

# Fire Management Plan

Amberton Estate

Prepared for  
Stockland  
by Strategen

February 2016



# **Fire Management Plan**

Amberton Estate

Strategen is a trading name of  
Strategen Environmental Consultants Pty Ltd  
Level 2, 322 Hay Street Subiaco WA  
ACN: 056 190 419

February 2016

## ***Limitations***

### **Scope of services**

This report ("the report") has been prepared by Strategen Environmental Consultants Pty Ltd (Strategen) in accordance with the scope of services set out in the contract, or as otherwise agreed, between the Client and Strategen. In some circumstances, a range of factors such as time, budget, access and/or site disturbance constraints may have limited the scope of services. This report is strictly limited to the matters stated in it and is not to be read as extending, by implication, to any other matter in connection with the matters addressed in it.

### **Reliance on data**

In preparing the report, Strategen has relied upon data and other information provided by the Client and other individuals and organisations, most of which are referred to in the report ("the data"). Except as otherwise expressly stated in the report, Strategen has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report ("conclusions") are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. Strategen has also not attempted to determine whether any material matter has been omitted from the data. Strategen will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to Strategen. The making of any assumption does not imply that Strategen has made any enquiry to verify the correctness of that assumption.

The report is based on conditions encountered and information received at the time of preparation of this report or the time that site investigations were carried out. Strategen disclaims responsibility for any changes that may have occurred after this time. This report and any legal issues arising from it are governed by and construed in accordance with the law of Western Australia as at the date of this report.

### **Environmental conclusions**

Within the limitations imposed by the scope of services, the preparation of this report has been undertaken and performed in a professional manner, in accordance with generally accepted environmental consulting practices. No other warranty, whether express or implied, is made.

### **Client: Stockland**

Report Version	Revision No.	Purpose	Strategen author/reviewer	Submitted to Client	
				Form	Date
Draft Report	Rev A	For review by client	Z Cockerill	Electronic (email)	2/09/2014
Final Report	Rev 0	Issued for use: for submission to City of Wanneroo and DFES	Z Cockerill / R Banks	Electronic (email)	4/11/2014
<b>Final Report</b>	<b>Rev 1</b>	<b>Issued for use: to address City of Wanneroo and DFES comments</b>	<b>Z Cockerill</b>	<b>Electronic (email)</b>	<b>12/02/2016</b>

Filename: STO14116\_01 R001 Rev 1 - 12 February 2016

## Table of contents

<b>1. Introduction</b>	<b>1</b>
1.1 Background	1
1.2 Purpose and application of the plan	1
1.3 Stakeholder consultation	1
<b>2. Aim and objectives</b>	<b>3</b>
2.1 Aim	3
2.2 Objectives	3
<b>3. Description of the area</b>	<b>4</b>
3.1 General overview	4
3.1.1 Development context and fire management planning	4
3.2 Local climate	7
3.2.1 Worst case fire weather conditions	7
3.2.2 Predominant fire weather conditions	8
3.2.3 Potential bush fire scenarios	8
Landform and topography	8
3.3 Vegetation	10
3.3.1 Vegetation complexes	10
3.3.2 On-site vegetation extent	10
3.3.3 Adjacent vegetation extent	10
3.4 Zoning and land use	12
3.4.1 Current zoning and land use	12
3.4.2 Proposed zoning and land use	12
3.4.3 Adjacent land use	12
3.5 Site assets	12
3.6 Water and power supply	12
3.7 Site access	13
<b>4. Fire problem</b>	<b>14</b>
4.1 Bush fire history, risk of ignition and suppression response capacity	14
4.2 Bush fire hazards	14
4.2.1 Classifying the bush fire hazard	14
4.2.2 Bush fire hazard performance criteria	22
4.2.3 Classifying the Bushfire Attack Level (BAL)	22
4.3 Summary of key bush fire issues	24
<b>5. Bush fire risk treatment and mitigation</b>	<b>25</b>
5.1 Development location	25
5.1.1 Location of residential lots	25
5.1.2 Public Open Space	25
5.1.3 Management of the conservation reserve	26
5.2 Vehicular access	26
5.3 Water supply	26
5.4 Siting of development	26
5.5 Design of development	27
5.6 Additional bush fire risk mitigation	27
5.7 Summary of bush fire risk mitigation and works program	27
<b>6. Implementation of the Fire Management Plan</b>	<b>30</b>
6.1 Implementation of bush fire risk treatment and mitigation	30
6.2 Assessment of bush fire risk treatment and mitigation measures	30
6.3 Legislative requirements, specifications and standards	32
<b>7. References</b>	<b>33</b>

## List of tables

Table 1: Key objectives of the FMP	3
Table 2: Predominant vegetation class and type	18
Table 3: Bush fire hazard levels and performance criteria	22
Table 4: Determination of Bushfire Attack Level (BAL)	23
Table 5: Construction standards	23
Table 6: Summary of bush fire risk mitigation measures and works program	28

## List of figures

Figure 1: Overall Estate Lot Layout Plan	2
Figure 2: Regional location	5
Figure 3: Site overview	6
Figure 4: Average monthly climate statistics for Gingin Aero (Station No. 9178)	7
Figure 5: Site topography	9
Figure 6: Vegetation complexes	11
Figure 7: Vegetation class map	19
Figure 8: Bush fire hazard assessment map	21
Figure 9: Fire Management Plan: Amberton Estate	31

## List of appendices

Appendix 1 Fire Management Plan compliance checklist
Appendix 2 January wind profiles for Gingin Aero (BoM 2014)
Appendix 3 Construction standards for BAL 12.5 as per AS 3959–2009
Appendix 4 Amberton Foreshore Preliminary Landscape Concept (Emerge 2014)
Appendix 5 City of Wanneroo annual firebreak notice
Appendix 6 AFAC bush fire glossary

# 1. Introduction

## 1.1 Background

Stockland is in the process of developing Amberton Estate (the project area), located at Eglinton in the City of Wanneroo. The project area is proposed to be developed primarily for residential purposes in line with the approved Eglinton Local Structure Plan (LSP) and indicative Overall Estate Lot Layout Plan (Figure 1), which may be subject to future modification.

The project area and adjacent land contains coastal vegetation that may pose an inherent bush fire risk to future assets of the development, particularly in areas where vegetation on steep slopes is to be retained, such as within the proposed conservation reserve to the north.

Stockland has commissioned Strategen to prepare a Fire Management Plan (FMP) for the project area to guide bush fire protection of the proposed Amberton Estate residential development and ensure a suitable, compliant and effective bush fire management outcome is achieved for the site.

The FMP has been prepared in accordance with *Planning for Bush Fire Protection Guidelines Edition 2* (PFBFP Guidelines; WAPC et al. 2010), with consideration of *Draft State Planning Policy 3.7 Planning for Bushfire Risk Management* (DoP & WAPC 2014a) and accompanying *Draft Planning for Bushfire Risk Management Guidelines* (DoP & WAPC 2014b). The FMP is for submission to City of Wanneroo (CoW) and Department of Fire and Emergency Services (DFES). A completed FMP compliance checklist is contained in Appendix 1.

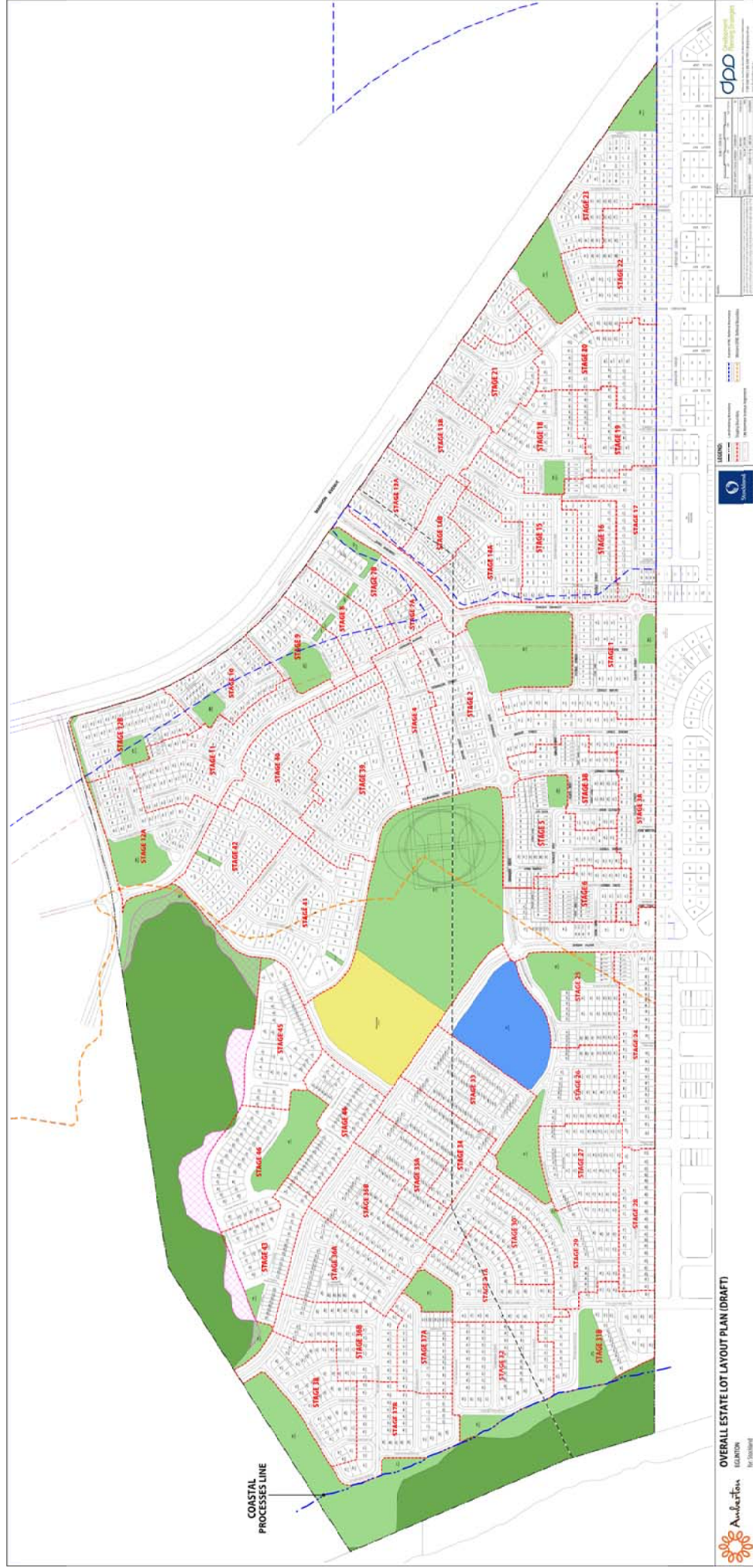
## 1.2 Purpose and application of the plan

The purpose of the FMP is to provide guidance on how to plan for and manage the potential bush fire risk to the project area through implementation of a range of bush fire risk treatment and mitigation measures. The FMP outlines how future on-site assets can be protected during the summer months when the threat from bush fire is at its peak. This is particularly relevant when existing fire appliances in the area may be unable to offer an adequate emergency suppression response. Therefore, the developer should aim to ensure site assets are self-protecting from bush fire.

Implementation of the FMP is a shared responsibility between the developer, CoW and prospective landowners to ensure bush fire risk treatment and mitigation measures are adopted and implemented on an ongoing basis to achieve bush fire management objectives.

## 1.3 Stakeholder consultation

Strategen has undertaken consultation with the developer, CoW and DFES to ensure aims and objectives of the FMP are in accordance with stakeholder expectations and the FMP maintains compliance with PFBFP Guidelines.



Source: DPS 2014

Fire Management Plan: Amberton Estate  
Overall Estate Lot Layout Plan



## 2. Aim and objectives

### 2.1 Aim

The FMP aims to achieve a reduction in the occurrence of uncontrolled bush fires and minimise potential impacts on life and property of the proposed development through the following:

- quantifying the bush fire hazard and assessing the bush fire risk to the project area
- documenting bush fire prevention requirements of the project area to provide ongoing protection to future residents, visitors and built assets of the subject land
- identifying bush fire protection issues, appropriate strategies and those persons and/or organisations who have a responsibility to implement the FMP
- complying with PFBFP Guidelines and maintaining compatibility with bush fire management on neighbouring subdivisions
- providing guidance for the developer, CoW and prospective landowners to protect the subject land and on-site assets in the event that fire appliances may not be available to offer an adequate bush fire suppression response.

### 2.2 Objectives

Key objectives of the FMP and the relevant section/s of this document in which they are addressed are outlined in Table 1.

Table 1: Key objectives of the FMP

Objective	Section
Define areas where values are located	Section 3.5
Define and rank fire hazard areas	Section 4.2.1
Nominate individuals and organisations responsible for fire management and associated works within the project area	Section 5.7
Propose bush fire risk treatment and mitigation measures for the project area, with due regard for life, property and the environment	Section 5
Provide performance criteria and acceptable solutions for all fire management works (e.g. development location, vehicular access, water supply, siting of development and design of development)	Section 4.2.2 and Section 5

### 3. Description of the area

#### 3.1 General overview

Amberton Estate occupies 198 ha and forms Precinct 3 of the overall Eglinton LSP, located at Eglinton in the City of Wanneroo (Figure 2). Amberton Estate is situated approximately 18 km northwest of Joondalup and 43 km northwest of the Perth CBD. The site is partially developed, with the initial stages of development currently being constructed in the southeast. The remaining undeveloped portion of the site to the west comprises the balance of Lot 9007, as well as a narrow 'Parks and Recreation' reserve along the coast (Figure 3).

The project area is bound by the following:

- Indian Ocean to the west
- future development stages of the Eglinton LSP to the north
- Marmion Avenue and future development stages of the Eglinton LSP to the east
- current and future stages of the Shorehaven residential development to the south.

On-site vegetation is currently restricted to the undeveloped portion of the site to the west, of which the majority is proposed to be cleared following approval and development of ongoing stages of Amberton Estate.

Vegetation to the west within the foreshore reserve and to the north within a proposed conservation reserve is proposed to be retained as per the Eglinton LSP. All other on-site and surrounding areas of vegetation will be subject to various levels of clearing and disturbance following approval of ongoing stages of Eglinton and Shorehaven development.

##### 3.1.1 Development context and fire management planning

Amberton Estate forms Precinct 3 of the overall Eglinton LSP, which is to be developed in accordance with the Alkimos Eglinton District Structure Plan and higher level planning documents including the Metropolitan Region Scheme (MRS) and City of Wanneroo District Planning Scheme No. 2 (DPS No. 2).

Initial development stages of Amberton Estate are currently being constructed in the southeast of the site, with future stages to occur over the remaining undeveloped portion of the site, followed by development of adjacent precincts at Eglinton to the north and east once the required approvals are in place.

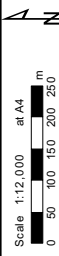
This FMP has been prepared for Amberton Estate to manage the bush fire risk to future assets of the development and meet State bush fire planning requirements. A similar approach and methodology regarding vegetation and bush fire hazard assessment documented in this FMP has been adopted for other developments along the coastal strip in the locality, such as at Alkimos.







**Figure 3: Site overview**



Scale 1:12,000 at A4  
 0 50 100 150 200 250 m  
 Coordinate System: GDA 1994, MGA Zone 50  
 Note that positional errors may occur in some areas  
 Date: 11/06/2014  
 Author: JCrub  
 Source: Client 2014.  
 Path: Q:\Consult\2014\STO14116\ArchMap\_documents\IR001\Rev0\STO14116\_01\_R001\_Rev0\_F003.mxd

**Legend**

- Existing roads
- Project area boundary



**STRATEGEN**

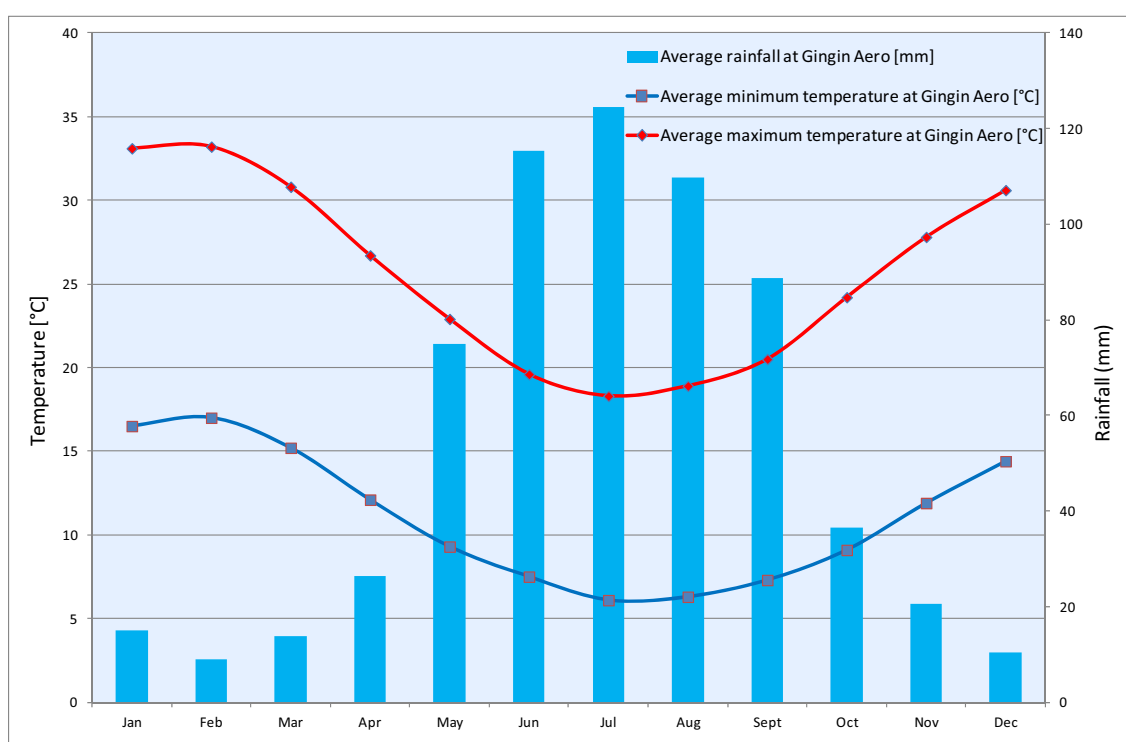
info@strategen.com.au www.strategen.com.au



## 3.2 Local climate

Eglinton experiences a Mediterranean climate characterised by mild, wet winters and warm to hot, dry summers. The closest Bureau of Meteorology (BoM) weather station at Gingin Aero (Station No. 9178), located approximately 24 km northeast of the project area, provides average monthly climate statistics for the locality recorded since 1996, as illustrated in Figure 4. Climatic conditions at Eglinton are slightly cooler than Gingin Aero, with higher annual rainfall due to maritime effects and proximity to the Indian Ocean; however, the variations are not expected to be significant and statistics from Gingin Aero are considered suitable for the purposes of the fire weather assessment.

Average annual rainfall recorded at Gingin Aero is 648.4 mm (BoM 2014). Rainfall may occur at any time of year; however, most occurs in winter in association with cold fronts from the southwest. Highest temperatures occur from December to March, with average monthly maximums ranging from 30.6°C in December to 33.2°C in February (BoM 2014). Lowest temperatures occur from June to September, with average monthly minimums ranging from 6.1°C in July to 7.5°C in June (BoM 2014).



Source: BoM 2014

Figure 4: Average monthly climate statistics for Gingin Aero (Station No. 9178)

### 3.2.1 Worst case fire weather conditions

Southwest Western Australia generally experiences a cool to mild growing season in the months of August through to November of each year, followed by four months of summer drought conditions, which is when the potential for bush fire occurrence is at its peak.

Worst case fire weather conditions can occur during this dry period when a low pressure trough forms off the west coast and strong winds develop from the north or northeast. These conditions are sometimes associated with 'Extreme' or 'Catastrophic' fire dangers, which are consistent with very high temperatures, low relative humidity and strong winds. Based on the predominant summer climatic conditions of the local area, 'Extreme' and 'Catastrophic' fire dangers occur less than 5% of the time during the designated bush fire season, which equates to around six days between December and March (McCaw & Hanstrum 2003).

### 3.2.2 Predominant fire weather conditions

Predominant fire weather conditions are those that occur 95% of the time during the designated bush fire season. For the subject locality, these generally correlate with average January climatic conditions.

Mean January 9:00 am and 3:00 pm wind profiles for Gingin Aero are contained in Appendix 2. These illustrate that the predominant winds during the designated bush fire season are from the east in the morning averaging around 21 km/h; and from the southwest in the afternoon averaging around 26 km/h (BoM 2014).

Mean January 9:00 am and 3:00 pm relative humidity for Gingin Aero is approximately 48% and 33% respectively, with the January mean maximum temperature peaking at around 33°C (BoM 2014). These predominant fire weather conditions correlate with an average fire danger index of 'High', as determined using the Commonwealth Science and Industrial Research Organisation (CSIRO) Fire Danger and Fire Spread Calculator (CSIRO 1999).

### 3.2.3 Potential bush fire scenarios

A fire front approaching the site from the west within the foreshore reserve is considered unlikely to significantly impact future assets of the proposed development since the on-ground fire environment, environmental characteristics and potential fire conditions are not overly conducive to intense bush fire occurrence in this area. The low available fuel loads and broken up nature of the low shrubland vegetation, as well as the small fire run and predominant winds are not expected to be capable of supporting a bush fire with significant fire intensity and ember attack characteristics.

A fire front approaching the site from the north within the conservation reserve is considered a possible and much higher bush fire risk scenario that could impact future assets of the proposed development under suitable fire weather conditions. The vegetation consists of more intact, continuous shrubland vegetation under steep slopes, so there is an associated increase in potential bush fire risk, particularly with regards to ember attack on days of 'Extreme' or 'Catastrophic' fire weather and associated strong north/north-easterly winds.

## Landform and topography

The project area is located on the Swan Coastal Plain, which is characterised by a low-lying coastal plain mainly covered with woodlands. Younger sandy areas and limestones are dominated by heath and/or *Eucalyptus gomphocephala* (Tuart) woodlands (McKenzie et al. 2003).

The project area and adjacent land contains undulating to steep topography with numerous coastal dunes that vary in elevation and orientation (Figure 5). The majority of vegetation within and adjacent to the project area is proposed to be cleared as part of ongoing development at Eglinton and Shorehaven. As a result, slope will only be a factor contributing to the bush fire hazard and potential Bushfire Attack Level (BAL) in those areas where the current vegetation extent is proposed to be retained (i.e. within the foreshore reserve to the west and conservation reserve to the north).

Elevation within the north-south elongated foreshore reserve fluctuates between 1 mAHD (Australian Height Datum) at the shore line and 15 mAHD at dune high points, with an average slope of 5–10 degrees. Elevation within the east-west elongated ridge line of the conservation reserve fluctuates between 20 mAHD and 40 mAHD, with slopes exceeding 10 degrees in some areas.

Following site earthworks and levelling, both reserves will generally be located up-slope of future lots. Consequently, the existing topography and slope under vegetation will not increase the level of bushfire attack on the proposed development in terms of increased fire intensity or rate of spread should a bush fire emanate from these areas and approach the site. Ember attack however still remains a threat to future lots, particularly on days of 'Extreme' and 'Catastrophic' fire danger. This information is further considered as part of the BAL assessment for the development (refer to Section 4.2.3).







### 3.3 Vegetation

#### 3.3.1 Vegetation complexes

Regional vegetation survey and mapping of the Swan Coastal Plain, undertaken by Heddle et al. (1980), indicates the project area and adjacent land is contained predominantly within the Quindalup Vegetation Complex, with a small portion to the southeast contained within the Cottesloe Vegetation Complex Central and South (Figure 6). These vegetation complexes are described as:

- Quindalup Complex: coastal dune complex consisting mainly of two alliances including the strand and fore dune alliance and the mobile and stable dune alliance (local variations include low closed forest of *Melaleuca lanceolata*-*Callitris preissii* and closed scrub of *Acacia rostellifera*)
- Cottesloe Complex Central and South: mosaic of woodland of *Eucalyptus gomphocephala* and open forest of *E. gomphocephala*-*E. marginata*-*Corymbia calophylla* with closed heath on the limestone outcrops.

#### 3.3.2 On-site vegetation extent

Aside from existing cleared and developed areas in the southeast of the site, the project area is a combination of low shrubland and open heath (both of the Class C shrubland vegetation class) consistent with the Quindalup Complex. Ongoing development stages of Amberton Estate will eventually result in clearance of the majority of on-site vegetation in preparation of a significant built and landscaped footprint across the site.

Vegetation to be retained to the west within the foreshore reserve consists of very low shrubland with numerous bare sand dunes. Vegetation growth in the foreshore reserve is restricted due to maritime effects, prevailing winds and salt drift, plus added disturbance from off-road vehicle use along the coastal strip.

Vegetation to be retained to the north within the conservation reserve consists of a combination of low shrubland and open heath. Low shrubland is generally lower in height and poses less of a bush fire risk compared to open heath, which contains a denser and taller continuation of coastal vegetation.

The above observations are consistent with detailed vegetation survey undertaken over the Eglinton LSP area by PGV Environmental (2013). The dominant on-site vegetation types were surveyed as:

- *Acacia cyclops* shrubland
- *Melaleuca systema*, *Lomandra maritima* low open heath
- *Acacia rostellifera*, *Melaleuca systema* low open heath.

