Natural Area
CONSULTING MANAGEMENT SERVICES

# City of Gosnells

# Access and Bushfire Management Plan
# Holmes Street Bushland North

D4 – 28 September 2016

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|---|---|
| **Document Title** | Holmes Street Bushland North Bushfire and Access Management Plan |
| **Location** | \\10.0.0.210\DropBox\Drop Box\Client Folders - NAC\City of Gosnells\RFT 18-2015 Holmes St Bushland North\NA Working Documents\ |

| Draft/Version No. | Date | Changes | Prepared by | Approved by | Status |
|---|---|---|---|---|---|
| D1 | 31 March 2016 | New document | SH | LS | Draft for client review and comment |
| D2 | 31 May 2016 | Additions to recommendations and management section | SH | LS | Draft for client comment and review |
| D3 | July 2016 | City of Gosnells Comments | SH | LS | Draft for client comment and review |
| D4 | 28 September 2016 | City of Gosnells Comments | SH/SB | LS | Draft for client comment and review |

# Contents

# 1.0 Introduction

The City of Gosnells commissioned Natural Area Consulting Management Services (Natural Area) to undertake baseline environmental studies within Holmes Street Bushland North (HSBN), to inform its proposed environmental management program for the area. Survey outcomes were utilised to prepare management plans for the area including this Access and Bushfire Management Plan. The site is part of Bush Forever Site 125 located approximately 17 km south-east of the Perth Central Business District and covers approximately 53.6 ha (Figure 1). The site is made up of 17 separate lots, and is split into two main portions: north-west of Harpenden Road and Gay Street Bushland south-east of Harpenden Road.

## 1.1 Access and Bushfire Management Plan Aims

The aim of the Access and Bushfire management plan is to ensure:

- access is appropriate to allow inclusive use by the community as well as fulfilling needs for bushfire management
- threats from fire to reserve visitors, nearby residents and the natural environment are kept as low as reasonably practicable
- appropriate compartmentalisation of bushland into management zones to assist with fire and ecological management
- integration of fire management with ongoing management of the bushland.

## 1.2 Management Plan Objectives

The objectives of access management plan are:

- to encourage inclusive access to and use of the reserve by local residents and community members
- balance bushland and human values within the reserve
- outline various management arrangements that will be implemented in the short, medium and longer term
- to compartmentalise the bushland into management zones to assist in fire and ecology management as well as bushfire suppression
- to formalise and manage access manage access for multiple uses
- exclude off-road vehicle access
- to reduce undesirable access to existing tracks to be closed and rehabilitated
- provide an improved level of visitor safety and passive surveillance.

The objectives of bushfire management within the HSBN are to:

- protect life, property and the environment
- fulfil obligations under the *Bushfires Act 1954* (WA)
- identify and provide for the protection of built assets
- identify and protect sensitive natural assets
- protect the ecological and amenity values of the reserve
- integrate of fire management into the management of the bushland's ecology, including weed management, rehabilitation, rubbish removal, safe maintenance of a variety of fuels ages, recording of fire history, programmed fire fuel assessments
- protect landscape values (including flora and fauna) from inappropriate suppression techniques

- reduce the frequency, impact and area of unplanned fires
- provide enhanced access for fire suppression
- minimise the spread of disease and weeds during fire-fighting operations when establishing emergency firebreaks, and during post-fire clean-up activities
- minimise impacts on air quality.

Note: Recommendations in this plan have been amalgamated with relevant recommendations made within the Revegetation and Weed Management Plan, and the Fauna Management Plan to minimise duplication, with codes assigned to each to identify the management plan it originated from. These codes are:

- **AB** – Holmes Street Bushland North Access and Bushfire Management Plan (this Plan)
- **RW** – Holmes Street Bushland North Revegetation and Weed Management Plan
- **FM** – Holmes Street Bushland North Fauna Management Plan.

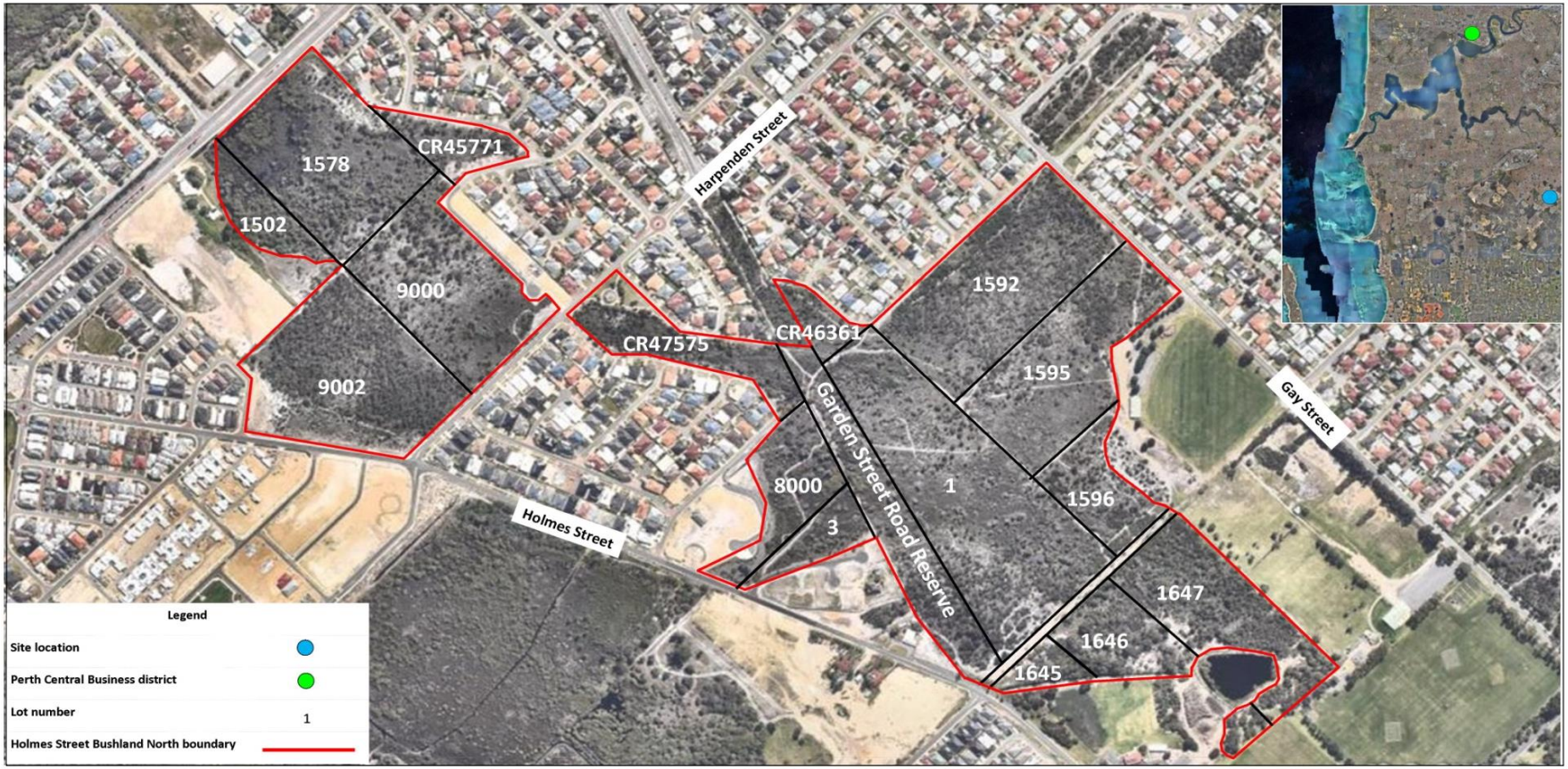


**Figure 1:**
**Site location**
**Holmes Street Bushland North**

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**Client:** City of Gosnells
**Project:** Holmes Street Bushland North Management Plan
**Image Source:** NearMap, 2015
**Prepared by:** Sharon Hynes
**Datum:** GDA 94, Zone 50

0 200
Metres

# 2.0 Site Characteristics

## 2.1 Regional Context

According to Interim Biogeographical Regionalisation of Australia (IBRA) descriptions, Perth is located within the Swan Coastal Plain region. The Swan Coastal Plain comprises two major divisions, the Swan Coastal Plain 1 – Dandaragan Plateau and Swan Coastal Plain 2 – Perth Coastal Plain (Mitchell, Williams and Desmond, 2002), with the Peppermint Grove Foreshore Reserve situated in the latter.

## 2.2 Climate

The climate experienced in the area is Mediterranean, with dry, hot summers and cool, wet winters. The Bureau of Meteorology (2016) describes the climate at the Perth Airport (ID: 009021) as:

- average rainfall is 771.6 mm pa, with the majority falling between May and August
- average maximum temperature ranges from 17.9 °C in winter to 31.9 °C in summer, with the highest recorded maximum being 46.7 °C
- average minimum temperatures range from 8.0 °C in winter to 17.5 °C in summer, with the lowest recorded minimum being -1.3 °C
- predominant wind directions include morning easterlies and westerly sea breezes during summer months, with an average wind speed of 23.8 km/h and gusts of more than 100 km/h, particularly during storm events (Figure 2).

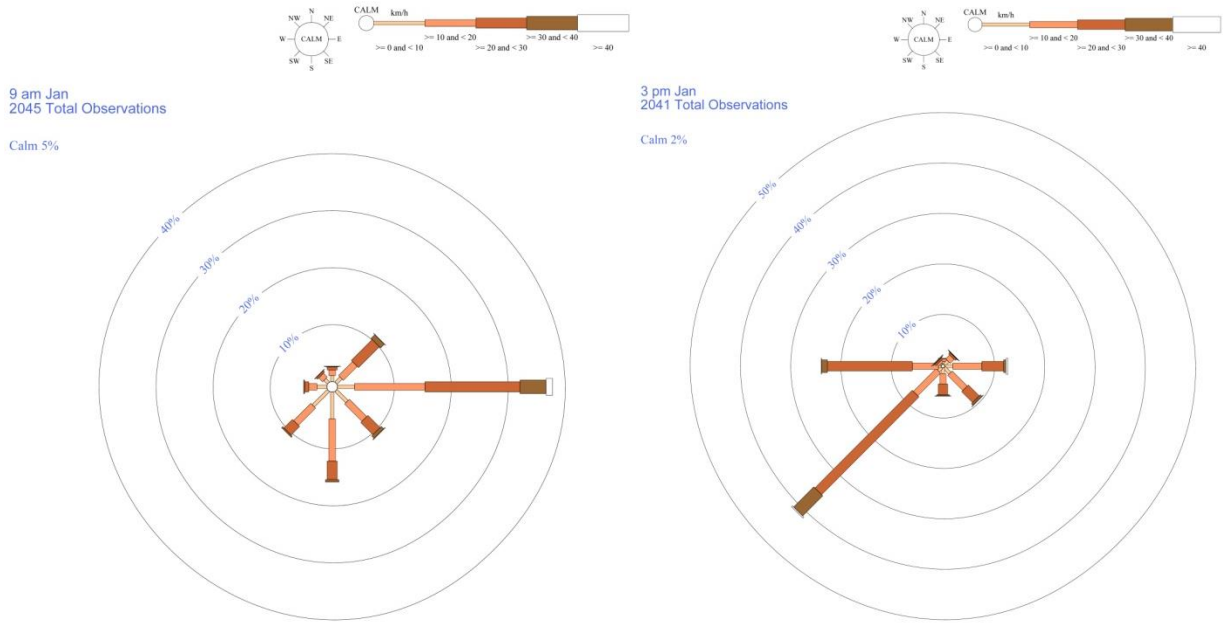


**Figure 2:** Predominant summer wind directions – morning and afternoon

Weather influences fire behaviour through:

- lightning strike as a potential ignition source
- wind contributing to the rate of fire spread, ember and firebrand movement
- moisture content of fire-fuel loads present.

## 2.3 Topography

The topography of the HSBN is flat in those portions bounded by Gay Street, Holmes Street and Harpenden Street to the north. Those portions north of Harpenden Street include a dune ridge, with height ranging from 20 – 25 m AHD (Figure 3).

## 2.4 Vegetation Characteristics

According to WALGA (2015), the vegetation at the site is the Southern River complex, which is characterised by *Corymbia calophylla* (Marri)*, Eucalyptus marginata* (Jarrah), and *Banksia* species to fringing woodland of *E. Rudis* (Flooded Gum) – *Melaleuca rhaphiophylla* (Paperbark) along riverbanks (Heddle, Loneragan and Havel, 1980). In addition to the vegetation within the Reserve, a portion of Bush Forever Site 125 is located nearby on the southern side of Holmes Street (Figure 19). All of these flora species were found apart from *Eucalyptus rudis*, with *Melaleuca preissiana* found in dampland areas, *Corymbia calophylla* adjacent dampland areas and *Banksia* species and *Eucalyptus marginata* in dryland areas.

## 2.5 Existing Land Use and Assets

The HSBN is managed by the City of Gosnells for recreation and conservation. Zoning under Town Planning Scheme 6 (Figure 4) includes:

- local open space
- public purposes
- residential
- residential development.

The surrounding land is zoned:

- residential
- residential development
- other regional roads
- parks and recreation.

Assets within and surrounding the site (Figure 5) include:

- residential areas
- playgrounds
- sports clubrooms and facilities
- sporting fields
- communications towers
- vet clinic and residence
- irrigation pump station
- composting facility
- powerlines passing through bushland (Lot 91 road reserve)
- Huntingdale Community Facility.

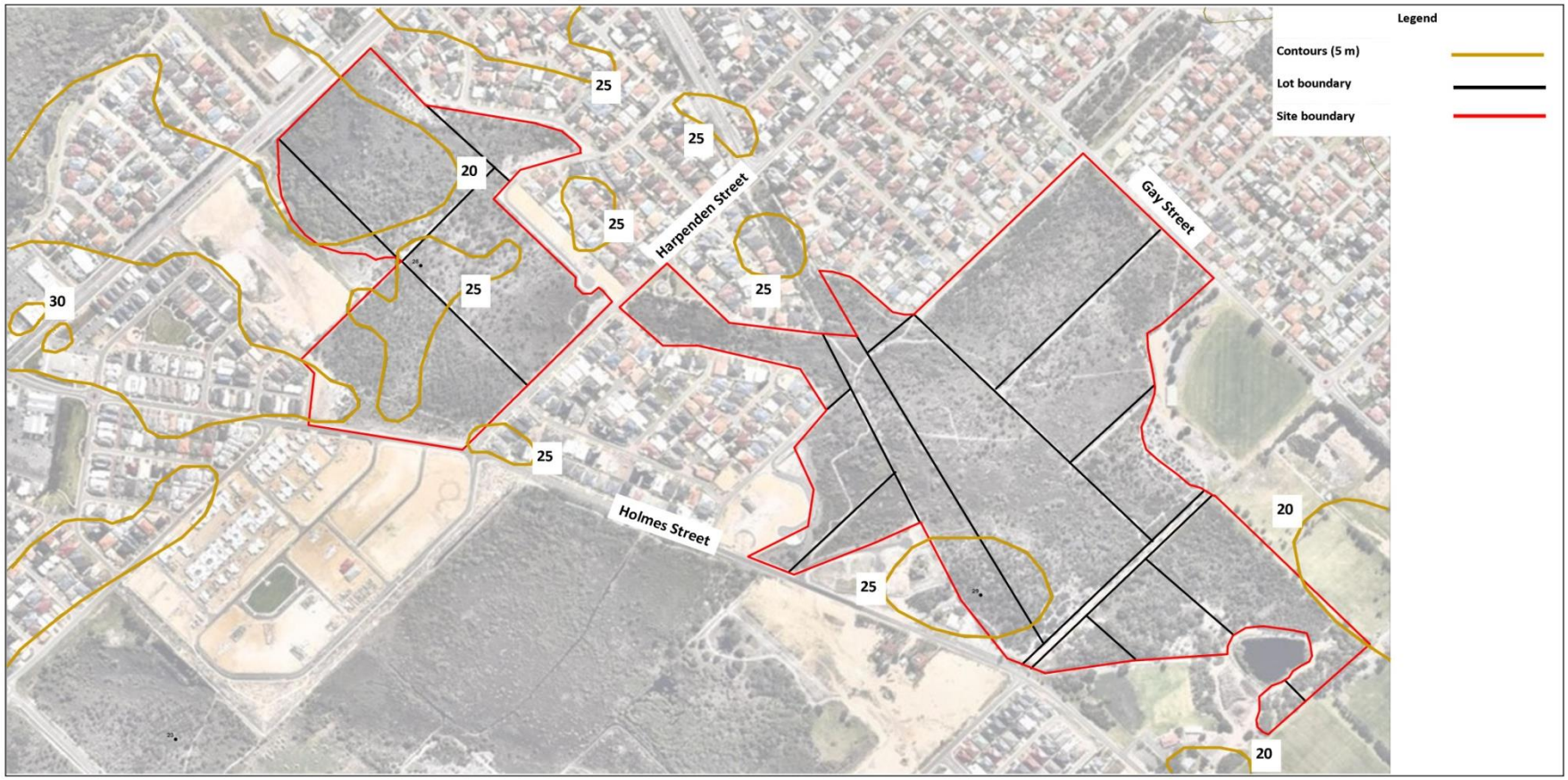


**Figure 3:**
**Contours**
**Holmes Street Bushland North**

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**Client:** City of Gosnells
**Project:** Holmes Street Bushland North Bushfire and Access Management Plan
**Image Source:** NearMap, 2015
**Prepared by:** Sharon Hynes
**Datum:** GDA 94, Zone 50

