SOP 2.2.6

Managing Hazardous Trees

The ACT Rural Fire Service Chief Officer has issued this SOP under Section 38(1) of the *Emergency Act 2004* – A Chief Officer may determine standards and protocols.

Purpose

This Standard Operating Procedure (SOP) is a risk control for safe operations around hazardous trees, during and after a fire.

It provides practices consistent with national standards developed by the Australasian Fire Authorities Council (AFAC) for identifying, marking, isolating and managing tree hazards (Managing Tree Hazards). It ensures a harmonised approach for managing tree hazards within the ACT and when on deployment interstate.

Scope

This SOP is applicable to all personnel from the ACT Rural Fire Service brigades, as defined in the Emergencies Act 2004, engaging in firefighting and storm operations within the ACT or cross border.

Background

Tree hazards are caused by falling trees, limbs or branches and pose a potential health and safety risk for responding firefighters and other emergency services personnel. Tree hazards remain into clean-up operations following incidents, as fire, flood or storms can weaken trees, especially those with underlying structural defects, and undermine tree roots.

Falling trees, limbs and branches can strike people as well as blocking access and egress along roads, designated escape routes or fire control lines. They can also strike utilities and buildings.

The risks associated with fire, storm or flood-weakened trees can persist for a considerable time period after an event, posing risks to the general public.

In addition, there is an inherent tree hazard in the landscape through ageing and weak tree structures.

Definitions

In this SOP the following terms have specific meanings.

Term	Meaning
Advanced or intermediate feller	A tree feller meeting the requirements of the units of competencies: • FPIFGM3212 Fall Trees Manually – Intermediate, or • FPIFGM3213 Fall Trees Manually - Advanced

Term	Meaning
Assess (tree hazard)	To locate and evaluate the extent of tree hazard and to determine an appropriate risk control measure, by personnel with expertise and experience.
Blacking out	The process of extinguishing or removing burning material along or near the fire control line, and trenching logs to prevent rolling to make the fire safe. Also referred to as 'mopping up'.
Clear and present danger (CPD) tree (also known as a 'cross tree').	A tree, limb or branch that is expected to fall within the timeframe of the current operation and impact personnel in its potential impact zone.
Falling objects protection systems (FOPS)	Provide protection for a vehicle's occupants using an engineered reinforcement installed onto a vehicle roof or ceiling structure to reduce possible injuries in the case of a falling object. FOPS must be fitted to all heavy plant engaged in tree removal.
Hangers	Limbs which are hooked up or tangled in other limbs and can be dislodged by external factors, such as wind or machinery, other trees or fire, during an operation.
Identify (tree hazard)	The ability to recognise stands of or individual trees that present an increased risk to personnel.
Indicator tree	A tree marked to indicate the presence and direction of a nearby tree hazard. An indicator tree is used when the symbol on the hazard tree is obscured or difficult to see from the control line, or if it is unsafe to mark the tree.
Occupant Protection Guards (OPGs)	OPGs may be fitted to all heavy plant engaged in tree removal.
Potential clear and present danger tree (potential CPD). Also known as a 'slash tree'.	A tree that, in its current state, is not a CPD tree but may become one, if it catches alight or is impacted by wind or other disturbances.
Potential impact zone	The area underneath or surrounding a CPD tree where a limb, tree or branch has potential to impact personnel.
Rollover protection system (ROPS)	ROPS provides protection for the vehicle operator in the case of a rollover. ROPS must be fitted to all heavy plant engaged in tree removal. Excavators are exempt from this requirement.
Tree hazard	Trees, limbs or branches which have the potential to fall during the current operation. This includes trees with potential to become hazardous through exposure to fire in a prescribed burning or back burning operation. Tree hazard is a term that may refer to the presence of a specific tree hazard associated with an individual tree, a set of tree hazards in an area or to large areas of tree hazard at the landscape level.

Procedure

Personnel operating in an environment where there is a known or potential tree hazard should have the knowledge required to identify trees that may pose a risk, mark and isolate trees accordingly and communicate potential risk.

Risk management for hazardous trees consists of five steps:

1. Identify the presence of tree hazards
2. Assess the risk associated with the tree hazards
3. Mark hazardous trees
4. Isolate hazardous trees
5. Manage and communicate the hazard.

