A	B	B

APPENDIX F

PACIFIC MOTORWAY YELGUN
INTERCHANGE RAMPS SSD
CALCULATIONS



F1 PACIFIC MOTORWAY RAMPS SSD

The calculation of the required stopping distance for an exiting vehicle is based on the requirements of Austroads 2008 *Guide to Road Design Part 3 Geometric Design*. The speed limit on the Pacific Motorway is 110 km/h. The speed limit on the off-ramp is 60 km/h. The length of the southbound off ramp is 450 m long and the northbound off-ramp is 600 m.

Vehicles accessing the off ramp would be travelling between 60 km/h (lower limit) and 110 km/h (upper limit) and slowing down to almost zero at the give way point. The applicable Stopping Sight Distance (SSD) requirements are shown in Table F.1.

Table F.1 Stopping sight distance

Vehicle speed (km/h)	Desirable sight distance for highways and freeways ¹	Grade correction for assumed 2% upgrade	Adjusted desirable sight distance
60	81 m	-2 m	79 m
110	260 m	-7 m	253 m

(1) Assumes driver reaction time of 2.5sec

Assuming that the vehicle is travelling at 110 km/h at the point of exiting, the SSD requirement is 253 m. As an added margin of safety, an additional buffer distance of 100 m has been added to the SSD. This means that should the queues be larger than anticipated, or should there be an incident (such as a vehicle break-down), vehicles could queue in the additional gap without affecting the safety of the Pacific Motorway or ramps.

This means that the maximum allowable queue length on the ramps is as follows:

- southbound off-ramp: 97 m
- northbound off-ramp: 247 m.

The relevant queuing distances are shown in Figure F.1.



Figure F.1 Yelgun Interchange stopping and queue distances

APPENDIX G

TRAFFIC CONTROL PLANS

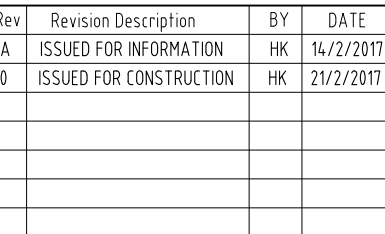




M1 MOTORWAY

SPLENDOUR IN THE GRASS FESTIVAL SITE

1. THIS PLAN HAS BEEN PREPARED FOR SPLENDOR IN THE GRASS FESTIVAL 2017.
2. THIS PLAN IS VALID FROM 21ST – 23RD JULY, 2017.
3. THESE PLANS ARE TO BE READ IN CONJUNCTION WITH ONE ANOTHER AND SHALL NOT TO BE SEPARATED.
4. ALL PARKING CONTROL SIGNS IN A SECTION OF ROAD SHOULD BE MOUNTED AT APPROXIMATELY THE SAME HEIGHT AND SHOULD NOT BE SO HIGH THAT MOTORISTS MAY NOT NOTICE THEM.
5. INSTALLATION OF ALL NO-STOPPING SIGNS TO COMPLY WITH THE REQUIREMENTS OF AS1742.11-1999, IN PARTICULAR, THE HEIGHT CLEARANCE TO THE BOTTOM EDGE OF THE SIGN TO BE:
 - A MINIMUM OF 2.0 METRES ABOVE A FOOTPATH;
 - A MINIMUM OF 2.2 METRES ABOVE THE ROAD SURFACE
 - UNLESS STATED OTHERWISE ALL SIGNS TO BE STANDARD AS PER AS 1742.1
6. SIGN SIZE DENOTED BY LETTER AT END OF SIGN SPECIFICATION EG:
 - R4-1-40A = A SIZE SIGN
 - R4-1-40B = B SIZE SIGN



DO NOT SCALE DRAWINGS, USE FIGURED DIMENSIONS

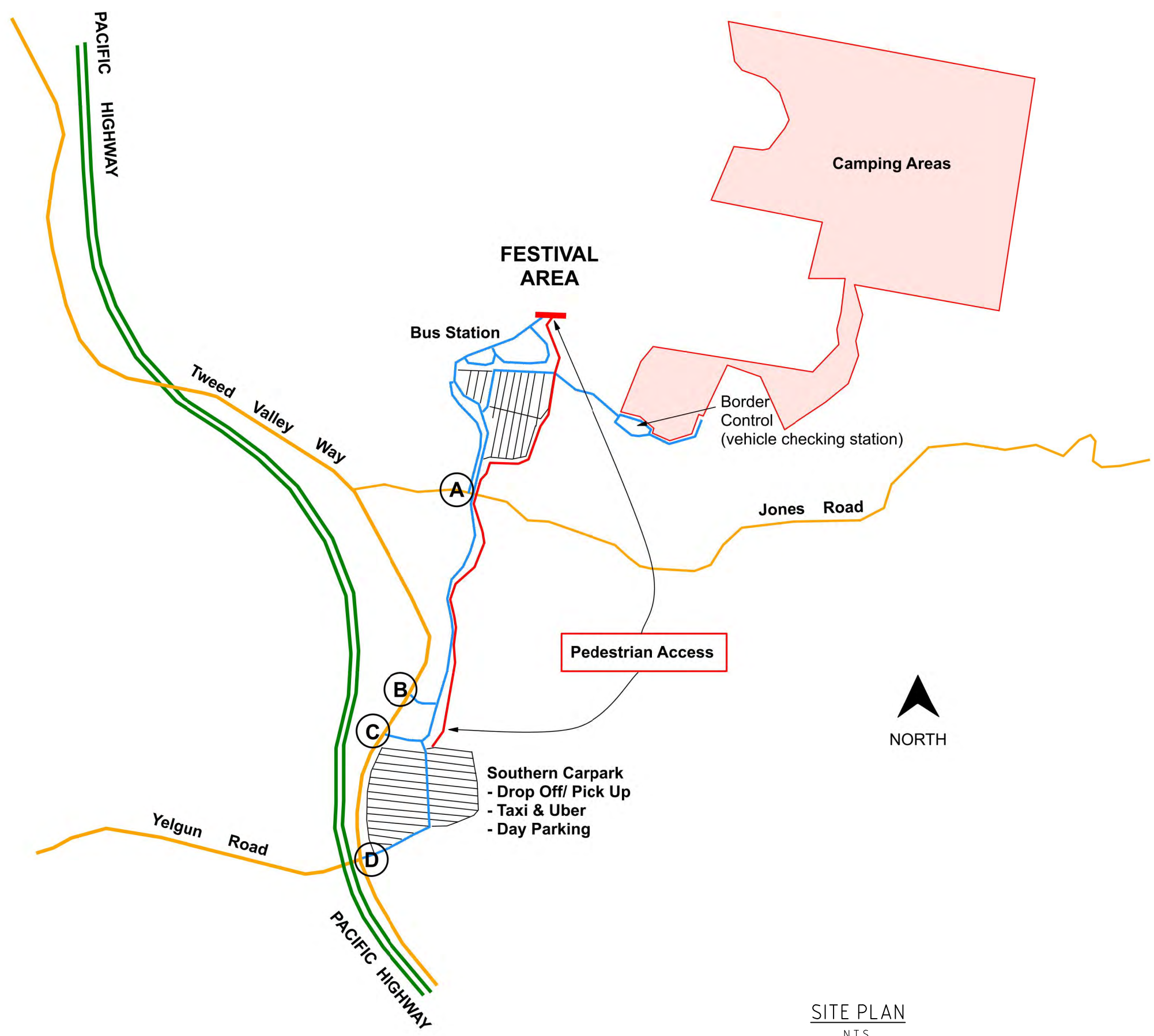
ABN 58 594 160 789
Scarrabelottis Rd NASHUA NSW 2479
Ph: 02 6629 1552 Fax: 02 6629 1566
E: office@aldersonassociates.com.au
Web: aldersonassociates.com.au



**North Byron
Parklands**

Project:	SPLENDOUR IN THE GRASS FESTIVAL 2017
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Drawn: TM	Scale: As Shown		Issued: Hayden Kress RMS Design & Inspect TCPs 7333016159	Date:
Issued: HK	Original Size: A3	Sheet no: 1 of 18		Revision: 0
Job Number: 17073	Drawing Number: 170214-17073-TCP01			



SITE PLAN
N.T.S.



Rev	Revision Description	BY	DATE
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Client:
SPLENDOUR IN THE GRASS



