Travers

bushfire & ecology

bushfire protection assessment

Section 4.55 application

Extension of Building A1
Lot 806 DP 752038
8 Lady Penrhyn Drive, Beacon Hill

Under Section 100B of the Rural Fires Act (1997)

May 2019
(REF: 18VM06)

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Lot 806 DP 752038
8 Lady Penrhyn Drive, Beacon Hill

Report Author:	Nicole van Dorst BPAD-L2 23610
Plans prepared:	Bronte Talbot
Checked by:	John Travers BPAD-L3 15195
Date:	03/05/2019
File:	18VM06

BPAD Bushfire Planning & Design Accredited Practitioner Level 3

BPAD Bushfire Planning & Design Accredited Practitioner Level 2

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TBE Environmental Pty Ltd
ABN 85 624 419 870
PO Box 7138
Kariong NSW 2250

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

t: 02 4340 5331
e: info@traversecology.com.au
www.traversecology.com.au

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
EP&A Act	*Environmental Planning & Assessment Act 1979*
FDI	fire danger index
IPA	inner protection area
LEP	Local Environmental Plan
OPA	outer protection area
PBP	*Planning for Bush Fire Protection 2006*
RF Act	*Rural Fires Act 1997*
RFS	NSW Rural Fire Service
SFPP	special fire protection purpose

EXECUTIVE SUMMARY

Development consent for the seniors living facility at 8 Lady Penrhyn Drive, Beacon Hill was issued on 30 December 2010. Consent conditions for the development are outlined within the following documents;

- Northern Beaches Council Modification of Development Consent (ref: Mod2016/0334)
- NSW Land and Environment Court for Appeal No. 10973 of 2009 (*Lipman Properties v Warringah Council*) granted on 30 December 2010
- NSW Rural Fire Service General Terms of Approval (ref: D09/0941) dated 4 Feb 2010.

The proposed changes subject to this new Section 4.55 application includes:

- Amendment to the dwelling footprint for the residential building identified as A1. The APZ provided to the building maintains the 60m setback to the north. The building setback to the west has been reduced from 20m to 10m.

The building is considered a special fire protection purpose (SFPP) development within *Planning for Bushfire Protection (2006).* As a result the subsequent extent of bushfire attack that can potentially impact the building should not exceed a radiant heat flux of $10kW/m^2$. This rating assists in determining the size of the asset protection zone (APZ) to provide the necessary defendable space between hazardous vegetation and a building.

The assessment found that bushfire can potentially affect the proposed building from the existing tall heath vegetation located beyond Lady Penrhyn Drive to the west and the forest vegetation located to the north resulting in possible ember and radiant heat attack.

The bushfire risk posed to the development can however be effectively mitigated as appropriate bushfire protection measures have been put in place and will be maintained in perpetuity.

The assessment has concluded that the proposed development will continue to provide compliance with *PBP* to ensure the building is not exposed to radiant heat levels of $>10kW/m^2$. This proposal relies on an alternative solution (i.e. incorporation of uphill slopes of 11 – 15 degrees within the hazard vegetation). The application is required to be submitted to the NSW RFS for their general terms of approval.

The following table confirms the proposals compliance with the NSW Bushfire Safety Authority identified above.

NSW RFS BSA	Compliance statement
At the commencement of building works and in perpetuity the entire property shall be managed as an inner protection area (IPA) as outlined within section 4.1.3 and Appendix 5 of 'Planning for Bush Fire Protection 2006' and the NSW Rural Fire Service's document 'Standards for asset protection zones'.	Complies. The entire site is currently managed as an inner protection area.
A minimum 60 metre asset protection zone (APZ) setback is to be provided from the northern boundary of the subject site to proposed units A1, B1 and A2. In accordance with section 88B of the 'Conveyancing Act 1919' a restriction to the land use shall be placed on the property requiring the provision of this APZ which shall be maintained as outlined within section 4.1.3 and Appendix 5 of 'Planning for Bush Fire Protection 2006' and the NSW Rural Fire Service's document 'Standards for asset protection zones'. This restriction can be extinguished upon commencement of any future proposed development within the adjoining lots to the north, but only if the hazard is entirely removed or managed as part of the proposal.	Complies. Building A1 maintains a 60m APZ setback to the northern boundary
A minimum 45 metre asset protection zone (APZ) setback is to be provided from the northern boundary of the subject site to proposed unit B2. In accordance with section 88B of the 'Conveyancing Act 1919' a restriction to the land use shall be placed on the property requiring the provision of this APZ which shall be maintained as outlined within section 4.1.3 and Appendix 5 of 'Planning for Bush Fire Protection 2006' and the NSW Rural Fire Service's document 'Standards for asset protection zones'. This restriction can be extinguished upon commencement of any future proposed development within the adjoining lots to the north, but only if the hazard is entirely removed or managed as part of the proposal.	N/A. No changes are proposed to the approved B2 building and therefore the 45m setback has been maintained.
A minimum 20 metre asset protection zone (APZ) setback is to be provided along the entire length of the south eastern, southern and south western property boundaries of the subject site, particularly to proposed units A1, B2, B3, B4 and C1. In accordance with section 88B of the 'Conveyancing Act 1919' a restriction to the land use shall be placed on the property requiring the provision of this APZ which shall be maintained as outlined within section 4.1.3 and Appendix 5 of 'Planning for Bush Fire Protection 2006' and the NSW Rural Fire Service's document 'Standards for asset protection zones'. This restriction can be extinguished upon commencement of any future proposed development within the adjoining lots, but only if the hazard is entirely removed or managed as part of the proposal.	The setback between the south-western boundary and Building A1 is proposed to be reduced from 20m to 10m. As detailed within Section 2.3 of this report an alternative solution approach was used to determine the radiant heat exposure on the building. Based on an uphill slope (11 – 15 degrees) within the hazardous tall heath vegetation the radiant heat exposure on Building A1 will be <10kW/m^2.