Responsibilities

Role	Responsibilities
Brigade members	• Comply with this SOP when working in an area where hazardous trees may be present.
Incident Controller, Divisional Commander	• Approve proposed management of hazardous trees.
Planning Officer	• Include warnings and advice on the management of hazardous trees in the Incident Action Plan (IAP). • Map all known hazardous trees along the areas that are yet to be assessed.
Incident Controller, Divisional Commander, Task Force Leaders, Sector Leaders, Crew Leaders	• Provide strong leadership on awareness and proactive management of hazardous trees in fire operations. • Task inspection, assessment and marking hazardous trees in fire-affected work areas prior to deployment. • Deliver the pre-operational briefing including the management of hazardous trees.

Identifying hazardous trees

When identifying hazardous trees, the characteristics to look for include:

- Trees with hangers or damaged limbs that could fall and impact personnel in planned work areas or access routes
- Trees affected by one or more of the following:
  - excessing rot content including dry sides, scars or hollows
  - exposed root systems
  - root, trunk or stem damage
  - storm, floods, snow or fire damage
  - impact by machinery
  - snigged logs
  - trees that are alight or still smoking – internally or in root area
  - insect attack
  - dead trees
  - shallow root systems in unstable, eroded or steep ground

- trees that have been cut, wind-thrown or pushed up and which have become caught in or ledged against another tree, stopping it from falling to the ground
- trees with excess lean or an obvious lean towards the work area or trees with the potential to fall on other trees and impact the work area.

External factors can also impact the extent of tree hazards, including:

- impact of fire
- wind exposure – especially where there has been a change to exposure due to tree removal or potential for unusually increased wind exposure due to weather or geography
- trees with snow in their canopy that may obscure stem damage or weight of snow may cause failure
- drought, leading to increased risk of tree hazard in some vegetation types
- stress and insect infestation
- excessive drainage problems from land management operations
- exposure to vibration from heavy plant or machinery.

There is also the potential for tree hazards to interact with other hazards, such as gas supplies, water supplies, powerlines (above and below ground), adjacent buildings and trees and terrain features, such as steep slopes.

See the *Hazardous tree identification checklist* in Appendix 1.

Tree hazard identification must be conducted at a safe distance from the tree being assessed.

Assessing risk of hazardous trees

Tree hazard assessment involves evaluating the tree hazard risk and determining what risk control measures are appropriate.

Everyone on the incident ground should be able to identify Clear and Present Danger (CPD) trees. All other trees that may be potential CPD trees must be assessed by a qualified tree assessor who must hold current certification as an Advanced Tree Feller or Tree Assessor.

Assessing the risk of hazardous trees may also require assessment of the type of risk control measures most appropriate in a specific circumstance. These include consideration of:

- habitat value of the tree hazard (hollows are an important habitat for a wide range of fauna)
- cultural, social and historic significance of the tree hazard, such as scar trees.

Trees with cultural, social or ecological importance should only be removed if it is unreasonable to modify the operation to exclude the tree from being impacted. All such trees should be identified by reference to the Pre-Suppression Atlas and consultation with PCS Cultural Officers.

Risk assessment and management is described in more detail in Appendix 2, *Risk control measures*.

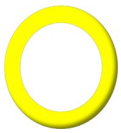
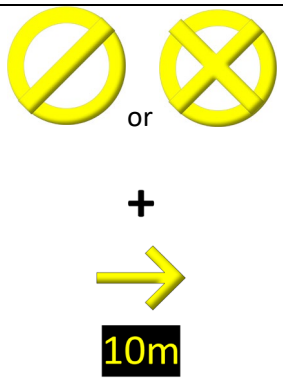
Marking hazardous trees

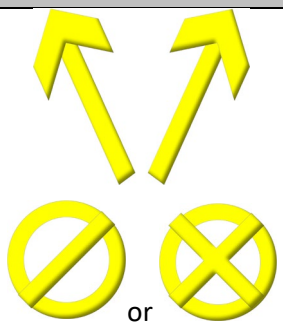
All identified hazardous trees must be cordoned off or marked, and advice given to crews operating in the vicinity. Yellow paint should be used to mark hazardous trees, consistent with national standards. The following rules apply:

- Only biodegradable paint may be used.
- Mark on two sides of the tree if it is safe to do so.

- If it is not safe to mark a tree, an indicator tree should be marked.
- Tree marking should be 30 cm in diameter, if the tree size allows.
- The symbol should be clearly visible from the control line and access routes.
- The mark should be 1.5m off the ground.
- Paint must not be applied to rocks or rocky outcrops.

