Travers

bushfire & ecology

bushfire protection assessment

Rezoning Application
Lot 1 DP 1139826
Ralston Avenue
Belrose

April 2017
(REF: A17029B)

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Ralston Avenue, Belrose

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BPAD Bushfire Planning & Design Accredited Practitioner Level 3

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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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Executive Summary

Travers bushfire & ecology has been engaged to undertake a revised bushfire assessment (second revision) for the planning proposal located off Ralston Avenue, Belrose within Lot 1 DP 1139826.

The development area, perimeter road and creation of a 'pocket park' have been informed as a direct result of the bushfire and ecological requirements. This second revision of the report has been prepared following consultation with the NSW Rural Fire Service to address issues including the feasibility and ongoing management of the asset protection zones (refer to Foreword).

Previous bushfire & ecological studies were undertaken over 135.3 ha of lands owned by *Metropolitan Local Aboriginal Land Council (MLALC)* and 0.86 ha of land comprising public roads which are proposed to be closed. Following initial constraint assessments between 2008 and 2011 a development precinct was determined which focused on approximately 23.32ha of plateau lands.

The balance of the developable area of the site will comprise the public open space, stormwater management and asset protection zones (APZ) for bushfire protection. Each of these elements has been designed in an integrated manner to enable the recreational use of these spaces and to utilise the natural landscape as a defining element of the visual character and mitigate any potential impacts on water quality.

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, 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*.

A bushfire protection assessment (second revision) has been undertaken for the proposed rezoning located at Lot 1 DP 1139826, Ralston Avenue, Belrose.

The key principle for the proposal is to ensure that future development is capable of complying with the *Section 117 Direction* and *PBP*.

Planning principles for the proposal include the provision of adequate access including perimeter roads, establishment of adequate APZs for future housing, allowing for minimum lot depths to accommodate APZs and the introduction of controls which avoid placing inappropriate developments (such as petrol stations) in hazardous areas and the inappropriate placement of combustible material in APZs.

Our assessment found that bushfire can potentially affect the site from the surrounding forest and heath vegetation communities resulting in possible ember attack, radiant heat and potentially flame attack, however these issues can be suitably addressed through the implementation of combined bushfire protection measures as outlined in this report

The past fire history of the surrounding landscape is such that considerable planning focus has been undertaken for traffic capability, asset protection, emergency management, fire trail construction, hazardous fuels management, building construction standards, water management and peripheral land management on land owned by the land owner. The

bushfire risk posed to the rezoning proposal however can be mitigated if a full suite of bushfire protection measures (including APZs) are implemented and managed in perpetuity.

Upon final design engagement with recommendations made within this report the future development of these lands in accordance with the attached bushfire protection plan (Schedule 1) will provide compliance with the planning principles of *Planning for bush fire protection 2006* and *Community Resilience Practice Note 2/12 – Planning Instruments and Policies* (refer Table 4.1)

In conclusion we can advise that;

- The R2 low density residential zoning is a suitable development class and is unremarkable in comparison to other similar topographical developments.

- The requirements established in *s.177 Direction 4.4 Planning for Bushfire Protection* and *Plan Sydney* have been satisfied.

- Safe evacuation can be provided through three evacuation routes leading through established residential areas and away from the hazard.

- APZs can be provided that exceed the minimum requirements of PBP 2006 and AS3959.

- The wider landscape beyond the APZ will be managed by Strategic Fire Advantage Zones.

- Adequate APZ's adjacent to power lines will be implemented to ensure access is not affected by unmanaged lands.

- The planning proposal will improve bushfire protection measures afforded to existing development through the removal of hazardous vegetation and improved access for firefighting suppression.

- Costs for the development and implementation of bushfire protection measures will be imposed on the landowner and the developer.

- There have been no additional burdens on emergency services demonstrated.

- Environmental constraints have been minimised

Therefore there can be no doubt that the Ralston Avenue planning proposal has been subjected to comprehensive bushfire assessment and fuel management planning initiatives. Coupled with the proposed community association management approach the planning proposal fulfils all the requirements of the Section 117 Direction, PBP, DCN 2/12 and AS3959 and we summarise those points in the table below.

Table 4.1: Planning Principles

Direction 4.4	Compliance statement
In the preparation of a planning proposal the relevant planning authority must consult with the Commissioner of the NSW Rural Fire Service	**Yes**. The NSW RFS has been consulted with correspondence from the RFS dated 25/2/2015, 26/6/2015, 9/7/2015 and most recently (undated) but received by this firm in November 2016.
A planning proposal must:	
(a) have regard to *Planning for Bushfire Protection 2006*,	**Yes**. A bushfire protection assessment report and fuel management plan were prepared in 2015 along with addendum advice in November 2016 and again in 2017; and in full accord with *PBP*.
(b) introduce controls that avoid placing inappropriate developments in hazardous areas, and	**Yes**. The response to the NSW RFS on November 4 2016 advised of additional bushfire protection measures beyond those required in *PBP.* Those measures will form the development control measures and be provided within the Area Plan thus designing future residential development appropriate for the level of risk. Importantly the nature of the residential development is an appropriate use and the proposed hazard management controls are in accordance with, and often beyond, PBP to effectively address the level of hazard. Importantly though the concept of the site permitting ‘‘inappropriate development’ such as schools or retirement villages can be eliminated via the Community Management Statement which manages the privately owned community title development. In the unlikely event that a future proposal could involve a private school or retirement village then that application would need to be considered by both Council and the RFS through the normal means. Given the nature of the private communal lands then the likelihood of a change is low. Notwithstanding the theory that it may occur any such an application would need to pass the Council and the RFS tests. Again that is highly unlikely given the effects of fire, often difficult to evacuate and more susceptible to smoke impacts.
(c) ensure that bushfire hazard reduction is not prohibited within the APZ.	**Yes**. Significant environmental studies have been undertaken to ensure APZs have been excluded from environmentally significant land.
A planning proposal must, where development is proposed, comply with the following provisions, as appropriate:	
(a) provide an Asset Protection Zone (APZ) incorporating at a minimum: (i) an Inner Protection Area bounded by a	**Yes**. The APZs recommended exceed the minimum requirements outlined in *PBP* for subdivision development (i.e. Appendix 2 of

Direction 4.4	Compliance statement
perimeter road or reserve which circumscribes the hazard side of the land intended for development and has a building line consistent with the incorporation of an APZ, within the property, and (ii) an Outer Protection Area managed for hazard reduction and located on the bushland side of the perimeter road,	*PBP*).
(c) contain provisions for two-way access roads which links to perimeter roads and/or to fire trail networks	**Yes**.
(d) contain provisions for adequate water supply for firefighting purposes	**Yes**. Water supply will comply with *PBP*.
(e) minimise the perimeter of the area of land interfacing the hazard which may be developed	**Yes.** The perimeter is located on a level terrace and circumscribes the edge of the downslopes resulting in the best design possible. Intrusions of bushland into the development have been removed and minimised to allow safe evacuation.
(f) introduce controls on the placement of combustible materials in the Inner Protection Area.	**Yes** – can be a condition of consent at DA stage.

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

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Foreword

*Travers Bushfire & Ecology (“*TBE”*)* has been requested to provide a response to the issues raised by NSW Rural Fire Service (“RFS”) in their undated correspondence circa September 2016 regarding the Planning Proposal (PP) for Ralston Avenue, Belrose following the gateway determination. The RFS advise that the Planning Proposal does not conform to the *S117 Direction* and the RFS planning policy entitled *Planning for Bush Fire Protection 2006 (“PBP”).*

We can advise that the proposed development does comply with the Section 117 Direction, PBP 2006 and AS3959 ‘*Construction of bushfire prone areas*’. We do note some inconsistencies and amendments have been made to the bushfire protection measures (November 2016) and they are shown on Figure 1 within. This revised plan remains consistent with the *Section 117 Direction* and the specifications and requirements required by *Planning for Bushfire Protection* (2006).

The Planning Proposal amendments include;

1. Increased asset protection zones (APZs) reflecting smoother boundaries, increased depth on the southern aspect and the provision of APZs on the *TransGrid* electrical easements, lands adjacent to Ralston Avenue and Wyatt Avenue and owned by MLALC.

2. A reduction of the reserve (E3 Zone) has occurred (0.90ha to 0.70ha). This is necessary given the need to deny potential for fire entering the site from the north-west aspect; and the need to impose a degree of common sense in respect of protecting the current land owner’s responsibilities (re; Section 63 of the *Rural Fires Act*) in respect of the *TransGrid* asset.

3. Improved road alignment in the north east to Wyatt Avenue with larger APZs.

4. Notation of the available fire trails in the vicinity of the *TransGrid* easement zones and beyond.

5. Consideration of a community title approach to APZ management.

We also note the primary concern raised by the RFS was in relation to the slope gradient within the APZ and external to the APZ. We can advise the RFS concerns are incorrect and this is fully explained herein.

Regional context of bush fire prone lands

By way of comparison to the Planning Proposal locality the Sydney basin consists of topography and fuel conditions that contribute to an ever present bushfire potential. The ever expanding urban fringe will in most cases be located adjacent to bushland or grassland and with that comes the likely impact of bush or grass fires. One only needs to look at the existing residential development peripheral to Garigal National Park. Whilst these areas were mostly predominantly developed before the advent of contemporary bushfire planning, it is nonetheless apparent that communities can live in a bushfire prone environment when location suitability work in harmony with effective design solutions.

This Planning Proposal is no different in topography to many nearby residential communities, and significant bushfire planning design measures have been implemented in regard to asset protection zones, road access design as well as the ongoing fuel management of nearby hazards. Notwithstanding the extent of planning undertaken to date is compliant with PBP, it is clearly understood that the RFS require additional defendable space in the form of broader asset protection zones and that has been provided.

By way of contrast the broader Sydney region between the Nepean and Hawkesbury Rivers and out to Blackheath are set amidst vast bushfire prone areas with regular mid to large scale bushfire events occurring between July and February in most years.

The sheer extent and scale of the national park systems that fringe the Sydney environ from the south to the north e.g. Moreton, Blue Mountains, Wollemi, Yengo, Dharug, Popran and Brisbane Water National Parks total some 1.155 million hectares of unmanaged natural landscapes and these contribute to at times long running campaign bushfire events of which the general public would be mostly unaware.

Within the central Sydney zone are many other national parks that fringe river systems such as Ku-ring-gai Chase, Davidson, Lane Cove, Georges River and Cattai. In addition, local government bushland reserves create additional linkages to those national parks and ultimately create a significant fire prone landscape in which millions of residents live, work and play.

A recent analysis undertaken by Macquarie University-affiliated *Risk Frontiers group*[1] (2016) reveals that more than 100,000 households in Sydney and surrounds are exposed to high bushfire risks because they live within 100 metres of bushland. Notably;

- Gosford has 26,595 households
- Blue Mountains regions has 23,068 households
- Hornsby has 19,983 households
- Ku-ring-gai has 15,719 households
- Warringah has 6,592 households

For the existing communities of Warringah fringing the national park and / or Council lands the risk remains continually present and every summer brings with it the potential for dry weather and strong winds which can lead to fire events and community disruption.

The fact that the broader Sydney region is located amidst such a vast bushfire prone landscape is also not lost on the resources applied to protect the communities from that ever present risk. Funding for protective and preventative measures is provided, in the main, from insurance levies and these in turn fund the operation of the two fire services i.e. Fire & Rescue NSW and the NSW Rural Fire Service.

In light of regulatory approach applied to development control in bushfire prone areas then the proposed R2 use of the land is quite appropriate.

There can be no doubt that the Rawson Avenue planning proposal has been subjected to comprehensive bushfire assessment and fuel management planning initiatives. Coupled with the proposed community association management approach the planning proposal fulfils all the requirements of the Section 117 Direction, PBP, DCN 2/12 and AS3959. These measures will encapsulate all the required planning, design and control (measures) for safe residential living and can be provided within the Area Plan for the precinct.

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[1] *Risk Frontiers* and *MapData Sciences* (Address Risk Rating) https://www.riskfrontiers.com/arr.htm

Communications with RFS

A more detailed response to the matters raised by the RFS has been prepared and is attached. We look forward to meeting with the RFS to discuss this project in detail. The following Table F1 provides a summary (starting from most recent) of the preliminary reporting / assessment phases of the planning proposal and subsequent consultation which has been undertaken in accordance Condition 3 of the Gateway Determination Issued by the Department of Planning and Environment (DPE) and Section 117 Direction 4.4 – Planning for Bushfire Protection.

Table F.1 – Consultation outcomes

Comments from Authority	Response from proponent
Onsite meeting with NSW RFS representatives – 1st October 2015. RFS issues discussed on site include:	A site inspection occurred with three (3) officers of the RFS in attendance (Jason Maslen, Garth Bladwell and George Sheppard). They noted the slopes were as per the advice of TBE and that the APZ's were on lands that are either rocky or stable. The RFS referred to one area to the south west that required further detail to be provided in regard to APZ management and road construction. TBE advised this was within PBP acceptable limits but agreed to provide engineering advice regarding road design at DA stage. A revised bushfire protection assessment and fuel management plan have been prepared (December 2015) to detail the matters raised at the site inspection.
• Request for clarification on how and who will manage the APZ. How it will be funded in perpetuity. Who will hold the fund and what mechanism can be put in place to ensure that the required ongoing management tasks are completed.	• The Fuel Management Plan (FMP) has been updated to provide further clarification outlining funding and ongoing management of the APZ by MLALC.
• Width of the APZ in the southern side of the development lots.	• APZ width have been clarified within the Bushfire Protection Assessment (BPA)
• Classification of the short and tall heath vegetation on the mid northern side of the development area.	• A forest vegetation formation has been used to determine the APZ distances in this area as identified within the BPA (revision 1 & 2)
• NSW RFS will not support isolated lots in the north-eastern side of the site (Lots 1, 2 & 3).	• This was resolved by lot redesign to facilitate the retention and protection of the Duffys Forest vegetation within the E3 zone. The two/three lots are as per PBP 2006 and surrounded by two roads and are therefore not isolated and should be reviewed by the RFS as being permissible.
• Amend the Fuel Management Plan with the latest vegetation mapping.	• The FMP has been updated to reflect the latest vegetation mapping.