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Metres

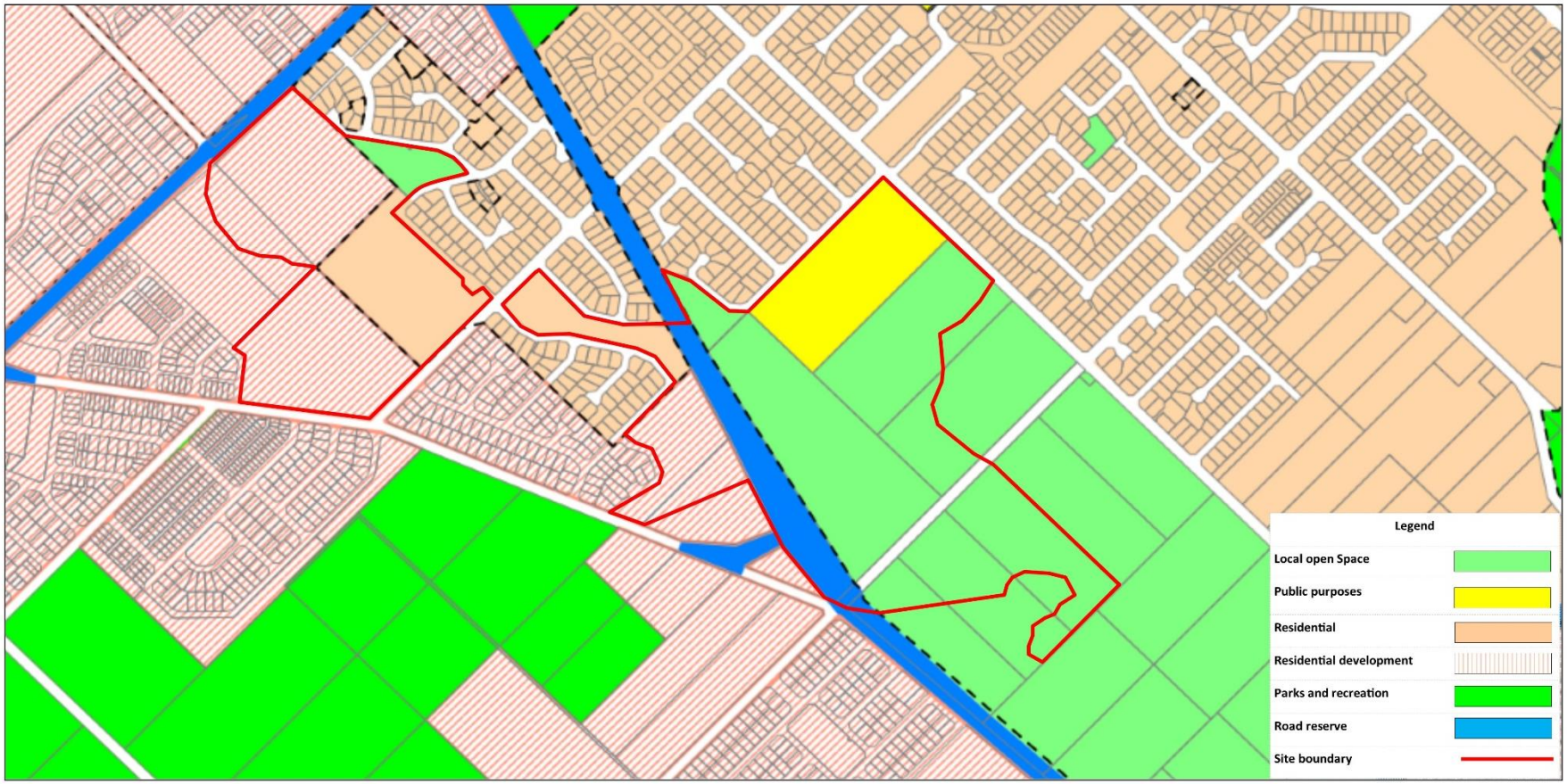


**Figure 4:**
**Zoning**
**Holmes Street Bushland North**

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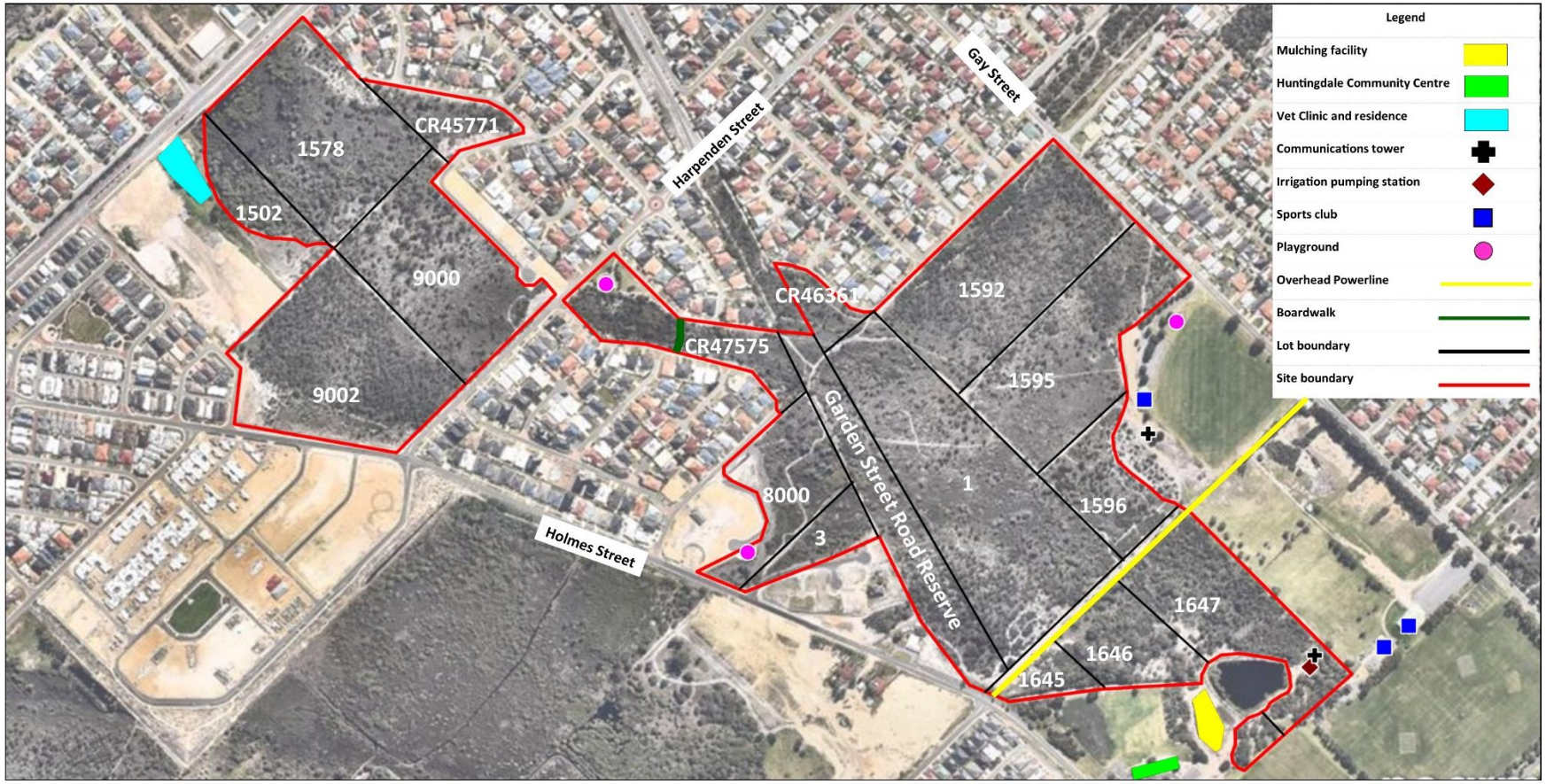


**Figure 5:**
**Infrastructure and assets to consider in fire management**
**Holmes Street Bushland North**

N

**Client:** City of Gosnells
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**Image Source:** NearMap, 2015
**Prepared by:** Sharon Hynes
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Metres

# 3.0 Access

Public and management access to and within the HSBN is not formally facilitated. Informal pedestrian and illegal off-road vehicle access takes advantage of existing fire access tracks and informal tracks. The aim of this management plan is to encourage and facilitate inclusive access to pedestrian and cyclist traffic, to provide for fire management and suppression access, to provide management access, and to exclude unauthorised off-road vehicle activity. Proposed access and current fencing is shown in Figures 9 and 10.

Key to the improvement and management of access will be management of entry by appropriate fencing and gates, the identification and improvement of multi-purpose strategic fire access tracks (SFAT) and the closure of redundant fire access tracks (FAT) and walk trails. Sandy SFATs should be upgraded with a trafficable material such as compacted limestone.

It is noted that the City is in the early stages of a Master Planning process for the adjacent Sutherlands Parks Sports Complex, and that the integration of HSBN management planning and that being planned for the sports complex is critical to the good functioning and integration of the two facilities.

| **Recommendation** | |
|---|---|
| **AB 1** | It is recommended that the City ensure compatibility of proposed activities and developments in both the HSBN and the Sutherlands Parks Sports Complex through the integration of planning. |

## 3.1 Access Tracks

Whilst pedestrians and dog walkers largely take advantage of existing fire access tracks, they are not suitable for those with limited mobility or disabilities, those pushing prams, or cyclists (Figure 6). To provide inclusive access, sandy SFATs identified for retention and enhancement as multi-purpose assets need:

- to be made trafficable with material that provides a suitable, compact surface
- to be enhanced using material that minimises the potential for *Phytophthora* dieback movement such as compacted limestone, with further investigation by the City into the potential use of ‘cracker dust’ as an alternative material with potentially greater inhibition of *Phytophthora* dieback
- to be appropriately engineered and of suitable width and height to accommodate fire emergency vehicles
- to provide good field of view to users to enhance safety and safety perception.

All redundant FATs and walk tracks should be decommissioned and revegetated. The placement of logs on these tracks will assist in deterring access and guiding user access to upgraded SFATs

**Figure 6:** Sandy track

At present, the City does not have management responsibility for Lots 1502 and 1578 Warton Road, which are in private ownership. Similarly, Lot 1592 Gay Street is owned by the Department of Education. Public access to these properties is evident from footprints and vehicle tracks, as they are relatively unfenced and accessible. In the event that the City of Gosnells becomes the managing authority for these Lots, then access management initiatives can be pursued.

A number of smaller, informal sandy walking tracks are present throughout the site, with the majority being located in Lots 1, 1592, 1595, and 1596 (Figure 7). Ongoing use of these tracks can contribute to the spread of pathogens such as *Phytophthora* dieback, weeds, and physical damage to flora and vegetation.

| **Recommendation** | |
|---|---|
| **RW 18** | The decommissioning of FATs and other informal walk tracks will include the placing of logs at the ends of tracks to deter vehicle and pedestrian access, prior to rehabilitation. |

**Figure 7:** Informal sandy track

## 3.2 Fencing

Fencing of the entire HSBN perimeter is proposed by the City to establish a "frame" around the "picture", to manage access and present the bushland as an asset of value. The City's specifications require rural style fencing with pine post and star pickets at a ratio of 1 to 5 respectively, with 6 galvanised (2.5 mm) high tensile wire strands to protect environmental assets (Appendix 1). There are a number of variations of rural style fencing throughout the site (Figures 9 and 10), including:

- pine post and star picket fencing – with wire strand
- pine post with pine top rail fencing - with wire strand (Figure 8)
- pine post and ringlock fencing – fauna impermeable fencing, installed by developers during revegetation works.

One other fencing style was identified around the site:

- pine bollards – largely around Bodallin Crescent reserve, but also found in two other locations.

It is the City's intent that the entire perimeter of the HSBN is fenced, at a minimum, to its rural style fencing specification. This study has identified areas where this standard is not met (Table 1; Figure 11) and, on the basis of the different types of sub-standard fencing, presents cost estimates for the following scenarios:

- upgrade of existing fencing to meet the City's specification
- removal and replacement of existing fence to replace with fence meeting the City's specification
- installation of fencing where none exists
- upgrading existing fencing, where required, to provide fauna-impermeable fencing.

Fencing will accommodate existing gates where they are to be retained, and new gates where they are proposed to be installed (see 3.3 and 3.4). It should be noted that fencing installed to manage access may be the subject of reactive vandalism. It is critical that breaches are repaired as soon as possible to send a clear message that the City's management of the area is permanent. Inspection and prompt repair in the initial stages of access management are recommended to be priorities for the City.

**Table 1:** Fencing requirements within HSBN

| Fence Type | Length (m) | Meets Specification | Damage | Upgrade | Replace | Remove |
|---|---|---|---|---|---|---|
| Pine Bollard | 818.4 | No | No | No | Yes | Yes |
| Star picket wire strand (internal) | 751.3 | No | Yes (436 m) | No | No | Yes |
| Pine post/rail and wire | 520.8 | Yes | No | No | No | No |
| Pine post/star picket and wire | 2030.2 | Yes | Yes (511.74) | No | Yes | Yes |
| Fauna impermeable fencing | 757.8 | Yes | No | No | No | No |
| Unfenced | 1858.1 | No | N/A | No | Yes | No |

| Recommendations | |
|---|---|
| **AB 2** | The entire perimeter of the Bushland should be fenced in accordance with the City's rural style fencing specifications, with allowances made to accommodate existing and proposed gates (See 3.3 and 3.4). |
| **AB 3** | Fencing in the areas around the fauna underpass near the corner of Harpenden and Holmes streets should be upgraded to be fauna impermeable to prevent access onto roads and direct fauna into the underpass. |
| **AB 4** | The City's inspection and maintenance program for the HSBN should provide for damaged or vandalised fencing to be repaired or replaced promptly (Figure 10). |

**Figure 8:** Post and rail fence

### 3.2.1 Management Cells Fencing Requirements

HSBN has been broken down into management cells for the purpose of this Plan. Fencing requirements associated with each management cell are provided in Table 2 and illustrated in Figure 11). Both MC1 and MC4 (highlighted in pink in Table 2) are located on lots 1502, 1578 and 1592 which are currently privately owned, and any fencing requirements for these cells are pending until they come into the City's management.

