Bushfire Safety
CONSULTING

Fire Management Plan

Wildwood Development (Stages 2-4)

Subdivision Proposal

Lot 10 Flynn Drive
Banksia Grove
City of Wanneroo

WAPC Ref No. 146181 November 2012

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Wildwood Development (Stages 2-4)
Lot 10 Flynn Drive
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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 Wildwood Development (stages 2,3 and 4) of Lot 10 Flynn Drive, 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. A maximum Bushfire Attack Level BAL-29 is achieved for dwellings adjacent to woodland with an effective downslope 0-5 degrees. All dwellings will be sited a minimum of 20 metres from classified vegetation (extreme bushfire hazard).

This Plan includes a table on page 23 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 low and moderate, but as the development occurs, the unmanaged grass fuels will be removed and all hazard levels will become low. Residual hazard will remain in adjoining properties to the south and west and the Bush Forever Reserve to the north. Areas east of the development are currently being developed into a residential estate.

Access and egress from all proposed 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 public roads to required spacings and standards.

Both the City of Wanneroo and the Department of Fire and Emergency Services (DFES) 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 Lot 10 Flynn Drive, Banksia Grove in the City of Wanneroo. It includes stages 2, 3 and 4 of the Wildwood Development, stage 1 has been approved and is currently under construction. The site includes a 7 ha Bush Forever Reserve. It is located in Banksia Grove which is located 30 kilometres north of Perth and 5 kilometres north of the Wanneroo Townsite (Appendix A). The 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 "Residential" under the City of Wanneroo's District Planning Scheme No. 2.

As part of the subdivision approval (WAPC 146181), condition 18 states:

"A Fire Management Plan being prepared and implemented to the specifications of the local government in consultation with the Fire and Emergency Services Authority and to the satisfaction of the WAPC (Local Government)".

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 Subdivision Plan (Appendix C) outlines the development which will include the creation of 86 residential lots ranging in size between 500m2 and 1300m2.

The development adjoins a current residential development area to the immediate east, rural residential land to the south and west and includes a 7 ha Bush Forever Reserve adjacent to Flynn Drive. The total developable area is 13.0917ha.

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 DFES. 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 DFES, 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 east and rural residential bush blocks in Carramar to the south and west. Flynn Road forms the northern perimeter.

4.1 Description of the Subject Land

The subject land proposed for residential development is 13.0917ha in size. This adjoins the 7.1432ha Bush Forever Reserve.

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

In summary this land:

- Is cleared on areas proposed for development with stage 1 currently under construction
- Is adjacent to woodland vegetation to the north, west and south.
- Slopes in the range of 1-3 degrees under the woodland vegetation; and
- Is adjacent to a large residential area currently under construction east of the site.

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.

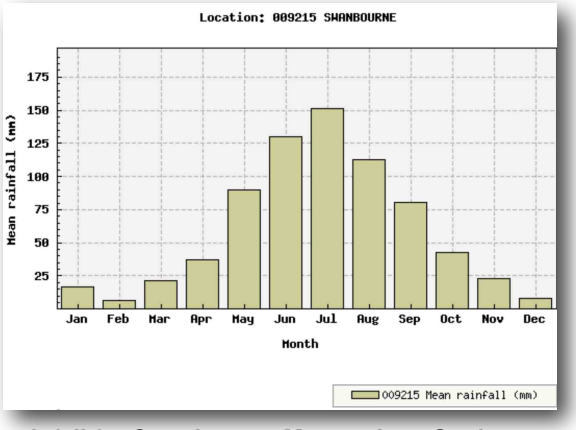

Figure 1: Mean maximum recorded temperatures and mean rainfall for Swanbourne Meteorology Station between 1993 and 2010

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.

