

# Bushfire

Services

## Fire Management Plan

2007/08 – 2011/12

Lower Prospect Canal

Holroyd City Council

November 2007

Our Reference: 5223



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## EXECUTIVE SUMMARY

The Fire Management Plan (FMP) describes the objectives, strategies and activities for fire management within the reserves forming the Lower Prospect Canal (LPC) that stretches from west to east across the Holroyd City Council local government area for a distance of approximately 7 km from the Blacktown local government area boundary in the west to the Guildford Pipehead near Albert Street in the east. The LPC is a linear reserve approximately 60 ha in size but ranging in approximately 60 m to 160 m in width with a probable average width of 80 m. The need for the preparation of a FMP was identified in the Lower Prospect Canal Plan of Management prepared in March 1999.

The LPC is significant in the items of cultural and environmental heritage, and as passive and active recreation space for the community. The cultural heritage significance is related to an historic water distribution system for Sydney. Items include the 'Covered Way', 'Aqueduct', 'Syphon', 'Sedimentation Channel' and the canal itself. The LPC is also noted as an area of regeneration and conservation of the endangered ecological community Cumberland Plain Woodland. The reserves support relatively significant stands of Grey Box Woodland and individuals of the threatened species of *Acacia pubescens* and *Pimelea spicata*.

The LPC also provides a rare, linear bushland corridor through Western Sydney, providing a path for the movement of native flora and fauna from the edge of the suburbs to within. This corridor also creates a long development/bushland interface that could potentially be impacted by bushfires.

This FMP demonstrates that the bushfire behaviour potential in all areas of the LPC would range from 'low' to 'medium' depending on the climatic conditions and the bushland remnant supporting the fire. The availability of fuel and the arrangement of the fuel in the narrow, linear compartments of the LPC would have the most effect on fire behaviour along the corridor. Fires can occur within any compartment, but as the area available to burn is relatively small and compartmentalised, these fires should not eventuate into a high intensity fire with widespread consequences.

There are four features of the LPC corridor landscape that contribute to the prevention of fire spread to, and fire impacting on, the neighbouring assets and community. These are; width of vegetated area, reduction of fire front potential, compartmentalisation, and slope leading to neighbouring assets. These features are discussed further within this FMP.

The analysis of likely fire behaviour has identified that there is a low threat to life and property adjacent the LPC corridor. The threat to visitors/users of the corridor and firefighters is also reduced due to available access and egress, as well as numerous potential fire control lines. In summary, landscape design and maintenance has resulted in a bushfire environment that does not readily allow high intensity fire at the interface with adjoining property. Similarly, the analysis of bushfire risk demonstrated that the internal and neighbouring assets were at 'minor' to 'insignificant' risk.

Bushfire risk management recommendations are divided into five broad strategies, as summarised below:

1. Avoid the risk – Landscape design: The proposed landscaping of the LPC corridor can be adequately managed by way of maintenance of compartments, including road and walkway truncations, bicycle track and maintenance road bisection, with access and defensible space maintained at the rear of neighbouring properties;
2. Reduce the hazard – Access and defensible space: Access and defensible space is the key component of fire suppression and property protection along the LPC corridor. The bushfire risk analysis section demonstrated that a low threat is present, and this threat can be adequately managed by ensuring access to perimeter locations to control and suppress fires;
3. Reduce ignition – Education: Readiness and awareness of the community is vital to ensure the safety of people and the preparation of their dwellings and assets. Extension programs share the fire management responsibility amongst the neighbouring residents and local community by providing information, raising awareness and improving their fire management capabilities;
4. Reduce vulnerability – Complementary strategies (neighbours): The recommended strategies within this FMP rely on the assumption that neighbouring properties have some form of managed setback from the LPC boundary. If this setback is not maintained well, then the strategies within this plan may fail; and
5. Understand and accept residual risk: Residual risk is defined as the bushfire risk that remains after the implementation of bushfire risk reduction measures. It acknowledges that despite the bushfire protection measures that are able to be put in place, some bushfire risk to life and property will remain and bushfires will continue to threaten life and property, at least to some extent.

In addition to life and property protection, a primary aim of this FMP is the protection, maintenance and enhancement of biodiversity and ecological values of the LPC. This FMP provides fire regime guidelines (thresholds) for the Cumberland Plain Woodland (CPW) endangered ecological community and threatened species *Acacia pubescens* and *Pimelea spicata*. This information includes monitoring, revegetation, weed management and prescribed burning guidelines.

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## 1. INTRODUCTION AND BACKGROUND

### 1.1 AREA AND TIMEFRAME FOR WHICH THE PLAN APPLIES

This Fire Management Plan (the Plan) was prepared for Holroyd City Council (HCC) under contract by Bushfire and Environmental Services Pty Ltd (BES). The plan describes the objectives, strategies and activities for fire management within the reserves forming the Lower Prospect Canal that stretches from west to east across the HCC local government area (hereafter referred to as the LPC) for the years 2007/08 to 2011/12.

### 1.2 BACKGROUND INFORMATION

The need for the preparation of a Fire Management Plan (FMP) was identified in the Lower Prospect Canal Plan of Management (POM) prepared in March 1999 (Environmental Partnership 1999). As part of the 'bushland management' strategies, the POM recommended the following:

*“Develop a fire management strategy that addresses the requirements of both the safety of park user and adjacent residential areas, and the ecological requirements of the vegetation in the corridor.”*

The POM includes a thorough and comprehensive inventory and study of the values and assets of the LPC. Notably the most obvious assets are the heritage items associated with the original canal operations that were constructed in the late 1880s and early 1900s to distribute water from the Upper Nepean Scheme to the expanding suburbs of Sydney. Such assets include the 'Covered Way', 'Aqueduct', 'Syphon' and the canal itself.

Since cessation of the canal operations and the associated 'heavy' management of the reserves such as regular mowing, the land is under a period of regeneration and today supports a compartmentalised, west-east orientated bushland corridor through an otherwise heavily developed suburban area. The vegetation community is a sub-component of the endangered Cumberland Plain Woodland and contains threatened flora. Not to mention the LPC is a regionally significant open space and environmental resource providing benefits to the local community in a range of aspects including active recreational opportunities such as the bicycle track that now forms the full length of the canal.

### 1.3 SCOPE AND PURPOSE

The plan addresses both the life and property protection and biodiversity conservation goals of fire management within the LPC. The Plan also provides guidance on fire prevention and fire suppression and should constitute a Bushfire Management Plan under Section 38(4) of the *Rural Fires Act 1997* (RF Act). Consequently any fire management, including fire suppression within the LPC, must be undertaken in a manner consistent with this Plan.

The Plan will be a component of the Lower Prospect Canal Plan of Management (Environmental Partnership 1999). It will also fulfil Holroyd City Council's Community Land Plan of Management objectives for the LPC under Section 36 of the *Local Government Act 1993*. Accordingly, the plan has been prepared to ensure consistency with the core objectives for management of community land categorised as 'bushland' (Section 36J of the *Local Government Act 1993*), i.e.;



- a) *to ensure the ongoing ecological viability of the land by protecting the ecological biodiversity and habitat values of the land, the flora and fauna (including invertebrates, fungi and micro-organisms) of the land and other ecological values of the land,*
- b) *to protect the aesthetic, heritage, recreational, educational and scientific values of the land,*
- c) *to promote the management of the land in a manner that protects and enhances the values and quality of the land and facilitates public enjoyment of the land, and to implement measures directed to minimising or mitigating any disturbance caused by human intrusion,*
- d) *to restore degraded bushland,*
- e) *to protect existing landforms such as natural drainage lines, watercourses and foreshores,*
- f) *to retain bushland in parcels of size and configuration that will enable the existing plant and animal communities to survive in the long term, and*
- g) *to protect bushland as a natural stabiliser of the soil surface.*

## **1.4 AIMS AND OBJECTIVES**

Six primary aims of the FMP have been identified for the LPC. These are set out below:

1. Prevent the occurrence and spread of fire,
2. Suppress fire in a manner that minimises the threat to human life and property and impact on the environment,
3. Protect from damage by fire all culturally significant assets,
4. Maintain a range of fire regimes within biodiversity threshold guidelines for plant communities,
5. Manage access for fire suppression and property protection, and
6. Outline fire strategies for cooperative and complementary fire management strategies with neighbours and fire authorities.

Objectives of the Plan are;

- No human life is lost or person injured as a result of fire within LPC;
- Infrastructure and property within and adjacent the LPC is not significantly damaged from bushfire,
- Biodiversity is not adversely impacted by fire or fire management activities, and
- Sites and features of cultural significance are not significantly damaged by fire and fire management activities.

These objectives will act as a performance indicator and will be utilised in the review and update of the plan.

## **1.5 PLANNING ENVIRONMENT**

The LPC is under the control of HCC. The management of the LPC is guided by the Lower Prospect Canal Plan of Management (Environmental Partnership 1999). The relevant planning controls and how they have been considered within this Plan is summarised below.

### **1.5.1 Holroyd Local Environmental Plan 1991**

The *Holroyd Local Environmental Plan 1991* (LEP) sets out what approvals are required for bushfire hazard reduction and the implementation of other bushfire protection measures. As the LPC is not within a 'rural fire district' as defined by the *Rural Fires Act 1997* (see Section 1.5.2 below) the usual process of hazard reduction application, process and undertaking as provided by the RF Act can not be utilised. The usual development assessment procedure outlined within the LEP is to be followed.

### **1.5.2 NSW Rural Fires Act 1997**

The RF Act imposes obligations on land managers to take all reasonable measures to prevent the occurrence and spread of wildfire to adjoining lands from lands under their care and management. The RF Act also places emphasis on cooperative fire management and wildfire suppression planning between the various organisations involved in fire management.

Sections 50 of the RF Act provides for the establishment of Bushfire Management Committees (BFMCs) based on local government areas. Under Sections 52 of the RF Act it is the responsibility of each of these BFMCs to prepare and adopt a Bushfire Risk Management Plan (BFRMP). These BFMCs are directed under Section 51 of the RF Act to have regard for the principles of ecologically sustainable development as described in Section 6 (2) of the *Protection of the Environment Administration Act 1991*, when developing BFRMPs and Operations Plans, without compromising the statutory obligations of life and property protection.

As HCC is not within a 'rural fire district' as defined by the RF Act, the above provisions cannot be utilised within Holroyd, and a BFRMP has not been prepared for the city. Nevertheless, the obligations and duty of care listed within the RF Act still applies to HCC and the management of the LPC can be based on the standards used within 'rural fire districts'

The RF Act also provides for the issuing of permits to light fires, and guidelines are available to assist in obtaining the appropriate approvals to conduct a burn.

### **1.5.3 NSW Threatened Species Conservation Act 1995**

The TSC Act aims to conserve biodiversity and to promote ecologically sustainable development by preventing the extinction of, and promoting the recovery of, all threatened plants, animals and ecological communities native to NSW, excluding fish and marine vegetation. The TSC Act requires all threatened species be managed by Recovery Plans and Threat Abatement Plans. DECC are responsible for developing these plans.

The TSC Act requires the consideration of threatened species and their habitats in the developmental planning process and a responsibility of the proponent to determine potential impacts on species. To ensure the beneficial

management of threatened species understanding the effects of different fire regimes is required. The most suitable fire regime for a species should be used whenever possible.

HCC, in conjunction with DECC must implement Recovery Plans and Threat Abatement Plans for species and communities listed under the TSC Act that are found within the LPC. Out of the two species within the LPC listed under the TSC Act, only the vulnerable species *Acacia pubescens* has an approved Recovery Plan (NPWS 2003), and the endangered species *Pimelea spicata* has a draft Recovery Plan (DEC 2004). Management requirements for the endangered ecological community Cumberland Plain Woodland are listed within various documents (DEC 2005) and other research (see Section 4). In the absence of, or lack of fire related information, this Plan has adopted the precautionary principle.

'High frequency fire', 'clearing of native vegetation' and 'removal of dead wood and dead trees', are listed by the TSC Act as 'Key Threatening Process' and need to be carefully considered and management when implementing fire management activities in the LPC.

#### **1.5.4 Commonwealth Environment Protection & Biodiversity Act 1999**

The EPBC Act provides for the protection of the environment, and the conservation of biodiversity, especially those aspects of the environment that are of National environmental significance. *Acacia pubescens* is listed as a vulnerable species under the Act.

Like that of the TSC Act, the EPBC Act requires the consideration of threatened species and their habitats in the developmental planning process and it is a responsibility of the proponent to determine potential impacts on species. To ensure the beneficial management of threatened species understanding the effects of different fire regimes is required. The most suitable fire regime for a species should be used whenever possible.

#### **1.5.5 NSW Biodiversity Strategy**

The *NSW Biodiversity Strategy* was developed by the New South Wales Government and develops a collaborative approach to biodiversity conservation. Its strategic goal is 'to protect the native biological diversity of NSW and maintain ecological processes and systems'. Inappropriate fire regimes have been identified in the Biodiversity Strategy as one of nine types of threats to biological diversity. Inappropriate fire regimes are also a key-threatening factor in many Australian ecosystems. This issue is targeted within the Biodiversity Strategy by Objective 3.4 'Improve fire management regimes', and requires the following actions:

- Priority Action 43: Manage fire in accordance with the principles of Ecologically Sustainable Development.
- Supporting Actions 44: Improve the considerations of fire threat in land-use planning and incorporate the results of applied fire research, including the knowledge and experience of local communities, in land management and land-use planning.
- Supporting Action 45. Continue a research program to examine the effects of fire on biodiversity.

This Plan is intended to assist HCC in achieving the Actions listed in the *NSW Biodiversity Strategy*.

## 2. SITE DESCRIPTION

A comprehensive site description is contained in the Lower Prospect Canal Plan of Management. The information below is a summary of those parts of the POM relevant to this FMP. Unless otherwise stated, the information in this Section 2 is sourced from the POM (Environmental Partnership 1999).

### 2.1 LOCATION

The LPC extends approximately 7 km within the Holroyd local government area from the Blacktown local government area boundary in the west to the Guildford Pipehead near Albert Street in the east. It is a linear reserve totalling approximately 60 ha in size but ranging in width from approximately 60 m to 160 m in width with a probable average width of 80 m. Figure 1 locates the LPC.