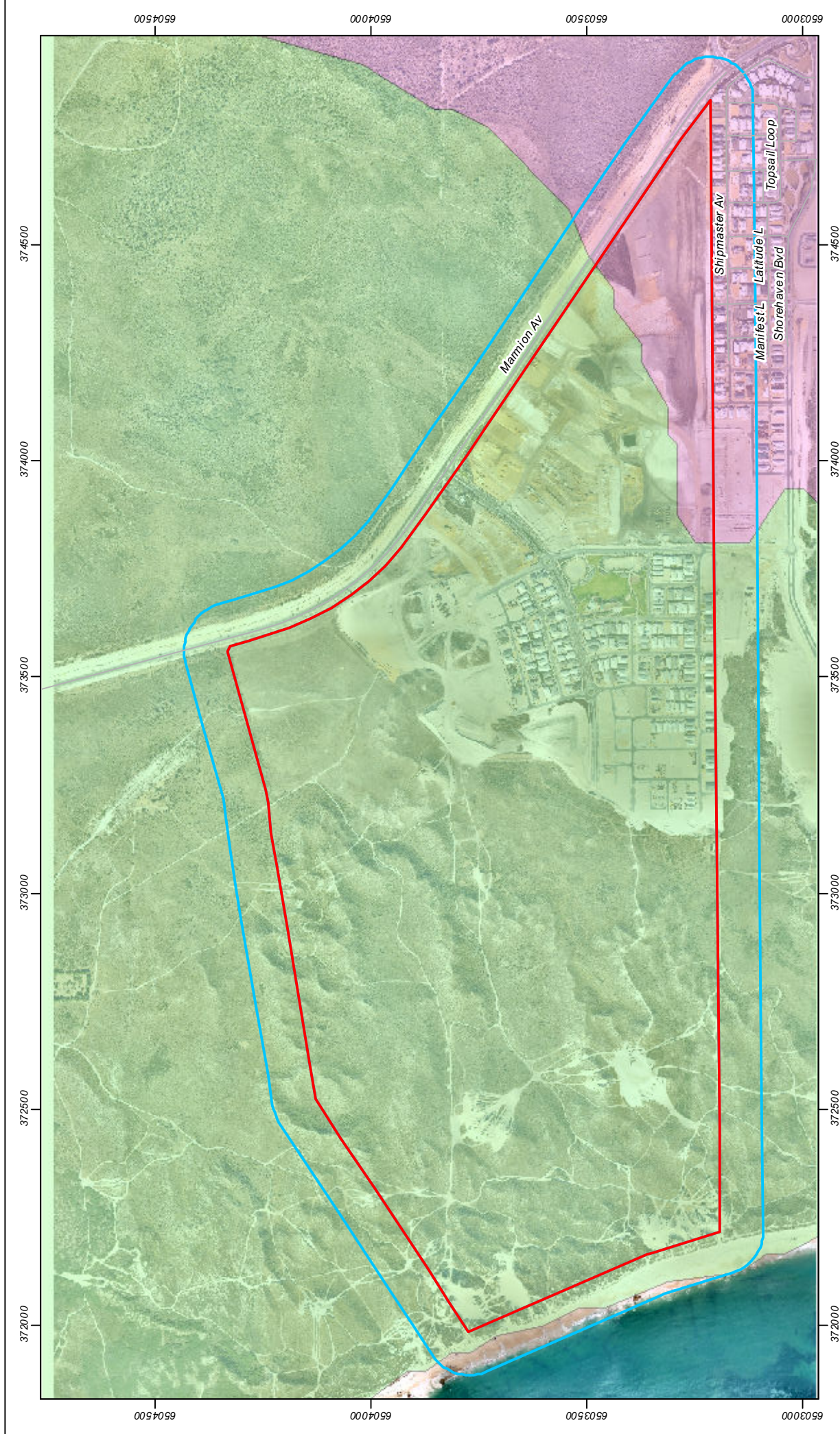
#### 3.3.3 Adjacent vegetation extent

Vegetation to the south consists of low shrubland, similar to that contained on site within the foreshore reserve. The vegetation is very low and sparse, particularly throughout sand dunes and areas disturbed by off-road vehicle use. Ongoing development of future stages of Shorehaven will remove the majority of vegetation to the south.

Vegetation to the north consists of low shrubland and open heath. Ongoing development of future precincts at Eglinton will remove the majority of vegetation to the north outside of the proposed conservation reserve.

Vegetation to the east (opposite Marmion Avenue) consists of a combination of low shrubland and low woodland. The low shrubland is similar to that contained on site and the low woodland contains a proportion of banksias, Grass trees and Tuarts, which become prevalent at further inland locations. Ongoing development of future precincts at Eglinton will remove the majority of vegetation to the east.





**Figure 6: Vegetation complexes**

**Legend**

- Existing roads
- Project area boundary
- 100 m wide assessment area

**Vegetation complexes**

- Cottesloe complex - central and south
- Quindalup complex

Scale 1:12,000 at A4

0 50 100 150 200 250 m

Coordinate System: GDA 1994 MGA Zone 50

Note that positional errors may occur in some areas

Date: 2/09/2014

Author: JCrub

Source: Client 2014

Path: Q:\Consult\2014\STO14116\A\Map\_documents\IR001\Rev0\STO14116\_01\_R001\_Rev0\_F008.mxd

### 3.4 Zoning and land use

#### 3.4.1 Current zoning and land use

The Eglinton LSP area is subject to the provisions of DPS No. 2, which establishes detailed statutory planning controls for the local government area, consistent with the broader controls under the MRS. Current MRS zoning across Amberton Estate is 'Urban', with a strip of 'Parks and Recreation' zoning along the coast in association with the foreshore reserve. Current zoning of the site under DPS No. 2 is predominantly 'Urban Development', with a strip of 'Parks and Recreation' zoning along the coast in association with the foreshore reserve.

#### 3.4.2 Proposed zoning and land use

Amberton Estate is proposed to be zoned and developed primarily for residential purposes in accordance with the indicative Overall Estate Lot Layout Plan (Figure 1), which may be subject to future modification. This will result in development of over 2000 dwellings, several landscaped Public Open Space (POS) areas, as well as town centre, educational, mixed use and commercial precincts. Road, water, sewerage, power, gas and communication infrastructure will also be provided throughout the site.

The proposed foreshore and conservation reserves, located to the west and north respectively, will retain the current vegetation extent, with the foreshore reserve also proposed to be subject to landscape design in accordance with Appendix 4, consisting of numerous lawn, path, drainage, access, car parking, cafe, lookouts and dune rehabilitation areas.

On-site POS will generally consist of low fuel areas, such as managed parks, but may constitute some minor planting of vegetation species consistent with the current shrubland vegetation types present in the area. However, in small discrete patches such as drainage basins and dune rehabilitation areas, this vegetation is considered low threat from a bush fire hazard perspective and is not expected to pose a significant bush fire risk to future life and property assets of the site. In addition, all POS areas are proposed to be subject to landscape design with access paths and low fuel recreation areas implemented where possible. Long term management of POS areas following implementation of the development will be the responsibility of CoW.

#### 3.4.3 Adjacent land use

Land adjacent to the project area is currently either unutilised or being prepared for residential development. Ultimately, the long term outlook is for urban communities to be developed along all adjoining boundaries of Amberton Estate, including:

- future development stages of Eglinton to the north
- future development stages of Eglinton to the east
- current and proposed stages of Shorehaven to the south.

### 3.5 Site assets

The project area is partially developed with some residences being constructed in the southeast of the site as part of initial development stages of Amberton Estate. The remaining undeveloped portion of the site to the west contains unutilised vegetated land. Ongoing development of the project area will significantly increase the critical life and property assets of the site, with over 2000 dwellings proposed. This will significantly intensify the number residents, visitors and built assets across the subject land.

### 3.6 Water and power supply

Reticulated water and underground power supply services will be provided throughout the project area through extension from surrounding areas of residential development.

### 3.7 Site access

Vehicular access to the project area is currently in the form of Cinnabar Drive, which navigates west off Marmion Avenue. A second access route is currently being constructed to link with Shorehaven to the south via Leeward Avenue, which ultimately links to Shorehaven Boulevard and back to Marmion Avenue. This will ensure that two different vehicular access routes are provided to the surrounding public road network for residents and visitors of Amberton Estate.

As Amberton Estate and adjoining residential developments progress, additional road access links will be provided to future stages of Eglinton to the north and east, as well as proposed stages of Shorehaven to the south. This will result in a future vehicular access network that will provide several links to the surrounding public road network, as indicated in Figure 1. The proposed vehicular access network will also provide buffers and access for emergency service vehicles between proposed residences and the surrounding vegetation extent, particularly adjacent to the conservation reserve.

## 4. Fire problem

### 4.1 Bush fire history, risk of ignition and suppression response capacity

The project area and adjacent land shows no evidence of recent bush fire occurrence. This is supported by the dominance of low shrubland vegetation and level of vegetation disturbance/clearing, as well as the relatively low level of visitor presence, which has resulted in a low risk of ignition to on-site vegetated areas. In addition, no fire scarring was observed during the site inspection and a review of Landgate (2014) indicates no recent bush fire occurrence in the area.

The risk of ignition increases at further inland locations where vegetation types and available fuel loads become more conducive to bush fire occurrence in association with the presence of Tuart and banksia woodland and forest. This is evident from a 2005 bush fire that occurred approximately 2.5 km northeast of the project area (Landgate 2014).

Based on the lack of bush fire history, ignition and occurrence of uncontrolled bush fires is considered to be uncommon throughout the project area and adjoining land. However, on development of the project area, the risk of ignition is expected to increase given the proposed increase in population, public access and urban development, particularly at the interface with vegetation contained within the northern conservation reserve. The expected increase in the risk of ignition will result in a subsequent increase in the overall bush fire risk to future assets of the development.

City of Wanneroo receives numerous bush fires per year ignited by a range of sources, usually associated with human presence, including:

- deliberately lit fires (e.g. suspected arson, torching of car bodies)
- accidental ignition (e.g. vehicle accidents, pole top fires, sparks from vehicle exhausts/machinery, agricultural and/or industrial work, incorrect disposal of cigarette butts, etc).

There are numerous emergency service resources located in City of Wanneroo that could provide a suppression response to the project area within 30 minutes if required, including local volunteer bush fire brigades stationed at Wanneroo, Quinns Rocks, Two Rocks and Wanneroo Fire Support.

### 4.2 Bush fire hazards

A bush fire hazard assessment aims to classify the bush fire hazard at both the strategic and local level, which leads to an assessment of the Bushfire Attack Level (BAL). A bush fire hazard assessment has been undertaken across the project area and adjacent land in accordance with procedures outlined in PFBFP Guidelines and *Australian Standard AS 3959–2009 Construction of Buildings in Bushfire-prone Areas* (AS 3959–2009).

#### 4.2.1 Classifying the bush fire hazard

##### *Fuel hazard assessment*

A comprehensive fuel hazard assessment of the project area and adjacent land was undertaken by Strategen during a site visit on 17 April 2014. The assessment was undertaken on the basis of a visual inspection of the following factors, cross-referenced with the Swan Coastal Plain Visual Fuel Load Guide (FESA 2012):

- vegetation type and structure
- vegetation condition and density
- fuel age
- scrub, litter and trash accumulation.

### *On-site fuel hazards*

Aside from existing cleared and developed areas in the southeast of the site, the project area is a combination of low shrubland and open heath (both of the Class C shrubland vegetation class) with numerous bare dune areas and informal access tracks. Development of ongoing stages at Amberton Estate will eventually clear the majority of on-site vegetation in preparation of a significant built and landscaped footprint across the site. Areas proposed for vegetation retention on site include the foreshore reserve to the west and conservation reserve to the north, with fuel hazards described as follows:

1. The foreshore reserve contains low shrubland vegetation, which is dominant throughout the coastal strip and consists of very low shrubs at less than 40 cm in height (Plate 1). *Melaleuca systema* and *Lomandra maritima* are the dominant species. Average available fuel loads were assessed to be less than 5 t/ha (tonnes per hectare) and this vegetation is considered to be low threat from a bush fire hazard perspective, particularly since the vegetation is broken up by numerous tracks and bare sand dune areas. Available fuel loads for this vegetation type are not expected to readily accumulate due to maritime effects, prevailing winds and salt drift.
2. The conservation reserve contains a combination of low shrubland (as described above, Plate 2) and open heath (Plate 3). Open heath contains a denser and taller continuation of shrubs (up to 2 m in height) compared to low shrubland, consisting mainly of *Acacia cyclops* and *Acacia rostellifera*. Average available fuel loads within open heath vegetation were assessed to be 5–8 t/ha.

The shrubland vegetation to be retained on site, particularly within the conservation reserve, will pose the majority of the bush fire risk to future assets of Amberton Estate.

### *Adjacent fuel hazards*

Vegetation to the south of the site consists of low shrubland (Plate 4), similar to that contained on site within the foreshore reserve. The vegetation is very low and sparse and completely devoid in areas of bare sand dunes and informal access tracks. Fuel hazards to the south are not expected to pose a significant bush fire threat to future assets of Amberton Estate, especially since the land is proposed to be cleared as part of future development stages of Shorehaven.

Vegetation to the north of the site is a combination of low shrubland and open heath, similar to that contained within the on-site foreshore and conservation reserves. Fuel hazards to the north outside of the conservation reserve are not expected to pose a significant bush fire threat to future assets of Amberton Estate, especially since the land is proposed to be cleared as part of future development stages of Eglinton.

Vegetation to the east of the site (opposite Marmion Avenue) consists of low shrubland, which is similar to the vegetation contained on site, and grades to low woodland with increasing distance to the east. The commencement of low woodland vegetation is located greater than 100 m from the site's eastern boundary and consists of banksias, Grass trees and Tuarts, which subsequently increases the available fuel load potential. Fuel hazards to the east are not expected to pose a significant bush fire threat to future assets of Amberton Estate given the hazard separation distance provided by Marmion Avenue (80 m plus adjoining verges and cleared/disturbed land) plus proposed clearing of the land as part of future development stages of Eglinton.





Plate 1: Low shrubland with bare sand dunes and access tracks within foreshore reserve



Plate 2: Low shrubland within conservation reserve





Plate 3: Open heath within conservation reserve

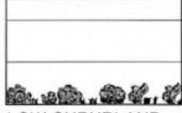

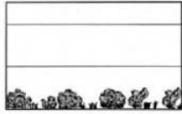



Plate 4: Low shrubland vegetation to the south proposed to be cleared as part of future stages of Shorehaven

### Vegetation class

An assessment of vegetation class within and adjacent to the project area has been undertaken in accordance with procedures outlined in PFBFP Guidelines (Table 2).

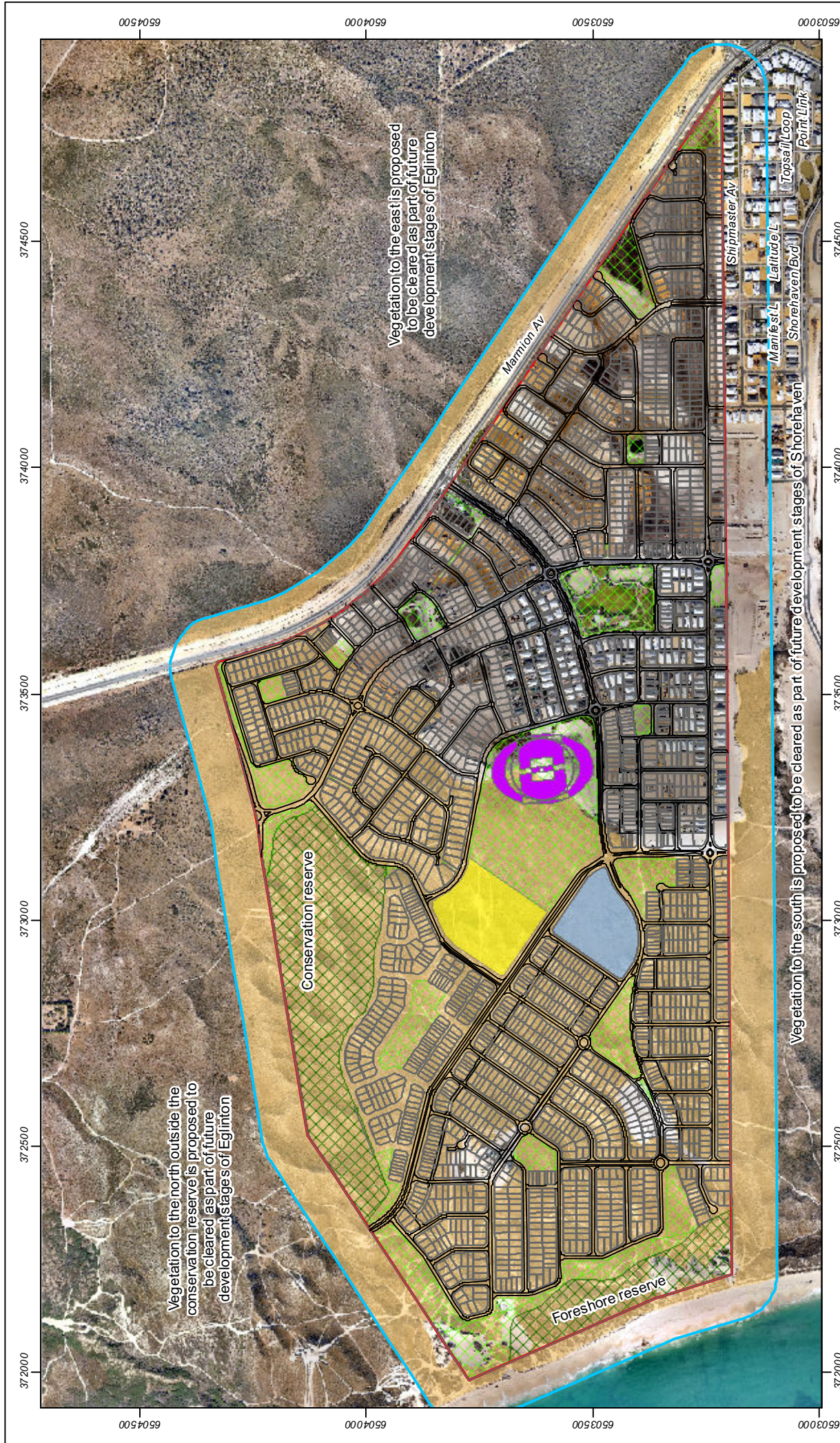
Table 2: Predominant vegetation class and type

Predominant vegetation	Vegetation class	Vegetation type	Figure (as per PFBFP Guidelines)	Description (as per PFBFP Guidelines)
On-site vegetation, including within the foreshore reserve and conservation reserve	Shrubland	Low shrubland	 <p>C LOW SHRUBLAND FIGURE 2.2-12</p>	Shrubs less than 2 m high; greater than 30% foliage cover; understoreys may contain grasses; Acacia and Casuarina often dominant in the arid and semi-arid zones
		Open heath	 <p>C OPEN HEATH FIGURE 2.2-11</p>	Found in wet areas and/or areas affected by poor soil fertility or shallow soils; shrubs 1–2 m high often comprising Banksia, Acacia, Hakea and Grevillea; wet heaths occur in sands adjoining dunes of the littoral (shore) zone; montane heaths occur on shallow or waterlogged soils
Adjacent vegetation extent to the north, south and east (proposed to be cleared and developed)	Shrubland	Low shrubland	 <p>C LOW SHRUBLAND FIGURE 2.2-12</p>	Shrubs less than 2 m high; greater than 30% foliage cover; understoreys may contain grasses; Acacia and Casuarina often dominant in the arid and semi-arid zones
		Open heath	 <p>C OPEN HEATH FIGURE 2.2-11</p>	Found in wet areas and/or areas affected by poor soil fertility or shallow soils; shrubs 1–2 m high often comprising Banksia, Acacia, Hakea and Grevillea; wet heaths occur in sands adjoining dunes of the littoral (shore) zone; montane heaths occur on shallow or waterlogged soils

### Location of bush fire hazards

The location of existing bush fire hazard areas is outlined in the vegetation class map (Figure 7). This map has been created using the abovementioned vegetation class descriptions.





**Figure 7: Vegetation class map**

**Legend**

Scale 1:11,500 at A4  
 0 50 100 150 200 250 m  
 Coordinate System: GDA 1994 MGA Zone 50  
 Note that positional errors may occur in some areas  
 Date: 2/09/2014  
 Author: JCRub  
 Source: Client 2014  
 Path: Q:\Consult\2014\STO14116\ArchMap\_documents\R001\Rev0\STO14116\_01\_R001\_Rev0\_F.007.mxd

- Project area boundary
- Existing roads
- Carriageway
- Lot boundaries
- NC
- Primary School
- Oval Layout
- POS areas
- Shrubland
- Vegetation class
- Foreshore and Conservation reserves



**STRATEGEN**

info@strategen.com.au www.strategen.com.au



### *Bush fire hazard levels*

Bush fire hazard levels of the predominant vegetation are displayed in the bush fire hazard assessment map (Figure 8). Classifying the bush fire hazard by assessing the predominant vegetation is a key to the initial determination of site suitability for development. This also leads to determination of the potential level of construction standard by the application of AS 3959–2009 for any proposed development located within 100 m of an assessed bush fire prone area (i.e. any area with a 'Moderate' or 'Extreme' bush fire hazard level).

The current bush fire hazard level across the developable area is 'Low', due to the presence of low shrubland vegetation. This hazard will be removed following clearing, earthworks and development of a significant built and landscaped footprint across the site and ongoing development stages of Amberton Estate.

The bush fire hazard level within the foreshore reserve is 'Low' due to the presence of low shrubland vegetation, which is considered low threat from a bush fire hazard perspective due to:

- the current low level of available fuels and lack of potential for fuel accumulation
- the non-continuous nature of the vegetation due to the presence of bare sand dunes and vegetation disturbance from informal access tracks
- the landscape design proposed throughout the foreshore reserve, which will create numerous low fuel landscaped and built areas (refer to Appendix 4).

The bush fire hazard level within the conservation reserve was assessed as:

- 'Low' in shrubland areas located on predominantly flat ground
- 'Moderate' in areas of shrubland vegetation on steep slopes due to the associated increase in risk from ember attack.

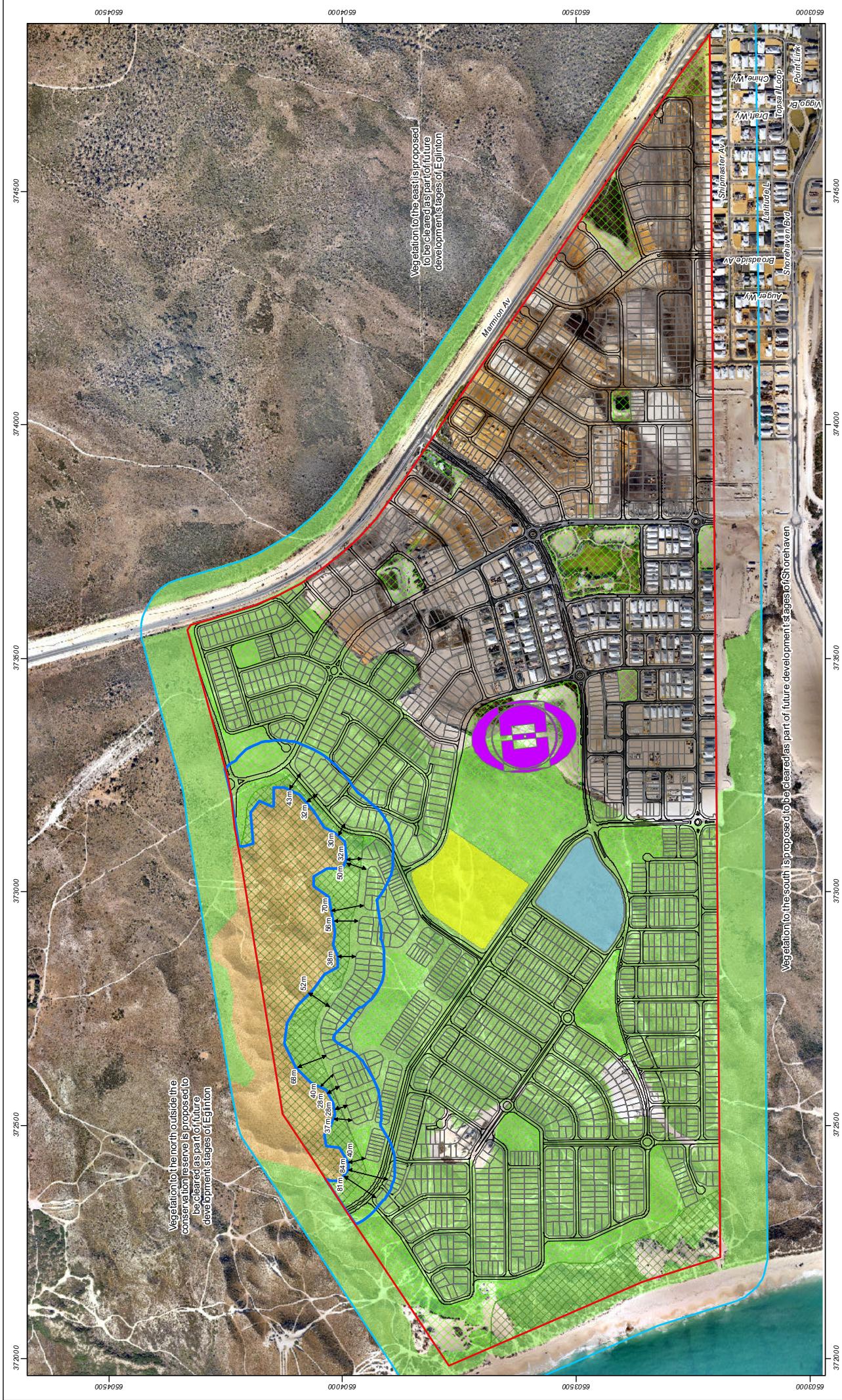
The bush fire hazard level to the south is 'Low' due to the presence of low shrubland vegetation. This hazard will be removed on development of future stages of Shorehaven.

The bush fire hazard level to the north outside the conservation reserve is 'Low' due to the occurrence of shrubland vegetation. These hazards will be removed on development of future stages of Eglinton to the north.

The bush fire hazard level to the east is 'Low' due to the occurrence of low shrubland vegetation. These hazards will be removed on development of future stages of Eglinton to the east.

According to AS 3959–2009 and PFBFP Guidelines, land with an assessed 'Moderate' or 'Extreme' bush fire hazard level is classified as bush fire prone land, which triggers implementation of AS 3959–2009 for any adjacent proposed development within 100 m, as depicted in Figure 8 by the 100 m wide BAL assessment area and associated distances assessed between proposed lots and 'Moderate' bush fire hazard areas.





**Figure 8: Bush fire hazard assessment map**



#### 4.2.2 Bush fire hazard performance criteria

The relationship between various bush fire hazard levels and development performance criteria is set out in Table 3. A proportion of proposed lots are situated within 100 m of vegetation with a 'Moderate' bush fire hazard rating, as depicted in Figure 8. Consequently, a comprehensive suite of bush fire risk treatment and mitigation measures, including implementation of AS 3959-2009, will need to be implemented to protect site assets from these hazards.

Compliance with performance criteria for a 'Moderate' bush fire hazard level will be achieved for the proposed development, focussing on the key areas of development location, vehicular access, water supply, siting of development and design of development. Performance criteria will be achieved through adoption of recommended acceptable solutions outlined in PFBFP Guidelines.

Table 3: Bush fire hazard levels and performance criteria

Bush fire hazard level	Bush fire protection performance criteria required
Low hazard	Development does not require special bush fire planning controls. Despite this, DFES strongly recommends that ember protection features be incorporated in design where practicable.
Moderate hazard	Performance criteria for: <ul style="list-style-type: none"> <li>• location (Element 1)</li> <li>• vehicular access (Element 2)</li> <li>• water (Element 3)</li> <li>• siting of development (Element 4)</li> <li>• design of development (Element 5).</li> </ul>
Extreme hazard	Development is to be avoided in areas with these hazard levels.