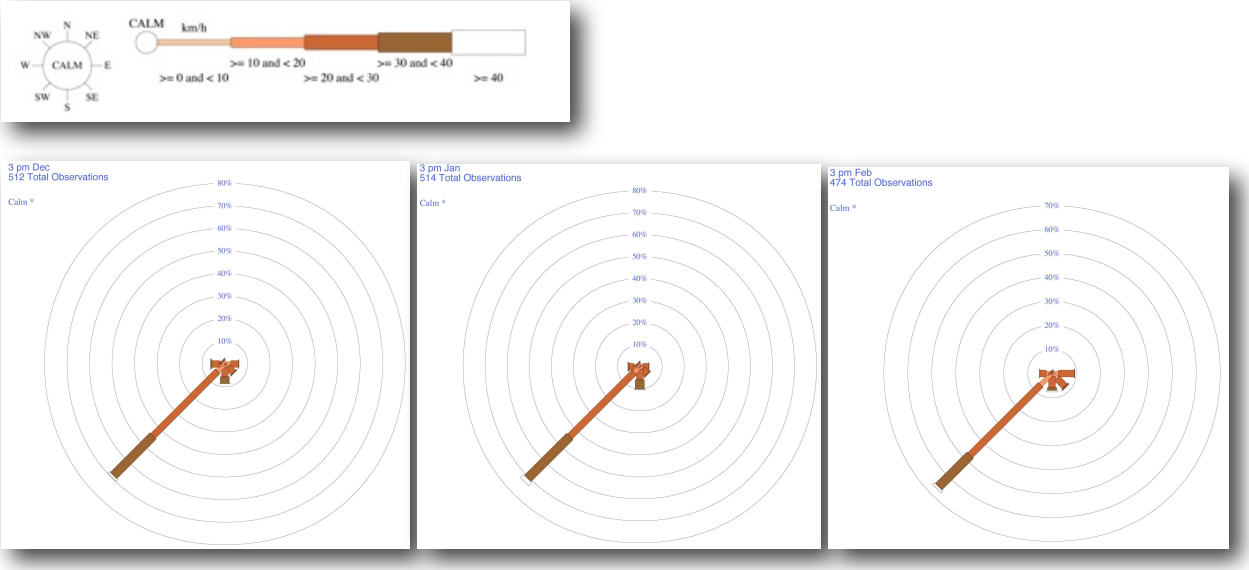

Figure 2: Rose of wind direction and wind speed in km/hr for 3pm in December, January and February between 1993 and 2010 at the Swanbourne Bureau of Meteorology Station

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 has some unmanaged grass fuels which will be removed as the site is developed. The woodland fuels surrounding the site include tree canopy fuels in the range 10-16 metres high, bark and leaf litter fuels which accumulate under the canopy. The middlestorey (or intermediate vegetation) includes regrowth trees and banksia species. The elevated fuel layer includes many heath species from 0.5 up to 1m in height. Near surface and surface fuels dominate in the woodland areas and include leaf litter from Eucalypts and Banksia trees and needles from Sheoak trees. Grasses and low heath species also contribute to this fuel layer.

4.4 Assets

When the site is fully developed it will contain 86 new lots. Of the 86 lots, 29 are located on the perimeter of the development adjacent to woodland vegetation. These dwellings will be the most exposed to predicted radiant heat from a bushfire. All dwellings located within 100 metres require increased construction standards to mitigate the predicted exposure from radiant heat, flame contact and ember attack. Residential assets sited near woodland in adjoining areas are similarly exposed.

4.5 Access

The subdivision will be serviced by loop roads, that provide a range of access and egress options for residents and emergency services. The existing firebreak on the southern and western perimeter of the site will be maintained to comply with City of Wanneroo Standards.

4.6 Water Supply

Reticulated water and hydrants is provided to the entire development to Water Corporation, DFES and City of Wanneroo Standards.

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). Evidence of a fire (or fuel reduction burn) was observed on the property west of the site during the site inspection.

Bushfires are common in the City of Wanneroo, in the 2009-2010 financial year, the volunteer fire brigades attended to 132 fires. 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.

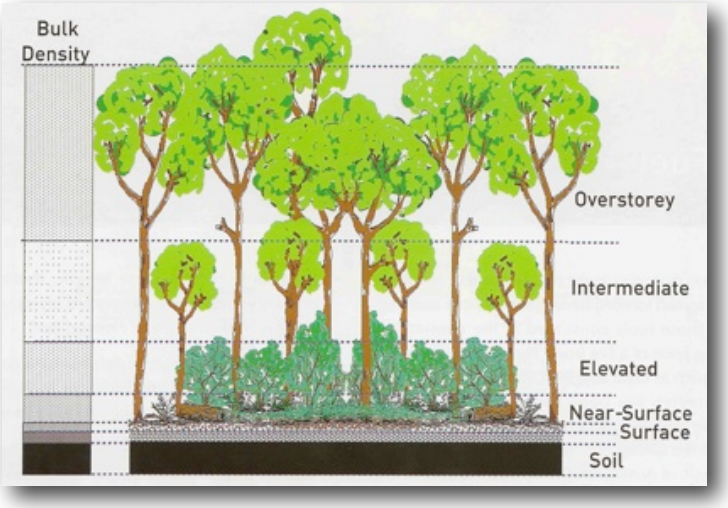

Figure 3 : The five obvious fuel layers in a forest environment that could be associated with fire behaviour (Gould et al. 2007)

5.1 Vegetation Type and Class

The site assessment undertaken for this study identified the dominant vegetation type surrounding the development site is woodland. The overstorey canopy heights and composition of dominant species varies, however the elevated layer mostly consists of intact heath vegetation. The vegetation classes are mapped in Appendix D.

