Fire Management Plan

Reserves of the Southern Foothills, Mount Lofty Ranges

Incorporating Sturt Gorge Recreation Park, O'Halloran Hill Recreation Park, Shepherds Hill Recreation Park, Marino Conservation Park and Hallett Cove Conservation Park.

Department
for Environment
and Heritage

Government
of South Australia

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The Native Vegetation Council approved extension of this plan as a bushfire management plan until 31 December 2026 through the Native Vegetation Regulations 2017, Reg 9(1) Sch 1(17).

Please note that the Department for Environment and Heritage is now the Department for Environment and Water.

Government of South Australia

Department for Environment and Heritage

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EXECUTIVE SUMMARY

This Fire Management Plan for the Reserves of the Southern Foothills includes: Sturt Gorge, Shepherds Hill and O'Halloran Hill Recreation Parks and Marino and Hallett Cove Conservation Parks located in the southern foothills of the Mount Lofty Ranges (MLR). The plan has been developed to provide direction for fire management activities, including bushfire suppression in these reserves. The plan emphasises the protection of life and property, as well as providing direction for land managers in the protection and enhancement of the natural and cultural heritage of the reserves. It is important to note there will be a transitional phase where the activities and works proposed in the plan are implemented and implementation will be dependant upon ongoing prioritisation of fire management and regional resources. Some degree of flexibility will need to remain for fire suppression in those areas where there has only been partial implementation of works.

The Reserves of the Southern Foothills were identified as a priority for fire management planning within the Department for Environment and Heritage (DEH) Adelaide Region, to address the following issues.

- High visitor numbers, particularly during the fire season, to all of the reserves within the plan area.
- Positioning of the reserves within the metropolitan area and the protection of significant built and natural assets adjacent to the reserves due to this.
- General protection of life, property and environmental values.
- High fuel levels in some areas of the reserves due to a lack of fire in the past and modification of the natural vegetation.
- Protection of significant fauna and flora species, some of which are unique to the area.
- Regeneration and revegetation processes changing fuel hazards.
- Risk of arson and accidental fire ignitions.

These issues are addressed by:

- applying a risk assessment process to identify life, property and environmental values that may be threatened by bushfires;
- applying DEH Fire Management Zoning Principles to guide the management of fuel in Asset and Buffer zones and designating Conservation zones;
- applying DEH Ecological Fire Management Guidelines to determine appropriate fire regimes in Conservation zones; and
- auditing tracks within the reserves of this plan using the Government Agencies Fire Liaison Committee's (GAFLC) guidelines for firebreaks and fire access tracks in South Australia.

A number of actions as a result of applying the above processes are recommended, including:

- fuel reduction:

  - in Asset and Buffer zones using a variety of methods including prescribed burning and mechanical removal;
  - in strategic areas within the Conservation zone to provide some landscape protection within the reserves and increase patchiness within the vegetation (to reduce the possibility of a block or reserve burning in a single fire event);
  - to complement weed management strategies;
- alteration and/or upgrade of fire access points and track classifications to increase the:
  - safety of firefighting personnel involved in a fire suppression effort;
  - response time of fire suppression agencies; and
  - type of resources that can safely be deployed to assist in a fire suppression effort.
- identification of suppression considerations that may assist bushfire suppression operations and to contribute to improved fire management.

This draft plan was released for public comment for a period of four weeks over November and December 2007. Comments were evaluated and incorporated where considered appropriate. A major review of this plan will occur after ten years of implementation, or earlier if required.

CONTENTS

List of Tables

List of Figures

List of Attached Maps

1 SCOPE AND PURPOSE

The intention of this plan is to provide a strategic framework for fire management activities in the Reserves of the Southern Foothills, MLR. This plan incorporates Sturt Gorge, Shepherds Hill and O'Halloran Hill Recreation Parks and Marino and Hallett Cove Conservation Parks, including adjoining land proposed for addition into these reserves. The plan defines objectives for ecological fire management and the protection of life and property, particularly in relation to visitors and adjacent landholders. Strategies and works are suggested in order to allow those objectives to be met. Pre-suppression works and activities will increase the level of bushfire preparedness and guide management and suppression strategies during bushfire incidents.

Sturt Gorge Recreation Park (RP) was identified as a priority reserve within the DEH Adelaide Region requiring a fire management plan. After consideration it was decided that the nearby Shepherds Hill and O'Halloran Hill Recreation Parks and Marino and Hallett Cove Conservation Parks could be incorporated into the plan. These reserves were identified due to a number of factors, including:

- location within the *MLR Bushfire Prone Area* (Planning SA, 2006);
- proximity to the high density residential areas of the Adelaide metropolitan area;
- high visitor numbers, especially during the fire season; and
- general protection of life, property and environmental assets within the plan area.

This Fire Management Plan aims to:

- assess the level of risk (particularly in relation to the above issues) and the existing fire management and reserve management objectives;
- identify objectives for fire management within the reserves; and
- outline strategies for risk mitigation and propose operational works to increase the level of bushfire preparedness and guide suppression management during bushfire incidents.

Operational works outlined in this plan will be implemented in a staged manner depending on available resources. Adjoining lands are considered in the plan, but only in the context of works required to likelihood of fires burning out of DEH reserves and impacting these assets. Fire management planning for land outside of the reserves is the responsibility of the Onkaparinga and Mitcham District Bushfire Prevention Committees (DBPC), in accordance with the requirements of the *Fire and Emergency Services Act 2005*. DEH is represented on these committees, along with Local Government and the Country Fire Service (CFS).

A large wall plot showing three map frames is provided as an attachment to this plan. Map 1 illustrates terrain, tenure and infrastructure; Map 2 displays floristic vegetation and last fire and Map 3 shows the plan area in terms of the management strategies presented in Section 11 (Reserve Prescriptions).

2 THE PLANNING FRAMEWORK

The policy and planning framework for fire management on DEH reserves is shown in Figure 1 (below). Reserve Management Plans provide the overarching strategy for all management activities in reserves and are prepared as a requirement under the *National Parks and Wildlife Act 1972* (or *Wilderness Protection Act 1992* where relevant). Fire Management Plans are produced for reserves in accordance with Fire Management Policy and Procedures. An outcome of the fire management planning process is the identification of strategies and operational works for risk mitigation over a 10 year period (as set out in Appendix 1). These works are prioritised and programmed into a works schedule, which is prepared on an annual basis. Response Plans provide a greater level of detail in regards to fire suppression. Response Plans are used in the early stages of an incident and are reviewed annually to ensure currency.

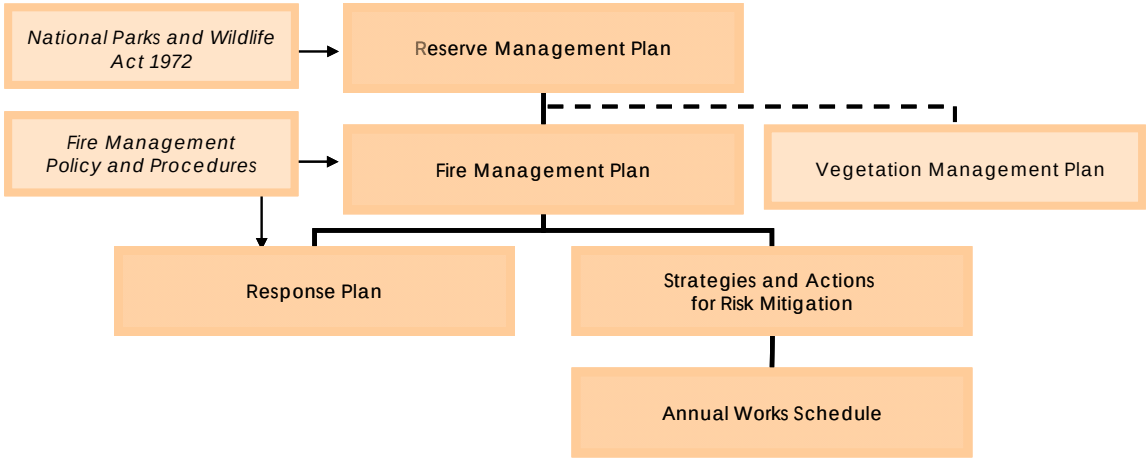

FIGURE 1 – THE PLANNING FRAMEWORK

2.1 Legislation

Under the provisions of the *National Parks and Wildlife Act 1972,* DEH has responsibilities for fire management activities within reserves constituted under this Act.

DEH is required to meet the provisions under the *Native Vegetation Act 1991* when prescribing any works that involve the clearance of native vegetation, or the use of fire (note that fire is also defined as 'clearance' under the Act). All prescribed burns must be approved through the process delegated to DEH by the Native Vegetation Council (NVC).

The *Fire and Emergency Services Act 2005* outlines the responsibilities of DEH and other fire authorities in relation to fire management within proclaimed reserves. Under this Act, the Chief Officer (CFS) must take steps to have any relevant provisions of a management plan for a government reserve brought to the attention of members of CFS who might exercise powers under this section with respect to the reserve.

As a result of the recent *Ministerial Review of Bushfire Management in South Australia* (Monterola, 2007) amendments to the *Fire and Emergency Services Act 2005* have been recommended, as well as changes in regards to fire management planning and the management framework. As a result of the review the requirement for District Bushfire

Prevention Committees will cease and regional Bushfire Management Committees will be established to address fire management at a landscape scale. CFS prepared Bushfire Management Plans will replace District Bushfire Prevention Plans, which are generally prepared by local Government. Bushfire Management Plans will be developed, implemented and reviewed, incorporating a broader perspective on bushfire management values and local knowledge through an expanded number of stakeholders and increased community engagement.

2.2 DEH Fire Management Policy

DEH has a Fire Management Policy, which states "DEH will manage fire in the State's reserve system to protect life, property and environmental assets and enhance the conservation of natural and cultural heritage" (DEH, 2005a). This policy outlines a number of key principles relating to bushfire suppression, prescribed burning and fuel reduction.

- Fire is recognised as a natural component of the South Australian environment and the ecosystems conserved in the reserve system.
- The maintenance of biodiversity and ecosystem processes in reserves depends on appropriate fire regimes.
- Fire should be managed in a way that protects and maintains biodiversity values, as well as providing for the protection of life and property.

The policy also states "DEH is committed to the planned use of fire (prescribed burning) as a management tool for reducing fuel hazard to protect life, property and biodiversity values, and for ecological management" (DEH, 2005a). Property protection activities, where recognised as a priority, will be carried out in such a way to minimise the negative impacts on biodiversity.

The policy specifies that Fire Management Plans will provide the framework for:

- the management of bushfire suppression, including identification of strategic access and control lines; and
- prescribed burning for ecological management and fuel reduction purposes.

2.3 Zoning Policy

DEH has a Zoning Policy that outlines the zoning standard that is used for fire management planning on DEH managed lands (DEH, 2006c). Zoning is derived from:

- the level of perceived risk, using the *Policy and Procedure for Risk Assessment in DEH Fire Planning* (DEH, 2006d);
- the overall fuel hazard, which is assessed using the *Overall Fuel Hazard Guide for South Australia* (DEH, 2006e); and
- the activities considered appropriate to mitigate the threat that fire poses to life, property and environmental assets.

Three distinct zones exist (Asset zone (A-zone), Buffer zone (B-zone) or Conservation zone (C-zone)) and these are applied according to landscape objectives. A- and B-zones are

determined by fuel management objectives whereas C-zones are designated to assist in the conservation of biodiversity through the application of appropriate fire regimes (DEH, 2006c). For more information on zoning, refer to Section 8 of this plan (Fire Management Zones) and the *Policy and Procedure for Fire Management Zoning in DEH Fire Planning* (DEH, 2006c).

2.4 Local and Regional Environmental Planning

The Reserves of the Southern Foothills are part of the *Flinders Lofty Block IBRA Region* (Interim Biogeographical Regionalisation for Australia) (DEH (Cwlth), 2005), which has survey data included within *Biological Survey of the Southern Mt. Lofty Ranges, SA* publication (Armstrong, *et al.*, 2003). This survey was conducted as part of the greater *Biological Survey of SA,* with the objectives of:

- improving knowledge of South Australian biodiversity;
- determining biological variation across the state; and
- managing nature conservation in the long-term.

The *Regional Recovery Plan for Threatened Species and Ecological Communities of Adelaide and the Mount Lofty Ranges, South Australia 2009-2019*, is a regional biodiversity plan, which is currently in draft form (DEH, 2008a). The Plan will be implemented in order to guide the conservation, management and rehabilitation of habitats at a regional level.

The *Integrated Natural Resource Management Plan* has been developed for the MLR and Greater Adelaide Region (Matthews and Lewis, 2003), which identifies the following objectives for managing fire for biodiversity gain.

- Fire management leading to enhanced biodiversity assets.
- Reduced bushfire frequency.
- Fire used in suitable circumstances to achieve planned biodiversity outcomes.

The *Strategic Plan* of the SA Government states under *Objective Three – Attaining Sustainability,* a target of *No Species Loss* (T3.8) (DPC, 2004). As a result of this target, a strategy entitled *No Species Loss: A Biodiversity Strategy for South Australia 2007-2017* has been produced (DEH, 2007b). The southern foothills are located in the Mediterranean biome (encompassing part of the *Flinders Lofty Block IBRA Region)* in which a key threat to biodiversity is inappropriate fire regime (DEH, 2006k).

The fire management planning objectives, strategies and works outlined in this plan were developed with careful consideration given to providing for the maintenance of ecological integrity. This fire management plan is consistent with the objectives outlined in these local and regional environmental plans.

2.5 Reserve Management Planning

Reserve management plans are a statutory requirement under the *National Parks and Wildlife Act 1972* or *Wilderness Protection Act 1992*. Reserve management plans provide the overarching strategy for all management activities in reserves.

In relation to fire, a reserve management plan will:

- provide an overview of any fire-related issues in the reserve in question;
- state DEH responsibilities for managing fire in the reserve system in accordance with DEH Fire Management Policy; and
- identify the requirement for a Fire Management Plan based on the nature of any fire-related issues.

Fire Management Plans will be prepared for all fire-prone reserves, consistent with the objectives of the reserve management plan. In the absence of a reserve management plan, a Fire Management Plan for a reserve may still be prepared consistent with the objectives of the *National Parks and Wildlife Act 1972* and the *Wilderness Protection Act 1992* (if the reserve is a Wilderness Protection Area).

The following reserve management plans exist for the reserves of the southern foothills:

- Hallett Cove Conservation Park (CP) – adopted 1986 (DEP, 1986), draft 2009 (DEH, 2009)
- Sturt Gorge RP – adopted 2008 (DEH, 2008c).
- O'Halloran Hill RP – adopted 2008 (DEH, 2008d).
- Marino CP – adopted 1992 (DEP, 1992), draft 2009 (DEH, 2009)
- Shepherds Hill RP – adopted 2008 (DEH, 2008b).

Updated reserve management plans are currently being prepared or are in draft form for all of the reserves in the plan area. These updated plans will include reference to adjoining lands recommended for dedication into DEH reserves, including the Craigburn Farm land into the Sturt Gorge plan of management and the SA Department for Transport, Energy and Infrastructure (DTEI) land parcel at Darlington into the O'Halloran Hill plan of management and also to adjoining lands to be excised, such as 26 ha of land supporting the Southern Expressway.

There are a number of specific comments relating to fire management objectives and suppression strategies in the plans of management for reserves in the plan area. These comments should be considered in context with the age of the document. Recently there has been a shift in fire management policy and in protection and suppression strategies across Australia. This fire management plan is consistent with the strategies and direction outlined in the updated plans of management.

2.6 Vegetation Management Planning

Sturt Gorge RP has a Vegetation Management Plan, which aims to direct resource allocation towards priority conservation objectives (Quarmby, 2003). The plan identifies that a number of the environmental weed species present within Sturt Gorge RP increase the risk of fire. The plan proposes strategies for the control of these weeds, along with recommendations for the revegetation of native species. The plan recognises that a number of past revegetation efforts within the reserve did not meet these objectives. The thinning of inappropriate vegetation to reduce fire threat is supported. Revegetation consistent with fire management objectives may be undertaken within A- and B-zones. Vegetation Management Plans prepared for any of the reserves in the plan area in the future should take the zoning and

strategies within this fire management plan into consideration when planning sites for revegetation.

2.7 Consultation

DEH is committed to close cooperation and involvement with State and Commonwealth organisations, special interest groups and the broader community to achieve the goals of biodiversity conservation and protection of life and property. To achieve this the CFS, Metropolitan Fire Service (MFS), Local Government, DBPC, lessees, conservation and volunteer groups and ecologists have been consulted during the development of this plan.

DEH fire management plans are prepared and adopted in accordance with the *Policy and Procedures for Fire Management Planning: Project Management and Consultation* (DEH, 2007c). Consultation is not a statutory requirement for fire management plans but is a Departmental policy. The plan was put forward for DEH internal consultation for a period of four weeks before it was released externally for public consultation also for a period of four weeks.

2.8 General Objectives for Fire Management

DEH has a responsibility for fire management within the reserves incorporated into this fire management plan. Fire management objectives that apply to all the reserves in the plan area are as follows.

- To provide for the protection of human life and property during bushfire events.
- To ensure that sound conservation and land management principles are applied to fire management activities (where information is available on species, habitat, cultural and built heritage, then it will be taken into account during suppression activities).
- To provide for the strategic containment of bushfires.
- To complement District Bushfire Prevention Plans.
- To undertake bushfire suppression activities in a safe and professional manner.
- To establish and maintain perimeter access.
- To manage fire regimes to ensure consistency with the fire management guidelines in conservation zones (refer to Table 2 - Section 7.3).

3 BUSHFIRE ENVIRONMENT

Shepherds Hill RP and part of Sturt Gorge RP are located within the City of Mitcham, which is declared as part of the *Mount Lofty Ranges Bushfire Prone Area* (Planning SA, 2006). The area was zoned after the 1983 Ash Wednesday bushfires when the State Government agreed that a large part of the MLR, from the Fleurieu Peninsula to the Barossa Valley is subject to an increased risk of bushfire. The components of any landscape contributing to the bushfire potential include terrain, slope and aspect, climate and weather, vegetation and land use. The reserves in the plan area are highly disturbed and fragmented, support a high density of weed species and are located within the urban fringe of metropolitan Adelaide.

3.1 Location

All of the reserves covered in this plan are part of the Southern Lofty District of DEH Adelaide Region and all are located within the foothills of the MLR, including those that extend along the coast between Marino and Hallett Cove. Sturt Gorge, Shepherds Hill and O'Halloran Hill Recreation Parks are situated within the Hills Face Zone of the MLR, while Marino and Hallett Cove Conservation Parks are positioned on rising ground overlooking St. Vincents Gulf on the coastal margin of the southern Adelaide metropolitan area. The reserves in the plan area span over three Local Government Areas, the City of Marion, City of Onkaparinga and the City of Mitcham. Marino and Hallett Cove Conservation Parks and O'Halloran Hill RP lie within the City of Marion, Shepherds Hill RP is within the City of Mitcham and Sturt Gorge RP is located within both the City of Mitcham and City of Onkaparinga. Refer to Map 1 (Terrain, Tenure and Infrastructure) for the location of each of the reserves covered in this fire management plan.

Sturt Gorge RP (244 ha) together with the adjoining Craigburn Farm land (189 ha) proposed for reservation are situated 13 km south of Adelaide, between the suburbs of Bellevue Heights and Flagstaff Hill. The Sturt River flows through the centre of Sturt Gorge RP and this is the boundary between Mitcham and Onkaparinga City Councils. Shepherds Hill RP (77 ha) is located 2 km north of Sturt Gorge RP in the suburbs of Pasadena and Eden Hills. O'Halloran Hill RP (292 ha) including the land supporting the Southern Expressway and the adjoining DTEI land parcel (70 ha) is located approximately 1 km west of Sturt Gorge RP. Marino CP (30 ha) is located less than 2 km west of O'Halloran Hill RP, while Hallett Cove CP (50 ha) is located almost 2 km south of Marino CP.

3.2 Climate

The southern foothills of the MLR experiences a Mediterranean climate of cool wet winters and warm to hot dry summers. The average daily maximum temperature is 27°C during the summer. Rainfall predominantly occurs in winter and spring, varying from 515 mm annually in the coastal areas of Hallett Cove and Marino, to nearly 800mm annually over the high altitude areas near Sturt Gorge RP (DEHAA, 1998a; b; c). Along the coast humidity levels are normally low, particularly during summer.

During the summer months the prevailing winds are from the south-east in the morning, often shifting to south-west by the late afternoon. Extreme fire weather conditions occur on days with hot northerly winds and low humidity. Local winds are variable and strong, particularly in

the rugged hilly areas of Sturt Gorge and O'Halloran Hill Recreation Parks. Gusty, dry northerly gully winds are also a feature of the foothills and these are usually experienced in the evenings during the warmer months (DEHAA, 1998b).

3.3 Terrain

The reserves discussed in this plan form part of the *Flinders Lofty Block IBRA Region* (Interim Biogeographical Regionalisation for Australia) (DEH (Cwlth), 2005). IBRA regions are a nationally accepted landscape-based classification system. The foothills of the MLR incorporating Shepherds Hill RP and part of Sturt Gorge RP have rugged topography and abundant vegetation. However, the foothills incorporating O'Halloran Hill RP, Hallett Cove and Marino Conservation Parks have gently undulating to very steep topography with limited natural vegetation cover. For general terrain information across the plan area, refer to Map 1 (Terrain, Tenure and Infrastructure).

Sturt Gorge RP is comprised of an undulating plateau with an approximate elevation of 200 metres. It is characterised by very steep slopes and extensive inaccessible cliffs formed where the Sturt River has incised a deep gorge. Flat terrain is confined to small river flats and the ridgetop areas of Craigburn Farm land. O'Halloran Hill RP has two primary landforms; flat terrain to the south and steeply sloping terrain to the north comprising rugged hills face gullies. Marino CP is characterised by steep west facing slopes with a lower elevation near the coast rising up to a higher elevation toward the eastern boundary of the reserve. Shepherds Hill RP and Hallett Cove CP have gentle slopes in comparison to the other reserves and both have minor creeks. The western boundary of Hallett Cove CP terminates with rugged cliffs near the coast that extend across two thirds of the length of the reserves western boundary.

