WHEATBELT REGION
REGIONAL FUEL MANAGEMENT PLAN

GOVERNMENT OF WESTERN AUSTRALIA

Department of **Biodiversity, Conservation and Attractions**

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Table of contents

1. Introduction

This regional fuel management plan (RFMP) assesses risks associated with bushfire in the Parks and Wildlife Service of the Department of Biodiversity, Conservation and Attractions' (the department) Wheatbelt Region to assist planning the department's fuel management program. It interprets the department's Bushfire Risk Management Framework into regional indicators of acceptable bushfire risk and recommends tactics by which these may be achieved. The annual comparison of the current landscape condition to the indicators will inform planning for fuel management in the region.

The RFMP addresses bushfire risk at a regional scale. Fire management requirements relating to local tenures, species, or populations of species are addressed separately in documents such as nature conservation strategies, local area management plans, species recovery plans, and individual burn prescriptions.

The RFMP considers the hazard posed by bushfire to people, communities, infrastructure, and the natural environment. It is underpinned by the principle that managing the fuel available to bushfire is the most efficient and effective way to reduce the impacts of unplanned bushfire. This plan should be read in conjunction with the department's Bushfire Risk Management Framework which further describes this principle and bushfire risk management criteria.

Targets in the RFMP apply to land managed by the department and the tactics proposed are restricted to prescribed burning and physical fuel management such as scrub rolling. Other key aspects of managing bushfire-related risk (including preparation for, response to and recovery from bushfire) are not within the RFMP scope.

The RFMP will be reviewed annually, and a comprehensive review undertaken at the end of its five-year life at the beginning of 2031. Any important new information that emerges between reviews will be incorporated immediately and the plan re-endorsed if those changes are significant.

2. Bushfire risk criteria

2.1. Bushfire risk management zones

A bushfire risk management zone (BRMZ) is an area with similar environmental variables, land use and cultural conditions and therefore a similar characteristic risk profile. It is an area within which fuel management activities are guided by a single set of bushfire risk indicators. Western Australia's BRMZs are defined and described in the department's Bushfire Risk Management Framework.

The department's Wheatbelt Region lies predominantly within the Agricultural BRMZ and Southern Rangelands BRMZ. On the western edge there are small areas of South West and Midwest and Southern Coastal BRMZ and on the northern edge of the region there is a small area of Central Rangelands BRMZ.

2.2. Fire management areas

The department divides the land it manages into six fire management areas (FMAs) to guide bushfire risk assessment and fuel management planning. These areas are defined according to the primary purpose of fuel management in the area and described relative to their proximity to assets.

The department's indicators of acceptable bushfire risk (defined in the department's Bushfire Risk Management Framework) allow fuel management activities to be tailored according to the risk profile and the management purpose of the land, including designating areas where there are no targets due to the limited capacity or requirement to manage fuels. The settlement-hazard separation (SHS), critical infrastructure buffer (CIB), critical transport corridor (CTC), agricultural interface (AgI), landscape risk reduction (LRR) and remote area management (RAM) categories are applied to the Wheatbelt Region.

Table 1: Fire management areas in the DBCA Wheatbelt Region. (Refer to the department's Bushfire Risk Management Framework for more information.)

Fire management area	Description
Settlement-hazard separation (SHS)	• An area of managed fuel adjacent to towns, subdivisions, and other areas of human settlement. • Management objective is to reduce the likelihood of direct flame contact, damaging intensities of radiant heat and ember attack from posing a threat to people. • Breadth of area considers the fuels, climate and topography of the area and the nature of the appropriate fuel management strategies. • Fuels are managed relatively intensively to minimise the likelihood of a bushfire being sustained and to facilitate fire suppression. • The use of fuel management to achieve other land management objectives is supported where it is complementary to the primary management intent.
Critical infrastructure buffer (CIB)	• An area of low fuel around items of critical infrastructure. • Management intent and intensity of fuel management is similar to SHS, however the CIB will generally be applied to a less extensive

Fire management area	Description
	area than the SHS due to these assets having a higher level of resilience to ember attack. • Only applies in BRMZs where the most appropriate strategy to protect critical infrastructure from bushfire is localised, rather than landscape-scale fuel management.
Critical transport corridor (CTC)	• An area of low fuel adjacent to critical transport corridors. • Management objective is minimising the potential for disruption of critical transport between WA and the eastern states of Australia. • Fuels are managed to increase the arrival time of an approaching bushfire, improve suppression effectiveness and limit landscape-scale spread of a bushfire that may endanger people, damage infrastructure, cause financial or social disruption, or threaten SHS or CIB FMAs.
Agricultural interface (AgI)	• An area of low fuel applied to large continuous areas of native vegetation that occur adjacent to agricultural land. • Management objective is to prevent large, intense bushfires entering agricultural land from native vegetation or vice versa. • Fuels are managed to prevent the occurrence of large bushfires that may endanger people, damage infrastructure, cause financial or social disruption, degrade the natural environment or threaten SHS or CIB FMAs.
Landscape risk reduction (LRR)	• Encompasses areas where the density or significance of infrastructure, economic activity or environmental assets necessitates fuel management at a landscape scale. • Fuel management will achieve a range of outcomes, including preventing the occurrence of large bushfires that may threaten life, damage infrastructure, cause financial or social impacts, degrade the natural environment, or threaten SHS or CIB fire management areas. • This is usually achieved by creating a mosaic of fuel ages to reduce the likelihood of fires igniting and spreading and provides greater opportunity for suppression.
Remote area management (RAM)	• Areas where remoteness, inaccessibility, resource constraints and a lack of consequential assets make it impractical or unnecessary to intervene in the prevailing fire regimes. • Fuel management activities are a lower priority but may still occur where required to achieve land management outcomes.