The following marking system should be used:

Type of hazard	Marking	Type of marking
Clear and present danger tree		Yellow paint on tree Place flagging around tree
Potential CPD trees Protection not assured Has not a high probability of surviving the fire intact based on the proposed protection measures and likely response resources available.		This tree is not currently or obviously a CPD tree but may become one if it catches alight or is impacted by another disturbance. Potential CPD trees must be referred to a tree assessor for assessment. Yellow paint on tree.
Potential CPD trees Protection assured Has a high probability of surviving the fire intact based on the proposed protection measures and likely response resources available.		This tree is not currently or obviously a CPD tree but may become one if it catches alight or is impacted by another disturbance. Potential CPD trees must be referred to a tree assessor for assessment. Yellow paint on tree.
Indicator tree – used when it is too dangerous to mark a CPD tree or when the marking on the tree is obscured.		Paint an arrow to indicate the direction of the CPD tree and write the distance to it underneath the arrow.

Type of hazard	Marking	Type of marking
Trees with hangers	 or	Use one of the symbols with a cross or slash and an arrow to point to the hangers.
Flagging tape for tree hazard	 or	Yellow and black tape is the standard colour for tree hazards. Other tapes should only be used if yellow and black tape is not available.

Isolating hazardous trees

Flagging tape will be used to exclude personnel from the fall zone of hazardous trees or from sections of the fireground containing any hazardous trees where no action has been taken to manage the risk.

If it is practicable and safe to do so, an exclusion zone should be sealed off using the flagging tape tied to nearby trees or other objects.

Where a section of road is to be excluded, tape may be tied to trees on either side of the road to block access to that section of the road.

The standard exclusion is a distance of twice the height of the tree associated with the tree hazard. This may need to be adjusted according the risk assessment.

Personnel must not enter the exclusion zone unless qualified to remove the tree. Personnel must not park vehicles within an exclusion zone.

Hazardous tree should be identified at the following stages:

- on entering a fireground and by reference to the Pre-Suppression Atlas
- along access routes
- dynamically throughout the firefighting operation
- before any mop up activities are commenced.

The existence of a hazardous tree must be communicated to all fire ground personnel as well as to the IMT, if one is in place.

Managing hazardous trees

Suitably trained and experienced personnel will determine the method of control and priorities for managing hazardous trees.

Control methods may include a combination of:

- Move operations to avoid the tree – such as constructing a fire containment line.
- Keep personnel away from the tree – personnel must not work within the fall zone of identified and marked hazardous trees.

- Construct a mineral earth break around the hazardous tree.
- Education – ensure all personnel are aware of the risks posed by hazardous trees.
- Remove the tree – by either mechanical or manual means.

If a CPD tree is on fire, do not attempt to fall it. Members must mark an exclusion zone and let the tree fall, rather than place personnel at risk while removing it by either manual or mechanical methods.

For tree felling operations, refer to the relevant chainsaw training and qualifications and the SOP, Working Around Heavy Plant.

For planned burns, CPD trees should be removed or an exclusion zone established before the commencement of the burn. If it is an environmentally, culturally or historically significant tree, it should be marked and an exclusion zone established.

Appendix 1: Hazardous tree identification checklist

This checklist can be used to assist in the identification of potentially hazardous trees. If work is undertaken and any of these hazards are identified, and persons or machinery are within the fall zone of the tree, then controls must be identified.

Common features of a potentially or clearly hazardous tree Note: List is not exhaustive	YES	NO	Tree hazard can be assessed by		Cultural / Historic significance [1]		GPS Lat/Lon Coordinates and 8 digit grid reference	Control / Comment
			Fire-fighter at safe distance from tree	Tree Assessor / Advanced Tree Feller	YES	NO		
"Hung up tree" or "widow-maker" (suspended limbs)			✓	✓				
Excessive rot content in tree				✓				
Scars				✓				
Dry side				✓				
Hollows				✓				
Burnt out tree butt, trunk or limbs			✓	✓				
Thermal imaging camera shows substantial heat or hot spot in tree compared to surrounding timber			✓	✓				

[1] To identify trees of cultural or historical significant, refer to Pre-Suppression Atlas and PCS Cultural Officers

Common features of a potentially or clearly hazardous tree Note: List is not exhaustive	YES	NO	Tree hazard can be assessed by		Cultural / Historic significance [1]		GPS Lat/Lon Coordinates and 8 digit grid reference	Control / Comment
			Fire-fighter at safe distance from tree	Tree Assessor / Advanced Tree Feller	YES	NO		
Tree trunk with substantial damage			✓	✓				
Hazardous tree located within 2 lengths of tree to be felled			✓	✓				
Storm, wind or snow damaged tree			✓	✓				
Tree's root system likely to uproot due to its location (slope, wet area)				✓				
Tree with exposed root system				✓				
Tree with excessive lean			✓	✓				
Tree larger than the capacity of the felling machine				✓				
Thick undergrowth which cannot be removed at the base of the tree				✓				
Tree limbs interlocking with other trees				✓				
Location which restricts the feller's safe movement (boulders, steep, road fill)				✓				

