Bushfire Safety
CONSULTING

Fire Management Plan

Subdivision Proposal

Special Residential

Portion of Lot 9134 Pinjar Road
Banksia Grove
City of Wanneroo

WAPC Ref No. 146580

November 2012

Subdivision Proposal (WAPC No. 146580)
Portion of Lot 9134 Pinjar Road - Special Residential
Banksia Grove
CITY OF WANNEROO

Front Cover Photo: Aerial photograph of development site (source: nearmap.com)

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Executive Summary

This Fire Management Plan has been prepared following the assessment of a portion of Lot 9134 Pinjar Road, Banksia Grove in the City of Wanneroo.

The development site has been assessed for vegetation class and bushfire hazard rating levels. It has been determined that all proposed buildings will fall within the acceptable level of risk. Bushfire Attack Level BAL-29 is not exceeded for any of the six proposed dwellings. All dwellings will be sited a minimum of 20 metres from classified vegetation.

This Plan includes a table on page 24 showing responses to the Performance Criteria outlined in the Planning for Bushfire Protection Guidelines - Edition 2 (WAPC et al. 2010).

Currently, the site's bushfire hazard level is rated as extreme, but as the development occurs, vegetation will be removed and managed and hazard levels will become low. Residual hazard will remain in the adjoining property to the west. Areas of hazard south of the development are earmarked for development so existing hazard will reduce.

Access and egress from all the proposed 6 lots will adequately service the development.

Water is adequate for residential needs and for a water supply during fire emergencies by the provision of fire hydrants on Pinjar and Redheart Roads and Moort Rise.

Both the City of Wanneroo and FESA have a public education program to raise the community's awareness to its responsibilities regarding preparing homes from a bushfire attack and what to do if an event happens.

If there is a bushfire within or near the site, implementing this Fire Management Plan will reduce the threat to residents and firefighters.

1. Introduction

The site subject to this Fire Management Plan (FMP) is a portion of Lot 9134 Pinjar Road, Banksia Grove in the City of Wanneroo. The site includes a strip of land 3.7462ha in size which is currently undeveloped. It is located in Banksia Grove which is located 30 kilometres north of Perth and 5 kilometres north-east of the Wanneroo Townsite (Appendix A). Banksia Grove residential development when complete will be home to approximately 12,000 residents, housed in 4,000 dwellings as outlined in the Banksia Grove Structure Plan (Appendix B).

Banksia Grove is an urban development initiative involving the Western Australian Government through the Department of Housing, partnering with the Walker Corporation and PRM Property Group Pty Ltd.

The site is zoned “Special Residential” under the City of Wanneroo’s District Planning Scheme No. 2.

As part of the subdivision application for the six “Special Residential” lots, the Fire and Emergency Services Authority of Western Australia (FESA) has requested a bushfire hazard assessment be prepared prior to determination.

This FMP has been prepared to satisfy this condition. This Plan provides responses to the performance criteria that fulfil the intent of the bushfire hazard management issues outlined in the Planning for Bushfire Protection Guidelines - Edition 2 (WAPC et al. 2010).

Community bushfire safety is a shared responsibility between governments, fire agencies, communities and individuals. The planning and building controls outlined in this Plan, if fully implement, will mitigate the risk to people and property; however, it will not remove the risk. How people interpret the risk, prepare and maintain the property and buildings and what decisions and actions they take (i.e. evacuate early or stay and defend or other) greatly influence the outcome of a bushfire.

1.1 The Proposal

The proposed Special Residential Subdivision Plan (Appendix C) outlines six proposed lots will be created, each 5000m2 in size.

It is a linear shaped development extending north south sandwiched between the existing urban environment in the east and the woodland vegetated rural residential lots in Carramar to the west.

The project management team, which commenced work in December 2005, will develop the entire Banksia Grove Project over a 10 to 12 year period.

1.2 Objectives

The purpose of this FMP is to address bushfire management issues within the proposed development. If there is a bushfire within or near the site, implementing the FMP will reduce the threat to residents and firefighters.

Achievable and measurable goals of this Plan include ensuring:

- The development is located in an area where the bushfire hazard does not present an unreasonable level of risk to life and property
- Vehicular access to the development is safe, if there is a bushfire occurring
- Water is available to the development so that life and property can be defended from bushfire
- The development is sited to minimise the effects of a bushfire, and
- The development design will minimise the effects of a bushfire.

This document sets out the roles and responsibilities of the developer, residents, the City of Wanneroo and the Fire and Emergency Services Authority (FESA). It is important that the measures and procedures outlined in this FMP are reviewed as necessary.

This FMP includes:

- 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
- Addressing vehicular access
- Siting buildings to include building protection zones
- Water supply, and
- Maps and plans of fire reduction measures.

2. Statutory and Policy Framework

Relevant key legislation, policy and guidelines include the following:

2.1 Bush Fires Act

The Act sets out provision to diminish the dangers resulting from bushfires, prevent, control and extinguish bushfires and for other purposes. The Act addresses various matters including prohibited burning times, enabling Local Government to require land owners/occupiers to plough or clear firebreaks, to control and extinguish bushfires and establish and maintain Bush Fire Brigades.

2.2 State Planning Policy No. 3.4 Natural Hazards and Disasters

The objectives of this Policy are to:

- Include planning for natural disasters as a fundamental element when preparing all statutory and non-statutory planning documents, specifically town planning schemes and amendments, and local planning strategies, and
- Use these planning instruments to minimise the adverse effects of natural disasters on communities, the economy and the environment.

The Policy determines those areas that are most vulnerable to bushfire and where development is appropriate and not appropriate. The provisions and requirements contained in Planning for Bush Fire Protection Guidelines - Edition 2 (WAPC et al. 2010) were used in this determination.

2.3 Planning for Bush Fire Protection Guidelines (2010)

These Guidelines were prepared by FESA, the Western Australian Planning Commission (WAPC) and the Department of Planning. The document is the foundation for fire risk management planning on private land in Western Australia.

The document addresses important fire risk management and planning issues and sets out performance criteria and acceptable solutions to minimise the risk of bushfires in new subdivisions and developments. It addresses management issues including the location, design and siting of the development, vehicular access and water.

3. Bushfire Impacts

Reliable records began in 1900 and since then there have been 729 civilian fatalities from bushfires in Australia, of those 21 (or 3 per cent of the national total) have occurred in Western Australia. Bushfires have killed more people in Australia than any other natural disaster.

3.1 Building Survival

Buildings survive bushfires due to a number of factors; some relate to the way a bushfire behaves at a site, others relate 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:

- 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, and
- Power supply.

It is likely that buildings are lost because of their vulnerability to the mechanisms of bushfire attack. Buildings constructed to Australian Standard (AS 3959) are more likely to survive a bushfire compared to buildings with no construction standards, however building survival is not guaranteed.

3.2 Human Fatalities

The final report from the Victorian Bushfires Royal Commission (VBRC) into the Black Saturday bushfires handed down on 31 July 2010 is the most comprehensive evidence ever assembled about the circumstances surrounding fatalities in an Australian bushfire.

Where people died on Black Saturday contrasts strikingly with studies from previous bushfire fatalities (VBRC 2010). Historically about 32 per cent of people have died in late evacuations (Risk Frontiers et al. 2008); however, on Black Saturday the majority of people (113 out of 173) died inside or close to structures. In a "Black Saturday" type of bushfire, safety can only be assured if people leave early, well before any fire arrives. When the Fire Danger rating is "Catastrophic" most buildings cannot be defended.

Most people die in bushfires from being exposed to radiant heat. Protection is provided by wearing long sleeved natural fibre clothing, having solid barriers and maintaining a long distance between people and the fire (i.e. source of radiant heat).

Bushfires also generate enormous amounts of smoke and wind, and when these factors are combined with the fire, they can cause many trees to come down.
If people do not evacuate early before a fire impacts road conditions become extremely hazardous. Many fatalities have occurred during late evacuation or fleeing.

4. Description of the Area

Banksia Grove is a relatively new suburb located within the City of Wanneroo. When complete, Banksia Grove will be home to 4 schools, restaurants, cafes and retail outlets. The project will create over 4000 home sites and approximately 12,000 residents will call it home by 2020. Banksia Grove had a population of 4718 at the 2011 census.

The subject land is bounded by urban development to the north and east and rural residential bush blocks in Carramar to the west.

4.1 Description of the Subject Land

The subject land is 3.7462 ha in size, being approximately 85m wide and 450m long. The linear shape of the development site will allow six “Rural Residential” lots to be created.

This FMP focuses on the subject land and immediate surrounding area (Appendix C).

In summary this land is:

- Undeveloped and generally vegetated in low woodland with an understorey of open heath
- Gently sloping, downhill to the west north-west
- Surrounded to the north and east by residential development and low woodland to the south and west.