Source: WAPC et al. 2010

Compliance of the proposed development with bush fire protection performance criteria and associated acceptable solutions is documented in a completed compliance checklist (Appendix 1).

#### 4.2.3 Classifying the Bushfire Attack Level (BAL)

This procedure, as outlined in PFBFP Guidelines and AS 3959-2009, uses a combination of the state-adopted Fire Danger Index (FDI) rating, vegetation class, slope under classified vegetation and the distance maintained between proposed development areas and classified vegetation to specify the BAL. Based on the specified BAL, construction requirements for proposed buildings can then be assigned.

##### *BALs imposed by the northern conservation reserve*

'Moderate' bush fire hazards retained within the northern conservation reserve will pose a permanent bush fire risk to future assets of the project area. Therefore, future lots located within 100 m of the 'Moderate' hazard should be prioritised for bush fire protection measures and will be required to implement BAL 12.5 construction standards on the basis of the following Method 1 BAL calculation carried out in accordance with AS 3959-2009 (also refer to Table 4):

1. The adopted Fire Danger Index for WA is FDI 80.
2. The classified vegetation type is shrubland.
3. The slope under classified vegetation is up-slope from the proposed development area.
4. The minimum distance between future lots and 'Moderate' hazard areas is 28 m.

A Method 2 BAL calculation for the above also arrives at BAL 12.5, which reaffirms the need for building protection against potential ember attack as a minimum requirement for the affected lots.

Table 4: Determination of Bushfire Attack Level (BAL)

Vegetation class	Bushfire Attack Level (BAL)				
	BAL FZ	BAL 40	BAL 29	BAL 19	BAL 12.5
	Distance (m) of the site from the predominant vegetation class				
	All up-slopes and flat land (0 degrees)				
Shrubland	<7	7–<9	9–<13	13–<19	19–<100

Source: WAPC et al. 2010

***Remaining lots of Amberton Estate***

All proposed lots of Amberton Estate located further than 100 m from 'Moderate' bush fire hazard areas will not require heightened levels of construction standards, as per AS 3959–2009.

***Building Protection Zone (BPZ)***

All proposed lots of Amberton Estate with an assessed BAL rating (i.e. BAL 12.5 lots) will be required to implement a 20 m wide BPZ. The BPZ is to be taken from the edge of any proposed building and maintained at less than 2 t/ha on an annual basis to provide low fuel defensible space for the protection of critical life and property assets from adjacent bush fire hazards. Road reserves, paths, managed POS, building setbacks, lawn areas and managed gardens are suitable options for inclusion into the BPZ. Fuel management within the BPZ should target the understorey and prevent accumulation of trash, litter and scrub/grass fuels on the ground, but allow retention of individual overstorey trees and shrubs.

***Construction standards***

Relevant sections of AS 3959–2009 that outline construction standards for buildings in areas specified as BAL 12.5 are provided in Table 5. Construction standards for BAL 12.5 are fully explained in Appendix 3.

Table 5: Construction standards

Bushfire Attack Level (BAL)	Classified vegetation within 100 m of the site and heat flux exposure thresholds	Description of predicted bush fire attack and levels of exposure	Relevant section of AS 3959–2009
BAL 12.5	$\leq 12.5 \text{ kW/m}^2$	Ember attack	3 and 5

Source: WAPC et al. 2010

### 4.3 Summary of key bush fire issues

The following is a summary of key bush fire issues that have been considered as part of the FMP to inform development of specified bush fire risk treatment and mitigation measures:

- the project area and adjoining land has not been subject to recent bush fire occurrence
- the risk of ignition is currently low, but is expected to increase following the proposed increase in population, public access and urban development, particularly at the interface with the northern conservation reserve
- response times in the event that the site is threatened by uncontrolled bush fire is within 30 minutes from local volunteer bush fire brigades
- following development, Amberton Estate will represent a significant built and landscaped footprint, which will result in removal of on-site vegetation, except for that retained within the foreshore reserve to the west and the proposed conservation reserve to the north
- the foreshore reserve contains low shrubland vegetation considered to be low threat from a bush fire hazard perspective ('Low' bush fire hazard)
- the conservation reserve will pose a permanent bush fire risk to future assets of the development through retention of shrubland vegetation on steep slopes ('Moderate' bush fire hazard)
- adjoining land to the north, south and east contains shrubland vegetation ('Low' bush fire hazards) proposed to be cleared to permit ongoing development of the Shorehaven and Eglinton urban residential developments
- following earthworks and site levelling, 'Moderate' hazards within the conservation reserve will be situated up-slope from proposed Amberton Estate lots
- a proportion of proposed lots are situated within 100 m of 'Moderate' bush fire hazard areas, which triggers implementation of AS 3959–2009 for these lots
- to mitigate the bush fire risk posed by the northern conservation reserve, particularly with regards to potential ember attack, BAL 12.5 will need to be implemented for all proposed lots within 100 m of the 'Moderate' hazard extent
- all proposed lots assessed as BAL 12.5 will require implementation of a 20 m wide BPZ
- all remaining lots located further than 100 m from 'Moderate' bush fire hazards will not require application of AS 3959–2009 or increased building construction standards
- performance criteria and acceptable solutions will be achieved for a 'Moderate' bush fire hazard level, focussing on the key areas of development location, vehicular access, water supply, siting of development and design of development.

## 5. Bush fire risk treatment and mitigation

The following subsections outline how the inherent bush fire risk to future life and property will be mitigated to achieve a suitable and effective bush fire management outcome for Amberton Estate. This will be achieved by complying with performance criteria and associated acceptable solutions in accordance with PFBFP Guidelines. Where applicable, these measures are illustrated on an aerial image of the project area in Figure 9 to assist with implementation of the FMP.

### 5.1 Development location

#### 5.1.1 Location of residential lots

Strategic location, layout and management of future development at the planning stage can reduce future fire threat and risk to critical life and property assets.

All proposed lots of the Amberton Estate residential development will be contained within a significant built and landscaped footprint, where the majority of on-site vegetation is proposed to be cleared following earthworks and site levelling (Figure 9). A proportion of proposed lots on the periphery of the development to the north will be located within 100 m of 'Moderate' bush fire hazards retained within the proposed conservation reserve. These lots will require application of AS 3959–2009 and increased building construction standards, as assessed in Section 4.2.3 and discussed in Section 5.4.

The bulk of vegetation currently surrounding Amberton Estate will eventually be removed on development of surrounding residential communities in Shorehaven to the south and future stages of Eglinton development to the north and east. Ultimately, the long term outlook is for cleared and built urban communities to be developed along all adjoining boundaries of Amberton Estate (aside from the northern conservation reserve) (Figure 9).

Further to the above, this FMP makes provision for 100 m wide cleared buffers to be constructed on site adjacent to each development stage under construction, maintained annually at less than 2 t/ha to mitigate the bushfire risk from development staging.

The above measures will ensure the development is not located on land subject to either a 'Moderate' or 'Extreme' bush fire hazard level or require construction standards applicable to BAL 40 or BAL FZ. This meets performance criteria for development location (Element 1) by adopting acceptable solution A1.1.

#### 5.1.2 Public Open Space

On-site POS will generally consist of low fuel areas, such as managed parks, but may constitute some minor planting of vegetation species consistent with the current shrubland vegetation types present in the area. However, in small discrete patches such as drainage basins and dune rehabilitation areas, this vegetation is considered low threat from a bush fire hazard perspective and is not expected to pose a significant bush fire risk to future life and property assets of the site. In addition, all POS areas are proposed to be subject to landscape design with access paths and low fuel recreation areas implemented where possible, as is the case with the foreshore reserve (refer to Appendix 4).

All POS areas will need to be maintained at or less than 5 t/ha on an annual basis, which can be achieved through preventing the accumulation of understorey fuels via mechanical slashing, chemical spraying for weed management and manual removal of trash and litter fuels prior to the onset of the designated bush fire season (Figure 9). Long term management of POS areas following implementation of the development will be the responsibility of CoW.

### 5.1.3 Management of the conservation reserve

Management actions and associated responsibilities for the northern conservation reserve will be specified in a separate management plan, which may include requirements for internal firebreaks and public/emergency access.

## 5.2 Vehicular access

Vehicular access to the project area is currently in the form of Cinnabar Drive, which navigates west off Marmion Avenue (refer to Access Route 1 on Figure 9). A second access route is currently being constructed to link with Shorehaven to the south via Leeward Avenue, which ultimately links to Shorehaven Boulevard and back to Marmion Avenue (refer to Access Route 6 on Figure 9). This measure adopts acceptable solution A2.1 by ensuring all residents and visitors of the development are provided with at least two vehicular access routes connecting to the public road network at all times.

The Overall Estate Lot Layout Plan outlined in Figure 1 is proposed to be modified to ensure a through access road is provided for Stage 45 lots adjacent to the northern conservation reserve and the existing dead end is removed. The through road will be in the form of an 18 m wide road reserve, including a footpath along the northern verge, located along the full southern perimeter of the northern conservation reserve boundary. This will essentially provide through access between Access Route 3 and Access Route 2 and will form the majority of a BPZ along this interface (Figure 9). Streetscape trees, if planted along this road, will occur at minimum 10 m intervals along the southern road verge only.

Fencing will not be installed along the southern POS boundary of the conservation reserve to ensure emergency fire services can properly access the conservation reserve interface and provide efficient suppression should a bushfire occur. These measures will negate the requirement to construct a firebreak along the southern perimeter of the northern conservation reserve.

As Amberton Estate and adjoining residential developments progress, additional vehicular access links will be provided to future stages of Eglinton development to the north and east, as well as existing and proposed stages of Shorehaven to the south. This will result in a future vehicular access network that will provide several links to the surrounding public road network (Figure 9). The proposed vehicular access network will also provide buffers and access for emergency service vehicles between proposed residences and the surrounding vegetation extent, particularly adjacent to the conservation reserve.

All public roads and culs-de-sac will be constructed to specifications in accordance with Main Roads WA, CoW and DFES requirements, which align with acceptable solution A2.2 and A2.3. Acceptable solutions A2.4, A2.5, A2.6, A2.7, A2.8, A2.9 and A2.10 are not applicable in this instance.

The proposed vehicular access network is considered adequate for the purposes of bush fire protection and will ensure the development meets performance criteria for vehicular access (Element 2).

## 5.3 Water supply

Reticulated water supply services will be provided throughout the proposed development for each lot, extended from adjacent areas of residential development. A network of hydrants will also be provided along the internal road network at locations which meet relevant water supply authority and DFES requirements (Figure 9). These measures will ensure the development meets performance criteria for water supply (Element 3) by adopting acceptable solution A3.1.

## 5.4 Siting of development

When considering the overall bush fire management of the project area, protection should be provided to critical life and property assets (residents, visitors and built assets) as a minimum requirement. Low fuel buffers between fire hazard areas and critical assets, as well as application of AS 3959–2009, can be implemented to achieve this.



Shrubland vegetation subject to significant slopes within the northern conservation reserve ('Moderate' bush fire hazard) is considered the predominant bush fire risk to future assets of Amberton Estate.

Proposed lots located within 100 m of this hazard should be prioritised for bush fire protection through provision of low fuel defensible space in the form of a BPZ, as well as heightened levels of building construction standards through the application of AS 3959–2009. The BAL assessment undertaken in Section 4.2.3 achieves this through the following recommendations, as depicted in Figure 9:

1. Future lots located within 100 m of 'Moderate' bush fire hazard areas of the northern conservation reserve will be required to implement BAL 12.5 construction standards to mitigate the increased risk from ember attack associated with potential bush fire in this area.
2. All BAL 12.5 lots will require a 20 m wide BPZ through a combination of an 18 m wide road reserve and footpath, plus 2 m building setbacks. The BPZ is to be managed at less than 2 t/ha on an ongoing basis. The Overall Estate Lot Layout Plan outlined in Figure 1 will require the following modifications to reflect the above recommendations and maintain compliance with PFBFP Guidelines:
  - (a) provision of an 18 m wide road reserve along the full southern boundary of the northern conservation reserve (road realignment will be required, as discussed in Section 5.2)
  - (b) modify the lot layout to satisfy the above modification, in particular for Stages 43, 45 and 46.
3. All proposed lots of Amberton Estate located further than 100 m from 'Moderate' bush fire hazard areas will not require heightened levels of construction standards, as per AS 3959–2009.

The above measures will ensure the development meets performance criteria for siting of development (Element 4) by adopting acceptable solutions A4.1, A4.2, A4.3, A4.4 and A4.5, where applicable.

## 5.5 Design of development

The bush fire management concept provided in Figure 9 is expected to reduce the vulnerability of life and property assets from the effects of bush fire and greatly assist bush fire prevention and suppression operations. Given the proposed development is considered to comply with Element 4 Siting of development, there are no additional special design requirements.

## 5.6 Additional bush fire risk mitigation

The following measures will be implemented in addition to those outlined previously to provide a more thorough level of bush fire protection to residents, visitors and built assets of the subject land:

Annual fuel inspections: undertaken by CoW in accordance with the current City of Wanneroo annual firebreak notice (Appendix 5) under provisions of the *Bush Fires Act 1954*. Failure to comply with this FMP and the specified requirements of the current annual notice may result in the issuing of fines.

Landowner education and awareness: landowners should obtain a copy of local government and DFES bush fire information booklets that are currently available. In addition, attendance by landowners at annual DFES bush fire awareness briefings would be advantageous.

Section 70 Notification on Title: to be placed on all lots of the proposed development affected by a BAL rating to ensure prospective landowners are aware that an FMP exists over the site and that specified building requirements may apply.

## 5.7 Summary of bush fire risk mitigation and works program

A summary of the bush fire risk treatment and mitigation measures described in Section 5, as well as a works program, is provided in Table 6. These measures will be implemented to ensure ongoing protection of proposed life and property assets is achieved. Additional optional measures are also provided and can be adopted by residents to further mitigate their risk to life and property from uncontrolled bush fires. Timing and responsibilities are also defined to assist with implementation of each management measure.

Table 6: Summary of bush fire risk mitigation measures and works program

Bush fire risk mitigation	Recommended works	Mandatory	Optional	Timing	Responsibility
Development location	Undertake development in accordance with Figure 1 (to be updated where necessary to reflect final design) to ensure future life and property are contained within a significant built and landscaped footprint through vegetation clearance, earthworks and site levelling. This will ensure development does not occur on land subject to either a 'Moderate' or 'Extreme' bush fire hazard level or require construction standards applicable to BAL 40 or BAL FZ. Refer to FMP Section 5.1.1.	Yes	No	During implementation of the development	Developer
	Construct 100 m wide, on-site cleared buffers adjacent to each individual development stage to mitigate the bushfire risk from development staging. The cleared buffers will be maintained annually at less than 2 t/ha. Refer to FMP Section 5.1.1.	Yes	No	During implementation of the development	Developer
	Develop POS in accordance with approved landscape design plans and ensure all POS is maintained at less than 5 t/ha through annual management of understorey fuels. Refer to FMP Section 5.1.2.	Yes	No	Manage POS annually prior to commencement of the designated bush fire season	Developer during development, CoW thereafter
	Implement any bush fire management measures outlined in the management plan for the northern conservation reserve, such as firebreaks or access. Refer to FMP Section 5.1.3.	Yes	No	During implementation of the development where applicable	Developer
Vehicular access	Implement an internal road network providing all residents and visitors of the development with at least two vehicular access routes connecting to the public road network at all times. Refer to FMP Section 5.2.	Yes	No	During implementation of the development	Developer
	Construct a through access road in the form of an 18 m wide road reserve and footpath along the full southern perimeter of the northern conservation reserve. Refer to FMP Section 5.2.	Yes	No	During implementation of the development	Developer
	Prohibit fencing along the southern POS boundary of the conservation reserve. Refer to FMP Section 5.2.	Yes	No	During implementation of the development	Developer
	Streetscape trees, if planted along the above road, will occur at minimum 10 m intervals along the southern road verge only. Refer to FMP Section 5.2.	Yes	No	During implementation of the development	Developer
Water supply	Construct all public roads and culs-de-sac in accordance with Main Roads WA, CoW and DFES requirements. Refer to FMP Section 5.2.	Yes	No	During implementation of the development	Developer
	Provide a reticulated water supply through extension of the existing reticulated water supply from adjacent developed areas. Refer to FMP Section 5.3.	Yes	No	During implementation of the development	Developer
	Provide a network of hydrants along the internal road network at locations which meet relevant water supply authority and DFES requirements. Refer to FMP Section 5.3.	Yes	No	During implementation of the development	Developer
Siting of development	Apply BAL 12.5 building construction standards for all proposed lots located within 100 m of 'Moderate' bush fire hazard areas of the northern conservation reserve, as per Figure 9. Refer to FMP Section 5.4.	Yes	No	During building construction	Developer, prospective landowners, builder

Bush fire risk mitigation	Recommended works	Mandatory	Optional	Timing	Responsibility
Bush fire risk mitigation	Create a 20 m wide BPZ adjacent to BAL 12.5 lots through a combination of an 18 m wide road reserve and footpath, plus 2 m building setbacks, as per Figure 9. The BPZ is to be managed at less than 2 t/ha on an ongoing basis. Refer to FMP Section 5.4.	Yes	No	During building construction and annual maintenance thereafter	Developer during development, CoW and prospective landowners thereafter (i.e. with regards to maintenance of the road reserve and building setbacks respectively)
	Modify Figure 1 to reflect the following: <ul style="list-style-type: none"> <li>provision of an 18 m wide road reserve along the full southern boundary of the northern conservation reserve</li> <li>realign the road accordingly to achieve the above</li> <li>modify the lot layout to satisfy the above modifications, in particular for Stages 43, 45 and 46.</li> </ul> Refer to FMP Section 5.4.	Yes	No	Prior to subdivision application	Developer
	Comply with acceptable solutions for A4.1, A4.2, A4.3, A4.4 and A4.5 where applicable. Refer to FMP Section 5.5.	Yes	No	During implementation of the development	Developer
	Comply with the current City of Wanneroo annual firebreak notice. Refer to Appendix 5. Refer to FMP Section 5.6.	Yes	No	Annually prior to the onset of the designated bush fire season	Developer and prospective landowners
	Undertake an inspection of fuel hazards across proposed lots to assess compliance with the FMP and City of Wanneroo annual firebreak notice. Refer to FMP Section 5.6.	Yes	No	Annually prior to the onset of the designated bush fire season	CoW
	Issue work orders or fines where compliance with the <i>Bush Fires Act 1954</i> , FMP or City of Wanneroo annual firebreak notice has been compromised. Refer to FMP Section 5.6.	Yes	No	Annually prior to the onset of the designated bush fire season	CoW
	Obtain bush fire information booklets and attend annual DFES bush fire awareness briefings. Refer to FMP Section 5.6.	No	Yes	Annually	Prospective landowners
	Place a Section 70 Notification on all lots of the proposed development affected by a BAL rating to ensure prospective landowners are aware that an FMP exists over the site and that specified building requirements may apply. Refer to FMP Section 5.6.	Yes	No	On creation of Titles	Developer
	Restrict the installation of roof-top evaporative air-conditioners due to the associated increase in vulnerability to ember attack.	No	Yes	During implementation of the development	Developer, builder, prospective landowners
	Comply with the DFES/CoW-determined burning periods. Refer to Appendix 5.	Yes	No	As specified by DFES/CoW	Developer, prospective landowners
Design of development					
Additional bush fire risk mitigation					
Optional building measures					
Restricted and prohibited burning times					

## **6. Implementation of the Fire Management Plan**

### **6.1 Implementation of bush fire risk treatment and mitigation**

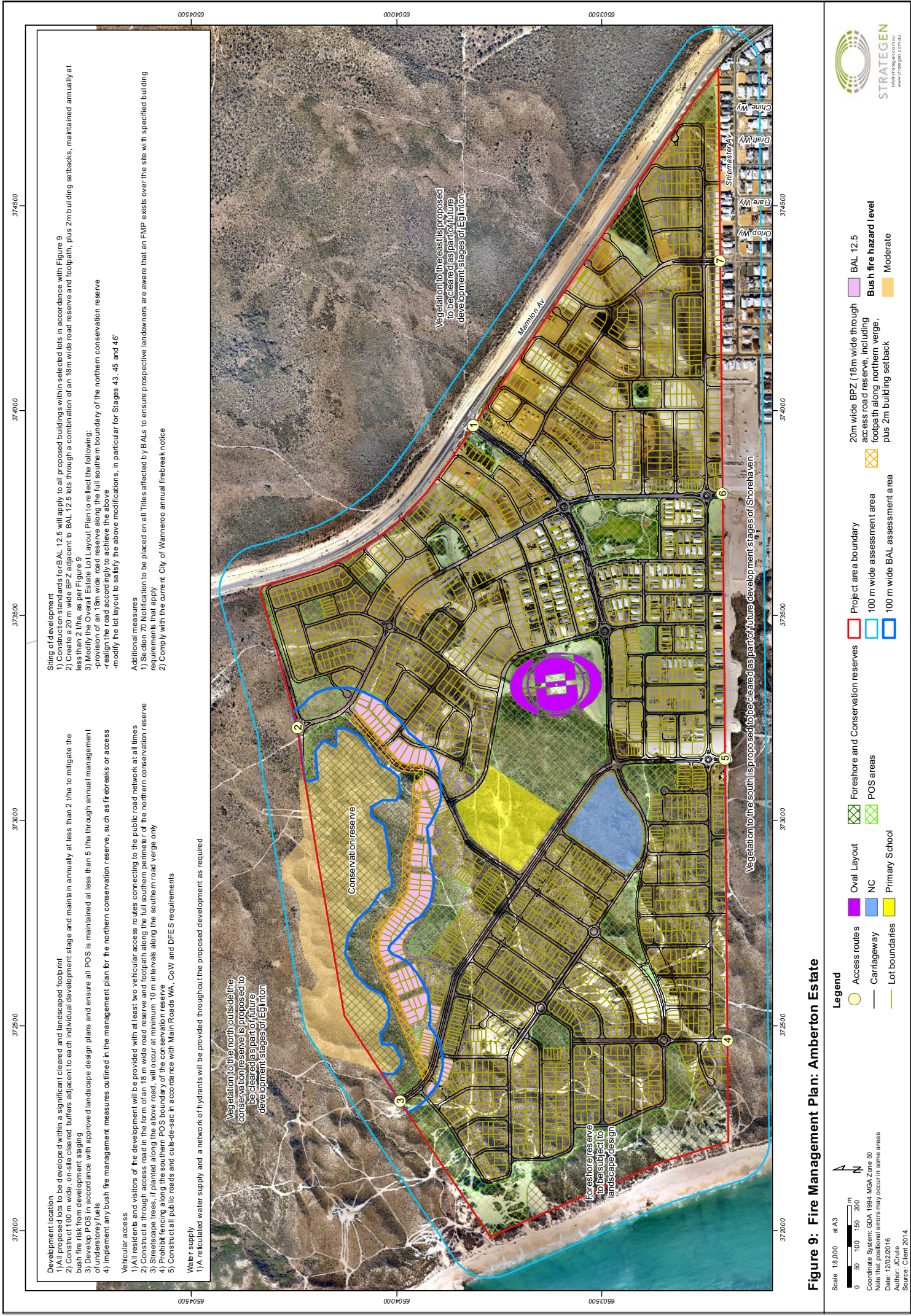
The works program provided in Table 6 provides clear direction for the implementation of all works associated with this FMP, including appropriate timing and responsibilities. In addition, the full range of bush fire risk treatment and mitigation measures, as well as location of implementation as specified in this FMP, is provided in Figure 9. The plan has been overlain on an aerial image of the project area to assist with implementation.

### **6.2 Assessment of bush fire risk treatment and mitigation measures**

Implementation of the bush fire risk treatment and mitigation measures outlined in this FMP will ensure that should a bush fire occur within or adjacent to Amberton Estate, fire intensity on-site will be minimised and life and property assets are expected to be protected. In addition, a fire occurring on the site is highly likely to be readily contained within 30 minutes, which is the expected emergency response time provided by local bush fire brigades.

The cost of undertaking the various tasks and initiatives outlined in the FMP will provide significant cost benefit to the developer and landowners when compared with the possible loss of life, infrastructure and environmental values of the site.







### 6.3 Legislative requirements, specifications and standards

The legislative requirements, specifications and standards applicable to implementation of this FMP are referenced in Section 7 and Appendix 6 and pertain to the following:

- *Bush Fires Act 1954*
- *Planning and Development Act 2005*
- *Environment Protection and Biodiversity Conservation Act 1999*
- *Environmental Protection Act 1986*
- *Wildlife Conservation Act 1950*
- Building Code of Australia
- Planning for Bush Fire Protection Guidelines (Edition 2)
- Australian Standard AS 3959–2009 Construction of Buildings in Bushfire Prone Areas
- City of Wanneroo annual firebreak notice.

## 7. References

- Bureau of Meteorology (BoM) 2014, *Climate statistics for Australian locations: Monthly climate statistics for Gingin Aero*, [Online], Commonwealth of Australia, available from: [http://www.bom.gov.au/climate/averages/tables/cw\\_009178.shtml](http://www.bom.gov.au/climate/averages/tables/cw_009178.shtml), [3/06/2014].
- Commonwealth Science and Industrial Research Organisation (CSIRO) 1999, *Fire Danger and Fire Spread Calculator*, Commonwealth Science and Industrial Research Organisation, Perth.
- Department of Planning and Western Australian Planning Commission (DoP & WAPC) 2014a, *Draft State Planning Policy 3.7 Planning for Bushfire Risk Management*, Western Australian Planning Commission, Perth.
- Department of Planning and Western Australian Planning Commission (DoP & WAPC) 2014b, *Draft Planning for Bushfire Risk Management Guidelines*, Western Australian Planning Commission, Perth.
- Emerge 2014, *Amberton Foreshore Preliminary Landscape Concept (Masterplan Rev H)*, plan prepared for Stockland, June 2014.
- Fire and Emergency Services Authority (FESA) 2012, *Visual Fuel Load Guide for the scrub vegetation of the Swan Coastal Plain and Darling Scarp including Geraldton Sandplains & Leeuwin Ridge Regions of Western Australia*, Bush Fire and Environmental Protection Branch, Fire and Emergency Services Authority, Perth.
- Hedde EM, Loneragan OW & Havel JJ 1980, *Darling System, Vegetation Complexes*, Forest Department, Perth.
- Landgate 2014, *Firewatch*, [Online], Government of Western Australia, available from: [http://firewatch.landgate.wa.gov.au/landgate\\_firewatch\\_public.asp](http://firewatch.landgate.wa.gov.au/landgate_firewatch_public.asp), [25/07/2014].
- McCaw L and Hanstrum B 2003, 'Fire environment of Mediterranean south-west Western Australia', in *Fire in Ecosystems of South-West Western Australia: Impacts and Management*, eds I Abbott & ND Burrows, Backhuys Publishers, Leiden, Netherlands, pp. 171–188.
- McKenzie NL, May JE and McKenna S 2003, *Bioregional Summary of the 2002 Biodiversity Audit of Western Australia*, Department of Conservation and Land Management, Perth.
- PGV Environmental 2013, *Vegetation Associations and Condition*, plan prepared for Stockland, November 2013.
- Smith R 2003, *Rural Urban Bush Fire Threat Analysis (RUBTA)*, Fire and Emergency Services Authority of Western Australia, Perth.
- Standards Australia (SA) 2009, *Australian Standard AS 3959–2009 Construction of Buildings in Bushfire-Prone Areas*, Standards Australia, Sydney.
- Standards Australia & Standards New Zealand (SA & SNZ) 2009, *Australian Standard/New Zealand Standard AS/NZS ISO 31000:2009 Risk management – Principles and guidelines*, Standards Australia/Standards New Zealand, Sydney/Wellington.
- Western Australian Planning Commission, Department of Planning and Fire and Emergency Services Authority (WAPC et al.) 2010, *Planning for Bush Fire Protection Guidelines (Edition 2)*, Western Australian Planning Commission and Fire and Emergency Services Authority, Perth.





