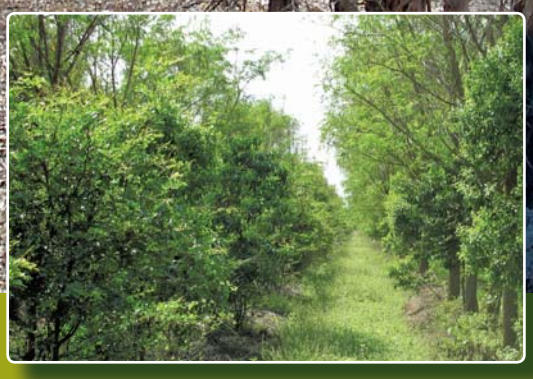
Guidelines for Plantation Fire Protection



GOVERNMENT OF WESTERN AUSTRALIA

Bush Fire and Environmental Protection Branch

FESA
Fire & Emergency Services Authority of Western Australia

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These guidelines replace the 2001 'Guidelines for Plantation Fire Protection'. They have had a wide and varied input base, and the Fire and Emergency Services Authority (FESA) thanks all who contributed.

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Objective

These guidelines will provide both local government and the plantation industry with a set of best practice fire protection standards for plantations that aim to protect human life and local community interests, while minimising fire risk to plantation assets.

Introduction

The nature of plantations has changed significantly in recent years with the diversity in species production and the expansion in the location of plantations.

The development of new products for timber and trees, as well as improved silvicultural techniques has seen the number of plantations in Western Australia increase.

The competing needs of protecting the community and of the plantations have been considered in the development of these guidelines. However, the protection of local communities from bush fires is the most important consideration. To achieve this balance Local Government (LG), the Fire and Emergency Services Authority (FESA) and plantation managers will continue to work closely together.

Tree plantings are considered as a legitimate rural land use activity. These guidelines reflect the changing needs of the plantation industry in Western Australia and aim to identify the appropriate fire protection requirements that will benefit the whole community. However, it is acknowledged that one set of criteria will not meet the needs of all the various plantation types.

Endorsement

FESA and the Western Australian Planning Commission (WAPC) endorse these guidelines and encourage local authorities to adopt them either by statutory or non-statutory means.

These guidelines have been reviewed and agreed upon by FESA and the Forest Industries Federation of Western Australia (FIFWA). FESA endorses the application of industry-based code of practices including the *Code of Practice for Timber Plantations in Western Australia*[1] and the *Mallee Cropping Code of Practice*.

1. Implementation

These guidelines are designed to be minimum standards that can be tailored, responding to local risk and local government requirements.

If there is a disagreement between the plantation manager and the local government regarding fire standards, during the plantation planning approvals process, a FESA representative should be contacted for further advice.

[1] Produced by the Forest Industries Federation of Western Australia.

1.1 Local Government

A statutory ability for the Local Government (LG) to consider the impact of plantations and implement provisions of these guidelines may be achieved by their inclusion in a town planning scheme. This could be by a policy statement and/or the consideration of tree plantations as a development requiring Local Government determination through town planning schemes.

Local Governments are encouraged to have consistency in their adoption of these guidelines. Variation from the guidelines may be appropriate if, after consultation, the LG can clearly demonstrate that local conditions require specific management.

The LG will clearly advertise the restricted and prohibited burning times, as well as fire break requirements, in their Annual Fire Break Notices.

1.2 Plantation Managers

It is the responsibility of the plantation manager to implement conditions outlined in their plantation fire management plan.

Fire management plans must adhere to environmental standards as outlined in the *Code of Practice for Timber Plantations in Western Australia*.

Plantation managers must make themselves aware of the bushfire zone that the plantation is in, and note the restricted and prohibited burning times for each zone as instructed by the LG and comply with the LG Annual Fire Break Notice.

All plantation managers must adhere to and consult legislative requirements relating to plantations in Western Australia.

Plantation managers must adhere to these guidelines as a basic fire management document.

2. Planning for Plantation Fire Management

When planning and establishing a plantation fire management is an integral part of the process and measures to reduce the fire risk must be considered at the earliest possible stage, this is likely to occur when choosing the location or designing the site. Plantation managers must take into consideration all risks associated with the site such as community values, site-specific requirements, existing land use and the desired plantation species.

2.1 External Fire Breaks and Setback Distances

The main aim of the planning process is to ensure that there is no added risk to existing or proposed structures by the location of the plantation. This is often achieved by applying appropriate setback distances in the area plan for the plantation.

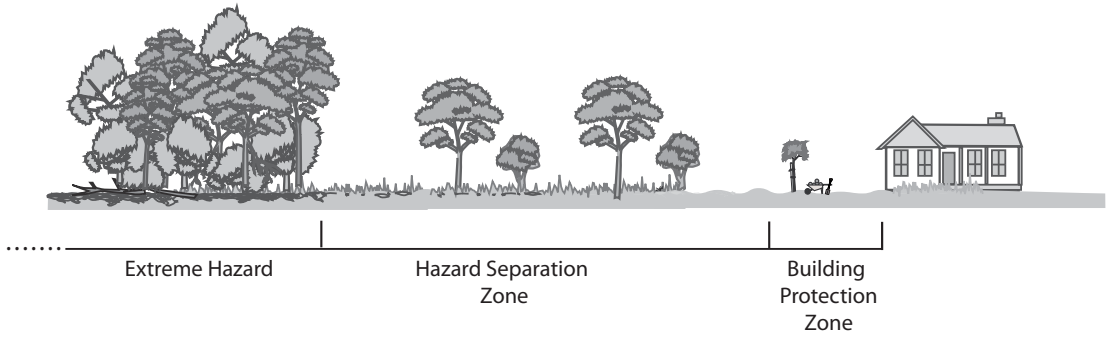
Therefore sites for plantations should be chosen carefully keeping in mind the following:

- Plantation separation distances must reflect potential fire behaviour driven by local variations in topography, aspect and slope. The hazard separation zone:
  - between the plantation and an existing or approved habitable building must be a minimum of 100 metres, unless the building has been constructed to an appropriate higher standard.
  - between the plantation and an existing or approved non-habitable structure (i.e. sheds and enclosed storage areas) must be a minimum of 50 metres.

- Plantations developed within one kilometre of the boundary of any local development[2] may be required to provide additional fire protection measures as determined by the LG.
- Plantation managers are responsible at the time of development for separation distances between existing and approved buildings. Compliance with separation distances will apply for the life of the plantation until a change in land use has been registered.

  Buildings or structures constructed after approval and establishment of the plantation becomes the responsibility of the planning approvals process to ensure that those buildings are constructed to the appropriate standard.[3] Buildings constructed after the establishment of the plantation should not adversely affect the plantation. Compliance with separation distances will occur at time of plantation development and will be appropriate for the life of the plantation until a change in land use has been registered.
- Early and regular consultation with the relevant LG is essential in identifying any local fire regulations in place that will effect the establishment of a plantation, such as the Annual Fire Break Notice.