### 2.2 Topography

Much of the LPC has been altered in the past, creating a local topography depending on the operations around the original canal. Most of the LPC is relatively flat, with some sections of short and steep embankments as a result of cut and fill to achieve the grades of the canal. There are no predominant landscape slope or terrain patterns within the LPC.

### 2.3 BIODIVERSITY AND CONSERVATION SIGNIFICANCE

Owing to its early designation as a corridor for the distribution of Sydney's water supply, and consequently protection from other development, the LPC contains reserved regenerating Cumberland Plain Woodland.

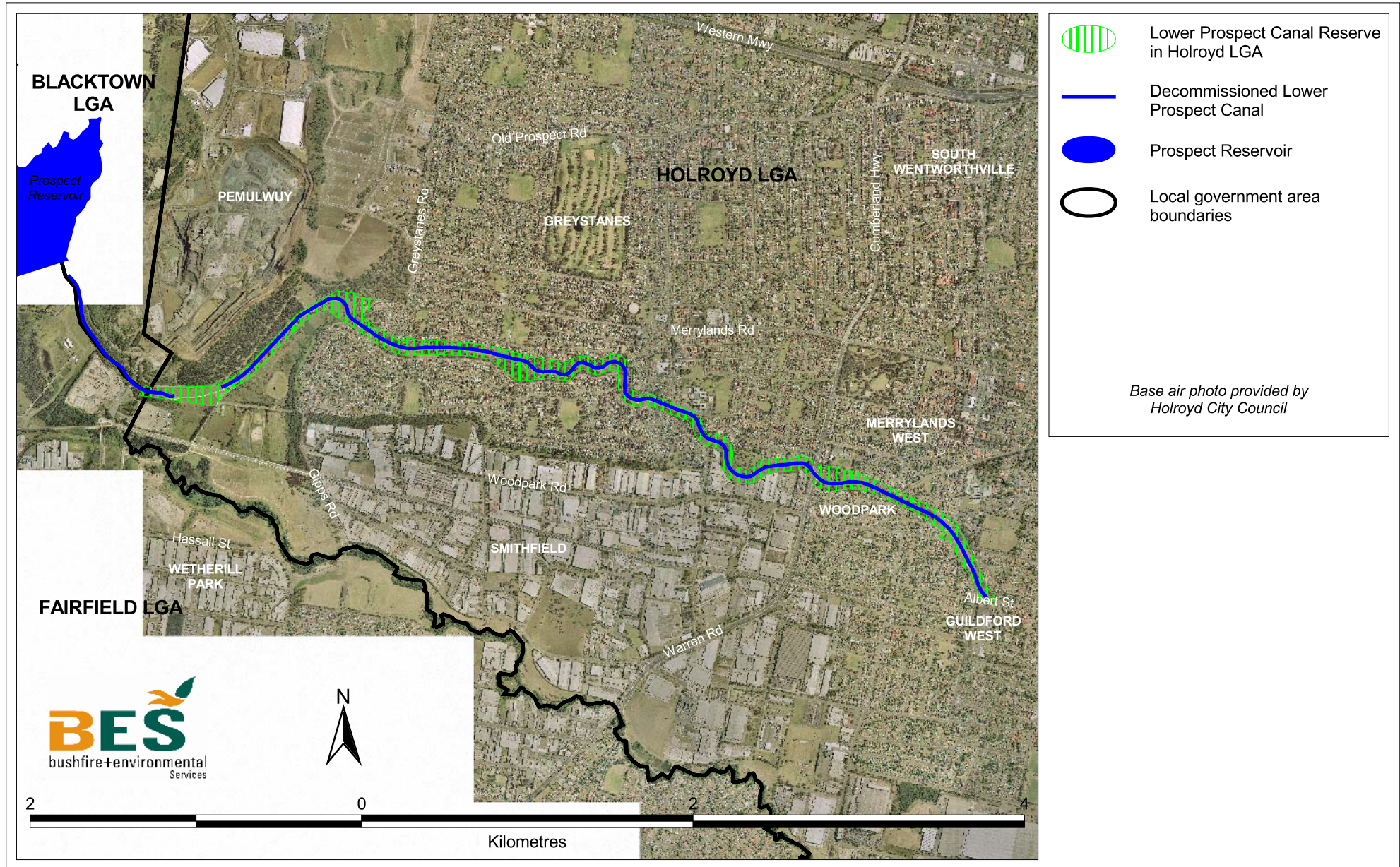
The POM refers to three previous vegetation studies of the LPC and one previous mapping study of Sydney vegetation, and one primary fauna investigation and supporting literature review used to gain an understanding of the biodiversity along the corridor.

Generally speaking, the corridor contains scattered and regenerating remnants of Grey Box Woodland, part of the Cumberland Plain Woodland assemblages. This woodland is dominated by Grey Box *Eucalyptus moluccana* and Forest Red Gum *Eucalyptus tereticornis*, with occasional trees of Broad-leaved Ironbark *E. fibrosa*, Thin-leaved Stringybark *E. eugenoides* and Rough-barked Apple *Angophora floribunda* as mapped by Benson (1992). NPWS (2002) mapped the vegetation as Shale Plains Woodland, a more general description for the type and structure of woodland within the LPC and other similar areas of Western Sydney.

Structurally speaking, the shrub layer is poorly developed across the board due to a long history of mowing which was ceased in 1994 (M Costigan 2006, pers.comm.), except along embankments, in drainage depressions and underneath dense stands of trees where mowing was difficult or not undertaken. From anecdotal reports the understorey seems to be regenerating well, with the new challenge being weed invasion. Stands of Privet, African Olive and to a lesser degree, Lantana, are establishing themselves along the corridor. The ground layer contains the trade mark diversity of Cumberland Plain Woodland vegetation, with the LPC displaying a diverse range of herbs and grasses.



Figure 1: Location of Lower Prospect Canal



The vegetation community displayed within the LPC was once widely distributed throughout Western Sydney, but today occurs in only small and isolated remnants, and often not well reserved, being within private property and threatened by the continuing pressures of development. As a result, this vegetation community is listed as an endangered ecological community on Schedule 1, Part 3 of the Threatened Species Conservation Act 1995. In addition to this important listing, the LPC corridor is listed as a key core biodiversity area for Grey Box Woodland in the Western Sydney region by the Urban Bushland Biodiversity Study (NPWS 1997). Such areas contain very good remnants of communities poorly represented in NPWS estate in Western Sydney. There is no area of Grey Box Woodland conserved except for an insignificant area in the Windsor Downs Nature Reserve.

In addition to the status of the vegetation within the LPC, the importance of its spatial context is a matter that could be overlooked. The LPC corridor provides a rare, linear bushland corridor through Western Sydney, providing a path for the movement of native flora and fauna from the edge of the suburbs to within.

### 2.3.1 Flora

Vegetation surveys by Thomas (1993) and James (1994) have recorded a total of 136 native plant species within the LPC corridor. Two plant species are considered threatened under legislation (Table 1), a further 3 species are considered regionally rare and vulnerable and of particular conservation significance (Benson & McDougall 1991), and a further 30 species are considered to be inadequately conserved in Western Sydney (Benson & McDougall 1991).

**Table 1: Threatened flora recorded within the Lower Prospect Canal corridor**

Species	TSC Act	EPBC Act
<i>Acacia pubescens</i> (Downey Wattle)	Vulnerable	Vulnerable
<i>Pimelea spicata</i>	Endangered	Endangered

### 2.3.2 Fauna

A field survey in 1998 undertaken for the preparation of the POM was used as the primary basis for determining the status and conservation significance of the LPC for fauna habitat. Other reports or fauna studies of nearby or related sites, and the NPWS Atlas was used to substantiate the results of the field surveys. In summary, 4 threatened species were recorded to be either within the LPC corridor or within the surrounding region and thought to utilise the habitats within the corridor. These are listed in Table 2 below.

**Table 2: Threatened fauna recorded within the Lower Prospect Canal corridor**

Species	TSC Act	EPBC Act
Large Land Snail	Endangered	
Regent Honeyeater	Endangered	Endangered
Swift Parrot	Vulnerable	Endangered
Powerful Owl	Vulnerable	

## 2.4 CULTURAL HERITAGE

Although it is known that the general area and location of the LPC corridor was inhabited by Aboriginal people (Environmental Partnership 1999) there is no recorded Aboriginal heritage site within the corridor. This is most likely due to the large degree of earth movement such as cut and fill required to construct the canal in the late 1880s. Some sites may have been buried or completely destroyed during a time where a lack of knowledge and general disregard for Aboriginal culture meant that archaeological sites would not have been preserved.

The European heritage of the LPC corridor is well studied and documented, as the existence of the corridor is due to an historic water distribution system for the continuation of Sydney's water supply.

The canal itself is of heritage significance, and the 'Covered Way', 'Aqueduct', 'Syphon' and 'Sedimentation Channel' are all of particular heritage significance. The POM describes these heritage assets in detail.

## 2.5 RECREATIONAL USE

The canal has been transformed into a well used bicycle and walking track linking many areas, other parks and schools. Other recreational opportunities include field naturalist pursuits (e.g. bird watching), walking, sightseeing, heritage appreciation and picnicking.

## 2.6 PROPOSED LANDSCAPING OF THE LPC CORRIDOR

An extensive landscaping proposal finalised in mid 2002 is currently underway and will be the focus of the LPC management in many years to come. The plan involves revegetation of otherwise cleared areas of the corridor, and the promotion of regeneration for other woodland areas, or areas with potential for regeneration. This plan must consider the landscaping efforts and devise a strategy for ensure and maintain fire management consistent with the landscaping objectives.

## **2.7 EXISTING BUSHFIRE ASSETS AND ADVANTAGES**

The compartmentalised nature of the LPC corridor means that most of it is accessible by vehicle. Those areas that aren't currently accessible are some steeper areas or locations where remnant trees and embankments will not allow the passage of a vehicle. Fire control can occur from many points within the corridor, predominantly where roads truncate the corridor or terminate at the corridor boundary. The bicycle track (and maintenance roads) span the length of the corridor allowing vehicles to respond to different areas. This good current level of access is a major advantage for the control and suppression of fire.

Other advantages include the public perimeter road separating houses from the corridor itself. For those parts of the corridor that are adjacent development, at least one quarter of the corridor interface is separated (protected) by a public road, creating a large manageable space and perimeter access for fire protection.

Holroyd City Council currently have a policy to maintain a 3 m shrub/grass and 10 m canopy setback from the rear of fences (M Costigan 2006, pers.comm.).



### 3. BUSHFIRE RISK ANALYSIS

This chapter describes the environment which influences fire within the LPC corridor through an examination of the fire history, fire weather, a field based analysis of the likely bushfire behaviour potential (including fuels), and an analysis of assets at risk.

#### 3.1 FIRE HISTORY

Written fire records for the LPC corridor date back to only 1994. Prior to this date fire history was not recorded, however, it is thought that, as the LPC was managed by water utility government departments and organisations up until this date, fire was not a regular occurrence due to the regular mowing regime and a strong focus on maintenance. No doubt small grass fires may have occurred, but these have not been recorded or mapped in any way.

Fire had not impacted the area whilst under NPWS management, and the first recorded fires to impact the site were in 2004, followed by 2005, 2006 and 2007. All fires were small in size and easily contained within compartmentalised landscaped areas such as between access ways, the bicycle track, mowed areas and fence lines. The largest fire was only approximately 150 m by 100 m, with most being around the 50 m by 20 m size (1000 m<sup>2</sup>). The size of the fire seems to be reflected by the area in which ignition had occurred. Most areas are accessible by vehicle (aiding rapid suppression) and are compartmentalised (providing control lines for effective control).

The size and timing of the recorded fires and known fuel loads demonstrate that the intensity of the fires were low. The size of the burnt areas were generally not large enough to have allowed a higher intensity fire to develop, with the largest of the fires having its intensity subdued by the low fuel loads present in the understorey. Out of the 8 recorded fires (Table 3), 4 occurred during the cooler months outside of the bushfire season (between October and March), and it was only the later years (2006 and 2007) when fires occurred in the summer months. The ability of these fires to sustain in the cooler months is because they, as all the recorded fires, were grass fires, where grass under a scattered canopy or no canopy at all is subject to solar radiation at any time of the year and can be cured within a matter of days. Figures 4 to 9 locate each fire listed in Table 3.

There is currently no area that is known (recorded) to have experienced more than one fire, and all fires are thought to have occurred through arson (M Costigan 2006, pers.comm.). There has been no recorded damage to property (M Costigan 2006, pers.comm.).

**Table 3: Fire history within the Lower Prospect Canal corridor**

Date	Location	Size
2004, June	Area 7 (Fire Management Unit 1); grass fire northern side of bicycle track midway along Area 7.	1,125 m <sup>2</sup>
2004, September	Area 4 (Fire Management Unit 2); fire within larger remnant on southern side of bicycle track, eastern end of Aqueduct.	13,000 m <sup>2</sup>
2005, June	Area 3 (Fire Management Unit 4); grass fire at eastern end on northern side of bicycle track.	1,000 m <sup>2</sup>
2006, February	Area 1 (Fire Management Unit 6); grass fire mid way on southern side of bicycle track.	750 m <sup>2</sup>
2006, February	Area 1 (Fire Management Unit 5); fire within remnant east of Cumberland Highway on steep embankment on southern side of bicycle track.	9,500 m <sup>2</sup>
2006, June	Area 4 (Fire Management Unit 3); within remnant at eastern end on the northern (eastern) side of bicycle track.	1,200 m <sup>2</sup>
2007, February	Area 4 (Fire Management Unit 2); grass fire on southern side of bicycle track, eastern end of Aqueduct.	1,375 m <sup>2</sup>
2007, February	Area 3 (Fire Management Unit 4); grass fire on mid way on southern side of bicycle track.	1,050 m <sup>2</sup>

## 3.2 FIRE WEATHER

An analysis of the fire weather experienced at Holroyd and surrounding region provides insight into how a climatic factor, or combination of factors, may affect the bushfire behaviour potential within the LPC corridor. These are useful in gaining some understanding of the wildfire weather potential and conditions suitable for prescribed ecological burns.

### 3.2.1 Climate

The LPC corridor experiences a climate characterised by mild winters and warm summers (UMBC 2003). The area occupies an intermediate position in the spectrum of climatic change from the coast to Penrith, although the rainfall is towards the lower end of the spectrum. Mean annual rainfall at nearby Lidcombe is 816 mm, occurring throughout the year, with an average 60% falling from January to June (UMBC 2003).

