Abel Ecology

Bushfire Assessment Report

for

346 – 352 Whale Beach Road, Palm Beach NSW 2108
Lots 327, 328, 329 and 330, DP 16362

Proposed new residential dwelling

Prepared for:	**The applicant c/- Harry Seidler & Associates Architects**
Report No:	**AE21-2232-REP-ISS-1**
Prepared by:	**Abel Ecology**
Date:	**3 March 2021**

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Document History

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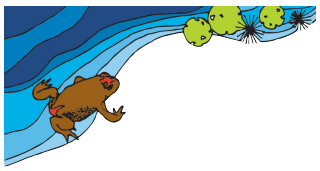

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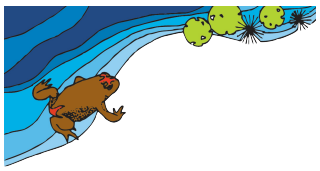

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List of Abbreviations

AHIMS	Aboriginal Heritage Information Management System
APZ	Asset Protection Zone
BAL	Bushfire Attack Level
NCC	*National Construction Code*
BC Act 2016	*Biodiversity Conservation Act 2016*
BFMC	Bushfire Management Committee
DCP	Development Control Plan
DP	Deposited Plan
DTS	Deemed-To-Satisfy
EP&A Act 1979	*Environmental Planning and Assessment Act 1979*
EP&A Regulation 2000	*Environmental Planning and Assessment Regulation 2000*
EPBC Act 1999	*Environmental Protection and Biodiversity Conservation Act 1999*
IPA	Inner Protection Area
kW/m^2	kilowatts per square metre (being a measure of radiant heat)
LEP	Local Environment Plan
LGA	Local Government Area
LLS Act 2013	*Local Land Services Act 2013*
NP&W Act 1974	*National Parks and Wildlife Act 1974*
NR	Nature Reserve
PDA	Principal Development Area
PBP 2019	*Planning for Bushfire Protection 2019*
RFS	Rural Fire Service
RF Act 1997	*Rural Fires Act 1997*
RF Regulation 2013	*Rural Fires Regulation 2013*
RHF	Radiant Heat Flux
SEPP	State Environmental Planning Policy

Note regarding maps in this report

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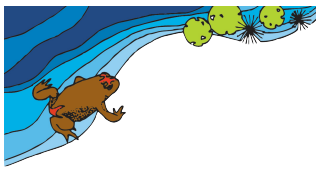


Executive summary

This Bushfire Assessment Report has been prepared by an Accredited BPAD Practitioner using the Simplified Procedure (Method 1) as detailed in Appendix 1 of *Planning for Bushfire Protection 2019*.

This proposal has been prepared in accordance with *Planning for Bushfire Protection 2019* in its entirety and the development complies most relevant Acceptable Solutions in *PBP 2019*.

Abel Ecology makes no warranties as to the accuracy of the information provided in the report. All enquiries related to the information and conclusions presented in this report must be made to the Practitioner.

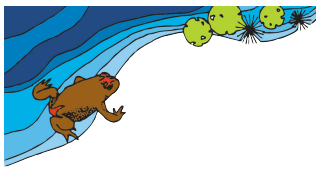
A bushfire assessment of the proposed development site at Lots 327, 328, 329 and 330, DP 16362, 346 – 352 Whale Beach Road, Palm Beach NSW (the 'site') was undertaken on 17 February 2021. Lot 329 of 530 m^2 has an existing dwelling and side building, while Lot 327 of 612.5 m^2, Lot 328 of 556 m^2, and Lot 330 of 587.64 m^2 are vacant (all measurements of area are approximate). Combined, the site is approximately 2,286 m^2. Existing infrastructure associated with the current dwelling includes an outbuilding. The proposal is to knockdown the existing dwelling and outbuilding on Lot 329 and rebuild a new residential dwelling, which will occupy an approximate area of 921 m^2 (over six [6] levels). The associated infrastructure includes a pool, rainwater tank, patio areas, decks, and storage/workshop areas.

The aim of the assessment was to ascertain the potential fire hazard and establish the site capability for an Asset Protection Zone (APZ) while complying with Council's requirements and relevant legislation. The report will be used to ensure the proposed development satisfies the performance requirements of the *National Construction Code* (NCC), and *Planning for Bushfire Protection 2019*.

The access road to the dwelling footprint is from Whale Beach Road. Whale Beach Road is a council bitumen through road, which is >980 metres long, of suitable grades, 5.5 - 6 metres wide and is regularly maintained.

Northern Beaches Council has listed a Biodiversity Overlay across the southeast corner of Lot 327. No threatened ecological communities and no threatened plant species were discovered upon site inspection. Abel Ecology has completed a Prescribed Ecological Assessment Report (PEAR) (AE21 2233 REP ISS 1 3Mar21) on the site and has concluded the proposed development will have no significant impacts on plant species or ecological communities listed in NSW or Commonwealth legislation. No part of the principal development area has been identified as critical habitat for threatened species.

With regard to any clearing of native vegetation on the property, it is the responsibility of the landowner to check whether all required permissions from local and statutory authorities are in place. This may include Parts 3, 4 and 5 of the *EP&A Act 1979*; s.4.46 and s.4.53 licences; licence or conservation agreement under the *NP&W Act 1974*; or approvals under the *Local Land Services Act 2013* and or the *Biodiversity Conservation Act 2016*.



The vegetation hazard which will most significantly influence fire behaviour is the Tall Heath to the east of the proposal footprint.

The following conclusions and recommendations apply:

The site is mapped as bush fire prone land. In our opinion, the site is not sterilised by the bushfire threat. This report concludes that the proposed development can comply with *PBP 2019*. The owners will therefore be able to construct the proposed dwelling with the following measures included:

a) This proposal has been prepared in accordance with *PBP 2019* in its entirety and the development complies with most relevant Acceptable Solutions in this version of *PBP*.

b) The site is mapped as bush fire prone land.

c) Building construction for all aspects of the proposed dwelling must comply with section 3 and 8 (BAL - 40) of *Australian Standard 3959* (2018) *Construction of buildings in bushfire-prone areas* and *Table 7.4a* of *PBP 2019* and as modified by Section 7.5, 7.5.1, 7.5.2, 7.5.3 and 7.5.4 (where applicable) of *PBP 2019*.

- Proposed Class 10 buildings are to comply with Section 7 of this report and:
  - Class 10a: Sheds – s.8.3.2 of *PBP 2019* and,
  - Class 10b: Fences and gates – Section 7.6 of *PBP 2019*.

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d) We recommend a site Vegetation Management Plan (VMP) be produced for the on-going management and maintenance of the site asset protection zone. The APZ will be maintained to Inner Protection Area condition as per Sec. 6.1 and 6.8 of this report, Appendix 4 of *PBP 2019* and the RFS *Standards for Asset Protection Zones* (Appendix 2 and see www.rfs.nsw.gov.au). The VMP will observe mapped Slope Constraint areas, retention of hollow-bearing trees and area mapped on the Biodiversity Overlay across the southeast corner of Lot 327 (Abel Ecology 2021). Total clearance of all vegetation is not acceptable. Vegetation management undertaken to establish the required APZ shall be minimised while still complying with *PBP 2019* guidelines.

e) In accordance with a site Vegetation Management Plan, an asset protection zone is to be maintained permanently on the north aspect:
- To IPA condition (15% tree canopy cover) for a horizontal distance of 2 metres from the external wall of the dwelling to the north boundary.
- Trees will need to be removed to achieve this requirement.

f) In accordance with a site Vegetation Management Plan, an asset protection zone is to be maintained permanently on the east aspect:
- To IPA condition (15% tree canopy cover) for a horizontal distance of 3 - 10 metres from the external wall of the dwelling to the east boundary.
- Trees will need to be removed to achieve this requirement.

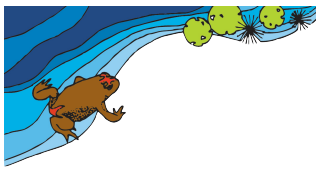
g) In accordance with a site Vegetation Management Plan, an asset protection zone is to be maintained permanently on the west aspect:
   - To IPA condition (15% tree canopy cover) for a horizontal distance of 10 metres from the external wall of the dwelling to the west boundary.
   - Trees will need to be removed to achieve this requirement.

h) In accordance with a site Vegetation Management Plan, an asset protection zone is to be maintained permanently on the south aspect:
   - To IPA condition (15% tree canopy cover) for a horizontal distance of 12 metres from the external wall of the dwelling.
   - Trees will need to be removed to achieve this requirement.

i) Whale Beach Road offers adequate access and egress to firefighters, emergency workers, and those involved in evacuation and complies with the performance criteria in *Table 7.4a of PBP 2019*.

j) All weather access to the site will be provided in recognition of the risk to fire fighters and/or evacuating occupants. A 70 metre unobstructed path cannot be demonstrated between the most distant external part of the proposed dwelling and the nearest part of the public access road (road speed limit <70 km/h) that supports the operational use of emergency firefighting vehicles. Therefore there must be access to the rear of the dwelling for operational activities via Whale Beach Road. Firefighters must be able to access to the rear of the dwelling. The access driveway must:

   - The site driveway carriageway/swept path (excluding drainage and edging) will be a minimum four metres wide.
   - Be clearly sign-posted, two-wheel drive, paved all-weather driveway.
   - The dead end incorporates a turning area compliant with Figure A3.3 Type C of *PBP 2019*.
   - Is less than 200 metres in length and contains no bridges. The proposed driveway on-site is eleven metres long, nine metres wide.
   - Crossfall of the pavement is not more than 10 degrees.
   - The site driveway does not exceed 15 degrees and is not more than 10 degrees.
   - Curves have a minimum inner radius of six metres and are minimal in number to allow for rapid access and egress.
   - The minimum distance between inner and outer curves is six metres.
   - A minimum vertical clearance of four metres to any overhanging obstructions, including tree branches.
   - The site driveway does not traverse through a wetland or other land potentially subject to periodic inundation (other than flood or storm surge).
   - The internal road surfaces have a capacity to carry fully-loaded fire fighting vehicles (23 tonnes), bridges and causeways are to clearly indicate load rating.
   - There is suitable access for a Category 1 fire appliance to within four metres of the static water supply where no reticulated supply is available, and
   - Is regularly maintained.



k) The proposed site access driveway does comply with *Table 7.4a of PBP 2019*.

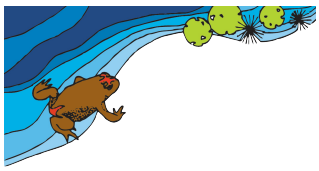
l) Utility services along Whale Beach Road are adequate to meet the needs of firefighters and others assisting in bush fire fighting. Gas and electricity services are to be located so as to not contribute to the risk of fire to the buildings. Gas and electricity services are to be installed as per Sec. 6.4 of this report.

m) Fire hazard management for the subject site needs to take into account hollow-bearing trees, and native vegetation that is:

- Mapped on the Biodiversity Overlay across the southeast corner of Lot 327 and,
- Is protected under a SEPP (Vegetation in Non-Rural Areas) 2017, or SEPP No 19 - Bushland in Urban Areas 1986 and SEPP (Coastal Management) 2018.

n) Water supply is to be provided in accordance with Sec. 6.3 of this report and *Table 7.4a of PBP 2019*.

o) Residents of bushfire prone areas are encouraged to build their own Bushfire Survival Plan.



Introduction

Abel Ecology was engaged by Greg Holman of Harry Seidler & Associates Architects, to prepare a bushfire assessment for a proposed dwelling. The report will be used to supplement a development application to Northern Beaches Council. The report will be used to ensure the proposed development satisfies the performance requirements of the *National Construction Code* (NCC), and *Planning for Bushfire Protection 2019*.

We have considered the details sent to us and completed a detailed inspection of the site on 17 February 2021. This report serves to:

a) Identify the site and proposed development,
b) Determine the bushfire threat, and
c) Identify work to be completed in order to improve the chances of building survival in the event of a bushfire. These works will satisfy the Performance Requirements of the *National Construction Code* (NCC) and achieve compliance with *Planning for Bushfire Protection 2019* (*PBP 2019*).

The Bushfire Assessment Report concludes, the site is not sterilised by the bushfire threat and the owners will be able to construct the dwelling provided appropriate precautions are taken. This report concludes that the proposed development can comply with *PBP 2019*.