**Table 2:** Fencing requirements per management cell

| Management Cell | Fence Install (m) | Remove (m) | Remove and Replace (m) |
|---|---|---|---|
| MC1 | 501.8 | 0 | 0 |
| MC2 | 47.8 | 0 | 27 |
| MC3 | 0 | 0 | 0 |
| MC4 | 524.8 | 0 | 0 |
| MC5 | 481.94 | 0 | 0 |
| MC6 | 531.7 | 488.1 | 315.3 |

| Management Cell | Fence Install (m) | Remove (m) | Remove and Replace (m) |
|---|---|---|---|
| MC7 | 44.1 | 0 | 59.4 |
| MC8 | 43 | 0 | 772.4 |
| MC9 | 0 | 335.9 | 0 |

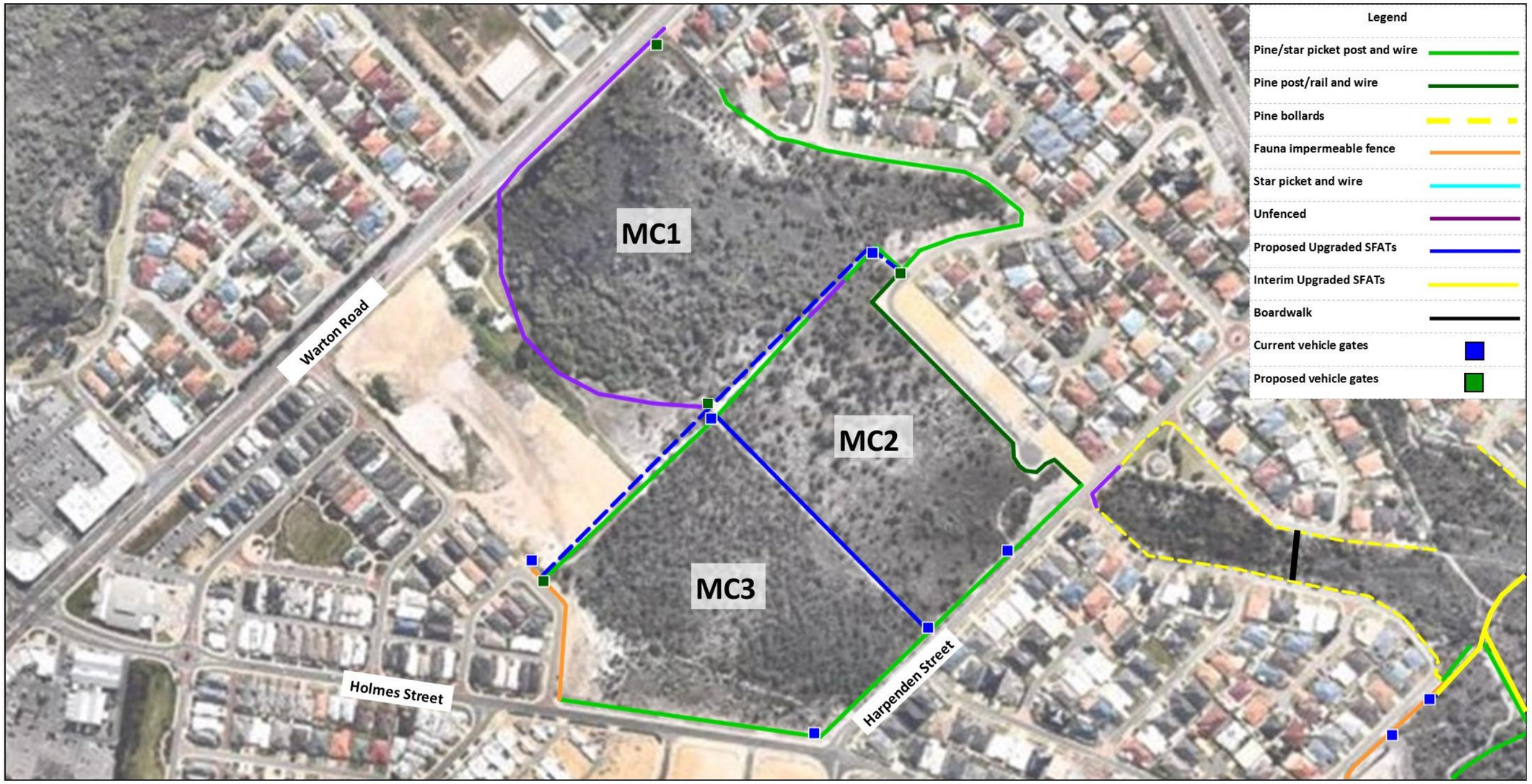


**Figure 9:**
**Current fencing**
**Harpenden Street Bushland - Holmes Street Bushland North**

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**Client:** City of Gosnells
**Project:** Holmes Street Bushland North Bushfire and Access Management Plan
**Image Source:** NearMap, 2015
**Prepared by:** Sharon Hynes
**Datum:** GDA 94, Zone 50

0 100
Metres

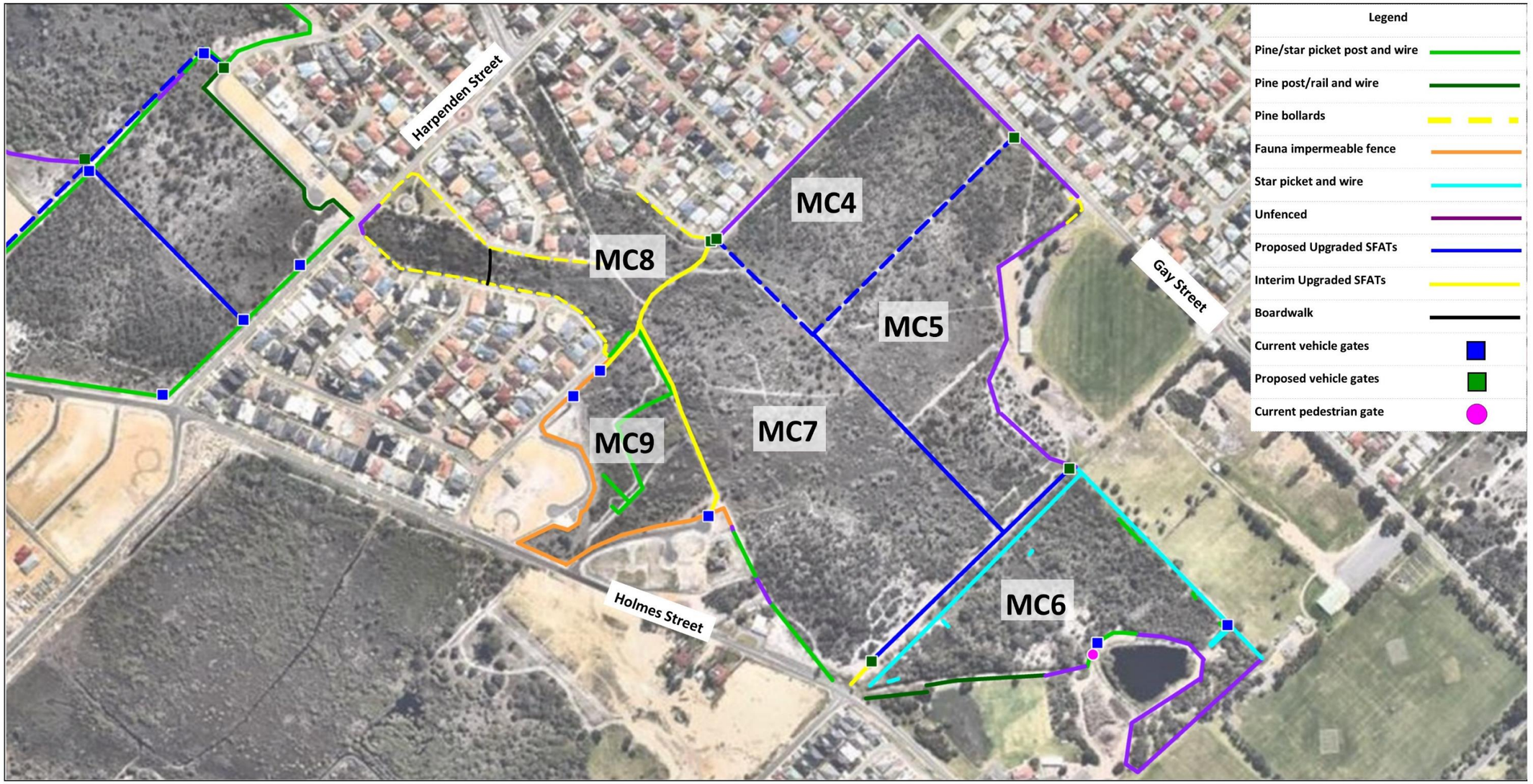


**Figure 10:**
**Current fencing**
**Gay Street Bushland - Holmes Street Bushland North**

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**Client:** City of Gosnells
**Project:** Holmes Street Bushland North Bushfire and Access Management Plan
**Image Source:** NearMap, 2015
**Prepared by:** Sharon Hynes
**Datum:** GDA 94, Zone 50

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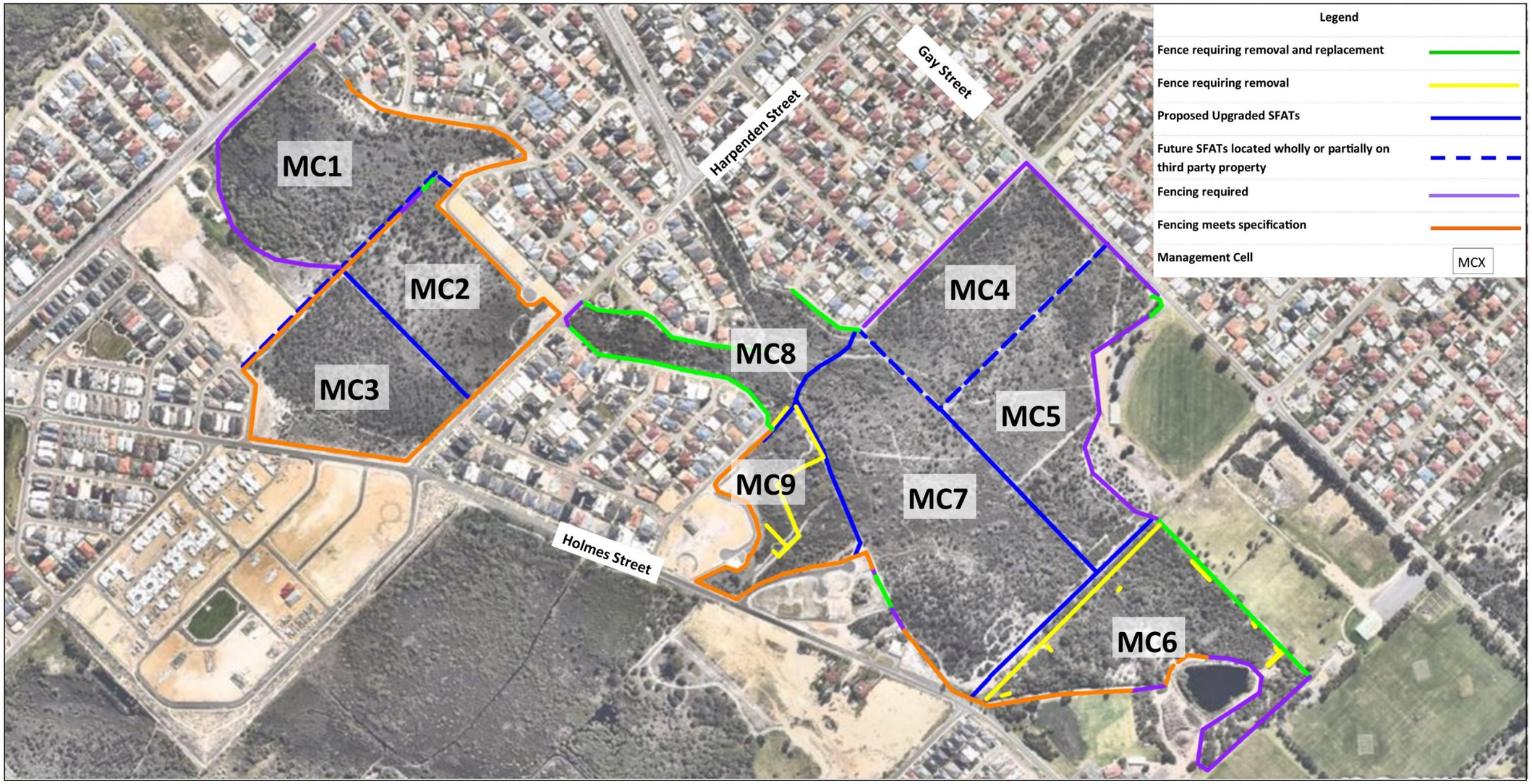


**Figure 11:**
**Fencing requiring maintenance, installation or replacement**
**Gay Street Bushland - Holmes Street Bushland North**

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**Client:** City of Gosnells
**Project:** Holmes Street Bushland North Bushfire and Access Management Plan
**Image Source:** NearMap, 2015
**Prepared by:** Sharon Hynes
**Datum:** GDA 94, Zone 50

0 200
Metres

## 3.3 Access Paths and Gates

An evaluation of existing gates and potential new gates was undertaken by this study, assessed against their provision of good access to SFATs. Section 6.9.2 provides a definitive proposal with regard to Strategic Fire Access Tracks and gates. Pedestrian and vehicle access gates are to generally align with SFATs, and which will provide both a trafficable surface for pedestrian and cycle traffic, as well as vehicle access for general maintenance and fire management.

### 3.3.1 Pedestrian Gates

Pedestrian access will generally align with vehicular access to Strategic Fire Access Tracks, and will be located to one side of the vehicle gate, with a suitable hardstand connection to existing pedestrian paths or the kerb. Gates will be of a design that permits access to pedestrians, bicycles, prams and gophers whilst excluding motorised off-road vehicles. Locations of proposed gates are shown on Figures 9 and 10.

| **Recommendations** | |
|---|---|
| **AB 5** | Pedestrian gates should be installed adjacent to vehicle gates at entries to Strategic Fire Access Tracks as illustrated in Figure 9 to allow access by pedestrians, bicycles, prams and gophers. |
| **AB 6** | Gates should be designed to permit access to pedestrians, bicycles, prams and gophers whilst excluding motorised off-road vehicles. |

### 3.3.2 Vehicle Access Gates

Eleven vehicle access gates are present in and around the HSBN, all of which are rural style and a minimum of 3.6 m wide; an additional nine are proposed (Figures 9 and 10; Table 3). The CoG minimum standard for fire-fighting vehicle access to gates has increased to 4 m wide, with new gates needing to meet this requirement and existing gates to be upgraded over time. Existing fencing will need to be adjusted to accommodate the increased width of gates and the installation of recommended gates. Seven current vehicle gates do not meet the new standard and will need to be replaced over time (Table 3). Some gates are currently padlocked with a key common to the City of Gosnells. It is recommended that all gates be keyed to the City's 'G&M' key, which is also accessible to fire fighters.

**Table 3:** Vehicle gate requirements per management cell

| Management Cell | Meets standard (4 m) | Below Standard/Replace (3.6 m) | New Gate to be Installed |
|---|---|---|---|
| MC1 | 0 | 1 | 2 |
| MC2 | 0 | 3 | 1 |
| MC3 | 0 | 1 | 1 |
| MC4 | 0 | 0 | 2 |
| MC5 | 0 | 0 | 1 |
| MC6 | 0 | 2 | 0 |
| MC7 | 0 | 0 | 2 |
| MC8 | 0 | 0 | 0 |
| MC9 | 3 | 0 | 0 |

Additionally, appropriate crossovers will need to be constructed at gate locations around the site perimeter that are sandy, with mountable kerbs replacing any non-mountable kerbs. Crossovers can be constructed from limestone, concrete. Costings are included in Section 8.0.

When the City of Gosnells becomes the managing authority for Lots not currently under their control (Lots 1502, 1578 and 1592, Figure 1), the need for additional vehicle access points will need to be reviewed. Vehicle access points requiring gates are shown as green squares in Figure 9 and 10.

**Figure 12:** Locked gate – note no crossover in place

| **Recommendation** | |
|---|---|
| **AB 7** | Vehicle gates should be 4 m wide (i.e.: 2 x 2 m) to allow appropriate access for emergency vehicles, and should be installed where proposed gates are shown on Figures 9 and 10. |

### 3.3.3 Strategic Fire Access Tracks

It is the intention of the City of Gosnells to apply a strategic approach to the management of bushfire in the HSBN. The City has identified FATs that are superfluous to good fire and ecological management. These are to be decommissioned and revegetated. A number of existing FATs are to be retained and upgraded to provide high quality access to fire-fighting appliances, management vehicles and the community. They will create a pattern of fire management compartments separated by an integrated framework of highly trafficable Strategic Fire Access Tracks (SFAT) (see Table 7; Figure 24). More detail on SFATs is provided in Section 6.9.2

# 4.0 Infrastructure

Infrastructure within and adjoining the HSBN (Figure 5) that requires consideration in a fire management scenario is limited to:

- communications towers
- irrigation pump station
- formal play area in the vicinity of Harpenden Street in Lot CR47575
- boardwalk located in Lot CR47575
- powerline between MC5/MC7 and MC6
- fencing, bollards and gates around the Reserve.

Consideration must also be given to infrastructure located in the immediately vicinity of the HSBN:

- Huntingdale Community Facility
- mulch storage and composting facility
- communications tower
- sporting facilities, including clubrooms
- residential dwellings
- vet clinic and residence.

An additional playground is located outside of the HSBN boundary in proximity to playing fields and ovals along Gay Street.

In order to enhance usage of the reserve, consideration should be given to:

- seating at a number of points along formalised pedestrian access ways
- shaded rest areas
- exercise equipment
- signage.

## 4.1 Exercise Equipment

The HSBN has great potential to provide a fitness benefit to the local and broader community. SFATs should be integrated into existing and planned movement networks within the adjacent Sutherlands Park Sporting Complex, to provide jogging circuits.

The installation of exercise equipment along SFATs would complement the proposed largely passive recreational focus of the HSBN and nearby playing fields located on Gay Street. It will also broaden the HSBN user demographic and, potentially, attract more users to the bushland. It is recommended that the City investigate and pursue the installation of appropriate exercise equipment in the HSBN, taking into consideration:

- the number of exercise stations
- the type of equipment to be installed
- appropriate location(s)
- construction material(s) and engineering requirements
- vandalism.

| Recommendations | |
|---|---|
| **AB 8** | The City of Gosnells should seek to integrate the multiple use SFAT network with existing and planned movement networks within the Sutherlands Park Sporting Complex, to provide jogging circuits. |
| **AB 9** | The City should investigate and pursue the installation of appropriate exercise equipment on walk trails in the HSBN. |

## 4.2 Signage

Signage will help to establish the identity of the HSBN and enhance visitor use of the Reserve. A signage strategy should include directional and entry statement signage as a minimum. The *Ellis Brook Valley Signage Strategy Manual* (Chameleon Creative, 2006), which has been adopted by the City for use in natural areas, provides detailed specifications on signage types, design and costings, and which can be used within the HSBN.

