

30th July 2013

The Chief Executive Officer
City of Wanneroo
Locked Bag 1
WANNEROO WA 6946

Attention: Tim Dawson

Dear Sir,

RE: BANKSIA GROVE NORTH PRECINCT – FIRE MANAGEMENT PLAN - WAPC REFERENCE NO: 144123

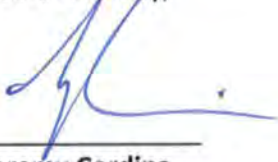
Condition No. 18 of the above Western Australian Planning Commission (WAPC) subdivision approval reads as follows:

"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)"

As such please find enclosed Fire Management Plan (FMP) for the Northern Precinct within Banksia Grove. To address requirements outlined in this document a 70A notification will be placed on all lots affected by the FMP (as outlined on appendix I). All prospective purchasers affected by the FMP (as outlined on appendix I) will be advised by condition of contract:

"The attached Banksia Grove Annexure G forms part of the Banksia Grove Sale of Land Contract to purchase lot Notification Under Section 70A"

Yours faithfully,



Jeremy Cordina
Project Manager
BANKSIA GROVE MANAGEMENT

Enclosed: North Precinct Fire Management Plan

City of Wanneroo IM 31/7/2013

Fire Management Plan

City of Wanneroo IM 31/7/2013

Banksia Grove - Northern Precinct

Subdivision Proposal (WAPC 144123)

Lot 9139 Flynn Drive

Banksia Grove

City of Wanneroo

July 23, 2013

Subdivision Proposal (WAPC No. 144123)
Northern Precinct
Lot 9139 Flynn Drive
Banksia Grove
CITY OF WANNEROO

Front Cover Photo: Aerial photograph of development site (source: Landgate)

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Executive Summary

This Fire Management Plan has been prepared following the assessment of the Northern Precinct of Lot 9139 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 11 dwellings, 8 dwellings are exposed to BAL-19 and 38 dwellings are exposed to BAL-12.5. All of the remaining lots (471 out of 528), are greater than 100 metres from classified vegetation and do not require any additional bushfire construction standards. All exposed dwellings will be sited a minimum of 20 metres from classified vegetation and 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).

Approximately 60% of the site is currently rated as extreme bushfire hazard, but as vegetation is removed, the hazard level will change to low. Vegetation and bushfire hazard east of the site will also be removed for the adjacent proposed North East Precinct development. Residual bushfire hazard will remain in the Bushforever site to the immediate north and one isolated area of hazard south of Flynn Drive.

Areas west 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 a portion of Lot 9139 Flynn Drive, known as the Northern Precinct in Banksia Grove, City of Wanneroo. Banksia Grove is located 30 kilometres north of Perth and 5 kilometres north-east 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 144123), condition 18 states:

"A Fire Management Plan being prepared, approved and relevant provisions implemented during subdivisional works, in accordance with WAPC's *Guideline Planning for Bushfire Protection Edition 2, May 2010 (in particular Appendix 3)* to the specifications of the local government (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 528 residential lots and 1 Public Open Space (POS) lot.

The development adjoins existing development stages of Banksia Grove to the west and proposed residential development to the immediate east. The site includes an area reserved for a primary school development and adjoins the Banksia Grove Catholic Primary School.

The site is adjacent to a Bushforever Reserve on the north perimeter and Joondalup Drive on the south. The total developable area is 35.6758 ha.

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 west, A Bushforever Reserve to the north, proposed development land to the east and Joondalup Drive to the south.

The natural woodland vegetation in the area is predominantly low banksia woodland.

4.1 Description of the Subject Land

The subject land proposed for residential development is 35.6738 ha in size.

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

In summary this land:

- Has already been cleared on the western perimeter and is under development adjacent to Joondalup Drive;
- Is adjacent to woodland vegetation to the north and east; and
- Has gentle slopes in the range of 1-5 degrees under the woodland vegetation;

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.

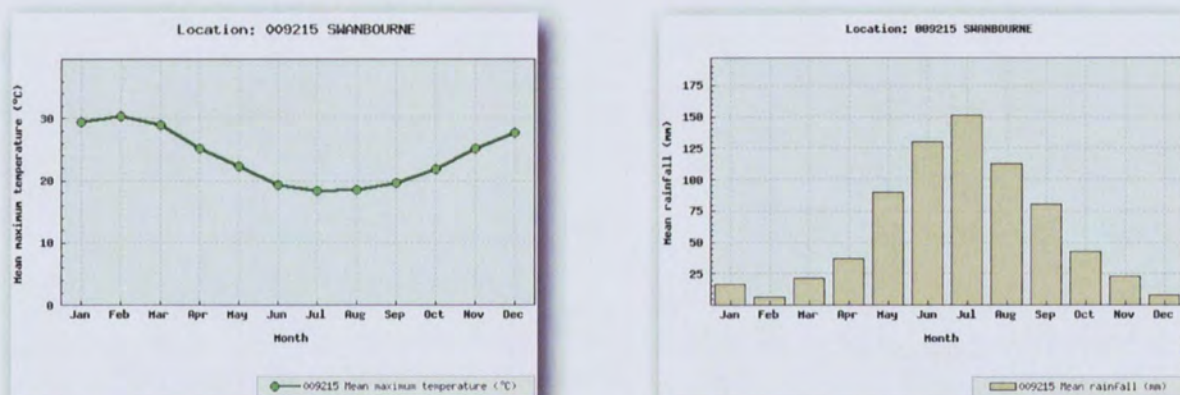


Figure 1: Mean maximum recorded temperatures and mean rainfall for Swanbourne Meteorology Station between 1993 and 2010

The site is 8 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.