1.1 Planning relationships

1.1.1 Legislation

a) Section 4.14 *Environmental Planning and Assessment Act 1979,*
b) Clause 272 *EP & A Regulation 2000,*
c) Section 10.3 *EP & A Act 1979,*
d) *Rural Fires Act 1997* (amended) s.63(1), 63(2).

1.1.2 Planning policies

a) *Planning for Bushfire Protection 2019,*
b) Northern Beaches Council – Pittwater LEP 2014,
c) Northern Beaches Council – Pittwater DCP 2014,
d) Adjacent land is controlled by the Warringah Pittwater Bushfire Risk Management Plan 2010.

2 The site and proposed development

2.1 Existing site description

On Site

The site is identified as Lots 327, 328, 329 and 330, DP 16362, 346 – 352 Whale Beach Road, Palm Beach NSW (Figure 1 and Figure 2).

The site is approximately 2,288 m^2 in area and is zoned:

a) Bush Fire Prone Land, Vegetation Buffer 30 m (Figure 3),
b) Environmental Living (E4).

The site is a rough rectangle shape with a frontage of 79 metres to Whale Beach Road and a depth of 24 - 29 metres along its length (Figure 1).

The current land use is consistent with a residential dwelling. The site has been historically cleared, and has recently formed part of a managed garden, as clumps of ornamental plants have established on-site. The highest elevation point is on the western boundary and the site slopes evenly but steeply (40 - 60°) to the frontage of Whale Beach Road, falling in elevation 19 metres over 24 - 29 metres, and Whale Beach Road a further seven metres below. Parts of the site have been terraced; there are regular sandstone outcrops and there are small cliff lines running along the west and east boundaries that vary in height from two to ten metres high.

The site is accessed from Whale Beach Road. Whale Beach Road is a council bitumen through road, which is >980 metres long, of suitable grades, 5.5 - 6 metres wide and is regularly maintained. There is no site driveway, two vehicles can fit into a small pull-in area off Whale Beach Road outside Lot 329. The only suitable turning points for medium-rigid vehicles are three-point-turns at the closest road intersections: Florida Road and Ocean Place 1.1 km to the north, and Whale Beach Road and Norma Road 680 metres to the south. There are limited, unevenly spread areas where the formed road provides space for medium-rigid vehicles to pass in opposite directions safely.

Figure 1. Aerial photo of the site.

Site locality - Lots 327, 328, 329 and 330, DP 16362, 346 – 352 Whale Beach Road, Palm Beach NSW

Scale: Picture width = 630 metres

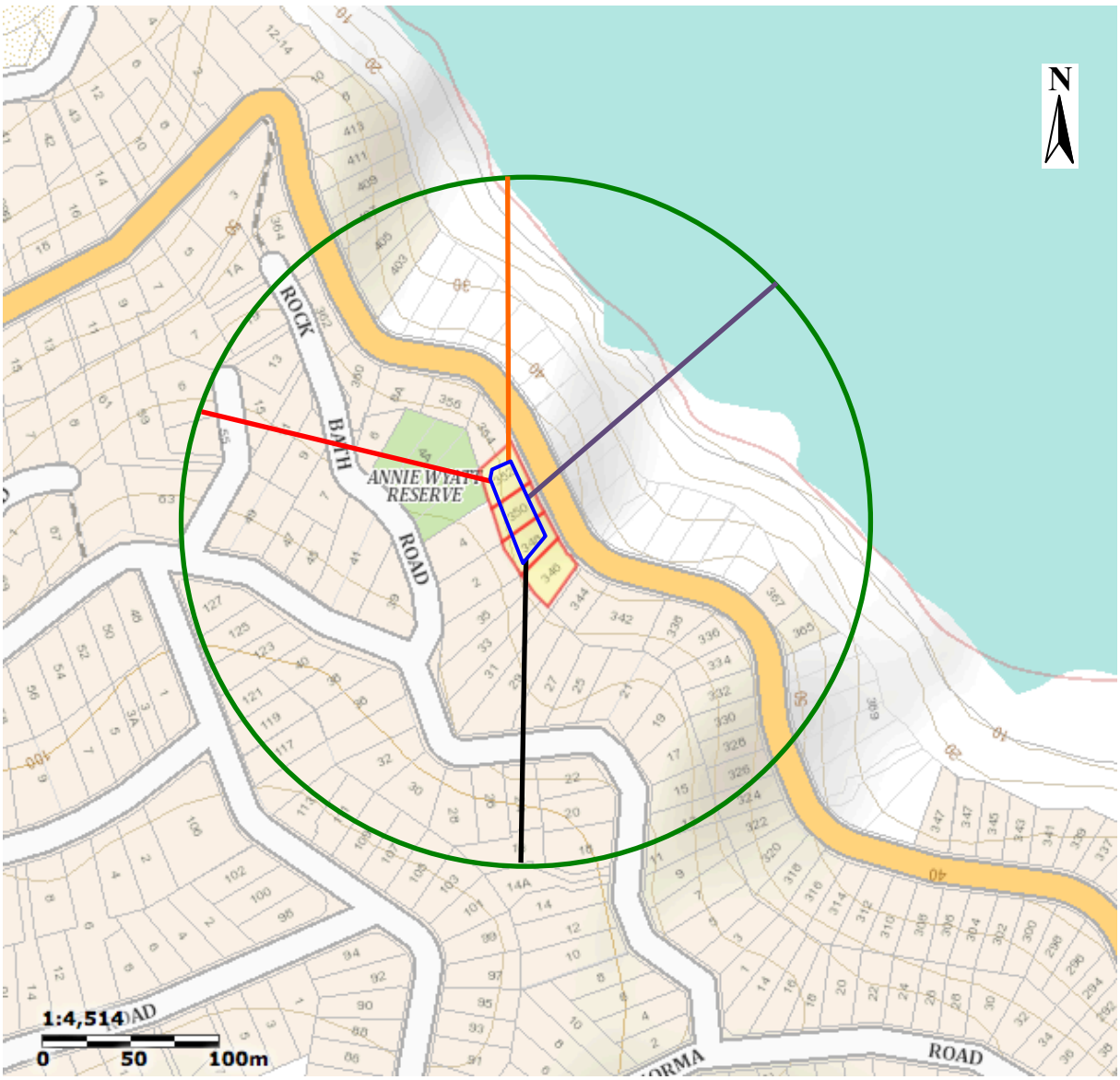


Figure 2. Topographic map of the site with 140 m assessment area.

Site locality – Lots 327, 328, 329 and 330, DP 16362, 346 – 352 Whale Beach Road, Palm Beach NSW

140 m assessment area

Proposed dwelling

North Fire Run Transect

Northwest Fire Run Transect

Northeast Fire Run Transect

South Fire Run Transect

Scale: Picture width = 630 metres

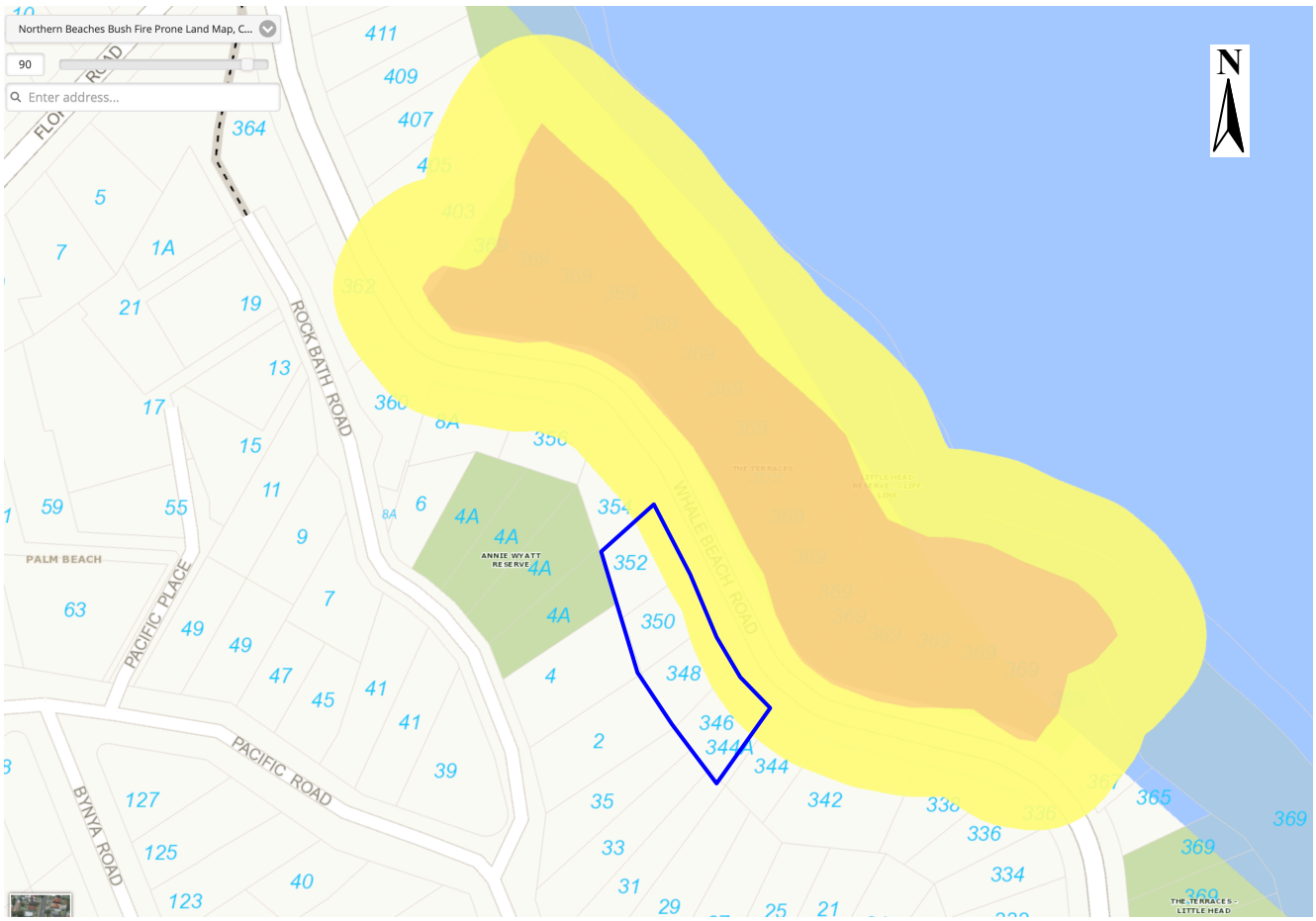


Figure 3. Bush Fire Prone Land map.

Scale: Picture width = 460 metres

- Subject land
- Bush Fire Prone Land – Vegetation Category 1
- Bush Fire Prone Land – Vegetation Category 2
- Bush Fire Prone Land – Vegetation Buffer 30 m

Extract from the Bush Fire Prone Land Map for the Northern Beaches Local Government Area, dated 18 February 2021.

Figure 4. Tall Heath and Low Closed Forest are both examples of the structure of vegetation onsite.

Figure 5. Managed garden on adjacent property (Lot 331, DP 16362) to the north of the proposed development site.

Adjacent Properties

Adjacent properties are consistent with a coastal residential landscape (Figure 1). The majority of adjacent properties on the west, north and south aspects of the proposed development site are all existing residential properties with managed gardens to >140 metres.

Properties to the west are upslope of the proposed development site, properties to the north and south are level in elevation with the proposed development site (Figure 2).

A drainage easement (two metres wide) is present on the immediate southern boundary of Lot 327 and is zoned Public Recreation (RE1).

Annie Wyatt Reserve shares the west boundary with Lot 330 to the northwest of the principal development area. Annie Wyatt Reserve is managed for conservation and is periodically burned to reduce bushfire risk to immediate residents. Annie Wyatt Reserve has not been mapped as bushfire prone land (Figure 3) or considered as a significant threat to the proposal due to its size being <1 Ha (actual size 0.3 Ha). The existing 'Remnant Vegetation' within Annie Wyatt Reserve is classified as 'low hazard' vegetation (Remnant Vegetation 10/13.2 t/Ha) in accordance with the provisions for A1.11 remnant bushland classification on page 88 of *PBP 2019*.