Temperatures range from an average daily maximum of 18°C in July to 28°C in January, and an average daily minimum of 3°C in July to 18°C in February (UMBC 2003).

### 3.2.2 Forest Fire Danger Index

The most useful and widely accepted indicator of the variation in bushfire weather patterns is the Forest Fire Danger Index (FFDI). Gill and Moore (1996) analysed historic FFDI values for various weather stations in Western Sydney. Whilst Gill and Moore (1996) suggest that FFDI is poorly predicted between stations, the local FFDI values at LPC are likely to follow the general trends supported by the analysis of Gill and Moore (1996).

These data show days of higher FFDI, can be expected in spring and summer. Those months of higher FFDI are attributed to the occurrence of the strong N-SW winds throughout Western Sydney. Extreme FFDI values (*i.e.* >50) have occurred in all months from September to March in Western Sydney.

The weather and historical data plus local knowledge of fire weather patterns indicate that:

- adverse fire weather conditions are most common in spring and summer, although extreme fire weather days may occur at any time from September through to March,
- adverse fire weather conditions are likely to be associated with strong winds from the west, northwest and to a lesser extent the southwest, and
- southerly 'blusters' may adversely affect fire behaviour.

### 3.2.3 Conditions associated with wildfire

A frequent atmospheric phenomenon in spring and summer results in a low pressure cell of very warm continental air trapped between a blocking high pressure cell in the Coral Sea and a cool maritime air mass advancing eastwards across the Great Australian Bight. As the anticyclone moves out to sea and cool dry air invades the southern part of the continent, a flow of very warm, dry air and strong NW winds is generated ahead of the cold front. This weather pattern and the accompanying southerly bluster is relatively common and is the most threatening fire weather pattern likely to affect Western Sydney.

Extreme bushfire weather conditions are most likely on days with dry seasonal conditions, low relative humidity, higher temperature and strong wind. The FFDI data and historical fire records for Western Sydney indicate a bushfire season that occurs mainly in spring and summer, but may extend to autumn. Adverse fire weather conditions usually occur over one or two days but may extend for a week or more. It is typical of bushfires in the region that periods of more rapid fire spread and higher fire intensities occur during the afternoon, associated with stronger wind, higher temperatures and lower relative humidity.

Weather conditions at the LPC will support the spread of fire in most years and under adverse conditions may result in high intensity fire depending on fuel loads, or a fire difficult to control through open grassland. These occasional extreme fire weather days are more likely when the strong and gale force winds from the west and north-west occur in January and February (Gill and Moore, 1996).

Strong southerly wind changes following conditions of stronger winds from other sectors provide particularly difficult firefighting conditions. During and immediately after a southerly change the fire intensity is typically similar to that occurring under the preceding winds (*e.g.* N-SW) as fuels may take up to 2 hours to absorb the moisture,

cooler conditions provided by the southerly winds. The small size of the bushland remnants at LPC means that the major problem with southerly changes moving the flank of a fire northward, is less significant.

Although the N-SW sector winds during spring and summer may potentially cause the most difficult fire weather conditions, the strength of winds from the N-SE and the SW-SE sectors may support high intensity fire despite their lower temperature and higher relative humidity, particularly in lighter fuels such as grasses.

#### **3.2.4 Conditions suitable for prescribed burns**

Research and management experience has shown that there are advantages and disadvantages for burning in any season of the year. For example, Tolhurst (1992) recognised that autumn burns provide a longer period of reduced ground fuel loads than spring burns, yet Catling (1991) identified the importance of spring fires for maintaining habitat complexity and reducing fire effects on moist gullies.

For ecologically based burning, Tolhurst (1999) suggested that the relative abundance of key fire response species and their method of persistence determines the best season to burn a particular community. Thus, it is not a simple matter of just selecting appropriate weather conditions for burning. Objectives of each prescribed burn must be clearly known before selecting the season and weather conditions under which burning is to occur.

Autumn and winter are the preferred time of year for prescribed burning at LPC, as these seasons provide relatively favourable weather conditions. Generally, the most favourable periods for prescribed burning occur when there is:

- dry surface fuels (moisture levels of 10 to 20 percent),
- a high level of moisture recovery in fine fuels at night, and
- a low probability of dry north-westerly winds, or strong winds from any direction.

Spring may be an appropriate time to burn to reduce the likelihood of burning the moister fauna refuge areas but at this time of the year adverse fire weather conditions (especially wind) may cause fire to escape from any remaining smouldering material. Widespread spring burning may also have an adverse impact on the reproduction of fauna and the subsequent dispersal of young (particularly for avifauna). Despite these concerns, occasional spring burning appears appropriate for providing variability within the fire regime (see Section 4) and minimising the impacts of overly repetitious and uniform fire regimes.

### **3.3 FIRE BEHAVIOUR POTENTIAL (FIRE HAZARD)**

Bushfire behaviour potential (BBP) is a term used to describe the potential behaviour of a fire under selected conditions at specific locations. BBP in this instance has been evaluated through analysis of the following factors: slope, aspect, and fuel. Each factor is discussed in the following sections along with a discussion on the affects of various landscape features.

### **3.3.1 Slope**

Steeper slopes can significantly increase the rate of spread of fires, and it has been shown that with each 10<sup>0</sup> increase or decrease in slope a corresponding doubling or halving, respectively, in the rate of spread can be expected (McArthur 1967). Thus, the relationship of the steepness of slope, and whether a fire moves upslope or downslope, is vital to understanding bushfire behaviour potential. Indeed, slope and wind are often the major factors determining the direction of fire spread.

There are some very steep embankments, however these are short in distance and usually upslope leading away from the development interface. The remainder of the LPC is relatively flat or consisting of slight undulating terrain. As most of the slopes of the LPC are in the lower range, and the steeper embankments are bushland areas are relatively small and isolated, the effect of slope on fire behaviour is not significant.

### **3.3.2 Aspect**

Fire behaviour may also vary with aspect, and this is particularly noticeable with lower intensity fires or in areas with steeper slopes. Aspects that are more exposed to solar radiation are usually drier and have higher fuel temperatures during the hotter parts of a day. Fire behaviour will also vary with the exposure each aspect provides to the prevailing wind. For the purposes of fire management, aspect is divided into sectors with the N-SW sector considered as contributing most to bushfire behaviour, followed by the SW-SE sector and the N-SE sector.

Aspect would not have an overly significant effect on fire within the LPC due to the small and compartmentalised nature of the remnants. There are embankment areas, drainage depressions and some sheltered locations where aspect may reduce rate of spread or fire intensity in a small area, but as the bushland areas are not large, aspect would not have a greater effect over other parameters such as wind, which may be affected by the level of canopy cover.

Aspect may however be a consideration when selecting the lighting method used in a prescribed burn during cooler months of the year, e.g. shady aspects may need to dry out longer prior to burning.

### **3.3.3 Fuels**

Vegetation communities can be categorised into four fuel groups based upon their estimated contribution to the potential behaviour of bushfire. The methodology for classifying these fuels groups is adapted from Dovey (1994).

As the vegetation within the LPC is a form of regenerating Cumberland Plain Woodland and grassland, the fuel group is considered to be within the 'medium', 'lower' and 'minimal' fuel groups depending on their condition, level of disturbance and history of regeneration (Table 4).

**Table 4: Description of the four fuel groups adapted from Dovey (1994)**

Fuel group	Characteristics of each fuel group
High	Continuous fuels, higher quantity, available to burn during average seasons ( <i>higher fire intensity expected</i> ); nil in LPC.
Medium	Less continuous fuels, medium level quantity, available to burn during average seasons but may be less often than high ( <i>medium or high fire intensity expected</i> ) e.g. Cumberland Plain Woodland; present in LPC but not widespread and only in disturbed and regenerating, smaller remnants.
Lower	Possibly discontinuous fuels, low-medium fuel quantity, moister fuels unlikely to contribute to high intensity fires in average season, fuel structure facilitates easier control ( <i>fire intensities may range from low-high and generally regarded as easier to control</i> ) e.g. Regenerating woodland and grasslands covering the majority of the LPC.
Minimal	Unlikely to burn or always burn within controllable limits; mowed grassland within LPC.

Notable features of the fuel group analysis for the LPC include:

- no areas of 'high' fuel group,
- only a few smaller remnants with regenerating understorey are classified in the 'medium' fuel group,
- the 'lower' fuel dominating the LPC as grassland and regenerating grassy woodland, and
- grassy fuels often burn rapidly but not with the same overall fire intensity of forests and heathlands that fall into the 'higher' fuel groups not present at the LPC. Grassy fuels may also become fire prone earlier in the season than heavier fuel types and areas of greater shading of the soil. Grassy fuels can also provide a conduit for fires between remnants.

### 3.4 ANALYSIS OF LIKELY FIRE BEHAVIOUR

Based on the information provided in the fire weather and fire behaviour potential sections above, likely fire behaviour can be predicted. Bushfire behaviour potential at sites with larger and more continuous expanses of vegetation is usually analysed using a method developed by Dovey (1994). This method applies weightings to slope, aspect and fuel loadings for each defined area of a site. The results are a ranking of areas into higher, medium and lower bushfire behaviour potential. This analysis does not indicate how often an area will receive potentially damaging fires nor the actual intensity of a fire. It does, however, provide a useful comparative ranking indicating sites of higher and lower potential fire behaviour compared to others in an area. However, the use of this method is not appropriate at the LPC owing to the small size, shape, orientation and isolation of the remnants.

The likely fire behaviour within the corridor can not be determined by its physical attributes due to its relatively small size and narrow shape. In the cooler months, outside of the bushfire season, these parameters may have

greater influence on ignition, fire spread and intensity. Fuel loadings will have a pronounced influence on the intensity of a fire, though intensities should remain controllable due to the grassy understorey, at least for the duration of this plan. Fine fuel loadings and the contribution of the understorey after significant regeneration, and lack of fire and other disturbance could alter this.

The bushfire behaviour potential in all areas would range from 'low' to 'medium' (after Dovey 1994) depending on the climatic conditions and remnant supporting the fire. The availability of fuel and the arrangement of that fuel in narrow, linear compartments has the most effect on fire behaviour along the LPC corridor. Fires can occur within any compartment, but as the area available to burn is relatively small and compartmentalised, these fires should not eventuate into a high intensity fire with widespread consequences.

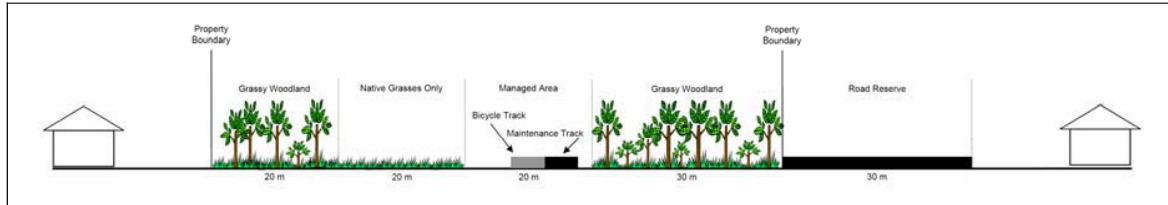
It is the combination of undesirable fire weather (i.e. hot and dry westerly winds during summer) and the potential for a grassfire to spread from west to east along the corridor that would produce the worst-case scenario fire for the LPC. Such a condition with the right ignition point may cause a fire that could spot ahead of itself. However, with the absence of an established understorey, and the ability for a fire to enter a canopy, a grassy understorey fire does not produce a level of ember attack that would significantly threaten surrounding houses and structures. It may travel fast, reaching fences and sheds within backyards before firefighters can attend the scene, but the damage is likely to be confined to these type of structures.

There are four features of the LPC corridor landscape that contribute to the prevention of fire spread to, and fire impacting on, the neighbouring assets and community. These are; width of vegetated area, reduction of fire front potential, compartmentalisation, and slope leading to neighbouring assets. These features are expanded on below.

### **3.4.1 Width of vegetated area**

The width of much of the LPC corridor is such that it does not lend itself to a high intensity fire that would impact on neighbouring properties. Ranging between 60 m to 160 m, and mostly being within a width of approximately 80-90 m, the corridor is of a size where large or intense fires should not occur to directly impact on neighbouring properties. Although almost 100 m wide in most places, the corridor does not contain all bushland. It is dissected in the middle by a bicycle track, often with a maintenance trail beside, and within a mown area approximately 20 m in width. Only some areas, particularly within Fire Management Units 2, 3 and 5 (refer to Section 5.6 for description and maps of Fire Management Units), support remnant woodland, but even these stands are patchy, have a grassy understorey for the most part and are separated by grassy areas, mown areas and the bicycle track. A typical cross-section of the LPC corridor based on the western end of Fire Management Unit 2 is shown in Figure 2 below. The cross-section shows that within the 90 m corridor there are only two areas that contain grassy woodland (with little to no understorey shrubs), and these are either side of the bicycle track and are no greater than 30 m in width.

**Figure 2: Typical cross-section through Lower Prospect Canal reserve within FMU 2**



### 3.4.2 Reduction of fire front potential

Using the analysis on the width of the LPC corridor, and taking into account the sections of woodland, wide fire fronts should not occur and impact directly onto adjacent boundaries. Fires may run the length of the corridor, indirectly affecting neighbouring development, but fires should not occur on large fronts towards the property boundary. The worst-case scenario fire introduced above would run parallel to adjoining properties, and can only reach significant intensities under extreme conditions in this parallel direction (where they are restricted by compartmentalisation), and not in the direction of adjoining assets (*i.e.* perpendicular to the interface). A higher intensity laterally spreading fire can result in high radiant heat from the longer flanks of the fire or be shifted toward assets with a sudden localised wind shift.

### 3.4.3 Compartmentalisation

The LPC corridor consists of a number of accessible and separated strips or compartments of land, separated by lateral roads (bridges) and walkways and changes in corridor direction. These boundaries act as transverse firebreaks and potential fire control lines. The sectoral nature of compartments and their narrow widths, coupled with the division provided by the managed zone within the middle of the corridor containing the bicycle track, provide an environment where fires can be controlled before they can spread and reach intensities and direction that may cause damage to neighbouring assets.