The RFMP identifies where each FMA occurs in the region and details bushfire risk indicators for each fuel type within them. The effective management of bushfire risk in the Wheatbelt Region requires complementary activities in the FMAs including SHS, CIB, CTC, AgI and LRR. These areas have differing management intents, but do not represent a hierarchy of priorities for fuel management.

2.3. Asset value

The department's Bushfire Risk Management Framework applies the National Emergency Risk Analysis Guidelines (NERAG) and the State Emergency Management Prevention and Mitigation Procedure (SEMPMP) to group and prioritise assets at risk from bushfire. These priorities are used to define FMAs and guide the planning of mitigation activities.

Table 2: Asset class categorisation and prioritisation used when assessing bushfire risk.

Asset class	Priority	Description
Settlements	1	Areas of higher population density and low resilience to bushfire: • settlements, towns, and subdivisions • recreation and camping sites with high fire-season visitation.
Dispersed population	2	Areas of low or transient population density and low resilience to bushfire: • individual dwellings • roads with high usage in fire-vulnerable areas • recreation and camping sites with moderate fire-season visitation.
Critical infrastructure	2	Locations where there is a considerable threat to critical infrastructure with State-level significance and no redundancy: • major highways and other primary distributors • major rail routes • major infrastructure associated with electricity generation • gas transmission pipelines • water supply and pipelines and associated pumps and pumping stations • major optical TELCO cables • major wastewater treatment sites.
Protected species and communities	2	Areas that are critical to the survival of a legislatively protected species or threatened ecological communities (TEC) with low resilience to fire.
Economic assets	3	Locations where bushfires may have a significant effect on the livelihood of individuals or community financial sustainability, such as: • farmland • infrastructure of local and/or regional significance • major industry e.g. mine sites, refineries, manufacturing plants • plantation timber resources • water supply catchments.
Other assets	3	Other significant built, natural, or cultural assets, such as: • infrastructure of local significance • significant ecological communities or species habitat • areas with specific fire regime requirements • fire vulnerable Aboriginal or European heritage sites.

2.4. Asset resilience

The likelihood that the potential consequences of a bushfire will be realised depends partly on the resilience of the asset to fire. It is difficult to model resilience given there are many variables that affect the outcome of a fire, however some considerations for determining the resilience of an asset are shown in Table 3 (settlements) and Table 4 (biodiversity assets).

Table 3: Factors affecting the resilience of settlements to bushfire. Some of these factors are also applicable to other built assets and recreation sites.

More resilient to fire →	Less resilient to fire
Interface community[1]	Intermix community[2]
Hardened urban area without vegetation	Vegetation exists within developed area
Multiple access routes	One access route
Access routes highly trafficable	Access routes have limited trafficability
Access routes protected by low fuel buffers	Access routes have adjacent vegetation
Surrounding vegetation is fragmented	Surrounding vegetation is continuous
Adequate refuge available (oval, beach etc.)	Little refuge available
Most residents are capable of self-evacuation	Large population of elderly, infirm or children
Local population well prepared for fire	Population has low level of preparedness
Adequate water supply	Limited water available for fire fighting
Most dwellings constructed of brick	Dwellings constructed of timber or fibro
Building APZs[3] well maintained	Building APZs poorly maintained
Permanent resident population	Campsite or tourist/transient population

[1] An interface community is where a clear demarcation exists between urban areas and native vegetation and bushland does not continue into the developed area.
[2] An intermix community is where structures occur throughout a bushland area without a clear demarcation between urban and bushland areas.
[3] Asset protection zone: a low-fuel area maintained around a building to increase the likelihood that it will survive a bushfire.

Table 4: Factors affecting the resilience of species, communities, and ecosystems to bushfire.

More resilient to fire →	Less resilient to fire
Key plant species are resprouters	Key plant species are obligate seeders
No other threatening processes occurring	Fire may exacerbate other threatening process
Species have short juvenile periods	Species have long juvenile periods
Species have wide distributions	Species have restricted distributions
Species have multiple populations	Species have few populations
Connections exist between populations	Populations are isolated
Fauna is more mobile	Fauna is less mobile
Fauna is adapted to persistence in refugia	Fauna has limited ability to persist in refugia
Fauna can utilise a variety of habitats	Fauna has specialised habitat requirements
Habitat re-establishes rapidly post-fire	Habitat slow to re-establish post-fire
Fauna has a broad diet or can vary diet post-fire	Fauna has specific dietary requirements
Fire has little effect on predation rate	Fauna vulnerable to post-fire predation
Fauna has high rate of population increase	Fauna has low rate of population increase

Asset resilience is combined with the asset class priority rating (Table 2) to provide a regional priority for each asset. This is done using the matrix in Table 5. The regional priority is recorded in Table 8 of the RFMP and will guide the programming of works to mitigate bushfire risk.

