05

Studies (Part 2)

PRELIMINARY TRAFFIC ASSESSMENT

PLANNING PROPOSAL – RESIDENTIAL DEVELOPMENT

LOT 273 IN DP 755266

15 MULLOWAY ROAD
CHAIN VALLEY BAY

PREPARED FOR: NOEL SMITH

OCTOBER 2016

16/126

PRELIMINARY TRAFFIC ASSESSMENT
NOEL SMITH

PLANNING PROPOSAL
RESIDENTIAL DEVELOPMENT
LOT 273 IN DP 755266
15 MULLOWAY ROAD, CHAIN VALLEY BAY.

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QUALITY ASSURANCE

This document has been prepared, checked and released in accordance with the Quality Control Standards established by Intersect Traffic Pty Ltd.

Issue	Date	Description	By
A	20/09/16	Draft	PA
B	26/09/16	Edit	JG
D	10/10/16	Final Proof / Client Amendments	JG
E	10/10/16	Approved	JG

This document has been authorised by

Date 10th October 2016

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1.0 INTRODUCTION

Intersect Traffic Pty Ltd (Intersect Traffic) has been engaged by Optima Developments Pty Ltd on behalf of Noel Smith to prepare a Preliminary Traffic Assessment for a planning proposal for a residential development proposal on Lot 273 in DP 755266 15 Mulloway Road, Chain Valley Bay. The proposal is likely to yield in the order of 174 low density residential lots.

The planning proposal includes the half width road pavement construction of Mulloway Road along the site frontage and the construction of (4) four public roads accessing the residential subdivision – (3) three from Mulloway Road at the northern end of the site and (1) one via an extension of Teraglin Road at the western side of the property. The road upgrading / improvements are to be in accordance with Central Coast Council requirements. The proposed concept development plan is shown in ***Attachment A***.

This report is required to support a planning proposal to Central Council as the consent authority for the rezoning of the subject land for low density residential development. It will allow the Council and NSW Roads and Maritime Services (RMS) to assess the proposal in regard to its traffic impacts on the local and state road network.

This report presents the findings of the traffic assessment and includes the following;

1. An outline of the existing situation in the vicinity of the site.
2. An assessment of the traffic impacts of the proposed development including the predicted traffic generation and its impact on existing road and intersection capacities.
3. Determines any triggers for the provision of additional infrastructure.
4. Reviews parking, public transport, pedestrian and cycle way requirements for the proposed development, including assessment against Council's DCP and Australian Standard requirements.
5. Presentation of conclusions and recommendations.

2.0 SITE LOCATION

The subject site is located on the southern side of Mulloway Road, Chain Valley Bay. The centre of the site is approximately 600 metres west of Chain Valley Bay Road, approximately 2.0 kilometres from the Pacific Highway south of the site and 500 metres east of the Lake Macquarie foreshore parkland with its boat ramp and jetty. Residential developments adjoin its eastern and western borders, whilst Karignan Creek forms the southern boundary of the property.

The only vehicular access to the site constructed as a rural access crossing is located close to the centre of the site frontage on Mulloway Road. ***Figure 1*** below shows the site location from a local context.

The site contains the land title of Lot 273 in DP 755266, is addressed as 15 Mulloway Road, Chain Valley Bay and has a total area of approximately 17 ha. A single dwelling and sheds are currently located on the site.

Pursuant to the Wyong LEP (2013) the site is currently zoned E3 – Environmental Management covering approximately 80% of the property (at the northern end) and E2 - Environmental Conservation covering approximately 20% of the property (at the southern end). ***Photograph 1*** shows the existing conditions at the site while ***Photograph 2*** shows the existing vehicular access to the site.

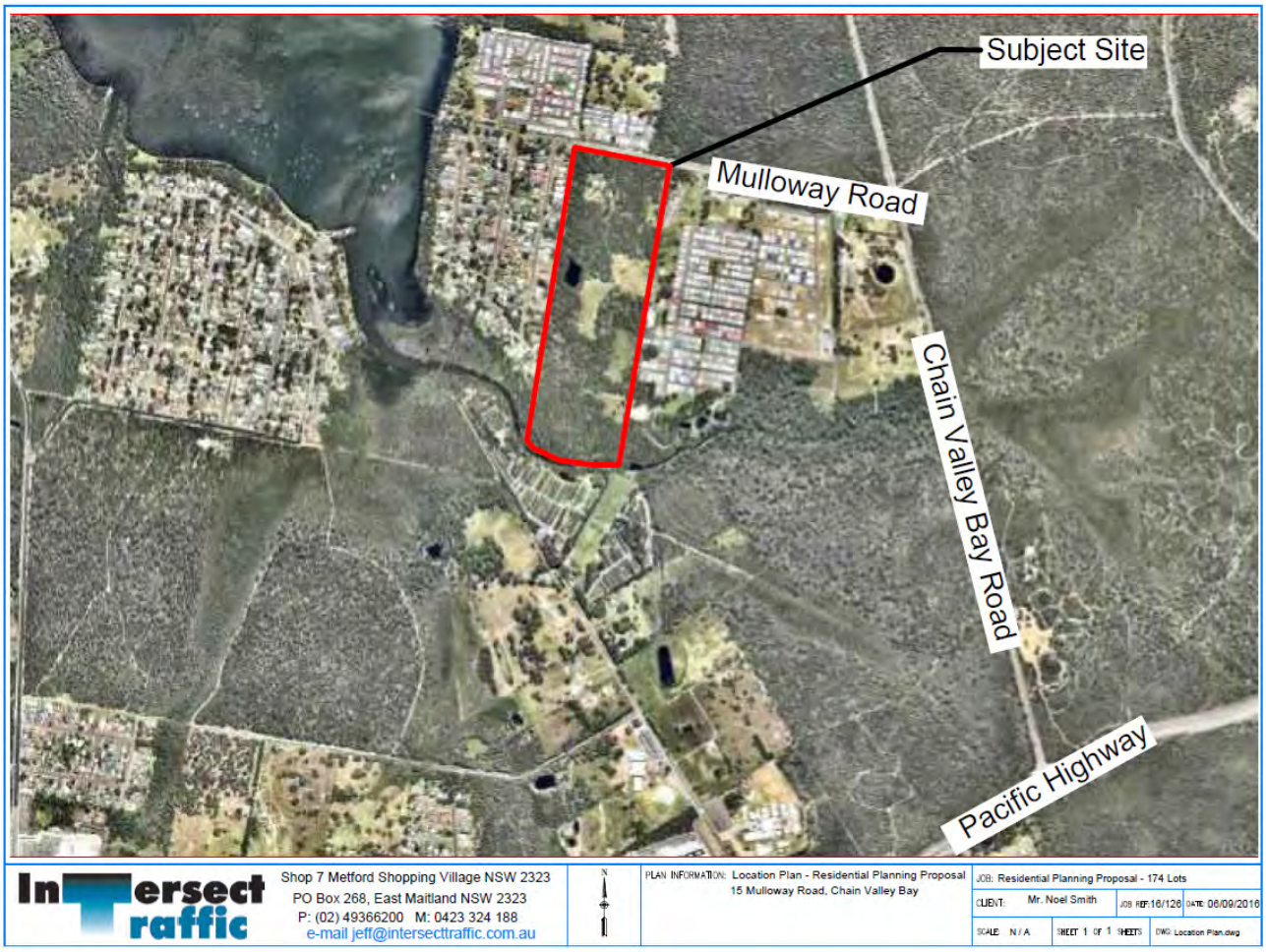


Figure 1 – Site Location

Photograph 1 – Development site from Chain Valley Bay Road

Photograph 2 – Existing vehicular access to the site

3.0 EXISTING ROAD NETWORK

3.1 Pacific Highway

The Pacific Highway would currently be classified as an arterial road under a functional road classification and as such is under the care and control of NSW RMS. The Pacific Highway is a major transport route and connects the southern suburbs of Newcastle and the Central Coast suburbs. In the vicinity of the site it is a median separated (dual carriageway) four lane two way road with each carriageway having a sealed width of approximately 12.5 metres. Lane widths are approximately 3.7 metres with break down / shoulder sealed widths of 4.0 metres (approx.) adjacent to the inside lane and 0.3 to 1.0 metre (approx.) adjacent to the outside lane. ***Photograph 3*** below shows the standard of the Pacific Highway in this location. At the time of inspection the Pacific Highway was in good condition and an 80 km/h speed zone applied in this location.

Photograph 3 – The Pacific Highway adjacent to Chain Valley Bay Road

3.2 Chain Valley Bay Road

Chain Valley Bay Road is a local collector road under the care and control of Central Coast Council. In the vicinity of the site it is two way two lane rural road with a sealed carriageway width of approximately 6.5 metres. Sealed lane widths vary between 3.0 and 3.5 metres and the grassed and / or gravel shoulders are generally 1.5 metres wide. Chain Valley Bay Road provides access to other local roads and to properties along its length and connects to the Pacific Highway approximately 1.5 km south of Mulloway Road. The intersection with the Pacific Highway is constructed as a rural channelised right turn (CHR) / auxiliary left turn (AUL) T- intersection with a U-turn facility for eastbound traffic.

A 50 km/h speed zoning applies to Chain Valley Bay Road adjacent to its intersection with Mulloway Road and an 80 km/h speed zoning applies to Chain Valley Bay Road adjacent to the Pacific Highway intersection. At the time of inspection Chain Valley Road was found to be in fair

condition. ***Photograph 4*** shows Chain Valley Bay Road in the vicinity of Mulloway Road and ***Photograph 5*** shows Chain Valley Bay Road in the vicinity of the Pacific Highway.

Photograph 4 – Chain Valley Bay Road in the vicinity of Mulloway Road

Photograph 5 – Chain Valley Bay Road in the vicinity of the Pacific Highway

3.3 Mulloway Road

Mulloway Road is an urban road with a sealed carriageway varying between 6.5 and 10 metres wide (approximately). The varying widths are due to the presence of kerb and gutter for various lengths on either side of the street in front of the existing residential areas. In other locations grass and / or gravel shoulders of various widths with the presence of grassed verges / table drains exist. Under a functional road hierarchy it would be classified as a local road and therefore is under the care and control of Central Coast Council. It provides access to properties along its length and connects to Chain Valley Bay Road to the east of the site and nearby streets and the foreshore of Lake Macquarie to the west. Its intersection with Chain Valley Bay Road is constructed as a modified rural basic right turn (BAR) / basic left turn (BAL) give way controlled T-intersection.

A 50 km/h speed zone exists along Mulloway Road. On inspection Mulloway Road was observed to be in fair condition. ***Photograph 6*** below shows Mulloway Road at the southern end of the proposed development.

Photograph 6 – Mulloway Road in the vicinity of the site

4.0 ROAD NETWORK IMPROVEMENTS

No proposed road network improvements are known in the vicinity of the site that would increase the capacity of the road network. Upgrading works as part of Central Coast Council's and NSW RMS forward works programs may occur in the future.

5.0 TRAFFIC VOLUMES

To determine existing traffic volumes on the road network Intersect Traffic undertook traffic counts at the Chain Valley Bay Road and Mulloway Road T intersection during the AM and PM peak traffic periods on Thursday 8th September 2016. Counts were undertaken from 8 am to 9 am and 4.30 pm to 5.30 pm as the likely peak hour traffic periods for residential development. Intersect Traffic had also undertaken AM and PM peak traffic counts at the Pacific Highway / Chain Valley Bay Road roundabout on Friday 23rd September 2011 for a previous project. Counts were undertaken between the hours of 8 am and 9 am and 3 pm and 4 pm at this intersection. The manual count sheets for both these locations are provided in ***Attachment B.***

The peak traffic volumes recorded in the September 2011 AM and PM peak period traffic counts for Intersection A (The Pacific Highway / Chain Valley Bay Road) were AM - Pacific Highway east 1,845 vtph, Pacific Highway west 1,987 vtph and Chain Valley Bay Road 200 vtph and PM - Pacific Highway east 2,107 vtph, Pacific Highway west 2,251 vtph and Chain Valley Bay Road 224 vtph. These peak hour traffic count figures have been increased by 1.5% per annum for 5 years to estimate likely traffic volumes in 2016. The projected 2016 peak hour traffic figures have then been increased by 1.5% per annum for a further 10 years to estimate likely traffic volumes in 2026.

The September 2016 AM and PM peak period traffic counts for Intersection B (Chain Valley Bay Road / Mulloway Road) were similarly increased by 1.5% per annum for 10 years to estimate likely traffic volumes in 2026.

The resultant 2016 and 2026 peak hour traffic volumes for Intersection A and Intersection B adopted within this report for road network capacity assessment are as shown below in ***Table 1***;

Table 1 – Intersect Traffic Peak Hour Data - Intersections A and B

Intersection	Road	2016 AM peak (vtph)	2016 PM peak (vtph)	2026 AM peak (vtph)	2026 PM peak (vtph)
A	Pacific Highway West	1988	2270	2307	2634
A	Pacific Highway East	2141	2425	2484	2814
A*	Chain Valley Bay Road	215	241	250	280
B	Mulloway Road	183	186	212	216
B	Chain Valley Bay Road north	65	66	75	77
B*	Chain Valley Bay Road south	212	218	246	253

The traffic figures presented in the above table for Chain Valley Bay Road (A*) and Chain Valley Bay Road south (B*) should (and do) very closely correlate as the sites are approximately 1.5 kilometres apart with very few accesses to properties over this distance.

Further data collection on the local road network to update the 2011 counts will be carried as part of a traffic impact assessment for the proposal during the development application process should the project progress to that stage.

6.0 ROAD CAPACITY

The capacity of urban and rural roads is generally determined by the capacity of intersections. However, Tables 4.3, 4.4 & 4.5 of the RMS's *Guide to Traffic Generating Developments* provides some guidance on mid-block capacities for urban and rural roads and likely levels of service. These tables are reproduced below.

Table 4.3
Typical mid-block capacities for urban roads with interrupted flow

Type of Road	One-Way Mid-block Lane Capacity (pcu/hr)	
Median or inner lane:	Divided Road	1,000
	Undivided Road	900
Outer or kerb lane:	With Adjacent Parking Lane	900
	Clearway Conditions	900
	Occasional Parked Cars	600
4 lane undivided:	Occasional Parked Cars	1,500
	Clearway Conditions	1,800
4 lane divided:	Clearway Conditions	1,900

Table 4.4
Urban road peak hour flows per direction

Level of Service	One Lane (veh/hr)	Two Lanes (veh/hr)
A	200	900
B	380	1400
C	600	1800
D	900	2200
E	1400	2800

Table 4.5
peak hour flow on two-lane rural roads (veh/hr)
(Design speed of 100km/hr)

Terrain	Level of Service	Percent of Heavy Vehicles			
		0	5	10	15
Level	B	630	590	560	530
	C	1030	970	920	870
	D	1630	1550	1480	1410
	E	2630	2500	2390	2290
Rolling	B	500	420	360	310
	C	920	760	650	570
	D	1370	1140	970	700
	E	2420	2000	1720	1510
Mountainous	B	340	230	180	150
	C	600	410	320	260
	D	1050	680	500	400
	E	2160	1400	1040	820

The data for Table 4.5 assumes the following criteria:

- *terrain level* with 20% no overtaking.
- *rolling* with 40% no overtaking.
- *mountainous* with 60% no overtaking.
- 3.7 m traffic lane width with side clearances of at least 2m.
- 60/40 directional split of traffic.