Properties on the east aspect are all existing residential properties, and are downslope of the proposed development site. However, properties on the east aspect have never been developed and all contain intact remnant native vegetation that is unmanaged due to Council slope constraints, potential erosion issues, and landuse zoning for Environmental Conservation (E2) (Figure 1, Figure 2, and Figure 3).

2.2 Existing vegetation description

On Site

The vegetation description is according to Figures A1.2 in *PBP 2019* based on Keith (2004). The vegetation and fuel load within the site boundaries on all aspects of the PDA is reflective of a transition between Tall Heath (36.9 t/Ha) and Coastal Enriched Sandstone Dry Forest [PCT: 1776] (Remnant - 10/13.2 t/Ha - Low Closed Forest) (Figure 4).

Adjacent Properties

North

Suburban residential properties at the north boundary have managed gardens for 48 metres (<4 t/Ha) (Figure 5), then there is unmanaged Tall Heath (36.9 t/Ha) for 79 metres, then bare rock shelf for >13 metres. The existing 'Remnant Vegetation' within Annie Wyatt Reserve is classified as 'low hazard' vegetation (Remnant Vegetation 10/13.2 t/Ha) in accordance with the provisions for A1.11 remnant bushland classification on page 88 of *PBP 2019*.

East

The vegetation on residential properties adjacent to the east boundary is unmanaged and is reflective of a transition between Tall Heath (36.9 t/Ha) (the predominant unmanaged vegetation to the east, Coastal headland clay heath PCT: 1817) and a small patch of Rainforest (10/13.2 t/Ha) on the east edge of Whale Beach Road (Figure 4). The small patch of Rainforest is approximately 10 metres wide at the north end (Lot 273 DP 16362), and 25 metres wide at the south end (Lot 267, DP 16362). Species observed in this rainforest patch include: Wonga Wonga Vine *Pandorea pandorana*, *Cassytha pubescens*, Crofton Weed *Ageratina adenophora*, Cheese Tree *Glochidion ferdinandi*, Sweet Pittosporum *Pittosporum undulatum*, tree fern *sp.*, Rusty Fig *Ficus rubiginosa*, Turpentine *Syncarpia glomulifera*, Coast Banksia *Banksia integrifolia*, and Lilly Pilly *Syzygium smithii*. Abel Ecology's (2021) Prescribed Ecological Assessment Report referred to the moister vegetation as 'Coastal Enriched Sandstone Moist Forest' as the plant community type at the southern boundary of the site. Furthermore, the vegetation to the east of the site has been classified as Category 2 on the Northern Beaches Local Government Area Bushfire Prone Land Map (Figure 3) supporting the lower hazard assessment of the vegetation.

South

A drainage easement (two metres wide) is present on the immediate southern boundary of Lot 327 and the vegetation structure is characteristic of Remnant Vegetation (10/13.2 t/Ha - 'Coastal Enriched Sandstone Moist Forest'). Suburban residential properties further south all have managed gardens for >140 metres (<4 t/Ha) (Figure 1 and Figure 6).

West

Suburban residential properties at the west boundary all have managed gardens (<4 t/Ha) (Figure 7).

Figure 6. Managed garden on adjacent property (Lot 414, DP 19651) to the south of the proposed development site.

Figure 7. Managed garden on adjacent property (Lot 415, DP 19651 and Lot 2, DP 407282) to the west of the proposed development site.

2.3 The proposal

The proposal is to erect a residential dwelling with the appropriate level of bushfire protection measures in order to meet the required performance criteria of *Planning for Bushfire Protection 2019* (*PBP 2019*). This includes the clearance/maintenance of an Asset Protection Zone (APZ) within the Principal Development Area (PDA) of the site. The PDA is principally on Lots 328, 329 and 330, DP 16362, with the APZ extending onto Lot 327, DP 16362 (Figure 8).

The proposed building footprint (Figure 8) occupies an area of 581 m^2 (approx.). To meet the bushfire protection measures stated in *PBP 2019* the proposed APZ distances are:

- 2 metres on the north aspect to the north site boundary,
- 3 - 10 metres on the east aspect, all area from the external wall of the proposed building to the east site boundary,
- 12 metres on the south aspect and,
- 10 metres on the west aspect, all area from the external wall of the proposed building to the west site boundary.

Within the APZ, tree canopy will be reduced/maintained to 15 per cent cover and will continue to be maintained consistent with inner protection area (IPA) condition. Trees will need to be removed to achieve this requirement.

2.4 Significant environmental features

Northern Beaches Council has listed a Biodiversity Overlay across the southeast corner of Lot 327. No threatened ecological communities and no threatened plant species were discovered upon site inspection. Abel Ecology has completed a Prescribed Ecological Assessment Report (PEAR) (AE21 2233 REP ISS 1 3Mar21) on the site and has concluded the proposed development will have no significant impacts on plant species or ecological communities listed in NSW or Commonwealth legislation.

The following State Environmental Planning Policies also apply to the site:

- SEPP (Vegetation in Non-Rural Areas) 2017,
- SEPP No 19—Bushland in Urban Areas 1986, and
- SEPP (Coastal Management) 2018.

The site is not shaded on the Biodiversity Values Land Map. Refer to the site PEAR Report (Abel Ecology 2021 - AE21 2233 REP ISS 1 3Mar21).

2.5 Threatened flora and fauna

Within the Principal Development Area (PDA) incorporating the proposed Asset Protection Zone (Figure 8) no threatened plant species were discovered upon site inspection. The threatened species Grey-headed Flying-fox was detected visiting the site (Abel Ecology 2021). There is also evidence for two threatened microbat species visiting the site, the Little Bentwing-bat and the Eastern Bentwing-bat (Table 10). It is also likely that Powerful Owl forages on site. These species are highly mobile and forage/ hunt over wide areas of land. None of them appear to be roosting or nesting on site (Refer to PEAR, Abel Ecology 2021).

No part of the site has been identified as critical habitat for threatened species. No 'Areas of Outstanding Biodiversity Value' were discovered upon site inspection.

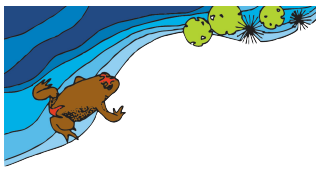
2.6 Archaeological and Heritage Significant sites

Abel Ecology is not aware of Heritage Significant sites on the land. Databases have not been searched.

Abel Ecology is not aware of Aboriginal relics on the land. Databases have not been searched.

-	FECA	UCA	GFA
Level 0	152.25m²	56.87m²	209.12m²
Level 1	231.41m²	55.28m²	286.69m²
Level 2	360.81m²	54.02m²	414.83m²
Roof	10.38m²	-	10.38m²
Total	754.85m²	166.17m²	921.02m²

Figure 8. Site proposal diagram.



3 Survey methodology

Survey methods were applied in accordance with assessment methodology set in Appendix 1 of *Planning for Bushfire Protection* 2019, Table A1.12.5 for infill. The report has also been prepared in accordance with Appendix 2, 3, and 4 of *PBP 2019*.

A trained consultant used a slope meter on-site to gain the effective slope angle used in the site analysis.

See Appendix 1 for definitions of fire management terminology.

4 Assessment of bushfire hazard

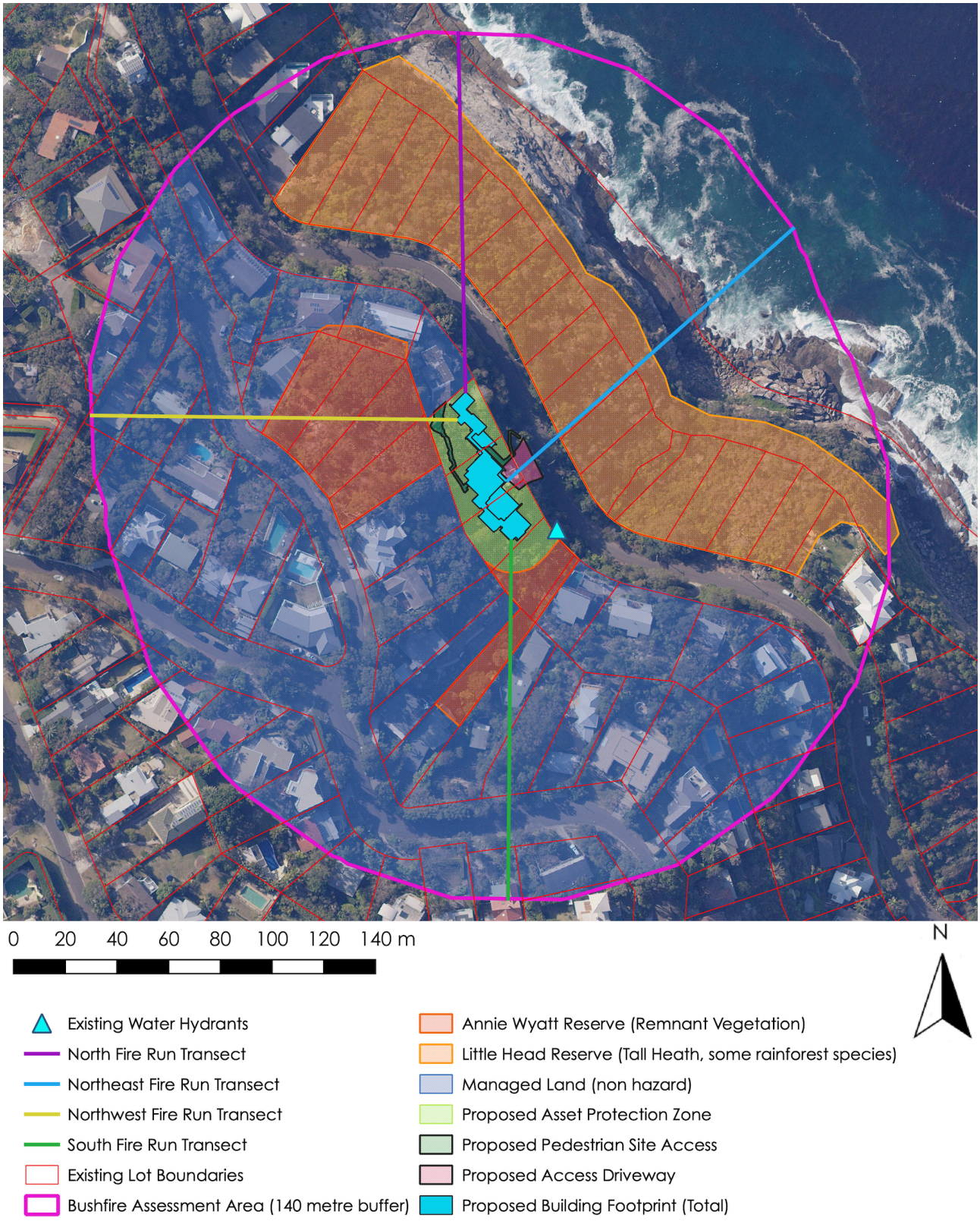


Figure 9. Bushfire assessment area within 140 metres of the proposal.