NSW RFS letter – 9th July 2015 In response to advice that that the DPE has issued the developer with an E3 Environmental Management zoning. • RFS raise the same previous concerns about APZs on steep lands • Further site analysis required on behalf of the applicant to identify suitable areas for possible development • RFS advise that there is opportunity for limited development adjoining established residential areas along Ralston Avenue.	TBE response – see below

NSW RFS letter – 26th June 2015. Provision of additional comments:	TBE letter of response to the NSW RFS – 11th August 2015
• Location of APZ on slopes greater than 18 degrees in not supported in general. Proposal to develop a Fuel Management Plan (FMP) to address the issue of APZs on steep slope in unsupported. The submission of a FMP at development application stage to address these issues in considered too late in the process and is unacceptable.	• TBE recommend RFS visit the site to appreciate the bushfire risk and that an FMP has been prepared to address feasibility and ongoing management of the APZs. Further slope analysis plans were prepared to highlight areas where slopes exceed 18 degrees. TBE advised that where slopes did exceed 18 degrees (in limited cases) it consisted of rock ledges, devoid of fuel which aid in reducing the overall bushfire risk.
• Majority of APZ's will not be located within individual allotments which will remain privately own. The question is who would enforce a positive covenant and who would undertake the APZ works.	• The land owner responsible for ongoing management of the E3 zoned land is MLALC. This is to be enforced under a positive covenant in accordance with the FMP. The APZ is to be self-managed with audits undertaken by specialist firms. On-going funds for management will be from the development consortium.
• APZ's are proposed in E2 zoned land which may conflict with the objectives of the zone.	• Proposed zoning was amended from E2 to E3 and an FMP was prepared to address ecological constraints and any zoning conflicts.
• An additional 1m APZ where slopes exceed 18 degrees is considered	• The APZ was determined based on AS3959 which identifies an APZ

inconsequential to compensate for the additional increase in slope.	of 61m adjacent to forest vegetation on slopes of >15 to 20 degrees. Further slope analysis was provided and RFS concern should now be resolved.
• A 100m Strategic Fire Advantage Zone (SFAZ) is expected to fall to the NSW RFS creating an additional burden on existing resources.	• FMP was prepared to refine location of the SFAZ within land owned and managed by MLALC. Ecological burning is recommended in accordance with the FMP. SFAZ is not a burden and falls in line with contemporary bushfire planning initiatives with the funding model an agreed protocol with contributions from insurance companies, state & local government.
• Recommendation to edge the SFAZ with a fire trail is considered unachievable given the terrain. Addition of fire trails will create an additional financial burden of the RFS	• An FMP has been prepared and existing fire trails will be enhanced and managed in accordance with FMP. The land is not owned by the RFS so it is not burden.

Office of Environment and Heritage (OEH) Letter – 27th February 2015	TBE letter of response to NSW RFS & Office of Environment & Heritage (OEH) – 4th May 2015
• NSW RFS has confirmed that the proposal does not comply with PBP 2006. Resolution of the bushfire protection measures is required before further consideration can be given to the biodiversity impact.	• RFS noted that they were not opposed to development of the site. FMP to be prepared to further outline proposals compliance with PBP.
• It is likely that the APZs will need to be revised in order to ensure the proposal complies with bushfire planning guidelines	• Modification of APZs may occur as a result of final development design, fuel management or other relevant studies. • Further details were provided on the scope of the FMP and a timeline for its development.

NSW Rural Fire Service (RFS) letter – 20th February 2015. RFS advise that they are not opposed to the development in principle and reiterate their concerns expressed in previous correspondence (6th June). These concerns include:	Travers bushfire & ecology (TBE*)* letter of response to the NSW RFS & Office of Environment & Heritage (OEH) – 4th May 2015
• Do not support location of APZs on land exceeding 18 degrees and	• RFS regularly permit APZ's on land >18 degrees and PBP permits

recommend a modified lot layout	the development of an alternate solution. The APZ's within the site, for the most part, are well below 18 degrees. The APZ's on steeper land consist of sandstone outcrops.
• BAL ratings under AS3959 are valid were the effective slope does not exceed 20 degrees. The slopes on site often exceed this.	• TBE advised a fuel management plan would be prepared illustrating slope gradients to comply with PBP.
• Requirement for public road widths are to comply with PBP regardless of final ownership. Perimeter roads are to have 8m width. All other roads 6.5m	• TBE concur that public roads are to comply with PBP requirements.

Introduction 1

Travers bushfire & ecology has been engaged to undertake a bushfire protection assessment (second revisions) for the proposed rezoning located at Lot 1 DP 1139826, located at the end of Ralston Avenue, Belrose.

The proposal is located on land mapped by *Northern Beaches Council* as being bushfire prone. *Direction 4.4, Planning for bush fire protection* 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* 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 planning proposal (refer Figure 1.1) aims to create three (3) distinct land uses / zones;

- **Development precinct** - 17.27ha portion of Lot 1 DP 1139826 for future residential development (Zoned R2). A small pocket park of 0.3ha in size will be zoned as RE1.

- **Conservation Lands** - This environmental management zone will be used as a biodiversity offset. The conservation lands will be zoned as E3 Environmental Management to allow integrated management of the asset protection zones and conservation lands by the future Community Association and Metro Local Aboriginal Land Council. The proposed offset area is an ecologically significant landscape which is known to contain threatened flora, fauna, ROTAP species and the EEC, Coastal Upland Swamp. It will create a conservation parcel which would ideally become an addition to Garigal National Park (with dual management with Community Association), or alternatively become a BioBank site.

- **Asset protection zones** - Creation of asset protection zones – proposed to be zoned as part of the E3 zoned land. These lands will be managed as asset protection zones in full compliance with NSW Rural Fire Service limitations in regard to APZ management. Habitat retention will be a key priority for the fuel management works given the dual role that the asset protection zones play in buffering the impacts of development on the urban/ bushland interface. Retention of trees, shrubs and surface fuels will be targeted for their intrinsic ecological value with ongoing management specified through a legally applied 'fuel management plan'.

The plan of proposed subdivision (refer Figure 1.2) provides for approximately 156 lots, which are anticipated to range in size from 600 –2,425m^2. The actual dwelling mix and type will be determined at the development application stage.

The bushfire constraints have been highlighted and asset protection zones (APZ) have been recommended, based on the concept subdivision plan. Recommendations have also been made for future road and fire design, fuels management, traffic management, emergency management, building construction, water supply and peripheral land management.

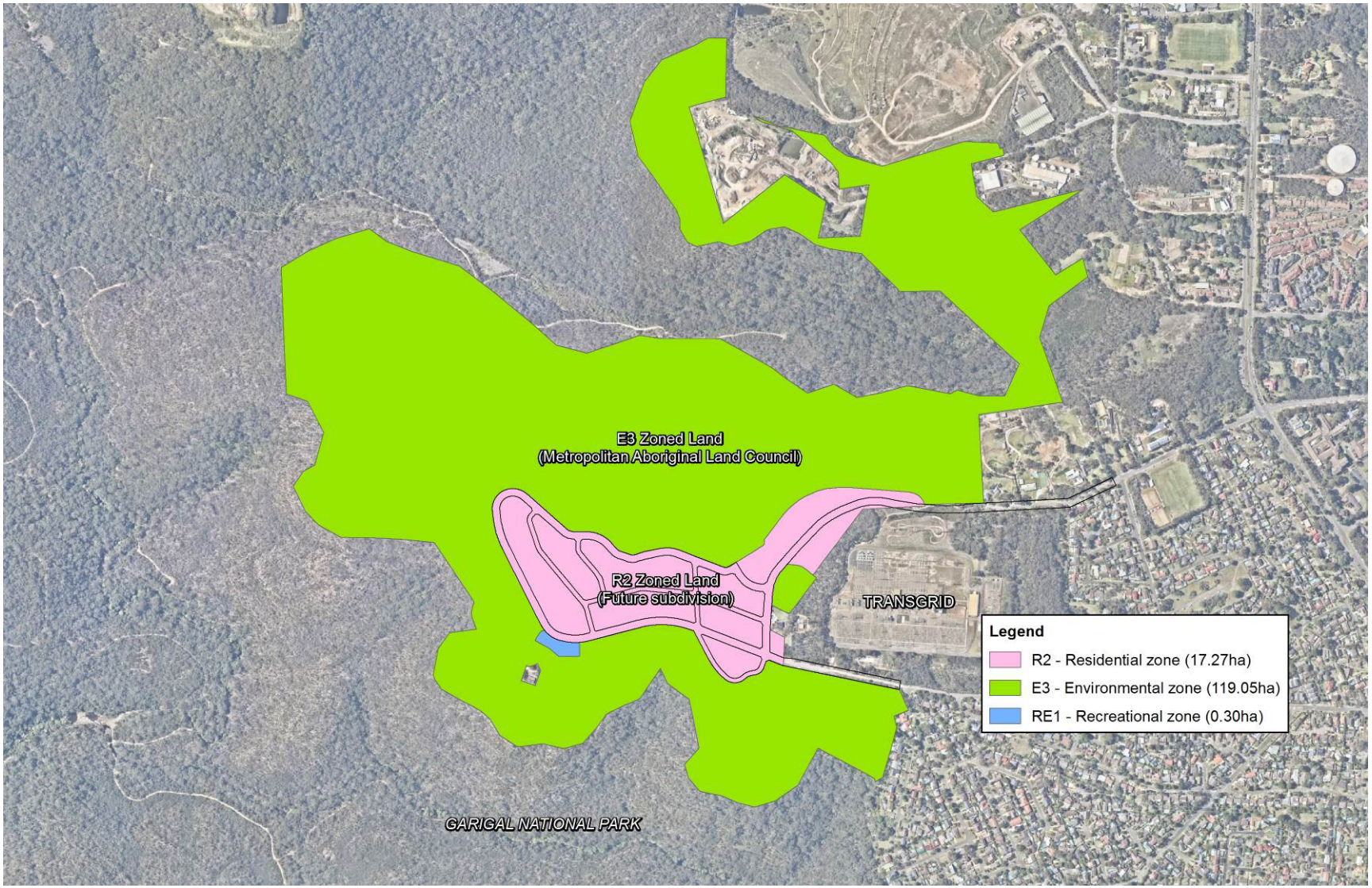


Figure 1.1 – Proposed zoning *(LTS Lockley – 22/03/17)*

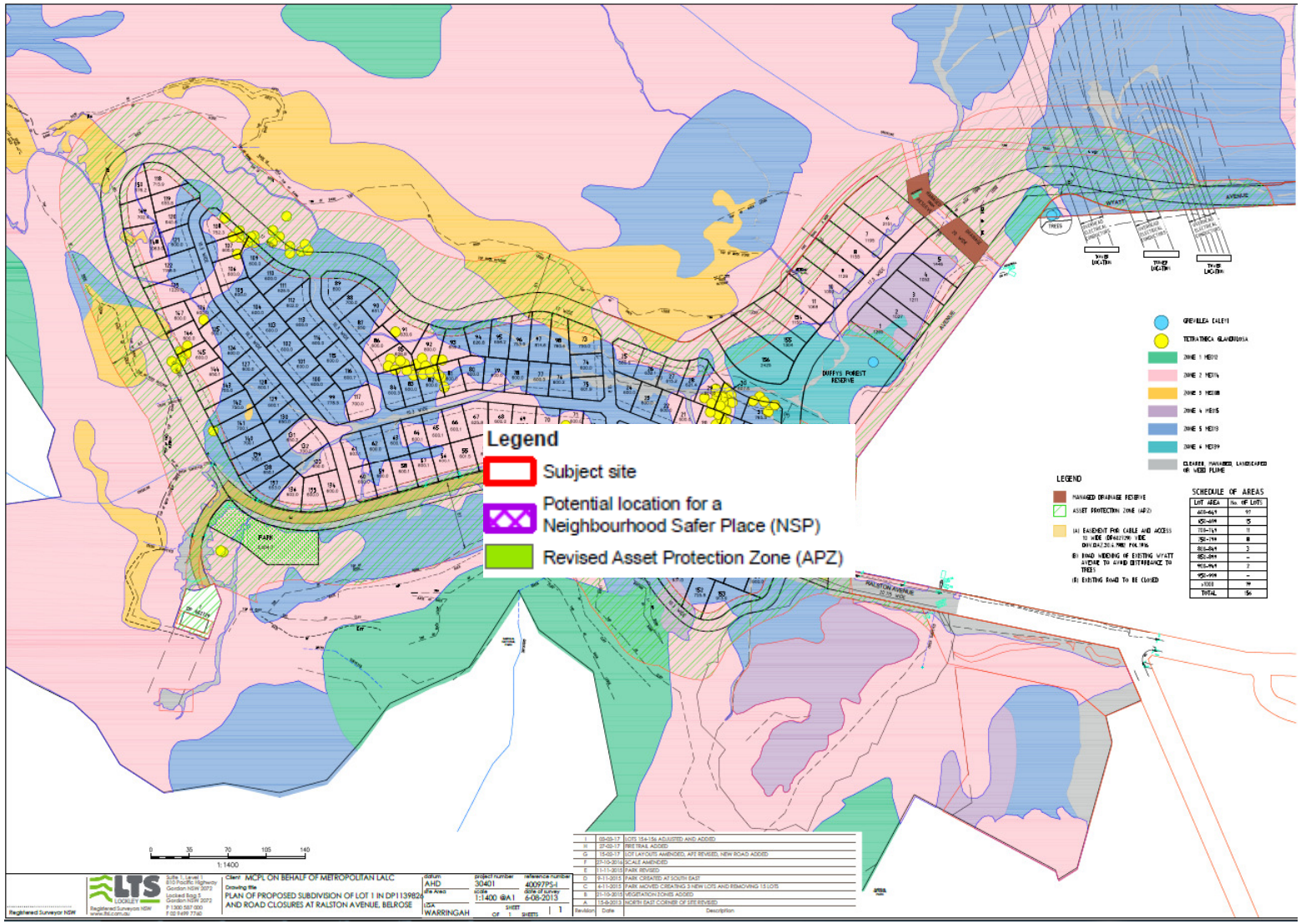


Figure 1.2 – Subdivision Concept Plan

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:

- Plan of proposed rezoning prepared by *TBE*, dated 22/03/2017
- Plan of proposed subdivision prepared by *LTS Lockley*, dated 3/3/2017
- Warringah Local Environmental Plan 2011
- Warringah Local Environmental Plan 2000
- Fuel Management Plan, 2015 prepared by *Travers bushfire & ecology*
- Ecological Assessment, 2015 prepared by *Travers bushfire & ecology*
- *Google* aerial photography
- Topographical maps *DLPI of NSW* 1:25,000
- *Planning for bush fire protection 2006 (NSW RFS)*
- Australian Standard 3959 *Construction of buildings in bush fire prone areas*
- *Community Resilience Practice Notes 2/12 Planning Instruments and Policies.*

An inspection of the proposed development site and surrounds was undertaken by John Travers on several occasions in 2011 and 2017 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 1 DP 1139826, Ralston Avenue, Belrose (refer Figure 1.3). The proposed development area is located on a plateau area of approximately 17 ha. The development area is proposed to be accessed from residential areas to the east via Ralston and Wyatt Avenue. The remaining perimeter to the north, west and south is gentle to steep sloping sandstone escarpments that consist of a variety of vegetation formations ranging from forest to heathland communities.