Title:
SITE PLAN

Project:
SPLENDOUR IN THE GRASS
FESTIVAL 2017

ISSUE FOR CONSTRUCTION

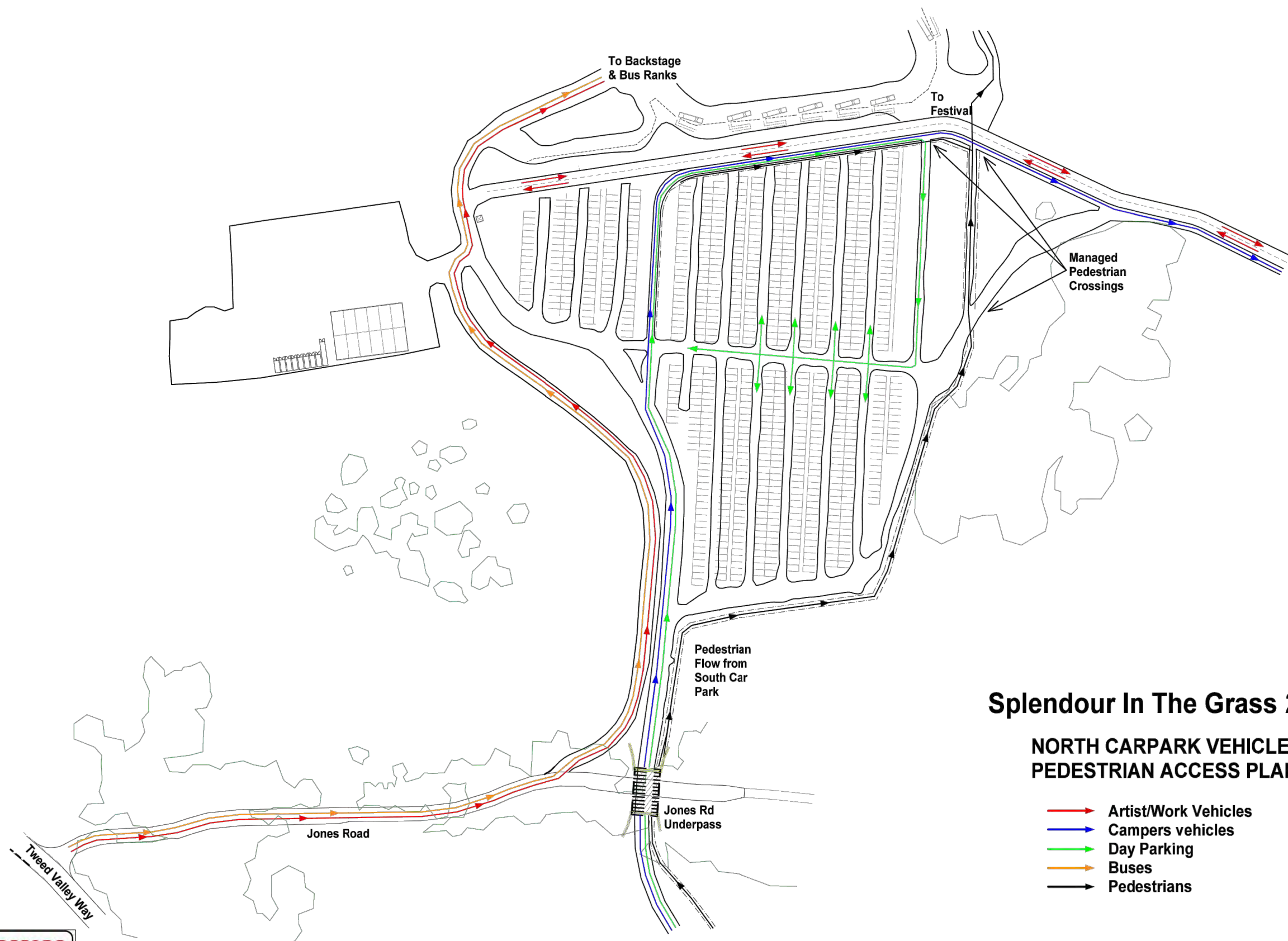
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Issued: HK	Original Size: A3	Sheet no: 2 of 18
Job Number: 17073	Drawing Number: 170214-17073-TCP01	

Issued:

Hayden Kress
RMS Design & Inspect TCPs 7333016159

Date:

Revision:
0



Splendour In The Grass 2017

NORTH CARPARK VEHICLE & PEDESTRIAN ACCESS PLAN

- Artist/Work Vehicles
- Campers vehicles
- Day Parking
- Buses
- Pedestrians

SITE PLAN
N.T.S.



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Site Details:



Title:
INTERNAL - VEHICLE AND PEDESTRIAN ARRIVALS

Project:
SPLENDOUR IN THE GRASS
FESTIVAL 2017

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Splendour In The Grass 2017
NORTH CARPARK VEHICLE & PEDESTRIAN EGRESS PLAN

- Artist/Work Vehicles
- Campers vehicles
- Day Parking
- Buses
- Pedestrians

SITE PLAN
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Client:
SPLENDOUR IN THE GRASS

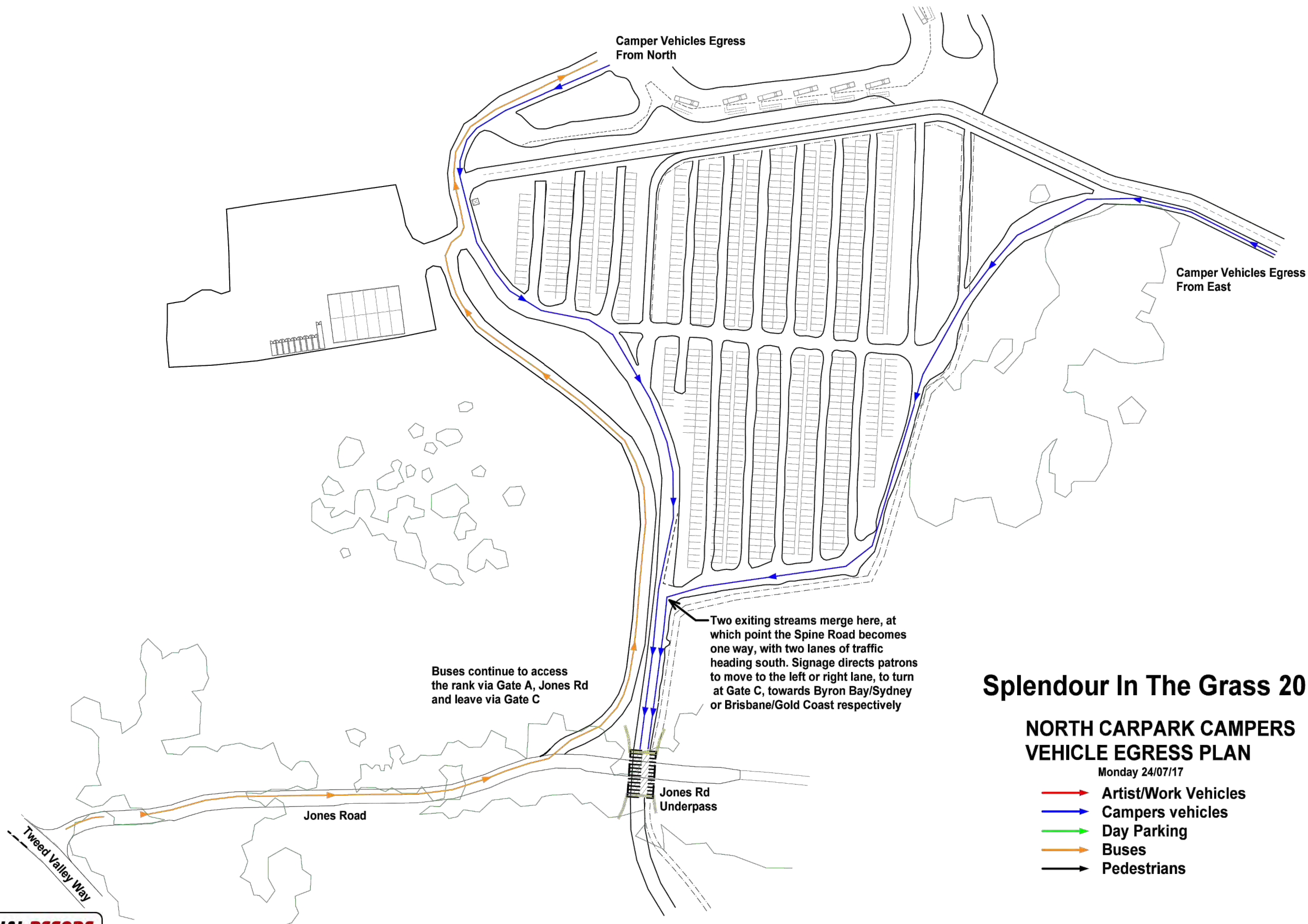


Title:
INTERNAL - DAY PARKING AND PEDESTRIAN DEPARTURES

Project:
SPLENDOUR IN THE GRASS FESTIVAL 2017

ISSUE FOR CONSTRUCTION

Drawn: TM	Scale: As Shown	Issued:	Date:
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Job Number: 17073	Drawing Number: 170214-17073-TCP01	Hayden Kress RMS Design & Inspect TCPs 7333016159	



