Macedon Ranges Shire Council

Hanging Rock Reserve Fire Management Plan

Adopted by Council

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Introduction

Fire Management Plans for Hanging Rock have been in place since as early as 1989 (*Fire Protection Plan for Hanging Rock*, C.F.A. and D.C.& E. May 1989).

The current Fire Management Plan has referenced these plans, using many of the established protocols and aligns them with current land use and updated fire management practices.

The overarching objectives of the Fire Management Plan are based on the State Controllers Intent (Strategic Control Priorities), namely in order of priority:

1. Protection and preservation of life is paramount
2. Issuing of community information and community warnings detailing incident information that is timely, relevant and tailored to assist community members make informed decisions about their safety.
3. Protection of critical infrastructure and community assets that supports community resilience
4. Protection of residential property as a place of primary residence.
5. Protection of assets supporting individual livelihoods and economic production that supports individual and community financial sustainability
6. Protection of environmental and conservation values that considers the cultural, biodiversity, and social values of the environment

In order to achieve this intent, the Plan details a number of risk management “controls” which reflect the current utilisation of the reserve. They also support the long term ecological objectives of the area which are a fundamental part of the public appeal / value of the site.

Broadly speaking fire management objectives therefore are based on two principles:

1. Preventing a fire entering the reserve, regardless of where the fire approaches from. Containing the fire to the reserve in the event that a fire starts on it.

The above implies that the wellbeing of the reserve is contingent on:

- Management of the land inside the reserve itself (under the framework stipulated in this, Environmental Management Plan and Plans developed for various events held at the Reserve)
- Management of the land outside of the reserve, especially those private land holdings in close proximity to it.

Fire management of the Hanging Rock Reserve is therefore a partnership between Council and Community.

Contextual Information

Implications of Land Use

Utilisation of the Hanging Rock Reserve has increased with its popularity. Currently the reserve is host to a number of events and concerts which see the number of visitors to the site exceed 5000 people at any one time. Events include horse racing, car shows, markets, musical events.

Day-to-day use of the park by tourists who enjoy the surrounds of the park and its walking tracks, typically amount to much smaller numbers on each day but are present on most days – the exceptions being special events.

It is important to recognise that the manner in which private land holdings (especially adjacent to the reserve itself) are managed is critical, especially given that the likelihood of ignitions occurring by accident on small acreage properties is relatively high.

This plan therefore provides a land management protocol for neighbouring properties to minimise the ability of fire to impact on the reserve itself. This protocol is voluntary, however in some cases may be actionable under the CFA Act 1958, Section 41 – Fire Prevention Notices.

Similarly it should be noted that a number of dwellings on land adjacent to the reserve rely on vegetation management on the reserve to create a defensible space around their homes

In summary the fire management plan must accommodate:

1. Normal use of the reserve – recreational use, frequent but small numbers.
2. Special Events – Short duration, large groups of 1,000 people or more
3. Adjacent land holdings – Private land use with potential to impact on park and defensible space provisions for dwellings close to boundaries.

Responsibilities for Land Management and Burning

Hanging Rock consists of a Crown allotment (the “Rock” and adjoining racecourse) and freehold land (the East Paddock). Macedon Ranges Shire Council is the Committee of Management for the Crown allotment and the owner of the East Paddock. The Victorian Department of Environment, Land, Water and Planning is the delegated owner of the Crown allotment on behalf of the Crown.

Authorisation for the use of fire at the reserve is less clear cut and governed by a number of different Acts and government agencies. However, as a guide the following protocols should be used:

- Fire for warmth or cooking (General Public) – Solid fuel fires are not permitted at the reserve.
- Fire for Cooking (Special Events) – Solid fuel fires may be deemed suitable for professional catering purposes at special events and authorised under that process.
- “Heap” Burns by Macedon Ranges Shire Council or Delegate – Burning of fallen vegetation and similar by Park Management (e.g. Rangers) is permitted outside of the Fire Danger Period without a Permit to Burn provided that the fire complies with Local Law 10.
- Ecological or Fuel Reduction Burns – Any burns in standing vegetation (either bushland or grassland) require a formal “Burn Plan” to be developed in consultation with the Macedon Ranges Shire Council as the land manager, DELWP as the land owner and the fire agency (CFA or DELWP) responsible for provision of equipment and people (crews).

Considerations for Ecological and Fuel Reduction Burning

Ecological burning at Hanging Rock Reserve has occurred previously at the Hanging Rock Reserve in two areas:

1. Native Grasslands in the Racecourse area (CCZ2)
2. South Western corner of the bushland adjacent to the Rock itself (CCZ1).

A review of the 1989 Fire Management Plan in 1993 (*Hanging Rock Recreation Reserve Management Plan*, Loder & Bayly Consulting Group September 1993), recommended that “no fuel reduction burns occur in the area above the upper management trail around the rock” (Now identified in this Plan as CCZ1). This trail is located at the change of slope from shallow gradients to the precipitous rock and scree slopes closer to the rock itself.

The same report also recommended mosaic burning of the native grasslands located inside the horse track (known as CCZ2 in this Plan).

Outside of the issues of containment, the use of fire was seen as potentially problematic due to the likelihood of woody weeds increasing in prevalence. Seedling stock was recommended as a possible alternative to using fire for natural regeneration.

Therefore, this plan recommends the use of fire for ecological purposes is to be limited to the regeneration of native grasses in the area bound by the racing track.

Fire History at Hanging Rock

Hanging Rock Reserve has experienced little in the way of wildfire events (only exception 1898 where 30 acres was burnt), however local history indicates that house fires and fires on properties in close proximity to the reserve are comparatively common. Details of fire history are provided in **Appendix 3**.

Historically small fires near the reserve have been contained typically by the quick response of fire crews to the area mixed with land management practices on the private holdings which typically remove the long grass prior to summer by grazing and mowing. One of the main containment concerns relates to the large number of fences in the area and stands of trees close to driveways and roadsides, slowing the response overall.

Prevention of Fire

Fire Management Domains

The Hanging Rock Reserve Environmental Management Plan divides the reserve into a number of “Management Zones”. For consistency the fire management “domains” mirror these areas. These are described below and are shown in **Figure 1**.