**Appendix 1**  
**Fire Management Plan compliance**  
**checklist**



Compliance checklist for performance criteria and acceptable solutions

Element	Acceptable solution	Compliance	Yes/No	Explanation (if no)
1. Location	A1.1 Development location	Does the proposal comply with performance criteria P1 by applying acceptable solution A1.1?	Yes	
2. Vehicular access	A2.1 Two access routes	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.1?	Yes	
	A2.2 Public roads	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.2?	Yes	
	A2.3 Cul-de-sacs	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.3?	Yes	
	A2.4 Battle axes	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.4?	N/A	
	A2.5 Private driveways	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.5?	N/A	
	A2.6 Emergency access ways	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.6?	N/A	
	A2.7 Fire service access routes	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.7?	N/A	
	A2.8 Gates	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.8?	N/A	
	A2.9 Firebreak widths	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.9?	N/A	
	A2.10 Signs	Does the proposal comply with performance criteria P2 by applying acceptable solution A2.10?	N/A	
3. Water	A3.1 Reticulated areas	Does the proposal comply with performance criteria P3 by applying acceptable solution A3.1?	Yes	
	A3.2 Non-reticulated areas (a)	Does the proposal comply with performance criteria P3 by applying acceptable solution A3.2?	N/A	
	A3.3 Non-reticulated areas (b)	Does the proposal comply with performance criteria P3 by applying acceptable solution A3.3?	N/A	
4. Siting of development	A4.1 Hazard separation – moderate to extreme bush fire hazard level	Does the proposal comply with performance criteria P4 by applying acceptable solution A4.1?	Yes	
	A4.2 Hazard separation – low bush fire hazard level	Does the proposal comply with performance criteria P4 by applying acceptable solution A4.2?	N/A	
	A4.3 Building protection zone	Does the proposal comply with performance criteria P4 by applying acceptable solution A4.3?	Yes	
	A4.4 Hazard separation zone	Does the proposal comply with performance criteria P4 by applying acceptable solution A4.4?	N/A	
	A4.5 Reduction in bush fire attack level due to shielding	Does the proposal comply with performance criteria P4 by applying acceptable solution A4.5?	N/A	
5. Design of development	A5.1 Compliant development	Does the proposal comply with performance criteria P5 by applying acceptable solution A5.1?	Yes	

Element	Acceptable solution	Compliance	Yes/No	Explanation (if no)
	A5.2 Non-compliant development	Does the proposal comply with performance criteria P5 by applying acceptable solution A5.2?	N/A	

Note: Performance criteria and acceptable solutions are in accordance with *Planning for Bush Fire Protection Guidelines (Edition 2)* (WAPC et al. 2010).

### **Applicant Declaration**

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

Full name: Roger Banks

Applicant signature:



Date: 12/02/2016



## Appendix 2

January wind profiles for Gingin Aero  
(BoM 2014)



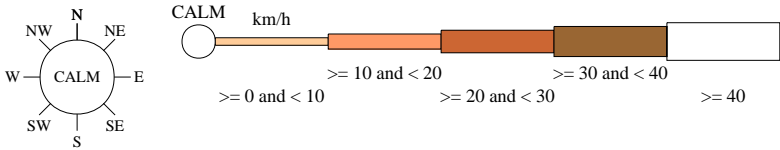
Rose of Wind direction versus Wind speed in km/h (01 May 1996 to 30 Sep 2010)

Custom times selected, refer to attached note for details

GINGIN AERO

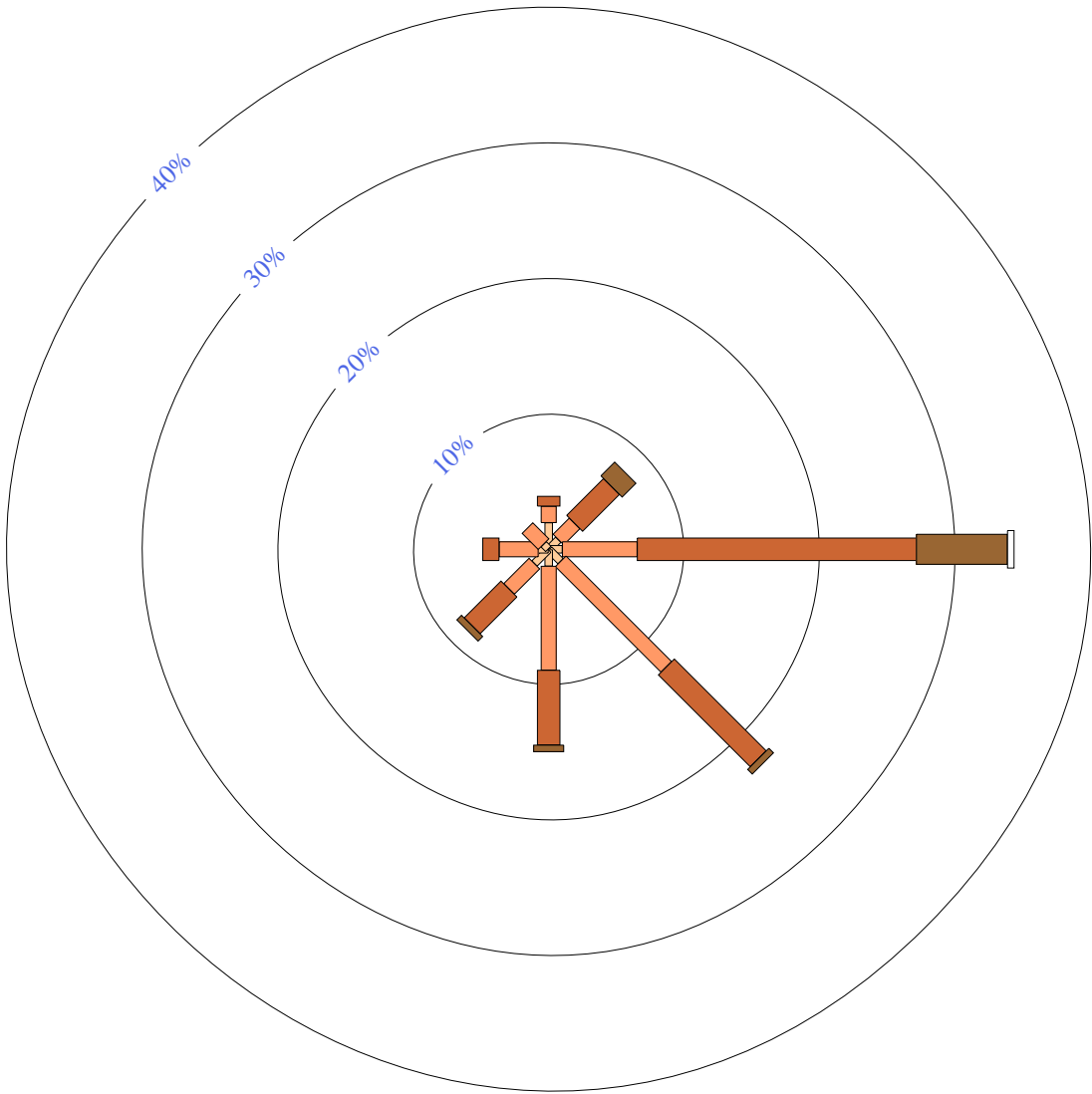
Site No: 009178 • Opened Jan 1968 • Still Open • Latitude: -31.4628° • Longitude: 115.8642° • Elevation 73m

An asterisk (\*) indicates that calm is less than 0.5%.  
Other important info about this analysis is available in the accompanying notes.



9 am Jan  
411 Total Observations

Calm \*



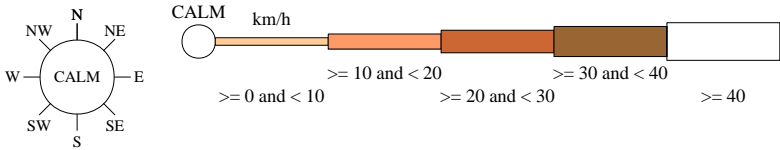
Rose of Wind direction versus Wind speed in km/h (01 May 1996 to 30 Sep 2010)

Custom times selected, refer to attached note for details

GINGIN AERO

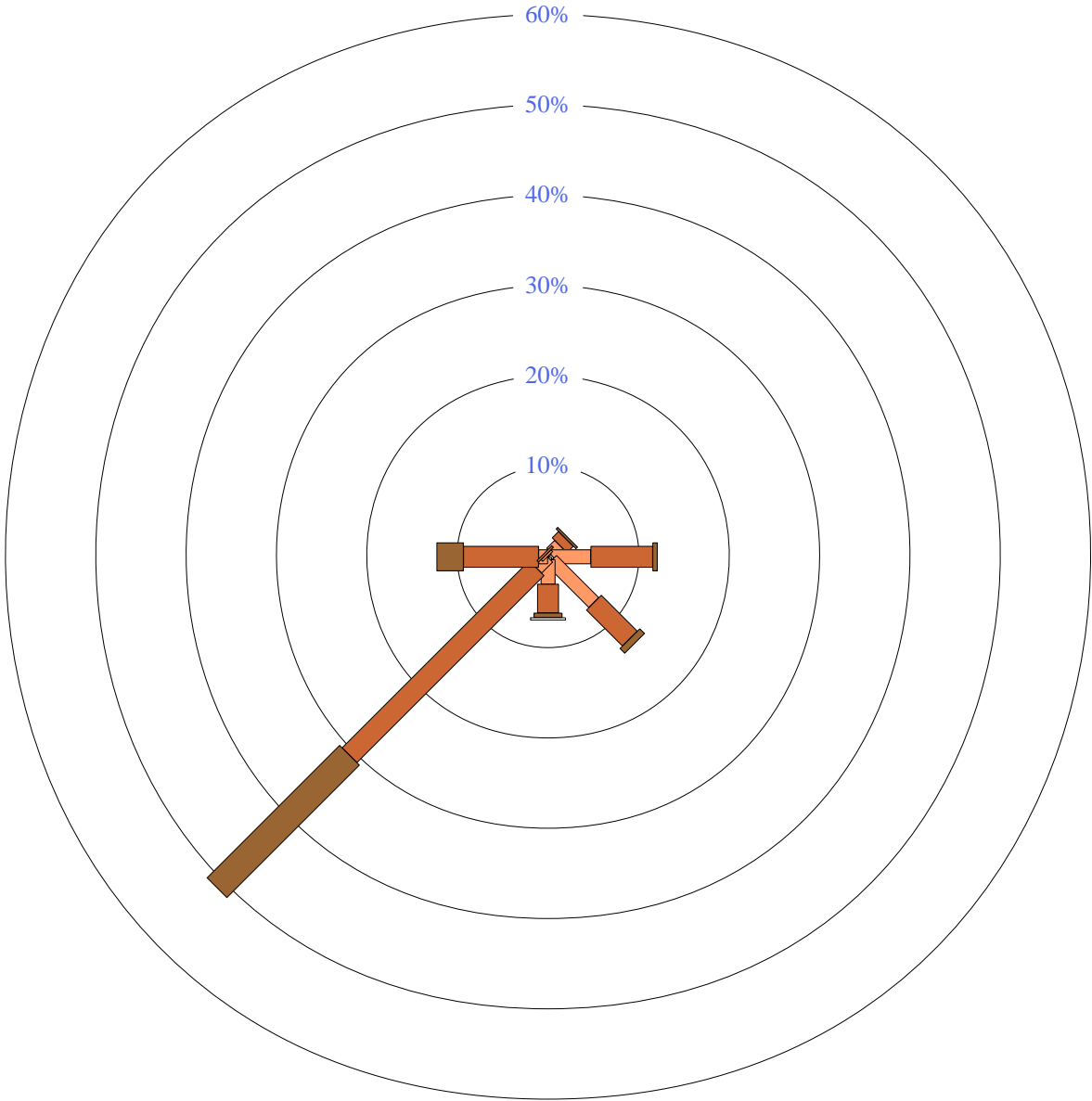
Site No: 009178 • Opened Jan 1968 • Still Open • Latitude: -31.4628° • Longitude: 115.8642° • Elevation 73m

An asterisk (\*) indicates that calm is less than 0.5%.  
Other important info about this analysis is available in the accompanying notes.



3 pm Jan  
410 Total Observations

Calm \*





## **Appendix 3**

**Construction standards for BAL 12.5**

**as per AS 3959–2009**



## **SECTION 5 CONSTRUCTION FOR BUSHFIRE ATTACK LEVEL 12.5 (BAL — 12.5)**

### **5.1 GENERAL**

A building assessed in Section 2 as being BAL—12.5 shall comply with Section 3 and Clauses 5.2 to 5.8.

NOTE: There are a number of Standards that specify requirements for construction; however, where this Standard does not provide construction requirements for a particular element, the other Standards apply.

Any element of construction or system that satisfies the test criteria of AS 1530.8.1 may be used in lieu of the applicable requirements contained in Clauses 5.2 to 5.8 (see Clause 3.8).

NOTE: BAL—12.5 is primarily concerned with protection from ember attack and radiant heat up to and including  $12.5 \text{ kW/m}^2$  where the site is less than 100 m from the source of bushfire attack.

### **5.2 SUBFLOOR SUPPORTS**

This Standard does not provide construction requirements for subfloor support posts, columns, stumps, piers and poles.

NOTE: The exclusion of requirements for subfloor supports applies to the principal building only and not to verandas, decks, steps, ramps and landings (see Clause 5.7).

***C5.2** Ideally, storage of combustible materials beneath a floor at this BAL would not occur and on this assumption, there is no requirement to enclose the subfloor space or to protect flooring materials from bushfire attack. However, should combustible materials be stored, it is recommended the area be protected as materials stored in the subfloor space may be ignited by embers and cause an impact to the building.*

### **5.3 FLOORS**

#### **5.3.1 Concrete slabs on ground**

This Standard does not provide construction requirements for concrete slabs on the ground.

#### **5.3.2 Elevated floors**

This Standard does not provide construction requirements for elevated floors, including bearers, joists and flooring.

### **5.4 EXTERNAL WALLS**

#### **5.4.1 Walls**

That part of an external wall surface that is less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings having an angle less



than 18 degrees to the horizontal and extending more than 110 mm in width from the wall (see Figure D3, Appendix D) shall be of—

- (a) non-combustible material; or
- (b) fibre-cement external cladding, a minimum of 6 mm in thickness; or
- (c) bushfire-resisting timber (see Appendix F); or
- (d) a timber species as specified in Paragraph E1 and listed in Table E1, Appendix E; or
- (e) a combination of any of Items (a), (b), (c) or (d) above.

There are no requirements for external wall surfaces 400 mm or more from the ground or for external wall surfaces 400 mm or more above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the wall (see Figure D3, Appendix D).

#### **5.4.2 Joints**

All joints in the external surface material of walls shall be covered, sealed, overlapped, backed or butt-jointed to prevent gaps greater than 3 mm.

Alternatively, sarking-type material may be applied over the outer face of the frame prior to fixing any external cladding.

#### **5.4.3 Vents and weepholes**

Vents and weepholes in external walls shall be screened with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium, except where the vents and weepholes are less than 3 mm (see Clause 3.6), or are located in an external wall of a subfloor space.

### **5.5 EXTERNAL GLAZED ELEMENTS AND ASSEMBLIES AND EXTERNAL DOORS**

#### **5.5.1 Bushfire shutters**

Where fitted, bushfire shutters shall comply with Clause 3.7 and be made from—

- (a) non-combustible material; or
- (b) a timber species as specified in Paragraph E1 and listed in Table E1, Appendix E; or
- (c) bushfire-resisting timber (see Appendix F); or
- (d) a combination of any of Items (a), (b) or (c) above.

#### **5.5.2 Windows**

Window assemblies shall comply with one of the following:

- (a) They shall be completely protected by a bushfire shutter that complies with Clause 5.5.1.

or

(b) They shall be completely protected externally by screens with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

or

(c) They shall comply with the following:

(i) For window assemblies less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the window frame (see Figure D3, Appendix D), window frames and window joinery shall be made from one of the following:

(A) Bushfire-resisting timber (see Appendix F).

or

(B) A timber species specified in Paragraph E2 and listed in Table E2, Appendix E.

or

(C) Metal.

Or

(D) Metal-reinforced PVC-U. The reinforcing members shall be made from aluminium, stainless steel, or corrosion-resistant steel and the frame and sash shall satisfy the design load, performance and structural strength of the member.

(ii) Externally fitted hardware that supports the sash in its functions of opening and closing shall be metal.

(iii) Where glazing is less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the window frame (see Figure D3, Appendix D), the glazing shall be Grade A safety glass minimum 4 mm, or glass blocks with no restriction on glazing methods.

NOTE: Where double glazed units are used the above requirements apply to the external face of the window assembly only.

(iv) Where glazing is other than that specified in Item (iii) above, annealed glass may be used.

(v) The openable portions of windows shall be screened with mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

### **5.5.3 Doors—Side-hung external doors (including French doors, panel fold and bi-fold doors)**

Side-hung external doors, including French doors, panel fold and bi-fold doors, shall comply with one of the following:

(a) They shall be protected by a bushfire shutter that complies with Clause 5.5.1.

or

(b) They shall be completely protected externally by screens with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

or

(c) They shall comply with the following:

(i) Doors shall be—

(A) non-combustible; or

(B) a solid timber door, having a minimum thickness of 35 mm for the first 400 mm above the threshold; or

(C) a door, including a hollow core door, with a non-combustible kickplate on the outside for the first 400 mm above the threshold; or

(D) a fully framed glazed door, where the framing is made from materials required for bushfire shutters (see Clause 5.5.1), or from a timber species specified in Paragraph E2 and listed in Table E2, Appendix E.

(ii) Where doors incorporate glazing, the glazing shall comply with the glazing requirements for windows.

(iii) Doors shall be tight-fitting to the doorframe and to an abutting door, if applicable.

(iv) Where any part of the door assembly is less than 400 mm from the ground or less than 400 mm above decks, carport roofs, awnings and similar elements or fittings having an angle less than 18 degrees to the horizontal and extending more than 110 mm in width from the door (see Figure D3, Appendix D), that part of the door assembly shall be made from one of the following:

(A) Bushfire-resisting timber (see Appendix F).

or

(B) A timber species specified in Paragraph E2 and listed in Table E2, Appendix E.

or

(C) Metal.

or

(D) Metal-reinforced PVC-U. The reinforcing members shall be made from aluminium, stainless steel, or corrosion-resistant steel and the door assembly shall satisfy the design load, performance and structural strength of the member.

(v) Weather strips, draught excluders or draught seals shall be installed at the base of side-hung external doors.

#### **5.5.4 Doors—Sliding doors**

Sliding doors shall comply with one of the following:

(a) They shall be protected by a bushfire shutter that complies with Clause 5.5.1.

or

(b) They shall be completely protected externally by screens with a mesh with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

or

(c) They shall comply with the following:

(i) Any glazing incorporated in sliding doors shall be Grade A safety glass complying with AS 1288.

(ii) There is no requirement to screen the openable part of the sliding door. However, if screened, the screens shall be a mesh or perforated sheet made of corrosion-resistant steel, bronze or aluminium.

NOTE: The construction of manufactured sliding doors should prevent the entry of embers when the door is closed. There is no requirement to provide screens to the openable part of these doors as it is assumed that a sliding door will be closed if occupants are not present or during a bushfire event. Screens of materials other than those specified may not resist ember attack.

(iii) Sliding doors shall be tight-fitting in the frames.

#### **5.5.5 Doors—Vehicle access doors (garage doors)**

The following apply to vehicle access doors:

(a) The lower portion of a vehicle access door that is within 400 mm of the ground when the door is closed (see Figure D4, Appendix D) shall be made from—

(i) non-combustible material; or

(ii) bushfire-resisting timber (see Appendix F); or

(iii) fibre-cement sheet, a minimum of 6 mm in thickness; or

(iv) a timber species specified in Paragraph E1 and listed in Table E1, Appendix E; or

(v) a combination of any of Items (i), (ii), (iii) or (iv) above.

(b) Panel lift, tilt doors or side-hung doors shall be fitted with suitable weather strips, draught excluders, draught seals or guide tracks, as appropriate to the door type, with a maximum gap no greater than 3 mm.

(c) Roller doors shall have guide tracks with a maximum gap no greater than 3 mm and shall be fitted with a nylon brush that is in contact with the door (see Figure D4, Appendix D).

(d) Vehicle access doors shall not include ventilation slots.

#### **5.6 ROOFS (INCLUDING VERANDA AND ATTACHED CARPORT ROOFS, PENETRATIONS, EAVES, FASCIAS, GABLES, GUTTERS AND DOWNPIPES)**



### **5.6.1 General**

The following apply to all types of roofs and roofing systems:

- (a) Roof tiles, roof sheets and roof-covering accessories shall be non-combustible.
- (b) The roof/wall junction shall be sealed, to prevent openings greater than 3 mm, either by the use of fascia and eaves linings or by sealing between the top of the wall and the underside of the roof and between the rafters at the line of the wall.
- (c) Roof ventilation openings, such as gable and roof vents, shall be fitted with ember guards made of non-combustible material or a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

### **5.6.2 Tiled roofs**

Tiled roofs shall be fully sarked. The sarking shall—

- (a) have a flammability index of not more than 5;
- (b) be located directly below the roof battens;
- (c) cover the entire roof area including the ridge; and
- (d) be installed so that there are no gaps that would allow the entry of embers where the sarking meets fascias, gutters, valleys and the like.

### **5.6.3 Sheet roofs**

Sheet roofs shall—

- (a) be fully sarked in accordance with Clause 5.6.2, except that foil-backed insulation blankets may be installed over the battens;

or

- (b) have any gaps greater than 3 mm, under corrugations or ribs of sheet roofing and between roof components, sealed at the fascia or wall line and at valleys, hips and ridges by—

- (i) a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium; or
- (ii) mineral wool; or
- (iii) other non-combustible material; or
- (iv) a combination of any of Items (i), (ii) or (iii) above.

### **5.6.4 Veranda, carport and awning roofs**

The following apply to veranda, carport and awning roofs:

- (a) A veranda, carport or awning roof forming part of the main roof space [see Figure D1(a), Appendix D] shall meet all the requirements for the main roof, as specified in Clauses 5.6.1, 5.6.2, 5.6.3, 5.6.5 and 5.6.6.

(b) A veranda, carport or awning roof separated from the main roof space by an external wall [see Figures D1(b) and D1(c), Appendix D] complying with Clause 5.4 shall have a non-combustible roof covering.

NOTE: There is no requirement to line the underside of a veranda, carport or awning roof that is separated from the main roof space.

#### **5.6.5 Roof penetrations**

The following apply to roof penetrations:

(a) Roof penetrations, including roof lights, roof ventilators, roof-mounted evaporative cooling units, aerials, vent pipes and supports for solar collectors, shall be adequately sealed at the roof to prevent gaps greater than 3 mm. The material used to seal the penetration shall be non-combustible.

(b) Openings in vented roof lights, roof ventilators or vent pipes shall be fitted with ember guards made from a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

(c) All overhead glazing shall be Grade A laminated safety glass complying with AS 1288.

(d) Glazed elements in roof lights and skylights may be of polymer provided a Grade A safety glass diffuser, complying with AS 1288, is installed under the glazing. Where glazing is an insulating glazing unit (IGU), Grade A toughened safety glass, minimum 4 mm, shall be used in the outer pane of the IGU.

(e) Flashing elements of tubular skylights may be of a fire-retardant material, provided the roof integrity is maintained by an under-flashing of a material having a flammability index no greater than 5.

(f) Evaporative cooling units shall be fitted with butterfly closers at or near the ceiling level or, the unit shall be fitted with non-combustible covers with a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

(g) Vent pipes made from PVC are permitted.

#### **5.6.6 Eaves linings, fascias and gables**

The following apply to eaves linings, fascias and gables:

(a) Gables shall comply with Clause 5.4.

(b) Eaves penetrations shall be protected the same as for roof penetrations, as specified in Clause 5.6.5.

(c) Eaves ventilation openings greater than 3 mm shall be fitted with ember guards made of non-combustible material or a mesh or perforated sheet with a maximum aperture of 2 mm, made of corrosion-resistant steel, bronze or aluminium.

Joints in eaves linings, fascias and gables may be sealed with plastic joining strips or timber storm moulds.

This Standard does not provide construction requirements for fascias, bargeboards and eaves linings.

#### **5.6.7 Gutters and downpipes**

This Standard does not provide material requirements for—

- (a) gutters, with the exception of box gutters; and
- (b) downpipes.

If installed, gutter and valley leaf guards shall be non-combustible.

Box gutters shall be non-combustible and flashed at the junction with the roof with non-combustible material.

### **5.7 VERANDAS, DECKS, STEPS, RAMPS AND LANDINGS**

#### **5.7.1 General**

Decking shall be either spaced or continuous (i.e., without spacing).

There is no requirement to enclose the subfloor spaces of verandas, decks, steps, ramps or landings.