### 3.4.4 Slope leading to neighbouring assets

Another significant feature of the LPC corridor is the predominance of upslopes leading away from the interface adjoining assets. The vegetation is either raised above the surrounding residential areas, or otherwise relatively flat. Fire must travel downhill over short distances to affect properties (see Section 3.3.1 for influence of slope on fire).

## 3.5 DAMAGE POTENTIAL

### 3.5.1 Life and property

The threat to human life is regarded as the most important of all the bushfire threats. Protection of life receives the highest priority in all fire management planning and is implicit within every fire management strategy.

The threat to life and property can be considered by comparing the bushfire risk analysis above with the location of houses and built assets. The analysis of likely fire behaviour and fire history has identified that there is a low threat



to life and property adjacent the LPC corridor. The threat to visitors/users of the corridor and firefighters is also reduced due to available access and egress, as well as numerous potential fire control lines.

There is no record of significant fire damage to neighbouring assets along the LPC corridor, including fences (a result of the compartmentalisation of the corridor, control lines, upslopes leading away from neighbouring properties, and low fuel loads). This shows that although damage as a result of fire could occur at some point in time, its frequency and significance is likely to be low. Landscape design and maintenance has resulted in a bushfire environment that does not readily allow high intensity fire at the interface with adjoining property. It is highly unlikely that damage will occur to neighbouring residences or significant assets as a result of flame contact or radiant heat. Damage, or spot fires, as a result of ember attack, however, does have potential. Although the quantity of airborne embers produced from woodland in the corridor would be less than produced by more mature remnants of Cumberland Plain vegetation in other Western Sydney reserves.

### **3.5.2 Natural Heritage**

Section 4 of the Plan discusses fire management for biodiversity conservation and the impact of fire on biota. In general terms the threat to flora and fauna is less from a single wildfire than it is from inappropriate fire regimes (*i.e.* the combination of fire frequency, fire intensity, time of year burned, pattern of burn, *etc.*). Inappropriate fire intervals in particular are known to cause a decline in species richness and abundance.

Another potential threat from wildfire is damage resulting from fire suppression activities. This threat includes potential damage to existing tracks through the use of heavy vehicles and the creation of new tracks as fire control lines. New tracks have the potential to become vectors for problems associated with access such as weed and pest invasion, erosion and fire ignition. Fire suppression activities may also exacerbate pest problems through the spreading of weed species.

### **3.5.3 Cultural heritage**

Items of cultural heritage at LPC include the sandstone features of the canal and associated structures 'Covered Way', 'Aqueduct', 'Syphon' and 'Sedimentation Channel'. It is known that the bushfire risk to these features is generally minor. Fire can blacken the sandstone, but would not affect its structural qualities. A threat will also be posed by any prescribed burning in these areas. Assessment of vulnerability and options for management of these structures for protection from bushfire and prescribed burning are discussed further in Section 5.8.

## **3.6 BUSHFIRE RISK ASSESSMENT**

Based on the analysis provided throughout this chapter, the following tables assesses the risk to people, property (infrastructure, assets, private property), environmental assets, and cultural assets. The methodology adopted is that given in AS 4360-2004 whereby a risk classification scheme is developed through qualitative scales of likelihood and of consequence. The terminology describing risk factors used in the assessment is consistent with bushfire risk management planning process adopted by the NSW Rural Fire Service for 'rural fire districts' of NSW.

This assessment adopts a definition of likelihood based on likelihood of occurrence over the currency of the plan. The scale of likelihood are shown below and are based on AS 4360. Values have been allocated to the likelihood descriptors on a scale of 1 to 5 with 1 being extremely rare (extremely unlikely) and 5 being almost certain.

**Table 5: Scale of likelihood for AS 4360-2004**

Descriptor	Description
Almost certain (5)	The event is expected to occur in most circumstances during the currency of the plan
Likely (4)	The event will probably occur in most circumstances during the currency of the plan
Possibly (3)	The event might occur at some time over the currency of the plan
Unlikely (2)	The event could occur at some time over the currency of the plan
Rare (1)	The event may occur only in exceptional circumstances

Rating codes and the level of risk were then calculated by multiplying likelihood levels and consequence levels with the rating determined as per the scale outlined below.

**Table 6: Rating codes and level of risk rating for AS 4360-2004**

Level of risk	Risk rating
0 - 4	insignificant
5 - 9	minor
10 - 14	moderate
15 - 19	major
20 - 25	extreme

**Table 7: Analysis of risk factors**

Risk Factor	Analysis of the risk factor
<p>1. The likelihood of human and natural fire ignitions, as influenced by time, space and demographics</p>	<p>Natural ignitions within the LPC are unlikely.</p> <p>Human induced ignitions are known to occur due to long length of urban / bushland interface.</p> <p>The LPC has a history of human induced fire ignitions.</p>
<p>2. The potential spread and severity of a bushfire, as determined by fuel, topography and weather conditions.</p>	<p>The nature of the LPC corridor is such that it does not lend itself to severe and widespread fires.</p> <p>Severe fire weather from the westerly sector could drive a grass fire along sections of the corridor, and spotting could occur. Ember attack on surrounding houses would be low.</p>
<p>3. The proximity of assets vulnerable to bushfire and likely bushfire paths</p>	<p>Residential dwellings and associated structures run along the majority of the length of the LPC corridor. Although the majority of these assets are set back from the corridor with backyards managed appropriately. Fences and backyard structures may be proximate to unmanaged vegetation within the corridor.</p> <p>A community component of the Endangered Ecological Community <i>Cumberland Plain Woodland</i> covers a lot of the corridor, and the threatened species <i>Acacia pubescens</i> and <i>Pimelea spicata</i> occur in a few small locations. Inappropriate fire regimes may threaten these communities.</p> <p>Heritage structures such as the Aqueduct and canal are within the grassland.</p>
<p>The vulnerability of assets, or their capacity to cope with, and recover from bushfire</p>	<p>Fences and sheds (and the life) maybe destroyed.</p> <p>Fire may impact threatened species and communities and exacerbate weed and pest invasion.</p> <p>Heritage structures are not considered vulnerable to low of medium intensity fires.</p>

**Table 8: Bushfire Risk Assessment – Life**

<b>Vulnerability Criteria</b>	<b>Consequence (A)</b>	<b>Likelihood (B)</b>	<b>Level of risk (A x B)</b>	<b>Rating</b>
Populated area where the combination of threat and vulnerability expose a community to a significant likelihood of fatalities and major injuries.	5	1	5	Minor
Less likely to be fatalities or major injuries due to the presence of attributes which afford some protection.	4	1	4	Insignificant
Loss of life or major injury highly unlikely. Medical/hospital treatment may be required.	3	2	6	Minor
Minor injuries only - first aid treatment. No major injuries or fatalities likely.	2	2	4	Insignificant
No injuries or fatalities likely.	1	4	4	Insignificant

**Table 9: Bushfire Risk Assessment - Property (infrastructure, assets and private property)**

Vulnerability Criteria	Consequence (A)	Likelihood (B)	Level of risk (A x B)	Rating
Extensive and widespread loss of property. Major impact across a large part of the community and region. Long term external assistance required to recover	4	1	4	Insignificant
Localised damage to property. Short-term external assistance required to recover.	3	1	3	Insignificant
Short-term damage to individual assets. No external assistance required to recover.	2	2	4	Insignificant
Inconsequential or no damage to property. Little or no disruptions to the community.	1	3	3	Insignificant

**Table 10: Bushfire Risk Assessment - Environment**

Vulnerability Criteria	Consequence (A)	Likelihood (B)	Level of risk (A x B)	Rating
Extinctions of native species.	5	1	5	Minor
Irreversible damage to the environment.	4	1	4	Insignificant
Long-term damage to the environment over a landscape scale.	3	1	3	Insignificant
Short-term, localised damage to the environment.	2	3	5	Minor
Minor impact on the environment.	1	3	5	Insignificant

**Table 11: Bushfire Risk Assessment - Cultural sites**

<b>Vulnerability Criteria</b>	<b>Consequence (A)</b>	<b>Likelihood (B)</b>	<b>Level of risk (A x B)</b>	<b>Rating</b>
Loss and/or irreversible damage to sites or objects of national, state or regional significance.	5	1	5	Minor
Extensive damage to sites or objects of national, state, regional or local significance requiring major external assistance.	4	1	4	Insignificant
Short-term damage to individual objects. Short term external assistance required to repair.	3	1	3	Insignificant
Short-term, localised damage to a small number of sites, objects and the cultural landscape.	2	2	4	Insignificant
Minor impact on sites or items and are repairable with little to no external assistance.	1	2	2	Insignificant

## 4. BIODIVERSITY CONSERVATION

### 4.1 PRINCIPLES AND THRESHOLDS

#### 4.1.1 Principles

A primary aim of this FMP is the protection, maintenance and enhancement of biodiversity and ecological values of the LPC. That is, the protection and recovery of the native vegetation and associated habitats of the LPC, and the constituent native flora and fauna species. This aim is supported primarily by the strategy of keeping fire regimes in the LPC within the appropriate thresholds for each species, population and ecological community where possible.

Contemporary ecological research in fire-prone vegetation communities has established some general principles about the appropriate fire regimes required to conserve biodiversity. Management of fire for conservation purposes in LPC will be guided by the following general principles:

- Groups of plant and animal species respond similarly to fire according to characteristics of their life history. Therefore it is not necessary to individually specify fire regimes for the conservation of every species. Rather, an overview is needed of the requirements for broad groups of species. Requirements for most plant species can be summarised on the basis of a small number of groups. Scientific understanding of the requirements for groups of animals (and particularly invertebrates) is less advanced;
- Plant and animal communities are inextricably linked. Plants form an important component of habitat for animals. Fire managers must consider this important interaction;
- A diversity of fire regimes may be needed to maintain biodiversity. This means that over time, there is a place for fires of high, moderate and low intensity, frequency and size. Extinctions may be likely when fire regimes of relatively fixed intensity, frequency and extent prevail without variation;
- There is a threshold in fire regime variability that marks a critical change from high species diversity to low species diversity (Bradstock *et al.*, 1995). For some groups of biota these thresholds separating desirable and undesirable fire regimes can be defined. Management should therefore be targeted toward desirable fire regimes using these thresholds as a guide. The advantage of using thresholds to determine fire regimes is that it is not directing an ecosystem to a single state but maintaining it in a range of states above the threshold (Walker 1989);
- Management strategies involve the manipulation of fire regimes. While scientific information supporting this strategy may be incomplete, fire management using this framework can progress as further knowledge is accumulated. Assessment of fire regimes through the mapping of individual fires (including the characteristics of the fire) will be ongoing so that strategies (manipulation of fire regimes) can be regularly reviewed, refined and adjusted. In addition strategies, where possible, need to be assessed against their ecological objectives and not limited to a surrogate indicator such as the implementation of the strategy.

#### 4.1.2 Thresholds

Table 12 provides fire regime guidelines (thresholds) for the Cumberland Plain Woodland (CPW) endangered ecological community and threatened species *Acacia pubescens* and *Pimelea spicata*. The thresholds are based upon the above mentioned principles for biodiversity conservation and current best practice fire management guidelines for the CPW, *Acacia pubescens* and *Pimelea spicata* as identified in the published literature, including published recovery plans (NPWS 2003 and DECC 2004) and through consultation with relevant experts (P Watson pers. comm., 2006).

Scientific understanding of the fire requirements of animal species is not as advanced as that for plants. It is, therefore, more difficult to prescribe specific fire management strategies for animal species. The major effects of fire on animals are through changes to their habitat and the availability of food, shelter and breeding sites (Williams & Gill 1995). Therefore, the effect of fire regimes on the habitat requirements of animals is significant. Further discussion on the effect of fire regimes on threatened fauna and recommended safeguards are provided in Section 6.5.7.

It is important to note the thresholds outlined are based on the current level of knowledge and not comprehensive research. Further research is required to refine biodiversity thresholds and is an important component of this Plan. In addition, it is important to note that the 'ecological consequences of high frequency fires' and inappropriate fire regimes is a Key Threatening Process under Schedule 3 of the TSC Act and is not only an important consideration for the management of CPW, *Acacia pubescens* and *Pimelea spicata* (see Appendix 1 for NSW Scientific Committee final determination), but for all biodiversity within the LPC.

#### **Cumberland Plain Woodland (endangered ecological community – TSC Act)**

Whilst a recovery plan has not yet been prepared for the CPW, there has been some research informing the management of fire within CPW, including research specific to the CPW (Watson 2006) and research conducted in similar grassy woodlands in other parts of south-eastern Australia (Lunt and Morgan 1999, Prober *et. al* 2004). The work of Watson (2006) confirms that fire has a powerful influence on the floristic composition and structure of CPW remnants with an abundance of Blackthorn *Bursaria spinosa* in sites where fire frequency is low, a greater diversity of other native shrubs, particularly obligate seeders, where there are moderate fire frequencies, and a dominance of native grasses and forbs, particularly Kangaroo Grass *Themeda australis*, in high fire frequency sites.

In the context of the LPC, this research suggests that a range of fire regimes, and in particular fire frequencies should be maintained across the LPC, to maximize the diversity of habitats and to avoid the development of a homogenous vegetation, both structurally and floristically, that is characterised by being particularly shrubby or grassy. Watson (2006) suggests that the maintenance of a floristically and structurally diverse CPW will require some fire and suggests that inter-fire intervals should ideally range between 4 and 12 years. Watson (2006) also proposes the use of a simple monitoring program, focused on flowering of obligate seeder shrubs, Kangaroo Grass health, and Blackthorn expansion, to monitor the need or otherwise for either the application or exclusion of fire.



Watson (2006) also observed that weeds were most abundant in remnants where the fire regime was characterised by a low fire frequency, highlighting the importance of fire management in the management of weeds within the LPC.

***Acacia pubescens* (vulnerable species – (EPBC Act and TSC Act)**

*Acacia pubescens* is a shrub 1-5 m in height that flowers between August and October when plants are 3 to 5 years old. Peak seed production occurs in November, although seed production is generally low and this species seems to rely on vegetative re-growth, which it does vigorously after fire (J Rawling pers. com. 2003).

