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Memo

To:	Anthony Witherdin	From:	Fred Gennaoui
	Recipient's Office		Sydney
File:	Memo-RFS Concerns	Date:	November 5, 2018

Reference: **Bushfire Emergency at Mundamia URA**

BACKGROUND

The Department has commissioned Stantec to undertake a review of the road capacity and evacuation times in the event of a bushfire emergency at Mundamia. The review is to consider:

- evacuation times based on the current proposal (SSD 7169) in isolation, as well as the evacuation times at full development (i.e. SSD 7169 plus the residual development in the Mundamia URA)
- include advice regarding whether the proposed road network will provide for the safe evacuation of residents in times of a bushfire emergency (please see attached letter from RFS dated 28 May 2018 outlining the matters it recommends the Department consider)
- include recommendations, where relevant, to provide for the safe evacuation of residents.

These matters are addressed below.

ACCESS ROADS

Vehicular access to the two residential subdivisions ((i.e. SSD 7169 plus the residual development in the Mundamia URA) is proposed via a realigned George Evans Road. George Evans Road which has one traffic lane in each direction with sealed shoulders also provides access to the University of Wollongong campus, via a roundabout. Beyond the university access, George Evans Road is currently unsealed. It is understood this road will be realigned and constructed for a length of about 300 m north of the University.

George Evans Road intersects with Yalwal Road forming a T-junction controlled by give way signs; at that location there are two marked westbound lanes in Yalwal Road to allow westbound through traffic to pass a vehicle turning right, the remaining of Yalwal Road has one traffic lane in each direction with sealed shoulders.

To the north of the subdivisions, Jonsson Road and Stonegarth Road are unsealed roads connecting to George Evans Road. A new roundabout is proposed at the junction of George Evans Road with the entrance to the two proposed subdivisions.

The RFS has noted that to the north of the site, the locality is constrained by way of the Shoalhaven River and access to the west may not be the preferred option, with regard to the increased likelihood that a fire front could travel from a north westerly direction and therefore any evacuating residents may choose to leave and travel east into the increased safety provided by West Nowra, then Nowra and its surrounds.

FIRE EVACUATION

A bush fire evacuation assessment has been undertaken to determine the time it would take for all vehicles to exit the subdivision (s) and reach a safe location. For the purposes of this assessment the analysis has looked at the time taken for vehicles from the subdivision to reach Yalwal Road.

Once vehicles reach Yalwal Road intersection, the time taken for vehicles to enter Yalwal Road is expected to vary greatly as Yalwal Road may also be used for evacuating other areas and is expected to be operating at capacity but most likely under police control. Under these conditions vehicles will access Yalwal Road via either courtesy gaps, or traffic management measures which will need to be established. This aspect does not form part of this assessment.

Trip Generation

For the purposes of this assessment, the following assumptions were adopted.

Jemalong Subdivision (SSD 7169)

It has been assumed that the bush fire evacuation has been assumed to occur when all 346 dwellings within the area are occupied.

A recent study completed for Shoalhaven Council for the Bangalee area has been identified that approximately 11% of all dwellings within the area have five or more persons residing in the premises. It has been therefore assumed that each dwelling would generate one vehicle movement during a bush fire, with any dwelling accommodating five or more people generating two vehicle movements. Therefore, a trip rate per dwelling of 1.11 vehicles has been derived.

Adopting this rate, the Jemalong subdivision would generated about 385 cars during evacuation.

Residual development in the Mundamia URA)

As per previous assessment the following land uses and corresponding trip generation have been assumed for this area:

- Residential 237 dwellings generating 265 cars
- Child Care Centre for 55 children and 10 staff generating 57 cars. This assumes that 15% of children are local and their trip generation already included in the residential component.
- Retail 1994 m^2 GLFA requiring 103 car spaces (based on RMS 6.1 spaces per 100 m^2); this assumes that 15% of customers/staff are local and their trip generation already included in the residential component.

Thus, the total generation of this area during an evacuation is about 425 cars.

University

The University has a car park which can accommodate 200 cars. It has been assumed that the car park will be fully occupied in time of evacuation.