***C5.7.1** Spaced decking is nominally spaced at 3 mm (in accordance with standard industry practice); however, due to the nature of timber decking with seasonal changes in moisture content, that spacing may range from 0–5 mm during service. The preferred dimension for gaps is 3 mm (which is in line with other ‘permissible gaps’) in other parts of this Standard. It should be noted that recent research studies have shown that gaps at 5 mm spacing afford opportunity for embers to become lodged in between timbers, which may contribute to a fire. Larger gap spacings of 10 mm may preclude this from happening but such a spacing regime may not be practical for a timber deck.*

#### **5.7.2 Enclosed subfloor spaces of verandas, decks, steps, ramps and landings**

##### **5.7.2.1 Materials to enclose a subfloor space**

This Standard does not provide construction requirements for the materials used to enclose a subfloor space except where those materials are less than 400 mm from the ground.

Where the materials used to enclose a subfloor space are less than 400 mm from the ground, they shall comply with Clause 5.4.

##### **5.7.2.2 Supports**

This Standard does not provide construction requirements for support posts, columns, stumps, stringers, piers and poles.

##### **5.7.2.3 Framing**

This Standard does not provide construction requirements for the framing of verandas, decks, ramps or landings (i.e., bearers and joists).

#### **5.7.2.4 Decking**

This Standard does not provide construction requirements for decking that is more than 300 mm from a glazed element.

Decking less than 300 mm (measured horizontally at deck level) from glazed elements that are less than 400 mm (measured vertically) from the surface of the deck (see Figure D2, Appendix D) shall be made from—

- (a) non-combustible material; or
- (b) bushfire-resisting timber (see Appendix F); or
- (c) a timber species, as specified in Paragraph E1 and listed in Table E1 of Appendix E;
- (d) PVC-U; or
- (e) a combination of any of Items (a), (b), (c) or (d) above.

### **5.7.3 Unenclosed subfloor spaces of verandas, decks, steps, ramps and landings**

#### **5.7.3.1 Supports**

This Standard does not provide construction requirements for support posts, columns, stumps, stringers, piers and poles.

#### **5.7.3.2 Framing**

This Standard does not provide construction requirements for the framing of verandas, decks, ramps or landings (i.e., bearers and joists).

#### **5.7.3.3 Decking**

This Standard does not provide construction requirements for decking unless it is less than 300 mm from a glazed element.

Decking less than 300 mm (measured horizontally at deck level) from glazed elements that are less than 400 mm (measured vertically) from the surface of the deck (see Figure D2, Appendix D) shall be made from—

- (a) non-combustible material; or
- (b) bushfire-resisting timber (see Appendix F); or
- (c) a timber species, as specified in Paragraph E1 and listed in Table E1, Appendix E; or
- (d) a combination of any of Items (a), (b) or (c) above.

### **5.7.4 Balustrades, handrails or other barriers**

This Standard does not provide construction requirements for balustrades, handrails and other barriers.

## **5.8 WATER AND GAS SUPPLY PIPES**



Above-ground, exposed water and gas supply pipes shall be metal.

## **Appendix 4**

### **Amberton Foreshore Preliminary Landscape Concept (Emerge 2014)**





# AMBERTON FORESHORE MASTER PLAN REV H PRELIMINARY LANDSCAPE CONCEPT

dwg • A-06  
date • JUNE 2014  
rev • 1  
scale • 1:1000 @ A1



© THIS DRAWING CAN NOT BE PUBLISHED OR DISPLAYED WITHOUT THE WRITTEN PERMISSION OF THE CLIENT & AUTHOR AND IS ISSUED FOR INFORMATION PURPOSES ONLY AND MAY ALTER WITHOUT NOTIFICATION

**emerge**  
ASSOCIATES  
Integrated Science & Design





## Appendix 5

### City of Wanneroo annual firebreak notice



# Protect your home and property from bushfires

NOTICE TO ALL OWNERS OR OCCUPIERS OF LAND IN THE DISTRICT OF THE CITY OF WANNEROO REGARDING FIREBREAKS.

The City of Wanneroo hereby gives notice pursuant to Section 33 of the **Bush Fires Act 1954** to all owners or occupiers of land in its district that they are required on or before 15 November, or within 14 days of becoming the owner or occupier of the land if that occurs after the 15 November, to annually plough, cultivate, scarify, or otherwise clear firebreaks as specified in this Notice and thereafter up to, and including the 30 April, annually, to maintain the firebreaks clear of flammable matter.

## 1. Land having an area of 2000m<sup>2</sup> or more

A firebreak not less than 3 metres wide and 3 metres high immediately inside and around all external boundaries of the land must be cleared.

## 2. Land having an area of less than 2000m<sup>2</sup>

A firebreak not less than 2 metres wide and 2 metres high immediately inside and around all external boundaries of the land must be cleared.

## 3. Buildings

A firebreak not less than 3 metres wide immediately around all external walls of every building must be cleared. Whenever a firebreak is cleared by burning the provisions of the Act and Regulations made thereunder must be observed. If pursuant to Item (2) of this Notice, mowing or slashing is carried out the height of vegetation thereafter must not exceed, as far as is reasonably practicable, 20mm over the entire area of the firebreak. The use of chemicals is subject to all restrictions imposed by the Department of Agriculture. Attention is drawn to the Flammable Liquids Regulations made under the Explosives and Dangerous Goods Act 1961, which requires a site on which flammable liquid is stored to be totally cleared of all flammable material for a minimum distance of 5 metres surrounding the site.

If it is considered to be impracticable for any reason to comply with the provisions of this Notice, application may be made not later than the 1st day of November annually to the Council or its authorised officer for permission to provide alternative fire protection measures. If permission is not granted the requirements of this Notice must be complied with.

## Penalty

An owner or occupier of land who fails or neglects in any respect to comply with the requirements of this Notice is liable to a maximum fine of \$5,000.

## DATES TO REMEMBER

- Firebreaks must be cleared by 15 November (AND KEPT CLEAR UNTIL APRIL 30)
- Burning permits required all year round
- Burning prohibited between 1 December to 31 March

## When and how to obtain a fire permit

Permits are available from the City of Wanneroo at the following locations:

### WANNEROO ANIMAL CARE CENTRE

Located at the rear of the Ashby Operations Centre, 1204 Wanneroo Road, Ashby

The City's Rangers / Fire Control Officers are available to issue permits 7 days a week \* from 4pm - 6pm

\*Except Good Friday

### CITY OF WANNEROO CIVIC CENTRE

23 Dundobar Road, Wanneroo

The City's Fire Control Officers / Permit Issuing Officers are available to issue permits Monday to Friday 9am - 4pm

## NEED ADVICE?

Further advice about how to protect your home, constructing firebreaks, and when and how to burn off, is available from the City of Wanneroo during office hours on 9405 5000.



23 Dundobar Road, Wanneroo, WA 6065  
Locked Bag 1, Wanneroo, WA 6946

T : (08) 9405 5000 F : (08) 9405 5499  
After Hours : 1300 13 83 93

E : [enquiries@wanneroo.wa.gov.au](mailto:enquiries@wanneroo.wa.gov.au)  
[wanneroo.wa.gov.au](http://wanneroo.wa.gov.au)



City of  
Wanneroo

PROTECT YOUR HOME  
AND PROPERTY FROM  
BUSHFIRES



## Keeping your home safe from fire

There are a number of ways you can help keep your home safe from fire:

- Install smoke detectors in your home
- Clear vegetation away from the walls of your home
- Clear all rubbish and flammable material from around your home to create a 20 metre circle of safety
- Store firewood, timber, petrol, and kerosene well away from your home
- Prior to summer, clean all leaves and debris from your gutters
- Don't have flammable trees such as conifers near buildings
- Have branches trimmed that overhang the house or powerlines
- Fit wire insect screens or shutters to windows and glass doors

If a firebreak is impractical along your boundary for environmental or other reasons notify the City of Warreroo by 1 October to obtain permission to install firebreaks in alternative positions, or of a different nature.

### ALTERNATIVE METHODS OF REDUCING FIRE

#### HAZARDS ON VACANT LAND

- For urban land less than 2000m<sup>2</sup>, if mowing or slashing is carried out, the height of the vegetation must not exceed, as far as is reasonably practical, 20mm over the entire area of the firebreak
- The use of chemicals is subject to all restrictions imposed by the Department of Agriculture
- Mulching • Disposal at an authorised rubbish tip site

## When and how to burn

### NO BURNING FROM 1 DECEMBER - 31 MARCH

Burning off - that is, bush/running fire including grass, on any land is totally prohibited between 1 December and 31 March. Fire permits for burning material other than garden rubbish are required all year round.

A person in control of the fire must stay with the fire until it is completely extinguished.

### GARDEN RUBBISH AND REFUSE

The burning of garden refuse is permitted between the hours of 6pm and 11pm, provided the fire danger rating is not VERY HIGH, SEVERE, EXTREME or CATASTROPHIC or a TOTAL FIRE BAN has been declared.

Fire danger rating signs are located at the following locations:

- Corner of Joondalup Drive and Warreroo Road
- Warreroo Road, south of the Yanchep Beach Road turn off
- Warreroo Road, Carabooda • Marmion Avenue, Jindalee
- Neaves Road, Mariginiup • Old Yanchep Road, Pinjar
- Gnangara Road, Landsdale • Country Side Drive, Two Rocks

### Other points to remember when burning garden refuse and rubbish are:

- All bush and flammable material must be thoroughly cleared within two metres of all points of the site of the fire
- The material must be on the ground, and be no more than one metre wide and one metre high

### Only one heap may be burnt at any one time

#### Incinerators may be used providing:

- The incinerator is properly constructed and designed to prevent the escape of sparks of burning material
- The incinerator is situated not less than two metres away from a building or fence
- An area of two metres surrounding the incinerator is clear of all flammable material

### BARBECUES

Only gas or electric barbecues may be lit during VERY HIGH, SEVERE, EXTREME or CATASTROPHIC fire danger rating or declared TOTAL FIRE BAN. The lighting of solid fuel barbecues is not permitted on these days.

### SMOKE NUISANCES

City of Warreroo residents are advised to be mindful of smoke issues associated with any burning that they conduct. Steps should be taken to avoid undue smoke impact to neighbours and adjacent roads. Smoke across roadways can severely impact motorists' visibility and therefore road safety. Issues of smoke nuisance are regulated by the Waste Avoidance and Resource Recovery Act 2007.

### CAMPFIRES

Campfires must not be lit on VERY HIGH, SEVERE, EXTREME or CATASTROPHIC fire danger days or declared TOTAL FIRE BAN. A person must remain in attendance at the site during the whole time the fire is burning. The user must extinguish the fire using water or earth before leaving the area.

## Hints for safer burning

- Don't light a fire on a hot or windy day
- Don't burn more than you can control
- Let your neighbours know you'll be burning material
- Make sure smoke and sparks will not affect your neighbour's washing or enter open windows
- Cut or rake long grass around trees, building and fences before burning
- Burn against the wind
- On a sloping block, burn from the top down
- Keep a hose or spray pack at hand to dampen down fierce fires
- If in doubt, don't burn material yourself - call the Volunteer Fire Brigade
- Stay with the fire until it is completely extinguished
- Where possible, don't burn any closer than 20 metres from your home or other buildings

## Penalties

Under the Bush Fires Act 1954, failing to comply with regulations can result in a fine ranging from \$250 to \$250,000 or imprisonment.

Failure to maintain 2/3 metre firebreak as per firebreak order	\$250
Offence relating to lighting fire in the open air	\$250
Setting fire to bush during prohibited burning times	\$250
Failure of occupier to extinguish bush fire	\$250
Major offences result in Court action with fines ranging from \$250 to \$250,000 or imprisonment for 14 years.	

### THE BIGGEST PENALTY OF ALL

The biggest penalty of all would be losing your loved ones or home to fire. Please ensure you, your family and your home are kept safe by taking the necessary precautions.

## Special rural and residential land

Owners and occupiers of special rural and special residential land should be aware of their responsibilities to take bush fire prevention measures, while ensuring they do not contravene Town Planning Scheme provisions which control the removal of vegetation in Special Residential and Special Rural Zones.

These special rural zones were created in areas of natural flora, and the Scheme recognises the importance of preserving the natural environment in these areas. Anyone found cutting down, lopping or damaging trees in these areas without City approval may be guilty of an offence.

However, bush fire prevention, including the installation of firebreaks, is essential regardless of the zoning of the land.

Below are some guidelines for installing firebreaks in special rural zones to prevent bush fires, while minimising damage to the natural environment.

- A 3 metre wide and 3 metre high firebreak should be cleared around the perimeter of special rural or special residential lots
- These firebreaks need not be strictly around the perimeter, but may deviate according to the flora
- The firebreak does not have to be ploughed but can instead be created by clearing and removing all flammable material
- Care should be taken to avoid damaging or removing significant trees and shrubs
- Avoid the build up of undergrowth and leaf litter

## Appendix 6

### AFAC bush fire glossary



## **BUSHFIRE GLOSSARY**

Prepared by Rural and Land Management Group for  
AFAC Agencies

January 2012



**Disclaimer**

While all possible care has been taken to ensure a comprehensive and accurate publication, the Australasian Fire Authorities Council and its servants or agents shall not be liable for technical or editorial errors contained herein or omissions there from; nor for incidental or consequential liability in any way resulting from the information or advice that is contained in this publication or use of that material.

**Copyright © 2010 Australasian Fire Authorities Council**

All rights reserved. Except under the conditions described in the Copyright Act 1968 of Australia and subsequent amendments, no part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without the prior permission of the copyright owner.

January 2012

AFAC Limited (ABN 52 060 049 327)  
Level 5, 340 Albert Street  
East Melbourne Victoria 3002  
Telephone: 03 9419 2388  
Facsimile: 03 9419 2389

Email: [afac@afac.com.au](mailto:afac@afac.com.au)  
Internet: <http://www.afac.com.au>  
<http://knowledgeweb.afac.com.au/>



## **Preface**

The AFAC Bushfire Glossary has been developed to promote an exchange of information between member agencies on terminology used specifically in bushfires.

The Glossary has been developed based on a set of agreed business rules. It includes the bushfire technical terms, their definition or description as adopted and applied by the AFAC member agencies. It does include some fire terms that are of a general industry wide nature for completeness. It excludes terms for which an agreed definition could not be reached by the member agencies.

This document is not designed to be a text book or to provide a discussion of a term beyond the definition/description of that term. Nor is it an attempt to modify or redefine terms defined in codes, standards or legislation. Terms that have been adopted for use by the fire management industry from another discipline will maintain the meaning ascribed to them in their originating discipline.

It is proposed that this Glossary will be reviewed regularly to ensure that it continues to be relevant and meets the needs of AFAC member agencies. This is the fifth review. It is the current 2012 version.

AFAC acknowledges the significant contribution of the Rural and Land Management Glossary Working Group lead by Greg Esnouf and Country Fire Authority staff, Matthew Fraser and Jo Richards, who contributed generously of their time and expertise in the establishment of this document and the work of the Genesis Institute to provide a framework for refining the glossary.

Previous versions of the Glossary were titled Wildfire Glossary. The term wildfire has been replaced with the term bushfire in line with a trend towards using language more accepted by the general public.

The terms appear in alphabetical order excluding spaces. In this way it is possible to find a compound word without knowing if it is one or two words.

## **Aim**

The purpose of this Glossary is to seek to facilitate a greater understanding by using common language between bushfire and land management agencies and support organisations during the prevention of, preparedness for, response to and recovery from bushfires.

# Index

Accelerant .....	1	Bole damage .....	3
Adaptor .....	1	Bracken .....	3
Adsorption.....	1	Branch .....	3
Advance burn .....	1	Breakaway .....	3
Advancing fire .....	1	Breeching.....	4
Aerial detection.....	1	Briefing.....	4
Aerial fuel .....	1	Broad area hazard reduction .....	4
Aerial ignition .....	1	Broadcast burning.....	4
Aerial ignition device (AID).....	1	Buffer .....	4
Aerial Observer .....	1	Bulk water carrier .....	4
Aerial reconnaissance .....	1	Burn back .....	4
Aerosol .....	1	Burning brands.....	4
After action review (AAR).....	1	Burning conditions.....	4
AIIMS structure .....	1	Burning off .....	4
Air attack .....	1	Burning out .....	4
Air attack Supervisor .....	1	Burning program.....	4
Air base Manager .....	1	Burning rotation .....	4
Air mass.....	1	Burning unit .....	4
Air Observer .....	1	Burn out.....	4
Air operations.....	1	Burn over .....	4
Air operations Manager .....	2	Burn plan.....	4
Aircraft Officer.....	2	Bushfire.....	4
Airside .....	2	Bushfire danger period .....	4
Allocated resources.....	2	Bushfire management .....	4
Anchor point.....	2	Byram-Keetch Drought index (BKDI).....	4
Aqueous film forming-foam (AFFF) .....	2	Cache .....	4
Area ignition .....	2	Campaign fire.....	4
Area of origin.....	2	Candle (Candling).....	5
Arson .....	2	Candlebark.....	5
Aspect.....	2	Canopy .....	5
Asphyxiants .....	2	Canopy cover .....	5
Assembly area .....	2	Canopy density .....	5
Assessment .....	2	Catastrophic fire danger .....	5
Assets .....	2	Central ignition .....	5
Assisting agency .....	2	Chaining .....	5
Atmospheric stability .....	2	Charged line .....	5
Attack time.....	2	CIMS.....	5
Australasian Inter-service Incident Management System (AIIMS) .....	2	Class A foam.....	5
Automatic dispatch .....	2	Class labels.....	5
Automatic weather station (AWS) .....	2	Climate.....	5
Available fuel.....	2	Clinometer .....	5
Available resources .....	2	Cloud cover .....	5
Backburn .....	3	Coarse fuels .....	5
Back fire.....	3	Code of Practice.....	5
Backing fire.....	3	Cold front.....	5
Bark fuel .....	3	Cold trailing.....	5
Bark heaps.....	3	Collecting head .....	5
Basal accumulation .....	3	Combat agency/authority.....	5
Base camp .....	3	Combustion.....	5
Bay(s).....	3	Command .....	6
Beaufort wind scale.....	3	Communications plan .....	6
Blacking out.....	3	Compartment .....	6
Blackspot .....	3	Competency.....	6
Blank cap .....	3	Conduction.....	6
Blow down.....	3	Contained.....	6
Blow up .....	3	Contour lines.....	6
Bole .....	3	Control .....	6
		Control authority .....	6

Controlled.....	6	Edge burning.....	9
Controlled burning .....	6	Elevated fuel .....	9
Control line.....	6	Embers .....	9
Convection .....	6	Emergency centre .....	9
Convection burn .....	6	En route resources.....	9
Convection column .....	6	Entrapment.....	9
Convective activity .....	6	Equilibrium moisture content (EMC) .....	9
Convergence zone .....	6	Equipment .....	9
Convoy.....	6	Escape route .....	9
Coordination .....	7	Evacuation .....	9
Cordon.....	7	Exposures.....	10
Coupe .....	7	Extinguishing agent.....	10
Crew .....	7	Extreme fire behaviour .....	10
Crew leader .....	7	Extreme fire danger .....	10
Critical burnout time .....	7	Facilities .....	10
Critical incident stress .....	7	Fall back fire control line.....	10
Critical incident stress debriefing.....	7	Fine fuel .....	10
Cross bearings .....	7	Fingers .....	10
Crown fire.....	7	Fire .....	10
Crown scorch.....	7	Fire access track.....	10
Crowning .....	7	Fire behaviour.....	10
Crowning potential.....	7	Fire Behaviour Analyst .....	10
Curing .....	7	Fire behaviour model.....	10
Dead fuel .....	7	Fire behaviour prediction .....	10
Debrief.....	7	Fire behaviour prediction system .....	10
Deep-seated fire.....	7	Fire bombing.....	11
Defensive strategy.....	7	Fire brand.....	11
Dehydration .....	7	Fire climate .....	11
Delayed aerial ignition devices (DAID) .....	7	Fire control.....	11
Deliberate fire .....	8	Fire control agent .....	11
Delivery hose.....	8	Fire control line.....	11
Delivery valve .....	8	Fire crew .....	11
Demobilisation .....	8	Fire danger .....	11
Depth of burn.....	8	Fire danger class .....	11
Desiccant .....	8	Fire danger index (FDI).....	11
Desorption.....	8	Fire danger rating .....	11
Detection.....	8	Fire ecology.....	11
Dew .....	8	Fire edge .....	11
Dew point temperature .....	8	Fire effects .....	11
Dieback.....	8	Fire environment .....	11
Diffused pattern .....	8	Firefighter .....	11
Direct attack.....	8	Firefighting operations .....	11
Dispatch.....	8	Fire frequency.....	11
Division .....	8	Fire front .....	11
Dominant height .....	8	Fireground .....	11
Downwind .....	8	Fire hazard .....	12
Dozer .....	8	Fire intensity .....	12
Dozer line .....	8	Fireline .....	12
Drain time.....	8	Fireline intensity .....	12
Drift .....	8	Fire lookout.....	12
Drip torch .....	8	Fire management.....	12
Drop pass.....	9	Fire potential .....	12
Drop pattern.....	9	Fire preparedness .....	12
Drop zone (DZ) .....	9	Fire prevention .....	12
Drought .....	9	Fire regime .....	12
Drought index.....	9	Fire report .....	12
Dry bulb temperature .....	9	Fire retardant.....	12
Dry firefighting .....	9	Fire risk .....	12
Duff.....	9	Fire run.....	12
Ecological burning .....	9	Fire scar.....	12

Fire season .....	12	Fuel modification .....	15
Fire simulator .....	12	Fuel moisture content .....	15
Fire spread.....	12	Fuel moisture differential .....	16
Fire storm .....	13	Fuel profile .....	16
Fire suppressant .....	13	Fuel quantity.....	16
Fire suppression .....	13	Fuel reduction.....	16
Fire suppression organisation .....	13	Fuel reduction burning .....	16
Fire suppression plan .....	13	Fuel separation .....	16
Fire tetrahedron .....	13	Fuel type .....	16
Fire threat.....	13	Fuel weight .....	16
Fire tower .....	13	General origin area .....	16
Fire training simulator .....	13	Going fire .....	16
Fire triangle .....	13	Grass fire .....	16
Fire weather .....	13	Grassland curing .....	16
Fire weather forecast .....	13	Grid ignition .....	16
Fire whirl .....	13	Ground crew .....	16
Fire wind.....	13	Ground fire .....	16
First attack.....	13	Ground fuel.....	16
Fixed wing aircraft .....	13	Habitat .....	16
Flame angle .....	13	Hand crew .....	16
Flame depth .....	13	Hand line.....	16
Flame height.....	14	Hand trail .....	16
Flame length.....	14	Hang up.....	16
Flame Zone.....	14	Hazard.....	16
Flame zone .....	14	Hazard reduction .....	16
Flaming zone .....	14	Head.....	16
Flammability.....	14	Head attack.....	16
Flammable.....	14	Head fire .....	16
Flank attack .....	14	Heat exhaustion.....	17
Flanks of a fire .....	14	Heat stress .....	17
Flare up .....	14	Heat stroke .....	17
Flash fire .....	14	Heat transfer.....	17
Foam.....	14	Heavy fuels.....	17
Foam blanket.....	14	Heel.....	17
Foam Class A .....	14	Heel fire .....	17
Foam Class B.....	14	Helibase (HB) .....	17
Foam concentrate .....	14	Helicopter .....	17
Foam inductor .....	14	Helipad (HP) .....	17
Foam solution.....	14	Helitack crew .....	17
Forest .....	14	Heli-torch .....	17
Forest fire .....	14	High fire danger .....	17
Forest type .....	14	High intensity fire.....	17
Forward looking infrared (FLIR).....	15	Hold over fire .....	17
Forward rate of spread (FROS).....	15	Hop over .....	17
Frontal fire intensity.....	15	Hose bandage .....	17
Front end loader.....	15	Hose strangler.....	17
Fuel.....	15	Hot Refueller.....	17
Fuel age .....	15	Hot spot .....	17
Fuel arrangement.....	15	Humus.....	17
Fuel array .....	15	Hygrometer.....	17
Fuel assessment .....	15	Ignition.....	17
Fuel bed depth .....	15	Ignition pattern.....	18
Fuelbreak.....	15	Ignition source .....	18
Fuelbreak system .....	15	Incendiary .....	18
Fuel continuity.....	15	Incendiary device.....	18
Fuel depth .....	15	Incident.....	18
Fuel load .....	15	Incident Action Plan (IAP) .....	18
Fuel management .....	15	Incident control .....	18
Fuel map.....	15	Incident Control Centre (ICC).....	18
Fuel model.....	15	Incident Controller.....	18

Incident Control Point (ICP).....	18
Incident control system (ICS) .....	18
Incident management .....	18
Incident Management Team (IMT) .....	18
Incident objective.....	18
Incident strategies.....	18
Indirect attack .....	18
Induced wind.....	18
Infrared scanning .....	18
Initial attack.....	18
Instability.....	19
Interface .....	19
Inversion.....	19
Island .....	19
Isobar.....	19
I zone .....	19
Jump fire.....	19
Jump over.....	19
Junction zone .....	19
Keetch-Byram Drought Index (KBDI) .....	19
Knock down.....	19
Ladder fuels.....	19
Lag time.....	19
Lead agency.....	19
Lee (leeward).....	19
Legislation .....	19
Light fuel.....	19
Lighting pattern.....	19
Lightning.....	19
Lightning fire .....	19
Lightning formation.....	19
Light patrol unit.....	19
Line ignition.....	19
Litter .....	20
Litter bed fuel.....	20
Litter fall .....	20
Living fuels.....	20
Living shrub fuel .....	20
Local winds.....	20
Log .....	20
Logistics .....	20
Lookout .....	20
Lookout tower.....	20
Low intensity fire.....	20
Low-moderate fire danger .....	20
Medium fuels .....	20
Mineral earth .....	20
Mobilisation .....	20
Moisture content .....	20
Mopping up .....	20
Mosaic .....	20
Move up method.....	20
Multi-agency response.....	20
Natural barrier.....	20
Near surface fuel.....	21
Needle bed.....	21
Nozzle .....	21
One lick method .....	21
Operations.....	21
Operations point .....	21

Parallel attack .....	21
Parallel fire suppression.....	21
Parallel method.....	21
Parts of a Fire .....	21
Patch burning.....	21
Patrol .....	21
Peat.....	21
Perimeter .....	21
Peri urban interface .....	21
Permit burn.....	21
Personal protection equipment (PPE) .....	21
Personal protective clothing (PPC) .....	21
Plan of attack .....	21
Planned burning.....	21
Pocket .....	21
Point of attack.....	22
Point of origin .....	22
Portable dam .....	22
Predicted rate of spread .....	22
Pre-incident plan.....	22
Pre-suppression plan .....	22
Prepared community .....	22
Preparedness .....	22
Pre-planned dispatch.....	22
Prescribed burn .....	22
Prescribed burn plan.....	22
Prescribed burning.....	22
Prescribed fire.....	22
Prescription.....	22
Prevention .....	22
Profile litter moisture content.....	22
Profile moisture content.....	22
Psychrometer.....	22
Pulaski tool.....	22
Pumper .....	22
Quick-fill pump .....	23
Rain gauge .....	23
Rakehoe (McLeod tool).....	23
Rate of spread (ROS).....	23
Reaction time.....	23
Rear.....	23
Reburn .....	23
Reconnaissance .....	23
Recovery .....	23
Red Flag Warning.....	23
Regeneration burn.....	23
Re-ignition.....	23
Relative humidity (RH) .....	23
Relay pumping .....	23
Relief.....	23
Report of fire .....	23
Residence time .....	23
Resources.....	23
Response.....	23
Response time .....	23
Responsible authority.....	23
Retardant .....	23
Risk.....	24
Risk analysis .....	24
Road Management Point.....	24



