BUSHFIRE MANAGEMENT PLAN

STAGE D YANCHEP GOLF ESTATE

Project Number EP10-017(15)

Prepared for Peet Funds Management Ltd
August 2016

Document Control

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Executive Summary

Peet Funds Management Limited (Peet) have engaged Emerge Associates and Bushfire Safety Consulting Pty Ltd to prepare this Bushfire Management Plan (BMP) to support the subdivision of Stage D within Yanchep Golf Estate, a large staged residential development within the locality of Yanchep.

Yanchep Golf Estate is located approximately 56 km north of the Perth Central Business District (CBD) within the City of Wanneroo, and falls under the endorsed Yanchep City Local Structure Plan (LSP) as shown in **Appendix A**. The Stage D area is approximately 16.5 hectares (ha) and covers part of Lot 9004 Yanchep Beach Road, Yanchep. The Stage D area is referred to herein as "the site" and its location is shown generally in **Figure 1**, and its specific boundaries shown in **Figure 2**.

The site has historically been cleared for broad scale agricultural land uses and it is bound by Yanchep Beach Road to the south, a 'Primary Regional Road' reservation associated with the future Mitchell Freeway extension to the east, and existing or future residential development associated with the Yanchep Golf Estate development to the north and west. Yanchep National Park is located approximately 130m east of the Mitchell Freeway reserve. As part of the subdivision and development process, the site will be almost entirely cleared of any existing vegetation, however some trees will be retained in areas of public open space that will be landscaped and managed as public parkland.

The site is currently identified as a "Bushfire Prone Area" under the state-wide *Map of Bush Fire Prone Areas* (2016) released by the Office of Bushfire Risk Management (OBRM), as shown in **Figure 3**. The identification of Bushfire Prone Areas within any portion of the site generally requires further assessment of the bushfire hazard implications in accordance with *State Planning Policy 3.7 Planning in Bushfire Prone Areas* and the *Guidelines for Planning in Bushfire Prone Areas* (WAPC *et al*. 2015).

This BMP has been prepared to support the subdivision of the site, and to assess and identify any potential bushfire risks that are likely to apply to the site, and ensure that any bushfire risk can be appropriately managed. As part of this BMP:

- All areas within 100 metres (m) of the site boundary have been assessed to determine the presence of bushfire prone vegetation (i.e. classified vegetation in accordance with *Australian Standard (AS) 3959-2009 Construction of buildings in bushfire prone areas* (AS 3959)).
- Where classified vegetation is present, the bushfire hazard rating has been determined in accordance with Appendix Two of the *Guidelines for Planning in Bushfire Prone Areas* (WAPC et al. 2015).
- Bushfire Attack Level (BAL) ratings have been determined for the site based on classified vegetation within the surrounding 100 m. Areas to the north and west of the site form part of the broader Yanchep Golf Estate development area. Any classified vegetation in these areas (within 100 m of the site) will either be removed as part of subdivision or maintained to a low fuel level within public open space (i.e. managed to a low threat standard in accordance with Clause 2.2.3.2 of AS 3959) to ensure that an acceptable level of risk is achieved.
- The BAL assessment indicates that new dwellings can be located so that they are not be exposed to an unacceptable level of bushfire risk (i.e. BAL-29 is not exceeded).

The permanent bushfire hazards impacting on the site are associated with vegetation within the freeway reserve east of the site and vegetation south of the site which will be developed for urban residential purposes in the future. The area east of the site is vested with Main Roads Western Australia (Main Roads), and will support the future northern expansion of the Mitchell Freeway. The

freeway construction is currently not expected to be commenced for at least 25 years, at which point the classified vegetation within the reserve will be removed. The area to the south has existing subdivision approval (to support residential development), however timing for the commencement of these works is not currently know. While these two areas of bushfire risk will be removed in the future, due to either unknown or long development timeframes these areas have been assumed to be present in their current state at the time that residential construction is progressed within the site, presenting a conservative approach to assessing bushfire risk.

Based on the species and current condition of vegetation within the freeway reserve it is not considered likely that there will be any increase in future fuel loads within the reserve. A review of historic aerial photography shows that since the area was cleared in 1965 there has been no significant re-establishment of vegetation east of the site. Based on this pattern, and the rate of decline in condition of vegetation, the post development hazard assessment has been based on the existing conditions at the time of assessment, and the assumption that fuel loads are unlikely to increase in the future, prior to the total removal of the hazard as part of the construction of the freeway extension.

Any new dwellings constructed within 100 m of classified bushfire prone vegetation will require consideration of the need for increased construction standards to address AS 3959. A Bushfire Attack Level (BAL) assessment has been undertaken as part of this BMP in order to demonstrate that, with the provision of appropriate Asset Protection Zones (APZs), no areas within the site are exposed to an unacceptable level of bushfire risk (i.e. greater than BAL-29). This BAL assessment has incorporated a Method 1 assessment in accordance with Section 2 of AS 3959, providing a basic assessment of radiant heat flux utilising the standard conditions of AS 3959.

As part of the subdivision approval process, any lots deemed to require bushfire management responses through the detailed BAL assessment (i.e. a BAL rating of BAL-12.5 or greater), will be subject to a notification pursuant to Section 165 of the *Planning and Development Act 2005*. The notification will be placed on the certificate(s) of title, indicating that the lot is subject to the requirements of a Bushfire Management Plan (i.e. increased construction standards to meet increased BAL ratings). The lots likely to be subject to notification have been shown within **Figure 14**.

The site will be provided with an adequate water supply through the provision of reticulated water and fire hydrants and sufficient vehicle access to and from the site, to ensure residents and fire fighters are able to respond appropriately in the event of a bushfire in the vicinity of the site.

It is expected that the implementation of this BMP will reduce the threat posed by bushfires to future residents, visitors and fire fighters in the areas proposed for urban development associated with this BMP, but is entirely reliant on the implementation of relevant bushfire protection measures by the future land owner or occupier within the proposed lots and fire emergency response.

Based on the bushfire hazard and BAL assessment contained within this BMP, the following key recommendations should be considered as part of the implementation of development within the site:

- By implementing this BMP, the bushfire risk to development within the site can be minimised through the provision of appropriate APZs combined with increased construction standards in accordance with AS 3959.
- The BAL assessment undertaken as part of this BMP indicates that no future lots within the site will be exposed to an unacceptable level of radiant heat flux (i.e. no greater than BAL-29) and BAL-29 is not exceeded.

- The BAL ratings determined within this BMP and BAL assessment can be used as part of the subdivision and building licence process to inform BAL ratings within lots, and will be confirmed/certified prior to building construction through the completion of **Appendix D**.
- A notification pursuant to Section 165 of the *Planning and Development Act 2005 be* placed on the certificate(s) of titles for lots likely to be exposed to a BAL rating of BAL-12.5 or higher indicating that the proposed lots are subject to the requirements of a Bushfire Management Plan (i.e. increased construction standards to meet increased BAL ratings).
- The Bushfire Prone Areas determined for the site (shown in **Figure 11**) can be used by the City of Wanneroo to update the state-wide *Map of Bushfire Prone Areas* (OBRM 2016).

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1 Introduction

Peet Funds Management Limited (Peet) have engaged Emerge Associates and Bushfire Safety Consulting Pty Ltd to prepare this Bushfire Management Plan (BMP) to support the subdivision application for Stage D within Yanchep Golf Estate, a large staged residential development within the locality of Yanchep.

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The site is currently identified as a "Bushfire Prone Area" under the state-wide *Map of Bush Fire Prone Areas* (2016) released by the Office of Bushfire Risk Management (OBRM), as shown in **Figure 3.** The identification of Bushfire Prone Areas within any portion of the site generally requires further assessment of the bushfire hazard implications on proposed development to be undertaken in accordance with State Planning Policy 3.7 Planning in Bushfire Prone Areas and the *Guidelines for Planning in Bushfire Prone Areas* (WAPC *et al*. 2015), as generally detailed within **Plate 1**.

1.1 Accreditation

This BMP has been prepared jointly by Emerge Associates and Bushfire Safety Consulting.

Bushfire Safety Consulting is owned and operated by Rohan Carboon, an experienced bushfire consultant to the urban planning industry. Rohan has undergraduate degrees in Environmental Management and postgraduate qualifications in Bushfire Protection and has been providing bushfire risk and hazard assessment and mitigation advice to the urban planning and development industry for more than six years. He first worked professionally in community bushfire safety education in 1999 and has been involved in land management including bushfire suppression since 1993.

Bushfire Safety Consulting is a Corporate Bronze Member of the Fire Protection Association of Australia. Rohan has obtained BPAD Level 1 BAL Assessor accreditation under the Fire Protection Association of Australia's new Western Australian accreditation scheme, is in the process of obtaining Level 2 accreditation. He will also be applying to progress to Level 3 accreditation in 2016.

Emerge Associates has been working jointly with Bushfire Safety Consulting for more than four years to undertake detailed bushfire assessments to support the land use development industry. Emerge Associates' personnel are also in the process of obtaining BPAD Level 1 BAL Assessor accreditation, and will progress to Level 2 accreditation as the Western Australian system is developed.

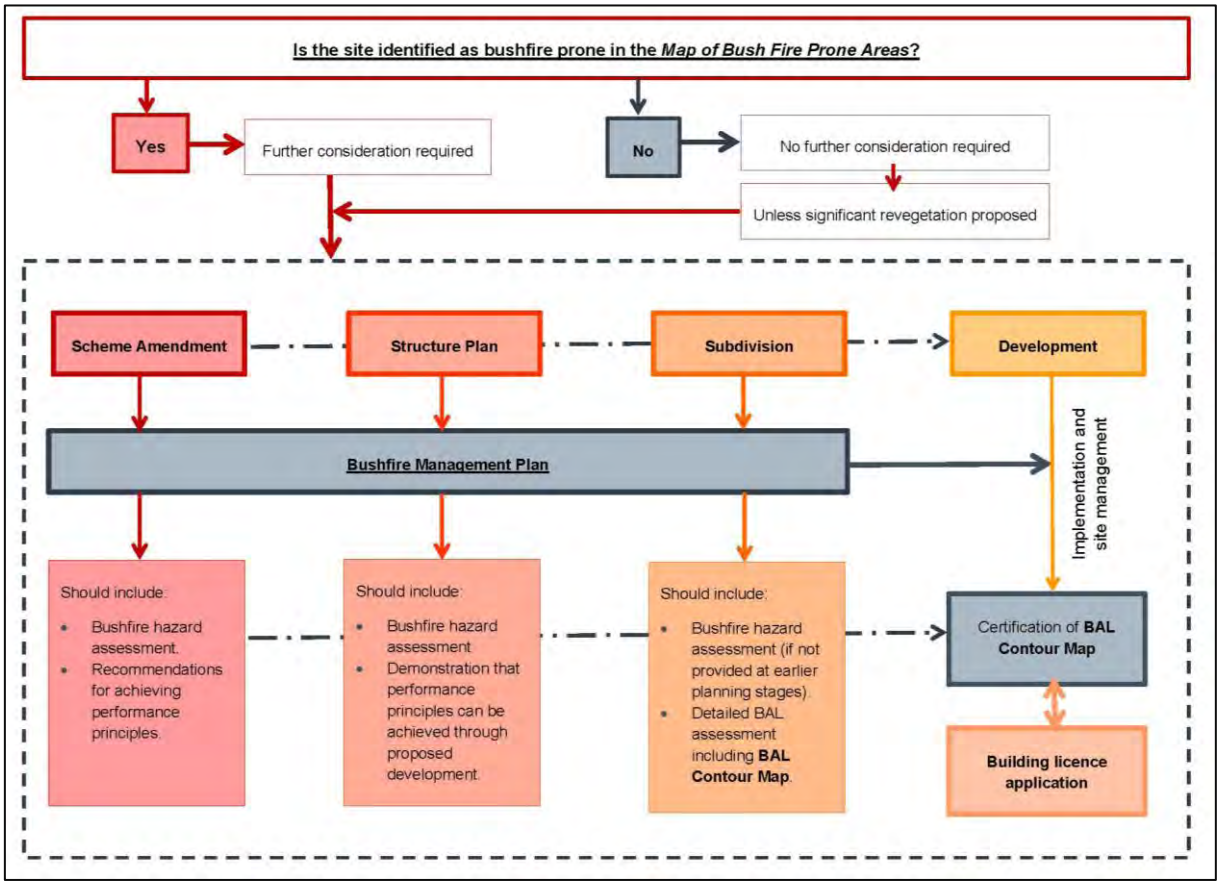

Plate 1: Bushfire planning and assessment process, based on SPP 3.7 (WAPC 2015) and the Guidelines for Planning in Bushfire Prone Areas (WAPC et al. 2015

1.2 Aim

This BMP has been prepared to support the proposed residential subdivision of the site, in accordance with the layout provided in **Appendix B** and **Figure 4**, and to satisfy any conditions placed on subdivision approval granted by the Western Australian Planning Commission (WAPC) relating to bushfire.

This BMP aims to assess bushfire hazard levels in the vicinity of the site (within 100 m) particularly with regard to hazards that will exist post development, and to ensure that the threat posed by the identified bushfire hazard can be mitigated to acceptable levels through the subdivision layout and built form appropriate for residential development. In doing so, this BMP aims to minimise the potential impact of bushfires on development within the site, and reduce the threat to life, property and the environment. The bushfire risk will be mitigated to acceptable levels as defined in the *Guidelines for Planning in Bushfire Prone Areas* (WAPC *et al.* 2015).

1.3 Statutory policy and framework

The following key legislation, policies and guidelines are relevant to the preparation of a bushfire management plan.

1.3.1 *Fire and Emergency Services Act 1998*

Areas within Western Australia have now been designated as bushfire prone by the Fire and Emergency Services (FES) Commissioner, through the release of the *Map of Bush Fire Prone Areas* (OBRM 2016 or as updated). The *Fire and Emergency Services Act 1998* (FES Act) enables the statutory delineation of Bushfire Prone Areas, which are areas within 100 m of classified bushfire prone vegetation. In turn, Bushfire Prone Areas enable the implementation of the regulations and guidelines outlined below. The *Map of Bush Fire Prone Areas* (OBRM 2016) as currently mapped for the site is shown in **Figure 3.**

1.3.2 *Bush Fires Act 1954*

The *Bush Fires Act 1954* (Bush Fires Act) sets out provisions to reduce the dangers resulting from bushfires, prevent, control and extinguish bushfires, and for other purposes. The Bush Fires Act addresses various matters including prohibited burning times, enabling Local Government to require landowners and/or occupiers to plough or clear fire breaks to control and extinguish bushfires and to establish and maintain bushfire brigades.

Pursuant to the Bush Fires Act, the City of Wanneroo publishes annual firebreak advice that can be accessed from: http://www.wanneroo.wa.gov.au/info/20035/community_health_and_safety /195/firebreaks

1.3.3 *Planning and Development (Local Planning Scheme Amendment) Regulations 2015*

The *Planning and Development (Local Planning Scheme Amendment) Regulations 2015* (WAPC 2015a) (the Regulations) include deemed provisions which reference the FES Commissioner's power to designate bushfire prone areas, and provide a mechanism to apply *State Planning Policy 3.7 Planning in Bushfire Prone Areas* (WAPC 2015) and the related assessment requirements through planning and development decisions.

1.3.4 *Building Regulations 2012*

All building work in Western Australia is required to comply with the requirements of the Building Code of Australia (BCA). The Building Regulations 2012 recognise that properties that are located within designated bushfire prone areas (within the *Map of Bush Fire Prone Areas*) may require additional assessment for bushfire risk and for construction of dwellings to be in accordance with *Australian Standard (AS) 3959-2009 Construction of buildings in bushfire prone areas* (Standards Australia 2009).

Under the Building Regulations 2012 and associated building standards, where a dwelling is identified in a designated bushfire prone area there is generally no requirement to upgrade existing dwellings in accordance with t *Australian Standard (AS) 3959-2009 Construction of buildings in bushfire prone areas*. If additions or extensive renovations are being considered, these may require increased construction standards in accordance with *Australian Standard (AS) 3959-2009 Construction of buildings in bushfire prone areas*.

1.3.5 *State Planning Policy 3.7 Planning in Bushfire Prone Areas*

The Department of Planning and WAPC have released *State Planning Policy 3.7 Planning in Bushfire Prone Areas* (December 2015) (SPP 3.7). SPP 3.7 aims to:

- Avoid any increase in the threat of bushfire to people, property and infrastructure. The preservation of life and the management of bushfire impact are paramount.
- Reduce vulnerability to bushfire through the identification and consideration of bushfire risks in decision-making at all stages of the planning and development process.
- Ensure that higher order strategic planning documents, strategic planning proposals, subdivision and development applications take into account bushfire protection requirements and include specified bushfire protection measures.
- Achieve an appropriate balance between bushfire risk management measures and, biodiversity conservation values and landscape amenity, with consideration of the potential impacts of climate change.

SPP 3.7 makes provision for further detailed bushfire hazard assessment to be undertaken for areas identified as bushfire prone within the *Map of Bush Fire Prone Areas*. It also outlines the information that is required to support the various stages of planning and the potential for bushfire conditions to be applied through the subdivision process.

1.3.6 *Guidelines for Planning in Bushfire Prone Areas* (WAPC et al. 2015)

The *Guidelines for Planning in Bushfire Prone Areas* (WAPC *et al.* 2015) ("the Guidelines") have been prepared by the WAPC and DFES, to assist in the interpretation of SPP 3.7 and provide advice on planning, designing or assessing a proposal within a bushfire prone area. The Guidelines are the predominant document to be used by decision-making authorities and referral agencies when considering the appropriateness of strategic planning proposals, subdivisions, and development applications.

The guidelines address important bushfire risk management and planning issues and outline performance criteria and acceptable solutions to minimise the risk of bushfires in new subdivisions and developments. The guidelines also address management issues including location, siting and design of the development (and consideration of Bushfire Attack Level (BAL) ratings), vehicular access and water requirements.

1.3.7 *Australian Standard AS 3959 – 2009 Construction of buildings in bushfire prone areas*

The Australian Standard *AS 3959-2009 Construction of buildings in bushfire prone areas* (AS 3959) specifies requirements for the construction of buildings in bushfire prone areas in order to improve their resistance to bushfire attack from embers, radiant heat, flame contact, and combinations of these attack forms.

The objective of AS 3959 is to provide detailed methods for assessing bushfire attack and to prescribe specific construction details for buildings to reduce the risk of ignition from a bushfire, appropriate to the:

- Potential for ignition caused by burning embers, radiant heat or flame generated by a bushfire.
- Intensity of the bushfire attack on the building.