3.4 Fuel

3.4.1 Overall Fuel Hazard

The overall fuel hazard is used in fire management planning to determine the level of risk posed by bushfire to life, property and environmental assets in the risk assessment. It is derived from the assessment of four fuel layers in vegetation: *Surface, Near-surface, Elevated and Bark Fuel* (Figure 2). *Canopy Fuel* is not measured as part of overall fuel hazard.

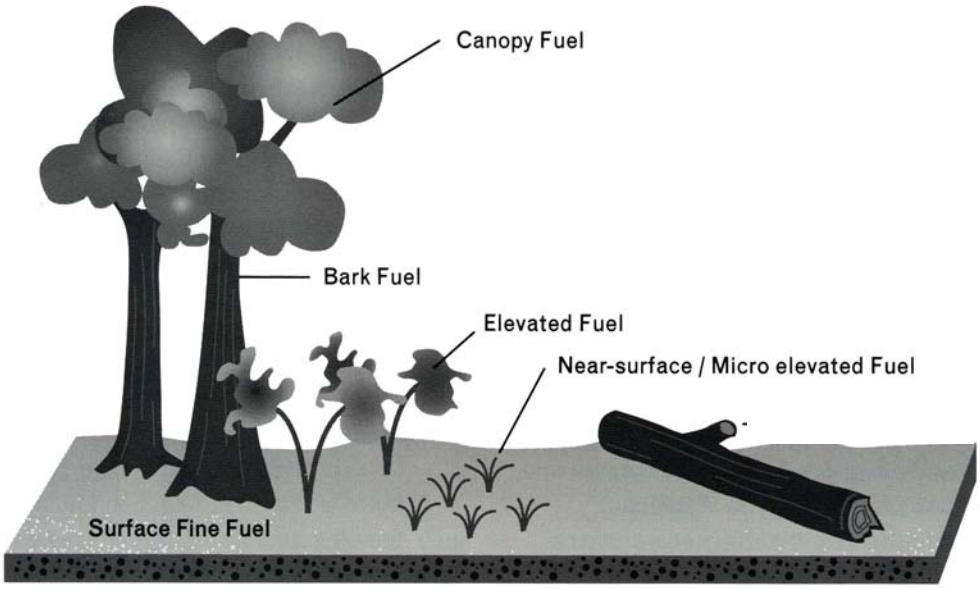

FIGURE 2 – COMPONENTS OF FUEL IN VEGETATION

Source: (Tolhurst and Cheney, 1999)

Each fuel layer contributes to different aspects of fire behaviour: flame depth and height, surface fire combustion and rate of spread, spotting and crown fire (DEH, 2006e). Each layer, as well as the overall fuel hazard can be assessed as: *Low, Moderate, High, Very High* or *Extreme* (DEH, 2006e).

The overall fuel hazard for vegetation within the reserves in the plan area was assessed by sampling in 2005. The outcome of the assessment is explained in more detail for each reserve in Section 11. For more information on fuel hazard assessment methodology and evaluation refer to the *Overall Fuel Hazard Guide for South Australia* (DEH, 2006e).

3.4.2 Likely Maximum Overall Fuel Hazard

Maximum overall fuel hazard levels have been estimated for Major Vegetation Sub-groups (MVS) within the plan area in order to provide a guide for fire management (Table 1). The process used to derive MVS is described in Section 6.1 and the extent of each MVS within the plan area is shown on Map 2 (Vegetation Communities and Fire). Within the plan area *Eucalyptus* woodlands with a grassy understorey (MVS No. 9) is dominated by Grey Box. Box bark is generally fine textured and held tightly to the tree (DEH, 2006e). Sporadic spotting is likely to be caused by long unburnt box bark if flame heights exceed 0.5 m and fire is able to 'climb' the tree (DEH, 2006e).

The likely maximum overall fuel hazard for MVS can be used for planning and incident management, however should be supported by on-ground sampling as areas of vegetation remain unmapped and it is likely that other factors (such as high weed density) will influence the overall fuel hazard. Weeds can disturb native ecosystems by changing fuel properties, leading to an alteration in fire behaviour and aspects of fire regime (including fire frequency, intensity, extent, type, season) (Brooks, *et al.*, 2004). Exotic grasses that have invaded Australian environments are known to alter the structure of the fuel by modifying biomass,

curing pattern, fuel arrangement and continuity which leads to a shift in fire regime (Stoner, *et al.*, 2004). Refer to Section 7.4 for more information regarding weeds in the plan area.

TABLE 1 – LIKELY MAXIMUM OVERALL FUEL HAZARD FOR MAJOR VEGETATION SUB-GROUPS

MVS No	MVS Name	Dominant Species Layers	Likely Maximum Overall Fuel Hazard	Significant Fuel Layers
9	*Eucalyptus* woodlands with a grassy understorey	*Eucalyptus microcarpa, E. camaldulensis var. camaldulensis, E. leucoxylon, Acacia pycnantha, A. paradoxa, *Olea europaea ssp. europaea, Olearia ramulosa, Astroloma humifusum, Themeda triandra, *Briza maxima, Lomandra densiflora*	Very High	Surface
32	Other shrublands	*Allocasuarina verticillata, Beyeria lechenaultii, Acrotiche patula, Eutaxia microphylla var. microphylla, Pomaderris paniculosa spp. paniculosa, Gahnia lanigera*	High	-

* *denotes introduced species*

3.5 Extreme Fire Conditions

Strong winds, combined with high temperatures and low humidity encourages moderate to severe fire intensity and behaviour, which is unmanageable by suppression activities. There is a dramatic increase in the likelihood of major bushfire events when the following conditions are experienced:

- *Very High* to *Extreme* fuel hazard levels in native vegetation;
- low humidity, decreased soil and fuel moisture, particularly during drought years;
- high winds shifting direction during the course of a fire;
- lightning strikes as a result of increased thunderstorm activity during spring and towards the end of autumn; and
- steep terrain.

4 FIRE HISTORY AND FIRE REGIMES

DEH has written records of fire incidents dating back to 1975 and these have been reviewed during the compilation of this plan. A total of 99 records exist pertaining to fires that have occurred within or in close proximity to the Reserves of the Southern Foothills since 1975. Anecdotal records exist of fires occurring within the plan area prior during the 1930's and 1960's.

4.1 Mapping Fire Occurrences

Map 2 (Vegetation Communities and Fire) has been compiled from the latest DEH fire incident reports. Last fire includes the most recent, complete firescar by year (mapped fires only). The quality of the firescar mapping varies, depending on the methods of capture, which ranges from the digitising of enlarged aerial photographs to the interpretation of hand drawn maps. It is important to note that only visible fire scars have been mapped. Consequently, the mapped fires may be regarded as a minimum estimate of fire occurrences.

4.2 Natural and Anthropogenic Fires

The largest fire recorded in the plan area burnt a total of 35 ha within O'Halloran Hill RP in 1990. This cause of this fire was attributed to arson. A 15 ha fire occurred in Sturt Gorge RP in 1976 and a 10 ha fire occurred in O'Halloran Hill RP in 1989. In 1982, a 60 ha fire occurred in the vicinity of O'Halloran Hill RP, however this fire only burnt 10 ha of the reserve. In 1986 a 0.5 ha fire that started and was contained within Hallett Cove CP was attributed to ignition by lightning. Thirty fires that have occurred within the plan area since 1975 have been attributed to or suspected to have occurred as a result arson. Since 1975 two fires have been attributed to ignition by campfires and one fire as a result of a burn-off on adjacent land.

4.3 Prescribed Burning

Records show that prescribed burning was implemented within Sturt Gorge and Shepherds Hill Recreation Parks from as early as 1989. Since 2003 prescribed burning has been undertaken within Sturt Gorge RP, with approximately 30 ha burnt in various locations across the reserve.

5 DAMAGE POTENTIAL TO LIFE AND PROPERTY

5.1 Land Use

Areas adjoining the reserves have a variety of land uses. Due to the position of the reserves in the heavily populated urban fringe, significant capital assets including residential developments, public buildings (e.g. education, medical and aged care facilities), water utilities and public recreation areas surround the reserves. Native vegetation in the surrounding landscape is contiguous with parts of Sturt Gorge and Shepherds Hill Recreation Parks, however the majority of the landscape is degraded and fragmented. To a lesser extent, grazing and agricultural land exists adjacent to Sturt Gorge and O'Halloran Hill Recreation Parks and Marino CP. Refer to Map 1 for an overview of land tenure.

All landholders are obliged to comply with the *Fire and Emergency Services Act 2005,* which outlines responsibilities for fire preparedness. DEH will implement works for fire management on DEH managed lands within the plan area; however adjoining landholders are also required to implement works on their own property to minimise the threat of fire.

Management Strategies

Land Use

1. Implement fuel management strategies on DEH managed lands to minimise the risk to life, property and the environment (refer to Section 11 and Map 3 for further information).

5.2 Built Assets

There are a number of built assets at risk from bushfires within the reserves including:

- DEH assets such as infrastructure associated with walking trails and reserve orientation, including interpretative information, barriers and signs.
- infrastructure associated with the ten leased areas, these are:
  - Eden Field Archers clubrooms and courses and the Marion Pony Club dressage arena and clubrooms in Shepherds Hill RP;
  - Flagstaff Hill Scout Hall and sheds used by the Scouting Association of SA in Sturt Gorge RP;
  - Southern Field Archery Club, Sturt Pistol Club, Holdfast Model Aircraft Club, historic bluestone cottage and horse agistment area, radio tower, Riding for the Disabled and Starline Golf Driving Range in O'Halloran Hill RP.
- SA Water assets within Sturt Gorge RP.

There are numerous assets, which are located in close proximity to the reserves including:

- private homes and associated assets in the suburbs of: St Marys, Pasadena, Eden Hills, Bellevue Heights, Craigburn Farm land, Blackwood, Blackwood Park, Coromandel Valley, Flagstaff Hill, Flagstaff Pines, O'Halloran Hill, Seacliff Park, Seaview Downs, Trott Park, Darlington, Bedford Park, Seacombe Heights, Marino and Hallett Cove.

- various community assets including those that require special protection due to the presence of vulnerable members of the community, such as hospitals, schools, kindergartens and child care centres. These include:
  - Bellevue Residential Care Centre and Resthaven Retirement Village complex adjacent to Sturt Gorge RP;
  - Hallett Cove Surf Life Saving Club facility south of Hallett Cove CP;
  - O'Halloran Hill MFS Fire Station on Majors Road adjacent to O'Halloran Hill RP;
  - Flinders Medical Centre and Private Hospital complex, less than 1 km from Sturt Gorge RP; and
  - educational facilities such as Flagstaff Hill Kindergarten, Flagstaff Oval Kindergarten, St. Stephen's Primary School, St. Peter's Lutheran School, Bellevue Heights Primary School and Flagstaff Hill Junior and Primary School, Blackwood High School, Flinders University, Onkaparinga TAFE and Glenthorne Farm (which is part of Adelaide University).
- landscaping along the DTEI roads, particularly along the Southern Expressway.
- assets representing a significant capital outlay, such as:
  - Happy Valley Reservoir and the associated infrastructure managed by SA Water, as well as the surrounding plantations; and
  - the Australian Maritime and Safety Authority Lighthouse adjacent to Marino CP, including affixed communication equipment.

DEH will undertake fire management works and activities to minimise impact on built assets, for both public and private buildings and agricultural areas. More detail is provided on Map 1 and in Section 11.

Management Strategies

Built Assets	2. Implement fuel management strategies appropriate to asset protection (refer to Section 11 and Map 3 for further information).
	3. Encourage volunteer participation in undertaking approved fuel reduction activities.

5.3 Visitor Use

The Reserves of the Southern Foothills are popular bushwalking, bicycle and horseriding destinations with trails traversing all of the reserves in the plan area. Camping is not permitted in metropolitan DEH reserves and as a result, visits are generally short-term, undertaken during the daylight hours by the local community. Visitors from non-local origin also visit the reserves, particularly Hallett Cove CP, as the reserve is educationally valuable. Of all the reserves covered in this fire management plan Hallett Cove CP has the highest visitor numbers.

Management Strategies

Visitor Use

4. Implement fuel management strategies appropriate to visitor safety (refer to Section 11 and Map 3 for further information);

5. Consider reserve closures on extreme fire weather days to ensure visitor safety (at the discretion of the Director National Parks);

5.4 Heritage Values

5.4.1 Indigenous Heritage

The land comprising the Reserves of the Southern Foothills forms part of the 'Country' of the Kaurna people (Tindale, 1974). The most significant Aboriginal heritage sites exist within Hallett Cove CP. There is also evidence of indigenous occupation throughout some of the other reserves. More information relating to indigenous heritage values are given within Section 11. In carrying out this plan DEH will comply with the *Aboriginal Heritage Act 1988* and the *Aboriginal Heritage Handbook and Strategy* (DEH, 2006a).

5.4.2 Non-indigenous Heritage

Within O'Halloran Hill RP there are three sites and objects that relate to the reserves history including a bluestone cottage, a bluestone quarry and the pea farm ruins (DEH, 2008d). The pea farm ruins are listed on the Local Heritage Register (DEH, 2008d). Other unlisted non-indigenous heritage sites occur throughout the planning area. More information relating to non-indigenous heritage values are given within Section 11 (Fire Management Blocks). Fire poses a risk to these historical values and they should be protected in the event of a fire.

5.4.3 Geological Features

Hallett Cove CP contains significant geological monuments, which demonstrate the late Palaeozoic glaciation of Southern Australia that occurred about 280 million years ago (DEH (Cwlth), 2006). The reserve, along with the adjoining Sandison Reserve was listed as a Geological Site on the SA Heritage Register in 1993 (DEH (Cwlth), 2006). Sturt Gorge RP is also listed as a State Heritage Place on the SA Heritage Register as it is geologically significant, due to the presence of the Sturt Tillite Precambrian glacial deposit, visible along the Sturt River (DEH (Cwlth), 2006). Although fire may not have a direct impact on these geological sites, suppression techniques in these areas should take these features into consideration so any likely impact or damage is avoided.

Management Strategies

Heritage Values

6. Implement fuel management strategies for the protection of heritage values where practicable (refer to Section 11 and Map 3 for further information).

7. Ensure liaison at bushfires occurs to identify heritage values, where time allows. Once the fire has passed evaluate sites to establish if damage has occurred.

8. Ensure suppression strategies take into account significant historical sites in order to minimise impacts and undertake post-fire rehabilitation.

6 SPECIES AND COMMUNITIES OF CONSERVATION SIGNIFICANCE

Dominant vegetation communities for the plan area are outlined in the following section, followed by the flora and fauna of conservation significance. The plan area does not support species of national conservation significance, however there are a number of state rated species and a threatened community that are considered important.

6.1 Major Vegetation Sub-groups (MVS)

Floristic mapping for this plan uses a compilation of regional vegetation mapping data that has been reclassified to comply with the National Vegetation Information System (NVIS) classification for Australia. The MVS level of the NVIS classification emphasises the structural and floristic composition of the dominant stratum but with additional types identified according to typical shrub or ground layers occurring with a dominant tree or shrub stratum. There are two MVS within the plan area that have been mapped by DEH. Refer to Map 2 (Vegetation Communities and Fire) for an overview. Refer to Table 1 (Section 3.4.2) for a detailed description of the species composition. Ecological Fire Management Guidelines for MVS are outlined in Table 2 (Section 7.3).

The Major Vegetation Sub-groups represented in the plan area are:

- *Eucalyptus* woodlands with a grassy understorey (MVS No. 9); and
- Other shrublands (MVS No. 32).

Grey Box *(Eucalyptus microcarpa)* is a major overstorey species in MVS No. 9; however Red Gums *(E. camaldulensis)* and SA Blue Gum *(E. leucoxylon)* are also present, especially along the drainage lines. Unclassified and highly modified vegetation, dominated by exotic Olive *(Olea europaea* ssp. *europaea)* shrubland occurs throughout Shepherds Hill RP, Sturt Gorge RP and O'Halloran Hill RP. Isolated patches of remnant understorey species (particularly native grasses) still persist in these areas. Areas of unclassified modified pastures (exotic grasslands) are also prevalent. The area classified as other shrubland (MVS No. 32) occurs within Hallett Cove CP as well as in Marino CP. In Hallett Cove CP, MVS No. 32 is characterised by emergent Drooping Sheoak *(Allocasuarina verticillata)* trees. In Marino CP, MVS No. 32 supports a coastal shrubland dominated by Prickly Ground Berry *(Acrotriche patula),* Twiggy Daisy Bush *(Olearia ramulosa)* and Mallee Pomaderris *(Pomaderris paniculosa).* Unclassified woodland and shrubland revegetation areas, some supporting non-indigenous species, occur within most of the reserves.

6.2 Flora, Fauna and Ecological Communities

The Environmental Database of South Australia contains records from several data sources, including the Threatened Plant Population Database, the Biological Survey of South Australia and opportunistic sightings of significant flora and fauna.

Fire response information, where known, is included for these species and communities of conservation significance in Appendix 1, 2 and 3. In most cases (with the exception of Sturt Gorge RP and Marino CP), species distributions are poorly defined, because the database

only contains point locations from site visits or observations. Many of the species records are several years old and require verification.

In this plan *'of conservation significance'* is used to describe important or rated populations or species of flora and fauna as well as vegetation communities. These may be:

- Nationally rated, that is, listed as Threatened (with a rating of Extinct, Critically Endangered, Endangered, Vulnerable or Conservation Dependent) under the federal *Environment Protection and Biodiversity Conservation (EPBC) Act 1999;*
- South Australian rated, listed as Threatened (with a rating of Endangered, Vulnerable or Rare) under the *National Parks and Wildlife Act 1972, Revised Schedules 7, 8 and 9.*
- Provisionally listed as Threatened (with a rating of Endangered or Vulnerable) in South Australia, that is, included on the unpublished DEH *Provisional List of Threatened Ecosystems of South Australia* (DEH, 2005b).

There are a number of flora and fauna species as well as one community considered to be of conservation significance within the plan area. The species of conservation significance include some of the species listed below. Refer to Appendix 2 for a detailed list.

- Cunningham's Skink *(Egernia cunninghami)* – rated as Vulnerable at the state level;
- Crested Shrike-tit *(Falcunculus frontatus)* – rated as Vulnerable at the state level;
- Black-chinned Honeyeater *(Melithreptus gularis)* – rated as Vulnerable at the state level;
- Yellow-tailed Black-Cockatoo *(Calyptorhynchus funereus)* – rated as Vulnerable at the state level;
- Variable Glycine *(Glycine tabacina)* – rated as Vulnerable at the state level;
- Red-leg Grass *(Bothriochloa macra)* – rated as Vulnerable at the state level;
- Rock Logania *(Logania saxatilis)* – rated as Rare at the state level;
- Pale Flax-lily *(Dianella longifolia* var. *grandis)* – rated as Rare at the state level;
- Behr's Cowslip Orchid *(Diuris behrii)* – rated as Rare at the state level;
- Grey Box Grassy Low Woodland – provisionally listed as Endangered at the state level.

There is a commitment to increase our capacity to incorporate species' requirements into improved ecological fire management. However, how each or all of a site's unique attributes (in terms of vegetation, soil, lithology, aspect, terrain, fire regimes, post-fire age of vegetation) contribute to the survival of a particular species is a complex question. It is beyond the scope of this plan to extrapolate site records for species across a landscape or to determine what the critical habitat requirements are for all species.

6.2.1 Grey Box Grassy Low Woodland

Status

Grey Box woodland is a significantly depleted community of conservation significance. The status of the community was initially identified by Neagle (1996) and rated *Conservation Priority 4*; that is, much depleted, poorly conserved within SA, with only a few large examples

remaining across the state. It was also recommended by Neagle (1996) that any good representations of the community be protected under Heritage Agreements or acquired by the then SA National Parks and Wildlife Service "as a matter of urgency".

Grey Box Grassy Low Woodland is recorded as Endangered on the DEH unpublished provisional list of threatened South Australian ecosystems developed in 2005 (DEH, 2005b). The current status of the community is considered to be declining (DEH, 2005b).

Components

The overstorey of this community is dominated by Grey Box trees. Other overstorey species include SA Blue Gum, River Red Gum and Drooping Sheoak. Understorey species typically represented within the community include Golden Wattle *(Acacia pycnantha),* Twiggy Daisy-bush, Mount Lofty Grass-tree *(Xanthorrhoea quadrangulata),* Yacca *(X. semiplana),* Kangaroo Thorn *(Acacia paradoxa),* Narrow-leaf Hop-bush *(Dodonaea viscosa ssp. angustissima),* Rock Fern *(Cheilanthes austrotenuifolia)* and Soft Tussock Mat-rush *(Lomandra densiflora).*

Introduced species including Boneseed *(Chrysanthemoides monilifera)*, African Daisy *(Senecio pterophorus),* European Olive, Soursob *(Oxalis pes-caprae),* Broad-leaf Cotton-bush *(Asclepias rotundifolia),* Fennel *(Foeniculum vulgare)* and other exotic shrubs, grasses and herbs are commonly associated with Grey Box woodland within the plan area.

Location

Grey Box woodland originally had a wide distribution throughout the foothills, slopes and plains of the MLR, however recent surveys indicate that only an estimated 1,250 ha remains within the region (Quarmby, 2003). The community occurs predominantly in heavy clay soils across the south-western slopes of the MLR from Mount Osmond to McLaren Vale (Armstrong, *et al.*, 2003). Within the plan area remnant patches exist, less than 44 ha within Shepherds Hill RP and about 48.6 ha within Sturt Gorge RP (Turner, 2001). The National Trust managed Watiparinga Reserve (which is contiguous with Shepherds Hill RP) conserves 28 ha of Grey Box woodland (Turner, 2001). Sturt Gorge RP conserves the second largest remnant of the community on land managed by DEH in the MLR (Quarmby, 2003). The largest remnant of the community on DEH land is conserved outside the plan area, at total of 163.2 ha within Belair National Park (Quarmby, 2003; Turner, 2001).