### 4.2.1 Entry Statement Signage

As community usage of the site increases, an entrance statement will be appropriate at all gated entrances (e.g.: Figures 13 and 14). Entry statement signage provides:

- information highlighting the environmental, ecological, social and cultural values of the site
- indication of reserve boundaries and location of key features
- acceptable and prohibited activities.

Entry Statement signage design should refer to sign type 5 –Primary Interpretive Trail Sign in *Ellis Brook Valley Signage Strategy Manual* (Chameleon Creative, 2006) (Figure 13).


**Figure 13:** Sign type 5 –Primary Interpretive Trail Sign at Ellis Brook Valley

Consideration should be given to developing and appropriate name for the HSBN to provide the bushland an identity relevant to its cultural, historical and urban context. Recommended signage locations are shown in Figure 14.

| **Recommendation** | |
|---|---|
| **AB 10** | Entry Statement signage design should refer to sign type 5 –Primary Interpretive Trail Sign in *Ellis Brook Valley Signage Strategy manual (2006)*. |
| **AB 11** | An appropriate name should be developed for the HSBN to provide the bushland an identity relevant to its cultural, historical and urban context. |

### 4.2.2 Directional and Interpretive Signage

As one of the aims for the HSBN is inclusive use, there is the need for signage that shows directions to the main access points and features within the Bushland (e.g.: 'you are here' type signage or direction and distance to key features). A track/trail naming system will assist with trail totems with colour and symbols for different trails, with potential naming options including the names of local flora and/or fauna species.

Interpretive signs should be considered for installation along SFATs. These should, though, be kept to a minimum, as they have the potential to detract from the bushland experience. 'QR' codes for smart phones might provide a more discreet option where the size of signs could be kept to a minimum but information on features could be readily available and managed by the City.

| **Recommendations** | |
|---|---|
| **AB 12** | A walk trail identification/naming system should be prepared to enhance the experience of visitors to the HSBN. |
| **AB 13** | Trail totems should be considered by the City using design sign type 9 B – Small Directional Totems as described in *Ellis Brook Valley Signage Strategy manual (2006)*, with colours, symbols and trail names for each trail chosen by the City. |
| **AB 14** | Interpretive signs should be kept to a minimum, with the use of 'QR' codes considered to provide information to users via smart phones, tablets, iPads, and similar. |

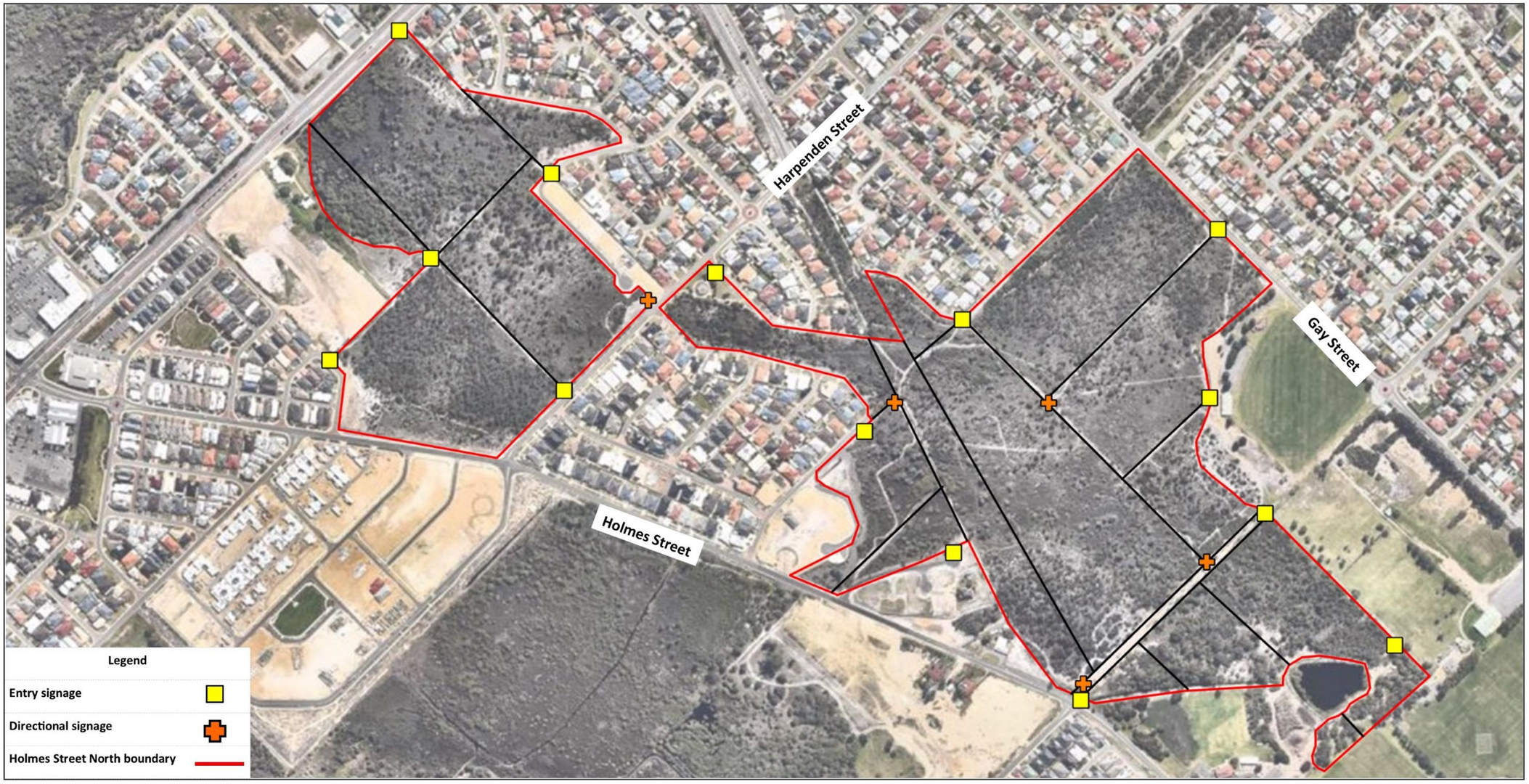


**Figure 14:**
**Recommended signage locations**
**Holmes Street Bushland North**

N

**Client:** City of Gosnells
**Project:** Holmes Street Bushland North Management Plan
**Image Source:** NearMap, 2015
**Prepared by:** Sharon Hynes
**Datum:** GDA 94, Zone 50

0 200
Metres

# 5.0 Disturbances

Site assessment activities identified a number of disturbance activities (Figure 16) within the HSBN, including:

- illegal dumping of rubbish
- unmanaged pedestrian access
- BMX jumps
- uncontrolled vehicle access.

Unmanaged pedestrian and uncontrolled vehicle access will be addressed through fencing and gates. Rubbish dumping and BMX jumps are expected, from experience, to continue in spite of access management.

## 5.1 Illegal Rubbish Dumping

Rubbish dumping was the most common disturbance activity noted during the site assessment, with green waste and household rubbish of varying descriptions found in all areas (Figure 15). Rubbish dumping was worse in areas near residential housing particularly where access was easier due damaged fencing, unfenced areas or unlocked vehicle gates, reinforcing the requirement standardised fencing and maintenance.

Rubbish and other dumped materials identified around the HSBN perimeter should be removed immediately prior to the installation of fencing. Other areas of identified dumping should be programmed to be cleaned up following the upgrading of vehicular access to the bushland. It is recommended that the City of Gosnells promptly remove rubbish noted during site inspection activities, and program where necessary follow-up remedial activities such as weed management and revegetation.

**Figure 15:** Illegal rubbish dumping observed in HSBN

| Recommendations | |
|---|---|
| **AB 15** | Removal of dumped materials around the HSBN perimeter should be programmed to occur immediately prior to the installation of fencing. |
| **AB 16** | Removal of dumped materials inside the HSBN should be programmed to occur following the upgrading of vehicular access to the bushland. |
| **AB 17** | The City of Gosnells should promptly remove rubbish noted during site inspection activities, and where necessary program follow-up remedial activities such as weed management and revegetation. |

## 5.2 BMX Jumps

It is expected that the encouragement of community use of the HSBN will engender a sense of ownership and provide a level of passive surveillance that currently does not exist. People engaged in undesirable activities generally prefer un-surveilled locations and, when public use of an area increases to a critical mass, they tend to relocate to 'quieter' areas.

In addition, passive surveillance will result in undesirable activities being reported as they are observed. This provides an opportunity for the City to respond in a timely fashion to reports and address the problem. This provides the reporting public confidence that they are being heard, and also the City the opportunity to intervene at an early stage.

The creation of BMX jumps is a common disturbance in bushland areas. If left unattended, these disturbances grow in size, damaging vegetation and providing an ideal situation for weeds to take hold. It is recommended that the City address, as a matter of priority, BMX activity in the HSBN as soon as it becomes aware of it. This will help to avoid the problems associated with larger developments and assist to gradually get the message across that this type of activity is not tolerated in the HSBN.

| Recommendation | |
|---|---|
| **AB 18** | As a matter of priority, the City should remove BMX jumps and other such developments in the HSBN as soon as practical after it becomes aware of the activity. |


**Figure 16:**
**Disturbances**
**Holmes Street Bushland North**

N

**Client:** City of Gosnells
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**Image Source:** NearMap, 2015
**Prepared by:** Sharon Hynes
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0 200
Metres

# 6.0 Fire Management

Bushfires are a natural and necessary occurrence within the Australian ecosystem with much of the vegetation having developed characteristics that promote the spread of fire. Vegetation characteristics that promote fire include flammable bark, dry coarse leaf litter and leaves that contain flammable oils (CSIRO, 2008). Consequently, residential areas in proximity to remnant native vegetation are at risk from bushfire impacts such as ember attack. To mitigate this risk, the ecological processes and characteristics of native vegetation need to be understood and managed. A site visit carried out in January 2016 allowed the assessment of:

- vegetation class as per AS 3959 – 2009
- bushfire hazard as per AS 3959 – 2009
- visual fire fuel load
- bushfire risk factors.

## 6.1 Fire History

Information supplied by the City indicated that four fires have occurred within the site boundary since 2006 (City of Gosnells, 2016, Figure 17).

## 6.2 Vegetation Class

The amount and type of vegetation present at the reserve directly contributes to the risks associated with fire. Vegetation class within the reserve were assessed using descriptions provided in *AS 3959 – 2009 Construction of Buildings in Bushfire Prone Areas* (2011). A handheld GPS unit in association with observations was the basis of data collection, and later mapped to provide a representation of the vegetation classes within the reserve. The assessment indicated the presence of five distinct vegetation classes across the HSBN (Table 4, Figure 18).

**Table 4:** Vegetation classification as per AS 3959 - 2009

| Vegetation Classification | Description | Photograph |
|---|---|---|
| B5 Woodland | Trees 10-30 m high; 10- 30% foliage cover dominated by eucalyptus; understory low trees to tall shrubs typically dominated by Acacia, Callitris or Casuarina |  |

| Vegetation Classification | Description | Photograph |
|---|---|---|
| B7 Low Woodland | Low trees and shrubs 2 – 10 m high; foliage cover less than 10%; dominated by eucalypts and acacias. Often has a grass understory or low shrubs. Acacia and Casuarina woodlands grade to Atriplex shrublands in the arid and semi - arid zones. |  |
| D13 Closed Scrub | Found in wet areas and/or areas affected by poor soil fertility or shallow soils; > 30% foliage cover. Shrubs > 2 m high, typical of coastal wetlands and tall heaths. |  |
| D14 Open Scrub | Shrubs > 2 m; 10 – 30% foliage cover with a mixed species composition. |  |

| Vegetation Classification | Description | Photograph |
|---|---|---|
| G21 Closed Tussock Grassland | All forms, including situations with shrubs and trees if the over storey foliage cover is < 10% |  |

## 6.3 Fire Fuel Load Assessment

A hybridised approach was adopted to assess the fire-fuel load at the reserve using a visual method described by Department of Fire and Emergency Services(DFES) along with the Vesta methodology that considers the arrangement of fuel and how that influences fire spread. The fuel load assessment included:

- fuel layers and fuel hazard attributes
- assessment of bark type and amounts (i.e. fine and elevated fine fuel)
- fuel within the continuous flaming zone (i.e. surface and near surface fine fuel; live and dead plant material)
- assessment of risks to assets and infrastructure.

Thirty-two 1-$m^2$ quadrats were set up in various locations within the Reserve with the position marked on a handheld GPS device. Each quadrat was photographed and the depth of leaf litter was measured, along with any higher near-surface fuel present. The fuel load at each location (t/ha) was compared to the fuel load photographs in the *Visual Fuel Load Guide* prepared by DFES (Edition 3, 2015).

The fire-fuel load was variable throughout the site, and included:

- surface fuel in the form of leaf litter and dry weedy grasses
- near surface fuel in the form of dead trees, twigs and branches
- flammable vegetation.

Lower fire-fuel loads were recorded in locations with areas of managed parkland (0 – 5 tonnes per hectare) and higher fuel loads observed in areas with deeper areas of leaf litter, dead twigs and branches (up to 25 tonnes per hectare), with the average across the site 12.8 tonnes per hectare. Figure 19 shows quadrat locations and fire fuel loads, and photographs of each quadrat are provided in Appendix 2.

## 6.4 Bushfire Hazard

The bushfire hazard at the site was broadly assessed on the basis of vegetation class as described in AS 3959 – 2009, with ratings being low, moderate or extreme. The majority of the site was rated moderate or extreme on the basis of the type and amount of vegetation present (Figure 20).

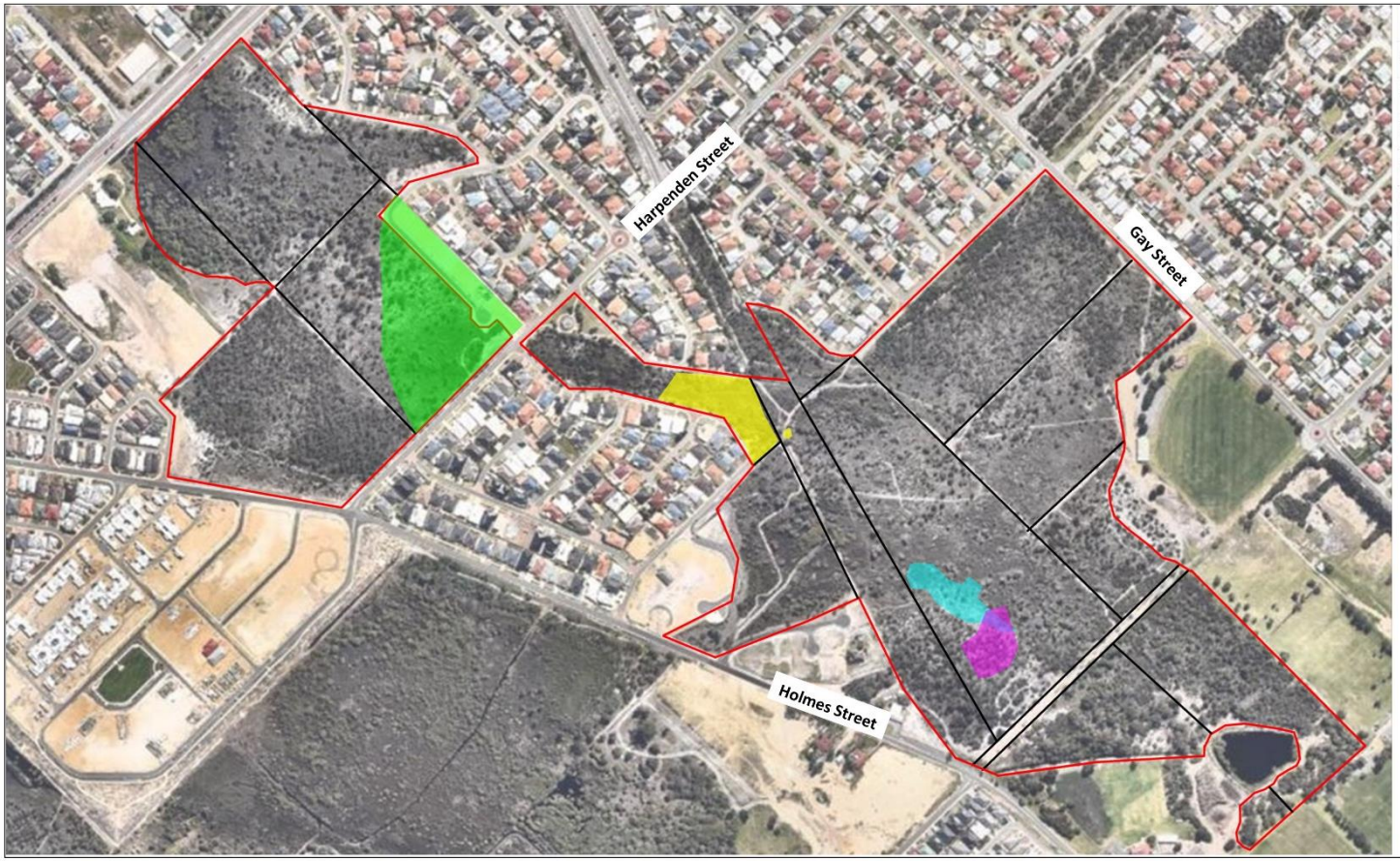


**Figure 17:**
**Fire History—2006—2015**
**Holmes Street Bushland North**

N

**Client:** City of Gosnells
**Project:** Holmes Street Bushland North Bushfire and Access Management Plan
**Image Source:** NearMap, 2015
**Prepared by:** Sharon Hynes
**Datum:** GDA 94, Zone 50