Common features of a potentially or clearly hazardous tree Note: List is not exhaustive	YES	NO	Tree hazard can be assessed by		Cultural / Historic significance [1]		GPS Lat/Lon Coordinates and 8 digit grid reference	Control / Comment
			Fire-fighter at safe distance from tree	Tree Assessor / Advanced Tree Feller	YES	NO		
Inadequate holding wood to ensure safe directional control of the tree				✓				
Dead tree			✓	✓				
Burning tree			✓	✓				
Another tree lodged in the tree to be removed				✓				

Assessor (PRINT NAME) ..... Date .....

Supervisor (PRINT NAME) ..... Date .....

Appendix 2: Risk control measures

Prescribed burning

Phases of prescribed burning	Risk treatment					
	Hierarchy of control					
	Level 1	Level 2			Level 3	
	Eliminate	Substitute	Isolate	Engineering	Administration	PPE
Planning	• Identify and plan tree hazard management requirements, such as removal.	• Plan work areas (control lines) along areas of reduced tree hazard (pre-treated roads or strategic breaks)	• Exclude areas of the burn that will not have tree hazard management performed (internal tracks). • Plan pre-burn candling or edge burning.	• All heavy plant engaged in tree removal must be fitted with FOPS and ROPS and may be fitted with OPGs. Excavators are exempt from requiring ROPS.	• Map areas of high tree hazard • Mapping of tree hazard pre-treatment • Establish system to mark tree hazards during operations • Establish effective protection options for trees that can be protected from fire. • Schedule burns when fuel and soil moisture conditions are moderate (Keetch Byram Drought Index values less than 100).	• PPE
Preparation (pre-ignition)	• Plan crew staging and traffic management processes to avoid tree hazards • Establish exclusion zones • Remove trees (after approval) that become CPD trees if impacted by fire and for which protection cannot be assured	• Move control lines to areas with less exposure to hazardous trees	Prevent potential CPD trees from catching alight, e.g.: • Clear fuel around trees using hand tools or machinery • Candle (burn) tree to remove flammable bark	• All heavy plant engaged in tree removal must be fitted with FOPS and ROPS and may be fitted with OPGs. Excavators are exempt from requiring ROPS.	• Use trained and accredited fellers and plant operators involved with tree removal • Establish crew deployment procedures based on dynamic risk assessment	• PPE

Phases of prescribed burning	Risk treatment					
	Hierarchy of control					
	Level 1	Level 2			Level 3	
	Eliminate	Substitute	Isolate	Engineering	Administration	PPE
	• Treat CPD trees by tree removal or limb / branch removal if appropriate and safe to do so		during suitable conditions • Apply ground based retardants[2] or suppressants if it is within ecological constraints • Wet down tree with water • Plan pre-burn candling or edge burning.			
Post-ignition	• Prevent ignition of potential CPD trees by minimising the fire intensity (e.g. the use of backing flanking fire) • Rapid extinguishment • Treat CPD trees by tree removal or limb / branch removal if appropriate and safe to do so	• Where safe and practical, use plant to treat hazardous trees	• Relocate control line • Traffic management • Exclude personnel from areas that have not been assessed and treated for tree hazards • Delay blacking out until areas have been assessed and treated for tree hazards	• All heavy plant engaged in tree removal must be fitted with FOPS and ROPS and may be fitted with OPGs. Excavators are exempt from requiring ROPS.	• Establish crew deployment based on dynamic risk assessment • Use lookouts, awareness, communications, escape routes and safety zones (LACES) to manage risk (e.g. identify escape routes) • Mark hazardous trees • Record and map hazardous trees	• PPE
Recovery and making safe for public	• PCS to assess need for removal of any hazardous tree that could impact areas	• Provide information on alternative	• Exclude public from un-assessed and untreated areas		• Signage • Records of hazardous trees retained	• PPE

[2] Ground-based retardants must not be used in an identified “no retardant” zone, such as Namadgi.