Splendour In The Grass 2017

NORTH CARPARK CAMPERS VEHICLE EGRESS PLAN

Monday 24/07/17

- Artist/Work Vehicles
- Campers vehicles
- Day Parking
- Buses
- Pedestrians



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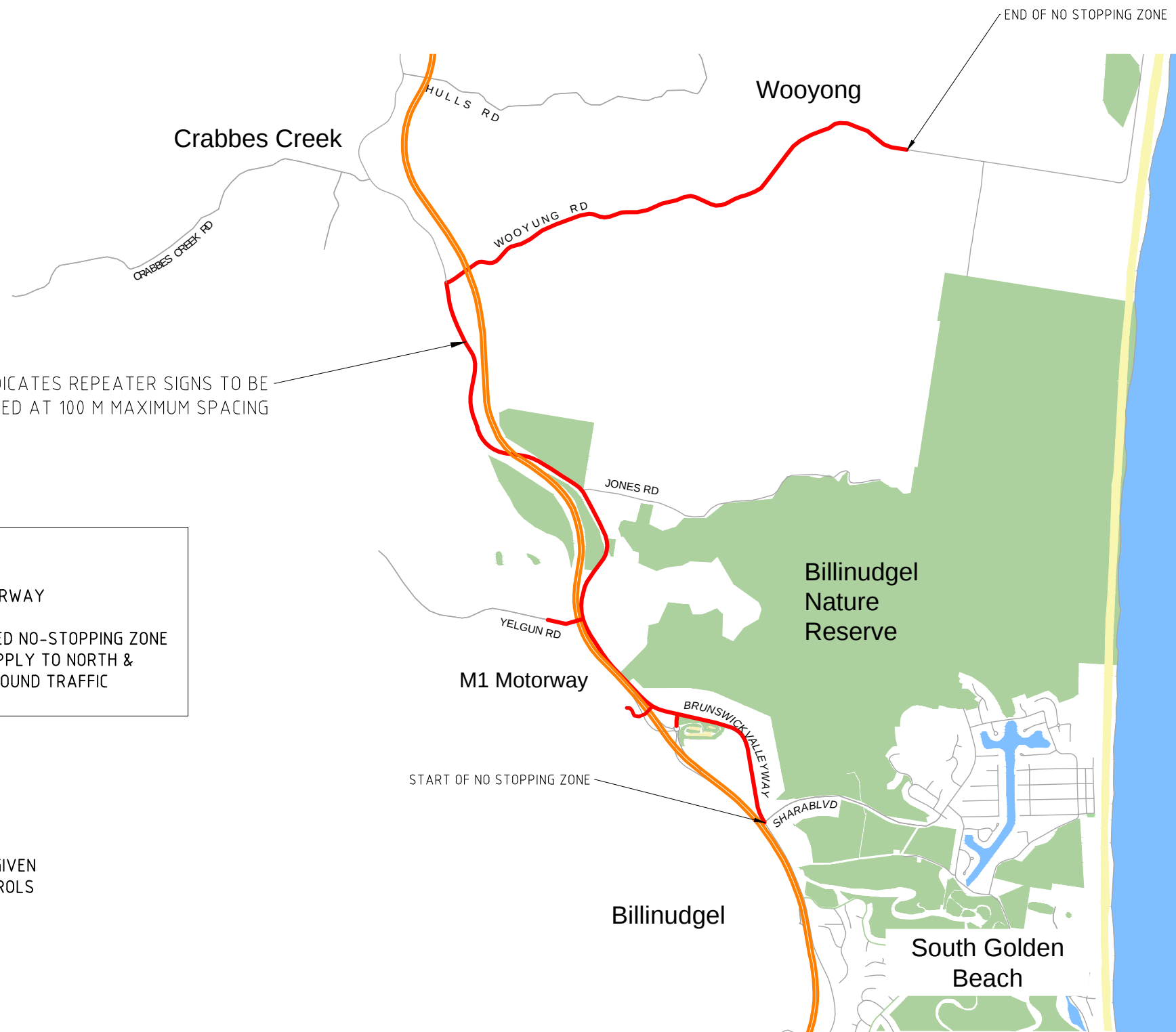
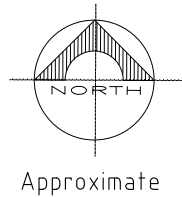


Title:
INTERNAL - CAMPING
DEPARTURES

Project:
SPLENDOUR IN THE GRASS
FESTIVAL 2017

ISSUE FOR CONSTRUCTION

Drawn: TM	Scale: As Shown	Issued:	Date:
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Job Number: 17073	Drawing Number: 170214-17073-TCP01	Hayden Kress RMS Design & Inspect TCPs 7333016159	



△ RED LINE INDICATES REPEATER SIGNS TO BE INSTALLED AT 100 M MAXIMUM SPACING

KEY

- M1 MOTORWAY
- PROPOSED NO-STOPPING ZONE SIGNS APPLY TO NORTH & SOUTH BOUND TRAFFIC

NOTE:
CONSIDERATION WIL BE GIVEN
TO AREA PARKING CONTROLS
(NO STOPPING AREA).



R5-400



R5-400

75 M MAX

END OF NO STOPPING ZONE



R5-400



R5-400

75 M MAX

START OF NO STOPPING ZONE

PLAN
N.T.S.



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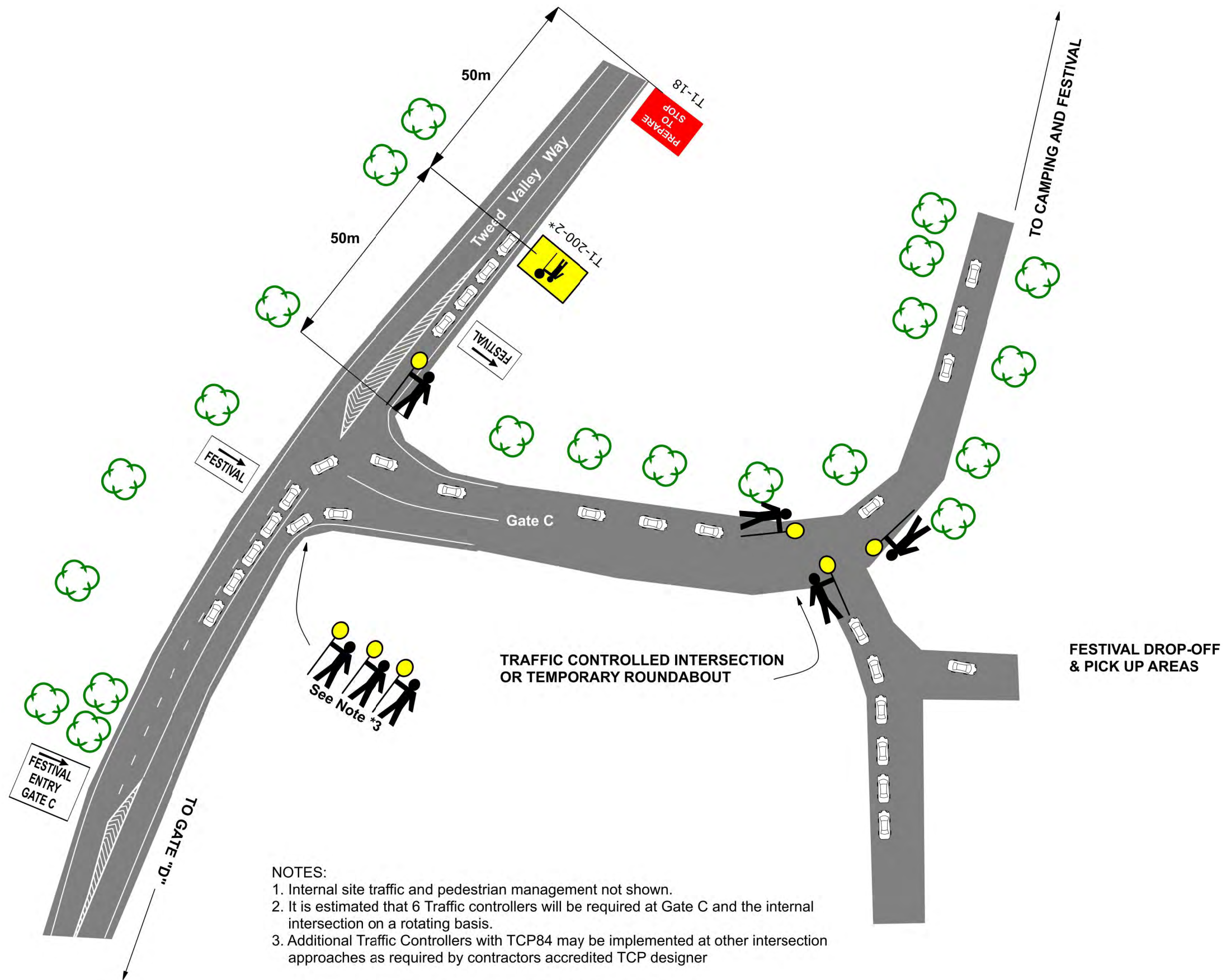


Title:
NO STOPPING PLAN

Project:
SPLENDOUR IN THE GRASS
FESTIVAL 2017

ISSUE FOR CONSTRUCTION

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Job Number: 17073	Drawing Number: 170214-17073-TCP02	Hayden Kress RMS Design & Inspect TCPs 7333016159	



- NOTES:
- 1. Internal site traffic and pedestrian management not shown.
 - 2. It is estimated that 6 Traffic controllers will be required at Gate C and the internal intersection on a rotating basis.
 - 3. Additional Traffic Controllers with TCP84 may be implemented at other intersection approaches as required by contractors accredited TCP designer

