Blackash Practice Note PN-01

Canopy Coverage in Bushfire Asset Protection Zones

Version 1.1

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BLACKASH
BUSHFIRE CONSULTING

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Practice Notes

Blackash Practice Notes do not introduce new regulatory requirements and do not replace the provisions of applicable legislation, policy instruments or recognised technical standards. Instead, they document accepted assessment approaches used by suitably qualified bushfire practitioners to interpret and explain the functional intent of bushfire protection measures and support proportionate, risk-based planning outcomes consistent with the framework of *Planning for Bush Fire Protection 2019*.

These Practice Notes are intended to assist the application of expert and professional judgement in circumstances where prescriptive mapping, aerial imagery or standardised assessment methods alone may not fully resolve site conditions. They are provided as supporting technical guidance and should be read in conjunction with relevant statutory requirements and agency guidance.

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1. Introduction

Planning for Bush Fire Protection 2019 (PBP) defines an Asset Protection Zone (APZ) as

> *A fuel-reduced area surrounding a built asset or structure which provides a buffer zone between a bush fire hazard and an asset. The APZ includes a defendable space within which firefighting operations can be carried out. The size of the required APZ varies with slope, vegetation and FFDI.*

An APZ performs multiple functions within the bushfire protection framework. It provides a buffer between hazard vegetation and the asset, creates an area of reduced fuel that supports suppression activities, enables backburning and hazard-reduction operations where required, and improves access and operational safety for firefighters and occupants defending property. Where designed correctly and maintained over time, an APZ reduces the likelihood of direct flame contact, limits exposure to damaging radiant heat and reduces the potential for ember attack affecting the building envelope.

The width of an APZ is determined using the vegetation- and slope-based site assessment methodology set out in Appendix 1 of PBP, which establishes the required separation distance between hazard vegetation and development based on the level of bushfire threat. Once this separation distance is established, vegetation within the APZ must be managed so that bushfire fuels are minimised and do not provide a pathway for fire spread either at ground level or through the tree canopy. Appendix 4.1 of PBP supports this objective by specifying vegetation-structure requirements within APZs, including canopy-cover limits at maturity of less than 15% within Inner Protection Areas (IPAs) and less than 30% within Outer Protection Areas (OPAs), together with requirements for canopy separation and the management of shrub, grass and surface fuels.

While PBP clearly establishes both the methodology for determining APZ width and the vegetation-management outcomes required within the zone, it does not prescribe a detailed method for calculating canopy cover or for determining how retained canopy trees interact with the edge of hazard vegetation used to define APZ separation distances. In practice, this creates uncertainty where canopy trees are retained within landscaped environments, infill development sites or managed land settings that satisfy the fuel-reduction objectives of Appendix 4.1 but still contain mature tree cover.

This Blackash Canopy Coverage document provides a consistent methodology for interpreting and applying the canopy-cover provisions of Appendix 4.1 in a manner that remains aligned with the purpose of APZs as defined by PBP. The approach recognises that APZs are intended to function as fuel-reduced defendable space rather than vegetation-free areas, and that retained canopy trees may form part of an effective APZ where fuel continuity is controlled and vegetation structure satisfies the performance intent of PBP. The methodology therefore supports a balanced application of APZ requirements that maintains the protective function of the zone while enabling appropriate tree retention consistent with the broader objective of PBP to reduce bushfire risk through practical, proportionate and performance-based planning outcomes.

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2. Determination of APZ

The required width of an APZ is determined in accordance with the site assessment methodology set out in Appendix 1 of PBP. This methodology establishes the minimum separation distance between a building or structure and adjacent bushfire hazard vegetation based on the classification of vegetation formation, the effective slope under the vegetation in the direction of fire spread toward the asset, and the relevant Fire Danger Index applicable to the locality.

The resulting APZ distance is intended to achieve a radiant heat exposure outcome that supports defendable space objectives and reduces the likelihood of direct flame contact, intense radiant heat exposure and ember attack affecting the building envelope.

Appendix 1 adopts a vegetation formation–based approach to hazard assessment rather than an individual tree-based assessment. Vegetation is classified using the formation categories derived from the Keith (2004) vegetation classification framework as adopted by PBP, and the effective slope beneath the hazard vegetation is measured for a distance of up to 100 metres from the asset in the direction of potential fire spread. These inputs are used to determine the required separation distance to achieve the radiant heat performance objective, typically expressed as limiting radiant heat exposure to a threshold point expressed in kW/m² at the building or asset.