*Acacia pubescens* has an approved Recovery Plan and the fire regime and threshold conclusions have been made using the life cycle and fire response information from within the Plan (NPWS 2003). As there have been no comprehensive studies on *A. pubescens*, most of the fire response information contained within the Recovery Plan is based on assumptions from other Acacias. Thomas (1994) suggests that the minimum threshold is 5 to 7 years, and consecutive fires 2 years apart may lead to a gradual decline of the species. The threshold of 5 to 7 years would allow sufficient time for seedlings to flower, replenish the soil seedbank and allow for re-sprouting individuals to become fire resistant, although a period of 10 years may be required for an adequate seedbank to develop.

Less is known about fire intensity and seasonality, although, like other Acacias, a hot fire is required to break the seed case,. As such late summer and autumn is likely to be the preferred season to promote germination from seed and because regenerating seedlings and re-sprouting plants are more likely to encounter moister conditions for growth.

***Pimelea spicata* (endangered species – EPBC ACT and TSC Act)**

*Pimelea spicata* is a slender decumbent or erect shrub with stems to 50 cm high that flowers sporadically throughout the year. The species reproduces vegetatively from a stout tap root and also germinates relatively easily from seed. The species is also known to be capable of maintaining a long-lived persistent soil seed bank and as such it is thought that there may be populations in existence that are represented only by a soil stored seed bank (DECC 2004).

A recovery plan has been prepared for *Pimelea spicata* and the fire regime and threshold recommendations in this plan are based upon the life cycle and disturbance response information provided in the recovery plan (DECC 2004). The species is known to re-sprout vigorously from a stout tap route following disturbances such as fire. However it is unsure how long is required for a fire resistant taproot to develop in young plants however it has been estimated that this may take more than three years (NPWS 1997). Germination from seed is also common after fire however seed production may not occur in until plants are 1.5 -2 years old.

Notwithstanding the species ability to re-sprout or germinate from seed following fire it is likely that repeated frequent fires will exhaust both the soil stored seed bank and the resources stored in the tap root, thus reducing the ability to re-sprout, and thus may lead to local extinctions of the species. Conversely a long term absence of disturbances such as fire is also likely to lead to the local extinction of the species.

Given the state of our current understanding of the disturbance ecology of *Pimelea spicata* the recovery plan recommends that fire intervals of less than ten years be avoided.

**Table 12: Fire regime threshold guidelines<sup>1</sup> for vegetation communities and threatened flora**

Community / Species	<i>a decline in biodiversity is predicted/possible if there is:</i>			Minimum to optimum threshold to be used in the FMP
<b>Cumberland Plain Woodland (CPW)</b>	3 consecutive fires, with each of the fires less than 4 years apart	no fire for 12 years	successive fires that totally scorch or consume the tree canopy	4 – 12 years
Acacia pubescens	2 consecutive fires, with each of the fires less than 5 – 7 years apart			5 – 7 years
Pimelea spicata	2 consecutive fires, with each of the fires less than 10 years apart			At least 10 years

<sup>1</sup> Table 12 provides fire regime guidelines (thresholds) for the vegetation communities and threatened flora within the LPC. The thresholds are based upon the principles for biodiversity conservation listed in Section 4.0 and current best practice but should be reviewed annually in the context of any relevant new information.

## 5. BUSHFIRE RISK MANAGEMENT

Bushfire risk management should aim to reduce both the likelihood and consequences of bushfires. Broad strategies to achieve this aim are summarised in Table 13 and detailed in the following subsections.

Implementation of these strategies provides an effective way of minimising the risk to adjoining residential areas. However as no development adjacent a bushland area can be guaranteed to be entirely safe from bushfires, providing an acceptable level of protection and a tolerable residual risk, is to some extent a compromise between the level of threat, inconvenience, dangers, and costs (financial and environmental) involved in providing the protection. To create this balance and minimise adverse impacts on the LPC corridor, a 'joint responsibility' for fire protection should be a major planning focus, whereby primary protection is to be achieved immediately adjacent to assets on adjoining lands. This can be facilitated by proposed bushfire education programs.

**Table 13: Bushfire risk reduction strategies and actions**

Strategy	Actions
Avoid the risk	<ul style="list-style-type: none"> <li>▪ appropriate landscaping design.</li> </ul>
Reduce the hazard	<ul style="list-style-type: none"> <li>▪ clearing of fuels and provision of access areas and defensible space zones.</li> </ul>
Reduce ignition	<ul style="list-style-type: none"> <li>▪ local bushfire education and extension programs.</li> <li>▪ communications regarding Total Fire Ban days and burn permits.</li> </ul>
Reduce vulnerability	<ul style="list-style-type: none"> <li>▪ development and implementation of cooperative and complimentary fire management strategies with neighbours and adjoining residences.</li> </ul>
Understand and accept residual risk	<ul style="list-style-type: none"> <li>▪ manage with early detection and fire suppression operations .</li> <li>▪ local bushfire education and extension programs.</li> </ul>

### 5.1 AVOID THE RISK – LANDSCAPE DESIGN

The additional hazard that may be created from the proposed landscaping of the LPC corridor can be adequately managed by way of maintenance of compartments, including road and walkway truncations, bicycle track and maintenance road bisection and access and defensible space maintained at the rear of neighbouring properties (refer to Section 5.2 below).

The risk associated within inappropriate fire regimes for Cumberland Plain Woodland and threatened flora are discussed in Section 5.7.

## **5.2 REDUCE THE HAZARD – ACCESS AND DEFENDABLE SPACE**

Access and defendable space is the key component of fire suppression and property protection along the LPC corridor. The bushfire risk analysis section demonstrated that a low threat is present, and this threat can be adequately managed by ensuring access to perimeter locations to control and suppress fires. Most, if not all houses are setback off the boundary with the LPC reserves, providing a minimum managed separation distance, or asset protection zone of at least 10 m, and more in many instances. This level of separation, coupled by the additional defendable space to be created or maintained along the fence line within the LPC, should afford protection against flame contact and radiant heat from a grassy woodland fire travelling downslope across short distances and often parallel to the boundary.

Holroyd City Council currently aim to maintain a 3 m setback for shrubs and grasses, and a 10 m setback for tree canopies at the rear of fences along the LPC. This Plan recommends that the setback for shrubs and grasses be increased to a distance of 5 m, so that firefighters can operate around vehicles in areas where accessible, and the canopy setback be removed (in regards to a bushfire protection strategy) as it is not seen to be necessary (only 5 m setback from all obstructions, including tree trunks).

This level of management should occur for all perimeter sections of the LPC corridor where public perimeter roads or adjoining parks are not present. It should allow thoroughfare by NSW Fire Brigade pumpers in some sections, and NSW Rural Fire Service tankers in others where four wheel drive capability is required. It is noted that Holroyd is not a 'rural fire district' and is within NSW Fire Brigades jurisdiction. Contacting nearby Blacktown Rural Fire Service Control Centre in Florence Street, Prospect to coordinate a supportive response arrangement to provide the vehicles equipped to fight bushland interface fires is highly recommended.

## **5.3 REDUCE IGNITION - EDUCATION**

The establishment of access and defendable space zones, as proposed in this plan, provides a significant improvement in the protection of community assets adjoining the LPC corridor. Despite these works, some assets within adjoining lands cannot be adequately protected without complimentary bushfire protection activities. Education/extension programs by Holroyd City Council and NSW Fire Brigades should be conducted to facilitate this process.

The objective of extension programs is to effectively share the fire management responsibility amongst the neighbouring residents and local community by providing information, raising awareness and improving their fire management capabilities. Readiness and awareness of the community is vital to ensure the safety of people and the preparation for their dwellings and assets. To achieve this objective, it is recommended that Holroyd City Council implement the following initiatives:

- All bushfire management works undertaken within the LPC should be advertised to neighbours and to relevant stakeholder groups,
- Continue to support community groups who have an interest in the LPC. Community based groups offer an effective means to raise awareness of fire related issues and encourage public cooperation and participation in fuel management practices,

- In conjunction with local fire brigades, undertake advertising and other community-awareness campaigns aimed at reducing the frequency of bushfires, increasing asset protection, and providing safe bushfire response behaviour, and
- Use media statements, signs within the reserve, leaflets, displays and other available interpretative media to disseminate fire related messages.

It is recommended that Council produces its own interpretative media (leaflets, displays, signs) that focuses on encouraging private/personal ownership of fire management whilst also promoting appreciation of the community's natural and cultural resources provided by the LPC reserves. In the interim, Council should liaise with NSW Fire Brigade to investigate opportunities currently available (e.g. FireWise).

#### **5.4 REDUCE VULNERABILITY – COMPLEMENTARY STRATEGIES (NEIGHBOURS)**

As noted above, the action of neighbouring landholders can reduce the vulnerability of assets against fire. The organisation of backyards, including sheds, woodpiles, maintenance of lawn and green waste piles, is imperative in preventing a small grass fire within the LPC from destroying a fence, shed or even spread to a house. The recommended strategies within this Plan rely on the assumption that neighbouring properties have some form of managed setback from the LPC boundary. If this setback is not maintained well, then the strategies within this plan may fail. Maintenance and complimentary strategies can be encouraged through education.

#### **5.5 UNDERSTAND AND ACCEPT RESIDUAL RISK**

Residual risk is defined as the bushfire risk that remains after the implementation of bushfire risk reduction measures. It acknowledges that despite the bushfire protection measures that are able to be put in place, some bushfire risk to life and property will remain and bushfires will continue to threaten life and property, at least to some extent.

The concept of residual risk is inherent in most if not all fire management plans. For example, there is also no guarantee of 100% life and property protection when applying the NSW standard for new development in bushfire prone areas 'Planning for Bushfire Protection' (NSWRFS 2006). It is simply not possible to develop this level of bushfire protection for life and property located in areas adjoining bushfire prone lands.

The residual risk remaining after 'Planning for Bushfire Protection' is applied is apparently accepted by society as reasonable, as the standard has been approved through legislative processes. However this apparent acceptance of a residual risk in 'Planning for Bushfire Protection' only applies to new development in a 'rural fire district' and there is no state-wide or local guideline available on acceptable risk for existing developments.

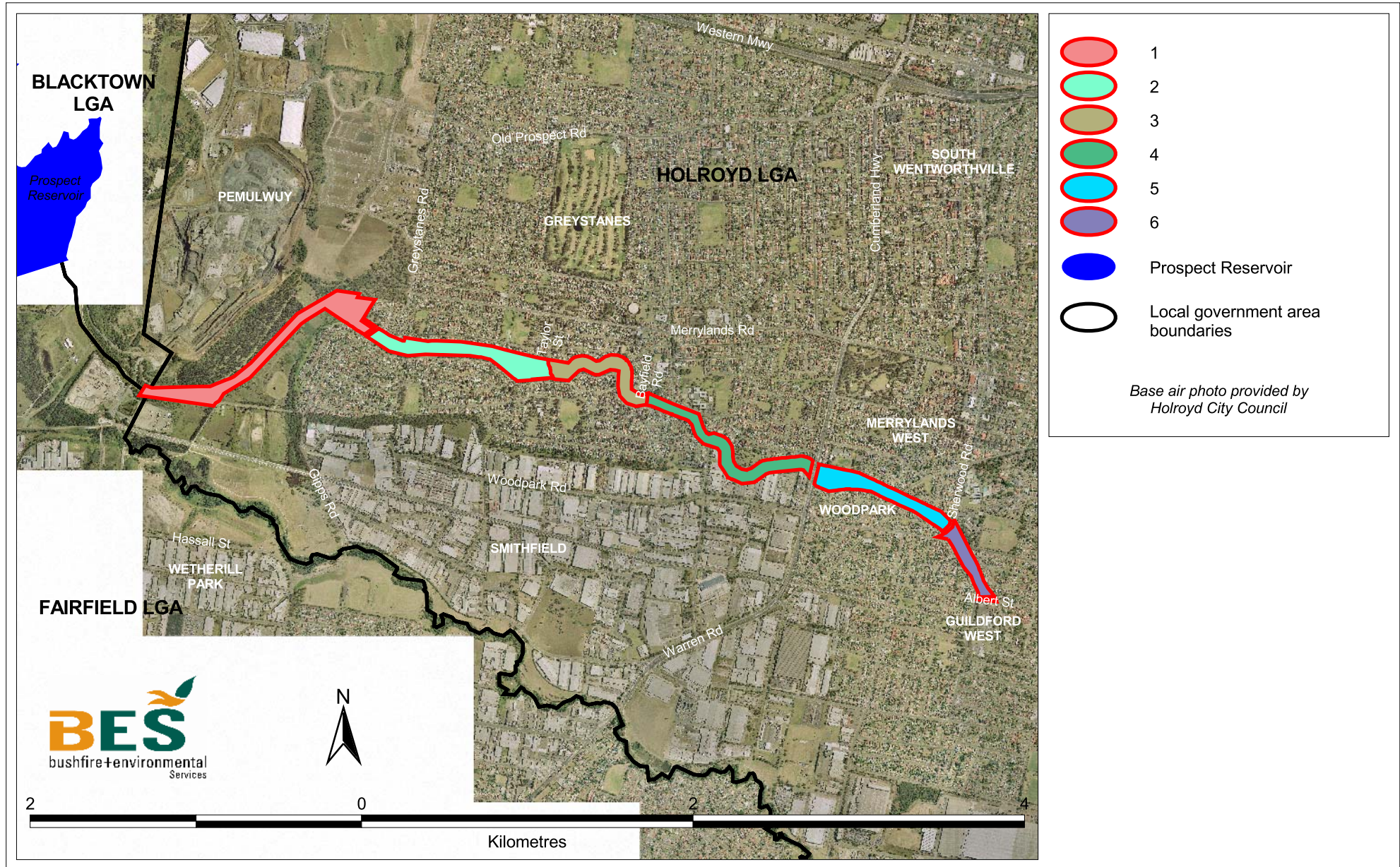
A diversity of opinion within the community is inevitable regarding what is an acceptable level of residual bushfire risk. It can be effectively argued that environmental impacts (including socio-economic impacts) will be excessive unless a higher level of residual bushfire risk is accepted, but it is clear that a higher level of residual risk includes a higher risk to life, as well as property.

## **5.6 FIRE MANAGEMENT UNITS (FMUs)**

The LPC has been divided into 6 Fire Management Units (FMUs) based on similarities in bushfire environment, likely fire behaviour and control points. Figure 3 identifies the FMUs throughout the LPC corridor. The FMUs are different to the 'Areas' used for landscaping. Each FMU is listed below, and this process allows the strategies for each FMU to be detailed and indicated on maps that follow each FMU table.