4.2 Fire Climate

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 enhanced if thunderstorms develop accompanied by lightning and little or no rain.

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

The Bureau of Meteorology website (www.bom.gov.au/weather/wa/sevwx/perth/bushfires.shtml) states that extreme fire weather conditions in the Perth region typically occur with strong easterlies or north easterly winds associated with a strong high to the south of the state and a trough offshore. Easterly winds represent about 60 per cent of extreme fire weather days (events) compared to less than 5 per cent associated with southerly winds. About 15 per cent 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 weather station at Swanbourne (28 km south of the study site) indicate the area experiences warm dry summers and cool wet winters (Figure 1), and is classified as a Mediterranean climate. Mean maximum temperatures vary from 31 degrees Celsius in February to 18 degrees Celsius in July.

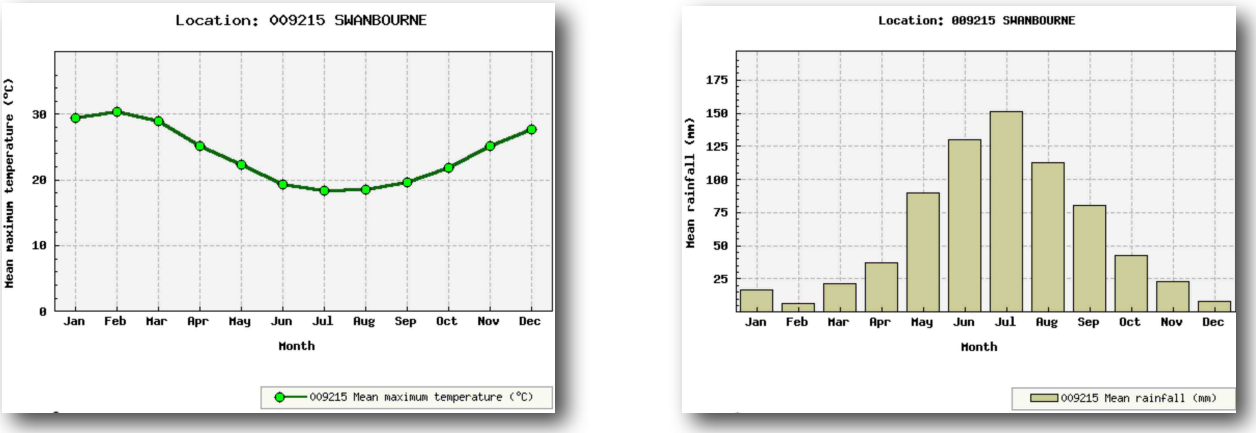

Figure 1: Mean maximum recorded temperatures and mean rainfall for Swanbourne Meteorology Station between 1993 and 2010

The site is 7.5 kms from the coast and is significantly influenced by land and sea breezes. These are created by the daily heating and cooling of the land surface next to the ocean. The sea breeze occurs when the air over the land heats up and becomes more buoyant and rises, denser moist air over the ocean then flows inland. Sea breezes can strengthen prevailing wind, reduce it or even reverse it, depending on the strength and direction of the two airstreams (Cheney and Sullivan 2008).

Data from the Bureau of Meteorology weather station at Swanbourne indicate that the predominant winds in the summer months at 3 pm near the study site are south-westerlies (Figure 2). Wind strength, direction and frequency of the south-west wind is clearly dominant and occurs 70-80 per cent of the time. Winds from the west and south occur < 10 per cent of the time.

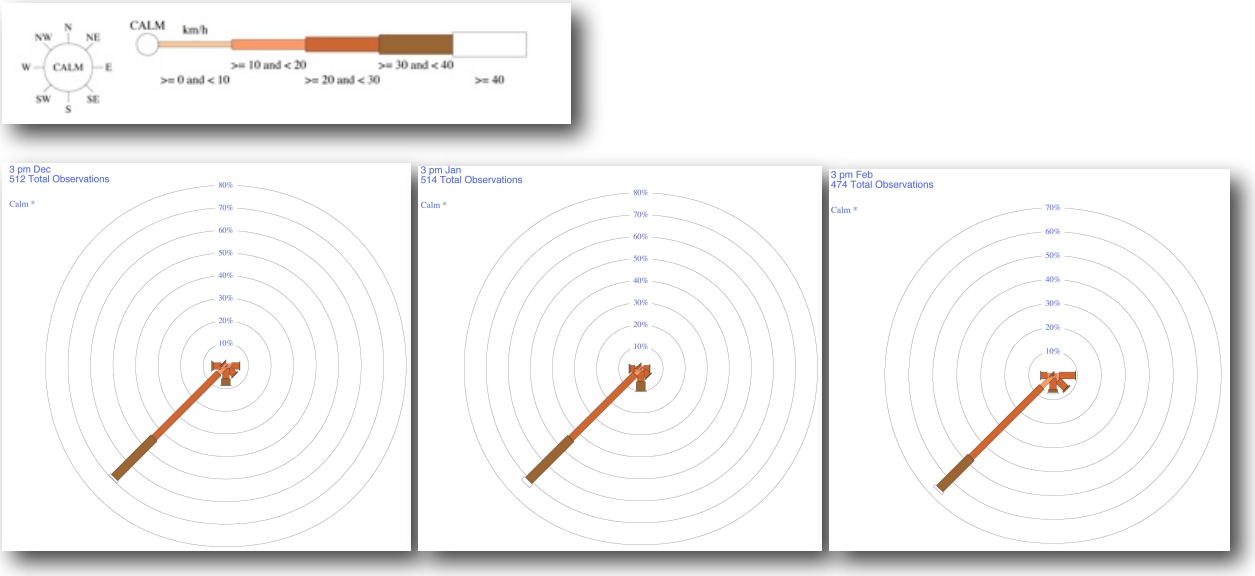

Figure 2: Rose of wind direction and wind speed in km/hr for December, January and February between 1993 and 2010 at the Swanbourne Bureau of Meteorology Station

Interpreting Figure 2 - Wind speed Vs Direction Plot

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 is the frequency of calm conditions. Each branch of the rose represents wind coming from that direction, with north to 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/hr 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).

4.3 Bushfire Fuels

The study site is vegetated in low woodland comprised of predominantly banksia and sheoak species. An intact heath understorey (open shrubland) exists under the low woodland canopy. In the north east corner, scrub vegetation exists and canopy foliage cover is less than 10%. Bushfire fuels will be significantly reduced on the site when building envelopes and building protection zones are established.

4.4 Assets

When the site is fully developed it will contain 6 new lots that will occupy the transitional zone between urban lots to the east and rural residential lots to the west. There are dwellings and development east and north of this site that are and will be within 100 metres of classified vegetation. These dwellings are also at risk of bushfire attack.

4.5 Access

The subdivision will be serviced by Moort Rise (a 15 metre wide road reserve) on the western boundary. Pinjar Road immediately adjoins the eastern boundary of all lots. A short Emergency Access Way links the dead end road with Pinjar Road. The residential development east and north of the site provide numerous access options.

4.6 Water Supply

Reticulated water is provided to the entire development. Two fire hydrants exist on Pinjar Road and one on Redheart Road. Three fire hydrants are proposed in Moort Rise. This will adequately supply the small subdivision.

4.7 Bushfire History

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 that time.

Anthropological and historical evidence suggests that much of the Swan Coastal Plain was regularly burnt by the Aborigines until the middle of the nineteenth century (Hallam 1975, Abbott 2003).

Bushfires are common in the City of Wanneroo, in the 2009-2010 financial year, the volunteer fire brigades attended to 132 fires (City of Wanneroo 2010). More recent bushfire history includes:

- 10 January 2010, a fire started near Neaves Road and old Yanchep Road. A bushfire “Advice” was issued for people in Banksia Grove. No properties were threatened and the “All Clear” was issued at the 4.30pm on the same day.

Areas of native vegetation surrounded by residential estates are susceptible to frequent bushfires due to the high risk of arson and great potential for accidental ignitions (Walker 1981, Burrows and Abbott 2003).

5. Bushfire Hazard Assessment

Assessing bushfire hazards at a strategic level takes into account the predominant class of vegetation on the site and surrounding area for a minimum of 100 metres. The vegetation class map for the site and surrounding area for a minimum of 100 m is shown in Appendix D. Fuel layers in a typical forest environment can be broken down into 5 obvious segments (Figure 3). These defined fuel layers are used in the following descriptions regarding vegetation types, fuel structure and bushfire hazard levels.

