Travers

bushfire & ecology

bushfire protection assessment

Proposed subdivision and mixed-use development (inclusive of seniors housing)

Chatswood Golf Leisure Resort
128 Beaconsfield Road, Chatswood

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

May 2020
(REF: A19WRL02)

Bushfire Protection Assessment

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(Inclusive of seniors housing)

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128 Beaconsfield Road, Chatswood

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File:	19WRL02

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This report has been prepared to provide advice to the client on matters pertaining to the particular and specific development proposal as advised by the client and / or their authorised representatives. This report can be used by the client only for its intended purpose and for that purpose only. Should any other use of the advice be made by any person, including the client, then this firm advises that the advice should not be relied upon. The report and its attachments should be read as a whole and no individual part of the report or its attachments should be relied upon as meaning it reflects any advice by this firm. The report does not suggest or guarantee that a bush or grass fire will not occur and or impact the development. This report advises on matters published by the NSW Rural Fire Service in their guideline *Planning for Bush Fire Protection 2019* and other advice available from that organisation.

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

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EXECUTIVE SUMMARY

Travers bushfire & ecology has been requested to undertake a bushfire protection assessment for the proposed staged subdivision and the construction of a mixed-used development comprising seniors housing and a new club house at No. 128 Beaconsfield Road, Chatswood.

The proposed seniors housing and club house (Class 9b assembly building) is categorised by the NSW Rural Fire Service (NSW RFS) as being a special fire protection purpose (SFPP) and this requires the NSW RFS to issue a bushfire safety authority (BSA) in accordance with *Planning for Bush Fire Protection 2019 (PBP).*

PBP dictates that the subsequent extent of bushfire attack that can potentially impact a SFPP building must 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.

Our assessment found that bushfire can potentially affect the proposed development from the narrow corridor of Sydney Coastal Dry Sclerophyll Forest located within the golf course to the north-east and south-east, resulting in possible ember and radiant heat attack.

In recognition of the bushfire risk posed to the site by the surrounding bushland, *Travers bushfire & ecology* propose the following combination of bushfire measures:

- Provision of APZs in compliance with the performance requirements outlined in *PBP.* This assessment involved the use of an alternative solution (i.e. NSW RFS Comprehensive Fuel Loads and reduced flame width calculations) to determine minimum APZ requirements.

- Provision of access in accordance with the performance requirements outlined in *PBP.* This involves the provision of turning heads allowing Category 1 fire tankers to enter, circulate and exit the development in a forward direction, as well as providing fire-fighting access to all aspects of the development.

- Water, electricity and gas supply in compliance with the acceptable solutions outlined in *PBP.*

- Building construction in compliance with BAL 12.5 as outlined in *Australian Standard AS3959-2018*, and *PBP*.

- Creation of 88B easements to ensure the ongoing maintenance of APZs which fall within Lot 1 and Lot 2 (residual golf course land): and

- The use of the proposed club house as a safe refuge in a bushfire event, therefore reducing the impact on the local road network in an evacuation. Whilst the club house will be located over 100m from bushfire prone vegetation, the club house will adopt a BAL 12.5 construction standard to increase the building's resilience in a bushfire event (i.e. prevent the entry of embers) and to provide a safe haven for visitors and residents.

GLOSSARY OF TERMS

APZ	asset protection zone
AS	*Australian Standard*
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
BSA	bushfire safety authority
DA	development application
EEC	endangered ecological community
EP&A Act	*Environmental Planning & Assessment Act 1979*
FDI	fire danger index
ILU	independent living units
IPA	inner protection area
LGA	local government area
m	metres
OPA	outer protection area
PCT	plant community type
PBP	*Planning for Bush Fire Protection 2019*
NCC	*National Construction Code*
NSW RFS	NSW Rural Fire Service
SFPP	special fire protection purpose
VMP	vegetation management plan

TABLE OF CONTENTS

Introduction 1

Travers bushfire & ecology has been requested to undertake a bushfire protection assessment for the proposed staged subdivision and the construction of a mixed-used development comprising seniors housing and a new club house at No. 128 Beaconsfield Road, Chatswood.

The property is located on land that is mapped by *Willoughby City Council* as being bushfire prone. This triggers a formal assessment by Council in respect of the NSW RFS policy against the provisions of *PBP.*

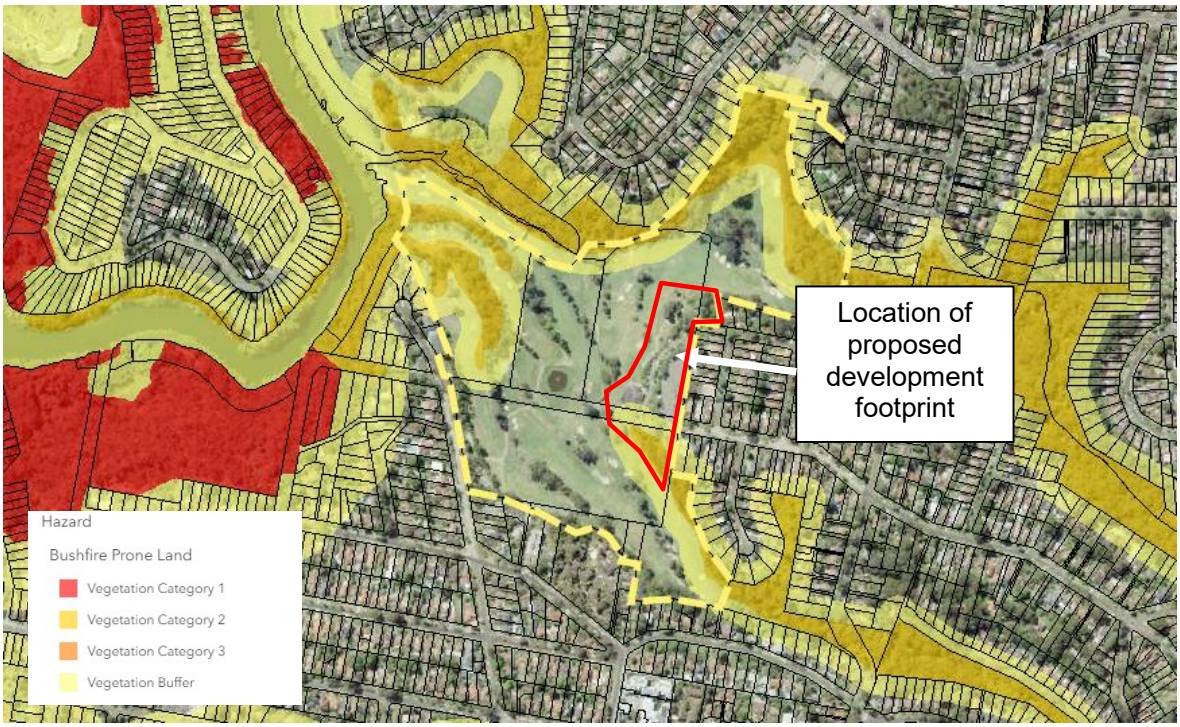


Figure 1.1 – Bushfire prone land map
(source: Planning Portal, 2019)

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 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 proposed development involves the proposed staged subdivision of existing Part Lot 163 DP752067, part Lot 1 DP651667, part Lot 1 DP1124646 and part Lot 22 DP626634 – refer Figures 1.2 & 1.3 as follows.

Stage 1 land subdivision

The initial stage 1 subdivision involves the creation of four (4) allotments (Lot 10, 11, 12 & 13) and will occur prior to construction of the Chatswood Golf & Leisure development.

- Lot 10 – This E4 zoned allotment is owned by *Watermark Chatswood Pty Ltd;*
- Lot 11 – This will be location of the new golf club house and extends into part of the future car park when completed and will be owned by Chatswood Golf Club;
- Lot 12 – This will be the location of the self-care apartments when completed and will be owned by *Watermark Chatswood Pty Ltd*; and
- Lot 13 – This is the residue land forming part of the overall golf course and will be owned by Chatswood Golf Club.