Risk

The decline of this woodland community is thought to have occurred as a direct result of land clearing, invasion of exotic species and urbanisation (DEH, 2005b). Evidence of timber cutting is apparent from the coppice regrowth of Grey Box trees within Sturt Gorge RP (Quarmby, 2003). The remnant stands of this community that survive are severely degraded due to weed infestation, particularly by European Olive and Boneseed and also by herbaceous weeds and annual grasses (Armstrong, *et al.*, 2003). Sturt Gorge RP protects the largest remnant of Grey Box woodland in the plan area (DEH, 2005b; Quarmby, 2003). The risk of Sturt Gorge RP burning in its entirety during a single fire event has been assessed as *Moderate.* Within the reserve the risk posed by fire to the local extinction of flora has been assessed as *High*.

Management Strategies

Grey Box Grassy Low Woodland

9. Refer to ecological fire management guidelines for ecological communities of conservation significance when implementing prescribed burns and aim to manage within these guidelines. Refer to Appendix 3 for further information;
10. Avoid burning large continuous remnants of Grey Box woodland in their entirety during a single fire event, instead aim to increase patchiness within the remnants;
11. Implement ecological/experimental burns as part of an integrated weed management strategy in order to reduce the abundance of environmental weeds posing a threat to the integrity of Grey Box woodland;
12. Determine the response of the community to different disturbance regimes through the application of ecological/experimental burns.

7 ECOLOGICAL FIRE MANAGEMENT

The management of fire to maintain biodiversity is discussed in more detail in the Draft DEH *Guidelines for Ecological Fire Management* (DEH, 2006g). This approach is being used as a sound basis for the management of fire for biodiversity across Australia (Andersen*, et al.*, 2003; FEWG, 2004; Hopkins and Saunders, 1987; Whelan*, et al.*, 2002). It is based on accumulating knowledge of species, populations and communities and their response to fire regimes, and then applying this knowledge to fire management practices to maximise biodiversity outcomes. Ecological Fire Management Guidelines are used to assist in achieving management objectives in C-zones within all DEH Fire Management Plans. For more information on C-zones refer to Section 8.5 of this Fire Management Plan.

7.1 Fire Regimes for Biodiversity Conservation

Fire regime is described as the history of fire in a particular vegetation type or area including the fire frequency, interval, intensity, extent and seasonality of burning (Brooks*, et al.*, 2004). It is therefore assumed that avoiding adverse fire regimes across the majority of the habitat for any given species should minimise the risk of adverse impacts or local extinction. That is, an adverse fire regime confined to a minor proportion of the habitat of any particular species may influence local distribution, but will have little effect on the persistence of that species across the landscape. A range of different fire intensities, frequencies, seasons and scales of burning need to be incorporated into ecologically based regimes if they are to result in the conservation of biodiversity.

7.2 Development of Ecological Fire Management Guidelines

Vital Attributes

Ecological fire management guidelines for an area will be developed from knowledge of the life histories (vital attributes) of the flora and fauna species that inhabit that particular area. The vital attributes of a species are the characteristics which affect its persistence at a site after fire, the environmental conditions required for re-establishment, and the longevity of the species following disturbance (Noble and Slatyer, 1981). For fauna, these vital attributes are the habitat and life history characteristics: shelter, food, and breeding requirements of species (Friend and Williams, 1996).

Key Fire Response Species

Examination of vital attributes of the species present in a particular area assists in defining the *Key Fire Response Species* for a particular community or vegetation type. These are the species most susceptible to decline due to inappropriate fire regimes: either too frequent or too infrequent fire, low or very high intensity fire, or fire in a particular season. These species and their needs in relation to fire regime provide a guide to the acceptable thresholds of fire regime (interval, season or intensity) for that particular area.

Methodology

Ecological Fire Management Guidelines have been developed from the research and analysis of available data relating to the *Key Fire Response Species* within the Reserves of the

Southern Foothills. The approach used by DEH to define the Ecological Fire Management Guidelines involves the identification of fire regime thresholds using flora and the assessment of the potential impacts of these thresholds against known faunal requirements, particularly the requirements of species of conservation significance. The steps taken in the development of the Ecological Fire Management Guidelines are as follows:

- Vital attributes data of plant and animal species, and ecological communities are gathered and assessed.
- This knowledge is used to identify the Thresholds of Potential Concern (TPC) of fire regime (fire interval, intensity, season & type) where species significantly decrease (Section 7.3.1).
- Ecological Fire Management Guidelines are formed from these thresholds and are then used to guide the fire management practices to ensure that adequate habitat is available to maintain biodiversity (i.e. species, populations & communities) (Section 7.3).

Figure 3 (below) illustrates this process.

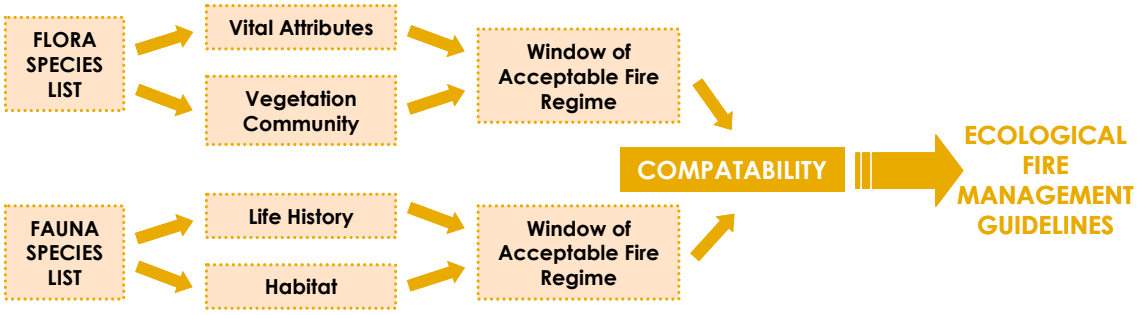

FIGURE 3 – APPROACH FOR DETERMINING ECOLOGICAL FIRE MANAGEMENT GUIDELINES

Adapted from (DEH, 2006g)

7.3 Interpreting Ecological Fire Management Guidelines

Ecological Fire Management Guidelines have been defined for Major Vegetation Sub-groups (MVS), enabling fire management to strategically plan and manage fire across the Reserves of the Southern Foothills in a way that will ensure the maintenance and enhancement of biodiversity (Table 2). Guidelines for five aspects of fire regime (interval, frequency, spatial, intensity and season) have been determined for all MVS within the planning area (where data is available). The upper and lower limits of fire interval for a particular MVS have been proposed, as well as recommendations on the management of fire frequency. Fire intensity requirements for species regeneration and undesired seasonal burning patterns have also been identified. Ecological Fire Management Guidelines should not be used as prescriptions; instead they define a window of "acceptable" fire regime that ensures the conservation of existing species.

TABLE 2 – ECOLOGICAL FIRE MANAGEMENT GUIDELINES FOR MVS IN THE PLAN AREA

		FIRE REGIME						
		Thresholds of Potential Concern		Spatial Criteria	Frequency		Intensity	Season
MVS No	MVS NAME	TPC 1 – Lower threshold in years	TPC 2 – Upper threshold in years	Inter-fire intervals within TPC1 and TPC2 across more than X% of the extent of this MVS within the planning area	Avoid more than 2 fires within a period of X years	Avoid more than 2 successive fires of low intensity	Some medium to high intensity fire needed to regenerate some species	Avoid 2 or more successive fires in season[1]
9	*Eucalyptus* woodlands with a grassy understorey	20	25	50%	40	Yes	Yes	Spring
32	Other shrublands	20	35	50%	40	#	#	#

\# Denotes that fire response is unknown or ambiguous for this MVS thus the required data is not available to propose Ecological Fire Management Guidelines. When data becomes available this table will be updated.

[1] Note that this is not restricted to the same year, but may relate to fires occurring in the same season over a number of years.

Threshold of Potential Concern

The *Threshold of Potential Concern* (TPC) for a vegetation type or community is the level of fire regime element (i.e. fire interval, frequency, intensity or season) where *Key Fire Response Species* are likely to significantly decline if exceeded. Fire regimes beyond that level are likely to lead to local extinction of significant biodiversity.

- TPC1 demonstrates the recommended lower limit for fire interval for a particular MVS. That is, vegetation within this MVS will be represented predominantly by early successional species if the inter-fire interval is less than the time specified, and those species that require longer to flower and set seed can disappear from a community.
- TPC2 demonstrates the recommended upper limit for fire interval for a particular MVS. That is, populations of some species (e.g. obligate seeders) are likely to reduce within this MVS if fire is absent for more than the time specified.

Ecological Fire Management in the Reserves of the Southern Foothills

As illustrated in Table 2, the recommended minimum fire interval has been defined as 20 years across 50% of the total of each MVS within the planning area. However, the upper limit varies from 25 to 35 years across 50% of the total of each MVS within the planning area. It was determined that it may be undesirable to subject any of the MVS within the planning area to two or more successive fires of less than 40 years apart. Furthermore three or more successive fires of low intensity are likely to impact MVS No. 9. Fire intensity requirements for species regeneration suggest that MVS No. 9 requires some medium to high intensity fire to regenerate a number of species. Undesired seasonal burning patterns have also been identified where the data is available, with spring burning likely to impact MVS No. 9.

7.4 Weeds

Weeds can have significant impacts on native vegetation and ecological communities within reserves (Saunders*, et al.*, 1991). Disturbance (e.g. grazing, nutrient inputs, erosion, fragmentation) is likely to promote weed invasion, and fire in areas already affected by one or more of these disturbance mechanisms is likely to lead to weed proliferation (Hobbs, 1991; Hobbs, 2002; Hobbs and Huenneke, 1992). It is well known that disturbance, especially fire, is an important mechanism in natural systems (Hobbs and Huenneke, 1992).

The reserves in the plan area are degraded as a result of a history of disturbance and contain a number of weeds of concern. A large proportion of the weeds that occur within the plan area have been identified as a management priority within the *Sturt Gorge Recreation Park Vegetation Management Plan* (Quarmby, 2003). Some of the most significant weed species within the plan area include European Olive, Boneseed, Bridal Creeper *(Asparagus asparagoides),* Blackberry *(Rubus fruticosus* aggregate) and exotic grasses such as Phalaris *(Phalaris aquatica)* and Large Quaking-grass. Fire management guidelines for these species and other weeds of concern are included in Appendix 1.

Weeds can significantly alter the fuel within ecosystems, and hence fire regime (Saunders*, et al.*, 1991). Native Kangaroo Grass *(Themeda triandra)* grasslands are known to support a lower density of fuel when the environmental weed Phalaris is not present (Stoner*, et al.*, 2004). When Phalaris is present, fine fuel biomass has been recorded reaching levels three times higher than what would occur in natural Kangraoo Grass grasslands. Both Kangaroo Grass and Phalaris occur across the Reserves of the Southern Foothills, with Phalaris identified as a management priority within the Vegetation Management Plan for Sturt Gorge RP (Quarmby, 2003).

All prescribed burns conducted by DEH will assess weed presence and outline weed control measures in the Environmental Assessment Table (EAT), completed as a requirement of the prescribed burn planning process (DEH, 2004; 2006f). The EAT will describe the weed control to be implemented post-burn, however investment will be based on the reserves overall habitat quality and also management priorities within the region.

Fire has been accepted as a tool for weed management, prescribed as part of an integrated approach (Hobbs, 2003). An integrated approach to weed management involves the planned use of fire coupled with other weed control techniques (including herbicide, biological, mechanical and physical control) noting that the combination, timing

and application of methods is likely to differ depending on the target species and to minimise off target damage.

Volunteers, community groups and DEH pest plant programs have completed significant weed management work within the reserves. Monitoring programs should ensure that vulnerable areas are evaluated pre and post-fire to determine what post-fire weed control is required.

Management Strategies

Weeds

13. Refer to Ecological Fire Management Guidelines (Table 2 - Section 7.3) and fire management guidelines for introduced flora species (Appendix 1) during prescribed burn planning.
14. Consider the use of fire as part of an integrated weed management strategy.
15. Conduct post-fire weed control subject to regional priorities.
16. Identify the potential impact of weed species prior to any prescribed burn in prescribed burn panning, as part of the EAT. This will identify any priority weed species and recommend post-fire actions to mitigate the impact of weeds.
17. Monitor weeds pre- and post-fire to determine what post-fire weed control is required and its effectiveness.
18. Ensure hygiene practices are implemented to reduce weed spread across the plan area.

7.5 Pest Fauna

The conditions that result following a fire can be favourable to some fauna species, but for other species these conditions may result in population decline. There is evidence that pest animals can flourish in the conditions existing after a fire. Herbivores, such as the introduced Rabbit *(Oryctolagus cuniculus)* and native Kangaroos *(Macropus* spp.) can benefit from the post-fire regeneration, finding suitable food within the recently burnt area (Gill and Catling, 2002; Murphy and Bowman, 2007). Predation on small mammals and birds by Foxes *(Vulpes vulpes)* may increase post-fire due to the reduction in shelter sites or cover and the increased access a fire provides (Gill and Catling, 2002). The degree of impact by these pest species post-fire depends on a number of factors, including the pre-fire abundance of the species and characteristics of the fire (e.g. fire size, shape, season, intensity and location).

Within the Reserves of the Southern Foothills, a number of introduced fauna have been observed. These include the Rabbit, Brown Hare *(Lepus capensis),* House Mouse *(Mus musculus),* Black Rat *(Rattus rattus)* and Fox, which are seen on occasion. Domestic stray cats and dogs and a range of introduced birds are also observed within the reserves.

It is important that the information collected on introduced fauna pre-fire is used to determine appropriate management post-fire. There is the opportunity to increase the rate

of eradication programs for introduced fauna after fire, to take advantage of the reduced vegetation cover and/or possible concentration of fauna in a smaller area.

Management Strategies

Pest Fauna

19. Collect relevant information in prescribed burn planning as part of the EAT on introduced fauna, to determine appropriate management post-fire.

7.6 Plant Pathogens

The *Environment Protection and Biodiversity Conservation Act 1999* has identified Phytophthora *(Phytophthora cinnamomi)* as a key threatening process, which means that it is a major threat to native vegetation and associated fauna, particularly threatened species. Phytophthora is a soil and waterborne fungus that causes disease and death to a variety of native plant species (as well as introduced species). It occurs in areas of high rainfall and because of this the southern foothills have been identified as being particularly at risk, however at the time of writing, Phytophthora has not been identified within the plan area. The fungus can spread with mud carried on vehicle tyres, walking boots and equipment, so there is significant risk of Phytophthora infestation.

DEH has a Standard Operating Procedure, which addresses Phytophthora threat management (DEH, 2002a). This outlines hygiene procedures and guidelines to protect the integrity of natural areas by minimising the risk of Phytophthora infestation and spread in DEH reserves.

Management Strategies

Plant Pathogens

20. Ensure the *Standard Operating Procedure – Phytophthora Threat Management* (SOP-002) (DEH, 2002a) is adhered to in Phytophthora risk areas, which includes all the reserves in the plan area.

21. Ensure hygiene practices are implemented to reduce the spread of Phytophthora across the plan area. Refer to the *DEH Operating Procedure - Phytophthora Vehicle Disinfection Units* (DEH, 2003).

8 FIRE MANAGEMENT ZONES

8.1 Zoning Background

Fire management zones as detailed in the *Policy and Procedure for Fire Management Zoning in DEH Fire Planning* (DEH, 2006c) have been introduced into DEH fire management planning to:

- ensure that appropriate management actions are implemented to meet the requirements for asset protection and ecological management on DEH reserves and DEH managed land;
- clarify the areas where different fire management activities will be undertaken on DEH reserves and DEH managed land;
- ensure a standard approach to the application of fire management zones on DEH reserves and DEH managed land across South Australia; and
- assist in the development of fire management plans and programs for DEH reserves and DEH managed land.

Fire management zones are categorised according to the primary objective for fire management – Asset Zone (A-zone), Buffer Zone (B-zone) or Conservation Zone (C-zone). These zones were determined, giving consideration to fuel hazard levels in different habitat types and the level of risk to life, property, cultural and biodiversity assets Zoning within the planning area is described in Section 11 and also displayed on Map 3..

Details on fuel reduction methods within A- and B-zones are provided within the EAT (as part of prescribed burn planning), which is prepared before the implementation of each prescribed burn and also before fire management works are undertaken within DEH managed land. The EAT is required where native vegetation is being cleared and is not exempt under the *Native Vegetation Act 1991*. Refer to the *Interim Environmental Assessment Table Guidelines* (DEH, 2004) and the *Policy and Procedure for Prescribed Burning* (DEH, 2006f) for more information.

8.2 Risk Assessment

A risk assessment was conducted in line with the *Policy and Procedures for Risk Assessment in DEH Fire Planning* (DEH, 2006d), as a requirement of the compilation of this fire management plan. The risk assessment is a tool used to gauge the risks arising from bushfire to life, property and environmental values, within and adjacent to the reserves in the plan area. The risk assessment considered visitor use, assets (built, heritage and environmental) and neighbouring properties for all reserves in the plan area. Risk assessment is a function of likelihood and consequence.

- Likelihood considers the possibility that a fire related risk will occur and is assessed on a basis of *Rare* to *Almost Certain (Rare, Unlikely, Possible, Likely, Almost Certain).*
- Consequence considers bushfire risk based on impacts to life, property and environmental values and is ranked from *Insignificant* to *Critical (Insignificant, Minor, Moderate, Major, Critical)*.

- Based on the derived likelihood and consequence ratings, the overall risk for each scenario is determined using a Risk Matrix and ranked from *Low* to *Extreme (Low, Moderate, High, Extreme).*

Refer to the *Policy and Procedures for Risk Assessment in DEH Fire Planning* for further information (DEH, 2006d). Risk assessment is ongoing and continually reviewed to reflect the changing landscape. The application of fire management zones as well as recommended actions and works in this plan are derived from the risk assessment process.

8.3 Asset Zone (A-zone)

An Asset Zone, or A-zone, as explained by DEH (2006c), aims to provide the highest level of protection to human life and property by implementing the most intensive fuel management strategies. An A-zone will mainly be used in reserve areas adjacent to high value assets requiring protection from bushfires (e.g. residential areas, leased areas, public utilities, historical features, visitor areas). The depth of an A-zone will range from 40 to 100 metres, however under some circumstances, as described in the Policy, the depth may be reduced to less than 40 metres (DEH, 2006c).

The areas designated as A-zones are located within Shepherds Hill, Sturt Gorge and O'Halloran Hill Recreation Parks and also within Marino CP (Map 4). The application of the A-zones within the reserves was derived through the risk assessment process, as these built assets were regarded as being subject to *High* to *Very High* bushfire risk.

A-zone Objectives

- To provide a low fuel area of at least 40 m to help protect life (owners/firefighters) and property/built assets from radiant heat damage, flame contact and short distance ember attack.
- To modify the rate of spread and fire intensity providing the highest degree of safety for fire crews during suppression.

Prescriptions for Fuels in A-zones

The overall fuel hazard as described within DEH (2006e) should not exceed *Moderate* for the areas designated as A-zones. There should be *Low* to *Moderate* fine fuel at ground or near surface levels and fuels should also be discontinuous. This will minimise the risk of a fire carrying across the zone, at or close to ground level and to reduce the path for transfer of fire into adjacent land.

Fuel Management Strategies in A-zones

Slashing, mowing, selective fine fuel removal, trail or firebreak construction and prescribed burning are acceptable methods of fuel management in A-zones. Fuel reduction should be undertaken, as appropriate when fuel levels exceed prescribed limits (DEH, 2006c). Within bushland in this zone, selective shrub removal, thinning and clearing of woody weeds may be prescribed (DEH, 2006c). Fuel reduction includes both native and exotic vegetation.

8.4 Buffer Zone (B-zone)

A Buffer Zone, or B-zone, as explained within DEH (2006c), aims to provide a buffer area to assist in reducing the speed, intensity and spotting potential of a bushfire. This zone is usually 40 to 1000 metres wide and may apply in bushland areas in close proximity to assets requiring protection from bushfire, in the urban interface or urban fringe. It may also be used to provide strategic fuel reduction for a landscape, which would otherwise carry *High* to *Extreme* fuel hazard levels.

B-zones have been allocated to all of the reserves in the plan area (Map 4). In Sturt Gorge and O'Halloran Hill RP B-zones have been positioned to strengthen the A-zones. B-zones have been placed along the northern boundaries of both O'Halloran Hill RP and Marino CP where the threat to residential properties from bushfire is increased. A B-zone has been placed along the eastern boundary of Shepherds Hill RP where it abuts National Trust land to reduce the likelihood of burning through contiguous vegetation.

B-zone Objectives

- To minimise the likelihood of bushfire impacting on property and ecological assets.
- To assist in reducing bushfire intensity, ember attack and spotting potential, likely to impact on the assets within the surrounding urban areas or assets within the reserves.
- To provide a suppression advantage to assist in containing bushfires within defined areas, that is to minimise the likelihood of fires entering the reserve from the wider landscape or exiting the reserve.
- To enhance safe access for firefighters.

Prescriptions for Fuels in B-zones

The overall fuel hazard as described within DEH (2006e) should not exceed *High* for the areas designated as B-zones.

Fuel Management Strategies in B-zones

Fuel management will be undertaken to achieve the desired level of fuel, once the available fuels exceed the prescribed limit (DEH, 2006c).

8.5 Conservation Zone (C-zone)

The Conservation zone, or C-zone, as explained within DEH (2006c) is the default zone for all areas within a reserve that are not otherwise zoned as Asset or B-zones (this may include anomalous areas such as grazing leases, as in the case of Craigburn Farm land). C-zones have been applied to all of the reserves in the plan area. The C-zone allows for fire management activities to meet ecological and conservation management objectives.

C-zone Objectives

- To manage fire to meet the reserve management objectives as specified within the

C-zone Objectives

Reserve Management Plans listed in Section 2.5 of this document.