The separation distance determined under Appendix 1 represents the required distance between the building envelope and the edge of the bush fire hazard vegetation. PBP does not prescribe whether this hazard interface is measured to individual tree trunks or canopy drip lines. Instead, the methodology operates at the scale of vegetation formations and fuel structure, meaning the relevant reference point is the edge of the bush fire hazard rather than individual vegetation elements.

Accordingly, the location of the hazard interface is determined by the extent of unmanaged vegetation capable of supporting bushfire spread, taking into account the presence or absence of surface fuels, near-surface fuels, elevated fuels and canopy connectivity. In particular, the presence of ladder fuels that provide vertical continuity between surface and canopy fuel layers is a key determinant of whether vegetation contributes to the bushfire hazard interface, as these fuels enable flame development to transition from ground-level fire into elevated and canopy fuels and therefore significantly influence the potential intensity and spread behaviour of a bushfire approaching an asset.

Once the required APZ width has been established using Appendix 1, vegetation within the APZ is to be managed in accordance with the fuel-structure requirements set out in Appendix 4.1 of PBP. These requirements define the vegetation characteristics necessary to maintain the effectiveness of the APZ as defendable space, including limits on canopy cover at maturity, canopy separation distances and controls on shrub, grass and surface fuel structure. The determination of APZ width under Appendix 1 and the management of vegetation within the APZ under Appendix 4.1 operate together to ensure that the separation distance remains effective over time and continues to achieve the intended bushfire protection outcomes.

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3. Application of Expert Judgement in Defining the APZ Hazard Interface

PBP provides a structured methodology for determining AP) widths using vegetation formation and slope under Appendix 1; however, it does not prescribe a fixed rule for identifying the precise spatial starting and finishing point of the bushfire hazard interface on the ground.

In practice, the identification of this interface requires the application of expert judgement to determine the boundary between hazard vegetation and managed land, consistent with the intent of PBP and the vegetation-structure outcomes described in Appendix 4.1.

For larger developments, subdivision-scale projects and precinct-level planning exercises, the outer edge of the vegetation canopy (drip line) typically provides a practical and defensible reference for defining the starting and finishing point of hazard vegetation. This boundary is commonly described as the line of management, representing the interface between vegetation retained in a natural or unmanaged condition and vegetation that is subject to ongoing fuel management consistent with APZ objectives. The line of management may be established through a Vegetation Management Plan (VMP), ecological assessment, arboricultural advice, landscape design documentation or bushfire specialist assessment, and should reflect the extent of vegetation intended to remain outside the managed APZ environment.

For smaller scale developments, including single dwellings, infill development and site-specific building envelopes, the line of management requires detailed site-based determination rather than reliance on canopy extent alone. In these circumstances, retained trees are often located within the APZ and the presence of canopy cover does not, of itself, define the bushfire hazard interface. Instead, the location of the line of management should be determined having regard to the vegetation structure beneath the canopy, including the presence or absence of surface fuels, near-surface fuels and ladder fuels that enable vertical and horizontal fire continuity.

Where vegetation beneath retained canopy trees is maintained in accordance with the Inner Protection Area performance intent of Appendix 4.1 of PBP, including discontinuous shrub layers, limited litter accumulation and managed grass fuels, the area beneath the canopy may appropriately form part of the APZ rather than representing unmanaged hazard vegetation. Accordingly, the determination of the line of management at smaller scales relies on expert assessment of fuel structure and ongoing maintenance conditions to ensure that the effective bushfire hazard interface reflects the extent of vegetation capable of supporting bushfire spread rather than the outer extent of canopy projection alone.

It is important to distinguish between apparent canopy continuity visible in aerial photography and the actual structure of vegetation fuels at ground level when determining the location of the line of management for smaller scale developments. While aerial imagery may indicate a continuous tree canopy across a site, this does not necessarily represent continuous bushfire hazard vegetation for the purposes of PBP. In many developed or partially developed settings, areas beneath retained canopy trees comprise managed land such as maintained grassed areas, landscaped curtilage, driveways, hardstand surfaces or other disturbed environments that do not support the surface, near-surface or ladder fuel continuity required for bushfire spread. Accordingly, the presence of canopy cover alone should not be relied upon to define the hazard interface, and site inspection is necessary to confirm whether vegetation beneath the canopy functions as unmanaged bushfire hazard

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vegetation or forms part of the managed fuel-reduced environment consistent with the objectives of Appendix 4.1.