The development site includes a 7 ha Bush Forever Reserve in the northern portion adjoining Flynn Drive. The dominant vegetation in this reserve is woodland. Where Euclayptus species such as Jarrah (*Eucalyptus marginata*) are the dominant overstorey species (Figure 4), canopy heights average 12-16 metres. Where Banksia species are more dominant including in the western half of the Bush Forever Reserve

and to the west and south of the site, the canopy heights are lower and vary between 6 and 12 metres (Figure 5).

Where canopy cover is less than 10% of the total foliage cover the vegetation is assessed according to the dominant understorey. In two isolated area this includes shrubland (Figure 6). Scrub species are also present north of the development site. Unmanaged grass fuels occur on the western portion of the residential site (Figure 7) There is no vegetation east of the site as this area has been cleared and is currently being developed. Managed vegetation includes those areas surrounding existing dwellings on the rural residential lots south and west of the site. Residents have established gardens and irrigated lawns surrounding their homes.

Figures 4 & 5: Eucalypt woodland vegetation adjoining the northern perimeter of the residential area (left) and mixed Banksia and Eucalypt woodland vegetation with intact heath elevated fuel layer (right)

Figures 6 & 7: The intact heath understorey occurs throughout the woodland areas and shrubland is designated where overstorey foliage cover does not achieve 10% (left) and introduced grasses dominate on the development site (right)

5.2 Slope

The site has gentle slopes in the range of 1- 3 degrees. Contour lines with 1 metre intervals are highlighted on the subdivision plan in Appendix C which show the site sloping downwards to the drainage area on the southern central boundary. Effective slopes measured under the woodland vegetation surrounding the proposed residential area are also in the range of 1-3 degrees.

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 ratings of low, moderate and extreme. Low hazard occurs in areas of mineral earth, moderate hazard occurs in the areas of unmanaged grass fuels and extreme hazard occurs in the Bush Forever Reserve which is vegetated with woodland. North of Flynn Drive and south and west of the site, the woodland vegetation is also rated as extreme bushfire hazard.

The grass fuels on the site will be removed as earthworks and development continues, however the extreme hazard in the Bush Forever Reserve is permanent. The extreme hazard in surrounding rural residential properties will remain unless more intensive development occurs on these areas in the future. 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 low, moderate and extreme on the development site due to different vegetation types. The maximum Bushfire Attack Level (BAL) is predicted to be BAL-29 and this will only occur where dwellings are sited 20 metres from woodland with an effective downslope in the range of 0-5 degrees. If sited adjacent to woodland on with an effective upslope or flat land, the BAL rating is BAL-19. More than half of the dwellings within 100 metres of classified vegetation will result in a BAL-12.5 rating (or predominantly ember attack).

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 a developing residential area with a substantial network of public roads in a low bushfire hazard environment. Pinjar Road (a major north south access road) is located 100 metres east of the proposed residential area. There are four public roads linking the new development with the adjoining development area providing several access routes.

The immediate road network on and surrounding the site is outlined in Appendix F and the Banksia Grove Structure Plan (Appendix B) outlines the broader district road network.

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

Acceptable Solution A2.1: Two Access Routes

Loop roads provide each resident with two access routes and four public roads link the subdivision to the adjoining residential area (also currently under development).

Acceptable Solution A2.2: Public Roads

All proposed public roads will comply with the following standards:

- 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 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 A2.9 : Firebreaks

The existing firebreak on the southern and western perimeter of the site will be maintained to City of Wanneroo Standards to allow Light Unit 4WD access to the rear of the lots.

Acceptable Solutions A2.10 : Signs

Signs will be erected where the firebreak adjoins Wallangara and Moort Rise. 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 'Fire Service Access - No Public Access'

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 DFES. Residential dwellings (Class 1a) require fire hydrants to be sited within (or every) 200 m in land zoned residential.

Fire services require ready access to an adequate water supply during fire emergencies.

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 20 m minimum BPZ will be established on the perimeter of the site between bushfire hazard and residential dwellings. This includes the southern, western and northern perimeter of the residential site. On the northern perimeter, the BPZ will include the entire 16 m road reserve and 4 metres on all lot frontages / edges.