- To assist in the conservation of species and populations such as the rated species listed in Appendix 1 and 2 through the application of appropriate fire regimes.
- To assist in the conservation of communities, such as the rated Grey Box woodland community in Sturt Gorge and Shepherds Hill RP, through the application of appropriate fire regimes.
- To provide landscape protection.

Strategies for Achieving Objectives in C-zones

The strategies for achieving the C-zone objectives are:

- prescribed burning for ecological management (i.e. an *Ecological Burn*); and
- prescribed burning for Landscape Protection (i.e. a *Landscape Protection Burn*).

An Ecological Burn within C-zones must follow the *Policy and Procedures for Ecological Burning* (DEH, 2006h). An ecological burn shall:

- aim to meet Ecological Fire Management Guidelines for the vegetation communities that occur within the plan area (Table 2 and Appendix 3);
- have explicit ecological and burn objectives (consistent with this plan); and
- have specific monitoring established to assess that burn and ecological objectives are achieved and collect additional vital attribute data to contribute to refining fire management guidelines.

A landscape protection within C-zones will aim reduce the likelihood of a whole reserve or contiguous block of vegetation burning in a single fire event. The appropriate Ecological Fire Management Guidelines (Table 2) for the vegetation communities concerned should be met. If the proposed burn is outside the stated guidelines for the MVS in question then justification must be provided in the Environmental Assessment Table (EAT) developed for the proposed prescribed burn. Priority should be given to burns that link existing areas of low fuel hazard (e.g. recent bushfires) to create strategic corridors that will assist in restricting the extent of bushfires.

8.6 Burn Preparation

All prescribed burning (regardless of the objective, tenure or zoning) will adhere to the planning process utilising the EAT, as detailed in Figure 4 and within the *Policy and Procedures for Prescribed Burning* (DEH, 2006f). The prescribed burn proposals will be assessed for impact against other issues (e.g. a prescribed burn for a threatened species must not significantly affect general habitat/vegetation values, cause weed spread or cause an unbalanced age class distribution). Approval will only be given if the potential risks of inaction outweigh the risks of conducting the burn on both target and non-target species.

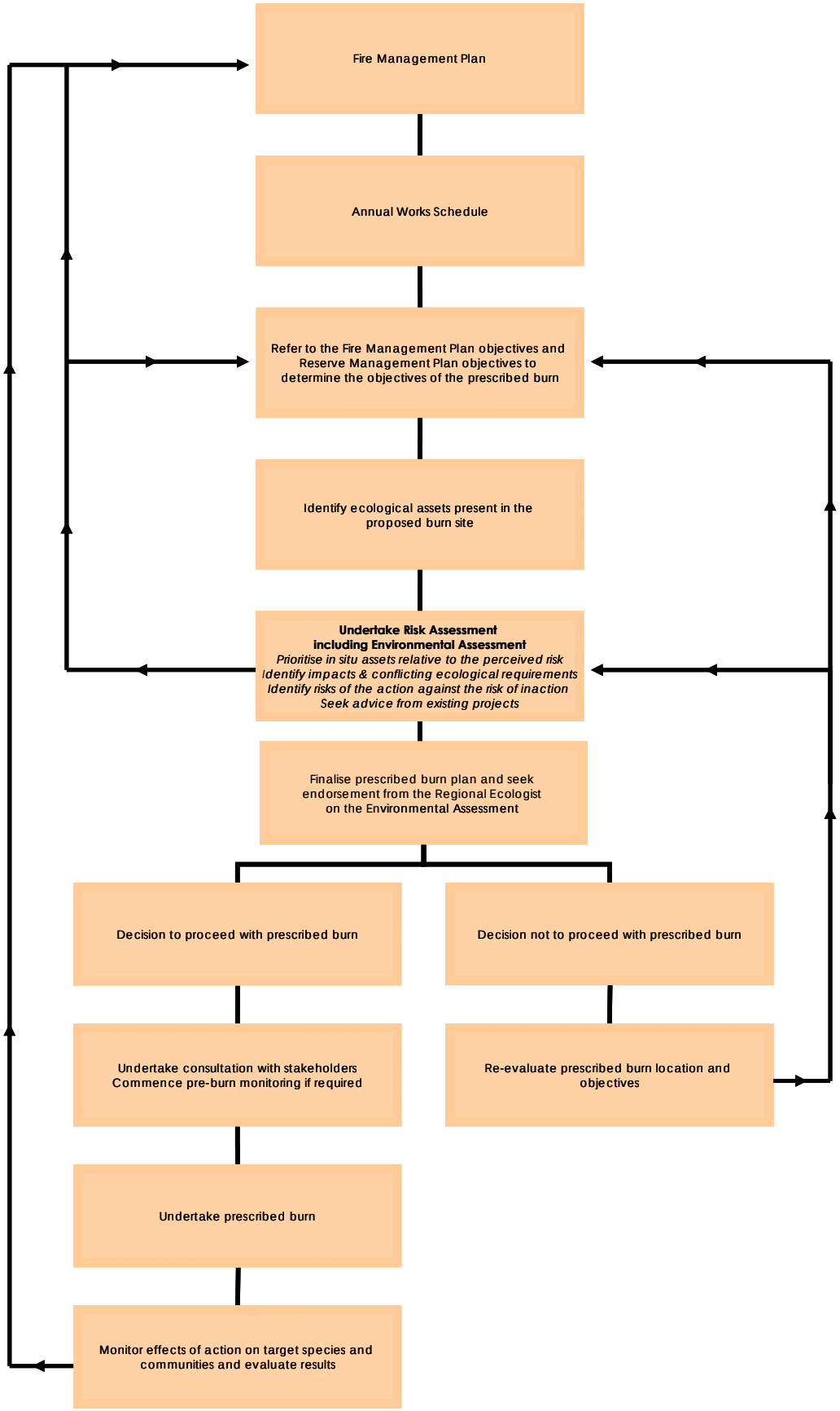

FIGURE 4 – BURN PLANNING PROCESS

9 BUSHFIRE SUPPRESSION

9.1 Legislation

Section 97 of the *Fire and Emergency Services Act 2005* explains the importance of this fire management plan and the role of the CFS during a fire incident on DEH land. The legislation states that under fire or threat of a fire a member of the CFS must consult with the person in charge (if that person is in the presence of, or may be immediately contacted by, the member of the CFS of that reserve) and if the prescribed action would affect a government reserve, they must take into account any relevant provisions of a management plan for the reserve that have been brought to the attention of the member.

9.2 Policies and Procedures

The following Policies and Procedures are to be used in conjunction with this fire management plan.

- DEH Fire Management Policy.
- DEH Fire Management Policy and Procedures (covering various aspects of fire management).
- CFS Chief Officer Standing Orders (COSOs).
- CFS Standard Operating Procedures (SOPs).
- CFS Operations Management Guidelines (OMGs).

Strategies implemented during an incident will be determined by the Incident Management Team (IMT), taking this plan into consideration.

9.3 Response – Role of CFS and DEH

The CFS has overall responsibility for fire suppression activities in SA country areas (that is, areas outside MFS fire districts). Response to a fire in Shepherds Hill and Sturt Gorge Recreation Parks is undertaken jointly by CFS and DEH brigades who form the Sturt and Mawson CFS Groups as well as the MFS. O'Halloran Hill RP and Marino and Hallett Cove Conservation Parks lie within the MFS response area, however both DEH and CFS brigades from the Mawson Group respond to fires in these reserves.

DEH responds to fires in the Mt Lofty Ranges in conjunction with CFS. The minimum DEH response for reserve fires or fires threatening reserves is set out in a Response Plan for the Adelaide Region (DEH, 2006i) and is determined according to the fire danger rating of the day. As a fire escalates DEH responds according to a staged District, Region and Statewide response.

Local CFS brigades are relied upon for fire suppression activities, particularly in the early stages of an incident. The cooperation, support and understanding between CFS, DEH brigades, MFS and the local community have been vital to successful fire suppression both on and off reserves in the past, and will be critical to the success of this plan.

9.4 Suppression Considerations

Efforts should contain bushfires using existing control lines, previously burnt areas and natural low fuel areas. Predicted fire intensity should be considered before adopting suppression strategies. Firefighter safety and the protection of life and property are paramount. Reserve specific suppression information is detailed within Section 11.

9.4.1 Ground Crews

Considerations

- Coastal/sea breezes can influence fire behaviour, especially in Marino and Hallett Cove Conservation Parks.
- Steep terrain in areas such as Sturt Gorge RP can influence fire behaviour.
- During *High* to *Very High* fire danger days consider backburning from control lines or access tracks, taking into account specific management objectives for each reserve.
- During extreme fire danger days, suppression may be confined to asset protection.
- The use of foams should be minimised in creek lines.
- Water for fire suppression can be sourced from mains water points in the surrounding streets.
- Refer to the Adelaide Region Fire Response Plan (DEH, 2006i) for current information on available utilities and facilities (note the Response Plan is updated annually).
- Implement precautionary hygiene measures as outlined in Section 7.6.
- Gates providing access to DEH managed lands are illustrated on Map 3.
- Track classifications were recorded using GAFLC standards (GAFLC, 2005) and are shown on Map 3. Note that classifications may vary depending on what works have been completed and whether there has been any degradation of tracks since the assessment was conducted.

9.4.2 Machinery Use

Considerations

- Steep terrain within these reserves will often considerably reduce the effectiveness and pose risks for machinery operators.
- Machinery use during fire suppression is to be in accordance with the *Policy and Procedures for Earthmoving Equipment* (DEH, 2006j), which states that CFS must liaise with a delegated DEH officer before engaging earthmoving equipment on DEH managed lands.
- Minimal disturbance suppression techniques and specialised equipment that reduces impacts to the landscape shall be used wherever possible.
- Standards for control lines are to be accordance with the *Standard Operating Procedure for Fire Control Lines* (DEH, 2002d).

- The use of control lines will be determined by the IMT, based on fire severity and weather conditions, giving due consideration to safety and strategic advantage.
    - New fire access on reserves will only be constructed for the purpose of fire suppression, where provided for in planning, or where approved by the Incident Controller in liaison with DEH staff.
    - Minimal disturbance suppression techniques and specialised equipment that reduces impacts to the landscape shall be used wherever possible.
- Implement precautionary hygiene measures as outlined in Section 7.6.

9.4.3 Aerial Suppression

Considerations.

- Aerial suppression may be the most appropriate strategy in difficult terrain to complement works undertaken by ground crews.
- Shepherds Hill and Sturt Gorge Recreation Parks are located within the MLR Primary Response Zone for aerial fire suppression, however O'Halloran Hill RP and Marino and Hallett Cove Conservation Parks do not fall within this zone.
- If a fire threatens life or property the use of water bombers may be requested by the Incident Controller through the Duty CFS Regional Coordinator and CFS Deputy State Coordinator.
- Implementation of aerial suppression is to be in accordance with the *Standard Operating Procedure for Air Operations* (DEH, 2002c).
- The use of retardant should be in accordance with the *Standard Operating Procedure for Fire Suppression Chemicals* (DEH, 2002b) and restricted:
    - to critical situations such as the protection of built assets (on and off-reserve); and
    - in environmentally sensitive areas, including wetlands, watercourses and the habitat of threatened species.

9.5 Fire Access

Guidelines on the use of fire access tracks and firebreaks in South Australia have been approved by the Government Agencies Fire Liaison Committee (GAFLC, 2005). The guidelines include prescriptions and standards for various fire access tracks and firebreaks. They also provide guidelines for adjacent fuel management, positioning and maintenance, mapping, signage and safety. Fire access points and tracks have been reviewed as part of this plan. The current standard of tracks is illustrated on Map 4. Proposed changes are outlined within Section 11 and summarised within Section 12.

9.6 Post-Fire Rehabilitation and Recovery

DEH has a *Policy and Procedure for Post-fire Rehabilitation* (DEH, 2007a) to ensure that the post-fire rehabilitation and recovery of a reserve is identified during an incident. A post-fire rehabilitation plan should be prepared and should describe the areas affected by fire and impacts on the natural and built environment. Specific objectives of post-fire rehabilitation plans are outlined in the Policy and Procedure.

10 RESEARCH AND MONITORING

Where prescribed burns in C-zones are likely to impact on species of conservation significance, planning will be undertaken with the relevant Recovery Teams (where they exist). In the absence of a Recovery Team consultation will be undertaken with the appropriate DEH staff.

10.1 Monitoring

Monitoring will be established in conjunction with any prescribed burns conducted within the plan area, in accordance with DEH Policy and Procedures. This includes the *Policy and Procedure for Prescribed Burning* (DEH, 2006f), incorporating the Environmental Assessment Table and monitoring procedures. Refer to Section 8.5 and 8.6 of this plan for general information on C-zone burning and the planning requirements.

In the past Flinders University has had some involvement in post-burn monitoring of weed populations in Sturt Gorge RP, however at the time of writing the university has no further work planned. Within Shepherds Hill and O'Halloran Hill Recreation Parks and Marino and Hallett Cove Conservation Parks fire has not been prescribed and recently, only minor bushfires have occurred. As a result there has not been opportunity to carry out post-burn monitoring.

It is recommended that monitoring be undertaken to:

Monitoring

22. Investigate the fuel accumulation rates of the various MVS that occur within the plan area. These data will help DEH staff determine if and when fuel reduction works are required, ultimately assisting in the scheduling of operational works and activities in B-zones;

23. Assess the suitability of the proposed weed management guidelines for the control of introduced species flowing fire, including Olive, Dog Rose, Bridal Creeper, Boneseed, Salvation Jane, African Boxthorn, Horehound, Blackberry and African Daisy (Appendix 1).

10.2 Research

Any fire-related research that is proposed within the plan area should be discussed with the Senior Fire Research Officer, Fire Management Branch.

It is recommended that research should be undertaken to:

Research

24. Investigate the suitability of the Ecological Fire Management Guidelines for MVS through the assessment of historical fire regimes in similar communities across the state (Table 2).

25. Explore the response of Rock Logania to fire within Sturt Gorge RP and use this to update the Ecological Fire Management Guidelines (Appendix 2);

26. Determine suitable fire regimes for the management of Grey Box woodland and use this information to update the Ecological Fire Management Guidelines (Appendix 3)

11 FIRE MANAGEMENT BLOCKS

The plan area has been divided into 15 fire management blocks to ensure that information and issues unique to a particular area have been addressed. Block boundaries are also based on access and the practicalities of implementing the fire management objectives of a particular area. Shepherds Hill RP, Marino and Hallett Cove Conservation Parks are treated in their entirety as blocks for fire management purposes. Sturt Gorge RP and the adjoining Craigburn Farm land are divided into seven blocks, while O'Halloran Hill RP and the adjoining DTEI land parcel are divided into five blocks. Refer to Table 3 (below) for information on the name, size and location of each block.

TABLE 3 – OVERVIEW OF FIRE MANAGEMENT BLOCKS

Reserve Name	Block Name	Area (ha)
Shepherds Hill Recreation Park	Shepherds Hill Block	77
Sturt Gorge Recreation Park	Tillite Block	32
	Gorelon Block	53
	Gorge Block	62
	SA Water Block	16
	Flagstaff Block	71
	Bushland Block	47
	Craigburn Block	152
O'Halloran Hill Recreation Park	Ocean Boulevard Block	91
	Morphett Block	142
	Pea Farm Block	75
	Trott Block	54
	Lease Block	7
Marino Conservation Park	Marino Block	30
Hallett Cove Conservation Park	Hallett Cove Block	55

11.1 Fire Management Reserve Prescriptions

Each reserve has been described and actions and works have been proposed at the block level in the following section. This includes summaries of relevant information such as land use, vegetation, fuel hazard, fire risk, fire access, assets, zoning, recommended works and guidelines for suppression. Known species and communities of conservation significance are listed in Appendix 1, 2 and 3 along with the reserve and block name and the associated vegetation community. The corresponding fire response and fire management guidelines are listed in Table 2 (Section 7.3) and Appendix 1 and 2. Objectives, (in addition to those in Section 2.7) and actions that only apply to a specific reserve are included in the following sections. A map to supplement the fire management strategies has been created for the plan area (Map 3).

11.2 Mapping

Three maps have been produced to complement this fire management plan. These maps are provided as an attachment to the plan.

Map 1 (Terrain, Tenure and Infrastructure) illustrates physical landscape features with land ownership, generalised land use and infrastructure relevant to the plan area.

- Physical landscape is displayed using a combination of contours, drainage & water bodies.
- DEH reserves are shown in context with neighbouring land tenures, such as SA Water land.
- Generalised land use is depicted, including built up areas, educational institutions, recreational reserves as well as the distribution of native and planted vegetation (orchards, vineyards and pine plantations).
- Regional scale infrastructure is displayed including roads, railways, high voltage powerlines, water pipelines, CFS stations and communication towers.

Map 2 (Vegetation and Fire) provides a snap shot in time of the fire history for the plan area and depicts vegetation communities.

- Fire history is shown by year.
- Vegetation communities are mapped as Major Vegetation Sub-groups.

Map 3 (Fire Management and Access) shows the plan area in terms of the management strategies presented in the following section.

- Proposed zoning is displayed in a context of fire management block boundaries.
- Current fire access is symbolised according to the GAFLC track classification.
- Fire related infrastructure and infrastructure other than roads is depicted including gates, buildings and leased assets where data are available.
- Significant assets within and adjacent the reserves are shown and labelled, as are the names of fire tracks within reserves.

HALLETT COVE CONSERVATION PARK

Tenure, (Size), Land Use

Hallett Cove CP (49 ha) will be treated in its entirety as Hallett Cove Block (55 ha), including Sandison Reserve managed by the National Trust to the east, for fire management purposes.

Vegetation

MVS No. 32

Three distinct topographic zones exist within the reserve, each with separate vegetation characteristics. The majority of the remnant vegetation has survived in the south-western corner of the reserve along the coastal dune system and within the natural ampitheatre. The eroded steeper sections of the ampitheatre are quite bare, while the moderate slopes support emergent Drooping Sheoak low trees over a low open shrubland. Unclassified vegetation exists throughout the remaining portion of the reserve and these vegetation characteristics are briefly described in the Hallett Cove CP Management Plan (DEP, 1986). The low coastal dunes between Black Cliff and the southern boundary are dominated by salt tolerant species. Waterfall Creek is dominated by Narrow-leaf Bulrush *(Typha domingensis)* and Common Boobialla *(Myoporum insulare*). Round-leaf Pigface *(Disphyma crassifolium)* and Coastal Climbing Lignum *(Muehlenbeckia gunnii)* grow on the rocky cliffs. The remaining portion of the coastal plateau was progressively cleared and little remnant vegetation remains. This area has been the site of many revegetation efforts which today forms a woodland structure, supporting *Melaleuca* species and Kangaroo Thorn *(Acacia paradoxa)* over exotic grass and pasture species.

Fire History

The historical incidence of bushfire in this reserve has been low; only eight fires have been recorded within the reserve since 1975, the majority of these have been attributed to ignition by human causes, however a fire in 1986 was attributed to lightning. The last fire occurred as a result of arson in 2002 and burnt an area of less than 1 ha.

Fuel Hazard

Overall *Extreme* in the revegetated areas on the plateau supporting mature *Melaleuca* and Kangaroo Thorn thickets. *Very High* in the Pale Turpentine Bush *(Beyeria lechenaultii)* and Kangaroo Thorn shrubland, the northern boundary revegetation area and the picnic area. *Moderate* in the western plateau revegetation area. *Low* in the creek line near the eastern boundary and the north-eastern corner.

Elevated *Very High* in areas supporting Pale Turpentine Bush, Kangaroo Thorn and mature *Melaleuca*. *Moderate* in the western revegetation area and in the creek line. *Low* in the north-eastern corner.

Natural Values

The reserve conserves geological sediments and features of worldwide significance, which are listed on the State Heritage Register (DEH (Cwlth), 2006). The glacial and other sedimentary features are exposed primarily in the ampitheatre area, along Waterfall Creek and along a broad coastal strip approximately 300 m wide, extending from the high tide zone.

Seven state rated species have been recorded for the reserve. Fauna and flora of conservation significance are included in Appendix 1 and 2.

Heritage Values

Within the reserve there is evidence of indigenous occupation, as significant crude stone artefacts have been located (DEH (Cwlth), 2006). These indigenous heritage values list the reserve on the State Heritage Register (DEH (Cwlth), 2006). The ruins of an old farmhouse exist within the north-eastern area, however it is not listed on the State Heritage Register.

Assets

Within Reserve Substantial infrastructure exists within the reserve, including a 1 km boardwalk, interpretive and directional signs, three trailheads (located at each of the major entrances) and boundary fencing.

Off Reserve Residential properties of Hallett Cove on all but the western boundary. City of Marion reserves to the north, east and south (including associated minor public recreation facilities), Sandison Reserve to the west and the Hallett Cove Surf Lifesaving Club to the south.

Fire Risk

Risk of burning in a single fire event: *Moderate*

Hallett Cove Block is at risk of burning in a single fire event due to the small size of the reserve and its exclusion from the MLR Primary Response Zone for aerial suppression.

Fire Tracks (GAFLC classifications)

Major	Along the eastern boundary (south of gate 2) (un-named)
Standard	Running east–west in the centre of the reserve (un-named)
	Along the southern boundary (un-named)
	Along the ampitheatre rim (un-named)
Minor	Running north-south in the centre of the reserve (un-named)
	Along the eastern boundary (north of Waterfall creek) (un-named)
	Along the northern boundary (un-named)

Specific Management Objectives for Hallett Cove Block

- Minimise the risk of the entire block being burnt in a single fire event.
- Minimise the likelihood of fire impacting on residential assets along the eastern, northern and southern boundaries due to short distance ember attack.
- Minimise the likelihood of fire impacting on residential assets along northern boundary due to radiant heat.
- Minimise the likelihood of fire escaping and impacting on the neighbouring City of Marion reserves.
- Minimise the risk that fire may pose to the natural and heritage values of Hallett Cove CP.
- Ecological fire management to maintain or promote natural values of the reserve, taking into account the risk that fire may pose to the immature revegetation areas.