Figure 1.2 – Stage 1 subdivision plan
(source: JBW Surveyors Pty Ltd)

Stage 2 stratum subdivision

This subdivision will occur over the newly formed Lots 11 & 12 to create the following:

- Lot 21 – to encompass land with critical ownership requirements of the golf club (i.e. varying levels associated the golf club building); and
- Lot 22 – to encompass land with critical ownership requirements of the serviced self-care apartments.

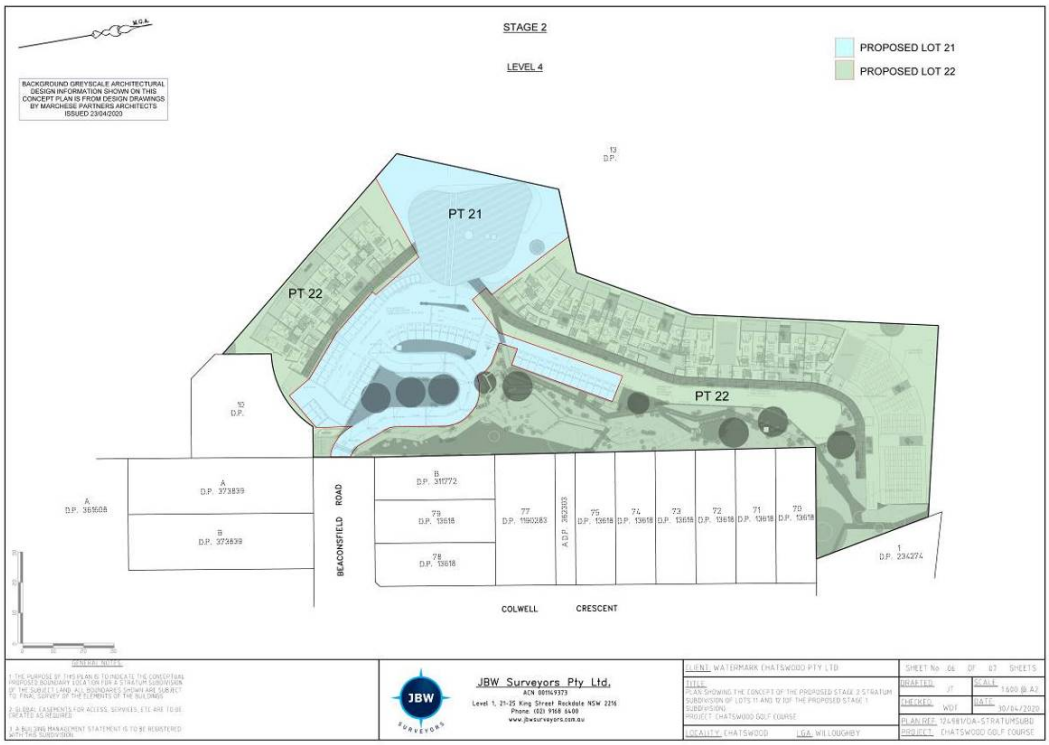


Figure 1.3 – Stage 2 stratum subdivision
(source: JBW Surveyors Pty Ltd)

The proposal will involve the construction of a mixed-used development within the newly created allotments as follows:

- Demolition of the existing club house and construction of a new four (4) storey club house inclusive of a recreational gym and swimming pool. This will primarily be used by existing golf club patrons and future independent living units (ILU) residents, although these facilities will also be available for use by the wider community.
- One-hundred and six (106) ILUs comprising of eighty-two (82) two (2) bedroom units and twenty-four (24) three (3) bedroom units within two (2) five (5) storey seniors living buildings. The building envelope has been positioned to step down in alignment with the escarpment to reflect the natural topography of the site.
- Construction of a new onsite car park with three hundred and nine (309) parking spaces in total with two (2) basement levels.

The primary access to the site is currently provided via Beaconsfield Road from the east.

Schedule 1 attached depicts the bushfire constraints and the APZs provided for the proposed built assets on site.

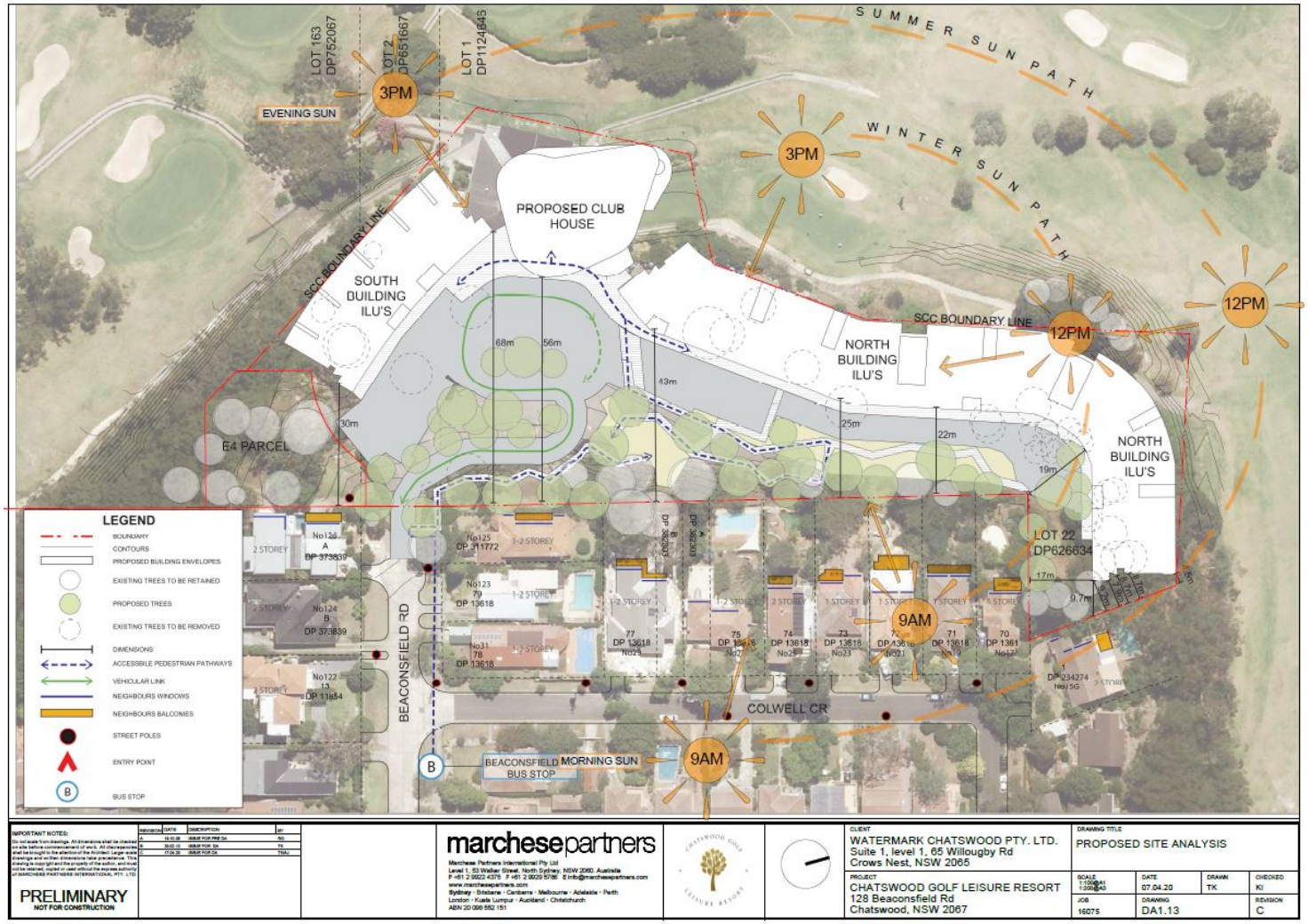


Figure 1.4 – Site Analysis Plan
(Source: *Marchese Partners*, dated 07/04/2020)

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:

- Subdivision plans prepared by *JBW Surveyors Pty Ltd*, dated 30/4/2020
- Site and elevation plans – prepared by *Marchese Partners*, Job number 16075, dated 17.04.2020.
- Biodiversity Development Assessment Report prepared by *Travers bushfire & ecology, April 2020*
- Arboricultural Impact Assessment Report prepared by *Travers bushfire & ecology, April 2020*
- Vegetation Management Plan prepared by *Travers bushfire & ecology, April 2020.*
- Traffic Impact Assessment (ref: 19.484r01v01) prepared by *Traffix Traffic & Transport Planners,* dated December 2019
- Landscape Masterplan prepared by *Somewhere Landscape Architects*, dated 30.04.2020
- Local environmental plans
- *NearMap* aerial photography
- topographical maps DLPI of NSW 1:25,000
- Australian Standard 3959 *Construction of buildings in bushfire-prone areas*
- *Planning for Bush Fire Protection 2019 (NSW RFS) (PBP)*

1.4 Site description

Chatswood Golf Course has an overall site area of approximately 18ha and is located east of Mooney Street and west of Beaconsfield Road, within the local government area (LGA) of Willoughby. The site consists of an 18-hole golf course, club house building, maintenance shed and associated car parking (refer Figure 1.5).