The criteria for the roads at Intersection A, the Pacific Highway and Chain Valley Road, are rural road, a level terrain, 5% heavy vehicles and 80 km/h speed zoning. Therefore the use of Table 4.5 above is warranted, noting the level of service (LoS), vehicles per hour, require factoring by 0.9 for a reduction of the speed travel from 100 km/h to 80 km/h. A desirable level of service on a rural road is generally considered to be a level of service (LoS) C or better however on an arterial road such as the Pacific Highway a LoS D is still considered acceptable. Utilising this criteria and from Table 4.5 above a LoS E for two way two lane of flow occurs when mid-block traffic volumes exceed 2,500 vtph x 0.9 = 2,250 vtph. Therefore the two way two lane mid-block traffic volume threshold for a LoS D is 2,250 vph. This means the two way four lane mid-block traffic volume threshold for a LoS D for the Pacific Highway is approximately 4,500 vtph. Therefore it is considered that the Pacific Highway in the vicinity of the site as a four lane two way rural road has a two-way mid-block road capacity of 4,500 vtph.

Similarly, for a LoS C on a two way two lane flow occurs when mid-block traffic volumes exceed the 1,550 x 0.9 vtph = 1,395 vtph, the two way two lane mid-block traffic volume threshold for a LoS C is 1,395 vtph. This means the two-way two lane mid-block traffic volume threshold for a LoS C for Chain Valley Bay Road is 1,395 vph.

The roads at Intersection B, Chain Valley Road and Mulloway Road, have a 50km/h speed zoning are two way two lane, local urban roads. Therefore the use of Table 4.4 urban roads above is warranted. As above, a LoS C for a one lane of traffic flow is exceeded when mid-block traffic volumes exceed the LoS D of 900 vtph. The two way two lane mid-block traffic volume threshold for a LoS C is therefore 1,800 vtph. This means the two-way two lane mid-block traffic volume threshold for a LoS C for Chain Valley Bay Road and Mulloway Road are 1,800 vtph.

From the traffic data sourced and calculated in ***Section 5*** and noting the likely technical two-way mid-block road capacities of the Pacific Highway, Chain Valley Bay Road and Mulloway Road are well in excess of the existing or predicted 2016 traffic volumes and the predicted 2026 traffic volumes on the road network it is considered that the adjacent road network is operating within its technical capacity and has scope to cater for additional traffic generated by the new development.

7.0 ALTERNATE TRANSPORT MODES

Busways Central Coast operates public transport (bus) services to the area. Buses on Route 98 (Lake Haven to Chain Valley Bay via Blue Haven) and Route 95 (Lake Haven to Morisset via Gwandalan and Mannering Park) travel past the site. The service route includes Mulloway Road, Teraglin Drive and Trevally Avenue which adjoin the proposed development.

Route 95 and 98 bus route services are provided on morning and evenings and operates on weekdays only. It provides transport to various nearby local suburbs and railway stations as well as to other bus service routes (such as the Route 99 bus service) for bus and train travel to destinations further afield. Route 99 which provides a regular service to Swansea and Charlestown on weekdays also provides a very infrequent weekend only service to Mulloway Road in the vicinity of the proposed development.

The nearest bus stop is located on Mulloway Road approximately 250 metres west of the site as shown in ***Photograph 7***. The local bus route map (extract) is provided below in ***Figure 2***.

Figure 2 – Local Bus Routes

Photograph 7 – Bus stop Mulloway Road in the vicinity of the site.

A 2.5 metre wide concrete pathway on Mulloway Road (***Photograph 8***) commences 150 metres west of Chain Valley Bay Road, is approximately 650 metre long, is continuous along the full length of the northern frontage of the development and ends at Trevally Avenue. In practice it operates as a shared cycleway / pedestrian path. There are no other pedestrian facilities in the vicinity.

Photograph 8 – Off-road cycle / pedestrian path in Mulloway Road adjacent to the site.

8.0 DEVELOPMENT PROPOSAL

The planning proposal involves the rezoning of land titled Lot 273 in DP 755266 - 15 Mulloway Road, Chain Valley Bay North to permit a residential development. The proposal is likely to yield in the order of 174 low density residential lots. The planning proposal includes the half width road pavement construction of Mulloway Road along the site frontage and the construction of (4) four public roads accessing the residential subdivision – (3) three from Mulloway Road at the northern end of the site and (1) one via an extension of Teraglin Road at the western side of the property. The proposed concept development plan is shown in ***Attachment A***.

It would be expected that most of traffic generated by the development would utilise Mulloway Road and Chain Valley Bay Road south of Mulloway Road in their trip making as part of their origin / destination travel routes for all purposes.

All new internal roads, connections and other roadside infrastructure would be constructed to the requirements of Central Coast Council as per the Wyong Council DCP (2013) and engineering documentation. Detailed assessment of road upgrading requirements would need to be further assessed at development application stage should the rezoning proposal proceed to that stage of the approval process.

9.0 TRAFFIC GENERATION

The RMS' *Guide to Traffic Generating Development's* provides specific advice on the traffic generation potential of various land uses. However the RMS has released a Technical Direction (TDT 2013/4) releasing the results of updated traffic surveys and as a result amended land use traffic generation rates.

In regard to low density residential dwellings the following amended advice is provided within the Technical Direction.

Daily vehicle trips = 10.7 per dwelling in Sydney, 7.4 per dwelling in regional areas
Weekday average evening peak hour vehicle trips = 0.99 per dwelling in Sydney (maximum 1.39), 0.78 per dwelling in regional areas (maximum 0.90).
Weekday average morning peak hour vehicle trips = 0.95 per dwelling in Sydney (maximum 1.32), 0.71 per dwelling in regional areas (maximum 0.85).
*(The above rates do **not** include trips made internal to the subdivision, which may add up to an additional 25 %).*

Adopting an average rate approach for regional areas the following additional development traffic from the proposed planning proposal can be calculated (rounded up)

- *Daily vehicle trips* — *174 x 7.4 =* ***1288 vtpd***
- *AM weekday peak hour* — *174 x 0.71 =* ***124 vtph***
- *PM weekday peak hour* — *174 x 0.78 =* ***136 vtph***

10.0 TRIP DISTRIBUTION

Before carrying out any traffic assessment the peak hour traffic generated by the development needs to be distributed through the adjoining road network. This involves making a number of assumptions as to distribution patterns to and from the development. In distributing the generated peak hour traffic through the adjacent road network the following assumptions have been made for this site.

- In the AM peak period 40% of traffic will enter the site and 60% will exit the site – based on the existing traffic count at the Chain Valley Bay Road / Mulloway Road intersection.
- In the PM peak period 60% of traffic will enter the site and 40% will exit the site– based on the existing traffic count at the Chain Valley Bay Road / Mulloway Road intersection.
- 90% of traffic entering / exiting the site will be via Mulloway Road east.
- 10% of traffic entering / exiting the site will be via Mulloway Road west or Teraglin Drive.
- Traffic distributed at the intersection of Mulloway Road and Chain Valley Bay Road will have a 90% origin / destination via Chain Valley Bay Road south and 10% will have an origin / destination via Chain Valley Bay north.
- Traffic at the intersection of Chain Valley Bay Road and the Pacific Highway will be distributed in similar proportions to the traffic count data.
- These assumptions will result in the trip distributions shown in ***Figure 3*** for the relevant traffic movements.

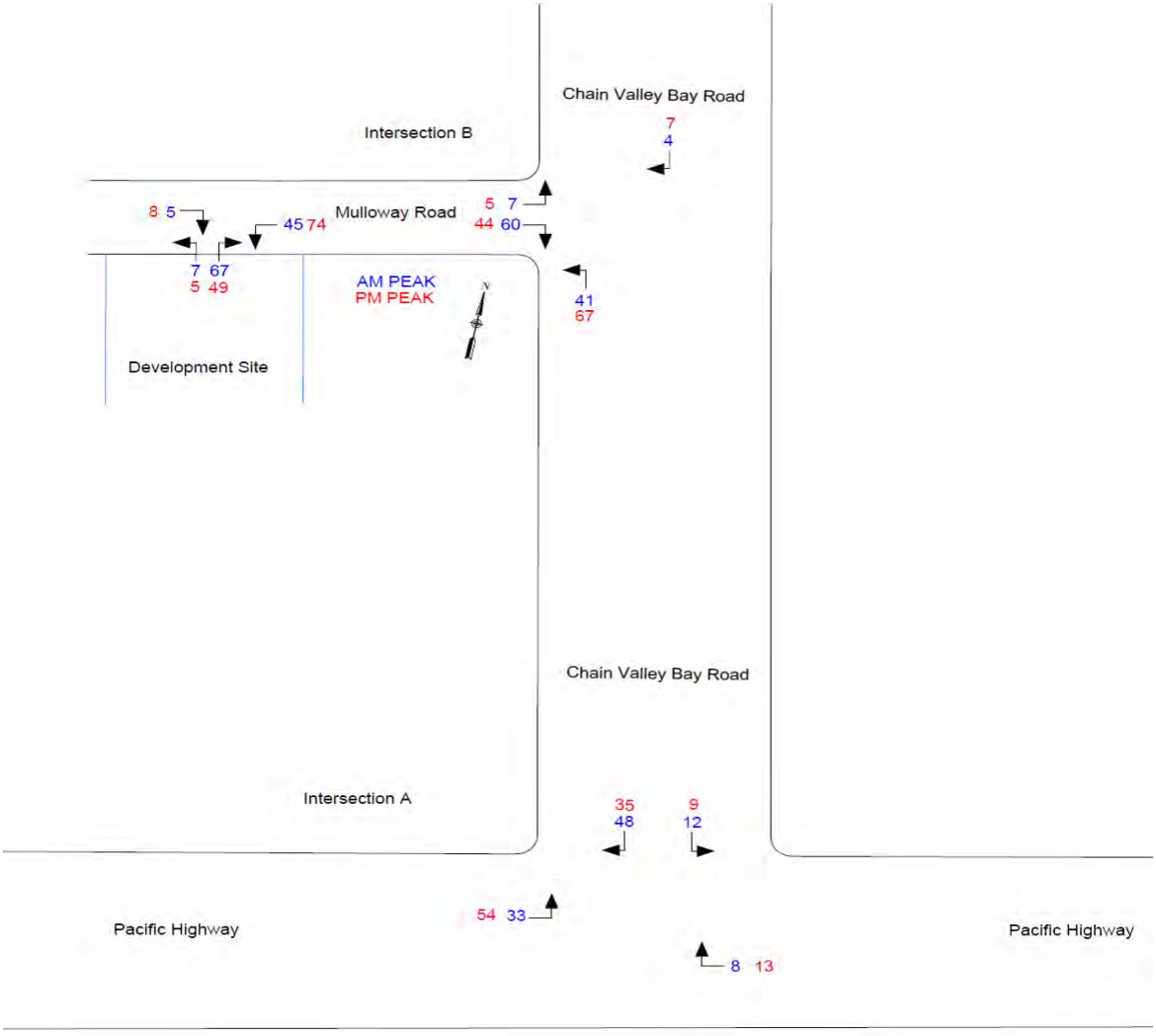


Figure 3 – Development Trip Distribution

11.0 TRAFFIC IMPACTS OF DEVELOPMENT

11.1 Road Network Capacity

It has previously been shown in ***Section 6*** of this report that the local road network is currently operating well within its technical mid-block capacity.

The proposed planning proposal is likely to generate the following additional traffic on the local road network based on the trip distributions shown in ***Figure 3***;

- The Pacific Highway west of Chain Valley Bay Road – 81 vtph in the AM peak and 89 vtph in the PM peak.
- The Pacific Highway east of Chain Valley Bay Road – 20 vtph in the AM peak and 22 vtph in the PM peak.
- Chain Valley Bay Road south of Mulloway Road – 101 vtph in the AM peak and 111 vtph in the PM peak.
- Chain Valley Bay Road north of Mulloway Road – 11 vtph in the AM peak and 12 vtph in the PM peak.
- Mulloway Road west of Chain Valley Bay Road – 112 vtph in the AM peak and 123 vtph in the PM peak.
- Mulloway Road west of the accesses at Mulloway Road and Teraglin Drive – a combined total of 12 vtph in the AM peak and 13 vtph in the PM peak.

The addition of this traffic onto the 2016 traffic volumes determined in ***Section 5*** will not result in the capacity thresholds for the local road network determined in ***Section 6*** to be reached. Even considering the predicted 2026 traffic volumes these road capacity thresholds are not reached. This is demonstrated in ***Table 2*** below.

Table 2 - Road Capacity Assessment – post development

					Post Development			
Intersection	Road	Capacity (vtph)	Development AM (vtph)	Development PM (vtph)	2016 AM peak (vtph)	2016 PM peak (vtph)	2026 AM peak (vtph)	2026 PM peak (vtph)
A	Pacific Highway West	4500	81	89	2069	2359	2388	2723
A	Pacific Highway East	4500	20	22	2161	2447	2504	2836
A*	Chain Valley Bay Road	1350	101	111	316	352	351	391
B	Mulloway Road	1800	112	123	295	309	324	339
B	Chain Valley Bay Road north	1800	11	12	76	78	86	89
B*	Chain Valley Bay Road south	1800	101	111	313	329	347	364

Therefore in analysing the assessment shown in ***Table 3*** above it can be concluded that the local road network subject to suitable intersection controls being in place has sufficient spare capacity to cater for the additional traffic generated by the proposed planning proposal.

It is noted that all roads within the planning proposal will need to be constructed in accordance with Central Coast Council's DCP requirements and some upgrading to existing roads may also be required particularly in terms of pavement and shoulder width along the site frontage on Mulloway Road for which the planning proposal results in additional traffic. Additional traffic volumes on Chain Valley Bay Road and Teraglin Road will be minimal therefore pavement and shoulder widening on these roads may not be warranted or reasonable. These road safety issues and road standard issues will be further investigated should the planning proposal proceed to a development application in the future.

11.2 Intersection Capacity

In assessing intersection performance the main intersection of concern will be the Pacific Highway / Chain Valley Bay Road roundabout.

The impacts of the development are best assessed using the SIDRA intersection modelling software. This software package predicts likely delays, queue lengths and thus levels of service that will occur at intersections. Assessment is then based on the level of service requirements of the RMS shown below;

Table 4.2
Level of service criteria for intersections

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

Assumptions made in this modelling were;

- The intersection layout will remain as per current conditions.
- Traffic volumes used in the modelling were collected by Intersect Traffic on Friday 23rd September 2011.
- 2016 and 2026 traffic volumes have been predicted using a 1.5 % per annum background traffic growth rate.
- Traffic generated by the planning proposal is distributed as per ***Figure 3.***
- Development traffic at the intersection of Chain Valley Bay Road and the Pacific Highway will be distributed in similar proportions to the traffic count data.

The results of the modelling are summarised in ***Table 3*** below showing the 'all vehicles' summary results except for the LoS which is the worst result for any movement. The Sidra Movement Summary Tables are provided in ***Attachment C***.