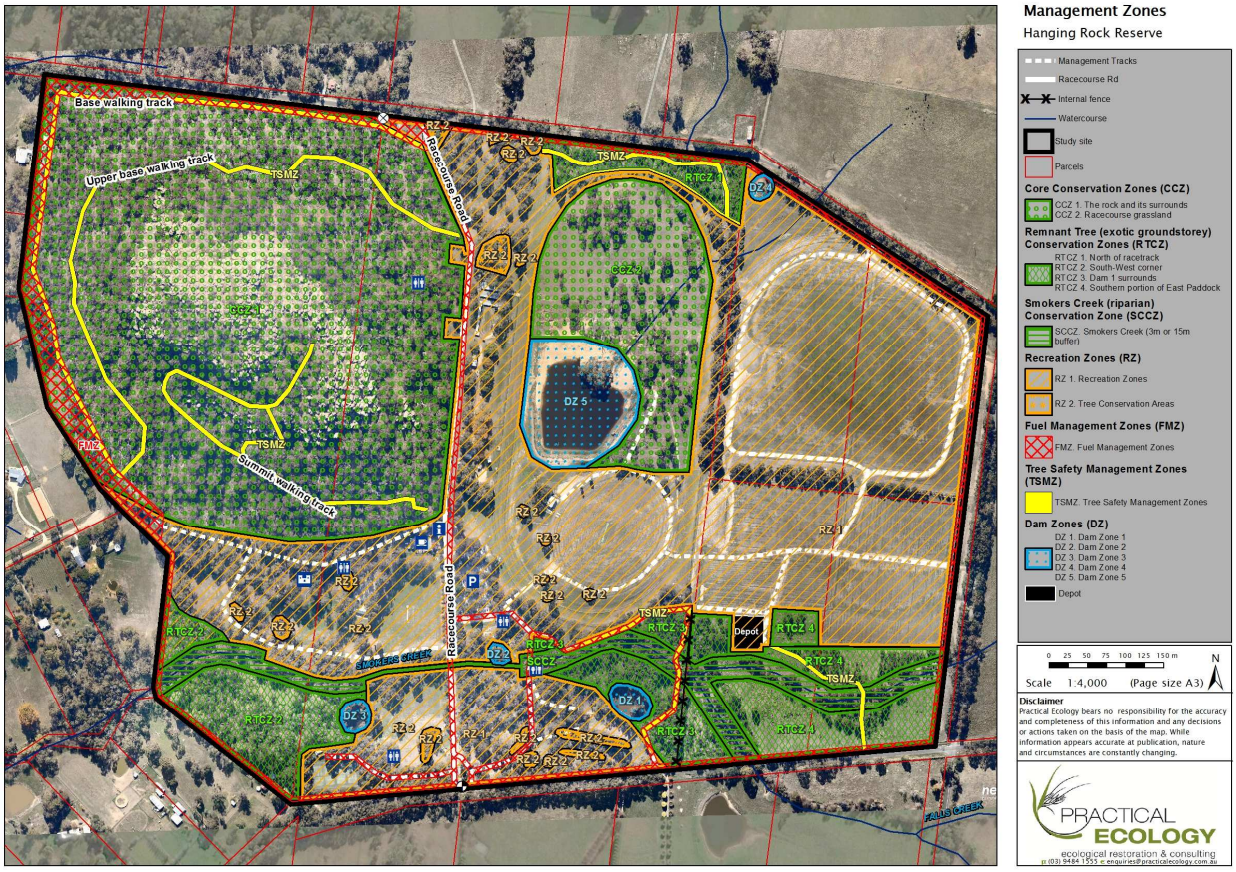


Figure 1: *Management Zones (Fire Management Domains). Predominantly mown parklands with ecological burning limited to native grasslands and some clearing of understorey in the northwest corner to reduce ladder fuels into the bushland.*

The Fire Management Domains mirror the Environmental Management Zones (as identified by Practical Ecology") and are as follows:

- CCZ1 Core Conservation Zone 1 - "The Rock and its Surrounds"
- CCZ2 Core Conservation Zone 2 – "The Racecourse Grassland"
- RTCZ1 Remnant Tree Conservation Zone 1 – "North of the Race Track"
- RTCZ2 Remnant Tree Conservation Zone 2 – "South West Corner of the Reserve"
- RTCZ3 Remnant Tree Conservation Zone 3 – "Dam 1 Surrounds"
- RTCZ4 Remnant Tree Conservation Zone 4 – "Southern Portion of the Eastern Paddock"
- SMCZ "Smokers Creek Conservation Zone"
- RZ1 Recreation Zone 1 – Unnamed, consider as Eastern Paddock and Parklands south of Hanging Rock.
- RZ2 Recreation Zone 2 – "Tree Conservation Areas"
- FRZ Fuel Reduction Zones – Some boundaries
- TSMZ Tree Safety Management Zones – Various paths and tracks
- DZ1 to DZ5 Dam Zone 1 to 5

In addition, the Fire Management Plan identifies the following zone outside of the Reserve:

- Private Land Holdings (Neighbours)
- Road Intersections

An assessment of the loss scenarios for these domains can be viewed in **Appendix 1**.

Fire Management Domains Excluded from Formal Fire Management

A number Management Zones have been identified as not requiring formal Fire Management due to their limited extent or potential to significantly degrade the "environmental values" of those areas. These include:

- DZ1 to DZ5 - Dam Zones 1 to 5
- RZ1 – Recreation Zone 1 – Eastern Paddocks and Parklands
- RZ2 – Recreation Zone 2 – Tree Conservation Areas
- SMCZ – Smokers Creek Conservation Zone
- RTCZ1 – Remnant Tree Conservation Zone 1 – North of Race Track
- RTCZ3 – Remnant Tree Conservation Zone 3 – Dam 1 Surrounds
- TSMZ – Tree Safety Management Zones

Additional information regarding the environmental management of these areas can be found in the Environmental Management Plan.

It may appear the intent of the Fire Management Objectives to create fuel reduction zones around the park perimeter could be considered to conflict with the RTCZ1 and RTCZ3 listed above, however it is recognised that in these areas:

- The remnant vegetation is not continuous in nature
- The area is predominantly surrounded by grasslands or areas with cleared understorey.
- The area is readily accessed by most Fire Vehicle Types allowing for rapid response.
- Ignition scenarios are less likely than in other areas of the Reserve. To illustrate this, the area does not play host to cooking activities or vehicle parking.

Fire Management activities in this area are consistent with the Environmental Management Practices.

Prevent Fire – CCZ1 – The Rock and its Surrounds

The key environmental objectives listed in the Environmental Management Plan for this zone are as follows:

- To ensure the core conservation areas within the Reserve are primarily managed for their ecological values, and to ensure the adjacent 'zones' where other management principles apply (fuel reduction and tree safety works) are clearly identified, to minimise the conflict between different management purposes.
- To enhance the vegetation quality and habitat values across the management zone
- To maintain the existing trail network and ensure paths and infrastructure integrates with the natural values of the area.
- To prevent further soil erosion and improve the stability of the ground layer

To ensure vegetation adjoining the walking tracks does not present a safety risk to visitors.
The Fire Management Objectives are:

- To facilitate the movement of firefighting equipment to higher fuel load areas as quickly as possible, thereby limiting the potential for a fire to spread to other parts of the reserve.
- Ensure that fire appliances can use the existing tracks without undue risk (falling trees and low branches).
- Limit the potential for a small (local) fire moving from private land onto the Reserve and increasing in intensity immediately upon entry.
- Ensure that fallen timber provides a suitable environment for fauna and flora, whilst not contributing to excessively long Residual Burn Times (hence ecological damage in the event of a fire).

Since it is intended that the steep slopes and vegetation closest to the rock itself is managed without the use of fire, the integrity of the formed tracks and fuel reduction lines on the park boundary are of high priority.