Table 5: Matrix for determining the regional priority of assets in each class. The asset class priority is shown in Table 2, and the asset resilience is set with guidance from the criteria in Table 3.

Asset class priority	Resilience		
	High	**Medium**	**Low**
1	3	2	1
2	4	3	2
3	5	4	3

2.5. Risk treatment strategies

The department applies two broad strategies for managing fuels to reduce bushfire risk:

1. Establishment and maintenance of low fuel areas close to assets or in strategic locations in order to interrupt a fire run. Low fuel areas may be established by prescribed burning or physical fuel modification.
2. Landscape-scale fuel management using prescribed burning to create a mosaic of fuel availability within which there is reduced potential for the development of large bushfires and increased opportunities for successful fire suppression.

These strategies are applied individually or in combination to achieve the fuel conditions required by the indicators of acceptable bushfire risk.

2.6. Tolerable fuel age

The tolerable fuel age is the maximum age at which fuel in an FMA is deemed to be in a managed state. It is defined as the age at which the fuel will burn with an intensity that is double the upper limit at which machine and tanker attack on the head fire is possible under 95th percentile fire danger index (FDI) weather conditions[4] (see Section 2.7). This is determined by using fuel accumulation and fire behaviour models for the appropriate fuel type. Where this period is unknown, an alternative figure of 1.5 times the minimum period required post-fire before the vegetation will again sustain a bushfire is used.

Table 6: Maximum intensity and rate of spread thresholds for head fire attack on a bushfire.

Machine and tanker attack possible	Intensity < 2000kW/m and/or ROS < 400m/hr in forest
	Intensity < 2000kW/m and/or ROS < 1000m/hr in shrubland
	Intensity < 5000kW/m and/or ROS < 6500m/hr in grassland

2.7. Weather conditions

When defining the range of each FMA and the tolerable age of fuels within it, the department's bushfire risk management criteria require the application of the conditions that produce the 95th percentile FDI in the area. Worse fire conditions than this would only be expected to occur approximately seven times per year.

The 95th percentile weather conditions have not been applied to the Wheatbelt Region RFMP. Weather conditions derived from the Bureau of Meteorology weather reanalysis project were not considered to accurately reflect extreme fire conditions in the region. This is likely due to there being only five years' data currently available from the weather reanalysis project. Weather variables

[4] The intensity values for machine and tanker attack are doubled because the thresholds in Table 6 relate to head fire intensity, while the department's usual approach to a direct attack on a bushfire is to begin from the tail fire and work along the flank to the head. This means that most of the suppression effort is undertaken on parts of the fire exhibiting much lower fire intensity than the head fire. Flank fire intensity may be up to four times lower than head fire intensity, but a more conservative two-fold factor is used to set the risk indicators.

considered to represent extreme fire weather conditions have been contributed by experienced DBCA fire staff. This will be reviewed as more data becomes available.

3. The Wheatbelt Region

The Wheatbelt Region extends 400km from the Goldfields, including the western parts of the Southern Rangelands BRMZ (Great Western Woodlands), in the east to the Darling Scarp in the west, and more than 500km from the northern extent of the Shire of Dalwallinu in the north to near the Stirling Range in the south. This vast area inland from the Darling Scarp covers more than 131,000 square kilometers and accounts for six per cent of Western Australia. Scale is a significant factor in the Wheatbelt Region with many reserves, threatened species and pressures on these natural assets.

Rapid and extensive agricultural development of the Wheatbelt from the early 1900s led to an altered landscape dominated by an introduced grass fuel type in a zone that is one of the most productive cropping regions in Australia. However, little natural vegetation remains, with 57 per cent of the South West Botanic Province, more than 80 per cent of the Avon Wheatbelt bioregion and more than 90 per cent of some parts of the Wheatbelt Region cleared. In the Agricultural BRMZ, the vegetation that remains has high conservation value and is mostly on public Crown lands. Regionally, the Crown reserves in this zone are often the largest and most intact remnants with the vegetation types generally poorly represented in the conservation reserve system.

East of the Agricultural BRMZ's 'clearing line', the Southern Rangelands BRMZ is identified as a mostly intact and diverse vegetation system. In total this zone is 16 million hectares in size and extends from the vermin proof fence east of Hyden to the South Australian border. The Southern Rangelands BRMZ straddles the department's Wheatbelt, Goldfields and South Coast regions. This zone is internationally significant as the largest intact Mediterranean woodland in the world, with over 3000 plant, 50 mammal, 240 bird and several hundred reptile and amphibian species. The western portion of this zone is often referred to as the 'Great Western Woodland'. The Southern Rangelands BRMZ has a few small settlements, several areas of freehold and numerous mining interests with associated built infrastructure and utility services.

From November to February there is an increased risk of large bushfires occurring in the Agricultural BRMZ that impact life and property values. This often coincides with severe weather conditions, high paddock fuels combined with ignition sources such as harvesting equipment. The risk diminishes after harvest and continues to lessen as paddocks are further grazed. The bushfire risk in the Southern Rangelands BFMZ remains relatively consistent through late spring to late autumn with most bushfire ignitions originating from lightning.