Figure 3: Fire Management Units (FMU) at Lower Prospect Canal

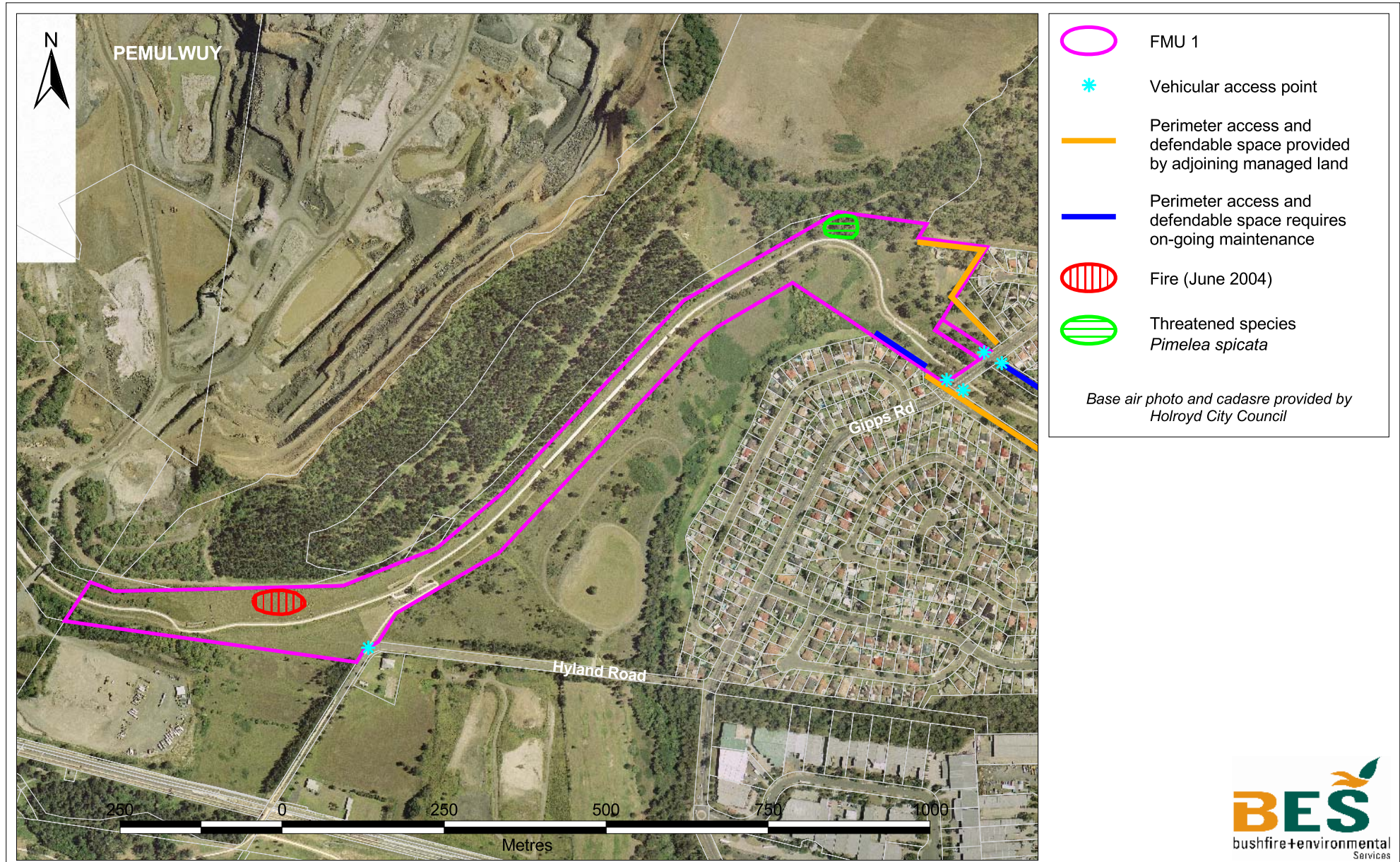


### 5.6.1 FMU 1: Blacktown LGA – Gipps Road bridge

<b>Points to be maintained for vehicular access</b>
▪ Western end from Hyland Road.
▪ Eastern end from Gipps Road bridge on either side of corridor and bridge.
<b>Perimeter protection and defensible space</b>
▪ Adequate perimeter protection along houses in northern section of Munro Street and Bilpin Street adjacent Scout Hall area. To be maintained.
▪ Perimeter protection not required along remaining sections where no adjoining developed interface.
<b>Environmental and cultural heritage issues</b>
▪ Grey Box Woodland (Cumberland Plain Woodland) endangered ecological community.
▪ <i>Pimelea spicata</i> present west of the scout hall.
▪ Canal.



Figure 4: FMU 1: Blacktown LGA - Gipps Road bridge

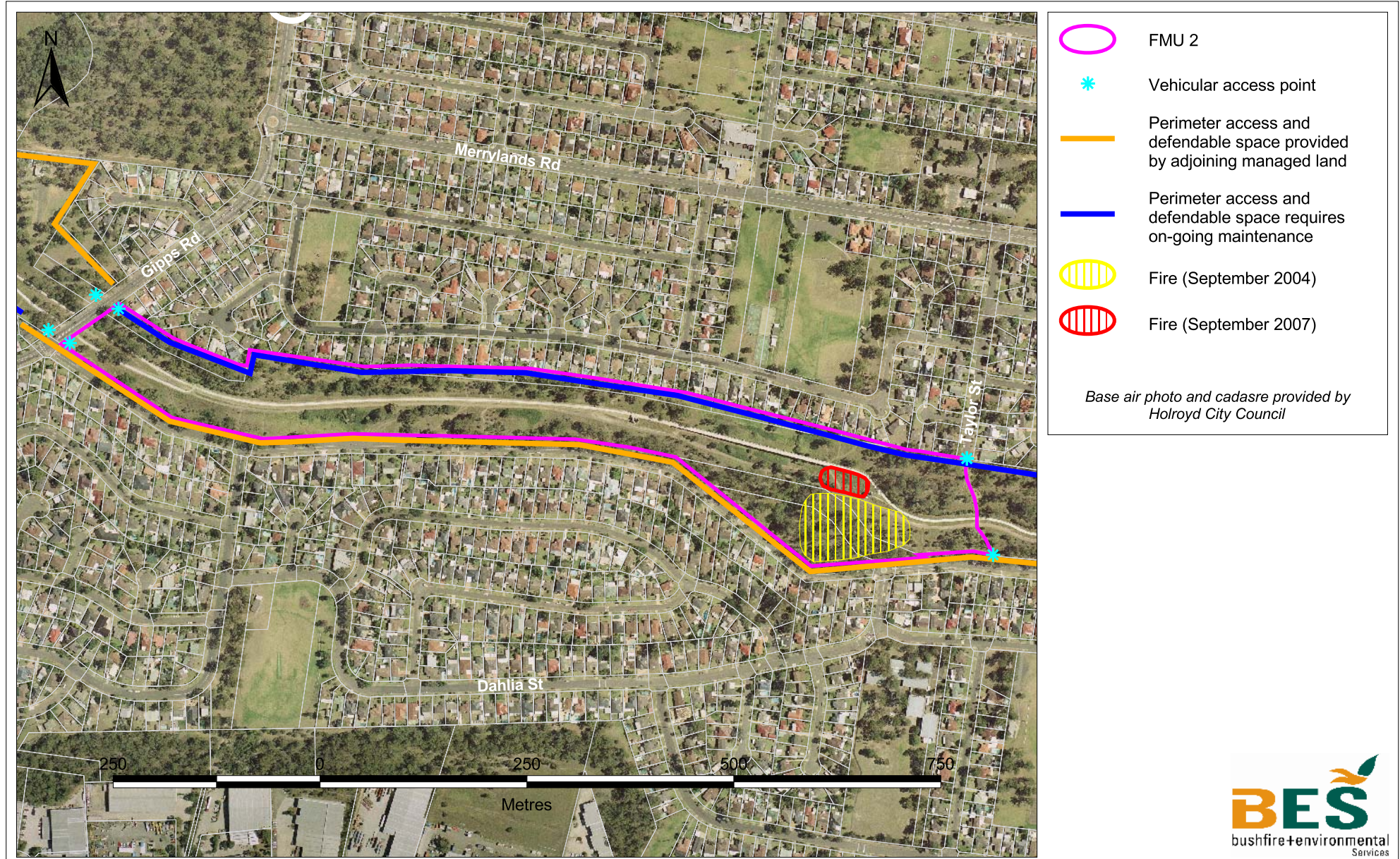


### 5.6.2 FMU 2: Gipps Road bridge – Taylor Street walkway

<b>Points to be maintained for vehicular access</b>
▪ Eastern end from Gipps Road bridge on neither side of corridor and bridge.
▪ Western end from Taylor Street walkway on either side.
<b>Perimeter protection and defensible space</b>
▪ Adequate perimeter protection along entire southern perimeter as Macquarie Road.
▪ Perimeter protection along the northern perimeter up to the aqueduct where it requires establishment.
<b>Environmental and cultural heritage issues</b>
▪ Grey Box Woodland (Cumberland Plain Woodland) endangered ecological community
▪ Canal.
▪ Aqueduct.
▪ Syphon.



Figure 5: FMU 2: Gipps Road bridge - Taylor Street walkway

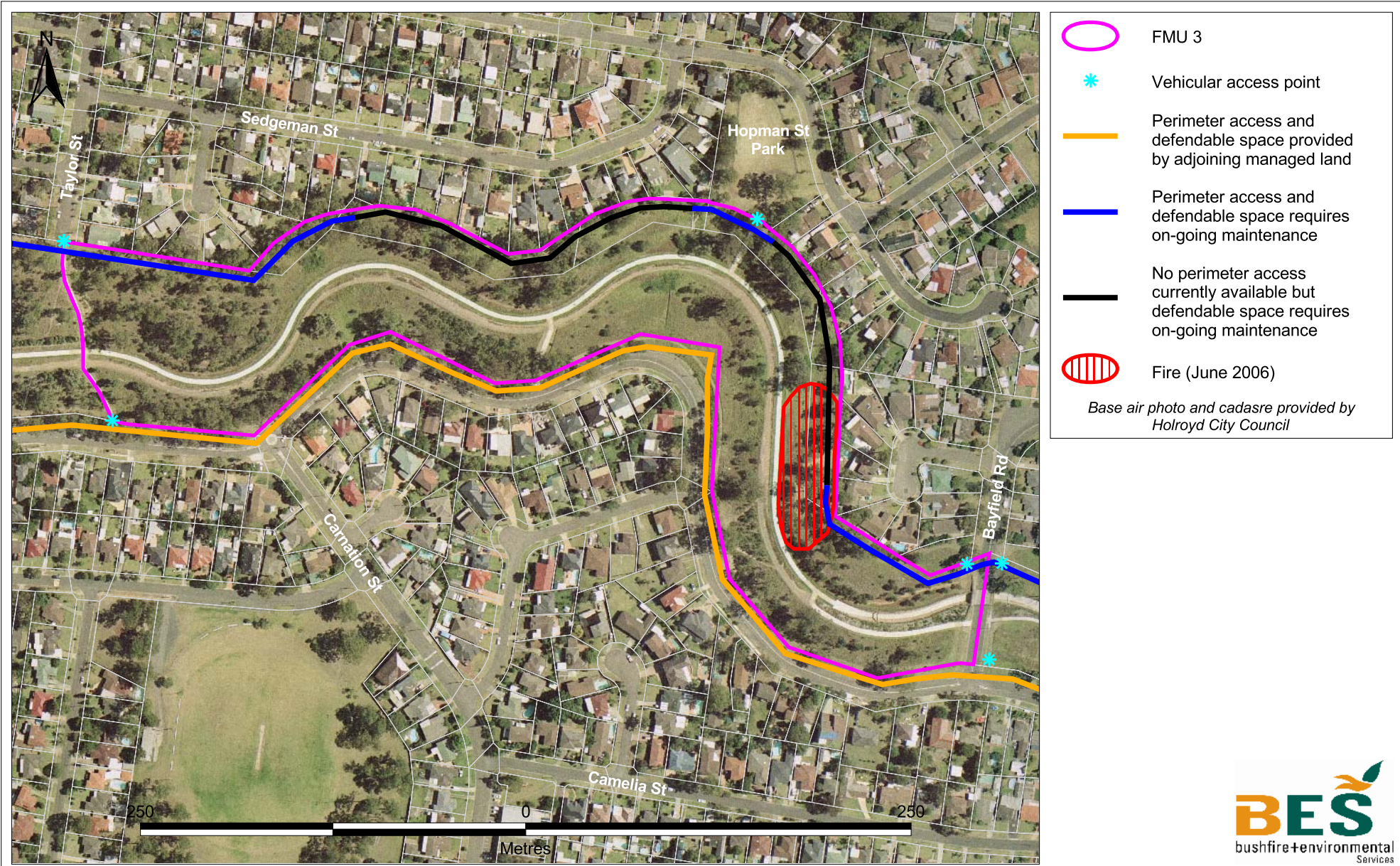


### 5.6.3 FMU 3: Taylor Street walkway – Bayfield Road bridge

<b>Points to be maintained for vehicular access</b>
▪ Western end from Taylor Street walkway on either side.
▪ Access from Hopman Street Park.
▪ Western end from Bayfield Road bridge on northern side.
<b>Perimeter protection and defensible space</b>
▪ Adequate perimeter protection along entire southern perimeter as Macquarie Road.
▪ Perimeter protection inadequate along most of the northern side, and no vehicle access from Hopman Street Park west to Laver Place and east to Hoad Place. Vehicle access to be established were possible.
<b>Environmental and cultural heritage issues</b>
▪ Grey Box Woodland (Cumberland Plain Woodland) endangered ecological community.
▪ Canal