The identification of the line of management is critical because it establishes the functional boundary between managed land, as described within PBP, and bushfire hazard vegetation that informs the determination of APZ separation distances under Appendix 1. In this context, managed land includes areas where vegetation structure is modified and maintained so that it does not support bushfire spread consistent with the fuel-reduction objectives of Appendix 4.1. Conversely, vegetation beyond the line of management that retains continuous surface, near-surface, elevated or canopy fuels capable of supporting bushfire spread forms the relevant hazard interface for the purposes of determining APZ width.

Accordingly, the application of expert judgement in defining the line of management ensures that APZ distances are measured to the edge of the effective bushfire hazard, rather than to individual tree trunks or isolated canopy elements, and supports a consistent and repeatable approach to distinguishing between retained landscape canopy within managed environments and vegetation formations that continue to function as bushfire hazard under the PBP framework.

Guidance Note

Where canopy extent is interpreted using aerial photography or map-based reference material, such as a Vegetation Management Plan (VMP), ecological mapping boundary or landscape documentation, the outer canopy projection (drip line) should generally be adopted as the practical reference for defining the extent of vegetation for the purposes of establishing the line of management. This approach provides a consistent and repeatable method for interpreting canopy extent at a precinct or subdivision scale where vegetation structure beneath the canopy cannot be reliably confirmed from remote sources alone.

Where site-specific assessment is undertaken, the location of the line of management should be determined through field inspection and expert judgement applied by a suitably qualified bushfire practitioner, typically a BPAD Level 3 Certified Practitioner. In these circumstances, the determination of the line of management is informed by the observed vegetation fuel structure, including the presence or absence of surface fuels, near-surface fuels, elevated fuels and ladder fuels, rather than canopy projection alone. This allows the hazard interface to be defined based on the effective bushfire fuel boundary, ensuring that managed land beneath retained canopy trees can appropriately form part of the APZ where consistent with the objectives of Appendix 4.1 of PBP.

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4. Consideration of Canopy Cover

Tree canopy cover within an APZ is addressed in Appendix 4.1 of PBP as part of the vegetation-structure requirements necessary to maintain the effectiveness of defendable space surrounding development.

These requirements specify that tree canopy cover should be less than 15% at maturity within the Inner Protection Area (IPA) and less than 30% within the Outer Protection Area (OPA), with canopy separation distances of 2–5 metres.

The purpose of these limits is to reduce the potential for fire spread through the canopy layer and to minimise vertical and horizontal fuel continuity that may otherwise increase flame height, radiant heat exposure and ember production in the vicinity of buildings.

Importantly, canopy cover controls operate as part of a broader fuel-structure framework that also includes limits on shrub cover, grass height, surface litter accumulation and the removal of ladder fuels capable of linking surface and canopy fuel layers.

PBP does not prescribe a spatial assessment scale or measurement methodology for determining canopy cover within an APZ under Appendix 4.1.

The canopy cover thresholds of less than 15% at maturity within the Inner Protection Area and less than 30% within the Outer Protection Area are expressed as vegetation-structure performance outcomes rather than mapped quantitative compliance metrics. Accordingly, the assessment of canopy cover requires the application of expert judgement having regard to projected canopy extent at maturity, canopy spacing and the presence or absence of ladder fuels and near-surface fuel continuity, to confirm that retained vegetation does not contribute to bushfire spread toward the asset.

A key consideration in this assessment is whether the retained canopy structure is capable of supporting horizontal or vertical fire spread within the canopy layer, as the intent of the canopy cover limits in Appendix 4.1 is to prevent the development of continuous canopy fuels that would enable fire to propagate through the tree layer toward the building envelope.

In practical terms, the application of expert judgement in assessing canopy cover within an APZ requires consideration of how a bushfire is likely to interact with the canopy layer. This includes whether fire is capable of spreading into the canopy from surface or near-surface fuels through the presence of ladder fuels, whether it can travel horizontally through connected canopy structure, or whether fire burning in adjacent vegetation is likely to drop out of the canopy as embers, burning material or flame contact into the managed APZ environment.