0 200
Metres


**Figure 18:**
**Vegetation Class as per AS 3959**
**Holmes Street Bushland North**

N

**Client:** City of Gosnells
**Project:** Holmes Street Bushland North Bushfire and Access Management Plan
**Image Source:** NearMap, 2015
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0 200
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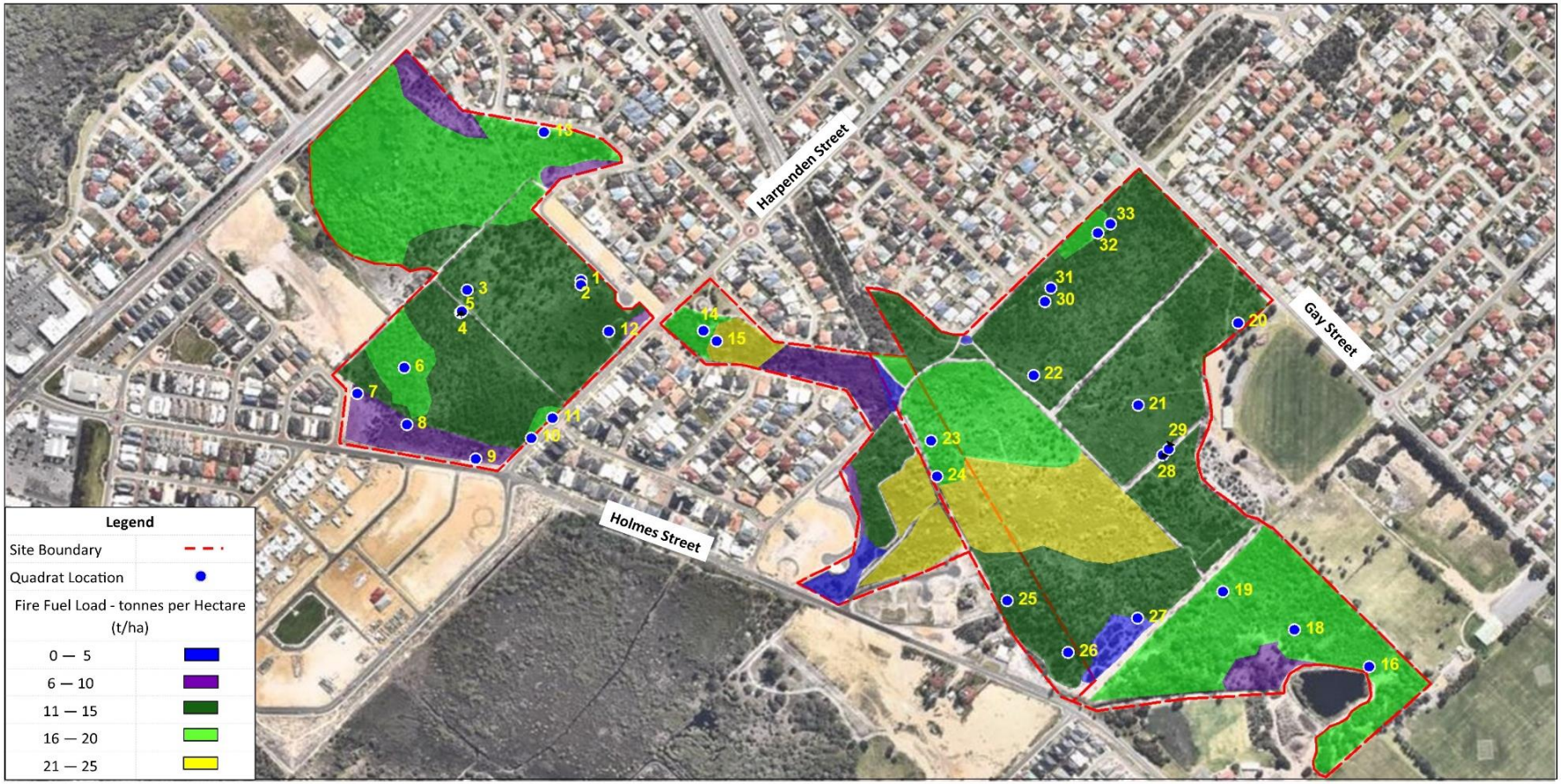


**Figure 19:**
**Fire fuel Load—Tonnes per Hectare (t/ha)**
**Homes Street Bushland North**

**Client:** City of Gosnells
**Project:** Holmes Street Bushland North Management Plan
**Image Source:** NearMap, 2015
**Prepared by:** Sharon Hynes
**Datum:** GDA 94, Zone 50

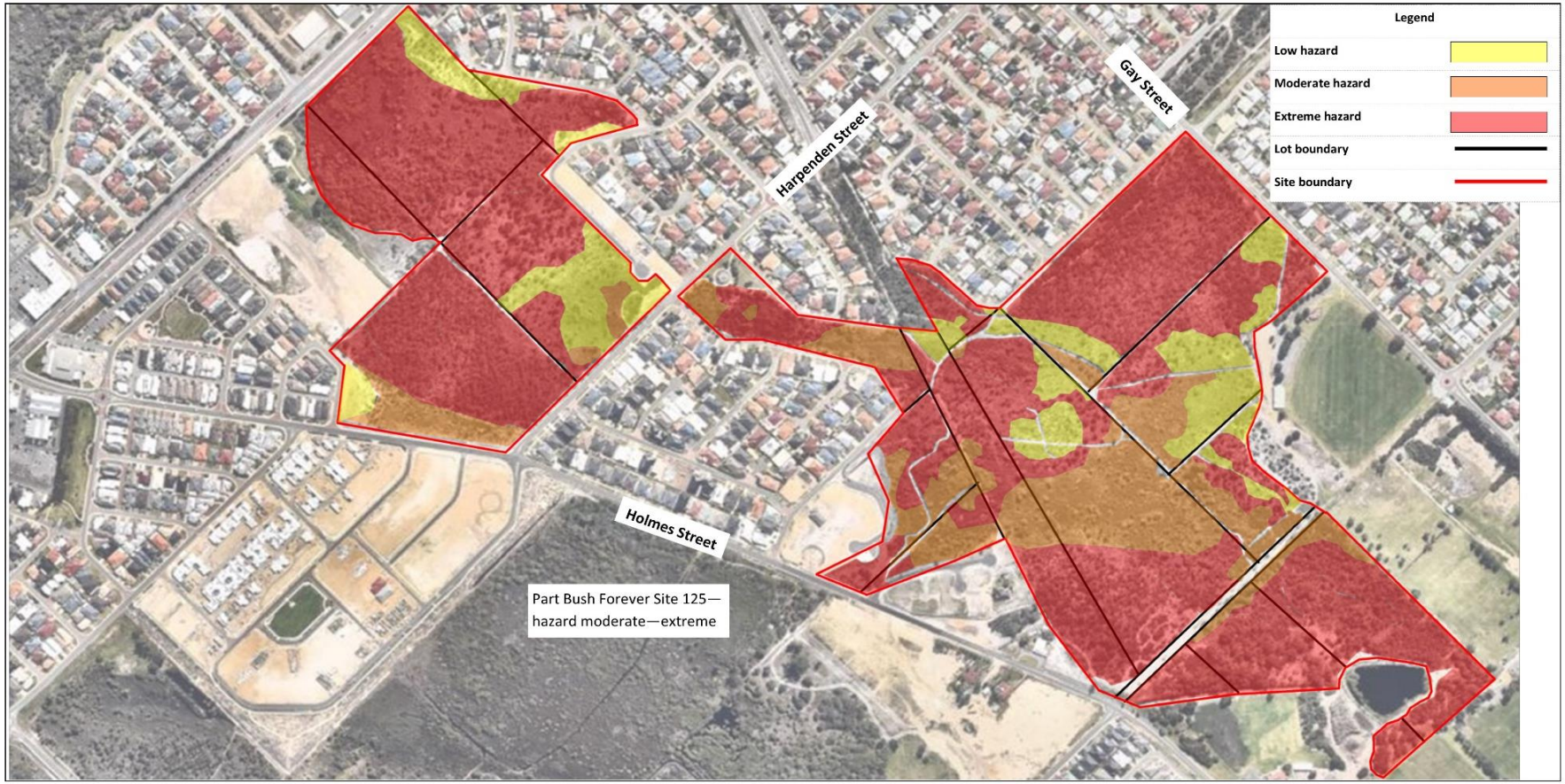


**Figure 20:**
**Bushfire Hazard**
**Holmes Street Bushland North**

N

**Client:** City of Gosnells
**Project:** Holmes Street Bushland North Bushfire and Access Management Plan
**Image Source:** NearMap, 2015
**Prepared by:** Sharon Hynes
**Datum:** GDA 94, Zone 50

0 200
Metres

## 6.5 Risk Assessments

Risk assessments were undertaken to determine the potential for fire within the reserve and the level of risk to nearby infrastructures and homes. The risk assessment involved a desktop Fire Hazard Assessment and an on-ground Field Hazard Assessment. The methodology for these evaluations were developed using information contained in *Planning for Bush Fire Protection Guidelines* (WAPC, DoP and FESA, 2010) along with *AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines* and *Rural Urban Bush Fire Threat Analysis* (RUBTA) (FESA, 2003).

### 6.5.1 Fire Hazard Assessment

The Fire Hazard Assessment is a desktop survey that utilises aerial imagery, maps, database searches and written reports. This took into consideration several factors including risk of ignition, visitor use and fuel load. The outcome was a 'score' in the form of a hazard rating (low, medium, high or extreme; Table 5). Fire management of the site was reviewed as part of the assessment process. This took into consideration ease of access, response time, water supply and resources available. The outcome was a 'score' (low, medium, high or extreme; Table 6) with higher scores associated with fire management deficiencies.

**Table 5:** Fire hazard assessment

| Hazard | Yes | No | Score |
|---|---|---|---|
| Risk of ignition present | ✓ | | 1 |
| Fuel load > standard intensity | ✓ | | 1 |
| Vegetation assessment area with fire hazard manageability | ✓ | | 1 |
| Hazard reduction in < 80% of assessment zone | ✓ | | 1 |
| High visitor use | | ✓ | 0 |
| Recent or proposed residential or other developments | ✓ | | 1 |
| | | **Total** | **5** |
| | | **Hazard Rating** | **High** |

Hazard rating: Extreme = 6, High = 4 – 5, Medium = 2 – 3, Low = 0 – 1

**Table 6:** Management assessment

| Management Assessment | Yes | No | Score |
|---|---|---|---|
| Site access difficult or inaccessible | ✓ | | 1 |
| Response time > 30 minutes | | ✓ | |
| Inadequate water supply | | ✓ | |
| Inadequate resources | | ✓ | |
| | | **Total** | **1** |
| | | **Hazard Rating** | **Low** |

Hazard rating: Extreme = 4, High = 3, Medium = 2, Low = 1

The Fire Hazard Assessment indicated that the fire hazard is 'High' (Table 3), suggesting that Council, DFES and community attention is required to assist with determining the appropriate fire management options. The management assessment indicated that the risk is 'low' (Table 4) and can be managed through routine operations and procedures.

### 6.5.2 Field Fire Hazard Assessment

The Field Fire Hazard Assessment was developed using information contained in *Planning for Bush Fire Protection Guidelines* (WAPC, DoP and FESA, 2010) along with *AS/NZS ISO 31000:2009 Risk Management – Principles and Guidelines* and *Rural Urban Bush Fire Threat Analysis* (RUBTA) (FESA, 2003). These assessments took into consideration environmental and human features including:

- vegetation type
- slope
- overhanging vegetation
- weed density
- presence of larger dead vegetation
- ecological values
- the distance to nearest fire station
- site access
- infrastructure.

Outcomes of this assessment are provided in Table 7.

**Table 7:** Field fire hazard assessment

| Risk Factor | Information recorded | Response |
|---|---|---|
| Vegetation type(s) and classes | Describe vegetation types and classes present within reserve (as per Table 2.3 AS 3959- 2009 | ▪ Type B Woodland<br>▪ Type D Scrub<br>▪ Type G Grassland<br>(*refer to Figure 17 and Table 3*) |
| Slope of land between vegetation and infrastructure | Calculate slope of land (as per AS 3959-2009) | Mostly flat land; dune crest in Lots 1502, 1578, 9002 and 9000, slope 0 -5$^{o}$ |
| Potential ignition sources | Describe | ▪ lightning<br>▪ cigarette butts<br>▪ arson |
| Weeds | Describe species | Includes:<br>▪ grasses such as Wild Oats (*Avena barbata*) and Blowfly Grass (*Briza maxima*)<br>▪ woody weeds such as Flinders Range Wattle (*Acacia iteaphylla*) and Castor Oil Plant (*Ricinus communis*)<br>▪ bulbs such as Pink Gladiolus (*Gladiolus caryophyllaceus*)<br>▪ herbs and shrubs such as Geraldton Carnation Weed (*Euphorbia terracina*) and Cape Weed (*Arctotheca calendula*)<br>Refer Revegetation and Weed Management Plan |

| Risk Factor | Information recorded | Response |
|---|---|---|
| | Density (approximate) | Varies – refer Revegetation and Weed Management Plan |
| | Approximate area affected | Refer Revegetation and Weed Management Plan |
| Leaf litter | Approximate area | Variable |
| | Approximate depth | Average depth approximately 50 mm |
| Fuel Load | Tonnes per hectare based on Visual Fuel Load Guide, (FESA, 2012) | Average fuel load across site approximately 12.8 t/ha (refer to Appendix 2) |
| Presence of larger dead vegetation | Describe | Dead and fallen shrubs, branches and trees |
| | Approximate area | Scattered throughout bushland |
| Ecological values | Significant flora, fauna and ecological communities | **Flora:** *Jacksonia gracillima (P3)*<br>**Fauna:** observations of:<br>▪ Carnaby's Cockatoo *(Calyptorhynchus latirostris)*<br>▪ Forest Red-tailed Black Cockatoo (*Calyptorhynchus banksia naso*)<br>▪ Southern Brown Bandicoot (*Isoodon obesulus fusciventer*)<br>▪ Rainbow Bee Eater (*Merops ornatus*)<br>**Ecological communities:** Banksia Woodland on Swan Coastal Plain (endangered, EPBC Act 1999 (Cwlth)) |
| Presence of rubbish material, such as broken glass | Location (approx.), describe | Small amounts of litter |
| Presence of human urban features | Types e.g.: playgrounds, homes | Playgrounds within reserve boundaries, playing fields and homes nearby |
| | Location | Various locations |
| | Average distance from vegetation classes | 20 m minimum for residential properties, playgrounds closer |
| Fire hydrants | Locations | City of Gosnells urban road network |
| Other fire water sources | Describe | Various lakes and drainage sumps |
| Fire access tracks and similar | Locations | Vehicle access limited due to the presence of sandy tracks |
| | Accessibility (gates, locks, etc.) | Gates locked with key common to City of Gosnells |
| Fire station | Distance to nearest fire station | Canning Vale and Maddington both approx. 10 – 15 minutes away; the Gosnells Volunteer Bushfire Brigade is approx. 10 – 15 minutes away |

| Risk Factor | Information recorded | Response |
|---|---|---|
| Fire Management Plan | Prepared (yes/no) | No |
| | Review date | N/A |
| Further development in proximity to reserve proposed? | Yes/no | Yes – refer Figure 1 showing areas cleared for development |
| Roads accessible by emergency responders? | Yes/no | Yes – Roads accessible |
| Firebreak | Width | Sandy tracks approx. 4 – 6 m wide |
| | Location | Located around edge of reserve, with some internal sandy tracks present |
| Fire history known/approximated | Describe | Evidence of fire, refer Section 5. 1 for fire history |
| Proximity to schools, nursing homes, shopping centres, etc. | Describe, distance type, etc. | None close by |
| Heritage or cultural values | Aboriginal, European or other heritage or cultural sites within the bushland area or nearby | No registered Aboriginal sites |

## 6.6 *Jacksonia gracillima*

*Jacksonia gracillima*, listed as a priority 3 species under the *Wildlife Conservation Act 1950* (WA) in need of further research to determine if it is endangered in the wild, was recorded within the Reserve (Figures 21 and 22). Habitat for *Caladenia huegelii* (Grand Spider Orchid), *Drakaea elastica* (Glossy-leaf Hammer-orchid) and *Diuris purdiei* (Purdie's Donkey-orchid) that are all listed as Threatened under the *Wildlife Conservation Act 1950* (WA) and as Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) was recorded on site, although no plants were observed during 2015 surveys. *Caladenia huegelii* has previously been recorded on site within the Garden Street Road Reserve. The presence of these species will be considered when implementing fire management measures.