Table 3 – The Pacific Highway / Chain Valley Bay Road T Intersection – Sidra Modelling – Results Summary

Model Scenario	Degree of Saturation (v/c)	Average Delay (s)	LoS	95% back of Queue Length (cars)
2016 AM	2.201	128.7	F	106.4
2016 AM + development	1.573	93.6	F	94.4
2016 PM	1.531	48.2	F	53.6
2016 PM + development	2.201	128.7	F	106.4

This modelling shows that the Pacific Highway / Chain Valley Bay Road intersection does not currently operate satisfactorily during both the AM and PM peak periods and obviously would continue to do so post development and in 2026. Whilst average delays, LoS and 95 % back of queue lengths for the majority of movements at the intersection remain at acceptable levels based on the RMS assessment criteria listed above the right turn movement from Chain Valley Bay Road has unacceptable average delays, LoS and 95 % back of queue lengths. The intersection would therefore require upgrading with a higher level of intersection control required.

This would be further investigated should the proposal proceed past Gateway and updated traffic counts collected at the intersection. As the intersection is currently 'failing' the upgrading of the intersection would also provide benefit to existing road users and future developments in the area. It would therefore be unreasonable to expect the developer to fully fund the development and the upgrading of the intersection should be contained within a Section 94 developer contributions plan providing a mechanism for a fair and reasonable contribution to the intersection upgrade from all developers who would gain benefit from the intersection upgrade as well as the road authority for existing traffic.

In assessing the performance of the Chain Valley Bay Road / Mulloway Road intersection it is noted that by observation this intersection is currently operating with uninterrupted flow conditions. Further existing and future traffic volumes will remain below the thresholds contained in the following table taken from Austroads *Guide to Traffic Management – Part 6 – Intersections, Interchanges & Crossings (2009)* for which the guide states a detailed analysis to demonstrate adequate capacity is available is unlikely to be necessary as uninterrupted flow conditions would prevail.

Major road type[1]	Major road flow (vph)[2]	Minor road flow (vph)[3]
Two-lane	400	250
	500	200
	650	100
Four-lane	1000	100
	1500	50
	2000	25

Notes:
1. Major road is through road (i.e. has priority).
2. Major road flow includes all major road traffic with priority over minor road traffic.
3. Minor road design volumes include through and turning volumes.

On this basis it is concluded that the proposed planning proposal will not result in a change to uninterrupted flow conditions through the Chain Valley Bay Road / Mulloway Road intersection and further intersection analysis is not required.

Overall it is concluded that the planning proposal will not adversely impact on the operation of the Chain Valley Bay Road / Mulloway Road T intersection as it has sufficient spare capacity to cater for the additional traffic generated by the planning proposal however the additional traffic generated will exacerbate the unsatisfactory LoS (F) that currently exists at the Pacific Highway / Chain Valley Bay Road T intersection and this intersection will be required to be upgraded to either a roundabout or signal controlled intersection. Further intersection analysis on the proposed new external road connections to the subdivision will be carried out should the proposal proceed to a development application in the future.

Assessment of safe intersection sight distance for the new connections would be further reviewed at detailed design stage however from observation on-site the available sight distance at the proposed subdivision accesses on both Mulloway Road and Teraglin Drive would exceed the Austroad requirements (*Table 3.2 of Austroads Guide to Road Design – Part 4A Unsignalised and signalised intersections*) of approximately 100 metres for a 50 km/h design speed.

11.3 On-site car parking

On-site car parking in accordance with Central Coast Council as per Wyong Council DCP 2013 needs to be provided within the planning proposal. Whilst this will be assessed in detail in future development applications for development on the individual allotments contained in the planning proposal a general assessment has been carried out in this report.

The following residential lot sizes are proposed within the proposal;

- Standard Lot – 450 m^2 to 580 m^2;
- Corner Lot – 700 m^2 to 812 m^2

As the lot sizes are equal to or greater than the minimum lot size required by Central Coast Council it is considered that a dwelling with suitable covered and uncovered parking can be provided in accordance with the Wyong Council DCP 13.

12.0 PEDESTRIAN & CYCLE FACILITIES

The planning proposal will generate pedestrian and bicycle traffic therefore a nexus would exist to provide additional facilities. As stated in ***Section 7*** a shared concrete pedestrian path / cycleway already exists along the full frontage of the proposed development. As such there is no requirement to upgrade this aspect of these facilities. Internal pedestrian pathways on the newly created public roads would need to be provided to Central Coast Council subdivision requirements contained in the Council's relevant DCP.

13.0 PUBLIC TRANSPORT FACILITIES

The proposed development is likely to generate additional public transport usage of the existing service to the area. However, it is noted that very few of the new residential lots will be more than 400 metres away from the existing bus services using Mulloway Road, Teraglin Drive and Trevally Avenue. Therefore it is considered that the bus service routes would not need to alter in the future if the development proceeds.

It is however noted that the perimeter road within the proposed residential subdivision is shown as 8 metres in width while other road widths are 6.5 metres. Wyong Council's DCP requires a minimum 9 metre carriageway width if any of these roads are for minor bus routes. The various street reserve, carriageway and verge widths for the range of road types within Wyong Council DCP 13 are presented in the Table of Appendix B of the Subdivision section of the DCP. These road widths would need to be accommodated within future subdivision designs should the proposal progress further in the rezoning process. Further consultation with the provider of the local bus services i.e. Busways and NSW Transport would also be required to determine likely future bus routes, stops and facilities should a future development application be lodged for the subdivision proposal.

14.0 CONCLUSIONS

This preliminary traffic impact assessment for a planning proposal for residential development on Lot 273 in DP 755266 15 Mulloway Road, Chain Valley Bay has concluded;

- Existing traffic volumes on the local road network are within the technical mid-block road capacities determined by Austroads and the NSW Roads and Maritime Services (RMS) therefore the local road network has capacity to cater for additional traffic associated with new development in the area.
- The planning proposal when fully developed is likely to generate an additional 1288 vtpd; as well as 124 vtph during the AM peak and 136 vtph during the PM peak traffic periods.
- The local road network currently has sufficient spare capacity to cater for the traffic generated by this development without adversely impacting on current levels of service experienced by motorists on the local road network.
- Sidra modelling of the Pacific Highway / Chain Valley Bay Road intersection has shown that the right hand turn movement onto the Pacific Highway from Chain Valley Bay Road currently operates with unsatisfactory average delays, LoS and 95 % back of queue lengths which is only exacerbated by the proposed development. Therefore this intersection will be required to be upgraded to either a roundabout or signal controlled intersection before further development occurred.
- As the Pacific Highway / Chain Valley Bay Road intersection is currently 'failing' the upgrading of the intersection would also provide benefit to existing road users and future developments in the area. It would therefore be unreasonable to expect the developer to fully fund the development and the upgrading of the intersection should be contained within a Section 94 developer contributions plan providing a mechanism for a fair and reasonable contribution to the intersection upgrade from all developers who would gain benefit from the intersection upgrade as well as the road authority for existing traffic.
- The Chain Valley Bay Road / Mulloway Road intersection currently operates with uninterrupted flow conditions and would continue to do so should the planning proposal be fully developed.
- The available sight distance at the proposed subdivision access connections on both Mulloway Road and Teraglin Drive would exceed the Austroad requirements (*Table 3.2 of Austroads Guide to Road Design – Part 4A Unsignalised and signalised intersections*) of approximately 100 metres for a 50 km/h design speed.
- The proposed new lots within the planning proposal are considered large enough to accommodate the car parking requirements of Central Coast Council, the Wyong Council DCP 2013.
- The proposed subdivision will generate pedestrian and cycle traffic therefore a nexus would exist to provide additional facilities. However existing facilities in the immediate vicinity of the site are already considered satisfactory for the development whilst internal facilities within the subdivision will be constructed to Central Coast Council's requirements. Contribution to regional facilities would need to be via a valid S94 contributions plan.
- The site is likely to generate increased usage for the existing public transport services however the site could be easily serviced via the existing bus routes. The need for the bus route to be diverted through the new development will need to be the subject of future consultation with Central Coast Council, Transport NSW and Busways should the planning proposal proceed to development application stage. Some of the internal subdivision roads may need to be constructed to cater for buses and suitable bus stops and shelters provided.

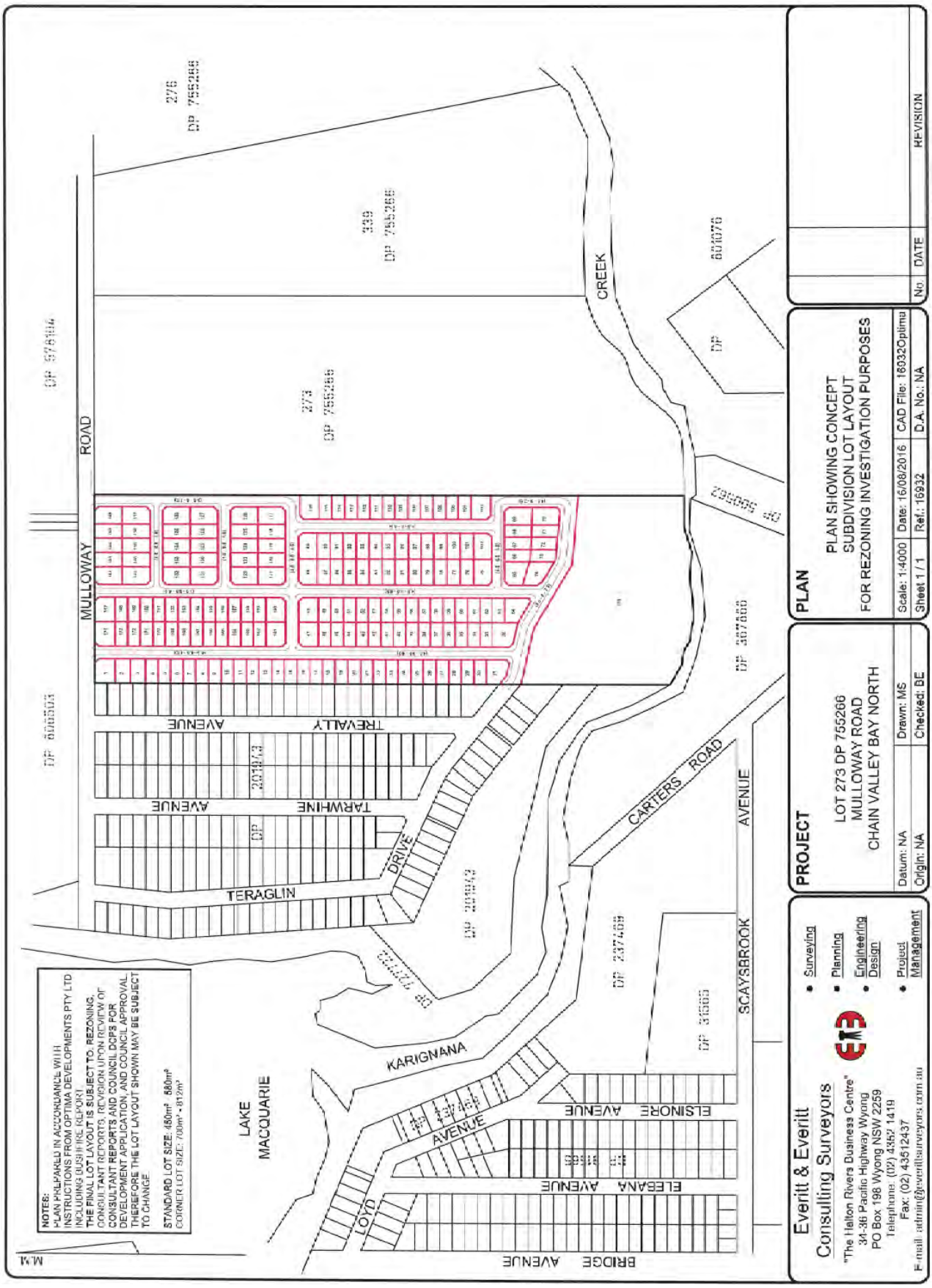
15.0 RECOMMENDATION

Having carried out this preliminary traffic impact assessment for the proposed planning proposal for a residential development on Lot 273 in DP 755266 Mulloway Road, Chain Valley Bay it is recommended that the proposal can be supported from a traffic impact perspective as subject to the upgrading of the Pacific Highway / Chain Valley Bay Road intersection it will not adversely impact on the local and state road network and complies with all relevant Central Coast Council, Austroads, and NSW Roads and Maritime Services (RMS) requirements.

JR Garry BE (Civil), Masters of Traffic
Director
Intersect Traffic Pty Ltd

ATTACHMENT A

Development Plans


MULLOWAY ROAD
CREEK
TREVALLY AVENUE
TARWHINE AVENUE
TERAGLIN DRIVE
CARTERS ROAD
SCAYSBROOK AVENUE
KARIGNANA AVENUE
ELSINORE AVENUE
ELEBANA AVENUE
BRIDGE AVENUE
LOYD
LAKE MACQUARIE
NOTES:
PLAN PREPARED IN ACCORDANCE WITH INSTRUCTIONS FROM OPTIMA DEVELOPMENTS PTY LTD INCLUDING DUSHI INC REPORT
THE FINAL LOT LAYOUT IS SUBJECT TO, REZONING, CONSULTANT REPORTS, REVISION UPON REVIEW OF CONSULTANT REPORTS AND COUNCIL DCPs FOR DEVELOPMENT APPLICATION, AND COUNCIL APPROVAL THEREFORE THE LOT LAYOUT SHOWN MAY BE SUBJECT TO CHANGE
STANDARD LOT SIZE: 480m² - 680m²
CORNER LOT SIZE: 700m² - 912m²
PROJECT
LOT 273 DP 755266
MULLOWAY ROAD
CHAIN VALLEY BAY NORTH
Datum: NA
Drawn: MS
Origin: NA
Checked: BE
PLAN
PLAN SHOWING CONCEPT SUBDIVISION LOT LAYOUT FOR REZONING INVESTIGATION PURPOSES
Scale: 1:4000
Date: 16/08/2016
CAD File: 16032Optima
Sheet 1 / 1
Ref.: 16932
D.A. No.: NA
No.
DATE
REVISION
Everitt & Everitt
Consulting Surveyors
"The Halton Rivers Business Centre"
34-36 Pacific Highway Wyong
PO Box 198 Wyong NSW 2259
Telephone: (02) 4352 1419
Fax: (02) 43512437
E-mail: admin@everittsurveyors.com.au
Surveying
Planning
Engineering Design
Project Management

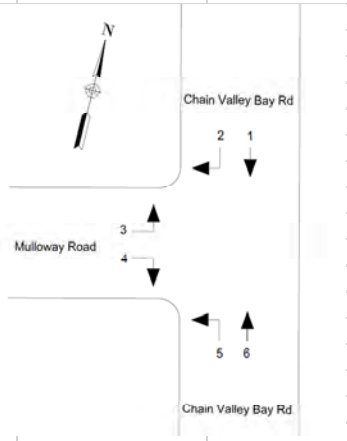
ATTACHMENT B

Traffic Count Data

Date	8th September 2016
Day	Thursday
Time	8:00am - 9:00am
Weather	Cloudy
Conducted by:	Peter

MOVEMENT	1	2	3	4	5	6
8:00 - 8:15	15	4	1	32	16	3
8:15 - 8:30	9	2	0	29	12	2
8:30 - 8:45	5	2	4	26	11	4
8:45 - 9:00	8	2	3	22	17	1
SUM	37	10	8	109	56	10
PEAK	37	10	8	109	56	10