NSW RFS BSA	Compliance statement
A fire management plan is to be prepared that addresses the following requirements: a) Contact person / department and details; and b) Schedule and description of works for the construction of asset protection zones and their continued maintenance.	*TBE* prepared a fuel management plan (FMP) which address item a) and b). This plan has been prepared taking into consideration the conditions granted on 30 December 2010 by the NSW Land and Environment Court for Appeal No. 10973 of 2009.
At the commencement of building works and in perpetuity the entire property surrounding the existing dwelling shall be managed as an inner protection area (IPA) as outlined within section 4.1.3 and Appendix 5 of 'Planning for Bush Fire Protection 2006' and the NSW Rural Fire Service's document 'Standards for asset protection zones'.	Complies. The entire site is currently managed as an inner protection area.
Water, electricity and gas are to comply with section 4.1.3 and 4.2.7 of 'Planning for Bush Fire Protection 2006'	Complies. Water, electricity and gas services have been installed in accordance with this condition.
Property access roads shall comply with sections 4.1.3(2) and 4.2.7 of 'Planning for Bush Fire Protection 2006'.	Complies. Access roads have been constructed in accordance with this condition. There are no changes to the access road proposed as part of this application.
Internal roads shall comply with section 4.2.7 of 'Planning for Bush Fire Protection 2006'.	
Arrangements for emergency and evacuation are to comply with section 4.2.7 of 'Planning for Bush Fire Protection 2006'. An Emergency/Evacuation Plan is to be prepared detailing the following: 1) under what circumstances will the complex be evacuated; 2) where will occupants be evacuated to; 3) roles and responsibilities of persons co-ordinating the evacuation; 4) roles and responsibilities of persons remaining with the complex after evacuation; and 5) a procedure to contact the NSW Rural Fire Service District Office / NSW Fire Brigade and inform them of the evacuation and where they will be evacuated to.	Complies. A bushfire emergency evacuation plan was prepared by this firm in October 2014. This plan outlines the evacuation triggers and procedures for either sheltering in place or evacuation off site. It is recommended that the evacuation plan is updated to reflect the amended development design.
New construction shall comply with Australian Standard AS3959-1999 'Construction of buildings in bush fire-prone areas' Level 1.	The A1 building is to comply with BAL 12.5 as outlined in AS3959 (2009).
Roller doors, tilt-a-doors and other such doors shall be sealed to prevent the entry of embers into the building.	Roller doors are to comply with this condition.

NSW RFS BSA	Compliance statement
Roofing shall be gutterless or guttering and valleys are to be screened to prevent the build-up of flammable material. Any materials used shall have a Flammability Index of no greater than 5 when tested in accordance with Australian Standard AS1530.2-1993 'Methods for Fire Tests on Building Materials, Components and Structures - Test for Flammability of Materials'.	The A1 building is to comply with this condition.
The existing dwelling is required to be upgraded to improve ember protection. This is to be achieved by enclosing all openings (excluding roof tile spaces) or covering openings with a non-corrosive metal screen. Where applicable, this includes any sub floor areas, openable windows, doors, vents, weepholes and eaves.	N/A.

TABLE OF CONTENTS

Introduction 1

Travers bushfire & ecology has been requested to undertake a bushfire protection assessment for the Section 4.55 application to amend the proposed A1 building footprint at the approved senior's facility at Lot 806 DP 752038, 8 Lady Penrhyn Drive, Beacon Hill.