Sometimes bushfires originating in the Southern Rangelands BRMZ burn from this zone and either directly or indirectly impact the Agricultural BRMZ. Mitigation works between the two zones has historically been concentrated along the vermin proof fence to manage impacts of bushfires between these two risk zones.

3.1. Tenure and management arrangements

DBCA is responsible for managing 728 reserves and other parcels of land in the Wheatbelt Region. These reserves collectively total more than 1,110,400 hectares (or nine per cent of the total area of the Wheatbelt Region) and are managed by the department in accordance with the *Conservation and Land Management Act 1984* (CALM Act).

While most of the reserves are vested solely with the Conservation and Parks Commission of Western Australia, 15 reserves are jointly vested with the Shire of Wyalkatchem and one reserve with the Shire of Kondinin.

The reserves are located across 48 local government authorities (LGA) and at least one township occurs in all LGAs. Some LGAs have more than one township such as Wickepin with four. The largest towns are Northam, Narrogin, Katanning and Merredin with a population base of between four and six thousand. The population of most of the other towns are in the mid to low hundreds.

There are several towns with department-managed lands surrounding them. Fuel management should be developed in the context of a joint approach with other land managers based upon a risk assessment approach.

The department has management responsibilities for bushfire mitigation on non-townsite unallocated Crown land (UCL) and unmanaged non-townsite reserves (UMR). Allocation of resources is based on the associated risk.

Much of the remaining land area in the Agricultural BRMZ is private property and the primary land use is broadacre agricultural production. Cereal cropping is the predominant activity over these lands, often in combination with sheep production. In many cases, cropping is the only activity occurring on these lands. There is a general decreasing population base living on farmland and in rural towns in the Wheatbelt Region with an increasing trend towards corporate large-scale farms, fly-in fly-out farming, and in many communities a loss of knowledge, experience and motivation in the bushfire suppression business.

Individual local authorities and several agencies are responsible for managing other reserves, while there are also many reserves that are 'unmanaged' and small areas of UCL occur. Often the distinction between tenure is unclear and it is common where parcels of land hold multiple tenure types and managing agencies.

Most of the land in the Southern Rangelands BRMZ is UCL. This area is highly prospective for minerals and many mining leases and tenements occur with several active mines and associated infrastructure.

3.2. Climate and vegetation

There is a large variation in the climate across the two primary BRMZs that occur within the Wheatbelt Region. The climate is broadly classified as temperate, characterised by hot-dry summers and a winter-dominated rainfall. In the Agricultural BRMZ, rainfall generally decreases in an east-northeasterly direction, and annual averages range from 600mm in Frankland, 490mm in Narrogin to 285mm in Dalwallinu. Significant rainfall in the north-east of the Agricultural BRMZ and the adjacent Southern Rangelands BRMZ is often associated with northwest cloud bands from autumn to spring. Ex-tropical cyclones and tropical lows may also bring extensive rainfall to this region in summer and less likely in the Agricultural BRMZ.

Climate cycles such as the southern annular mode (SAM) and Indian Ocean dipole (IOD) are important factors influencing seasonal and annual patterns of rainfall, which in turn affect vegetation growth and soil moisture availability. These seasonal conditions can significantly influence the availability of vegetation as fuel for bushfires, and their potential to burn large tracts of land across multiple vegetation types.

Extreme fire weather conditions occur across the Wheatbelt Region on several occasions and, less frequently, catastrophic conditions throughout the bush fire season. Climate projections suggest that the number of days with 'severe' fire danger ratings will increase, and more broadly fire weather will be harsher in the future, driven largely by changes in rainfall.

Much of the natural vegetation throughout the Agricultural BRMZ has been replaced by annual pastures and crops. Remnants of natural vegetation within this zone range widely in their size and distribution. In the west, most natural vegetation occurs as small, isolated remnants surrounded by agricultural lands. Further to the east where clearing ceased more recently, larger remnants occur and the landscape is generally less fragmented.

The natural vegetation of the Wheatbelt Region is very diverse, comprising about 120 vegetation associations within existing reserves and over 5000 species of flora. At a landscape scale within the Agricultural BRMZ some vegetation associations have been drastically and preferentially cleared. Others have been severely degraded by altered hydrology causing secondary salinisation and more frequent inundation. Many of these vegetation associations are now so degraded and devoid of flammable vegetation that they act as large, linear firebreaks.

In the Wheatbelt Region's portion of the Southern Rangelands BRMZ, much of the original vegetation is intact, comprising of large areas of semi-arid woodlands, sandplain heath and shrubland and pure or mixed mallee stands. The composition of these vegetation associations changes markedly from north to south. For example, mallee stands in the south generally comprise a *Melaleuca* species understorey in the south, whereas in the north, mallee stands tend to contain fewer understory species. Inappropriate fire regimes can significantly alter species composition and structure in this zone.