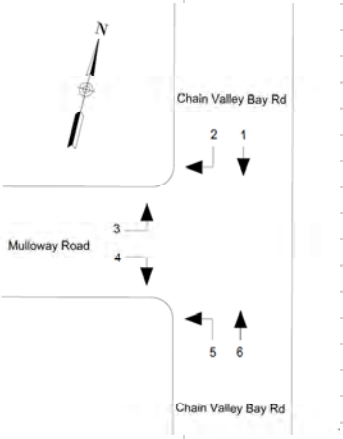
Leg	PHT (vph)
Chain Valley Bay Road North	65
Chain Valley Bay Road South	212
Mulloway Road	183



Date	8th September 2016
Day	Thursday
Time	4.30 pm - 5.30 pm
Weather	Fine
Conducted by:	Peter

MOVEMENT	1	2	3	4	5	6
4:30 - 4:45	1	1	2	15	31	8
4:45 - 5.00	5	4	2	21	23	9
5:00 - 5:15	3	3	2	21	23	8
5:15 - 5:30	7	2	1	11	24	8
SUM	16	10	7	68	101	33
PEAK	16	10	7	68	101	33

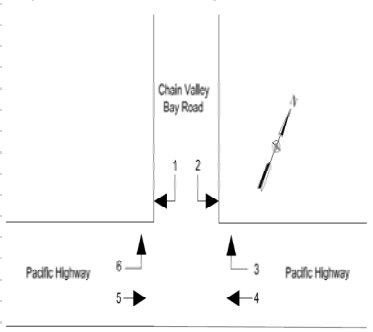
Leg	PHT (vph)
Chain Valley Bay Road North	66
Chain Valley Bay Road South	218
Mulloway Road	186



Date	23-09-11
Day	Friday
Time	3 pm - 4 pm
Weather	Fine
Conducted by:	Brad

	1	2	3	4	5	6
3:00 pm - 3:15 pm	20	4	6	267	248	15
3:15 pm - 3:30 pm	27	4	4	271	240	22
3:30 pm - 3:45 pm	25	6	6	257	261	19
3:45 pm - 4:00 pm	31	5	5	266	257	25
	103	19	21	1061	1006	81
Projected 2016 volumes	111	20	23	1143	1084	87
PEAK	103	19	21	1061	1006	81

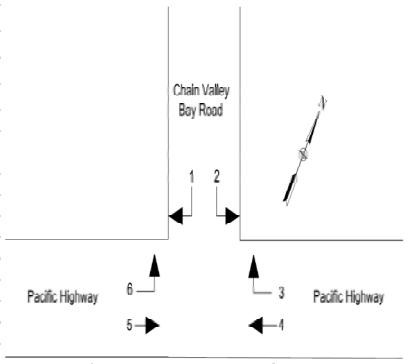
	Mid-Block Volumes
Pacific Highway East	2107
Pacific Highway West	2251
Chain Valley Bay Road	224



Date	23-09-11
Day	Friday
Time	8:00 - 9:00am
Weather	Fine
Conducted by:	Brad

	1	2	3	4	5	6
8:00 am - 8:15 am	28	3	4	259	224	7
8:15 am - 8:30 am	27	3	4	245	193	12
8:30 am - 8:45 am	38	5	1	234	194	8
8:45 am - 9:00 am	42	7	2	251	216	9
	135	18	11	989	827	36
Projected 2016 volumes	145	19	12	1065	891	39
PEAK	135	18	11	989	827	36

	Mid-Block Volumes
Pacific Highway East	1845
Pacific Highway West	1987
Chain Valley Bay Road	200



ATTACHMENT C

Sidra Summary Tables

MOVEMENT SUMMARY

Site: AM2016

Pacific Highway Chain Valley Bay Road T Intersection
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Pacific Highway east											
5	T1	1065	5.0	0.282	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
6	R2	12	5.0	0.044	18.1	LOS B	0.1	1.0	0.74	0.90	53.4
Approach		1077	5.0	0.282	0.2	NA	0.1	1.0	0.01	0.01	79.4
North: Chain Valley Bay Road											
7	L2	19	5.0	0.028	12.0	LOS A	0.1	0.7	0.48	0.90	59.8
9	R2	145	5.0	1.121	317.6	LOS F	27.4	199.7	1.00	2.58	10.0
Approach		164	5.0	1.121	282.2	LOS F	27.4	199.7	0.94	2.38	11.1
West: Pacific Highway west											
10	L2	39	5.0	0.022	7.0	LOS A	0.0	0.0	0.00	0.63	63.7
11	T1	891	5.0	0.236	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
12u	U	1	5.0	0.006	27.9	LOS B	0.0	0.1	0.84	0.88	46.5
Approach		931	5.0	0.236	0.4	NA	0.0	0.1	0.00	0.03	79.0
All Vehicles		2172	5.0	1.121	21.6	NA	27.4	199.7	0.08	0.20	54.1

MOVEMENT SUMMARY

Site: PM2016

Pacific Highway Chain Valley Bay Road T Intersection
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Pacific Highway east											
5	T1	1143	5.0	0.303	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
6	R2	23	5.0	0.132	26.0	LOS B	0.4	2.9	0.85	0.94	47.9
Approach		1166	5.0	0.303	0.6	NA	0.4	2.9	0.02	0.02	78.8
North: Chain Valley Bay Road											
7	L2	20	5.0	0.035	13.0	LOS A	0.1	0.8	0.53	0.93	58.9
9	R2	111	5.0	1.531	1056.9	LOS F	53.6	391.1	1.00	3.40	3.3
Approach		131	5.0	1.531	897.5	LOS F	53.6	391.1	0.93	3.02	3.9
West: Pacific Highway west											
10	L2	87	5.0	0.049	7.0	LOS A	0.0	0.0	0.00	0.63	63.7
11	T1	1084	5.0	0.287	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
12u	U	1	5.0	0.007	32.3	LOS C	0.0	0.2	0.87	0.91	44.1
Approach		1172	5.0	0.287	0.6	NA	0.0	0.2	0.00	0.05	78.3
All Vehicles		2469	5.0	1.531	48.2	NA	53.6	391.1	0.06	0.19	38.8

MOVEMENT SUMMARY

Site: AM2016 + dev

Pacific Highway Chain Valley Bay Road T Intersection
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Pacific Highway east											
5	T1	1065	5.0	0.282	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
6	R2	20	5.0	0.078	19.0	LOS B	0.2	1.7	0.76	0.91	52.7
Approach		1085	5.0	0.282	0.4	NA	0.2	1.7	0.01	0.02	79.1
North: Chain Valley Bay Road											
7	L2	31	5.0	0.046	12.1	LOS A	0.2	1.2	0.48	0.92	59.7
9	R2	193	5.0	1.573	1095.7	LOS F	94.4	688.9	1.00	4.93	3.2
Approach		224	5.0	1.573	945.8	LOS F	94.4	688.9	0.93	4.37	3.7
West: Pacific Highway west											
10	L2	72	5.0	0.040	7.0	LOS A	0.0	0.0	0.00	0.63	63.7
11	T1	891	5.0	0.236	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
12u	U	1	5.0	0.006	27.9	LOS B	0.0	0.1	0.84	0.88	46.5
Approach		964	5.0	0.236	0.6	NA	0.0	0.1	0.00	0.05	78.4
All Vehicles		2273	5.0	1.573	93.6	NA	94.4	688.9	0.10	0.46	26.1

MOVEMENT SUMMARY

Site: PM2016 + dev

Pacific Highway Chain Valley Bay Road T Intersection
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Pacific Highway east											
5	T1	1143	5.0	0.303	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
6	R2	34	5.0	0.213	29.6	LOS C	0.7	4.8	0.87	0.96	45.7
Approach		1177	5.0	0.303	0.9	NA	0.7	4.8	0.03	0.03	78.2
North: Chain Valley Bay Road											
7	L2	29	5.0	0.050	13.1	LOS A	0.2	1.2	0.53	0.95	58.8
9	R2	146	5.0	2.201	2254.7	LOS F	106.4	776.5	1.00	4.39	1.6
Approach		175	5.0	2.201	1883.2	LOS F	106.4	776.5	0.92	3.82	1.9
West: Pacific Highway west											
10	L2	141	5.0	0.079	7.0	LOS A	0.0	0.0	0.00	0.63	63.7
11	T1	1084	5.0	0.287	0.0	LOS A	0.0	0.0	0.00	0.00	79.9
12u	U	1	5.0	0.007	32.3	LOS C	0.0	0.2	0.87	0.91	44.1
Approach		1226	5.0	0.287	0.9	NA	0.0	0.2	0.00	0.07	77.6
All Vehicles		2578	5.0	2.201	128.7	NA	106.4	776.5	0.07	0.31	20.9

Travers

bushfire & ecology

bushfire protection assessment

Rezoning Application
Lot 273 DP 755266
15 Mulloway Road, Chain Valley Bay

Under Section 117(2) Direction No 4.4
of the *EP&A Act*

June 2016
(REF: A16015B)

Bushfire Protection Assessment

Rezoning Application
Lot 273 DP 755266
15 Mulloway Road, Chain Valley Bay

Report Authors:	Nicole van Dorst BPAD Level 2
Plans prepared:	Emma Buxton
Checked by:	John Travers BPAD A 15195
Date:	17 June 2016
File:	A16015B

Disclaimer:

This report has been prepared to provide advice to the client on matters pertaining to the particular and specific development proposal as advised by the client and / or their authorised representatives. This report can be used by the client only for its intended purpose and for that purpose only. Should any other use of the advice be made by any person including the client then this firm advises that the advice should not be relied upon. The report and its attachments should be read as a whole and no individual part of the report or its attachments should be relied upon as meaning it reflects any advice by this firm. The report does not suggest or guarantee that a bush or grass fire will not occur and or impact the development. This report advises on matters published by the *NSW Rural Fire Service* in their guideline *Planning for Bush Fire Protection 2006* and other advice available from that organisation.

The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.

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PO Box 7138
Kariong NSW 2250

38A The Avenue
Mt Penang Parklands
Central Coast Highway
Kariong NSW 2250

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e: info@traversecology.com.au
www.traversecology.com.au

EXECUTIVE SUMMARY

A bushfire protection assessment has been undertaken for the proposed rezoning located at Lot 273 DP 755266, 15 Mulloway Road, Chain Valley Bay. The proposal seeks to rezone the northern portion of the site from E3 Environmental Management to R2 Low Density Residential whilst retaining the E2 Environmental Conservation land to the south.

This report identifies matters for consideration for the planning proposal and highlights the required bushfire protection measures, including asset protection zones (APZs), for future development under the *Environmental Planning and Assessment Act 1979 (EP&A Act), Section 117 Direction 4.4 and* in accordance *Planning for Bush Fire Protection 2006* (*PBP*) and *Community Resilience Practice Note 2/12 Planning Instruments and Policies*.

The key principle for the proposal is to ensure that future development is capable of complying with *PBP*. Planning principles for the proposal include the provision of adequate access including perimeter roads, establishment of adequate APZs for future housing, specifying minimum lot depths to accommodate APZs and the introduction of controls which avoid placing inappropriate developments in hazardous areas and placement of combustible material in APZs.

Our assessment found that bushfire can potentially affect the site from the forest vegetation beyond Mulloway Road to the north-east and the forested wetland vegetation located to the south and south-east of the site (within the E2 zoned land) resulting in possible ember attack, radiant heat and potentially flame attack. Pockets of remnant vegetation also exist within the adjoining land to the east.

The bushfire risk posed to the rezoning proposal can be mitigated if appropriate bushfire protection measures (including APZs) are put in place and managed in perpetuity.

The assessment has concluded that future development on site will provide compliance with the planning principles of *PBP* and *Community Resilience Practice Note 2/12 – Planning Instruments and Policies*.

John Travers *B.App.Sc. / Ass. Dip. / Grad. Dip / BPAD A*
Nicole van Dorst *B.App.Sc / Grad. Dip* BPAD D

GLOSSARY OF TERMS

AHIMS	Aboriginal Heritage Information System
APZ	Asset protection zone
AS1596	*Australian Standard – The storage and handling of LP Gas*
AS2419	*Australian Standard – Fire hydrant installations*
AS3745	*Australian Standard – Planning for emergencies in facilities*
AS3959	*Australian Standard – Construction of buildings in bushfire-prone areas 2009*
BAL	*Bushfire attack level*
BCA	*Building Code of Australia*
BSA	Bushfire safety authority
EEC	Endangered ecological community
FDI	Fire danger index
IPA	Inner protection area
LEP	*Local environmental plan*
OPA	Outer protection area
PBP	*Planning for bush fire protection 2006*
RFS	NSW Rural Fire Service
SFPP	Special fire protection purpose

TABLE OF CONTENTS

Introduction 1

Travers bushfire & ecology has been requested by *Optima Developments Pty Ltd* to undertake a bushfire protection assessment for the proposed rezoning located at Lot 273 DP 755266, 15 Mulloway Road, Chain Valley Bay.

The proposal is located on land mapped by *Wyong Shire Council* as being bushfire prone. *Direction 4.4, Planning for Bush Fire Protection 2006 (PBP)* identifies matters for consideration for planning proposals that will affect, or are in proximity to land mapped as bushfire prone.

As such, the proposal is subject to the requirements of Section 117(2) of *the Environmental Planning and Assessment Act 1979 (EP&A Act)* which requires Council to consult with the Commissioner of the NSW Rural Fire Service (RFS) and to take into account any comments by the Commissioner.

1.1 Aims of the assessment

The aims of the bushfire protection assessment are to:

- Review the bushfire threat to the landscape
- Undertake a bushfire attack assessment in accordance with *PBP*
- Provide advice on planning principles, including the provision of perimeter roads, asset protection zones (APZs) and other specific fire management issues
- Review the potential to carry out hazard management over the landscape, taking into consideration the proposed retention of trees within the final development plans.

1.2 Project synopsis

The proposal seeks to rezone the northern portion of the site from E3 Environmental Management to R2 Low Density Residential whilst retaining the E2 Environmental Conservation land to the south.

This assessment has assumed the removal of all forest vegetation within the proposed R2 zoned land as part of future development applications. However, any future proposal to retain and revegetate this land would require the implementation of APZs

The proposal at this stage does not involve a concept plan and as such the bushfire constraints have been highlighted and minimum APZs based on BAL 29 have been recommended to guide future development of the site. Recommendations have also been made for future road design, building construction, water supply and utilities.

1.3 Information collation

To achieve the aims of this report, a review of the information relevant to the property was undertaken prior to the initiation of field surveys. Information sources reviewed include the following:

- Wyong Local Environmental Plan 2013
- Flora and Fauna Assessment, 2016 prepared by *Travers bushfire & ecology*
- *Nearmap* aerial photography
- Topographical maps *DLPI of NSW* 1:25,000
- *Australian Standard 3959 Construction of buildings in bushfire-prone areas*
- *Planning for Bush Fire Protection 2006 (PBP)*
- *Community Resilience Practice Notes 2/12 Planning Instruments and Policies.*

An inspection of the proposed development site and surrounds was undertaken by Nicole van Dorst on 22 March 2016 to assess the topography, slopes, aspect, drainage, vegetation and adjoining land use. The identification of existing bushfire measures and a visual appraisal of bushfire hazard and risk were also undertaken.

1.4 Site description

The site is located at Lot 273 DP 755266, 15 Mulloway Road, Chain Valley Bay (refer Figure 1.1). It is situated to the south of the Mulloway Road and to the east of Trevally Avenue.