Where canopy trees are separated and the vegetation beneath them is managed so that vertical and horizontal fuel continuity is limited, the canopy is unlikely to support sustained fire spread toward the asset and may appropriately form part of the fuel-reduced environment intended by Appendix 4.1 of *PBP*.

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5. Vegetation Assessment Guide

The *Vegetation Assessment Guide* (Commonwealth of Australia 2013) supports the consistent identification and classification of vegetation for bushfire planning purposes by providing a structured framework for determining vegetation formation, structure and fuel characteristics relevant to the application of *PBP*.

The guide assists practitioners in distinguishing between vegetation that functions as bushfire hazard vegetation and vegetation that may be considered managed land, through consideration of canopy structure, shrub density, ground fuels, disturbance history and landscape context.

This approach aligns with the Appendix 1 methodology in PBP, which relies on vegetation formation and effective slope to determine APZ widths, rather than assessment at the scale of individual trees.

Importantly, the *Vegetation Assessment Guide* also supports the interpretation of vegetation condition at a site scale, particularly where aerial imagery suggests continuous canopy cover but field inspection confirms that surface, near-surface or ladder fuels are absent or discontinuous.

In these circumstances, the guide provides a basis for determining whether vegetation contributes to the effective bushfire hazard interface or forms part of a managed landscape consistent with the fuel-reduction intent of Appendix 4.1 of PBP. As such, the guide is a supporting tool for establishing the line of management, confirming vegetation classifications used in APZ determination and ensuring that canopy cover assessments are informed by actual fuel structure rather than canopy extent alone.

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6. Determination of Canopy Cover within Asset Protection Zones

The determination of canopy cover for the purposes of Appendix 4.1 requires consideration of projected canopy extent at maturity, rather than the existing canopy condition at the time of assessment. This ensures that vegetation retained within an APZ will continue to satisfy the defendable space objectives of PBP over the life of the development.

In practice, canopy cover should be assessed having regard to the horizontal projection of tree crowns across the vegetated portion of the APZ and the spacing between retained canopy elements to confirm that canopy connectivity does not contribute to bushfire spread.

Where canopy trees are retained over managed land that satisfies the fuel-reduction intent of Appendix 4.1, the presence of canopy cover alone does not necessarily indicate the presence of bushfire hazard vegetation; rather, canopy cover must be considered together with the structure and continuity of surface, near-surface and elevated fuels beneath the canopy to determine whether the vegetation contributes to the hazard interface and thus the potential to carry uncontrolled bushfire or appropriately forms part of the managed APZ environment.

Figure 1 provides guidance for the assessment and interpretation of tree canopy cover within APZs in accordance with Appendix 4.1 of PBP. Blackash have provided a Visual Reference Guide at Figure 2 using the

The Visual Reference Guide is intended to support consistent application of canopy cover thresholds within both Inner Protection Areas (IPAs) and Outer Protection Areas (OPAs) by distinguishing between canopy presence that contributes to bushfire hazard continuity and canopy that can appropriately be retained within a managed fuel-reduced landscape. Blackash have provided canopy cover using the %Canopy App at Figure 2 as a photo reference visual reference guide. The %Cover App should be used to determine canopy cover.

The guide recognises that canopy cover limits form part of a broader vegetation-structure framework under PBP and should not be interpreted in isolation from the management of surface fuels, near-surface fuels, elevated fuels and ladder fuels.

The canopy cover limits of less than 15% at maturity within the IPA and less than 30% within the OPA are intended to maintain discontinuity in the canopy layer so that vegetation within the APZ does not provide a pathway for fire spread toward buildings.

Table 1 supports the practical application of these limits by identifying how canopy cover should be interpreted in the context of retained trees within landscaped environments, developed settings and partially disturbed vegetation areas where the presence of canopy does not necessarily represent unmanaged bushfire hazard vegetation. In particular, the guide reinforces that canopy cover should be assessed based on projected mature crown extent and canopy spacing, and must be considered together with the presence or absence of ladder fuels and continuous shrub layers that enable vertical and horizontal fuel continuity.