The site is bound by low density residential development to the south, east and west and the Lane Cove River in the north. The vegetation impacting the development site (proposed Lot 1) is restricted to two (2) parcels of remnant / narrow width vegetation located within the golf course and fronting residential allotments to the north-east and south-east.

Figure 1.5 – Aerial appraisal
(source: Marchese Partners)

1.5 Legislation and planning instruments

Is the site mapped as bushfire prone?	Yes
Proposed development type	Proposed subdivision and SFPP development
Is the development considered integrated for the purposes of Section 100B of the *Rural Fires Act 1997?*	Yes – referral to and approval by the NSW RFS is required for the issue of a bushfire safety authority (BSA)
Is the proposal located in an Urban Release Area as defined under Clause 273 of the EP&A Regulations?	No
Zoning	RE2 Private Recreation and E4 Environmental Living (refer Figure 1.6)
Significant environmental features	Yes – the proposed development (including APZs) will involve the removal of native vegetation. A Biodiversity Development Assessment, Arborist report and Vegetation Management Plan have been prepared by this firm to address the environmental impacts on the site.
Details of any Aboriginal heritage	No
Does the proposal rely on an alternative solution?	Yes – Comprehensive fuel loads and reduced flame width calculations.

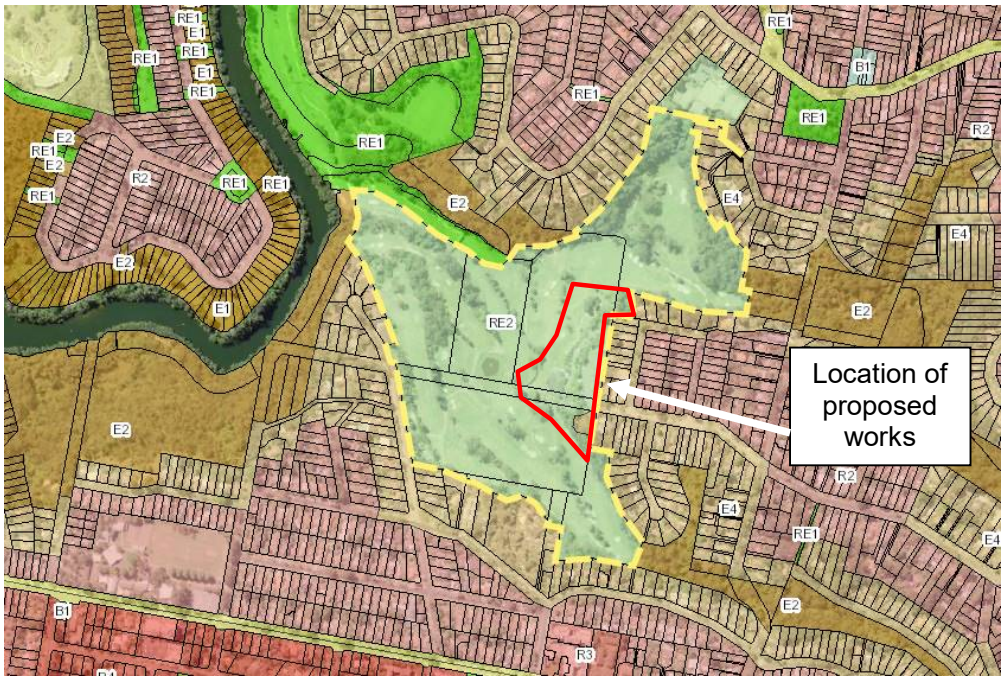


Figure 1.6 – Zoning map
(source: Planning Portal, 2019)

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) if using the simplified acceptable solutions in *PBP 2019,* or alternatively, the vegetation class if adopting the NSW RFS 'Comprehensive Vegetation Fuel Loads' (as allowable when undertaking an assessment under Method 2 of *AS3959*). The hazardous vegetation is calculated for a distance of at least 140m from a proposed building envelope.

Extensive vegetation survey of the development site has been undertaken by *Travers bushfire & ecology* with the preparation of a Biodiversity Development Assessment Report for the development application (DA). The vegetation communities are depicted in Figure 2.1 with the vegetation conversions identified in the following Table 2.1.

Table 2.1 – Vegetation

Vegetation community	Vegetation formation	Vegetation classification	Comprehensive fuel loads (t/ha)	Acceptable solution fuel loads (t/ha) *(PBP 2019)*
Smooth barked Apple-Coastal Banksia / Chees tree Open Forest (PCT 1778) – refer Figure 2.1	Dry Sclerophyll Forest (shrubby)	Sydney Coastal Dry Sclerophyll Forest	21.3/27.3	22/36.1

The following assessment has adopted the comprehensive fuel loads identified in Column 4 above and therefore has adopted an alternative solution approach.

Figure 2.1 – Vegetation Communities
(source: Travers bushfire & ecology, 2020)

2.2 Effective slope

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

The effective slope within the hazardous Sydney Coastal Dry Sclerophyll Forest is 0-5º cross slope to the south-east and level to upslope within the remnant forest to the north-east.

2.3 Bushfire attack assessment

The following assessment has determined the APZ and bushfire attack levels (BAL) levels via the following approaches:

- Table A1.12.1 of *PBP 2019*, and
- Appendix B Method 2 (alternative solution) of *AS3959 Construction of buildings in bushfire prone areas* (2009).

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 2.2 provides a summary of the bushfire attack assessment based on special fire protection purpose (SFPP) development and the methodologies identified above.

Table 2.2 – Bushfire attack assessment

Aspect	Vegetation formation within 140m of development	Effective slope of land	Assessment method used	Minimum APZ required equivalent to 10kw/m^2 (metres)	APZ provided (metres)	BAL construction standard
Clubhouse (Class 9b building)						
North, south, east & west	Managed land	Level	Deemed to satisfy	N/A	>100	BAL 12.5 (refer Note 1)
ILU (SFPP)						
North, south, east & west	Managed land	0-5 ^{0D}	Deemed to satisfy	N/A	>100	BAL 12.5
North-east	Remnant Forest (refer Note 2)	Level to upslope	Deemed to satisfy	38	38	
South-east	Sydney Coastal DSF FLAME WIDTH 20m	0-5 ^{0C}	Alternative solution Method 2 AS3959	Refer Note 3	41	
	Sydney Coastal DSF FLAME WIDTH 40m				69	

Notes: * Slope is either ‘u’ meaning upslope or ‘c’ meaning cross slope or ‘d’ meaning downslope

Note 1: Following the implementation of asset protection zones as per the recommendations of this report the proposed club house will be located over 100m from hazardous vegetation and therefore does not require compliance with *AS3959 (2009).* However, in this circumstance it is recommended that the club house is used as a safe refuge in a bushfire event, therefore reducing the impact on the local road network in an evacuation. In order to provide for a safe refuge, the club house should adopt a BAL 12.5 construction standard to increase the building's resilience in a bushfire event (i.e. prevent the entry of embers) and to provide a safe haven for visitors and residents.

Note 2- *PBP* describes remnant vegetation as a parcel of vegetation with a size of less than 1ha or a shape that provides a potential fire run directly towards a building not exceeding 50m. The vegetation to the north-east exhibits these qualities and therefore the threat posed is considered low and APZ setbacks for this aspect are the same as for the rainforest category outlined in *PBP*.