Figure 6: FMU 3: Taylor Street walkway - Bayfield Road bridge

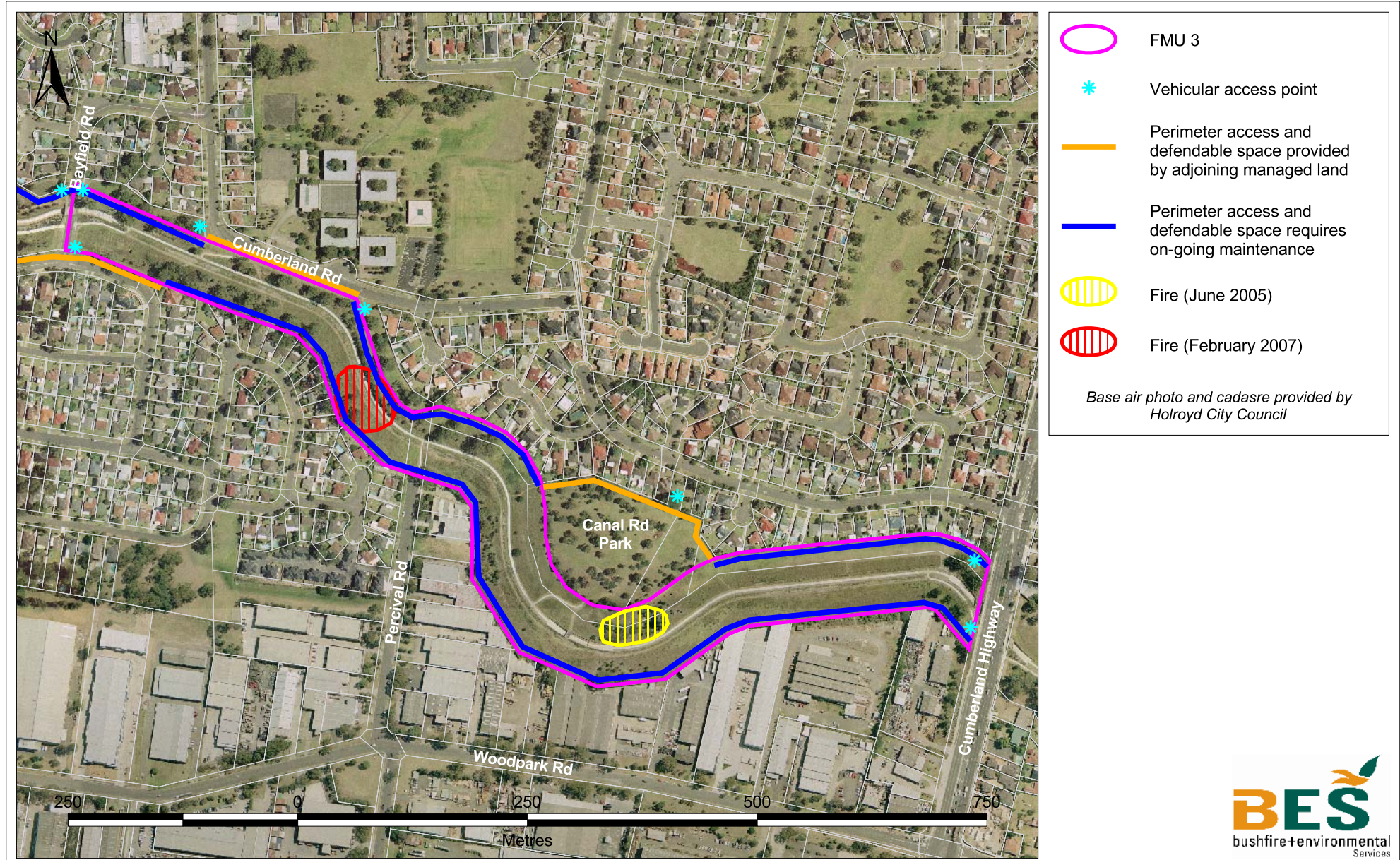


#### 5.6.4 FMU 4: Bayfield Road bridge – Cumberland Highway bridge

<b>Points to be maintained for vehicular access</b>
▪ Western end from Bayfield Road bridge on either side.
▪ Cumberland Road on northern side.
▪ Percival Road on southern side.
▪ Canal Road Park on northern side.
▪ Cumberland Highway on either side.
<b>Perimeter protection and defendable space</b>
▪ Inadequate perimeter protection along both sides. To be established.
<b>Environmental and cultural heritage issues</b>
▪ Grey Box Woodland (Cumberland Plain Woodland) endangered ecological community.
▪ Canal.



Figure 7: FMU 4: Bayfield Road bridge - Cumberland Highway bridge

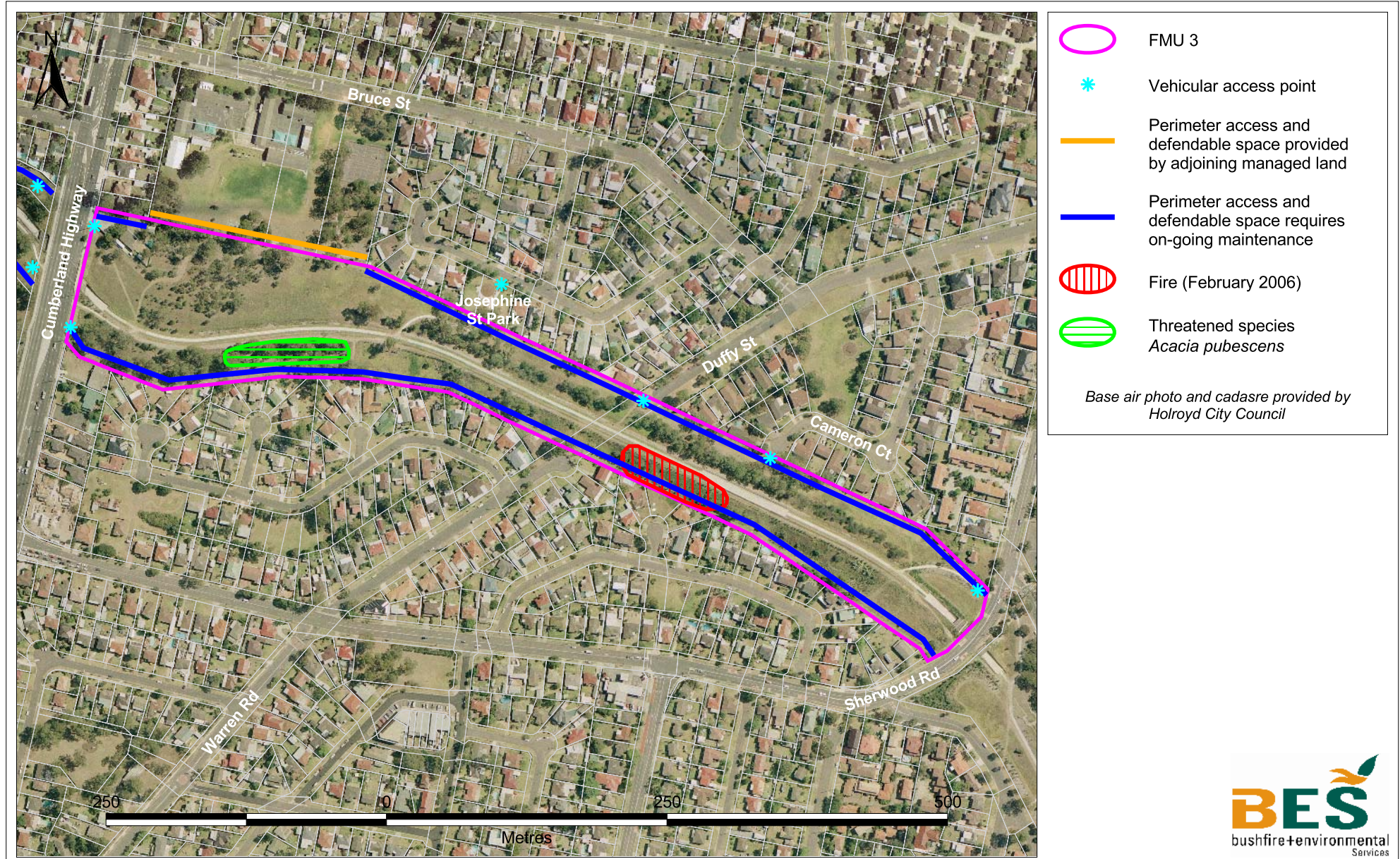


### 5.6.5 FMU 5: Cumberland Highway bridge - Sherwood Road bridge

<b>Points to be maintained for vehicular access</b>
▪ Cumberland Highway on either side.
▪ Josephine Street Park on northern side.
▪ Duffy Street on northern side.
▪ Cameron Court on northern side.
▪ Sherwood Road on northern side.
<b>Perimeter protection and defendable space</b>
▪ Perimeter protection along both sides require maintenance.
<b>Environmental and cultural heritage issues</b>
▪ Grey Box Woodland (Cumberland Plain Woodland) endangered ecological community
▪ <i>Acacia pubescens</i> present on southern side at western end.
▪ Canal.



Figure 8: FMU 5: Cumberland Highway bridge - Sherwood Road bridge

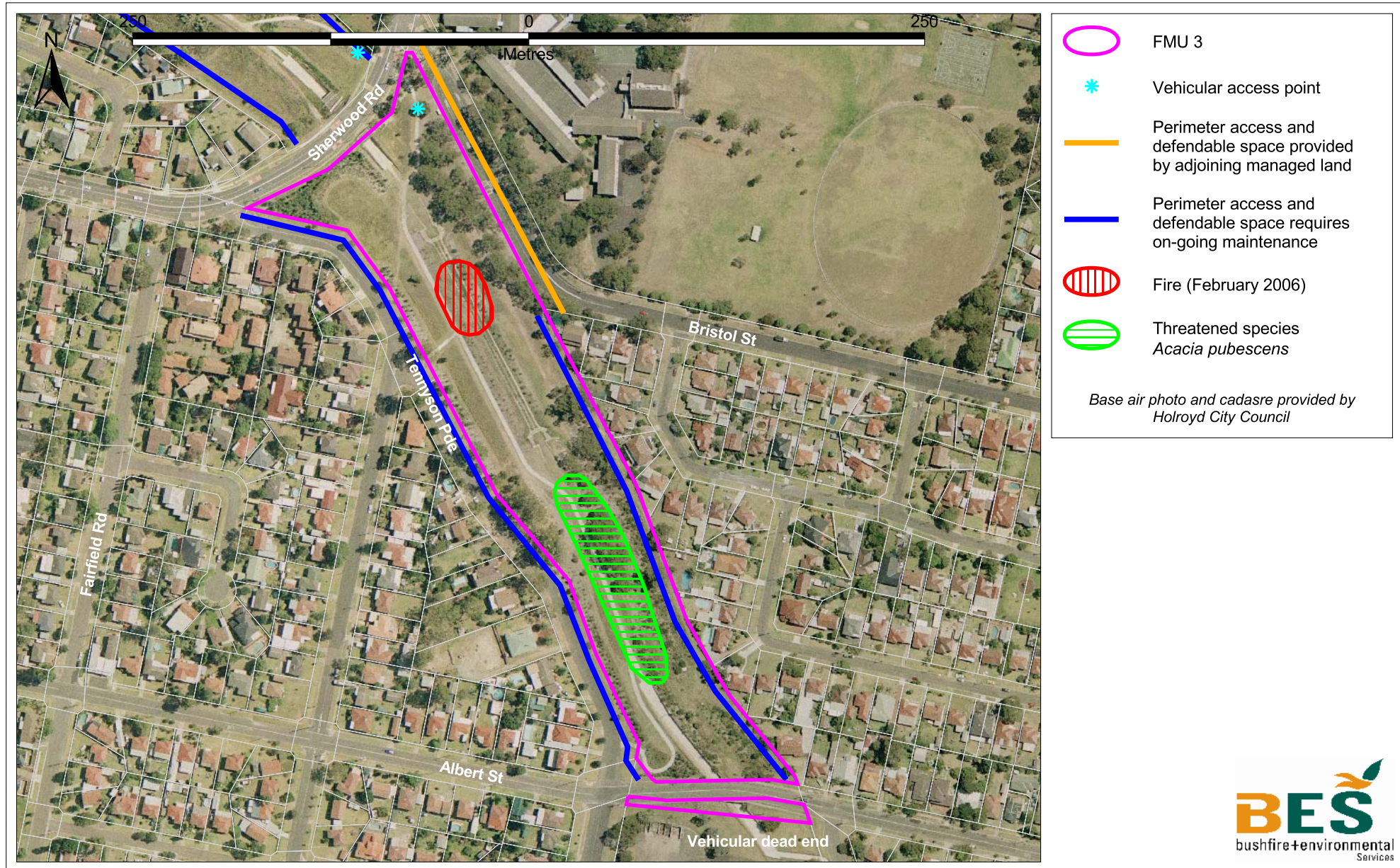


### 5.6.6 FMU 6: Sherwood Road bridge – Albert Street

<b>Points to be maintained for vehicular access</b>
▪ Sherwood Road on northern side.
▪ Dead end for vehicles at the end of LPC.
<b>Perimeter protection and defensible space</b>
▪ Perimeter protection along both sides require maintenance.
<b>Environmental and cultural heritage issues</b>
▪ Grey Box Woodland (Cumberland Plain Woodland) endangered ecological community.
▪ <i>Acacia pubescens</i> present on northern side at eastern end.
▪ Canal.



Figure 9: FMU 6: Sherwood Road bridge - Albert Street



## 5.7 MANAGEMENT STRATEGIES FOR BIODIVERSITY CONSERVATION

### 5.7.1 Vegetation communities and flora and fauna species

Managing fire to maintain biodiversity within the LPC is complex as fire regimes are required that satisfy the ecological requirements of a range of flora and fauna species, including threatened species, while ensuring other environmental issues (e.g. pest animals, weed invasion and smoke emissions) are also appropriately managed. In addition to these management complexities, it is recognised that the bushfire environment cannot be totally controlled, and wildfire will contribute to the fire regimes experienced. While it is not possible to accurately predict wildfire frequency, it is expected that for the short term wildfire will continue to affect parts of the LPC on a moderate frequency.

As discussed in Section 4, to protect, maintain and enhance the biodiversity and ecological values of the LPC a diversity of fire regimes within the threshold guidelines identified in Table 12 is required spatially and temporally. However, whilst it is desirable to keep fire regimes within the thresholds identified in Table 12, it is not considered a major concern if a proportion of the vegetation goes beyond the upper fire interval guidelines as this will enable more accurate evaluation of the appropriateness of the upper threshold over time. Similarly, whilst repeated fire intervals shorter than the threshold guidelines would be inappropriate, an occasional fire at an interval shorter than the threshold guideline interval may, in some cases, be an appropriate contribution to fire regime variation (Bradstock *et al.* 1995). For instance an occasional shorter fire interval (e.g. less than 4 years) may be desirable to promote the vegetative regrowth of *Acacia pubescens* (NPWS 2003).