Rural .....	24
Rural urban interface (RUI) .....	24
Safe.....	24
Safety zone.....	24
Scorch height.....	24
Scout.....	24
Scrub .....	24
Scrub fire .....	24
Secondary fire control line .....	24
Sector .....	24
Seen area.....	24
Severe fire danger .....	24
Shift .....	24
Shift change.....	24
Situation report.....	24
(Sitrep).....	24
Size up .....	24
Slash .....	24
Slash burn.....	25
Sleeper .....	25
Slip-on unit.....	25
Slop over .....	25
Smoke management .....	25
Smoke Plume.....	25
Smoker .....	25
Softwood .....	25
Soil Dryness Index (SDI).....	25
Southern Oscillation Index (SOI) .....	25
Spark arrestor.....	25
Spot fire.....	25
Spot ignition .....	25
Spot over .....	25
Spotting.....	25
Staging area.....	25
Stand by.....	25
Static water supply.....	25
Step-up method .....	25
Strike teams .....	25
Strip burning.....	26
Strip ignition .....	26
Stripping .....	26
Structure .....	26
Sub surface fire .....	26
Sub surface fuel.....	26
Suction hose .....	26
Supply hose .....	26
Support agency .....	26
Surface fire .....	26
Surface fuel .....	26

Surface moisture content .....	26
Tactics .....	26
Tail fire .....	26
Tanker .....	26
Task force.....	26
Task group .....	26
Technical advisors.....	26
Temperature (dry bulb) .....	26
Temperature (wet bulb) .....	26
Test fire .....	26
Thermal imagery.....	26
Thermal radiation .....	26
Thermohygrograph .....	27
Time lag.....	27
Tongues.....	27
Topography.....	27
Torch.....	27
Torching.....	27
Traffic Management Point.....	27
Travel time .....	27
Under storey.....	27
Upwind.....	27
Urban .....	27
Urban interface.....	27
Urban rural interface (URI) .....	27
Values at risk.....	27
Vehicle Control Point .....	27
Very high fire danger .....	27
Warning device .....	27
Water bombing.....	27
Water point.....	27
Water tank.....	27
Wetting agent .....	27
Widow maker.....	27
Wilderness Area.....	27
Wildfire .....	27
Wildfire control plan.....	27
Wildland urban interface (WUI).....	28
Wind direction .....	28
Windfall.....	28
Wind throw.....	28
Wind speed .....	28
Wind strength .....	28
Windrow .....	28
Windrow burning.....	28
Windward .....	28
Woodland .....	28

## Bushfire Glossary

Term	Definition
<b>Accelerant</b>	Any substance (such as oil, gasoline, etc) that is applied to a fuel-bed to expedite the burning process.
<b>Adaptor</b>	A fitting used to couple different sized hoses, hoses of the same size with different threads, or different types of couplings, or to connect the male to male, or female to female parts of the same type of coupling.
<b>Adsorption</b>	The taking in of water vapour from the air by dead plant material.
<b>Advance burn</b>	A prescribed fire that reduces fuel through a forest area before felling operations. It is intended to improve the safety of timber harvesting operations and as a silvicultural tool to protect lignotubers and standing trees.
<b>Advancing fire</b>	That portion of the fire with rapid fire spread and higher intensity which is normally burning with the wind and/or up slope.
<b>Aerial detection</b>	The discovering, locating and reporting of fires from aircraft.
<b>Aerial fuel</b>	See: Elevated fuel
<b>Aerial ignition</b>	Ignition of fuels by dropping incendiary devices or materials from aircraft.
<b>Aerial ignition device (AID)</b>	Inclusive term applied to equipment designed to ignite wildland fuels from an aircraft.
<b>Aerial Observer</b>	See: Air Observer
<b>Aerial reconnaissance</b>	Use of aircraft for detection of fires and observing fire behaviour, values-at-risk, suppression activity, and other critical factors to facilitate command decisions on strategy and tactics needed for fire suppression.
<b>Aerosol</b>	Airborne solid or liquid particles dispersed or suspended in a gas stream.
<b>After action review (AAR)</b>	A discussion, focused on performance standards, of an event that enables those involved to discover what happened, why it happened, and how to sustain strengths and improve on weaknesses. An After action review is a tool incident command personnel and units can use to get maximum benefit from every incident. It provides a review of the incident upon its completion to identify and discuss effective and non-effective performance and lessons learned and how to apply them in the future. (adapted from NWCG)
<b>AIIMS structure</b>	The combination of facilities, equipment, personnel, procedures, and communications operating within a common organisational structure with responsibility for the management of allocated resources to effectively accomplish stated objectives relating to an incident (AIIMS).
<b>Air attack</b>	The direct use of aircraft in the suppression of bushfires.
<b>Air attack Supervisor</b>	Primarily responsible for the safety and efficient tactical coordination of aircraft operations when fixed and/or rotary firebombing aircraft are operating at a fire (Air Attack Supervisor Training Manual).
<b>Air base Manager</b>	An experienced, trained person who is appointed to manage all the functions and personnel on an air base or helicopter base.
<b>Air mass</b>	A meteorological term referring to an extensive body of air within which the conditions of temperature and moisture in a horizontal plane are essentially uniform.
<b>Air Observer</b>	The primary role of the air observer is to aerially obtain intelligence to assist the planning of fire suppression operations (NSWRFS).
<b>Air operations</b>	The use of aircraft in support of an incident for the purposes of suppression, transportation of personnel, equipment or supplies, or for aerial reconnaissance.

## Bushfire Glossary

Term	Definition
<b>Air operations Manager</b>	The air operations manager position is responsible for overall coordination of air operations and air support activities in support of an incident.
<b>Aircraft Officer</b>	The aircraft officer is responsible for ground operations and overall provision of support, enabling a safe and efficient air operation to be conducted.
<b>Airside</b>	The parts of an airport not normally open to unauthorised people. It comprises the apron, taxiways, runways and the areas containing them.
<b>Allocated resources</b>	Resources working at an incident (AIIMS).
<b>Anchor point</b>	An advantageous location, usually a barrier to fire spread, from which to start constructing a fireline. The anchor point is used to minimize the chance of being flanked by the fire while the line is being constructed (NWCG).
<b>Aqueous film forming-foam (AFFF)</b>	A synthetic amber coloured liquid concentrate mixed with water to form an agent that is capable of forming water-solution films on the surface of flammable liquids that prevent the escape of fuel vapours, excludes oxygen and maintain the surface when disturbed (self healing).
<b>Area ignition</b>	Ignition of several individual fires throughout an area, either simultaneously or in rapid succession, and so spaced that they add to and influence the main body of the fire to produce a hot, fast-spreading fire condition. Also called simultaneous ignition.
<b>Area of origin</b>	General location where the fire started.
<b>Arson</b>	The deliberate setting of a fire where the intent of the person responsible was to cause harm or destruction to life or property.
<b>Aspect</b>	The direction towards which a slope faces.
<b>Asphyxiants</b>	Substances which interfere with the respiratory process.
<b>Assembly area</b>	See Staging area.
<b>Assessment</b>	The process of determining if an individual has the prescribed skills, knowledge and experience needed to acquire a specific capability.
<b>Assets</b>	Anything valued by people which includes houses, crops, forests and, in many cases, the environment.
<b>Assisting agency</b>	An agency directly contributing suppression, support or service resources to another agency.
<b>Atmospheric stability</b>	The degree to which the atmosphere resists turbulence and vertical motion.
<b>Attack time</b>	See Elapsed time
<b>Australasian Inter-service Incident Management System (AIIMS)</b>	A nationally adopted structure to formalise a coordinated approach to emergency incident management.
<b>Automatic dispatch</b>	See Pre-planned dispatch.
<b>Automatic weather station (AWS)</b>	The Bureau's standard AWSs use sensors to monitor temperature, humidity, wind speed and direction, pressure and rainfall. Various advanced sensors are available for specialised applications. These sensors can monitor cloud height (ceilometer), visibility, present weather, thunderstorms, soil temperature (at a range of depths) and terrestrial temperature. (Developed from the BOM)
<b>Available fuel</b>	The portion of the total fuel that would actually burn under various environmental conditions.
<b>Available resources</b>	The resources at an incident and available for allocation at short notice. (AIIMS)

## Bushfire Glossary

Term	Definition
<b>Backburn</b>	<ol style="list-style-type: none"> <li>1. A fire started intentionally along the inner edge of a fireline during indirect attack operations to consume fuel in the path of a bushfire (Australia).</li> <li>2. A counterfire commenced from within continuous fuel for the purpose of fighting a fire (New Zealand).</li> </ol>
<b>Back fire</b>	See: Backburn (Preferred term).
<b>Backing fire</b>	The part of a fire which is burning back against the wind or down slope, where the flame height and rate of spread are reduced.
<b>Bark fuel</b>	The flammable bark on tree trunks and upper branches.
<b>Bark heaps</b>	Accumulations of bark and branch material resulting from timber harvesting operations. Soil may be mixed with bark heaps, but generally the heap is formed by a machine dropping fresh bark on the top of the heap.
<b>Basal accumulation</b>	Bark fallen from a tree and forming a relatively high and localized accumulation of fine fuel.
<b>Base camp</b>	A location where personnel are accommodated and fed for a period of time. A base camp usually contains catering, ablution and accommodation facilities, a water supply and a lighting system, and may include other facilities such as car parking maintenance and servicing. (AIIMS)
<b>Bay(s)</b>	A marked indentation (s) in the fire perimeter usually located between two fingers.
<b>Beaufort wind scale</b>	A system for estimating wind speeds based on observation of visible wind effects. A series of descriptions of visible wind effects upon land objects or sea surfaces is matched with a corresponding series of wind speed ranges, each being allocated a <i>Beaufort number</i> .
<b>Blacking out</b>	The process of extinguishing or removing burning material along or near the fire control line, felling stags, trenching logs to prevent rolling and the like, in order to make the fire safe.
<b>Blackspot</b>	An area where two-way radio coverage does not exist.
<b>Blank cap</b>	The metal cap used on delivery outlets and on the suction inlet of the pump to prevent discharge of water.
<b>Blow down</b>	See: Wind throw.
<b>Blow up</b>	Sudden increase in fireline intensity or rate of spread of a fire sufficient to preclude direct control or to upset existing suppression plans. Often accompanied by violent convection and may have other characteristics of a fire storm. (NWCG)
<b>Bole</b>	The trunk of a tree.
<b>Bole damage</b>	The damage to the trunk of a living tree by fire, mechanical equipment or disease.
<b>Bracken</b>	Bracken fern varies significantly in height and density. If Bracken is generally upright (either alive or dead) with the majority of its biomass in the top half of the plant and only the stems in touch with the ground, then it is considered to be part of the elevated fuel. If however, it has collapsed and most of its biomass is in touch with the ground, then it is considered to be Near-surface fuel.
<b>Branch</b>	A tapered pipe, fitted to the end of a hose line, which increases the velocity (converting pressure energy to kinetic energy) of the water or foam solution travelling through the hose, and forms an effective firefighting jet or spray.
<b>Breakaway</b>	The points at which a fire, after it has been contained, escapes into unburnt areas across a fireline or fire edge.

## Bushfire Glossary

Term	Definition
<b>Breeching</b>	A device to divide one hose line into two or collect two hose lines into one.
<b>Briefing</b>	A general overview of an operation.
<b>Broad area hazard reduction</b>	Large scale removal of selected fuel before the onset of a bushfire danger period.
<b>Broadcast burning</b>	See: Prescribed burning (Preferred term)
<b>Buffer</b>	A strip or block of land on which the fuels are reduced to provide protection to surrounding lands.
<b>Bulk water carrier</b>	A large tanker used for replenishing water to firefighting tankers.
<b>Burn back</b>	See: Reburn (Preferred term).
<b>Burning brands</b>	Lofted burning material such as bark, usually flaming.
<b>Burning conditions</b>	The state of the combined components of the fire environment that influence fire behaviour and fire impact in a given fuel type. Usually specified in terms of such factors as fire weather elements, fire danger indices, fuel load and slope.
<b>Burning off</b>	Generally setting fire - with more or less regard to areas carrying unwanted vegetation such as rough grass, slash and other fuels.
<b>Burning out</b>	To intentionally light fires to consume islands of unburned fuel inside the fire perimeter.
<b>Burning program</b>	A program of prescribed burns scheduled these for a designated area over a nominated time, normally looking ahead over one fire season (for the coming spring to the following autumn), but can also look ahead five years or more.
<b>Burning rotation</b>	The period between burning of a prescribed area for management purposes.
<b>Burning unit</b>	A specified land area for which prescribed burning is planned.
<b>Burn out</b>	<ol style="list-style-type: none"> <li>1. A fire set to consume islands of unburnt fuel inside the fire perimeter and between the fire edge and fireline (Australia).</li> <li>2. A counterfire commenced from a natural or previously constructed firebreak for the purpose of fighting a fire (New Zealand).</li> </ol>
<b>Burn over</b>	A section of fire that overruns personnel and/or equipment.
<b>Burn plan</b>	The plan which is approved for the conduct of prescribed burning. It contains a map identifying the area to be burnt and incorporates the specifications and conditions under which the operation is to be conducted.
<b>Bushfire</b>	Un planned vegetation fire. A generic term which includes grass fires, forest fires and scrub fires both with and without a suppression objective.
<b>Bushfire danger period</b>	A period of the year either established by legislation or declared by the relevant agency, when restrictions are placed on the use of fire due to dry vegetation and the existence of conditions conducive to the spread of fire.
<b>Bushfire management</b>	All those activities directed to prevention, detection, damage mitigation, and suppression of bushfires. Includes bushfire legislation, policy, administration, law enforcement, community education, training of fire fighters, planning, communications systems, equipment, research, and the multitude of field operations undertaken by land managers and emergency services personnel relating to bushfire control.
<b>Byram-Keetch Drought index (BKDI)</b>	See: Keetch-Byram Drought Index
<b>Cache</b>	A predetermined complement of supplies stored in a designated location. (CIMS).
<b>Campaign fire</b>	A fire normally of a size and/or complexity that requires substantial firefighting resources, and possibly several days or weeks to suppress.



## Bushfire Glossary

Term	Definition
<b>Candle (Candling)</b>	A tree (or small clump of trees) is said to candle when its foliage ignites and flares up, usually from the bottom to top.
<b>Candlebark</b>	Long streamers of bark that have peeled from some eucalypt species that form fire brands conducive to very long distance spotting.
<b>Canopy</b>	The crowns of the tallest plants in a forest – the overstorey cover.
<b>Canopy cover</b>	Canopy cover refers to 2 dimensions (ie plan view, area coverage)
<b>Canopy density</b>	Canopy density refers to 3 dimensions (ie mass/volume)
<b>Catastrophic fire danger</b>	The highest fire danger rating as determined by fire agencies and generally with a Forest fire danger index greater than 100 or a Grassland fire danger index greater than 150.
<b>Central ignition</b>	A method of prescribed burning in which fires are set in the centre of an area to create a strong convective column. Additional fires are then set progressively closer to the outer control lines causing indraft winds to build up. This has the effect of drawing the fires towards the centre.
<b>Chaining</b>	The process of flattening vegetation (usually mallee or scrub) by dragging a heavy chain or cable between two large tractors or bulldozers.
<b>Charged line</b>	A line of fire hose filled with water under pressure and ready to use.
<b>CIMS</b>	Coordinated Incident Management System used in New Zealand.
<b>Class A foam</b>	See: Foam
<b>Class labels</b>	Class labels identify the type of hazardous material being stored or transported. These are grouped under broad classifications according to the predominant type of risk involved.
<b>Climate</b>	The atmospheric conditions of a place over an extended period of time.
<b>Clinometer</b>	An instrument used to measure the angle of a slope.
<b>Cloud cover</b>	The amount of sky covered or obscured by cloud, expressed in eighths. Eight eighths is complete cloud cover.
<b>Coarse fuels</b>	Dead woody material, greater than 25mm in diameter, in contact with the soil surface (fallen trees and branches). Some researchers categorise forest fuels as: fine <6 mm diameter; twigs 6-25 mm diameter; coarse >25 mm diameter.
<b>Code of Practice</b>	Document giving methods developed to assist compliance with acts and regulations in the performance of work.
<b>Cold front</b>	A cold front is the delineation between cold polar air moving towards the equator and undercutting warm tropical air moving poleward. The temperature differences across a cold front can be extreme and associated with strong winds. The warm tropical air is forced to rise and become unstable with the development of large cumuliform clouds. Severe weather such as thunderstorms, squall lines and severe turbulence may accompany these cold fronts. (BOM)
<b>Cold trailing</b>	A method of determining whether or not a fire is still burning, involving careful inspection and feeling with the hand, or by use of a hand-held infrared scanner, to detect any heat source.
<b>Collecting head</b>	A collecting head is used to collect (usually from two to four) lines into the suction inlet of a pump.
<b>Combat agency/authority</b>	See: Control authority
<b>Combustion</b>	Rapid oxidation of fuels producing heat, and often light.

## Bushfire Glossary

Term	Definition
<b>Command</b>	The direction of members and resources of an agency in the performance of the agency's role and tasks. Authority to command is established in legislation or by agreement within an agency. Command relates to agencies and operates vertically within an agency.
<b>Communications plan</b>	Details the methods and systems for people to communicate with each other, the incident management structure, including the actual radio channels/mobile phone numbers. (AIIMS)
<b>Compartment</b>	(1) Forestry Definition – A basic administrative unit of a managed forest. (2) Building Definition - An enclosed space with floor, walls and ceiling.
<b>Competency</b>	Skills and knowledge and their application within an occupation to the standard of performance required in the workplace. (Vic report)
<b>Conduction</b>	The transfer of thermal energy between regions of matter due to temperature gradient.
<b>Contained</b>	The status of a wildfire suppression action signifying that a control line has been completed around the fire, and any associated spot fires, which can reasonably be expected to stop the fire's spread. (NWCG)
<b>Contour lines</b>	Contour lines connect points of equal elevation on a topographical map.
<b>Control</b>	The overall direction of response activities in an emergency situation. Authority for control is established in legislation or in an emergency response plan, and carries with it the responsibility for tasking and coordinating other agencies in accordance with the needs of the situation. Control relates to situations and operates horizontally across agencies.
<b>Control authority</b>	The agency, service, organization or authority with legislative responsibility for control of the incident. (Also referred to as the responsible authority or agency.) (AFAC)
<b>Controlled</b>	The stage during fire suppression activities at which the complete perimeter of a fire is secured and no breakaway is expected.
<b>Controlled burning</b>	See: Prescribed burning.
<b>Control line</b>	See: Fireline
<b>Convection</b>	1. As applied in meteorology, atmospheric motions that are predominantly vertical, resulting in vertical transport and mixing of atmospheric properties; distinguished from advection.  2. As applied in thermodynamics is a mechanism of heat transfer occurring because of the bulk movement of fluids.
<b>Convection burn</b>	See: Central ignition
<b>Convection column</b>	The rising column of smoke, ash, burning embers and other particle matter generated by a fire.
<b>Convective activity</b>	General term for manifestations of convection in the atmosphere, alluding particularly to the development of convective clouds and resulting weather phenomena, such as showers, thunderstorms, squalls, hail, and tornadoes. (NWCG)
<b>Convergence zone</b>	1. See: Junction zone.  2. In fire weather, that area where two winds come together from opposite directions and are forced upwards often creating clouds and precipitation. (NWCG)
<b>Convoy</b>	Two or more vehicles driving together under the control of a single Convoy Leader.

## Bushfire Glossary

Term	Definition
<b>Coordination</b>	The bringing together of agencies and elements to ensure effective response to an incident or emergency. It is primarily concerned with the systematic acquisition and application of resources in accordance with the requirements imposed by the emergency or emergencies. Coordination relates primarily to resources and operates: <ul style="list-style-type: none"> <li>• vertically, within an agency, as a function of the authority to command;</li> <li>• horizontally, across agencies, as a function of the authority to control.</li> </ul>
<b>Cordon</b>	A cordon is the means to maintain an area and is used to restrict movement into and out of an area.
<b>Coupe</b>	A defined forest area in which timber harvesting takes place.
<b>Crew</b>	See: Fire crew.
<b>Crew leader</b>	Person responsible for the supervision and management of crews
<b>Critical burnout time</b>	Total time a fuel can burn and continue to feed energy to the base of a forward-travelling convection column.
<b>Critical incident stress</b>	Unusually strong emotional reactions which have the potential to interfere with the ability of personnel to function, either at the incident scene or later, arising from any situation faced during operations.
<b>Critical incident stress debriefing</b>	The process in which teams of professional and peer counsellors provide emotional and psychological support to incident personnel who are or have been involved in a critical (highly stressful) incident.
<b>Cross bearings</b>	Intersecting lines of sight from two or more points on the same object; used to determine the location of bushfire from lookouts.
<b>Crown fire</b>	A fire that advances from top to top of trees or shrubs.
<b>Crown scorch</b>	Browning of the needles or leaves in the crown of a tree or shrub caused by heat from a fire.
<b>Crowning</b>	A fire ascending into the crowns of trees and spreading from crown to crown.
<b>Crowning potential</b>	A probability that a crown fire may start, calculated from inputs of foliage moisture content and height of the lowest part of the tree crowns above the surface. (NWCG)
<b>Curing</b>	Drying and browning of herbaceous vegetation due to mortality or senescence.
<b>Dead fuel</b>	Fuels with no living tissue in which moisture content is governed almost entirely by absorption or evaporation of atmospheric moisture (relative humidity and precipitation). (NWCG)
<b>Debrief</b>	To gather information from the participants in an action so as to gauge the success or otherwise of the action at the end of the task, shift, tour or incident.
<b>Deep-seated fire</b>	A fire burning far below the surface in duff, mulch, peat, or other combustibles as contrasted with a surface fire.
<b>Defensive strategy</b>	A firefighting strategy used where the protection of life and assets is a priority when a fire is: <ul style="list-style-type: none"> <li>(i) located in inaccessible or remote location OR</li> <li>(ii) too intense to be safely or effectively attacked directly.</li> </ul>
<b>Dehydration</b>	Excessive loss of water from the body's tissues. Dehydration may follow any condition in which there is a rapid depletion of body fluids.
<b>Delayed aerial ignition devices (DAID)</b>	An incendiary device that will ignite after a predetermined time.

## Bushfire Glossary

Term	Definition
<b>Deliberate fire</b>	A fire resulting from a person placing burning material to cause ignition. The intent of the person may have been to cause harm or destruction to life or property (arson-criminal offence) or to modify fuels and/or vegetation for land management purposes (summary offence). See also Arson.
<b>Delivery hose</b>	Hose used to transport water under pressure.
<b>Delivery valve</b>	On a pump, the valved outlet through which water is discharged.
<b>Demobilisation</b>	The orderly release of resources no longer required at an incident.
<b>Depth of burn</b>	The reduction in forest floor litter thickness (cm) due to consumption by fire. Most commonly used in connection with prescribed burning.
<b>Desiccant</b>	A chemical that, when applied to a living plant causes or accelerates the drying out of its aerial parts.
<b>Desorption</b>	The loss of moisture to the atmosphere from dead plant material.
<b>Detection</b>	The discovery of a fire. Individuals, fire towers, reconnaissance aircraft and automatic devices may be used, either alone or in combination.
<b>Dew</b>	The moisture which collects in small droplets on the surface of substances and vegetation by atmospheric condensation, chiefly at night.
<b>Dew point temperature</b>	This is a measure of the moisture content of the air and is the temperature to which air must be cooled in order for dew to form. The dew-point is generally derived theoretically from dry and wet-bulb temperatures, with a correction for the site's elevation. (BOM)
<b>Dieback</b>	The progressive dying, from the top downward, of twigs, branches or tree crowns.
<b>Diffused pattern</b>	A spray pattern (as opposed to straight stream) of water or foam.
<b>Direct attack</b>	A method of fire attack where wet or dry firefighting techniques are used. It involves suppression action right on the fire edge which then becomes the fireline.
<b>Dispatch</b>	The act of ordering attack crews and/or support units to respond to a fire, or from one place to another.
<b>Division</b>	A portion of the incident comprising of two or more sectors. The number of sectors grouped in a Division should be such as to ensure effective direction and control of operations. Divisions are generally identified by a local geographic name.
<b>Dominant height</b>	Mean height of the largest trees in a stand. A specified number per unit area are generally selected.
<b>Downwind</b>	Away from the wind direction. In the direction opposite to the direction from which the wind is blowing. The direction that smoke will travel.
<b>Dozer</b>	A crawler tractor fitted with a blade which can be transported to a fire on a tray truck or trailer. Dozer is a shortened form of "Bulldozer"
<b>Dozer line</b>	Fireline constructed by the front blade of a dozer.
<b>Drain time</b>	The time (minutes) it takes for foam solution to drop out from the foam mass; for a specified percent of the total solution contained in the foam to revert to liquid and drain out of the bubble structure.
<b>Drift</b>	The effect of wind on smoke or on a water drop.
<b>Drip torch</b>	A canister of flammable fuel fitted with a wand, a burner head and a fuel flow control device. It is used for lighting fires for prescribed burning, backburning and burning out.