The property is located on land that is mapped by Northern Beaches Council as being bushfire prone. This triggers a formal assessment by Council in respect of the NSW Rural Fire Service (RFS) policy against the provisions of *Planning for Bush Fire Protection 2006 (PBP).*

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 mitigation measures, including the provision of asset protection zones (APZs), construction standards and other specific fire management issues
- Review the potential to carry out hazard management over the landscape

1.2 Project synopsis

The original development consent for the seniors living facility was issued in 2010 – Court Appeal no. 10973 of 2009. The RFS issued their general terms of approval for that application on the 4th of February, 2010. A number of subsequent Section 4.55 applications have been submitted in relation to changes to the internal access design and amendments related to the community centre building.

The proposed changes subject to this new amendments include:

- The construction of an enlarged seniors living building (building A1) over the footprint of a previously approved seniors living building. The building extends a further 10m to the west and 4m to the south.
- The new footprint will accommodate14 units with 14 basement parking spaces (the previously approved building contained 4 units with 6 basement parking spaces).

Building construction has been completed for the remainder of the site including seven (7) other buildings each containing 4 units, a community centre and civil infrastructure. There is no change to the development other than the changes to building A1.

Whilst the building footprint has been amended, the building will not be exposed to radiant heat levels of >10kW/m^2.

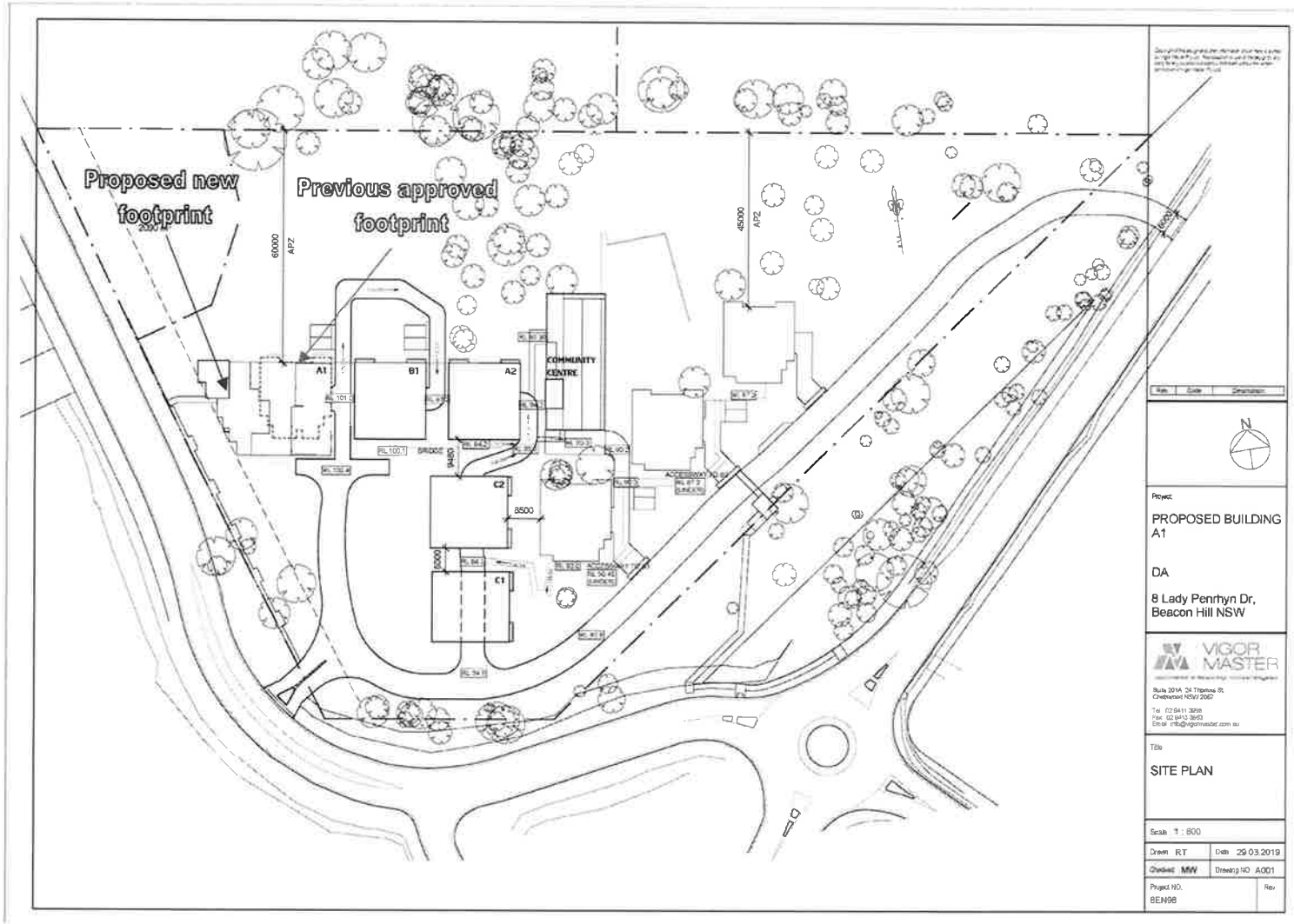


Figure 1.1 – Site plan

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:

- Site plans prepared by *Vigormaster Pty Ltd*, dated 29.03.2019
- *Google* aerial photography
- Topographical maps DLPI of NSW 1:25,000
- Australian Standard 3959 *Construction of buildings in bushfire-prone areas*
- *Planning for bush fire protection 2006 (NSW RFS).*

An inspection of the proposed development site and surrounds was undertaken 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 aged care facility is located to the east of Lady Penrhyn Drive, Beacon Hill within the local government area (LGA) of the Northern Beaches.

The site is adjoined by Lady Penryhn Drive in the west and south and Willandra Road in the east (refer Figure 1.2). The land adjacent to the sites northern boundary supports open forest and tall heath vegetation whilst the land to the south-east and beyond Lady Penrhyn Drive to south-west supports tall heath vegetation.

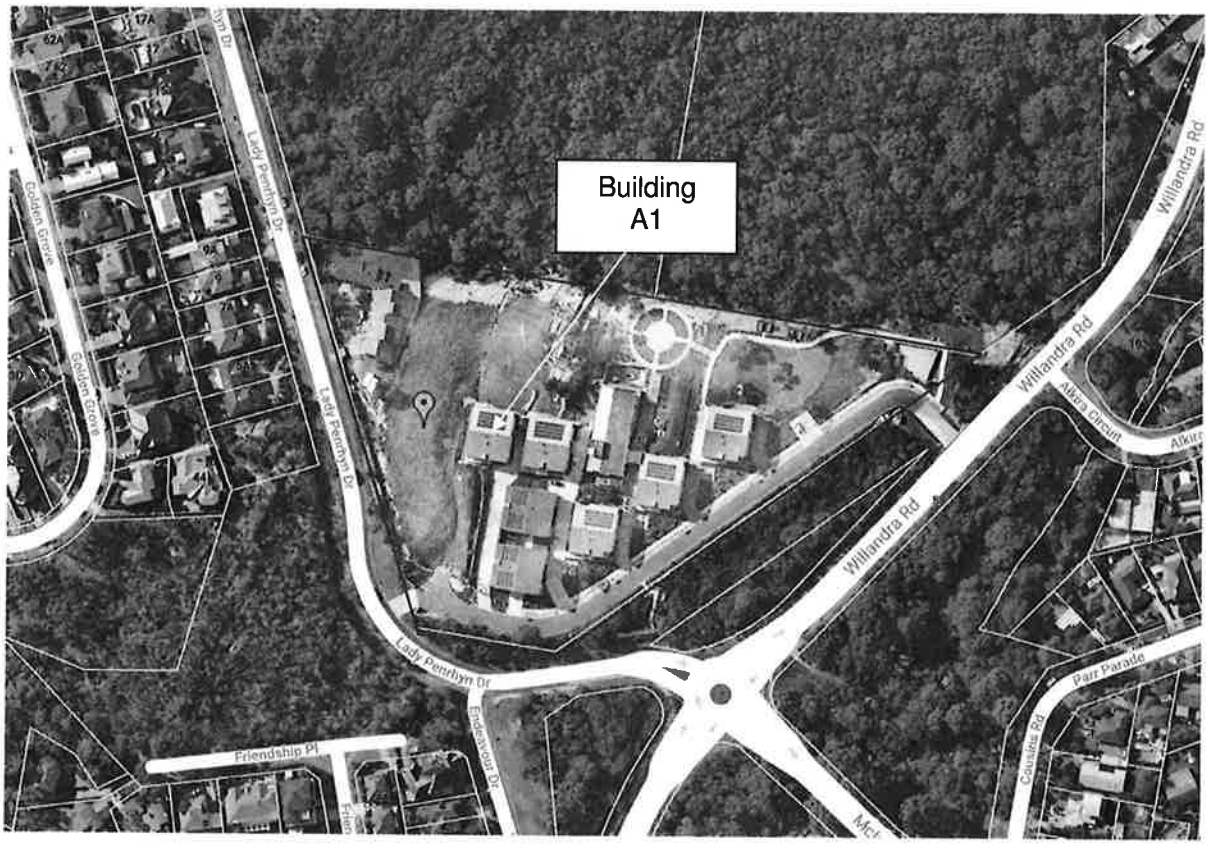


Figure 1.2 – Aerial appraisal

1.5 Legislation and Planning Instruments

Is the site mapped as bushfire prone?	Yes
Proposed development type	Seniors living development (Section 4.55 application)
Is the development considered integrated for the purposes of Section 100B of the *Rural Fires Act 1997*	Yes – referral and approval by the NSW RFS is required
Is the proposal located in an Urban Release Area as defined under Clause 273 of the EP&A Regulations?	No
Significant environmental features	No
Details of any Aboriginal heritage	No
Does the proposal rely on an alternative solution	Yes – Calculations to determine the radiant heat exposure take into account the steep uphill topography within the hazard vegetation to the west.