Two separate methods are outlined in AS 3959 for determining the impact of bushfire on dwellings and have been outlined below:

- **Method 1**, outlined in Section 2 and Appendix A of AS 3959, provides a basic assessment of radiant heat flux levels at various distances from classified vegetation (up to 100 m). This method assumes standard fuel loads for classified vegetation as outlined in AS 3959 and considers the effective slope beneath vegetation. This method can be used to determine appropriate setbacks to dwellings to achieve different levels of radiant heat exposure (i.e. BAL-12.5 to BAL-FZ).
- **Method 2**, outlined in Appendix B of AS 3959, provides a framework for a more rigorous and site specific assessment of radiant heat flux exposure for a site, involving bushfire engineering analysis and modelling using site specific data (e.g. climate/weather conditions during fire season, actual onsite fuel loads associated with classified vegetation etc.).

Vegetation that does not trigger a BAL assessment (i.e. low threat) according to Clause 2.2.3.2 of AS 3959 includes the following:

a) Vegetation of any type more than 100 m from the site.
b) Single areas of vegetation less than 1 ha in area and not within 100 m of other areas of vegetation being classified.
c) Multiple areas of vegetation less than 0.25 ha in area and not within 20 m of the site or each other.
d) Strips of vegetation less than 20 m wide (measured perpendicular to the elevation exposed to the strip of vegetation) regardless of length and not within 20 m of the site or each other, or other areas of vegetation being classified.
e) Non-vegetated areas, including waterways, roads, footpaths, buildings and rocky outcrops.
f) Low threat vegetation, including grassland managed in a minimal fuel condition, maintained lawns, golf courses, maintained public reserves and parkland, vineyards, orchards, cultivated gardens, commercial nurseries, nature strips and wind breaks.

2 Proposal and Objectives

Community bushfire safety is a shared responsibility between state and local governments, fire agencies, communities and individuals. How future residents interpret the risk posed by bushfire hazards, prepare and maintain their properties and buildings and what decisions and actions they take (i.e. evacuate early or stay and defend or other) will greatly influence the consequences of any bushfire that occurs in the local area in proximity to the site.

Residential subdivision is proposed within the site in accordance with the subdivision layout as attached in **Appendix B** and shown in **Figure 4**. Implementing this BMP will ensure that adequate steps are taken during the development process so that if there is a bushfire within or near the site that the threat to residents, property and emergency response personnel can be managed in collaboration with any emergency response.

Achievable and measurable goals of this plan include ensuring:

- Development can be located in an area where the bushfire hazard does not present an unreasonable level of risk to life and property (i.e. BAL-29 is not exceeded).
- Vehicular access to the development is safe if a bushfire occurs.
- Water is available to the development, so that life and property can be protected from bushfire.
- Development is sited to minimise the effects of a bushfire.
- Development design will minimise the effects of a bushfire.

This BMP provides:

- Identification of those portions of the site designated as Bushfire Prone Areas under the OBRM's *Map of Bushfire Prone Areas* (OBRM 2016)
- A description of the site, the surrounding area, fire climate and bushfire history
- A summary of research into the related effects of a bushfire
- A bushfire hazard assessment
- Identification of determined site specific Bushfire Prone Areas based on the assessment of classified vegetation within the site and surrounding 100 m
- A description of the proposed road network and how this addresses vehicular access for bushfire risk purposes
- An outline of the water supply requirements within the site for firefighting purposes
- An outline of the requirements for the internal siting of buildings to include asset protection zones
- A BAL assessment to outline the acceptable siting and design of any new dwellings based on accommodating appropriate bushfire hazard mitigation measures from surrounding classified vegetation.
- An outline of the roles and responsibilities associated with the implementation of this BMP.

3 Description of the Area

3.1 General

The site has been historically cleared of native vegetation (prior to 1953) for broad scale agricultural land uses and more recently planted with Tuarts and non-endemic Eucalypt species. Vegetation within the site is largely comprised of woodland of planted non-endemic trees over weeds, with some scattered remnant or planted native species.

The site is bound by Yanchep Beach Road to the south, a 'Primary Regional Road' reservation associated with the future Mitchell Freeway extension to the east, and existing or future residential development associated with the Yanchep Golf Estate development to the north and west. Yanchep National Park is located approximately 130m east of the Mitchell Freeway reserve. Further south of Yanchep Beach Road is an area proposed for future urban development and has existing subdivision approval.

3.2 Climate and fire weather

The behaviour of bushfires is significantly affected by weather conditions and they burn more aggressively when high temperatures combine with low humidity and strong winds. In Perth and surrounding coastal areas, the fire risk is greatest from summer through autumn when the moisture content in vegetation is low. Summer and autumn days with high temperatures, low humidity and strong winds are particularly conducive to the spread of fire. This threat is increased if thunderstorms develop, accompanied by lightning and little or no rain.

Research indicates that virtually all house losses from bushfire have occurred during severe, extreme or catastrophic conditions (i.e. when the Fire Danger Index is over 50) (Blanchi *et al*., 2010).

The Bureau of Meteorology (2014) states that extreme fire weather conditions in the Perth region typically occur with strong easterly or north-easterly winds associated with a strong high to the south of the state and a trough offshore. Easterly winds represent approximately 60% of extreme fire weather days (events) compared to fewer than 5% associated with southerly winds. About 15% of Perth events occurred in a westerly flow following the passage of a trough.

Very dangerous fire weather conditions often follow a sequence of hot days and easterly winds that culminate when the trough deepens near the coast and moves inland. Winds can change from easterly to northerly and then to westerly during this sequence of climatic events.

Data from the Bureau of Meteorology (BoM) weather station at the Gingin RAAF airport (Gingin Aero), approximately 19 km north-east of the site, indicates that the area experiences warm dry summers and cool wet winters (as shown in **Plate 2** and **Plate 3** below), and is classified as a Mediterranean climate. Mean maximum temperatures vary from 33.2°C in February to 18.3°C in July (BoM 2015) and is shown in **Plate 2**, while the highest mean rainfall occurs between May and October, as shown in **Plate 3**.

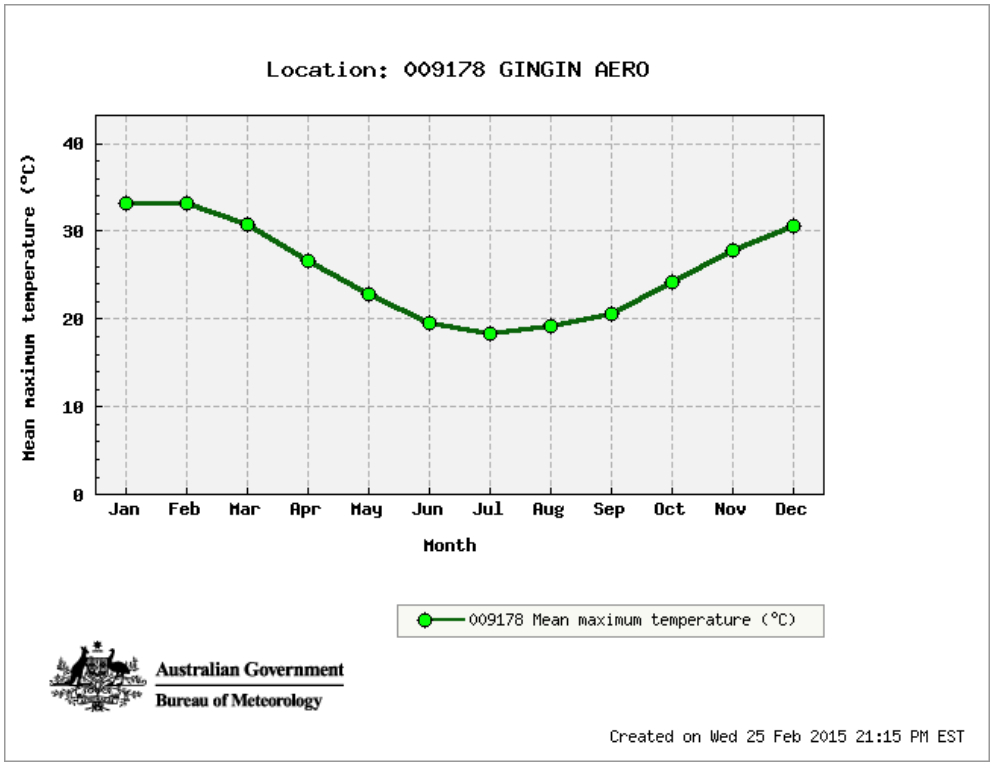

Plate 2: Mean maximum recorded temperatures and mean rainfall for the Gingin Aero Bureau of Meteorology Station between 1996 and 2014 (Bureau of Meteorology 2015)

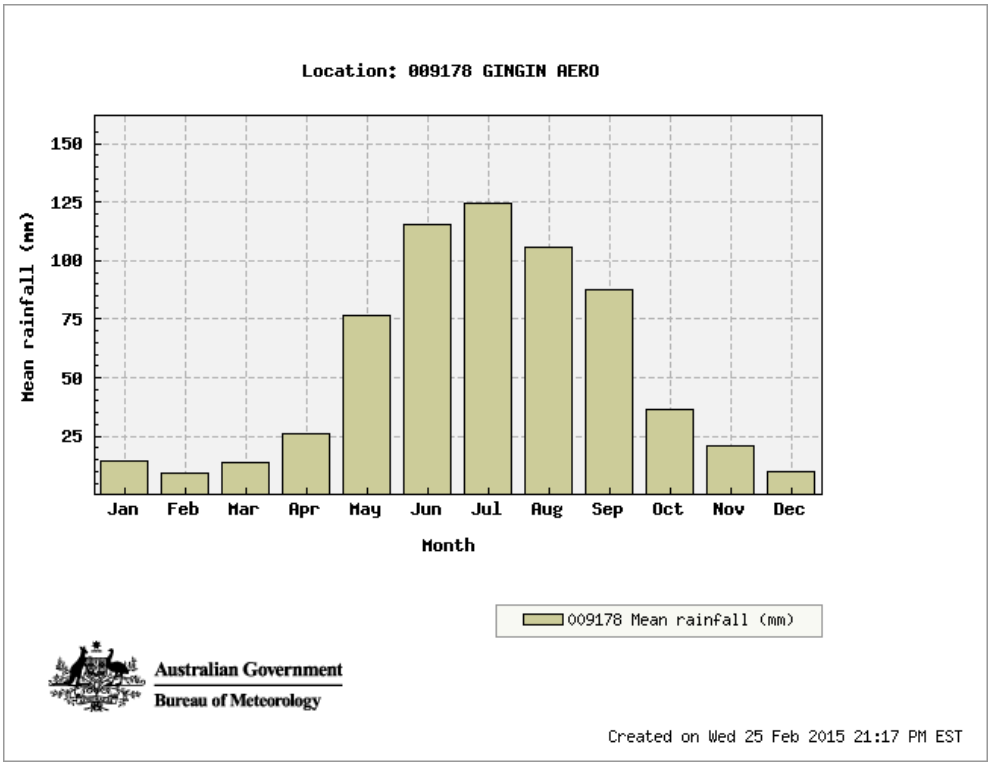

Plate 3: Mean rainfall for the Gingin Aero Bureau of Meteorology Station between 1996 and 2015 (Bureau of Meteorology 2015)

Data from the Gingin Aero weather station indicates that the predominant winds near the site in the summer months at 3 pm are south-westerly (Bureau of Meteorology 2015). Easterly and south-easterly winds are more common in February. Wind strength, direction and frequency from the south-west are dominant and occur 45 to 55 per cent of the time.

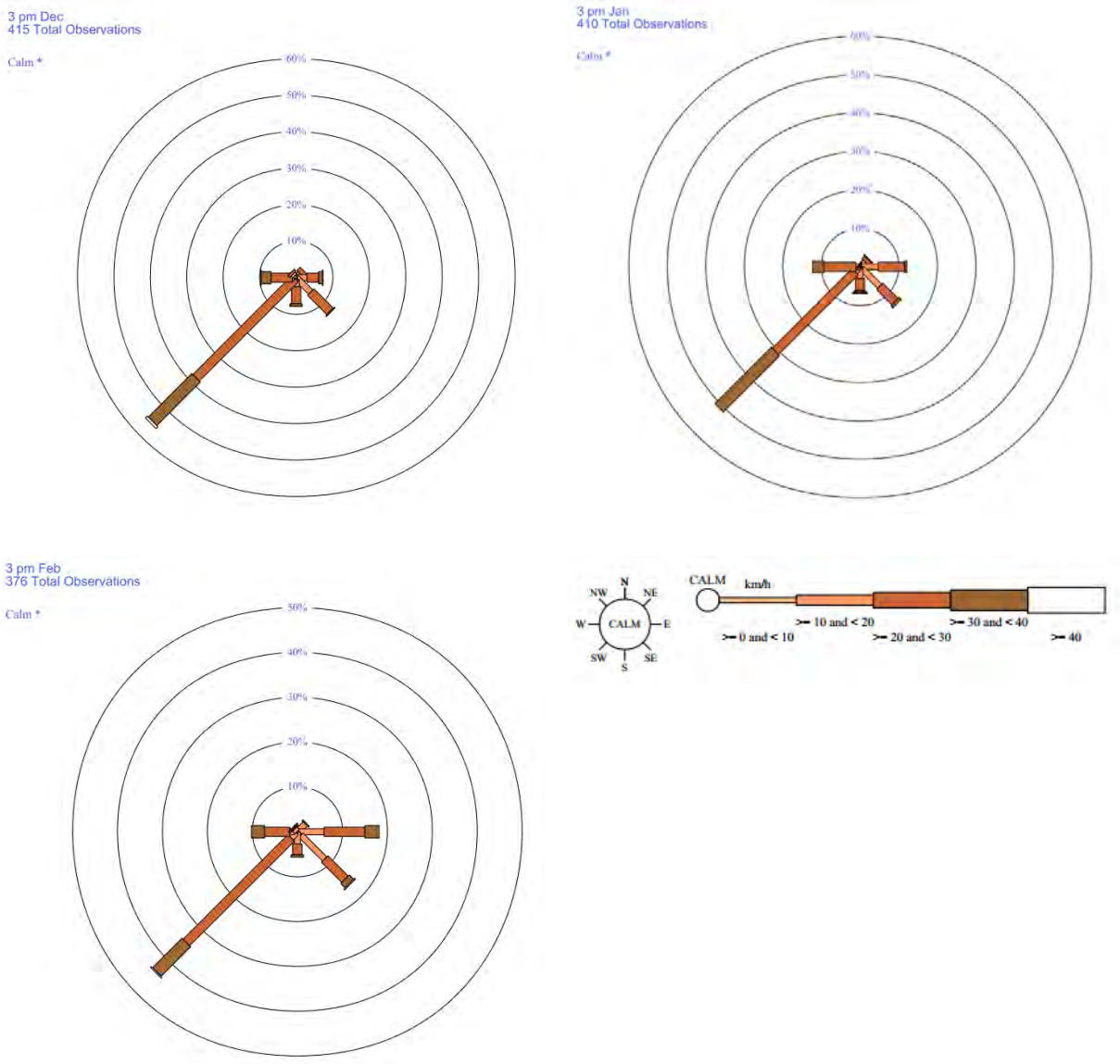

Plate 4: Rose of wind direction and wind speed in km/h for December, January and February between 1996 and 2010 at the Gingin Aero Bureau of Meteorology Station (Bureau of Meteorology 2015)

Wind roses summarise the occurrence of winds at a location, showing their strength, direction and frequency. The percentage of calm conditions is represented by the size of the centre circle - the bigger the circle, the higher the frequency of calm conditions. Each branch of the rose represents wind coming from that direction, with north found at the top of the diagram. Eight directions are used. The branches are divided into segments of different thickness and colour, which represent wind speed ranges in that direction. Speed ranges of 10 km/h are used. The length of each segment within a branch is proportional to the frequency of winds blowing within corresponding range of speeds from that direction (BOM, 2010).

3.3 Topography

The topography of the site is generally undulating, with natural surface heights ranging from 17 metres Australian Height Datum (m AHD) in the north-east corner to 34 m AHD in the central-east and north-west portion of the site. The topography of the site is shown in **Figure 5**.

3.4 Land use

The site is currently zoned 'Urban' under the Metropolitan Region Scheme (MRS) and 'Urban Development' under the City of Wanneroo's District Planning Scheme (DPS) No. 2.

The site is surrounded to the north, west and south by areas that are similarly zoned and are associated with the broader Yanchep Golf Estate development (to the north and west), and neighbouring urban development (to the south). Land east of the site is reserved for "Primary Regional Roads" under the MRS, and is associated with the future Mitchell Freeway extension.

Yanchep National Park is located approximately 130 m east of the site, and contains a significant level of bushfire fuels which could influence the behaviour of an approaching bushfire. This is discussed further in **Section 4.3**.

Current MRS zones and reservations within and surrounding the site are shown in **Figure 6**.

3.5 Bushfire fuels

The majority of the site has been historically cleared of native vegetation to facilitate agricultural land uses and was predominantly used for livestock grazing. More recently, Tuarts and non-endemic species have been planted throughout the site.

Vegetation within the site is largely comprised of woodland of planted non-endemic trees including; **Eucalyptus utilis*, **Corymbia ficifolia* and **Pinus pinaster* over weeds. Scattered remnant or planted native species, *Xanthorrhoea preissii* and *Eucalyptus todtiana,* were also present amongst the planted vegetation. The portion of the site adjacent to Yanchep Beach Road contains a woodland of planted *Eucalyptus gomphocephala* trees. These areas are in 'Completely Degraded' condition.

A small area in the southeast corner of the site contains remnant low woodland of *Banksia attenuata* over a shrubland of *Xanthorrhoea preissii* and *Calothamnus quadrifidus* over low shrubland of *Hibbertia hypericoides*. This area is in 'Very Good' condition.

Bushfire fuels surrounding the site are generally limited to vegetation within the future freeway reserve east of the site. Remnant vegetation north and west of the site will be removed or maintained to a low fuel level as part of the broader Yanchep Golf Estate urban development. Woodland vegetation occurs between the site and Yanchep Beach Road, however this vegetation will be managed and maintained to a low fuel level as part of the entry statement for the site. In the long term, this area will be maintained by the City of Wanneroo as part of the Yanchep Beach Road reserve.