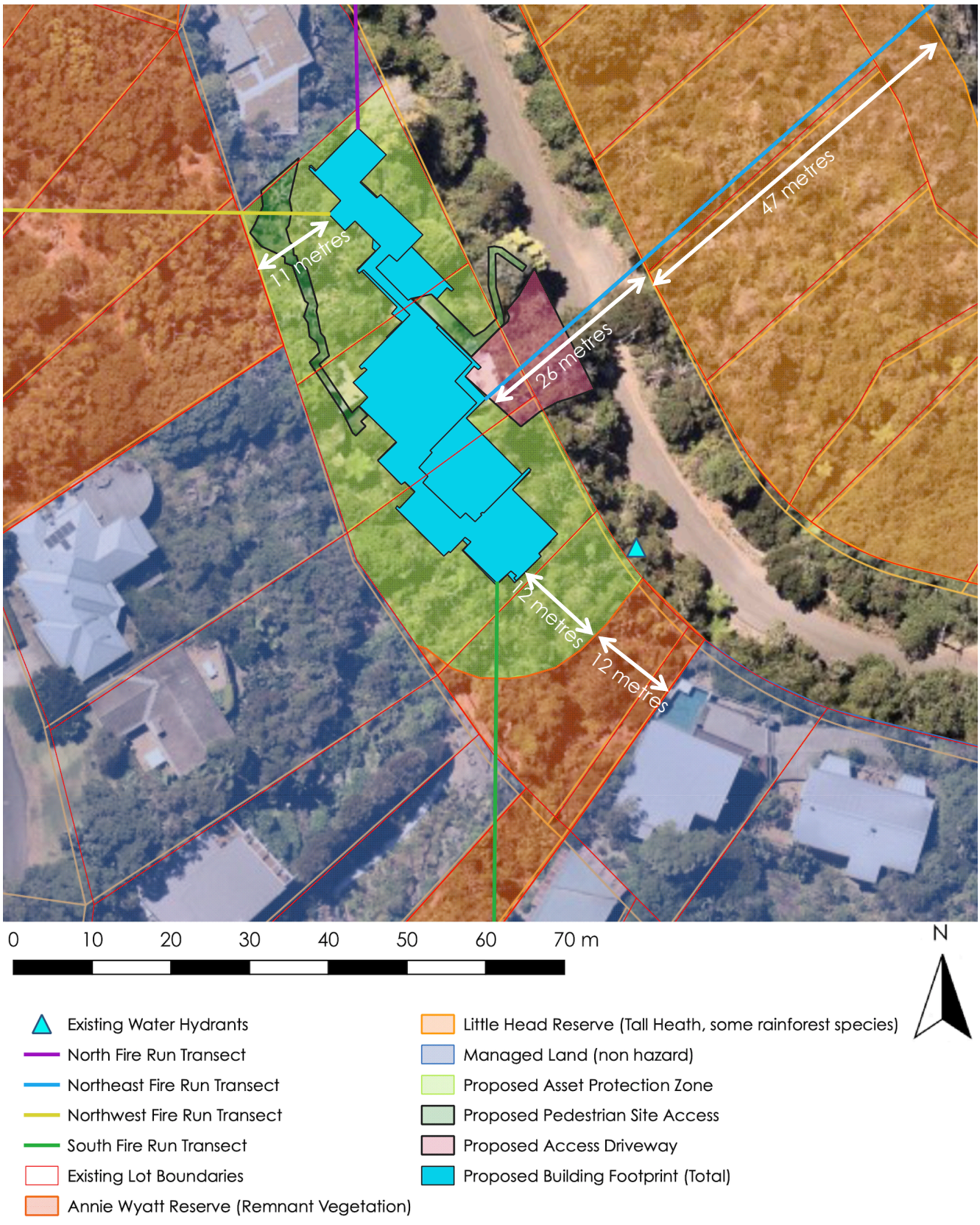
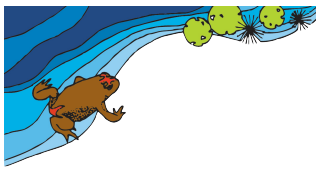


Figure 10. The proposed dwelling in relation to bushfire protection measures and hazard.



Hazard rating is assessed as follows:

Table 1: North Aspect - DTS Method 1: Appendix 1 of *Planning for Bushfire Protection 2019* and Table A1.12.5 *of PBP 2019*.	
Slope (Starting from the external wall of the proposed dwelling)	Downslope 22° for 26 metres then, downslope 6° for 17 metres, then downslope 26° for 97 metres (This transect is drawn in Figure 2 and Figure 9).
Effective slope	Downslope 15° - 20°.
Comment: The maximum slope range of Table A1.12.5 *of PBP 2019* is downslope 15° - 20°. The true effective slope is downslope 26°, but this is outside the modelling of Deem-To-Satisfy Method 1 as per Appendix 1 of *PBP 2019*. Downslope 15° - 20° is considered appropriate to determine a BAL rating.	
Vegetation	Tall Heath (36.9 t/Ha).
Separation from Hazard (Edge of managed land)	44 metres (IPA).
Comment: A separation of 44 metres is achievable on this fire-run because this is the separation distance between the proposed external wall of the dwelling and where the fire-run transect in Figure 2, Figure 9 and Figure 10 crosses Whale Beach Road and descends down into un-managed vegetation. The residential development and managed gardens adjacent the north site boundary and Whale Beach Road fit the definition of 'low hazard vegetation exclusions' in accordance with the provisions of A1.10 on page 88 of *PBP 2019* and therefore meet *PBP 2019* requirements for a defendable space. Due to the radiant heat flux from the northeast aspect (see table below), Table A1.12.5 of *PBP 2019* does permit the APZ to be reduced to 19 metres and still be a deemed-to-satisfy separation distance for BAL-40 construction of the dwelling. The proposed position of the dwelling sits inside the BAL-40 envelope based on assessments of bushfire attack from the northeast.	
Recommended APZ In accordance with Table A1.12.2 of *PBP 2019*.	2 metres (IPA) – all site area from the external wall of the proposed dwelling to the north site boundary.
Comment: Adjacent residential property (e.g. Lot 331) is considered managed land.	
Required building construction standard with recommended APZ In accordance with Table A1.12.5 and Sec. 7.5 of *PBP 2019*.	BAL-40.
Comment: The radiant heat flux from the northeast aspect (40 kW/m^2) requires a BAL-40 building construction standard on the north aspect of the building.	

Table 2: Northwest Aspect - DTS Method 1: Appendix 1 of *Planning for Bushfire Protection 2019* and Table A1.12.5 of *PBP 2019*.	
Slope (Starting from the external wall of the proposed dwelling)	Upslope 26° for 14 metres, then upslope 9° for 22 metres, then level 0° for 32 metres, then upslope 6° for >72 metres (This transect is drawn in Figure 2 and Figure 9).
Effective slope	Upslope – level.
Vegetation	'Remnant Vegetation' (Rainforest 10/13.2 t/Ha).
Comment: Annie Wyatt Reserve has not been mapped as bushfire prone land (Figure 3) or considered as a significant threat to the proposal due to its size being <1 Ha (actual size 0.3 Ha). The existing 'Remnant Vegetation' within Annie Wyatt Reserve is classified as 'low hazard' vegetation (Rainforest 10/13.2 t/Ha) in accordance with the provisions for A1.11 remnant bushland classification on page 88 of *PBP 2019*. *PBP 2019* refers to the vegetation category of 'Rainforest' as a fuel load surrogate to reflect the lower bushfire behaviour potential expected from 'low hazard' forest remnants.	
Separation from Hazard (Edge of managed land)	11 metres (IPA).
Comment: An APZ of 11 metres is achievable because this is the separation distance between the proposed external wall of the dwelling and where the fire-run transect in Figure 2, Figure 9 and Figure 10 crosses the site's west boundary. Table A1.12.5 of *PBP 2019* does permit the APZ to be reduced to 8 metres and still be a deemed-to-satisfy separation distance for BAL-40 construction of the dwelling.	
Recommended APZ In accordance with Table A1.12.2 of *PBP 2019*.	10 metres (IPA) on the west aspect, all area from the external wall of the proposed building to the west site boundary.
Comment: A landscape design will need to address maintenance of an APZ on slopes greater than 18°.	
Required building construction standard with recommended APZ In accordance with Table A1.12.5 and Sec. 7.5 of *PBP 2019*.	BAL-40.
Comment: The radiant heat flux from the northeast aspect (40 kW/m^2) requires a BAL-40 building construction standard on the northwest/west aspect of the building.	

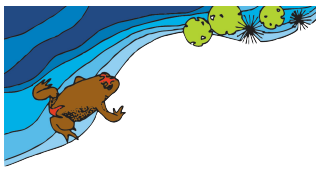


Table 3: Northeast Aspect - DTS Method 1: Appendix 1 of *Planning for Bushfire Protection 2019* and Table A1.12.5 of *PBP 2019*.	
Slope (Starting from the external wall of the proposed dwelling)	Downslope 31° for 14 metres then flat 0° for 11 metres, then downslope 25° for 49 metres, then cliff and ocean for >66 metres (This transect is drawn in Figure 2 and Figure 9).
Comment: The fire run is 49 metres long perpendicular to the contour lines.	
Effective slope	Downslope 15° - 20°.
Comment: The maximum slope range of Table A1.12.5 of *PBP 2019* is downslope 15° - 20°. The true effective slope is downslope 25°, but this is outside the modelling of Deem-To-Satisfy Method 1 as per Appendix 1 of *PBP 2019*. Downslope 15° - 20° is considered appropriate to determine a BAL rating.	
Vegetation	Tall Heath (36.9 t/Ha).
Comment: The existing Category 2 vegetation east of Whale Beach Road is classified as 'low hazard' vegetation in accordance with the provisions of A1.11 on page 88 of *PBP 2019* and Northern Beaches Council's Bushfire Prone Land map (Figure 3).	
Separation from Hazard (Edge of managed land)	26 metres (IPA).
Comment: An APZ of 26 metres is achievable because this is the separation distance between the proposed external wall of the dwelling and where the fire-run transect in Figure 2, Figure 9 and Figure 10 meets the east boundary of the Whale Beach Road corridor.	
Recommended APZ In accordance with Table A1.12.2 of *PBP 2019*.	3 - 10 metres (IPA) on the east aspect, all area from the external wall of the proposed building to the east site boundary.
Comment: A landscape design will need to address maintenance of an APZ on slopes greater than 18° on the south aspect of the proposed building.	
Required building construction standard with recommended APZ In accordance with Table A1.12.5 and Sec. 7.5 of *PBP 2019*.	BAL-40.
Comment: The radiant heat flux from the northeast aspect (40 kW/m^2) requires a BAL-40 building construction standard on the northeast/east aspect of the building.	

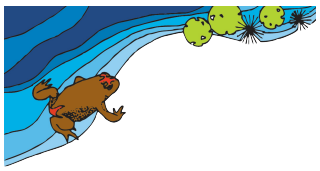
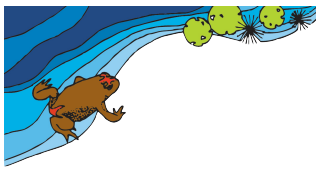


Table 4: South Aspect - DTS Method 1: Appendix 1 of *Planning for Bushfire Protection 2019* and Table A1.12.5 of *PBP 2019*.	
Slope (Starting from the external wall of the proposed dwelling)	Upslope 24° for 18 metres, then level for 21 metres, then 14° upslope for >98 metres (this transect is drawn in Figure 2 and Figure 9).
Effective slope	Upslope.
Vegetation	'Remnant Vegetation' (Rainforest 10/13.2 t/Ha) for 44 metres, thereafter managed gardens for >96 metres.
Separation from Hazard (Edge of managed land)	12 metres (IPA).
Recommended APZ In accordance with Table A1.12.2 of *PBP 2019*.	12 metres (IPA).
Comment: A Vegetation Management Plan will need to exist on Lot 327, to maintain the required APZ on the south aspect of the proposed building for a BAL-40 outcome. A landscape design will need to address maintenance of an APZ on slopes greater than 18° on the south aspect of the proposed building.	
Required building construction standard with recommended APZ In accordance with Table A1.12.5 and Sec. 7.5 of *PBP 2019*.	BAL-40.
Comment: The radiant heat flux from the northeast aspect (40 kW/m^2) requires a BAL-40 building construction standard on the south aspect of the building.	

Table 5: Summary Table - DTS Method 1: Appendix 1 of *Planning for Bushfire Protection 2019* and Table A1.12.5 of *PBP 2019*. FFDI 100

Proposed Dwelling on Lots 327, 328, 329 and 330, DP 16362.	**Effective Slope**	**Vegetation**	**Separation distance from un-managed vegetation**	**Bushfire Attack Level**
North Aspect	Downslope 15° - 20°	Tall Heath	44 metres	BAL-40
Northwest Aspect	Up-slope	'Remnant Vegetation'	11 metres	BAL-40
Northeast Aspect	Downslope 15° - 20°	Tall Heath	26 metres	BAL-40
South Aspect	Up-slope	'Remnant Vegetation'	12 metres	BAL-40



5 Issues arising from the assessment

5.1 Assessment outcome

Dominant hazard

The dominant bushfire hazard to the proposal/PDA is from unmanaged Tall Heath on the east aspect of the proposal footprint. Remnant vegetation also exists on the northwest, and southern aspects.