## Bushfire Glossary

Term	Definition
<b>Drop pass</b>	Indicates that the firefighting aircraft has the target in sight and will make a drop of fire control agent on this run over the target.
<b>Drop pattern</b>	The distribution of an aerially delivered fire control agent drop on the target area in terms of its length, width, and momentum (velocity x mass) as it approaches the ground. The latter determines the relative coverage level of the fire control agent on fuels within the pattern.
<b>Drop zone (DZ)</b>	Target area for firefighting aircraft, or cargo dropping.
<b>Drought</b>	Prolonged absence or marked deficiency of precipitation (rain). (BOM)
<b>Drought index</b>	A numerical value reflecting the dryness of soils, deep forest litter, logs and living vegetation.
<b>Dry bulb temperature</b>	Technically, the temperature registered by the dry-bulb thermometer of a psychrometer. However, it is identical to the temperature of the air. (Degrees Celsius). (NZ)
<b>Dry firefighting</b>	The suppression of a fire without the use of water. This is normally achieved by removing the fuel by the use of hand tools, burning or machinery.
<b>Duff</b>	The layer of decomposing vegetative matter on the forest floor below the litter layer, the original structure still being recognisable.
<b>Ecological burning</b>	A form of prescribed burning. Treatment with fire of vegetation in nominated areas to achieve specified ecological objectives.
<b>Edge burning</b>	A term used to describe perimeter burning of an area in mild conditions prior to large scale prescribed burning. This practice is used to strengthen buffers and to reduce mop-up operations.
<b>Elevated fuel</b>	The standing and supported combustibles not in direct contact with the ground and consisting mainly of foliage, twigs, branches, stems, bark and creepers.
<b>Embers</b>	Glowing particles cast from the fire (as 'showers' or 'storms'). (Vic report)
<b>Emergency centre</b>	A facility where the coordination of the response and support to the incident is provided.
<b>En route resources</b>	Resources despatched to an incident that have not yet checked in. (AIIMS)
<b>Entrapment</b>	A situation in which individuals are exposed to life threatening or potentially life threatening conditions from which they cannot safely remove themselves.
<b>Equilibrium moisture content (EMC)</b>	The moisture content that a fuel element would attain if exposed for an infinite period in an environment of specified constant dry-bulb temperature and relative humidity. When a fuel element has reached its EMC, it neither gains nor loses moisture as long as conditions remain constant.
<b>Equipment</b>	All material supplied to an incident excluding personnel and vehicles.
<b>Escape route</b>	A planned route away from danger areas at a fire.
<b>Evacuation</b>	The temporary relocation of persons from dangerous or potentially dangerous areas to safe areas.

## Bushfire Glossary

Term	Definition
<b>Exposures</b>	<p>Parts of the same structure or other structures or property not directly involved in the fire but at risk of being burnt or damaged if the fire is not controlled. In the bushfire context:</p> <ol style="list-style-type: none"> <li>1. Property that may be endangered by a fire burning in another structure or by a bushfire. In general, property within 12 metres of a fire may be considered to involve an exposure hazard, although in very large fires the danger may exist at much greater distances.</li> <li>2. Direction in which a slope faces, usually with respect to cardinal directions (N, S, E, W).</li> <li>3. The general surroundings of a site, with special reference to its openness to winds and sunshine.</li> </ol>
<b>Extinguishing agent</b>	A substance used to put out a fire by cooling the burning material or blocking the supply of oxygen, or chemically inhibiting combustion or combinations of these mechanisms.
<b>Extreme fire behaviour</b>	<p>A level of bushfire behaviour characteristics that ordinarily precludes methods of direct suppression action. One or more of the following is usually involved:</p> <ul style="list-style-type: none"> <li>• high rates of spread</li> <li>• prolific crowning and/or spotting</li> <li>• presence of fire whirls</li> <li>• a strong convective column.</li> </ul> <p>Predictability is difficult because such fires often exercise some degree of influence on their environment and behave erratically, sometimes dangerously.</p>
<b>Extreme fire danger</b>	The second highest fire danger rating as determined by fire agencies and generally with a Forest fire danger index between 75 and 99 or a Grassland fire danger index greater between 100 and 149.
<b>Facilities</b>	Permanent and temporary facilities where personnel sleep, cook, maintain and repair equipment. (AIIMS)
<b>Fall back fire control line</b>	Any fire control line which is at a distance from the fire perimeter, and is the second control line at which the fire perimeter may be stopped should it cross the first fire control line. Also known as 'fallback line'.
<b>Fine fuel</b>	Fuel such as grass, leaves, bark and twigs less than 6mm in diameter that ignite readily and are burnt rapidly when dry.
<b>Fingers</b>	Long and narrow slivers of fire which extend beyond the head or flanks. (AFAC)
<b>Fire</b>	The chemical reaction between fuel, oxygen and heat. Heat is necessary to start the reaction and once ignited, fire produces its own heat and becomes self-supporting.
<b>Fire access track</b>	A track constructed and/or maintained expressly for fire management purposes.
<b>Fire behaviour</b>	The manner in which a fire reacts to the variables of fuel, weather and topography.
<b>Fire Behaviour Analyst</b>	Person responsible for developing fire behaviour predictions based on fire history, fuel, weather, and topography. (NWCG)amended
<b>Fire behaviour model</b>	A set of mathematical equations that can be used to predict certain aspects of fire behaviour.
<b>Fire behaviour prediction</b>	Prediction of probable fire behaviour usually prepared by a fire behaviour analyst in support of fire suppression or prescribed burning operations. (NWCG)
<b>Fire behaviour prediction system</b>	A system that uses a set of mathematical equations to predict certain aspects of fire behaviour in wildland fuels when provided with data on fuel and environmental conditions.



## Bushfire Glossary

Term	Definition
<b>Fire bombing</b>	A technique of suppressing a bushfire by dropping water, foam or retardants on it from an aircraft.
<b>Fire brand</b>	A piece of flaming or smouldering material capable of acting as an ignition source. eg eucalypt bark.
<b>Fire climate</b>	The composite pattern or integration over time of the fire weather elements that affect fire occurrence and fire behaviour in a given area.
<b>Fire control</b>	See Fire suppression.
<b>Fire control agent</b>	A substance that acts as an Extinguishing agent, and or a Fire retardant and or a Fire suppressant.
<b>Fire control line</b>	See: Fireline.
<b>Fire crew</b>	A general term for two or more firefighters organised to work as a unit. (NWCG)
<b>Fire danger</b>	Sum of constant danger and variable danger factors affecting the inception, spread, and resistance to control, and subsequent fire damage; often expressed as an index. (NWCG)
<b>Fire danger class</b>	A segment of a fire danger index scale identified by a descriptive term and or a colour code. The classification system may be based on more than one fire danger index and an assessment of risk exposure.
<b>Fire danger index (FDI)</b>	A relative number denoting the potential rates of spread, or suppression difficulty for specific combinations of temperature, relative humidity, drought effects and wind speed.
<b>Fire danger rating</b>	A relative class denoting the potential rates of spread, or suppression difficulty for specific combinations of temperature, relative humidity, drought effects and wind speed, indicating the relative evaluation of fire danger.
<b>Fire ecology</b>	The study of the relationships between fire, the physical environment and living organisms.
<b>Fire edge</b>	Any part of the boundary of a going fire at a given time. <i>NOTE:</i> The entire boundary is termed the 'fire perimeter'.
<b>Fire effects</b>	The physical, biological and ecological impact of fire on the environment. (NWCG)
<b>Fire environment</b>	The surrounding conditions, influences, and modifying forces of topography, fuel, and weather that determine fire behaviour. (NWCG)
<b>Firefighter</b>	Any employee, volunteer or agent of any fire agency who occupies, or is designated, to undertake a role for the purpose of fire suppression.
<b>Firefighting operations</b>	Any work or activity directly associated with control of fire.
<b>Fire frequency</b>	A general term referring to the recurrence of fire in a given area over time (NWCG). Also see: Fire regime
<b>Fire front</b>	The part of a fire within which continuous flaming combustion is taking place. Unless otherwise specified, the fire front is assumed to be the leading edge of the fire perimeter. In ground fires, the fire front may be mainly smouldering combustion. (NWCG)
<b>Fireground</b>	The area in the vicinity of a fire suppression operations, and the area immediately threatened by the fire. It includes burning and burnt areas; constructed and proposed fire lines; the area where firefighters, vehicles, machinery and equipment are located when deployed; roads and access points under traffic management control; tracks and facilities in the area surrounding the actual fire; and may extend to adjoining area directly threatened by the fire.

## Bushfire Glossary

Term	Definition
<b>Fire hazard</b>	A fuel complex, defined by volume, type condition, arrangement, and location, that determines the degree of ease of ignition and of resistance to control.
<b>Fire intensity</b>	See: Fireline intensity.
<b>Fireline</b>	A natural or constructed barrier, or treated fire edge, used in fire suppression and prescribed burning to limit the spread of fire.
<b>Fireline intensity</b>	<p>The rate of energy release per unit length of fire front usually expressed in kilowatts per metre (Kw/m). The rate of energy release per unit length of fire front, defined by the equation <math>I = Hwr</math>, where</p> <p><math>I</math> = fireline intensity (kW/m)  <math>H</math> = heat yield of fuel (kJ/kg)-16,000 kJ/kg <math>w</math> = dry weight of fuel consumed (kg/m<sup>2</sup>) (mean total less mean unburnt)  <math>r</math> = forward rate of spread (m/s)</p> <p>The equation can be simplified to <math>I = w r/2</math>  where <math>I</math> = fireline intensity (kW/m)  <math>w</math> = dry weight of fuel consumed (tonnes/ha)  <math>r</math> = forward rate of spread (m/hr)</p>
<b>Fire lookout</b>	A structure strategically located and manned to detect the occurrence and the location of fires. It may be a tower or a structure on a high point
<b>Fire management</b>	All activities associated with the management of fire prone land, including the use of fire to meet land management goals and objectives.
<b>Fire potential</b>	The chance of a fire or number of fires occurring of such size, complexity or impact that requires resources (both a pre-emptive management and suppression capability) from beyond the area of the fire origin. (BCRC)
<b>Fire preparedness</b>	All activities undertaken in advance of bushfire occurrence to decrease its extent and severity and to ensure more effective fire suppression.
<b>Fire prevention</b>	All activities concerned with minimising the incidence of bushfire particularly those of human origin.
<b>Fire regime</b>	The history of fire in a particular vegetation type or area including the frequency, intensity and season of burning. It may also include proposals for the use of fire in a given area. (AFAC)
<b>Fire report</b>	An official record of a fire, generally including information on cause, location, action taken, damage, costs, etc., from start of the fire until completion of suppression action. These reports vary in form and detail from agency to agency (NWCG). Also see Report of Fire
<b>Fire retardant</b>	A chemical generally mixed with water, designed to retard combustion by a chemical reaction. It is applied as slurry from the ground or air to fuels ahead of the fire.
<b>Fire risk</b>	Processes, occurrences or actions that increase the likelihood of fires occurring.
<b>Fire run</b>	A rapid advance of a fire front. It is characterised by a marked transition in intensity and rate of spread.
<b>Fire scar</b>	<p>1) A healing or healed-over injury caused or aggravated by fire on a woody plant.</p> <p>2) A mark left on a landscape by fire.</p>
<b>Fire season</b>	The period during which bushfires are likely to occur, spread and do sufficient damage to warrant organised fire control.
<b>Fire simulator</b>	A device that imposes simulated fire and smoke on a projected landscape scene, for the purpose of informing fire suppression personnel of potential fire situations either for an actual fire or hypothetical fire(s).
<b>Fire spread</b>	Development and travel of fire across surfaces.

## Bushfire Glossary

Term	Definition
<b>Fire storm</b>	Violent convection caused by a large continuous area of intense bushfire often characterised by destructively violent surface indrafts, a towering convection column, long distance spotting, and sometimes by tornado-like whirlwinds. (AFAC)
<b>Fire suppressant</b>	An additive designed to reduce the surface tension of water and/or to hold water in suspension thus increasing water's efficiency as a fire extinguishing agent. Suppressants are applied directly to the burning fuels.
<b>Fire suppression</b>	The activities connected with restricting the spread of a fire following its detection and before making it safe.
<b>Fire suppression organisation</b>	<ol style="list-style-type: none"> <li>1. The personnel and equipment collectively assigned to the suppression of a specific fire or group of fires.</li> <li>2. The personnel responsible for fire suppression within a specified area.</li> <li>3. The management structure, usually shown in the form of an organization chart of the persons and groups having specific responsibilities in fire suppression.</li> </ol> (NWCG)
<b>Fire suppression plan</b>	See Incident action plan (IAP).
<b>Fire tetrahedron</b>	An instructional aid in which the sides of the tetrahedron (comprising 4 triangular shaped figures) are used to represent the 4 components of combustion and flame production process-fuel, heat, oxygen and the chemical chain reaction.
<b>Fire threat</b>	The impact a fire will have on a community.
<b>Fire tower</b>	Tower strategically located and manned to detect and report the occurrence and location of fires. A type of Fire lookout
<b>Fire training simulator</b>	A training device that imposes simulated fire and smoke on a projected landscape scene, for the purpose of instructing fire suppression personnel in fire situations and fire suppression techniques.
<b>Fire triangle</b>	Diagrammatic expression of the three elements that are necessary for a fire to occur. FUEL – HEAT – OXYGEN. The removal of any one of these will extinguish a fire.
<b>Fire weather</b>	Weather conditions which influence fire ignition, behaviour, and suppression. (NWCG)
<b>Fire weather forecast</b>	A weather prediction specially prepared for use in wildland fire operations and prescribed fire. (NWCG)
<b>Fire whirl</b>	Spinning vortex column of ascending hot air and gases rising from a fire and carrying aloft smoke, debris, and flame. Fire whirls range in size from less than one foot to over 500 feet in diameter. Large fire whirls have the intensity of a small tornado. (NWCG)
<b>Fire wind</b>	The inflow of air close to a fire caused by the action of convection. It is not to be confused with a prevailing wind.
<b>First attack</b>	See: Initial attack
<b>Fixed wing aircraft</b>	A heavier than air aircraft which obtains lift for flight by forward motion of wings through the air.
<b>Flame angle</b>	The angle of the flame in relation to the ground, caused by wind direction or the effect of a slope.
<b>Flame depth</b>	The depth of the zone within which continuous flaming occurs behind the fire edge.

## Bushfire Glossary

Term	Definition
<b>Flame height</b>	The average maximum vertical extension of flames at the leading edge of the fire front. Occasional flashes that rise above the general level of flames are not considered. This distance is less than the flame length if flames are tilted due to wind or slope. (NWCG)
<b>Flame length</b>	The distance between the flame tip and the midpoint of the flame depth at the base of the flame (generally the ground surface), an indicator of fire intensity. (NWCG)
<b>Flame Zone</b>	The highest level of bushfire attack as a consequence of direct exposure to flames from the fire front in addition to heat flux and ember attack. (AS 3959 - 2009)
<b>Flame zone</b>	The area around fuels where the combustion of gases occurs to form flames.
<b>Flaming zone</b>	See: Flame zone.
<b>Flammability</b>	The ease with which a substance is set on fire.
<b>Flammable</b>	Capable of being ignited and of burning with a flame.
<b>Flank attack</b>	Obtaining control of a fire by attacking its side/s (flank).
<b>Flanks of a fire</b>	Those parts of a fire's perimeter that are roughly parallel to the main direction of spread. (NWCG)
<b>Flare up</b>	Any sudden acceleration of fire spread, or intensification of fire, or a part of the fire. A flare up is of relatively short duration and does not radically change existing control plans. (NWCG)
<b>Flash fire</b>	A fast moving fire consuming most of the fine fuels available.
<b>Foam</b>	Foam is a mass of bubbles formed by mixing air with water and a foam concentrate in specific proportions. It is used as a firefighting agent to form a smothering, cooling and/or ignition preventing layer of the surface over a fuel.
<b>Foam blanket</b>	A layer of foam which forms an insulating and reflective barrier to heat and is used for fuel protection, suppression, and mop-up. (NWCG)
<b>Foam Class A</b>	A mixture of foam concentrate & water specifically formulated for extinguishing bushfires. The foam is biodegradable, non toxic and is used at very low concentrates. It may be delivered aspirated or non-aspirated. (See also Foam solution).
<b>Foam Class B</b>	A foam formulated for application on Class B fires
<b>Foam concentrate</b>	The concentrated foaming agent as received from the manufacturer which, when added to water, creates a foam solution.
<b>Foam inductor</b>	Equipment consisting of an inlet connection, ejector pump and a discharge assembly, for the induction of foam concentrate.
<b>Foam solution</b>	The mixture of water and foam concentrate.
<b>Forest</b>	An area, incorporating all living and non-living components, that is dominated by trees having usually a single stem and a mature or potentially mature stand height exceeding 2 metres and with existing or potential crown cover of overstorey strata about equal to or greater than 20 per cent. This definition includes Australia's diverse native forests, woodlands and plantations, regardless of age.
<b>Forest fire</b>	A fire burning mainly in forest and/or woodland.
<b>Forest type</b>	A category for describing a forest commonly based on the predominant tree species, tree form and structure.

## Bushfire Glossary

Term	Definition
<b>Forward looking infrared (FLIR)</b>	Hand held or aircraft mounted device designed to detect heat differentials and display them. FLIRs have thermal resolution similar to IR line scanners, but their spatial resolution is substantially less; commonly used to detect hot spots and flare ups obscured by smoke, evaluate the effectiveness of firing operations, or detect areas needing mop-up. (NWCG)
<b>Forward rate of spread (FROS)</b>	The speed with which a head fire moves in a horizontal direction across the landscape.
<b>Frontal fire intensity</b>	See: Fireline Intensity
<b>Front end loader</b>	Earthmoving equipment designed to move loose earth and/or loads into vehicles. A multi-purpose bucket is fitted to articulated arms at the front of the vehicle. May be either wheeled or tracked.
<b>Fuel</b>	Any material such as grass, leaf litter and live vegetation which can be ignited and sustains a fire. Fuel is usually measured in tonnes per hectare. Related Terms: Available fuel, Coarse fuel, Dead fuel, Elevated dead fuel, Fine fuel Ladder fuels, Surface fuels, and Total fine fuel.
<b>Fuel age</b>	The period of time lapsed since the fuel was last burnt.
<b>Fuel arrangement</b>	A general term referring to the spatial distribution and orientation of fuel particles or pieces. (NWCG)
<b>Fuel array</b>	The totality of fuels displayed in a location: fine and coarse, live and dead. (Vic report)
<b>Fuel assessment</b>	The estimation or calculation of total and available fuel present in a given area.
<b>Fuel bed depth</b>	Average height of surface fuels contained in the combustion zone of a spreading fire front. (NWCG)
<b>Fuelbreak</b>	A natural or manmade change in fuel characteristics which affects fire behaviour so that fires burning into them can be more readily controlled.
<b>Fuelbreak system</b>	A series of modified strips or blocks tied together to form continuous strategically located fuel breaks around land units.
<b>Fuel continuity</b>	The degree or extent of continuous or uninterrupted distribution of fuel particles in a fuel bed thus affecting a fire's ability to sustain combustion and spread. This applies to aerial fuels as well as surface fuels.
<b>Fuel depth</b>	The average distance from the bottom of the litter layer to the top of the layer of fuel, usually the surface fuel.
<b>Fuel load</b>	The oven dry weight of fuel per unit area. Commonly expressed as tonnes per hectare. (AFAC). (Also known as fuel loading)
<b>Fuel management</b>	Modification of fuels by prescribed burning, or other means. (AFAC)
<b>Fuel map</b>	A map showing areas of varying fuel quantities and types and usually indicates past fire history.
<b>Fuel model</b>	Simulated fuel complex for which all fuel descriptors required for the solution of a mathematical rate of spread model have been specified. (NWCG)
<b>Fuel modification</b>	Manipulation or removal of fuels to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control (e.g., lopping, chipping, crushing, piling and burning).(NWCG)
<b>Fuel moisture content</b>	The water content of a fuel expressed as a percent of the oven dry weight of the fuel particle. (%ODW)

## Bushfire Glossary

Term	Definition
<b>Fuel moisture differential</b>	A term used to describe the situation where the difference in the moisture content between fuels on adjacent areas results in noticeably different fire behaviour on each area.
<b>Fuel profile</b>	The vertical cross section of a fuel bed down to mineral earth.
<b>Fuel quantity</b>	See: Fuel load.
<b>Fuel reduction</b>	Manipulation, including combustion, or removal of fuels to reduce the likelihood of ignition and/or to lessen potential damage and resistance to control.
<b>Fuel reduction burning</b>	The planned application of fire to reduce hazardous fuel quantities; undertaken in prescribed environmental conditions within defined boundaries.
<b>Fuel separation</b>	The action of separating fuel for the purpose of providing a mineral earth firebreak. Also means the actual gap between fuel layers or particles eg gap between individual hummock grasses or gap between surface and canopy fuels
<b>Fuel type</b>	An identifiable association of fuel elements of distinctive species, form, size, arrangement, or other characteristics that will cause predictable rate of spread or difficulty of control under specified weather conditions. (AFAC)
<b>Fuel weight</b>	See Fuel load.
<b>General origin area</b>	The larger area where the fire started that is readily identifiable based on macro scale indicators and witness statements. (NWCG)
<b>Going fire</b>	Any bushfire which is expanding and suppression actions have not yet contained the fire.
<b>Grass fire</b>	Any fire in which the predominant fuel is grass or grass like. (NWCG)
<b>Grassland curing</b>	The proportion of dead material in grasslands – usually increases over summer as tillers die off and dry out, increasing the risk of grassland fire.
<b>Grid ignition</b>	A method of lighting prescribed fires where ignition points are set individually at a predetermined spacing through an area.
<b>Ground crew</b>	See: Hand crew.
<b>Ground fire</b>	Fire that consumes the organic material beneath the surface litter ground, such as a peat fire. (NWCG)
<b>Ground fuel</b>	All combustible materials below the surface litter, including duff, roots, peat and saw dust dumps that normally support a glowing or smouldering combustion without flame.
<b>Habitat</b>	The local environment of conditions in which an animal or plant lives.
<b>Hand crew</b>	A fire suppression crew trained and equipped to fight fire with hand tools.
<b>Hand line</b>	A fireline constructed with hand tools. (NWCG) (Wildfire context)
<b>Hand trail</b>	See Hand line.
<b>Hang up</b>	A situation in which a tree is lodged in another and prevents it from falling to the ground.
<b>Hazard</b>	A source of potential harm or a situation with potential to cause loss.
<b>Hazard reduction</b>	See: Fuel Management
<b>Head</b>	See: Head Fire
<b>Head attack</b>	Directly knocking down the head of a fire. Recommended only for low intensity fires where firefighters can be sure that the fire will not flare up unexpectedly.
<b>Head fire</b>	The part of a fire where the rate of spread, flame height and intensity are greatest, usually when burning downwind or upslope.



## Bushfire Glossary

Term	Definition
<b>Heat exhaustion</b>	A form of shock, due to depletion of body fluids resulting from overexposure to a hot environment.
<b>Heat stress</b>	Illness caused by the body overheating.
<b>Heat stroke</b>	A life-threatening condition that develops when the body's temperature-regulating and cooling mechanisms are overwhelmed and body systems begin to fail.
<b>Heat transfer</b>	The transfer of thermal energy from one physical system to another by conduction, convection or thermal radiation.
<b>Heavy fuels</b>	See: Coarse fuels.
<b>Heel</b>	See: Rear (Preferred term).
<b>Heel fire</b>	See: Backing Fire.
<b>Helibase (HB)</b>	A location for parking, refuelling and maintenance of helicopters operating in support of an incident.
<b>Helicopter</b>	A form of heavier-than-air, rotor-wing aircraft whose lift is produced by engine-driven rotors which behave as if they were both propellers and wings.
<b>Helipad (HP)</b>	A designated location which meets specific requirements for a helicopter to take off and land.
<b>Helitack crew</b>	An initial attack crew specially trained in the tactical and logistical use of helicopters for fire suppression.
<b>Heli-torch</b>	An aerial ignition device hung from or mounted on a helicopter to disperse ignited lumps of gelled gasoline. Used for backburns, burnouts, or prescribed burns. (NWCG)
<b>High fire danger</b>	The second lowest fire danger rating as determined by fire agencies and generally with a Forest fire danger index between 25 and 49 or a Grassland fire danger index between 25 and 49.
<b>High intensity fire</b>	Fires with an average intensity greater than 3000 kW.m <sup>-1</sup> and flame heights greater than 3 m, causing complete crown scorch or possibly crown fires in forests. Uncontrollable by direct attack. The term is also applied to stationary fires burning in very high fuel loads (such as logging slash).
<b>Hold over fire</b>	See: Sleeper
<b>Hop over</b>	See: Breakaway.
<b>Hose bandage</b>	A means of affecting a temporary repair to a canvas or synthetic hose.
<b>Hose strangler</b>	A crimping device for stopping the flow of water in a hose.
<b>Hot Refueller</b>	A trained person responsible for the operation of the equipment for the 'hot' refuelling of helicopters.
<b>Hot spot</b>	1. A particularly active part of a fire. 2. An area of smouldering fuels requiring to be extinguished during patrol operations.
<b>Humus</b>	Layer of decomposed organic matter on the forest floor beneath the fermentation layer and directly above the soil. It is that part of the duff in which decomposition has rendered vegetation unrecognizable and mixing of soil and organic matter is underway. See Also: Duff & Litter
<b>Hygrometer</b>	An Instrument which measures the humidity in the air.
<b>Ignition</b>	The beginning of flame production or smouldering combustion; the starting of a fire.

## Bushfire Glossary

Term	Definition
<b>Ignition pattern</b>	The manner in which a prescribed burn, backburn, or burnout is set, determined by weather, fuel, ignition system, topographic and other factors having an influence on fire behaviour and the objective of the burn.
<b>Ignition source</b>	A source of energy sufficient to initiate combustion.
<b>Incendiary</b>	A burning compound or metal used to produce intense heat or flame, like a bomb.
<b>Incendiary device</b>	Device designed and used to start a fire.
<b>Incident</b>	Any unplanned event requiring emergency intervention. (AIIMS)
<b>Incident Action Plan (IAP)</b>	The plan used to describe the incident objectives, strategies, resources and other information relevant to the control of an incident. (AIIMS)
<b>Incident control</b>	See: Incident management
<b>Incident Control Centre (ICC)</b>	The location where the Incident Controller and various members of the Incident Management Team provide overall direction of response activities. (See also Incident Control Point)
<b>Incident Controller</b>	The individual responsible for the management of all incident control activities across a whole incident (AIIMS)
<b>Incident Control Point (ICP)</b>	The location where the Incident Controller and, where established, members of the Incident Management Team provide overall direction of response activities in an emergency situation. (See also Incident Control Centre)
<b>Incident control system (ICS)</b>	A command structure to systematically and logically manage suppression of emergency incidents including bushfires, from small, simple incidents to large, difficult or multiple situations. It is designed to develop in modular fashion from the top (Incident Controller) downwards. Refer NIMS, AIIMS, CIMS
<b>Incident management</b>	The process of controlling the incident and coordinating resources. (EMA)
<b>Incident Management Team (IMT)</b>	The group of incident management personnel comprising the Incident Controller, and the personnel he or she appoints to be responsible for the functions of Operations, Planning and Logistics. (AIIMS)
<b>Incident objective</b>	An incident objective is a goal statement indicating the desired outcome of the incident. Incident objectives guide the development of the Incident Action Plan and must reflect the policies and needs of the control authority and supporting agencies. All factors affecting the incident and its potential impact must be considered before determining the objective. (AIIMS)
<b>Incident strategies</b>	The incident strategies will be developed from the incident objectives and will describe how the Incident Management Team plans to resolve the incident. There is a requirement for strategies to be developed throughout the incident and they should be reviewed for each operational period. (AIIMS)
<b>Indirect attack</b>	A method of suppression in which the control line is located some considerable distance away from the fire's active edge. Generally done in the case of a fast-spreading or high-intensity fire and to utilize natural or constructed firebreaks or fuelbreaks and favourable breaks in the topography. The intervening fuel is usually backburnt; but occasionally the main fire is allowed to burn to the line, depending on conditions.(NWCG)
<b>Induced wind</b>	See: Fire wind.
<b>Infrared scanning</b>	Use of an optical-electronic system for identifying or obtaining imagery of thermal infrared radiation to detect non-smoking fires or fire perimeters through smoke.
<b>Initial attack</b>	The first suppression work on a fire.