Note 3 - A performance-based assessment using Appendix B of *AS3959* was undertaken to determine the required APZ (equivalent to <10kW/m2) based on Sydney Coastal DSF (*PBP* fuel load 21.3/17.3/ha) on slopes of 5 degrees (cross slope) and flame width of 20m and 40m. The results of the assessment were prepared using the bushfire attack assessor (BFAA) developed by *Flamesol* and are included as Attachment 1.

The vegetation to the south-east is narrow in width and occurs within the golf course land and to the rear of the adjoining residential properties.

Specific Protection Issues 3

3.1 Asset protection zones

Table 3.1 outlines the proposal's compliance with the performance criteria for APZs.

Table 3.1 – Performance criteria for asset protection zones

Performance criteria		Acceptable solution	Acceptable solution	Performance solution	Comment
Asset Protection Zones (APZS)	Radiant heat levels of greater than 10kW/m² (calculated at 1200K) will not be experienced on any part of the building.	The building is provided with an APZ in accordance with table A1.12.1 of *PBP 2019.*	☐	☑	Complies with the performance requirements – Refer Section 2.3. The ILUs and club house are not exposed to radiant heat thresholds >10kWm^2.
	APZ maintenance is practical, soil stability is not compromised and the potential for crown fires is minimised.	APZs are located on lands with a slope of less than 18°.	☐	☑	Complies with the performance requirements. A portion of the APZ occurs on slopes exceeding 18º (southern portion of site). Refer Note 1 below for more detail.
	APZs are managed and maintained to prevent the spread of a fire towards the building.	The APZ is managed in accordance with the requirements of Appendix 4 of *PBP*, and is wholly within the boundaries of the development site.	☑	☐	Yes – can be made a condition of consent. A portion of the APZ extends within the E4 zoned land and into the adjoining proposed Lot 2. An 88B instrument will apply to the entire APZ area to ensure ongoing maintenance.
	The APZ is provided in perpetuity.	Other structures located within the APZ need to be located further than 6m from the refuge building.	☑	☐	Yes – can be made a condition of consent

Performance criteria		Acceptable solution	Acceptable solution	Performance solution	Comment
Landscaping	Landscaping is designed and managed to minimise flame contact and radiant heat to buildings, and the potential for wind-driven embers to cause ignitions.	Landscaping is in accordance with Appendix 4.	☑	☐	Complies
		Fencing is constructed in accordance with section 7.6 (refer Note 2 below).	☑	☐	To be made a condition of consent.
Note 1: The APZ to the south-east of the independent living units does encroach upon land with slopes >18º. In accordance with the acceptable solutions under *PBP,* APZs are to be avoided where slopes are greater than 18º due to potential problems and practicality associated with maintenance and the potential for crown fires to develop. The impact of crown fires developing and impacting the development is negated by the angle of the slope and potential fire run which will direct fire intensity to the north-east and away from the development. In terms of the practicality and soil stability, this is negated by some degree by the rock benches which provide a natural terrace therefore preventing soil erosion. A geo-technical opinion has been provided by JKGeotechnics (refer Appendix 3). Generally, maintenance of the APZ within the steep land (>18º) will be undertaken using hand machinery only. Tree removal on slopes of >18º is needed in some areas (to ensure a canopy separation of 2-5m) however, pruning of trees will also occur where applicable to maintain canopy separation.					
Note 2 - Section 7.6 of *PBP* states that all fences in bush fire prone areas should be made of either hardwood or non-combustible material. However, in circumstances where the fence is within 6m of a building, or in areas of BAL 29 or greater, they should be made of non-combustible material only.					

3.2 Building protection

The APZ (building setback), as depicted in Schedule 1, is based on ensuring the building (and its occupants) are not exposed to a radiant heat level of >10kW/m^2.

All proposed ILUs and the club house are to be constructed to a BAL 12.5 rating in accordance with *Australian Standards AS3959 (2018) Construction of buildings in bushfire-prone areas,* with additional construction requirements as outlined within Section 7.5 of *PBP.*

3.3 Hazard management

APZs are required to be managed as an IPA in accordance with NSW RFS guidelines *Standards for Asset Protection Zones* (RFS, 2005), with landscaping design to comply with Appendix 4 of *PBP*. Appendix 2 provides maintenance advice for vegetation within the APZ.

A Vegetation Management Plan and an Arborist Report have been prepared by this firm and form part of the documentation in the DA submission. These documents provide detail on the tree retention and removal requirements, as well as guidelines on ongoing maintenance of the APZ.

In addition, a landscape plan has been prepared by *Somewhere Landscape Architects* which depicts a pedestrian maintenance path within the steep land to the south. This will aid in the ongoing APZ maintenance requirements and provide access for fire-fighting operations. *Travers bushfire & ecology* can confirm that the landscape has been prepared in compliance with Appendix 4 of *PBP*.

An 88b instrument is to apply to all APZ areas to ensure their ongoing maintenance. This will include Lot 1 and sections of the APZ which extend within the adjoining proposed Lot 2.

The Residential E4 site located at the southern side of the entrance to the Golf Course, off Beaconsfield Road, is not included in the site and does not permit Seniors Living Development. However, this area is required to be maintained as an APZ (until such time as a DA is lodged allowing the restriction to be removed).

3.4 Access for fire-fighting operations

The intent of measures required by the NSW RFS for internal roads is "*to provide safe operational access for emergency services personnel in suppressing a bush fire, while residents are accessing or egressing an area*".

The primary access point to the development is via the existing Beaconsfield Road which provides an egress route to the east, away from the direct threat of bushfire. It is understood that the existing cul-de-sac turning area at the western end of Beaconsfield Road is currently undersized and the requirement to provide an adequate turning area at the end of Beaconsfield Rd cannot be achieved at this stage.

The proposed internal road will consist of a 5.9m wide driveway which will provide access to the car parking areas (i.e. minimum aisle width of 5.8m). The traffic report states that a fire truck can enter, circulate and exit the development (ground floor only) in a forward direction, as per the following swept path analysis based on an 8.8m long medium ridged vehicle (noting that the length of a Category 1 fire vehicle is 7.8m). In addition, a pedestrian maintenance path has been provided to bushland areas to provide pedestrian access for firefighting operations. A medium ridged vehicle (8.8m long) is also capable of undertaking a three point manoeuvre as depicted in Figure 3.3 in the northern portion of the site.

Figure 3.1 – Swept path analysis – Level 3 (site entry/exit)

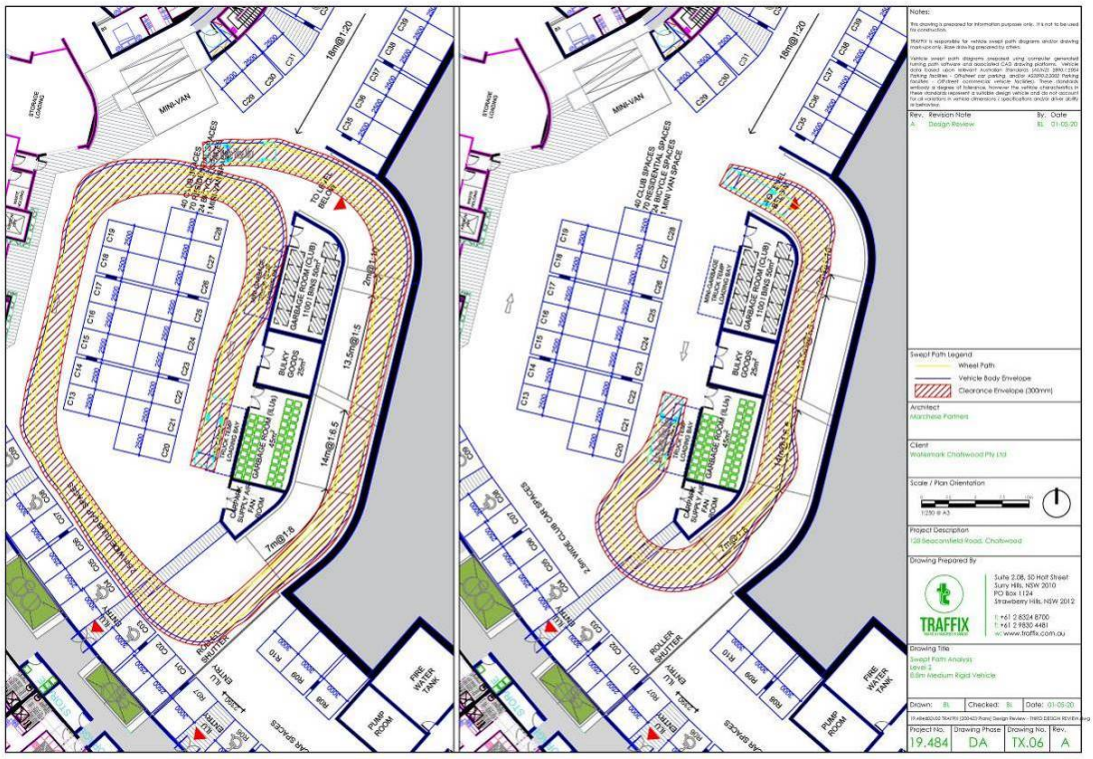


Figure 3.2 – Swept path analysis (Level 2)