Recommended Works

Pre-suppression

Existing:

- All internal tracks are slashed on annual basis with verge trimming and grading or re-sheeting done on a cyclical basis.

Proposed:

	PROPOSED ZONING		PROPOSED WORKS	
	A-zone	**B-zone**	**Track Upgrades**	**Fuel Reduction**
HALLETT COVE BLOCK	-	(40m minimum) along the northern boundary between the north-eastern corner of the reserve and Gate 1	Along northern boundary (Major incorporating 10m firebreak)	Remove elevated fuel and fine fuels between northern boundary and fire access track
		(40m minimum) along the eastern boundary between the north-eastern corner of the Reserve and Gate 2	Along southern boundary (Major) & realign to boundary	Ensure that any revegetation between the central track and the eastern boundary is developed as an open woodland structure with heath patches not exceeding *High* fuel loads. Selectively thin if required
			Along eastern boundary (Major incorporating 10m firebreak) & realign to boundary	
			Upgrade Waterfall Creek bridge to 5m wide and install ford across creek near the eastern boundary	
			Upgrade all other internal vehicle tracks to standard tracks	

Suppression Considerations

The geological values of the reserve are unlikely to be impacted upon negatively by fire, however every effort must be taken to ensure that geological sites are not disturbed by vehicles or earthworks. Where and when the above strategies have been implemented, the IMT should aim to contain bushfires:

- within the block, whilst minimising impacts on sedimentary geological assets within the ampitheatre area;
- using existing control lines; and
- using previously burnt areas and natural low fuel areas, such as the adjoining grassland of the western plateau.

All vehicles are to be kept out of the ampitheatre area. Hose lays may be appropriate if undertaken sensitively. The reserve is not included within the MLR Primary Response Zone for aerial suppression, however water bombers should be requested if a bushfire threatens life and property.

MARINO CONSERVATION PARK

Tenure, (Size), Land Use

Marino CP (30 ha) will be treated in its entirety as Marino Block for fire management purposes.

Vegetation

MVS No. 32

Much of Marino CP was cleared as a result of its previous land use as a recreation and plantation reserve managed by the City of Marion. The reserve also contained a former dumpsite, now filled and partly rehabilitated. Today, the reserve supports a classified remnant patch of MVS No. 32 at the western end, which is represented by a coastal shrubland. This is recognised as an important remnant along the Adelaide metropolitan coastline. The coastal shrubland community is dominated by woody species, mainly Prickly Ground Berry, Twiggy Daisy Bush and Mallee Pomaderris, but with significant numbers of Dwarf Hakea *(Hakea rugosa)*, Common Fringe-myrtle *(Calytrix tetragona)* and Dryland Tea-tree *(Melaleuca lanceolata)* as well as many herbaceous plants such as sedges, lilies, and native daisies. In the central portion of the reserve, areas have been revegetated to replicate the community represented by MVS No. 32 in Hallett Cove CP, supporting Drooping Sheoak over a low shrubland. There is some invasion by weedy grasses, but this is relatively minor. Marino CP protects the southernmost extent of the Elegant Wattle *(Acacia victoriae)* more commonly found in the Flinders Ranges (DEP, 1992).

Fire History

No records of bushfire have been recorded by DEH since 1975. Anecdotal information suggests that there has been at least one fire near the eastern boundary within the last 15 years.

Fuel Hazard

Overall *Low* in cleared and revegetated areas in the western sector. *Moderate* to *Very High* in remnant coastal shrubland patches, where the height of the elevated fuel increases and the density of near surface fuels increases.

Elevated *Low* to *Moderate* in cleared and revegetated areas in the western sector. *High* to *Very High* in the remnant coastal shrubland.

Natural Values

Fauna and flora of conservation significance that have been recorded for this block are included in Appendix 1 and 2.

Heritage Values

No heritage features have been recorded within this block.

Assets

Within Reserve Minor reserve infrastructure.

Off Reserve Significant infrastructure including the Adelaide to Noarlunga railway corridor to the west and the Marino Lighthouse and reserve managed by the Australian Maritime Safety Authority to the south. Note that communication equipment is affixed to the lighthouse. Other assets include residential

properties in the suburb of Marino to the north, a quarry to the east and agricultural/grazing land to the south.

Fire Risk

Risk of burning in a single fire event: *High*

Marino Block is at significant risk of burning in a single fire event due to its small size and its exclusion from the MLR Primary Response Zone for aerial suppression.

Fire Tracks

Major	Easement providing access to the lighthouse (extension of Nimboya Road) (un-named)
Standard	Along the southern boundary (un-named) Along the eastern boundary (un-named) Running north-south in the western heath area (un-named) Along the northern boundary (part) (un-named) Running north-south in the eastern area (extension of Nimboya Road) (un-named)
Minor	Running east-west in the western heath area (un-named) Along the lighthouse perimeter (un-named) Along the northern boundary (part) (un-named)

Specific Management Objectives for Marino Block

- Minimise the risk of the entire block burning in a single fire event.
- Minimise the likelihood of loss/damage to the lighthouse and associated assets due to direct radiation and short distance ember attack.
- Minimise the likelihood of loss/damage to the residences between Bundarra Road and Bundarra Drive, which directly abut the reserve and Sheidow Terrace from direct radiation and short distance ember attack.
- Minimise the risk of fire escaping the reserve into adjoining grazing areas.
- Ecological fire management to maintain or promote natural values of the reserve, taking into account the risk that fire may pose to the immature revegetation areas.

Recommended Works

Pre-suppression

Existing:

- Vehicular tracks slashed on annual basis with verge trimming and grading or re-sheeting done on a cyclical basis.
- 10 m wide firebreak maintained in south-eastern corner of reserve by slashing.

Proposed:

	PROPOSED ZONING		PROPOSED WORKS	
	A-zone	B-zone	Access	Fuel Reduction
MARINO BLOCK	(40m) in north–western corner	B-zone (40m) along the northern boundary (south of residences abutting the reserve)	Upgrade the north-south track in the eastern area to Major so this can be used to access the Lighthouse	Establish a 10m wide slashed area adjacent to the north-south track in the eastern area
			Upgrade the Lighthouse perimeter track to Major	Complete selective minimal manual slashing of elevated fuels in the A-zone in the north-western corner
			Upgrade part of the southern boundary track to Major	Investigate the difference between fuel reduction methods in the north-western B-zone for species regeneration purposes.
			Establish a turn-around point in the south-western corner	
			Upgrade the northern boundary track to Standard and realign this to the boundary	Manage revegetation activities, woody weed removal and spraying in the B-zone to comply with fuel levels
			Upgrade most other internal tracks to Standard where practical	
			Investigate installation of two additional emergency access gates onto private land to the south of the reserve	
			Close and rehabilitate the easement (extension of Nimboya Rd) currently providing access to the Lighthouse	

Suppression Considerations

Where and when the recommended strategies have been implemented, the IMT should aim to contain bushfires within the block using:

- existing control lines;
- previously burnt areas; and
- natural low fuel areas, such as the adjoining pastureland.

It is feasible for bushfires in this area to be suppressed by ground crews. The reserve is not included within the MLR Primary Response Zone for aerial suppression, however water bombers should be requested if a bushfire threatens life and property.

O'HALLORAN HILL RECREATION PARK

Tenure, (Size), Land Use

O'Halloran Hill RP (296 ha) including 26 ha of land supporting the Southern Expressway (that will be excised from the reserve in the future) and the adjoining DTEI land parcel at Darlington (70 ha) (currently proposed for reservation) have been separated into five blocks for fire management purposes, as described below:

Ocean Boulevard Block	(91 ha) only a few remnant patches of native vegetation exist. Rehabilitation of the remnant open grassy woodland communities near the Ridgeline Track has been carried out.
Morphett Block	(142 ha) including the DTEI land parcel, which is degraded and supports woody weeds. Within O'Halloran Hill RP, revegetation has occurred since the mid-1970s. Weed control has been undertaken, as well as the rehabilitation of the native grassland/open grassy woodland communities.
Pea Farm Block	(75 ha) long history of clearing and grazing. Target site for revegetation since the mid-1970s. As a result, the area has developed into an urban forest.
Lease Block	(7 ha) leased by the Starline Golf Driving Range. The driving range supports irrigated exotic grasses. North of the driving range there are exotic grasses and other weedy species.
Trott Block	(54 ha) minor remnant grassland patches occur along the northern boundary. The existing native vegetation is a result of revegetation. Revegetation in the north-eastern and south-western areas is now well established. The area has developed an inappropriate floristic structure due to the use of non-endemic species.

Vegetation

No mapping exists for this reserve.

After a long history of clearing and grazing, very little native vegetation remains within O'Halloran Hill RP and within the DTEI land parcel. The historical associations are considered to have been Grey Box and Drooping Sheoak woodland with patches of Mallee Box *(E. porosa)* woodland. Remnant Grey Box trees can be found throughout the reserve, along with remnant Red Gum, Peppermint Box *(E. odorata)*, Golden Wattle *(Acacia pycnantha)*, Bull Oak *(Allocasuarina luehmannii)*, species of *Melaleuca* and a number of heath species including *Grevillea* and *Hakea* (DEH, 2008d). Minor remnant native grassland patches occur along the northern boundary of Trott Block.

Revegetation has been carried out since the 1970's in Ocean Boulevard Block, Morphett Block, Trott Block and Pea Farm Block. Thousands of trees have been planted, which has resulted in the development of an urban forest dominated by non-indigenous species. Recent revegetation efforts have focussed on the central portion of the reserve, with the aim to reconstruct the historical *Eucalyptus* woodland supporting Grey Box and Drooping Sheoak.

The area supports significant woody weeds, including European Olive, Desert Ash *(Fraxinus rotundifolia),* Boneseed, Montpellier Broom *(Genista monspessulana)* and African Daisy. Species of concern are included in Appendix 1.

Fire History

Twelve fires have been recorded within the reserve since 1975. A few of the most recent incidents are described below.

- In 1990 a fire burnt 35 ha of the reserve.
- In 1995 a fire burnt 8 ha of the reserve before burning onto other land and impacting on a further 2 ha.
- In 2002 a fire burnt 1 ha of Morphett Block and was attributed to arson.
- In 2007 lightning is suspected to be the cause of a bushfire that started off-reserve and burnt 74 ha of O'Halloran Hill CP and adjacent lands, including the Southern Expressway corridor.

A further four fires have been recorded as occurring in close proximity to the reserve since 1975 with the most recent in 2007. This fire was about 7 ha in size and occurred south of the reserve off Majors Road, on private property. The cause of this fire is thought to be due to a slasher.

Fuel Hazard

Taken from 2005 fuel sampling data

Overall *Moderate* to *High* across the majority of the reserve, however sections have been classified as *Low* and as *Very High*. *Moderate* to *High* in the moister gullies supporting a weedy understorey and in woodland or grassland areas also with a weedy understorey, including species of Wild Oats (e.g. *Avena barbata)*. *Low* across the northern slopes, in the areas surrounding leased assets and within the DTEI land parcel. *Very High* in areas of dense Phalaris and in areas with older stands of planted Eucalypt species.

Natural Values

O'Halloran Hill RP is part of the Metropolitan Open Space System and a key component of the Marion South 'Greenbelt'. No nationally significant or state rated species of flora or fauna occur within the reserve. Significant revegetation exists in the central portion of the reserve.

Heritage Values

No indigenous heritage sites or objects are listed for this reserve (DEH, 2008d). Within Pea Farm Block, non-indigenous heritage assets include the Pea Farm ruins (adjacent Main South Road in the south-eastern corner of the block), a Bluestone Quarry (north of the Pea Farm ruins) and a Bluestone Cottage and outbuildings (off Majors Road) (DEH, 2008d). The Pea Farm ruins are listed on the Local Heritage Register managed by the City of Marion.

Assets

FIRE MANAGEMENT BLOCKS	Within Reserve		Off-Reserve			
	Other	Leased Assets	Residential Assets	Significant Infrastructure	Community Assets	Other
OCEAN BOULEVARD	Fencing and directional signs	Sturt Pistol Club (4ha) minor buildings, carparking and other minor facilities (such as targets).	Along the northern boundary, directly adjoining the reserve	Linwood Quarries		To the west is an transitional area (from agriculture to suburban residential and light industry development)
	Large, high voltage powerlines and water mains along the old Morphett Rd corridor.	Southern Field Archery Club (10ha) minor buildings, carparking and other minor facilities	Seaview Downs (downslope)			Golf Park Reserve to the north
MORPHETT	Minor park infrastructure		Seacombe Heights and Darlington surround the block	Southern Expressway corridor to the east	Glenthorne Farm to the south, (managed by Adelaide University)	Roy Lander and Vista Street Reserve adjoining to the north-west
	Powerlines and water mains along the old Morphett Rd corridor.					
PEA FARM	Historic Pea Farm Ruins	Bluestone cottage residence and land (5ha)	Proposed Darlington housing will directly abut the reserve	Happy Valley Reservoir (SA Water land) to the south east	Onkaparinga Institute of TAFE complex to the east	
		Horse agistment area leased by Riding for the Disabled (6ha)	Flagstaff Pines to the west, separated by South Road and agricultural land	Southern Expressway corridor to the west	Glenthorne Farm to the south, separated by Majors Road	
					MFS Fire Station on Majors Road	
LEASE		Starline Golf Driving Range (5ha), associated buildings, carparking, driving range and fencing			Glenthorne Farm to the south	
					Onkaparinga TAFE to the west	
TROTT PARK	Fencing and minor park entrance signs	Holdfast Model Aircraft Club (6ha)	Low density residential land and agricultural land to the south		MFS Fire Station on Majors Road	Klippel Avenue and Aroona Road City of Marion Reserves
	Significant immature revegetation planted in 2003 exists throughout the block	Radio tower (20m^2), south of Majors Road	Residences and agricultural assets to the west, off Perry Barr Rd		Glenthorne Farm to the east, separated by Morphett Road	Grazing land and agistment areas south of the block
			Trott Park along Tyson Avenue			

Fire Risk

Risk of burning in a single fire event: *Low*

The likelihood of O'Halloran Hill RP and the adjacent DTEI land parcel burning in a single fire event is considered *Unlikely* as the reserved area is primarily grassland and historically there has been a low occurrence of fire.

Fire Tracks (GAFLC classifications)

Major Morphett Road Track
Providing access to Starline Driving Range (un-named)

Standard Providing access under the expressway (un-named)
Bicycle veloway (running either side of the Southern Expressway)
Running east-west across Morphett Block (un-named)
Running east-west behind Pea Farm Block lease (un-named)
Running north-south behind Pea Farm Block lease (un-named)
Around the boundary of Trott Block, besides lease area (un-named)
Providing access to Trott Block lease assets (un-named)
Providing access to Ocean Boulevard Block lease assets (part) (un-named)
Along southern and western boundary of Ocean Boulevard Block (part) (un-named)

Minor Two tracks running east-west across Pea Farm Block (un-named)
Five tracks within Morphett Block (un-named)
Within horse agistment lease running north-west (un-named)
Around the boundary of Trott Block lease assets (un-named)
Providing access to Ocean Boulevard Block lease assets (part) (un-named)
Along southern and western boundary of Ocean Boulevard Block (part) (un-named)
Running east-west across the ridgeline in northern section of Ocean Boulevard Block (un-named)
Along the northern boundary of Ocean Boulevard Block (un-named)

Specific Management Objectives for O'Halloran Hill RP and DTEI land parcel

- Provide track and control line network to minimise the risk of a fire escaping the reserved area or a bushfire burning the entire reserved area in a single event.
- Reduce the likelihood of fire escaping the reserved area and impacting upon assets, which adjoin or are located within close proximity to the reserved area, including:
    - residential assets within the suburbs of Trott Park, Darlington, Seaview Downs, Seacombe Heights, Seacliff Park, Darlington and Flagstaff Pines;
    - agricultural land and assets;
    - infrastructure such as the Happy Valley Reservoir;
    - City of Marion reserves within Trott Park; and
    - community assets such as the Glenthorne Farm establishment, Onkaparinga TAFE or the O'Halloran Hill MFS Fire Station.
- Reduce the likelihood of fire escaping a block and impacting upon adjoining blocks.
- Reduce the likelihood of spotting across major adjoining roads and lease areas.
- Reduce the likelihood of fires impacting on assets located within the reserved area, including:
    - lease assets such as those associated with the Southern Field Archery Club, Sturt Pistol Club, Starline Golf Driving Range, Radio Tower, Holdfast Model Aircraft Club or the Bluestone Cottage and horse agistment area.
    - infrastructure such as the radio tower in Trott Block and the water pipeline on the eastern boundary of Pea Farm Block;
    - natural assets including the immature revegetation area within Trott Block; and
    - historical Pea Farm ruins.
- Ecological fire management to maintain or promote natural values of the reserve and as part of an integrated weed management strategy, taking into account the risk that fire may pose to the immature revegetation areas.

Recommended Works

Pre-suppression

Existing:

- All internal tracks are slashed on annual basis with verge trimming and grading or re-sheeting done on a cyclical basis.
- 10 m firebreak maintained around the Bluestone Quarry and Pea Farm ruins through slashing.
- Lessees undertake building maintenance and protection strategies to reduce fire threat to assets.
- Lessees maintain *Low* fuel levels within lease areas through slashing and/or mowing.

Proposed:

Refer to the summary on the following page.

Suppression Considerations

Where and when the above strategies have been implemented, the IMT should aim to:

- contain bushfires within the block;
- minimise the likelihood of fires burning a block and escaping into another block and/or escaping the reserved area into surrounding landscape;
- use previously burnt areas, moister gullies and natural low fuel areas to support fire suppression activities; and
- contain bushfires by using surrounding road networks, control lines, and natural low fuel areas such as irrigated and hardened surface areas.

The reserve is not included within the MLR Primary Response Zone for aerial suppression, however water bombers should be requested if a bushfire threatens life and property.

Proposed:

		PROPOSED ZONING		PROPOSED WORKS		
		A-zone	B-zone	Track Upgrades	Selective Thinning of Vegetation	Fuel Reduction
FIRE MANAGEMENT BLOCKS	OCEAN BOULEVARD	(40m) around the lease assets (to be maintained by lessee).	(40m minimum) along the northern boundary.	Along southern, northern and western boundary (standard)	Along all boundary tracks.	10m wide firebreak along the ridgeline track.
				Along the ridgeline between Ridgefield Avenue and Morphett Road Track (standard)	Restrict revegetation to canopy species planted greater than 20m from tracks whereas native grass or shrub species may be developed closer to the tracks.	20m wide firebreak along Morphett Road Track.
				Morphett Road Track (major)		
				Tracks providing access to lease assets (major)		
	MORPHETT		(60m minimum) along north western boundary and adjacent to Morphett Road Track (part),	Establish around boundary of TSA land parcel and name as Alpine Track (major)		10m wide firebreak along the bicycle veloway and newly established North and Alpine Tracks.
				Establish between boundary track and existing track network and names as North Track (major)		
				Cycling track on DEH land (major)		
				Install vehicle access gates off Alpine Road, Bede Steet and Ridgecrest Avenue.		
	TROTT	(40m) along southern boundary (western section).	(40m) along southern boundary (eastern section).	10m wide firebreak to be maintained along the southern boundary track.	Where existing revegetation areas have *Very High* fuel loads or above.	10m wide firebreak in the A- and B-zones along the southern boundary track.
		(40m) All of the southern narrow extension.			As required within southern boundary A-zone.	Within southern boundary A-zone control Phalaris and Wild Oats within revegetation areas, or undertake fuel reduction burning to reduce fine fuels.
		(40m minimum) Entire leased area (to be maintained by the lessee).				
	PEA FARM	(40m) around Pea Farm ruins through slashing,	(100m) around A-zone and Pea Farm ruins,	Along eastern block boundary (major incorporating 15m wide firebreak)		15m wide firebreak along newly established major track.
		(40m) around the lease assets (to be maintained by the lessee) ,		Install gate and develop access to the Pea Farm ruins (major incorporating a 10m wide firebreak)		10m wide firebreak along the internal track running along the boundary.
				Maintain a 10m wide slashed track along the southern boundary of the leased area		Lessee to maintain lease area with fuel levels at *Moderate* or below with grazing, clearing fallen vegetation and woody weed control.
						10m wide slashed access track along southern boundary of the leased area.
	LEASE	(40m) around the built assets through slashing and mowing (to be maintained by the lessee).				Lessee to undertake effective weed control within undeveloped section of the lease block to ensure fuel loads do not exceed *High* within 40m of the northern lease boundary.
						Lessee to maintain *Low* fuel levels within carpark facility around the assets.

SHEPHERDS HILL RECREATION PARK

Tenure, (Size), Land Use

Shepherds Hill RP (77 ha) will be treated in its entirety as Shepherds Hill Block for fire management purposes. Two small recreational leases are held by the Marion Pony Club and the Eden Field Archery Club.

Vegetation

MVS No. 9

Steeper areas of the reserve protect remnant patches of Grey Box woodland. Less than 44 hectares of this woodland over exotic shrubs and herbs are preserved within the reserve. The woodland remnant has been severely degraded by weed invasion, but is gradually being restored. Stands of River Red Gum occur throughout the riparian zone of Walkers and Wattiparringga Creeks. The understorey in this area is dominated by Blackwood *(Acacia melanoxylon)* over tussock grasses. Cleared areas of the reserve are dominated by Olives over exotic grasses.

Shepherds Hill RP adjoins other reserves that protect remnant vegetation, including Watiparinga Reserve to the east managed by the National Trust and three reserves managed by the City of Mitcham: Ellis Reserve to the south, Saddle Hill Reserve to the north and Sleeps Hill Reserve to the north-east.

Fire History

Thirty-three fires have been recorded within and in close proximity to the reserve since 1975. A significant portion of these fires was attributed to or was suspected to have occurred as a result of human causes. In 1989 DEH conducted prescribed burning for habitat management within the reserve. The largest bushfire recorded by DEH occurred in 1990 and started within the reserve, burning into other land. This fire burnt 7 ha of the reserve and 3 ha of other land. Since 2002, six small fires have occurred, predominantly in the north-western sector of the reserve and in adjacent land. Five of these fires have been attributed to arson with four of these fires occurring over a two day period in 2004.