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SPLENDOUR IN THE GRASS

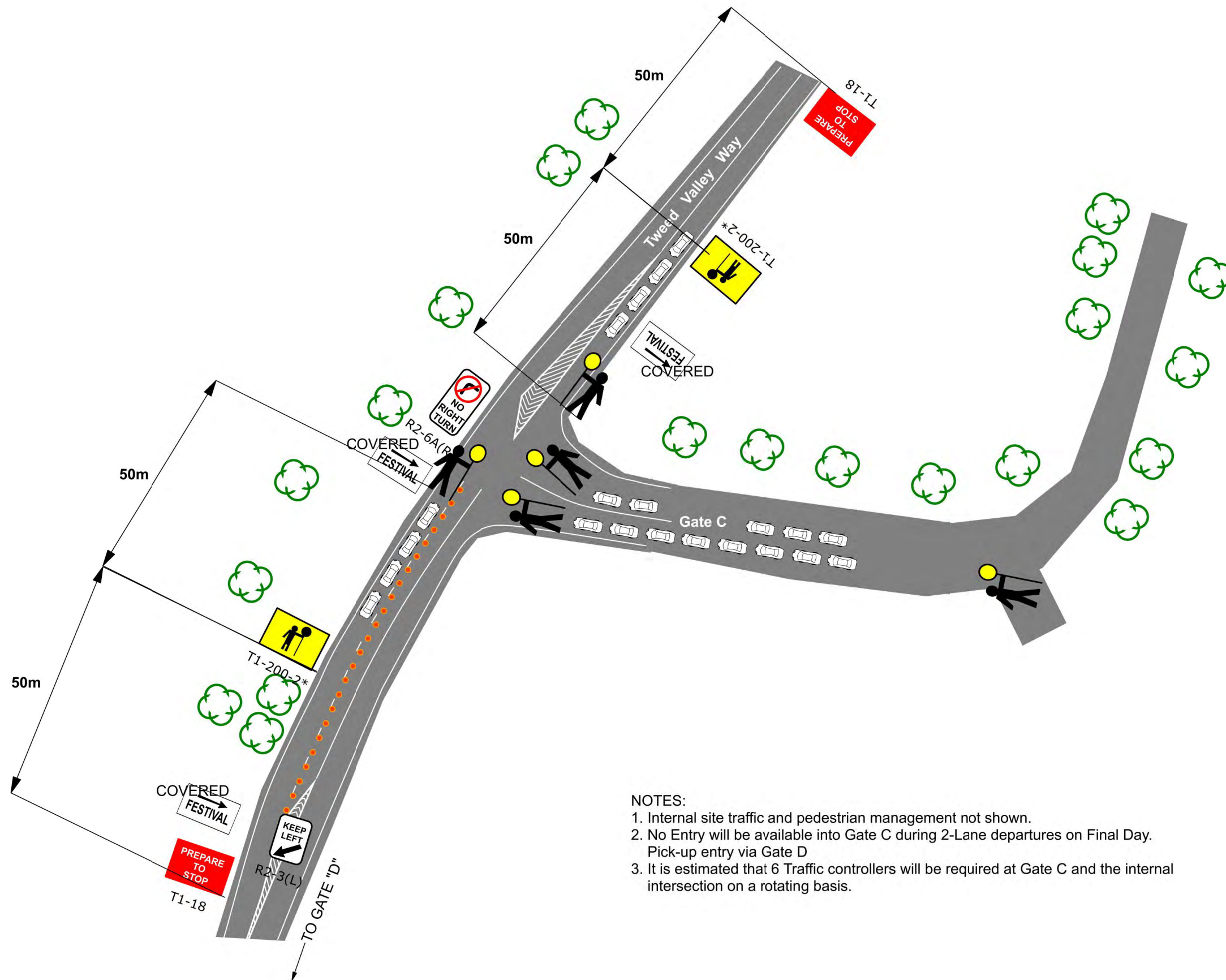


Title:
TRAFFIC CONTROL AT GATE C
PEAK ARRIVALS

Project:
SPLENDOUR IN THE GRASS
FESTIVAL 2017

ISSUE FOR CONSTRUCTION

Drawn: TM	Scale: As Shown	Issued:	Date:
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Job Number: 17073	Drawing Number: 170214-17073-TCP04	Hayden Kress RMS Design & Inspect TCPs 7333016159	



- NOTES:
- 1. Internal site traffic and pedestrian management not shown.
 - 2. No Entry will be available into Gate C during 2-Lane departures on Final Day. Pick-up entry via Gate D
 - 3. It is estimated that 6 Traffic controllers will be required at Gate C and the internal intersection on a rotating basis.



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Client:
SPLENDOUR IN THE GRASS



Title:
TRAFFIC CONTROL AT GATE C
2 LANE DEPARTURE

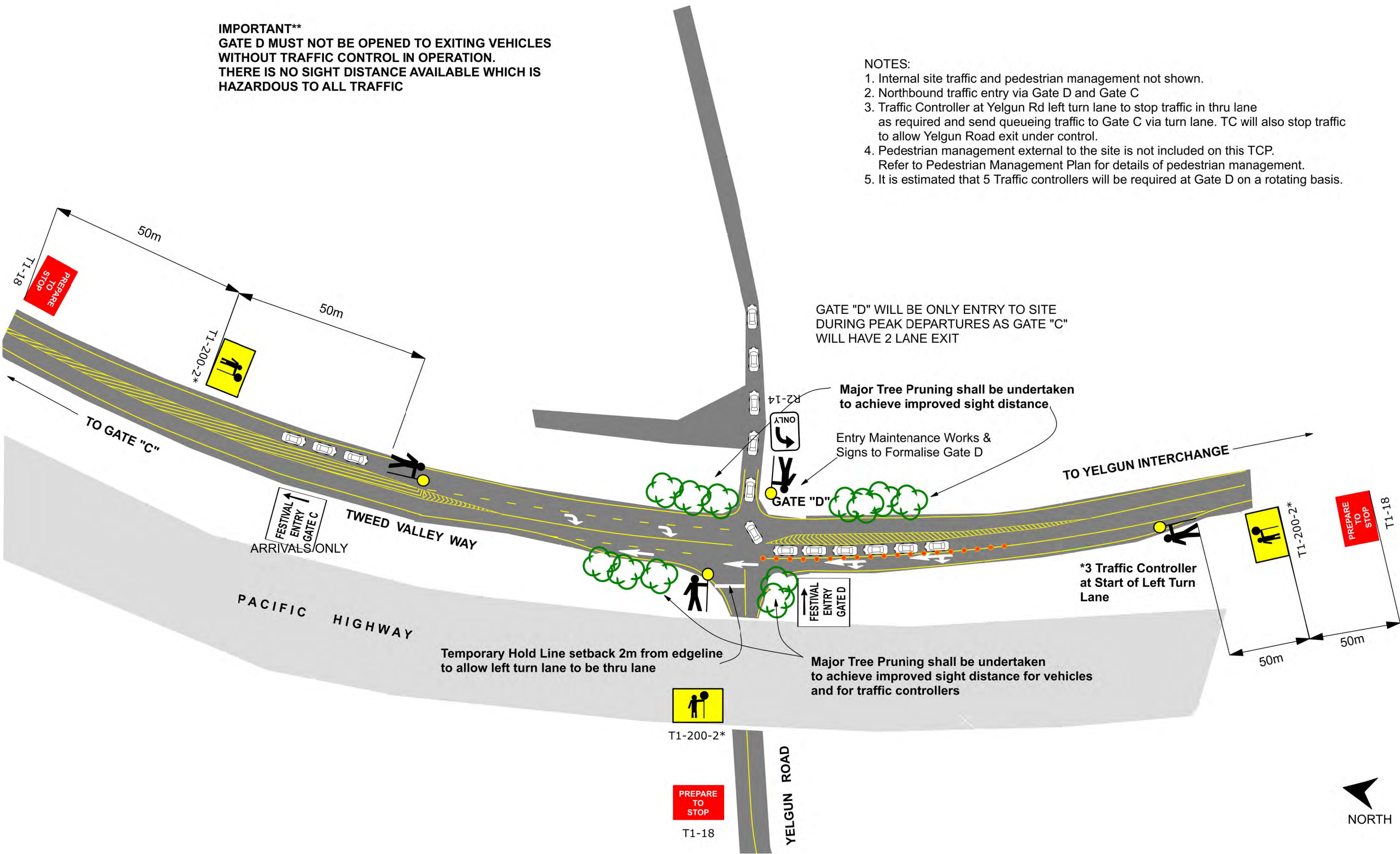
Project:
SPLENDOUR IN THE GRASS
FESTIVAL 2017

ISSUE FOR CONSTRUCTION

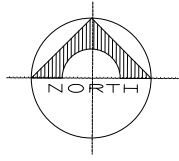
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Issued: HK	Original Size: A3	Sheet no: 9 of 18	Revision: 0
Job Number: 17073	Drawing Number: 170214-17073-TCP05	Hayden Kress RMS Design & Inspect TCPs 7333016159	

IMPORTANT**
GATE D MUST NOT BE OPENED TO EXITING VEHICLES
WITHOUT TRAFFIC CONTROL IN OPERATION.
THERE IS NO SIGHT DISTANCE AVAILABLE WHICH IS
HAZARDOUS TO ALL TRAFFIC

- NOTES:
- 1. Internal site traffic and pedestrian management not shown.
 - 2. Northbound traffic entry via Gate D and Gate C
 - 3. Traffic Controller at Yelgun Rd left turn lane to stop traffic in thru lane as required and send queueing traffic to Gate C via turn lane. TC will also stop traffic to allow Yelgun Road exit under control.
 - 4. Pedestrian management external to the site is not included on this TCP. Refer to Pedestrian Management Plan for details of pedestrian management.
 - 5. It is estimated that 5 Traffic controllers will be required at Gate D on a rotating basis.



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A	ISSUED FOR INFORMATION	HK	14/2/2017			SPLENDOUR IN THE GRASS	TRAFFIC CONTROL AT GATE D PEAK ARRIVALS & DEPARTURES	Drawn:	Scale:	Issued:	Date:				
0	ISSUED FOR CONSTRUCTION	HK	21/2/2017			Site Details:	Project:	TM	As Shown	HK	Original Size: A3	Sheet no: 10 of 18	Revision:		
							SPLENDOUR IN THE GRASS FESTIVAL 2017	Issued:							
								Job Number:	Drawing Number:						
								17073	170214-17073-TCP06	Hayden Kress RMS Design & Inspect TCPs 7333016159		0			