On all lots sited on the western and the one lot on the southern perimeter, the 20 m BPZ will be included on each lot and includes the 10m wide vegetation buffer. The vegetation buffer will require the removal of most near surface, surface and elevated fuels (i.e. leaf and bark litter and shrubs).

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

- Width: 20 m minimum between dwellings and bushfire hazard as outlined in Appendix G
- Location : Within the boundaries of the lot on which the building is situated
- 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 four representative locations adjacent to bushfire hazard (Appendix G). 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 : Upslope, Flat and Downslope 2 degrees(See Table 1)
Vegetation Class : Woodland
Setback distances : 20m (See Table 1)

Example BAL Assessment Number	Setback Distance (m)	Classified Vegetation	Effective Slope (degrees)	BAL Rating
1	20	Woodland	Flat	BAL-19
2	20	Woodland	Upslope	BAL-19
3	20	Woodland	Upslope	BAL-19
4	20	Woodland	Downslope 2	BAL-29

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

A dwelling with 20m setback and adjacent to woodland vegetation with an effective upslope 0-5 degrees or flat ground results in a BAL-19 rating (Table 1). If the effective slope under the woodland is downslope 0-5 degrees the BAL rating results in BAL-29.

An exposure of BAL-19 means there is a risk of ember attack and burning debris ignited by wind borne embers and a likelihood of exposure to radiant heat. The risk is considered to be moderate (Standards Australia 2009). The construction elements are expected to be exposed to a heat flux not greater than 19kWm2. The recommended construction sections are 3 and 6 in AS 3959-2009.

An exposure of BAL-29 means there is an increased risk of ember attack and burning debris ignited by wind borne embers and a likelihood of exposure to an increasing level of radiant heat. The risk is considered to be high (Standards Australia 2009). The construction elements are expected to be exposed to a heat flux not greater than 29kWm2. 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 highlighted in Appendix G require a BAL assessment at building licence application stage.

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 DFES 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 design of gardens and 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. DFES 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.

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 DFES, 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, DFES’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?	N/A
	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?	N/A
	Does the proposal comply with the performance criteria by applying acceptable solution A2.6?	N/A
	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?	Yes
	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 public roads to standards outlined in Element 6.2 Vehicular Access
- Install water supply and hydrant to comply with standards outlined in Element 6.3 Water
- Upgrade the firebreak on the southern and western perimeter to City of Wanneroo Firebreak Standards
- Establish the Building Protection Zone on the perimeter of the development site as outlined in Element 6.4 Building Siting and Appendix G by removing surface, near surface and elevated fuels
- 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 and lots on the southern and western perimeter maintain the firebreak to standards
- Ensuring that vacant lots comply with the City of Wanneroo's Fire Control Notice
- Ensuring construction of dwellings complies with AS 3959, 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 dwellings on lots highlighted in Appendix G 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 DFES Responsibilities