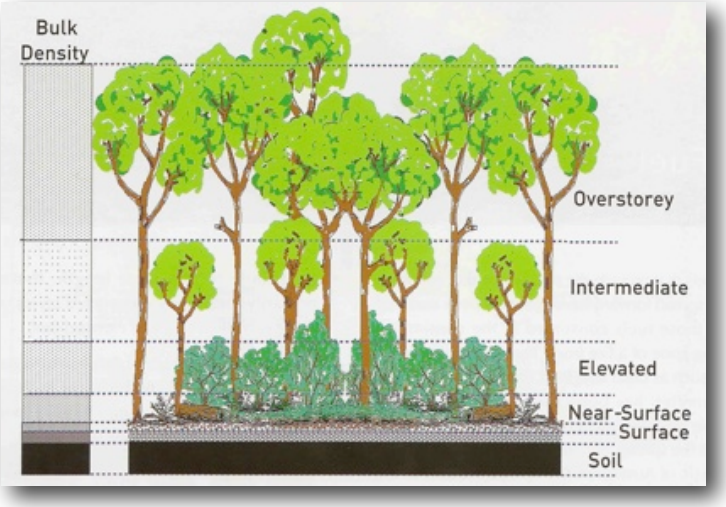

Figure 3 : The five obvious fuel layers in a forest environment that could be associated with fire behaviour (Gould et al. 2007)

5.1 Vegetation Type and Class

The site assessment undertaken for this study identified two vegetation classes as identified and mapped in Appendix D. The site is 90% covered in a low woodland with canopy heights in the range of 5 - 10m. The dominant genus are Banksia, Eucalyptus and Allocasuarina species (Figure 4). Some trees have poor canopy health. The low woodland supports a healthy and intact open heath (shrubland) elevated vegetation layer and near surface fuels such as Hibbertia species.

In the north west corner of the site scrub vegetation dominates. The dominant genus is Leptospermum (Tea tree) and Adenanthos (Wollybush) which grows in clumps 2-3 metres high (Figure 5).

The low woodland vegetation type extends into adjoining rural residential properties to the west. It also extends to the south on the western side of Pinjar Road.

There is no vegetation north or east of the site as these areas have been cleared and are currently under residential development.

Managed vegetation includes those areas surrounding existing dwellings on the rural residential lots west of the site. Residents have established gardens and irrigated lawns surrounding their homes.

Vegetation will be removed to create building envelopes and an overlapping building protection zones on the site. This will also reduce overall bushfire hazard on the site.

Figures 4 & 5: Low woodland vegetation with an open shrubland elevated layer (left) and scrub vegetation dominated by tea tree species (right)

5.2 Slope

The site slopes downslope to the west north-west in the range of 3-4 degrees. This is consistent across the entire site. Contour lines with intervals of 1 metre can be seen in the subdivision plan (Appendix C).

5.3 The Bushfire Hazard Assessment Levels

The vegetation class map (Appendix D) outlines the dominant vegetation types on the study site and surrounding area for a minimum of 100 m. Descriptions of the vegetation class structure and dominant species are outlined in section 5.1 Vegetation Type and Class. The bushfire hazard assessment levels were determined using Appendix 1 of the Planning for Bushfire Protection Guidelines - Edition 2 (WAPC et al. 2010).

The study site has a bushfire hazard rating of extreme due to the extent of low woodland and scrub vegetation. Low bushfire hazard occurs in areas of managed vegetation such as irrigated lawns, roads and residential areas.

As the site develops, building envelopes and building protection zones will be established and vegetation will be removed. This will lead to a reduction in the bushfire hazard. Long-term hazard will remain in the adjoining rural residential properties to the west.

The bushfire hazard rating map for the site and surrounding area is shown in Appendix E.

6. Fire Mitigation Strategies

This report adopts an acceptable solution and performance-based system of control for each bushfire hazard management issue. It is consistent with Appendix 2 of the Planning for Bushfire Protection Guidelines - Edition 2 (WAPC et al. 2010). The management issues are:

- Location of the development
- Vehicular Access
- Water
- Siting of the development, and
- Design of the development.

Acceptable solutions are provided for four out of the five management issues and each illustrates one example of satisfactorily meeting the corresponding performance criteria. A performance-based approach is provided for one management issue.

6.1 Element: Location of the Development

Intent

To ensure that development/intensification of land use is located in areas where bush fire hazard does not present an unreasonable level of risk to life and property.

Acceptable Solution

Bushfire hazard levels are rated as extreme on the development site due to vegetation being low woodland. Low bushfire hazard occurs where managed vegetation exists surrounding dwellings and the urban environment.

The maximum Bushfire Attack Level (BAL) is predicted to be BAL-29 for all dwellings. All dwellings achieve a minimum 20 metre separation from the low woodland west of the site.

Hazard Separation Zones (HSZ's) exist to reduce fire intensity on dwellings. Construction standards will be increased to align with the appropriate Bushfire Attack Level (BAL) to offset the requirement for a HSZ because the small lot sizes do not permit their inclusion.

The site will be provided with an adequate water supply and access to fight fires and all exposed dwellings should be constructed to AS 3959 standards.

6.2 Element: Vehicular Access

Intent

To ensure vehicular access serving a subdivision development is safe if a bushfire occurs.

Background

The development site is located adjacent to an urban area with a substantial network of public roads in a low bushfire hazard environment. Pinjar Road borders the eastern boundary of the entire site and is a two-lane public road providing two access routes.

The western perimeter road (Moort Rise) provides access to all lots. The road network adjoining the site is outlined in Appendix F.

This proposal complies with the performance criteria by applying the following acceptable solutions:

Acceptable Solution A2.1: Two Access Routes

All six lots within the subdivision have direct driveway access to Moort Rise on the western boundary of each lot. This road provides two access routes from all lot driveways because the dead end is linked to Pinjar Road via a 62 metre long Emergency Access Way. This complies with the requirements for two access routes.

Acceptable Solution A2.2: Public Roads

Pinjar Road and the western boundary road reserve will comply with minimum standards for public roads. The following public road standards apply:

- Minimum trafficable surface: 6 m
- Horizontal clearance: 6 m
- Vertical clearance: 4 m
- Maximum grades: 1 in 8
- Maximum grades over 50 m: 1 in 5
- Maximum average grade: 1 in 7
- Minimum weight capacity: 15 tonnes
- Maximum crossfall: 1 in 33
- Minimum inner radius of curves: 12 m

Acceptable Solution A2.3: Cul-de-sacs (including dead end roads)

One 450m cul-de-sac is proposed to run the full length of the development on the immediate west boundary of the site. The road reserve is 14 metres in width and the following standards apply:

- Maximum length: 200 m, but can be extended to 600 m if less than eight lots are serviced and if alternative emergency access is provided
- Minimum trafficable surface: 6 m
- Horizontal clearance: 6 m
- Maximum grades: 1 in 8
- Maximum grades over 50 m: 1 in 5
- Maximum average grade: 1 in 7
- Minimum weight capacity: 15 tonnes
- Maximum crossfall: 1 in 33
- Minimum inside radius of curves: 12 m
- Turn around area requirements: (see Appendix F)

Acceptable Solution A2.5: Private Driveways

Private driveways are unlikely to exceed 50 m in length but it is possible. This will be dependent on the driveway access point and the location of the dwelling. If a private driveway exceed 50 metres in length the following standards apply:

- Minimum trafficable surface: 4 m
- Horizontal clearance: 6 m
- Vertical clearance: 4 m
- Maximum grades: 1 in 8
- Maximum grades over 50 m: 1 in 5
- Maximum average grade: 1 in 7
- Minimum weight capacity: 15 tonnes
- Maximum crossfall: 1 in 33
- Minimum inside radius of curves: 12 m
- Turn around area designed to accommodate 3.4 fire appliances and to enable them to turn around safely within 50 m of a house (requirements outlined in Appendix F)

Acceptable Solution A2.6: Emergency Access Ways

A short 62 metre Emergency Access Way is proposed to link the cul-de-sac head with Pinjar Road to provide two access routes for all residents and emergency services. The Emergency Access Way provides alternative links to public roads during emergencies. It must be constructed of compacted limestone and easily trafficable by 2WD vehicles. It must achieve the following requirements :

- Minimum trafficable surface: 6 m
- Horizontal clearance: 6 m
- Vertical clearance: 4 m
- Maximum grades: 1 in 8
- Maximum grades over <50 m: 1 in 5
- Maximum average grade: 1 in 7
- Minimum weight capacity: 15 tonnes
- Maximum crossfall: 1 in 33
- Minimum inner radius of curves: 12 m
- Must be signposted

Acceptable Solutions A2.8 : Gates

Two gates are required at both ends of the Emergency Access Way. Both gates must be a minimum width of 3.6 metres and meet the following requirements:

- Design and construction: to be approved by relevant local government
- Emergency access way gates: must not be locked

Acceptable Solutions A2.10 : signs

Signs will be erected where the emergency access way adjoins the public roads. They will meet the following requirements:

- Minimum height above ground: 0.9 m
- Design and construction: to be approved by City of Wanneroo
- Lettering Height: 100 mm
- To display the following wording 'Emergency Access Only'.