Approximate

KEY



TRAFFIC FLOW RELATING TO SIGNAGE



M1 MOTORWAY



FESTIVAL GATE



FESTIVAL TURN RIGHT



FESTIVAL STRAIGHT AHEAD



VMS - CAUTION QUEUING AHEAD



TO TWEED HEADS, GOLDCOAST AND BRISBANE TURN RIGHT

TO BYRON BAY, BALLINA AND SYDNEY TURN LEFT



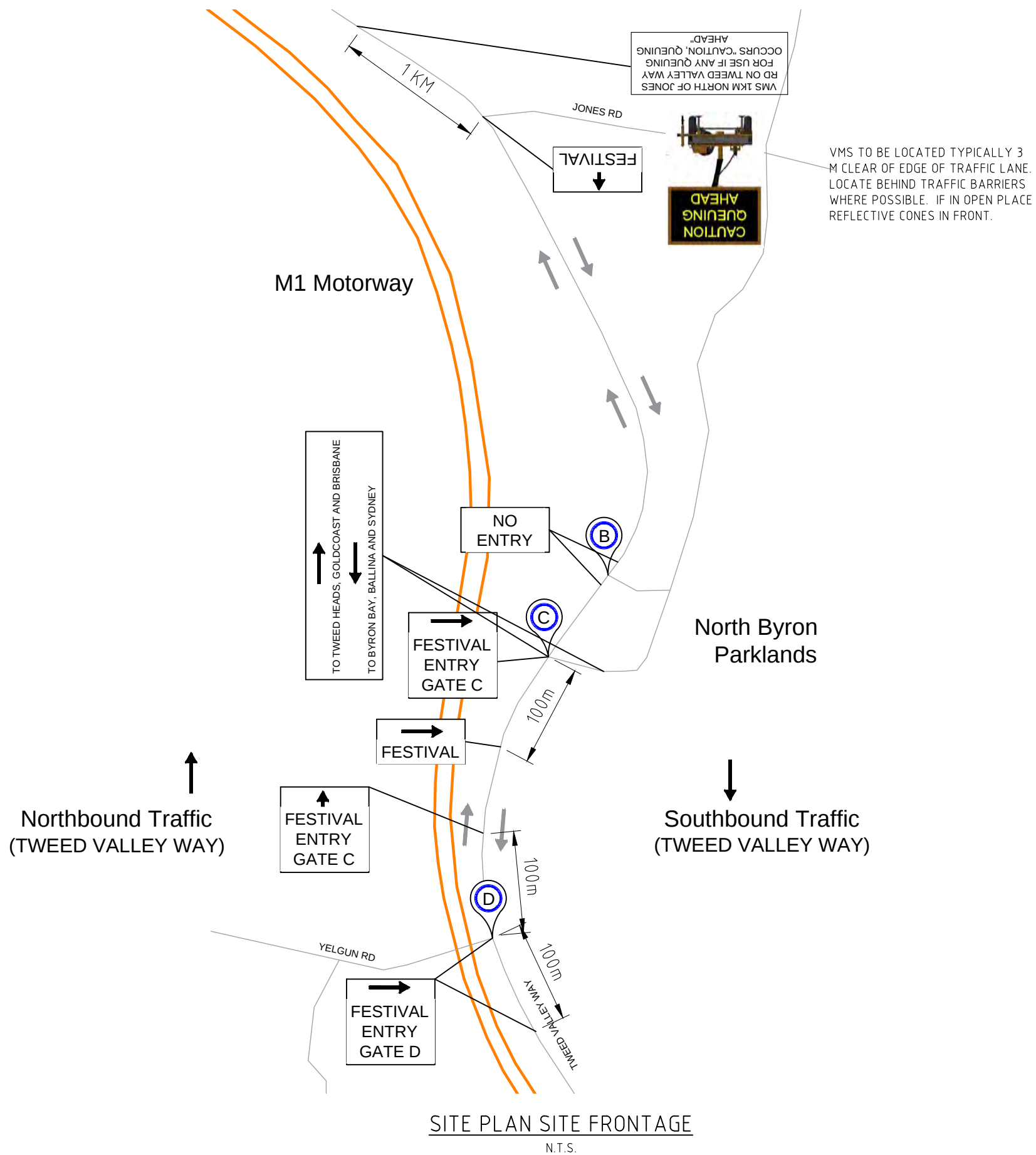
FESTIVAL ENTRY GATE D (TURN RIGHT)



FESTIVAL ENTRY GATE C (STRAIGHT AHEAD)



FESTIVAL ENTRY GATE C (TURN RIGHT)



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SIGNAGE PLAN

Project:
SPLENDOUR IN THE GRASS
FESTIVAL 2017

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Job Number: 17073	Sheet no: 11 of 18
Drawing Number: 160906-17039-TCP07	

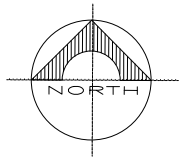
Issued:

Hayden Kress
RMS Design & Inspect TCPs 7333016159

Date:

Revision:

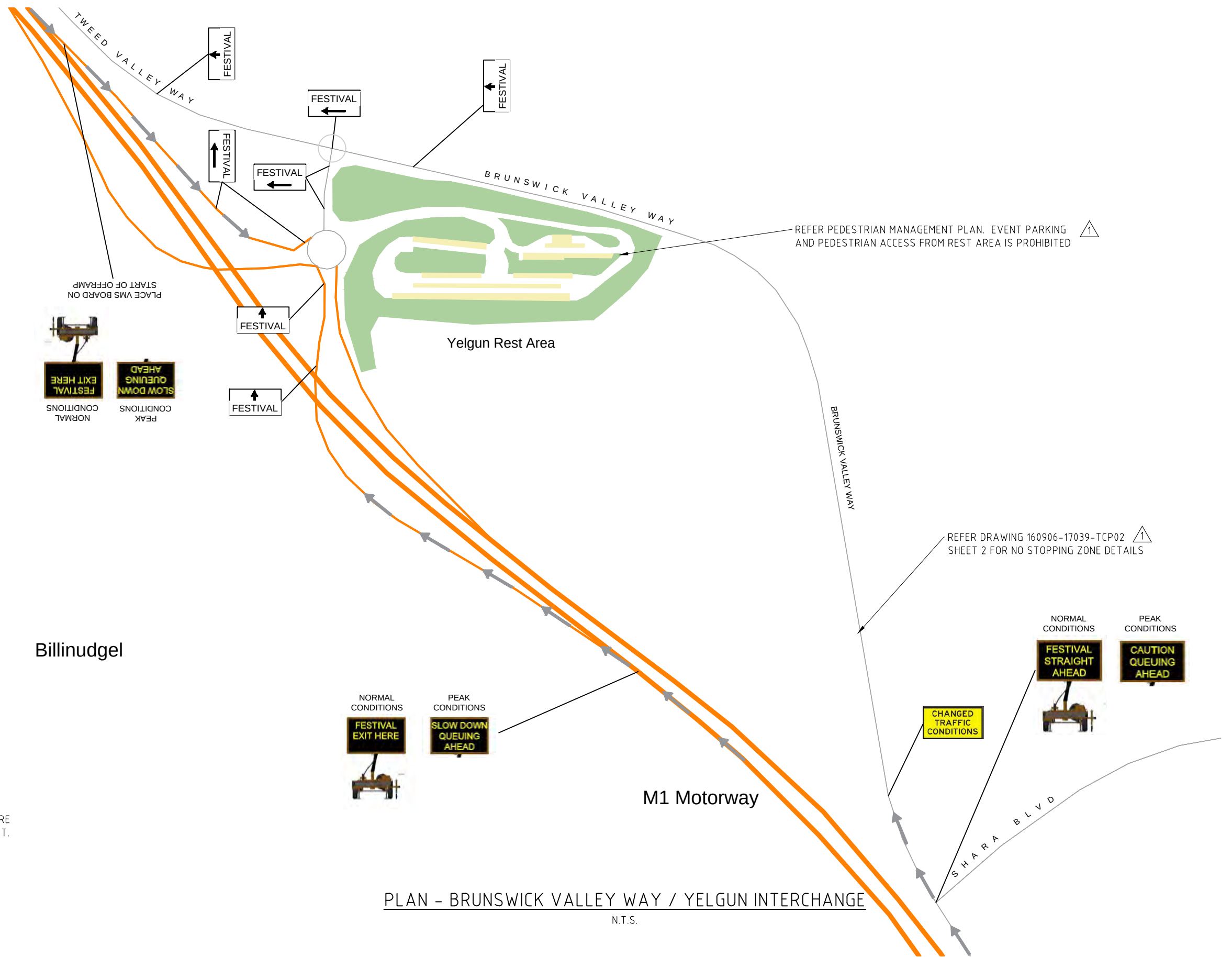
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Approximate

KEY

- M1 MOTORWAY
- TRAFFIC FLOW RELATING TO SIGNAGE
- VMS (NORMAL CONDITIONS)
- VMS (PEAK CONDITIONS)
- FESTIVAL TURN LEFT
- FESTIVAL STRAIGHT AHEAD
- CHANGED TRAFFIC CONDITIONS



PLAN - BRUNSWICK VALLEY WAY / YELGUN INTERCHANGE
N.T.S.



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SPLENDOUR IN THE GRASS

Site Details:

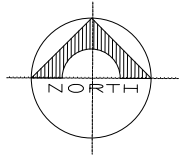


Title:
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SIGNAGE PLAN

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SPLENDOUR IN THE GRASS
FESTIVAL 2017

ISSUE FOR CONSTRUCTION

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Job Number: 17073	Drawing Number: 170214-17073-TCP08	Hayden Kress RMS Design & Inspect TCPs 7333016159	

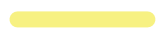


Approximate

KEY



TRAFFIC FLOW RELATING TO SIGNAGE



BRUNSWICK VALLEY WAY



M1 MOTORWAY



FESTIVAL TURN LEFT



FESTIVAL STRAIGHT AHEAD



FESTIVAL TURN RIGHT

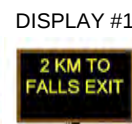


VMS (DISPLAY #1)

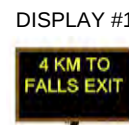


VMS (DISPLAY #2)

VMS TO BE LOCATED TYPICALLY 3 M CLEAR OF EDGE OF TRAFFIC LANE. LOCATE BEHIND TRAFFIC BARRIERS WHERE POSSIBLE. IF IN OPEN PLACE REFLECTIVE CONES IN FRONT.