Table 1.1 provides a summary of the planning, cadastral, topographical, and disturbance details of the subject site.

Table 1.1 – Site features

Location	Lot 1 DP 1139826
Size	Approximately 17ha (development land only)
Local government area	Northern Beaches Council
Grid reference	333600E 6266800N
Elevation	Approximately 150-170m AHD
Topography	Situated upon a plateau area with minor slopes, increasing near the northern and southern subdivision boundary.
Geology and soils	Geology; Sandstone Soils; Lambert Soil Landscape, Somersby Soil Landscape and Hawkesbury Soil Landscape
Catchment & drainage	French's Creek (to the south) and Fireclay Creek (to the north) into Middle Harbour Creek.
Vegetation	Coastal Sandstone Heath and Sydney Sandstone Ridgetop Woodland (predominately)
Existing land use	Private land and residential
Clearing	Clearing for the existing residence and asset protection zones, and any road, track and existing electrical structure

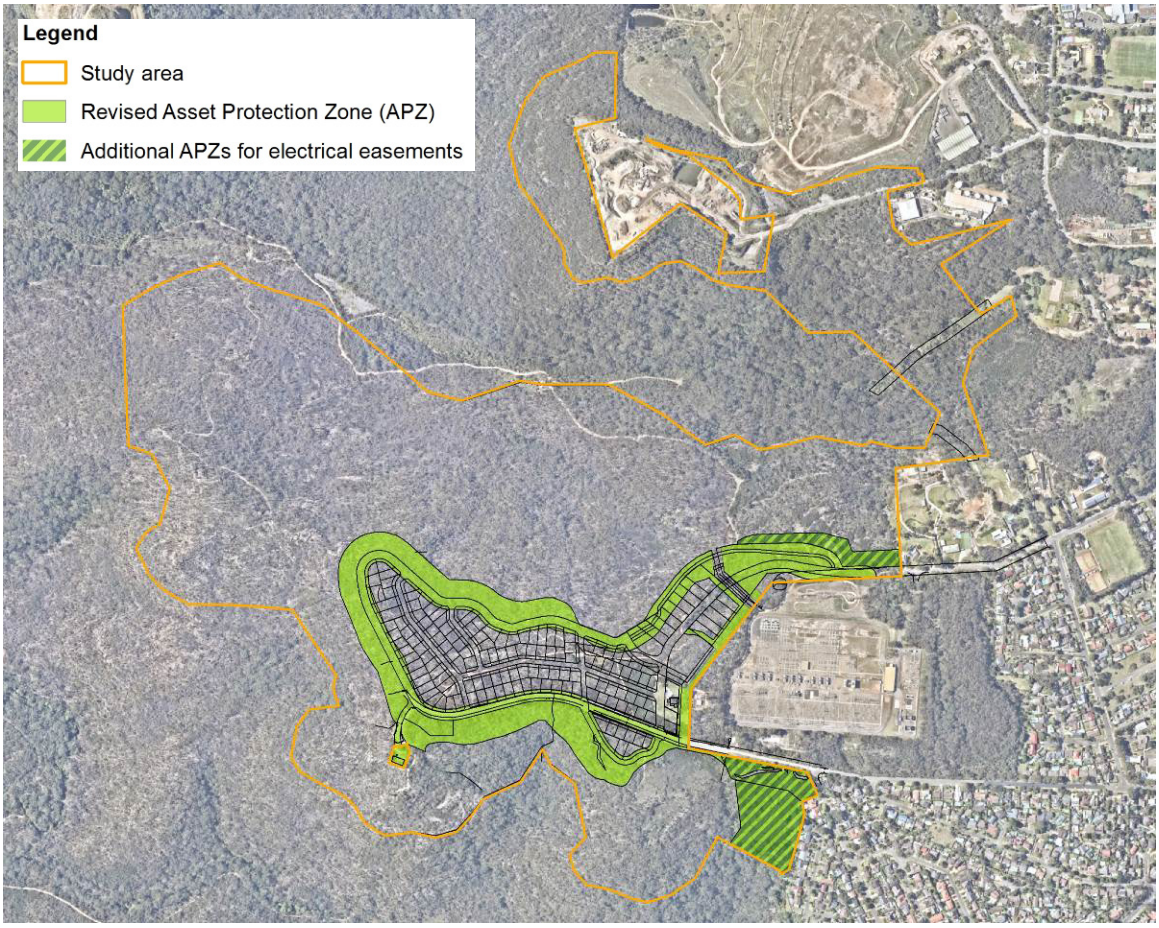


Figure 1.3: Aerial Appraisal of investigation area

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.* 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 *Northern Beaches Council* as being bushfire prone (refer Figure 1.4).

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 *NSW 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).

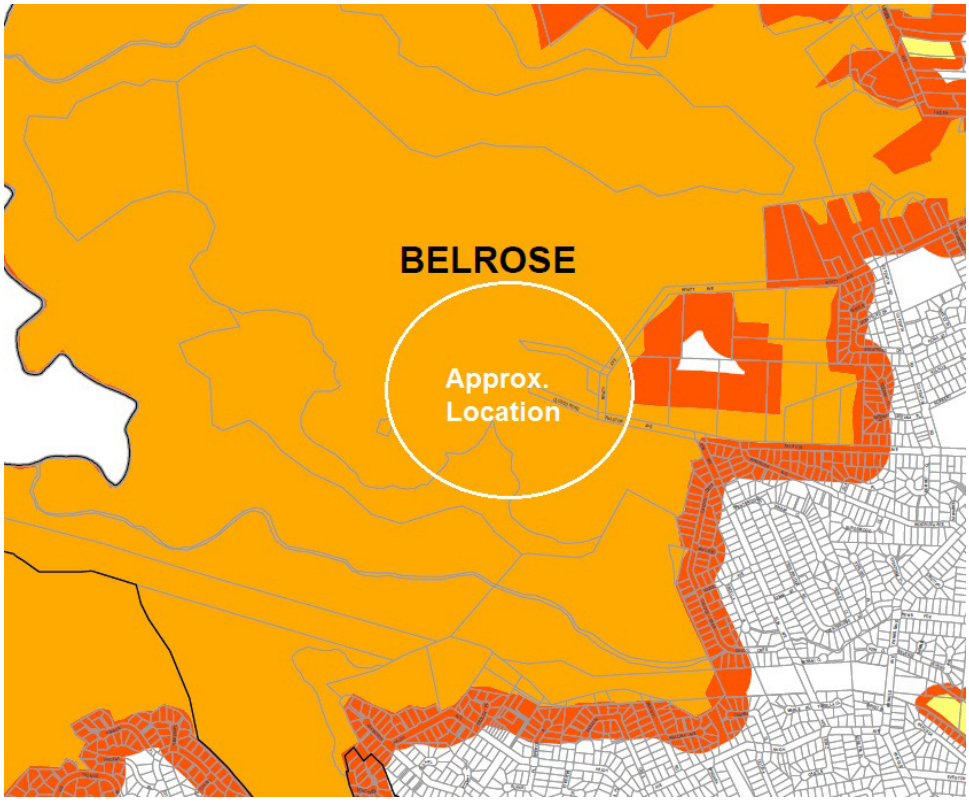


Figure 1.4: Bushfire Prone Land Map
(Source: Northern Beaches Council Council)

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 identified on the Warringah LEP 2011 Land Application Map as a 'deferred matter'. LEP 2000 applies to all deferred land until a review of deferred lands is complete and a planning proposal process is undertaken to bring this land into Warringah's standard LEP 2011.

Warringah Local Environmental Plan (LEP) 2000

The site is zoned under *Warringah LEP 2000* as Locality C8 – Belrose North (refer Figure 1.5). The land surrounding the property to the north, south and west is zoned under the current LEP 2011 as E1 – National Parks and Reserves.

The proposal seeks to amend the *LEP 2000* and contribute to the planning process to bring this land into Warringah's standards LEP. The proposal is to rezone the central development area as R2 low density residential whilst maintaining the land surrounding the development as an offset area will be rezoned as E3 – Environmental Management. The proposal also includes the rezoning of a small parcel of land to RE1 – Public Recreation.

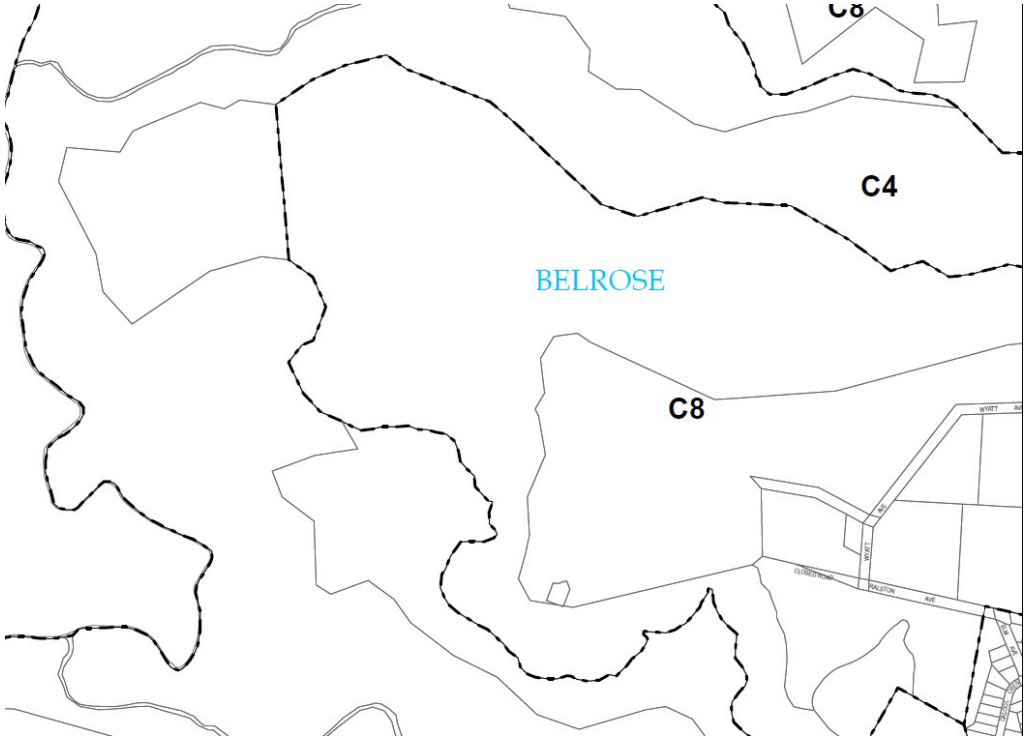


Figure 1.5: Warringah LEP 2000
(Source: *Northern Beaches Council website*)

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 *NSW RFS* planning document entitled *Planning for bush fire protection 2006 (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 asset protection zones for future housing

3. Specifying minimum residential lot depths to accommodate asset protection zones 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 asset protection zones.

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 Standards AS3959 - 2009

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 Class 1, 2 & 3 buildings. The construction manual for the deemed-to-satisfy requirements is the *Australian Standard AS3959 2009.*

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 in future planning for master plans and / or subdivision proposals.

1.6 Environmental & Cultural Constraints

1.6.1 Environmental Constraints

The proposed development is in accord with the ecological constraints and offset analysis prepared by *Travers bushfire & ecology* (November 2017) – see 'survey effort' constraints plan at Figure 1.6 and 1.7

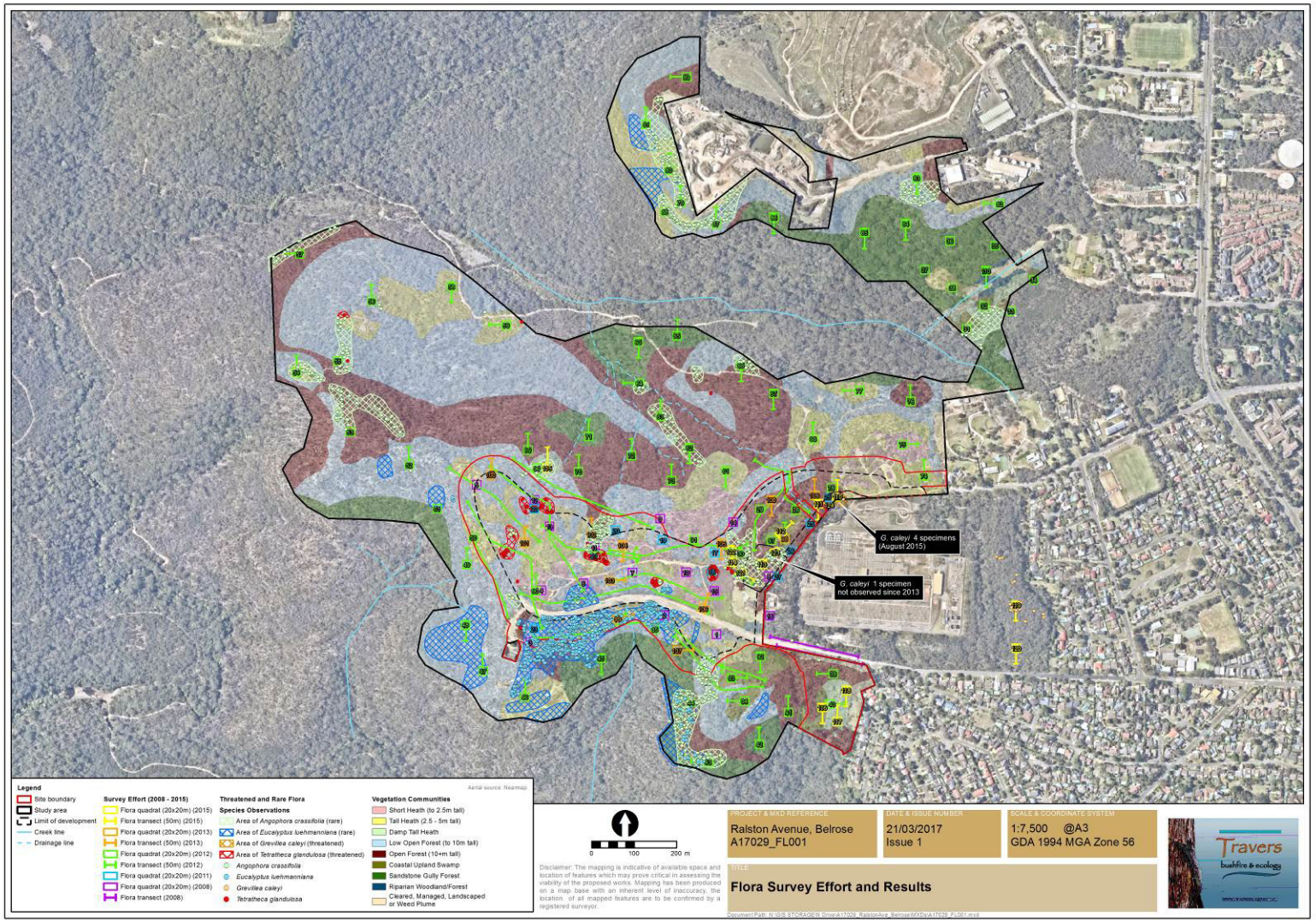


Figure 1.6 - Vegetation Communities, Flora Survey Effort & Results
(Source: Travers bushfire & ecology, 2017)