6.3 Element: Water

Intent

To ensure water is available to the development to enable life and property to be defended from bushfire.

Acceptable Solution

The development is provided with a reticulated water supply, together with fire hydrants, that meet the specifications of the Water Corporation and FESA. Residential dwellings (Class 1a) require fire hydrants to be sited within (or every) 200 m in land zoned residential. Three fire hydrants currently exist on adjacent public roads, two are located on Pinjar Road and a further hydrant is located on Redheart Road. They are located within 200m of each other and no additional hydrants are required to service the development.

A further 3 fire hydrants will be located on Moort Rise. Fire services require ready access to an adequate water supply during fire emergencies. The location of fire hydrants are shown in Appendix G.

6.4 Element: Siting of the Development

Intent

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

Acceptable Solution: Building Protection Zone (BPZ)

One of the most important fire protection measures influencing the safety of people and property is to create a BPZ around buildings. The building protection zone is a low fuel area immediately surrounding a building. Non-flammable features such as driveways, roads, road reserves, footpaths, lawn or landscaped gardens (including deciduous trees) can form parts of a BPZ.

World first research into land management and house loss 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 to determine house survival when compared with other land management practices, such as broad scale fuel reduction burning remote from residential areas (Gibbons et al. 2012).

Creating a BPZ will ensure vegetation and fuels, within close proximity to dwellings, are managed to reduce predicted radiant heat flux levels and improve the survival of buildings.

Managing vegetation in the BPZ has two main purposes:

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

A permanent BPZ will be established for 20m minimum to the west of dwellings. It will also be established for a minimum of 20 m to the north, east and south or to the lot boundary. It must be a minimum of 20m in width to the west of all dwellings because this is the direction of woodland vegetation (i.e. bushfire hazard).

The BPZ between lots can be less than 20 metres as the adjoining lots will have an overlapping BPZ. It is not possible to site a full 20m BPZ surrounding each dwelling due to the density of development. Similarly a 20m BPZ may not be achieved east of each dwelling which is acceptable given there is no bushfire hazard east of the lots. A strip of remnant vegetation may be retained on the east boundary of lots to screen dwellings from Pinjar Road beyond the 20m BPZ. The width of this vegetation strip is determined by the site of the dwelling on the lot (Appendix H).

The BPZ must be established and maintained to the following standards:

- Width: 20 m minimum to the west of all dwellings and can including Moort Rise Road Reserve as indicated in Appendix H
- Width: 20m minimum between lots (i.e. to the north and south) and on the east side of dwellings or to the lot boundary
- Fuel load: reduced to and maintained at 2 tonnes per hectare
- All tree crowns are a minimum of 10 m apart
- All trees to have lower branches pruned to a height of 2 m
- All tall shrubs or trees are not to be located within 2 m of a building (including windows)
- No tree crowns or foliage is to be within 2 m of any building, this includes existing trees and shrubs and new plantings
- All fences and sheds are constructed with non-combustible materials (i.e. colorbond, brick or limestone)
- All shrubs to contain no dead material within the plant
- No tall shrubs are to be in clumps within 3 m of the building
- No trees are to contain dead material in the crown or on the bole.

By achieving these standards, it will be possible to construct dwellings to an appropriate standard (i.e. BAL-29 or less) under the Australian Standard (AS 3959-2009) Construction of buildings in bushfire-prone areas. A Hazard Separation Zone is not able to be included in the design due to the small lot sizes. The removal of this design feature is offset by an increase in construction standards and compliance with AS 3959.

6.4.1 Building Siting and Predicted Bushfire Attack Levels

The following Bushfire Attack Level (BAL) assessment demonstrates that the fuel management surrounding dwellings achieves acceptable levels of risk.

The AS 3959-2009 has six categories of Bushfire Attack Level, namely BAL-LOW, BAL-12.5, BAL-19, BAL-29, BAL-40 and BAL-FZ. These categories are based on heat flux exposure thresholds.

The method for determining the BAL involves a site assessment of vegetation and local topography. The assumed Fire Danger Index (FDI) for Western Australia is 80. The BAL identifies the appropriate construction standard that applies as a minimum standard in Construction of buildings in bushfire-prone areas (AS 3959-2009).

Methodology and Assumptions

The following BAL examples were determined using the methodology in Appendix A of AS 3959-2009. This methodology is also outlined in the Planning for Bush Fire Protection Guidelines. Example BAL assessments were undertaken in six representative locations adjacent to bushfire hazard (Appendix H). The results of these assessments are shown in Table 1.

The criteria to determine the BAL is outlined as follows:

Designated FDI : 80
Flame Temperature : 1090
Slope : Downslope 3 - 4 degrees (See Table 1)
Vegetation Class : Woodland
Setback distances : minimum 20m (See Table 1)

Lot Number	Setback Distance (m)	Classified Vegetation	Effective Slope (degrees)	BAL Rating
1	30	Woodland	Downslope 4	BAL-19
2	20	Woodland	Downslope 4	BAL-29
3	24	Woodland	Downslope 4	BAL-29
4	35	Woodland	Downslope 4	BAL-12.5
5	25	Woodland	Downslope 4	BAL-19
6	22	Woodland	Downslope 3	BAL-29

Table 1: Bushfire Attack Level (BAL) Assessment for six example dwellings (See Appendix H for site details)

A dwelling with a >35m setback between vegetation will achieve a BAL rating of BAL-12.5. A dwelling with a setback distance between 25m and 35m will achieve a BAL rating of BAL-19. A dwelling with a setback between 20m and 25m will achieve a BAL rating of BAL-29. All provide acceptable solutions because construction standards will be increased to mitigate the increased exposure (Table 1).

A Bushfire Attack Level of BAL-12.5 means the risk is considered to be low. The construction elements are expected to be exposed to a radiant heat flux not greater than 12.5kW/m^2. There is a risk of ember attack and burning debris ignited by windbourne embers and a likelihood of exposure to radiant heat (Standards Australia 2009). The recommended construction sections are 3 and 5 in AS 3959-2009.

A Bushfire Attack Level of BAL-19 means the risk is considered to be moderate. The construction elements are expected to be exposed to a radiant heat flux not greater than 19kW/m^2. There is a risk of ember attack and burning debris ignited by windbourne embers and a likelihood of exposure to radiant heat (Standards Australia 2009). The recommended construction sections are 3 and 6 in AS 3959-2009.

A Bushfire Attack Level of BAL-29 means the risk is considered to be high. The construction elements are expected to be exposed to a radiant heat flux not greater than 29kW/m^2. There is an increased risk of ember attack and burning debris ignited by windbourne embers and a likelihood of exposure to an increased level of radiant heat (Standards Australia 2009). The recommended construction sections are 3 and 7 in AS 3959-2009.

This example assessment demonstrates that all proposed buildings will fall within the acceptable level of risk (i.e. BAL-29 and lower) and will have construction standards increased to meet AS 3959 requirements. All lots require a BAL assessment at building licence application stage to confirm accurate construction standard requirements.

There are opportunities for each new lot owner to site their dwelling in a variety of locations within the lot, the only restriction is having a 20m minimum setback from the woodland vegetation.

6.4.5 Landscaping Considerations

Landscaping can both assist in the survival of the building and be a determining measure in its destruction. Landscaping can protect buildings by forming a barrier or deflector for windborne debris and radiant heat. It can also bring the fire directly to the building so a degree of care needs to be exercised when selecting and locating landscaping.

All plants will burn under the right conditions and plants do not achieve a “fire resistance level” to meet the Building Code of Australia (BCA). Placing plants too close to a building, under timber decks or next to windows will provide a direct threat to the building. Having a clearance around the building will achieve the desired effect of creating a break between the vegetation and the building. A pathway around the building may be one way to achieve this requirement. The landscaping can then be provided further out from the building.

Bark chips and combustible mulch near a building is not recommended and is a particular problem when the windows have low sill heights. The FESA document titled

"Plant Guide within the Building Protection Zone" provides a useful list of species and spacing requirements to achieve compliance with vegetation within a building protection zone in the Swan Coastal Plain. It can be downloaded at http://www.fesa.wa.gov.au/safetyinformation/fire/bushfire/BushfireProtectionPlanningPublications/FESA%20Plant%20Guide-BP%20Zone-Final-w.pdf. It will provide guidance for appropriate revegetation of the site.

Work from Ramsay and Rudolf (2003) has identified 14 major plant attributes that assist people to determine suitable plant species for gardens surrounding buildings (i.e. in the building protection zone). This is a useful reference book for residents to plan their garden design and select suitable plant species.

6.5 Design of the Development

Performance Criteria

The design of the development is appropriate to the level of bushfire hazard that applies to the site.

Acceptable Solution

All on site development is to comply with the performance criteria or acceptable solutions 1 - 4 in "Planning for Bushfire Protection" Guidelines. The buildings are to comply with AS 3959-2009 Construction of buildings in bushfire-prone areas and the City of Wanneroo has the responsibility to ensure dwellings meet this standard.