Hazard Separation Zone Distances.



Plantation HSZ Low fuel zone <8 t/ha + firebreak 6 m + BPZ 20 m<2 t/ha

Total 100 m

2.2 Fuel Reduction

Where native forest or remnant vegetation is located adjacent to or within a plantation fuel reduction is encouraged, where possible, before planting. It is recommended that plantation managers, where possible and subject to environmental constraints, consider maintaining all non-plantation vegetation at less than eight tonnes per hectare. It is important that consideration is given to fuel reduction and other management techniques to reduce the risk of unplanned fire.

There are a number of factors that increase the risk of fire including:

- Permanent landscape features.
- Local and site specific conditions may provide decreased/increased fire risk.
- Harvesting techniques.
- Management regimes.
- Surrounding natural vegetation.
- Internal remnant vegetation.

[2] Refer to Appendix 4 for a definition of local development.

[3] Appropriate standard refers to the relevant Bushfire Attack Level as determined by Council under AS3959 (2009) Construction of Buildings in Bushfire Prone Areas (as amended) and any other relevant Building regulations that apply.

Managing fuel loads in plantation areas and along fire breaks can be achieved by:

- Controlled grazing.
- Ploughed strips.
- Slashed strips.
- Clearing and heaping.
- Chopper rolling.
- Mechanical mulching and grinding.
- Weed control e.g. herbicide sprays.
- Prescribed burning.
- Whole tree harvesting.

Pruning and thinning are commonly used silvicultural techniques, however they are likely to increase available fuel loads until the residue generated from these activities naturally breaks down, is burnt or physically removed.

3. Fire Management Plans

It is vital that all plantations have a Fire Management Plan. The plantation manager must submit a plan for each plantation development project to the LG with the initial planning application.[4]
The plantation manager must advise the LG of any updates to Fire Management Plan or annual works programs throughout the life of the plantation.

The Fire Management Plan, as detailed within these guidelines or as per Australian Forestry Standard 4708, must include:

a) Land owner and/or occupier information such as identification of the plantation company and all relevant contact details, including a 24 hour fire contact phone number.
b) Contact details of local fire control agencies.
c) A firefighting equipment register and details of any cooperative arrangements.
d) Plantation species, area and layout including compartment size.
e) Fire protection measures such as:
    - Fire detection and reporting mechanisms.
    - Initial response and attack of fires, including resource dispatch and communication with relevant authorities (e.g. FESA, LG and local fire brigade).
    - Identify potential ignition sources.
    - Access in and around the plantation.
    - Access roads must be clearly signed.
    - Methods of firebreak maintenance.
    - Measures to protect services e.g. power lines and gas pipelines.
    - Water supplies and approximate capacities of these supplies.

[4] *Code of Practice for Timber Plantations in WA*—'plantation managers may require Town Planning approval for plantations prior to settlement, in such cases; the plantation manager will submit draft plantation management plans, until gaining the necessary approvals.'

- Surrounding vegetation type, age since last burnt and if the site is being effectively managed, if available.
- Sites fire history, where available.
- Harvesting procedures and other measures used to reduce hazards (e.g. slashing and thinning programs).
- Fuel reduction program, if applicable, including herbicide weed control and controlled grazing.

f) Surrounding local features including:
- Existing plantations.
- Proximity to towns/settlements.
- Remnant vegetation.
- Significant values relevant to the site.[5]

g) Provision of a map at a suitable scale:
- Plantation maps must be provided to the LG and to FESA, and provide additional maps if requested by FESA or LG.
- These maps are to be held in suitable containers and clearly sign posted at the main property entrances or other LG approved locations for use by personnel attending a fire.
- Plantation managers must check and update these maps annually to ensure their quality and accuracy, dates on the maps may assist with this.

h) Fire management maps will indicate:
- Compartment boundaries and size.
- Water supplies including irrigation channels and dams.[6]
- Emergency access/egress (fire breaks).
- Structures houses, sheds etc.
- Significant features e.g. creek crossings, dead end access tracks, areas of remnant vegetation.

i) Standardised map legends are to be applied across the plantation industry.[7]

4. Plantation Fire Protection Specifications

Plantation access for fire management and suppression must be appropriate to ensure that the local community is not placed at an increased risk of fire from any plantation establishment. Consider fuel reduction and other management techniques to reduce the risk of unplanned fire.

It is essential to carefully consider the design of a plantation to reduce the effects of fire. Plantation managers must look at design elements, including the plantation layout and firebreak construction, to limit potential fire run and reduce the likelihood of wind and water erosion, while providing suitable emergency services access.

[5] This may include declared rare flora, historical sites, cultural and community sites. Contact your LG for more information.
[6] Refer to Appendix 3 for more information on water supplies.
[7] Refer to Appendix 2 for an example of standardised map legend items.

4.1 Compartment Size and Layout

There are certain plantation species and different stages of plantation lifecycles that can create an increased fire risk. The compartment size and layout will consider the highest predicted fire risk and mitigate against the risk through proper planning and fuel load management.

- Compartments should be no larger than 30 hectares, where possible or as prescribed by the LG.
- Compartments may be considered up to 100 hectares in size depending on local conditions, plantation species and if endorsed by the LG.
- Compartment boundaries should, where practicable, follow existing roads or natural features, to ensure ease of fire suppression and reduce soil erosion.
- Fuel load management techniques (e.g. between row slashing or grazing) should be considered when planning compartment size.
- Plantation managers should consider site topography, slope, aspect, road direction, strategic access to water and planting direction, as they relate to fire control and compartment size.
- The layout will ensure that the fire breaks are maintained sufficiently for emergency services access and to LG specified requirements.