Bushfire Threat Assessment 2

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

PBP provides a methodology to determine the size of any APZ that may be required to offset possible bushfire attack.

These elements include the potential hazardous landscape that may affect the site and the effective slope within that hazardous vegetation.

2.1 Hazardous fuels

PBP guidelines require the identification of the predominant vegetation formation in accordance with David Keith (2004) to determine APZ distances.

The hazardous vegetation within 140m of the proposed A1 building includes the:

- Dry sclerophyll forest vegetation located to the north beyond the sites boundary.
- Tall heath associated with the bushland located beyond Lady Penryn Drive to the west.

The remaining land, within 140m of Building A1, is not considered a bushfire threat as it consists of a managed landscape.

2.2 Effective Slope

The effective slope is assessed for a distance 100m external to a building facade.

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 (as depicted in Schedule 1) within the hazardous vegetation is:

- Level to upslope within the forest to the north.
- 11-15 degrees upslope within the tall heath to west.

Photo 1: Tall heath vegetation on uphill slopes to the west.

2.3 Bushfire Attack Assessment

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

Column 4 identifies the APZ setbacks as required under PBP 2006 (Appendix 2). Column 5 identifies the APZs provided to the building footprint and the expected radiant heat impact on the building.

Table 2.1 – Bushfire Attack Assessment

Aspect	Vegetation within 140m of development	Effective slope of land	APZ required Appendix 2 of PBP (metres)	APZ / radiant heat exposure to building (metres)	Building Construction standard
North	Forest	Level to upslope	60	60 <10kW/m^2	BAL 12.5
West	Tall heath	15^{0U}	45	31m 9.88kW/m^2	As above
South-west		11^{0U}	45	38m 8.62kW/m^2	As above
East and south	Managed land	N/A	N/A	>100m	As above

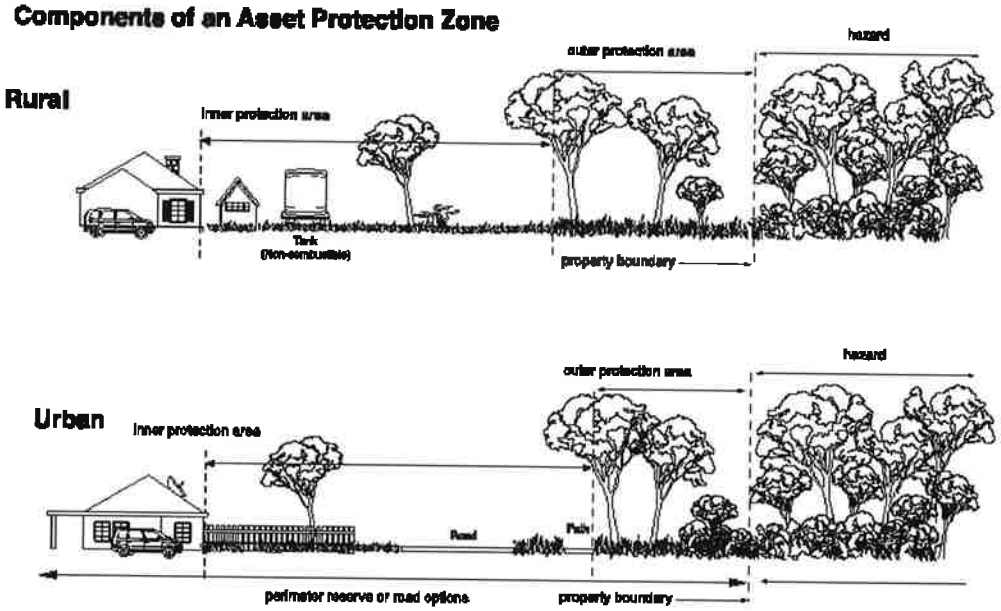
*Notes: * Slope is either 'U' meaning upslope or 'C' meaning cross slope or 'D' meaning downslope*

Note 1: A performance based assessment using Appendix B of *AS3959* was undertaken to determine the radiant heat impact on the building based on tall heath vegetation on an upslope of 11^0 & 15^0. The results of the assessment, provided within Appendix 2, were prepared using the bushfire attack assessor (BFAA) developed by *Newcastle Bushfire Consulting*

Specific Protection Issues 3

3.1 Asset protection zones

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 $10 kW/m^2$ for SFPP developments.