The predicted highest BAL level for any dwelling is BAL-29 which will be mitigated by compliance with the Australian Standard AS3959.

6.6 Public Education and Community Awareness

Community bushfire safety is a shared responsibility between individuals, the community, government and fire agencies. FESA has an extensive Community Bushfire Education Program including a range of publications, a website and Bushfire Ready Groups. The 30 page booklet Prepare, Act, Survive provides excellent advice on preparing for and surviving the bushfire season. Other downloadable brochures include 'Fire Danger Ratings and what they mean for you' and 'Bushfire Warnings and what you should do'.

The City of Wanneroo's website and local bushfire brigades provide bushfire safety advice to residents. The website provides links to the downloadable brochure 'Protect Your home and Property from Bushfires' (found at: http://www.wanneroo.wa.gov.au/Residents/Fire_Services). It also provides details on how to become a volunteer for the local Bush Fire Brigade.

Banksia Grove residents are eligible for membership in the Wanneroo Bush Fire Brigade. Professional, qualified consultants also offer bushfire safety advice and relevant services to residents and businesses in high risk areas.

6.7 Community Fire Refuges and Fire Safer Areas

There are no designated Community Fire Refuges in the City of Wanneroo. However, at the time of an emergency, the relevant authorities can select an evacuation centre and FESA, the City and Police will provide this information to residents.

A predetermined centre cannot be nominated because there are no purpose built structures (such as bunkers) designed to withstand the impacts of a bushfire. This means the location of an evacuation centre is not determined until the position of the fire and the characteristics of a specific event are considered by authorities. There would be nothing more dangerous than sending residents to a centre which is in the direct path of a fire.

The safest place to be during a bushfire is away from it. Where to go is an important element when people are relocating during a time of emergency (NSW Rural Fire Service 2004). The preferred option for residents is to designate a destination that is not in a bushfire-prone area and will be safe to travel to before a bushfire attack.

Those who find themselves threatened by a bushfire need options (VBRC 2009). This may be because their plan to leave is no longer possible because they cannot reach a place away from the fire front, or their plan to defend their property fails. Residents may also be caught away from their home when a bushfire threatens.

The concept of a "Neighbourhood Safer Place" and Neighbourhood Safer Precincts" has arisen from recommendations by the Victorian Bushfire Royal Commission into the Black Saturday bushfires.

There are many areas within the City of Wanneroo including urban areas within Banksia Grove that are not bushfire-prone, but they have not been declared. Obviously a non-bushfire-prone area can provide a safe location for people during a bushfire, but there is no official criteria in Western Australia to determine these areas.

As there is no specific criteria to guide this process, FESA's general advice is for residents, when their household bushfire survival plans have failed, is to go to a safer place such as a local open space or building where people may go to seek shelter from a bushfire (FESA 2010).

7. Conclusion

This plan provides acceptable solutions and responses to the performance criteria that fulfil the intent of the bushfire hazard management issues outlined in Planning for Bushfire Protection Guidelines - Edition 2 (WAPC et al. 2010). However, community bushfire safety is a shared responsibility between governments, fire agencies, communities and individuals.

The planning and building controls outlined in this plan will reduce the risk of bushfire to people and property, it will not remove all risk. How people interpret the risk, prepare and maintain their properties and buildings and what decisions and actions they take (i.e. evacuate early or stay and defend or other) greatly influence their personal safety. Residents need to be self reliant, and not expect warnings or assistance from emergency services.

7.1 Compliance Checklist for Performance Criteria and Acceptable Solutions

Element	Question	Answer
1: Location	Does the proposal comply with the performance criteria by applying acceptable solution A1.1?	Yes
2: Vehicular access	Does the proposal comply with the performance criteria by applying acceptable solution A2.1?	Yes

Element	Question	Answer
2: Vehicular access	Does the proposal comply with the performance criteria by applying acceptable solution A2.2?	Yes
	Does the proposal comply with the performance criteria by applying acceptable solution A2.3?	Yes
	Does the proposal comply with the performance criteria by applying acceptable solution A2.4?	N/A
	Does the proposal comply with the performance criteria by applying acceptable solution A2.5?	Yes
	Does the proposal comply with the performance criteria by applying acceptable solution A2.6?	Yes
	Does the proposal comply with the performance criteria by applying acceptable solution A2.7?	N/A
	Does the proposal comply with the performance criteria by applying acceptable solution A2.8?	Yes
	Does the proposal comply with the performance criteria by applying acceptable solution A2.9?	N/A
	Does the proposal comply with the performance criteria by applying acceptable solution A2.10?	Yes
3: Water	Does the proposal comply with the performance criteria by applying acceptable solution A3.1?	Yes
	Does the proposal comply with the performance criteria by applying acceptable solution A3.2?	N/A
	Does the proposal comply with the performance criteria by applying acceptable solution A3.3?	N/A

Element	Question	Answer
4: Siting of the Development	Does the proposal comply with the performance criteria by applying acceptable solution A4.1?	Yes - Construction standards are increased to align with site bushfire attack level.
	Does the proposal comply with the performance criteria by applying acceptable solution A4.2?	N/A
	Does the proposal comply with the performance criteria by applying acceptable solution A4.3?	Yes
	Does the proposal comply with the performance criteria by applying acceptable solution A4.4?	No - However the proposal does satisfactorily comply with performance criterion P4 because building construction standards are to be increased to comply with AS 3959-2009 to offset the removed Hazard Separation Zone. Construction standards will achieve a maximum of BAL-29.
	Does the proposal comply with the performance criteria by applying acceptable solution A4.5?	N/A - Shielding not applicable.
5: Design of the Development	Does the proposal comply with the performance criteria by applying acceptable solution A5.1?	No - However the proposal does comply with the performance criterion P5 because building construction standards will be increased to comply with AS 3959-2009 to offset the requirement for a HSZ. BAL-29 is not exceeded.
	Does the proposal comply with the performance criteria by applying acceptable solution A5.2?	Yes - The proposal complies as the development will meet the performance criteria because of compliance with AS 3959 and BAL-29 is not exceeded.

8. Implementing the Fire Management Plan

8.1 Developer's Responsibilities

To maintain a reduced level of risk from bushfire, the developer's responsibilities are to:

- Install the public road and emergency access way to standards outlined in Element 6.2 Vehicular Access
- Install water supply and hydrant to comply with standards outlined in Element 6.3 Water
- Lodge a Section 70A Notification on each Certificate of Title exposed to AS 3959 construction standards, proposed by this subdivision. The notification shall alert purchasers and successors in title, to these exposed lots, of the responsibilities of the Fire Management Plan and bush fire building construction requirements
- Comply with the City of Wanneroo's Fire Control Notice as published, on all vacant land, and
- Supply a copy of this Fire Management Plan and The Homeowners Bush Fire Survival Manual, Prepare, Act, Survive (or similar suitable documentation) and the City of Wanneroo's Fire Break Notice to each lot owner subject to AS 3959 construction standards.

8.2 Property Owners' Responsibilities

The owners/occupiers of the site, as created by this proposal, are to maintain a reduced level of risk from bushfire, 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. The owners' will be responsible for:

- Complying with the City of Wanneroo's annual Firebreak Notice
- Ensuring that vacant lots comply with the City of Wanneroo's Fire Control Notice
- Ensuring construction of dwellings complies with AS 3959, and
- Establishing and maintaining the BPZ at the property owner's/occupier's own cost.

As part of the building license application, the property owner or the City of Wanneroo (at the property owner's expense) shall have the proposed dwelling re-assessed for Bushfire Attack Level (at the time of construction) with results to be submitted as part of the building licence application.

8.3 City of Wanneroo's Responsibilities

The responsibility for compliance with the law rests with individual property owners and occupiers and the following conditions are not intended to unnecessarily transfer some of the responsibilities to the City of Wanneroo.

The City of Wanneroo shall be responsible for:

- Providing fire prevention and preparedness advice to landowners upon request
- Monitoring bush fuel loads in all areas of public open space, road reserve sites and liaising with relevant stakeholders to maintain fuel loads at safe levels
- Maintaining public roads to appropriate standards and ensuring compliance with the City of Wanneroo's Fire Control Notice
- Ensuring dwellings are constructed to AS 3959 where applicable, and
- Endorsing a section 70A notification on each title affected by this Fire Management Plan.

8.4 FESA's Responsibilities

FESA is required to maintain district fire fighting capabilities for structural and bush fires.