3.3. Fire management considerations

Fire is an important agent of change in the south west of WA. For millions of years, naturally occurring fires have shaped the evolution of the region's plants, animals and ecosystems. In recent millennia, the deliberate introduction and use of fire by humans to manage the availability of natural resources has brought further changes to the distribution and abundance of biota in the landscape. Aboriginal people in the Wheatbelt Region used fire for a variety of cultural purposes. Clearing of native vegetation for agriculture, particularly west of the State barrier fence, has fragmented the landscape; disrupting patterns of fire ignition and spread. Today, fire is both an agent of renewal and destruction in the landscape and is an important consideration in landscape management. The challenge for the Wheatbelt Region is to devise practical and feasible approaches to fire management on the lands it manages that protects life, property and livelihood from the adverse impacts of bushfires while conserving cultural and biodiversity values.

Whilst fuel management is broadly divided based upon the two zones mentioned previously, the tenure that the department has responsibility for in the Agricultural BRMZ is further categorised by size. Each category has specific fire management objectives and strategies, based upon a bushfire risk profile dependent on size classes. The Wheatbelt Region parks and reserves management plan

categorizes fuel management strategies to be undertaken to protect life, property and conservation values. Based upon the degree of risk, additional works may be undertaken on individual reserves to mitigate the risk of bushfires impacting specific values.

Most of the bushfires occurring in the Agricultural BRMZ are caused by agricultural activities during harvest between late October and early January, and pasture and stubble burns from mid-February to early May. Generally, there is a greater likelihood of bushfires originating on non-departmental tenure that subsequently impact reserves. Occasionally, fires are started by lightning and arson. The likelihood of a bushfire impacting reserves in the Agricultural BRMZ is estimated, on average, less than once every 300 years for small reserves (100-500 hectares) and once every 67 years for larger (>500 hectare) remnants and reserves.

In the unfragmented Southern Rangelands BRMZ, the frequency of fire increases to around once every 40 years for larger (>500 hectare) reserves, and most of these fires are caused by lightning during the summer bushfire season. The frequency and distribution of bushfires vary from year to year based on preceding rainfall and vegetation growth, prevailing drought conditions, and thunderstorm activity associated with trough movements. Generally, the need for intervention by extinguishing bushfires in this zone declines after the harvest, especially in autumn when paddocks are generally bare. The zone has a vast mosaic of fire patterns and as a rule fuel management and suppression can be planned around fire scars and the vegetation types, especially salt lake systems and mature eucalypt woodlands that generally do not burn under most conditions.

A variety of lodged, registered and unregistered Aboriginal heritage sites and cultural landscapes exist in the region which can be adversely impacted by bushfire and prescribed burning activities. To achieve appropriate fire management planning and operational outcomes the department will undertake thorough assessment of Aboriginal culture as part of its burn planning process and, where possible, develop and implement strategies to protect cultural values.

There are a range of mitigation strategies available to fire managers based upon resource availability and risk. Strategies for works can include, but are not limited to, mechanical modification of fuels, prescribed burning, access, detection, early suppression, and within the Southern Rangelands BRMZ at a landscape level the use of natural barriers (salt lakes) and fire scars within fuel management planning.

3.4. Key fuel management strategies

The primary objective of the department's fire management in the Wheatbelt Region is to protect human life (people and communities) and important community infrastructure. The department also aims to manage fire in a way that promotes ecosystem health and avoids compounding the effects of other threatening processes.

To achieve these objectives, the department:

- uses prescribed burning to maintain a landscape scale mosaic of fuel age and structure to inhibit the spread of bushfires, create opportunities for successful fire suppression, and maintain adequate habitat linkages to support biota
- uses prescribed burning to maintain a mosaic of fuel age and structure within reserves to reduce bushfire risk to and from surrounding lands and to support ecosystem resilience
- uses prescribed burning or other forms of fuel management to maintain areas of low-fuel adjacent to private property and important infrastructure

- applies prescribed fire to the landscape with consideration of ecosystems and the requirements of important species and ecological communities.

To meet the objectives above requires the management of fire at a reserve or landscape scale. To achieve this, fire management strategies will:

- use bushfire mitigation works including fuel modification, fire prevention, access tracks and bushfire suppression measures, as appropriate, to reduce the risk of bushfire to life, property and infrastructure
- where necessary, undertake bushfire mitigation works to reduce the risk and impact of bushfire on critical transport corridors including, but not limited to, the Great Eastern Highway and the Great Northern Highway
- consider the effects of fire management strategies on biodiversity and cultural assets during their planning and implementation
- use fuel modification, bushfire suppression and prescribed fire to assist with the reinstatement and maintenance of ecologically appropriate fire regimes
- liaise and engage with relevant stakeholders in the planning and management of fire
- improve knowledge of, and capacity to manage, fire through appropriate research, operational experience, stakeholder and community consultation, and applying an adaptive management approach
- in relation to the timing of prescribed burning and its potential impact, consider adjacent land uses especially within or adjacent to the Agricultural BRMZ.

The approach to manage fuel loads in the Wheatbelt Region for each reserve considers the BRMZ, size, and the relative risk to life and human values from bushfire.

- The management of fuel to mitigate bushfire risk will consider the accumulation of ground fuels within most of the natural vegetation systems within both the Agricultural and Southern Rangelands BRMZs. However, fuel accumulation in some fuel types stabilises or even declines with longer fire intervals as the vegetation senesces and decays.