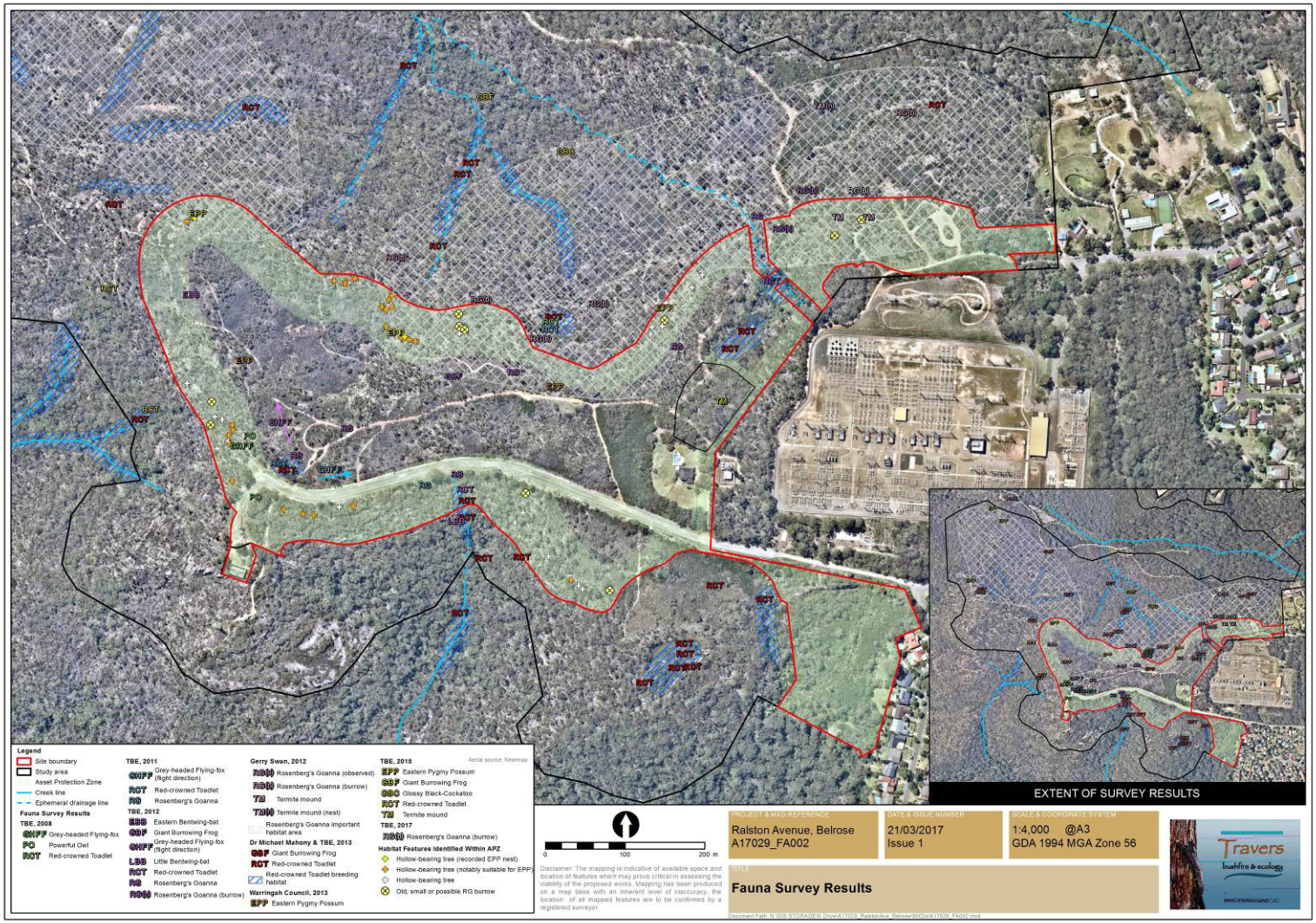


Figure 1.7 - Fauna Survey Results
(Source: Travers bushfire & ecology, 2017)

Bushfire Threat Assessment 2

To assess the bushfire threat and to determine the required width of an asset protection zone 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. However, when determining construction standards in accordance with *AS3959 – Construction in bushfire-prone areas* AUSLIG Pictorial Analysis is used to determine the vegetation, and hence APZ setbacks and building construction standards (refer Section 3.2 of this report).

The hazardous vegetation is calculated for a distance of at least 140 metres from a proposed development boundary and is summarised within Table 2.1 below and in Figure 2.1

Table 2.1 – Vegetation Descriptions

Vegetation Community (TBE, 2012)	Vegetation Formation (David Keith & PBP)	AUSLIG Pictorial Analysis (AS3959, 2009)
Sandstone Gully Forest	Dry sclerophyll Forest	Forest
Low Open Forest	Dry sclerophyll Forest	Forest
Open Forest	Dry sclerophyll Forest	Forest
Tall Heath & Damp Tall Heath	Tall heath	Scrub
Coastal Upland Swamp	Freshwater wetland	Scrub
Cleared, managed, landscaped, weed plume	N/A	N/A

These vegetation formations and their location are depicted within Schedule 1 attached.

Generally forest vegetation is located on the periphery of the proposed development boundary to the north, south and east. Pockets of tall heath vegetation are also present particularly to the south-west and north. The freshwater wetland formation (Coastal Upland Swamp) is located in the south-east of the development lands.

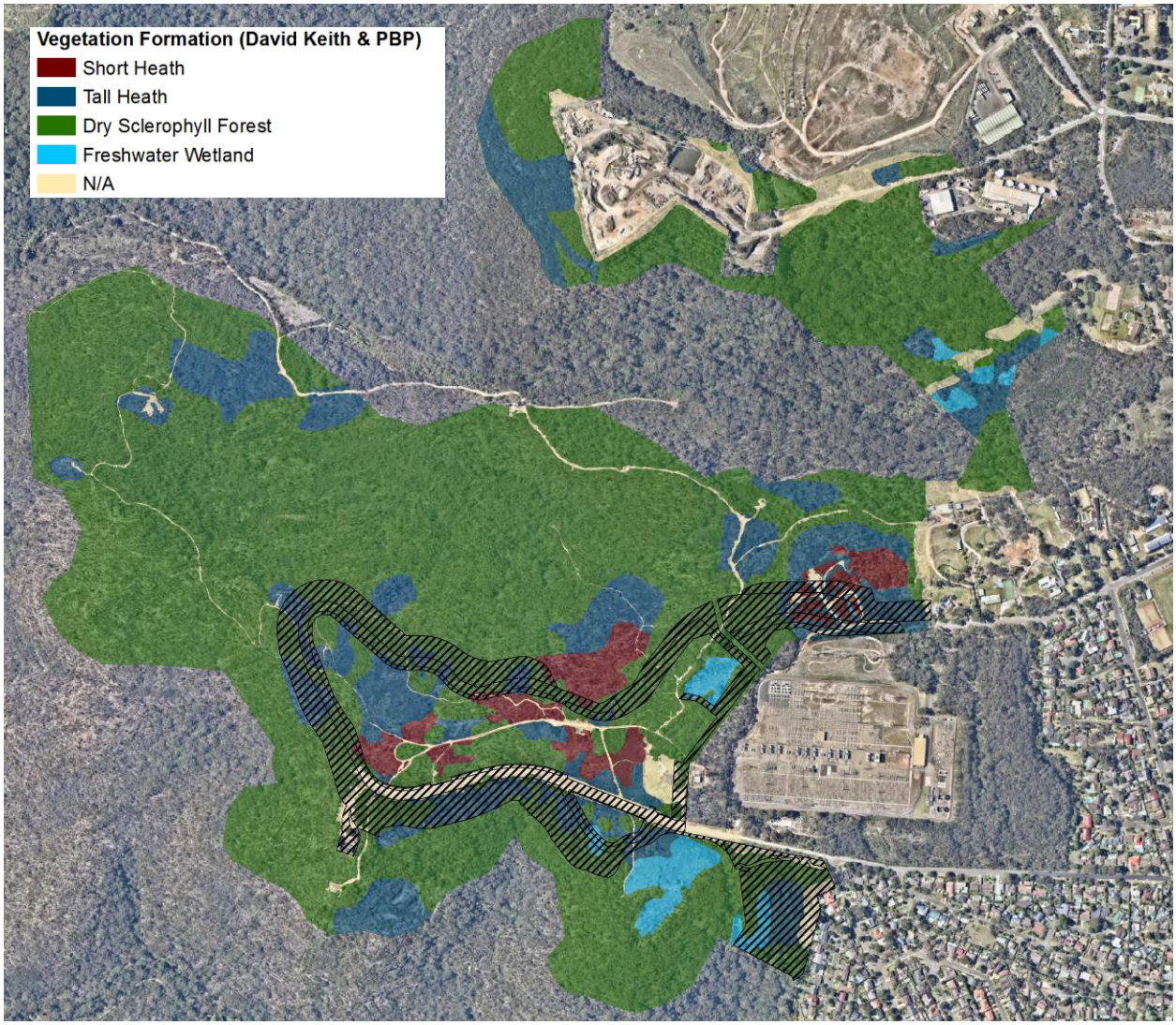


Figure 2.1 – Vegetation formations

The following photographs depict the hazardous vegetation surrounding the site.

Photo 1 – Low open forest

Photo 2 – Coastal Upland Swamp with fringing low open forest in the background.

2.2 Effective Slope

The effective slope is assessed for a distance 100 metres. 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 vegetation is variable but is summarised as:

- Level to upslope within the narrow strip of forest vegetation between the electrical substation and the development lands in the east.
- Varying slope of between 0–5 and up to 10 degrees to the north-east.
- Variable slope of between 16-20^0 downslope within the forest to the south, west and north-west; with an occasional slope of 22-24 degrees as explained in Table 2.2 below.

The Australian Standard AS3959 permits slopes up to and including 20 degrees for determination of bushfire attack (for assessments of building applications in bushfire prone areas. Figure 2.2 portrays the slopes in excess of 20 degrees for the two vegetation communities i.e. forest and heath. This clarifies the extent of steep slopes and their affectation. The RFS nominate 18 degrees as an upper limit for APZ's except where it can be shown that fuels can be managed without risk to environmental resources e.g. soils and plants.

The small sections of APZ depicted in dark blue in the south, north and north-east represent rock face / ledges. These are typically devoid of normal three strata fuel layers and are easier to manage e.g. no removal of trees and little in the way of shrub removal required. Rocky escarpments can also have the effect of reducing the bushfire risk posed to a site and act, in effect, as a radiant heat barrier. The management of fuel in this area would not affect soil stability and removal of trees is not required.

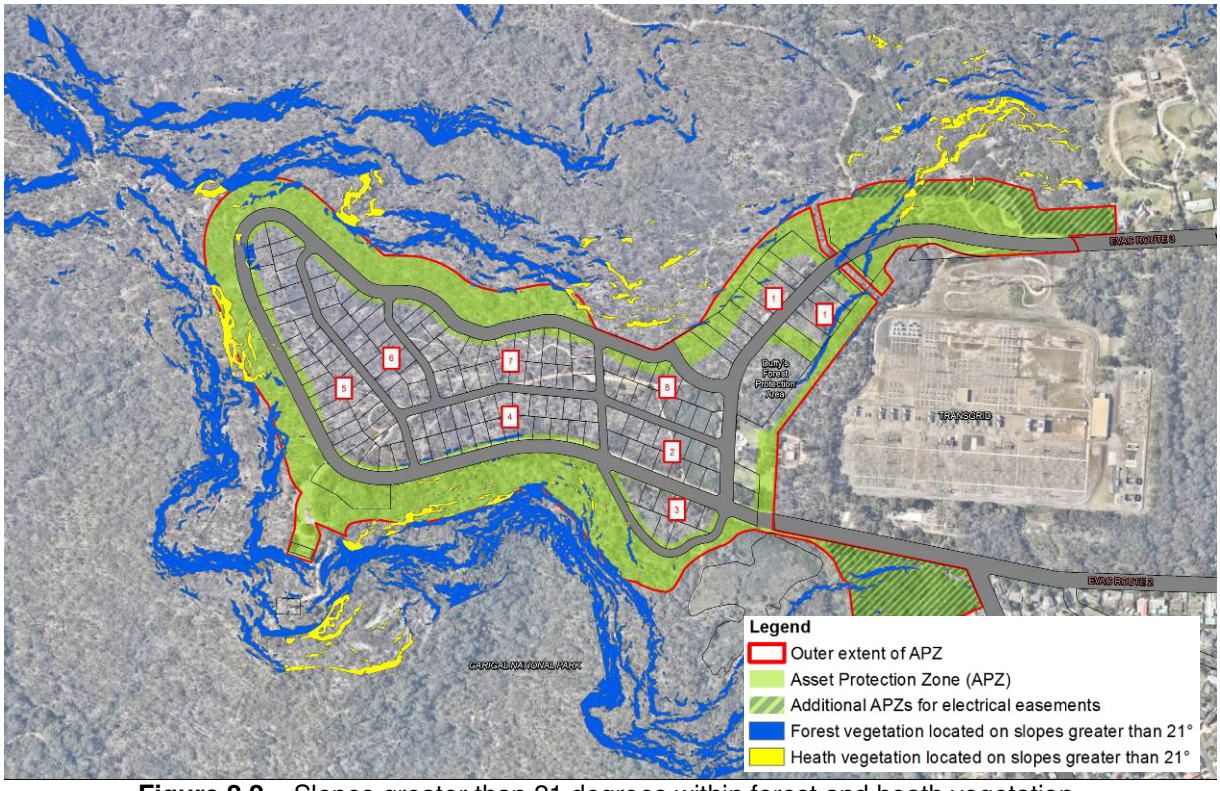


Figure 2.2 – Slopes greater than 21 degrees within forest and heath vegetation

2.2.1 Explanation regarding slopes in excess of 20 degrees.

As depicted in Figure 2.3 the majority of the APZ supports slopes of between 0–18 degrees arising from the many sandstone escarpments making up the yellow and blue coloured lands.