Landholdings south of Yanchep Beach Road are currently undergoing separate subdivision processes and vegetation within these lots may be removed prior to development within the site as part of subdivision in this area, removing the hazard. The bushfire hazard implications arising from these areas are discussed further in **Section 4.3**.

3.6 Assets

In accordance with the approved Yanchep City LSP and the proposed Yanchep Golf Estate Stage D subdivision, the site will support the development of residential lots, a Local Activity Centre, two large area of POS and one small POS/Public Access Way. The proposed subdivision plan is shown in **Figure 4**.

Dwellings exposed to bushfire hazard will be those located within 100m of classified vegetation that is likely to remain in the medium to long term. These areas are considered bushfire prone, as discussed further in **Section 5.2.4.3**.

3.7 Access

The site is currently accessible from Yanchep Beach Road which forms the southern boundary of the site, and from existing residential subdivision immediately west of the site. Once subdivided, the site will be accessible from Yanchep Beach Road and via road connections from adjacent residential development to the west (existing development) and will also connect to future development north of the site. The 'Primary Regional Road' reserve associated with the future Mitchell Freeway extension immediately east of the site restricts access from the east, however sufficient two-way access for residents and emergency personnel is provided from the south, north and west, as shown in **Figure 4**.

3.8 Water Supply

Reticulated water will be provided to the entire development. Fire hydrants will be spaced according to Water Corporation and DFES standards and provide emergency services with access to an adequate water supply.

4 Bushfire Context and Current Situation

4.1 Bushfire history

Fires have been common on the Swan Coastal Plain for thousands of years and the anthropological and historical evidence suggests that Aboriginal people regularly burnt this area (Hallam 1975, Abbott 2003).

A recent study has concluded that bushfires may have been in the Australian landscape for 50 million years longer than previously thought. The adaption of eucalypts that allows them to recover from bushfires has been traced back more than 60 million years (Crisp *et al*., 2011), indicating fire has been in the Australian landscape since at least that time.

Bushfires are common in the City of Wanneroo and more specifically in the area surrounding the site. Large fires have occurred near Yanchep National Park in 2011 and 2013.

More recent bushfire history includes on the 9 and 10 January 2015, a fire that started near Bullsbrook, and burnt towards Old Yanchep Road on strong easterly winds. Emergency warnings were issued for residents in its path. The fire tracked north of Banksia Grove towards Yanchep National Park but was contained before it reached this area.

Given that bushfires are common in the City of Wanneroo, this BMP plays an important role in ensuring that the development of the land can appropriately mitigate the risk and threat posed from bushfire.

4.2 Bushfire risk

The risk management process described in AS/NZS ISO 31000:2009 *Risk management – Principles and guidelines* is a systematic method for identifying, analysing, evaluating and treating emergency risks.

Bushfire risk is determined by assessing:

- Bushfire hazard (i.e. bushfire prone vegetation)
- Threat level (i.e. proximity of the hazard to assets and people)
- Vulnerability of the asset
- Consequence rating (i.e. a rating for the potential outcome once the ‘incident’ has occurred)
- Likelihood rating (i.e. the chance of an event).

It is not necessary to undertake a standalone site specific bushfire risk assessment in accordance with AS/NZS ISO 31000:2009 as part of this BMP, as risk has been appropriately considered in the specific context of the *Guidelines for Planning in Bushfire Prone Areas* (WAPC et al. 2015) and AS 3959.

The vulnerability of assets such as dwellings is impacted by several factors. Some relate to the way a bushfire behaves at a site, others to the design and construction materials in the building and siting of surrounding elements. Infrastructure, utilities and human behaviour are also factors. Leonard (2009) identified the following factors as relevant considerations:

- Terrain (slope)
- Vegetation (overall fuel load, steady state litter load, bark fuels, etc.)
- Weather (temperature, relative humidity and wind speed)

- Distance of building from unmanaged vegetation
- Individual elements surrounding the building that are either a shield or an additional fuel source
- Proximity to surrounding infrastructure
- Building design and maintenance
- Human behaviour (ability to be present and capacity to fight the fire)
- Access to the building and how that influences human behaviour
- Water supply for active and/or passive defence
- Power supply.

Where buildings are lost, this is likely to occur as a result of their vulnerability to the mechanisms of bushfire attack. Buildings constructed to increased standards under AS 3959 are more likely to survive a bushfire than buildings that do not conform to these construction standards, although building survival is not guaranteed.

The vulnerability of people is determined by several factors, including age, fitness levels, gender, level of preparation, and number of occupants who can actively defend a property. The development will be comprised of the existing residential dwellings and outbuildings as well as an area of land that is managed for horticultural purposes.

The OBRM release the state-wide *Map of Bush Fire Prone Areas*, which designates bushfire prone areas within Western Australia. The site is identified as bushfire prone (as shown in **Figure 3**) and as such the requirements of AS 3959 apply to any new dwellings that may be constructed or improvements (as well as the state bushfire management framework outlined in SPP 3.7, discussed in **Section 1.3**).

4.3 Bushfire hazard

Assessing bushfire hazards takes into account the predominant class of vegetation on the site and surrounding area for a minimum of 100 m, in accordance with Section 2.2.3 and Table 2.3 of AS 3959, as shown in **Figure 7**. The assignment of vegetation classifications is based on an assessment of vegetation structure, which includes consideration of the various fuel layers of different vegetation types. For example, fuel layers in a typical forest environment can be broken-down into five segments as illustrated in **Plate 5** below. These defined fuel layers are used in the following descriptions regarding vegetation types, fuel structure and bushfire hazard levels.

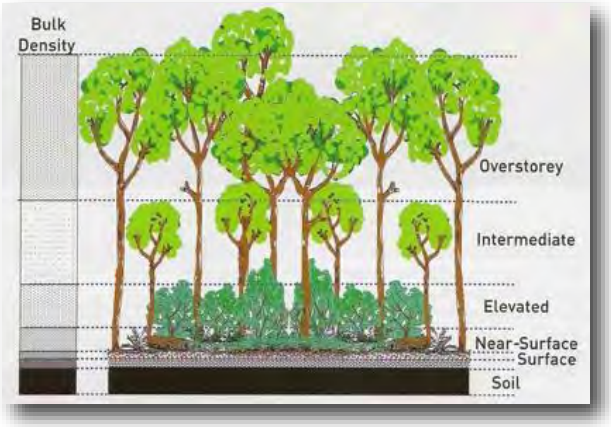

Plate 5: The five fuel layers in a forest environment that could be associated with fire behaviour (Gould et al. 2007)

4.3.1 Existing vegetation type and structure

4.3.1.1 Vegetation within the site

'Woodland' (Class B) vegetation within the site consists of planted non-endemic trees including an overstorey of **Eucalyptus utilis*, **Corymbia ficifolia* and **Pinus pinaster* over weeds with some scattered remnant or planted native species in the elevated and near-surface fuel layers (see **Figure 7** and **Plate 6** below). The southern portion of the site contains open woodland vegetation with an overstorey of planted *Eucalyptus gomphocephala* (Tuarts) trees. These areas are in 'Completely Degraded' condition. 'Woodland' (Class B) of *Banksia attenuata* over *Xanthorrhoea preissii*, *Calothamnus quadrifidus*, and *Hibbertia hypericoides* in the intermediate to elevated fuel layers occur in the south-east corner of the site and is shown within **Figure 7**. This area is in 'Very Good' condition.

Plate 6: Woodland vegetation in the north of the site

An area of 'shrubland' (Class C) is identified within the southern central portion of the site and is dominated by *Melaleuca systena* with some emergent *Xanthorrhoea preissii*. An example of this vegetation is shown within **Plate 7**.

Within the eastern portion of the site, areas of 'grassland' (Class G) have been identified and are shown in **Plate 8**.

To the north and west of the site, areas of low threat vegetation have been identified and include cleared bare ground or constructed residential areas, and are considered to be low threat in accordance with Clause 2.2.3.2(e) of AS 3959. Examples of these areas have been provided in **Plate 9** and **Plate 10**.

Plate 7: Shrubland vegetation in the north of the site

Plate 8: Grassland vegetation within the eastern portion of the site

Plate 9: Cleared areas north of the site, considered to be low threat.

Plate 10: Recent residential development west of the site, considered to be low threat

4.3.1.2 Vegetation surrounding the site (within 100 m)

Classified vegetation surrounding the site is generally limited to vegetation within the future freeway reserve east of the site. This area is largely comprised of patches of 'woodland' (Class B) and 'open forest' (Class A) vegetation (see **Figure 7** and **Plate 11** and **Plate 12**) of planted native and non-native species including *E. gomphocephala, Agonis* flexuosa and **Pinus pinaster* overstorey and some scattered native species that are likely to have re-colonised the area from adjacent areas, including areas of 'shrubland' (Class C) and 'open scrub' (Class D) (see **Figure 7** and **Plate 13** below) containing *Acacia saligna, Banksia sessilis, Xanthorrhoea preissii and Spyridium globulosum* in the intermediate to elevated fuel layers. The understorey throughout the freeway reserve is largely made up of unmanaged grassland of **Carpobrotus edulis* and low grassy weeds (see **Figure 7** and **Plate 14)**, and much of the area contained no overstorey species. This area is in 'Degraded' or 'Completely Degraded' condition.

Directly south of the site, on the opposite side of Yanchep Beach Road, 'woodland' and 'grassland' vegetation have been identified. This area is associated with future urban development, however development has yet to progress.

Plate 11: Woodland vegetation in the south of the freeway reserve, east of the site

Plate 12: Open forest vegetation within the freeway reserve, east of the site

Plate 13: Open scrub vegetation within the freeway reserve, east of the site

Plate 14: Unmanaged grassland within the freeway reserve, east of the site

4.3.2 Bushfire hazard assessment – existing site conditions

The vegetation classification map (**Figure 7**) outlines the existing vegetation classifications within the site and in the surrounding 100 m assessment area as identified in AS 3959. Descriptions of the vegetation types, structure and fuel layers are outlined in **Section 4.3.1**.

The bushfire hazard assessment levels were determined using Appendix Two of the *Guidelines for Planning in Bushfire Prone Areas* (WAPC *et al*. 2015).

Most areas within the site have a 'Moderate' or 'Extreme' bushfire hazard rating due to the presence of extensive woodland vegetation over unmanaged grassland fuels.

Existing bushfire hazards surrounding the site can be seen in **Figure 8** and are associated with areas of classified vegetation surrounding the site (as shown in **Figure 7**) within the freeway reserve east of the site, and located within areas subject to existing or future urban development to the north and west of the site, between the site and Yanchep Beach Road, and south of Yanchep Beach Road. These areas pose 'Moderate' or 'Extreme' bushfire hazards.

4.3.3 Post development vegetation types and structure

4.3.3.1 Vegetation within the site

All vegetation within the will be removed as part of the proposed subdivision, or where retained will be located within public open space. There are two areas of public open space area within the site (as shown in **Figure 4**) which will be landscaped and designed to meet the requirements of 'low threat' vegetation in accordance within Clause 2.2.3.2 of AS 3959, and therefore will pose no future hazard to residential dwellings within the site. Where vegetation is proposed to be retained within public open

space, these areas will be managed to meet the requirements of low threat vegetation in accordance with Clause 2.2.3.2 (f) of AS 3959 and is shown in **Figure 9**. All other areas within the site will be considered low threat in accordance with Clause 2.2.3.2 (e) of AS 3959, as shown within **Figure 9**.

4.3.3.2 Vegetation surrounding the site (within 100 m)

Due to the unknown timeframes for development of the Mitchell Freeway (likely to be at least 25 years) and urban development south of Yanchep Beach Road, these areas of classified vegetation have been assumed to remain the same at the time of dwelling construction within the site, as shown within **Figure 9**. This provides a conservative assessment of bushfire hazard, as in the future classified vegetation from within these areas is likely to be completely removed, particularly to the south of Yanchep Beach Road.

Based on the species and current condition of vegetation within the freeway reserve it is not considered likely that there will be any increase in future fuel loads within the reserve. A review of historic aerial photography shows that since the area was cleared in 1965 there has been no significant re-establishment of vegetation east of the site. Based on this historic regrowth pattern, and the rate of decline in condition of vegetation, the post development classification of vegetation has been based on the existing conditions at the time of assessment, and the assumption that fuel loads are unlikely to increase in the future, prior to the total removal of hazard associated with the construction of the freeway extension. This is shown within **Figure 9**.

Areas within Yanchep Golf Estate (and the proponent's landholdings) that are within 100 m of the site will be removed or managed as part of development within the site, and will therefore be considered low threat in accordance with Clause 2.2.3.2 of AS 3959, either Clause (e) or (f). This has been shown within **Figure 9**.

Vegetation between the site and Yanchep Beach Road will be managed and maintained to a low fuel level as part of the entry statement for the site in accordance with Clause 2.2.3.2 of AS 3959. In the long term, this area will be maintained by the City of Wanneroo as part of the Yanchep Beach Road reserve. Earthworks within the site associated with the construction of the proposed road network (shown in **Figure 4**) will require some battering to extend into the freeway reserve, as per discussions with Main Roads. This battering will require the clearing of some classified vegetation north-east of the site resulting in low threat areas in accordance with Clause 2.2.3.2 (e) of AS 3959, as shown in **Figure 9**. In addition to the above, a 3m firebreak will be created within the freeway reserve, adjacent to the eastern boundary of the site.

4.3.4 Bushfire hazard assessment – post development site conditions

The post development site condition vegetation mapping for the site is shown in **Figure 9**, and outlines the dominant vegetation types that will remain within the site and surrounding area within 100 m after development has been completed.

The bushfire hazard assessment levels were determined using Appendix Two of the *Guidelines for Planning in Bushfire Prone Areas* (WAPC *et al*. 2015) and are shown in **Figure 10**.

The post-development bushfire hazard rating changes substantially compared to the pre-development conditions due to the removal of the majority of vegetation from within the site to accommodate the development. Based on the above, the post development hazards impacting on the site are associated with vegetation within the freeway reserve east of the site and vegetation within areas proposed for future urban development to the south of the site.

Yanchep National Park lies approximately 130 m east of the site (and is outside the 100 m assessment area), and contains extensive areas of intact vegetation and significant levels of bushfire fuels which could promote the development of a large landscape scale bushfire. AS 3959 mitigates this risk with appropriate increases in construction standards for exposed dwellings.

By undertaking an assessment of the post-development classified vegetation and associated bushfire hazards within and surrounding the site (within 100 m) as shown in **Figure 9**and **Figure 10** respectively, this BMP has determined site specific bushfire prone areas (see **Figure 11**) that can be used by the City of Wanneroo to update the OBRM *Map of Bush Fire Prone Areas*, where appropriate.

4.3.5 Effective slope

Ground levels within the site are currently undulating however earthworks associated with the subdivision of the site will provide a level ground to accommodate development.

The effective slopes beneath classified vegetation within 100 m surrounding the site are effectively flat or upslope to the north, south and west, and effectively downslope by varying degrees to the east, as shown in **Figure 12**.

4.4 Summary of bushfire threat

Bushfires are common in the City of Wanneroo and there is a possibility of a bushfire impacting the site, primarily from the east of the site, from vegetation within the future Mitchell Freeway road reserve, and from significant fuel loads within Yanchep National Park, located east of the freeway reserve.

5 Bushfire Mitigation Strategy

This BMP provides an outline of the mitigation strategies that will ensure that as development progresses, and an acceptable solution and/or performance-based system of control is adopted for each bushfire hazard management issue. This approach is consistent with Appendix Four of the *Guidelines for Planning in Bushfire Prone Areas* (WAPC *et al.* 2015).The management issues addressed as part of this BMP are:

- Location of the development
- Siting and design of the development
- Vehicular access
- Water supply.

5.1 Bushfire risk management

As previously discussed, it is not necessary to undertake a standalone risk assessment as per AS/NZS ISO 31000:2009 *Risk management – Principles and guidelines*. Land use planning bushfire risk mitigation and building control strategies are detailed in the following sections and provide responses to the bushfire protection performance criteria outlined in Appendix Four of the *Guidelines for Planning in Bushfire Prone Areas* (WAPC *et al.* 2015). This has involved an 'acceptable solution' approach for addressing the intent of the performance principle as outlined in the guidelines.

The compliance checklist is attached as **Appendix C**, and the responses detailed below.

5.1.1 Element: Location

5.1.1.1 Intent

To ensure that strategic planning proposals, subdivision and development applications are located in areas with the least possible risk of bushfire to facilitate the protection of people, property and infrastructure.

5.1.1.2 Acceptable Solution A1.1 Development location

While development within the site is being progressed within 100 m of areas of Moderate and Extreme bushfire hazards (as shown in **Figure 10**), development can be sited and designed to manage or mitigate the associated bushfire risk by addressing:

- Vehicular access to and from the site (formal and/or emergency access), including multiple access routes.
- Adequate water supply to enable life and property to be defended against bushfire.
- Siting and design of development within the site, including provision of Asset Protection Zones (APZ) and increased building construction standards where required.

These mitigation options are outlined further in **Section 5.1.2** to **Section 5.1.4** below.

5.1.2 Element: Siting and design of development

5.1.2.1 Intent

To ensure the siting and design of development minimises the level of bushfire impact.

5.1.2.2 Background

A BAL assessment has been undertaken as part of this BMP in order to demonstrate that no residential lots within the site are exposed to an unacceptable level of bushfire risk (i.e. greater than BAL-29), and to determine the BAL rating (where applicable) to inform building construction.

The extent of classified vegetation posing a bushfire risk to the site (as shown in **Figure 9**) is restricted to the following main areas:

- Forest (Class A), woodland (Class B), scrub (Class D) and grassland (Glass G) vegetation within the Mitchell Freeway reserve, east of the site
- Woodland (Class B) and grassland (Class G) vegetation south of Yanchep Beach Road, associated with areas proposed for future urban development.

5.1.2.3 Building siting and potential management considerations

AS 3959 has six categories of Bushfire Attack Level (BAL) which trigger varying degrees of increased construction standards in sensitive land use developments (e.g. residential development, hospitals, schools, nursing homes, child care facilities etc.) within 100 m of classified bushfire prone vegetation. The categories of BALs have been summarised in **Table 1** below.