**Figure 21:** *Jacksonia gracillima*


**Figure 22:**
***Jacksonia gracillima* locations**
**Holmes Street Bushland North**

N

**Client:** City of Gosnells
**Project:** Holmes Street Bushland North Management Plan
**Image Source:** NearMap, 2015
**Prepared by:** Sharon Hynes
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0 200
Metres

## 6.7 Assessment Limitations

Trained personnel using accepted methods carried out the fuel load assessments; however, limitations include:

- vegetation characteristics may change at different times of the year
- the visual assessment methods are qualitative and thus reliant on the judgement of those carrying out the work.

Despite these limitations, the fire-fuel load assessment does provide a suitable guide to the fire risks present within the reserve and will assist with ongoing fire management at the reserve.

## 6.8 Implications

The site and risk assessment process indicates there is a risk of fire occurring at the site. Potential impacts associated with fire include:

- smoke damage
- ember attack
- proximity to flames
- damage to infrastructure and built assets
- injury to visitors and others.

Predominant winds at the time of any fires will determine the direction of spread and thus the potential for smoke and ember attack in surrounding areas, noting that fire travels faster uphill. The presence of fine fire fuels (thinner than a finger width), such as dry grass, leaves, twigs and loose bark, are a major contributor to the heat and speed of a fire. Management of these fuels will be an important means of limiting the spread of fire within the site and neighbouring areas.

## 6.9 Bushfire Management

Bushfire management most commonly involves the management of fuel to reduce the risk and intensity of unplanned fires. Fire is more easily suppressed when the intensity (fire temperature) is reduced.

An understanding of bushfire fuel loads is key to both fire management and fire suppression. Assessments of fuel loads and bushfire hazard are provided in Figures 18 and 19 respectively. This is a snapshot of a dynamic situation which requires periodic updating. It is recommended that the City maintain the currency of fuel load mapping, in particular, by updating baseline mapping to capture fuel reduction arising from unplanned bushfire or planned fuel reduction burns. It is also recommended that fuel load is reassessed and mapped on a regular basis.

It is the intention of the City of Gosnells to apply a strategic approach to the management of bushfire hazard and risk in the HSBN. In the first instance, the management of annual grassy weeds through the implementation of the Revegetation and Weed Management Plan will assist in the reduction of fuel loads and fire risk. In the second instance, the City proposes a bushfire fuel reduction program based on the rationalisation of existing Fire Access Tracks to create a pattern of fire management cells separated by an integrated framework of highly trafficable Strategic Fire Access Tracks (SFAT). The SFAT network will also provide enhanced access and egress for fire suppression vehicles and activities, improving the potential for containment and suppression from the current circumstance.

| Recommendation | |
|---|---|
| **AB 19** | Bushfire fuel loads and fire history mapping should be updated on a regular basis to capture reductions to loads brought about by planned and unplanned bushfires, and natural increases in loads over time. |

### 6.9.1 Fire Access Tracks

Existing Fire Access Tracks are based on the cadastral boundaries of the individual properties that make up the HSBN. Their locations have not been planned to assist in the management of the HSBN's ecology, fire management, fire suppression or community access (Figure 23). They typically comprise soft, sandy tracks 4 to 6 metres wide, with the exception of SFAT 6 which is an average of 11 m wide. They are currently maintained annually to ensure compliance with the requirements of the *Bushfires Act 1954* (WA).

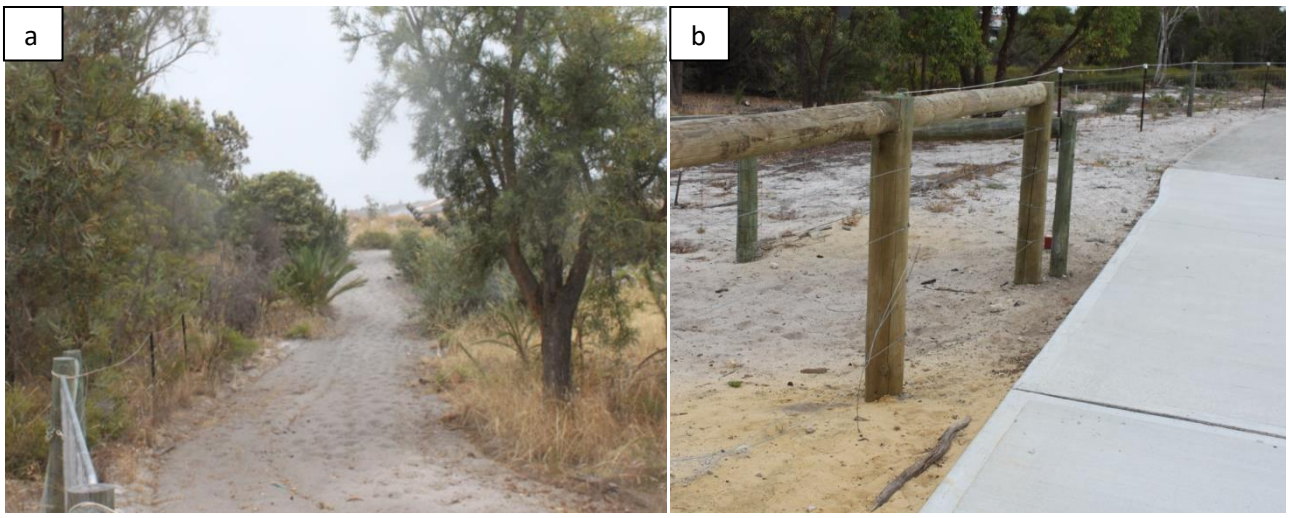


**Figure 23:** a) firebreak around internal Lot perimeter; b) low fuel zone created by footpath and fence

### 6.9.2 Strategic Fire Access Tracks

It is the intention of the City of Gosnells to apply a strategic approach to the management of bushfire hazard and risk in the HSBN. In doing so, the City has identified FATs that are potentially superfluous to good fire and ecological management. The City proposes a rationalisation of existing FATs to create a pattern of fire management compartments separated by an integrated framework of highly trafficable Strategic Fire Access Tracks (SFATs) (Table 7; Figure 24).

Certain FATs are also proposed to be maintained in the interim pending the extension of Garden Street Road Reserve, with nominated SFATs needing to be reviewed if the proposed extension occurs. These tracks are highlighted in yellow in Figure 23 and green in Table 6.

SFATs will be upgraded to a 4-metre wide compacted crushed limestone surface that is trafficable to vehicles and pedestrians. Vertical clearance of 6 metres will be created and maintained from the edge of the SFAT. All SFAT upgrade works should be undertaken using proper hygiene methods to minimise the potential spread of *Phytophthora* dieback or other pathogens across the site.

Current FATs proposed for upgrading to SFAT range between 4 and 6 metres width. It is not anticipated that any significant clearing of vegetation would be required in the upgrade process, which would nonetheless be exempt under Schedule 6 of the Environmental Protection Act (1986). All construction works must be carried out in such a way as to absolutely minimise damage to native vegetation. Bare soil areas adjacent to SFATs are to be revegetated with appropriate native species.

Gates with a width of 4 m will be constructed at each SFAT entry point. Pedestrian access gates will be provided alongside each vehicle access gate.

Three of the SFATs are located entirely or partially on land that is not currently owned or managed by the City:

- SFAT 1 occurs within Lots 1578, 1502 and 500 Warton Road. Its upgrade should occur when management of the properties comes across to the City, or in liaison with the owners (highlighted pink in Table 8).
- Almost all of SFAT 5 and a portion of SFAT 4 is located within Lot 1592. Their upgrade will need to be undertaken in consultation with the Department of Education, the land owners.

It is recommended that the City engage with the Department of Planning regarding Lots 1578 Warton Road and 1592 Gay Street to determine the State Government's intention in relation to the fulfillment of their Bush Forever function and, potentially, their acquisition for conservation purposes.

**Table 8:** Strategic Fire Access Tracks upgrade requirements

| Strategic Fire Access Tracks | Require Upgrade | Length (m) | Total area ($m^2$) |
|---|---|---|---|
| SFAT 1 | Yes | 432.4 + 35.3 | 1870.8 |
| SFAT 2 | Yes | 279.7 | 1118.8 |
| SFAT 3 | Yes | 207.8 | 831.2 |
| SFAT 4 | Yes | 175.2 + 352.5 | 2110.8 |
| SFAT 5 | Yes | 372.2 | 1488.8 |
| SFAT 6 | Yes | 355.4 + 38.4 | 1575.2 |
| SFAT 7 | Yes | 248.8 | 995.2 |
| | **Total area ($m^2$) for crushed limestone installation** | | **9990.8** |

**Legend:** Interim SFAT pending the extension of Garden Street Road Reserve
SFAT located on privately-owned Lot 1578 Warton Road
SFAT located on privately-owned Lot 1592 Gay Street

| Recommendations | |
|---|---|
| **AB 20** | Identified SFATs (Figure 23) should upgraded using appropriate hygiene methods to provide a highly trafficable surface, such as compacted crushed limestone, that will provide general and fire management access, improved access and safety for emergency fire response vehicles and personnel, and improved and controlled community access. |

| Recommendations | |
|---|---|
| **AB 21** | SFATs should be upgraded and maintained to a minimum 4 m width with vertical clearance to 6 m height, with the minimal necessary vegetation clearing undertaken to protect vegetation condition and fauna habitat. |
| **AB 22** | All SFAT upgrade works should be carried out so as to avoid or minimise damage to native vegetation. |
| **RW 7** | Revegetation of bare soil areas along the margins of upgraded SFATs should comprise only low-growing plants such as ground covers and shrubs below 0.5 m mature height. |
| **AB 23** | All SFAT gates are to be a minimum 4 m width. |
| **AB 24** | The City of Gosnells should engage with the Department of Planning regarding Lots 1578 Warton Road and 1592 Gay Street to determine the state government's intentions regarding the fulfilment of their Bush Forever function and, potentially, their acquisition for that purpose. |

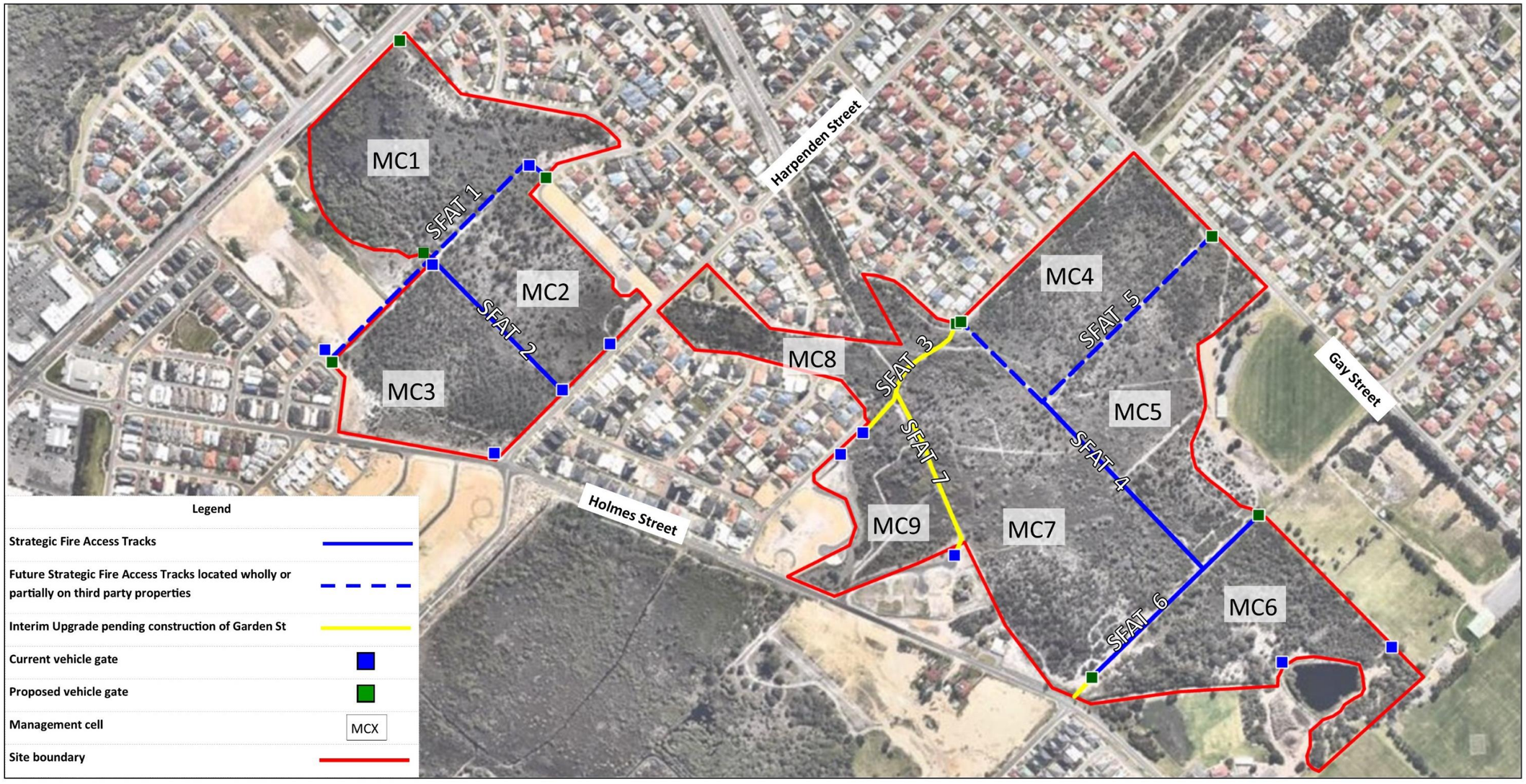


**Figure 24:**
**Strategic Fire Access and management cells**
**Holmes Street Bushland North**

N

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**Image Source:** NearMap, 2015
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0 200
Metres

### 6.9.3 Fire Fuel Load Management

The fire fuel load assessment indicates loads ranging from 0 – 5 up to 21 – 25 tonnes per hectare. The currently accepted practice is a fire fuel load of 8 t/ha for Banksia Woodlands on the basis of human risk factors, meaning that much of the site has a higher fuel-load. However, ecological factors suggest longer periods between fires and which will result in higher fuel loads over time, and are reflected in those identified during the assessment process.

Management objectives for fire fuel load include:

- ameliorating impacts of wildfire in a fire-prone environment
- providing fauna refugia through the use of a mosaic burning pattern across the site
- achieving reduced fire fuel loads around key assets and infrastructure
- achieving a minimum 20 m low fuel separation zone between vegetation and building walls of residential dwellings and other occupied premises
- retaining old-growth high fuel zones within nominated management cell cores to enhance the conservation values at the site.

Table 9 details current fire fuel loads for each management cell, dominant species and response to fire, prescribed fire management and recommended fire frequency whilst giving consideration to conservation values and bushfire risk to assets, infrastructure and human values.

Fire fuel load reduction can include controlled burns (Section 6.9.4), ongoing weed control in areas of infestation by chemical, mechanical or manual means, slashing of weeds in open pasture areas and the manual removal of dead and fallen trees, shrubs, branches and leaf litter in high fuel load areas (Figure 25). Review of fire fuel load should occur annually where fire fuel load has previously been recorded above 8 – 15 t/ha, with areas having lower loads reviewed every 2 – 3 years.

**Figure 25:** Near surface fuel load in the vicinity of Harpenden Street fence, Lots 9000, 9002

| Recommendations | |
|---|---|
| **AB 25** | It is recommended that a fire fuel load of 8 – 15 t/ha is maintained for HSBN. |
| **AB 26** | Fire fuel loads for HSBN are recommended to be reviewed annually in areas with fuel loads higher than 8 – 15 t/ha, and every 2 – 3 years for areas previously recorded below 8 t/ha. |
| **AB 27** | A 20 m low fuel load zone is recommended between vegetation within the site and residential buildings and infrastructure. |
| **AB 28** | Manual fire fuel load reduction needs to consideration protection of vegetation type, condition, along with fauna habitat requirements and refugia within HSBN. |

### 6.9.4 Controlled Burns

Controlled burns are a management option, with a mosaic burn pattern recommended at a suitable frequency that considers human and ecological factors. When controlled burns are used as a management tool, Banksia Woodlands are burnt every 8 – 12 years based on the flora species present and how quickly they produce seed after a fire, with some species such as *Conostephium pendulum* and *Melaleuca lateritia* taking as long as 60 months until seeding (Burrows, Wardell-Johnson and Ward, 2007). Research carried out by Valentine, Reaveley, Fisher and Wilson (2012) in relation to reptiles found a greater diversity in banksia sites that had not been burnt for 16 years or more. Similarly, Valentine and Hobbs (2014) found that the density of Banksia trees, a key food source of the Carnaby's Cockatoo (*Calyptorhynchus latirostris*), and cone productivity of *Banksia attenuata* was greater with a fire free period of 10 – 30 years, with *Banksia menziesii* higher in locations that had not been burnt for 35 years or more.