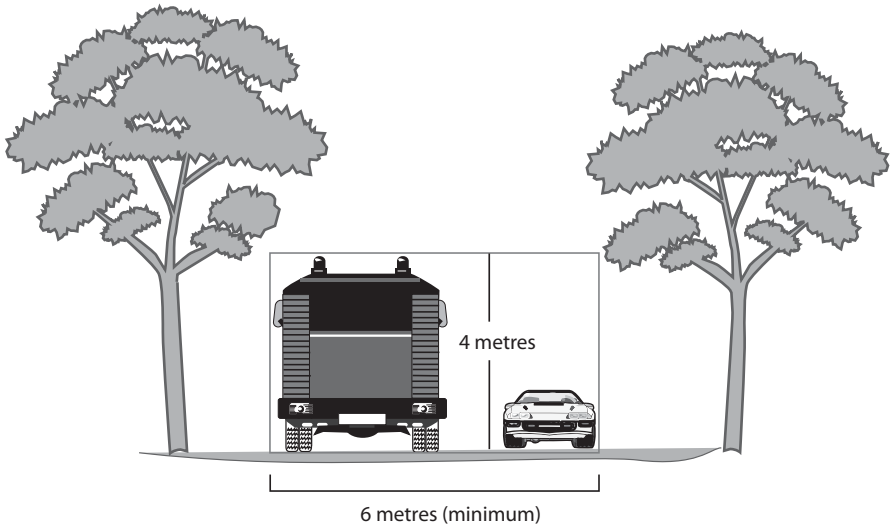
4.2 Fire Breaks and Access

Internal and external fire breaks are required for all plantations to enable access to all areas of a timber plantation in the event of fire. Access must be provided to and into plantations to meet fire suppression requirements.[8]

- Fire breaks must be maintained in line with the Annual Fire Break Notice developed by the LG.
- The planting layout must ensure vehicle access is maintained at appropriate intervals, depending on local conditions.
- Tracks should be aligned to provide straight through access at junctions, where possible.
- Fire breaks should be aligned to access remnant native vegetation areas and reliable water supplies, where possible.
- The access routes must allow one lane of traffic with passing areas, where possible.
- Passing bays are recommended to be provided at 200 metre intervals and are a minimum of 20 metres long and six metres wide.
- The minimum trafficable surface must be 6 metres, or a width appropriate to the most likely form of fire suppression vehicle.
- There must be sufficient horizontal and vertical clearance that allows vehicles to travel on access routes easily. It is recommended that the minimum horizontal clearing is six metres and the vertical clearing four metres.

[8] For more information on fire breaks refer to FESA's '*Firebreak Location, Construction and Maintenance Guidelines.*'

Minimum road width and vertical clearance.



- The maximum grades on fire breaks must be no greater than one in eight to ensure access by fire suppression vehicles.
- The maximum cross fall on fire breaks should not exceed one in thirty-three.
- No through roads should be avoided if possible, but if they do exist, they must be well signposted and include the distance to the end of the road. The road must have a turnaround large enough to accommodate a 2.4 rural fire appliance with a minimum inner radius of 12 metres. Road signs should be produced to comply with Australian Standard 1743 Road Sign Specifications.
- New gates must be a minimum 3.6 metres wide, established gates may remain in situ.
- The main fire breaks must be capable of a minimum load limit of 15 tonnes during the restricted and prohibited burning periods.
- No point within the plantation is to be more than 300 metres from a fire break, perimeter break, open paddock or other three metres minimum wide access to ensure all areas of the plantation are accessible with firefighting hose.
- Where power lines pass through the plantation the clearing of vegetation must be in accordance with suppliers' [9] specifications.
- Erosion control measures should be in place to minimise degradation and maintain trafficable conditions.
- Fire break maintenance programs must take into account recognised fuel hazards.
- Fire break standards should take into account potential fire behaviour, including fuels and topography.
- Fire breaks must be regularly maintained and kept free of flammable material.
- When under the plantation managers control all plantation roads external to the plantation will comply with the general standards, where possible, as described in *Planning for Bush Fire Protection Guidelines*.

All plantations require fire breaks; however the width required may vary according to the size of the

[9] Refer to Planting Set back distance tables in Appendix 1.

site. All fire breaks must be fuel free zones, however exemptions may be applicable for areas with erosion issues.

Refer to FESA's *Environmental Guidelines for Machine Operations and Mitigation* and *Fire Break Location, Construction and Maintenance Guidelines* for more information on machine operations such as erosion controls in fire break maintenance.

4.3 Water Supplies

Plantation managers must provide water for firefighting purposes within plantation areas. A sufficient number of water points must be established and maintained in or nearby to all plantations. These strategic water supply points will be audited by the plantation manager prior to the start of every fire season. [10]

The following criteria must be met to ensure adequate water supply and viability:

- 50,000 litres of water must be permanently available for initial use during fire response.
- The water supply must meet the needs of the plantation and will be referred to as a strategic water supply.
- The strategic water supply options must be a secured source for the duration of the plantation.
- The capacity and location of the strategic water supply must be commensurate with the size of the plantation, larger plantations may require several water points to be made available.
- The strategic water supply should be no further than five kilometres or a 20 minute turnaround from the plantation, whichever is most efficient.
- Where no suitable water is available on a plantation an agreement with adjoining neighbours to establish a joint strategic water supply may be needed. A written formal agreement is necessary in such circumstances between the owner/manager/occupier.
- Where water availability is limited plantation managers must have mobile water supply or other arrangements in place during the bushfire season.
- Suitable fittings must be available for all hydrant or standpipe water supplies.
- Quick fill water pumps should be considered to minimise turnaround times, ensure water suction challenges are overcome and safe separation distances are maintained during refilling.
- There must be suitable access during the relevant bushfire season maintained with a hard stand and turnaround area at all water supplies.
- Water supply facilities must be designed and constructed so that heavy duty firefighting equipment is able to access the supply.
- All water supplies are to be marked on a plantation map and signposted in the field, the standard marking of a blue 'W' in a blue circle with a white background or the word 'water' written in blue on a white background is required.
- Landowners and plantation managers are encouraged to consider special access issues if they are planning to use other means of fire suppression such as helicopters or fixed wing water bombers.

[10] Start of fire season usually identified by the LG as the commencement of the restricted burning period.

5. Equipment and Training

Every plantation manager, owner and/or occupier has a legal responsibility to try and prevent fire from escaping their land in line with the *Bush Fires Act 1954*. It must be possible for them to attend a fire on their own plantation.

5.1 Equipment

- Plantation managers have a responsibility to provide adequately trained personnel for safe and effective operation of firefighting equipment, and a capability to carry out onsite fire suppression [11] as determined by the LG.
- Strategic Response and resource arrangements should be made available within the industry.
- Firefighting equipment must be in good working order and well maintained
- Fire suppression activities must meet the requirements of the *Bush Fires Act 1954*.
- Requirements shall not exceed other industries with similar fire risk.
- Differing operations at plantations or life cycle risk may mean additional equipment is needed.
- All harvest and road work machinery is to be fitted with an approved, serviceable fire extinguisher in line with Australian Standard 1851.1, generally the minimum requirement is a nine litre water extinguisher AS 1841.2 or a nine litre foam water extinguisher AS 1841.4 or a 4.5 kilogram dry powder extinguisher AS1841.5. This is a requirement of the *Bush Fires Act and Regulations 1954.*
- Vehicles and machinery travelling in plantations during the bushfire season must comply with Australian Standard 1687 and the *Bush Fires Act 1954* and must adhere to the requirements of Harvest Movement Bans and Vehicle Movement Bans when set by LG.
- Refueling of machinery will not occur in the planted area. A hard stand, free from flammable material, should be used where possible.
- Operators of machinery and equipment in a plantation are required to take all reasonable precautions to prevent fire escaping, for instance carrying a dry chemical fire extinguisher.