These ratings assist in determining the size of the APZ in compliance with Appendix 2 of *PBP* to provide the necessary defendable space between hazardous vegetation and a building. Table 3.1 outlines the proposed A1 building compliance with the performance criteria for APZs.

Table 3.1 – Performance Criteria for Asset Protection Zones (SFPP) (*PBP* guidelines pg. 19)

Performance Criteria as determined by RFS in PBP	Acceptable Solutions as required by RFS in PBP	Compliance statement with the acceptable solutions.
Radiant heat levels of greater than 10kW/m² will not be experienced by occupants or emergency services workers entering or exiting a building.	An APZ is provided in accordance with the relevant tables and figures in Appendix 2 of *PBP*. Exits are located away from the hazard side of the building. The APZ is wholly within the boundaries of the development.	The APZs provided to the west do not comply with Appendix 2 of *PBP* 2006. However as outlined in Section 2.3 above an alternative solution approach has been undertaken to confirm that radiant heat levels on the building are less than 10kW/m². As a result the proposal complies with the performance criteria. The APZ provided extends to include Lady Penrhyn Drive and its managed verge.
Applicant demonstrates that issues relating to slope are addressed: maintenance is practical, soil stability is not compromised and the potential for crown fire is negated.	Mechanisms are in place to provide for the maintenance of the APZ over the life of the development. The APZ is not located on land with a slope exceeding 18 degrees,	Complies
APZs are managed and maintained to prevent the spread of a fire towards the building.	In accordance with the requirements of *Standards for Asset Protection Zones* (RFS 2005).	Complies

3.2 Building protection

The proposed A1 building will comply with BAL 12.5 building construction standards as outlined in *AS3959 Construction of buildings in bushfire prone areas (2009)* with additional construction requirements as listed within Section A3.7 of Addendum Appendix 3 *PBP*.

3.3 Hazard management

As per previous consent conditions the owner of the lot will be required to manage the entire property as an inner protection area in accordance with RFS guidelines *Standards for Asset Protection Zones* (RFS, 2005) with landscaping to comply with Appendix 5 of *PBP*.

3.4 Access for firefighting operations

There are no changes proposed to the existing approved (and constructed) access design.

3.5 Water supplies

Fire hydrants have been installed and are not located in the road carriageway.

3.6 Gas

Table 3.2 outlines the required performance criteria for the proposals gas supply.

Table 3.2 – Performance Criteria for Gas Supplies

Performance criteria	Acceptable Solutions	Complies
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 and located on the non-hazard side of the development. If gas cylinders are to be kept close to the building the release valves must be directed away from the building and away from any combustible material, so that they do not act as a catalyst to combustion. . Polymer sheathed flexible gas supply lines to gas meters adjacent to buildings are not to be used	Complies - can be made a condition of consent.

3.7 Emergency and evacuation planning

Table 3.3 outlines the required performance criteria for the proposals emergency procedures.

Table 3.3 – Performance Criteria for Emergency and Evacuation Planning

Performance criteria	Acceptable Solutions	Complies
An Emergency and Evacuation Management Plan is approved by the relevant fire authority for the area.	An emergency / evacuation plan is prepared consistent with the RFS Guidelines for the Preparation of Emergency / Evacuation Plan. *Note: The applicant should provide a copy of the above document to the local Bush Fire Management Committee for their information prior to the occupation of any accommodation of a SFPP.*	Complies - can be made a condition of consent. (refer Note 1)
Suitable management arrangements are established for consultation and implementation of the emergency and evacuation plan.	An Emergency Planning Committee is established to consult with staff in developing and implementing and Emergency Procedures Manual. Detailed plans of all Emergency Assembly Areas including on site and off site arrangements as stated within AS3745 are clearly displayed, and an annual trial emergency evacuation is conducted.	Complies - can be made a condition of consent.

Note 1: A bushfire emergency evacuation plan was prepared by this firm in October 2014. This plan outlines the evacuation triggers and procedures for either sheltering in place or evacuation off site. It is recommended that the evacuation plan is updated to reflect the amended development design.

Conclusion & Recommendations 4

4.1 Conclusion

This bushfire protection assessment report has been prepared in support of a Section 4.55 application for the proposed amendments to the A1 building footprint.

The assessment found that bushfire can potentially affect the proposed building from the existing tall heath vegetation located beyond Lady Penrhyn Drive to the west and the forest vegetation located to the north resulting in possible ember and radiant heat attack.

The bushfire risk posed to the development can however be effectively mitigated as appropriate bushfire protection measures have been put in place and will be maintained in perpetuity.