Importantly, Table 1 also supports the application of expert judgement in distinguishing between canopy that forms part of retained hazard vegetation outside the line of management and canopy that occurs within managed land forming part of the APZ. This distinction is particularly relevant for smaller scale developments where retained canopy

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trees are commonly located within landscaped curtilage and where aerial imagery may indicate apparent canopy continuity that is not representative of actual bushfire fuel structure. The guide therefore provides a structured basis for determining whether canopy contributes to the effective bushfire hazard interface or appropriately forms part of the defendable space intended by Appendix 4.1 of PBP.

Figure 1 Crown Type Cover Visual Reference Card (source Vegetation Assessment Guide)

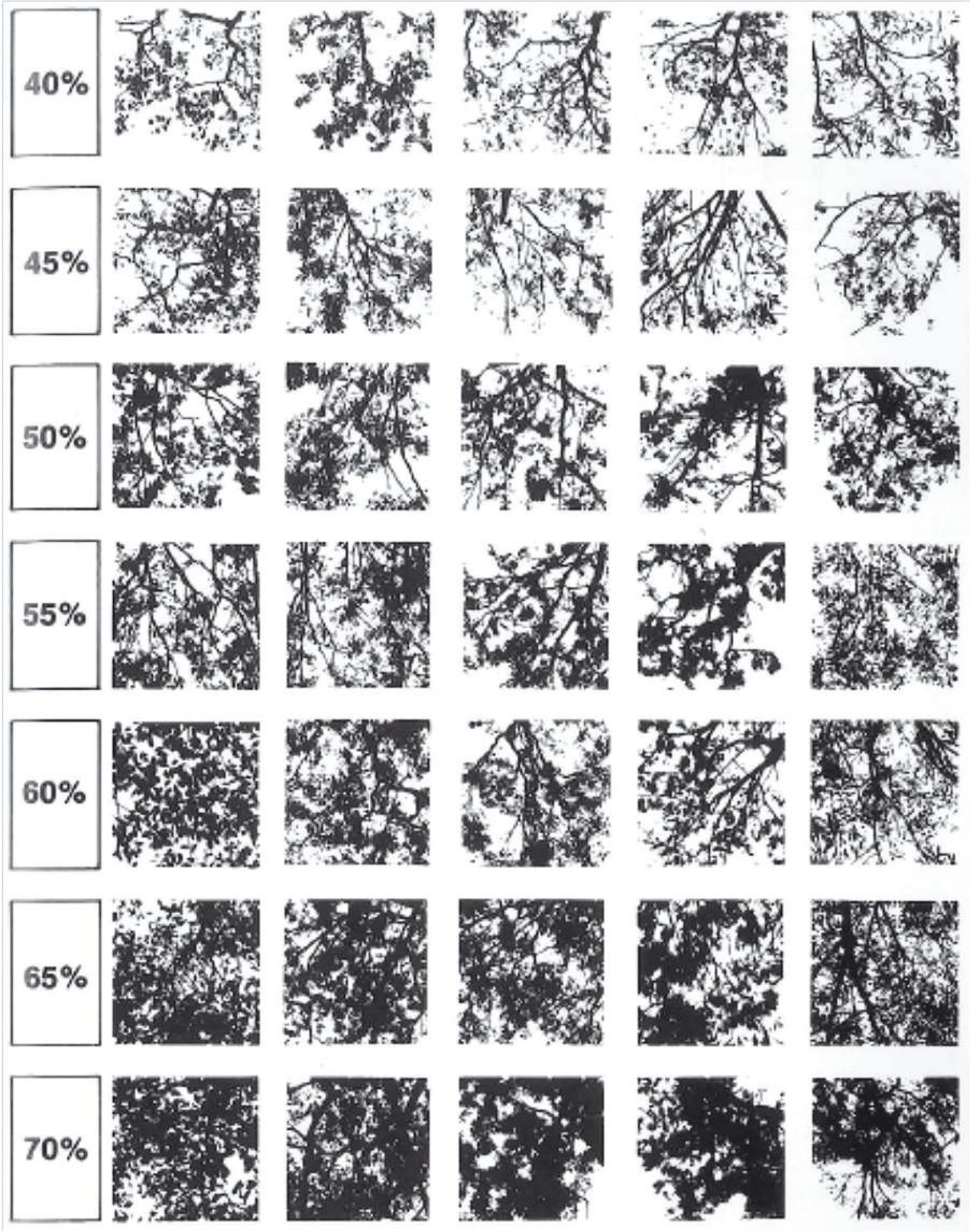

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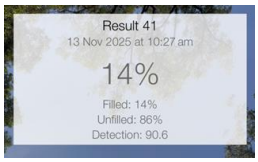
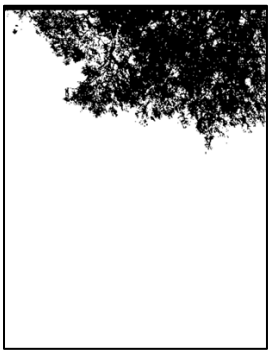
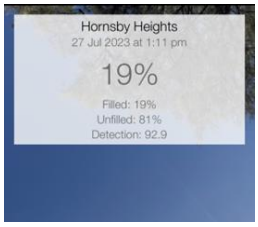
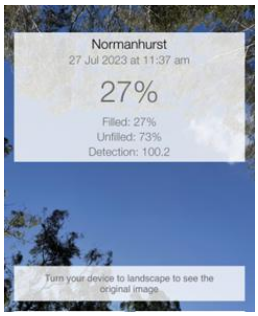
Figure 2 Blackash Canopy Cover Guide

Vegetation	Detection Level	Percentage	Description
			In a bush environment with 15% canopy cover, the vegetation is still relatively sparse, with more tree and shrub cover compared to areas with 10% canopy cover. The presence of a 20% canopy cover indicates a slightly denser vegetation arrangement, which can have implications for bushfire behaviour.