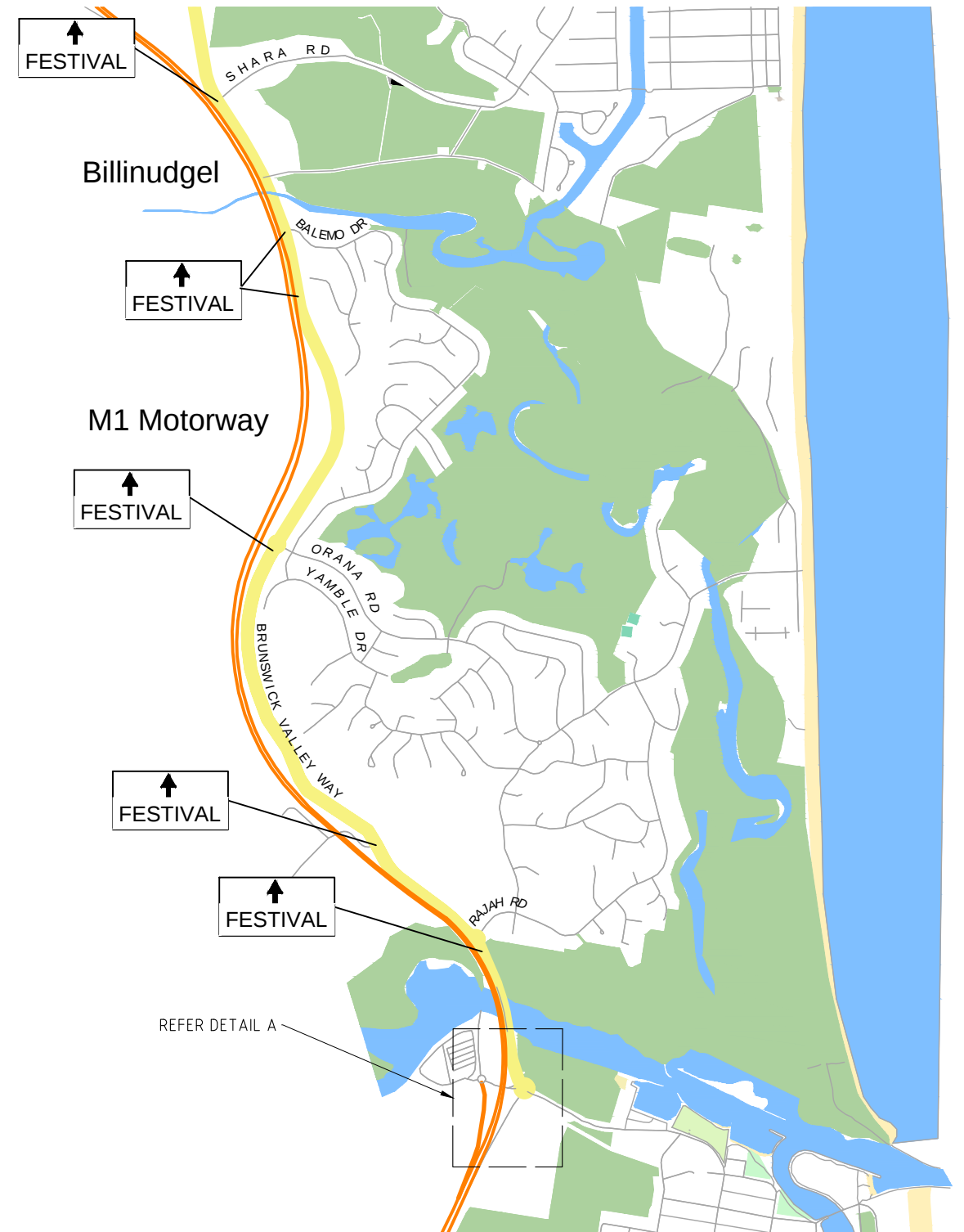
2 KM



2 KM

DETAIL A - BRUNSWICK NORTHBOUND OFF-RAMP

N.T.S.



PLAN - BRUNSWICK VALLEY WAY

N.T.S.



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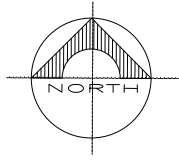


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Job Number: 17073	Drawing Number: 170214-17073-TCP09	Hayden Kress RMS Design & Inspect TCPs 7333016159	



Approximate

KEY



TRAFFIC FLOW RELATING TO SIGNAGE



M1 MOTORWAY



FESTIVAL TURN LEFT



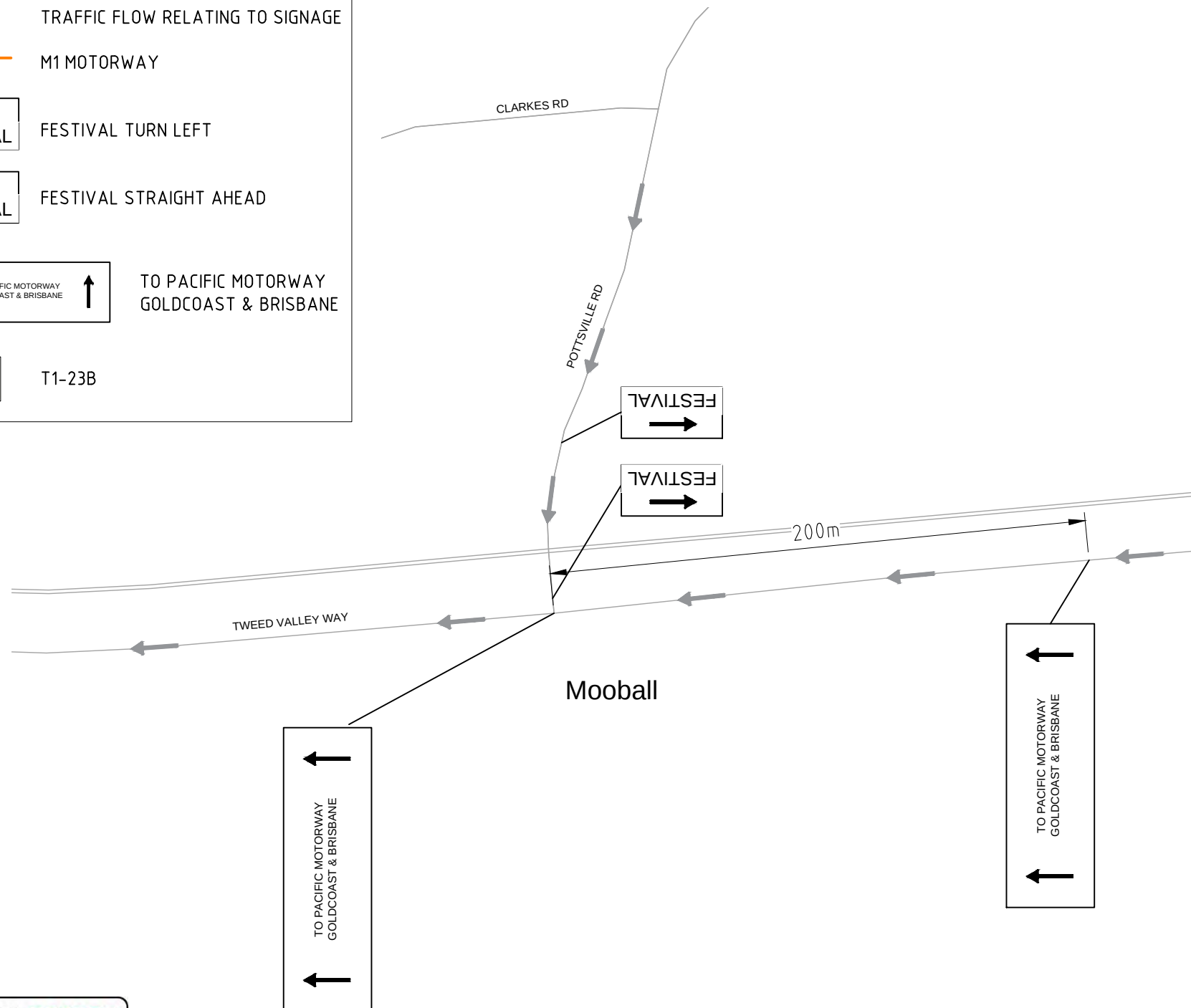
FESTIVAL STRAIGHT AHEAD



TO PACIFIC MOTORWAY
GOLDCOAST & BRISBANE

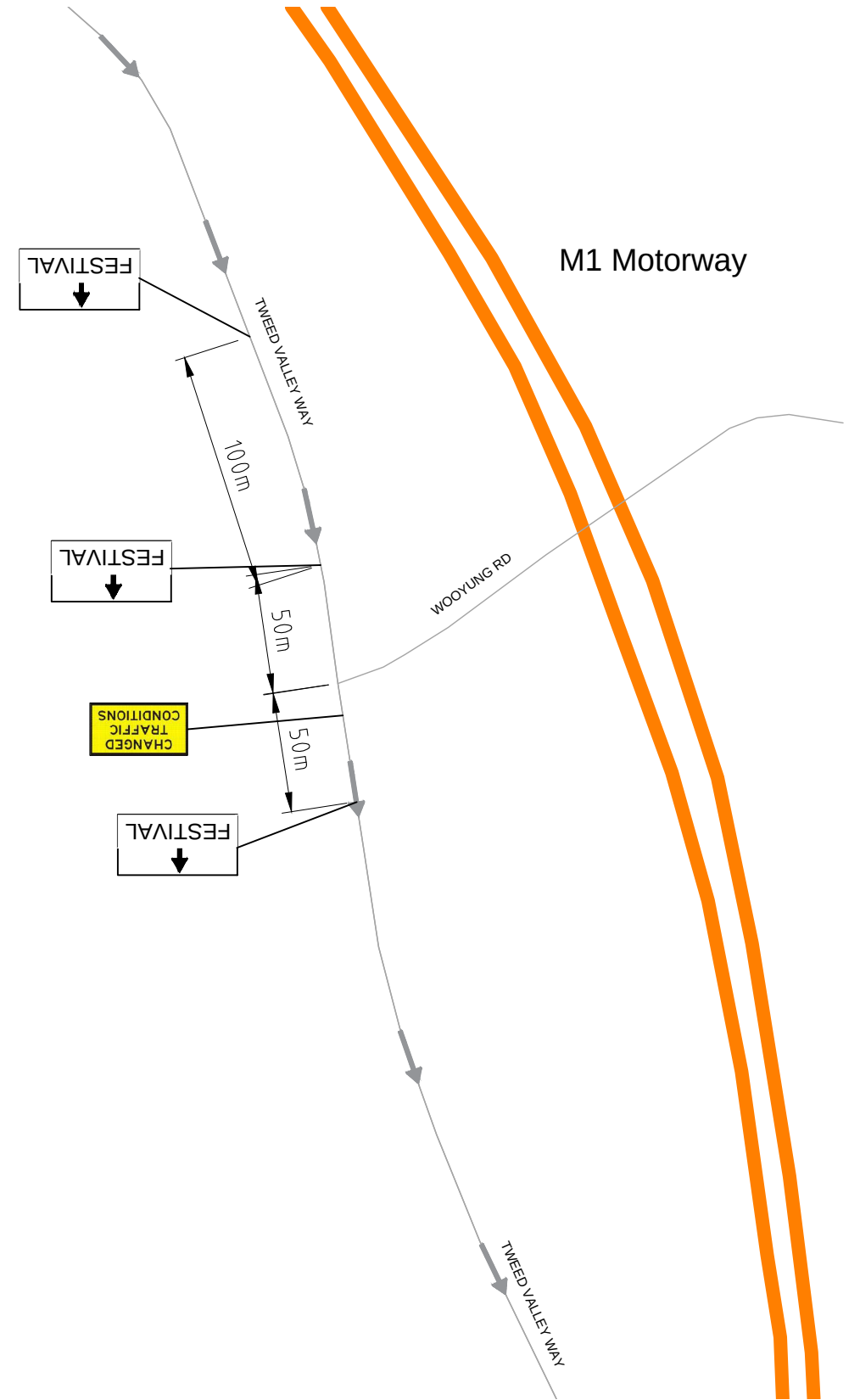


T1-23B



PLAN - MOOBALL

N.T.S.