The impact of fire in this part of the reserve is potentially significant, however history also shows that the area has not experienced a significant fire.

Under most circumstances, it is likely that any fire in this area would be identified very quickly by the public, neighbouring properties and staff. This coupled with the shape of the rock formation and rapid response times from nearby fire crews would under many circumstances limit the spread of the fire.

Key controls are:

1. Ensure the "Lower Base Walking Track" is maintained such that it facilitates movement of large format fire vehicles, namely:

    a. Vegetation and branches are removed to create an envelope of 4.5m wide x 4.5m high along the track itself.
    b. Trees are evaluated for their potential to "fall" on crews working in the Area (Refer to the Tree Management Zones discussion in the Environmental Management Plan).
    c. Passing bays are provided to allow trucks to pass each other. CFA Guidelines require passing bays for vehicles every 200m as a minimum. Each bay should be 20m long and 6m wide.

2. Ensure the “Upper Base Walking Track” is maintained in a manner that permits movement of 4WD type vehicles (e.g. Slip on types and Command Vehicles). This requires:

    a. Vegetation and branches are removed to create an envelope around the track of at least 3m wide x 3m high.
    b. Trees are evaluated for their potential to “fall” on crews working in the Area (Refer to the Tree Management Zones discussion in the Environmental Management Plan).
    c. Passing bays are provided at 200m centres as a minimum capable of allowing two 4WD vehicles to pass and turn around. This may take the form of a tee-type intersection or larger open area.

3. Ensure the area bound by the northern and western perimeter fence and the “Lower Base Walking Track” is managed in a manner which does not increase fuel, this requires:

    a. No additional plantings outside of replacement of fallen timber.
    b. Slashing of all understorey (grass, woody weeds and similar) in zone to a height of 10cm or less.
    c. “Candling” or similar in some areas where “bark hazard” (especially stringy barks) is rated as “Extreme”. Refer also **Figure 2.**
    d. Existing shrubs are managed in a manner which creates clumps rather than continuous middle storey. Additionally lower limbs are managed in a manner that does not create ladder fuel or hinder management of the grasses, woody weeds and similar.

4. Fallen timber is managed in a manner which does not hinder access for crews. This involves:

    a. Any limbs less than 20cm in diameter are removed from the zone. All other fallen timber evaluated on the basis of ability to adequately maintain the fuel reduction area using conventional equipment.
    b. Habitat logs are managed in a manner that does not create continuous windrows or similar, thereby blocking the movement of vehicles or crews.
    c. Habitat timber (logs exceeding 10cm diameter) does not exceed a density of 250 lineal metres per hectare. This measure is intended as a guide only.

Figure 2 *Example of candling, burning the bark on the lower parts of the trunk limits the potential for the fire to move up the tree into the canopy. Source:* CFA Fire Ecology Guide to Environmentally Sustainable Bushfire Management In Rural Victoria.

Prevent Fire – CCZ2 – The Racecourse Grassland

The key environmental objectives for this zone listed in the Environmental Management Plan are as follows:

- To maintain or reduce the current weedy/exotic grass levels
- To maintain the existing high diversity of indigenous grassland species
- To increase the indigenous grassland vegetation cover
- To maintain the safe functioning of the race track
- To maintain the sight lines across the race track via vegetation modification (shrub removal, sapling removal and lower branch removal)

To maintain the mature eucalypts and allow limited sapling regeneration

The Fire Management Objectives are:

- To ensure that fuel loads in the grassland areas are managed such that potential for injury and damage to exposures adjacent to the grassland are reduced to a tolerable level.
- Residual burn times in the native grassland are minimised to minimise damage associated with a fire in the event of one.
- Create a safe operational environment for crews responding to a fire – crews tactically containing the fire to the racecourse area rather than direct attack on the grassland itself.

The key controls for the grassland area are as follows:

1. Native grasslands on the racecourse area are to be strip burnt (or similar) on a 3 to 5 year rotational basis with the aims of reducing thatch and weeds and improving grassland health by enabling existing seed banks to germinate. The implementation of these burns should:

a. Be completed in accordance with a Burn Plan
b. Occur at end of the fire season, prior to winter rains, thereby allowing seeds to be fully developed, thereby resulting in less reliance on complete “blacking out” and more reliable conditions with a “cooler burn”.
c. Occur in consultation with Park Management and the CFA

2. Monitoring of the grassland during Spring and early Summer to evaluate fuel loads. In accordance with **Appendix 5**:

   a. Fuel loads should not exceed 3 Tonnes / Hectare (Refer to **Figure 5**)
   b. Average grass height should not exceed 50cm (key assumption and dictates flame heights)

3. In circumstances where fuel loads exceed an estimated 3 Tonnes / Hectare, the grass height exceeds 50cm or extended drought has occurred, the Fire Management Officer in consultation with key stakeholders (Environment Department, Reserve and Special Event Staff) may elect to mitigate the risk by:

   a. Slashing fuel reduction lines around the perimeter of the grassland (typically 100mm in height or less) for a distance which achieves the desired offsets to key exposures (stage structures, stables and other)
   b. Slash the entire racecourse area if deemed necessary.

4. Ensuring that fire vehicle access to the grassland is assured at all times (including special events). This access may be via the car parking area to the south of Dam 5 or via the racecourse itself as a last resort.

Prevent Fire - RTCZ2 - Remnant Tree Conservation Zone 2 “South West Corner of the Reserve”

The key environmental objectives for this zone listed in the Environmental Management Plan are:

- To enhance the vegetation quality and habitat values across of the management zone, including through the reduction in woody weeds and increases in indigenous vegetation cover.
- To maintain the existing mown management track and ensure adjoining and overhanging vegetation does not compromise its safety
- To maintain the existing Fuel Management Zone along the Reserve’s southern and western perimeter fences.

The Fire Management considerations for this area are of a higher priority than RTCZ1 due to:

- Fuel continuity from the reserve boundary to the base of the Rock.
- Higher likelihood of ignition due to public use – barbecues, vehicle parking and higher use of roads (hence potential for accidents and fires) adjacent to the zone as well as various recreational pursuits.
- Previous fire history in the area (Refer **Appendix 3**)
- Proximity of adjacent homes and the potential for ignitions on private land to impact on the Reserve.

The Fire Management Objectives are:

- Reduce ladder fuels and manage understorey plants.

- To create an adequate buffer between adjacent dwellings and the “bushland” (refer Bushfire Management Overlay in **Appendix 6**).
- Ensure fire vehicles are able to respond rapidly to small fires in the area and move safely through the area.
- Reduce the likelihood of a fire originating on private land or a public road moving into the Reserve and creating spot fires.

The Key Fire Management Controls for RTCZ2 are as follows:

1. Removal of all woody weed infestations from the entire area to reduce ladder fuels.

2. Maintenance of “informal” tracks through the area, especially near the fence lines to provide access for firefighting equipment. This requires:

    a. Keeping areas parallel to the fence for a distance of 30m into the Reserve sufficiently open to allow for the movement of a “Heavy Tanker”. This does not require a “formal” track but does require limbs to a height of 4.5m from the ground to be removed.
    b. Monitoring of trees for hazardous conditions in this same area.