DFES 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: 13/11/2012

9. References

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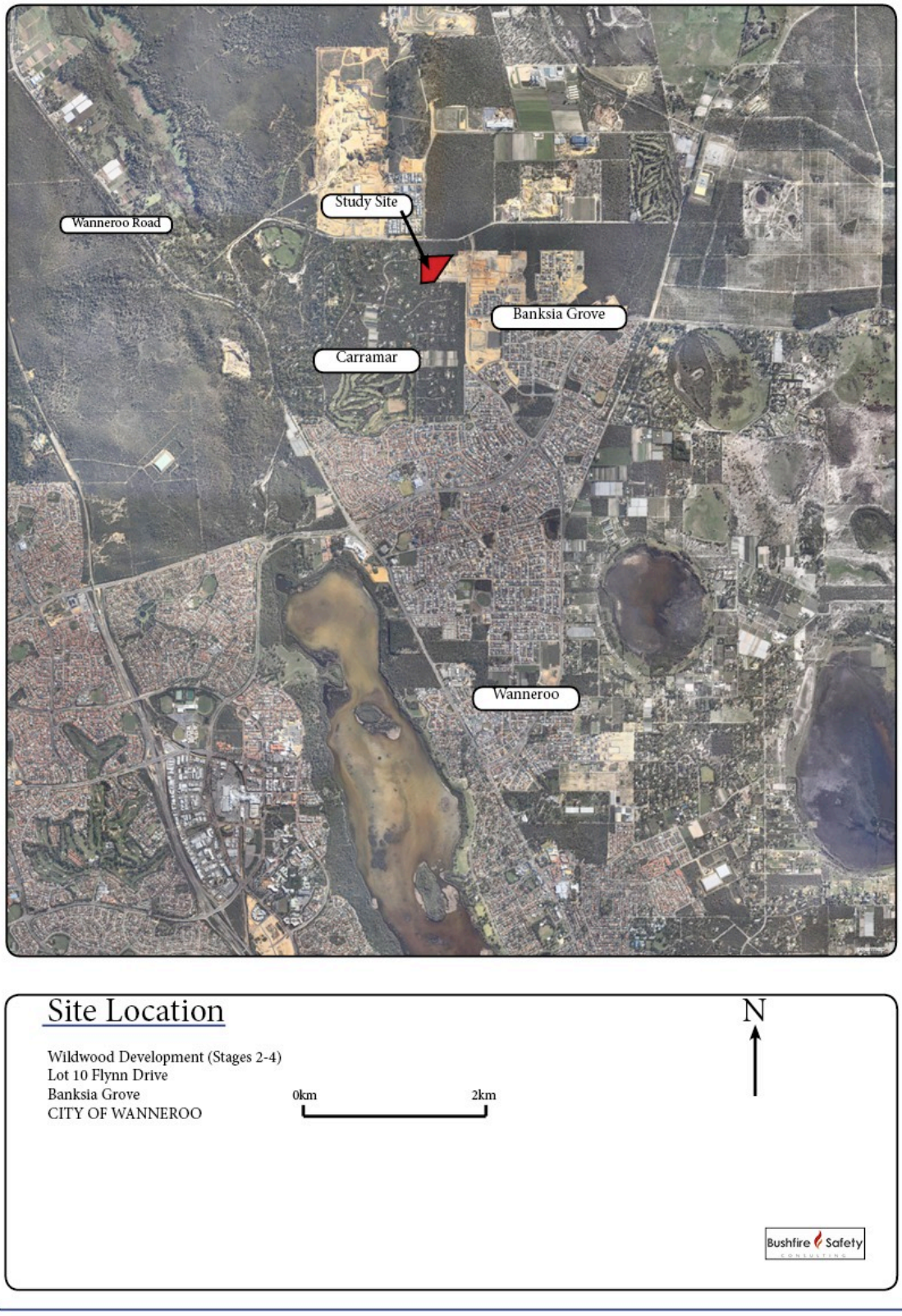
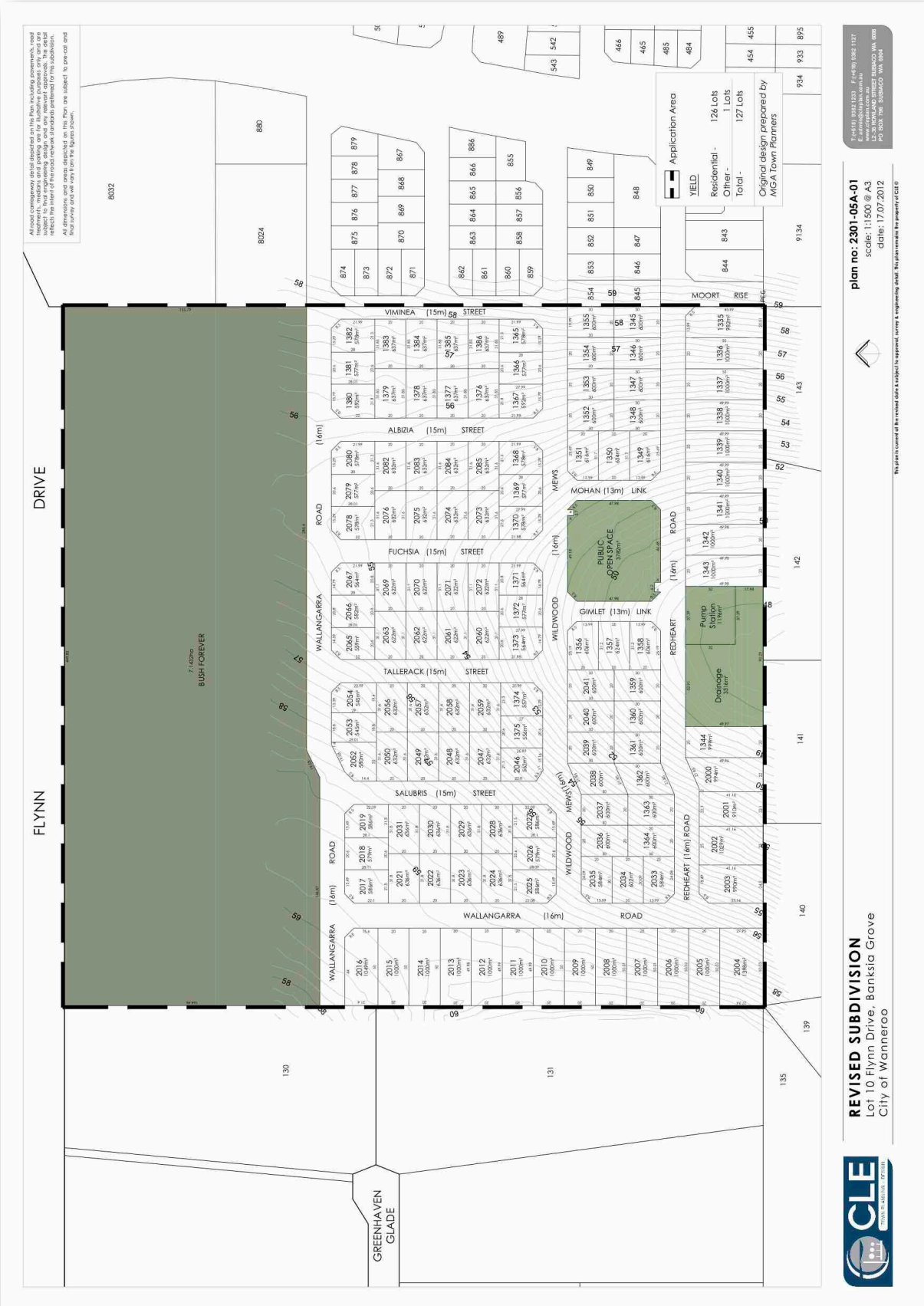
10. Appendices