The site is bounded to the east and west by low density residential development and by Lake Macquarie State Recreation Area to the north-east. The southern portion of the site supports Estuarine Swamp Oak Forest vegetation, an endangered ecological community (EEC) within E2 zoned land. Karignan Creek defines the sites southern boundary.

Figure 1.1 – Aerial appraisal
(Source: Sixmaps)

1.5 Legislation and planning instruments

1.5.1 Environmental Planning and Assessment Act 1979 (EP&A Act) and bushfire prone land

The *EP&A Act* governs environmental and land use planning and assessment within New South Wales. It provides for the establishment of environmental planning instruments, development controls and the operation of construction controls through the *Building Code of Australia (BCA).* The identification of bushfire prone land is required under Section 146 of the *EP&A Act*.

Bushfire prone land maps provide a trigger for the development assessment provisions. The proposed rezoning is located on land that is mapped by *Wyong Council* as being bushfire prone (refer Figure 1.2).

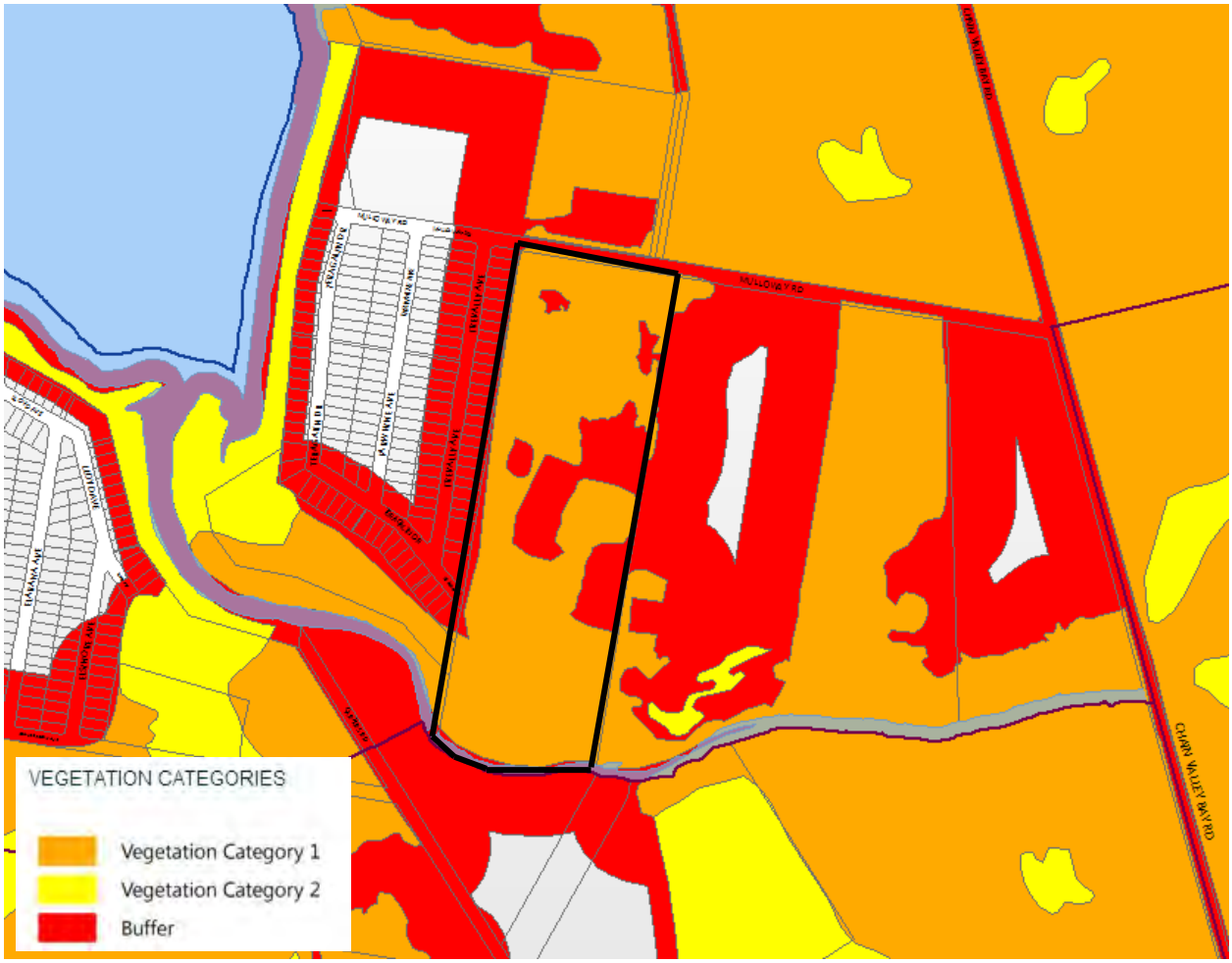


Figure 1.2 – Bushfire prone land map
(Source: Wyong Shire Council)

PBP (pg 4) stipulates that if a proposed amendment to land use zoning or land use affects a designated bushfire prone area then the Section 117(2) Direction No 4.4 of the *EP&A Act* must be applied. This requires Council to consult with the Commissioner of the RFS and to take into account any comments by the Commissioner and to have regard to the planning principles of *PBP* (detailed within Section 1.5.3).

1.5.2 Local Environmental Plan (LEP)

A LEP provides for a range of zonings which list development that is permissible or not permissible, as well as the objectives for development within a zone.

The site is zoned under the Wyong LEP 2013 as part E3 – Environmental Management and E2 – Environmental Conservation (refer Figure 1.3). The proposal seeks to amend the LEP to rezone the E3 portion of the land to R2 – Low Density Residential.

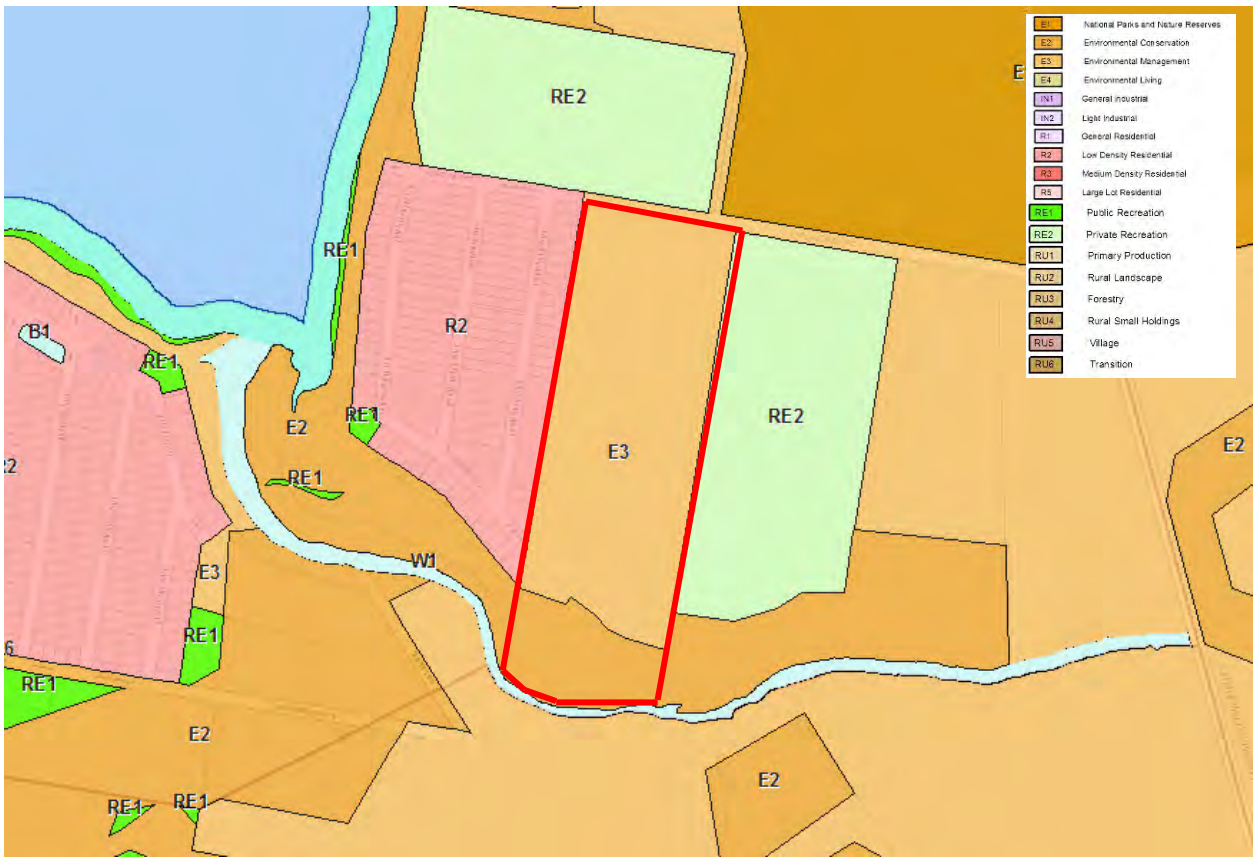


Figure 1.3 – Wyong LEP 2013
(Source: Wyong Shire Council website)

The proposal, including the provision of APZs, would seek to comply with the objectives of the proposed rezoning.

1.5.3 Planning for Bush Fire Protection 2006 (PBP)

Bushfire protection planning requires the consideration of the RFS planning document entitled *PBP. PBP* provides planning principles for rezoning to residential land as well as guidance on effective bushfire protection measures.

The policy aims to provide for the protection of human life (including fire fighters) and to minimise impacts on property and the environment from the threat of bushfire, while having due regard to development potential, on site amenity and protection of the environment.

PBP outlines the following planning principles that must be achieved for all rezoning proposals:

1. Provision of a perimeter road with two way access which delineates the extent of the intended development.

2. Provision, at the urban interface, for the establishment of adequate APZs for future housing.

3. Specifying minimum residential lot depths to accommodate APZs for lots on perimeter roads.

4. Minimising the perimeter of the area of land interfacing the hazard, which may be developed.

5. Introduction of controls which avoid placing inappropriate developments in hazardous areas, and

6. Introduction of controls on the placement of combustible materials in APZs.

In addition to the above, *PBP* outlines the bushfire protection measures required to be assessed for new development in bushfire prone areas. The proposed rezoning has been assessed in compliance with the following measures to ensure that future development is capable of complying with *PBP*:

- asset protection zones
- building construction and design
- access arrangements
- water supply and utilities
- landscaping
- emergency arrangements

1.5.4 Building Code of Australia (BCA) and the Australian Standard AS3959 Construction in bushfire-prone areas 2009 (AS3959)

The *BCA* is given effect through the *EP&A Act* and forms part of the regulatory environment of construction standards and building controls. The *BCA* outlines objectives, functional statements, performance requirements and deemed to satisfy provisions. For residential dwellings these include Classes 1, 2 and 3 buildings. The construction manual for the deemed to satisfy requirements is *AS3959.* Although consideration of *AS3959* is not specifically required in a rezoning proposal, this report (Section 3.2) provides the indicative setbacks for each dwelling construction level and can be used to guide future planning for master plans and / or subdivision proposals.

1.6 Environmental and cultural constraints

1.6.1 Environmental constraints

One (1) endangered ecological community exists on site which is mapped in pink on Figure 2.1 as Estuarine Swamp Oak Forest in the southern portion of the study area. This is equivalent to the endangered ecological community (EEC) called Swamp Sclerophyll Forest on Coastal Floodplains. The northern edge of the EEC is around the proposed boundary between the R2 and E2 zone. There is likely to be minimal direct impact upon the EEC with mitigation measures proposed in the accompanying Ecological Constraints Assessment

(*Travers bushfire &* ecology) that assist in limiting indirect impacts. No threatened flora species or endangered populations have been recorded to date however further survey is proposed in late winter and spring for cryptic species.

The recorded Wallum Froglet breeding area will need to be retained and protected with sufficient buffers to ensure that development will also not indirectly impacts on water quality and quantity to this area.

Squirrel Glider was recorded by call along the creek to a 'possible' level of certainty. If this species is found present within the proposed areas for rezoning, significant habitat retention measures and mitigation measures would be required to ensure denning and foraging habitat remains well represented within the study area.

No foraging activity by Glossy Black-Cockatoo was recorded during the preliminary survey and no evidence of owl activity was noted, therefore breeding by these species is not necessarily expected. If however found to be utilising large hollows during the winter breeding season sufficient habitat retention buffers would need to be provided for such trees. Any future recording of presence of Little Lorikeet would require a search for roost/nest hollows.

Koala is not expected to occur however habitat is high quality particularly the southern portions and if found to be present this would offer significant constraint.

Microbats typically will not constrain development provided hollow retention and relocation measures can be demonstrated. Other fauna species considered are unlikely to constrain development however full seasonal use of the extensive habitats present cannot be currently completely predicted.

1.6.2 Cultural constraints

A basic search was conducted on the Aboriginal Heritage Information System (AHIMS). The results show that there are no identified Aboriginal sites of significance within Lot 273 DP 755266 or within 50m of the site.

Bushfire Threat Assessment

2

To assess the bushfire threat and to determine the required width of an APZ for a development, a review of the elements that comprise the overall threat needs to be completed.

PBP provides a methodology to determine the size of any APZ that may be required to offset possible bushfire attack. These elements include the potential hazardous landscape that may affect the site and the effective slope within that hazardous vegetation.

2.1 Hazardous fuels

PBP guidelines require the identification of the predominant vegetation formation in accordance with David Keith (2004) to determine APZ distances for subdivision developments. The hazardous vegetation is calculated for a distance of at least 140m from a proposed building envelope.

Hazardous fuels surrounding the site consists of a mixture of dry sclerophyll forest and forested wetlands as outlined within the following table and depicted within Schedule 1 attached.

Table 2.1 –Vegetation Communities

Aspect	Vegetation Community	David Keith (2004)	Vegetation Formation (PBP 2006)
North-east & east	Narrabeen Doyalson Coastal Woodland (identified as green in Figure 2.1)	Dry Sclerophyll Forest	Forest
South	Estuarine Swamp Oak Forest (identified as pink in Figure 2.1)	Forested Wetlands	Forested Wetlands

Please note that additional APZ's may apply if future proposals include the retention of any 'unmanaged vegetation' within the site. For example;

- Retention of remnant patches of vegetation (i.e. less than 1ha in size or fire run <50m) will attract an APZ of between 11-14m; and
- Retention of forest vegetation (i.e. greater than 1ha in size) will attract an APZ of between 21 – 24m.

Figure 2.1 – Vegetation mapping (Source: Sixmap)

The following photographs depict the hazardous vegetation surrounding the site:

Photo 1 – Forest vegetation to the north-east (beyond Mulloway Road)

Photo 2 – Forested wetland to the south

Photo 3 – Remnant forest to the west (north-eastern corner of site)

Photo 4 – Planting / regeneration area within the remnant forest to the west (north-eastern corner of site)

2.2 Effective slope

The effective slope is assessed for a distance of up to 100m. Effective slope refers to that slope which provides the most effect upon likely fire behaviour. A mean average slope may not in all cases provide sufficient information such that an appropriate assessment can be determined.