Applicant Declaration

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

Full name: Rohan Carboon

Applicant signature: 

Date: 28/11/2012

9. References

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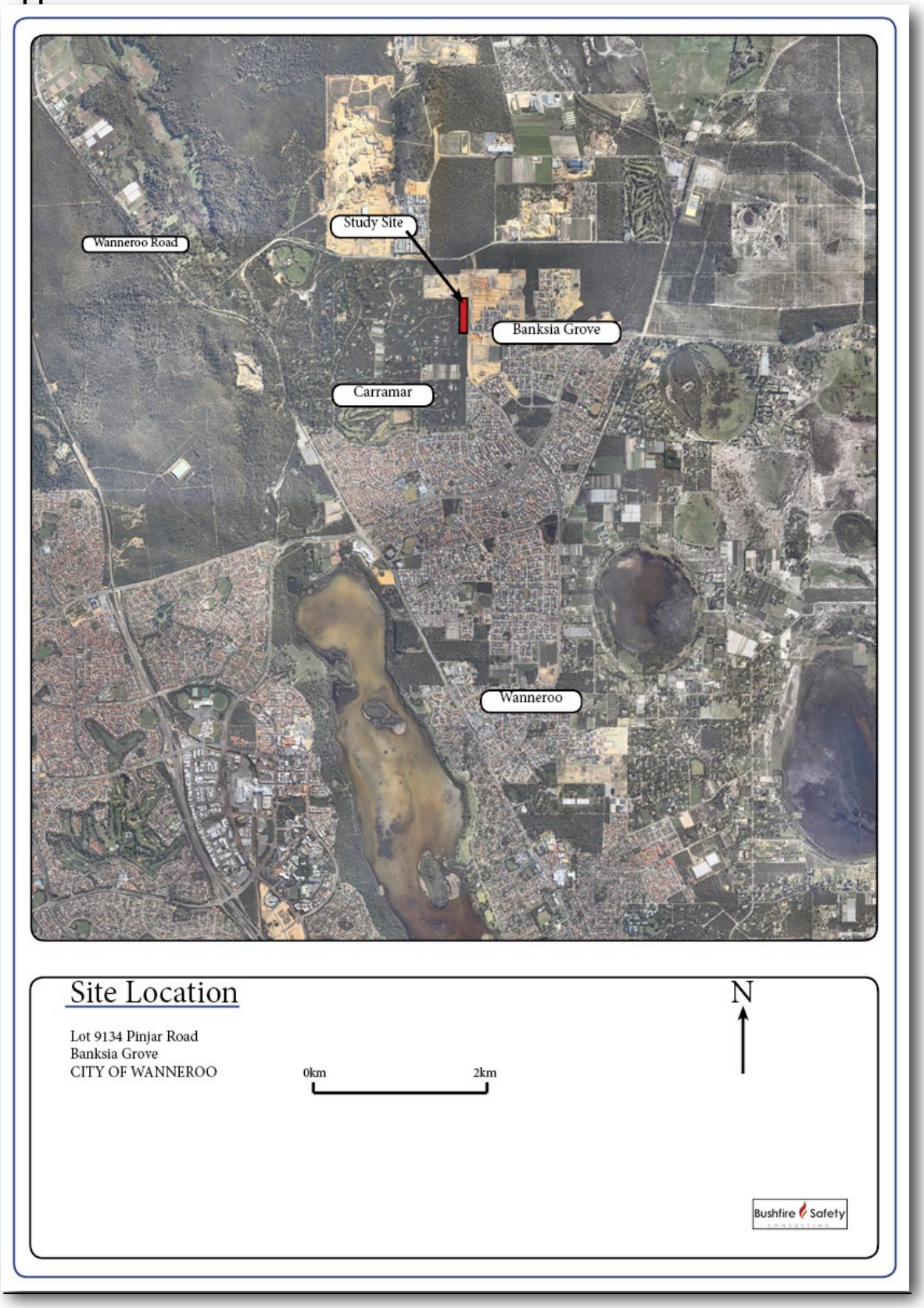
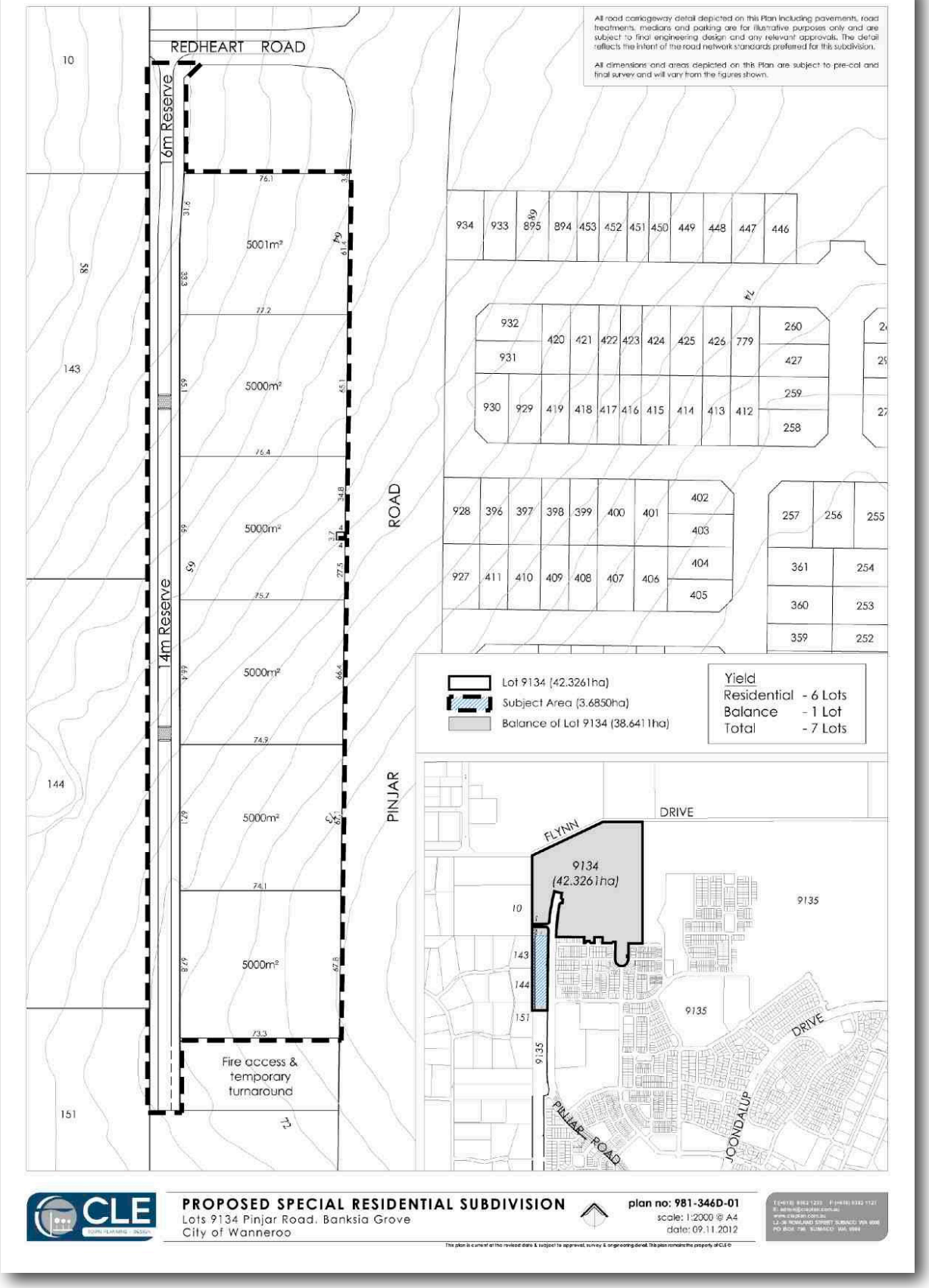
10. Appendices