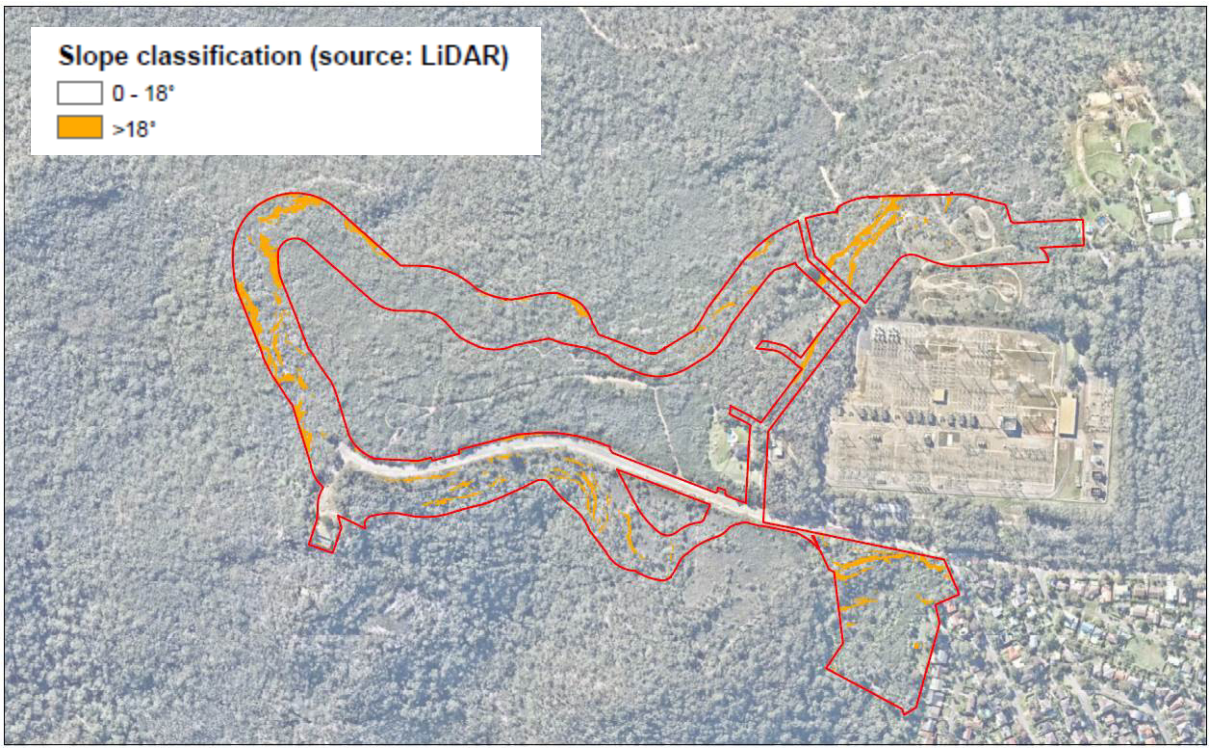


Figure 2.3 – Slopes analysis within the proposed APZ's

2.3 Bushfire Attack Assessment

A Fire Danger Index (FDI) of 100 has been used to calculate bushfire behaviour on the site using forest vegetation located within the Greater Sydney region. Table 2.2 below provides a summary of the bushfire attack assessment and the minimum required asset protection zones in compliance with BAL 29 building construction standards (AS3959, 2009).

Table 2.2 – Bushfire attack assessment

APZ Precinct ID (see numbering on Figure 2.2)	Aspect	Predominant vegetation within 140m of Development	Effective Slope of Land	APZ Required BAL 29 – AS3959 (Deemed to satisfy)	APZ provided / Compliance	Construction Standards
1	East	Forest	Level to upslope	25 metres northeast / 10 metres east	25m /10m Yes	BAL 29 (25–<35m) BAL 19 (35-<48m) BAL 12.5 (48-<100m)
	North-west	Open forest, Low open forest, Tall heath and Short heath	10 ° D	39 metres	39m Yes	BAL 29 (39–<53m) BAL 19 (53-<69m) BAL 12.5 (69-<100m)

APZ Precinct ID (see numbering on Figure 2.2)	Aspect	Predominant vegetation within 140m of Development	Effective Slope of Land	APZ Required BAL 29 – AS3959 (Deemed to satisfy)	APZ provided / Compliance	Construction Standards
	Internal north	Internal drainage	Level	10 metres (refer Note 1)	16 Yes (by an additional 6m)	BAL 29 (11–<16m) BAL 19 (16-<23m) BAL 12.5 (23-<100m)
	South	Duffys Forest protection area	6-8 $^{o\ U}$	25m	25m Yes	BAL 29 (25–<35m) BAL 19 (35-<48m) BAL 12.5 (48-<100m)
2	South	Forest	Level to upslope	25m	>60m Yes	BAL 29 (25–<35m) BAL 19 (35-<48m) BAL 12.5 (48-<100m)
	North, East & West	Proposed development and road corridor	N/A	N/A	>60m Yes	N/A
3	North	Proposed development and road corridor	N/A	N/A	>100m Yes	N/A
	South-east	Tall Heath	5$^{o\ D}$	15m	31m Yes (by an additional 16m)	BAL 29 (32–<43m) BAL 19 (43-<57m) BAL 12.5 (57-<100m)
		Coastal upland swamp, weed and low open forest	Level	25m	31m Yes (by an additional 6m)	BAL 29 (25–<35m) BAL 19 (35-<48m) BAL 12.5 (48-<100m)
	South-west	combination of low open forest and sandstone gully forest	20-22° D with short sections of steeper slope 24° D but only 19m in length and inclusive of rocky escarpments	61m	72m Yes (by an additional 11m)	BAL 29 (61–<78m) BAL 19 (78-<98m) BAL 12.5 (98-<100m)
4	North, east & west	Proposed development	N/A	N/A	>100m Yes	N/A
	South	Low open forest and Sandstone gully forest and unclassified further south	16-22° D	61m	72m Yes (by an additional 11m)	BAL 29 (61–<78m) BAL 19 (78-<98m) BAL 12.5 (98-<100m)
5	East	Proposed development	N/A	N/A	>100m Yes	N/A

APZ Precinct ID (see numbering on Figure 2.2)	Aspect	Predominant vegetation within 140m of Development	Effective Slope of Land	APZ Required BAL 29 – AS3959 (Deemed to satisfy)	APZ provided / Compliance	Construction Standards
	South	Tall heath, Low open forest and open forest	Variable closes due to orientation of the contours causing a level slope gradient but in the south-south-east the slopes are greater at 8-15° D	39-49m	73-74m Yes (by an additional 34-25m)	BAL 29 (39–<53m) BAL 19 (53-<69m) BAL 12.5 (69-<100m) BAL 29 (49–<64m) BAL 19 (64-<82m) BAL 12.5 (82-<100m)
	West & north	Low open forest and Sandstone gully forest and Low open forest	15-18° D	49-61m	61m Yes	BAL 29 (61–<78m) BAL 19 (78-<98m) BAL 12.5 (98-<100m)
6	South, east & west	Proposed development	N/A	N/A	>100m Yes	N/A
	North	Low open forest and Open forest	17° D	61 metres	61m Yes	BAL 29 (61–<78m) BAL 19 (78-<98m) BAL 12.5 (98-<100m)
7	North	Low open forest and Open forest	17-20° D	61 metres	61m Yes	BAL 29 (61–<78m) BAL 19 (78-<98m) BAL 12.5 (98-<100m)
	South, east & west	Proposed development	N/A	N/A	>100m Yes	N/A
8	South & west	Proposed development	N/A	N/A	>100m Yes	N/A
	North-west	Short heath, Tall Heath / Scrub and Low open forest	13-15° D	19 metres	39m Yes (by an additional 20m)	BAL 29 (19–<28m) BAL 19 (28-<29m) BAL 12.5 (29-<100m)

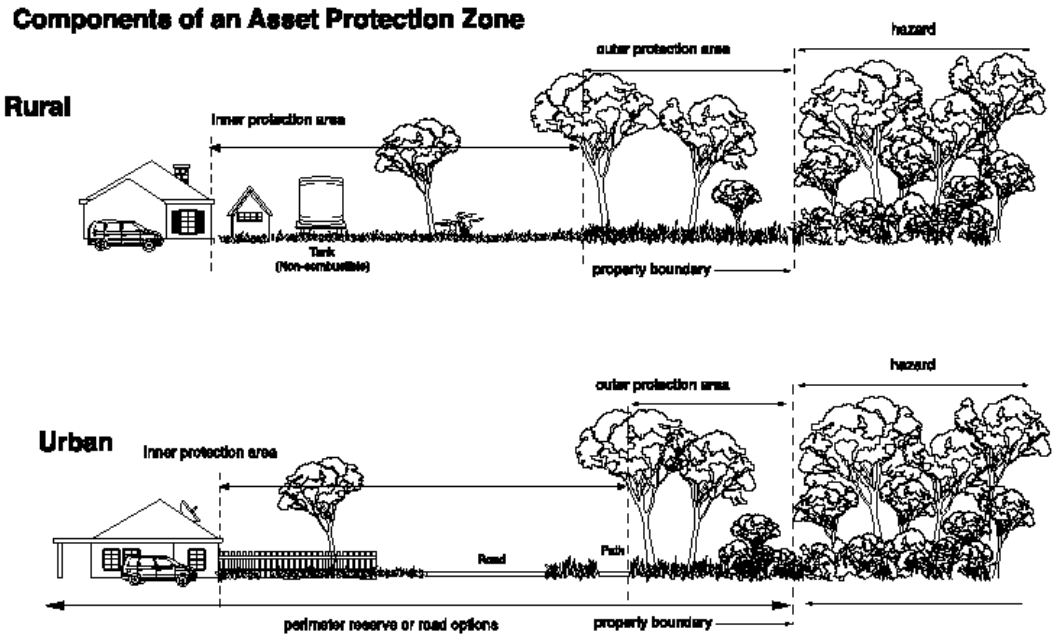
*Notes: * Slope is either 'U' meaning upslope or 'D' meaning downslope*

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:



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 APZ's.

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

Performance Criteria	Acceptable Solutions	Compliance with PBP
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 - refer Table 2.2. APZ's provided exceed the minimum requirements of Appendix 2. The APZ's have been determined based on BAL 29 (AS3959)
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 – Can be made a condition of consent at development application stage
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 degrees.	Yes – APZ's are generally situated on slopes of less than 18 degrees. There are a select few areas where the slopes exceed 18 degrees, these areas are rock ledges and can be incorporated into APZ management. Previous correspondence to the NSW RFS and the preparation of a Fuel Management Plan details the ongoing management of the APZs.

3.2 Building Protection

The construction of buildings in bushfire prone areas is subject to stringent rules pertinent to the building envelope being located on the non-hazardous side of the APZ. The role of the APZ is to provide a safe space to separate the hazard from the building.

In terms of future subdivision approval the minimum APZ must be provided in accordance with Appendix 2 of *PBP.* The APZs provided in Table 2.2 (Section 2.3) of this report exceed these requirements, whilst also considering the final building setbacks as per AS3959 (2009).

Although not required in terms of rezoning the following advice in relation to building construction levels can be used for future planning and development 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 (2009) – *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 which affects costs. This means that BAL 12.5 is much cheaper than BAL 29 when constructing a dwelling. However the length of the APZ's for BAL 12.5 would be too long and a compromise would be BAL 19 being used as a satisfactory development aspiration,

Table 2.2 column 7 above 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.

Approximately 156 residential lots will be created within the R2 zone.

No other permissible uses within the R2 zone will be developed. The privately owned community title development management structure that can limit development type, materials and activities. This would include inappropriate development such as secondary dwellings, bed and breakfast accommodation, boarding houses, childcare centres, educational establishments, group homes and or hospitals. Many of these uses are Special Fire Protection Purpose and are therefore vulnerable to the effects of fire, often difficult to evacuate and more susceptible to smoke impacts and by their very nature should be listed in the community management statement as not permissible.

Based on the assumption of 156 lots this would assume a population increase of 406 persons. (Based on based on the 2011 *Australian Institute of Family Studies* data which advises there is 2.6 persons, on average, per house hold).

The institute advises that in 2011 there were 7,760,000 households in Australia with 71.5% comprised of families, 24.3% were occupied by a person living alone and 4.1% were represented by groups of unrelated persons (share houses). The data from 1986 to 2011 shows the following trends;

- family households declined (77.1% in 1986 to 71.5% in 2011)
- one-person households increased (19% in 1986 to 24% in 2011)
- most of change in the representation of family and one-person households took place during the 10-year period between 1986 and 1996.

3.3 Hazard Management

Fuel management in the form of APZ maintenance will be undertaken in accordance with the fuel management plan and at the cost of the Community Association. There would be no burden upon RFS or other government resources services. The fuel management plan issued with the Planning Proposal confirms this approach and confirms appropriate controls can be implemented.