The effective slope within the hazardous areas is provided in detail within Table 2.1 however can be summarised as follows;

- 3 degrees downslope to the north-east (beyond Mulloway Road)
- Hummocky 0-2 degrees downslope within the forested wetland to the south & south-east
- Level to upslope within the remnant vegetation to the east

2.3 Bushfire attack assessment

It is important that the developer understands that there are different methods in determining APZ and BAL levels to ensure that there is a clear understanding of the implications for subdivision design and future dwelling construction:

Subdivision Approval – PBP 2006 Appendix 2 is used to determine APZ distances to achieve approval for subdivision development applications. This approach does not conform to the construction code AS3959 *Construction of buildings in bushfire prone areas* in all cases and therefore can pose significant implications for future dwelling approval.

In order to avoid potential future complications the assessment in the following Table 2.1 has been undertaken using a deemed to satisfy and alternate solution approach which provides the following two (2) different results in terms of APZ and BAL level outcomes. Either of these methods can be used to achieve dwelling approval following subdivision.

- ***Deemed to satisfy approach*** (DS) – The deemed to satisfy approach is undertaken in compliance with AS3959 and is used to obtain approval for a construction certificate as complying development in accordance with the Code's SEPP.

  The assessment uses Method 1 Table 2.4.2 of AS3959 and results in a cheaper bushfire assessment at building construction stage (refer Column 6 of Table 2.1). However it is often not the cheapest approach as BAL levels can be higher which lend to higher construction costs.

  The APZ and BAL setbacks are larger therefore decreasing the overall developable land within the site.

- ***Alternate solution approach*** (AS) – The alternative solution approach uses AS3959 Appendix B Method 2 assessment methodology to obtain a more accurate BAL rating with reduced APZ to maximise the developable area.

  This method can also provide future lots owners with the best way to achieve cheaper building construction costs. However future purchasers (particularly for lots around the perimeter of the development / fronting the bushland) will be required to lodge their dwelling application under Section 79BA of the *EP&A Act,* which will require a bushfire protection assessment report (i.e. increased cost for report) to support the lower BAL level.

Please note that the BAL levels depicted in Schedule 1 attached are based on an alternative solution approach (i.e. Column 5). The BAL setbacks provided in Column 6 (Table 2.1) have been provided to guide the developer on the setbacks required for complying development.

A fire danger index (FDI) of 100 has been used to calculate bushfire behaviour on the site based on its location within the Greater Sydney region. Table 2.1 provides a summary of the bushfire attack assessment using each of the above methods.

Table 2.1 – Bushfire attack assessment

Aspect	Vegetation formation within 140m of development (refer Note 1)	Effective slope of land	Minimum APZ required – alternative solution approach (meters)	Building construction standards (Alternative solution approach) (refer Note 2)	Building construction standards (Deemed to satisfy approach) (refer Note 3)
North-east (beyond Mulloway Road)	Forest (AS – 20/25) (DS – 25/35)	3° D	24	BAL 29 (24-<34) BAL 19 (34-<45) BAL 12.5 (45-<100)	BAL 40 (24-<32) BAL 29 (32-<43) BAL 19 (43-<57) BAL 12.5 (57-<100)
East	Remnant vegetation (refer Note 4) (AS - 8-10) (DS 10-12)	Level to upslope	9	BAL 29 (9-<13) BAL 19 (13-<19) BAL 12.5 (19-<100)	BAL 40 (8-<11) BAL 29 (11-<16) BAL 19 (16-<23) BAL 12.5 (23-<100)
South and south-east	Freshwater wetland (AS – 15/20) (DS – 25/35)	0-2° D (hummocky vegetation	18	BAL 29 (18-<25) BAL 19 (25-<37) BAL 12.5 (37-<100)	BAL 40 (24-<32) BAL 29 (32-<43) BAL 19 (43-<57) BAL 12.5 (57-<100)

Note 1: Fuel loads utilised for each method is provided in brackets. AS – Alternate solution, DS – Deemed to satisfy.

Note 2: A performance based assessment using Appendix B of *AS3959* was undertaken to determine the required minimum APZ and BAL level based on forest (fuel load 20/25), forested wetland (fuel load 15/20), and rainforest vegetation (fuel load 8/10) on a level or downslope of 2 or 3 degrees (determined to be the worst case scenario in each scenario). The results of the assessment, provided within Appendix 2, were prepared using the bushfire attack assessor (BFAA) developed by *Newcastle Bushfire Consulting.*

Note 3: Under clauses 3.36B and 3A.37 of the Codes SEPP the construction of dwellings on some bush fire prone land may be considered as complying development. For complying development to occur on future allotments, the land must be certified as being below a BAL 29 risk rating. A BAL Certificate must be obtained from the council or a person who is recognised by the RFS as a suitably qualified consultant in bush fire risk assessment prior to lodging an application for a CDC. Buildings assessed as BAL 40 or BAL FZ or where the assessment has used an alternate solution are not considered complying and must lodge their application under section 79BA to the RFS and a full bushfire protection assessment must be prepared.

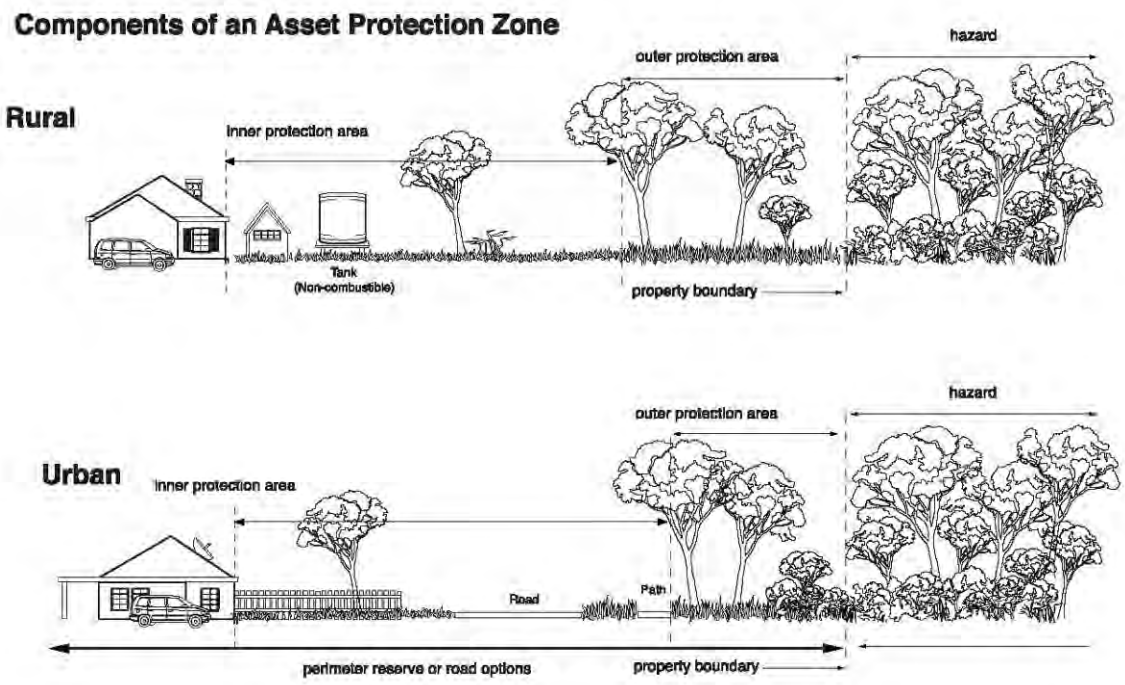
Note 4: *PBP* describes remnant vegetation as a parcel of vegetation with a size of less than 1ha or a shape that provides a potential fire run directly towards a building not exceeding 50m. The vegetation to the east exhibits these qualities and therefore the threat posed is considered low and APZ setbacks for this aspect are the same as for the rainforest category outlined in *PBP*.

Specific Protection Issues

3

3.1 Asset protection zones (APZs)

APZs are areas of defendable space separating hazardous vegetation from buildings. The APZ generally consists of two subordinate areas, an inner protection area (IPA) and an outer protection area (OPA). The OPA is closest to the bush and the IPA is closest to the dwellings. The IPA cannot be used for habitable dwellings but can be used for all external non-habitable structures such as pools, sheds, non-attached garages, cabanas, etc. A typical APZ and therefore defendable space is graphically represented below:



APZs and progressive reduction in fuel loads (Source: RFS, 2006)

Note: Vegetation management as shown is for illustrative purposes only. Specific advice is to be sought in regard to vegetation removal and retention from a qualified and experienced expert to ensure APZs comply with the *RFS* performance criteria.

PBP dictates that the subsequent extent of bushfire attack that can potentially emanate from a bushfire must not exceed a radiant heat flux of 29*kW/m*^{2} for residential subdivision developments. This rating assists in determining the size of the APZ in compliance with *PBP* to provide the necessary defendable space between hazardous vegetation and a building. Table 3.1 outlines the proposals compliance with the performance criteria for APZs.

Table 3.1 – Performance criteria for asset protection zones (*PBP* guidelines pg. 19)

Performance criteria	Acceptable solutions	Complies
Radiant heat levels at any point on a proposed building will not exceed 29kW/m^2.	APZs are provided in accordance with Appendix 2. APZs are wholly within the boundary of the development site.	Yes - Table 2.1 outlines the methodology for determining minimum APZ setbacks.
APZs are managed and maintained to prevent the spread of fire towards the building.	In accordance with the requirements of *Standards for Asset Protection Zones* (*NSW RFS* 2005).	Yes - to be made a condition of consent.
APZ maintenance is practical, soil stability is not compromised and the potential for crown fires is negated.	The APZ is located on lands with a slope of less than 18^o.	Yes - Slopes are less than 18^o.

3.2 Building protection

In terms of future subdivision approval, the minimum APZ must be provided in accordance with Appendix 2 of *PBP.* The APZs provided in Table 2.1 (Section 2.3) of this report comply with these requirements, whilst also considering the building setbacks as per *AS3959*.

Although not required in terms of rezoning, the following advice in relation to building construction levels can be used for future planning and subdivision design.

The construction classification system is based on five (5) bushfire attack levels (BAL). These are BAL – Flame Zone (FZ), BAL 40, BAL 29, BAL 19 and BAL 12.5 AS3959 – *Construction of buildings in bushfire-prone areas*. The lowest level, BAL 12.5, has the longest APZ distance while BAL – FZ has the shortest APZ distance. These allow for varying levels of building design and use of appropriate materials.

Table 2.1 provides an indication of the BALs that are likely to apply for future building construction. These BAL levels are for planning purposes only and will be assessed / confirmed prior to building construction stage.

3.3 Hazard management

Should the development be approved, the owner or occupier will be required to manage the APZ to the specifications of Council's approval.

In terms of implementing and / or maintaining APZs, there is no physical reason that would constrain hazard management from being successfully carried out by normal means (e.g. mowing / slashing).

The APZs are to be managed in accordance with the RFS guidelines *Standards for Asset Protection Zones (RFS, 2005),* with landscaping to comply with Appendix 5 of *PBP.*

A summary of the guidelines for managing APZs is attached as Appendix 1 to this report.

3.4 Access for fire fighting operations

Future residential development within the site will access Mulloway Road in the north.

Table 3.2 outlines the performance criteria and acceptable solutions for future public roads within future subdivision design. Based on the acceptable solutions future subdivision design should include an 8m wide carriageway adjacent to the southern and part western boundaries (perimeter road) of the residential development adjacent to bushland vegetation. All other internal public roads are to have a width of 6.5m.

Table 3.2 – Performance criteria for public roads (*PBP* guidelines pg. 20)

Performance criteria	Acceptable solutions
Fire fighters are provided with safe all weather access to structures (thus allowing more efficient use of fire fighting resources).	Public roads are two-wheel drive, all weather roads.
Public road widths and design that allow safe access for fire fighters while residents are evacuating an area.	Urban perimeter roads are two way, that is, at least two traffic lane widths (carriageway 8m minimum kerb to kerb) allowing traffic to pass in opposite directions. Non perimeter roads comply with Table 3.3 below. Perimeter road is linked with the internal road system at an interval of no greater than 500m in urban areas. Traffic management devices are constructed to facilitate access by emergency services. Public roads have a cross fall not exceeding 3^{o}. All roads are through roads. If unavoidable, dead end roads are not more than 200m in length, incorporate a minimum 12m outer radius turning circle, sign posted dead end and direct traffic away from the hazard. Curves of roads (other than perimeter) have a minimum inner radius of 6m and are minimal in number to allow for rapid access and egress. The minimum distance between inner and outer curves is 6m. Maximum grades for sealed roads do not exceed 15^{o} and an average grade of not more than 10^{o}. Minimum vertical clearance of 4m above the road at all times.
The capacity of road surfaces and bridges is sufficient to carry fully loaded fire fighting vehicles	The capacity of road surfaces and bridges is sufficient to carry fully loaded fire fighting vehicles (15 tonnes for reticulated water and 28 tonnes for all other areas). Bridges clearly indicate load rating.
Roads that are clearly sign posted (with easily distinguishable names) and buildings / properties that are clearly numbered.	Public roads >6.5m wide to locate hydrants outside of parking reserves to ensure accessibility to reticulated water. Public roads 6.5-8m wide are No Parking on one side with the hydrant located on this side to ensure accessibility to reticulated water. Public roads <6.5m wide provide parking within parking bays and locate services outside of parking bays to ensure accessibility to reticulated water. One way only public access are no less than 3.5m wide and provide parking within parking bays and locate services outside of parking bays to ensure accessibility to reticulated water.

Performance criteria	Acceptable solutions
There is clear access to reticulated water supply. Parking does not obstruct the minimum paved width	Parking bays are a minimum of 2.6m wide from kerb edge to road pavement. No services or hydrants are located within parking bays. Public roads directly interfacing the bushfire hazard are to provide roll top kerbing to the hazard side of the road.

Table 3.3 – Minimum widths for public roads that are not perimeter roads

Curve radius (inside edge) (metres width)	Swept path (metres width)	Single lane (metres width)	Two way (metres width)
<40	3.5	4.5	8.0
40-69	3.0	3.9	7.5
70-100	2.7	3.6	6.9
>100	2.5	3.5	6.5

3.5 Water supplies

Table 3.4 outlines the performance criteria and acceptable solutions for reticulated water supply.

Table 3.4 – Performance criteria for reticulated water supplies (*PBP* guidelines pg. 27)

Performance criteria	Acceptable solutions
Water supplies are easily accessible and located at regular intervals.	Reticulated water supply to urban subdivision uses a ring main system for areas with perimeter roads. Fire hydrant spacing, sizing and pressures comply with AS2419.1 - 2005. Where this cannot be met, the RFS will require a test report of the water pressures anticipated by the relevant water supply authority. In such cases, the location, number and sizing of hydrants shall be determined using fire engineering principles. Hydrants are not placed within any road carriageway. All above ground water and gas pipes external to the building are metal, including and up to taps. The provisions of parking on public roads are met.

3.6 Gas

Table 3.5 outlines the required performance criteria for the gas supply.

Table 3.5 – Performance criteria for reticulated water supplies (*PBP* guidelines pg. 27)

Performance criteria	Acceptable solutions
Location of gas services will not lead to the ignition of surrounding bushland land or the fabric of buildings	Reticulated or bottled gas bottles are to be installed and maintained in accordance with AS1596 (2002) and the requirements of relevant authorities. Metal piping is to be used. All fixed gas cylinders are to be kept clear of flammable materials to a distance of 10m and shielded on the hazard side of the installation. If gas cylinders are to be kept close to the building the release valves must be directed away from the building and at least 2m away from any combustible material, so that they do not act as a catalyst to combustion. Connections to and from gas cylinders are metal. Polymer sheathed flexible gas supply lines to gas meters adjacent to buildings are not to be used.