## Bushfire Glossary

Term	Definition
<b>Instability</b>	The tendency for air parcels to accelerate when they are displaced from their original position; especially, the tendency to accelerate upward after being lifted. Instability is a prerequisite for severe weather - the greater the instability, the greater the potential for severe thunderstorms. (Weather Zone)
<b>Interface</b>	See: Urban Rural interface.
<b>Inversion</b>	A layer of the atmosphere in which temperature increases with increasing elevation. A condition of strong atmospheric stability.
<b>Island</b>	An unburnt area within a fire perimeter.
<b>Isobar</b>	Lines on weather maps joining places which have the same air pressure.(BOM)
<b>I zone</b>	See: Urban Rural interface.
<b>Jump fire</b>	See: Spot fire
<b>Jump over</b>	See: Breakaway
<b>Junction zone</b>	An area of greatly increased fire intensity caused by two fire fronts (or flanks) burning towards one another.
<b>Keetch-Byram Drought Index (KBDI)</b>	A numerical value reflecting the dryness of soils, deep forest litter, logs and living vegetation, and expressed as a scale from 0 - 200 where the number represents the amounts of rainfall (mm) to return the soil to saturation.
<b>Knock down</b>	To reduce the flame or heat on the more vigorously burning parts of a fire edge. (NWCG)
<b>Ladder fuels</b>	Fuels that provide vertical continuity between strata. Fire is able to carry surface fuels into the crowns of trees with relative ease.
<b>Lag time</b>	The time delay in fuel moisture content responding to changing environmental conditions (for example, relative humidity). Technically, it is the time necessary for a fuel particle to lose approximately 63% of the difference between its initial moisture content and its equilibrium moisture content.
<b>Lead agency</b>	The organisation with the legislative or agreed authority for control of an incident.
<b>Lee (leeward)</b>	Away from the wind, on the sheltered side of something that the wind is blowing on.
<b>Legislation</b>	A set of rules made by a State, Territory or Federal Government; includes acts and regulation.
<b>Light fuel</b>	An assessment of fuel quantity indicating a low weight.
<b>Lighting pattern</b>	See: Ignition pattern.
<b>Lightning</b>	The flash of light accompanying a sudden electrical discharge which takes place from or inside a cloud, or less often from high structures or the ground or from mountains. A large electrical spark. Caused when the negative charge in the lower part of the cloud and the positive charge in the upper part of the cloud become so great that they can overcome the natural resistance of the air and discharge between negative and positive takes place. (BOM)
<b>Lightning fire</b>	A fire caused by lightning.
<b>Lightning formation</b>	See: Lightning.
<b>Light patrol unit</b>	See: Tanker.
<b>Line ignition</b>	See: Strip burning.

## Bushfire Glossary

Term	Definition
<b>Litter</b>	The top layer of the forest floor composed of loose debris of dead sticks, branches, twigs, and recently fallen leaves and needles, little altered in structure by decomposition. (The litter layer of the forest floor). (NWCG)
<b>Litter bed fuel</b>	Dead fine fuel, including surface fuel and fuel lower in the fuel profile.
<b>Litter fall</b>	The addition of litter that falls from vegetation to the forest floor.
<b>Living fuels</b>	Fuels made up of living vegetation.
<b>Living shrub fuel</b>	Living understorey fine fuel less than 2 metres above ground level.
<b>Local winds</b>	Winds which are generated over a comparatively small area by local terrain and weather. They differ from those which would be appropriate to the general pressure pattern. (NWCG)
<b>Log</b>	Documentation of information and actions arising during an incident
<b>Logistics</b>	The provision of facilities, services and materials in support of an incident.
<b>Lookout</b>	<ol style="list-style-type: none"> <li>1. A person designated to detect and report fires from a fixed vantage point.</li> <li>2. A member of a fire crew designated to observe the fire and warn the crew when there is danger.</li> <li>3. For structure see: Fire lookout</li> </ol>
<b>Lookout tower</b>	See: Fire tower.
<b>Low intensity fire</b>	A fire which travels slowly and only burns lower storey vegetation, like grass and lower tree branches, with an average intensity of less than 500 kW.m <sup>-1</sup> and flame height less than 1.5m. Usually causes little or no crown scorch and is easily controlled.
<b>Low-moderate fire danger</b>	The lowest fire danger rating as determined by fire agencies and generally with a Forest fire danger index less than 12 or a Grassland fire danger index less than 12.
<b>Medium fuels</b>	See Course fuels.
<b>Mineral earth</b>	When used in the context of fire control refers to a non-flammable surface (either natural or prepared) which provides a break in understorey, litter and humus fuels and hence a barrier (of varied effectiveness depending, amongst other things, on its width and the intensity of the approaching fire) to fire travelling on or near the ground surface.
<b>Mobilisation</b>	The processes and procedures for organisations to activate, assemble, and transport the requested resources to an incident.
<b>Moisture content</b>	See Fuel moisture content.
<b>Mopping up</b>	See Blacking out
<b>Mosaic</b>	Used in reference to the spatial arrangement of burnt and unburnt fuels at either a local or a landscape scale.
<b>Move up method</b>	See: Step-up method
<b>Multi-agency response</b>	The response to an incident where one or more agencies assist the jurisdictional control agency or agencies.
<b>Multiple fire situation</b>	A circumstance of high fire incidence over short periods of time in any administrative unit, usually overtaxing the normal initial attack capability of the unit.
<b>Natural barrier</b>	Any area where lack of flammable material obstructs the spread of vegetation fires.

## Bushfire Glossary

Term	Definition
<b>Near surface fuel</b>	Live and dead fuel, including suspended leaves, bark or twigs, effectively in touch with the ground but not lying on it, with a mixture of vertical and horizontal orientation.
<b>Needle bed</b>	A fuel bed consisting mainly of pine needles.
<b>Nozzle</b>	A fitting that is used with a branch to control the size, pattern and/or velocity of water or extinguishing medium being discharged.
<b>One lick method</b>	A progressive system of building a fireline on a wildfire without changing relative positions in the line. Each worker does one to several "licks", or strokes removing a set proportion of the fuel on the line, with a given tool and then moves forward a specified distance to make room for the worker behind. (NWCG)
<b>Operations</b>	The direction, supervision and implementation of tactics in accordance with the Incident Action Plan.
<b>Operations point</b>	The location from which the overall field operations are commanded by the Operations Officer. (AIIMS)
<b>Parallel attack</b>	Method of fire suppression in which fireline is constructed approximately parallel to, and just far enough from the fire edge to enable workers and equipment to work effectively, though the fireline may be shortened by cutting across unburned bays. The intervening strip of unburned fuel is normally burned out as the control line proceeds but may be allowed to burn out unassisted where this occurs without undue delay or threat to the fireline. (NWCG)
<b>Parallel fire suppression</b>	See: Parallel attack.
<b>Parallel method</b>	See: Parallel attack.
<b>Parts of a Fire</b>	See: Bay(s), Fingers, Flanks of a fire, Head.
<b>Patch burning</b>	Burning in patches to prepare sites for group planting or sowing or to form a barrier to subsequent fires. (NWCG)
<b>Patrol</b>	<ol style="list-style-type: none"> <li>1. To travel over a given route to prevent, detect, and suppress fires. Includes interaction with the public for wildland fire prevention and educational purposes.</li> <li>2. To go back and forth vigilantly over a length of control line during and/or after construction to prevent breakaways, suppress spot fires, and extinguish overlooked hot spots.</li> <li>3. A person or group of persons who carry out patrol actions. (NWCG)</li> </ol>
<b>Peat</b>	An amorphous organic material formed by anaerobic decomposition which usually means that the area is seasonally or permanently inundated with water. Peat fires burn by smouldering combustion and generate very high amounts of energy per unit area.
<b>Perimeter</b>	See: Fire perimeter.
<b>Peri urban interface</b>	See: Urban rural interface.
<b>Permit burn</b>	A burn carried out under permit from a Fire Authority.
<b>Personal protection equipment (PPE)</b>	The equipment and clothing designed to mitigate the risk of injury from the chemical, physical and thermal hazards that may be encountered at an incident.
<b>Personal protective clothing (PPC)</b>	The clothing designed to mitigate the risk of injury from the chemical, physical and thermal hazards that may be encountered at an incident.
<b>Plan of attack</b>	See: Incident Action Plan (Preferred term)
<b>Planned burning</b>	See: Prescribed burning.
<b>Pocket</b>	See: Island.

## Bushfire Glossary

Term	Definition
<b>Point of attack</b>	The part of the fire on which work is started when suppression forces arrive.
<b>Point of origin</b>	The specific location where the fire started.
<b>Portable dam</b>	A temporary water storage used in conjunction with power pumps and hose lines.
<b>Predicted rate of spread</b>	The rate of spread predicted by the application of fire spread models utilising appropriate inputs of fuel conditions, topography and weather. Also see Rate of Spread.
<b>Pre-incident plan</b>	Advanced planning and preparation for an emergency situation.
<b>Pre-suppression plan</b>	See Pre-Incident Plan
<b>Prepared community</b>	A community that has developed effective emergency management arrangements at the local level, resulting in: <ul style="list-style-type: none"> <li>• An alert, informed and active community that supports its voluntary organizations</li> <li>• An active and involved local government</li> <li>• Agreed and coordinated arrangements from prevention, preparedness, response and recovery.</li> </ul>
<b>Preparedness</b>	All activities undertaken in advance of the occurrence of an incident to decrease the impact, extent and severity of the incident and to ensure more effective response activities.
<b>Pre-planned dispatch</b>	The pre-planned dispatch of designated suppression forces to fires in predetermined zones. It is usually dependent on the location of the fire, and the forecast fire danger.
<b>Prescribed burn</b>	A fire utilised for Prescribed burning.
<b>Prescribed burn plan</b>	See: Burn plan.
<b>Prescribed burning</b>	The controlled application of fire under specified environmental conditions to a predetermined area and at the time, intensity, and rate of spread required to attain planned resource management objectives.
<b>Prescribed fire</b>	Any fire ignited by management actions to meet specific objectives. A written, approved burn plan must exist, and approving agency requirements (where applicable) must be met, prior to ignition.
<b>Prescription</b>	A written statement defining the objectives to be attained during prescribed burning.
<b>Prevention</b>	All activities concerned with minimising the occurrence of incidents, particularly those of human origin.
<b>Profile litter moisture content</b>	The moisture content, expressed as a percentage of oven-dry weight, of the entire leaf litter bed above the mineral soil surface.
<b>Profile moisture content</b>	See Fuel moisture content.
<b>Psychrometer</b>	The general name for instruments designed for determining the relative humidity of the air. A psychrometer consists of wet and dry bulb thermometers, generally with the aid of psychrometric tables or a psychrometric slide rule. (BOM)
<b>Pulaski tool</b>	A combination chopping and trenching tool widely used in fireline construction, which combines a single-bitted axe blade with a narrow adze-like trenching blade fitted to a straight handle. (NWCG)
<b>Pumper</b>	A firefighting vehicle equipped with a large capacity pump, water tank and hose. Generally intended to be operated when stationary, from reticulated or static water supplies.



## Bushfire Glossary

Term	Definition
<b>Quick-fill pump</b>	A high volume water pump used for filling tankers.
<b>Rain gauge</b>	The general name for instruments designed to measure the amount of rain that has fallen.
<b>Rakehoe (McLeod tool)</b>	A hand tool used for bushfire fighting, consisting of a combination of a heavy rake and hoe.
<b>Rate of spread (ROS)</b>	The speed with which a fire moves in a horizontal direction across the landscape at a specified part of the fire perimeter. See also Forward rate of spread.
<b>Reaction time</b>	The time taken between the report of a fire or incident, and the departure of the crew. See also Response time.
<b>Rear</b>	<ol style="list-style-type: none"> <li>1. That portion of a fire spreading directly into the wind or down slope.</li> <li>2. That portion of a fire edge opposite the head.</li> <li>3. Slowest spreading portion of a fire edge. Also called heel of a fire. (NWCG)</li> </ol>
<b>Reburn</b>	Repeat burning of an area over which a fire has previously passed, but left fuel that later ignites when burning conditions are more favourable. (NWCG)
<b>Reconnaissance</b>	To examine a fire area to obtain information about current and probable fire behaviour and other related fire suppression information. (NWCG)
<b>Recovery</b>	The coordinated process of supporting emergency affected communities in reconstruction of the physical infrastructure and restoration of emotional, social, economic and physical wellbeing.
<b>Red Flag Warning</b>	A process for passing critical safety information to incident suppression resources and support resources on which they can base decisions regarding strategy, tactics and deployment.
<b>Regeneration burn</b>	A burn lit under prescribed conditions for the purpose of achieving regeneration of a particular vegetation type.
<b>Re-ignition</b>	The action of a material that ignites again after it has been extinguished.
<b>Relative humidity (RH)</b>	The amount of water vapour in a given volume of air, expressed as a percentage of the maximum amount of water vapour the air can hold at that temperature.
<b>Relay pumping</b>	Using a series of pumps positioned at intervals along a line or lines of hose to share the workload of pumping water over a long distance.
<b>Relief</b>	The replacement of personnel whose period of time at the incident has concluded.
<b>Report of fire</b>	The notification of the detection of a fire to the fire service. (AFAC)
<b>Residence time</b>	The time required for the flaming zone of a fire to pass a stationary point; the width of the flaming zone divided by the rate of spread of the fire.
<b>Resources</b>	All personnel and equipment available, or potentially available, for incident tasks.
<b>Response</b>	Actions taken in anticipation of, during, and immediately after an incident to ensure that its effects are minimised, and that people affected are given immediate relief and support.
<b>Response time</b>	The time taken between the report of a fire or incident, and arrival at the scene. It includes both reaction time and travel time.
<b>Responsible authority</b>	See: Control authority.
<b>Retardant</b>	See: Fire retardant.

## Bushfire Glossary

Term	Definition
<b>Risk</b>	The exposure to the possibility of such things as economic or financial loss or gain, physical damage, injury or delay, as a consequence of pursuing a particular course of action. The concept of risk has two elements, i.e. the likelihood of something happening and the consequences if it happens. (AS4360)
<b>Risk analysis</b>	A systematic use of available information to determine how often specific events may occur and the magnitude of their likely consequences.
<b>Road Management Point</b>	A strategic position from which traffic can be observed and controlled. (See also Traffic Management Point and Vehicle Control Point)
<b>Rural</b>	Any area wherein residences and other developments are scattered and intermingled with forest, range, or farm land and native vegetation or cultivated crops.
<b>Rural urban interface (RUI)</b>	See Urban rural interface
<b>Safe</b>	The stage of bushfire suppression or prescribed burning when it is considered that no further suppression action or patrols are necessary.
<b>Safety zone</b>	An area cleared of flammable materials used for escape if the line is outflanked or in case a spot fire outside the control line renders the line unsafe. In fire operations, crews progress so as to maintain a safety zone close at hand, allowing the fuels inside the control line to be consumed before going ahead. Safety zones may also be constructed as integral parts of fuelbreaks. They are greatly enlarged areas which can be used with relative safety by fire fighters and their equipment in the event of a blow up in the vicinity. (Vic report)
<b>Scorch height</b>	1. The height above ground level up to which foliage has been browned by a fire. 2. A measurement for determining the acceptable height of flame during prescribed burning.
<b>Scout</b>	A person who checks and reports on conditions in the fire area.
<b>Scrub</b>	Refers to vegetation such as heath, wiregrass and shrubs, which grows either as an understorey or by itself in the absence of a tree canopy.
<b>Scrub fire</b>	Fires burning in scrub.
<b>Secondary fire control line</b>	See: Fall back fire control line.
<b>Sector</b>	A specific area of an incident which is under the control of a Sector Commander who is supervising a number of crews.
<b>Seen area</b>	The ground, or vegetation, that is directly visible from an established or proposed lookout point, or aerial detection flight route.
<b>Severe fire danger</b>	The third highest fire danger rating as determined by fire agencies and generally with a Forest fire danger index between 50 and 74 or a Grassland fire danger index between 50 and 74.
<b>Shift</b>	The period resources are allocated during an operation at the incident or on the fireground.
<b>Shift change</b>	Replacement of allocated crews and or equipment during operations.
<b>Situation report (Sitrep)</b>	A report on the progress of the fire and the efforts to control it. It confirms the location of the fire, its status and potential and the number, nature and effectiveness of resources deployed. Situation reports are normally provided at regular times until the fire is declared safe.
<b>Size up</b>	The evaluation of a fire to determine a course of action for suppression.
<b>Slash</b>	Accumulated fuel resulting from such natural events as wind, fire, snow breakage, or from such human activities as logging, cutting or road construction.

## Bushfire Glossary

Term	Definition
<b>Slash burn</b>	A prescribed burn conducted to consume slash for fire hazard reduction or silvicultural purposes.
<b>Sleeper</b>	1. A fire that starts up again after appearing to have been extinguished. 2. A fire that is detected some time after an ignition opportunity (usually from lightning or hop over events).
<b>Slip-on unit</b>	A tank, a live hose reel or tray, a small capacity pump, and an engine combined into a single one-piece assembly that can be slipped onto a truck bed or trailer and used for spraying water and/or foam on bushfires.
<b>Slop over</b>	See: Breakaway
<b>Smoke management</b>	Used by land managers and meteorologists planning a prescribed burn, to ensure that smoke does not cause problems downwind of the burn.
<b>Smoke Plume</b>	The column of smoke that rises from a fire. (See also Convection Column)
<b>Smoker</b>	An isolated small burning item such as a log, stump or tree, in an area of fire otherwise mopped up.
<b>Softwood</b>	A conventional term used to describe a tree, and the timber of trees, belonging to the group of plants with cones, such as pine and cypress.
<b>Soil Dryness Index (SDI)</b>	A form of Drought Index, usually with slightly more detailed inputs than the Keetch-Byram Drought Index. May be on a scale of 0-200 like the KBDI, but some versions have different scales (for example, Western Australia: 0-2000).
<b>Southern Oscillation Index (SOI)</b>	The comparison of surface air pressure differences between Tahiti and Darwin that shows a strong correlation with rainfall.
<b>Spark arrestor</b>	A device fitted to the exhaust system of machinery for trapping carbon sparks.
<b>Spot fire</b>	1. Isolated fire started ahead of the main fire by sparks, embers or other ignited material, sometimes to a distance of several kilometres. 2. A very small fire that requires little time or effort to extinguish.
<b>Spot ignition</b>	An ignition pattern using a series of spaced points of ignition.
<b>Spot over</b>	See: Breakaway
<b>Spotting</b>	Behaviour of a fire producing sparks or embers that are carried by the wind and start new fires beyond the zone of direct ignition by the main fire. (NWCG)
<b>Staging area</b>	An area where resources are mustered and prepared for allocation to an incident. It may include the provision of welfare and equipment maintenance facilities. (AIIMS)
<b>Stand by</b>	The period during which personnel are to be immediately available at home or other location for fire suppression purposes.
<b>Static water supply</b>	A supply of water in a reservoir or pond, of limited capacity.
<b>Step-up method</b>	A method used by a team of firefighters to construct a firebreak in which each firefighter completely constructs a section of the firebreak after which the entire team 'steps up' to the next section.
<b>Strike teams</b>	A set number of resources of the same type that have an established minimum number of personnel. Strike Teams always have a leader (usually in a separate vehicle), and have a common communications system. Strike Teams are usually made up of five resources of the same type such as: vehicles, crews, earth moving machinery, etc (AIIMS).

## Bushfire Glossary

Term	Definition
<b>Strip burning</b>	1. An ignition pattern using lines of continuous fire. 2. In hazard reduction, burning narrow strips of fuel and leaving the rest of the area untreated by fire. (NWCG)
<b>Strip ignition</b>	See: Strip burning.
<b>Stripping</b>	See: Strip burning.
<b>Structure</b>	A constructed object, usually a free-standing building above ground.
<b>Sub surface fire</b>	See: Ground fire
<b>Sub surface fuel</b>	See: Ground fuel
<b>Suction hose</b>	Hose used to draught from static/open water. It has a hard, usually reinforced, exterior to prevent it collapsing when a partial vacuum exists within the hose.
<b>Supply hose</b>	Hose feeding from a water supply to a pump.
<b>Support agency</b>	An organisation contributing services or resources directly to a lead agency.
<b>Surface fire</b>	Fire that burns loose debris on the surface, which includes dead branches, leaves, and low vegetation. (NWCG)
<b>Surface fuel</b>	Litter fuels made up of leaves, twigs, bark and other fine fuel lying on the ground, predominately horizontal in orientation.
<b>Surface moisture content</b>	The moisture content expressed as a percentage of oven dry weight of the top 5-10 mm of leaf litter.
<b>Tactics</b>	These are the tasking of personnel and resources to implement the incident strategies. Incident control tactics are accomplished in accordance with appropriate agency procedures and safety directives. (AIIMS)
<b>Tail fire</b>	See: Backing fire.
<b>Tanker</b>	A mobile firefighting vehicle equipped with a water tank, pump, and the necessary equipment for spraying water and/or foam on bushfires.
<b>Task force</b>	A combination of resources assembled for a specific purpose. Task Force always have a leader (usually in a separate vehicle), and have a common communications system. Task Forces are established to meet tactical needs and may incorporate a mixture of different resources types. (AIIMS)
<b>Task group</b>	A large or complex combination of resources assembled for a specific purpose including intrastate, interstate and international deployments made up of multiple strike teams or task forces and or other response or support resources in any combination.
<b>Technical advisors</b>	Are advisors with special skills needed to support incident activities/functions.(AIIMS)
<b>Temperature (dry bulb)</b>	The ambient air temperature recorded by an exposed thermometer.
<b>Temperature (wet bulb)</b>	Wet bulb temperature is measured by placing a moist, single-layer, muslin sleeve over the bulb of a dry bulb thermometer. The difference between dry and wet bulb readings is used to determine relative humidity and dewpoint values.
<b>Test fire</b>	A controlled fire ignited to evaluate fire behaviour.
<b>Thermal imagery</b>	A display or print out from an infra-red scanning device.
<b>Thermal radiation</b>	The process by which the surface of an object radiates its thermal energy in the form of electromagnetic radiation.

## Bushfire Glossary

Term	Definition
<b>Thermohygrograph</b>	An instrument that simultaneously and continuously measures and records temperature and relative humidity, normally by tracing each onto a revolving chart. Charts can be either for one day or one week of continuous recording.
<b>Time lag</b>	See: Lag time
<b>Tongues</b>	See: Fingers
<b>Topography</b>	The surface features of a particular area or region. It may include mountains, rivers, populated areas, roads and railways and fuel types.
<b>Torch</b>	See: Candle
<b>Torching</b>	See: Candle
<b>Traffic Management Point</b>	Point along movement routes that are staffed by emergency personnel to direct and control traffic flow. (See also Road Management Point and Vehicle Control Point)
<b>Travel time</b>	The time taken between the departure of a crew, and arrival at the incident. See also Response time.
<b>Under storey</b>	The lowest stratum of a multi-storeyed forest.
<b>Upwind</b>	Towards the wind direction. In the same direction as the direction from which the wind is blowing. The opposite direction to that smoke will travel.
<b>Urban</b>	Area in which residences and other human developments form an essentially contiguous covering of the landscape, includes most area within cities & towns, subdivisions, commercial and industrial parks, and similar development whether inside city limits or not.
<b>Urban interface</b>	See Urban rural interface
<b>Urban rural interface (URI)</b>	The line, area, or zone where structures and other human development adjoin or overlap with undeveloped bushland.
<b>Values at risk</b>	The natural resources or improvements that may be jeopardised if a fire occurs.
<b>Vehicle Control Point</b>	A point on a vehicle access route controlled by a barrier, or similar means, at which a vehicle is required to stop. (See also Road Management Point and Traffic Management Point)
<b>Very high fire danger</b>	The forth highest fire danger rating as determined by fire agencies and generally with a Forest fire danger index between 25 and 49 or a Grassland fire danger index between 25 and 49.
<b>Warning device</b>	Audible devise fitted to fire bombing aircraft to alert ground crews of pending drop.
<b>Water bombing</b>	See: Fire bombing.
<b>Water point</b>	Any natural or constructed supply of water that is readily available for fire control operations.
<b>Water tank</b>	A container capable of storing a large volume of water.
<b>Wetting agent</b>	A chemical added in low concentration to water. It is used in firefighting to break down the surface tension of the water and to improve its penetration into fuels.
<b>Widow maker</b>	See: Hang up
<b>Wilderness Area</b>	Places where wilderness quality defined using thresholds of remoteness, naturalness and total area is recognised and valued by society.
<b>Wildfire</b>	See: Bushfire.
<b>Wildfire control plan</b>	See: Incident Action Plan

## Bushfire Glossary

Term	Definition
<b>Wildland urban interface (WUI)</b>	See: Urban rural interface
<b>Wind direction</b>	The direction from which the wind blows.
<b>Windfall</b>	See: Wind throw
<b>Wind throw</b>	An area of previously standing timber which has been blown over by strong winds or storms.
<b>Wind speed</b>	The rate of horizontal motion of the air past a given point expressed in terms of distance per unit of time. In the NZ Fire Danger Rating System, wind speed is measured at the standard height of 10 metres in the open, averaged over a 10-minute interval and in kilometres per hour.
<b>Wind strength</b>	Generally measured as wind speed. May be measured by the Beaufort wind scale.
<b>Windrow</b>	A long line of piled slash or debris resulting from forest or scrub clearing.
<b>Windrow burning</b>	The burning of windrows.
<b>Windward</b>	Towards the wind. You are windward if the wind is blowing on your face.
<b>Woodland</b>	A subset of forest plant communities in which the trees form only an open canopy (between 20% and 50% crown cover), the intervening area being occupied by lower vegetation, usually grass or scrub.