Table 1: Summary of BAL ratings, heat flux thresholds and associated construction standards, as outlined within AS 3959

Bushfire Attack Level (BAL)	Classified vegetation within 100 m of the subject building and heat flux exposure thresholds	Description of the predicted bushfire attack and levels of exposure	Construction section (within AS 3959)
BAL-LOW	See Clauses 2.2.3.2	There is insufficient risk to warrant specific construction requirements	4
BAL-12.5	≤ 12.5 kW/m^2	Ember attack	3 & 5
BAL-19	> 12.5 kW/m^2 to ≤ 19 kW/m^2	Increasing levels of ember attack and burning debris ignited by windborne embers blown together with increasing heat flux	3 & 6
BAL-29	> 19 kW/m^2 to ≤ 29 kW/m^2	Increasing levels of ember attack and burning debris ignited by windborne embers blown together with increasing heat flux	3 & 7
BAL-40	> 29 kW/m^2 to ≤ 40 kW/m^2	Increasing levels of ember attack and burning debris ignited by windborne embers blown together with the increased likelihood of exposure to flame	3 & 8
BAL-FZ	≤ 40 kW/m^2	Direct exposure to flames from fire front in addition to heat flux and ember attack	3 & 9

5.1.2.4 Methodology and assumptions

This BAL assessment has been undertaken in accordance with Method 1 of AS 3959, as outlined in **Section 1.4.7**. A Method 1 BAL assessment provides a basic assessment of radiant heat flux utilising the standard conditions of AS 3959, and is used to determine the minimum setback required to achieve an acceptable level of radiant heat exposure (i.e. BAL-29).

The criteria to determine the Method 1 BAL is outlined as follows:

- Designated FDI: 80
- Flame Temperature:1090
- Slope: Areas of flat or upslope and downslope, shown **Figure 11**
-
- Vegetation Class: Forest (Class A), woodland (Class B), scrub (Class D) and grassland (Class G), as shown in **Figure 9**.
- Setback distances: as per **Table 2** below.

In addition to the above, the following key assumptions have informed this assessment:

- Existing public roads and road reserves will continue to be maintained by the City of Wanneroo to a low threat standard in accordance with Clause 2.2.3.2 of AS 3959.
- All areas of existing and future public open space and road reserve surrounding the site (within Yanchep Golf Estate) are managed to a low threat standard in accordance with Clause 2.2.3.2 of AS 3959 by either the proponent or the City of Wanneroo.
- The proponent continues to undertake active fuel load management within any undeveloped portions of the site (and 100 m area surrounding the site that is within the proponent's landholdings), in order to maintain areas surrounding the development area to a low threat standard in accordance with Clause 2.2.3.2 of AS 3959. Fuel management works will continue to be undertaken by the proponent prior to and during bushfire season (November to May each year) as required, to ensure the site remains a low threat until such a time as the hazard is permanently removed or managed as part of residential development or public open space respectively. Management includes slashing of grasses to 100 mm and low pruning or removal of fallen branches and leaf litter (to maintain 2 tonnes per hectare) where required.

5.1.2.5 BAL assessment outcome

The results of this BAL assessment show that all future dwellings within the site will have bushfire risk mitigated through appropriate separation from bushfire hazards or through increased construction standards in accordance with AS 3959.

Based on a Method 1 BAL assessment, lots in the eastern portion of the site will be exposed to a maximum of BAL-19, with the majority of lots exposed to BAL-12.5 or BAL-LOW. There are no areas in the development exposed to a BAL rating of BAL-29 or above.

The outcomes of the BAL assessment are shown in **Table 2** below, and the BAL Contour Map has been provided in **Figure 13**.

Table 2: Results of BAL assessment

LOCATION OF CLASSIFIED VEGETATION	VEGETATION CLASSIFICATION	EFFECTIVE SLOPE	SETBACK DISTANCE	BAL RATING
Mitchell Freeway road reserve east of the site	Forest (Class A)	Downslope (5 – 10º)	33-<46 m	BAL-29
			46-<61 m	BAL-19
			61-<100 m	BAL-12.5
	Woodland (Class B)	Flat/ upslope	14-<20 m	BAL-29
			20-<29 m	BAL-19
			29-<100 m	BAL-12.5
		Downslope (0 – 5º)	17-<25 m	BAL-29
			25-<35 m	BAL-19
			35-<100 m	BAL-12.5
	Scrub (Class D))	Flat/ upslope	13-<19 m	BAL-29
			19-<27 m	BAL-19
			27-<100 m	BAL-12.5
		Downslope (0 – 5º)	15-<22 m	BAL-29
			22-<31 m	BAL-19
			31-<100 m	BAL-12.5
		Downslope (5– 10º)	17-<24 m	BAL-29
			24-<35 m	BAL-19
			35-<100 m	BAL-12.5
	Grassland (Class G)	Flat/ upslope	8-<12 m	BAL-29
			12-<17 m	BAL-19
			17-<50 m	BAL-12.5
		Downslope (0 – 5º)	9-<14 m	BAL-29
			14-<20 m	BAL-19
			20-<50 m	BAL-12.5
		Downslope (5– 10º)	10-<16 m	BAL-29
			16-<23 m	BAL-19
			23-<50 m	BAL-12.5
South of Yanchep Beach Road	Woodland (Class B)	Flat/ upslope	14-<20 m	BAL-29
			20-<29 m	BAL-19
			29-<100 m	BAL-12.5

LOCATION OF CLASSIFIED VEGETATION	VEGETATION CLASSIFICATION	EFFECTIVE SLOPE	SETBACK DISTANCE	BAL RATING
		Downslope (0 – 5°)	17-<25 m	BAL-29
			25-<35 m	BAL-19
			35-<100 m	BAL-12.5
	Grassland (Class G)	Flat/ upslope	8-<12 m	BAL-29
			12-<17 m	BAL-19
			17-<50 m	BAL-12.5
		Downslope (0 – 5°)	9-<14 m	BAL-29
			14-<20 m	BAL-19
			20-<50 m	BAL-12.5

The BAL ratings shown within **Figure 13** give an indication of the likely BAL ratings that future dwellings will be subject to. Following the completion of subdivision works, it is expected that the BAL ratings determined for future subdivided lots as part of this BAL assessment will be confirmed/certified prior to the building licence stage. This will involve the completion of **Appendix D**, which can then be used to inform the building design process. **Appendix D** provides a template for the certification process, and will be based on outlining the BAL rating for each individual lot from classified vegetation within 100 m of the lot.

As part of the subdivision approval process, any lots deemed to require bushfire management responses through the BAL assessment undertaken as part of this BMP (i.e. higher construction standards for BAL-12.5 or greater), will be subject to a notification pursuant to Section 165 of the *Planning and Development Act 2005* placed on the certificate(s) of title indicating that the lot is subject to the requirements of a Bushfire Management Plan (i.e. increased construction standards to meet increased BAL ratings). The lots that may be subject to notification, based on the BAL assessment completed as part of this BMP, have been shown in **Figure 14**.

As no future dwellings exceed BAL-29, additional planning or development approval (in addition to that already required) will not be required to address bushfire considerations.

5.1.2.6 Acceptable solution A2.1: Asset Protection Zone

One of the most important bushfire protection measures influencing the safety of people and property is to create an Asset Protection Zone (APZ) around buildings. The APZ is a low fuel area immediately surrounding a building. Non-flammable features such as irrigated landscapes, gardens, driveways and roads can form parts of an APZ.

Recent research into land management and house losses during the 'Black Saturday' Victorian bushfires concluded that the action of private landholders who managed fuel loads close to their houses was the single most important factor in determining house survival when compared with other land management practices, such as broad scale fuel reduction burning remote from residential areas (Gibbons et al., 2012).

Managing vegetation in the APZ has two main purposes:

- To reduce direct flame contact and radiant heat from igniting the building during the passage of a fire front.
- To reduce ember attack and provide a safer space for people to defend (if required) before, during and after a fire front passes.

Generally a 20 m wide APZ is recommended around dwellings, however where this cannot be accommodated, the width of the APZ can be reduced as long as BAL-29 is not exceeded. The woodland (Class B) vegetation (downslope 0-5^{o}) has the greatest influence on the BAL ratings within the site based on distance from the site compared to the other vegetation classes. Using woodland as a basis, the minimum width of the APZ should be 17 m wide (to ensure BAL-29 is not exceeded) which would also satisfy the minimum APZ requirements for shrubland (Class C) and grassland (Class G).

The proposed subdivision provides for a minimum 20 m wide APZ between future dwellings in the south and east of the site and the adjacent bushfire hazard within the areas of future urban development and the freeway reserve, respectively. For the dwellings located adjacent to the freeway reserve, the majority of this APZ is composed of road reserves which form part of the internal road network, and also forms part of a powerline easement which has specific management requirements and building restrictions (e.g. no dwellings can be constructed within the easement; no vegetation greater than 3m in height). For dwellings located within the southern portion of the site, the APZ is provided by the existing Yanchep Beach Road reserve.

The provision of a minimum 20 m wide APZ achieves an acceptable level of radiant heat flux exposure (i.e. no greater than BAL-29) from classified vegetation east of the site, and is therefore considered to be an acceptable solution as outlined in Appendix Four of the *Guidelines for Planning in Bushfire Prone Areas* (WAPC and DFES 2015).

The fuel managed areas of road reserves can act as APZ areas because the long term maintenance of these areas by the City of Wanneroo. In addition areas managed to a low threat standard can act as APZ areas because of the landscaped nature and maintenance of these areas. APZ/s must be established and maintained to the following standards:

- Width: minimum 20 m
- Fine fuel load: reduced to and maintained at two tonnes per hectare
- Trees (crowns) are a minimum distance of ten metres apart. A small group of trees within close proximity to one another may be treated as one crown provided the combined crowns do not exceed the area of a large or mature crown size for that species
- No tall shrubs or trees located within two metres of a building
- No tree crowns overhang the building
- Fences within the APZ (where present) are constructed using non-combustible materials (e.g. iron, brick, limestone, metal post and wire)
- Sheds (where present) within the APZ should not contain flammable materials.

It is the responsibility of the proponent and, following handover, the City of Wanneroo to maintain the APZ where it falls within public road reserve or public open space, to the above standards. It is the responsibility of owners of lots within a designated BAL rating of BAL-12.5 or above to maintain their individual lot/s to the above standards.

The APZs are shown in **Figure 14**, and align with the separation provided by the existing public road network.

5.1.2.7 Acceptable solution A2.2: Hazard separation zone

A Hazard Separation Zone (HSZ) is a fuel managed zone to create separation between dwellings and bushfire hazards. This generally extends out to 100 m from buildings. The need for a HSZ can be avoided through the appropriate management of areas to a low threat standard, and where classified vegetation exists through the provision of an appropriate APZ and an increase in construction standards for dwellings (where applicable) in accordance with AS 3959. The BAL assessment within this BMP demonstrates that if any new dwellings are constructed in the future, development will achieve an acceptable level of risk (i.e. BAL-29 is not exceeded). Therefore this acceptable solution is not applicable.

5.1.3 Element: Vehicular access

5.1.3.1 Intent

To ensure vehicular access serving a subdivision/development is available and safe during a bushfire event.

5.1.3.2 Background

The proposed road network for the site can be clearly seen in the proposed subdivision plan shown in **Figure 4**. There is one major intersection with Yanchep Beach Road in the south of the site which will be the main entry for the site. There are three intersections to the west and one to the north which will connect with adjacent existing or future subdivision areas associated with the broader Yanchep Golf Estate development. The road network to the west provides additional access to Yanchep Beach Road. Infrastructure reserves in the east of the site limit access through to the east, however this is compensated by the extensive internal road network and access to the north, south and west of the site.

The site has a perimeter public road system ensuring that dwellings are separated from any adjacent bushfire hazard, and that emergency vehicles have access between the bushfire hazard and residential dwellings. A number of lots will be located directly adjacent to the freeway reserve to the east, however will be separated from the bushfire risk by a powerline easement in which no development is permitted.

A combination of public roads and public access ways (which will support standard Fire Service Access Route requirements) provide emergency access for residents and emergency vehicles along the entire eastern boundary of the site. This will ensure that residents are able to be appropriately evacuated, and that emergency services personnel are able to defend residential dwellings from any bushfire threat approaching the site from the east, which is of particular importance given the extent of vegetation retained within Yanchep National Park approximately 130 m east of the site.

5.1.3.3 Acceptable solution A3.1: Two access routes

The primary bushfire hazard is located to the east of the site. The proposed road network within the site, as shown in **Figure 4**, outlines an interconnected loop road system including one intersection with Yanchep Beach Road, and four with surrounding residential subdivisions to the west and north.

Development to the west of the site has already been progressed as part of the Yanchep Golf Estate development, therefore existing road access will be available for residences at all times once development occurs within the site. Further access to Yanchep Beach Road will be established as part of development within the site, which will provide a major thoroughfare from the site and surrounding development through to Yanchep Beach Road. This will achieve performance principle P3, as outlined in Appendix Four of the *Guidelines for Planning in Bushfire Prone Areas* (WAPC and DFES 2015).

5.1.3.4 Acceptable solution A3.2: Public roads

Surrounding public roads and all new public roads and laneways within the site will comply with the following minimum standards:

- Minimum trafficable surface: 6 metres
- Horizontal clearance: 6 metres
- Vertical clearance: 4.5 metres
- Maximum grades over <50 metres: 1 in 10
- Minimum weight capacity: 15 tonnes
- Maximum crossfall: 1 in 33
- Minimum inner radius of curves: 8.5 metres.

5.1.3.5 Acceptable solution A3.7: Fire service access routes

Fire service access routes provide links between public roads for firefighting purposes, and are proposed at various points along the eastern boundary of the site (public access ways as shown in **Figure 4**). This will allow continuous access along the eastern boundary of the site, within the powerline easement, and will enable emergency vehicles access to bushfire that may threaten the site from permanent hazard situated within the freeway reserve to the east.

Fire service access routes must meet the following requirements:

- Surface: all weather.
- Dead end: not permitted.
- Minimum trafficable surface: 6 metres.
- Horizontal clearance: 6 metres.
- Vertical clearance: 4 metres.
- Maximum grades: 1 in 7.
- Maximum grade over <50 metres: 1 in 4.
- Maximum average grade: 1 in 5.
- Minimum weight capacity: 15 tonnes.
- Maximum crossfall: 1 in 33.
- Curves minimum inner radius: 12 metres.
- Provided as right of ways or public access easements in gross to ensure accessibility to the public and fire services during an emergency
- Turn around areas designed to accommodate 3.4 appliances and to enable them to turn around safely every 500 metres (where required).
- Erosion control measures and long term maintenance arrangements in place.
- Access to public road network: every 600 metres.
- Allow for two way traffic.
- Must be signposted.

In discussion with DFES and City of Wanneroo, it was determined that the fire service access routes could be formed of grassed areas (or similar) as long as vehicles could move safely through this area.

5.1.4 Element: Water

5.1.4.1 Intent

To ensure water is available to the subdivision, development or land use to enable people, property and infrastructure to be defended from bushfire.

5.1.4.2 Background

The development is located within an Emergency Services Levy (ESL) Category 3 area, which indicates that emergency bushfire response is provided by a volunteer fire and rescue service brigade, with the assistance of career fire stations. Fire response services require ready access to an adequate water supply during bushfire emergencies.

5.1.4.3 Acceptable Solution A4.1: Reticulated water

The site will be provided with a reticulated water supply and fire hydrants that will be installed by the proponent to meet the specifications of Water Corporation (Design Standard DS 63) and DFES. This will achieve performance principle P4, as outlined in Appendix Four of the *Guidelines for Planning in Bushfire Prone Areas* (WAPC and DFES 2015). Fire hydrants on land zoned as residential are required to be sited at or within 200 m of residential dwellings (Class 1a).

The Water Corporation will be responsible for all hydrant maintenance and repairs.

5.2 Future development

This BMP and associated BAL contour plan (see **Figure 13**) are expected to inform the implementation of the subdivision and construction requirements for future dwellings.

The predicted BAL ratings will be confirmed/certified for individual lots following the completion of subdivision works and will involve the completion of **Appendix D**. The BAL ratings specified as part of certification can be used by future owners of lots to support of the building licence application process.

Exceptions may apply to lots, where the applicable BAL rating may be decreased depending on the specific dwelling setback that is provided within the lot. This information will be detailed within **Appendix D**.

5.3 Public education

Community bushfire safety is a shared responsibility between individuals, the community, government and fire agencies. DFES has an extensive Community Bushfire Education Program including a range of publications, a website and Bushfire Ready Groups. The publication *Prepare. Act. Survive.* (DFES, 2012) provides excellent advice on preparing for and surviving the bushfire season. Other downloadable brochures are available from http://www.dfes.wa.gov.au/safetyinformation/fire/bushfire/pages/publications.aspx.

The City of Wanneroo provides bushfire safety advice to residents available from their website: http://www.wanneroo.wa.gov.au/homepage/61/fire_information.

Residents are able to access additional bushfire information via the above sources, or through contacting the City of Wanneroo or DFES directly.

5.4 Implementing the Bushfire Management Plan

Table 3 outlines the future and/or ongoing responsibilities of the future developer/s, lot owners or occupiers, and the City of Wanneroo relating to bushfire risk mitigation.

The future owners/occupiers of lots within the site, as created through the subdivision of the site, are to maintain a reduced level of risk from bushfire within their properties (where applicable, as outlined in **Section 5.1.2.6**), and will be responsible for undertaking, complying and implementing measures to protect their own assets (and people under their care) from the threat and risk of bushfire.

Table 3: Responsibilities for the implementation of the BMP

MANAGEMENT ACTION	TIMING
DEVELOPER/S	
Make a copy of this BMP available to each lot owner subject to AS 3959 construction standards.	As part of the sale of lots.
For each new lot created within areas exposed to a BAL rating exceeding BAL-LOW, lodge a Section 165 Notification on the Certificate of Title in order to alert purchasers and successors in title of the existence of the overarching BMP and specifically the requirements associated with meeting AS 3959 construction standards. An outline of lots likely to require notifications has been provided within **Figure 14**.	At the creation of titles within future subdivision stage/s.
Install the public roads to standards outlined in **Section 5.1.3** and ensure two access ways (either formal road or temporary emergency access) are provided at all times for each subdivision stage.	As part of subdivision and development.
On all vacant land, comply with the City of Wanneroo Firebreak Notices as published.	Ongoing, where applicable.
Design and landscape all managed public open space areas to create a low threat environment, in accordance with AS 3959.	As part of subdivision and development.
Continue to undertake fuel management works within the site until such a time as vegetation is permanently removed or landscaped as part of residential subdivision. This includes slashing of grasses, and removal or leaf litter and dead branches (where required) immediately prior to and during the bushfire season (November to May annually).	Ongoing, where applicable.
Install reticulated water supply and hydrants to Water Corporation, DFES and the City of Wanneroo standards.	As part of subdivision and development.
Provide detailed hydrant plans to the City of Wanneroo for monitoring.	At subdivision approval stage.
PROPERTY OWNER/OCCUPIER	
Ensuring that their property complies with the City of Wanneroo Firebreak Notices as published.	Ongoing, where applicable.
Establish and maintaining each property in accordance with the requirements of an APZ (where required) as outlined in this BMP, to minimise bushfire fuels within 100 m of classified vegetation.	Ongoing, where applicable.
Ensuring that where hydrants are located, they are not obstructed and remain visible	Ongoing, where applicable.