PLAN - WOYUNG RD

N.T.S.



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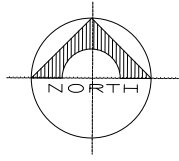


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Job Number: 17073	Drawing Number: 160906-17039-TCP10	Hayden Kress RMS Design & Inspect TCPs 7333016159	



Approximate

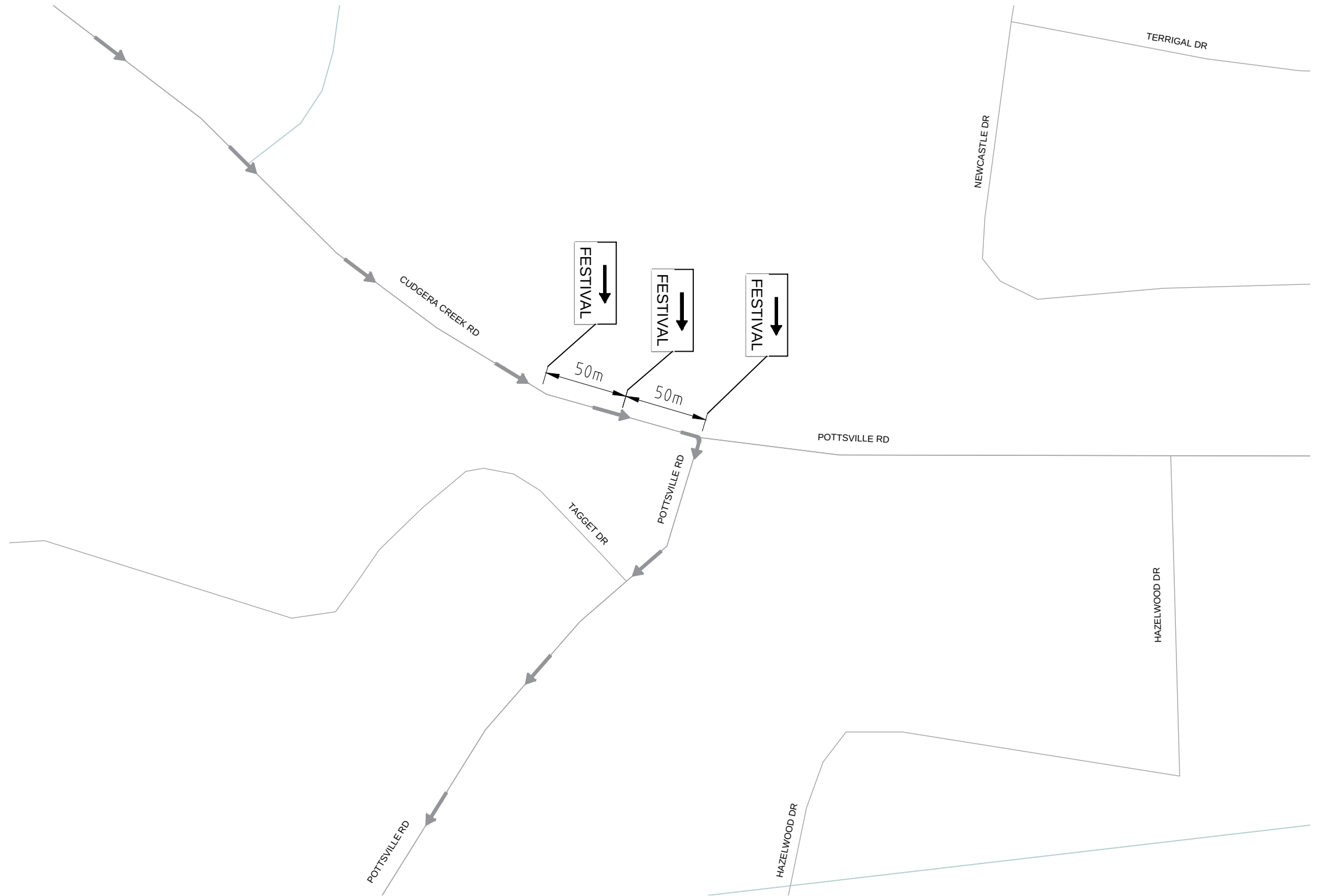
FESTIVAL

TRAFFIC FLOW RELATING TO SIGNAGE

KEY

FESTIVAL TURN RIGHT

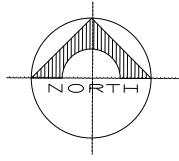
TRAFFIC FLOW RELATING TO SIGNAGE



PLAN - POTTSVILLE RD
N.T.S.



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A	ISSUED FOR INFORMATION	HK	14/2/2017			Site Details:		Project:	SPLENDOUR IN THE GRASS FESTIVAL 2017	Drawn:	Scale:	Issued:	Date:
0	ISSUED FOR CONSTRUCTION	HK	21/2/2017							TM	As Shown		
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						HK	A3	15 of 18	Hayden Kress RMS Design & Inspect TCPs 7333016159				
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						17073	160906-17039-TCP11		0				



Approximate



KEY

FESTIVAL TURN LEFT



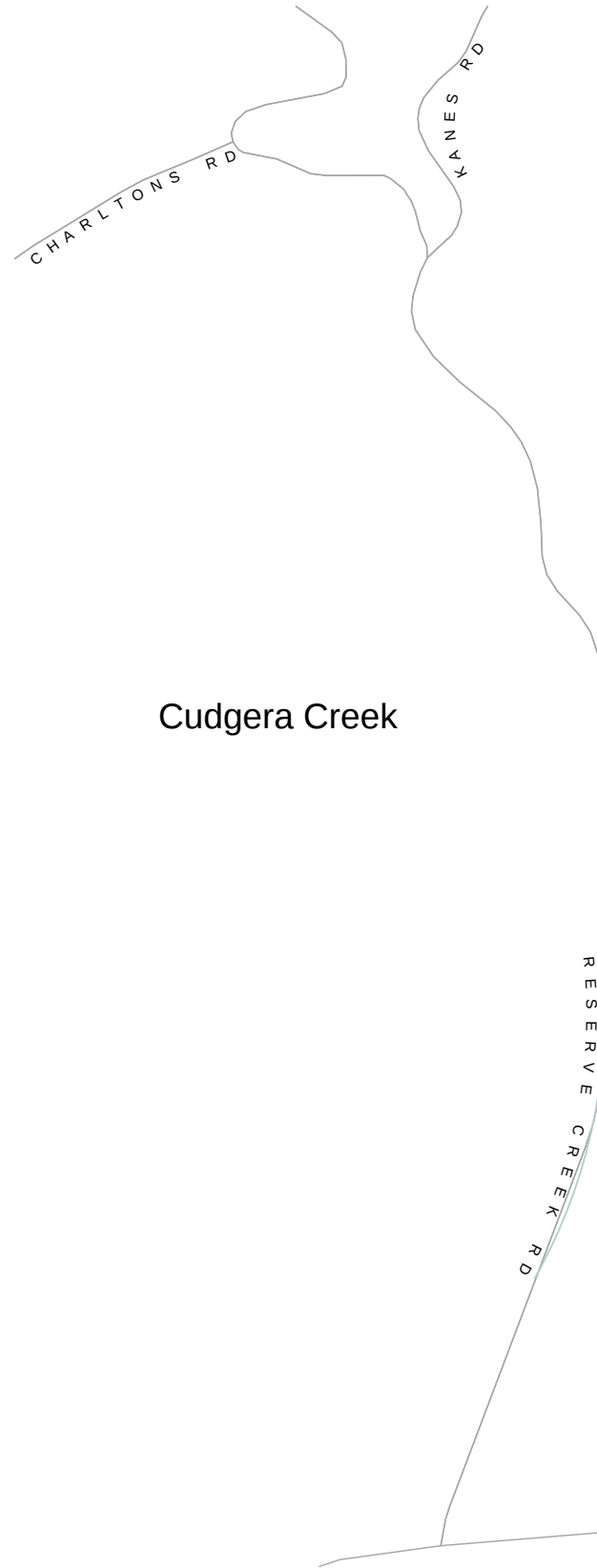
TRAFFIC FLOW RELATING TO SIGNAGE



VMS (DISPLAY #1)



VMS (DISPLAY #2)



Cudgera Creek

M1 Motorway

PLAN - CUDGERA CREEK RD

N.T.S.