Phases of prescribed burning	Risk treatment					
	Hierarchy of control					
	Level 1	Level 2			Level 3	
	Eliminate	Substitute	Isolate	Engineering	Administration	PPE
	where members of the public gather, e.g. public roads, picnic and camping areas	routes if high public traffic is expected			• Records of hazardous trees removed • Communicate any potential ongoing issues with land owner / manager	

Bushfire, flood and storm

Phases of emergency management	Risk treatment					
	Hierarchy of control					
	Level 1	Level 2			Level 3	
	Eliminate	Substitute	Isolate	Engineering	Administration	PPE
• Before	• Treat CPD trees by tree removal or limb / branch removal if appropriate and safe to do so from likely access routes and control lines	• Build alternative control strategy capability (aircraft, plant, monitoring)	• Relocate likely access road or control line away from areas of high tree hazard • Prevent potential CPD trees from catching alight • Clear fuel around trees (using hand tools or machinery) • Candle (burn) tree to remove flammable bark during suitable conditions • Apply ground-based retardants or suppressants[3] • Wet down trees with water.	• All heavy plant engaged in tree removal must be fitted with FOPS and ROPS and may be fitted with OPGs. Excavators are exempt from requiring ROPS.	• Mark high tree hazard areas • Mark CPD trees and, where applicable, potential CPD trees • Map areas of high tree hazard • Ensure availability of trained and experienced tree hazard assessors	• PPE
• During	En route: • Deploy crews via routes that have been assessed and treated • Do not respond to non-emergency incident types	En route: • Use alternative control strategy capability	En route: • Deploy crews on routes which have pre-existing tree clearance on both sides		En route: • Notify oncoming crews and incident control about identified hazardous trees	En route: • PPE

[3] Ground-based retardants must not be used in an identified “no retardant” zone, such as Namadgi.

Phases of emergency management	Risk treatment					
	Hierarchy of control					
	Level 1	Level 2			Level 3	
	Eliminate	Substitute	Isolate	Engineering	Administration	PPE
	until the tree hazard has been managed appropriately	(aircraft, plant, monitoring and planning)				
	At the incident • Treat CPD trees by tree removal or limb / branch removal if appropriate and safe to do so • Extinguish trees before fire can take hold • Prevent ignition of potential CPD trees by minimising the fire intensity (e.g. the use of backing flanking fire) • Prevent potential CPD trees from catching alight, e.g.: – Clear fuel around trees using hand tools or machinery – Candle (burn) tree to remove flammable bark during suitable conditions – Apply ground based retardants or suppressants – Wet down tree with water	At the incident • Adjust strategy on the day is required	At the incident • Withdraw from high tree hazard area under identified conditions, e.g. wind • Establish exclusion zone around identified hazardous tree • Move or abandon control line through identified high tree hazard areas • Relocate control line away from individual hazardous trees • Traffic management to isolate responders and public from risk	At the incident • All heavy plant engaged in tree removal must be fitted with FOPS and ROPS and may be fitted with OPGs. Excavators are exempt from requiring ROPS.	At the incident • Establish crew deployment procedures based on dynamic risk management • Use lookouts, awareness, communications, escape routes and safety zones (LACES) to manage risk • Mark CPD trees and potential CPD trees	At the incident • PPE

Phases of emergency management	Risk treatment					
	Hierarchy of control					
	Level 1	Level 2			Level 3	
	Eliminate	Substitute	Isolate	Engineering	Administration	PPE
After	• Treat CPD trees by tree removal or limb / branch removal if appropriate and safe to do so		• Relocate control line • Traffic management • Establish exclusion zones	• All heavy plant engaged in tree removal must be fitted with FOPS and ROPS and may be fitted with OPGs. Excavators are exempt from requiring ROPS.	• Defer crew deployment until full tree hazard assessment has been completed • Use dynamic risk assessment and LACES to manage risk after deployment • Mark and communicate ongoing risks	• PPE

Document information

Version history

Author	Version	Version Approval Date	Summary of Changes
Rohan Scott	1.0	10/03/2020	

Approved by

Name	Title/Role	Signature	Date
Joe Murphy	CO ACT RFS	J. Murphy	16-03-2020

Document Owner

Position	Section
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Related documents

Document name
AFAC Guideline: Managing Tree Hazards
Work Health and Safety Act 2011
Emergency Management Victoria, Joint Standard Operating Procedure J8.03
NSW RFS OP 1.3.1 Operational Protocol For Hazardous Trees and Appropriate Use of Chainsaws
Competency: FWPCOT2239 Trim and Cut Felled Trees
Competency: FWPFGM3212 Fall Trees Manually (Intermediate)
Competency: FWPFGM3213 Fall Trees Manually (Advanced)
2.2.7 Working Around Heavy Plant standard operating procedure
2.3.2 Deployment of Foam, Retardants and Gels for Fire Suppression guideline

Signed documents will be scanned and filed in TRIM.