MANAGEMENT ACTION	TIMING
at all times.	
Ensuring construction of dwelling/s complies with AS 3959 where a BAL rating greater than BAL-LOW is applicable, as detailed within the BAL assessment completed as part of this BMP (and **Appendix D** when completed).	As part of dwellings design and construction.
Construction of dwellings and any additional construction in the future, such as renovations are required to comply with AS 3959 where a BAL rating greater than BAL-LOW is applicable, as detailed within the BAL assessment completed as part of this BMP (and **Appendix D** when completed).	As part of design and construction.
CITY OF WANNEROO	
Providing fire prevention and preparedness advice to landowners upon request, including the *Homeowners Bush Fire Survival Manual, Prepare, Act, Survive* (or similar suitable documentation) and the City of Wanneroo Firebreak Notice.	Ongoing, as requested.
Ensuring bushfire hazard remains low in areas of existing and future public open space and public road reserves.	Ongoing.
Maintaining public roads and public access ways to appropriate standards and ensuring compliance with the City of Wanneroo Firebreak Notices.	Ongoing.
WATER CORPORATION	
The Water Corporation is responsible for the ongoing maintenance and repair of water hydrants.	Ongoing, when required.

6 Conclusions and Recommendations

6.1 Conclusion

The site is designated as bushfire prone within the state *Map of Bush Fire Prone Areas* (OBRM 2016). This BMP has been prepared to support the residential subdivision within the site and to address the requirements of SPP 3.7 and the *Guidelines for Planning in Bushfire Prone Areas* (WAPC and DFES 2015). This BMP incorporates a detailed BAL assessment to support the development of the site in accordance with the proposed subdivision. It has been demonstrated that the bushfire protection performance criteria outlined in the Guidelines (WAPC and DFES 2015) can be achieved through:

- Siting and design of development to ensure buildings are not exposed to an unacceptable level of radiant flux (i.e. greater than BAL-29) using appropriate mitigation measures. This includes:
  - Dwellings located within 100 m of identified classified vegetation will have the bushfire risk mitigated via compliance with AS 3959. The BAL assessment included in this BMP demonstrates that BAL-29 is not exceeded.
  - An appropriate APZ has been accommodated along the eastern boundary of the site, adjacent to the Mitchell Freeway and the southern boundary of the site by Yanchep Beach Road. The public roads, public access ways and public open space provide more than the required setback to ensure dwellings are not exposed to an unacceptable level of radiant heat flux (i.e. greater than BAL-29) from potential bushfires in the adjacent classified vegetation.
- Providing appropriate vehicular access options. An integrated road network allows egress to the north, south and west, through to existing and future urban development areas to the north, west and south, enabling people to move away from the main source of bushfire risk.
- Providing sufficient water supply to ensure emergency services are able to respond to a bushfire event. Reticulated water supply and hydrants are being provided as part of subdivision within the site, in accordance with the Water Corporation and City of Wanneroo requirements.

This BMP and the predicted BALs are expected to inform the building licence and construction requirements for future dwellings. The BAL assessment undertaken as part of this BMP indicates that all future lots will be subject to an acceptable level of bushfire risk, and BAL-29 is not exceeded. The BAL ratings applicable to lots have been shown in **Figure 13** and will be confirmed and certified as part of the lot title clearance process using **Appendix D**.

6.2 Recommendations

Based on the bushfire hazard and BAL assessment contained within this BMP, the following key recommendations should be considered for the implementation of development within the site:

- By implementing this BMP, the bushfire risk to development within the site can be minimised through the provision of appropriate APZs combined with increased construction standards in accordance with AS 3959.
- The BAL assessment undertaken as part of this BMP indicates that no future lots within the site will be exposed to an unacceptable level of radiant heat flux (i.e. no greater than BAL-29) and BAL-29 is not exceeded.

- The BAL ratings determined within this BMP and BAL assessment can be used as part of the subdivision and building licence process to inform BAL ratings within lots, and will be confirmed/certified prior to building construction.
- A notification pursuant to Section 165 of the *Planning and Development Act 2005 be* placed on the certificate(s) of titles for lots likely to be exposed to a BAL rating of BAL-12.5 or higher indicating that the proposed lots are subject to the requirements of a Bushfire Management Plan (i.e. increased construction standards to meet increased BAL ratings).
- The Bushfire Prone Areas determined for the site (shown in **Figure 11**) can be used by the City of Wanneroo to update the state-wide *Map of Bushfire Prone Areas* (OBRM 2016).

6.3 Declaration

The information provided within this BMP is true and correct to the best of our knowledge.

Signature:

Rohan Carboon

Bushfire Safety Consulting

August 2016

Signature:

Kirsten Knox

Emerge Associates

August 2016

7 References

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8 Glossary

AS	Australian Standard
AHD	Australian Height Datum
BAL	Bushfire Attack Level
BCA	Building Code of Australia
BHA	Bushfire Hazard Assessment
BMP	Bushfire Management Plan
BOM	Bureau of Meteorology
BPZ	Building Protection Zone
DFES	Department of Fire and Emergency Services (was FESA)
ESL	Emergency Services Levy
FESA	Fire and Emergency Services (now DFES)
HSZ	Hazard Separation Zone
LPS	Local Planning Scheme
LSP	Local Structure Plan
POS	Public Open Space
TPS	Town Planning Scheme
VBRC	Victorian Bushfires Royal Commission
WAPC	Western Australian Planning Commission

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FIGURES

Figure 1: Location Plan

Project: Bushfire Management Plan
Stage D Yanchep Golf Estate

Client: Peet Funds Management Limited

Plan Number: EP10-017(015)--F78b

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Approved:	KK	Date:	25/08/2016
Checked:	KK	Scale:	1:12,500@A4

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Figure 2: Site Plan

Project:	Bushfire Management Plan Stage D Yanchep Golf Estate
Client:	Peet Funds Management Limited

Plan Number: EP10-017(015)--F79b

Drawn:	ADB	Date:	25/08/2016
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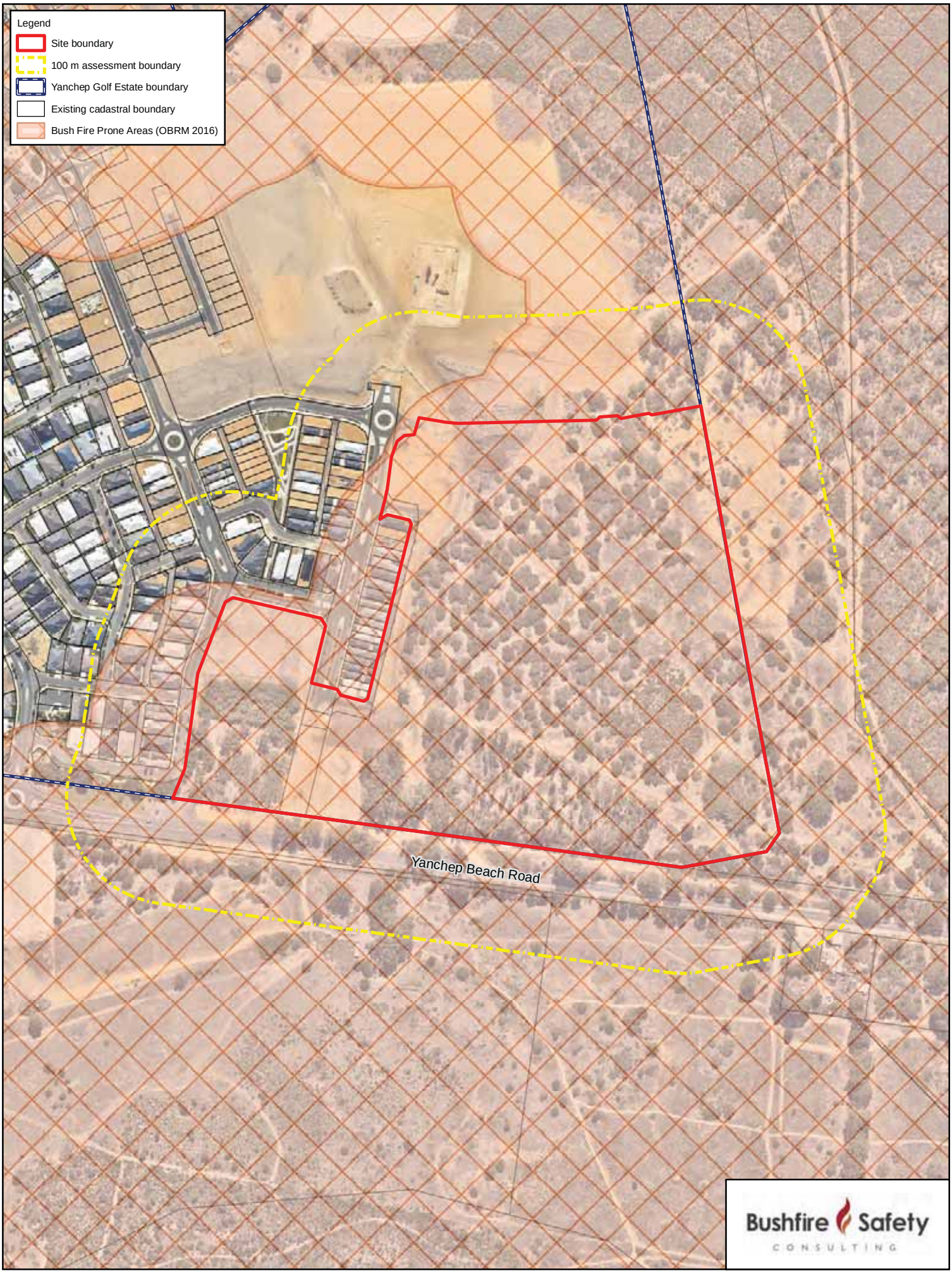

Figure 3: Map of Bushfire Prone Areas

Project: Bushfire Management Plan
Stage D Yanchep Golf Estate

Client: Peet Funds Management Limited

Plan Number: EP10-017(015)--F107

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Figure 4: Proposed Subdivision Plan

Project: Bushfire Management Plan
Stage D Yanchep Golf Estate

Client: Peet Funds Management Limited

Plan Number: EP10-017(015)--F85b

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Approved:	KK	Date:	26/08/2016
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Figure 5: Existing Site Topography

Project: Bushfire Management Plan
Stage D Yanchep Golf Estate

Client: Peet Funds Management Limited

Plan Number: EP10-017(015)--F82b

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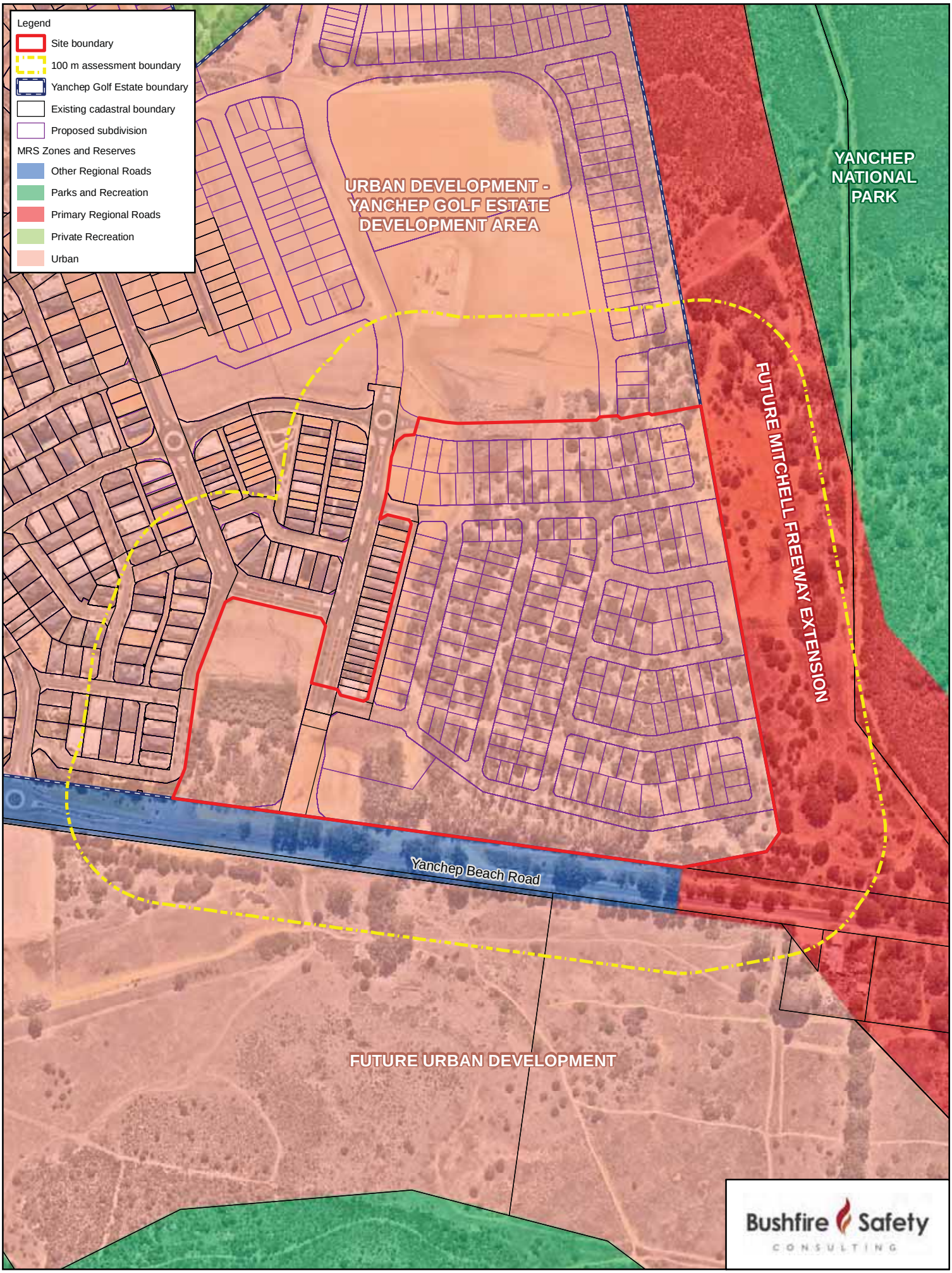

Figure 6: Local Context and Surrounding Land Uses

Project: Bushfire Management Plan
Stage D Yanchep Golf Estate

Client: Peet Funds Management Limited

Plan Number: EP10-017(015)--F80b

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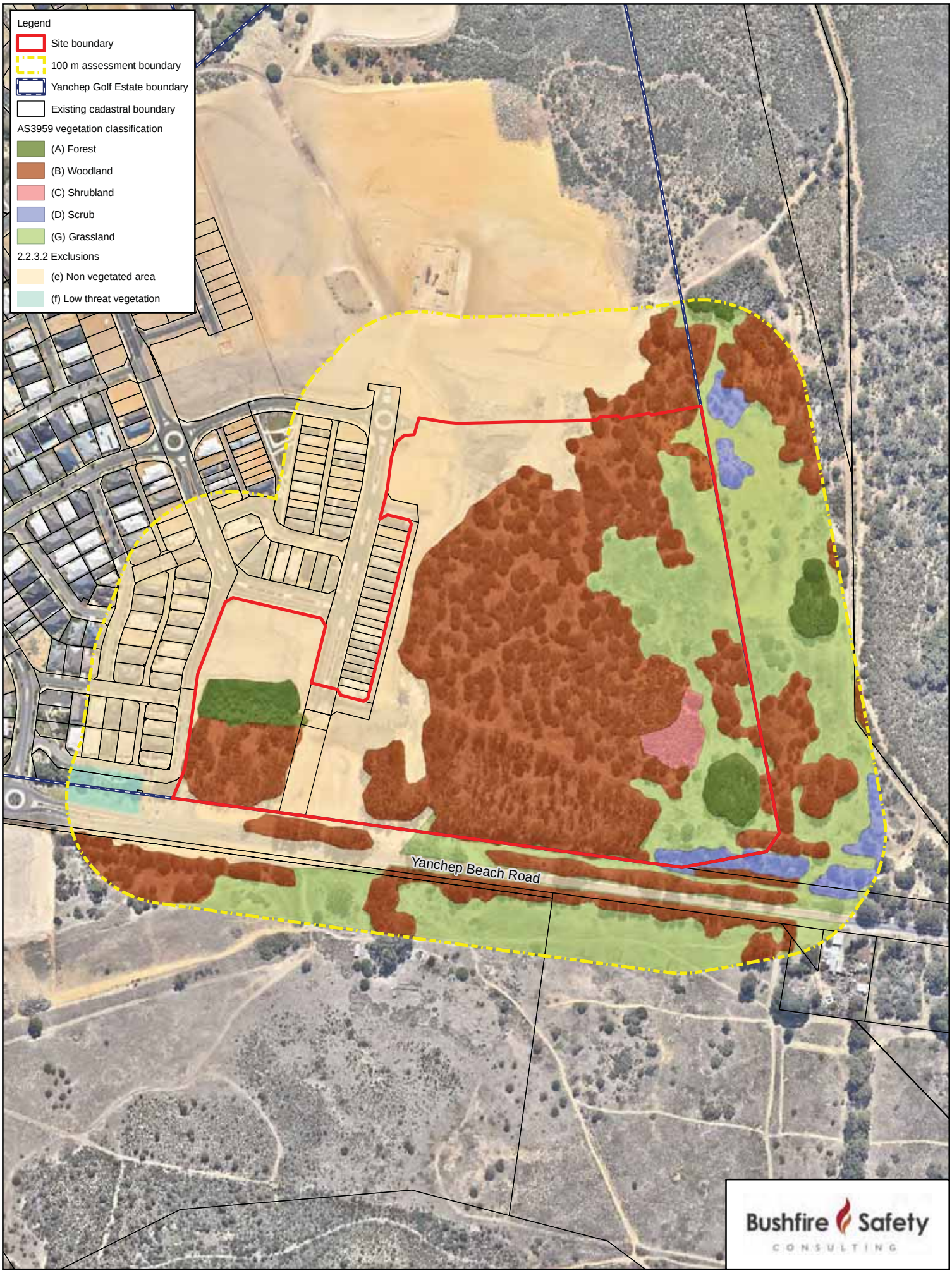