FALLS EXIT
4 KM TO

DISPLAY #1

FALLS EXIT
AT
POTTSVILLE

DISPLAY #2



FALLS EXIT
2 KM TO

DISPLAY #1

FALLS EXIT
AT
POTTSVILLE

DISPLAY #2



FALLS
EXIT
HERE

DISPLAY #1

FOLLOW
FESTIVAL
SIGNS

DISPLAY #2

FESTIVAL
→

CUDGERA CREEK RD



Rev	Revision Description	BY	DATE
A	ISSUED FOR INFORMATION	HK	14/2/2017
0	ISSUED FOR CONSTRUCTION	HK	21/2/2017

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Client:
SPLENDOUR IN THE GRASS

Site Details:

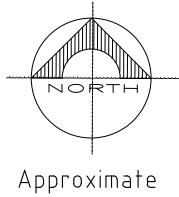


Title:
DIRECTIONAL AND INFORMATION
SIGNAGE PLAN

Project:
SPLENDOUR IN THE GRASS
FESTIVAL 2017

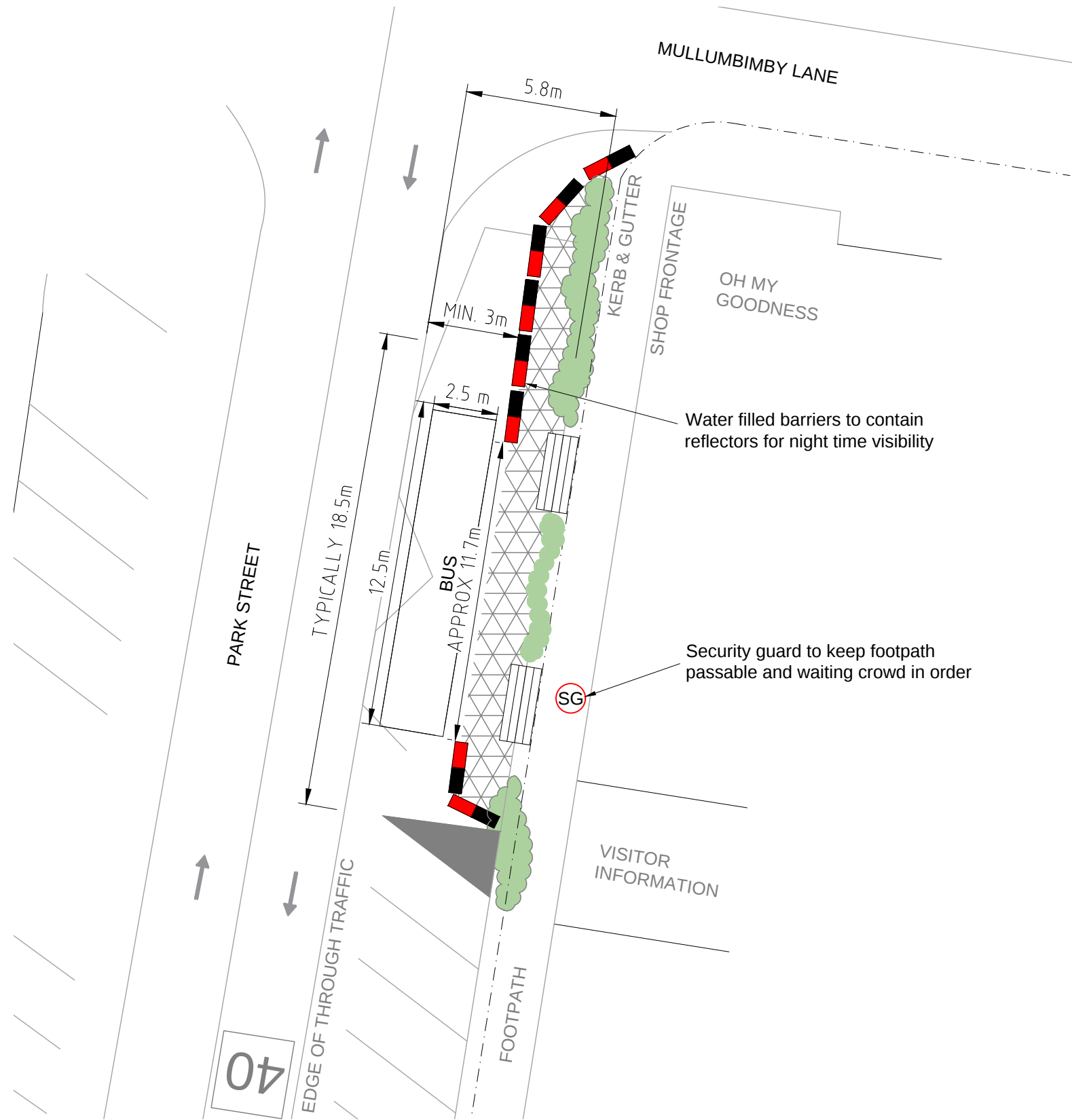
ISSUE FOR CONSTRUCTION

Drawn: TM	Scale: As Shown	Issued:	Date:
Issued: HK	Original Size: A3	Sheet no: 16 of 18	Revision:
Job Number: 17073	Drawing Number: 160906-17039-TCP12	Hayden Kress RMS Design & Inspect TCPs 7333016159	0



KEY:

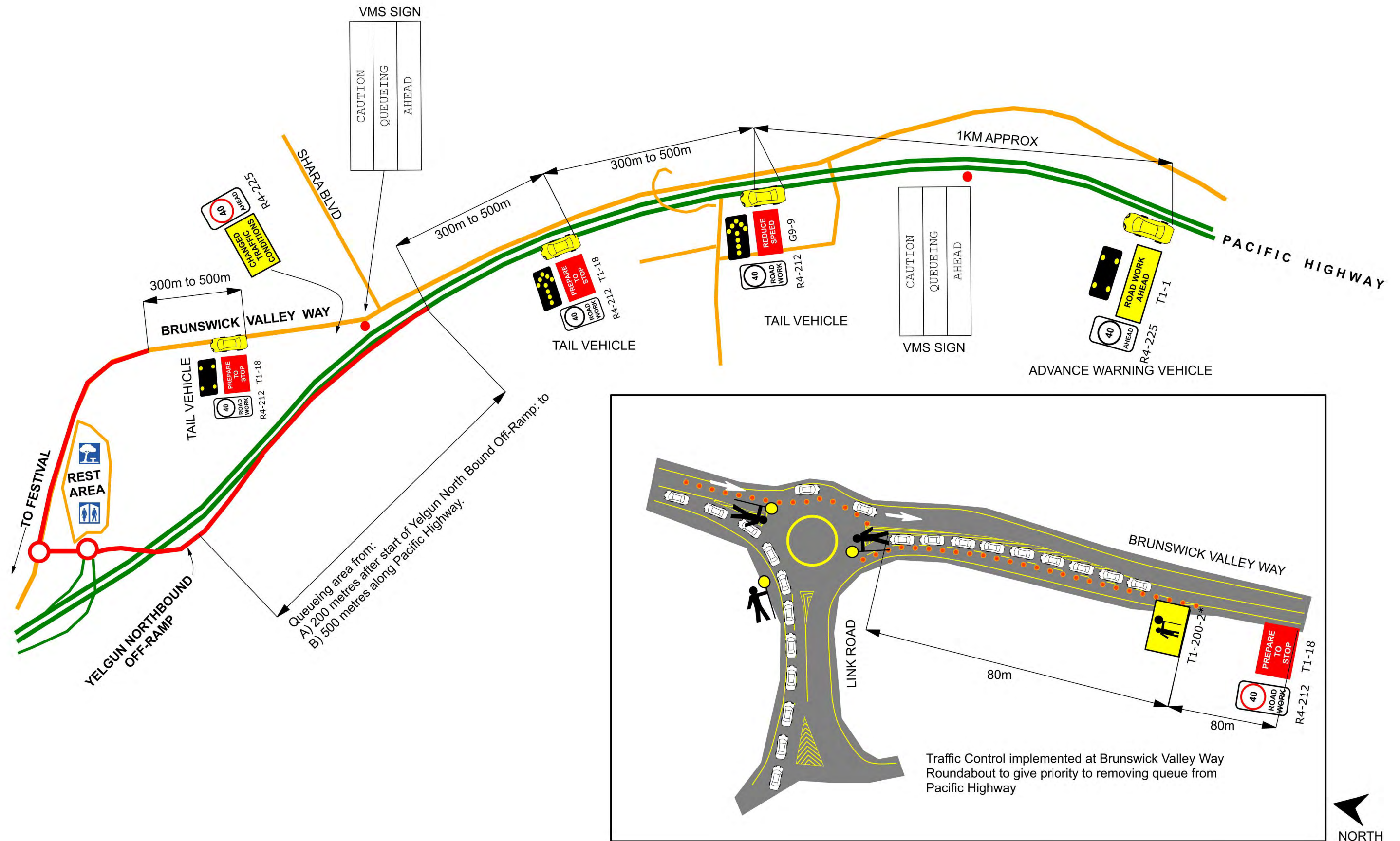
- Road Line Marking
- Approximate Kerb and Gutter Edge
- Stairs from Footpath to Roadside
- Water Filled Barriers (2m long)
- Bus Queuing Area
- Roadside Vegetation
- SG Security Guard



PLAN - TEMPORARY BUS BAY
SCALE: 1:200



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A	ISSUED FOR INFORMATION	HK	14/2/2017					Drawn: TM	Scale: As Shown	Issued:	Date:	
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						Job Number: 17073	Drawing Number: 170214-17073-TCP13	Hayden Kress RMS Design & Inspect TCPs 7333016159				
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Client:
 SPLENDOUR IN THE GRASS



Title:
 TRAFFIC CONTROL - PACIFIC HIGHWAY CONTINGENCY PLAN

Project:
 SPLENDOUR IN THE GRASS FESTIVAL 2017

ISSUE FOR CONSTRUCTION

Drawn: TM	Scale: As Shown	Issued:	Date:
Issued: HK	Original Size: A3	Sheet no: 18 of 18	Revision: 0
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