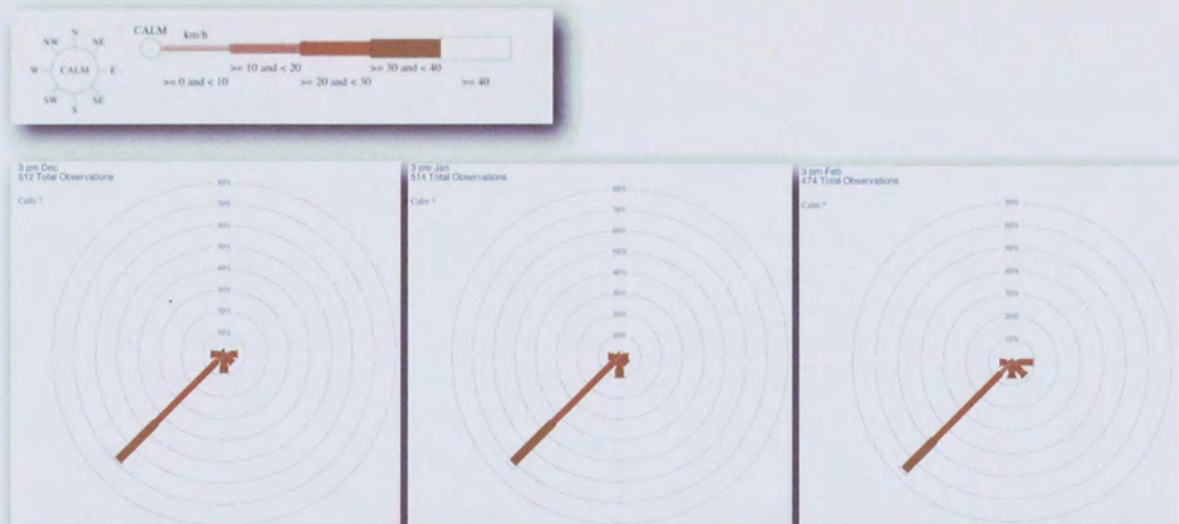


Figure 2: Rose of wind direction and wind speed in km/hr for 3pm in December, January and February between 1993 and 2010 at the Swanbourne Bureau of Meteorology Station

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 is either cleared for development or contains native low banksia woodland vegetation. Tree canopy heights in the woodland are generally low and in the range of 6-16 metres high. The woodland contains bark and leaf litter fuels which accumulate under the canopy. The middlestorey (or intermediate vegetation) includes regrowth trees and small banksia trees. 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 528 dwellings, however only 57 dwellings will be sited within 100 metres of classified vegetation. The remaining 471 dwellings will be sited in the middle of an urban landscape.

Occasionally dwellings are lost to ember attack at distances over 100 metres, however the most exposed dwellings to predicted radiant heat from a bushfire are located within 100 metres. These dwellings 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 and laneways that are all interconnected and provide a range of access and egress options for residents and emergency services. Importantly there is a perimeter road between the Bushforever site and dwellings.

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 small fire adjacent to the Banksia Grove Catholic Primary School was observed and media reports have identified the likely cause was arson.

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.

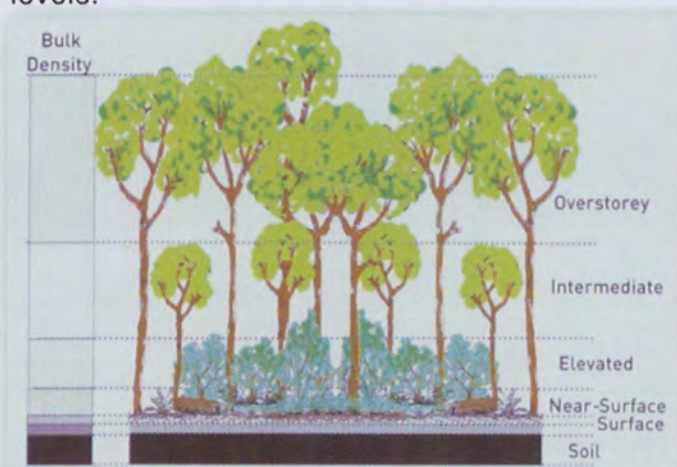


Figure 3 : The five obvious fuel layers in a forest environment that could be associated with fire behaviour (Gould et al. 2007)

5.1 Vegetation Type and Class

The site assessment undertaken for this study identified the dominant vegetation type on the development site is woodland. Banksia trees dominate the woodland vegetation although Jarrah and Sheoak trees are also common. Eucalypt trees are often 5-8 metres taller than the Banksia trees. The elevated fuel layer mostly consists of intact heath vegetation. The vegetation classes are mapped in Appendix D.

The woodland vegetation to the north of the site is dominated by banksia trees with an intact heath elevated fuel layer (Figure 4). Some taller Eucalypts are also present as are Sheok Trees. There is consistently a deep build up of Sheoak needles under the canopy of Sheoak trees. Evidence of an arson lit fire was observed near the Banksia Grove Catholic Primary School (Figure 5).

The western perimeter of the site is unvegetated as this was cleared to provide a buffer for the new development.

South of Joondalup Drive, the woodland canopy was sparse and scrub and shrubland vegetation occurred in the elevated fuel layer (Figure 6). Adjacent to the woodland was a drainage basin that is largely unvegetated (Figure 7).

Managed vegetation occurs in the Flynn Drive Road Reserve as this area has been extensively wood chipped and landscape planted.



Figures 4 & 5: Banksia woodland with intact elevated heath fuels (left) and evidence of the fire near the Banksia Grove Catholic Primary School (right)



Figures 6 & 7: The woodland vegetation (left) and the drainage basin south of Flynn Drive (right)

5.2 Slope

The site has gentle slopes in the range of 1- 5 degrees. Contour lines with 0.25 metre intervals are highlighted on the subdivision plan in Appendix C which shows the site sloping downwards to the south east. Effective slopes measured under the woodland vegetation surrounding the proposed residential area are also in the range of 1-5 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 and surrounding area has a bushfire hazard ratings of low and extreme. Low hazard occurs in areas of mineral earth where vegetation has been cleared. Low hazard also occurs over existing residential areas and road reserves.

Extreme hazard occurs in all areas of woodland vegetation. The bushfire hazard rating map for the existing (i.e. pre-development) site and surrounding area is shown in Appendix E.

All areas of POS within the development site are to be landscaped and managed environments and will therefore become "low threat" areas as defined in AS3959-2009. This is also to occur in the area proposed for a new primary school, fuel loads will be reduced by the developer to ensure the hazard is significantly lowered.

The extent of bushfire hazard post development is significantly different to the current situation. Obviously the site will be extensively cleared to accommodate the urban development. This is to be repeated in the North East Precinct Development (Appendix F) immediately to the east. As a temporary measure the vegetation will be managed in a 100m wide strip to ensure temporary hazard does not threaten this development.