APZ's will also be provided to the main access routes and transmission lines and a community safe refuge could be provided within the development footprint. These measures have been designed to improve the existing situation for the surrounding community and to support fire fighting operations. The implementation of these measures and the engagement of the Aboriginal community with reduce the already heavy burden on resources.

A community title approach appears to be the favoured approach by the RFS. The community association would be bound under a positive covenant to manage the APZ on an ongoing basis as outlined in the fuel management plan and the community management statement with the terms being agreed during the subdivision development application.

Funding will be via a special fund set aside to support integrated fuel management by professional fuel management staff. Similar arrangements have been successfully implemented within the LGA for bush fire prone areas.

Consultation with the *TransGrid* asset manager team is also intended to effectively manage the surrounding asset protection zones within the *TransGrid* land. *TransGrid* currently undertake hazard management at regular periods to protect their major asset in accord with their comprehensive fire management plan.

Indeed the Planning Proposal seeks to work with the existing bushfire infrastructure and to provide new practical on-ground actions to improve the overall bushfire outcome for both the site and the adjoining residential lands. These actions, through the full extent of the applicants land ownership, will strengthen bush fire preparedness and response for surrounding homes; and will be discussed with the relevant fire authorities prior to any DA submission for subdivision to determine best use of resources.

3.3.1 Management zones

The management zones relate to the need for asset protection, strategic burning and or ongoing land management works. They are discussed in greater detail within the fuel management plan prepared by this firm and dated 2017 from page 31 in Section 5.

Asset protection zones

The asset protection zone includes the land within the proposed development lots, the perimeter roads as well as the residual land external to the development lots. The construction and ongoing management of the APZs will require compliance with the *NSW RFS* guidelines *Standards for Asset Protection Zones (RFS, 2005)* whilst all future landscaping construction will need to comply with Appendix 5 of *PBP.*

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

Whilst the owner or occupier of each development lot will be required to manage the APZ to the specifications of the development consent documentation e.g. Council's / NSW RFS approval, it is the residual land that surrounds the concept development plan which will require careful planning to ensure APZ works are carried out and maintained in perpetuity.

The portion of the bushfire asset protection zones that are located external to future private lots will be located on various land tenures, for example, public roadways, parklands as well as residual private lands owned and managed by the community association set up under the provisions of the Community Title Legislation.

Strategic Fire Advantage Zone

The boundaries of the SFAZ has been designed based on the site features that facilitate hazard reduction burning operations. Boundaries include walking tracks fire trails and easements to ensure strategic planned burning can be undertaken in a safe way.

The surrounding land has been subject to a number of hazard reduction burns undertaken by the local fire authorities most recently in 2009/10, 2012/13 and 2016.

These burns have been undertaken in a safe manner based on the current circumstances on ground using existing fire trails and walking tracks. This planning proposal seeks to work with the existing infrastructure and to provide new linkages to improve the overall bushfire outcome for both the site and the adjoining residential lands. These linkages will be discussed with the relevant fire authorities prior to any DA submission for subdivision to determine best use of resources.

Fire trail works if required will be undertaken in accordance with the design specifications outlined in *PBP 2006* and in accordance with construction standards set by the RFS and or Warringah-Pittwater Bushfire Management Committee. These guidelines (as outlined in the FMP) include construction of fire trails with a minimum trafficable width of 4m with an additional 1m wide strip on each side of the road kept clear of bushes and long grass, a

maximum grade of 15º (preferably 10º) and a minimum clearance of 4m to any overhanging obstructions, including tree branches.

Land Management Zone

This land will be managed by MLALC in accord with offset conditions issued by OEH. Essentially this will relate to ecological burn regimes and weed management works.

A management plan will be prepared as a response to the biocertification process.

3.4 Fuel Management

A fuel management plan (FMP) has been prepared with its implementation and ongoing management being the responsibility of the community association. The FMP has been undertaken to facilitate the ongoing management of bushfire hazards within the proposed E3 zoned land especially focusing on the asset protection zone (APZ) landscape adjoining the R2 lands to provide assurance that all APZ's will be managed in perpetuity.

It is estimated that the initial works to create the APZ will be in the vicinity of $200,000-$250,000. Ongoing management of the APZ is likely to be in the vicinity of $120,000 after purchase of required machinery.

Amendments to the FMP will be the responsibility of the landowner and should be approved by *Northern Beaches Council*.

The implementation of the APZs will require modification of 10.15ha of the E3 land (including *TransGrid* Easements). Attention has been given to the varying landscape character and the need to provide habitat function through the retention of various landscape elements such as trees, shrubs, sandstone outcrops, etc.

In addition, a prescribed burning program is proposed in land entitled the Strategic Fire Advantage Zones (SFAZ) and Land Management Zones (LMZ). Hazard reduction burning is to be undertaken in consultation with surrounding landholders (Community Association & National Parks).

Ongoing management of the APZ is likely to be in the vicinity of $120,000 after purchase of required machinery. It is envisaged that some APZ works will occur by the development contractors at project start up whilst more sensitive works would be undertaken. For example, roadway and in-lot setback (5.18ha) would be undertaken by contractors, whilst E3 lands APZ (10.15ha) would be undertaken by *Community Association.* APZ management is detailed in Figure 3.1.

- The APZ located on E3 lands (10.15ha) and an additional 2.34ha internal to E3 lands will be managed by *Community Association* (69.5%)
- the public roadway comprises 19.3% (3.46ha) of the APZ
- the private allotments comprise 9.6% (1.72ha) of the APZ and are managed by the private allotment owners.
- the portion of RE1 lands comprise 1.7% (0.3ha) of the APZ and is managed by council as on open space park.

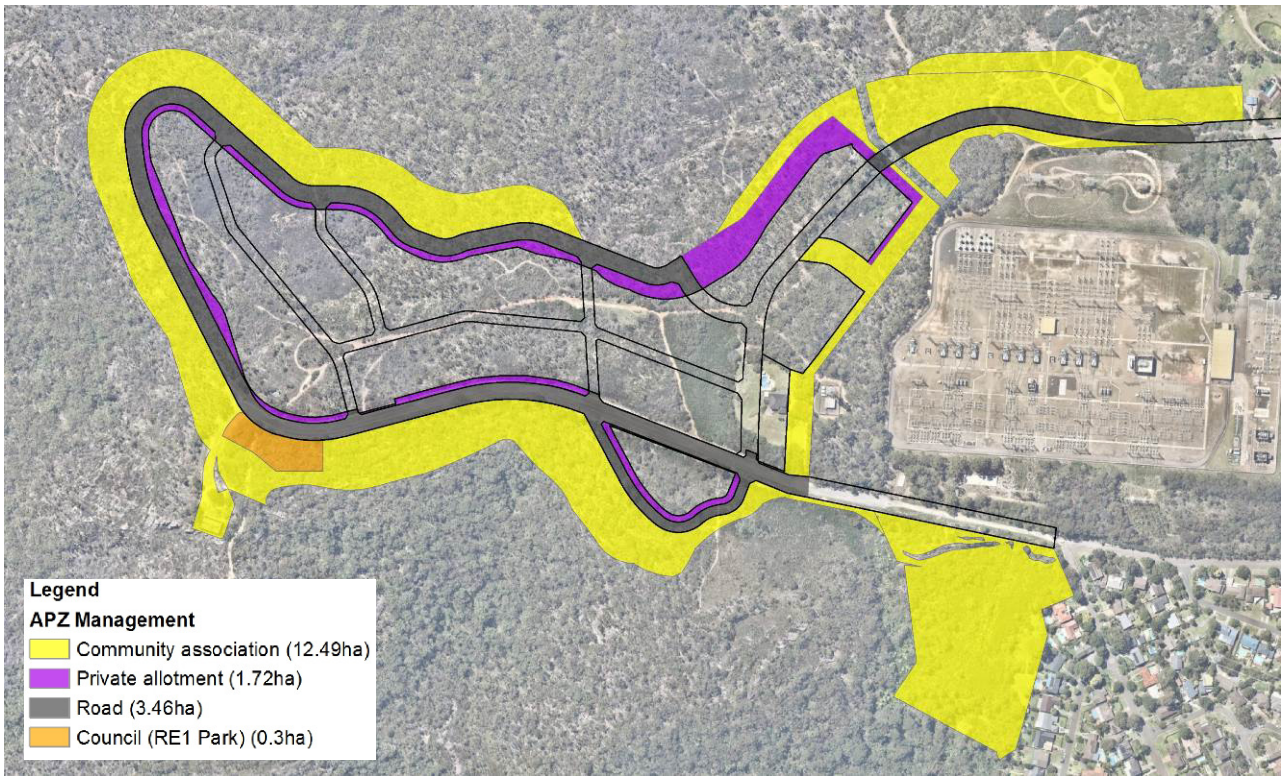


Figure 3.1 - APZ management

Upon initiation of the APZ within the E3 lands a detailed mapping exercise should be undertaken to define the management treatments across the five (5) APZs zones. This will be the basis of the future works sheets for the APZ zones and the auditing protocols.

Note: No works will be required in the *Coastal Upland Swamp* in APZ 4 – refer to FMP 2017 (TBE) for further details.

Training

Training should be undertaken to initiate work concepts and standards of care and / or construction of the APZ to assure adequacy with NSW Rural Fire Service (RFS) APZ standards; and to maintain habitat opportunities for insitu wildlife.

Ongoing auditing of works required

To ensure that regular reviews are undertaken, the FMP has an operational life span of 5 years. At the completion of this time period, the plan will be formally reviewed.

Given the expected residential development program for the project will be over 2-3 years, the FMP should be reviewed six monthly during the development stages of the project and annually after project stabilisation.

Of particular note will be the need to monitor lands that have been sold by the developer and are not built upon and therefore may cause an interim hazard for neighbouring allotments that have built houses. This can be a major impediment to hazard management and the management of those hazards must be dealt with quickly.

Plan monitoring

Monitoring will be undertaken on an annual basis with an audit review prepared by an independent bushfire adviser. The suggested schedule for maintenance of these tracks is outlined in the FMP.

This FMP will enable the land managers to understand the vegetated landscape and apply practical prescriptions to ensure that the future residents and neighbours are able to live safely.

There are a number of ways to evaluate the effectiveness of the FMP. The monitoring of the issues outlined below will determine the level of success from the implementation of the plan. It will also prove how effectively the actions recommended by the plan have reduced the impact of adverse fire events and management.

Plan success

The issues which will govern the FMP's success are:

- protection of life and property from the adverse effects of fire
- maintenance of reduced hazardous fuel levels in strategic locations associated with the residential settlements
- the demonstrated ongoing and effective management of the E3 APZ
- the retention of insitu habitat elements and wildlife utilisation within the E3 APZ
- maintenance of biodiversity through the appropriate management of fire regimes
- management of existing fire trails
- communication of management decisions in respect of the FMP 2015-21 and its implementation program.

3.5 Access for Fire Fighting Operations

Future residential development within the site will require access Ralston and Wyatt Avenue in the east to connect with the existing public road structure of Belrose. The two way road system is critical to bushfire planning be successful in any emergency event.

Road hierarchy must be designed to achieve sufficient traffic flow in order to enable an emergency evacuation in quick time and the proposed road system achieves that aspiration.

The planning proposal complies with the principles for rezoning of residential land as well as the acceptable solutions outlined in PBP for subdivision developments.

PBP requires the perimeter road to form part of the APZ (refer page 20 of PBP). *PBP* does not provide any recommendations for APZ's adjacent to roads. In this firms experience where we have recommended APZ's adjacent to roads the recommendation has not been followed through within the conditions of consent by the assessing authority.

As outlined in PBP the purpose of the road system to:

- provide firefighters with easier access to structures, allowing more efficient use of firefighting resources
- provide a safe retreat for fire fighters; and
- provide a clear control line from which to conduct hazard reduction burning

Whilst the perimeter roads are susceptible to flame impingement the planning proposal complies with the purpose of the road system allowing for safe retreat for fire fighters into the internal road system 'spine road design'.

In regard to the evacuation routes from the development several areas located under electrical easements were not identified to contain APZs in the previous version of the Planning Proposal. These areas are already permitted to be cleared under the provisions of the electrical easement (*Transgrid*) and therefore do not require rezoning and or approval through the Planning Proposal or development application process. In hindsight this created confusion with regard to ecological offsets and APZ's required for the PP.

To resolve any confusion these areas are now mapped as APZ's and resolve the pinch points noted by the RFS. The pinch points are not being affected by sensitive vegetation communities and or sensitive habitat features and have APZ's provided.

A plan is provided at Figure 3.1 is illustrative of the changes.

Specifically the changes involve;

Ralston Avenue

Part of the area south of the Ralston Avenue landscape is classified as 'coastal upland swamp' which is a wet swamp with vegetation rarely exceeding 1.5 metres and mostly between 1.0-1.5m. This is clearly an area of very low hazard and subsequently allows for a reduced asset protection zone. Figure 3.2 depicts this landscape and its extent.

A small area of heath (20m in width) is adjacent to the swamp and will remain. A small APZ will be located between the heath and the road corridor.

The vegetation within the electrical easement south of Ralston Avenue is a transition from heath to forest and a large part of that area will be managed as an APZ.

This means the whole of the southern edge of Ralston Avenue will be managed as an APZ.

The vegetation on the *TransGrid* (north) side of Ralston Avenue is a narrow vestige of uphill slope (up from the road) and is mostly less than 10-12m in width. Only small portions are greater widths and again these are upslope i.e. up from the road.

There is a wider portion at the eastern end of the *TransGrid* land and that land is 180m in length. The evacuation route no 2 does not require passage along that most eastern 180m portion of *TransGrid* vegetation. Rather the evacuation route turns south onto Elm Avenue, midway along the narrow portion of the vegetation, and heads through the suburban area of Belrose – see Figure 3.1.