3.7 Electricity

Table 3.6 outlines the required performance criteria for electricity supply.

Table 3.6 – Performance criteria for electricity services (*PBP* guidelines pg. 27)

Performance criteria	Acceptable solutions
Location of electricity services limit the possibility of ignition of surrounding bushland or the fabric of buildings Regular inspection of lines in undertaken to ensure they are not fouled by branches.	Where practicable, electrical transmission lines are underground Where overhead electrical transmission lines are proposed: • Lines are installed with short pole spacing (30m), unless crossing gullies, gorges or riparian areas: and • No part of a tree is closer to a power line than the distance set out in accordance with the specification in *Vegetation Safety Clearances* issued by *Energy Australia* (NS179, April 2002).

Conclusion & Recommendations

4

4.1 Conclusion

A bushfire protection assessment has been undertaken for the proposed rezoning located at Lot 273 DP 755266, 15 Mulloway Road, Chain Valley Bay.

Our assessment found that bushfire can potentially affect the site from the forest vegetation beyond Mulloway Road to the north-east and the forested wetland vegetation located to the south and south-east of the site within the E2 zoned land resulting in possible ember attack, radiant heat and potentially flame attack. Pockets of remnant vegetation also exist within the adjoining land to the east.

The assessment has concluded that future development on site will provide compliance with the planning principles of *PBP* and *Community Resilience Practice Note 2/12 – Planning Instruments and Policies*.

Future development on site is to comply with the following planning principles.

Table 4.1 – Planning principles

Planning principles	Recommendations
Provision of a perimeter road with two way access which delineates the extent of the intended development.	Given the presence of forest / forested wetland vegetation a perimeter road along the southern and part eastern boundaries is required.
Provision, at the urban interface, for the establishment of adequate APZs for future housing.	APZs have been recommended in compliance with BAL 29 (Method 2 - AS3959, 2009).
Specifying minimum residential lot depths to accommodate APZs for lots on perimeter roads.	Future subdivision design is to allow for the minimum APZs as recommended within Table 2.1 and as depicted within Schedule 1 attached.
Minimising the perimeter of the area of land interfacing the hazard, which may be developed.	Compliant.
Introduction of controls which avoid placing inappropriate developments in hazardous areas.	Future development consists of residential dwellings and is appropriate for the level of bushfire risk.
Introduction of controls on the placement of combustible materials in APZs.	Compliant – can be made a condition of consent.

The following recommendations are provided to ensure that future residential development is in accordance with, or greater than, the requirements of *PBP.*

4.2 Recommendations

Recommendation 1 - APZs are to be provided to the future residential development. APZs are to be measured from the exposed wall of any dwelling toward the hazardous vegetation. The minimum APZ must be achievable within all lots fronting the bushfire hazard as nominated in Table 2.1 and also as generally depicted in Schedule 1.

Recommendation 2 - Fuel management within the APZs is to be maintained by regular maintenance of the landscaped areas, mowing of lawns in accordance with the guidelines provided in Appendix 1, and as advised by the RFS in their publications.

Recommendation 3 - Building construction standards are to be applied for future residential dwellings in accordance with *Australian Standard AS3959 Construction of buildings in bushfire-prone areas (2009)* with additional construction requirements as listed within Section A3.7 of Addendum Appendix 3 of *PBP.*

Recommendation 4 – Public access roads are to comply with the acceptable solutions provided within Section 4.1.3 of *PBP* (refer Section 3.4 of this report). The requirement for a perimeter road (8m width) along the southern and part eastern boundaries is recommended with all other roads having a width of 6.5m.

Recommendation 5 – Water, electricity and gas supply is to comply with the acceptable solutions as provided within Section 4.1.3 of *PBP* (refer Sections 3.5, 3.6 and 3.7 of this report).

REFERENCES

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Chan, K.W. (2001) – *The suitability of the use of various treated timbers for building constructions in bushfire prone areas*. Warrington Fire Research.

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Keith, David (2004) – *Ocean Shores to Desert Dunes – The Native Vegetation of New South Wales and the ACT*. The Department of Environment and Climate Change.

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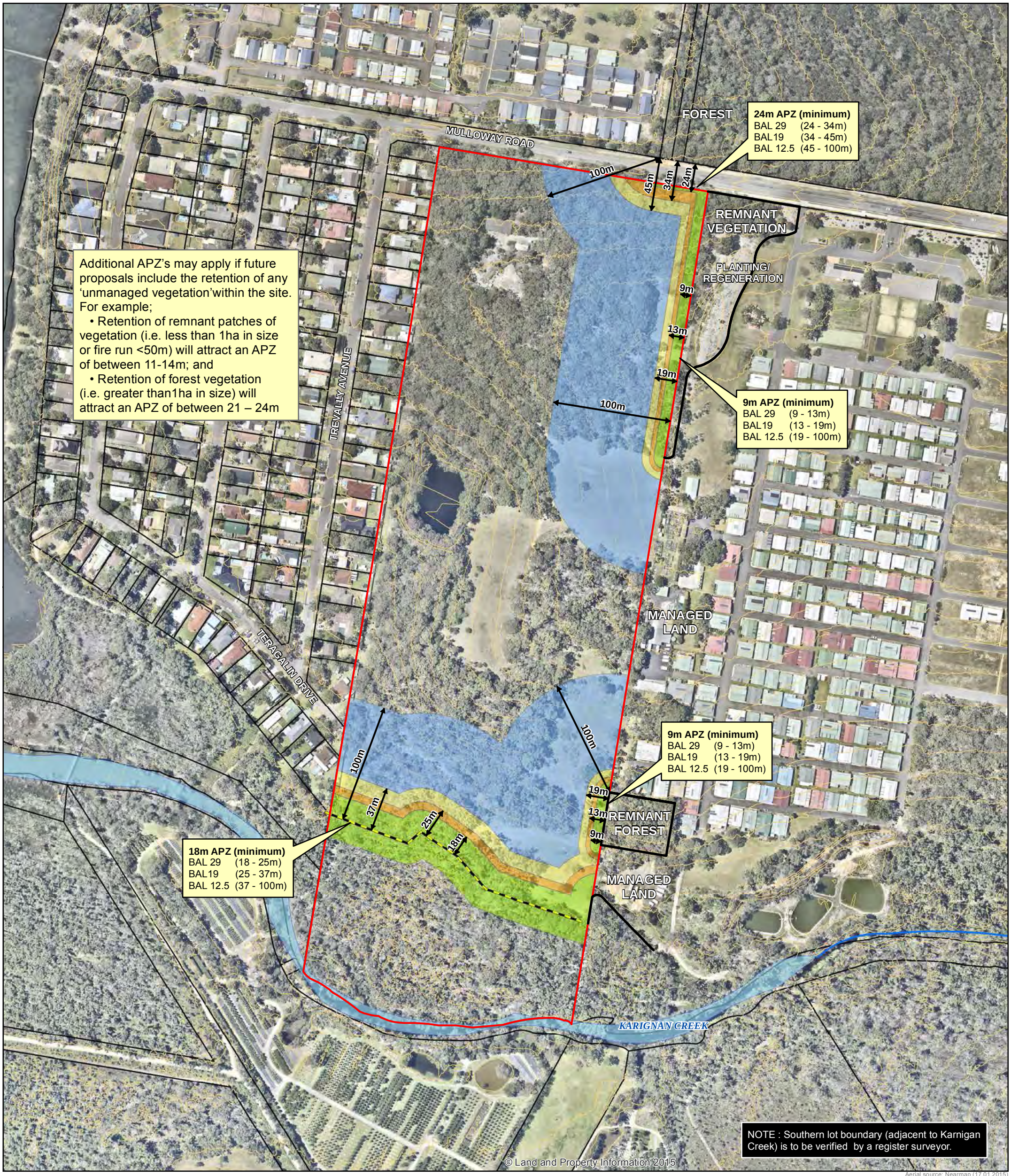
Umwelt, 2012. *Ecological Assessment for Rezoning Application Lots 93 – 96 Boundary Road, Medowie.*

Plan of Bushfire Protection Measures

S1



Aerial source: Nearmap (17.01.2015)

Legend

- Lot boundary (*Land & Property Information, 2016*)
- Waterbody (*Land & Property Information, 2016*)
- Creek line (*Land & Property Information, 2016*)
- Zoning boundary (*Wyong Local Environmental Plan, 2013*)
- Contour (1m)
- Minimum Asset Protection Zone (APZ) (alternative solution approach)

Bushfire Construction Standards

AS3959 (2009)*

- BAL 29
- BAL 19
- BAL 12.5

* Please refer to additional construction requirements for BAL levels which are contained in Addendum Appendix 3 of *'Planning for Bushfire Protection'* (2006).

Travers bushfire & ecology
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PROJECT & MXD REFERENCE	DATE & ISSUE NUMBER	SCALE & COORDINATE SYSTEM
15 Mullaway Rd, Chain Valley Bay A16015_BF001	16/06/2016 Issue 1	1:3,000 @ A3 GDA 1994 MGA Zone 56

0 50 100 m

TITLE

Schedule 1 - Bushfire Protection Measures

Disclaimer: The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered surveyor.

Document Path: N:\GIS STORAGE\N Drive\A16015_MullawayRoad_ChainValleyBay\MXDs\A16015_BF001.mxd

Management of Asset Protection Zones

A1

The RFS advises that when living in a bushfire prone environment APZs are required to be provided between hazardous fuels and a dwelling.

The RFS provides basic advice in respect of managing APZs in several documents namely *Planning for Bush Fire Protection 2006 (PBP)* and *Standards for Asset Protection Zones* (undated but circa 2006).

APZs provide a level of defendable space between the hazard and a habitable dwelling or similar structure. These zones are usually shown on plans adjacent to either cultural or natural assets (e.g. dwelling). They act to significantly lessen the impact of intense fire. The major mitigating factor that limits the effects of wildfire is the amount of fuel available to burn. By reducing the amount of fuel there will be a reduction in the intensity of the fire.

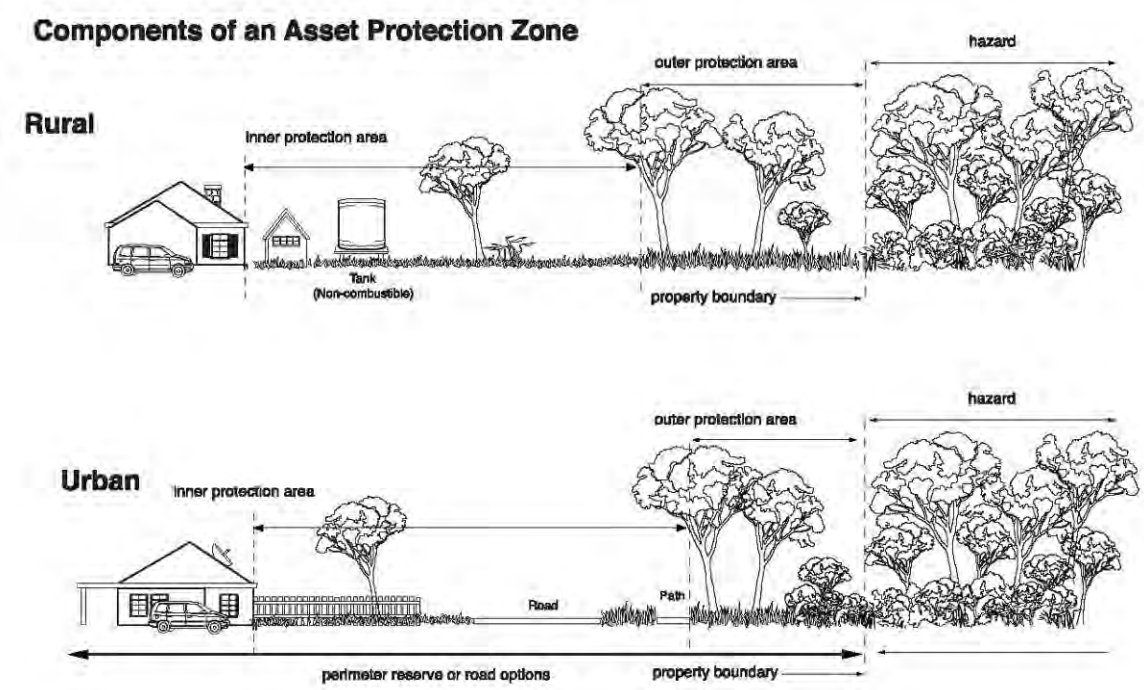
When considering bushfire fuel it is important to understand that it occurs in our native bushland in three vertical layers – see Table 1.

Table 1 – Fuel layers

Fuel layer name	Location of layer in vertical column	Type of fuel
Ground fuels	Below ground level	Peatmoss (always below the surface)
Surface fuels	0-200mm	Litter layer (leaves & twigs)
Aerial fuels	200-3,000mm	Shrubs and grasses
Canopy fuels	>3,000mm	Tree canopy

The APZ can be further classified into two sub-zones with each having a specific role. These sub-zone areas are called the inner protection area (IPA) and the outer protection area (OPA) – see figure below.

The IPA is managed as a fuel free zone while the OPA is managed as a fuel reduced zone. This means that the fuel free zone has little fuel available to be consumed in the event of a fire whilst the fuel reduced zones has less than normal fuel levels that could be consumed in the event of a fire.



APZs and progressive reduction in fuel loads (Source: RFS, 2006)

Inner protection area (IPA)

This area is almost free of all fuels and usually takes the form of grassy areas, car parks, roads, concrete areas, tracks or trails. It does not imply or require the wholesale removal of every tree and or shrub.

This zone is intended to stop the transmission of flame and reduce the transmission of radiant heat by the elimination of available fuel. This area also allows airborne embers to fall safely without igniting further outbreaks.

This zone also provides a safe fire fighting position and is operationally important for implementation of clear fire control lines.

Grasses may occur within an IPA if they are generally no higher than 50-75mm. Above this height, fuel weights tend to increase exponentially and consequentially cause greater flame heights and therefore fire intensity

Shrubs may occur within an IPA in the form of clumping amidst open grassy areas. The design of the clumping will be dependent on species selection and spatial density. For example, the larger the shrubs the less clumping may occur in a given area.

As a general rule, trees are allowed within an IPA but only where those trees are at least 5m away from a dwelling.

A recommended performance standard for the fuel load of an IPA is between 0-4t/ha. Shrubs may occur within an IPA commensurate with a spatial distribution of 15-20%. For example an area of 100m^2 (10mx10m) can have up to 20% of this area composed of shrubs.

If a shrub layer is present the following table shows the additional fuel weights that should be added to the calculated surface fuels.

Shrub cover	Fuel weight
10-30%	2.5 tonnes / ha
35-50%	5.0 tonnes / ha
55-75%	7.5 tonnes / ha

Presence of trees within an inner protection area

A tree may occur within an IPA if the canopy does not form a link with shrubs. The reason is to lessen any chance for vegetation linking and the capability for fire to extend into the canopy.

It is a basic premise in fire behaviour understanding that fire cannot occur in the canopy unless surface fuels such as grasses or shrubs are burning. This merging creates opportunity for fire to link with the canopy and therefore increase fire intensity by some significant amount.