Figure 7: Existing Site Conditions - AS 3959 Vegetation Classification

Project: Bushfire Management Plan
Stage D Yanchep Golf Estate

Client: Peet Funds Management Limited

Plan Number: EP10-017(015)--F86b

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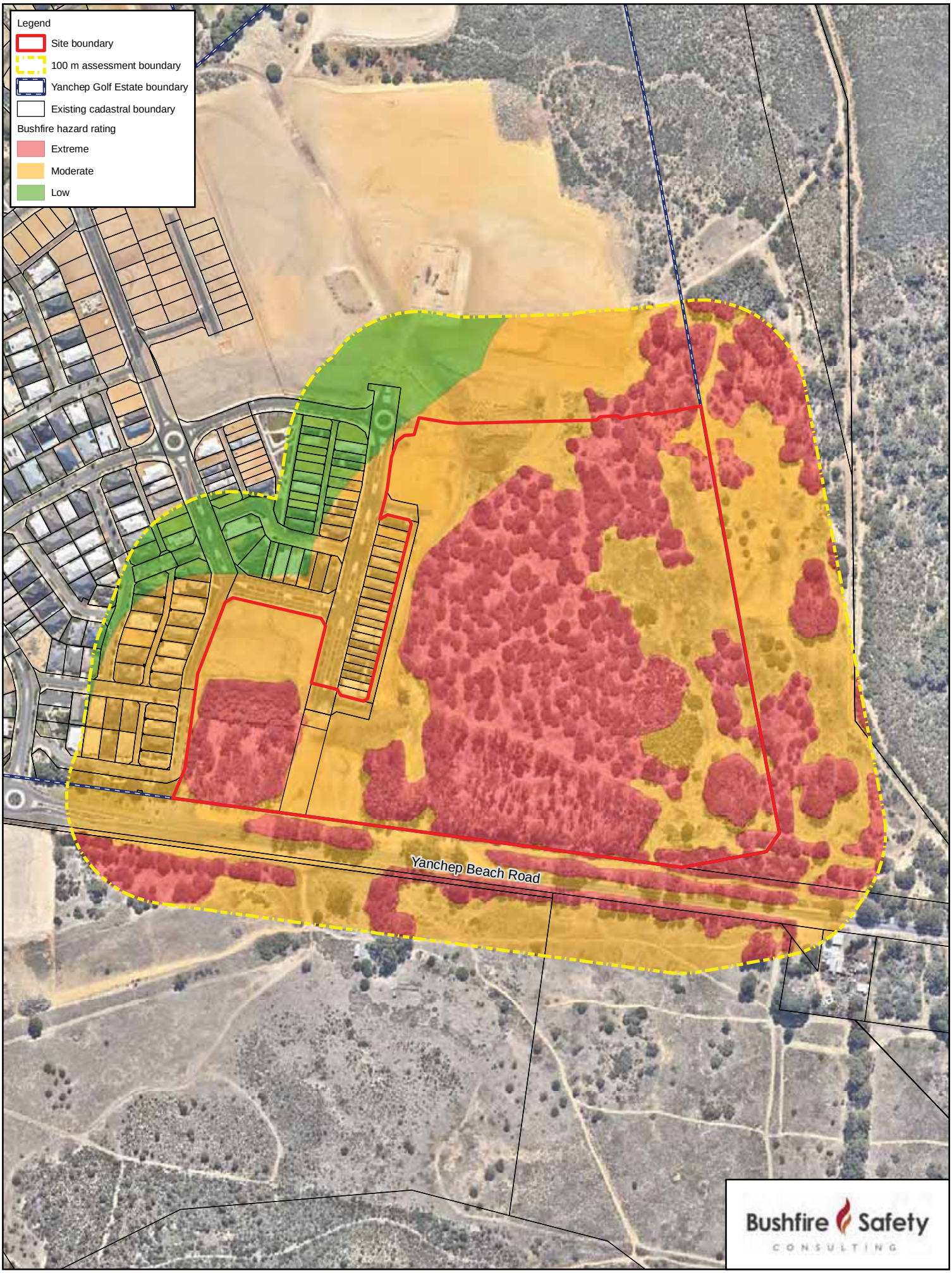

Figure 8: Existing Site Conditions - Bushfire Hazard Assessment

Project: Bushfire Management Plan
Stage D Yanchep Golf Estate

Client: Peet Funds Management Limited

Plan Number: EP10-017(015)--F87b

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Approved:	KK	Date:	26/08/2016
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Figure 9: Post Development Site Conditions - AS 3959 Vegetation Classifications

Project: Bushfire Management Plan
Stage D Yanchep Golf Estate

Client: Peet Funds Management Limited

Plan Number: EP10-017(015)--F88b

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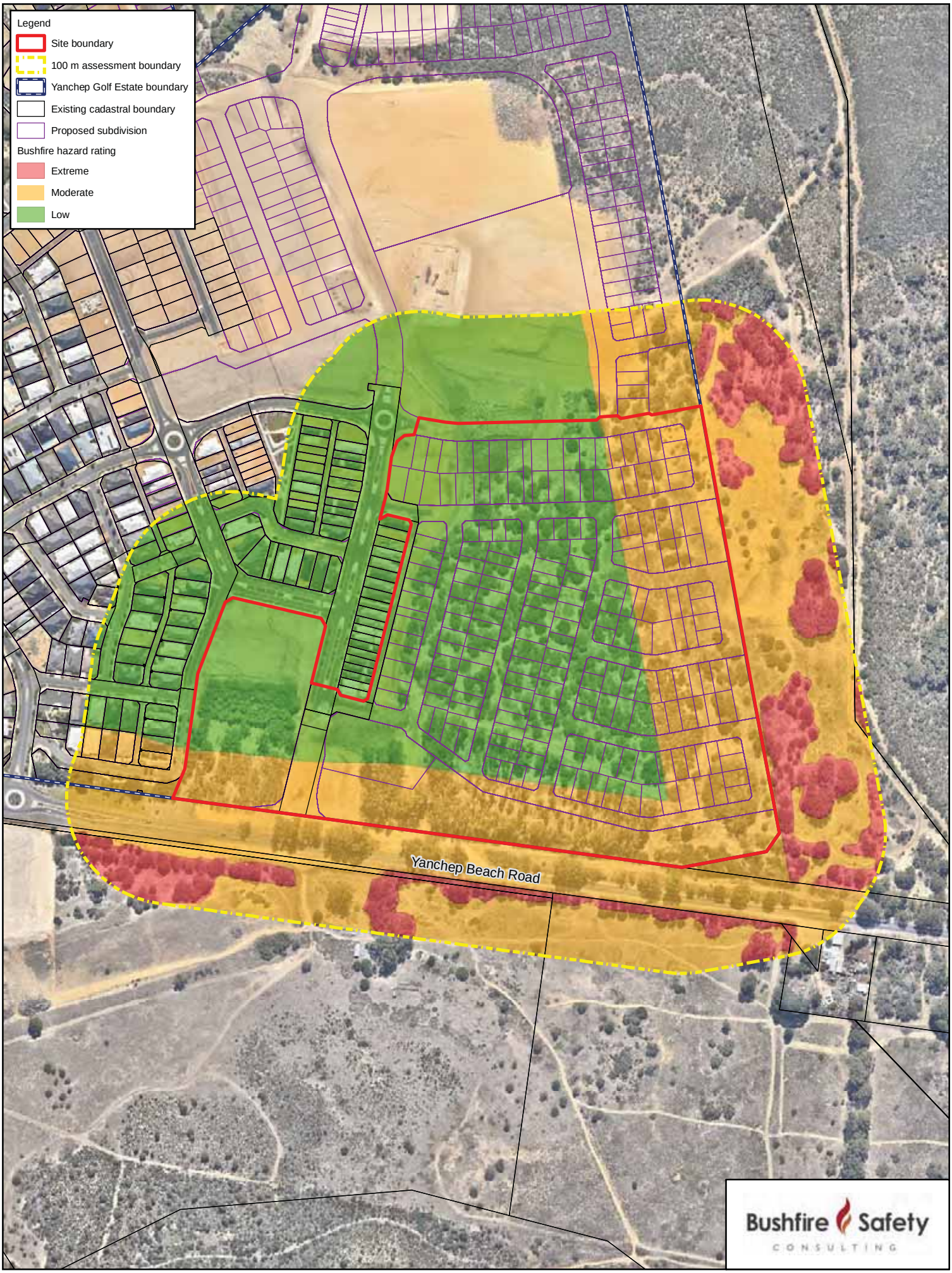

Figure 10: Post Development Site Conditions - Bushfire Hazard Assessment

Project: Bushfire Management Plan
Stage D Yanchep Golf Estate

Client: Peet Funds Management Limited

Plan Number: EP10-017(015)--F89b

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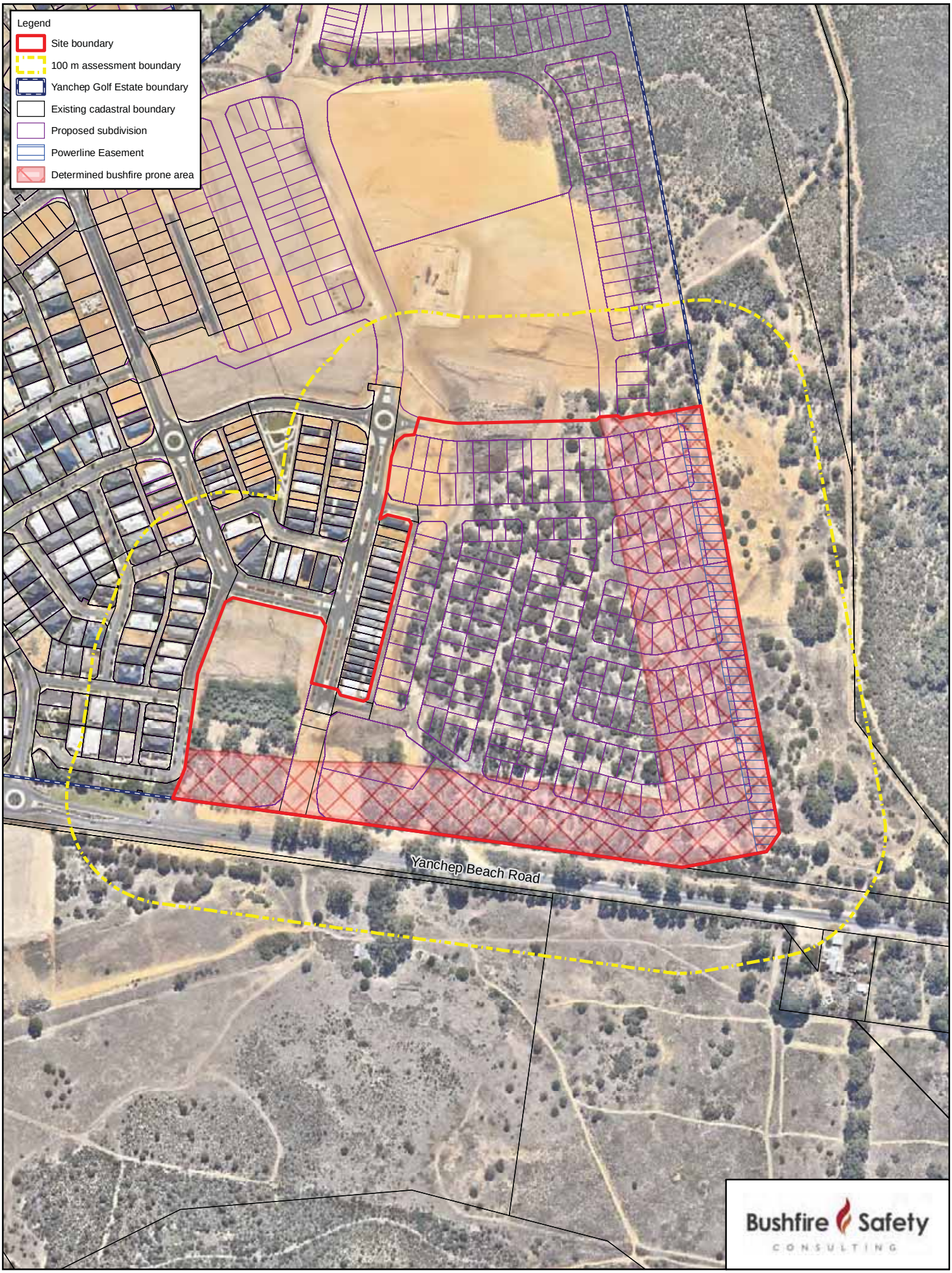

Figure 11:Determined Bushfire Prone Areas

Project: Bushfire Management Plan
Stage D Yanchep Golf Estate

Client: Peet Funds Management Limited

Plan Number: EP10-017(015)--F96a

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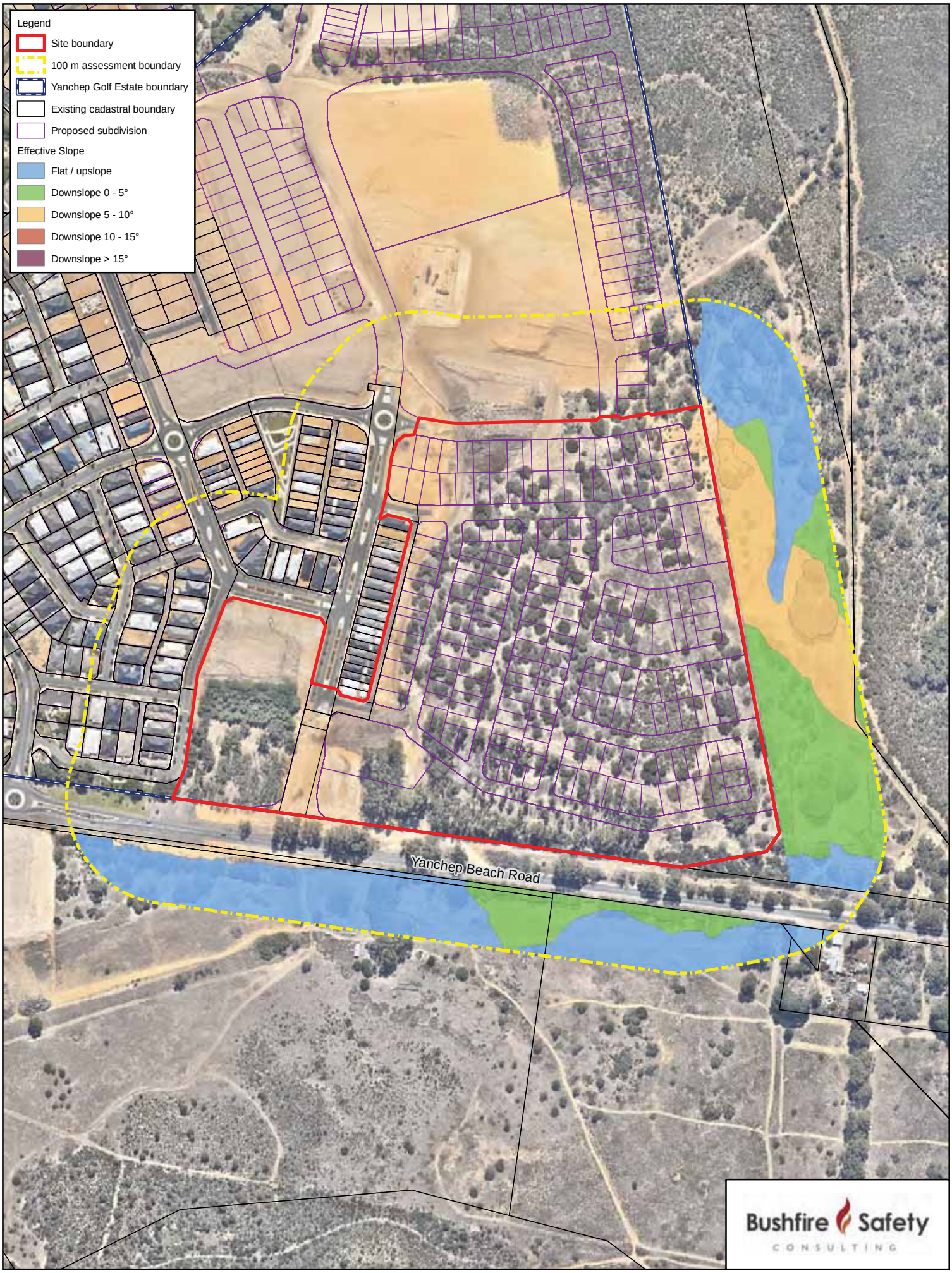