Fuel Hazard

Overall *Moderate* on the steep northern, southern and north-eastern aspects, except in patches of dense Olive, Phalaris and/or Kangaroo Thorn where fuel loads were assessed as *High* to *Very High. Low* in grazed and cleared areas.

Elevated *High* on the steep northern, southern and north-eastern aspects. *Moderate* to *Very High* in areas of Olive, Phalaris and/or Kangaroo Thorn.

Natural Values

The reserve contains less than 44 ha of remnant Grey Box woodland (Turner, 2001). The adjoining Watiparinga Reserve also protects remnant Grey Box Woodland with 28 ha recorded (Robertson, 1999). Significant old-growth Grey Box and River Red Gums survive in the riparian zone. No nationally significant species have been recorded within this reserve, however the area is known to support four flora and two fauna species of state conservation significance. Fauna and flora of conservation significance recorded for this reserve are included in Appendix 1 and 2.

Heritage Values

Numerous historical features relating to the early European occupation of the area have been noted throughout the reserve and also within the adjoining Saddle Hill Reserve. These include heritage trees, a ha-ha (a ditch acting as a boundary fence) and associated plants of the genus *Aloe*, a minor Sugar Gum *(Eucalyptus cladocalyx)* plantation, a bricked wall, stone ruins, a quarry and a sandpit. Several trees located on Ayliffes Road adjacent to the reserve show evidence of indigenous occupation, as footholds carved to assist in climbing have been identified (DEH, 2008b). There are no State Heritage Places or Sites recorded for this reserve (DEH, 2008b).

Assets

Within Reserve Minor buildings associated with the two recreational leases (Marion Pony Club and Eden Field Archers Club) and minor reserve infrastructure.

Off Reserve Significant built assets, such as the surrounding residential properties in Eden Hills, the three City of Mitcham Reserves, the National Trust reserve to the east, railway corridor to the south-east and the Women's Memorial Playing Field to the west (on the corner of Ayliffes Road and Shepherds Hill Road).

Fire Risk

Risk of burning in a single fire event: *Low*

The likelihood of a fire starting due to human caused ignitions and lightning was assessed as *Unlikely*. However the reserve is characterised by a *Moderate* to *High* overall fuel hazard and falls within the MLR Primary Response Zone for aerial suppression, which reduces the threat of the whole reserve burning in a single fire event.

Risk of visitor injury/death: *Moderate/High*

The likelihood of a fire causing injury or death in Shepherds Hill Block is *Rare* due to the size of the reserve and the availability of escape routes into the urban fringe.

Fire Tracks (GAFLC classification)

Major	Ridge Track (part)
	Gloucester Avenue Track
Standard	Ridge Track (part)
	Danthonia Track
	Viaduct Track (part)
	Extension of Redgum Drive (through Saddle Hill Reserve) (un-named)
	Boundary Track (eastern boundary)
	Graske Road Track
Minor	Viaduct Track (part)
	Boundary Track (southern boundary)
	Running east-west in the southeastern section of the block (un-named)
	Walkers Creek Track (except for the Walkers Creek crossing section)
	Ridge Track (part)
	Extension of Ward Avenue (un-named)

Specific Management Objectives for Shepherds Hill Block

- Minimise the risk of a fire burning the entire block in a single fire event.
- Reduce the likelihood of fire impacting lessee assets associated with exposure to radiant heat or ember attack.

- Minimise the likelihood of fire burning towards and threatening the adjoining residential assets within Eden Hills.
- Minimise impact to these residential assets from exposure to radiant heat and/or short distance ember attack.
- Minimise the likelihood of fire escaping into the neighbouring Watiparinga Reserve, east of Shepherds Hill RP or into any of the City of Mitcham reserves.
- Ecological fire management to maintain and promote the natural values of the reserve and as part of an integrated weed management strategy.

Recommended Works

Pre-suppression

Existing:

- All internal tracks are slashed annually with verge trimming and grading implemented as required.
- Lessees are required to carry out adequate building maintenance and strategies to reduce fire threat.
- 10 m slash zone is maintained along Ridge Track.

Proposed:

	PROPOSED ZONING		PROPOSED WORKS	
	A-zone	**B-zone**	**Track Upgrades**	**Fuel Reduction**
SHEPHERDS HILL BLOCK	(40m) to assist in the protection of the lease assets.	(100m minimum) in the south-western sector of the reserve.	Upgrade Ridge Track east of Boundary Track to a Major Track and the rest to a Standard Track	Establish 10m wide firebreak behind the residences off Springwood Close, Hillcrest Drive and Depindo Avenue.
	(40m minimum) along the southern and the south-eastern boundary of the reserve.	(100m) along the eastern boundary.	Upgrade Boundary Track including the City of Mitcham section to a Standard Track	Lessee to undertake woody weed control and other elevated fuels in Walkers and Watitparringga Creeks.
		(100m minimum) along the western boundary.	Upgrade Walkers Creek Track to a Standard Track	Woody weed, Phalaris and exotic grass control in the B-zones, in conjunction with fuel reduction burning as required, to maintain fuels at *High* or below.
	(40m) along the boundary south of the Marion Pony Club		Upgrade the extension of Ward Avenue to a Standard Track	
			Establish a new Standard Track along western boundary between Walkers Creek &	Woody weed and exotic grass control in the A-zone along the southern and south-eastern boundary, in conjunction with fuel reduction burning as required, to maintain fuels at *Moderate* or below.
	(10m - 40m) in the north-western corner		Upgrade Viaduct Track between Ridge Track intersections to a Standard Track & beyond Ridge Trackto a Minor Track. Provide a turnaround point within Watiparinga Reserve	
	(25 - 40m) in the north-eastern corner		Establish a new Standard Track between Graske Grove Track & Danthonia Track	

Suppression Considerations

Where and when the recommended strategies have been implemented, the IMT should aim to contain bushfires:

- within the reserve, or from burning toward and threatening the adjoining Watiparinga Reserve and other assets; and
- using existing control lines, previously burnt areas and natural low fuel areas.

It is feasible for bushfires in this area to be suppressed by direct attack through aerial and ground support. The use of earthmoving equipment should not be necessary in this reserve.

STURT GORGE RECREATION PARK

Tenure, (Size), Land Use

Sturt Gorge RP (244 ha) and the Craigburn Farm land (189 ha) that is proposed for reservation have been separated into seven blocks for fire management purposes:

Tillite Block (32 ha) Very steep terrain with various aspects, rocky outcrops and cliffs. Bisected by the Sturt River and previously grazed. Extensive revegetation has been carried out.

Gorelon Block (53 ha) Steep terrain and is bounded by residential ridgeline development on all but the northern side. Includes Renwick Street Reserve (City of Onkaparinga)

Gorge Block (62 ha) Covers the central portion of the reserve. Significant work has been done to control woody weed species in this block.

Bushland Block (47 ha) Apart from the riparian environment, the natural area has good diversity but poor integrity (e.g. limited extent, distribution and condition).

SA Water Block (16 ha) Apart from the riparian environment, the natural area has reasonable diversity but poor integrity. Significant woody weed control has been carried out.

Flagstaff Block (71 ha) Very high diversity and integrity compared to the rest of the reserve. Southern Cypress Pine (*Callitris gracilis*), a fire sensitive species is present. Includes reserve on Lilford Way to the west and reserve on York Drive to the south (City of Onkaparinga).

Craigburn Block (152 ha) Including the Craigburn Farm land. Composed of exotic pasture grasses with some remnant vegetation in the creek lines, steeper areas and on the eastern boundary. No regeneration apparent due to grazing.

Vegetation

MVS No. 9

The reserve and adjacent unreserved land supports *Eucalyptus* woodland with a grassy understorey. This is represented by degraded Grey Box woodland in the steeper areas and degraded River Red Gum woodland with an exotic grassy understorey in the riparian zone. Remnant Drooping Sheoak woodland exists in patches across the reserve. Craigburn Block is essentially grazed pastureland, however some old-growth Eucalypt species occur at the eastern end. Much of the vegetation that exists throughout the reserve is highly modified and invaded by Olives however remnant understorey species can still be found in these areas.

Fire History

Prior to the dedication of Sturt Gorge RP in 1973, numerous minor bushfires were recorded annually during the fire season, with the majority of these occurring at the western end of the reserve. Since the dedication of the reserve, 44 fires have been recorded by DEH within or in close proximity to the reserve. In 2002, a 5 ha bushfire occurred in Tillite Block and in 2004 a fire of less than 1 ha occurred in Bushland Block as a result of arson. Since 2004 two bushfires, each less than 1 ha in size occurred within Flagstaff Block.

Recently DEH has implemented prescribed burning throughout the reserve, including:

- 8.7 ha along the northern boundary of Bushland Block in 2005;
- 1.25 ha at the eastern end of Craigburn Block in 2005;
- two burns of 12 ha in total, off the south-western boundary of Flagstaff Block in 2004;
- two burns of 3.4 ha in total for asset protection off the south-western boundary of Flagstaff Block in 2004;
- two burns of 4.8 ha in total in the western section of Tillite Block in 2003; and
- 1.2 ha burn in the western section of Gorelon Block in 2003.

Detailed fire history is not available for Craigburn and SA Water Blocks, as they largely occur on unreserved land.

Fuel Hazard

Overall Ranging from *High* to *Very High* in the gullies, open and natural bushland areas depending on the level of exotic grasses, Kangaroo Thorn and Olive. *Moderate* across the steeper slopes and *Low* in areas that have been recently grazed, slashed or burnt. Generally, there is a lower overall fuel hazard in the western sector of the reserve as it is characterised by variable aspects.

Elevated *Moderate* in natural bushland areas as well as in areas of grassland dominated by exotic woody weeds such as Olives. *Extreme* bark fuels, particularly in areas dominated by Grey Box.

Natural Values

Nine flora and three fauna species of state conservation significance occur within Sturt Gorge RP, however no nationally significant species have been recorded. Flagstaff Block supports four *Rare* state listed species; Gorge Block supports four *Vulnerable* and nine *Rare* state listed species and Bushland Block supports two state listed species. Approximately 48 ha of Grey Box woodland occurs throughout the reserve, although much of this exists in a degraded form (Armstrong*, et al.*, 2003; Turner, 2001). Flora and fauna of conservation significance are included in Appendix 1 and 2.

The Sturt River and the associated watershed are important components of the Patawalonga Catchment area. The Sturt River area is geologically significant with exposures of Sturt Tillite occurring throughout the reserve. These geological features are listed on the State Heritage Register and considered a *Geological Monument* by the Geological Society of Australia (DEH (Cwlth), 2006).

Heritage Values

No indigenous heritage sites or objects are listed for this reserve (DEH, 2008c). The Warriparinga area, which is downstream of Sturt Gorge RP, is of spiritual significance to the Kaurna people, as it is linked with the Tjirbruki Dreaming (DEH, 2008c). Two sites with non-indigenous heritage values are located within Bushland Block; these are a small ruin and a roadway pavement. Two historic mine shafts exist in the western portion of the reserve, one was used to source silver, zinc and lead and the other to source copper and lead (Quarmby, 2003). Other objects of interest that have been noted by Flinders University throughout the reserve and include old trails, possible habitation sites, remains of shell holes, wire entanglements and trenches of military origin (DEH, 2008c).

Assets

FIRE MANAGEMENT BLOCKS	Within Reserve	Off-Reserve			
		Residential Assets	Significant Infrastructure	Significant Community Assets	Natural Assets
TILLITE	Minor reserve infra-structure	Flagstaff Hill to the east (especially Warri Parri Drive and Bellavista Road) Bedford Park to the northwest		Finders University and Medical Centre to the north Sturt River Caravan Park to the northwest	
GORELON	Minor reserve infra-structure	Flagstaff Hill on all but the northern boundary	Happy Valley Reservoir & an ETSA substation (south of Black Road)	Renwick Street Kindergarten	Renwick Street Reserve
GORGE	Minor reserve infra-structure	Bellevue Heights to the north (Eve Road, Gorge Road and Federation Court directly adjoin the reserve) Flagstaff Hill to the south		Resthaven Retirement Village and Bellevue Residential Care to the north	
BUSHLAND		Bellevue Heights to the east and north (especially Gorge Road and 1 residence on Bushland Drive)	Infrastructure associated with the dam on SA Water land to the south of the block	Bellevue Heights Primary School to the north and Blackwood High School to the north-east.	Blackwood Hill Reserve, managed by the City of Mitcham to the east and Mountbatten Reserve to the north.
SA WATER	41 foot high concrete arching mitigation dam wall				
FLAGSTAFF	Flagstaff Hill Scout Hall and associated buildings off Yorke Drive and other minor park infrastructure	Flagstaff Hill (including those along York Drive, Lilford Way, Catharina Street and Broadmeadow Drive directly adjoining the reserve)	Dam on SA Water land to the northeast of the block	Flagstaff Hill Junior and Primary School to the south Flagstaff Oval Kindergarten to the south (York Drive) Flagstaff Hill Recreation Ground to the south	Reserves adjacent to Lilford Way and York Drive, managed by the City of Onkaparinga
CRAIGBURN		To the east off Coromandel Parade, Protea Avenue and Craiglee Drive in Coromandel Valley. Directly above and south of the Sturt River Valley within Flagstaff Hill. Along Kingfisher Circuit, Ironbark Avenue, Sandlewood Court, Glendale Avenue and Riverglen Place in Flagstaff Hill To the east in Craigburn Farm and Blackwood Park.		Minda Inc.'s Riding for the Disabled infrastructure, which is located on the eastern boundary, St Peter's Lutheran and St Stephen's Primary Schools to the north-east.	Blackwood Hill Reserve, managed by the City of Mitcham to the north of Craigburn Road.

Fire Risk

Risk of burning in a single fire event: *Moderate*

The likelihood of Sturt Gorge RP burning in a single fire event was assessed as *Rare.* Historically there has only been a low occurrence of fire. The reserve lies within the MLR Primary Response Zone for aerial suppression; therefore it is likely that most bushfires would be controlled before the entire reserve is burnt. The western end has a lower overall fuel hazard; the risk of fire ignition in Tillite Block was assessed as *Moderate,* whereas the risk of fire ignition in Craigburn Block was assessed as *Very High* in the gullies.

Risk of visitor injury/death: *Moderate/High*

Due to the number of escape routes it is considered *Rare* that a visitor would be harmed.

Fire Tracks (GAFLC classification)

Major	SA Water access track (locked extension of Craigburn Road) (un-named)
	Starlight Track
	Providing access from gate 7 to Wittowirra Track (un-named)
	Vincent Track
Standard	Ctenotus Track (part)
	Gorelon Track (part)
	Makkibirra Track
	Tillite Track (part)
	SA Water access track off Craigburn Road (un-named)
	Along the southern Bushland Block boundary (un-named)
	Wittowirra Track
Minor	Ctenotus Track (part)
	Gorelon Track (part)
	Kurrakilla Track
	Lovely Valley Track
	Tillite Track (part)
	Turta Track
	SA Water access track to wetland area (un-named)
	Extension of private road off York Drive (un-named)

Specific Management Objectives for Sturt Gorge RP

- Minimise the likelihood of a fire escaping Sturt Gorge RP or the adjoining Craigburn Farm land and impacting upon assets which adjoin or are located within close proximity to the reserved area, including:
    - residential properties within the suburbs of Flagstaff Hill, Bellevue Heights, Bedford Park, Craigburn Farm land, Coromandel Valley, Blackwood and Blackwood Park;
    - significant community assets such as Renwick Street Kindergarten, Flinders University, Flagstaff Hill Junior and Primary School, Sturt River Caravan Park, Bellevue Residential Care and Resthaven;
    - agricultural land;
    - Minda Inc. land to the east;
    - the City of Mitcham reserves adjoining Bushland Block; and
    - significant infrastructure including the ETSA substation on Blacks Road and Happy Valley Reservoir.
- Minimise the likelihood of fires impacting on assets located within the reserve, including:
    - Flagstaff Hill Scout Hall and associated assets;
    - SA Water Block infrastructure associated with the dam; and
    - natural or geological assets.
- Minimise the risk of a fire burning the entire reserved area in a single fire event.
- Ecological fire management:
    - to maintain and promote the natural values of the reserve;
    - for species regeneration purposes;
    - to support a weed management strategies; and
    - taking into account the risk that fire may pose to the immature revegetation areas.

Recommended Works

Pre-suppression

Existing:

- Most internal tracks are slashed annually with verge trimming and grading or re-sheeting implemented on a cyclical basis.
- An 8 m wide fuel reduced zone is maintained with verge mowing along the edges of the easement (including track) in Gorelon Block.
- A 20 m wide firebreak is maintained with slashing behind residents on Gorelon Drive.
- 10 m wide firebreak maintained in south-western corner of the reserve by slashing.

Proposed:

Refer to the summary on the following pages.

Suppression Considerations

Further to the general suppression considerations detailed in Section 9.4, suppression planning should consider:

- containing bushfires within the reserve;
- minimising the likelihood of bushfires burning towards and threatening adjacent native vegetation, or assets;
- using previously burnt areas, moister gullies and natural low fuel areas to support fire suppression activities;
- using the surrounding road network as control lines;
- ensuring that geological sites are not impacted upon by suppression operations (i.e. heavy machinery); and
- protection of water quality during fire suppression activities.

It is feasible for bushfires to be suppressed by direct attack with air and ground support in the less steep and lower fuel areas of the reserve.

		PROPOSED ZONING		PROPOSED WORKS		
		A-zone	B-zone	Access	Selective Thinning of Vegetation	Fuel Reduction
FIRE MANAGEMENT BLOCKS	TILLITE	(40m) along western boundary and adjacent to residential asset on The Boulevard.	(150m minimum) to deepen the western boundary A-zone	Upgrade Tillite Track west of Ctenotus Track (standard)	10m wide along Ctenotus Track and Tillite Track (between the ford and Bonneyview Road)	30m strip burn to maintain fuel loads at *Moderate* or below
			(40m) along northern and eastern boundary	Upgrade Turta Track easement to a Standard Track		
	GORELON	(40m) along southwestern boundary between Warri Parri and Gorelon Drive	(200m minimum) covering the rest of the block	Upgrade Lovely Valley Track to a Standard Track	Thin vegetation, control weeds and remove elevated fuels to establish a 10m wide fire break behind residents along Katherine and Elura Courts	Slash or spray exotic grass strip along Bonneyview Road to a width of 10m
				Upgrade Gorelon Track to a Standard Track		
		(40m minimum) Renwick Street Reserve		Upgrade tracks within Renwick Street Reserve to a Standard Track	Within revegetation zones to provide a 10m wide fire break along the lengths of Starlight and Vincent Tracks	
	GORGE	(40m) along parts of the northern boundary	(40m) along southern and northern boundary of block	Upgrade track running from Gate 3 in the north, to link with the existing fire track behind Resthaven to a Standard Track	10m wide fuel reduced zone between Gate 3 and Gorge Road behind residences, by undertaking woody weed control, slashing and selective removal of elevated and fine fuels within zone.	
		(80m) adjacent to Resthaven Aged Care Facility at Bellevue Heights along the northern boundary	(40m) to buffer the 80m A-zone adjacent to Resthaven	Upgrade track running between the City of Mitcham Reserve off Eve Road and Gorge Road to a Standard Track		
			(40m minimum) along eastern and part of western block boundary			
	BUSH-LAND	(40m) adjacent to residential properties off Bushland Drive / Mountbatten Road	(80m minimum) north of Magpie Creek to northern boundary	Upgrade Kurrakilla Track to a Standard Track		20m wide along the eastern boundary of the proposed revegetation zone of the block.
			(150m minimum) along the southern block boundary	Upgrade the external track along the eastern boundary to a Standard Track		

FIRE MANAGEMENT BLOCKS	PROPOSED ZONING		PROPOSED WORKS		
	A-zone	B-zone	Access	Selective Thinning of Vegetation	Fuel Reduction
SA WATER		(200m minimum) east of the existing access track and dam wall	Minor track to the wetland area (standard)		Widen vegetation clearance along the dam service tracks to 8 m, both sides of Sturt River
			Service tracks to the dam wall (standard)		
FLAGSTAFF	(40m) along the western and southern boundaries	(70m minimum) to deepen the western boundary A-zone	Upgrade Minno Track and Witowirra Track to Standard Tracks	Establish 10m wide firebreak off newly established minor track (off York Drive).	Implement A-zone along the southern and western boundary by undertaking weed control in conjunction with prescribed burning to maintain fuels at *Moderate* or below.
	(40m) around Flagstaff Hill Scout Hall and associated buildings (lessee to maintain areas inside lease area)	(40m minimum) to deepen the southern boundary A-zone	Establish a new Minor Track behind residences off York Drive		
		(40m minimum) along the northern boundary adjacent to SA Water Block	Upgrade Marriyerti and Mari Tracks to Minor Tracks		10m wide fuel reduction zone along (and including) the western portion of Witowirra Track.
CRAIGBURN	(40m) along section of the eastern boundary near Craiglee Drive	(200m minimum) along entire eastern boundary	Upgrade track in the B-zone and track in the A-zone along the eastern boundary to a Standard Track		Maintain low fuel conditions in B-zone with grazing, slashing, woody weed control and/or recreational facility development
	(40 - 100m) along section of the eastern boundary near Fergusson Avenue extension	(40m minimum) along boundary of Bushland Block	Develop ford across Sturt River to link Craigburn Road and York Drive		20m wide firebreak along SA water access track from the SA Water boundary to Craigburn Road.
			Upgrade Woodcutters Track to a Standard Track		20m wide slashed zone along the eastern boundary beside the recommended standard track in the B-zone
			Upgrade track between Craigburn Road to York Drive to a Major Track and two tracks along the two primary ridgelines off the Craigburn Road extension track to Major Tracks		
			Maintain access to Craigburn Dam to ensure the water can be sourced during fire suppression operations		10-30m wide firebreak adjacent to recommended Major Track from Craigburn Road to York Drive.