5.2 Training

- The field staff employed by the plantation manager should attend a basic fire awareness training course or an equivalent, at a minimum.
- FESA will encourage plantation personnel to join existing local brigades to foster closer working relationships with the community and surrounding plantations.
- FESA will assist in facilitating multi agency fire training and promoting cross-organisational cooperation.

[11] Refer to FIFWAs *Fire Season Requirements* document.

6. Harvesting and Post Plantation Management

6.1 Harvesting

Harvest and vehicle movement bans may be put in place by:

- The LG—these are mandatory restrictions;
- The plantation manager may self-impose additional bans; or
- The declaration of Total Fire Bans.

The operation of machinery must be in accordance with the conditions of any restrictions in place.[12]

When mechanical pruning, harvesting and other plantation operations are taking place during the restricted and prohibited burning periods a mobile firefighting unit must be in the plantation.[13] The firefighting unit should remain onsite for at least 30 minutes at the conclusion of operations each day of harvest to ensure breakouts do not occur.

6.2 Post plantation management

Plantation fire management must continue until trees and post harvest debris is permanently removed. Once a plantation manager has finished with the site the land owner is responsible for general fire management responsibilities such as maintaining fire breaks, coppice and trash heaps consistent with LG requirements.

7. Plantation Species[14]

The plantation manager, along with personnel involved in fire protection programs; need to be aware of the changing fuel dynamics and their impact on fire behaviour in the plantation.

Most plantations have high grassy fuels for the first few years after planting, unless grass management strategies have been implemented.

- **Eucalyptus *globulus***. At first harvest they are usually 10 to 12 year old plantations and can have several rotations if coppice shoots are used. Generally there is little leaf litter until the trees are close to harvest age, approximately eight to 12 years, then branches, bark and leaves can accumulate. They are self-pruning and as they mature there is separation of ground and aerial fuels, reducing opportunities for crown fires.
- **Eucalyptus sp.** Managed as long rotation premium saw logs involve a thinning regime that can raise fuel loads and may require specific management. Saw log plantations often have an earlier separation of ground and aerial fuels.
- **Australian Sandalwood** (*Santalum spicatum*) These trees are dependent on a host tree to provide nutrients and water to the target species. The ratio of host to target species may vary through the lifecycle that may affect the potential fire hazard.
- (**Irrigated) Indian sandalwood** (*Santalum album*) This is a parasitic tree that relies on a host species to establish its roots and generally has a 15 year rotation. Active pruning is usually undertaken with pruning's being mulched back into soil mounds. This is particularly applicable to plantations in northern Western Australia.

[12] Refer to FIFWAs *Fire Season Requirements* document.
[13] Contact your LG for more information on harvesting requirements and restriction periods.
[14] This section of the document will require regular review to ensure its currency and applicability.

- **Pinus sp.** At the time of harvest they are usually 20 to 30 year old plantations but may be up to 50 years old, and have a varying fuel load throughout the life of a plantation depending on management regimes.
- **Mallee Eucalypts sp.** These species that are used for oil production may take five years to produce their first harvestable timber, followed by two to three year rotations from coppicing. Mallee grown for different end use will have different growing and harvesting regimes.
- **Kyoto Compliant Forest sp**. These Mallee species are popular for long duration non-harvested carbon accounting. Often these plantings are for periods of time exceeding 80 years. The long term management of fuel in these plantings is limited due to contract restrictions and needs to be factored in at planting.
- **Other Species.** All other species will be required to meet fire break and setback clearances as per the Pinus species tables unless it can be proven alternate widths are justified due to a different fire risk.

Appendix 1—Plantation Species Information

Eucalyptus globulus (Tasmanian blue gum)

1st Rotation Fuel Description		
Lifecycle situation	**Fuel Description**	**Fire Danger Hazard**
Young plantations Up to 4 years after planting	Grassy fuels dominate	Low hazard
	Fuel load: up to 4 tonnes per hectare	
	Vulnerable to grass fires	
Developing plantations 4 to 6 years after planting	Discontinuous fuel cover	Low – Moderate hazard
	Fuel rates depend on site location Fuel load: <5 tonnes per hectare	
	Canopy closure will reduce persistence of grassy fuels and wind inside plantation	
	Increase in forest litter and bark	
Older age plantations 7 years plus after planting	Continuous fuel cover	Moderate – High hazard
	Fuel load: up to 8 tonnes per hectare	
	Increase in heavy fuels >6 millimetres	
	Accumulation of bark streamers in Eucalypt plantations	
Harvested plantations 10 years after planting – up to 2 years post-harvest *Immediately following harvesting*	Fuel loading and arrangement will depend on harvest method: Rows of harvest slash dispersed evenly across site aligned with stumps at densities commensurate with harvest volumes. Infield slash – Fuel loads exceeding 8 tonnes per hectare (~10% of total harvest yield) with increase in heavy 'trash' fuels (>15 millimetres). **or** Slash accumulated at roadside (plantation perimeter) processing points in large debris piles, leaving the larger plantation area with a relatively low fuel load.	High hazard Hazard persistence dependant on: 1. fuel loading level produced at time of harvest. 2. fuel reduction program outcome. 3. rate of fuel decomposition.

Eucalyptus globulus (Tasmanian blue gum) (Continued)

Successive Rotation Fuel Description		
Lifecycle situation	**Fuel Description**	**Fire Danger Hazard**
Regrowth coppice plantation – 2 years post-harvest	Fine fuels (< 15 millimetres) and leaf material decomposed leaving semi decomposed limb/branch material (>15 millimetres) Fuel load: <5 tonnes per hectare.	Low – Moderate hazard
	Regrowth coppice regrowth vulnerable to fire	
	Return of grasses and weeds dependent on site location	
Thinned coppice stand, 2 to 3 years post-harvest	Multiple culled stems continuous in arrangement across the site	Moderate hazard. Spike in hazard 0 to 6 months following coppice thin.
	Fuel loads 6 to 8 tonnes per hectare	
	Suspended fuels at 0.5 metres of culled material over grass weeds	
	Coppice regrowth vulnerable to fire	
Coppice stand, 3 to 4 years post-harvest	Refer to **1st rotation site** information 0 to 4 years.	Refer to **1st rotation site** for hazard ratings
Coppice stand 4 or more years	Refer to **1st rotation site** information 4 years plus	Refer to **1st rotation site** for hazard ratings
Re-established plantation post-harvest	Refer to **1st rotation site** information 0 to 7 years plus for full rotation details.	Refer to **1st rotation site** for hazard ratings

Fire break and setback clearances		
Species—All Eucalypts [15]	**Horizontal Clearance**	**Vertical clearance**
Remnant vegetation	6 metres	4 metres
External fire break	15 metres	4 metres
Internal fire breaks	6 metres	4 metres
Dwellings and valuable property	100 metre HSZ incorporating at least a 6 metre fire break	
Western Power – Both sides from centreline		
Power – single pole support up to 33kV	15 metres	4 metres around lines
Power – double pole support 66-132kV	25 metres	5 metres around lines
Power – steel pylon support up to 330kV	35 metres	Contact service provider
Telstra – no heavy machinery to turn around on lines.		
Telephone (copper)	5 metres both sides or 6 metres total if accurately line marked	
Telephone (fibre optic)	10 metres both sides	
Water/sewer pipelines (Water Corporation)	20 metres	
Gas pipeline	30 metres easement plus additional setbacks as required by the WAPC Planning Bulletin 87 and the Department of Planning Land Use Guidelines in pipeline corridors.	