- The incidence of bushfires on reserves within the Agricultural BRMZ has declined in recent decades, predominantly through rapid suppression and active exclusion. The small size and isolation of many reserves also reduces the likelihood of bushfire spreading between reserves.

- On some reserves in the Agricultural BRMZ, the time since the previous fire is longer than desirable to regenerate some vegetation communities or maintain important habitat. If the time between fires is too long, species reliant on fire may senesce and disappear, and community diversity and structure decline.

- Fire that occurs too frequently can also lead to loss of plant species, particularly those that only regenerate from seed after fire. In the Southern Rangelands BRMZ, bushfires in recent decades caused by lightning have resulted in large areas of mature and regenerating eucalypt woodland being burnt. In some cases, the recovery of mature woodland and its habitat value for flora and fauna may take hundreds of years. For these reasons both the mature and regenerating woodlands are important areas to protect from burning in large, intense bushfires.

- The life history of key indicator species is used to identify appropriate fire regimes to conserve vegetation communities and fauna habitats. Some species depend on fire for their persistence or may be sensitive to fire.

- The traditional use of fire is an important part of Aboriginal culture and is integral to looking after country and cultural heritage. Aboriginal people may wish to be involved in fire management incorporating both traditional and western approaches.
- Fire can also interact with a range of other threats and processes such as weed and feral animal invasion, isolation (fragmentation) and drought. Management needs to consider these interactions to limit the potential for adverse impacts.
- Some plants or animals may not be able to re-colonise isolated (fragmented) reserves that are completely burnt in a single fire.
- The loss of biodiversity from reserves due to a combination of pressures has also influenced the frequency and intensity of fire, and how other species recover following fire. For example, the decline of digging marsupials due to feral predators has increased litter accumulation and decreased the ability of some plants to disperse and regenerate.
- The seasonal conditions preceding and following a bushfire or prescribed burn can have a major effect on the capacity of vegetation and fauna to recover afterwards, for example seed availability, seedling survival or the capacity of a plant to resprout.
- The effects of climate change, particularly changes to the seasonality, reliability and amount of rainfall, when combined with fire may affect the ability of plants and animals to successfully recover.

Specific to the Southern Rangelands BRMZ, the following objectives and strategies were developed to help inform the identification of FMAs in this zone.

Objectives:

1. Protect life and property.
2. Prevent the occurrence of landscape-scale bushfires (>30,000ha).
3. Mitigate the likelihood of bushfires crossing the agricultural interface in either direction.
4. Mitigate the likelihood of bushfires impacting critical transport corridors and critical infrastructure.
5. Protect regenerating fire-sensitive eucalypt woodlands from bushfire prior to reaching reproductive maturity (25-30 years old).
6. Protect mature fire-sensitive eucalypt woodlands from bushfire (which may burn under extreme fire conditions).
7. Protect other fire-sensitive species and communities if necessary, from bushfires.

Strategies (in indicative priority order):

1. Mitigate risk along the agricultural interface, major infrastructure corridors and the major transport corridors of Great Eastern Highway, Hyden Norseman Road and Great Northern Highway through the creation of low fuel buffers (up to 100m deep) in non-woodland fuels using mechanical treatments—chaining every 7-12 years, chopper-rolling 5-7 years and mulching 4-6 years.

2. Application of prescribed burning to achieve 45 per cent of the landscape within 10km of the agricultural interface will be less than tolerable fuel age to all non-woodland fuels.
3. Create and maintain landscape barriers to prevent spread of bushfires by joining areas of low fuel (eg. lake systems and fire scars) with additional prescribed burning. Treatment target is 60 per cent of fuel below tolerable age threshold and applies to all non-woodland fuels.
4. At a landscape scale, create a mosaic of fuel ages. This could include open-edged prescribed burns and bushfires. Treatment target is 30 per cent of fuel below tolerable age threshold and applies to all non-woodland fuel types.
5. Within the context of strategies 2-4 above, consider the treatment of fuel types that exceed their tolerable fuel age threshold where these occur within 500 metres of woodlands, prioritising i) regenerating and ii) mature woodlands, and iii) any other communities identified as bushfire sensitive. Treatment target is 60 per cent of fuel below threshold age and applies to all non-woodland fuel types.

4. Wheatbelt Region risk criteria

The Wheatbelt Region lies within the Agricultural BRMZ and Southern Rangelands BRMZs. The indicators of acceptable bushfire risk are based upon the fuel and fire behaviour characteristics of *Acacia* woodland, sandplain shrublands, Mallee-heath, semi-arid woodlands, plantation, *Banksia* woodland, thicket, dry eucalypt forest, and chenopod shrubland which have been broadly grouped across the region.

Table 7: Summary of bushfire risk criteria for the Wheatbelt Region.