The assessment has concluded that the proposed development will continue to provide compliance with *PBP* to ensure the building is not exposed to radiant heat levels of >10kW/m^2. As this proposal relies on an alternative solution (i.e. incorporation of uphill slopes of 11 – 15 degrees within the hazard vegetation), the application is required to be submitted to the NSW RFS for their general terms of approval.

The following recommendations are provided to ensure that the development is in accord or greater than the requirements of *PBP*.

4.2 Recommendations

Recommendation 1 - The development is as generally indicated on the attached Schedule 1 – Plan of Bushfire Protection Measures.

Recommendation 2 - APZs are to be provided to the proposed development as nominated in Table 2.1 and also as generally depicted in Schedule 1.

Recommendation 3 - The A1 building is to comply with BAL 12.5 as outlined within 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 *(Planning for Bush Fire Protection, 2006).*

Recommendation 4 - Roofing shall be gutterless or guttering and valleys are to be screened to prevent the build-up of flammable material. Any materials used shall have a Flammability Index of no greater than 5 when tested in accordance with Australian Standard AS1530.2-1993 'Methods for Fire Tests on Building Materials, Components and Structures - Test for Flammability of Materials'.

Recommendation 5 – Roller doors, tilt-a-doors and other such doors shall be sealed to prevent the entry of embers into the building.

Recommendation 6 – Gas supply is to comply with Section 4.2.7 of *PBP*.

Recommendation 7 – It is recommended that the existing evacuation plan is updated to be consistent with the RFS *Guidelines for the Preparation of Emergency / Evacuation Plan* and to reflect the amended development design.

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 bushfire-prone areas.*

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.

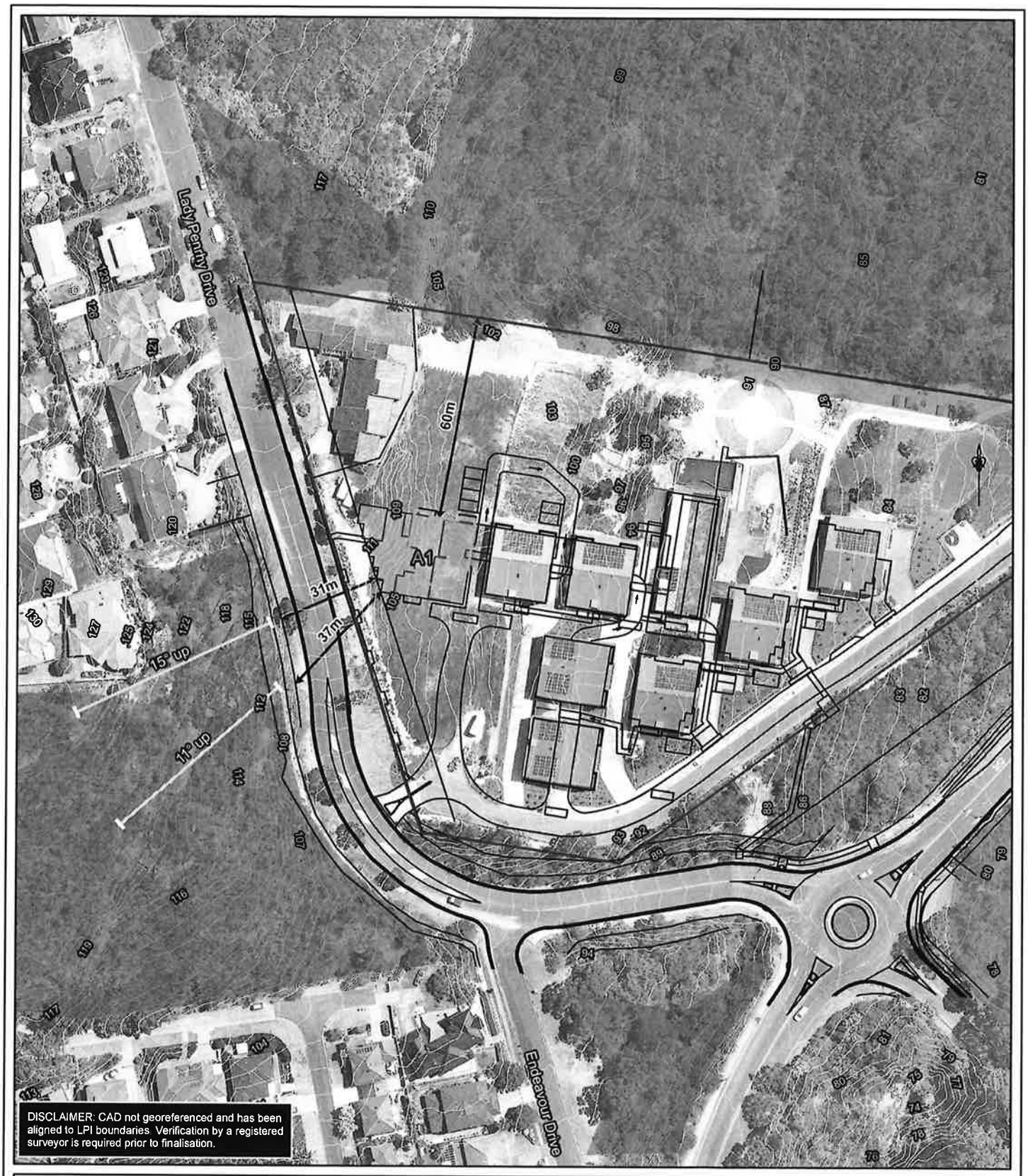
Rural Fire Service (2006) - *Planning for bushfire protection – a guide for councils, planners, fire authorities and developers.* NSW Rural Fire Service.