[15] This table covers Eucalypt species used for chipping production, fire break requirements including but not limited to Eucalypt spp. *cladocalyx, globulus, and saligna.*

Eucalyptus species for high value sawlogs

1st Rotation Fuel Description		
Lifecycle situation	**Fuel Description**	**Fire Danger Hazard**
Young plantations up to 4 years after planting	High value of final crop may justify intensive 2nd or 3rd year weed control. Grassy fuels sparse. Fuel load: <4 tonnes per hectare. As trees begin to dominate pasture suppressed.	Low hazard
Four to 10 years after planting	Fluctuating fuel loads. Average distance between trees increasing from 4 metres up to 8 to 10 metres. Grazing a viable option for fuel reduction. Coppice control herbicides can also reduce grassy fuel load. Visibility and access improved due to thinning. Fuel load: up to 8 tonne per hectare. When combined available grass fuels and leaf litter exceed 10 tonne per hectare, hazard reduction work must be undertaken. It is acceptable for between 20 to 40 percent of the area to be >8 tonne per hectare in any year, but the fuel load must be <5 tonne per hectare in the 300 metres to any external compartment boundary.	Low – Moderate hazard
10 to 25 years after planting	Slash levels reduce. Some accumulation of litter and bark (no bark streamers unless E globulus). Fuel reduction burning becomes possible. Pasture sparse when the canopy closes. Visibility and access good. No link between ground fuel and canopy. Fuel load: <4 tonne per hectare unless scrub layer has been able to establish. When combined available grass fuels and leaf litter exceed 10 tonne per hectare hazard reduction work must be undertaken It is acceptable for between 20 to 40 percent of the area to be >8 tonne per hectare in any year, but the fuel load must be <5 tonne per hectare in the 300 metres to any external compartment boundary.	Low – Moderate hazard *Depending on management techniques and decomposition rates.*
Harvested Plantations	Fuel loading and arrangement will depend on harvest method. Most harvest methods likely to leave the site clear of slash and debris. Excess large branches may justify heaping and burning, chipping.	Low hazard

Fire break and setback clearances		
Species—All Eucalypts [16]	**Horizontal Clearance**	**Vertical clearance**
Remnant vegetation	3 metres [17]	4 metres
External fire break	3 metres [18]	4 metres
Internal fire breaks	3 metres	4 metres
Dwellings and valuable property	100 metre HSZ incorporating at least a 6metre fire break	
Western Power – Both sides from centreline		
Power – Single pole support up to 33kV	15 metres	4 metres around lines
Power – double pole support 66-132kV	25 metres	5 metres around lines
Power – steel pylon support up to 330kV	35 metres	Contact service provider
Telstra – no heavy machinery to turn around on lines.		
Telephone (copper)	5 metres both sides or 6 metres total if accurately line marked	
Telephone (fibre optic)	10 metres both sides	
Water/sewer pipelines (Water Corporation)	20 metres	
Gas pipeline	30 metre easement plus additional setbacks as required by the WAPC Planning Bulletin 87 and the Department of Planning Land Use Guidelines in pipeline corridors.	

[16] This table covers Eucalypt species used for saw log production fire break requirements
[17] These fire breaks should be considered equivalent to the native bush or non-plantation bush. This is the minimum requirement unless the local government requires a wider fire break as their minimum standard for native bush fire breaks
[18] Minimum requirement or as prescribed by the local government

Australian Sandalwood (*Santalum spicatum*)

Lifecycle situation	Fuel Description	Fire Danger Hazard
Young plantations Up to 4 years after planting	Grassy fuels dominate with host plant more prominent	Low hazard
First dry season	First year after planting total weed control practiced	Low hazard
2 year old	Grass growth between trees is prominent but weed control still applied to some regimes to maximise seedling development	Low – Moderate hazard
3 to 4 year old	Canopy starts to close reducing the amount of new weeds and most weeds present dying off creating some flammable material between trees	Moderate – High hazard
5 to 15 year old	Tree canopy closes and weeds reduce significantly Grazing in and under trees is generally encouraged at this stage to reduce grass hazard	Low – Moderate hazard
Harvest 15 plus years	Canopy closure is complete and grass growth is minimal. Grazing still compatible maintaining very low ground fuel levels	Low Hazard

Fire break and setback clearances		
Species—Australian Sandalwood	**Horizontal Clearance**	**Vertical clearance**
Remnant vegetation	6 metres	4 metres
External fire break	10 metres	4 metres
Internal fire breaks	6 metres	4 metres
Dwellings and valuable property	100 metre HSZ incorporating at least a 6 metre fire break	
Western Power – Both sides from centreline		
Power – Single pole support up to 33kV	7 metres	3 metres around lines
Power – double pole support 66-132kV	7 metres	4 metres around lines
Power – steel pylon support up to 330kV	Contact service provider	Contact service provider
Telstra – no heavy machinery to turn around on lines.		
Telephone (copper)	5 metres both sides or 6 metres total if accurately line marked	
Telephone (fibre optic)	10 metres both sides	
Water/sewer pipelines (Water Corporation)	6 metres	
Gas pipeline	30 metre easement plus additional setbacks as required by the WAPC Planning Bulletin 87 and the Department of Planning Land Use Guidelines in pipeline corridors.	