Fuel type	Sandplain shrublands	Mallee-heath	Semi-arid woodlands	Plantation	Thicket	Dry eucalypt forest
Fuel accumulation and fire behaviour models	Expert judgement Anderson shrubland model	Expert judgement Cruz mallee-heath model	Expert judgement These woodlands require a new fuel accumulation model to reflect that flammability peaks ~40 to 200 years. Forest fire behaviour tables (Redbook) & Dry eucalypt forest fire (VESTA) In fuels <20 years old the semi-arid shrubland fire behaviour model may be more appropriate.	Expert judgement Mallet plantations are not considered a bushfire risk	Expert judgement Cruz mallee-heath model	Expert judgement Dry eucalypt forest fire model (VESTA)
Weather parameters applied	Location: Merredin Temperature: 40 °C Relative humidity: 10% Wind speed: 30km/h	Location: Ravensthorpe Temperature: 38°C Relative humidity: 8% Wind speed: 25km/h	Location: Merredin Temperature: 40 °C Relative humidity: 10% Wind speed: 30km/h	Location: Narrogin Temperature: 39°C Relative humidity: 15% Wind speed: 25km/h	Location: Merredin Temperature: 40 °C Relative humidity: 10% Wind speed: 30km/h	Location: Narrogin Temp: 39 °C Relative humidity: 15% Wind speed: 25km/h
Tolerable fuel age	9 years	20 years	NA Tolerable fuel ages are probably <20 and >200 years	NA	18 years	15 years
Settlement-hazard separation (SHS)	1km surrounding settlements	500m surrounding settlements	NA	NA	1km surrounding settlements	5km surrounding settlements
Critical infrastructure buffer (CIB)	100m surrounding critical infrastructure	100m surrounding critical infrastructure	NA	NA	100m surrounding critical infrastructure	100m surrounding critical infrastructure
Landscape risk reduction (LRR)	As defined in Table 8	As defined in Table 8	NA	NA	As defined in Table 8	As defined in Table 8
Critical transport corridor (CTC)	15km each side of National Highway 94 and the Trans Australian Railway	15km each side of National Highway 94 and the Trans Australian Railway	NA	NA	15km each side of National Highway 94 and the Trans Australian Railway	15km each side of National Highway 94 and the Trans Australian Railway
Agricultural Interface (AgI)	10km into native vegetation from the clearing line	10km into native vegetation from the clearing line	NA	NA	10km into native vegetation from the clearing line	10km into native vegetation from the clearing line
Remote area management (RAM)	NA	NA	NA	NA	NA	NA

**Banksia* woodland - small, scattered occurrences in the central Wheatbelt, will be treated as mallee heath.

5. Asset categorisation and prioritisation

The following table applies the department's bushfire risk criteria to identify and prioritise assets in the Wheatbelt Region, establishing where each FMA applies. Table 89 then provides the indicators of acceptable bushfire risk for these areas.

Table 8: Asset categorisation and prioritisation for the Wheatbelt Region.

Fire management area	Asset class	Asset description and occurrences	Resilience	Rationale
Regional priority 1				
SHS	Settlements	Settlements, towns and subdivisions with low resilience to bushfire – nil identified	SHS	Settlements
Regional priority 2				
SHS	Settlements	Wongan Hills, Bobakine (subdivsion), Hyden	Medium	Determined based on extent and location of departmental managed lands. Other land categories and landscape scale bush fire risk assessment may determine a different resilience rating.
CTC	Critical infrastructure Dispersed population Economic asset Other assets	Transport corridors with national-level significance and no redundancy. Includes National Highway 94 and the Trans Australian Railway	Medium	Applied to protect of the flow of people, goods and services between Western Australia and the eastern states.
AgI	Dispersed population Economic assets Other assets	Agricultural property, produce and associated infrastructure, individual livelihood and community sustainability. Areas of smaller or transient population, recreation sites and environmental asset. Extends 10km into native vegetation from the clearing line	Medium	Applies only to the AgI associated with the Southern Rangelands BRMZ adjacent to the clearing line.
LRR	Dispersed population Economic assets Protected species and communities Other assets	Lake Magenta Nature Reserve and adjacent UCL, Dragon Rocks Nature Reserve	Medium	These large reserves within a matrix of cleared agricultural land are of sufficient size for fire management to achieve bushfire risk mitigation and protection of environmental and economic assets.
		Great Western Woodlands as defined by the 'Great Western Woodlands' shapefile within DBCA's Corporate Data Distribution Program	Medium	The Great Western Woodlands is an internationally significant area containing an accumulation of important assets including threatened species, cultural heritage, mining, recreation and tourism. It also contains critical and regionally significant transport corridors and areas of agricultural interface.
Regional priority 3				
SHS	Settlements	Frankland River, Kojonup, Cranbrook (east), Tambellup, Broomehill, Katanning, Darkan (West), Arthur River, Woodanilling, Williams, Piesseville, Gnowangerup, Nyabing, Pingrup, Newdegate, Lake Grace, Kukerin, Dumbleyung, Kulin, Kondinin, Wickepin, Harrismith, Tincurrin, Dudinin, Brookton, Yealering, Karlgarin, Varley, Beverley, Quairading, Narembeen, Dalwallinu, Wubin, Kalannie, Beacon, Ballidu, Cadoux, Bencubbin, Mukinbudin, Goomalling, Dowerin, Westonia, Bullfinch, Southern Cross, Moorine Rock, Meckering, Cunderdin, Tammin, Kellerberrin, Merredin, Burracoppin, York, Kwolyin, Shackelton, Mawson, Bruce Rock, Pantapin, Yoting, Aldersyde, Mourambine, Yournaning, Buntine, Wubin, Dalwallinu, Pithara, Ballidu, Piawaning, Yerecoin, Calingiri, Bolgart, Kalannie, Cadoux, Goomalling, Dowerin, Minnivale, Dryandra Woodland Settlement, Wagin, Narrogin (section 5g), Williams, Highbury, Lake King, Hyden, Jitarning, Cuballing, Pingelly, Koorda, Wyalkatchem (joint	High	Determined based on extent and location of departmental managed lands. Other land categories and landscape scale bush fire risk assessment may determine a different resilience rating.