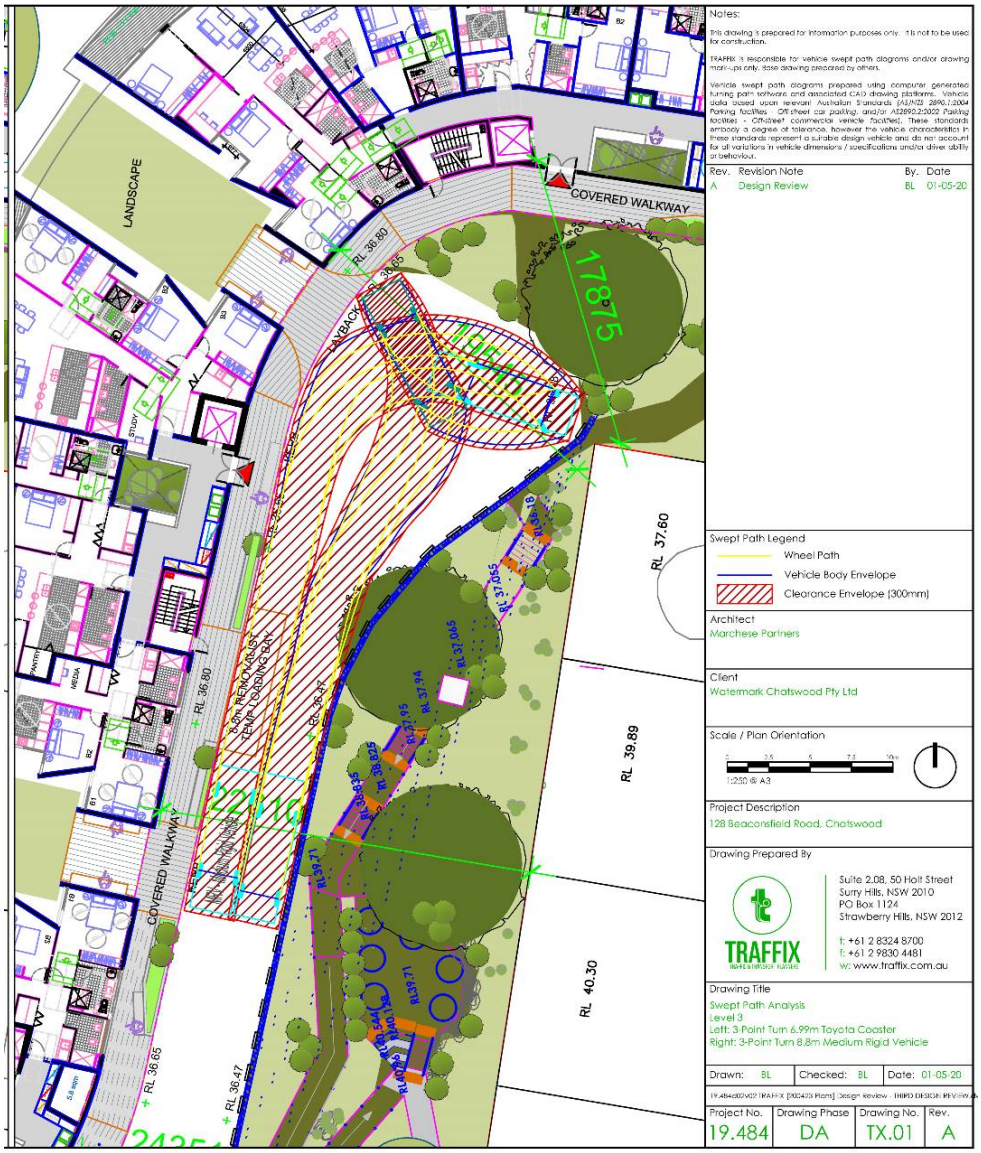


Figure 3.3 – Swept path analysis (northern portion of site)

Table 3.2 below outlines the proposal's compliance with the performance criteria for internal roads.

Table 3.2 – Performance criteria for internal roads

Performance criteria		Acceptable solution	Acceptable solution	Performance solution	Comment
FIREFIGHTING VEHICLES	Fire-fighting vehicles are provided with safe, all-weather access to structures and hazard vegetation.	SFPP access roads are two-wheel drive, all-weather roads.	☑	☐	Complies. Can be a condition of consent.
		Access is provided to all structures.	☑	☐	Complies. The proposed internal access road runs parallel and adjacent to the eastern site boundary to provide access to all building.
		Traffic management devices are constructed to not prohibit access by emergency services vehicles.	☑	☐	Complies. Can be a condition of consent.
		Access roads must provide suitable turning areas in accordance with Appendix 3.	☐	☑	Turning heads have been designed to allow for a three (3) point turn (see Figure 3.1-3.3 for swept path analysis).
		One way only public access roads are no less than 3.5m wide and have designated parking bays with hydrants located outside of these areas to ensure accessibility to reticulated water for fire suppression.	☑	☐	N/A. Roads are two way.
	The capacity of access roads is adequate for firefighting vehicles.	The capacity of road surfaces and any bridges / causeways are sufficient to carry fully loaded fire-fighting vehicles (up to 23 tonnes); bridges and causeways are to clearly indicate load rating.	☑	☐	Complies. Can be a condition of consent.
	There is appropriate access to water supply	Hydrants are located outside of parking reserves and road carriageways to ensure accessibility to reticulated water for fire suppression.	☑	☐	Complies. Can be a condition of consent.
		Hydrants are provided in accordance with *AS 2419.1:2005.*	☑	☐	Complies. Can be a condition of consent.

Performance criteria		Acceptable solution	Acceptable solution	Performance solution	Comment
		There is suitable access for a Category 1 fire appliance to within 4m of the static water supply where no reticulated supply is available.			N/A. Reticulated water is provided.
PERIMETER ROADS	Perimeter access roads are designed to allow safe access and egress for medium rigid fire-fighting vehicles while occupants are evacuating as well as providing a safe operational environment for emergency service personnel during fire-fighting and emergency management on the interface.	There are two-way sealed roads.	☐	☐	There are no perimeter roads associated with this development. Access to bushland areas will be provided via pedestrian pathways extending from the internal road network.
		8m carriageway width kerb to kerb.			
		Parking is provided outside of the carriageway width.			
		Hydrants are to be located clear of parking areas.			
		There are through roads, and these are linked to the internal road system at an interval of no greater than 500m.			
		Curves of roads have a minimum inner radius of 6m.			
		The maximum grade road is 15° and average grade is 10°.			
		The road crossfall does not exceed 3º.			
		A minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.			
NON-PERIMETER ROADS	Non-perimeter access roads are designed to allow safe access and egress for medium rigid fire-fighting vehicles while occupants are evacuating.	Minimum 5.5m width kerb to kerb.	☑	☐	Complies. Driveway widths are between 5.8-5.9m.
		Parking is provided outside of the carriageway width.	☑	☐	Complies.
		Hydrants are located clear of parking areas.	☑	☐	Complies. Can be a condition of consent
		There are through roads, and these are linked to the internal road system at an interval of no greater than 500m.	☐	☑	Based on site constraints, a through road cannot be provided. Beaconsfield Road is located over 50m from the hazardous vegetation, therefore providing a safe access / egress for fire fighting vehicles in compliance with the performance criteria.
		Curves of roads have a minimum inner radius of 6m.	☑	☐	Can be a condition of consent
		The maximum grade road is 15° and average grade is 10°.	☑	☐	Complies
		The road crossfall does not exceed 3°.	☑	☐	Complies

Performance criteria		Acceptable solution	Acceptable solution	Performance solution	Comment
		A minimum vertical clearance of 4m to any overhanging obstructions, including tree branches, is provided.	☑	☐	Complies. Can be a condition of consent. This is to apply to the porte cochere as well.