Thompson Point Reserve

Previous assessment of likely trip generation of the Thompson Point Reserve indicated a peak flow og 40 cars per hour on weekends. This volume has been assumed in this analysis.

Overall Trips

The overall number of cars likely to require evacuation in a peak scenario along George Evans Road would be of about 850 cars north of the University access increasing to 1050 cars south of it.

	Jemalong (SSD 7169)	All areas
Thompson Point Reserve	40	40
Jemalong (SSD 7169)	384	384
Remainder Mundamia URA		423
University	200	200
Total	**624**	**1047**

TRAFFIC ANALYSIS

Basis of Assessment

It has been assumed for the purpose of this assessment that

- All roads would be constructed to provide one traffic lane in each direction with shoulders.
- All vehicles between the subject areas and Yalwal Road along George Evans Rd are evacuated at the same time,
  - All evacuated vehicles would use the left lane only, allowing entry by emergency vehicles.
  - No traffic, other than emergency vehicles, would be permitted to access the area
  - Thompson Point Reserve trips, during the day only, will access Road 1 north of Road 16, before accessing George Evans Road
  - University trips, during the day only, will access George Evans Road at the existing roundabout
  - Cars generated by the Jemalong subdivision (SDD7169) will be accessing Road 1 then George Evans Road via (refer to Figure 1):
    - Road 9 - dwellings in areas 1, 4, 5 and 7 (39%)
    - Roads 11, 17 and 18 - dwellings in areas 2, 3, 6, 8 and 9 (46%)
    - Road 15 and 16 - dwellings in areas 10 and 11 (15% of trips)

  - Cars generated by the residual Mundamia UAR will all exit along George Evans Road west of Road 1.

The likely evacuation time required to reach the junction of George Evans Road with Yalwal Road would depend on the capacity of the different roads. Unless otherwise constructed, it has been assumed that Road 1 and George Evans Road would have one traffic lane in each direction with shoulders.

Whilst George Evans Road may be considered a rural road, it has been reasonably assumed that in an emergency situation a capacity of 1800 vph can be adopted for a single lane where overtaking is not permitted along the whole section of the roadway. (source: Austroads Guide to Traffic Engineering Part 3 Traffic Studies and Analysis section 4.1.1).