Building construction constraints

Our assessment indicates the required building construction is BAL-40 on all aspects of the proposal. The west, north and south aspects will be exposed up to 40 kW m^2 principally from the east, but also from pockets of remnant vegetation on the site and to the northwest. All Asset Protection Zones are achievable for this proposal.

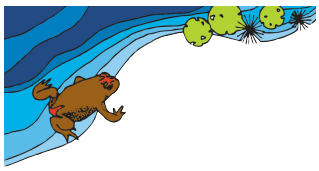
Building construction for all aspects of the proposed dwelling are to be built in accordance with the NCC, and must comply with section 3 and 8 (BAL-40) of *Australian Standard 3959* (2018) *Construction of buildings in bushfire-prone areas* and *Table 7.4a* of *PBP 2019* and as modified by Section 7.5, 7.5.1, 7.5.2, 7.5.3, and 7.5.4 (where applicable) of *PBP 2019*. Refer to AS 3959 (2018) for a detailed description.

The development is not in bush fire attack level - flame zone (BAL-FZ).

AS-3959-2018 is now available as PDF for free from -
https://infostore.saiglobal.com/en-au/standards/as-3959-2018-122340_saig_as_as_2685241/

Proposed Class 10 buildings are to comply with:

- There is no bushfire protection requirement for Class 10a and 10b structures located more than 6 metres from residential dwellings in bushfire prone areas.
- Where a Class 10a and 10b structure is located within 6 metres of a residential dwelling it must be constructed in accordance with the NCC and s.8.3.2 of *PBP 2019*. Class 10a buildings are non-habitable buildings being a private garage, carport, shed or the like.
- For Class 10b buildings, fences and gates. All fences and gates in bushfire prone areas should be made of either hardwood or non-combustible material. In circumstances where the fence or gate is located within 6 metres of a residential dwelling or in areas of BAL-29 or greater, they should be made of non- combustible material only (s. 7.6 of PBP 2019).



Asset Protection Zone

There is adequate space on the allotment to clear existing vegetation and permit a deemed-to-satisfy separation distance for BAL-40 construction of the dwelling. The APZ is located on lands with a slope exceeding 18°, and is wholly within the boundaries of the development site. The Asset Protection Zone (APZ) will consist of the total area of Lots 328, 329 and 330 and 12 metres is needed from the southern external wall of the building extending onto Lot 327 for BAL-40 compliance. This is a total area of approximately 1,324 m^2 (excluding the building footprint), and the APZ will be maintained to Inner Protection Area condition.

The APZ is not to impact on land zoned under Northern Beaches Council's Biodiversity planning overlay mapped across the southeast corner of Lot 327, therefore all APZs are achievable for this proposal. The site Landscape Plan will need to prioritise retainment of vegetation cover within the APZ that will mitigate adverse impacts of erosion onsite where the topography exceeds 18°.

An APZ will need to be maintained as Inner Protection Area condition for a distance of 12 metres on the south aspect, 3 - 10 metres on the east aspect, 10 metres on the west aspect, and 2 metres on the north aspect. The APZ distances reflect a balance between the requirements of Table A1.12.5 (*PBP 2019*), and the requirements of Northern Beaches Council LEP 2014. In saying that, the APZ could be larger, however in this case, Northern Beaches Council is unlikely to approve a larger APZ as the LEP states, the unnecessary clearance of vegetation should be avoided.

The APZ will be maintained to Inner Protection Area condition as per Appendix 4 of *PBP 2019* and the RFS document *Standards for Asset Protection Zones* (Appendix 2 and see www.rfs.nsw.gov.au).

Individual tree canopies must have at least two metre gaps between them, but close standing trees are allowed to form clumps as long as the tree canopy cover threshold is not exceeded for IPA condition.

5.2 Conformance with the objectives in *PBP 2019*

This is infill development as the proposal is to build a new residential dwelling, which does not fall under the special requirements for sub-division and Special Fire Protection Purposes.

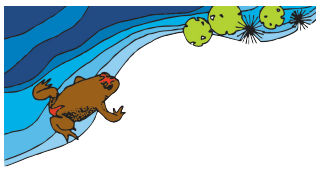
The proposed position of the dwelling will afford occupants and defenders protection from exposure to a bushfire (Objective i.). The siting of the dwelling is justified by the position of the BAL-40 zone illustrated in Figure 9 and Figure 10, in order to eliminate direct flame contact with the dwelling (Refer to Figure 9 and Figure 10). This relates directly with the performance criteria for infill in relation to 'siting and design' and (Objective iii.) of *PBP 2019*.

The dwelling will be constructed to BAL–40 and the design will offer adequate defence against the estimated radiant heat level and from ember attack. A BAL–40 outcome is not consistent with (Objective iii.) of *PBP 2019*, but a BAL–40 outcome is the best outcome for the site when the constraints of the site are taken into consideration.

Adequate space exists within the surrounding allotments to provide fire hazard protection. The building footprint will not be exposed to radiant heat levels exceeding 40 kW/m^2. The residential development, managed gardens on the north and west aspects, and managed road corridor on the east aspect fit the definition of Low Threat Vegetation - Exclusions (view list A1.10 *PBP 2019* pp.88) and therefore meet *PBP 2019* performance criteria for a defendable space (Objective ii.). The total area of Lots 328, 329 and 330 and 12 metres extending onto Lot 327 will be treated to IPA condition and meet on-site APZ requirements. The managed ground will continue to be treated to IPA condition and meet on-site APZ requirements (Objective iii.).

The landscape design will incorporate a defendable space immediately surrounding the dwelling. The APZ, which is wholly within the boundaries of the development site and located on land with a slope greater than 18 degrees, will be managed and maintained to prevent the spread of a fire towards the building. The proposed dwelling is separated from the area of Tall Heath to the east, for a minimum distance of 20 metres. The area between, is managed vegetation and a solid break in the fuel is created by Whale Beach Road. The site area between, will be landscaped appropriately to meet IPA condition and maintained through the enforcement of a Vegetation Management Plan (Objective v.).

Whale Beach Road offers adequate access and egress to firefighters, emergency workers, and those involved in evacuation (Objective iv.). Utility services along Whale Beach Road are adequate to meet the needs of firefighters and others assisting in bush fire fighting (Objective vi.).



The specific objectives of infill have also been met.

The specific objectives of infill are:

a) Provide a defendable space to enable unimpeded access for fire fighting around all elevations of the building.

   The Landscape Plan and APZ recommendations provides for unimpeded access around the dwelling. This objective is satisfied.

b) Provide better bushfire outcomes on a redevelopment site than currently exists, commensurate with the scale of works proposed.

   The proposal is not a redevelopment of the existing building. The proposal includes the demolition of the existing dwelling and then to construct a totally new residential dwelling. Better bushfire outcomes will be achieved by a new building that is fully compliant with the performance criteria of *PBP 2019* and BAL-40 compliant construction and therefore will result in an improved level of bushfire protection. This objective is satisfied.

c) Design and construct buildings commensurate with the bushfire risk.

   The works will comply with the relevant BAL. This objective is satisfied.

d) Provide access, services and landscaping to aid fire fighting operations.

   The provision of access, services and landscaping comply with *PBP* 2019. This objective is satisfied.

e) Not impose an increased bushfire management and maintenance responsibility on adjoining land owners.

   The development does not increase or offset bushfire management onto neighbouring lands. This objective is satisfied.

f) Increase the level of bushfire protection to existing dwellings based on the scale of the proposed work and level of potential risk.

   The work proposed is a new building that is fully compliant with the performance criteria of *PBP 2019* and BAL-40 compliant construction and therefore will result in an improved level of bushfire protection. This objective is satisfied.

5.3 Deviation from the objectives of *PBP 2019*

A BAL–40 outcome is not fully consistent with (Objective iii.) of *PBP 2019*, because there is the potential for direct flame contact with the building elements. Objective iii. of *PBP 2019*, states:

'*provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent the likely fire spread to buildings*'.

However, a BAL–40 outcome is the best outcome for the site when the constraints of the site are taken into consideration. The siting of the building could not be significantly improved to avoid possible flame contact and radiant heat exposure below 40 kW/m^2. BAL–40 construction standard is designed to prevent the likely fire spread to buildings.

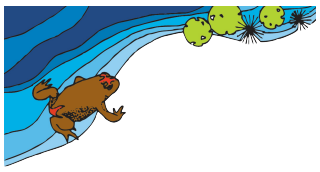
In our opinion we do not believe the aims and objectives of *PBP 2019* regarding appropriate separation distances has been compromised. The application will therefore not need to be referred to the local Rural Fire Service for comment in accordance with Section 4.14 of the *Environmental Planning and Assessment Act 1979*.

5.4 Flame length

Flame length is not expected to impact the building from the east and southern aspects of the PDA.

5.5 Expected radiant heat flux (RHF)

The BAL 40 construction is designed to deal with a 40 kW/m^2 level of radiation.



6 Infrastructure and other requirements

6.1 Asset Protection Zone management

All APZs are achievable for this proposal.

To meet the bushfire protection measures stated in *PBP 2019* for the proposed dwelling the proposed APZ distances are:

- 2 metres on the north aspect to the north site boundary,
- 3 - 10 metres on the east aspect, all area from the external wall of the proposed building to the east site boundary,
- 12 metres on the south aspect and
- 10 metres on the west aspect, all area from the external wall of the proposed building to the west site boundary.

Legislative responsibility to manage hazardous fuels s.63(2) *RF Act 1997*.

S.63(2) of the *Rural Fires Act 1997* No 65 states, "It is the duty of the owner or occupier of land to take the notified steps (if any) and any other practicable steps to prevent the occurrence of bush fires on, and to minimise the danger of the spread of bush fires on or from, that land."

The residents will be required to maintain fuel levels consistent with the provisions of the Asset Protection Zone being, Table 7.4a of *PBP 2019* and Appendix 4 of *PBP 2019* as well as the RFS *Standards for Asset Protection Zones* (Appendix 2 and see www.rfs.nsw.gov.au). The Asset Protection Zone is to be maintained on a permanent basis through the enforcement of a Vegetation Management Plan. The site is zoned as 'Land Management Zone with human settlement' not expected to be impacted upon by bushfire in the Warringah Pittwater Bushfire Risk Management Plan 2010. Ultimate responsibility will fall on the landowner to manage bushfire fuel on the property. With the landowners consent, hazard reduction will be completed by the RFS on a seven to ten year cycle.

Total clearance of all vegetation is not acceptable especially in areas where the topography exceeds 18°. Vegetation management undertaken to establish the required Asset Protection Zone shall be minimised while still complying with *PBP 2019* guidelines.

6.2 Preparation of your existing home for bushfire

The RFS have prepared a number of general tips to prepare your home for bushfire see Appendix 4 for more details.

6.3 Water supply

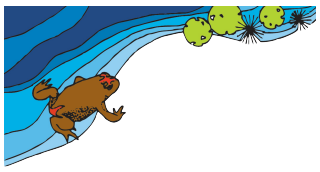
There is town mains water supply available. The nearest hydrant is located outside Lot 328 and outside the road carriageway of Whale Beach Road, 45 metres south from the front of the existing dwelling, and complies with the performance criteria for a reticulated water supply in Table 7.4a of *PBP 2019*. However in a bushfire emergency, it is possible the reticulated water supply is 'unreliable' due to a high water demand and lack of water pressure.

The steepness and elevation change between Whale Beach Road and the rear (west) side of the proposal does create a logistical challenge to firefighters, particularly for access and the provision of a reliable water source. A 70 metre unobstructed path cannot be demonstrated between the most distant external part of the proposed dwelling and the nearest part of the public access road site. Therefore, where applicable, fire hydrants / reticulated water supply to the site is to be installed compliant with the following:

- Fire hydrant spacing, design and sizing comply with the relevant clauses of Australian Standard AS 2419.1:2005 - *Fire hydrant installations System design, installation and commissioning,*
- Hydrants are not to be located within any road carriageway or parking bay,
- Fire hydrant flows and pressures are to comply with AS 2419.1:2005, and
- All above-ground water service pipes external to the building are metal, including and up to any taps.

In addition, a minimum 10,000 litre (or other amount as determined by a hydraulic engineer or other Accredited fire safety engineer), static concrete or metal water supply must be provided on site. A larger tank or pool (for example) can be provided, however the draw off for domestic purposes will need to be above the 10,000 litre line.