3. In remaining areas fallen timber is managed in a manner which does not hinder access for crews. This involves:

    a. Habitat logs are managed in a manner that does not create continuous windrows or similar, thereby blocking the movement of vehicles or crews.
    b. Habitat timber (logs exceeding 10cm diameter) does not exceed a density of 500 lineal metres per Hectare. This measure is intended as a guide only. This influences residual burn times and potential for environmental damage.

4. Bark hazard is appropriately managed, especially stringy barks within the 30m Fuel Reduction Line. This may involve candling of trees to reduce potential for fires to move into the canopy and causing spot fires.

5. Any additional plantings are completed in a manner that is staged as a means of reducing the likelihood of fires moving into the canopy. This requires:

    a. Planting areas out over a number of years – reducing the likelihood of fire moving through continuous ladder fuels across large areas.
    b. Planting in the Fuel Management Zone only occurs as a replacement for fallen trees (e.g. no additional plantings).

Prevent Fire – RTCZ4 - Remnant Tree Conservation Zone 4 “Southern Portion of the Eastern Paddock”

The Key Environmental Management Objectives for RTCZ4 are:

- To enhance the vegetation quality and habitat values across of the management zone, including through the reduction in any woody weeds and increases in indigenous vegetation cover.
- To maintain the open/non treed areas which are a refuge for kangaroos during major events.
- To maintain the internal road for site entry/exit purposes when required.
- To provide for the ongoing operations of an on-site works depot.
- The above objectives are consistent with the Fire Management Objectives which include:

- Creating a fuel reduction line on the property boundary in an area known to experience significant motor vehicle accidents.
- Provide a low fuel area away from car parks and events where emergency air services can land if required (helicopter – air ambulance).
- Improve reserve amenity in a highly visible area.

The Key Fire Management Controls in this area are:

1. Annual slashing of all open grass areas to a height of not more than 100mm. This excludes areas under trees.

2. Ensure all woody weeds are removed from the area.

3. Manage habitat logs in a manner that does not hinder vehicle movements or contribute to excessive residual burn times. This requires:

    a. Ensuring that open grass areas are not used for placement of habitat logs
    b. Limiting the density of habitat logs in timbered areas to a density of 500 lineal metres per hectare.

Prevent Fire – Road Intersections

The management of roadside vegetation close to the reserve is primarily focussed on reducing the likelihood of a vehicle accident. This strategy is twofold:

1. Reducing the risk of a fire starting on the side of the road

2. Improving road safety, especially around intersections known to have a history of motor vehicle accidents. These are in part managed by VicRoads and must be actioned in consultation with that Agency.

The intersections of interest include:

- Tee Intersection at Coach Road and Romsey Road
- Tee Intersection at Coach Road and South Rock Road
- Cross Road at Romsey Road and Straws Lane
- Cross Road at Straws Lane and South Rock Road
- Tee Intersection at Colwells Road and Straws Lane
- Tee Intersection at Colwells Road and Coach Road

In addition, the points of entry / egress from the Reserve are also of focus. These include:

- The main entry off South Rock Road
- The entry to the East Paddock on Straws Lane
- The north gate off Colwells Road.

The vegetation management strategies are based on sight distances at the intersections (**Appendix 7**) and involve:

1. Clearance of all woody weeds, Hawthorne and similar introduced understory plants for a distance of 100m either side of the entrances and intersections.

2. Removal of low hanging limbs from Pines, Cypress and similar trees to a height of 2.5m from the ground.

3. Thinning of young standing native vegetation to ensure that sight lines can be ensured. *Note that some clearance of native vegetation may require a planning permit.*

4. Slashing of any long grass full width in the same area by way of tractors, brush cutters and reach mowers.

Prevent Fire – Private Holdings

Due to the nature of land use in close proximity to Hanging Rock Reserve there is a high likelihood that small fires will occur. These small fires may impact on the reserve if the private holdings have significant fine fuels.

Future management strategies potentially enforceable by way of the CFA Act, Section 41 are as follows:

- Private land less than 10 acres – Slash or graze entire property prior to Fire Danger Period and maintain that standard over the summer period.
- Private land greater than 10 acres – Slash or crash graze as a minimum a 30m wide fuel reduction line from the boundary fence into the paddocks.
- All private land – Ensure that access for fire appliances is maintained such that:
    - Gates are at least 3m wide
    - Driveways have adequate clearance of vegetation for large trucks (4.5m high x 4.5m wide)
    - Any internal fences permit the easy movement of trucks reducing the likelihood of fire crews cutting fence lines.
    - Any drainage structures are capable of supporting 15 tonne vehicles.
    - Habitat timber is placed in a manner that does not hinder vehicle movement and the percentage of coverage does not exceed (density) or harbour any woody weeds.

Appendix 8 provides details relating to property by size in the area adjoining the reserve.

Appendix 1

Loss Scenarios for Fire Management Domains

Management Area	Loss Scenarios	Treatments	Control Priority
Native Grasslands *CCZ2: Racecourse Grassland*	Accidental ignition or similar in long native grass on high fire danger day results in involvement of adjacent bushland, structures, special event or similar.	Slash native grasslands after seed has matured or fuel reduction burn prior to January on a 3 to 5 year rotational basis.	Preservation of Life (1) and protection of assets supporting economic production (5). Containment of fire to reserve.
	Degradation of native grasslands, excessive accumulation of thatch and loss of ecological value.	Fuel reduction burning prior to January or during Autumn months to reduce thatch and allow fresh seed bank to germinate.	Ecological Burning. Also supports protection of environmental, conservation and cultural values (6).
Open Parklands *RZ: Recreation Zones* *RTCZ: Remnant Tree Conservation Zones*	Long grass and weed infestation in parklands leading to loss of amenity and community concern.	General appearance of the managed parklands routine mowing to create lawns and similar.	Amenity only.
	Long grass near property boundary provides fuel continuity from fire outside of the reserve, encouraging movement of fire into grasslands or bush and threatens public.	Property boundary exotic grasses to be slashed within 30m of all boundaries prior to height of fire season (typically before January)	Protection of assets supporting individual livelihoods and economic production that supports individual and community financial sustainability (5). Reducing likelihood of fire moving onto reserve.
	Hot exhaust or mechanical failure of motor vehicle or similar moving through long grass in Eastern Paddock results in fire on reserve.	Eastern paddock slashed to height of 75mm or less over summer period to reduce likelihood.	Reduce likelihood of starting fire.
	Fallen timber impacts on ability to gain access to small fire resulting in spread of fire into adjacent woodlands or bush, more damage and	Timber used for habitat purposes placed strategically to ensure vehicle access is not compromised during fire response. Habitat logs to comply with	Ensures rapid response times to fire at site, supporting all strategic control priorities whilst meeting ecological requirements.