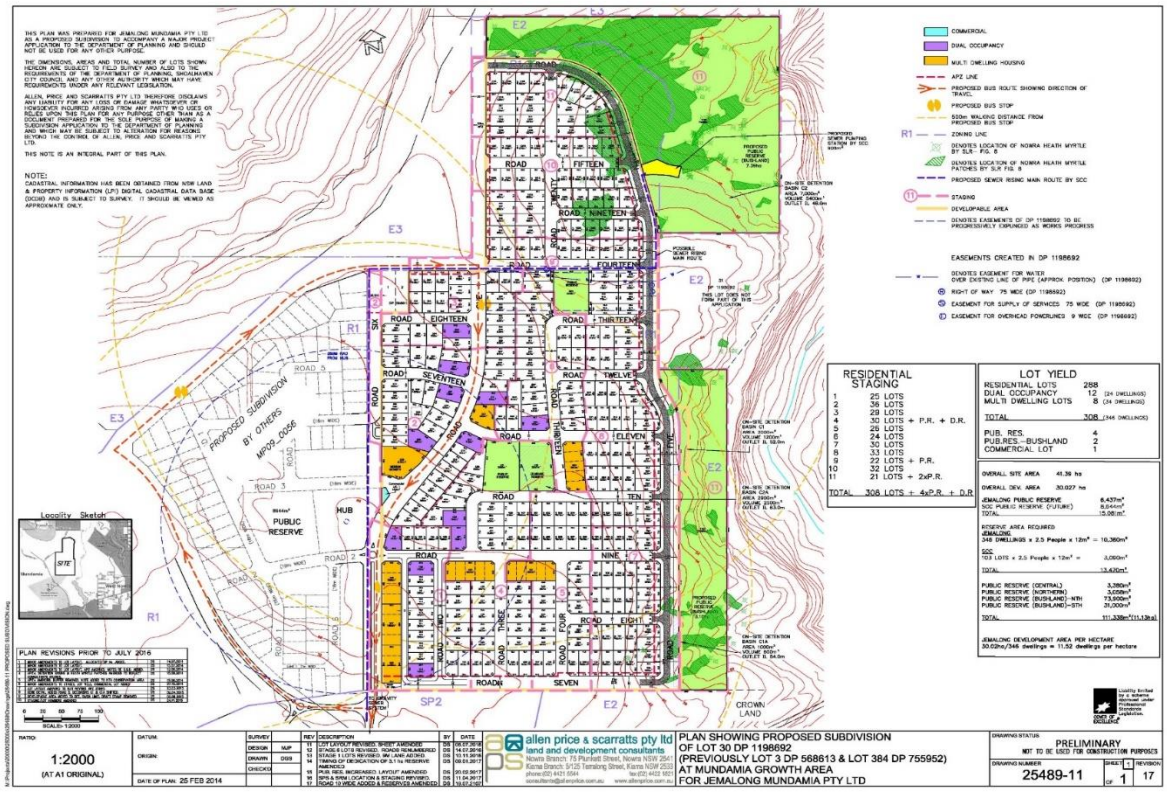

Figure 1: Potential subdivisions in Mundamia URA

Evacuation time for current proposal (SSD 7169) in Isolation

The following two scenarios have been tested to assess the need to evacuate the areas within 15, 30 and, 60 minutes:

- Scenario 1 - Night time evacuation - includes cars from residential dwellings only (refer Table 1).
- Scenario 2 - Daytime evacuation – includes cars from residential dwellings, the University and Thompson Point Reserve (Refer Table 2)

At night time a evacuation could be achieved in 15 mns along the whole route to Yalwal Road roads as noted in Table 1.

Road Section	Cars	Lane Capacity Per Hour	v/c	Lane Capacity Per 30mns	v/c	lane Capacity Per 15mns	v/c
Road 1, north of Road 14	58	1800	3%	900	6%	450	13%
Road 1, north of Road 9	234	1800	13%	900	26%	450	52%
Road 1, north of Road 7	384	1800	21%	900	43%	450	85%
George Evan Rd, north of University	384	1800	21%	900	43%	450	85%
George Evan Rd, north of Yalwal Rd	384	1800	21%	900	43%	450	85%

Table 1: Scenario 1 Volume to capacity Ratio Night Time Evacuation SDD 7169

During the day time a 30 minutes evacuation could be achieved along all sections of roads as noted in Table 2.

Road Section	Cars	Lane Capacity Per Hour	v/c	Lane Capacity Per 30mns	v/c	lane Capacity Per 15mns	v/c
Road 1, north of Road 14	98	1800	5%	900	11%	450	22%
Road 1, north of Road 9	274	1800	15%	900	30%	450	61%
Road 1, north of Road 7	424	1800	24%	900	47%	450	94%
George Evan Rd, north of University	424	1800	24%	900	47%	450	94%
George Evan Rd, north of Yalwal Rd	624	1800	35%	900	69%	450	139%

Table 2: Scenario 2 Volume to capacity Ratio Daytime Evacuation SDD 7169

Evacuation Times for Mundamia UAR Completed Development

The following two scenarios have also been tested to assess the need to evacuate the two areas within 15, 30 and, 60 minutes:

- Scenario 1 - Night time evacuation - includes only cars from residential dwellings in both areas
- (refer Table 3).
- Scenario 2 - Daytime evacuation – includes cars from all residential dwellings, the University and Thompson Point Reserve (Refer Table 4).

At night time an evacuation time of about 30 mns could be achieved along all sections of roads as noted in Table 3. A lesser time of about 15 mns would not be possible due to capacity constraints along George Evans Road.

Road Section	Cars	Lane Capacity Per Hour	v/c	Lane Capacity Per 30mns	v/c	lane Capacity Per 15mns	v/c
Road 1, north of Road 14	58	1800	3%	900	6%	450	13%
Road 1, north of Road 9	234	1800	13%	900	26%	450	52%
Road 1, north of Road 7	384	1800	21%	900	43%	450	85%
George Evans Rd, west of Road 1	263	1800	15%	900	29%	450	58%
George Evans Rd, north of University	647	1800	36%	900	72%	450	144%
George Evans Rd, north of Yalwal Rd	647	1800	36%	900	72%	450	144%

Table 3: Volume to capacity Ratio Scenario 3 Night Time Evacuation All Mundamia URA

During the day a 45 to 60 minutes evacuation time could easily be achieved along Road 1 and George Evans Road as noted in Table 4.