Appendix A: Site Location

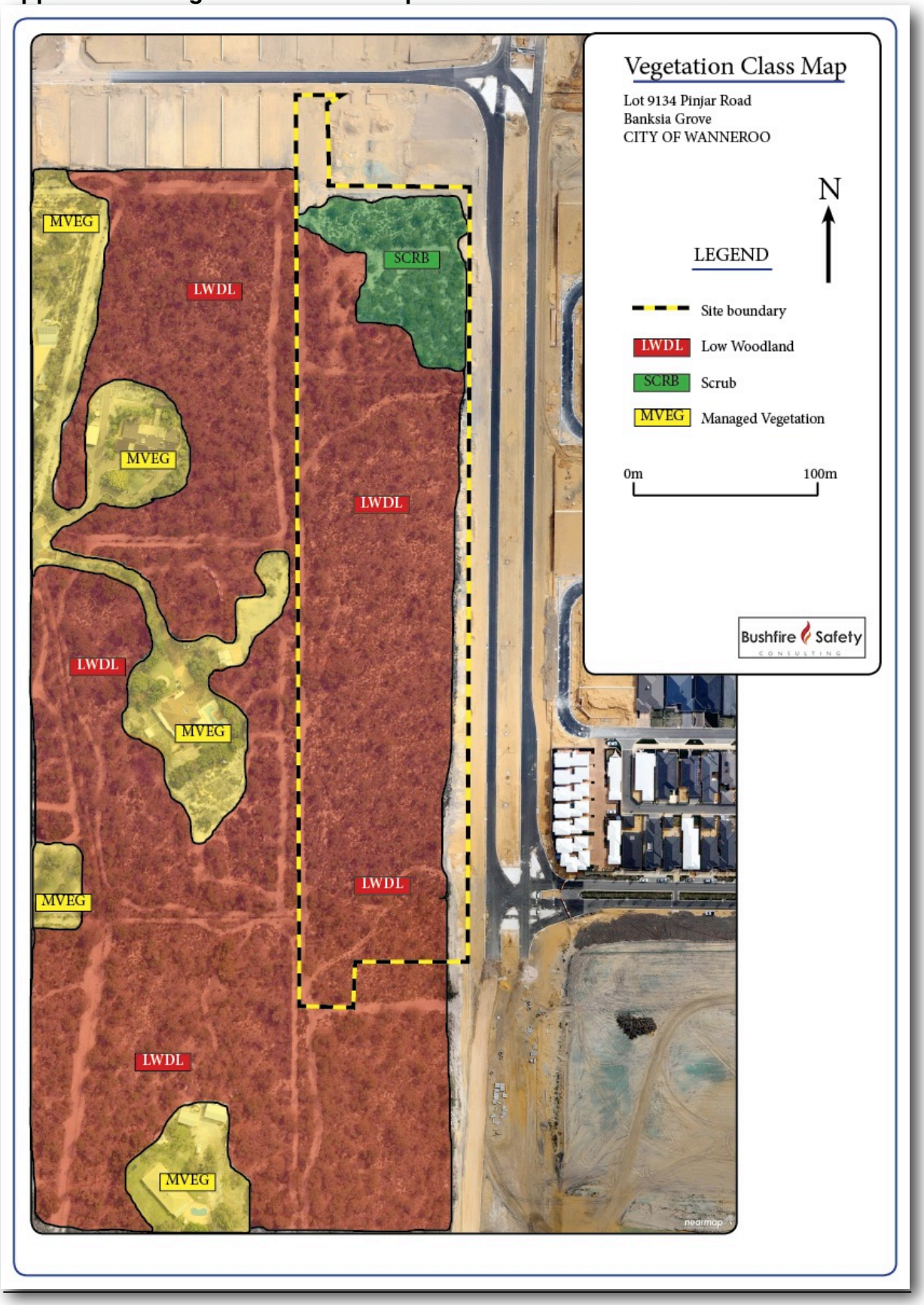


Appendix B: Banksia Grove Structure Plan

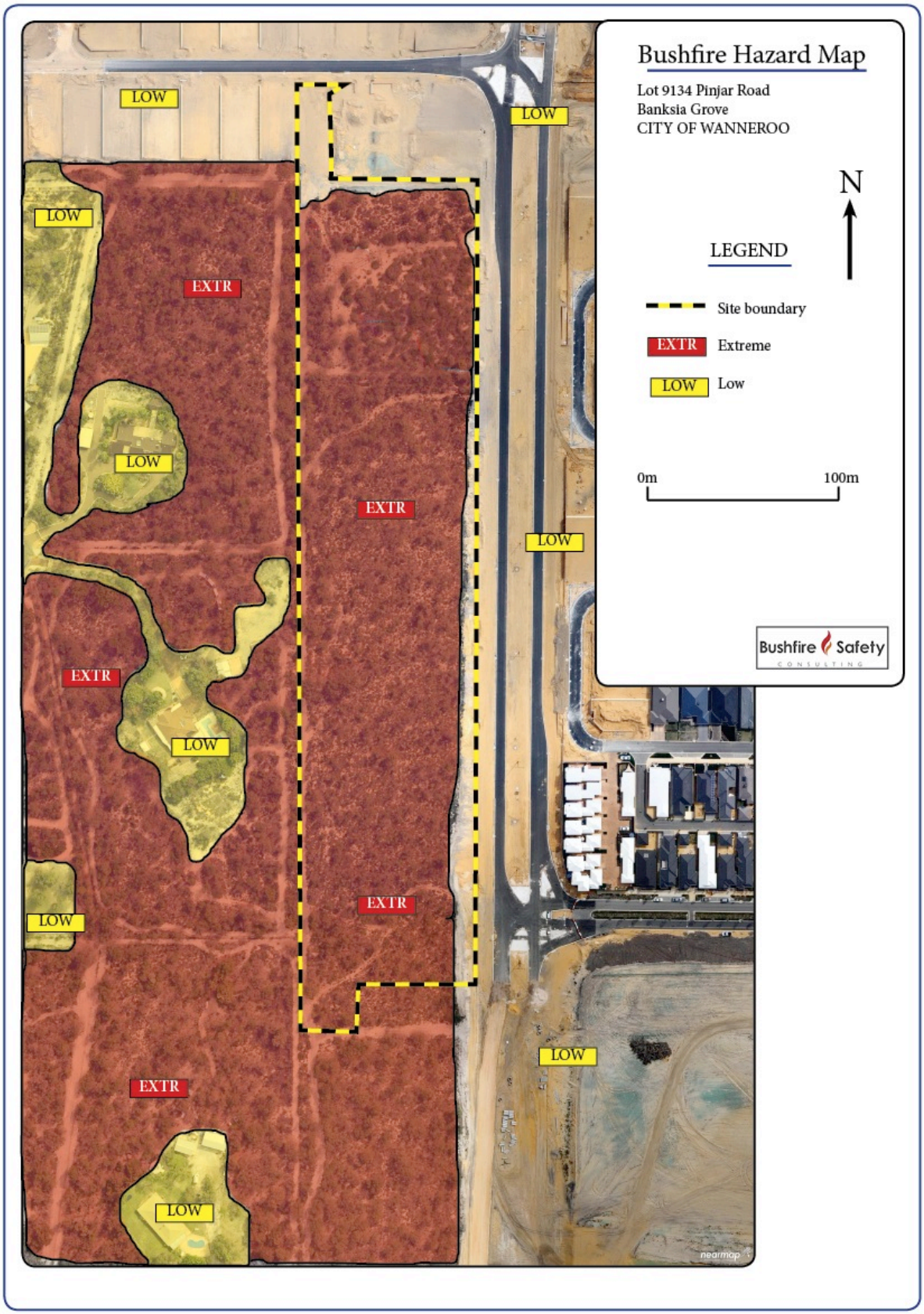
Appendix C: Proposed Special Residential Subdivision Plan