Appendix A: Site Location

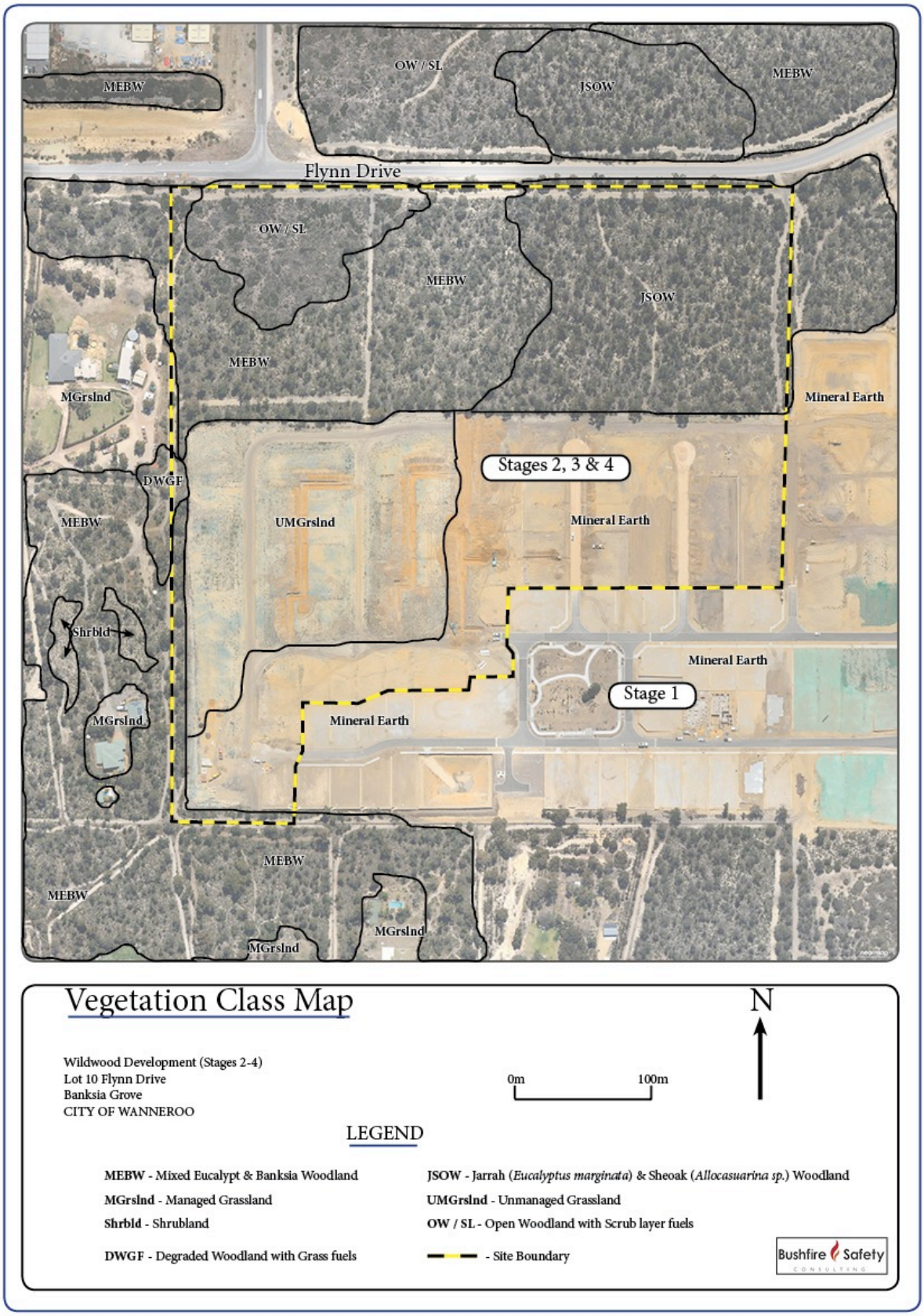


Appendix B: Banksia Grove Structure Plan

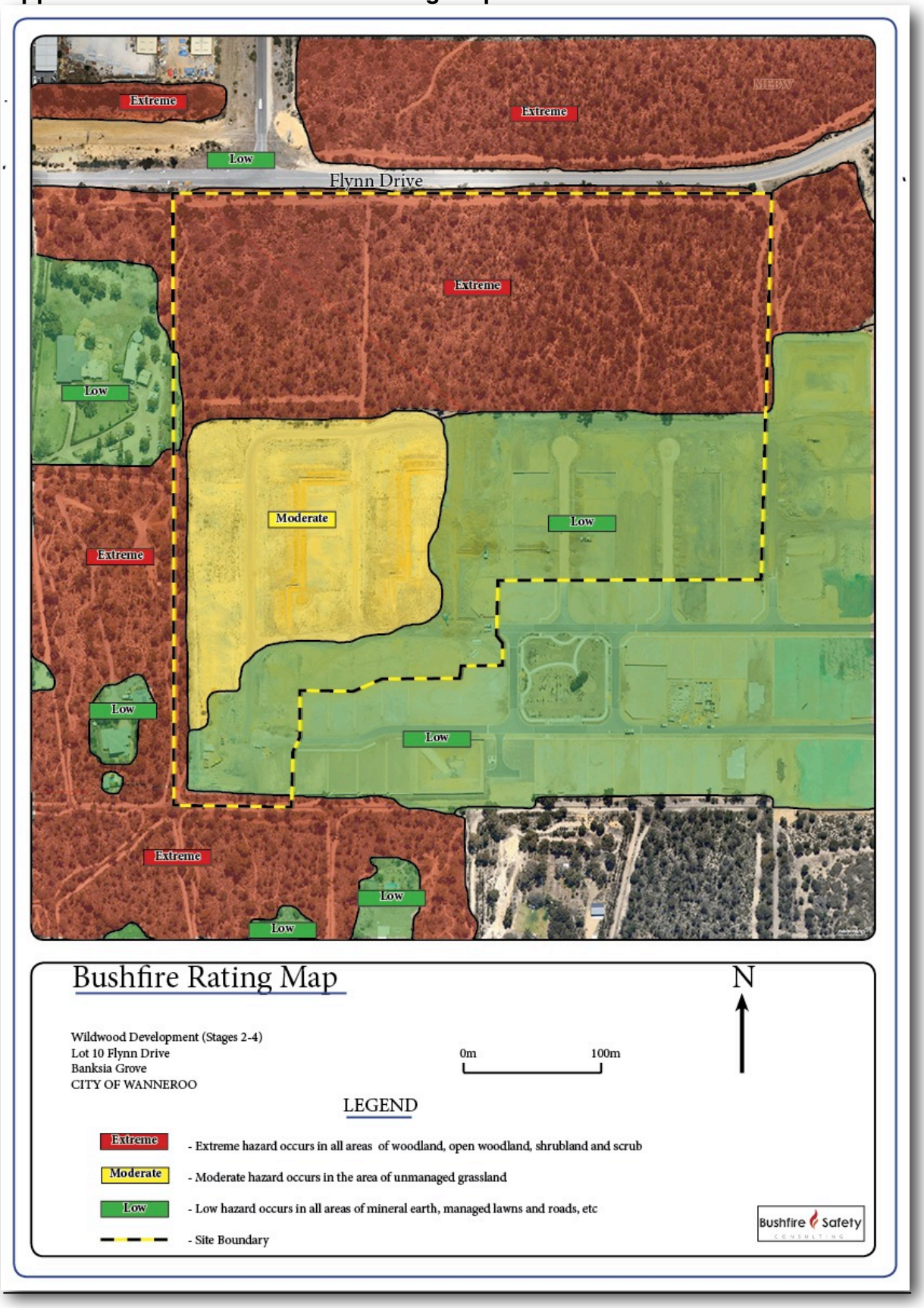
Appendix C: Subdivision Plan