As the HSBN is a large area, it will be possible to provide a fire management regime that considers human values and the flora and fauna present, with controlled burns targeting areas of interface with human use with older fuels maintained in denser, less accessible locations where people are rarer visitors. Controlled burns should always be undertaken under the supervision of trained personnel such as local volunteer fire brigade or DFES. Controlled burns usually involve flames which are no higher than 1 m and a scorch height of less than 5 m, with the aim of providing a cool burn that does not damage the foliage of trees. The perimeter of the burn area will be ignited first to protect surrounding properties (DFES, 2016). The best time to undertake a controlled burn is between late June and early September when there is more moisture in the vegetation present, which will lead to a cooler burn that will burn for a shorter period of time (DFES 2016). Controlled burns can also be carried out in autumn, however, leaf litter tends to be drier and the potential for fires burning beyond desired areas is greater. Areas surrounding site infrastructure and assets (Figure 5) should be burnt first to protect them. It is recommended that seed collection and appropriate plant salvage occurs ahead of any controlled burns.

To enable the most appropriate management of the HSBN, it has been split into nine management cells to enable more detailed strategies to be formulated. The location of proposed SFATs form the boundary of management cells within HSBN, with eight in total (Figure 24). Prescribed burning would be best focussed on cell boundaries to retain old growth vegetation and fuel levels within the centre, whilst reducing risk to surrounding assets and reducing potential fire spread to surrounding vegetated cells. Dominant vegetation will determine fire frequency, intensity and area burnt within management cells. Table 9 lists recommended fire management actions for each management cell within the HSBN, giving consideration to the fire response of dominant flora.

Before undertaking controlled burns at the HSBN, the City of Gosnells will need to:

- notify nearby residents of the planned burn
- ensure that vehicle access into bushland areas is via designated tracks only
- carried out in a manner that avoids the spread of dieback, which is known to be present within the site
- carry out pre-burn monitoring to review flora species present (native and non-native), fire fuel load, obvious presence of any conservation significant flora, fauna, and ecological communities well ahead of planned burns to enable appropriate information to be included on required permits
- apply for relevant permits well ahead of planned burns to allow sufficient time for approvals to be issued
- implement pre-burn weed control, seed and cuttings collection protocols
- implement post-burn protocols relating to weed control, monitoring the site for the presence of conservation significant flora (e.g.: *Drakaea elastica*, *Caladenia huegelii*) that may present after burns.

| **Recommendations** | |
|---|---|
| **AB 29** | Burns should occur within individual management cells at the extent, intensity and frequency listed in Table 5. |
| **AB 30** | It is recommended the City consider controlled burns on the periphery of vegetated blocks particularly near residential housing to minimise the risk of bushfires to surrounding properties, and to reduced potential for fires to spread across the site. |
| **AB 31** | It is recommended that seed collection and appropriate plant salvage is carried out in advance of any controlled burns. |
| **RW 3** | It is recommended that detailed weed mapping precedes any planned fuel reduction burn to inform post-fire weed management and monitoring. |
| **RW 4** | Post fire weed control should be undertaken as fires can promote weed growth. |
| **RW 5** | Residual herbicides such as Metsulfuron that can build up in the soil are recommended to be avoided during post fire weed control when more of the soil surface is exposed, with considerations given to using alternative herbicides or manual control. |
| **AB 32** | Effects of burns in dieback affected areas requires further investigation by the City. |
| **AB 33** | Post fire rubbish collection should also be undertaken opportunistically during other maintenance activities as fire may expose foreign material that were not evident pre-fire. |

**Table 9:** Fire Management Strategies and dominant flora response to fire

| Management Cell | Dominant Vegetation and Fire Response | Prescribed Fire Management | Recommended Fire Frequency |
|---|---|---|---|
| MC1*<br>7.14 ha<br>16-20 t/ha | ▪ *Banksia menziesii* (6)<br>▪ *Melaleuca preissiana* (6)<br>▪ *Phlebocarya ciliata* (5)<br>▪ *Eucalyptus todtiana* (6)<br>▪ *Dasypogon bromeliifolius* (7) | ▪ Retain core area of higher fuel load<br>▪ Protect 2015/16 revegetation areas fronting Dollarbird Road and Tincurrin Drive<br>▪ Peripheral burn generally around the roaded boundary of the management cell to a depth of 10 m<br>▪ FAT burn 5 m either side of track<br>▪ Priority fuel reduction to areas abutting residential dwellings on Tincurrin Drive and Dollarbird Road and vet clinic to achieve minimum 20 m low fuel separation distance, including road carriageway, verges and front lawns<br>▪ Low intensity burns during winter months (late June – early September)<br>▪ Post-burn weed and regeneration monitoring and management to follow CoG protocol (in preparation) | 10 – 12 years or longer |
| MC2<br>4.29 ha<br>11-15 t/ha | ▪ *Banksia menziesii* (6)<br>▪ *Banksia attenuata* (6)<br>▪ *Allocasuarina fraseriana* (6)<br>▪ *Regelia ciliata* (5) ***<br>▪ *Phlebocarya ciliata* (5)<br>▪ *Dasypogon bromeliifolius* (7)<br>▪ *Eremaea pauciflora* (2) | ▪ Retain core area of higher fuel load<br>▪ Protect 2015/16 revegetation areas fronting Harpenden Street<br>▪ Peripheral burn generally around the roaded boundary of the management cell to a depth of 10 m<br>▪ SFAT burn 5 m either side of track<br>▪ Priority fuel reduction to areas abutting residential dwellings on Dollarbird Road and Harpenden Street to achieve minimum 20 m low fuel separation distance, including road carriageway, verges and front lawns<br>▪ Low intensity burns during winter months (late June – early September)<br>▪ Specific care to be taken to ensure cool burn where *Eremaea pauciflora* is located<br>▪ Post-burn weed and regeneration monitoring and management to follow CoG protocol (in preparation) | 10 – 12 years or longer |

| Management Cell | Dominant Vegetation and Fire Response | Prescribed Fire Management | Recommended Fire Frequency |
|---|---|---|---|
| MC3<br>5.2 ha<br>11-20 t/ha | ▪ *Banksia menziesii* (6)<br>▪ *Banksia attenuata* (6)<br>▪ *Melaleuca preissiana* (6)<br>▪ *Jacksonia furcellata* (no data)<br>▪ *Eremaea pauciflora* (2) | ▪ Retain core area of higher fuel load<br>▪ Protect 2015/16 revegetation areas fronting Holmes Street and Gallinule Loop<br>▪ Protect planned revegetation adjoining 2015-16 revegetation area<br>▪ Peripheral burn generally around the roaded boundary of the management cell to a depth of 10 m<br>▪ SFAT burn 5 m either side of track<br>▪ Priority fuel reduction to areas abutting residential dwellings on Harpenden Street and Gallinule Loop to achieve minimum 20 m low fuel separation distance, including road carriageway, verges and front lawns<br>▪ Low intensity burns during winter months (late June – early September)<br>▪ Specific care to be taken to ensure cool burn where *Jacksonia furcellata* and *Eremaea pauciflora* are located<br>▪ Post-burn weed and regeneration monitoring and management to follow CoG protocol (in preparation) | 10 – 12 years or longer |
| MC4*<br>5.26 ha<br>11-15 t/ha | ▪ *Banksia attenuata* (6)<br>▪ *Banksia menziesii* (6)<br>▪ *Phlebocarya ciliata* (5)<br>▪ *Dasypogon bromeliifolius* (7)<br>▪ *Regelia ciliata* (5) *** | ▪ Retain core area of higher fuel load<br>▪ Peripheral burn generally around the roaded boundary of the management cell to a depth of 10 m<br>▪ SFAT burn 5 m either side of track<br>▪ Priority fuel reduction to areas abutting residential dwellings on Potter and Gay Streets to achieve minimum 20 m low fuel separation distance, including road carriageway, verges and front lawns<br>▪ Low intensity burns during winter months (late June – early September)<br>▪ Specific care to be taken to ensure cool burn where *Regelia ciliata* is located<br>▪ Post-burn weed and regeneration monitoring and management to follow CoG protocol (in preparation) | 10 – 12 years or longer |

| Management Cell | Dominant Vegetation and Fire Response | Prescribed Fire Management | Recommended Fire Frequency |
|---|---|---|---|
| MC5<br>6.3 ha<br>11-15 t/ha | ▪ *Banksia menziesii* (6)<br>▪ *Phlebocarya ciliata* (5)<br>▪ *Regelia ciliata* (5) ***<br>▪ *Kunzea glabrescens (ericifolia)* (1) | ▪ Retain core area of higher fuel load<br>▪ Protect planned revegetation areas associated with closure of FAT and other tracks, and formalisation of SFAT6<br>▪ SFAT burn 5 m either side of track<br>▪ Priority fuel reduction to area abutting residential dwellings on Gay Street and the sports club facility to achieve a minimum 20 m low fuel separation distance, including road carriageway, verges and front lawns<br>▪ Low intensity burns during winter months (late June – early September)<br>▪ Specific care to be taken to ensure cool burn where *Kunzea glabrescens* and *Regelia ciliata* are located<br>▪ Post-burn weed and regeneration monitoring and management to follow CoG protocol (in preparation) | 10 – 12 years or longer |
| MC6<br>5.66 ha<br>16-20 t/ha | ▪ *Corymbia calophylla* (6)<br>▪ *Melaleuca preissiana* (6)<br>▪ *Kunzea glabrescens* (1) | ▪ Retain core area of higher fuel load<br>▪ Consider burn as precursor to revegetation<br>▪ Protect planned revegetation areas associated with closure of FAT and other tracks, and formalisation of SFAT6<br>▪ SFAT burn 5 m either side of track as appropriate<br>▪ Priority fuel reduction to area beneath and adjacent to overhead powerline along SFAT6<br>▪ Priority fuel reduction to area adjoining communication tower and irrigation pumping infrastructure – potentially managed by physical removal of fuel<br>▪ Low intensity burns during winter months (late June – early September)<br>▪ Specific care to be taken to ensure cool burn where *Kunzea glabrescens* is located.<br>▪ Post-burn weed and regeneration monitoring and management to follow CoG protocol (in preparation) | 10 – 12 years or longer |

| Management Cell | Dominant Vegetation and Fire Response | Prescribed Fire Management | Recommended Fire Frequency |
|---|---|---|---|
| MC7**<br>10.33 ha<br>6-25 t/ha | ▪ *Banksia menziesii* (6)<br>▪ *Banksia attenuata* (6)<br>▪ *Regelia ciliata* (5) ***<br>▪ *Phlebocarya ciliata* (5)<br>▪ *Dasypogon bromeliifolius* (7)<br>▪ *Melaleuca systena (acerosa) (5)*<br>▪ *Melaleuca preissiana* (6)<br>▪ *Kunzea glabrescens* (1) | ▪ Retain core area of higher fuel load<br>▪ Consider burn as precursor to revegetation<br>▪ Protect planned revegetation areas associated with closure of small tracks and, general revegetation, and formalisation of SFAT6<br>▪ SFAT burn 5 m either side of track as appropriate<br>▪ Low intensity burns during winter months (late June – early September)<br>▪ Specific care to be taken to ensure cool burn where *Kunzea glabrescens* and *Regelia ciliata* are located.<br>▪ Post-burn weed and regeneration monitoring and management to follow CoG protocol (in preparation) | 10 – 12 years or longer |
| MC8**<br>2.7 ha<br>6-25 t/ha | ▪ *Melaleuca preissiana* (6)<br>▪ *Melaleuca systena* (5) | ▪ Central 6,800 $m^2$ portion of this cell was the subject of a prescribed burn in October 2015.<br>▪ SFAT3 burn 5 m either side of track<br>▪ Priority fuel reduction to area abutting residential dwellings on Kilmurray Elbow to achieve minimum 20 m low fuel separation distance, including road carriageway, verges and front lawns<br>▪ Low intensity burns during winter months (late June – early September)<br>▪ Specific care to be taken to ensure cool burn where *Regelia ciliata* is located<br>▪ Physical management of fuel in proximity to the playground near Bodallin Crescent/Harpenden Street POS<br>▪ Post-burn weed and regeneration monitoring and management to follow CoG protocol (in preparation) | 10-12 years, with no burn required until 2025 |

| Management Cell | Dominant Vegetation and Fire Response | Prescribed Fire Management | Recommended Fire Frequency |
|---|---|---|---|
| MC9** 3.1 ha 11-25 t/ha | ▪ *Banksia menziesii* (6)<br>▪ *Banksia attenuata* (6)<br>▪ *Melaleuca preissiana* (6)<br>▪ *Melaleuca systena* (5)<br>▪ *Regelia ciliata* (5) *** | ▪ Retain core area of higher fuel load<br>▪ Avoid burning within 2015/16/17 revegetation areas<br>▪ SFAT7 burn 5 m either side of track as appropriate<br>▪ Low intensity burns during winter months (late June – early September)<br>▪ Physical management of fuel in proximity to the playground on Aurea Place | 10 – 12 years or longer |

Notes:

* area outside of CoG management at time of writing: prescription applies to possible future management scenario

** area subject to future Garden Street extension

*** CoG experience suggests *Regelia ciliata* is more akin to 3: 100% scorch kills, no seed storage

Key:

1 100% scorch kills, on plant seed storage
2 100% scorch kills, in soil seed storage
5 Survives 100% scorch, basal sprouts
6 Survives 100% scorch, epicormics
7 Survives 100% scorch, large apical bud

(Source: Department of Parks and Wildlife, 2016)

### 6.9.5 Clearing Permits – Bushfire Management (DER)

As the HSBN is a designated environmentally sensitive area as defined in the *Environmental Protection Act 1986* (WA), a clearing permit is required for any activity that will result in the clearing of native vegetation, including activities associated with fire management such as maintaining firebreaks and undertaking controlled burns. Clearing permits will need to be obtained from the Department of Environment Regulation, with applications detailing:

- purpose of clearing, noting that purpose permits can be issued for a number of years at a time
- area(s) to be cleared ($m^2$, ha)
- species in areas to be cleared
- clearing method
- presence of environmental assets in and around area to be cleared.

Permits will need to be applied for with a sufficient lead time to allow assessment and issuing. Accordingly, in the lead up to the time of the year when fire break works may be carried out, it is recommended that those responsible for maintenance works should walk each of the fire breaks that requires maintenance to assist with advance planning of the activities.

### 6.9.6 Permit to Take Threatened Flora (DPaW)

A permit issued by the Department of Parks and Wildlife is also required any time threatened flora will be 'taken', which includes any direct injury or destruction of the plant as well as activities such as allowing stock to graze, clearing for fire break maintenance and controlled burns that may be carried out on site. While no threatened flora species have been recorded on site, habitat for the *Caladenia huegelii*, *Drakaea elastica* and *Diuris purdiei* that are all listed as threatened under the *Wildlife Conservation Act 1950* (WA) and as Endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) is present (Woodman, 2014 a and b). Fire responsive species such as *Drakaea elastica* or *Diuris purdiei* may appear post-fire. Others such as *Caladenia huegelii* may become more evident once thick undergrowth is removed by burning.

While the *Jacksonia gracillima* recorded on site is a priority 3 listed species, a permit to 'take' flora during controlled burns or other fire management activities on non-DPaW land is not technically required, their presence needs to be considered from a fire management perspective. Any fire management activity will need to be undertaken in a manner that complements the conservation status of this species, such as protecting individuals when installing and/or maintaining firebreaks. The typical fire-free period of eight years or more will be suitable for this species.

| **Recommendation** | |
|---|---|
| **AB 34** | Post fire monitoring of conservation significant flora should be undertaken, with location, population size, health and potential threatening processes recorded. |

### 6.9.7 Permitting – EPBC Act 1999

With the listing of the Banksia Woodlands of the Swan Coastal Plain ecological community as endangered under the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth), controlled burns and fire management activities may require approval from the Department of the Environment and Energy if impacts are likely to be significant.

### 6.9.8 Visitor Management

Signage advising of bushfire risk should be installed at all points of entry to the HSBN. Advice should be provided regarding visitor response to a bushfire event. This is anticipated to be limited to advice to exit the bushland, using SFATs, as quickly as possible.

# 7.0 Management Recommendations Summary

This section provides a summary of management recommendations made throughout this document (Table 10).