The post development bushfire hazard rating is outlined in Appendix G.

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 and extreme on the development site due to the absence or presence of vegetation. The maximum Bushfire Attack Level (BAL) is predicted to be BAL-29 and this will only occur for some dwellings facing the Bushforever Reserve. Of the 528 proposed dwellings, only 11% are exposed to a bushfire attack level that requires additional construction standards under the Australian Standard.

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 development design does not permit it.

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 developing and existing residential areas with a substantial network of public roads in a low bushfire hazard environment. Joondalup Drive (a major east west access road) is located on the southern perimeter of the site. There are ten public roads linking the new development with the adjoining development area providing numerous access routes.

The immediate road network on and surrounding the site is outlined in the Subdivision Plan in Appendix C 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 ten public roads link the subdivision to the adjoining residential areas.

Acceptable Solution A2.2: Public Roads

All proposed public roads and laneways 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

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.

A fire engineer will be engaged by the proponent for the future primary school development to provide details to DFES on how complete fire hydrant coverage will be achieved. An adequate water supply for fire suppression purposes at the future school will be achieved after the satisfactory completion of this process. The process to determine hydrant coverage and compliance with Australian and DFES standards is outlined in DFES guideline No: GL-07 which can be downloaded at : http://www.fesa.wa.gov.au/regulationandcompliance/buildingplanassessment/Guidelines/GL-07-Submission_of_plans_for_assessment_against_the_Deemed-to-Satisfy_fire_requirements_of_the_BCA.pdf.

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 BPZ will be established on the north perimeter of the site between bushfire hazard in the Bushforever Reserve and residential dwellings. This includes the road reserve (16m) and each lot having an additional setback of 4 metres to provide a total 20 metre separation.

On the southern perimeter, the BPZ will include Joondalup Drive to the southern edge of the bitumen surface. This has been measured at 30 metres.

All lots sited on the eastern perimeter require protection from the adjoining hazard. This will be achieved by treatment of the 100 m zone of adjoining vegetation. All of this land is proposed for development into POS or residential land in the North East Precinct of Banksia Grove (Appendix F). Treatment of this area is required prior to the creation of titles within 100 metres of the east boundary.

Some trees can be retained in the temporary treatment buffer, but as a minimum the removal of most near surface, surface and elevated fuels (i.e. leaf and bark litter and shrubs) is required.

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

- Width: 20 m minimum on north perimeter between dwellings and bushfire hazard, 30 m on south perimeter in Joondalup Drive and 100m minimum on east perimeter in adjacent development land as outlined in Appendix H;
- Location : Within the boundaries of the lot, or adjacent road reserves or the next stage of development;
- 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; and
- 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 at the site due to the small lot sizes and design of development. 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. BAL assessments were undertaken for all areas of development within 100 metres of classified vegetation (permanent woodland vegetation). The results of these assessments are shown in Table 1 and Appendix I.

The criteria to determine the BAL is outlined as follows:

Designated FDI : 80
 Flame Temperature : 1090
 Slope : Upslope, Flat and Downslope various degrees(See Table 1)
 Vegetation Class : Woodland
 Setback distances : 20, 35 and 52 - 100 m (See Table 1)

Example BAL Assessment Number	Setback Distance (m)	Classified Vegetation	Effective Slope (degrees)	BAL Rating
North interface	20	Woodland	Downslope	BAL-29
North interface	20	Woodland	Flat or Upslope	BAL-19
North interface	35-100.	Woodland	Down or upslope	BAL-12.5
South interface	52-100	Woodland	Downslope 9	BAL-12.5

Table 1: Bushfire Attack Level (BAL) Assessment for four indicative dwelling scenarios (See Appendix I for site details)

A maximum Bushfire Attack Level BAL-29 is achieved for 11 dwellings, 8 dwellings are exposed to BAL-19 and 38 dwellings are exposed to BAL-12.5 (Appendix I).

An exposure of BAL-12.5 means there is a risk of ember attack. The risk is considered to be low (Standards Australia 2009). The construction elements are expected to be exposed to a heat flux not greater than 12.5kWm². The recommended construction sections are 3 and 5 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 indicative 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. The exposed lots have highlighted in Appendix I with specific BAL ratings and thereby negate the need for a follow up 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?	N/A
	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?	N/A
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 for a small number of dwellings.
	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
- Establish the Building Protection Zone on the perimeter of the development site as outlined in Element 6.4 Building Protection Zone Requirements Siting and Appendix H
- Establish the 100 metre temporary BPZ in the North East Precinct Development area as outlined in Appendix H
- Ensure dwellings facing the Bushforever Reserve have a minimum 4 metre setback from the lot front
- Ensure dwellings located on the second street back from the Bushforever Reserve are setback a minimum 5 metres from the lot front
- Reduce fuel loads in the area designated for future Primary School Development and the POS Reserve
- 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 Firebreak 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 Firebreak Notice
- Ensuring construction of dwellings complies with AS 3959, and
- Maintaining the BPZ at the property owner's/occupier's own cost.

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 Firebreak 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: 23/07/2012