3.5 Water supplies

Table 3.3 outlines the proposal's compliance with the performance criteria for reticulated water supply.

Table 3.3 – Performance criteria for reticulated water supplies

Performance criteria	Acceptable solutions	Acceptable solution	Performance solution	Comment
An adequate water supply for firefighting purposes is installed and maintained.	Reticulated water is to be provided to the development, where available.	☑	☐	A reticulated water supply will be provided.
Water supplies are located at regular intervals. The water supply is accessible and reliable for fire-fighting operations.	Fire hydrant spacing, design and sizing comply with the *Australian Standard AS2419.1:2005.*	☑	☐	Can be a condition of consent.
	Hydrants are not located within any road carriageway.	☑	☐	Can be a condition of consent.
	Reticulated water supply to SFPPs uses a ring main system for areas with perimeter roads.	☑	☐	N/A
Flows and pressure are appropriate.	Fire hydrant flows and pressures comply with *AS2419:2005.*	☑	☐	Can be a condition of consent.
The integrity of the water supply is maintained.	All above-ground water service pipes external to the building are metal, including and up to any taps.	☑	☐	Can be a condition of consent.

3.6 Gas

Table 3.4 outlines the required performance criteria for the proposal's gas supply.

Table 3.4 – Performance criteria for gas supplies

Performance criteria	Acceptable solutions	Acceptable solution	Performance solution	Complies
Location and design of gas services will not lead to ignition of surrounding bushland or the fabric of buildings.	Reticulated or bottled gas is installed and maintained in accordance with *AS/NZS 1596:2014* and the requirements of relevant authorities, and metal piping is used.	☑	☐	Can be a condition of consent
	All fixed gas cylinders are kept clear of all flammable materials to a distance of 10m and shielded on the hazard side	☑	☐	Can be a condition of consent
	Connections to and from gas cylinders are metal.	☑	☐	Can be a condition of consent
	If gas cylinders need to be kept close to the building, safety valves are directed away from	☑	☐	Can be a condition of consent

Performance criteria	Acceptable solutions	Acceptable solution	Performance solution	Complies
	the building and at least 2m away from any combustible material, so they do not act as a catalyst to combustion.			
	Polymer-sheathed flexible gas supply lines to gas meters adjacent to buildings are not used.	☑	☐	Can be a condition of consent
	Above-ground gas service pipes external to the building are metal, including and up to any outlets.	☑	☐	Can be a condition of consent

3.7 Emergency and evacuation planning

A bushfire emergency evacuation plan has been prepared and forms part of the DA submission. The evacuation plan has been prepared in compliance with the acceptable solutions outlined in the Table 1 below. The proposal includes the provision of a safe on-site refuge within the club house. Although the club house is located over 100m from the hazardous vegetation, it will be constructed to a BAL 12.5 standard to improve the resilience of the building and to provide for a safe assembly point for residents and visitors.

Table 3.5 outlines the required performance criteria for the proposal's emergency procedures

Table 3.5 – Performance criteria for emergency and evacuation planning

Performance criteria		Acceptable solution	Acceptable solution	Performance solution	Comment
EMERGENCY MANAGEMENT	A bush fire emergency and evacuation management plan is prepared.	Bush fire emergency management and evacuation plan is prepared consistent with the: • The NSW RFS document: *A Guide to Developing a Bush Fire Emergency Management and Evacuation Plan* • *Australian Standard AS 3745:2010 Planning for emergencies in facilities.*	☑	☐	A bushfire emergency evacuation plan has been prepared for NSW RFS comment.
		The bush fire emergency management and evacuation plan should include planning for the early relocation of occupants.	☑	☐	
	Note: A copy of the bush fire emergency management and evacuation plan should be provided to the Local Emergency Management Committee for its information prior to occupation of the development.				
	Appropriate and adequate management arrangements are established	An Emergency Planning Committee is established to consult with residents (and their families in the case of aged care accommodation and schools) and	☑	☐	Can be a condition of consent

Performance criteria		Acceptable solution	Acceptable solution	Performance solution	Comment
	for consultation and implementation of the bushfire emergency and evacuation management plan.	staff in developing and implementing an Emergency Procedures Manual			
		Detailed plans of all emergency assembly areas including 'on-site' and 'off-site' arrangements as stated in *AS 3745:2020* are clearly displayed, and an annual emergency evacuation is conducted.	☑	☐	Can be a condition of consent

3.8 Multi-storey residential development

Buildings exceeding three (3) storeys in height are considered to be multi-storey buildings in the context of *PBP*. Multi-storey buildings are required to comply with the additional considerations outlined in Table 3.8.

Table 3.8 – Additional considerations for multi-storey development

Issue	Specific concern	Technical Considerations	Proposal's compliance
Population	Impact on existing community and infrastructure.	What capacity does the existing infrastructure have to allow evacuation of existing and proposed residents in the event of a bush fire?	Traffic studies have been undertaken by *Traffix* to determine the capacity of the existing Beaconsfield Road to support the proposed population. The proposal allows for three hundred and nine (309) car parking spaces in total (148 visitor parking for clubhouse, 159 ILU spaces, 1 ambulance and 1 minivan).This is an increase from the existing one-hundred (100) informal car spaces. Whist this report did not examine the impact of an 'evacuation' event the study did show an additional sixty-five (65) vehicles trips per hour during the PM peak which would result in a minimal increase to the average delay at the key intersections. As outlined in the bushfire evacuation plan, a safe refuge / on-site assembly point will be provided within the proposed club house. This will reduce the overall numbers of people evacuating in a bushfire event and will therefore limit the impact on the existing community. It will also provide a safe haven for existing golf club members in a compliant bushfire managed zone and within a building designed to BAL 12.5 construction standard.
Location of building	Locating on ridge tops emphasises the risk of convective plume interaction and wind related impacts	• Can the building be located away from ridge tops and areas that have a reduced bush fire exposure? • If unavoidable, what is the impact on the risk to the building? • Is this risk appropriate for the building and occupant numbers?	The golf club and both ILU building blocks are located adjacent to level and cross slope topography within close proximity to the golf fairways and managed urban land. The buildings will be exposed to a radiant heat flux of less than $10Wm^2$. This risk is considered low and is appropriate for the aged care residents.

Issue	Specific concern	Technical Considerations	Proposal's compliance
Design fire	Different elements of the flame could have different impacts on different levels of the building. The whole building could be impacted by ember attack and multiple floors could be alight simultaneously	• What are the flame dimensions, including the flame angle? • Where is the hottest part of the flame located? How would this impact on the proposed buildings? • How would warning systems in the building cope with this?	The proposal is provided with adequate APZs to avoid flame contact to the building and to limit radiant heat levels to <10kW/m^2. The building does have the potential to be exposed to ember attack, however this will be mitigated by building construction in compliance with BAL 12.5. An internal warning system can be implemented by management and will form part of the evacuation procedures.
Egress	Elevations exposed to bush fire risk	How does the emergency evacuation procedure take account of the location of bush fire prone vegetation?	Evacuation (if required) will occur to the east (via Beaconsfield Road). This road is located over 50m from remnant vegetation in the south and over 180m from remnant vegetation to the north, therefore providing for a safe evacuation route.
Building construction	Performance of the building façade in a bush fire scenario. Balconies may contain external features which could ignite and contribute to building ignition and fuel loads	• What wall and cladding materials are proposed and what is proposed for the openings / penetrations (windows and doors)? • How does the proposed building construction deal with fire spread from the vegetation to the inside of the building? • Is compliance with AS 3959 sufficient to ensure that the bush fire risk is mitigated? • Is this appropriate for the design fire scenario? • Are there balconies proposed? • What may be stored on the balconies? • Can there be restrictions on what is stored on the balconies due to fire risk?	Adequate APZs will be provided to avoid flame contact to the building and landscaping will be designed to prevent fire spread within the APZ. The proposed ILUs and club house will be provided with APZs designed to comply with BAL 12.5 construction. The expected radiant heat impact from the remnant vegetation to the ILUs is 9.74 kW/m^2 and less than 7 kW/m^2 for the club house. Construction in accordance with BAL 12.5 *(AS3959)* is sufficient in this situation based on the bushfire risk. Balconies are proposed on the western building facades and away from the bushfire hazard which is located in the south-east and north-east. The building does have the potential to be exposed to ember attack and therefore landscaping and placement of combustible materials on external decks will need careful control by management.