			The 20% canopy cover can influence fire behaviour in several ways. The vegetation may create continuous fuel pathways, enabling fire to spread more quickly than in sparser environments. However, this level of canopy cover might also provide some shelter and reduce wind-driven fire behaviour in comparison to more open areas.
			In a bush environment with 30% canopy cover, the vegetation is notably denser compared to areas with lower canopy cover percentages.

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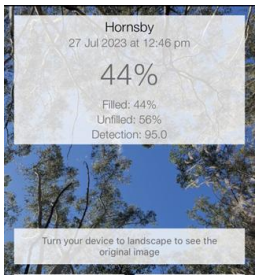
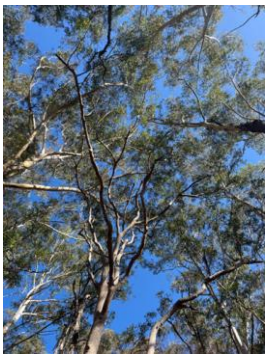
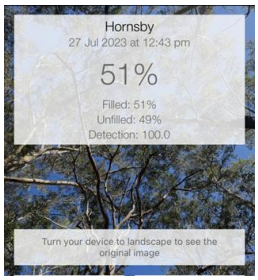
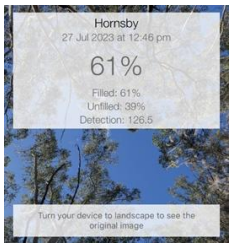
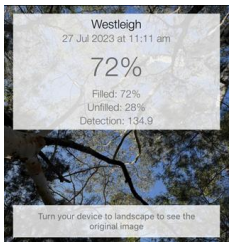
			40% canopy cover presents significant challenges and risks. The denser vegetation results in a substantial fuel load in the area, providing ample material for potential bushfires
			The 50% canopy cover can have considerable impacts on bushfire behavior. The dense vegetation can contribute to the formation of a well-developed canopy fire, where flames spread from one tree crown to another, generating intense and fast-moving fires.
			In areas with 60% canopy cover, the likelihood of ember showers during a bushfire event is heightened. Embers can be carried by the wind over long distances, igniting spot fires ahead of the main fire front, posing additional challenges for firefighting and containment.
			70% canopy cover indicates an exceptionally high bushfire threat, and proactive measures are essential to minimizing potential impacts and enhancing community resilience in the face of extreme bushfire risks. Community education, early warning systems, and emergency preparedness plans are paramount for protecting lives, property, and the environment.