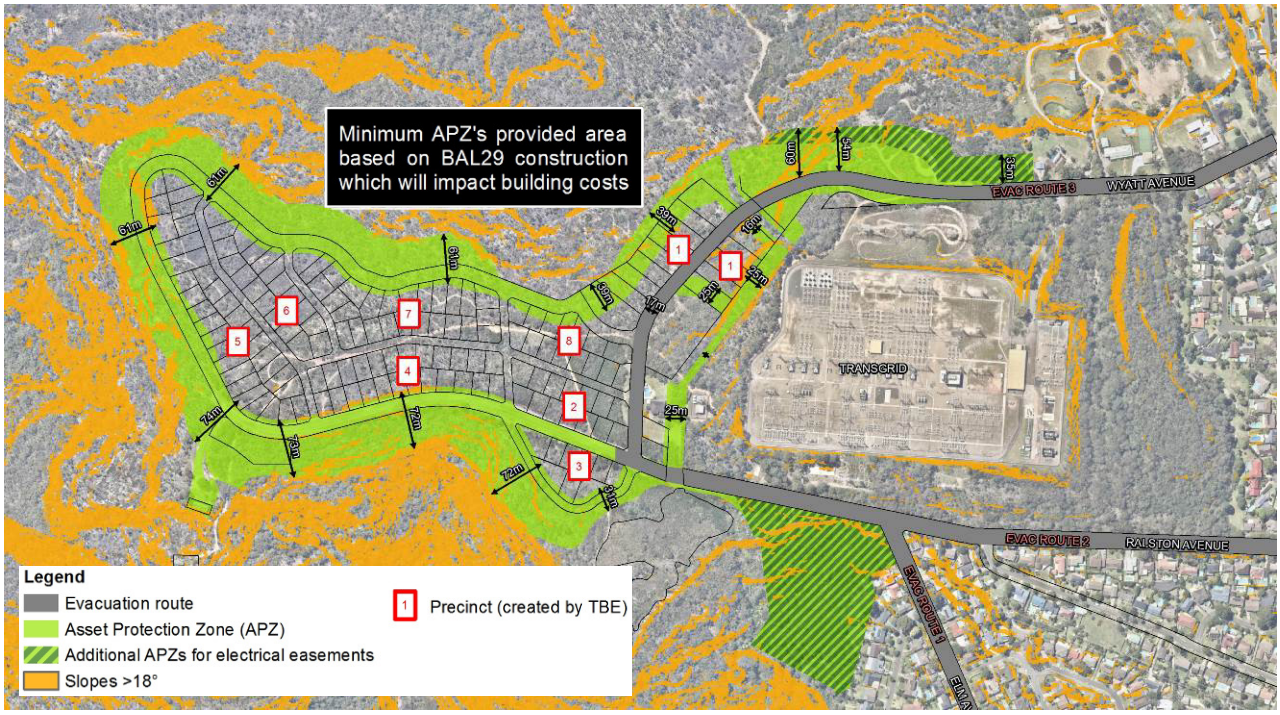


Figure 3.2 - APZs, evacuation route and slopes greater 18 degrees

Wyatt Avenue

The hazardous vegetation north of Wyatt Avenue is affected by heath vegetation (not Forest) and the slopes are predominantly <18 degrees apart from several small sandstone escarpments which are less than 2m in height (field verified by TBE).

Figure 3.1 above depicts the slopes. The <18 degrees are the uncoloured areas whilst the >18 degrees are the orange coloured areas. The >18 degree slopes are sandstone escarpments.

The proposed APZ areas are shown as green shaded areas.

Photo 1 below depicts Wyatt Avenue (facing west towards the beginning of the Planning Proposal land). The mown land to the left is part *TransGrid* land and part Wyatt Avenue verge.

Photo 2 depicts the reverse angle looking east and shows the residential nature of the street.

Photo 1 – Looking west along Wyatt Avenue

Photo 2 - Looking east along Wyatt Avenue

In conclusion *TBE* can confirm that the planning proposal can provide compliance with PBP.

Table 3.3 outlines the performance criteria and acceptable solutions for future public roads within future subdivision design.

Table 3.3: Performance criteria for public roads (*PBP* guidelines pg. 20)

Performance Criteria	Acceptable Solutions	Compliance
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.	Compliant
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 8 metres minimum kerb to kerb) allowing traffic to pass in opposite directions. Non perimeter roads comply with Table 3.4 below. Perimeter road is linked with the internal road system at an interval of no greater than 500 metres in urban areas. Traffic management devices are constructed to facilitate access by emergency services. Public roads have a cross fall not exceeding 3 degrees. All roads are through roads. If unavoidable dead end roads are not more than 200 metres in length, incorporate a minimum 12 metre 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 6 metres and are minimal in number to allow for rapid access and egress. The minimum distance between inner and outer curves is 6 metres. Maximum grades for sealed roads do not exceed 15 degrees and an average grade of not more than 10 degrees. Minimum vertical clearance of 4 metres above the road at all times.	Can be made compliant - The concept plan depicts a perimeter road which ranges in road reserve width of 17 – 20.115m. All other internal roads have a reserve width of 10.3m. All perimeter public roads must have a carriageway width of 8 metre wide and therefore future plans will need to replicate this. This width enables sufficient capability for fire trucks passing when cars are parked on roadsides. The road cross-sections as shown in the traffic report as well as the urban concept plan and water management/utility services have overall road reserves capable of achieving the RFS carriageway widths. Compliant - The internal roads have a reserve width of 10.3m however these internal roads act as traffic conduits in an emergency and traffic capability is an integral component of bushfire protection planning. Table 3.4 below is taken from PBP and provides the necessary pavement widths. In the case of non perimeter roads a minimum of 6.5 m is required. Compliant - The perimeter road will be linked with the internal road network at intervals of less than 500 metres. Compliant - There are no dead end roads.
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.	Compliant

Performance Criteria	Acceptable Solutions	Compliance
Roads that are clearly sign posted (with easily distinguishable names) and buildings / properties that are clearly numbered.	Public roads >6.5 metres wide to locate hydrants outside of parking reserves to ensure accessibility to reticulated water. Public roads 6.5 - 8 metres wide are No Parking on one side with the hydrant located on this side to ensure accessibility to reticulated water. Public roads <6.5 metres 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 3.5 metres wide and provide parking within parking bays and locate services outside of parking bays to ensure accessibility to reticulated water.	Compliant – can be made a condition of consent
There is clear access to reticulated water supply. Parking does not obstruct the minimum paved width	Parking bays are a minimum of 2.6 metres 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.	Compliant – can be made a condition of consent

Table 3.4: Road design minimum widths for public roads that are not perimeter roads required by the RFS

Curve radius (inside edge) (metres width)	Swept Path requirements (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

3.6 Water Supplies

Town reticulated water supply will be available to the future development in the form of an underground reticulated water system.

Table 3.6 outlines the performance criteria and acceptable solutions for reticulated water supply.

Table 3.5: Performance Criteria for reticulated water supplies (P*BP* 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.

3.7 Gas

Table 3.7 outlines the required performance criteria for the gas supply.

Table 3.6: 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 AS 1596 – 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 10 metres 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 2 metres 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.

3.8 Electricity

Table 3.8 outlines the required performance criteria for electricity supply.

Table 3.7: 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 (30 metres), 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).

3.9 Evacuation

Evacuation capability is critical when considering bushfire planning for new residential developments. Given the inherent bushfire risk posed to future development, close examination of evacuation routes have been undertaken.

Perimeter roads, connections to internal roads and external egress to the main road limit the potential for traffic congestion therefore maintaining good traffic fluidity for any uncontrolled evacuations. The road design has very specifically created linkages 'from the perimeter road design into the central residential zone' and vice versa, so that traffic flow can move away from the source of fire.

In addition the egress roads of Ralston Avenue and Wyatt Avenue are both 20m in width and are capable of providing fluid traffic flow in times of emergency. It is recommended that Ralston Avenue and Wyatt Avenue (the primary evacuation routes from the subdivision) utilise the widest possible pavement width within the existing 20m road reservation. A pavement width of 13-15 metres would be acceptable.

The main road intersection/s onto Forest Road (via Ralston and Wyatt) both provide controlled intersections. Indeed the long length of Ralston and Wyatt also provide a very long queue capacity for vehicles in an emergency event.

Evacuation can be thwarted by hazardous vegetation occurring near roads and causing pinch points. Figure 2.2 above on page 32 shows the slope of the land and the vegetation occurring on those slopes. The importance of this figure goes to the evacuation routes of Wyatt and Ralston and the lack of steep slopes and high intensity forest vegetation in those areas.

The site is also, as indicated on Figure 3.3 and Figure 3.4 below, are situated in close proximity to the nearest RFS *neighbourhood safer place/s*. The NSP is a place of safety for a person to shelter during the passage of a bushfire. Currently, the nearest NSPs are located at;

- Belrose Public School on the north eastern corner of Ralston Avenue and Contentin Road, Belrose. This is a direct 2 minute drive in an easterly direction along Ralston

Avenue or a 4 minute drive if an alternate route is taken in the event that a bushfire is impacting upon the remnant vegetation within *TransGrid* land.

Figure 3.3 – Neighbourhood Safer Place – Belrose Public School

- Bambara Reserve (Belrose Oval) and Belrose Community Centre on Forest Way (Near Bambara Road), Belrose. This is a 3 minute drive in a southerly drive from Ralston Avenue (refer Figure 7).

Figure 3.4 – Neighbourhood Safer Place – Belrose Community Centre

3.10 Possible 'safer place'

It should be noted that the NSP program is primarily designed for the existing wider community who reside in areas and residential developments that pre-date modern day bushfire development controls and are subject to a higher level of risk mainly due to inadequate asset protection zones, poor access design and no dwelling construction standards.

Future development within the planning proposal area will have a level of bushfire protection that exceeds PBP and hence reliance upon NSP would be less so.

Notwithstanding that there is potential for a NSP location within the planning proposal area as a site is available that can comply with the acceptable solutions (based on an FDI 120) identified in the NSW RFS document entitled '*Neighbourhood Safer Places - Places of Last Resort Guidelines 2012/13 Bush Fire Season*' -see Figure 3.5 below. This area meets the FDI requirements of the program (139m from the hazard source).

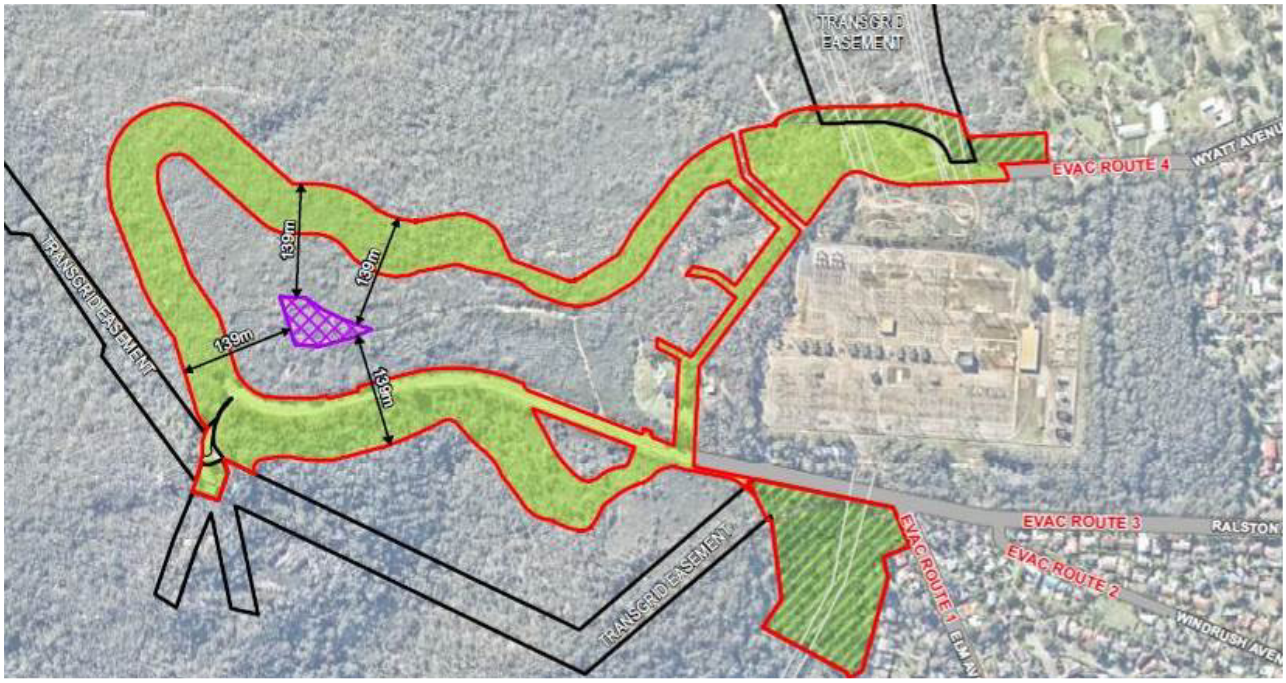


Figure 3.5 – possible location for NSP

Conclusion & Recommendations

4

4.1 Conclusion

A bushfire protection assessment (second revision) has been undertaken for the proposed rezoning located at Lot 1 DP 1139826, Ralston Avenue, Belrose.

The key principle for the proposal is to ensure that future development is capable of complying with the *Section 117 Direction* and *PBP*.

Planning principles for the proposal include the provision of adequate access including perimeter roads, establishment of adequate APZs for future housing, allowing for minimum lot depths to accommodate APZs and the introduction of controls which avoid placing inappropriate developments (such as petrol stations) in hazardous areas and the inappropriate placement of combustible material in APZs.

Our assessment found that bushfire can potentially affect the site from the surrounding forest and heath vegetation communities resulting in possible ember attack, radiant heat and potentially flame attack, however these issues can be suitable addressed through the implementation of combined bushfire protection measures as outlined below.

The past fire history of the surrounding landscape is such that considerable planning focus has been undertaken for traffic capability, asset protection, emergency management, fire trail construction, hazardous fuels management, building construction standards, water management and peripheral land management on land owned by the land owner. The bushfire risk posed to the rezoning proposal however can be mitigated if a full suite of bushfire protection measures (including APZs) are implemented and managed in perpetuity.

Upon final design engagement with recommendations made within this report the future development of these lands in accordance with the attached bushfire protection plan (Schedule 1) will provide compliance with the planning principles of *Planning for bush fire protection 2006* and *Community Resilience Practice Note 2/12 – Planning Instruments and Policies*. Future development on site is to comply with the planning principles identified in Figure 4.1.

In conclusion we can advise that;

- The R2 low density residential zoning is a suitable development class and is unremarkable in comparison to other similar topographical developments.
- The requirements established in *s.177 Direction 4.4 Planning for Bushfire Protection* and *Plan Sydney* have been satisfied.
- Safe evacuation can be provided through three evacuation routes leading through established residential areas and away from the hazard.

- APZs can be provided that exceed the minimum requirements of PBP 2006 and AS3959.