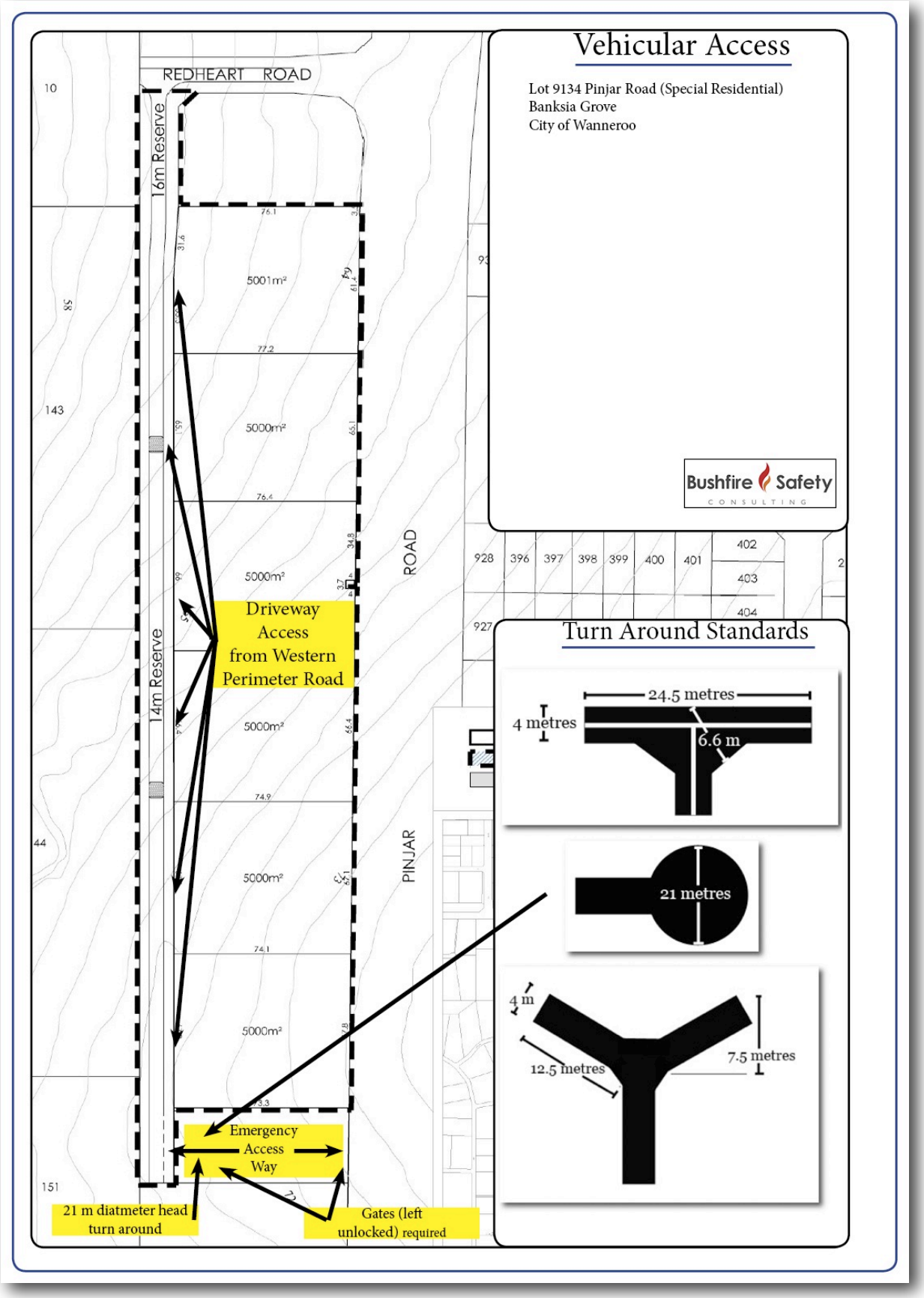
Appendix D: Vegetation Class Map



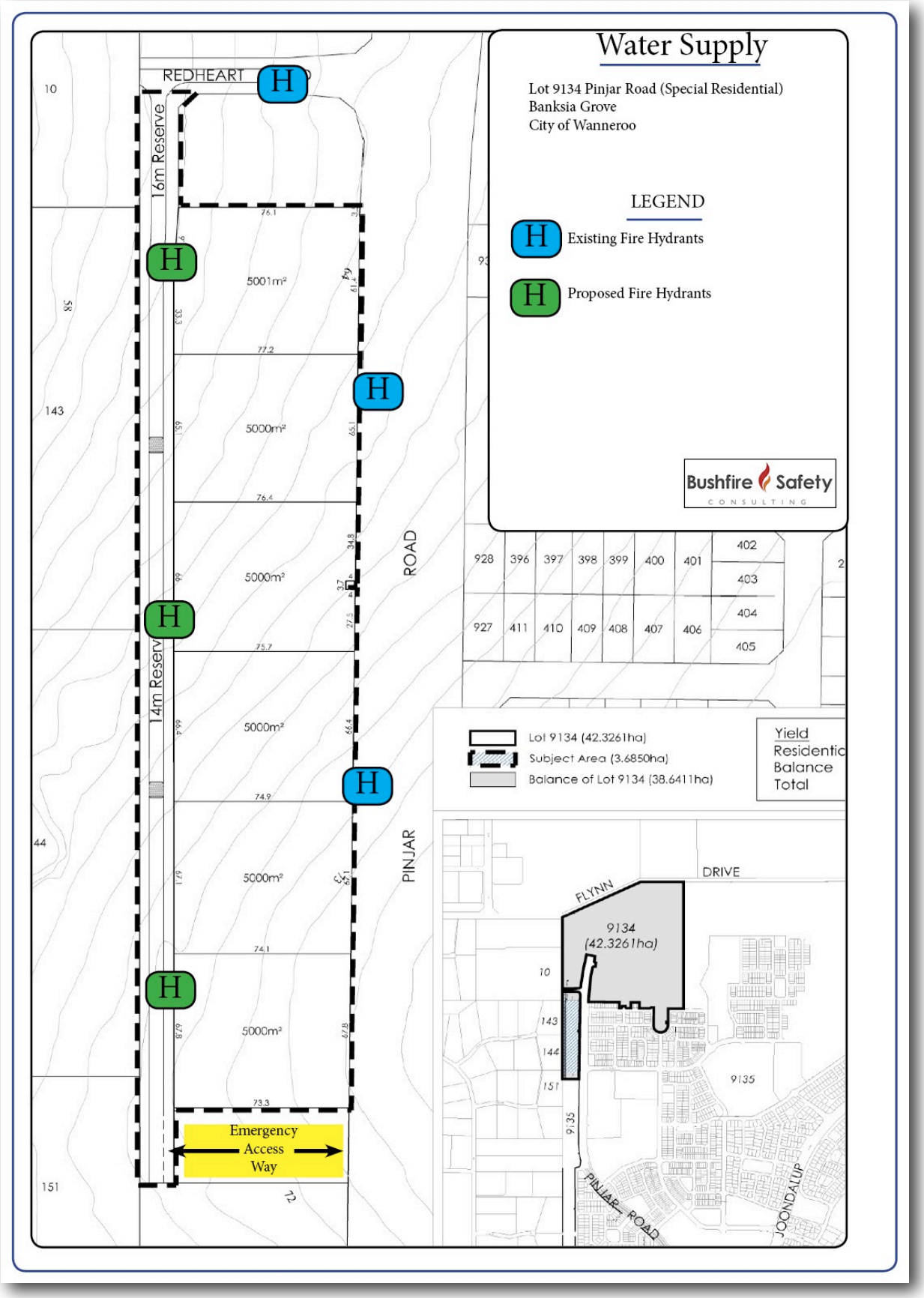
Appendix E: Bushfire Hazard Rating Map



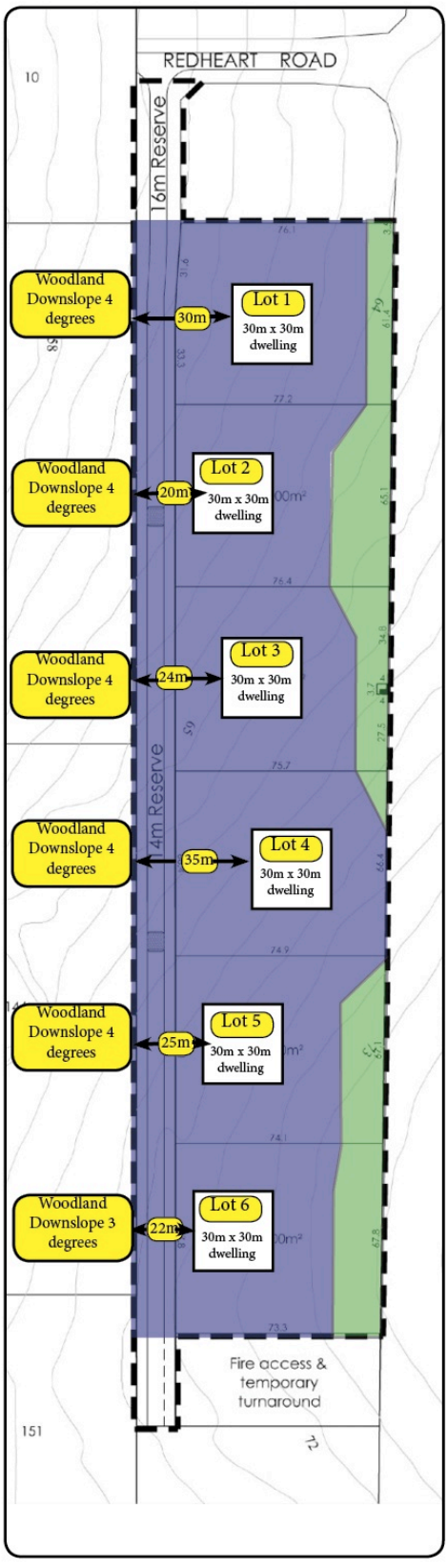
Appendix F: Vehicular Access



Appendix G: Water Supply



Appendix H: Building Protection Zone and Example BAL Ratings



Building Siting Examples

Lot 9134 Pinjar Road
Banksia Grove
CITY OF WANNEROO

LEGEND

Building Protection Zone (BPZ)
(20m minimum east and west of dwellings)

Native vegetation zone permitted outside of 20 m BPZ on east side of dwellings

All dwellings are located with a minimum 20 m BPZ (setback) from the adjacent woodland vegetation.

Lot Number	Setback Distance (m)	Classified Vegetation	Effective Slope (degrees)	BAL Rating
1	30	Woodland	Downslope 4	BAL-19
2	20	Woodland	Downslope 4	BAL-29
3	24	Woodland	Downslope 4	BAL-29
4	35	Woodland	Downslope 4	BAL-12.5
5	25	Woodland	Downslope 4	BAL-19
6	22	Woodland	Downslope 3	BAL-29

Table : BAL Ratings for example dwelling sites.