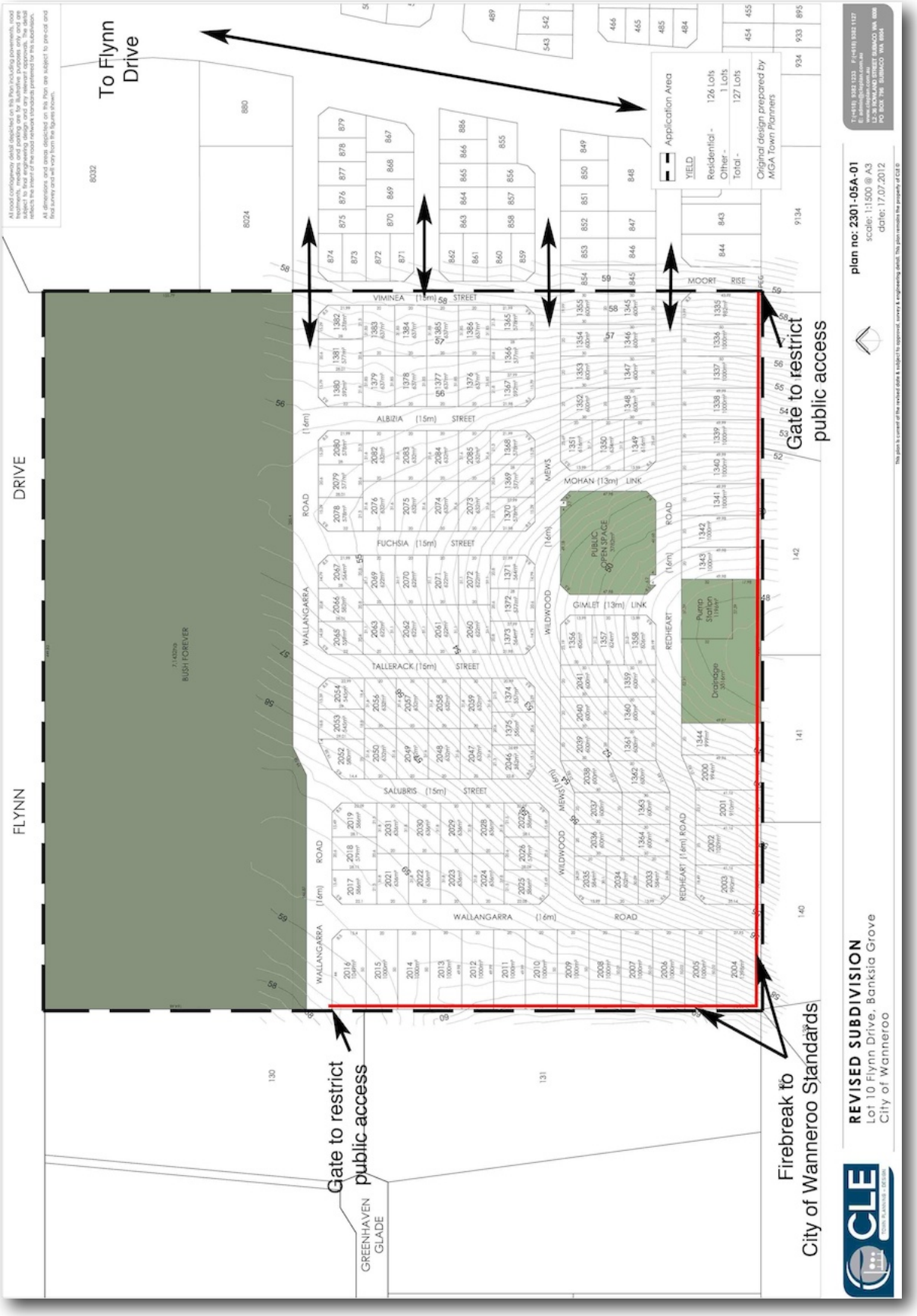
Appendix D: Vegetation Class Map



Appendix E: Bushfire Hazard Rating Map



Appendix F: Vehicular Access



Appendix G: Building Protection Zone and Example BAL Ratings