- If an underground tank is to be installed it shall have an access hole of 200 mm to allow tankers to refill direct from the tank and must be clearly marked/identified.
- Raised tanks have their stands constructed from non-combustible material or bushfire-resisting timber (see Appendix F AS 3959(2018)).
- Tanks on the hazard side of a building are provided with adequate shielding for the protection of fire fighters.
- A hardened ground surface for truck access is supplied within 4 metres of the tank or standpipe with access to the static water supply.
- Unobstructed access is to be provided at all times.
- A suitable accessible connection located within the IPA or non-hazard side and away from the building is to be provided for RFS purposes in the form of a 65 mm ball valve and Storz fitting.
- The ball valve, pipes and tank penetration must be adequate for full 50 mm inner diameter water flow through the Storz fitting and are metal.
- Supply pipes from tank to ball valve have the same bore size to ensure flow volume.
- Ball valve and pipes are adequate for water flow and are metal.
- All associated fittings to the tank shall be non-combustible/metal.

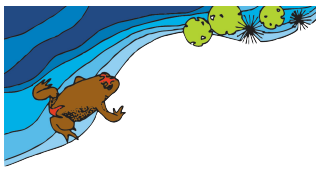


- All above-ground water service pipes or fittings external to the building(s) are metal, including and up to any taps.
- Standpipes/hydrants are not to be located within any road carriageway.
- A minimum 5hp or 3kW petrol- or diesel-powered pump shall be made available to the water supply.
- A 19 mm (internal diameter) fire hose and reel shall be connected to the pump. The fire hose reel must be capable of reaching all extremities of the proposed dwelling. Should the hose not reach all extremities of the building an additional hose reel shall be installed to cover those areas that are not covered.
- Access to the water supply (i.e. pump and hose reel) is to be shielded from radiant heat.
- Fire hose reels are constructed in accordance with AS/NZS 1221:1997 Fire hose reels, and installed in accordance with AS 2441:2005 Installation of Fire hose reels, and
- The property owner is encouraged to place a 'SWS' (static water supply) sign in a visible location on the road front and at any access point/standpipe for site static water supplies.

6.4 Gas and electricity services

Gas and electricity services are to be located so as to not contribute to the risk of fire to the building in the following ways:

- Reticulated or bottled gas is installed and maintained in accordance with AS/NZS 1596:2014 2014 – The storage and handling of LP Gas and the requirements of relevant authorities. Metal piping is to be used;
- All fixed gas cylinders are kept clear of all flammable materials to a distance of 10 metres and shielded on the hazard side of the installation;
- If gas cylinders need to be kept close to the building, the release valves are 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 are not used;
- Gas service pipes are metal, including and up to any outlets;
- The location of electricity services limits the possibility of ignition of surrounding bushland or the fabric of buildings;
- Where practical, electrical transmission lines are underground;
- Where overhead, electrical transmission lines are proposed, the lines must comply with the following:
    - Lines are installed with short pole spacing (30 metres), unless crossing gullies, gorges or riparian areas;
    - No part of a tree is closer to a power line than the distance set out in accordance with the specifications in *ISSC3 Guideline for Managing Vegetation Near Power Lines*.



6.5 Access and egress

The following roads provide access for fire fighting vehicles and evacuation opportunity for residents.

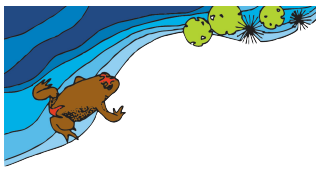
Public roads

Whale Beach Road provides all weather access to the property and complies with the performance criteria in Table 7.4a of *PBP 2019* in the following ways. Whale Beach Road is a two-wheel drive, all weather road, council bitumen through road, which is:

- Clearly sign-posted (buildings/properties are clearly numbered);
- >980 metres long, with seven through road connections along its length, the closest being 300 metres from the entrance to the site;
- Because access and egress can only be achieved through heath vegetation, a secondary access has been provided to an alternate point on the existing public road system. These being access to Florida Road (north end), and Norma Road (south end).
- Traffic management devices are constructed to not prohibit access by emergency services vehicles;
- Of suitable grades (does not exceed 15 degrees for sealed roads or an average of 10 degrees across its length, or other gradient specified by road design standards, whichever is the lesser gradient;
- Has a cross fall not exceeding 3 degrees;
- Six metres wide kerb to kerb, including curves;
- Designed to carry fully loaded fire fighting vehicles (up to 23 tonnes), bridges/causeways clearly indicate load rating;
- The are no dead ends;
- A height clearance of four metres is maintained;
- Provides clear access to reticulated water supply (hydrants are located outside of parking bays and road carriageways);
- Hydrants are provided in accordance with the relevant clauses of Australian Standard AS 2419.1:2005 - *Fire hydrant installations System design, installation and commissioning*;
- There will be suitable access for a Category 1 fire appliance to within 4 metres of the static water supply where no reticulated supply is available;
- Parking does not obstruct the minimum paved width; and
- Is regularly maintained.

Property access

All weather access to the site will be provided in recognition of the risk to fire fighters and/or evacuating occupants. There is access to the rear of the site for operational activities. Firefighters must be able to access the rear of the house from Whale Beach Road.



No specific access requirements apply in an urban area where 70 metres unobstructed path can be demonstrated between the most distant external part of the proposed dwelling and the nearest part of the public access road (road speed limit <70 km/h) that supports the operational use of emergency firefighting vehicles. This provision cannot be demonstrated for this proposal, therefore firefighters must be able to access all external areas of the house from Whale Beach Road.

The site driveway servicing the PDA does comply with the performance criteria in Table 7.4a of *PBP 2019* in the following ways. These are:

- The site driveway carriageway / swept path (excluding drainage and edging) is a minimum 4 metres wide;
- Clearly sign-posted, two-wheel drive, paved all-weather driveway;
- The dead end incorporates a turning area compliant with Figure A3.3 Type C of *PBP 2019*;
- Is less than 200 metres in length, and contains no bridges. The proposed driveway on-site is 11 metres long, nine metres wide;
- Crossfall of the pavement is not more than 10 degrees;
- The site driveway does not exceed 15 degrees and is not more than 10 degrees;
- Curves have a minimum inner radius of six metres and are minimal in number to allow for rapid access and egress;
- The minimum distance between inner and outer curves is six metres;
- A minimum vertical clearance of four metres to any overhanging obstructions, including tree branches;
- The site driveway does not traverse through a wetland or other land potentially subject to periodic inundation (other than flood or storm surge);
- The internal road surfaces have a capacity to carry fully-loaded fire fighting vehicles (23 tonnes), bridges and causeways are to clearly indicate load rating;
- There is suitable access for a Category 1 fire appliance to within 4 metres of the static water supply where no reticulated supply is available; and
- Is regularly maintained.

The proposed site access driveway does comply with Table 7.4a of *PBP 2019*.

RFS vehicle access and turning requirements

Turn-around areas for RFS vehicles, which comply with Appendix 3 of *PBP 2019* are not located along Whale Beach Road.

Whale Beach Road is a council bitumen through road. The only suitable turning points for medium-rigid vehicles are three-point-turns at the closest road intersections: Florida Road and Ocean Place 1.1 km to the north, and Whale Beach Road and Norma Road 680 metres to the south. There are limited, unevenly spread areas where the formed road provides space for medium-rigid vehicles to pass in opposite directions safely.

The most suitable turning area for RFS vehicles in the immediate vicinity of the site will be to use the proposed driveway. The proposed driveway can comply with Figure A3.3 Type C of *PBP 2019* (Figure 11 below).

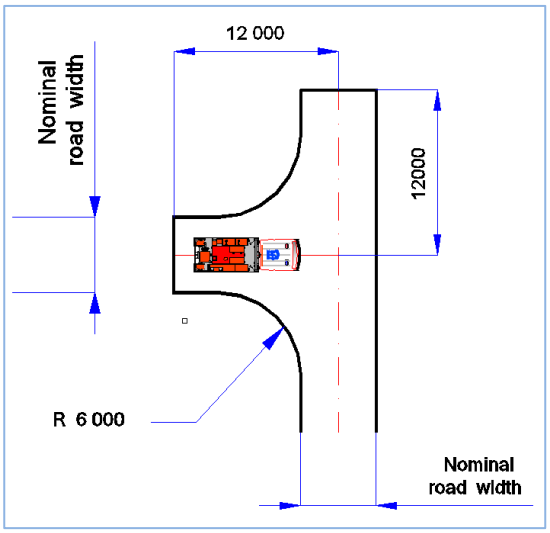


Figure 11 Type A

6.6 Availability of fire fighting services

The nearest NSW Fire and Rescue Station is located at 689 Barrenjoey Rd, Avalon Beach, 5.1 km from the site.

6.7 Additional protection measures

Residents of bushfire prone areas are encouraged to build their own Bushfire Survival Plan – details of where to start can be found in Appendix 3.

6.8 Landscaping

The Vegetation Management Plan within the asset protection zone is to comply with the principles of Appendix 4 of *PBP 2019* (see Appendix 2). For example, this means:

- Landscaping is not to abut the dwelling as this may cause a direct fire path to combustible building elements. Suitable impervious areas are provided immediately surrounding the building such as courtyards, paths and driveways. A pathway or non-combustible ground finish is to adjoin the dwelling for a distance of at least 1.0 metre.
- Total clearance of all vegetation is not acceptable especially in areas where the topography exceeds 18°. Vegetation management undertaken to establish the required Asset Protection zone shall be minimised while still complying with PBP guidelines. Where APZ and areas where the topography exceeds 18° overlap, priority will need to be made to retain native vegetation cover within the slope constraint area that will mitigate adverse impacts of erosion.
- Grassed areas, mowed lawns or ground cover plantings are provided in close proximity to the building. Garden beds of flammable shrubs are not to be located under trees and must be no closer than 10 metres from an exposed window or door.
- Planting of trees and shrubs are restricted in the immediate vicinity of the building, which over time, if not properly maintained, can come in contact with or overhang the building.
- Retained or planted trees and shrubs do not form a continuous stand from the hazard to the asset and will not over time compromise the asset protection zone.
- Local plant species that are of low flammability (low volatile oil levels, high moisture content in leaves and low levels of retained dead material) are selected or retained for use within the asset protection zone.
- The Vegetation Management Plan is to accommodate firefighter access to the rear of the dwelling.
- Fire hazard management for the subject site needs to take into account hollow-bearing trees, and area mapped on the Biodiversity Overlay across the southeast corner of Lot 327.
  - refer to the site PEAR Report (AE21 2233 REP ISS 1 3Mar21).

A full list of landscaping requirements can be found in Appendix 4 of *PBP 2019* and the RFS document *Standards for Asset Protection Zones* must also be consulted.

7 Building construction requirements

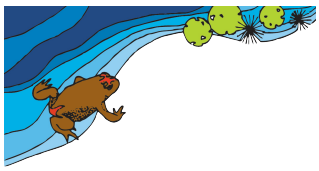
Our assessment indicates the required building construction is BAL-40 on all aspects of the proposal. The west, north and south aspects will be exposed up to 40 kW m^2 principally from the east, but also from pockets of remnant vegetation on the site and to the northwest. Building construction for all aspects of the proposed dwelling are to be built in accordance with the NCC, and must comply with section 3 and 8 (BAL-40) of *Australian Standard 3959* (2018) *Construction of buildings in bushfire-prone areas* and Table 7.4a of *PBP 2019* and as modified by Section 7.5, 7.5.1, 7.5.2, 7.5.3, and 7.5.4 (where applicable) of *PBP 2019*. Refer to AS 3959 (2018) for a detailed description.

The development is not in bush fire attack level - flame zone (BAL-FZ).

AS-3959 (2018) is now available as PDF for free from -
https://infostore.saiglobal.com/en-au/standards/as-3959-2018-122340_saig_as_as_2685241/

Proposed Class 10 buildings are to comply with:

- There is no bushfire protection requirement for Class 10a and 10b structures located more than 6 metres from a dwelling in bushfire prone areas. Where a Class 10a and 10b structure is located within 6 metres of a dwelling it must be constructed in accordance with the NCC as if it were a Class 1a building (s.8.3.2 of *PBP 2019*). Class 10a buildings are non-habitable buildings being a private garage, carport, shed or the like.
- For Class 10b buildings, fences and gates. All fences in bushfire prone areas should be made of either hardwood or non-combustible material. In circumstances where the fence connects directly to the dwelling or in areas of BAL-29 or greater, they should be made of non-combustible material (s.7.6 of PBP 2019).