9. References

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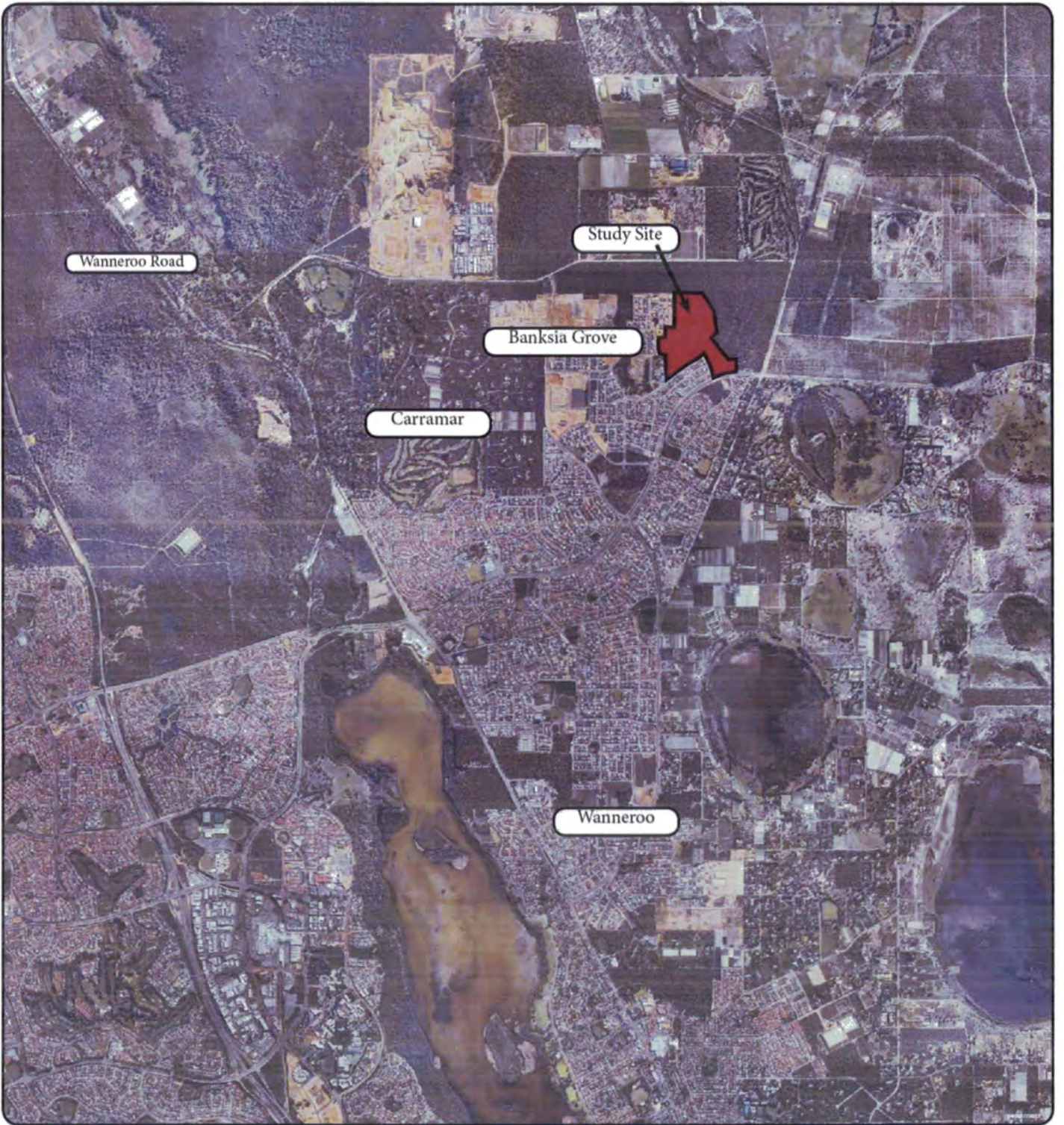
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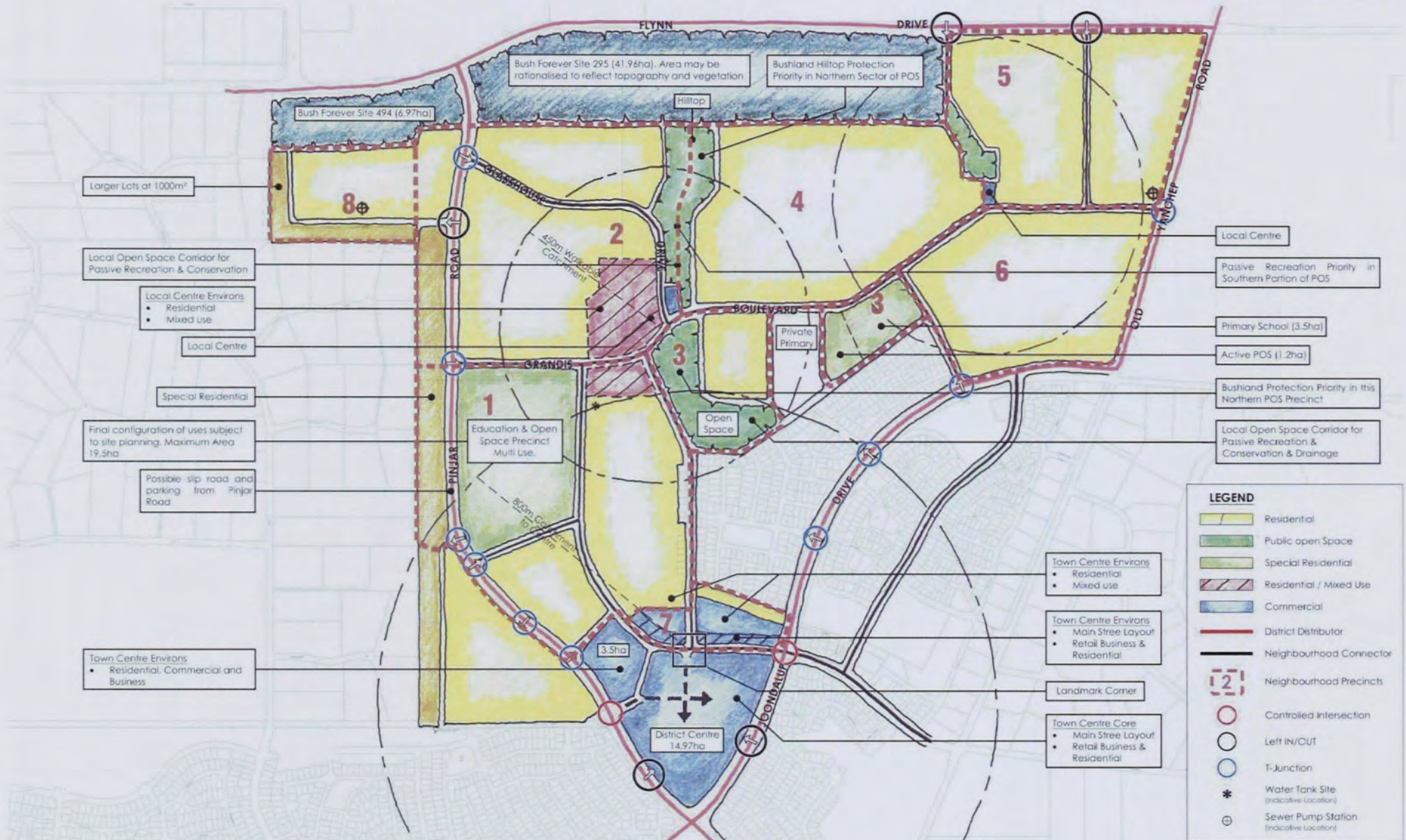