A lesser time of about 30 mns would not be possible due to capacity constraints along George Evans Road.

Road Section	Cars	Lane Capacity Per Hour	v/c	Lane Capacity Per 30mns	v/c	lane Capacity Per 15mns	v/c
Road 1, north of Road 14	98	1800	5%	900	11%	450	22%
Road 1, north of Road 9	274	1800	15%	900	30%	450	61%
Road 1, north of Road 7	424	1800	24%	900	47%	450	94%
George Evans Rd, west of Road 1	423	1800	24%	900	47%	450	94%
George Evans Rd, north of University	847	1800	47%	900	94%	450	188%
George Evans Rd, north of Yalwal Rd	1047	1800	58%	900	116%	450	233%

Table 4: Volume to capacity Ratio Scenario 4 Day time Evacuation All Mundamia URA

Adequacy of Proposed Road Network

The minimum anticipated evacuation time for the different scenarios are summarised in Table 5. These are based of the capacity of the full length of roadway to Yalwal Road to carry projected volumes not exceeding 85%.

	Night Time		Day Time	
	Volumes	**Minimum Evacuation Time**	Volumes	**Minimum Evacuation Time**
Jemmalong SDD 7169 in isolation	384	15 minutes	624	30 minutes
All of Mundamia URA	647	30 minutes	1,047	45-60 minutes

Table 5: Minimum Evacuation Times Due Based on Capacity Constraints

Evacuation of all cars in a lesser time than shown in Table 5 would necessitate additional capacity. This could be achieved by the provision of a second southbound traffic lane along George Evans Road and Road 1 south of Road 9 (as illustrated by in Figure 2)

- Banning parking in Road 1 south of Road 9 to allow two southbound lanes, and
- Providing a wider shoulder on the eastern side of George Evans Road to enable two cars abreast to travel southbound. Based on preliminary review of Council's Section 94 Plan, it is not clear if the contribution plan includes the provision of shoulders along George Evans Road.

Alternatively, evacuated traffic would be allowed to use the northbound traffic lane; however, emergency vehicles would be impeded by this measure to access the area and is therefore not supported.