Irrigated Tropical Indian Sandalwood (*Santalum album*)

Lifecycle situation	Fuel Description	Fire Danger Hazard
First dry season	First year after planting total weed control practiced and irrigation on a regular (7 to 10 day) cycle. Soil and vegetation stays moist. Fuel load minimised by intensive management.	Low hazard
2 year old (Second dry season)	Irrigation cycle lengthens by the end of the dry. Soil and vegetation incl. weeds stay moist and green.	Low hazard Intensive management still undertaken to promote plantation species growth.
3 to 4 year old	Irrigation lengthens to around four to six weeks – canopy starts to close reducing the amount of new weeds, irrigation not regular enough to sustain weed prominence most weeds dying off creating some flammable material.	Low hazard
5 to 15 year old	Tree canopy closed and weeds reduce significantly.	Low hazard
Harvest 15 plus years	Harvesting usually undertaken during the dry season at 15 years old. Whole tree harvesting usually with host tree remaining on site	Low hazard

Fire break and setback clearances		
Species—Australian Sandalwood	**Horizontal Clearance**	**Vertical clearance**
Remnant vegetation	6 metres	4 metres
External fire break	10 metres	4 metres
Internal fire breaks	6 metres	4 metres
Dwellings and valuable property	50 m HSZ	
Western Power – Both sides from centreline		
Power – Single pole support up to 33kV	7 metres	3 metres around lines
Power – double pole support 66-132kV	7 metres	4 metres around lines
Power – steel pylon support up to 330kV	Contact service provider	Contact service provider
Telstra – no heavy machinery to turn around on lines.		
Telephone (copper)	5 metres both sides or 6 metres total if accurately line marked	
Telephone (fibre optic)	10 metres both sides	
Water/sewer pipelines (Water Corporation)	6 metres	
Gas pipeline	30 metre easement plus additional setbacks as required by the WAPC Planning Bulletin 87 and the Department of Planning Land Use Guidelines in pipeline corridors.	

Pinus species[19] – long term crop

Lifecycle situation	Fuel Description	Fire Danger Hazard
Young plantations Up to 4 years after planting.	Grassy fuels dominate	Low hazard
	Fuel load: <5 tonnes per hectare	
	Vulnerable to grass fires	
Developing plantations shrubs and seedlings 3 to 6 years after planting	Discontinuous fuel cover	Moderate hazard
	Fuel rates depend on site location Fuel load: <5 tonnes per hectare	
	Pruning undertaken	
	Increase in forest litter, bark and needles	
Plantations 7 to 8 years after planting	Continuous fuel cover	High Hazard
	Canopy closure will reduce persistence of grassy fuels and wind inside plantation	
	Fuel load: up to 8 tonnes per hectare.	
	Increase in heavy fuels (>6 millimetre)	
Prescribed needle bed burning	Needle beds in P pinaster (only) are generally burnt at year 15 to 18 to reduce litter fuels to <12 tonne per hectare	High Hazard
First Thinning 12 to 18 year old	Fuel loading and arrangement will depend on thinning method: Assuming removal of 900 stems/ha of P. radiata fuel loads; • 5.1 tonnes per hectare aerial needles • 1.2 tonnes per hectare branch wood • 11–20 litter	Very High hazard dependant on; 1. Fuel loading level produced at time of harvest. 2. Fuel reduction program outcome. 3. rate of fuel decomposition
Second Thinning 18 to 22 year old	600 stems per hectare will be reduced to < 200stems per hectare with: • 6 to 7 tonnes per hectare aerial needles • 2 to 3 tonne per hectare branch wood • 25 to 30 tonne per hectare litter	
Harvested plantations 25 to 30years	Retaining surface mulch from logging residue are significant factors in reducing the level of weed competition in second rotation plantations	Moderate – High Post thinning residue until removal / mitigation of litter fuel
Pine plantations will be pruned as required in strategic locations for fire protection and to allow easy access in the event of a fire in accordance with local government fire break notices.		

[19] Pinus species includes but is not limited to *Pinus spp Radiata and Pinaster*

Fire break and setback clearances		
Species—Pine	**Horizontal Clearance**	**Vertical clearance**
Remnant vegetation	6 metres	4 metres
External fire break	15 metres	4 metres
Internal fire breaks	6 metres	4 metres
Dwellings and valuable property	100metre HSZ incorporating 6 metre fire break	
Western Power – Both sides from centreline		
Power – Single pole support up to 33kV	20 metres	4 metres around lines
Power – double pole support 66-132kV	30 metres	5 metres around lines
Power – steel pylon support up to 330kV	40 metres	Contact service provider
Telstra – no heavy machinery to turn around on lines.		
Telephone (copper)	5 metres both sides or 6 metres total if accurately line marked	
Telephone (fibre optic)	10 metres both sides	
Water/sewer pipelines (Water Corporation)	20 metres	
Gas pipeline	30 metre easement plus additional setbacks as required by the WAPC Planning Bulletin 87 and the Department of Planning Land Use Guidelines in pipeline corridors.	

Mallee species (short term rotation – for harvest)

Lifecycle situation	Fuel Description	Fire Danger Hazard
Young plantations Up to 2 years after planting	Grassy fuels dominate	Low hazard
	Fuel load: <5 tonnes per hectare	
	Vulnerable to grass fires Grass and weed control often undertaken	
Developing plantations 3 to 6 years after planting	Grassy fuel cover	Low Hazard
	Fuel rates depend on site location and intended product. Will be a mixture of grass and some leaf litter and fine limbs	
	Fuel load: <5 tonnes per hectare	
Plantation 6 to 10 years after planting	Continuous fuel cover, primarily of grass and leaf litter. Leaf litter will be around 2.5 to 3 tonne per hectare. Grass fuels will be around 5 tonnes per hectare unless grazed or harvested	Low – Moderate Hazard
	Planting format should prevent canopy closure within the belt and will allow harvesting of required products	

Fire break and setback clearances [20]		
Species—Oil Mallee	**Horizontal Clearance**	**Vertical clearance**
Remnant vegetation	6 metres	4 metres
External fire break	10 metres	4 metres
Internal fire breaks	6 metres	4 metres
Dwellings and valuable property	100 metre HSZ incorporating a 6 metre fire break	
Western Power – Both sides from centreline		
Power – Single pole support up to 33kV	7 metres	3 metres around lines
Power – double pole support 66-132kV	7 metres	4 metres around lines
Power – steel pylon support up to 330kV	Contact service provider	Contact service provider
Telstra – no heavy machinery to turn around on lines.		
Telephone (copper)	5 metres both sides or 6 metres total if accurately line marked	
Telephone (fibre optic)	10 metres both sides	
Water/sewer pipelines (Water Corporation)	6 metres	
Gas pipeline	30 metre easement plus additional setbacks as required by the WAPC Planning Bulletin 87 and the Department of Planning Land Use Guidelines in pipeline corridors.	

[20] If in an Integrated agroforestry situation external firebreak refers to the boundary of the combined agro forest and not individual belts.

Kyoto Compliant Plantings basal area <5m²/ha or a canopy >2metre tall and cover up to 20 percent at maturity over cadastral area Various Mallee Species.[21]

Indicative Planting format – Tree belts 10 metres wide, with three rows, 3 metres apart plus 2 metres for future overhang which results in a basal area at maturity of <5m²/ha.

Belts will be over 100 metres apart (centre to centre) which provides an effective minimum of 90 metres between belts.

Belts will be a maximum of 1000 metres in length before a six metre wide break is established.