Figure 12:Effective Slope

Project: Bushfire Management Plan
Stage D Yanchep Golf Estate

Client: Peet Funds Management Limited

Plan Number: EP10-017(015)--F92b

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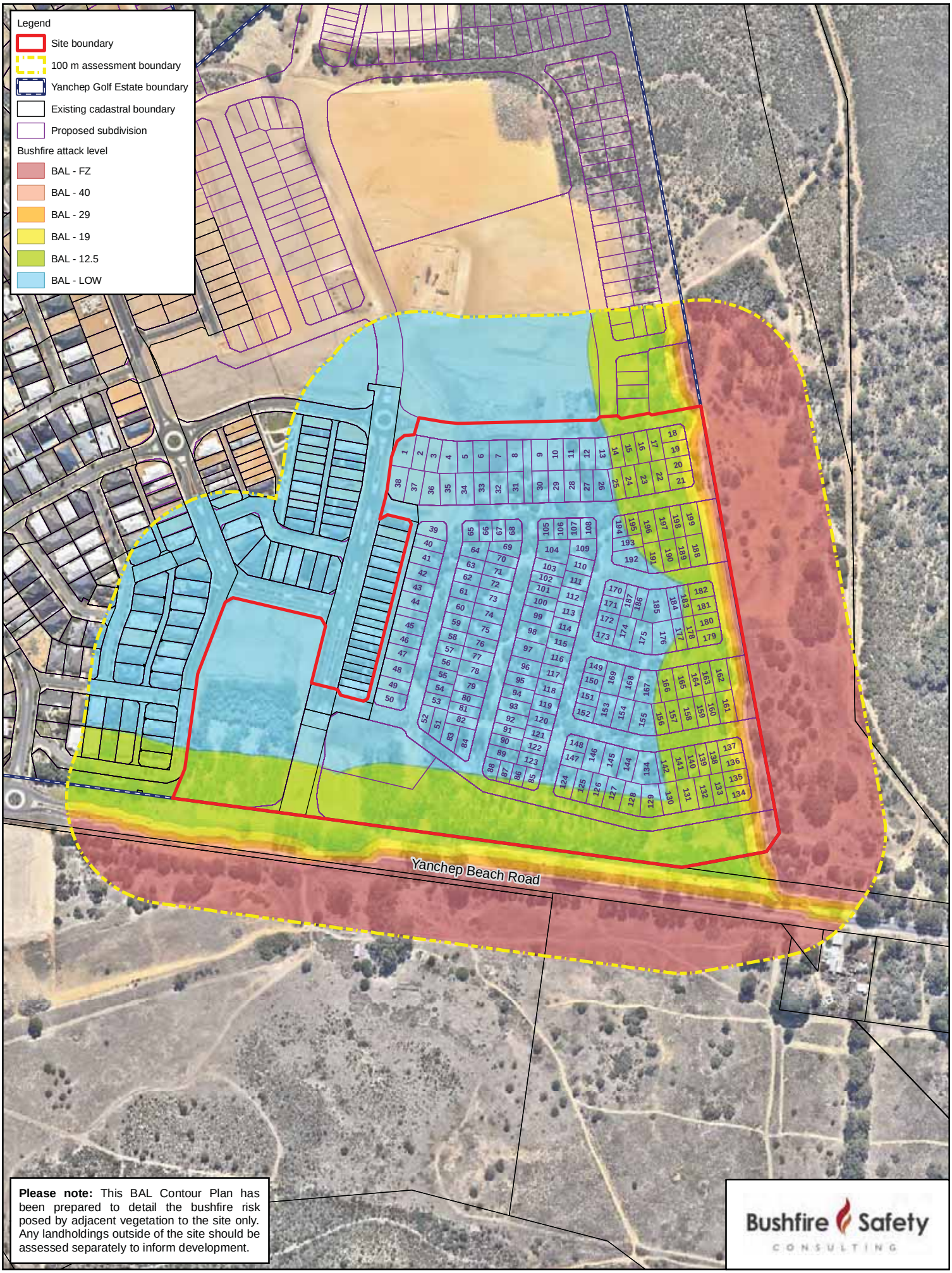

Figure 13:Bushfire Attack Level Contour Plan

Project: Bushfire Management Plan
Stage D Yanchep Golf Estate

Client: Peet Funds Management Limited

Plan Number: EP10-017(015)--F90a

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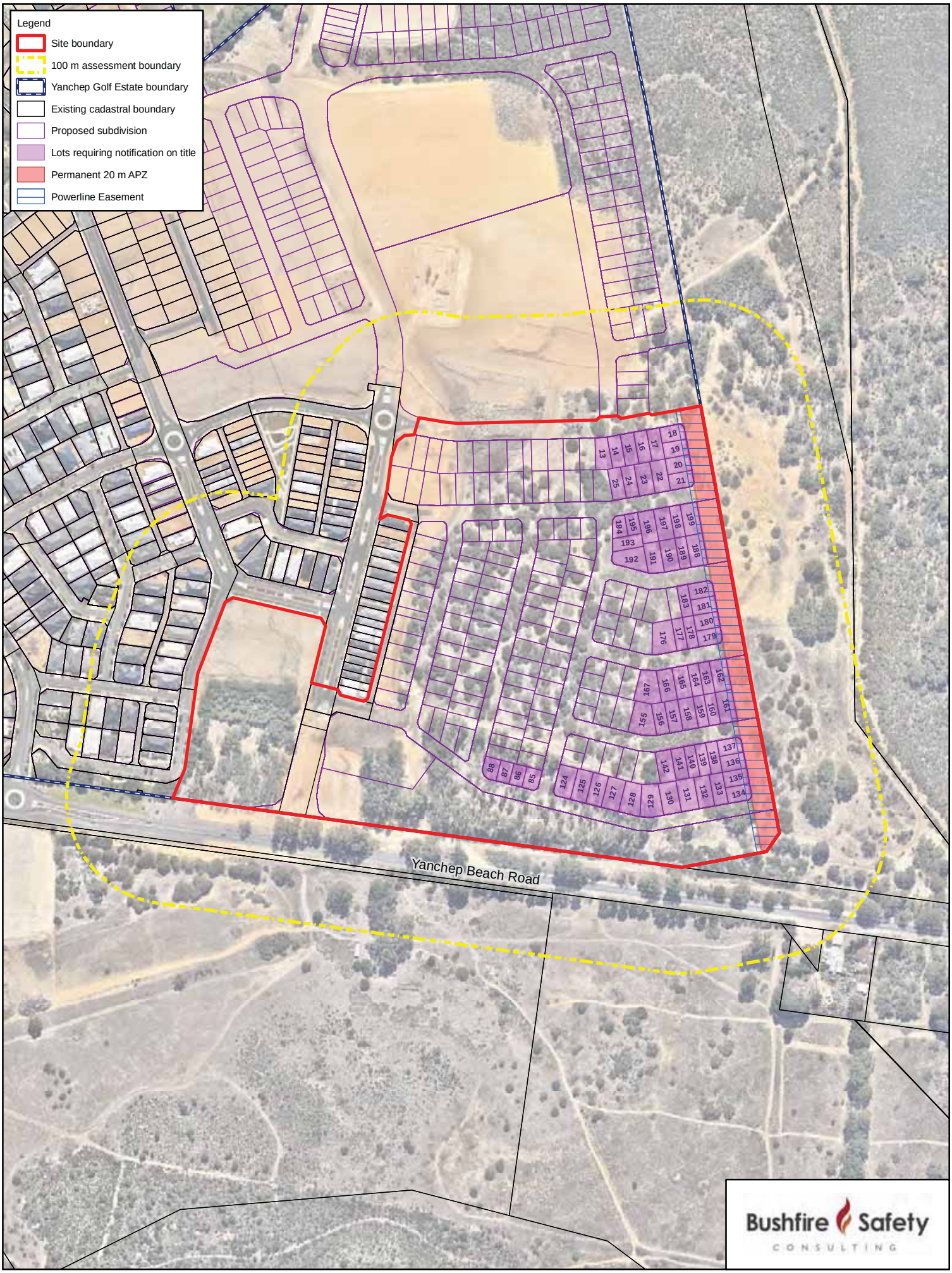

Figure 14:Notification and Asset Protection Zone Requirements

Project: Bushfire Management Plan
Stage D Yanchep Golf Estate

Client: Peet Funds Management Limited

Plan Number: EP10-017(015)--F91b

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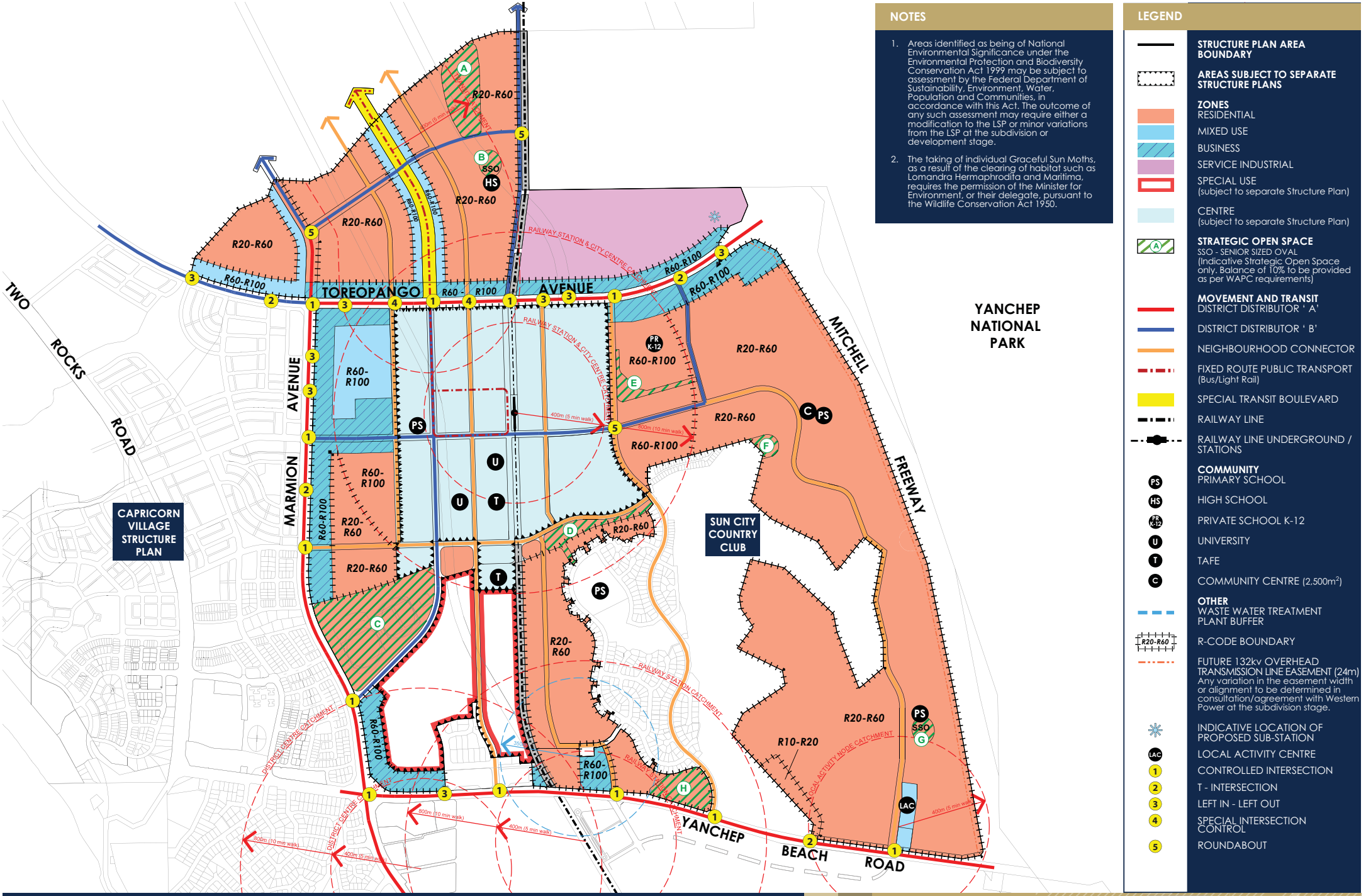
APPENDIX A

YANCHEP CITY LSP (TAYLOR BURRELL BARNETT 2012)



NOTES

1. Areas identified as being of National Environmental Significance under the Environmental Protection and Biodiversity Conservation Act 1999 may be subject to assessment by the Federal Department of Sustainability, Environment, Water, Population and Communities, in accordance with this Act. The outcome of any such assessment may require either a modification to the LSP or minor variations from the LSP at the subdivision or development stage.
2. The taking of individual Graceful Sun Moths, as a result of the clearing of habitat such as Lomandra Hermaphrodita and Maritima, requires the permission of the Minister for Environment, or their delegate, pursuant to the Wildlife Conservation Act 1950.

LEGEND

- **STRUCTURE PLAN AREA BOUNDARY**
- **AREAS SUBJECT TO SEPARATE STRUCTURE PLANS**
- **ZONES**
  - RESIDENTIAL
  - MIXED USE
  - BUSINESS
  - SERVICE INDUSTRIAL
  - SPECIAL USE (subject to separate Structure Plan)
  - CENTRE (subject to separate Structure Plan)
- **STRATEGIC OPEN SPACE**
  - SSO - SENIOR SIZED OVAL
  - (Indicative Strategic Open Space only. Balance of 10% to be provided as per WAPC requirements)
- **MOVEMENT AND TRANSIT**
  - DISTRICT DISTRIBUTOR ' A'
  - DISTRICT DISTRIBUTOR ' B'
  - NEIGHBOURHOOD CONNECTOR
  - FIXED ROUTE PUBLIC TRANSPORT (Bus/Light Rail)
  - SPECIAL TRANSIT BOULEVARD
  - RAILWAY LINE
  - RAILWAY LINE UNDERGROUND / STATIONS
- **COMMUNITY**
  - PRIMARY SCHOOL
  - HIGH SCHOOL
  - PRIVATE SCHOOL K-12
  - UNIVERSITY
  - TAFE
  - COMMUNITY CENTRE (2,500m²)
- **OTHER**
  - WASTE WATER TREATMENT PLANT BUFFER
  - R-CODE BOUNDARY
  - FUTURE 132kv OVERHEAD TRANSMISSION LINE EASEMENT (24m) Any variation in the easement width or alignment to be determined in consultation/agreement with Western Power at the subdivision stage.
  - INDICATIVE LOCATION OF PROPOSED SUB-STATION
  - LOCAL ACTIVITY CENTRE
  - CONTROLLED INTERSECTION
  - T - INTERSECTION
  - LEFT IN - LEFT OUT
  - SPECIAL INTERSECTION CONTROL
  - ROUNDABOUT

YANCHEP CITY STRUCTURE PLAN

PLAN 1 - STRUCTURE PLAN MAP

client - Yanchep Beach Joint Venture
date - 21 August 2012
plan - 07/004/G023I

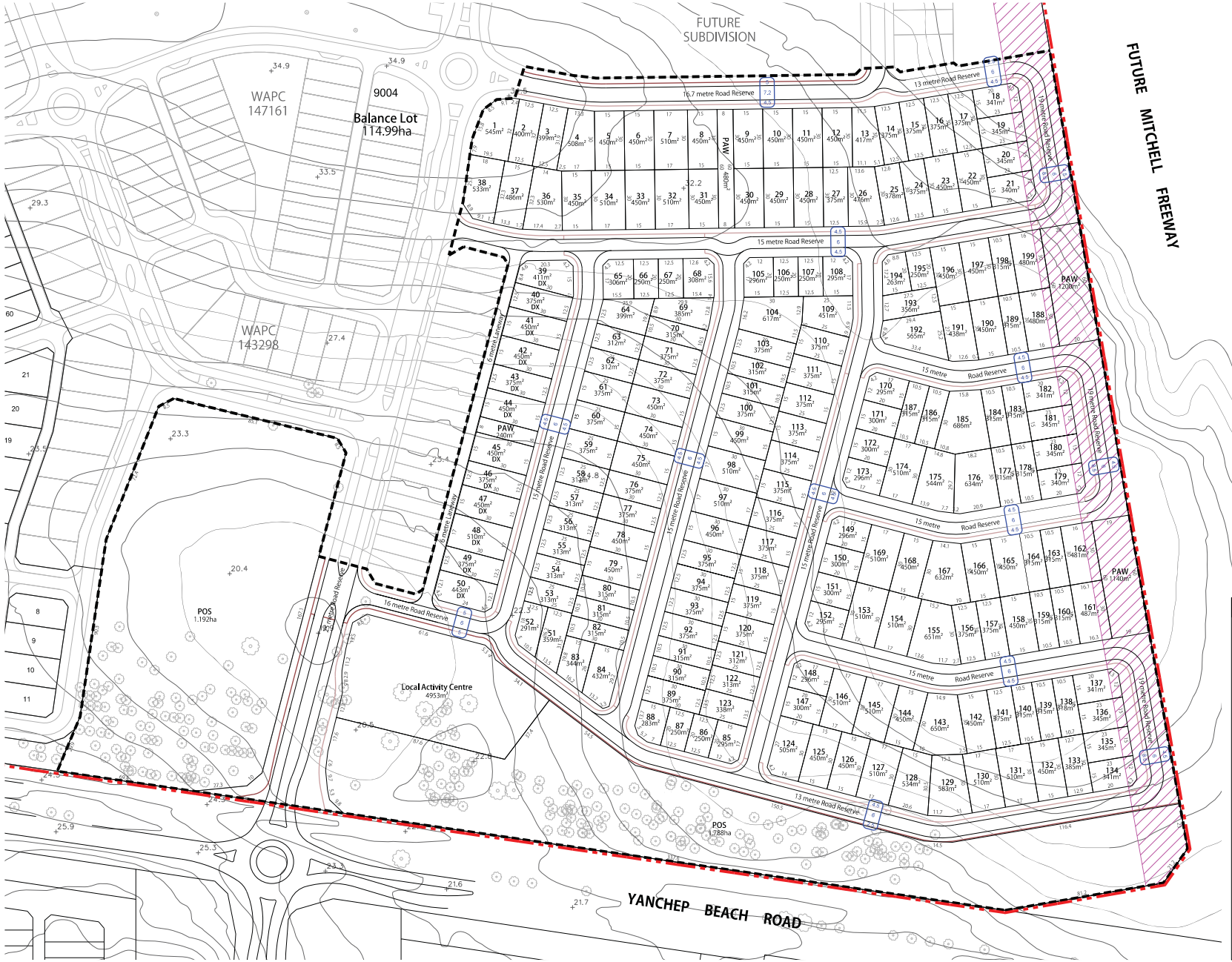
0m 200 400 600m

Yanchep beach joint venture

APPENDIX B

emerge ASSOCIATES | Bushfire Safety CONSULTING

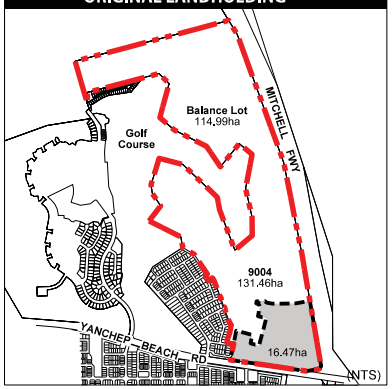
PROPOSED SUBDIVISION LAYOUT (CREATIVE DESIGN+PLANNING 2016)



LEGEND

- SUBJECT SITE
- SUBDIVISION APPLICATION BOUNDARY
- POWERLINE EASEMENT
- 2m FOOTPATH
- 1.5/1.8m FOOTPATH
- EXISTING TREES

ORIGINAL LANDHOLDING



LOT SUMMARY

R25 LOT YIELD			LOT AREA		
Size	No. Lots	% Total Lots	Average Size	% of Total Area	Area
235m² - 319m²	33	22.45%	314m²	16.86%	10374m²
320m² - 449m²	44	29.93%	378m²	27.06%	16645m²
450m² - 499m²	41	27.89%	454m²	30.30%	18641m²
500m² - 549m²	21	14.29%	516m²	17.62%	10839m²
550m² - 599m²	2	1.36%	574m²	1.87%	1148m²
600m² - 699m²	6	4.08%	645m²	6.29%	3870m²
Total Number of Lots	147				
Minimum Lot Size 312m²			Average Lot Size 418m²		
Maximum Lot Size 686m²			Total Lot Area 61517m²		