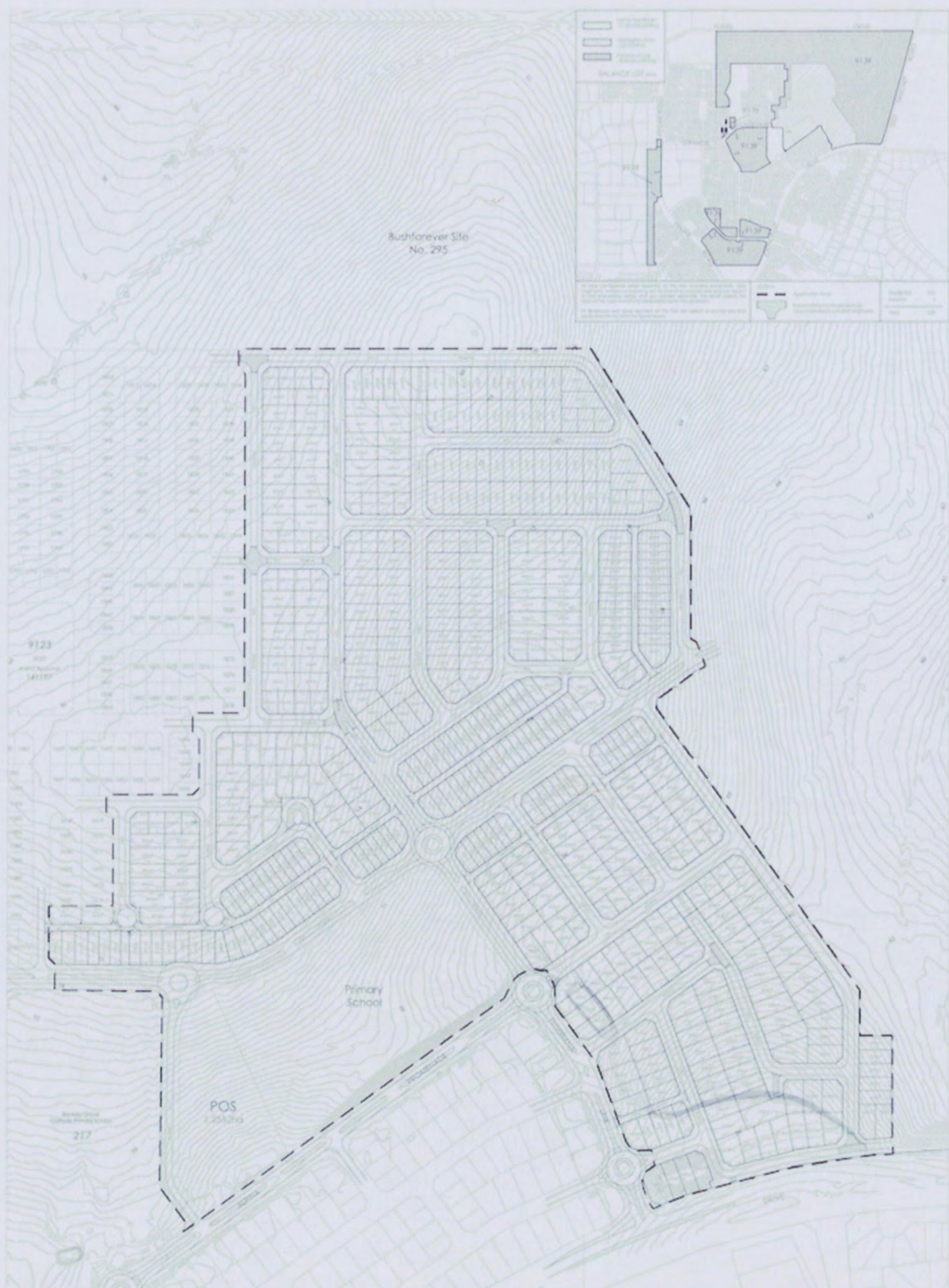
Appendix A: Site Location

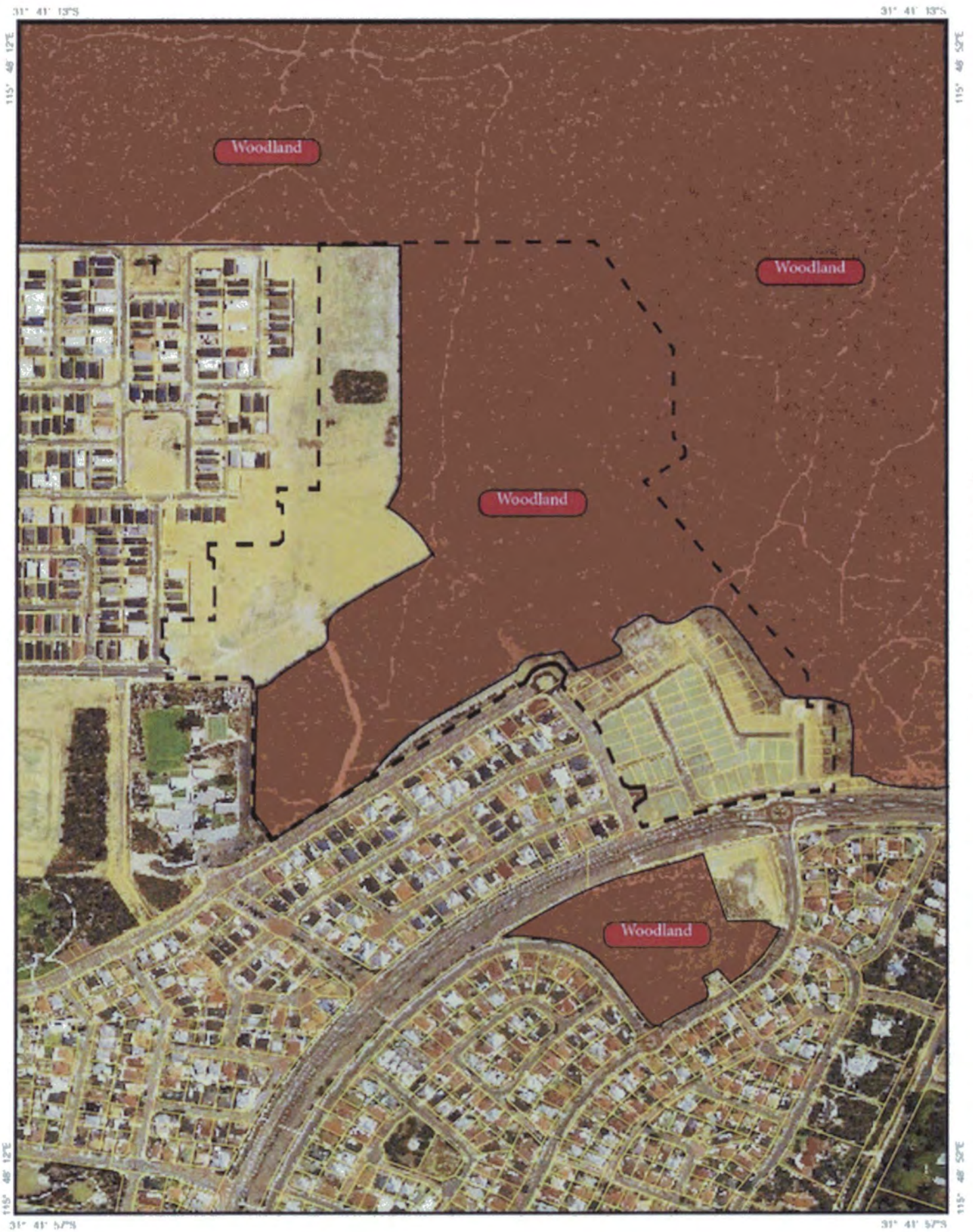
Northern Precinct
Lot 9139 Flynn Drive
Banksia Grove
CITY OF WANNEROO

0km 2km









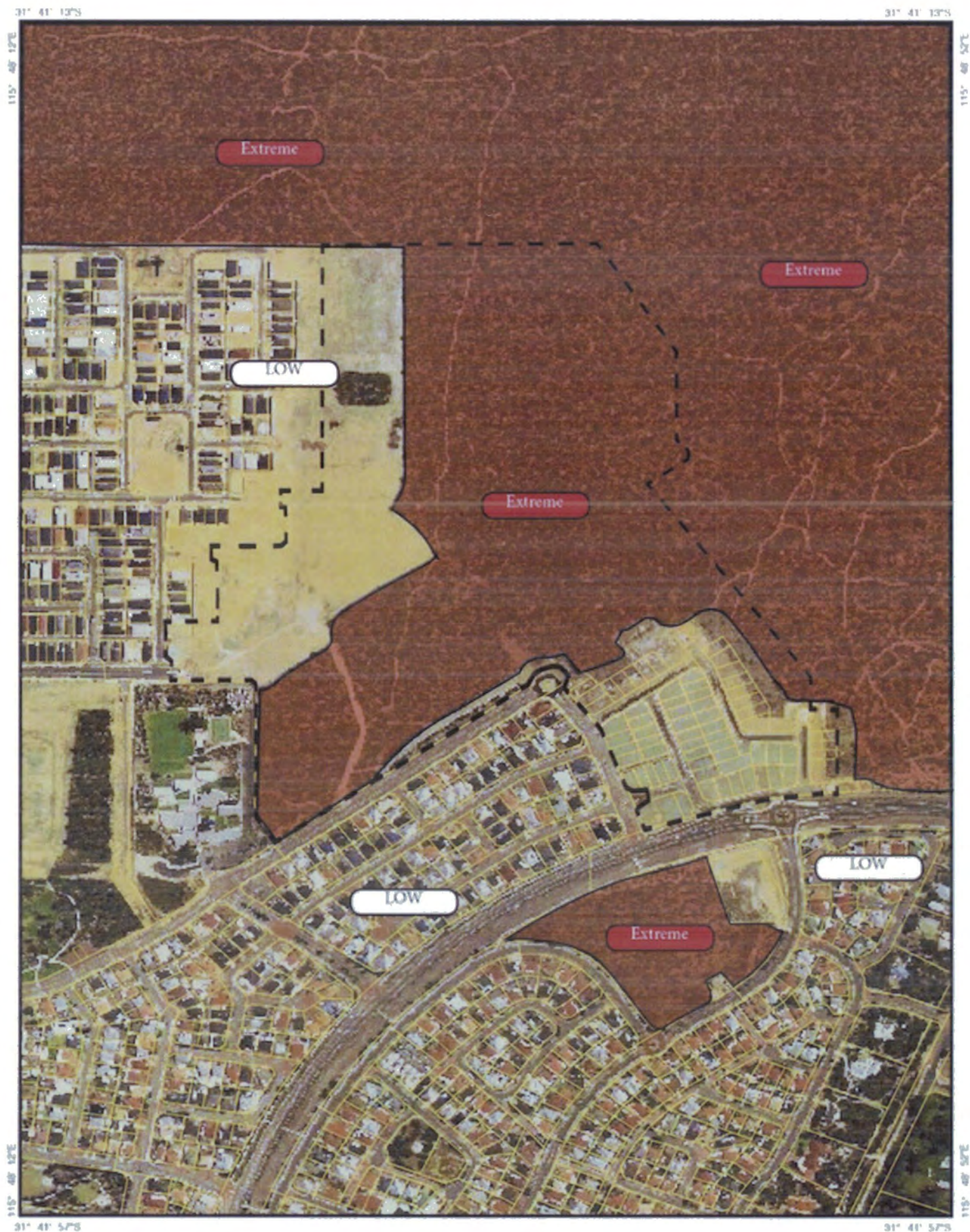
Appendix D: Vegetation Class Map

North Precinct - Lot 9139 Flynn Drive
Banksia Grove
City of Wanneroo

--- Site boundary



Bushfire Safety
CONSULTING



Appendix E: Bushfire Hazard Rating Map (pre-development)