Issue	Specific concern	Technical Considerations	Proposal's compliance
Car parking	Lower storey car park could be subject to ember attack and high radiant heat loads.	• Is the warning and suppression system designed to take account of bushfire impact? • Where are exits located? Are they guiding occupants away from the car park?	The majority of the car parking is provided on the two (2) basement levels which will be located underground. Level 3 car parking is on ground level with the hazard vegetation located approximately 30m away from the car park / egress point. In the event of an offsite evacuation, occupants can progress via the existing road network in an easterly direction. A safe refuge / assembly point has also been provided on site approximately 100m from the bushfire hazard. This safe refuge is located within the central portion of the site (proposed Lot 1) and away from the direct threat of bushfire.
Other engineering considerations	Access for fire fighters may be restricted or challenging. Risk implications of floor to floor fire spread.	• What would this mean for fire suppression? • How would warning and suppression systems take account of this? • What would this mean for evacuation?	Access to the buildings and bushland vegetation for fire-fighting operations is available via the proposed internal road network and pedestrian pathways within the site.

Conclusion & Recommendations

4

4.1 Conclusion

Travers bushfire & ecology has been requested to undertake a bushfire protection assessment for the proposed staged subdivision and the construction of a mixed used development comprising seniors housing and new club house at No. 128 Beaconsfield Road, Chatswood.

Our assessment found that bushfire can potentially affect the proposed development from the narrow corridor of Sydney Coastal Dry Sclerophyll Forest located within the golf course to the north-east and south-east, resulting in possible ember and radiant heat attack.

In recognition of the bushfire risk posed to the site by the surrounding bushland, *Travers bushfire & ecology* propose the following combination of bushfire measures:

- Provision of APZs in compliance with the performance requirements outlined in *PBP.* This assessment involved the use of an alternative solution (i.e. NSW RFS Comprehensive Fuel Loads and reduced flame width calculations) to determine minimum APZ requirements.

- Provision of access in accordance with the performance requirements outlined in *PBP.* This involves the provision of turning heads allowing Category 1 fire tankers to enter, circulate and exit the development in a forward direction.

- Water, electricity and gas supply in compliance with the acceptable solutions outlined in *PBP.*

- Building construction in compliance with BAL 12.5 as outlined in *AS3959-2018*, and *PBP.*

- Creation of 88B easements to ensure the ongoing maintenance of APZs which fall within Lot 1 and Lot 2 (residual golf course land).

- The use of the proposed club house as a safe refuge in a bushfire event, therefore reducing the impact on the local road network in an evacuation. Whilst the club house will be located over 100m from bushfire prone vegetation, the club house will adopt a BAL 12.5 construction standard to increase the building's resilience in a bushfire event (i.e. prevent the entry of embers) and to provide a safe haven for visitors and residents.

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

4.2 Recommendations

Recommendation 1 – APZs are to be provided to the proposed development as outlined in Table 2.2 and as depicted in Schedule 1.

Recommendation 2 – Fuel management within the APZs is to be maintained as an IPA by regular maintenance of the landscaped areas in accordance with the guidelines provided in Appendix 1, and / or as generally advised by the NSW RFS in their publications.

Recommendation 3 – At the issue of subdivision certificate, a suitably worded instrument shall be created over the newly formed Lot 1 & part of Lot 2 pursuant to section 88 of the *Conveyancing Act 1919* which:

- Ensures that the APZ as shown on the plan titled Schedule 1 – Bushfire Protection Measures prepared by *Travers bushfire & ecology* referenced 19WRL02_BF001 dated 17 February 2020 is managed as an IPA as outlined within Section 4.1.3 and Appendix 4 of *PBP* and the NSW Rural Fire Service document *'Standards for asset protection zones'.*

Recommendation 4 – Building construction standards are to be applied to all proposed buildings (i.e. club house and ILUs) in accordance with BAL 12.5 as outlined in *AS3959 Construction of buildings in bushfire prone areas (2018),* with additional construction requirements as outlined within Section 7.5 of *PBP*.

Recommendation 5 – Water, gas and electricity supply is to comply with the acceptable solutions outlined in Table 6.8c of *PBP*.

Recommendation 6 – Access is to comply with the performance criteria outlined Section 6.8b of *PBP*. Turning heads are to be designed in accordance with Figure 3.1 – 3.3 of this report.

Recommendation 7 – An emergency / evacuation plan is to be prepared consistent with the *RFS Guidelines for the Preparation of Emergency / Evacuation Plan* prior to building occupation.

Recommendation 8 – Fencing is to comply with Section 7.6 of *PBP*. All fences in bushfire prone areas should be made of either hardwood or non-combustible material. However, in circumstances where the fence is within 6m of a building or in areas of BAL 29 or greater, they should be made of non-combustible material only.

REFERENCES

Australian Building Codes Board (2019) – *National Construction Code*, 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*

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 (2018) – *Pre-release Planning for bushfire protection – a guide for councils, planners, fire authorities and developers*. NSW Rural Fire Service

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

- Subject site
- Contours - 1m(source: LiDAR)
- Edge of vegetation
- Asset Protection Zone (APZ)
- Building footprint

Aerial source: Nearmap

PROJECT & MXD REFERENCE	DATE & ISSUE	SCALE & COORDINATE SYSTEM
Beaconsfield Road, Chatswood 19WRL02_BF001	18/02/2020 Issue 1	1:2,500 @ A4 GDA 1994 MGA Zone 56

0 25 50 m

TITLE

Schedule 1 - Bushfire Protection Measures (Independant Living Units)

Document Path: N:\GIS STORAGE\N Drive\19WRL02_Beaconsfield_Chatswood\MXDs\19WRL02_BF001.mxd

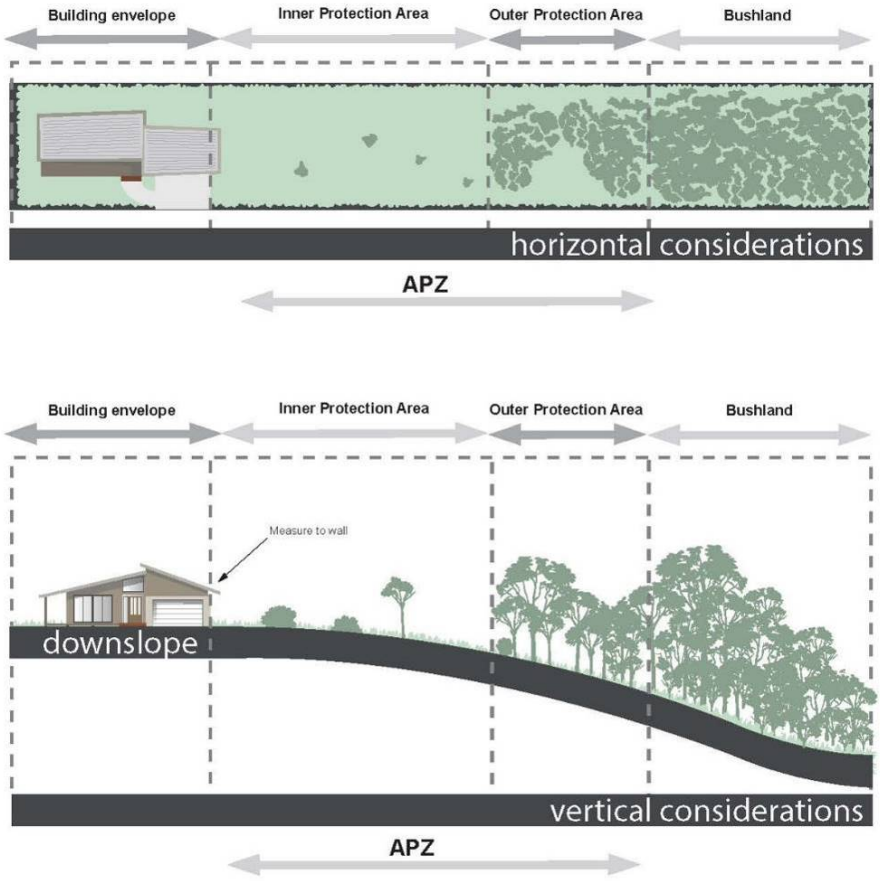
Disclaimer: The mapping is indicative of available space and location of features which may prove critical in assessing the viability of the proposed works. Mapping has been produced on a map base with an inherent level of inaccuracy, the location of all mapped features are to be confirmed by a registered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