8 Conclusion and recommendations

The site is mapped as bush fire prone land. In our opinion, the site is not sterilised by the bushfire threat. This report concludes that the proposed development can comply with *PBP 2019*. The owners will therefore be able to construct the proposed dwelling with the following measures included:

a) This proposal has been prepared in accordance with *PBP 2019* in its entirety and the development complies with most relevant Acceptable Solutions in this version of PBP.

b) The site is mapped as bush fire prone land.

c) Building construction for all aspects of the proposed dwelling must comply with section 3 and 8 (BAL-40) of *Australian Standard 3959* (2018) *Construction of buildings in bushfire-prone areas* and Table 7.4a of *PBP 2019* and as modified by Section 7.5, 7.5.1, 7.5.2, 7.5.3, and 7.5.4 (where applicable) of *Planning for Bush Fire Protection 2019*.

- Proposed Class 10 buildings are to comply with Section 7 of this report and:
- Class 10a: Sheds – s.8.3.2 of PBP 2019,
- Class 10b: fences and gates – Section 7.6 of *PBP 2019*.

AS-3959-2018 is now available as PDF for free from -
https://infostore.saiglobal.com/en-au/standards/as-3959-2018-122340_saig_as_as_2685241/

d) We recommend a site Vegetation Management Plan (VMP) be produced for the on-going management and maintenance of the site asset protection zone. The APZ will be maintained to Inner Protection Area condition as per Sec. 6.1 and 6.8 of this report, Appendix 4 of *PBP 2019* and the RFS *Standards for Asset Protection Zones* (Appendix 2 and see www.rfs.nsw.gov.au). The VMP will observe mapped Slope Constraint areas, retention of hollow-bearing trees and area mapped on the Biodiversity Overlay across the southeast corner of Lot 327 (Abel Ecology 2021). Total clearance of all vegetation is not acceptable. Vegetation management undertaken to establish the required Asset Protection zone shall be minimised while still complying with PBP guidelines.

e) In accordance with a site Vegetation Management Plan, an asset protection zone is to be maintained permanently on the north aspect:
- To IPA condition (15% tree canopy cover) for a horizontal distance of 2 metres from the external wall of the dwelling to the north boundary.
- Trees will need to be removed to achieve this requirement.

f) In accordance with a site Vegetation Management Plan, an asset protection zone is to be maintained permanently on the east aspect:
- To IPA condition (15% tree canopy cover) for a horizontal distance of 3 - 10 metres from the external wall of the dwelling to the east boundary.
- Trees will need to be removed to achieve this requirement.

g) In accordance with a site Vegetation Management Plan, an asset protection zone is to be maintained permanently on the west aspect:
- To IPA condition (15% tree canopy cover) for a horizontal distance of 10 metres from the external wall of the dwelling to the west boundary.
- Trees will need to be removed to achieve this requirement.

h) In accordance with a site Vegetation Management Plan, an asset protection zone is to be maintained permanently on the south aspect:
- To IPA condition (15% tree canopy cover) for a horizontal distance of 12 metres from the external wall of the dwelling.
- Trees will need to be removed to achieve this requirement.

i) Whale Beach Road offers adequate access and egress to firefighters, emergency workers, and those involved in evacuation and complies with the performance criteria in Table 7.4a of *PBP 2019*.

j) All weather access to the site will be provided in recognition of the risk to fire fighters and/or evacuating occupants. A 70 metre unobstructed path cannot be demonstrated between the most distant external part of the proposed dwelling and the nearest part of the public access road (road speed limit <70 km/h) that supports the operational use of emergency firefighting vehicles. Therefore there must be access to the rear of the dwelling for operational activities via Whale Beach Road. Firefighters must be able to access to the rear of the dwelling. The access driveway must:

- The site driveway carriageway / swept path (excluding drainage and edging) will be a minimum 4 metres wide;
- Be clearly sign-posted, two-wheel drive, paved all-weather driveway;
- The dead end incorporates a turning area compliant with Figure A3.3 Type C of *PBP 2019*;
- Is less than 200 metres in length, and contains no bridges. The proposed driveway on-site is 11 metres long, nine metres wide;
- Crossfall of the pavement is not more than 10 degrees;
- The site driveway do not exceed 15 degrees and is not more than 10 degrees;
- Curves have a minimum inner radius of six metres and are minimal in number to allow for rapid access and egress;
- The minimum distance between inner and outer curves is six metres;
- A minimum vertical clearance of four metres to any overhanging obstructions, including tree branches;
- The site driveway does not traverse through a wetland or other land potentially subject to periodic inundation (other than flood or storm surge);
- The internal road surfaces have a capacity to carry fully-loaded fire fighting vehicles (23 tonnes), bridges and causeways are to clearly indicate load rating;
- There is suitable access for a Category 1 fire appliance to within 4 metres of the static water supply where no reticulated supply is available; and
- Is regularly maintained.

k) The proposed site access driveway does comply with Table 7.4a of *PBP 2019*.

l) Utility services along Whale Beach Road are adequate to meet the needs of firefighters and others assisting in bush firefighting. Gas and electricity services are to be located so as to not contribute to the risk of fire to the buildings. Gas and electricity services are to be installed as per Sec. 6.4 of this report.

m) Fire hazard management for the subject site needs to take into account hollow-bearing trees, and native vegetation that is:

- Mapped on the Biodiversity Overlay across the southeast corner of Lot 327 and,
- Is protected under a SEPP (Vegetation in Non-Rural Areas) 2017, or SEPP No 19—Bushland in Urban Areas 1986 and SEPP (Coastal Management) 2018.

n) Water supply is to be provided in accordance with Sec. 6.3 of this report and Table 7.4a of *PBP 2019*.

o) Residents of bushfire prone areas are encouraged to build their own Bushfire Survival Plan.

9 Literature Review

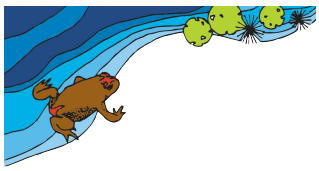
Abel Ecology 2021. Prescribed Ecological Assessment Report (PEAR) for 346, 348, 350 & 352 Whale Beach Road Palm Beach, Lots 327, 328, 329, 330 DP 16362, Proposed new dwelling (AE21 2233 REP ISS 1 3Mar21)

Keith, D. (2004). *Ocean shores to desert dunes: the native vegetation of New South Wales and the ACT*. Department of Environment and Conservation (NSW), Hurstville.

Standards Australia (2018) AS 3959. *Construction of buildings in bushfire-prone areas.* Standards Australia, Sydney.

Tozer, M.G. Turner, K., Keith, D.A., Tindall, D., Pennay, C., Simpson, C., MacKenzie, B., Beukers, P. and Cox, S. (2010). Native vegetation of southeast NSW: a revised classification and map for the coast and eastern tablelands. Cunninghamia, 11(3): 359-406.

Warringah Pittwater BFMC (2010). Bush Fire Prone Land Map for the Northern Beaches Local Government Area in New South Wales, NSW Rural Fire Service.



Appendix 1. Glossary of Definitions and Terms

This section defines and explains some commonly used expressions relating to bushfires.

Bushfire (or wild fire) is generally defined to mean any unplanned fire in vegetation. Fires can also be used for land management purposes such as grazing or hazard reduction. Bushfires generally have a seasonal pattern and occur in spring and summer but can occur at other times of year under suitable conditions. The behaviour of fires is primarily influenced by:

- fuel (type, load, moisture, continuity and compaction);
- ignition source;
- topography (slope and aspect); and
- weather (humidity, temperature, wind).

Bushfire danger is a relative measure of weather conditions (temperature, drought indices, humidity and wind speed) describing the likelihood of fire ignition, spread, control difficulty and damage potential. There is currently an emphasis on prevention and suppression of bushfires to minimise damage to human life and property.

Bushfire hazard is an assessment of the particular combination of available fuel (vegetation), slope and climate/weather pattern relating to a site. This includes leaf litter and ground cover, standing fuel of the shrub and canopy layers and the season of the year. The assessment is usually rated on a scale from 'low' (or insignificant) to 'extreme' and gives a final indicator of the potential severity of a fire.

Bushfire risk means the probability of a wildfire "igniting, spreading and causing damage to assets of value to the community" (Planning for Bushfire Protection 2019). Related to this is bushfire threat which is the threat of potential damage to life and property arising from a combination of hazard, risk and bushfire danger.

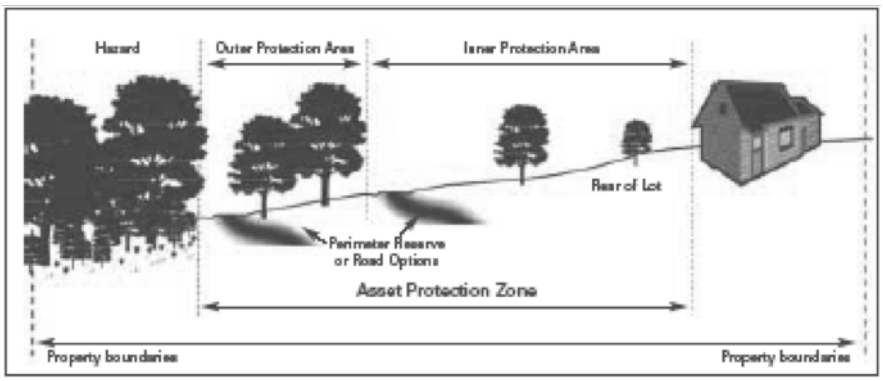
Hazard reduction means a reduction or modification of fuel by burning, chemical, mechanical or manual means.

Prescribed burn means a planned fire ignited by a land manager in accordance with a fuel management plan or for ecosystem management purposes.

Fire regime means the pattern of occurrence of fire, specifically the regularity, periodicity, seasonality, spatial extent, patchiness and intensity. This is important in terms of assessing risks and ecological impacts and is often used in prescribing a management goal to be achieved. There is debate about what constitutes a natural or pre European fire pattern. For the purpose of these definitions natural means an existence independent of human action.

Bushfire Risk Management is achieved by use of **Asset Protection Zones (APZ),** defined by the document "Planning For Bushfire Protection 2019" (NSW Rural Fire Service). An APZ acts as a buffer

zone between the development and the bushfire hazard, and consists of an Outer Protection Area (OPA) and an Inner Protection Area (IPA). The primary purpose of an Asset Protection Zone is to ensure that a progressive reduction of bushfire fuels occurs between the bushfire hazard and any habitable structures within the development.



OPA = Outer Protection Area

Location: adjacent to the hazard
Purpose: substantially reduces the intensity of an approaching fire, reducing the level of direct flame, radiant heat and ember attack on the IPA
Depth: between 10 and 15m deep, depending on the type of land use and vulnerability of the dwelling or persons affected.
Fuel Loading: discontinuous tree canopy and shrub layer; fine fuel load usually less than 8 tonnes per hectare.

IPA = Inner Protection Area

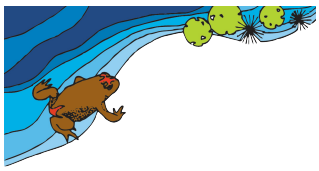
Location: extends from the edge of the OPA to the development to be protected
Purpose: minimise the impact of direct flame contact and radiant heat on the development
Depth: dependent upon the slope of the land

Performance criteria for IPA:

- Minimal fine fuel which can be set alight by a fire
- Any vegetation in the IPA does not provide a path for the transfer of fire to the development - i.e. fuels are discontinuous.

The presence of trees and shrubs in the IPA is acceptable provided that they:

- Do not touch or overhang the building;
- Do not form a continuous canopy;
- Are not species that retain dead material or deposit excessive quantities of ground fuel in a short time;
- Are located far enough away from a building that they will not ignite the building by direct flame contact or radiant heat emission.



Appendix 2. Asset Protection Zone maintenance

To meet the bushfire protection measures stated in *PBP 2019* for the proposed dwelling the proposed APZ distances are:

- 2 metres on the north aspect to the north site boundary,
- 3 - 10 metres on the east aspect, all area from the external wall of the proposed building to the east site boundary,
- 12 metres on the south aspect and
- 10 metres on the west aspect, all area from the external wall of the proposed building to the west site boundary.