In the long term the combined effect of the proposed fire management strategies for the LPC will be to create fire regime variability largely within the required biodiversity conservation thresholds. This will be achieved by restricting the proportion of the LPC that is burned in any year and by applying fire where necessary to obtain variability floristically and structurally. As a result, a mosaic of fire intervals, and thus vegetation assemblages and habitats, will be established across the LPC.

Given the long history of mowing throughout much of the LPC, the CPW is currently generally grassy rather than shrubby. However, over time, in the exclusion of mowing or other disturbances, the predominance of shrubs and particularly Blackthorn and exotics such as African Olive, is likely to increase substantially. As such, fire is unlikely to be necessary in the short term to address the predominance of shrubs such as Blackthorn. However in the medium to long-term, as a guide, approximately 50% of the LPC should be maintained so as there is a complex mosaic of shrubby (including obligate seeders where appropriate) and grassy areas, with approximately 30% and 20% respectively managed such that it is predominantly grassy or shrubby and dominated by Blackthorn. It should be emphasised that these proportions are guides only and are intended to maximise diversity and avoid the predominance of either grassy or shrubby habitats.

### 5.7.2 Monitoring

It is proposed that the need for the application or exclusion of fire within the LPC be assessed annually through the use of a simple monitoring program, focused on the flowering and seed set of obligate seeder shrubs, the health and abundance of Kangaroo Grass and other native grasses and forbs, and the abundance and expansion of Blackthorn. That is, an annual assessment should be undertaken by a suitably qualified person(s) to assess

whether there is an appropriate diversity of vegetation assemblages within the LPC, in line with the guidelines identified above, and, if not, to assess where strategies should be developed to either apply or exclude fire.

Where the application of fire is proposed in shrubby CPW, the capacity of the soil or plant stored seed bank to provide sufficient recruitment should be assessed. That is fire should be excluded until obligate seeders have had at least a couple of good flowering years. Some grassy areas should be burnt towards the lower end of the thresholds to maintain the vigour of native grasses, to provide weed control opportunities and to open up habitats for forbs. Where Blackthorn is encroaching upon other vegetation fire should be considered as the primary management tool.

The strategies for managing the effects of fire on the ecological values of the LPC generally and specifically on CPW, *Acacia pubescens* and *Pimelea spicata* are summarised below;

#### **Cumberland Plain Woodland**

- a) Maintain appropriate fire regimes for the community (see Table 7).
- b) Endeavour, through the application or exclusion of fire, to achieve a mosaic of structurally and floristically diverse assemblages within the CPW.

#### ***Acacia Pubescens* and *Pimelea spicata***

- a) Maintain appropriate fire regimes for the species' within and immediately surrounding the known populations (see Table 7).
- b) Do not burn more than 30% of the population within the LPC in any one year.
- c) Regularly monitoring the condition of the populations within the LPC and, in conjunction with DECC, undertake actions where necessary to mitigate against any adverse impacts on the species.
- d) Review fire regime guidelines and fire management strategies annually in the context of any further management information that may exist.
- e) Implement strategies *i.e.* signage and awareness amongst maintenance and emergency response personnel, to ensure that the populations of the species within the LPC are not adversely affected by access routes, control lines, or other fire suppression activities.

In addition to the strategies identified above which are designed to protect specific ecological values of the LPC, strategies have been developed to ensure that the proposed fire management activities contribute towards the recovery of heavily disturbed areas and the control of weeds and other pest species within the LPC as discussed below.

### 5.7.3 Revegetation and landscaping

Substantial areas within the LPC are being recovered passively through a combination of the exclusion of historic management actions, and in particular mowing, and integrated weed management. In addition, some heavily disturbed areas have been or are planned to be subject to active revegetation strategies or will be landscaped.

Fire can be an important tool in triggering and promoting the recovery process within CPW. However, in some instances, particularly in vegetation dominated by smaller saplings or where the seed bank is still relatively poorly developed, fire can retard the recovery process if inappropriately applied. As such, in those areas where passive or active regeneration is occurring within the LPC, fire should be excluded where possible, until it can be demonstrated that a fire will promote, rather than retard, the recovery process. An assessment of the desirability of fire within areas that are in the early stages of recovery or revegetation should be made by suitably qualified persons prior to any application of prescribed fire.

### 5.7.4 Weed species

Many exotic plant species respond well to the exposed, nutrient rich conditions following fire. Where a seed source exists inappropriate fire regimes or other fire management activities may allow these weeds to proliferate or penetrate new areas. Conversely, some weed species i.e. African Olive, are advantaged by the prolonged absence of fire and can alter habitats such that fire is impeded and thus infrequent fire frequencies are promoted. Notwithstanding the various responses of specific weeds to particular fire regimes, fire provides an important tool and opportunity for weed control particularly where weed regrowth can be identified and targeted by cost-effective strategies such as spot spraying.

Problematic weeds within the LPC include Asparagus Fern *Protoasparagus aethiopicus* and African Olive however it is likely that the LPC supports a diverse range of weed species typical of similar habitats within the Cumberland Plain. Table 8 lists some target weeds that are problematic within remnant CPW in Western Sydney and provides details on their responses to fire. Most if not all of these weeds will regenerate after fire, especially those annuals such as Fleabane *Conyza* spp., Bidens *Bidens pilosa*. Most annuals, if managed well, will be out-competed as recovery of native vegetation proceeds.

**Table 14: Problematic weeds within the CPW and their response to fire**

Target weed	Response to fire
African Lovegrass	Responds well to fire.
Asparagus Fern	Unknown but is expected to resprout after a low to moderate fire
Bidens	Responds well to fire with prolific germination. Mature fruit will be present within about 18 weeks of a high intensity fire.
Blackberry	Most probably same as Lantana
Blackberry nightshade	Responds well to disturbance and seed will germinate after fire.



Target weed	Response to fire
Boneseed	Mass germination expected after a fire (depending on quality of seed bank).
Bridal Creeper	Unknown fire response.
Cassia	Seed is long-lived in the soil and germination is likely to be stimulated by fire. Plants will also re-sprout from the roots of fire.
Chlorophytum	Dense germination after disturbance, but unsure whether fire will destroy seedbank.
Common Couch	Resprouts after fire and expected to respond well
Coreopsis	Unknown but will occur anywhere where there is or has been disturbance and is expected to dominate an area until natural vegetation comes regenerates.
Crofton Weed	Does not readily burn, although damaged plants typically resprout from the base after low intensity fires, and damaged seedlings can regenerate from the crown within 8 weeks of germination.
Dodder	Unknown.
Fireweed	Responds well to fire.
Fleabane	Re-shoots and germinates after low intensity fire.
Freesia	Germinate and resprout from existing corms. Will regenerate from low to moderate intense fires.
Golden Wreath Wattle	Being an Acacia it is expected to respond well from the seedbank.
Inkweed	Coppices from taproot, and massive germination of seed.
Kikuyu	Responds well to fire.
Lantana	Coppice from the base under moderate fires. Under extreme conditions it has been known to be eradicated from an area.
Lemon-scented gum	Coppices from base and seed germinates after fire.
Montbretia	Most probably same response as Watsonia.
Morning glory	Fire will kill the above ground biomass, but will regenerate from stolons.
Mother of millions	Does not respond well to fire and can be out competed by regeneration of other species.
Ochna	Coppices from base and seed germinates after fire.

Target weed	Response to fire
Oxalis	Germinates or resprouts after fire.
Paspalum	Will regenerate from rhizomes after a low intensity fire.
Pigeon Grass	Unknown fire response but does like disturbance.
Purple-top	Coppices from the base after fire.
Radiata pine	Usually killed by fire depending on intensity and size of pine trees.
Small leafed privet	Coppices from base and suckers from roots
Vinca	Unknown.
Watsonia	Unknown but expected to regenerate from underground structures after low to moderate intensity fires.
Wisteria	Unknown.

### 5.7.5 Burning techniques

It is not possible to include the details of a prescribed burning plan within a fire management plan. Prescribed burns are highly dependent on recent fire history information and, therefore, cannot be prepared in detail within a 5 year fire management plan and it is not possible to specify resource commitment or specific lighting patterns without knowing the weather parameters being utilised.

A prescription burn plan should include the following:

- appropriate approvals for burning;
- acceptable fire behaviour parameters and appropriate weather conditions;
- ignition patterns;
- resource requirements;
- appropriate notification of visitors, neighbours and fire authorities;
- visitor and traffic control, signposting ;
- smoke management; and
- safeguards required.



Preparation and implementation of a prescribed burning plan using the guidelines in this Plan requires a flexible and innovative approach.

The correct burning techniques are vital for success of the burn and fulfilment of biodiversity conservation objectives. Although it is relatively simple to monitor and implement variation in fire interval and season of burn, it is more difficult to monitor and implement variation in the pattern of burn and fire intensity. Variations in intensity can be achieved by adjusting the following practices:

- the direction of burn compared to the direction of the wind and slope;
- achieved ignition patterns (e.g. spot or line ignition);
- the point of ignition associated with areas of lighter and heavier fuel load;
- downhill versus uphill and downwind versus upwind fire spread create further options to achieve the desired burn pattern; and,
- burning at different time of day / night and in different weather conditions.

Another key factor in creating variability in burn pattern and fire intensity is the selection of appropriate weather conditions for burning. The range of appropriate weather conditions may be identified using the McArthur Fire Danger Meter Mark 5 and by considering the weather factors of seasonal dryness, temperature, relative humidity and wind.

The method and pattern of lighting prescribed fires is also important for fauna management. Avoid creating a converging fire that causes 'hot-spots' potentially entrapping fleeing wildlife. Instead, fires should spread from one end of a 'burning block' to the other. Potential control lines for prescribed burning are available in the form of roads, trails, canal and tracks.

### **5.7.6 Prescribed burning approvals**

#### **Permit to light a fire**

A person who lights a fire without the required approvals is guilty of an offence under the RF Act. Maximum penalty is \$110,000 and/or 14 years imprisonment. Further penalties maybe incurred if environmental regulatory legislation is breached or where a fire causes damage, injury or death.

The requirement for a permit to light a fire depends on the local council, the designated bushfire season (not always October to March), and the declaration of 'Total Fire Ban' or 'No Burn' days issued by the RFS and EPA respectively. Therefore it is recommended that the local NSW Fire Brigade Station be consulted for further and up-to-date information. The declaration of Total Fire Ban and No Burn days can be checked on an RFS and EPA information line respectively (RFS – 1800 654 443; EPA – 131 555).

Even when a permit is not required to conduct a burn, at least 24 hours notice must be provided to all adjacent landowners and the local NSW Fire Brigade Station.

### **Approval for open burning under POEO Act (Air Pollution)**

Ecological burns within Sydney require approval under the Protection of the Environment Operations (Control of Burning) Regulation 2000. Ecological burns are “not expressly permitted” (NSWRFS 2006) like those that are planned within a Bushfire Risk Management Plan (BFRMP) for hazard reduction purposes aimed to protect life, property and the environment. If not covered by a BFRMP, the argument for an ecological burn has more weight if it has a dual objective of protecting life, property or the environment (*e.g.* a hazard reduction burn within a National Park designed within the ecological thresholds and having ‘strategic fire advantage’ values).

It could be argued that an ecological burn at LPC is required to ‘protect’ the environment from a decline in biodiversity, although the burn is not based on hazard reduction principles. It is recommended that the argument of requiring the burn for protecting the environment, based solely on biodiversity principles and the requirements of appropriate management of threatened species and endangered ecological communities, is used within a standard application to the EPA. Applications to burn are required to be made to the Manager Sydney Local Government (PO Box 668 Parramatta NSW 2124 (02 9995 6837)) for specific approval under clause 9 of the Regulation.

### **Fire control**

The lighting and control of a prescribed burn would normally be performed by the fire authority in control of the area. In the case of Holroyd LGA, the NSW Fire Brigades (NSWFB) have jurisdiction. Fire authorities often use prescribed burning events as training days for their brigades, and a request in writing asking them for their assistance in burning would normally be well received, depending on their available resources at the time.

Although the fire authority is responsible for the operations of the burn, they should follow a ‘burn plan’ (see Section 5.7.5) written by a professional with skills in fire ecology. The operations should also be supervised by such a person.

## **5.8 MANAGEMENT STRATEGIES FOR CONSERVATION OF CULTURAL HERITAGE**

Repeated fires may have some adverse affect on cultural heritage features including blackening of sandstone by smoke and flames, cracking and exfoliation.

If these impacts are unacceptable, options are available to protect the facades, these include manually slashing grass and other vegetation from around the asset and/or the application of protective foam prior to burning.

## **6. PLAN ADMINISTRATION**

All strategies and plans must have mechanisms that show that progress is being made in dealing with the problem or it is successfully completing the prescribed actions. It is also necessary to determine the effectiveness of the plan and efficiency of individual actions.

### **6.1 MONITORING AND EVALUATION**

Monitoring should occur at both the management level and a biodiversity level. The specific and detailed fire regimes prescribed in this FMP are aimed at achieving long term goals of conservation biodiversity, though they will need reviewing after the implementation of any prescribed burns and pursuing fire history and natural regeneration.

A Recovery Plan is yet to be developed for the Cumberland Plain Woodland endangered ecological community, and the FMP may also need to be reviewed with respect to recommendations outlined in respective recovery plans.

Monitoring and evaluation against the plan objectives are effective way to monitor the implementation of the plan.

### **6.2 REVIEW OF THE PLAN**

A complete evaluation, review and updating of the plan should occur after five years (i.e. prior to the 2012 bushfire season). The review should;

- consider whether the plan has achieved the aims and objectives,
- reassess the strategies and environmental safeguards in light of current research and management best practice, and
- reassess the strategies taking into account of legislative changes, financial constraints, social philosophies, improvements in bushfire protection and suppression, and changes in vegetation.

Minor reviews should occur annually through the process of updating fire history and other resource data, preparing prescription burning and works programs. Small changes to the strategies within the Plan may be made without consulting the authors or similar. Matters that require a more significant variation should be discussed with the authors prior to implementation.

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