Management of Asset Protection Zones

A1

The RFS provides basic advice in respect of managing APZs through documents such as, *Standards for Asset Protection Zones* (RFS, 2005), with landscaping to comply with Appendix 5 of *PBP*.

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 property is to be managed to IPA standards only. A typical APZ is graphically represented below:



APZs and progressive reduction in fuel loads
(Source: PBP, 2019)

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

The following provides maintenance advice for vegetation within the IPA. The APZ is to be maintained in perpetuity and should be undertake regularly, particularly in advance of the bushfire season.

Inner protection area (IPA)
Fuel loads within the IPA are to be maintained so it does not exceed 4t/ha.

Trees are to be maintained to ensure:

- canopy cover does not exceed 15% at maturity
- trees (at maturity) do not touch or overhang the building
- lower limbs should be removed up to a height of 2m above ground
- tree canopies should be separated by 2 to 5m
- preference should be given to smooth barked and evergreen trees.

Shrubs are to be maintained to ensure:

- create large discontinuities or gaps in the vegetation to slow down or break the progress of fire towards buildings
- shrubs should not be located under trees
- shrubs should not form more than 10% of ground cover
- clumps of shrubs should be separated from exposed windows and doors by a distance of at least twice the height of vegetation.

Grass is to be maintained to ensure:

- grass should be kept mown (as a guide grass should be kept to no more than 100mm in height); and
- leaves and vegetation debris should be removed (litter fuel within the IPA should be kept below 1cm).

General advice for landscaping is provided below:

- Suitable impervious areas being provided immediately surrounding the building such as courtyards, paths and driveways
- Restrict planting in the immediate vicinity of the building which may over time, and if not properly maintained, come into contact with the building
- When considering landscape species consideration needs to be given to estimated size of the plant at maturity
- Avoid species with rough fibrous bark, or which retain / shed bark in long strips or retain dead material in their canopies
- Use smooth bark species of trees species which generally do not carry a fire up the bark into the crown
- Avoid planting of deciduous species that may increase fuel at surface / ground level (i.e. leaf litter)
- Avoid climbing species to walls and pergolas
- Locate combustible materials such as woodchips / mulch, flammable fuel stores away from the building
- Locate combustible structures such as garden sheds, pergolas and materials such timber garden furniture way from the building
- Use of low flammability vegetation species.

Performance based assessment

A2

Calculated February 14, 2020, 11:55 am (BALc v.4.8)

South-east (Flame width 20m)

Bushfire Attack Level calculator - AS3959-2009 (Method 2)			
Inputs		Outputs	
Fire Danger Index	100	Rate of spread	3.6 km/h
Vegetation classification	Forest	Flame length	26.73 m
Surface fuel load	21.3 t/ha	Flame angle	61 °
Overall fuel load	27.3 t/ha	Panel height	23.38 m
Vegetation height	n/a	Elevation of receiver	8.1 m
Effective slope	5 °	Fire intensity	50,905 kW/m
Site slope	5 °	Transmissivity	0.804
Distance to vegetation	41 m	Viewfactor	0.1057
Flame width	20 m	Radiant heat flux	9.49 kW/m²
Windspeed	n/a	Bushfire Attack Level	BAL-12.5
Heat of combustion	18,600 kJ/kg		
Flame temperature	1,200 K		

Rate of Spread - Mcarthur, 1973 & Noble et al., 1980

Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Calculated February 14, 2020, 11:58 am (BALc v.4.8)

South-east (Flame width 40m)

Bushfire Attack Level calculator - AS3959-2009 (Method 2)			
Inputs		Outputs	
Fire Danger Index	100	Rate of spread	3.6 km/h
Vegetation classification	Forest	Flame length	26.73 m
Surface fuel load	21.3 t/ha	Flame angle	73 °
Overall fuel load	27.3 t/ha	Panel height	25.56 m
Vegetation height	n/a	Elevation of receiver	7.18 m
Effective slope	5 °	Fire intensity	50,905 kW/m
Site slope	5 °	Transmissivity	0.765
Distance to vegetation	64 m	Viewfactor	0.0796
Flame width	40 m	Radiant heat flux	6.81 kW/m²
Windspeed	n/a	Bushfire Attack Level	BAL-12.5
Heat of combustion	18,600 kJ/kg		
Flame temperature	1,200 K		

Rate of Spread - Mcarthur, 1973 & Noble et al., 1980

Flame length - NSW Rural Fire Service, 2001 & Noble et al., 1980

Elevation of receiver - Douglas & Tan, 2005

Flame angle - Douglas & Tan, 2005

Radiant heat flux - Drysdale, 1999, Sullivan et al., 2003, Douglas & Tan, 2005

Geotechnical statement

A3

Date: 27 February 2020
Ref: 27168PNXlet2

Watermark Retirement Living
Suite 1, level 1, 65 Willoughby Road
Crows Nest, NSW 2065

Attention: Tony Olding
Email: tony@watermarkliving.com.au

GEOTECHNICAL OPINION
POTENTIAL IMPACT OF VEGETATION MANAGEMENT ON SLOPE STABILITY
BEACONSFIELD ROAD, CHATSWOOD, NSW

From an email from Mr Tony Olding of Watermark Retirement Living dated 21 November 2019, and review/comments to our previous letter (Ref 27168PNXlet dated 12 December 2019) by Nicole of Travers Ecology, we understand it is proposed to complete vegetative management of the 'E4' Zone in accordance with the standards of an Inner Protection Area (IPA) as outlined in Appendix 4 of NSW Rural Fire Service Planning for Bushfire Protection (PBP) 2019. The E4 Zone falls within the Asset Protection Zone (APZ) located at the southern end of the site between No. 126 Beaconsfield Road and Chatswood Golf Club (CGC), Chatswood, NSW.

We previously completed a walkover inspection of the topographic, surface drainage and geological conditions of the site and its immediate environs and prepared a letter (Ref. 27168PNXlet Rev1 dated 20 January 2020) containing our general geotechnical opinion on the potential impact of vegetation management on the slope stability of the site. We have been supplied with the Arboricultural Impact Assessment Report prepared by Travers (Ref. 19WRL02T, dated February 2020) which details a tree retention and removal plan.

Based on the provided information we understand that up to 255 trees are to be removed as part of the proposed development with a significant number of these trees falling within the steeper 'E4' Zone. Further, significant removal of grass and shrubs is also proposed.

Comments and Recommendations

In our opinion, the grass and shrub management proposed as part of the works will have limited impact on the overall stability of the slope however, if all undergrowth is removed, we would expect an increase in erosion. Where trees are to be removed, it is our recommendation the lower trunk and root ball be left in place to reduce the potential of scour, destabilisation of surface soils and loose boulders, and altering surface water runoff.

It is our recommendation that during and on completion of the clearing works, the geotechnical engineer inspect the site and provide recommendations on remediation (i.e. Removal of potentially loose boulders, battering/retention/backfilling of potentially unstable areas created as a result of tree removal, surface drainage etc.) to reduce likelihood of future instability.

Should you require any further information regarding the above, please do not hesitate to contact the undersigned.

Yours faithfully
For and on behalf of
JK GEOTECHNICS

Andrew Frost
Senior Engineering Geologist