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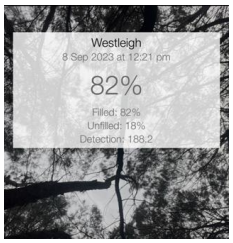
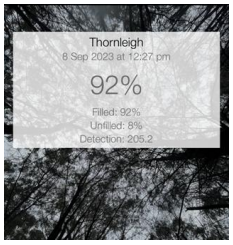
			In a bush environment with 80% to 100% canopy cover, the vegetation is extremely dense, with almost all of the area shaded and covered by the branches and leaves of trees and shrubs. The high canopy cover indicates a near continuous canopy layer, leaving little open space.
			In a bush environment with 80% to 100% canopy cover, the vegetation is extremely dense, with almost all of the area shaded and covered by the branches and leaves of trees and shrubs. The high canopy cover indicates a near continuous canopy layer, leaving little open space.

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7. Tree Retention Hierarchy for Asset Protection Zones

The following hierarchy provides a structured basis for prioritising tree retention within APZ in a manner consistent with the vegetation-structure objectives of Appendix 4.1 of PBP.

The hierarchy recognises that canopy retention within APZs must balance bushfire behaviour considerations, long-term landscape stability, and ecological value, while ensuring retained vegetation does not contribute to vertical or horizontal fuel continuity toward the asset.

Primary Retention Priority (Highest Value Trees)
The following trees should be prioritised for retention where they are compatible with the fuel-reduction intent of the APZ:

1. Trees with high Safe Useful Life Expectancy (SULE), as these trees are more likely to remain structurally stable and suitable for long-term integration within the APZ landscape management regime.
2. Trees with high ecological function containing hollows, particularly where they provide habitat value and do not contribute to fuel continuity beneath the canopy.
3. Smooth-barked species, which are less likely to generate bark-driven ember transport during bushfire events compared with fibrous or ribbon-barked species.

Secondary Retention Priority (Preferred Structural Characteristics)

Where primary retention criteria are satisfied, preference should be given to trees demonstrating favourable fuel-structure characteristics consistent with Appendix 4.1:

- Trees with elevated canopy structure and limited near-surface branching
- Trees with minimal ladder fuels beneath the canopy
- Trees located over managed grassed or landscaped surfaces
- Trees that are well separated from adjacent canopy elements, typically achieving the 2–5 m canopy separation intent in Appendix 4.1
- Trees positioned so they do not overhang buildings
- Trees that do not contribute to continuous canopy fuel pathways toward the asset
- Mature isolated canopy trees within established managed curtilage
- Trees identified for retention through ecological assessment, arboricultural advice or Vegetation Management Plans

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Definitions

Asset Protection Zone (APZ)[1]
A fuel-reduced area surrounding a built asset or structure which provides a buffer zone between a bush fire hazard and an asset. The APZ includes a defendable space within which firefighting operations can be carried out. The size of the required APZ varies with slope, vegetation and FFDI.

Bush fire[1]
An unplanned fire burning in vegetation; also referred to as wildfire.

Bush fire hazard[1]
Any vegetation that has the potential to threaten lives, property or the environment.

Bush fire prone land (BFPL) [1]
An area of land that can support a bush fire or is likely to be subject to bush fire attack, as designated on a bush fire prone land map.

Bush fire prone land map (BFPL) [1]
A map prepared in accordance with NSW RFS requirements and certified by the Commissioner of the NSW RFS under EP&A Act 1979 s.10.3(2).

Expert Judgement
The reasoned professional opinion of a suitably qualified practitioner, formed through the application of specialised knowledge, training and experience to the interpretation of legislation, policy, technical guidance and site-specific evidence where prescriptive methods alone are insufficient to determine an appropriate outcome.

Line of management
the spatial boundary between vegetation that is retained in a managed condition consistent with the fuel-reduction objectives of an Asset Protection Zone under PBP, and adjoining vegetation that remains in an unmanaged or natural state capable of supporting bushfire spread and therefore forming the bushfire hazard interface for the purposes of determining APZ separation distances.

The line of management represents the transition point between:

- managed land, where vegetation structure satisfies the fuel-reduction intent of Appendix 4.1 (including reduced surface fuels, absence of ladder fuels and controlled canopy spacing), and
- hazard vegetation, where continuous surface, near-surface, elevated or canopy fuels remain capable of sustaining bushfire spread.

Visual reference
A mapped, photographic or diagrammatic representation used to assist in the interpretation of vegetation structure, canopy extent, fuel condition or the location of the line of management for the purposes of assessing Asset Protection Zone requirements under *Planning for Bush Fire Protection 2019*.

[1] As defined in Definitions within PBP

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