Trees that have a canopy beginning near the ground (such as Forest Oaks *Allocasuarina*) form a continuous link with the tree canopy and shrubs. A forest canopy cannot therefore burn without fuel to feed that fire. In a tall open forest, where the trees are generally above 20m in height the canopy is separated from the land surface by some distance. In an open woodland the low canopy height (usually <5m) merges with the shrubland layer.

Knowing the relationship between the shrub layer and the tree canopy allows fire managers to design safer areas in the APZs. It is for this reason that vegetation such as Forest Oaks are usually excluded from an IPA.

Similarly, in open forests the height of the forest is sufficiently removed from the shrub layer. As a general rule, trees are allowed within an IPA where the density of those trees is commensurate with Table 2 below and located on slopes up to 20% with a westerly aspect.

In respect of trees that can be located in an IPA Table 2 provides guidelines.

Table 2 – Tree density in inner protection area

Distance from dwelling wall	Trees permitted on the exposed side of a dwelling	Trees permitted on the non exposed side of a dwelling
Within 5m	No trees	No trees
Between 5-10m	One tree per 100m^2	2 trees per 100m^2
Between 10-20m	<10 tree per 400m^2	<10 trees per 400m^2

Outer protection area (OPA)

This zone is designed to stop the development of intense fires and the transmission of severe radiated heat.

The OPA assumes all trees will remain but with either a modified shrub / grass layer or regular removal of the litter layer. In some sparse vegetation communities the shrub layer may not require modification.

The fire fighting advantage will manifest in reduced fire intensity. It achieves this by denying fire a significant proportion of the fuel to feed upon. Fuels containing small (or fine) leaves such as Forest Oaks (or similar) are targeted for removal due to the capacity to burn quickly and therefore feed fire up into adjacent trees.

In most cases, the removal of 85% of the litter layer will achieve a satisfactory OPA. A recommended performance standard for the fuel load of an OPA is between 4-6t/ha.

Managing the APZ

Fuel management within the APZs should be maintained by regular maintenance such as:

- Mowing grasses regularly - grass needs to be kept short and, where possible, green.

- Raking or manual removal of fine fuels - ground fuels such as fallen leaves, twigs (less than 6mm diameter) and bark should be removed on a regular basis. This is fuel that burns quickly and increases the intensity of a fire. Fine fuels can be removed by hand or with tools such as rakes, hoes and shovels.

- Removal or pruning of trees, shrubs and understorey - the control of existing vegetation involves both selective fuel reduction (removal, thinning and pruning) and the retention of vegetation. Prune or remove trees so that you do not have a continuous tree canopy leading from the hazard to the asset. Separate tree crowns by 2-5m. A canopy should not overhang within 2-5m of a dwelling. Native trees and shrubs should be retained as clumps or islands and should maintain a covering of no more than 20% of the area.

- Trees or tall shrubs may require pruning upon dwelling completion in line with *PBP.* Notwithstanding this, the presence of shrubs and trees close to a dwelling in a bushfire prone landscape requires specific attention to day to day management and owners and or occupier should be made aware that whilst landscaping can contribute to a way of life and environmental amenity the accumulated.

In addition, the following general APZ planning advice should be followed:

- Ensure that vegetation does not provide a continuous path to the house.

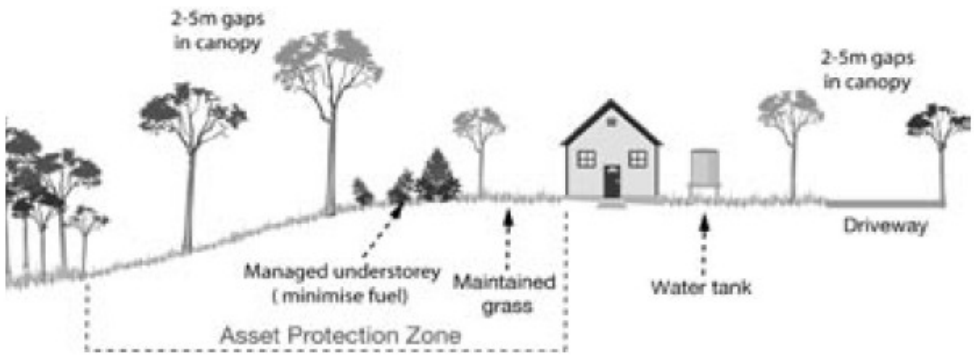
- Plant or clear vegetation into clumps rather than continuous rows.

- Prune low branches 2m from the ground to prevent a ground fire from spreading into trees.

- Locate vegetation far enough away from the asset so that plants will not ignite the asset by direct flame contact or radiant heat emission.

- Ensure that shrubs and other plants do not directly abut the dwelling. Where this does occur, gardens should contain low flammability plants and non flammable ground cover such as pebbles and crushed tile; and

- The following RFS illustrative diagram depicts one version of an ideal situation. Specific advice is to be sought from qualified experts to ensure that the implemented APZs meet the performance criteria of APZs.



Figures courtesy of NSW RFS 2006.

Performance based assessment

A2

NBC Bushfire Attack Assessment Report V2.1

AS3959 (2009) Appendix B - Detailed Method 2

Printed: 27/04/2016 **Assessment Date:** 14/04/2016

Site Street Address:	Mulloway Road, Chain Valley Bay		
Assessor:	Mr Admin; admin		
Local Government Area:	Wyong	**Alpine Area:**	No

Equations Used

Transmissivity: Fuss and Hammins, 2002
Flame Length: RFS PBP, 2001
Rate of Fire Spread: Noble et al., 1980
Radiant Heat: Drysdale, 1985; Sullivan et al., 2003; Tan et al., 2005
Peak Elevation of Receiver: Tan et al., 2005
Peak Flame Angle: Tan et al., 2005

Run Description: A North-East BAL 29

Vegetation Information

Vegetation Type:	Forest	**Vegetation Group:**	Forest and Woodland
Vegetation Slope:	3 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	20	**Overall Fuel Load(t/ha):**	25

Site Information

Site Slope	3 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	24

Fire Inputs

Veg./Flame Width(m):	100	**Flame Temp(K)**	1090

Calculation Parameters

Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	100

Program Outputs

Category of Attack:	HIGH	**Peak Elevation of Receiver(m):**	8.71
Level of Construction:	BAL 29	**Fire Intensity(kW/m):**	38129
Radiant Heat(kW/m2):	28.05	**Flame Angle (degrees):**	64
Flame Length(m):	22.19	**Maximum View Factor:**	0.443
Rate Of Spread (km/h):	2.95	**Inner Protection Area(m):**	24
Transmissivity:	0.834	**Outer Protection Area(m):**	0

Run Description:	B North-East BAL 19		
Vegetation Information			
Vegetation Type:	Forest	**Vegetation Group:**	Forest and Woodland
Vegetation Slope:	3 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	20	**Overall Fuel Load(t/ha):**	25
Site Information			
Site Slope	3 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	34
Fire Inputs			
Veg./Flame Width(m):	100	**Flame Temp(K)**	1090
Calculation Parameters			
Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	100
Program Outputs			
Category of Attack:	MODERATE	**Peak Elevation of Receiver(m):**	8.71
Level of Construction:	BAL 19	**Fire Intensity(kW/m):**	38129
Radiant Heat(kW/m2):	18.29	**Flame Angle (degrees):**	71
Flame Length(m):	22.19	**Maximum View Factor:**	0.299
Rate Of Spread (km/h):	2.95	**Inner Protection Area(m):**	34
Transmissivity:	0.804	**Outer Protection Area(m):**	0
Run Description:	C North-East BAL 12.5		
Vegetation Information			
Vegetation Type:	Forest	**Vegetation Group:**	Forest and Woodland
Vegetation Slope:	3 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	20	**Overall Fuel Load(t/ha):**	25
Site Information			
Site Slope	3 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	45
Fire Inputs			
Veg./Flame Width(m):	100	**Flame Temp(K)**	1090
Calculation Parameters			
Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	100
Program Outputs			
Category of Attack:	LOW	**Peak Elevation of Receiver(m):**	8.31
Level of Construction:	BAL 12.5	**Fire Intensity(kW/m):**	38129
Radiant Heat(kW/m2):	12.5	**Flame Angle (degrees):**	74
Flame Length(m):	22.19	**Maximum View Factor:**	0.21
Rate Of Spread (km/h):	2.95	**Inner Protection Area(m):**	45
Transmissivity:	0.781	**Outer Protection Area(m):**	0

Run Description:	D East BAL 29		
Vegetation Information			
Vegetation Type:	Remnant Vegetation	Vegetation Group:	Remnant Vegetation
Vegetation Slope:	0 Degrees	Vegetation Slope Type:	Level
Surface Fuel Load(t/ha):	8	Overall Fuel Load(t/ha):	10
Site Information			
Site Slope	0 Degrees	Site Slope Type:	Level
Elevation of Receiver(m)	Default	APZ/Separation(m):	9
Fire Inputs			
Veg./Flame Width(m):	100	Flame Temp(K)	1090
Calculation Parameters			
Flame Emissivity:	95	Relative Humidity(%):	25
Heat of Combustion(kJ/kg	18600	Ambient Temp(K):	308
Moisture Factor:	5	FDI:	100
Program Outputs			
Category of Attack:	HIGH	Peak Elevation of Receiver(m):	3.37
Level of Construction:	BAL 29	Fire Intensity(kW/m):	4960
Radiant Heat(kW/m2):	27.42	Flame Angle (degrees):	65
Flame Length(m):	7.44	Maximum View Factor:	0.413
Rate Of Spread (km/h):	0.96	Inner Protection Area(m):	9
Transmissivity:	0.874	Outer Protection Area(m):	0

Run Description:	E East BAL 19		
Vegetation Information			
Vegetation Type:	Remnant Vegetation	Vegetation Group:	Remnant Vegetation
Vegetation Slope:	0 Degrees	Vegetation Slope Type:	Level
Surface Fuel Load(t/ha):	8	Overall Fuel Load(t/ha):	10
Site Information			
Site Slope	0 Degrees	Site Slope Type:	Level
Elevation of Receiver(m)	Default	APZ/Separation(m):	13
Fire Inputs			
Veg./Flame Width(m):	100	Flame Temp(K)	1090
Calculation Parameters			
Flame Emissivity:	95	Relative Humidity(%):	25
Heat of Combustion(kJ/kg	18600	Ambient Temp(K):	308
Moisture Factor:	5	FDI:	100
Program Outputs			
Category of Attack:	MODERATE	Peak Elevation of Receiver(m):	3.56
Level of Construction:	BAL 19	Fire Intensity(kW/m):	4960
Radiant Heat(kW/m2):	18.54	Flame Angle (degrees):	73
Flame Length(m):	7.44	Maximum View Factor:	0.285
Rate Of Spread (km/h):	0.96	Inner Protection Area(m):	13
Transmissivity:	0.857	Outer Protection Area(m):	0

Run Description:	F East BAL 12.5		
Vegetation Information			
Vegetation Type:	Remnant Vegetation	**Vegetation Group:**	Remnant Vegetation
Vegetation Slope:	0 Degrees	**Vegetation Slope Type:**	Level
Surface Fuel Load(t/ha):	8	**Overall Fuel Load(t/ha):**	10
Site Information			
Site Slope	0 Degrees	**Site Slope Type:**	Level
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	19
Fire Inputs			
Veg./Flame Width(m):	100	**Flame Temp(K)**	1090
Calculation Parameters			
Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	100
Program Outputs			
Category of Attack:	LOW	**Peak Elevation of Receiver(m):**	3.64
Level of Construction:	BAL 12.5	**Fire Intensity(kW/m):**	4960
Radiant Heat(kW/m2):	12.23	**Flame Angle (degrees):**	78
Flame Length(m):	7.44	**Maximum View Factor:**	0.192
Rate Of Spread (km/h):	0.96	**Inner Protection Area(m):**	19
Transmissivity:	0.836	**Outer Protection Area(m):**	0
Run Description:	G South & south-east BAL 29		
Vegetation Information			
Vegetation Type:	Forest	**Vegetation Group:**	Forest and Woodland
Vegetation Slope:	2 Degrees	**Vegetation Slope Type:**	Downslope
Surface Fuel Load(t/ha):	15	**Overall Fuel Load(t/ha):**	20
Site Information			
Site Slope	2 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	18
Fire Inputs			
Veg./Flame Width(m):	100	**Flame Temp(K)**	1090
Calculation Parameters			
Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	100
Program Outputs			
Category of Attack:	HIGH	**Peak Elevation of Receiver(m):**	6.55
Level of Construction:	BAL 29	**Fire Intensity(kW/m):**	21352
Radiant Heat(kW/m2):	27.67	**Flame Angle (degrees):**	65
Flame Length(m):	15.83	**Maximum View Factor:**	0.429
Rate Of Spread (km/h):	2.07	**Inner Protection Area(m):**	18
Transmissivity:	0.848	**Outer Protection Area(m):**	0

Run Description:	H South & south-east BAL 19		
Vegetation Information			
Vegetation Type:	Forest	Vegetation Group:	Forest and Woodland
Vegetation Slope:	2 Degrees	Vegetation Slope Type:	Downslope
Surface Fuel Load(t/ha):	15	Overall Fuel Load(t/ha):	20
Site Information			
Site Slope	2 Degrees	Site Slope Type:	Downslope
Elevation of Receiver(m)	Default	APZ/Separation(m):	25
Fire Inputs			
Veg./Flame Width(m):	100	Flame Temp(K)	1090
Calculation Parameters			
Flame Emissivity:	95	Relative Humidity(%):	25
Heat of Combustion(kJ/kg	18600	Ambient Temp(K):	308
Moisture Factor:	5	FDI:	100
Program Outputs			
Category of Attack:	MODERATE	Peak Elevation of Receiver(m):	6.66
Level of Construction:	BAL 19	Fire Intensity(kW/m):	21352
Radiant Heat(kW/m2):	18.99	Flame Angle (degrees):	72
Flame Length(m):	15.83	Maximum View Factor:	0.303
Rate Of Spread (km/h):	2.07	Inner Protection Area(m):	25
Transmissivity:	0.824	Outer Protection Area(m):	0

Run Description:	I South & south-east BAL 12.5		
Vegetation Information			
Vegetation Type:	Forest	Vegetation Group:	Forest and Woodland
Vegetation Slope:	3 Degrees	Vegetation Slope Type:	Downslope
Surface Fuel Load(t/ha):	15	Overall Fuel Load(t/ha):	20
Site Information			
Site Slope	3 Degrees	Site Slope Type:	Downslope
Elevation of Receiver(m)	Default	APZ/Separation(m):	37
Fire Inputs			
Veg./Flame Width(m):	100	Flame Temp(K)	1090
Calculation Parameters			
Flame Emissivity:	95	Relative Humidity(%):	25
Heat of Combustion(kJ/kg	18600	Ambient Temp(K):	308
Moisture Factor:	5	FDI:	100
Program Outputs			
Category of Attack:	LOW	Peak Elevation of Receiver(m):	6.24
Level of Construction:	BAL 12.5	Fire Intensity(kW/m):	22878
Radiant Heat(kW/m2):	12.29	Flame Angle (degrees):	77
Flame Length(m):	16.79	Maximum View Factor:	0.204
Rate Of Spread (km/h):	2.21	Inner Protection Area(m):	37
Transmissivity:	0.794	Outer Protection Area(m):	0