Mallee – CFI/ Kyoto compliant plantings

Lifecycle situation	Fuel Description	Fire Danger Hazard
Young plantations Up to 2 years after planting.	Grassy fuels dominate Fuel load: <5 tonnes per hectare Vulnerable to grass fires Grass and weed control required	Low hazard
Developing plantations 3 to 6 years after planting	Grassy fuel cover Fuel rates depend on site location and will be a mixture of grass and some leaf litter and fine limbs Fuel load: <5 tonnes per hectare	Low hazard
Plantation 6 to 10 years after planting	Continuous fuel cover, primarily of grass and leaf litter. Leaf litter will be around 2 to 3 tonne per hectare Grass fuels will be around 5 tonne per hectare unless grazed or harvested.	Low hazard
	Planting format will prevent canopy closure within the belt	
	Continuous fuel cover, primarily of grass and leaf litter. Leaf litter will be greater than 3 tonne per hectare Grass fuels will be around 5 tonne per hectare unless grazed, harvested or out competed. When combined available grass fuels and leaf litter exceed 10 tonne per hectare hazard reduction work must be undertaken It is acceptable for between 20 to 40 percent of the area to be > 8 tonne per hectare in any year, but the fuel load must be < 5 tonne per hectare in the 300 metres to any external compartment boundary.	
	Planting format will permit canopy closure within the belt. When this occurs the fuel accumulation rate will increase.	
Plantation greater than 10 years after planting		Moderate hazard unless fuel loads are reduced

[21] Species can include Blue leaf and York gum, *Eucalyptus loxophleba sub species lissophloia* and *Eucalyptus kochii sub species plenissima, Eucalyptus polybractea* and/or any other species used for carbon pollution reduction scheme plantings.

Fire break and setback clearances		
Species—Mallee	**Horizontal Clearance**	**Vertical clearance**
Remnant vegetation	3 metres[22]	4 metres
External fire break	3 metres[23]	4 metres
Internal fire breaks	3 metres	4 metres
Dwellings and valuable property	100 metre HSZ incorporating a 6 metre fire break	
Western Power – Both sides from centreline		
Power – Single pole support up to 33kV	7 metres	3 metres around lines
Power – double pole support 66-132kV	7 metres	4 metres around lines
Power – steel pylon support up to 330kV	Contact service provider	Contact service provider
Telstra – no heavy machinery to turn around on lines.		
Telephone (copper)	5 metres both sides or 6 metres total if accurately line marked	
Telephone (fibre optic)	10 metres both sides	
Water/sewer pipelines (Water Corporation)	6 metres	
Gas pipeline	30 metre easement plus additional setbacks as required by the WAPC Planning Bulletin 87 and the Department of Planning Land Use Guidelines in pipeline corridors.	

[22] These fire breaks should be considered equivalent to the native bush or non-plantation bush. This is the minimum requirement unless the local government requires a wider fire break as their minimum standard for native bush fire breaks

[23] Minimum requirement or as prescribed by the Local Government.

Kyoto Compliant Plantings Carbon Farming Initiative (basal area >5m²/ha or a canopy cover up to 40 percent at maturity over cadastral area) Various Species [24]

Indicative Planting format –Rows two metres apart with four metres between pairs or any other planting format which results in a basal area at maturity of >5 m²/ha. Tree spacing will be 2.2 metres between trees. Planting density of 1500 spha with an anticipated 80 percent success rate = 1200 spha.

Mallee – CFI/Kyoto compliant plantings

Lifecycle situation	Fuel Description	Fire Danger Hazard
Young plantations Up to 2 years after planting	Grassy fuels dominate	Low hazard
	Fuel load: <5 tonnes per hectare	
	Vulnerable to grass fires Grass and weed control required	
Developing plantations 3 to 6 years after planting	Grassy fuel cover Fuel rates depend on site location and will be a mixture of grass and some leaf litter and fine limbs Fuel load: <5 tonnes per hectare	Moderate hazard
	Continuous fuel cover, primarily of grass and leaf litter. Leaf litter will be around 2 to 3 tonne per hectare Grass fuels will be around 5 t/ha unless grazed or harvested	
Plantation 6 to 10 years after planting	Planting format will result in canopy closure within the plantation	Moderate hazard unless fuel loads are reduced
	Continuous fuel cover, primarily of grass and leaf litter Leaf litter will be greater than 3 tonne per hectare Grass fuels will be around 5 tonne per hectare unless grazed or harvested When combined available grass fuels and leaf litter exceed 10 tonnes per hectare hazard reduction work must be undertaken It is acceptable for between 20 to 40 percent of the area to be > 8t/ha in any year, but the fuel load must be < 8 tonnes per hectare in the 300 metres adjacent to any external compartment boundary.	
	Planting format will permit canopy closure across the site. When this occurs the fuel accumulation rate will increase.	
Plantation greater than 10 years after planting		High

[24] Species can include Blue leaf and York gum, Eucalyptus loxophleba sub species lissophloia and Eucalyptus kochii sub species plenissima, Eucalyptus polybractea and/or any other species used for carbon pollution reduction scheme plantings.

Fire break and setback clearances		
Species—Mallee	**Horizontal Clearance**	**Vertical clearance**
Remnant vegetation	6 metres	4 metres
External fire break	10 metres	4 metres
Internal fire breaks	6 metres	4 metres
Dwellings and valuable property	100 metre HSZ incorporating a 6 metre fire break	
Western Power – Both sides from centreline		
Power – Single pole support up to 33kV	7 metres	3 metres around lines
Power – double pole support 66-132kV	7 metres	4 metres around lines
Power – steel pylon support up to 330kV	Contact service provider	Contact service provider
Telstra – no heavy machinery to turn around on lines.		
Telephone (copper)	5 metres both sides or 6 metres total if accurately line marked	
Telephone (fibre optic)	10 metres both sides	
Water/sewer pipelines (Water Corporation)	6 metres	
Gas pipeline	30 metre easement plus additional setbacks as required by the WAPC Planning Bulletin 87 and the Department of Planning Land Use Guidelines in pipeline corridors.	

Appendix 2—Plantation Map Legends[23]

Water Features

Watercourse—Perennial

Watercourse—Non-Perennial

Lake, artificial lake, natural pool perennial

Lake, natural pool non-perennial; Claypan non-perennial

Swamp perennial; swamp non-perennial

Marsh area

Coastline

Spring; Water hole

Tank; Well; Bore

Hydrant; Standpipe

Windmill; Windmill with tanks, well or bore

Permanent water point

Water Point—Helicopter

Dam; Earth dam; Dam mall

Land and Vegetation Information

Park/Reserve (with prepared ground)

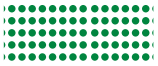
Forest Estate

Forest Park

National Park

Bushland

Orchard or Vineyard



Plantation

Road and Rail Information

Two or more lanes sealed

Two or more lanes unsealed

One lane sealed

One lane unsealed

Track

Restricted public access

[23] Subset Legend information from South-West Emergency Services Directory, Department of Environment and Conservation, 2008.