**Table 10:** Access and Bushfire Management recommendations

| **Recommendations** | |
|---|---|
| **AB 1** | It is recommended that the City ensure compatibility of proposed activities and developments in both the HSBN and the Sutherlands Parks Sports Complex through the integration of planning. |
| **RW 18** | The decommissioning of FATs will include the placing of logs at the ends of tracks to deter vehicle and pedestrian access, prior to rehabilitation. (RW: Appendix 5). |
| **AB 2** | The entire perimeter of the Bushland should be fenced in accordance with the City's rural style fencing specifications, with allowances made to accommodate existing and proposed gates (See 3.3 and 3.4). |
| **AB 3** | Fencing in the areas around the fauna underpass near the corner of Harpenden and Holmes streets should be upgraded to be fauna impermeable to prevent access onto roads and direct fauna into the underpass. |
| **AB 4** | The City's inspection and maintenance program for the HSBN should provide for damaged or vandalised fencing to be repaired or replaced promptly (Figure 10). |
| **AB 5** | Pedestrian gates should be installed adjacent to vehicle gates at entries to Strategic Fire Access Tracks as illustrated in Figure 9 to allow access by pedestrians, bicycles, prams and gophers. |
| **AB 6** | Gates should be designed to permit access to pedestrians, bicycles, prams and gophers whilst excluding motorised off-road vehicles. |
| **AB 7** | Vehicle gates should be 4 m wide (i.e.: 2 x 2 m) to allow appropriate access for emergency vehicles, and should be installed where proposed gates are shown on Figures 9 and 10. |
| **AB 8** | The City of Gosnells should seek to integrate the multiple use SFAT network with existing and planned movement networks within the Sutherlands Park Sporting Complex, to provide jogging circuits. |
| **AB 9** | The City should investigate and pursue the installation of appropriate exercise equipment on walk trails in the HSBN. |
| **AB 10** | Entry Statement signage design should refer to sign type 5 –Primary Interpretive Trail Sign in *Ellis Brook Valley Signage Strategy manual (2006)*. |
| **AB 11** | An appropriate name should be developed for the HSBN to provide the bushland an identity relevant to its cultural, historical and urban context. |
| **AB 12** | A walk trail identification/naming system should be prepared to enhance the experience of visitors to the HSBN. |
| **AB 13** | Trail totems should be considered by the City using design sign type 9 B – Small Directional Totems as described in *Ellis Brook Valley Signage Strategy manual (2006)*, with colours, symbols and trail names for each trail chosen by the City. |
| **AB 14** | Interpretive signs should be kept to a minimum, with the use of 'QR' codes considered to provide information to users via smart phones, tablets, iPads, and similar. |
| **AB 15** | Removal of dumped materials around the HSBN perimeter should be programmed to occur immediately prior to the installation of fencing. |

| Recommendations | |
|---|---|
| **AB 16** | Removal of dumped materials inside the HSBN should be programmed to occur following the upgrading of vehicular access to the bushland. |
| **AB 17** | The City of Gosnells should promptly remove rubbish noted during site inspection activities, and where necessary program follow-up remedial activities such as weed management and revegetation. |
| **AB 18** | As a matter of priority, the City should remove BMX jumps and other such developments in the HSBN as soon as practical after it becomes aware of the activity. |
| **AB 19** | Bushfire fuel loads and fire history mapping should be updated on a regular basis to capture reductions to loads brought about by planned and unplanned bushfires, and natural increases in loads over time. |
| **AB 20** | Identified SFATs (Figure 23) should upgraded using appropriate hygiene methods to provide a highly trafficable surface, such as compacted crushed limestone, that will provide general and fire management access, improved access and safety for emergency fire response vehicles and personnel, and improved and controlled community access. |
| **AB 21** | SFATs should be upgraded and maintained to a minimum 4 m width with vertical clearance to 6 m height, with the minimal necessary vegetation clearing undertaken to protect vegetation condition and fauna habitat. |
| **AB 22** | All SFAT upgrade works should be carried out so as to avoid or minimise damage to native vegetation. |
| **RW 7** | Revegetation of bare soil areas along the margins of upgraded SFATs should comprise only low-growing plants such as ground covers and shrubs below 0.5 m mature height. |
| **AB 23** | All SFAT gates are to be a minimum 4 m width. |
| **AB 24** | The City of Gosnells should engage with the Department of Planning regarding Lots 1578 Warton Road and 1592 Gay Street to determine the state government's intentions regarding the fulfilment of their Bush Forever function and, potentially, their acquisition for that purpose. |
| **AB 25** | It is recommended that a fire fuel load of 8 – 15 t/ha is maintained for HSBN. |
| **AB 26** | Fire fuel loads for HSBN are recommended to be reviewed annually in areas with fuel loads higher than 8 – 15 t/ha, and every 2 – 3 years for areas previously recorded below 8 t/ha. |
| **AB 27** | A 20 m low fuel load zone is recommended between vegetation within the site and residential buildings and infrastructure. |
| **AB 28** | Manual fire fuel load reduction needs to consideration protection of vegetation type, condition, along with fauna habitat requirements and refugia within HSBN. |
| **AB 29** | Burns should occur within individual management cells at the extent, intensity and frequency listed in Table 5. |
| **AB 30** | It is recommended the City consider controlled burns on the periphery of vegetated blocks particularly near residential housing to minimise the risk of bushfires to surrounding properties, and to reduced potential for fires to spread across the site. |
| **AB 31** | It is recommended that seed collection and appropriate plant salvage is carried out in advance of any controlled burns. |
| **RW 3** | It is recommended that detailed weed mapping precedes any planned fuel reduction burn to inform post-fire weed management and monitoring. |
| **RW 4** | Post fire weed control should be undertaken as fires can promote weed growth. |

| Recommendations | |
|---|---|
| **RW 5** | Residual herbicides such as Metsulfuron that can build up in the soil are recommended to be avoided during post fire weed control when more of the soil surface is exposed, with considerations given to using alternative herbicides or manual control. |
| **AB 32** | Effects of burns in dieback affected areas requires further investigation by the City. |
| **AB 33** | Post fire rubbish collection should also be undertaken opportunistically during other maintenance activities as fire may expose foreign material that were not evident pre-fire. |
| **AB 34** | Post fire monitoring of conservation significant flora should be undertaken, with location, population size, health and potential threatening processes recorded. |

# 8.0 Indicative Costings

Indicative costings for the formalisation of firebreaks and the installation of proposed fencing is listed in Table 10. Note the installation of SFAT 1 is pending on the acquisition of Lot 1578 Warton Road, and the installation of SFAT 5 will need to be undertaken in consultation with the land owners of Lot 1592 Gay Street as it occurs mostly within their land. Fencing for MC1 and MC4 is also pending the acquisition of lots 1578 and 1592 by the City. Costings have for both crushed limestone and concrete crossovers to gates on verges are listed as additional cost in Table 11, with final costings dependent on which material is chosen for crossovers.

**Table 10:** Indicative costings

| Activity | Unit | Qty | Unit rate | Cost ($ ex GST) |
|---|---|---|---|---|
| **SFATs Upgrade with crushed limestone** | | | | |
| SFAT 1 upgrade | $m^2$ | 1870.8 | 25.00 | 46,770.00 |
| SFAT 2 upgrade | $m^2$ | 1118.8 | 25.00 | 27,970.00 |
| SFAT 3 upgrade | $m^2$ | 831.2 | 25.00 | 20,780.00 |
| SFAT 4 upgrade | $m^2$ | 2110.8 | 25.00 | 52,770.00 |
| SFAT 5 upgrade | $m^2$ | 1488.8 | 25.00 | 37,220.00 |
| SFAT 6 upgrade | $m^2$ | 1575.2 | 25.00 | 39,380.00 |
| SFAT 7 upgrade | $m^2$ | 995.2 | 25.00 | 24,880.00 |
| **Subtotal (ex GST)** | | | | **249,770.00** |
| **Fencing removal (sub-standard/damaged)** | | | | |
| MC6 | Metre | 488.1 | 15.00 | 7,321.50 |
| MC9 | Metre | 335.9 | 15.00 | 5,038.50 |
| **Subtotal (ex GST)** | | | | **12,360.00** |
| **Fencing installation (Rural Style)** | | | | |
| MC1 | Metre | 501.8 | 25.00 | 12,545.00 |
| MC2 | Metre | 47.8 | 25.00 | 1,195.00 |
| MC4 | Metre | 524.8 | 25.00 | 13,120.00 |
| MC5 | Metre | 481.9 | 25.00 | 12,047.50 |
| MC6 | Metre | 531.7 | 25.00 | 13,292.50 |
| MC7 | Metre | 44.1 | 25.00 | 1,102.50 |
| MC8 | Metre | 43 | 25.00 | 1,075.00 |
| **Subtotal (ex GST)** | | | | **54,377.5** |
| **Fencing removal and replacement (Rural Style)** | | | | |
| MC2 | Metre | 27 | 35.00 | 947.00 |

| Activity | Unit | Qty | Unit rate | Cost ($ ex GST) |
|---|---|---|---|---|
| MC6 | Metre | 315.3 | 35.00 | 11,035.50 |
| MC7 | Metre | 59.4 | 35.00 | 2,079.00 |
| MC8 | Metre | 772.4 | 35.00 | 27,034.00 |
| **Subtotal (ex GST)** | | | | **41,095.50** |
| **New gates or gate upgrade to 4m width (including installation)** | | | | |
| MC1 | Ea. | 3 | 956.00 | 2868.00 |
| MC2 | Ea. | 4 | 956.00 | 3824.00 |
| MC3 | Ea. | 2 | 956.00 | 1912.00 |
| MC4 | Ea. | 2 | 956.00 | 1912.00 |
| MC5 | Ea. | 1 | 956.00 | 956.00 |
| MC6 | Ea. | 2 | 956.00 | 1912.00 |
| MC7 | Ea. | 2 | 956.00 | 1912.00 |
| **Subtotal (ex GST)** | | | | **15,296.00** |
| **Signage** | | | | |
| Entry Signage | Ea. | 14 | 4240.31 | **59,364.34** |
| Directional Signage | Ea. | 5 | 799.88 | **3,999.40** |
| **Subtotal (ex GST)** | | | | **63,363.74** |
| **Total (ex GST)** | | | | **436,262.74** |
| **GST** | | | | **43,626.27** |
| **Total (inc GST)** | | | | **479,889.01** |

**Table 11:** Additional indicative costings for limestone and concrete crossovers

| Activity | Unit | Qty | Unit rate | Cost ($ ex GST) |
|---|---|---|---|---|
| **Crushed limestone crossovers (including installation)** | | | | |
| MC1 | $m^2$ | 8.4 + 19.2 | 140.00 | 3,864.00 |
| MC2 | $m^2$ | 33 | 140.00 | 4,620.00 |
| MC4 | $m^2$ | 38.8 | 140.00 | 5,432.00 |
| MC7 | $m^2$ | 20.5 | 140.00 | 2,870.00 |
| MC8 | $m^2$ | 4.3 +26.3 | 140.00 | 4,284.00 |
| MC9 | $m^2$ | 17.4 | 140.00 | 2,436.00 |
| **Subtotal (ex GST)** | | | | **23,506.00** |
| **Reinforced concrete crossovers (including installation)** | | | | |
| MC1 | $m^2$ | 8.4 + 19.2 | 185.00 | 5,106.00 |

| Activity | Unit | Qty | Unit rate | Cost ($ ex GST) |
|---|---|---|---|---|
| MC2 | $m^2$ | 33 | 185.00 | 6,105.00 |
| MC4 | $m^2$ | 38.8 | 185.00 | 7,178.00 |
| MC7 | $m^2$ | 20.5 | 185.00 | 3,792.50 |
| MC8 | $m^2$ | 4.3 +26.3 | 185.00 | 5,661.00 |
| MC9 | $m^2$ | 17.4 | 185.00 | 3,219.00 |
| **Subtotal (ex GST)** | | | | **31,061.50** |

# 9.0 References

*AS 3959 – 2009 Construction of Buildings in Bushfire Prone Areas (incorporating amendments 1, 2 and 3)*

*Biosecurity and Agriculture Management Act 2007* (WA)

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# Appendix 1: City of Gosnells Fencing Specifications

CITY OF GOSNELLS

## SPECIFICATION

### Specification – Rural Style Fencing

This style of fencing is used predominantly to protect environmental assets:

### PREPARATION

The City will provide arial photography or plans for the proposed fenceline and provide sufficient pegging to determine the alignment required for the fence, along with any truncations. This will detail the location of gates to be installed and be sufficiently detailed for the contractor to determine material requisites.

The contractor will be responsible for fenceline clearing including vegetation removal and landform adjustments to allow the fence to follow the general topography along which the fence is to be erected.

Sites where hard digging is likely to be encountered are to be identified to the Principal and a quotation for additional work provided.

### MATERIALS

Galvanized 7/90/30 x 200 m Ringlock or equivalent (Stocklock or Griplock) agricultural fence

Galvanized 2.5 mm single strand High Tensile Plain Wire

4.0 mm White PVC coated horse sighter Wire

100-125 mm x 2.1 m CCA H4 treated pine log (for uprights)

150-175 mm x 2.4 m CCA H4 treated pine log (for box strainers)

1.8 m Galvanised Steel Star Pickets, BHP preferred (ensure holes match up with agricultural fencing wire)

Short, white PVC Star Picket Caps

3.6 m x 1200 mm high galvanized Weldmesh agricultural farm gate (with Brooker threaded hinges)

1.57 mm galvanized Tie Wire

### CONSTRUCTION

Box strainers are to be constructed out of treated pine logs and pinned,

Box strainers to be placed on both sides of agricultural gates,

Double box strainers at all corners and change in direction of fence,

Box strainers to be placed at maximum distance of 200m intervals along fence,

Ringlock to be fastened 50mm above ground level,

CITY OF GOSNELLS

All strands on Ringlock to be stapled to box strainers,

Four strands on Ringlock to be stapled evenly to pine uprights,

Four horizontal strands of Ringlock to be tied evenly to star pickets,

Ratio of star pickets to pine uprights is one in five (i.e. one pine upright to three star pickets) at spacing of 4 m,

All ends, joins and ties to be finished neatly with no wire protrusions,

Single strand PVC Wire to be installed at 100 mm above top of ringlock.

PVC Wire to be wrapped around pine posts twice, then wound back around wire three times and cut off flush,

All pine uprights to be buried to a depth of 900 mm,

All box strainers to be buried to a depth of 1200 mm,

All star pickets to be capped,

Fencing wire to be fixed to outside of fence at all times (i.e. on outside of reserve)

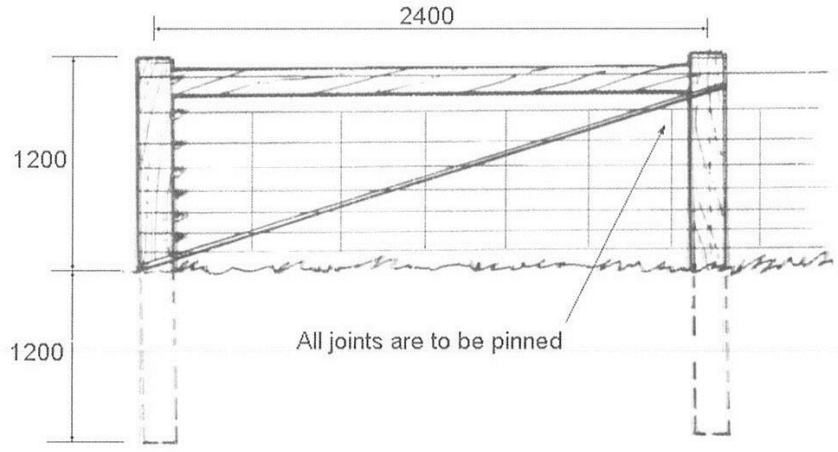
Fence to smoothly follow the overall contours of the land (Not to have sudden dips and rises),

Use 10 mm x 900 mm long High Tensile locking chain (non rusting) for Agricultural Gates,

Do not over tension fence, ensuring all vertical wires are in line,

Pedestrian Access ways to be 800mm wide and be boxed

**CONSTRUCTION – BOX STRAINER**



# Appendix 2: Fire fuel Load Quadrat Photos

Quadrat 1 = 10.5 t/ha

Quadrat 2 = 16.5 t/ha

Quadrat 3 = 10.5 t/ha

Quadrat 4 = 15 t/ha

Quadrat 5 = 16.5 t/ha

Quadrat 6 = 10.5 t/ha

| | | |
|---|---|---|
|  |  |  |
| Quadrat 7 = 1 t/ha | Quadrat 8 = 4 t/ha | Quadrat 9 = 3.5 t/ha |
|  |  |  |
| Quadrat 10 = 21.5 t/ha | Quadrat 11 = 21.5 t/ha | Quadrat 12 = 15 t/ha |

| | | |
|---|---|---|
|  |  |  |
| Quadrat 13 = 17 t/ha | Quadrat 14 = 12 t/ha | Quadrat 15 = 17 t/ha |
|  |  |  |
| Quadrat 16 = 16.5 t/ha | Quadrat 17 = 15 t/ha | Quadrat 18 = 11 t/ha |

| | | |
|---|---|---|
|  |  |  |
| Quadrat 19 = 21 t/ha | Quadrat 20 = 11 t/ha | Quadrat 21 = 15 t/ha |
|  |  |  |
| Quadrat 22 = 11 t/ha | Quadrat 23 = 15 t/ha | Quadrat 24 = 11 t/ha |

Quadrat 25 = 11 t/ha

Quadrat 26 = 7.5 t/ha

Quadrat 27 = 7.5 t/ha

Quadrat 28 = 10.5 t/ha

Quadrat 29 = 11 t/ha

Quadrat 30 = 12 t/ha

| | |
|---|---|
|  |  |
| Quadrat 31 = 16.5 t/ha | Quadrat 32 = 16.5 t/ha |