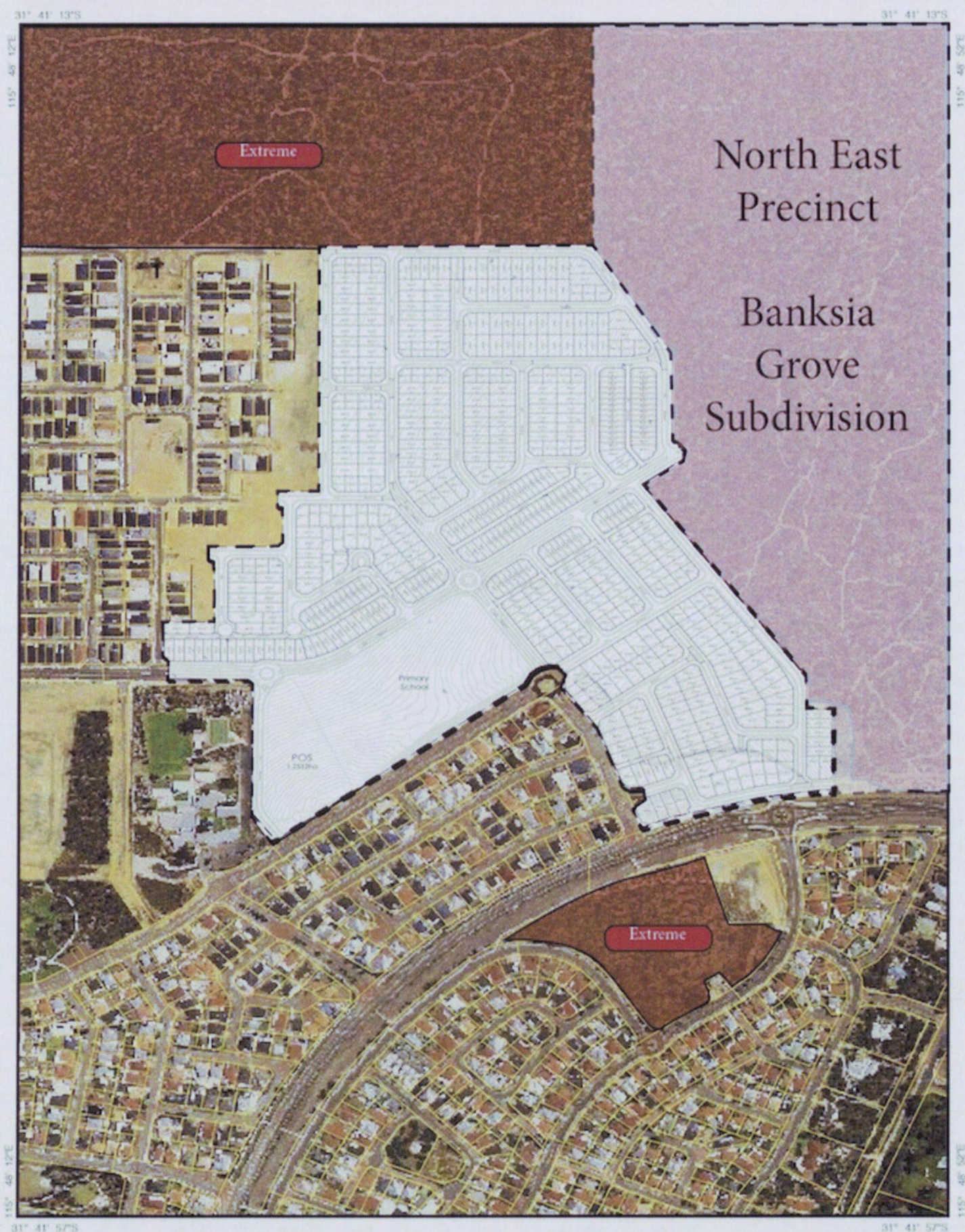
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Banksia Grove
City of Wanneroo