The APZ will be maintained to Inner Protection Area condition as per Appendix 4 of *PBP 2019* and the RFS document *Standards for Asset Protection Zones*. At least 75% of the ground cover must be retained after maintenance to prevent soil erosion:

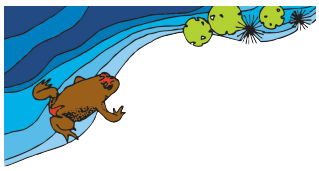
Inner Protection Area

Specification

a) Trees
   i. Canopy - average cover of whole IPA less than 15% (at maturity); not continuous from hazard to asset with 2-5 metres separation between tree crowns; not overhanging within 2-5 metres of building; islands of canopy permitted.
   ii. All lower limbs less than two metres above ground removed.
   iii. Preference should be given to smooth barked and evergreen trees.

b) Trees and shrubs
   i. Retained as clumps or islands, cover less than 10% of whole area.
   ii. Shrubs should not be located under trees.
   iii. Create large discontinuities or gaps in the vegetation to slow down or break the progress of fire towards buildings.
   iv. Clumps of shrubs should be separated from exposed windows and doors by a distance of at least twice the height of the vegetation.

c) Grass
   i. Should be kept mown (as a guide grass should be kept to no more than 100mm in height)
   ii. Leaves and vegetation debris should be removed.



Maintenance

The IPA is to be maintained as follows:

a) Minimal fine fuel at ground level which could be set alight by a bushfire,

b) Vegetation does not provide a path for the transfer of fire to the development - that is, fuels are discontinuous

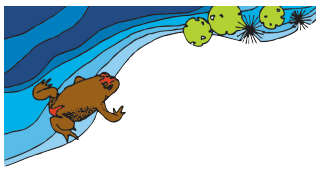
c) No trees to overhang the building

d) Trees must be well spread out and not form a canopy

e) Trees or shrubs that retain dead material or deposit excessive quantities of fuel in a short period of time must not be within the IPA

f) Trees and shrubs must be located far enough from the house that the radiant heat they produce or direct flame contact will not ignite the house.

g) Wooden sheds, combustible material, large areas/quantities of garden mulch, stacked flammable building materials etc., must not be within the IPA



Appendix 3. Fire emergency procedure

Bush Fire Survival Plan

We recommend that you prepare your own Bush Fire Survival Plan
http://www.rfs.nsw.gov.au/file_system/attachments/Attachment_BushFireSurvivalPlan.pdf

Personal safety and survival

(from s6.5 of Planning for Bushfire Protection 2001)
The survivability of a dwelling and its occupants is dependent upon the amount of preparation prior to the actual fire event.

As the bushfire approaches

Personal Protection

Protect yourself from radiant heat by wearing:

a) cotton overalls or thicker long sleeved shirt and long pants of cotton or wool;
b) clothes which are loose fitting;
c) a strong pair of shoes or boots with woollen or cotton socks;
d) gloves, if your hands are not used to working with tools;
e) goggles, if the smoke is thick;
f) a "bandana" or large handkerchief to protect the airways from smoke and hot air;
g) a wide-brimmed hat or hard hat if one is available; but
h) leave your ears uncovered - they warn you of heat levels.

DO NOT WEAR SYNTHETICS – WEAR WOOL, COTTON OR DENIM.

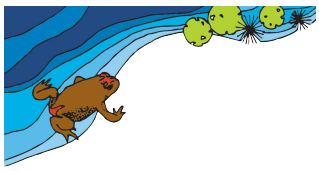
Protection of Children, Elderly and Pets

During the approach of a bushfire:

a) keep children, elderly and pets inside the house;
b) give them plenty of water to drink; and
c) make sure you keep track of their movements.

Outside the home

a) Close windows and doors and any shutters and fit any screens.
b) Block the down pipes and fill them with water.
c) Put doormats inside.
d) Store all combustible furniture and awnings.
e) Wet down wood piles and areas of garden mulch.



Inside the home

a) Fill all sinks, baths and any buckets with water and put a filled bucket in the roof.
b) Block any gaps under the doors with wet towels.
c) Place a ladder to provide access to the roof area.
d) Monitor the radio – keep a spare set of batteries.
e) Turn off any gas.

The car

a) Park in a cleared area.
b) Close all doors, windows and vents.
c) Leave the keys in the ignition.
d) Store woollen blankets inside.

When the bushfire is close

a) Remain outside as long as possible patrolling the area for spot fires.
b) Suppress any spot fires which start close to the house or in the guttering.
c) Take refuge when the smoke starts to thicken.
d) Take your hoses and fittings inside when you move inside.
e) Activate any sprinkler system.

As the bushfire passes over

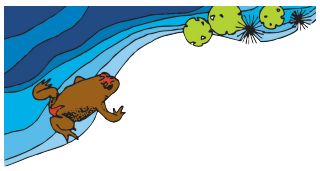
a) Remain calm and keep other occupants calm.
b) Move to the side of the house away from the main fire front.
c) Carry out regular inspections, particularly of windows to determine if they have shattered and embers have entered any rooms.

After the bushfire has passed

a) Before passing through a closed doorway, feel the door – if it is hot do not open it as there may be a fire on the other side – leave it closed to stop the fire spreading and exit via another route.
b) Check the house for fires – the roof, roof spaces and any under floor areas.
c) If the house is on fire move onto burnt out ground but keep clear of burning trees.

Evacuation or relocation

a) Research shows that where people are in attendance and are well prepared then dwelling are more likely to survive a bushfire. Early evacuation or relocation is a serious consideration where:
b) you are not confident that your house is prepared to withstand a bushfire;
c) you are worried about your children or elderly members of the household;
d) you suspect that you or members of the household will be unable to cope with the stress of staying;



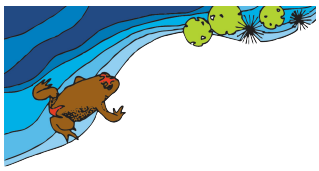
e) it is safe to leave and you have a clear idea of where a safe refuge is to be found; and
f) you know the destination to be safe.

If you do decide to relocate, or are directed to evacuate:

a) DO IT EARLY;
b) close all doors and windows and consider leaving them unlocked – a fire fighter may need access to your home;
c) know where you are going;
d) drive carefully.

NOTE: According to Section 60L of the *NSW State Emergency and Rescue Management Act 1989* No 165, you can be directed to evacuate an area or premises (https://www.legislation.nsw.gov.au/#/view/act/1989/165):

> ***60L Power of police to evacuate or to take other steps concerning persons***
> *(1) A directing officer may, if satisfied that there are reasonable grounds for doing so for the purpose of protecting persons from injury or death threatened by an actual or imminent emergency, direct, or authorise a police officer to direct, a person to do any or all of the following:*
>
> *(a) to leave any particular premises and to move outside the danger area,*
> *(b) to take any children or adults present in any particular premises who are in the person's care and to move them outside the danger area,*
> *(c) not to enter the danger area.*
>
> *directing officer means:*
> *(a) the Minister, or*
> *(b) the State Emergency Operations Controller, or*
> *(c) a police officer of or above the rank of sergeant, or*
> *(d) a police officer of a class prescribed by the regulations for the purposes of this definition.*



Appendix 4. Prepare your home

These tips are curtesy of the Rural Fire Service website -
http://www.rfs.nsw.gov.au/plan-and-prepare/prepare-your-property

A well prepared home is more likely to survive a bush fire.

Even if your plan is to leave early, the more you prepare your home, the more likely it will survive a bush fire or ember attack. A well prepared home can also be easier for you or firefighters to defend, and is less likely to put your neighbours' homes at risk. A well prepared home will also give you more protection if a fire threatens suddenly and you cannot leave.

Here are some basic maintenance tips to prepare your property:

- Clean your gutters of leaves and twigs
- Install metal gutter guards
- Repair damaged or missing tiles on the roof
- Install fine metal mesh screens on windows and doors
- Fit seals around doors and windows to eliminate gaps
- Enclose the areas under the house
- Repair or cover gaps in external walls
- Attach a fire sprinkler system to gutters
- Keep lawns short and gardens well maintained
- Cut back trees and shrubs overhanging buildings
- Clean up fallen leaves, twigs and debris around the property
- Have hoses long enough to reach around your house
- If you have a pool, tank or dam, put a Static Water Supply (SWS) sign on your property entrance, so firefighters know where they can get water
- Check and maintain adequate levels of home and contents insurance. Ensure it is up to date.

Appendix 5. Company Profile

Abel Ecology has been in the ecological consulting business since 1991, starting in the Sydney Region, and progressively more state wide in New South Wales since 1998, and now also in Victoria. During this time extensive expertise has been gained with regard to Master Planning, Environmental Impact assessments including biodiversity reports, bushfire reports, Vegetation Management Plans, Management of threatened species, Review of Environmental Factors, and as Expert Witness in the Land and Environment Court. We have done consultancy work for industrial and commercial developments, golf courses, civil engineering projects, tourist developments as well as residential and rural projects. This process has also generated many connections with relevant government departments and city councils in NSW. Our team consists of four scientists and two administrative staff, plus casual assistants as required.

Licences

NPWS s132C Scientific licence number is SL100780 expires 31 July 2021
NPWS GIS data licence number is CON95034
DG NSW Dept of Primary Industries Animal Care and Ethics Committee Approval expires 8 November 2021
DG NSW Dept of Primary Industries Animal Research Authority expires 8 November 2021

The Consultancy Team

Dr Danny Wotherspoon

Grad Dip Bushfire Protection (University of Western Sydney 2012)
PhD (researching Cumberland Plain vegetation and fauna habitat, at Centre for Integrated Catchment Management, University of Western Sydney, 2008)
Planning for Bushfire Protection Certificate course (University of Technology, 2006)
Consulting Planners Bushfire Training Course (Planning Institute of Australia, 2003)
MA (Macquarie University, 1991)
Wildlife Photography Certificate (Sydney Technical College, 1987)
Herpetological Techniques Certificate (Sydney Technical College, 1986)
Applied Herpetology Certificate (Sydney Technical College, 1980)
Dip Ed (University of New England, 1978)
BSc (Zoology, Ecology) University of New England 1974)

Dr Daniel McDonald

Cert IV – GIS (Riverina TAFE 2016)
PhD (The University of Sydney 2006)
M. Agr (The University of Sydney 1996)
B. Ag Sc. (The University of Sydney 1991)
Daniel is an accredited Biobanking Assessor
Quantified Tree Risk Assessment (QTRA) and Visual Tree Assessment (VTA)

Daniel is an experienced ecologist with expertise in fauna, plant species identification, vegetation assessment, agriculture, conservation genetics and seed collection and preservation. He is accredited both for BioBanking assessments and Biodiversity Certification. His present research interest is in Eastern Suburbs Banksia Scrub and fragmented endangered ecological communities.

Mark Mackinnon

Qualifications: Grad. Dip. of Bushfire Protection, B Env. Sci. (Hons).

Accredited Practitioner Level 3 - Bushfire Planning & Design (BPAD), Accreditation number 36395.

MEIANZ, General firefighter departmental accreditation, Snr 1st Aid Cert, Agricultural Chemical User Permit (1080 and PAPP), Chainsaw Lev.1 (Cross-cut), Manual 4x4 Driving Ticket, Medium-Rigid Vehicle Licence, Elevated-Work-Platform (+11m) Licence, Working at Height Cert., Simple & Complex Tree Climbing Cert., Venomous Snake and Reptile Handling Cert., Lyssavirus Immunisation (bat handling prerequisite), White Card.

Mark is a passionate and enthusiastic scientist who thrives in the field of natural resource management. In the last 6 years, Mark has worked for a number of inter-state government agencies and environmental consultancies. He has experience in threatened species, fire ecology, bushfire management, pest plant and animals, and landscape restoration. In particular he specializes in ornithology and bushfire management. Mark has a number of specialized field-based skills including: simple and complex tree climbing, working at heights, general firefighter departmental fire accreditation, venomous snake and reptile handling, immunization to handle bat species, and an A - class bird banding licence with mist-net endorsement. Mark is also skilled in ArcGIS mapping, first-aid, four -wheel-driving.