12 RECOMMENDATIONS

TABLE 4 – SUMMARY OF MANAGEMENT STRATEGIES

Management Strategies	
Land Use	1. Implement fuel management strategies on DEH managed lands to minimise the risk to life, property and the environment (refer to Section 11 (Fire Management Blocks) and Map 3 (Fire Management and Access) for further information).
Built Assets	2. Implement fuel management strategies appropriate to asset protection (refer to Section 11 (Fire Management Blocks) and Map 3 (Fire Management and Access) for further information).
	3. Encourage volunteer participation in undertaking approved fuel reduction activities.
Visitor Use	4. Implement fuel management strategies appropriate to visitor safety (refer to Section 11 (Fire Management Blocks) and Map 3 (Fire Management and Access) for further information).
	5. Consider reserve closures on extreme fire weather days to ensure visitor safety (at the discretion of the Director National Parks).
Heritage Values	6. Implement fuel management strategies for the protection of heritage values where practicable (refer to Section 11 (Fire Management Blocks) and Map 3 (Fire Management and Access) for further information).
	7. Ensure liaison at bushfires occurs to identify heritage values, where time allows. Once the fire has passed evaluate sites to establish if any damage has occurred.
	8. Ensure suppression strategies take into account significant historical sites in order to minimise impacts from these activities and undertake post-fire rehabilitation.
Grey Box Woodlands	9. Refer to ecological fire management guidelines for ecological communities of conservation significance when implementing prescribed burns and aim to manage within these guidelines. Refer to Appendix 3 for further information.
	10. Avoid burning large continuous remnants of Grey Box woodland in their entirety during a single fire event, instead aim to increase patchiness within the remnants.
	11. Implement ecological/experimental burns as part of an integrated weed management strategy in order to reduce the abundance of environmental weeds posing a threat to the integrity of Grey Box woodland.
	12. Determine the response of the community to different disturbance regimes through the application of ecological/experimental burns.

Management Strategies

Weeds	13. Refer to Ecological Fire Management Guidelines (Table 2 - Section 7.3) and fire management guidelines for introduced flora species (Appendix 1) during prescribed burn planning.
	14. Consider the use of fire as part of an integrated weed management strategy.
	15. Conduct post-fire weed control subject to regional priorities.
	16. Identify the potential impact of weed species prior to any prescribed burn in prescribed burn panning, as part of the EAT. This will identify any priority weed species and recommend post-fire actions to mitigate the impact of weeds.
	17. Monitor weeds pre- and post-fire to determine what post-fire weed control is required and its effectiveness.
	18. Ensure hygiene practices are implemented to reduce weed spread across the plan area.
Pest Animals	19. Collect relevant information in prescribed burn planning as part of the EAT on pest animals, to determine appropriate management post-fire.
Phytophthora	20. Ensure the *Standard Operating Procedure – Phytophthora Threat Management* (SOP-002) (DEH, 2002a) is adhered to in Phytophthora risk areas, which includes all the reserves in the plan area.
	21. Ensure hygiene practices are implemented to reduce the spread of Phytophthora across the plan area. Refer to the *DEH Operating Procedure - Phytophthora Vehicle Disinfection Units* (DEH, 2003).
Monitoring	22. Investigate the fuel accumulation rates of the various MVS that occur within the plan area. These data will help DEH staff determine if and when fuel reduction works are required, ultimately assisting in the scheduling of operational works and activities in B-zones.
	23. Assess the suitability of the proposed weed management guidelines for the control of introduced species flowing fire, including Olive, Dog Rose, Bridal Creeper, Boneseed, Salvation Jane, African Boxthorn, Horehound, Blackberry and African Daisy (Appendix 1).

Management Strategies

Research

24. Investigate the suitability of the Ecological Fire Management Guidelines for MVS through the assessment of historical fire regimes in similar communities across the state (Table 2).

25. Explore the response of Rock Logania to fire within Sturt Gorge RP and use this information to update the Ecological Fire Management Guidelines (Appendix 2).

26. Determine suitable fire regimes for the management of Grey Box woodland and use this information to update the Ecological Fire Management Guidelines (Appendix 3).

12.1 Recommended Works for Fire Management Blocks

A works schedule is being developed in tandem with this plan, to include the recommendations that were derived from the fire management planning process. The works schedule incorporates the suggested priority ratings and provides more detail regarding the specifics of track upgrades, fuel reduction works and prescribed burns. From the proposed works schedule, an annual works program will be developed and implemented by the Adelaide Region. Individual burn plans, incorporating the EAT will be produced prior to the implementation of any prescribed burn. Post-fire assessments will be conducted and used as a basis for performance reporting against objectives.

The following table provides a summary of the recommendations from Section 11 that are to be undertaken within fire management blocks, along with a priority rating for each activity (Table 5). The priority rating provides an indication only of the recommendations that should be implemented in the coming years. This is not intended to restrict the timing or dictate the order of implementation, as this will be defined within the works schedule prepared by Adelaide Region. Works are dependent on a number of variables including regional priorities, staff, resources, bushfire events (that have occurred since time of writing) and prescribed burning opportunities. There must be flexibility to reschedule as variables change and impact on the ability to implement works.

Note: Any works off reserve should be coordinated through the District Bushfire Prevention Committee.

TABLE 5 – WORKS TO BE UNDERTAKEN IN FIRE MANAGEMENT BLOCKS

	Recommended Works	Responsibility	Priority
All reserves	Identify all access gates with numbers and MGA94 grid references.	DEH	Moderate
Shepherds Hill Block	Fuel reduction to meet B-zone requirements. Implement woody weed, Phalaris and exotic grass control in the B-zones.	DEH	Moderate
	Name and identify all fire access tracks	DEH – Southern Lofty District	Moderate
	Fuel reduction to meet B-zone requirements through the establishment of a 10 m wide firebreak behind the residences off Springwood Close, Hillcrest Drive and Depindo Avenue.	DEH	Moderate
	Woody weed and exotic grass control to be implemented in the A-zones along the southern and south-eastern boundaries	DEH	Moderate
	Leasee to undertake woody weed control (particularly of Olives and elevated fuels) in Walkers and Wattiparringga Creek lines within 40 m vicinity of asset to meet B-zone requirements.	Eden Field Archery Club	Moderate
	Upgrades to control lines and access within reserve: • Ridge Track east of Boundary Track intersection to major track; • Walkers Creek Track, Viaduct Track between Ridge Track intersections, and Ridge Track (part) to standard tracks; • Establish standard track along western boundary between Walkers Creek Track and Viaduct Track • Establish standard track between Graske Grove fire track and Danthonia Track	DEH	Moderate
	Upgrades to tracks: • Boundary Track (including Council part) to standard track; • Establish the Ward Avenue fire track as a standard track.	DEH/City of Mitcham	High
	Upgrades to access tracks: • Provision of a turn-around point on Viaduct Track, within Watiparinga Reserve as the track is a dead end; • Viaduct Track beyond Ridge Track as a minor track, including the section within Watiparinga Reserve.	DEH to liaise with the National Trust	Moderate

	Recommended Works	Responsibility	Priority
Bushland Block	Fuel reduce B-zone to the required levels.	DEH	Moderate
	Negotiate the upgrade of the external track along the eastern boundary to a standard track.	DEH/City of Mitcham	High
	Fuel reduce to a width of 20 m along the eastern boundary of the proposed revegetation zone	DEH	Moderate
	Upgrade Kurrakilla Track to a standard track by providing one passing bay and maintaining a width of 4 to 5 m.	DEH	Moderate
Gorge Block	Establish standard tracks: • Behind Resthaven, between Gate 3 and Gorge Road, with egress onto Gorge Road; • From Gate 3 in the north, to link with the existing fire track behind Resthaven and extend to egress onto the City of Mitcham Reserve off Eve Road.	Planning SA, Resthaven	High
	Implement a 10 m wide fuel reduced zone between Gate 3 and Gorge Road behind residences, by undertaking woody weed control, slashing and selective removal of elevated and fine fuels.	DEH	Moderate
Tillite Block	Upgrade to standard tracks: • Tillite Track (west of Ctenotus Track); • Turta Track easement (behind residential properties on Warri Parri Drive).	DEH	Moderate
	Selectively thin vegetation to 10 m along Ctenotus and Tillite Tracks (between the ford and Bonneyview Road)	DEH	Moderate
	Fuel reduction burn a 30 m strip to maintain fuels at *Moderate* or below	DEH	Moderate
SA Water Block	Upgrade to standard tracks: • Access track to the wetland area; • Both service tracks to the to dam wall.	DEH	High
	Name and identify all fire access tracks	DEH – Southern Lofty District	Moderate
	Widen vegetation clearance along the dam service tracks to 8 m, both sides of Sturt River	DEH	Moderate

	Recommended Works	Responsibility	Priority
Gorelon Block	Upgrade to standard tracks: • Lovely Valley and Turta Tracks by providing passing bays and improving access and egress onto Lovely Valley Track; • Gorelon Track.	DEH	Moderate
	Upgrade Renwick Street Reserve tracks to standard tracks by improving access and egress.	DEH to liaise with the City of Onkaparinga	Moderate
	Establish access through to Gorelon Track from southern side of the Renwick Street Reserve.	DEH to liaise with the City of Onkaparinga	Moderate
	Selectively thin vegetation, control weeds and remove elevated fuels to establish a 10 m wide firebreak behind residents along Katherine and Elura Courts	DEH	Moderate
	Slash or spray exotic grass strip along Bonneyview Road to a width of 10 m.	DEH	Moderate
	Selectively thin revegetation to provide a 10 m wide firebreak along the lengths of Starlight and Vincent Tracks	DEH	Moderate
	Install access gate and directional sign at the Warri Parri Drive exit of Lovely Valley Track.	DEH	Moderate
Flagstaff Block	Fuel reduce A and B-zones to the required levels.	DEH	Moderate
	Implement a 10 m wide firebreak along and including the western portion of Witowirra Track	DEH	Moderate
	Upgrade Tracks: • Minno Track to a standard track and install emergency access onto York Drive; • Marriyerti and Mari Tracks to minor tracks; • Witowirra Track (eastern end) to a standard track.	DEH	Moderate
	Investigate establishment of at least a minor track behind residences off York Drive (north and east of Gate 6). Provide passing bays and investigate the possibility of a 10 m wide firebreak	DEH to liaise with the City of Onkaparinga	Moderate

	Recommended Works	Responsibility	Priority
Craigburn Block	Upgrade tracks: • Standard track along the eastern boundary in the B- zone using existing track networks where possible, incorporating a 20 m fire break; • Minor track along the eastern boundary in the A-zone using existing track networks where possible; • Major track between the B- and C-zones from Craigburn Road to York Drive incorporating a 10-30 m firebreak; • Two major tracks with 20 m firebreaks and turnaround points along the two primary ridgelines off the Craigburn Road extension track and the proposed north-south track; • Woodcutters Track off Murrays Hill Road as a standard track through to Blackwood Park.	DEH	Moderate
	Implement a 20 m wide firebreak along the SA Water access track from the SA Water Block boundary to Craigburn Road	DEH	Moderate
	Name and identify all fire access tracks	DEH – Southern Lofty District	Moderate
	Maintain low fuel levels in the B-zone with grazing, slashing, woody weed control and/or recreational facility development	DEH	Moderate
	Develop ford across Sturt River to provide access from York Drive to Craigburn Road.	DEH	Moderate
	Install emergency vehicle access gates from Blackwood Park to access the minor track along eastern boundary.	DEH to liaise with the City of Mitcham	Moderate

	Recommended Works	Responsibility	Priority
Marino Block	Investigate the difference between fuel reduction methods in the north-western B-zone for species regeneration purposes.	DEH	Low
	Upgrade to major tracks: • Central north-south track; • Lighthouse perimeter track; • Southern boundary track (part).	DEH	Low
	Upgrade to standard tracks: • Northern boundary track and also re-align this to the boundary; • Most other internal tracks.	DEH	Low
	Name and identify all fire access tracks	DEH – Southern Lofty District	Moderate
	Close and rehabilitate access along the lighthouse easement.	DEH	Low
	Establish a turn-around point in the south-western corner.	DEH	Moderate
	Establish a 10 m wide slashed area adjacent to the track in the central area, running north-south.	DEH	Low
	Establish passing bays on standard tracks.	DEH	Low
	Complete selective minimum manual slashing of elevated fuels greater than 1 m high in the A-zone in the north-western corner.	DEH	Moderate
	Manage revegetation activities, woody weed removal and spraying in the B-zone to comply with fuel levels	DEH	Moderate
	Investigate installation of two additional emergency access gates onto private land to the south of the reserve	DEH to liaise with DBPC and neighbouring landholders	Moderate

	Recommended Works	Responsibility	Priority
Hallett Cove Block	Fuel reduce B-zones to the required levels.	DEH	Moderate
	Remove elevated and fine fuels between northern boundary and fire access track	DEH	Moderate
	Ensure that any revegetation between the central track and the eastern boundary is developed as an open woodland structure, with heath patches not exceeding *High* fuel loads. Selectively thin if required.	DEH	Moderate
	Name and identify all fire access tracks	DEH – Southern Lofty District	Moderate
	Investigate installation of an additional emergency access gate on eastern boundary.	DEH to liaise with City of Marion	Moderate
	Upgrade fire access tracks: • Southern boundary track to major track; • Eastern and northern boundary tracks to major tracks, incorporating a 10 m wide fire break; • All other internal vehicle tracks to standard tracks.	DEH	Moderate
	Realign fire access tracks: • Eastern boundary track to boundary; • Southern boundary track to boundary.	DEH	Moderate
	Upgrade creek crossings: • Install ford across Waterfall Creek on eastern boundary; • Upgrade Waterfall Creek bridge to 5 m wide bridge with a load limit able to support fire appliances.	DEH	Moderate

	Recommended Works	Responsibility	Priority
Ocean Boulevard Block	Upgrade to standard tracks: • Tracks along the southern, northern and western boundary, selectively thin revegetation in these areas. • Along the ridgeline (running east-west) between Morphett Road track and Ridgefield Avenue, with a 10 m firebreak.	DEH	Moderate
	Upgrade to major tracks: • Morphett Road track with a 20 m wide firebreak; • Tracks providing access to lease assets.	DEH	Moderate
	Name and identify all fire access tracks	DEH – Southern Lofty District	Moderate
	Implement selective thinning of vegetation along all boundary tracks	DEH	Moderate
	Restrict revegetation to canopy species planted greater than 20 m from tracks. Native grass or shrub species may be planted closer to tracks.	DEH	Moderate
	A-zone to be maintained within leased areas by the relevant lessee.	Sturt Pistol Club / Southern Field Archery Club	High
Morphett Block	Establish major tracks & maintain 10 m firebreaks: • Around boundary of DTEI land parcel, between Ridgecrest Avenue and Alpine Road (name: Alpine Track); • Between boundary track and existing track network (name: North Track); • Cycling track on DEH land	DEH	Moderate
	Name and identify all fire access tracks	DEH – Southern Lofty District	Moderate
	Install vehicle access gates off Alpine Road, Ridgecrest Avenue and Bede Street.	DEH in liaison with the City of Marion	Moderate

	Recommended Works	Responsibility	Priority
Trott Park Block	Ensure that any revegetation within the block aims to develop an open woodland or grassland structure with fuel levels that do not exceed *High*. It is recommended that low flammable species be incorporated where possible.	DEH	Moderate
	Where existing revegetation areas have *Very High* fuel loads or above, selectively thin to achieve zone classifications	DEH	Moderate
	Maintain 10 m wide firebreak along southern boundary track, adjacent to the A- and B- zones.	DEH	Moderate
	Within A- zone along the southern boundary control Phalaris and Wild Oats within the revegetation area and/or implement fuel reduction burning to reduce fine fuels.	DEH	Moderate
	Name and identify all fire access tracks	DEH – Southern Lofty District	Moderate
	Lessee to maintain *Low* fuels within leased area through slashing and/or mowing.	Holdfast Model Aircraft Club	High
	Maintain narrow southern extension at *Low* fuel levels through slashing or suitable revegetation.	DEH in liaison with the City of Marion	High
Pea Farm Block	Install gate and develop access onto the track along the pipeline (external service track) from Pea Farm location.	DEH in liaison with the City of Marion	Moderate
	Upgrade/establish as major tracks: • Upgrade track along boundary between Majors Road and Pea Farm site to major track; • Establish major track along the eastern boundary of the Horse Agistment lease area.	DEH	Moderate
	Establish firebreaks: • 15 m wide along new major track; • 10 m wide along upgraded boundary track.	DEH	Moderate
	Name and identify all fire access tracks	DEH – Southern Lofty District	Moderate

	Recommended Works	Responsibility	Priority
	Maintain a 10 m wide slashed access track along southern boundary of the leased area.	DEH	Moderate
	Maintain 40 m slashed A-zone around Pea Farm ruins.	DEH	Moderate
	40 m minimum A-zone within leased area to be maintained by lessee with fuel levels at *Moderate* or below by grazing, clearing fallen vegetation and woody weed control. Although there are currently no built assets on land leased to Riding for the Disabled the lessee needs to ensure that a 40 m A-zone is maintained around any structures constructed in the future.	Bluestone cottage / Riding for the Disabled	High
Lease Block	Weed control to be carried out within undeveloped section to ensure fuel loads do not exceed *High* within 40 m of the northern lease boundary.	Starline Golf Driving Range	High
	Lessee to maintain *Low* fuel levels within car park facility around the assets.	Starline Golf Driving Range	High
	Name and identify all fire access tracks	DEH – Southern Lofty District	Moderate

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14 APPENDICES

Appendix 1 – Fire Response of Rated and Introduced Flora Species

Species	Common Name	EPBC Act Status	NPW Act Status	MVS No	Block/s	Life Form	Species Ecology and Fire Response	Fire Mgt Guidelines or Post Fire Mgt Recommendations	Source
**Asparagus asparagoides*	Bridal Creeper			9	SG HC	Herb	• *Weed of National Significance* • Adults resprout following fire • Flowers: August-September	• Weed control may be required post-fire.	Aus^
Austrostipa gibbosa	Swollen Spear-grass		R	9	FL BU GE	Perennial	• Resprouts following fire • Flowers: October-February	• #	Aus^
Austrostipa multispiculis	Small-seed Spear-grass		R	32	FL BU GE HC MA		• Little is known about the biology and ecology of this species	• #	
Bothriochloa macra	Red-leg Grass		V		GE TI	Perennial	• Adults resprout following fire • Primary juvenile period: 1 year • Flowers: December-February	• #	Aus^
Calocephalus citreus	Lemon Beauty-heads		U	9 32	HC MA	Perennial Herb	• Adults resprout following fire • Seeds dispersed by wind • Secondary juvenile period: < 1 year • Flowers: September-March	• #	SA^
Carex bichenoviana	Notched Sedge			9	TI SH	Perennial Herb	• Adults resprout following fire • Flowers: September-February	• #	Aus^
Carex inversa var. *major*	Knob Sedge		R	9	FL	Perennial	• Congeners resprout • Flowers: August-April	• #	Aus^

Refer to Table 1 (Section 3.4.2) for MVS Names and to Section 15 of this plan for a description of the codes used within Appendices
NOTE: List includes species known or likely to occur within the plan area.

Species	Common Name	EPBC Act Status	NPW Act Status	MVS No	Block/s	Life Form	Species Ecology and Fire Response	Fire Mgt Guidelines or Post Fire Mgt Recommendations	Source
Cassinia arcuata	Drooping Cassinia		U		HC	Shrub	• Seedlings readily recruit post fire • Seeds dispersed by wind • Primary juvenile period: 3 years • Lifespan and seedbank: 20 years • Flowers: October-June	• Weed control required post-fire.	Aus^
*Chrysanthemoides monilifera**	Boneseed			9	SH HC SG	Perennial Shrub	• *Weed of National Significance* • Lifespan: 10-20 years • Flowers: July-October • Fire kills adult plants • Seedlings readily recruit post-fire	• Follow up weed control may be required post fire • Refer to (Brougham, *et al.*, 2006) •	Aus^
Cladium procerum	Leafy Twig-rush		R		SG	Perennial	• Flowers: September-November	• #	Aus^
Cymbonotus preissianus	Austral Bears-ear		U		HC	Stemless Herb	• Adults resprout following fire • Primary juvenile period: 2 years • Lifespan and seedbank: 60 years • Flowers: October-February	• #	Aus^
Austrodanthonia eriantha	Hill Wallaby-grass		R		SG	Perennial Grass	• Flowers: in response to rain	• #	Aus^
Dianella longifolia var. *grandis*	Pale Flax-lily		R	9	GE FL TI SH	Perennial	• Congeners resprout • Flowers: September -January	• • #	Aus^

Refer to Table 1 (Section 3.4.2) for MVS Names and to Section 15 of this plan for a description of the codes used within Appendices
NOTE: List includes species known or likely to occur within the plan area.

Species	Common Name	EPBC Act Status	NPW Act Status	MVS No	Block/s	Life Form	Species Ecology and Fire Response	Fire Mgt Guidelines or Post Fire Mgt Recommendations	Source
Diuris behrii	Behr's Cowslip Orchid		R	32	MA	Perennial Herb	• Juvenile period 1 year • Strongly dependent on fire • Prefers late spring-summer-early autumn burning • Intolerant of competition • Flowers September-November	• Avoid burning late autumn through to early spring	SA^
*Echium Plantagineum**	Salvation Jane				SG HC MA	Herb	• Declared under the SA *Natural Resource Management Act 2004* • Adults killed by fire • Seedlings readily recruit post-fire • Some seeds are killed by fire	• Weed control may be required post-fire.	Aus^
Glycine tabacina	Variable Glycine		V	9	GE SH	Scrambler	• Flowers: mainly September-May	• #	Aus^
Logania saxatilis	Rock Logania		R	9	FL GE	Shrub	• Little is known about the biology and ecology of this species	• #	SA^
*Lycium ferocissimum**	African Boxthorn				MA HC SH SG	Shrub	• Primary juvenile period: 2 years • Fruit: Berry • Fruits dispersed by birds & foxes • Adults resprout following fire	• Weed control may be required post-fire. •	SA^
Maireana rohrlachii	Rohrlach's Bluebush		R	32	HC MA	Perennial Shrub	• Flowers/fruits: December-June	• #	Aus^

Refer to Table 1 (Section 3.4.2) for MVS Names and to Section 15 of this plan for a description of the codes used within Appendices
NOTE: List includes species known or likely to occur within the plan area.