- The wider landscape beyond the APZ will be managed by Strategic Fire Advantage Zones.

- Adequate APZ's adjacent to power lines will be implemented to ensure access is not affected by unmanaged lands.

- The planning proposal will improve bushfire protection measures afforded to existing development through the removal of hazardous vegetation and improved access for firefighting suppression.

- Costs for the development and implementation of bushfire protection measures will be imposed on the landowner and the developer.

- There have been no additional burdens on emergency services demonstrated.

- Environmental constraints have been minimised

Therefore there can be no doubt that the Ralston Avenue planning proposal has been subjected to comprehensive bushfire assessment and fuel management planning initiatives. Coupled with the proposed community association management approach the planning proposal fulfils all the requirements of the Section 117 Direction, PBP, DCN 2/12 and AS3959 and we summarise those points in the table below.

Table 4.1: Planning Principles

Direction 4.4	**Compliance statement**
In the preparation of a planning proposal the relevant planning authority must consult with the Commissioner of the NSW Rural Fire Service	**Yes**. The NSW RFS has been consulted with correspondence from the RFS dated 25/2/2015, 26/6/2015, 9/7/2015 and most recently (undated) but received by this firm in November 2016.
A planning proposal must:	
(a) have regard to *Planning for Bushfire Protection 2006*,	**Yes**. A bushfire protection assessment report and fuel management plan were prepared in 2015 along with addendum advice in November 2016 and again in 2017; and in full accord with *PBP*.
(b) introduce controls that avoid placing inappropriate developments in hazardous areas, and	**Yes**. The response to the NSWW RFS on November 4 2016 advised of additional bushfire protection measures beyond those required in *PBP*. Those measures will form the development control measures and be provided within the Area Plan thus designing future residential development appropriate for the level of risk. Importantly the development is not deemed inappropriate) i.e. not a school or retirement village) and the proposed controls are in accordance with PBP to address the level of hazard.

Direction 4.4	Compliance statement
(c) ensure that bushfire hazard reduction is not prohibited within the APZ.	**Yes**. Significant environmental studies have been undertaken to ensure APZs have been excluded from environmentally significant land.
A planning proposal must, where development is proposed, comply with the following provisions, as appropriate:	
(a) provide an Asset Protection Zone (APZ) incorporating at a minimum: (i) an Inner Protection Area bounded by a perimeter road or reserve which circumscribes the hazard side of the land intended for development and has a building line consistent with the incorporation of an APZ, within the property, and (ii) an Outer Protection Area managed for hazard reduction and located on the bushland side of the perimeter road,	**Yes**. The APZs recommended exceed the minimum requirements outlined in *PBP* for subdivision development (i.e. Appendix 2 of *PBP*).
(c) contain provisions for two-way access roads which links to perimeter roads and/or to fire trail networks	**Yes**.
(d) contain provisions for adequate water supply for firefighting purposes	**Yes**. Water supply will comply with *PBP*.
(e) minimise the perimeter of the area of land interfacing the hazard which may be developed	**Yes.** The perimeter is located on a level terrace and circumscribes the edge of the downslopes resulting in the best design possible. Intrusions of bushland into the development have been removed and minimised to allow safe evacuation.
(f) introduce controls on the placement of combustible materials in the Inner Protection Area.	Yes – can be a condition of consent at DA stage.

The following recommendations are provided to ensure that future residential development is in accord 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 2.2 and also as generally depicted in Schedule 1.

Recommendation 2 – Appropriate APZ setbacks are to be provided for the future development as depicted in Schedule 1 and outlined in Table 2.2. Fuel management within the APZs will need to be maintained by regular maintenance in accordance with the guidelines provided in Appendix 1, and as advised by the *NSW RFS* in their publications.

Recommendation 3 – The surrounding lands are to be maintained in accordance with the Fuel Management Plan (2017) prepared by *Travers bushfire & ecology*. This plan should be linked to the *Warringah bushfire risk management plan* for protection of the community.

Recommendation 4 - 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 5 – 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).

Recommendation 6 – A fire trail system should be designed and constructed in order to link with existing peripheral trails (if possible) to ensure the ongoing management of the peripheral landscape (see Rec' 3 above) is maintained in both fire management terms and environmental protection terms. There is ample scope for this to occur.

Recommendation 7 - 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 & 3.7 of this report)

References

Australian Building Codes Board (2010) – *Building Code of Australia*, Class 1 and Class 10 Buildings Housing Provisions Volume 2.

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

Councils of Standards Australia AS3959 (2009) – *Australian Standard Construction of buildings in bush fire-prone areas.*

Hon Brad Hazard (7 June 2012) – *Planning proposal to rezone land at Boundary Road, Medowie from 1 (c1) Rural Small Holdings Zone to 1(c5) Rural Small Holdings, 1(c4) Rural Small Holdings and 7(a) Environmental Protection.*

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.

Rural Fire Service (2006) - *Planning for bush fire protection– a guide for councils, planners, fire authorities and developers*. NSW Rural Fire Service.

Rural Fire Service (2006) - Bushfire Attack Software on RFS Web site.

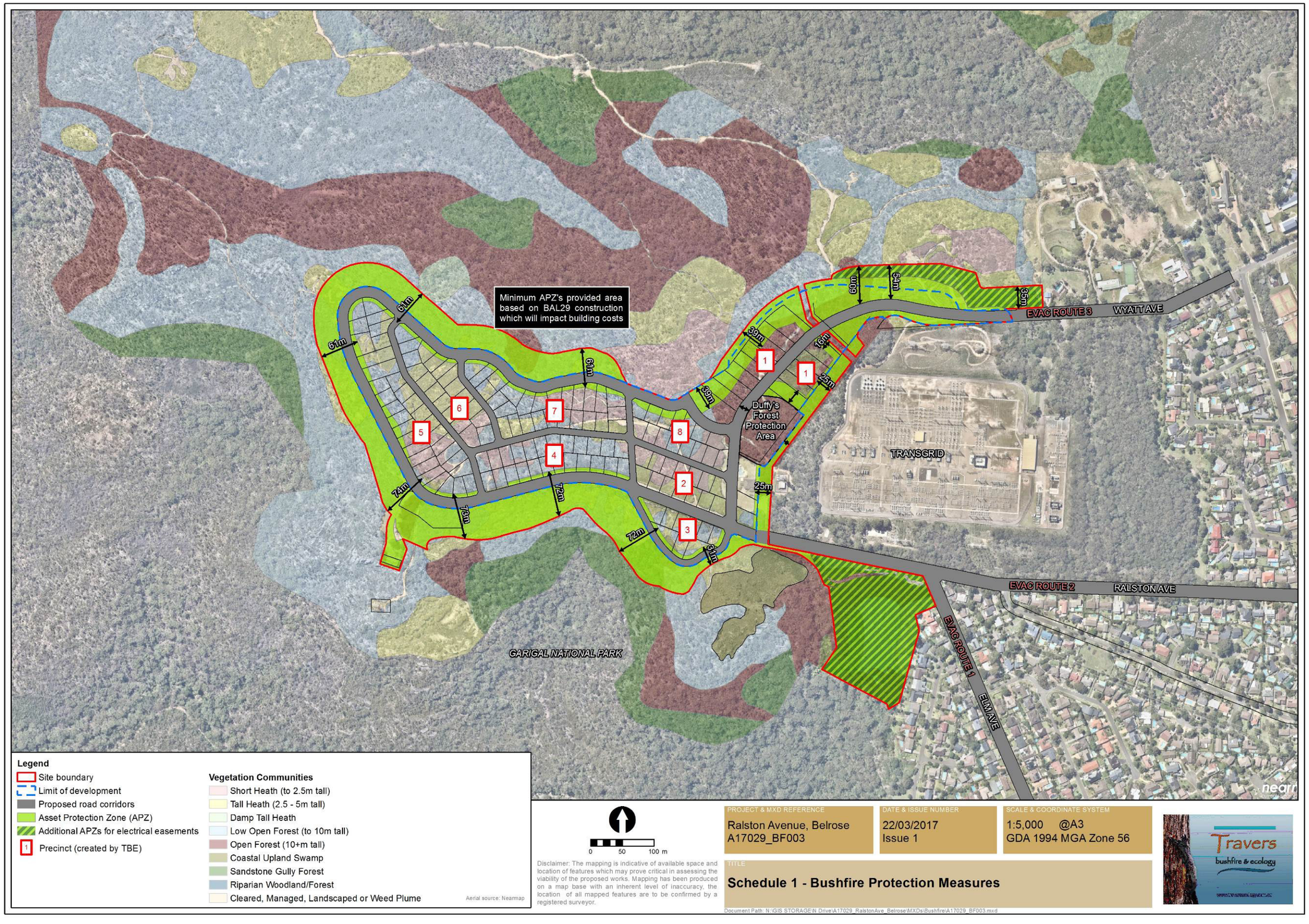
Tan, B., Midgley, S., Douglas, G. and Short (2004) - *A methodology for assessing bushfire attack.* RFS Development Control Service.

Travers, J. (2003) *The Ecological Management of Asset Protection Zones at Wallarah Peninsula – A Case Study*.

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

Plan of Bushfire Protection Measures

S1


Minimum APZ's provided area based on BAL29 construction which will impact building costs
EVAC ROUTE 3
WYATT AVE
EVAC ROUTE 2
RALSTON AVE
EVAC ROUTE 1
ELM AVE
Duffy's Forest Protection Area
TRANSGRID
GARIGAL NATIONAL PARK
1
2
3
4
5
6
7
8
61m
74m
73m
72m
39m
16m
25m
60m
54m
35m
31m
Legend
Site boundary
Limit of development
Proposed road corridors
Asset Protection Zone (APZ)
Additional APZs for electrical easements
Precinct (created by TBE)
Vegetation Communities
Short Heath (to 2.5m tall)
Tall Heath (2.5 - 5m tall)
Damp Tall Heath
Low Open Forest (to 10m tall)
Open Forest (10+m tall)
Coastal Upland Swamp
Sandstone Gully Forest
Riparian Woodland/Forest
Cleared, Managed, Landscaped or Weed Plume
Aerial source: Nearmap
0 50 100 m
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.
PROJECT & MXD REFERENCE
Ralston Avenue, Belrose
A17029_BF003
DATE & ISSUE NUMBER
22/03/2017
Issue 1
SCALE & COORDINATE SYSTEM
1:5,000 @A3
GDA 1994 MGA Zone 56
TITLE
Schedule 1 - Bushfire Protection Measures
Document Path: N:\GIS STORAGE\N Drive\A17029_RalstonAve_Belrose\MXDs\Bushfire\A17029_BF003.mxd
Travers bushfire & ecology

Management of Asset Protection Zones

A1

The *NSW Rural Fire Service (RFS)* advises that when living in a bushfire prone environment asset protection zones are required to be provided between hazardous fuels and a dwelling.

The *NSW RFS* provides basic advice in respect of managing asset protection zones in several documents namely *Planning for bush fire protection 2006 (PBP)* and *Standards for Asset Protection Zones* (undated but circa 2006).

Asset protection zones (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.

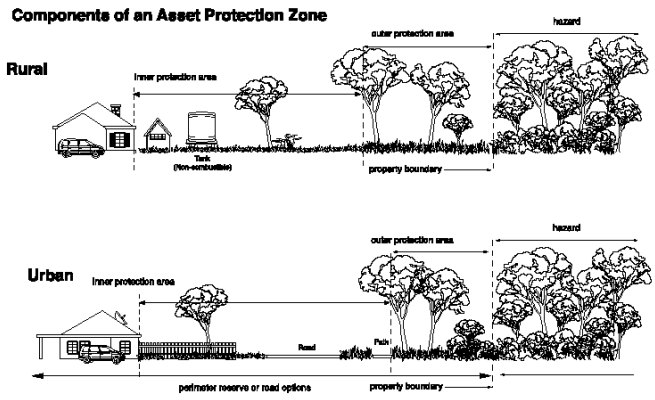
When considering bushfire fuel it is important to understand that it occurs in our native bushland in three vertical layers – see Table 1.

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	0-200 mm	Litter layer (leaves & twigs)
Aerial Fuels	200 – 3000 mm	Shrubs and grasses
Canopy Fuels	> 3000 mm	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.



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 5 metres away from a dwelling.

A recommended performance standard for the fuel load of an IPA is between 0 – 4 t/ha. Shrubs may occur within an IPA commensurate with a spatial distribution of 15-20%. For example an area of 100m2 (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 20 metres in height the canopy is separated from the land surface by some distance. In an 'open woodland' the low canopy height (usually < 5 metres) 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 5 metres	No trees	No trees
Between 5-10 metres	One tree per 100 m^2	2 trees per 100 m^2
Between 10-20 metres	<10 tree per 400 m^2.	<10 trees per 400 m^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 4-6 t/ha.

Managing the APZ

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

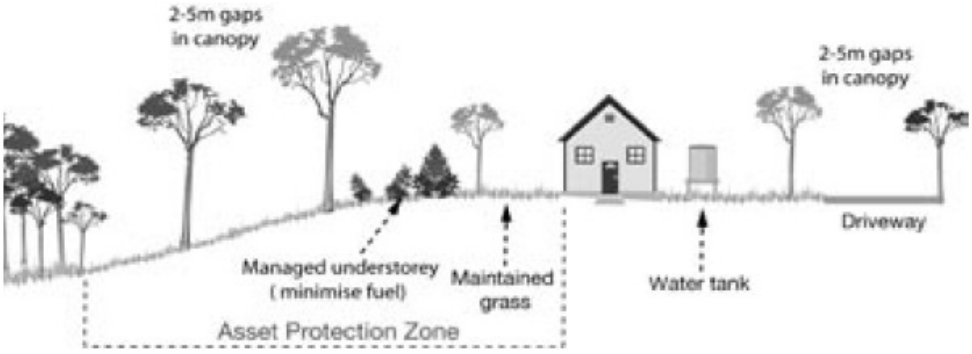
- Mowing grasses regularly - Grass needs to be kept short and, where possible, green.
- Raking or manual removal of fine fuels - Ground fuels such as fallen leaves, twigs (less than 6 mm in diameter) and bark should be removed on a regular basis. This is fuel that burns quickly and increases the intensity 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 two to five metres. A canopy should not overhang within two to five metres 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.
- Tree 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 two metres 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 crush tile; and

- The following *NSW 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.