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.

Plan of Bushfire Protection Measures

S1



Legend

- Lot boundary (Source: LPI)
- Contours -1m (Source: LiDAR)
- Building footprint
- Previous approved building A1 footprint

Vegetation Communities

- Low heath
- Open forest
- Remnant forest with weed infected understorey
- Tall heath

Aerial source:Nearmap

PROJECT & MXD REFERENCE	DATE & ISSUE	SCALE & COORDINATE SYSTEM
LadyPenrhynDr_BeaconHill 18VM06_BF001	2/05/2019 Issue 1 BT	1:1,500 @ A4 GDA 1994 MGA Zone 56

0 25 50 m

TITLE

Schedule 1 - Bushfire Protection Measures

Document Path: N:\GIS STORAGE\N Drive\18VM06_LadyPenrhynDr_BeaconHill\MXDs\18VM06_BF001.mxd

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.

Performance based assessment

A1

NBC Bushfire Attack Assessment Report V2.1

AS3959 (2009) Appendix B - Detailed Method 2

Printed: 2/05/2019 **Assessment Date:** 8/04/2019

Site Street Address: Lady Penrhyn Drive (Building A1), Beacon Hill

Assessor: Mr Admin; admin

Local Government Area: Warringah **Alpine Area:** No

Equations Used

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

Run Description: South-west

Vegetation Information

Vegetation Type:	Scrub/Tall Heath	**Vegetation Group:**	Shrub & Heath
Vegetation Slope:	11 Degrees	**Vegetation Slope Type:**	Upslope
Surface Fuel Load(t/ha):	25	**Overall Fuel Load(t/ha):**	25

Site Information

Site Slope	0 Degrees	**Site Slope Type:**	Downslope
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	38

Fire Inputs

Veg./Flame Width(m):	100	**Flame Temp(K)**	1200

Calculation Parameters

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

Program Outputs

Category of Attack:	LOW	**Peak Elevation of Receiver(m):**	4.06
Level of Construction:	BAL 12.5	**Fire Intensity(kW/m):**	25193
Radiant Heat(kW/m2):	8.62	**Flame Angle (degrees):**	82
Flame Length(m):	8.2	**Maximum View Factor:**	0.097
Rate Of Spread (km/h):	1.95	**Inner Protection Area(m):**	38
Transmissivity:	0.799	**Outer Protection Area(m):**	0

Run Description:	West		
Vegetation Information			
Vegetation Type:	Scrub/Tall Heath	**Vegetation Group:**	Shrub & Heath
Vegetation Slope:	15 Degrees	**Vegetation Slope Type:**	Upslope
Surface Fuel Load(t/ha):	25	**Overall Fuel Load(t/ha):**	25
Site Information			
Site Slope	0 Degrees	**Site Slope Type:**	Level
Elevation of Receiver(m)	Default	**APZ/Separation(m):**	31
Fire Inputs			
Veg./Flame Width(m):	100	**Flame Temp(K)**	1200
Calculation Parameters			
Flame Emissivity:	95	**Relative Humidity(%):**	25
Heat of Combustion(kJ/kg	18600	**Ambient Temp(K):**	308
Moisture Factor:	5	**FDI:**	100
Program Outputs			
Category of Attack:	LOW	**Peak Elevation of Receiver(m):**	3.58
Level of Construction:	BAL 12.5	**Fire Intensity(kW/m):**	19117
Radiant Heat(kW/m2):	9.88	**Flame Angle (degrees):**	82
Flame Length(m):	7.22	**Maximum View Factor:**	0.109
Rate Of Spread (km/h):	1.48	**Inner Protection Area(m):**	31
Transmissivity:	0.813	**Outer Protection Area(m):**	0