Species	Common Name	EPBC Act Status	NPW Act Status	MVS No	Block/s	Life Form	Species Ecology and Fire Response	Fire Mgt Guidelines or Post Fire Mgt Recommendations	Source
*Marrubium vulgare**	Horehound				MA SG SH HC	Erect or Spreading Perennial Herb	• Declared under the SA *Natural Resource Management Act 2004* • Flowers: September-March • Adults killed by fire and may reduce up to 80% of the seedbank • Seedlings readily recruit post-fire	• Weed control required post-fire either through spraying or burning at a short inter-fire interval	Aus^
Myoporum parvifolium	Creeping Boobialla		R		HC	Mat-forming Shrub	• Flowers: October-March • Adults killed by fire • Soil stored seed germinates post-fire	• #	Aus^
*Olea europaea**	European Olive			9	MA HC SH OH SG	Tree	• Declared under the SA *Natural Resource Management Act 2004* • Adults resprout following fire. • Seedlings are killed by fire • Flowers late spring • Seeds germinate in autumn. • Fruit: Berry - dispersed by birds	• Weed control required post-fire. • Drill and fill to kill adults • Hand pull or grubb seedlings.	SA^
*Phalaris aquatica**	Phalaris				SG	Erect Perennial Grass	• Flowers: September-November • Burning will stimulate germination	• Weed control needed following fire	Aus^
Podolepis muelleri	Button Podolepis		V	Coastal cliffs 32	HC MA	Annual Herb	• Flowers: August-October	• #	SA^
Ptilotus erubescens	Hairy Heads		R	9	SH	Erect Perennial Herb	• Fkowers: through spring and summer • Resprouting species	• #	Aus^

Refer to Table 1 (Section 3.4.2) for MVS Names and to Section 15 of this plan for a description of the codes used within Appendices
NOTE: List includes species known or likely to occur within the plan area.

Species	Common Name	EPBC Act Status	NPW Act Status	MVS No	Block/s	Life Form	Species Ecology and Fire Response	Fire Mgt Guidelines or Post Fire Mgt Recommendations	Source
*Rosa canina**	Dog Rose			9	SG	Shrub	• Declared under the SA *Natural Resource Management Act 2004* • Rose hips are eaten by birds • Adults resprout following fire • Response of seedlings & seeds unknown	• Weed control required post-fire. • Drill and swab to kill adults. • Hand pull or grubb seedlings.	SA^
Rubus spp.*	Blackberry				SH SG	Scramb-ling Semi-deciduous Shrub	• *Weed of National Significance* • 1 year to seed set • Readily resprouts following fire • Seeds distributed by birds	• Weed control needed following fire	Aus^
*Senecio pterophorus**	African Daisy			9	SH SG	Herb	• Flowers: December-February • Burning will stimulate germination	• Weed control may be required post-fire (prior to flowering)	Aus^

Refer to Table 1 (Section 3.4.2) for MVS Names and to Section 15 of this plan for a description of the codes used within Appendices
NOTE: List includes species known or likely to occur within the plan area.

Appendix 2 – Fire Response of Rated Fauna Species

Type	Species	Common Name	EPBC Act Status	NPW Act Status	MVS No	Block /s	Diet	Breeding	Species Ecology and Fire Response	Fire Management Guidelines	Source
Bird	*Acanthiza lineata*	Striated Thornbill		R			I	• Sites: Outer tree branches or shrubs • Material: bark, lichen and mosses • Season: Jul-Dec	• Found in open forests and woodlands dominated by eucalypts, with a well-developed understorey • Impacted by the loss of eucalypts • Frequent fire likely to reduce thick understorey	• Reduce the likelihood of extensive bushfires • Reduce the likelihood of frequent fires within known habitat	Aus^
Bird	*Chrysococcyx lucidus*	Shining Bronze-cuckoo		R		SG	I	• Sites: brood parasite • Material: variable • Season: Aug-Jan	• Continental movements • Home range size unknown, but it is likely that it is large • Driven by host response • Fire likely to increase parasitism by exposing nests • May benefit from exposed sites, to feed on insects	• Reduce the likelihood of extensive bushfires	SA^
Bird	*Calyptorhynchus funereus*	Yellow-tailed Black-cockatoo		V	9	SG	G	• Sites: hollows high in canopy • Material: woodchips • Season: Jul-Jan	• Nomadic or locally migratory • Higher intensity fire can increase hollow loss • Favours eucalypt woodland and pine plantations (Aleppo Pine) • Fire likely to impact the availability of food sources (seeds)	• Minimise loss of hollows (avoid high intensity fire) • Minimise the loss of important feeding sites & critical habitat (including Aleppo Pine stands) • Consideration should be given to replacement food sources if introduced pines are impacted by fire	Aus^

Refer to Table 1 (Section 3.4.2) for MVS Names and to Section 15 of this plan for a description of the codes used within Appendices
NOTE: List includes species known or likely to occur within the plan area.

Type	Species	Common Name	EPBC Act Status	NPW Act Status	MVS No	Block /s	Diet	Breeding	Species Ecology and Fire Response	Fire Management Guidelines	Source
Bird	*Falco peregrinus*	Peregrine Falcon		R		SG	C	• Sites: rock crevices, cliffs • Material: rock • Season: Aug-Nov	• Fire will influence the availability of prey species within home ranges • The same nesting sites may be used for many years • Pairs will maintain a home range approximately 20-30 km^2	• Reduce the likelihood of extensive bushfires	Aus^
Bird	*Falcunculus frontatus*	Crested Shrike-tit / Eastern Shrike-tit		V	9	SG	I	• Sites: vertical forks high in canopy • Material: bark & dry grass • Season: Sept-Jan	• Dependant on the canopy, should avoid burning the canopy • Sedentary, with some local movements in autumn and winter • Frequency of fires prevent insects from establishing beneath the bark of gum-barked trees • Peels bark from large branches or tree-trunks to extract prey from underneath • Has a large feeding territory >50 ha	• Avoid 2 or more successive fire intervals less than 10 years apart • Avoid high intensity fire resulting in crown fire or canopy scorch	Aus^
Bird	*Hieraaetus morphnoides*	Little Eagle		R		HC	C	• Site: high in mature woodland trees • Material: sticks, twigs, branches, leaves • Season: Aug-Nov	• High intensity fire likely to impact on nesting sites	• Avoid high intensity fire resulting in crown fire or canopy scorch	Aus^

Refer to Table 1 (Section 3.4.2) for MVS Names and to Section 15 of this plan for a description of the codes used within Appendices
NOTE: List includes species known or likely to occur within the plan area.

Type	Species	Common Name	EPBC Act Status	NPW Act Status	MVS No	Block /s	Diet	Breeding	Species Ecology and Fire Response	Fire Management Guidelines	Source
Bird	*Megalurus gramineus*	Little Grassbird		R	Swamps & marshes	HC	I	• Site: thick reedy vegetation • Material: reeds, coarse grasses & feathers • Season: Aug-Dec	• Stays within the dense cover of grasses and swamp vegetation. • Breeding often occurs after rain	• Reduce the likelihood of extensive bushfires	Aus^
Bird	*Melithreptus gularis*	Black-chinned Honeyeater		V		SG OH	I N	• Site: High in canopy • Material: Fragile cup of bark, hair, fur & wool • Season: Mainly Jul-Dec	• Prefers drier woodlands dominated by box Eucalypts often with little understorey • Local movements associated with flowering of food-plants • Forages in the upper canopy • High intensity fire likely to impact nesting sites and food availability • Fire may assist this species through the provision of feeding and breeding habitat by altering the structure of vegetation	• Avoid high intensity fire resulting in crown fire or canopy scorch	(Chapman, 1995) Aus^
Bird	*Myiagra inquieta*	Restless Flycatcher		V		SG	I	• Site: exposed low tree forks often over water • Material: Cup shaped of bark or grass • Season: Jul-Jan	• Fire likely to impact nesting sites	• Reduce the likelihood of extensive bushfires	Aus^

Refer to Table 1 (Section 3.4.2) for MVS Names and to Section 15 of this plan for a description of the codes used within Appendices
NOTE: List includes species known or likely to occur within the plan area.

Type	Species	Common Name	EPBC Act Status	NPW Act Status	MVS No	Block /s	Diet	Breeding	Species Ecology and Fire Response	Fire Management Guidelines	Source
Bird	*Phylidonyris pyrrhoptera*	Crescent Honeyeater		R		SG	N I	• Site: well concealed low in the centre of a shrub • Material: Cup shaped of plant materials • Season: Jul-Jan	• Either resident or migratory, usually in response to nectar availability • Fire likely to impact nesting sites and possibly food availability	• Reduce the likelihood of extensive bushfires	Aus^
Mammal	**Phascolarctos cinereus*	Koala		R		SG OH	H	• Season: approx Sept-Feb • Arboreal	• Introduced to the MLR • Occupy home ranges which vary in size depending on habitat quality • High intensity fires reduce available foraging habitat • Unlikely to escape from fast moving fires	• Promote localised patchiness in bushfires in core habitat areas (refuge areas) • Avoid canopy fires or crown scorch in known habitat areas • Avoid falling of trees during mop up in known habitat areas • Avoid spring & summer burning	Aus^
Reptile	*Egernia cunninghami*	Cunningham's Skink		V		SH SG	I H	• Season: late summer	• Prefers rocky crevices and leaf litter • Occupy home ranges • Normally found in crevices in rock formations • Likely to find refuge in these areas during a fire • Early successional species • Frequent fire likely to impact the availability of food sources within home ranges	• Reduce the likelihood of extensive bushfires • Reduce the likelihood of frequent fires within known habitat	R Aus^
Reptile	*Pseudonaja textilis*	Eastern Brown Snake		R		SG SH HC	C	• Season: late spring-early summer	• Open grassland, farmland or woodland	• #	Aus^

Refer to Table 1 (Section 3.4.2) for MVS Names and to Section 15 of this plan for a description of the codes used within Appendices
NOTE: List includes species known or likely to occur within the plan area.

Appendix 3 – Fire Response of Ecological Communities

Ecological Community	SA Proposed Status (DEH, 2005c)	Occurrence	Block	Components	Fire Response	Fire Management Guidelines	Source
Grey Box (*Eucalyptus microcarpa*) **Grassy Low Woodland**	Endangered	• 1,250 ha remains within the MLR, SA • <44 ha in Shepherds Hill RP & 28 ha within the adjoining Watiparinga Reserve • <49 ha in Sturt Gorge RP	SG SH	**Tree Layer** • Grey Box *(Eucalyptus microcarpa)* (locally dominant) • SA Blue Gum *(E. leucoxylon)* • River Red Gum *(E. camaldulensis)* • Drooping Sheoak *(Allocasuarina verticillata)* • Golden Wattle *(Acacia pycnantha)* • *European Olive *(Olea europaea ssp. europaea)* **Shrub and Ground Layer** • Twiggy Daisy-bush *(Olearia ramulosa)* • Mount Lofty Grass-tree *(Xanthorrhoea quadrangulata)* • Yacca *(X. semiplana)* • Kangaroo Thorn *(Acacia paradoxa)* • Narrow-leaf Hop-bush *(Dodonaea viscosa ssp. angustissima)* • Rock Fern *(Cheilanthes austrotenuifolia)* • Soft Tussock Mat-rush *(Lomandra densiflora).* • Kangaroo Grass *(Themeda triandra)* • *African Daisy *(Senecio pterophorus)* • *Boneseed *(Chrysanthemoides monilifera)* • *Soursob *(Oxalis pes-caprae)* • *Broad-leaf Cotton-bush *(Asclepias rotundifolia)* • *Fennel *(Foeniculum vulgare)*	• Most remnants are infested with woody weeds contributing to fire risk (with the exception of Watiparinga Reserve)	• Avoid burning entire remnants during a single fire event • Aim to increase patchiness within the remnants • Implement ecological/experimental burns as part of an integrated weed management strategy • Implement ecological/experimental burns to determine the response of the community to various fire regimes	SA^

15 SUMMARY OF CODES USED IN APPENDICES

Block Codes

Code	Block	Reserve	Code	Block	Reserve
SH	Shepherds Hill	Shepherds Hill RP	OB	Ocean Boulevard	O'Halloran Hill RP
TI	Tillite	Sturt Gorge RP	MO	Morphett	O'Halloran Hill RP
GN	Gorelon	Sturt Gorge RP	PF	Pea Farm	O'Halloran Hill RP
GE	Gorge	Sturt Gorge RP	TR	Trott	O'Halloran Hill RP
SAW	SA Water	Sturt Gorge RP	LE	Lease	O'Halloran Hill RP
FL	Flagstaff	Sturt Gorge RP	OH	ALL	O'Halloran Hill RP
BU	Bushland	Sturt Gorge RP	MA	Marino	Marino CP
CR	Craigburn	Sturt Gorge RP	HC	Hallett Cove	Hallett Cove CP
SG	ALL	Sturt Gorge RP			

Other Codes Used

NPW ACT STATUS		EPBC ACT STATUS		DIET OF RATED FAUNA SPECIES	
E	Endangered	EX	Extinct	C	Carnivore or scavenger. Mainly vertebrates.
V	Vulnerable	CE	Critically Endangered	H	Herbivore. Includes folivores, grazers and browsers.
				N	Nectar feeder
R	Rare	EN	Endangered	I	Insectivore/"arthropodivore"/omnivore
		VU	Vulnerable	G	Granivore. Typically peak in abundance after a fire event in fire-adapted vegetation, due to the stimulation of flowering and subsequent seed-set.

MISCELLANEOUS CODES	
#	Fire response is unknown or ambiguous, thus the required data is not available to propose Ecological Fire Management Guidelines. When data becomes available the table will be updated.
*	Introduced species

FIRE RESPONSE SOURCE	
R	Regional or local data
SA	South Australian data
Aus	Interstate data
^	Data/observations derived from published or unpublished literature.
E	Expert opinion (person knowledgeable in species genera)
I	Inferred from similar species (Senior Fire Ecologist - Fire Management Branch has inferred based on other species genera)

16 GLOSSARY OF ACRONYMS AND FIRE MANAGEMENT TERMINOLOGY

Term	Definition
Backburn(ing)	A fire started intentionally along the inner edge of a control line to consume the fuel in the path of a bushfire.
Bark Fuel	The flammable bark on tree trunks and upper branches (DEH, 2006e).
Bushfire	An unplanned fire. A generic term that includes grass fires, forest fires and scrub fires.
Canopy Fuel	The crowns (leaves and fine twigs) of the tallest layer of trees in a forest or woodland. Not measured as part of the overall fuel hazard assessment (DEH, 2006e).
CFS	The South Australian Country Fire Service.
Control line	A natural or constructed barrier, or treated fire edge, used in fire suppression and prescribed burning to limit the spread of fire.
DBPC	District Bushfire Prevention Committee.
DEH	The South Australian Department for Environment and Heritage.
DEH (Cwlth)	The Commonwealth Department of Environment and Heritage.
Direct attack	A method of bushfire attack where wet or dry firefighting techniques are used. It involves suppression action right on the fire edge, which becomes the control line.
DBPC	District Bushfire Prevention Committee.
Discontinuous fuels	Significant gaps between clumps or patches of fuel (DEH, 2006e).
DTEI	The South Australian Department for Transport, Energy and Infrastructure (or Transport SA).
EAT	DEH Environmental Assessment Table. Completed for all prescribed burns (as part of the Prescribed Burn Plan) and other fire management works where native vegetation is being cleared and is not exempt under the *Native Vegetation Act 1991* (DEH, 2004).
Elevated Fuel	Shrubs and juvenile understorey plants up to 3 m in height (DEH, 2006e)
EPBC Act	The commonwealth *Environment Protection and Biodiversity Conservation Act 1999.*
Extreme fire behaviour	A level of bushfire behaviour characteristics that ordinarily precludes methods of direct suppression action. One or more of the following is usually involved: high rates of spread; prolific crowning and/or spotting; presence of fire whirls and/or a strong convective column. Predictability is difficult because such fires often exercise some degree of influence on their environment and behave erratically, sometimes dangerously.
Fine fuels	Grass, leaves, bark and twigs less than 6mm in diameter.

Term	Definition
Fire access track	A track constructed and maintained expressly for fire management purposes.
Fire behaviour	The manner in which a fire reacts to the variables of fuel, weather and topography.
Firebreak	An area or strip of land where vegetation has been removed or modified to reduce the risk of fires starting and reduce the intensity and rate of spread of fires that may occur (GAFLC, 2005).
Fire danger	The combination of all factors, which determine whether fires start, spread and do damage, and whether and to what extent they can be controlled.
Fire danger rating	An evaluation of fire rate of spread, or suppression difficulty for specific combinations of fuel, fuel moisture, temperature, humidity and wind speed. The rating can be Low, Moderate, High, Very High or Extreme.
Fire frequency	The number of fires that have occurred on the same area over a time period.
Fire intensity	The rate of energy or heat release per unit time per unit length of fire front, usually expressed in kilowatts per metre (kw/m) (Pausas, *et al.*, 2003)
Fire interval	The interval between successive fires.
Fire management	All activities associated with the management of fire-prone land, including the use of fire to meet land management goals and objectives.
Fire regime	The history of fire in a particular vegetation type or area including the fire frequency, interval, intensity, extent and seasonality of burning (Brooks, *et al.*, 2004).
Fire scar	A destructive mark left on a landscape by fire.
Fire season	The period(s) of the year during which fires are likely to occur, spread and do sufficient damage to warrant organised fire control.
Fire severity	The effect of fire on an ecosystem, that is, on living plants, as well as on the amount and location of organic matter consumed during a fire (Pausas, *et al.*, 2003)
Fire suppression	The activities connected with restricting the spread of bushfire following its detection and making it safe.
Fuel	Any material such as grass, leaf litter and live vegetation, which can be ignited and sustains a fire. Fuel is usually measured in tonnes per hectare.
Fuel arrangement	A general term referring to the spacing and arrangement of fuel in a given area.
Fuel hazard	The overall fuel hazard is defined as the sum of the influences of bark fuel, elevated fuel and surface fine fuel (DEH, 2006e).
Fuel management	Modification of fuels by prescribed burning, or other means.
GAFLC	South Australian Government Agencies Fire Liaison Committee.
IBRA	Interim Biogeographical Regionalisation for Australia.

Term	Definition
Incident Controller (IC)	The individual responsible for the management of all incident operations and IMT.
IMT	Incident Management Team. The group of incident management personnel comprising the IC and the people he/she appoints to be responsible for the functions of Operations, Planning and Logistics.
Indirect attack	The use of backburning as a method of suppression to confine the fire within a defined area bounded by existing or prepared control lines. Control lines may be a considerable distance ahead of the fire.
Key Fire Response Species	These are the species most susceptible to decline due to inappropriate fire regimes: either too frequent or too infrequent fire, low or very high intensity fire, or fire in a particular season.
MFS	South Australian Metropolitan Fire Service.
MLR	Mount Lofty Ranges.
Near-surface fuel	Grasses, low shrubs and heath, sometimes containing suspended components (leaves, bark and/or twigs).
NPW Act	The South Australian *National Parks and Wildlife Act 1972.*
NVC	Native Vegetation Council. Established under the provisions of the *Native Vegetation Act 1991*, responsible for making decisions on a wide range of matters concerning native vegetation in SA (DWLBC, 2006).
'Of conservation significance'	In this plan, used to describe important or rated populations or species of flora and fauna as well as vegetation communities. These may be: Nationally rated, that is, listed as Threatened (with a rating of Extinct, Critically Endangered, Endangered, Vulnerable or Conservation Dependent) under the federal *Environment Protection and Biodiversity Conservation (EPBC) Act 1999;* South Australian rated, listed as Threatened (with a rating of Endangered, Vulnerable or Rare) under the *National Parks and Wildlife Act 1972, Revised Schedules 7, 8 and 9.* Provisionally listed as Threatened (with a rating of Endangered or Vulnerable) in South Australia, that is, included on the unpublished DEH *Provisional List of Threatened Ecosystems of South Australia* (DEH, 2005b).
Prescribed Burn Plan	The plan, which is approved for the conduct of prescribed burning. It contains a map identifying the area to be burnt and incorporates the specifications and conditions under which the operation is to be conducted.
Prescribed burning	The controlled application of fire under specified environmental conditions to a predetermined area and at the time, intensity, and rate of spread required to attain planned resource management objectives.
Response plan	A plan detailing the response for a risk or an area including the type and number of resources.
Retardant	A chemical generally mixed with water, designed to retard combustion by chemical or physical action. It is usually applied by aircraft but may be applied from tankers at the fire edge.

Term	Definition
Risk assessment	Used in DEH fire planning to assist in evaluating the threat to life, property and environmental assets posed by bushfire and also to aid in developing strategies and works for risk mitigation. Considers *Likelihood* and *Consequence* to determine an overall risk rating through a matrix (DEH, 2006d).
SA Water	South Australian Water Corporation.
Spotting	The ignition of spot fires from sparks or embers.
Total Fire Ban	A ban on lighting and maintaining of a fire in the open, which can be invoked at any time during the year. When invoked, the Total fire Ban is imposed for a period of 24 hours (from midnight to midnight) but may also be imposed for part of a day or days (Country Fire Service Regulations, 2003).
TPC	The *Threshold of Potential Concern* is defined as a point in time where *Key Fire Response Species* are likely to be affected by an aspect of fire regime.
'Weed of national significance'	20 priority weeds that pose future threats to primary industries, land management, human or animal welfare, biodiversity and conservation values at a national level. These weeds were identified and ranked through the assessment of invasiveness, impacts, potential for spread and socioeconomic and environmental aspects (Australian Weeds Committee, 1999).

Unless otherwise indicated, definitions for fire management terminology were adapted from (DEH, 2006b).

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