--- Site boundary



Bushfire Safety
CONSULTING

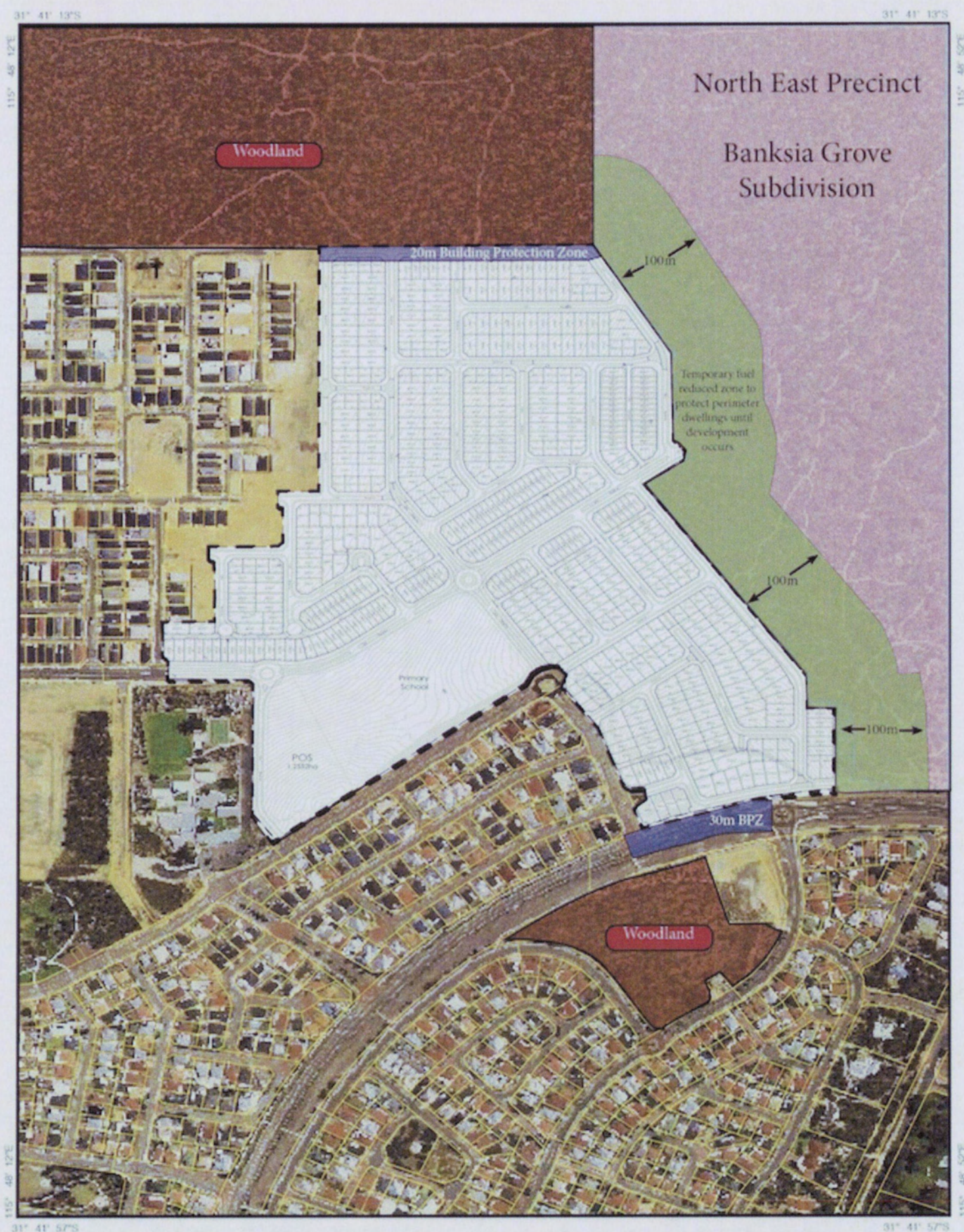




Appendix G: Bushfire Hazard Rating Map (post-development)

North Precinct - Lot 9139 Flynn Drive
Banksia Grove
City of Wanneroo

--- Site boundary



Appendix H: Building Protection Zone Requirements

North Precinct - Lot 9139 Flynn Drive
Banksia Grove
City of Wanneroo

--- Site boundary

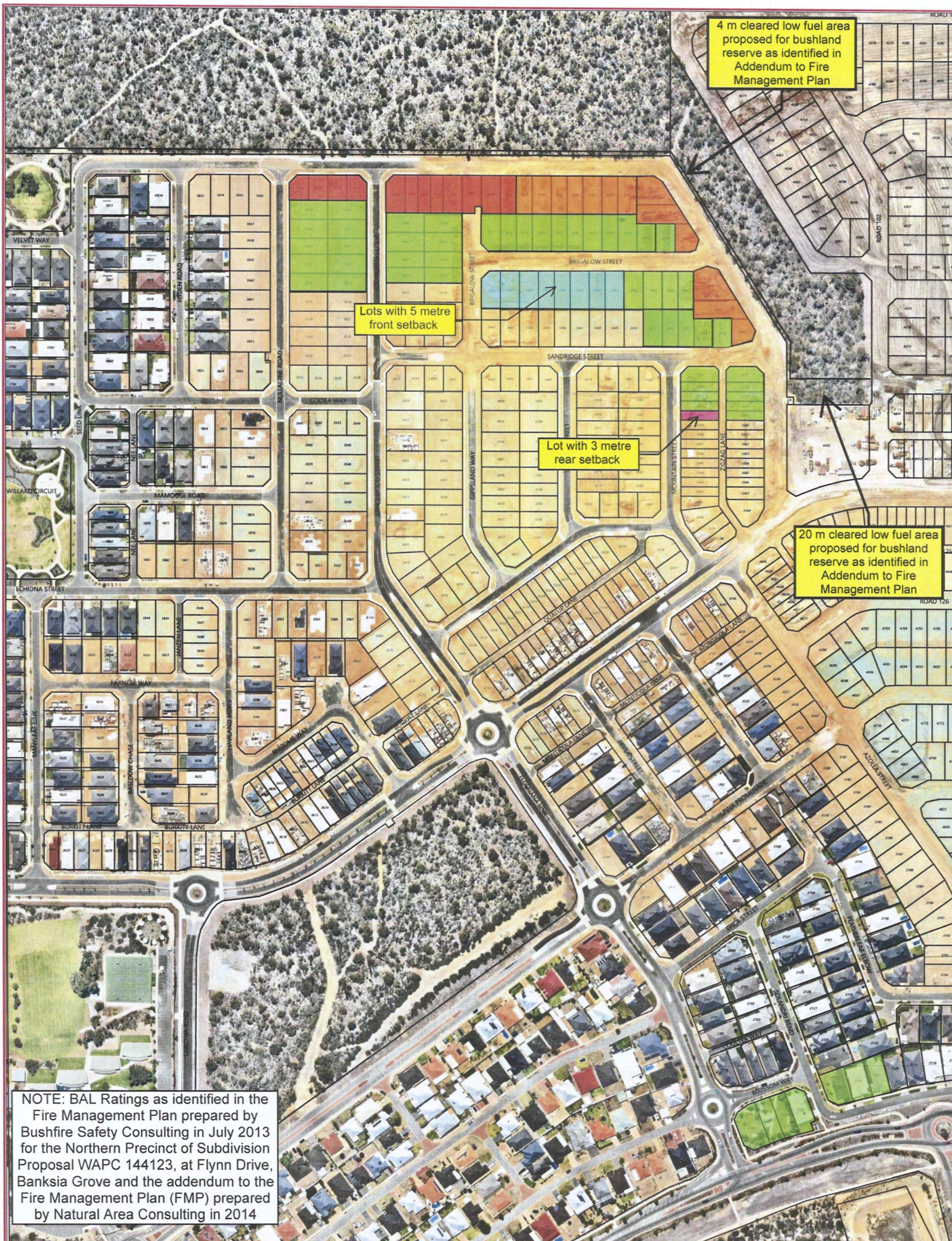
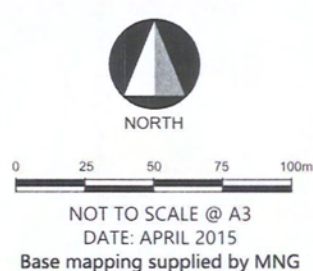


FIGURE 1: Bushfire Attack Level Ratings

Northern Precinct
Subdivision Proposal
Banksia Grove
WAPC 144123

	BAL-29
	BAL-19
	BAL-12.5
	Lot with 3m rear setback
	Lots with 5m front setback



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