Management Area	Loss Scenarios	Treatments	Control Priority
	longer time to extinguish and recover.	recommended densities.	
	Solid fuel barbecue or similar left unattended escapes confinement and involves open parkland grass and bush.	Use of solid fuel fire not permitted at park. Alternative cooking facilities available. Monitoring of park use by Rangers.	Elimination of ignition sources supports all strategic control priorities.
North Western perimeter area of Reserve *Part of CCZ1: The rock and its surrounds*	Fire starting on reserve burns in heavily timbered areas or reserve, radiant heat and embers place adjacent land owners at risk of involvement.	Removal of understory in accordance with Bushfire Management Overlays to reduce intensity of fires in close proximity of dwellings. Ensure land owners take adequate precautions on own property by slashing.	Preservation of Life (1), protection of residential property as a place of primary residence (4).
	Fire originating on property or roadside at north west boundary moves through long grass and enters reserve bushland, fire increases in intensity rapidly destroying bushland component of reserve.	Fuel reduction on private properties near reserve by way of slashing or grazing and management of timbered areas. Removal of understory in bushland near boundaries and provision of fire vehicle access around perimeter to facilitate a quicker response.	Protection of residential property as primary place of residence (4), Protection of assets supporting individual livelihoods and economic production (5) and preservation of ecological and conservation value of reserve (6). Bushland is seen as an essential part of the appeal.
	Lightning strike or similar causes a fire in bushland, fire vehicles unable to gain access to fire due to ground cover, logs and steep slopes resulting in damage to bushland at reserve.	Shallow slopes of North West corner cleared of understory, fire access track near fence and secondary line a change of slope nearer the rock formation. Management of habitat to a level which provides adequate cover but does not hinder response vehicles.	Rapid response time is critical to containment of fire in the “Untreated” bushland. Rapid movement of fire trucks and crews into area. Aerial support also available during summer period for steeper / inaccessible areas of the reserve (e.g. steep slopes).
	High fencing along perimeter of reserve hinders movement of trucks and fire crews,	Internal fire vehicle access track conforming to CFA requirements for clearance and weight.	Rapid response times improve all strategic outcomes.

Management Area	Loss Scenarios	Treatments	Control Priority
	delaying the response to an emergency.		
	Fire Crews overcome by radiant heat for intense fire in heavily timbered / undergrowth areas due to high fuel loads	Crews operate on shallow slopes close to reserve boundary in open timer with reduced fuel loads minimising the intensity of a burn to a manageable level.	Preservation of life (especially fire crews) responding to fire (1). Open forest provides more escape routes and much lower burn intensity. Shallow slopes more favourable for appliances.
"Untreated" Bushland *Part of CCZ1: The rock and its surrounds*	Accidental ignition on high risk day (total fire ban) leads to extreme fire behaviour in park and potential loss of life.	Park closed on total fire ban days, reducing potential for ignitions and involvement of public in event of fire starting.	Protection of Life (1), Community Warning (2) – closure of reserve elevates awareness in community.
	Steep slopes, extreme fuel loadings and difficult access result in extreme fire behaviour, dangerous levels of radiant heat and potential loss of life.	Any fire in park is likely to be "spotted" quickly before fire development reaches large fire front, aerial appliances suitable for response in rugged areas and open forest on shallow slopes suitable for trucks and crews. Separation distance between "Untreated" Bushland and residences adequate to reduce likelihood of involvement to tolerable level.	Rapid response to the area facilitated by open timbered areas on shallow slopes reduces the size of the fire and thus its overall intensity. Fires unlikely to reach "critical" (100m front) prior to initial attack by crews. Rapid response supports all Strategic Control Priorities.
	Embers from wildfire event outside the reserve lodge in the heavily timbered areas leading to spot fires and involvement of reserve.	Threat posed by ember attack from adjacent land cannot be entirely mitigated, however the lack of continuity in fuel at the reserve and managed grasslands may assist in containment should it occur (contingent on favourable conditions at the time). Public have a number of large open areas that they	Large external wildfire events may impact on the reserve. Management of reserve based on management of fires "local" to the reserve. Wildfire events on extreme days are difficult to contain and land management / treatments at the reserve are unlikely to mitigate such events.

Management Area	Loss Scenarios	Treatments	Control Priority
		can move to without leaving the reserve.	
Roadsides	Motor vehicle experiences mechanical failure and pulls to side of road starting a fire in long grass on side of road.	Roadside slashing programme and vegetation management envelope for distance of 3m from road shoulder reduces likelihood of long grass contacting hot exhausts and similar. Reduced fine fuel on reserve boundary (internal) for minimum 30m limits flame heights and improves rate of success for first responding crews.	Protection of assets supporting individual livelihoods and economic production (5) and preservation of ecological and conservation value of reserve (6). Due to poor "local" knowledge, may people rely on roadside verges to pull away from traffic flows.
	Large event leads to high traffic volumes and potential for motor vehicle accidents with potential for roadside fire.	Traffic management plans incorporated into event planning, low traffic speeds and well defined vehicle routes.	Preservation of Life (1).
	High speed intersection vehicle collision resulting in fire and involvement of roadside and adjacent lands, later impacting on reserve.	Vegetation management at intersections such as Straws Lane and South Rock Road, Romsey Rd, etc. Improved sight distances and thus higher situational awareness.	Preservation of Life (1).
	Strong winds result in trees falling over roads and resulting in vehicle accident with possible fire.	Vegetation management strategies on roadsides and inspection of trees considered high risk.	Risk of tree falls during storm events same as for other roads in Shire, risk deemed as low as reasonably practicable.
Buildings	Building impacted by wildfire event leads to damage to structure.	Wildfire behaviour in steep land close to buildings will be contingent on direction the fire is approaching from. Fire moving downslope will be slow and of reduced intensity, thus less likely to involve structures. Ember attack possible. Buildings not used for	Protection of assets supporting individual livelihoods and economic production (5).

Management Area	Loss Scenarios	Treatments	Control Priority
		refuge and have significant cleared zones before the "Untreated" Bushland area. Surrounding grasslands well managed by regular mowing.	
	Fire in structure leading to loss.	Various Building Codes and Regulations	Referred issue – out of scope.
Private Buildings and Land.	Fire on private land (burn off, mechanical fault, etc) spreads through long grass and crosses reserve boundary impacting of bushland.	Landowners in close proximity to reserve asked to slash entire property or graze paddocks in close proximity prior to the height of the fire season. Fire prevention notices issued to landowners not meeting the intent of these controls.	Protection of residential properties as a primary place of residence (4), protection of assets supporting individual livelihoods and economic production (5) and preservation of ecological and conservation value of reserve (6).
	Property with large number of fallen trees and woody weeds becomes involved in fire, hindering access for response, throwing embers into reserve and damaging infrastructure or bushland areas.	Guidance provided to land owners regarding fallen timber for habitat and similar. Awareness programmes for woody weeds such as gorse. Slashing and grazing of properties prior to summer.	As above, also ecological benefits for weed management.