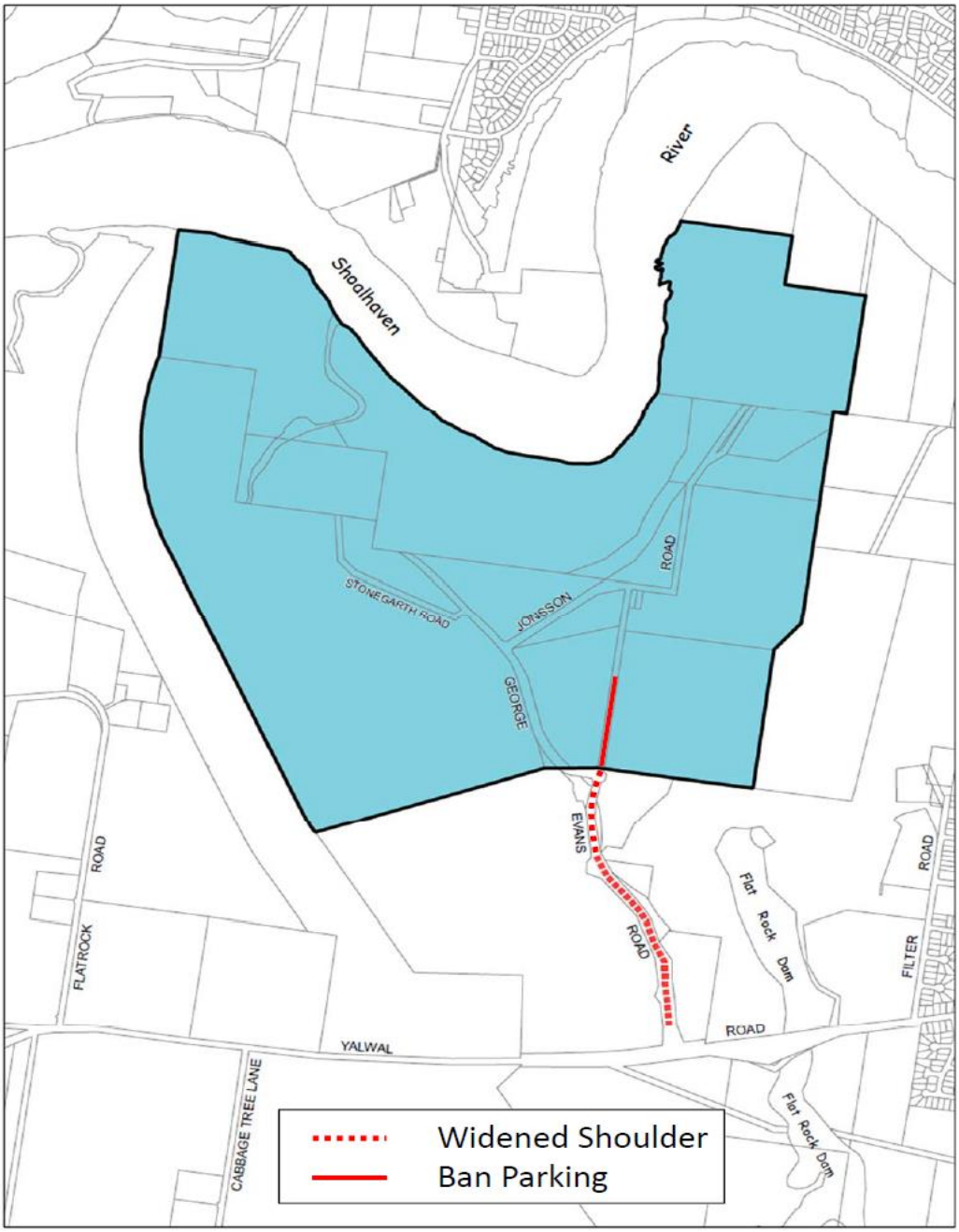

Figure 2: Measures to Reduce Evacuation Time

Once vehicles reach Yalwal Road junction, the time taken for vehicles to enter Yalwal Road is expected to vary greatly as Yalwal Road may also be used for evacuating other areas and is expected to be operating at capacity and most likely under police control. Under these conditions vehicles will access Yalwal Road via either courtesy gaps, or traffic management measures which will need to be established.

Yalwal Road has a two lane undivided carriageway west of Filter Street. Whilst no detail assessment of this road has been carried out, it is anticipated that it may be suitable for an evacuation time of about 60 mns. For shorter evacuation time, a second westbound lane would be required between George Evans and Filter Street. This measure may be constrained by the bridge over the Flat Rock Creek.

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CONCLUSIONS,

If the Jemalong Subdivision (SDD7169) is developed in isolation, all cars within the Mundamia URA to the north of Yalwal Road could be evacuated in 30 mns approximately.

At full development of the Mundamia URA, the evacuation time would increase to about 30 minutes at night time and up to approximate 60 minutes during the day.

RECOMMENDATIONS

The purpose of an evacuation strategy is to ensure the safety of all persons within the affected area accessed via George Evans Road. To provide an evacuation time of about 30 mns, at ultimate development of the Mundamia URA, the following measures should be considered:

- Roundabouts should be mountable
- Banning parking in Road 1 south of Road 9
- Widening the eastern side shoulder of the hole length of George Evans Road to result in two southbound traffic lanes in case of emergency
- Widening the northern side shoulder of Yalwal Road (where practical) to enable two eastbound traffic lanes in case of emergency
- All access point should be managed by Police or SES.

It is also recommended that Council prepare a Traffic Management Plan in conjunction with RFS to be implemented during a fire emergency in the Mundamia URA.

Fred Gennaoui
National Specialist, Transport & Traffic Planning
Stantec
Phone: 8378 7145

Fred.gennaoui@stantec.com