Road and Rail Information (Continued)

DEC management access only

Fire access track

Strategic fire break

Rural street address

Railway line

Station, siding

DRA: Two or more lanes sealed [24]

DRA: Two or more lanes unsealed

DRA: One lane sealed

DRA: One lane unsealed

DRA: Track

Road bridge

Culvert footbridge

Mine area, quarry; Minesite

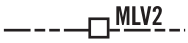
Gate

Earthworks

Transmission line

Building

Gas pipeline; Main line valve



Homestead, Farm, Isolated Building Name

'Marilla Homestead'

Heliport

LPG Gas Cylinders

Loading Ramp

Boundary Information

Local Government

Pastoral lease

Pastoral lease name

WANARRA

Regional park

Disease Risk Area (DRA)

[24] DRA: Disease Risk Area—any area of public land where the DEC considers that the earth, soil or trees may be, or may become infected with a forest disease, and constituted as such by the Governor. Access within DRA is restricted to certain roads and tracks only and may be controlled by signs, gates or other structures.

Appendix 3—Water Supply Requirements

Water Point Locations

Water points will be established at the best possible permanent water source available, this could be anything from a dam, to an irrigation channel. However the location will also consider:

- **Safety.**
- **Maintenance and easy location.**
- **Response time.**

Site Selection

The following points will be considered when selecting the location for a water point:

- **Permanency:** to be effective, water will be available year round.
- **Soil type:** choose clay type soils to prevent loss by seepage.
- **Entry/Egress:** avoid construction of water points on blind corners.
- **Manoeuvring room:** sufficient room for trucks to manoeuvre, especially at night, will be available.

Standpipe

Where static water supplies are provided through a standpipe the following criteria are recommended:

Location

Standpipes should be located to allow any vehicle using the standpipe to leave the road/track completely, and not restrict traffic flow and visibility.

Standpipe Construction

Standpipes should be of sound construction, and withstand a load of 150 kilograms at the pipe outlet without visible deformation of the structure.

Standpipes should be equipped with a metal stop valve at 1.5metres above surrounding surface level. Two metres of flexible hose of appropriate diameter should be fitted to the discharge pipe outlet.

Capacity

The minimum discharge should be 450 litres per minute.

The minimum discharge pipe diameter should be 75 millimetres.

Access

A vehicle hard standing area should be constructed between the edge of the road/track and the standpipe to a minimum length of 25 metres. These hard standing areas should be made to the same standard as the adjoining roadway, recommended to have a minimum compacted thickness of 200 millimetres at a compaction rate of 95 percent MDD.

Consideration should also be given to helicopter access and water points being identified onsite, as well as any possible surrounding areas.

Hydrants

If a reticulated water supply is available, a hydrant to Water Corporation specifications can be installed to satisfy this standard. The minimum flow required is 450 litres per minute.

Refer to the FESA guidelines available at www.fesa.wa.gov.au for more information regarding static water supplies.

Appendix 4—Glossary

Agro forestry

A land management process which allows the simultaneous production of trees and traditional agriculture products on the same unit of land, with a block size greater than one hectare (also referred to as Integrated Agro forestry).

Building Protection Zone

Low fuel area immediately surrounding buildings.

Cadastral Area

Parcel of land relating to the records of cadastre (the public register showing details of ownership).

Compartment

A subdivision of a plantation area for fire control or management purposes.

Farm Forestry

Farm Forestry Includes any trees on farm land which are managed to produce saleable products such as timber, oil, tannin, charcoal or carbon credits. Also includes the commercial management of native forest greater than one hectare on farms.

Fire Break

Any natural or constructed discontinuity in a fuel bed used to segregate, stop and control the spread of a bushfire or to provide a fire line from which to suppress a fire.

Fire Management

All activities associated with the management of fire on plantation properties, including the use and exclusion of fire to meet objectives.

Fire Management Plan

Specified procedures for preventing and controlling fires in plantations.

Fire Suppression

All activities associated with controlling and extinguishing a fire.

Habitable Building

Any building of Classes 1-9 in the Building Code of Australia used as a dwelling or workplace.

Hazard Separation Zone

Fuel reduction area between a fire hazard and the associated buildings that require a building protection zone. When combined with a building protection zone is required to be of sufficient width to ensure that all habitable buildings are located at least 100 metres from the identified bushfire hazard.

Local Development

All land and approved development within a residential, commercial, industrial, semi-rural zone (i.e. special rural/rural residential), special or additional use zone, or similar, plus any approved non-rural based development (i.e. tourist accommodation) within a rural zone, in addition to land identified within a local planning strategy or scheme where such development is likely.

Low Fuel Areas

Any area where fuels have been modified/reduced to the satisfaction of the Local Government Authority, this can be achieved by chemical, mechanical, grazing or fuel reduction burning procedures.

Minimum Load limit

The minimum load a fire break, road or other surface vehicles may be travelling on must be capable of carrying safely without suffering significant permanent deterioration or distress.

Plantation

Any area of planted trees, other than a wind break, that exceeds three hectares in a gazetted town site or elsewhere a stand of trees of 10 hectares or larger, that has been established by sowing or planting native or exotic tree species selected and managed intensively for their commercial and environmental value. A plantation includes roads, tracks, fire breaks and small areas of native vegetation.

Prescribed Burning

The controlled application of fire under specific environmental conditions to achieve predetermined objectives.

Rate of Spread

The forward progress, per unit of time, of the head fire or other specified part of the fire.

Strategic Water Point

Location of a water source that is the first chosen water supply for fire suppression requirements due to its locality, volume and security, making it almost certain that water supply will be available.

Trafficable surface

The quality of terrain will permit continued movement of 4WD fire-fighting vehicles.

Valuable Property

Approved structures with recognised value such as a school, hospital, hotel, motel or other tourist accommodation, a building wholly or principally used as a home by people with disabilities, or retirement village, sheds with flammable materials and machinery. As well as trees, crops or pasture used as a means of income.

Windbreaks/Shelter belts

Planted area of trees not exceeding 100 metres in depth and one kilometre in length. Separation between wind breaks must be 50 metres on side and 15 metres on ends to provide vehicle access.

Belt/Alley Plantings

Exceeding 10 hectares will be classed as a plantation and will be considered as defined in this Glossary as a 'Plantation'.

Acronyms

FESA	Fire and Emergency Services Authority of Western Australia.
WAPC	Western Australian Planning Commission.
LG	Local Government

Contact information

FESA Head Office

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Telephone	**(08) 9323 9300**
Toll free outside Perth metro area	**1800 199 084**
Facsimile	**(08) 9323 9470**
Email	**environment@fesa.wa.gov.au**