Appendix 2

Ecological Fire Considerations

Burning of the identified ecological units, especially in the bushlands closer to the rock are operationally problematic due to the steep slopes, heavy fuels and absence of containment lines. Additionally, the mix of vegetation, the small spatial extent and poor separation between the units is likely to result in unreliable burning outcomes. Unfavourable risk-reward.

The current management strategy therefore relies on rapid response to fire to contain ignitions whilst they are small and of a low intensity. Ecological values managed by way of replacement plantings, weed management and management of fallen timber.

Described in more detail elsewhere, the ecological vegetation classes (ECV) identified are as follows:

- Herb Rich Foothill Forest
- Montane Grassy Woodland / Rocky Outcrop Mosaic
- Swampy Riparian Woodland
- Grassy Woodland

The three Ecological Vegetation Divisions (EVD's) identified as suitable for prescribed burning are:

1. Forbey Forest, Herb Rich Footland Forest and Grassy Woodland. Fires tend to occur in the warmer months and tend to be "all consuming". Able to regenerate without fire. Fire interval ideally 35 years (Range 20 – 150 years)

2. High Altitude Scrubland / Woodlands, Montane Grassy Woodland and Rocky Outcrop Mosaic. Burns after extended drought and may take many decades to regenerate. Fire interval ideally 80 years (Range 50 to 120 years). Poor spatial segregation with aforementioned class.

3. Treed Swampy Wetlands, Swampy Riparian Woodlands. Burns during summer months but more typically after drought. Does not require fire to regenerate. Ideal fire interval 45 years (Range 30 to 85 years). Some spatial separation from the other two divisions above.

The most vulnerable Ecological Vegetation Division is considered to be the High Altitude Scrubland, located towards the summit of the rock formation.

Appendix 3

Fire History on and near Hanging Rock Reserve

The following compilation is incomplete and intended as a guide only.

- ***25 November 1895*** - A four-roomed weatherboard house, occupied by Lydia Shelton, and situated in the vicinity of the Hanging Rock destroyed by fire.
- ***13 January 1898*** - Fire broke out on the Hanging Rock Reserve and contained control after it had swept over about 30 acres.
- ***22 February 1940*** – Fire on Farm (Councillor G.Anderson) in close proximity to Rock – Mount Macedon threatened by fire under northerly conditions.
- ***12 March 1940*** – Fire beginning near Hanging Rock road (about 3.15 p.m.), the fire was swept up the mountainside by a moderate north-east winds. Fires threaten homes and Clyde School.

Based on more recent oral history the following fires are also noted:

- ***February 1983*** (Braemar Fire) – Spotting from the main fire in two locations in the Reserve, one in blackberry infestation near Smokers Creek timber Foot Bridge and another near the Kiosk.
- ***Mid 1980's*** – Fire started in Members Car Park (described as possible deliberate ignition) and spread to base of the Rock.
- ***Mid 1990's*** – "Combi Van" Fire in Car park of Reserve.
- ***2006*** – Fuel reduction burn in the south west corner of the "the Rock"
- ***2011 or 2012*** – Shed fire on private land near corner of South Rock Road and Coach Road
- ***2013, 2014 and 2015*** – Multiple accidental ignitions whilst burning off on corner of Romsey Road, Coach Road and South Rock Road.
- ***February 2014*** – Grass and Scrub Fire on South Rock Road Property as result of mechanical failure in VW Campervan vehicle. Contained on property.

Appendix 4

EVC 23: Herb Rich Foothill Forest

EVC 23: Herb-rich Foothill Forest

Description:
Occurs on relatively fertile, moderately well-drained soils on an extremely wide range of geological types and in areas of moderate to high rainfall. Occupies easterly and southerly aspects mainly on lower slopes and in gullies. A medium to tall open forest or woodland to 25m tall with a small tree layer over a sparse to dense shrub layer. A high cover and diversity of herbs and grasses in the ground layer characterise this EVC.

Large trees:

Species	DBH(cm)	#/ha
Eucalyptus spp.	70 cm	20 / ha

Tree Canopy Cover:

%cover	Character Species	Common Name
40%	*Eucalyptus globulus ssp. bicostata*	Eurabbie
	Eucalyptus obliqua	Messmate Stringybark
	Eucalyptus dives	Broad-leaved Peppermint

Understorey:

Life form	#Spp	%Cover	LF code
Immature Canopy Tree		5%	IT
Understorey Tree or Large Shrub	2	10%	T
Medium Shrub	3	5%	MS
Small Shrub	2	1%	SS
Prostrate Shrub	1	1%	PS
Large Herb	4	5%	LH
Medium Herb	11	25%	MH
Small or Prostrate Herb	3	5%	SH
Large Tufted Graminoid	2	5%	LTG
Large Non-tufted Graminoid	1	5%	LNG
Medium to Small Tufted Graminoid	6	20%	MTG
Medium to Tiny Non-tufted Graminoid	2	5%	MNG
Ground Fern	2	10%	GF
Scrambler or Climber	3	5%	SC
Bryophytes/Lichens	na	20%	BL

EVC 23: Herb-rich Foothill Forest – Central Victorian Uplands bioregion

LF Code	Species typical of at least part of EVC range	Common Name
T	*Acacia dealbata*	Silver Wattle
SS	*Hovea heterophylla*	Common Hovea
PS	*Acrotriche prostrata*	Trailing Ground-berry
LH	*Wahlenbergia stricta*	Tall Bluebell
LH	*Senecio tenuiflorus*	Slender Fireweed
LH	*Senecio minimus*	Shrubby Fireweed
LH	*Senecio quadridentatus*	Cotton Fireweed
MH	*Stellaria pungens*	Prickly Starwort
MH	*Viola hederacea sensu Willis (1972)*	Ivy-leaf Violet
MH	*Acaena novae-zelandiae*	Bidgee-widgee
SH	*Dichondra repens*	Kidney-weed
SH	*Hydrocotyle laxiflora*	Stinking Pennywort
LTG	*Lomandra longifolia ssp. longifolia*	Spiny-headed Mat-rush
MTG	*Lomandra filiformis ssp. coriacea*	Wattle Mat-rush
MTG	*Luzula meridionalis var. flaccida*	Common Woodrush
MTG	*Austrodanthonia pilosa*	Velvet Wallaby-grass
MTG	*Poa ensiformis*	Sword Tussock-grass
MNG	*Microlaena stipoides var. stipoides*	Weeping Grass
MNG	*Poa tenera*	Slender Tussock-grass
MNG	*Echinopogon ovatus*	Common Hedgehog-grass
GF	*Pteridium esculentum*	Austral Bracken
GF	*Asplenium flabellifolium*	Necklace Fern
SC	*Clematis aristata*	Mountain Clematis
SC	*Glycine clandestina*	Twining Glycine
SC	*Billardiera scandens var. scandens*	Common Apple-berry
SC	*Hardenbergia violacea*	Purple Coral-pea

Recruitment:
Continuous

Organic Litter:
40 % cover

Logs:
20 m/0,1 ha,

Weediness:

LF Code	Typical Weed Species	Common Name	Invasive	Impact
MH	*Hypochoeris radicata*	Cat's Ear	high	low
MH	*Centaurium erythraea*	Common Centaury	high	low
LNG	*Holcus lanatus*	Yorkshire Fog	high	high

Note: Stated Log Density of 20 lineal metres per 0.1 hectares, equivalent to 200 lineal metres of logs over 10cm diameter per Hectare.