Fire management area	Asset class	Asset description and occurrences	Resilience	Rationale
		managed), Trayning, Kununoppin, Nungarin, Westonia, Yellowdine, Carrabin, Marvel Loch, Badjaling Aboriginal Community, Kokerby		
CIB	Critical infrastructure	Great Northern Hwy (Wubin townsite to northern extent of Dalwallinu Shire)	CIB	Critical infrastructure and the road corridor are protected by low fuel buffers in the non-woodland vegetation generally to a depth of 100 metres. Maintenance zone considered inadequate. Fuel ages within the area have reach the potential to burn from fires at the higher intensities (25 years old).
Regional priority 4 & 5 Nil identified**.**				

6. Indicators of acceptable bushfire risk

Bushfire risk is maintained at an acceptable level in the Wheatbelt Region if fuels are managed to the condition described in the below table. The current landscape condition will be compared to these indicators at least annually and the outcomes of that comparison used to inform the development of the annual fuel management program.

Table 9: Summary of indicators of acceptable bushfire risk in the Wheatbelt Region.

Fire management area	Fuel type	Location	Target
Settlement-hazard separation (SHS)	Dry eucalypt forest	5km surrounding settlements	60% of fuel less than threshold intensity
	Sandplain shrubland, thicket	1km surrounding settlements	
	Mallee-heath	500m surrounding settlements	
	Semi-arid woodland	N/A	No targets apply
Critical infrastructure buffer (CIB)	Sandplain shrubland, thicket, mallee-heath, dry eucalypt forest	100m surrounding critical infrastructure	50% of fuel less than threshold intensity
	Semi-arid woodland	N/A	No targets apply
Critical transport corridor	Sandplain shrubland, thicket, mallee-heath	15 km Adjacent to National Highway 94 from Yellowdine to Norseman and National Highway 1 from Norseman to Eucla	45% of fuel less than threshold intensity
	Semi-arid woodland	N/A	No targets apply
Agricultural interface	Sandplain Shrubland, Thicket, Mallee-heath	10 km along the "clearing line" in continuous native vegetation where it intersects with cleared agricultural land	45% of fuel less than threshold intensity
	Semi-arid woodland	N/A	No targets apply
Landscape risk reduction (LRR)	Dry eucalypt forest	As defined in Table 8	45% of fuel less than threshold intensity
	Sandplain shrubland, mallee-heath, thicket	As defined in Table 8	30% of fuel less than threshold intensity
	Semi-arid woodland	N/A	No targets apply. Managed as required to meet land

Fire management area	Fuel type	Location	Target
			management objectives
Remote area management (RAM)	Dry eucalypt forest, sandplain shrubland, thicket, mallee-heath, semi-arid woodland	All other Parks and Wildlife Service managed lands	No targets apply. Managed as required to meet land management objectives

7. Spatial data

The descriptions of asset locations and FMA extents in Tables 8 and 9 are depicted spatially in a geodatabase that supports this RFMP. These data form the basis for comparison of the current landscape condition against the department's indicators of acceptable bushfire risk. This comparison will be conducted annually, at a minimum, and used to inform the fuel management program planning process. The master copy of the geodatabase is maintained in-house by the department's Regional Leader, Fire Management, with a copy provided to Fire Management Services Branch (FMSB) information officers to facilitate corporate reporting.

8. Monitoring and review

This plan will be regularly monitored and reviewed to ensure content remains accurate and up to date. The plan will be endorsed annually by the content custodian prior to being used in the burn program planning process.

FMSB will advise the Wheatbelt Regional Manager of any changes to the department's Bushfire Risk Management Framework that will need to be reflected in the RFMP.

The Regional Manager, or their delegate, will review the regional context statement, regional risk criteria and asset categorisation and prioritisation annually (at a minimum). The most important aspect of this review is confirmation that Table 8 continues to represent a comprehensive and accurate catalogue of the assets in the region requiring protection from bushfire. Any changes to Table 8 will also be reflected in the accompanying spatial data, including the mapping of FMA extents.

The spatial data that supports the RFMP will be reviewed at least annually to capture any changes in the distribution of assets, fuel, or department-managed tenure. Updated datasets will be provided to FMSB whenever any changes are made.

9. Knowledge gaps

The department's risk criteria and indicators of acceptable risk were developed using the best available science, practitioner judgement and supporting data. These inputs will be monitored by the department to ensure that the RFMP continues to reflect industry best-practice. It is expected that ongoing adjustment to the settings will be required as the State's social, political and natural environments change, better data become available, or knowledge of bushfire risk management is refined or improved. The framework will also be updated to incorporate the findings of any relevant research or adaptive management, and as new models are developed and refined.

Department of **Biodiversity, Conservation and Attractions**

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