R35 LOT YIELD			LOT AREA		
Size	No. Lots	% Total Lots	Average Size	% of Total Area	Area
235m² - 319m²	25	62.50%	282m²	57.37%	7065m²
320m² - 449m²	15	37.50%	349m²	42.63%	5249m²
Total Number of Lots	40				
Minimum Lot Size 250m²			Average Lot Size 307m²		
Maximum Lot Size 432m²			Total Lot Area 12314m²		

R50 LOT YIELD			LOT AREA		
Size	No. Lots	% Total Lots	Average Size	% of Total Area	Area
320m² - 449m²	6	50.00%	392m²	46.03%	2354m²
450m² - 499m²	5	41.67%	450m²	44.00%	2250m²
500m² - 549m²	1	8.33%	510m²	9.97%	510m²
Total Number of Lots	12				
Minimum Lot Size 375m²			Average Lot Size 426m²		
Maximum Lot Size 510m²			Total Lot Area 5114m²		

PROPOSED SUBDIVISION

Lot 9004 on Plan 401271, YANCHEP

A Peet Project

NORTH

Scale 1:2000 @ A3

0 20 40 60 80 100m

DATE:	30/10/2014	DRAFTEE:	RF
REVISED:	26/07/2016	PLANNER:	MM
PROJECTION:	PCG 94	CHECK:	MM
DATUM:	AHD	PLAN NUMBER:	PACYA-3-003j

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Creative DESIGN+PLANNING

APPENDIX C

COMPLIANCE CHECKLIST

Compliance Checklist

ELEMENT/QUESTION	RESPONSE	APPLICABLE SECTION OF BMP
1: Location		
Does the proposal comply with the performance criteria by applying acceptable solution A1.1 (development location)?	Yes. Any new dwellings within the site can be located to ensure BAL-29 is not exceeded.	**Section 5.1.1**
2: Siting and design of the Development		
Does the proposal comply with the performance criteria by applying acceptable solution A2.1 (asset protection zone)?	Yes. New dwellings can be located so that BAL-29 is not exceeded. A minimum 20 m APZ is provided adjacent to the Mitchell Freeway.	**Section 5.1.2.5 and Section 5.1.2.6**
Does the proposal comply with the performance criteria by applying acceptable solution A2.2 (hazard separation zone)?	Not applicable. The performance criteria P2 can be achieved through the provision of a compliant APZ and the application of increased construction standards in accordance with AS 3959.	**Section 5.1.2.7**
3: Vehicular access		
Does the proposal comply with the performance criteria by applying acceptable solution A3.1 (two access routes)?	Yes. The interconnected internal loop road system connects with the broader public road network.	**Section 5.1.3.3**
Does the proposal comply with the performance criteria by applying acceptable solution A3.2 (public road)?	Yes.	**Section 5.1.3.4**
Does the proposal comply with the performance criteria by applying acceptable solution A3.3 (cul-de-sac)?	Not applicable	-
Does the proposal comply with the performance criteria by applying acceptable solution A3.4 (battle-axe)?	Not applicable	-
Does the proposal comply with the performance criteria by applying acceptable solution A3.5 (private driveway longer than 50 m)?	Not applicable	-
Does the proposal comply with the performance criteria by applying acceptable solution A3.6 (emergency access way)?	Not applicable	-
Does the proposal comply with the performance criteria by applying acceptable solution A3.7 (fire services access routes)?	Yes. The public access ways will support the provision of a fire services access route adjacent to the Mitchell Freeway in accordance with the requirements of DFES.	**Section 5.1.3.5**
Does the proposal comply with the performance criteria by applying acceptable solution A3.8 (firebreak width)?	Not applicable	-
4: Water		
Does the proposal comply with the performance criteria by applying acceptable solution A4.1 (reticulated areas)?	Yes.	**Section 5.1.4.3**

ELEMENT/QUESTION	RESPONSE	APPLICABLE SECTION OF BMP
Does the proposal comply with the performance criteria by applying acceptable solution A4.2 (non-reticulated areas)?	Not applicable	-
Does the proposal comply with the performance criteria by applying acceptable solution A4.3 (individual lots within non-reticulated areas)?	Not applicable	-

APPENDIX D

CERTIFICATION OF BAL RATING TEMPLATE

CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT

Stage D Yanchep Golf Estate

PROJECT NUMBER: EP10-017(15)

Prepared for Peet Funds Management Limited
August 2016

Document Control

DOC NAME	CERTIFICATION OF BUSHFIRE ATTACK LEVEL ASSESSMENT STAGE D YANCHEP GOLF ESTATE				
DOC NO.	EP10-017(15)--090				
REVISION	DATE	AUTHOR		REVIEWER	
1					
A					

Disclaimer:

This document has been prepared in good faith and is derived from sources believed to be reliable and accurate at the time of publication. Nevertheless, this publication is distributed on the terms and understanding that the author is not responsible for the results of any actions taken based on information in this publication or for any error in or omission from this publication.

The content of this document has been prepared primarily to consider the layout of the development or the appropriate building construction standard, where relevant. The measures outlined are considered to be prudent minimum standards only based on the relevant experience of the author and the standards prescribed by the relevant authorities. The level of implementation of the fire precautions achieved will depend upon the actions of the landowner or occupiers of the land and is not the responsibility of the author. The relevant local government and fire authority (i.e. Department of Fire and Emergency Services or local bushfire brigade) should be approached for guidance on preparing for and responding to a bushfire.

Notwithstanding the precautions adopted in this report, it should always be remembered that bushfires burn under a wide range of conditions. An element of risk, no matter how small always remains. The objective of the Australian Standard AS 3959-2009 is to “prescribe particular construction details for buildings to reduce the risk of ignition from a bushfire while the front passes” (Standards Australia 2009). Building to the standards outlined in AS 3959 does not guarantee a building will survive a bushfire or that lives will not be lost.

Certification of Specified BAL Ratings

This document is a template that will be completed as part of the development process, to confirm/certify BAL ratings for lots within the site and will consider the BAL assessment completed as part of the BMP (Emerge Associates and Bushfire Safety Consulting 2016). This will provide an accurate and reasonable outline of the bushfire risk posed to the site from adjacent classified vegetation at the time of development and can be used by purchasers, builders, building surveyors and the City of Wanneroo to determine whether a BAL rating is applicable and applicable construction requirements.

This document has been prepared to provide a summary of the outcomes of the Bushfire Attack Level (BAL) assessment undertaken as part of the *Bushfire Management Plan* (BMP) (Emerge Associates and Bushfire Safety Consulting 2016) that was completed for the site in accordance with *Australian Standard (AS) 3959-2009 Construction of buildings in bushfire prone areas* (AS 3959), and to certify the specific BAL ratings determined for lots within the site.

Where dwellings are located in a bushfire prone area, this document can be used by the proponent future home owners, builders, building surveyors and the City of Wanneroo to ensure future dwellings within the site are constructed in accordance with the applicable BAL rating, pursuant to AS 3959. An outline of the BAL assessment methodology and BAL ratings is outlined within the attached **'Additional Information'**.

Table D1 below outlines the information relevant to the BAL assessment undertaken as part of the BMP (Emerge Associates and Bushfire Safety Consulting 2016) prepared for the site.

Table D1: Summary of BAL assessment

SUMMARY OF BAL ASSESSMENT			
Summary of site details	**Address**	Stage D Yanchep Golf Estate	
	Suburb	Yanchep	
	Local Government Area	City of Wanneroo	
	State	Western Australia	
Relevant Fire Danger Index (FDI)	FDI 80, Table 2.4.3 of AS 3959		
Has a Bushfire Management Plan or BAL Assessment report (or similar) been prepared?	A *Bushfire Management Plan* (Emerge Associates and Bushfire Safety Consulting 2016) was prepared and lodged with the City of Wanneroo in August 2016. This BMP included a BAL Assessment and BAL Contour Plan to be used to support future subdivision and development within the site.		
Assessment method	Method 1, AS 3959		
Assessor details	Emerge Associates and Bushfire Safety Consulting 2016		
Potential bushfire impacts within 100m of the site, based on AS 3959	**Plot 1**	**Vegetation classification**	To be completed
		Effective slope	To be completed
	Plot 2	**Vegetation classification**	To be completed
		Effective slope	To be completed

SUMMARY OF BAL ASSESSMENT			
	Plot 3 –	**Vegetation classification**	To be completed
		Effective slope	To be completed
	Plot 4	**Vegetation classification**	To be completed
		Effective slope	To be completed
	Plot 5	**Vegetation classification**	To be completed
		Effective slope	To be completed
	Plot 6 –	**Vegetation classification**	To be completed
		Effective slope	To be completed
BAL ratings	A BAL Contour Map is provided in **Figure D1**, with the relevant BAL ratings for each lot within the site detailed in **Table D2** (below). **Figure D1** has been attached separately to this Appendix.		
Key assumptions	• To be completed		

Specified BAL ratings

The results of the detailed BAL Assessment show that all future dwellings within the site have their bushfire risk mitigated through appropriate management of vegetation within 100 m of the site, provision of appropriate setbacks, and/or increased construction standards in accordance with AS 3959. The BAL contour plan for the Method 1 BAL assessment is shown in **Figure D1** (attached separately to this Appendix). **Table D2** below outlines the specific standard that a dwelling must be built to within an exposed lot (i.e. those lots exposed to a BAL rating greater than BAL-LOW).

The BAL ratings outlined within this document apply to the entire building constructed within the lot. It is possible that shielding provisions may apply and therefore there may be an opportunity to reduce the BAL rating for specific portions of the building in accordance with AS 3959. **Table D2** indicates where shielding could apply, and where people would like shielding provisions to be considered, a separate building specific BAL assessment should be completed with specific advice on shielding. It should be noted that where a BAL rating of 12.5 or higher applies, the minimum construction standard, regardless of shielding will be BAL 12.5. This is outlined further within the attached **'Additional Information'**.

Exceptions apply to some lots where the applicable BAL rating may be decreased a level (e.g. BAL-12.5 becomes BAL-LOW) where specific setbacks are provided within the lot. Where applicable, these exceptions have been outlined in **Table D2** below.

Table D2: Specified BAL ratings for exposed lots

BAL Ratings

- BAL-FZ
- BAL-40
- BAL-29
- BAL-19
- BAL-12.5
- BAL-LOW

Lot number	Classified vegetation within 100 m of lot	Distance of lot from vegetation	Effective slope	Specified BAL rating	Exceptions	Applicable AS 3959 Section / construction requirements	Shielding may apply
1	Woodland (Class B)						
	Scrub (Class D)						
	Grassland (Class G)						
2	Woodland (Class B)						
	Shrubland (Class C)						
	Grassland (Class G)						
3	Woodland (Class B)						
	Shrubland (Class C)						
	Grassland (Class G)						
4	Woodland (Class B)						
	Shrubland (Class C)						
	Grassland (Class G)						

Applicant Declaration

TO BE COMPLETED AS PART OF CERTIFICATION

I declare that the information provided is true and correct to the best of my knowledge.

Signature:

Name

Company

Date

Additional Information

Australian Standard 3959-2009 Construction of buildings in bushfire prone areas (AS 3959)

Australian Standard (AS) 3959 Construction of buildings in bushfire prone areas (AS 3959) (Standards Australia 2009) (AS 3959) specifies requirements for the construction of buildings in Bushfire Prone Areas in order to improve their resistance to bushfire attack from embers, radiant heat, flame contact, and combinations of these attack forms.

The objective of AS 3959 is to provide detailed methods for assessing bushfire attack and to prescribe particular construction details for buildings to reduce the risk of ignition from a bushfire, appropriate to the:

- Potential for ignition caused by burning embers, radiant heat or flame generated by a bushfire.
- Intensity of the bushfire attack on the building.

The Bushfire Attack Level (BAL) rating is determined through identification and assessment of the following parameters:

- Fire Danger Index (FDI) rating: assumed to be FDI 80 for Western Australia
- All classified vegetation within 100 m of the subject building
- Separation distance between the subject building and the classified vegetation source/s
- Slope of the land under the classified vegetation

The parameters applicable to the site are detailed within **Table D1**.

AS 3959 provides six BAL ratings: BAL-LOW, BAL-12.5, BAL19, BAL-29, BAL-40 and BAL-FZ, which are based on heat flux exposure thresholds. Each BAL rating is associated with appropriate construction standards that apply as a minimum for buildings in bushfire-prone areas (as per AS 3959). A summary of each BAL rating, associated heat flux and applicable section of AS 3959 has been summarised in **Table DA** below.

Table DA: Summary of BAL ratings, heat flux thresholds and associated construction standards, as outlined within AS 3959

Bushfire Attack Level (BAL)	Classified vegetation within 100 m of the subject building and heat flux exposure thresholds	Description of the predicted bushfire attack and levels of exposure	Construction section (within AS 3959)
BAL-LOW	See Clauses 2.2.3.2	There is insufficient risk to warrant specific construction requirements	4
BAL-12.5	≤ 12.5 kW/m^2	Ember attack	3 & 5
BAL-19	> 12.5 kW/m^2 to ≤ 19 kW/m^2	Increasing levels of ember attack and burning debris ignited by windborne embers blown together with increasing heat flux	3 & 6
BAL-29	> 19 kW/m^2 to ≤ 29 kW/m^2	Increasing levels of ember attack and burning debris ignited by windborne embers blown together with increasing heat flux	3 & 7
BAL-40	> 29 kW/m^2 to ≤ 40 kW/m^2	Increasing levels of ember attack and burning debris ignited by windborne embers blown together with the increased likelihood of exposure to flame	3 & 8
BAL-FZ	≤ 40 kW/m^2	Direct exposure to flames from fire front in addition to heat flux and ember attack	3 & 9

Shielding Provisions

Under AS 3959 the construction requirements for the next lower BAL rating determined for a dwelling may be applied to the elevation of the building not exposed to the source of bushfire attack (i.e. if the building is BAL-19, BAL 12.5 would apply). Under AS 3959, an elevation is deemed to not be subject to the source of bushfire attack if all straight lines between the elevation and source of bushfire attack are obstructed by another part of the building. Examples of this are shown within **Plate DA** below.

Where a BAL rating of 12.5 or higher applies, the minimum construction standard, regardless of shielding, will be BAL 12.5

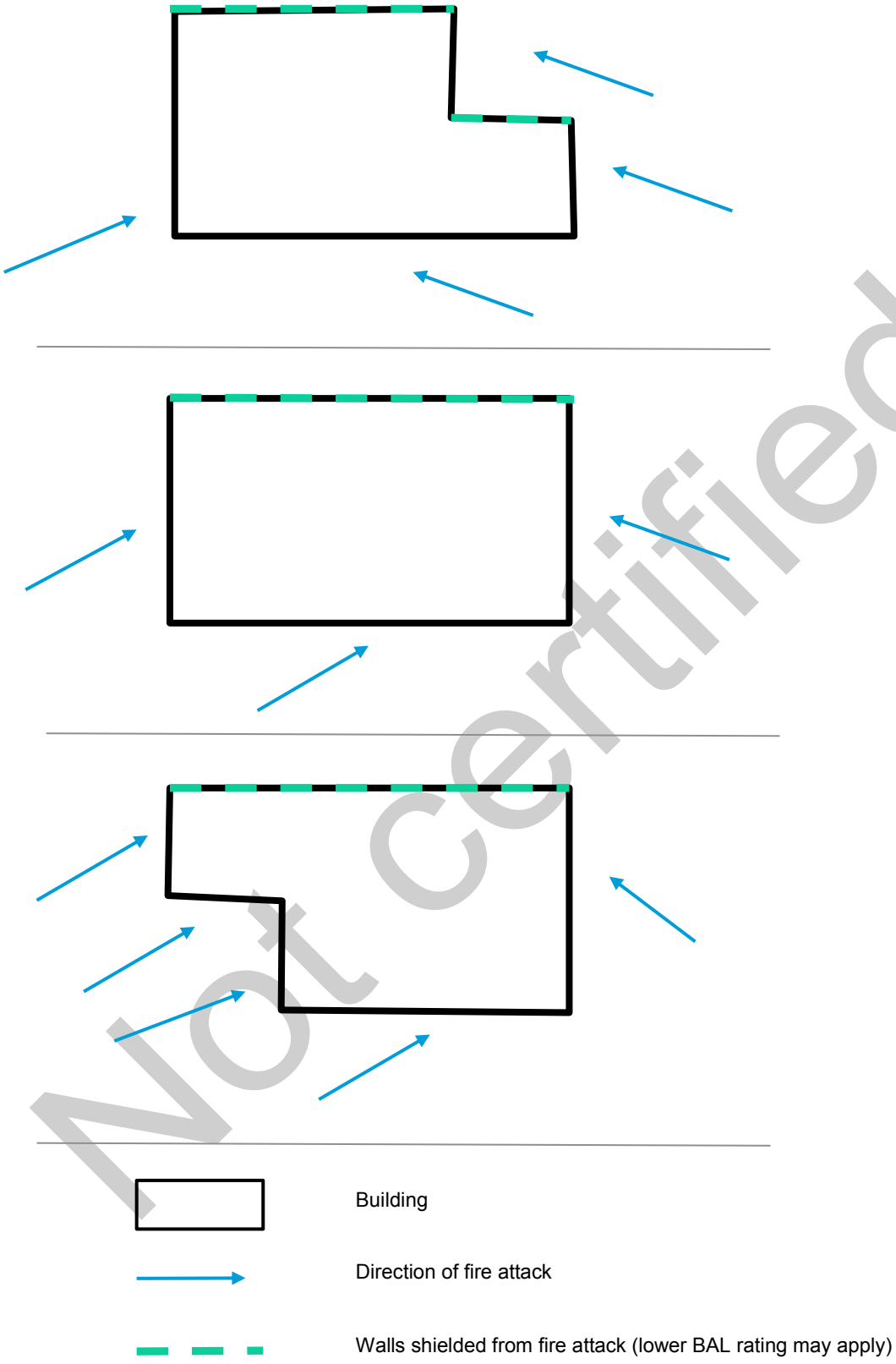

Plate DA: Examples of walls subject to shielding (Source: AS 3959)