Appendix 5

Grassland Management Information

Radiant Heat Flux	Likely Effects
>29 – 110 kW/m²	Flame Zone
29 kW/m²	Ignition of most timbers without piloted ignition (3 minutes exposure) (Level 3 construction) during the passage of a bush fire. Toughened glass could fail.
19 kW/m²	Screened float glass could fail (Level 2 construction) during the passage of a bush fire.
12.5 kW/m²	Standard float glass could fail (Level 1 construction) during the passage of a bush fire. Some timbers can ignite with prolonged exposure and with piloted ignition source (eg embers)..
10 kW/m²	Critical conditions. Firefighters not expected to operate in these conditions although they may be encountered. Considered to be life threatening < 1 minute in protective equipment. Fabrics inside a building could ignite spontaneously with long exposures.
7 kW/m²	Likely fatal to unprotected person after exposure for several minutes
4.7 kW/m²	Extreme conditions. Firefighter in protective clothing will feel pain. (60 seconds exposure)
3 kW/m²	Hazardous conditions. Firefighters expected to operate for a short period (10 minutes)
2.1 kW/m²	Unprotected person will suffer pain after 1 minute exposure – non fatal.

Source: NSW Planning for Bushfire Protection

Figure 3 *Radiant Heat thresholds, note that 10kw/sq.m is level for NSP buildings, over 7kw/sq.m is fatal as direct exposure*

Importantly the calculations provided below make a number of Key Assumptions, these are:

- FDI 120 – this is equivalent to Extreme Danger Rating in Grasslands (refer Figure 4)
- Grass height is 50cm
- Grassland is ungrazed and has 60% cover, equivalent to a fuel load of approximately 3 tonnes / hectare (refer Figure 5)
- Fire is fully developed (fire front has a width of 100m) – this is equivalent to half the width of the racecourse area.
- Flame energy output is 927 degrees celcius.
- Distance from native grassland to closest exposures (holding yards and stage laydown areas) is approximately 35m (refer to heat output detailed in Figure 6)

Fire Danger Rating [1]

Category	Forest Fire Danger Index	Grassland Fire Danger Index
Catastrophic (Code Red)	100 +	150 +
Extreme	75 – 99	100 – 149
Severe	50 – 74	50 – 99
Very High	25 – 49	25 – 49
High	12 – 24	12 – 24
Low–Moderate	0 – 11	0 – 11

Figure 4 *Fire Danger Rating versus Grassfire and Forest Fire Danger Index. A GFDI of 120 is equivalent to an "Extreme" rating. Typically a Total Fire Ban is declared at a rating of "Severe".*

Fuel Load t/ha										
Height	Percentage Cover									
cm	10	20	30	40	50	60	70	80	90	100
10	0.1	0.6	0.8	1.0	1.1	1.2	1.4	1.5	1.6	1.8
20	0.6	0.9	1.1	1.4	1.6	1.8	2.0	2.1	2.3	2.5
30	0.7	1.1	1.4	1.7	2.0	2.2	2.5	2.7	2.9	3.2
40	0.8	1.3	1.7	2.0	2.3	2.6	2.9	3.2	3.5	3.8
50	1.0	1.5	1.9	2.3	2.6	3.0	3.4	3.7	4.0	4.3
60	1.1	1.6	2.1	2.5	3.0	3.4	3.8	4.1	4.5	4.9
70	1.1	1.8	2.3	2.8	3.3	3.7	4.2	4.6	5.0	5.4
80	1.2	1.9	2.5	3.1	3.6	4.1	4.6	5.0	5.5	6.0
90	1.3	2.1	2.7	3.3	3.9	4.4	4.9	5.5	6.0	6.5
100	1.4	2.2	2.9	3.5	4.1	4.7	5.3	5.9	6.4	7.0

Figure 5 *Grassland Fuel Load Assessment. Base case of grass 50cm in height and 60% total cover is equivalent to 3 tonnes per hectare*

Separation Distance (m)	0° Slope	5° Slope	10° Slope
	RHF (kW/m^2)	RHF (kW/m^2)	RHF (kW/m^2)
0	111	111	111
5	58.32	66.75	76.29
10	28.26	32.96	38.2
15	18.41	21.62	25.23
20	13.42	15.79	18.45
25	10.38	12.23	14.27
30	8.33	9.81	11.44
35	6.85	8.06	9.39
40	5.73	6.75	7.85
45	4.86	5.73	6.65
50	4.17	4.91	5.7
55	3.62	4.26	4.93
60	3.16	3.72	4.31

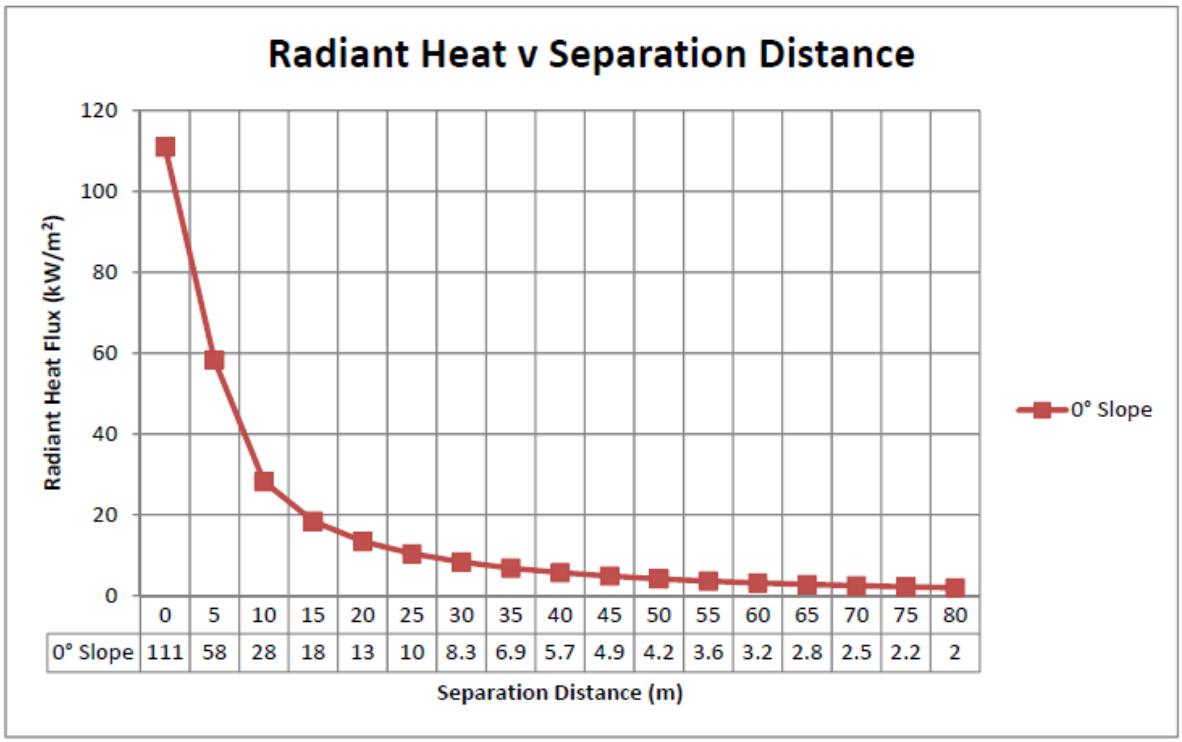


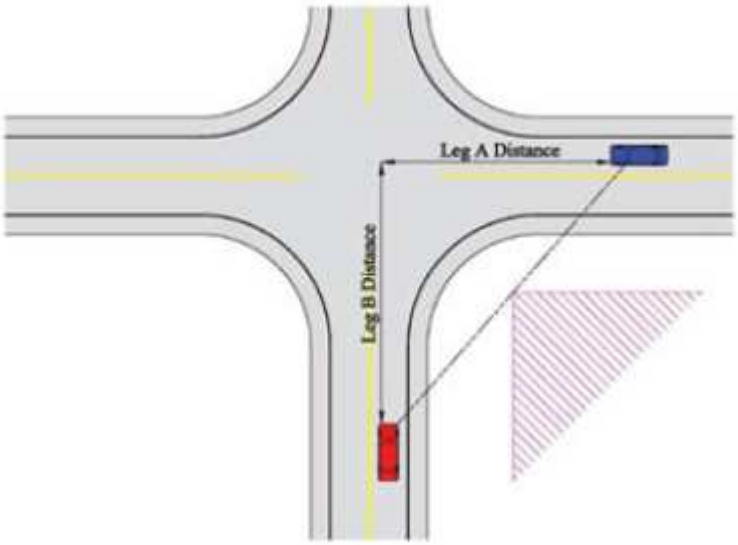
Figure 6 *Radiant Herat output on Level ground for fully developed fire in grasslands with Fuel load of 3 tonnes / hectare. Short direct exposure at 35m from fire results in potential loss of life. Source CFA Grassfire Interface Project.*

Appendix 6

Bushfire Management Overlay

Appendix 7

Sight Distances around Intersections



Defining clear sight triangle at intersections.

Table 3. Required Length of Leg for No Traffic Control

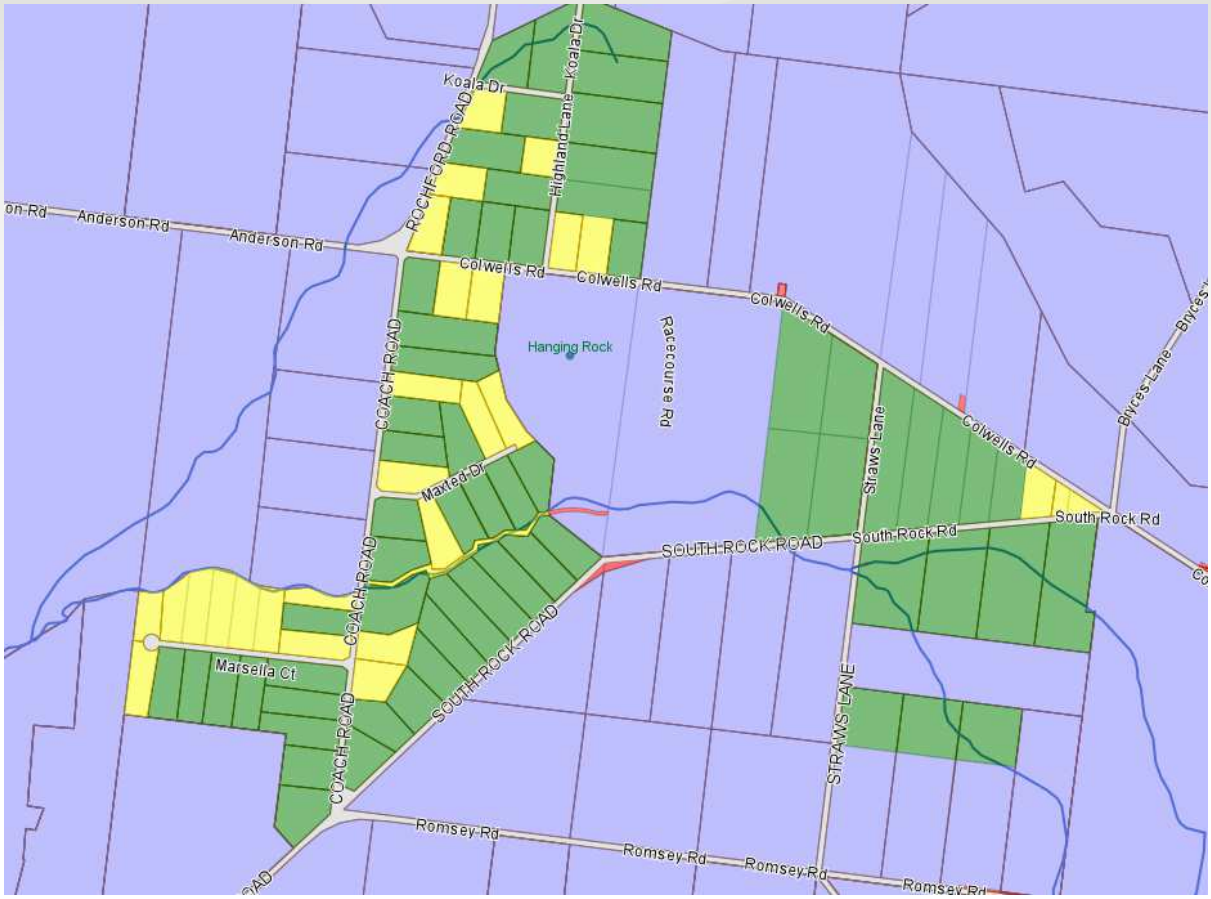
Speed Limit (MPH)	Length of Leg (Feet)
25	115
30	140
35	165
40	195
45	220
50	245
55	285
60	325
65	365

104km/hr 110m

Source: American Association of State Highway and Transportation Officials, *A Policy on Geometric Design of Highways and Streets*, 2004

Appendix 8

Parcel by Size



Colour Key:

- Red – zero to 4000 sq.m (Less than 1 acre)
- Yellow – 4000 to 20,000 sq.m (Between 1 and 5 acres)
- Green – 20,000 to 80,000 sq.m (Between 5 and 20 acres)
- Purple – Greater than 80,000 sq.m (20 acres or more)