Shire of Serpentine Jarrahdale

Banksia Woodland Management Plan

With Reserve Action Plans:

Brickwood Reserve
King Road Pony Club Reserve
Serpentine Sports Reserve
Yangedi Airfield Reserve
Bella Cumming Reserve
Tonkin Street Flora Reserve
Craghill Way Reserve
Pony Place Reserve
Wattle Road Nature Reserve

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Banksia Woodland Management Plan

1. Executive Summary

1.1. Introduction

Banksia woodland is a characteristic and highly recognisable vegetation type of the Swan Coastal Plain and was formerly the dominant vegetation type of the area. Its main feature is a tree layer of banksias, with scattered eucalypts and other trees within or emerging above the banksia canopy. While the banksia canopy contains at most four species, the understorey is highly diverse and species rich, and varies dramatically even within a short distance.

The Swan Coastal Plain has five main soil types, roughly located parallel to the coastline. The first three are sand dune systems with age increasing with distance from the coast (Quindalup, Spearwood and Bassendean systems), followed by the alluvial Pinjarra Plain and the Ridge Hill Shelf at the foot of the Darling Scarp.

Banksia woodlands principally occur on deep, low-nutrient Bassendean and Spearwood sands, occasionally on the eastern fringe of the Quindalup sands, and in sandy areas of the Ridge Hill Shelf. Limited areas can be found on sandy rises in the Pinjarra Plain and some sand flats. Banksia woodlands can fall within a number of floristic communities (sub-communities), of which five occur in the Shire of Serpentine Jarrahdale, on Bassendean sands and to a lesser extent the Ridge Hill Shelf. These five communities are:

- 20b (eastern *Banksia attenuata* and/or *Eucalyptus marginata* woodlands);
- 21a (central *Banksia attenuata* - *Eucalyptus marginata* woodlands);
- 21c (low lying *Banksia attenuata* woodlands or shrublands);
- 22 (*Banksia ilicifolia* woodlands); and
- 23a (central *Banksia attenuata* - *Banksia menziesii* woodlands).

In 2016 the “Banksia Woodlands of the Swan Coastal Plain” were listed as Endangered under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999.* This listing means that banksia woodlands have been assessed as both having undergone a high degree of loss and being under a continued high level of threat. Some of the sub-communities are also listed as Endangered under State legislation.

In 2017 (the most recent data available), the vegetation complex “Bassendean Central and South” (which roughly equates to banksia woodland) was assessed as having 31% remaining. The threats to banksia woodland are many and significant, including:

- Clearing and fragmentation (particularly for urban development and mining for basic raw materials)
- Dieback diseases (particularly caused by *Phytophthora cinnamomi*)
- Invasive species
- Fire regime change
- Hydrological degradation
- Climate change
- Grazing

Nine Shire natural area reserves contain banksia woodland, as well as areas with other uses such as sports fields. These reserves, and their approximate area of banksia woodland, are:

- Brickwood Reserve, Byford (2.13 ha)
- King Road Pony Club Reserve, Oldbury (18.08 ha)
- Serpentine Sports Reserve (Paul Robinson Reserve), Serpentine (3.41 ha)
- Yangedi Airfield Reserve, Hopeland (16.48 ha)
- Bella Cumming Reserve, Mundijong (1.72 ha)
- Tonkin Street Flora Reserve, Mundijong (2.05 ha)
- Craghill Way Reserve, Oakford (1.74 ha)
- Pony Place Reserve, Oakford (10.82 ha)
- Wattle Road Nature Reserve, Serpentine (0.97 ha)

Some of these reserves (Brickwood Reserve, Serpentine Sports Reserve, and Yangedi Airfield Reserve; and to a lesser extent King Road Pony Club Reserve and Craghill Way Reserve) also contain other types of vegetation (marri woodland and/or clay-based wetlands). Wattle Road Nature Reserve has transitional vegetation containing features of both banksia woodland and marri woodland.

The principal uses of the Shire reserves listed are conservation and recreation. The recreational uses include:

- Recreation centre and ovals – Brickwood Reserve
- Horse and pony clubs – King Road Pony Club Reserve and Serpentine Sports Reserve
- Golf club – Serpentine Sports Reserve
- Airfield and aircraft hangars – Yangedi Airfield Reserve
- Men's shed – Tonkin Street Flora Reserve
- Community hall – Pony Place Reserve
- Informal recreation – walking, riding, enjoyment of nature

1.2. Objectives

The objectives of this management plan are to:

- Provide background information and site descriptions for informed management of banksia woodland.
- Provide a framework for developing action plans for individual reserves.
- Define specific management objectives for maintaining and improving the conservation values of banksia woodland.
- Document the actions required to successfully manage banksia woodland.
- Identify any management constraints and possible ways to overcome them.
- Ensure consistent management into the future.
- Provide a plan for user groups to follow when managing banksia woodland.

1.3. Report Structure

This management plan is structured into the following sections:

- Background:
    - Identifies the location and physical characteristics of banksia woodland.

    - Identifies the legislation and policies that apply and have management implications for banksia woodland.
- Threats and pressures:
    - Analyses the threats to banksia woodland.
- Reserves:
    - Identifies the locations of Shire reserves containing banksia woodland, their vesting and tenure, and main user groups.
- Action Plan:
    - Provides guidance to land managers of banksia woodland on actions common to management of all banksia woodland.
- Reserve Action Plans:
    - Provides background information on Shire reserves containing banksia woodland, their vesting and tenure, main user groups, threats and pressures, and relevant actions.

2. Background

2.1. Location

Banksia woodland is a characteristic and highly recognisable vegetation type of the Swan Coastal Plain and was formerly the dominant vegetation type of the area. Its main feature is a tree layer of banksias, with scattered eucalypts and other trees within or emerging above the banksia canopy.

Banksia woodlands principally occur on deep, low-nutrient Bassendean and Spearwood sands, occasionally on the eastern fringe of the Quindalup sands, and in sandy areas of the Ridge Hill Shelf (Forrestfield soil system). Limited areas can be found on sandy rises in the Pinjarra Plain and some sand flats. Banksia woodlands in the Shire of Serpentine Jarrahdale occur on Bassendean sands and to a lesser extent the Ridge Hill Shelf (Forrestfield soil system).

The soil types of the coastal plain portion of the Shire of Serpentine Jarrahdale and their associated vegetation complexes are shown in Figure 1.

2.2. Soils

The exceptional biodiversity in banksia woodland is due to long-term geological activity, resulting in variations in soil types within relatively short distances. Banksia woodland occurs on the Swan Coastal Plain, where the soils originate from two sources. Firstly, erosion of the Darling Range formed the Pinjarra Plain soil complex, characterised by grey sandy duplex soils, clays, loams and gravels. Secondly, sea level fluctuations formed a series of sand dunes on top of the plain.

The Swan Coastal Plain has five main soil types, roughly located parallel to the coastline. The first three are sand dune systems with age increasing with distance from the coast (Quindalup, Spearwood and Bassendean systems), followed by the alluvial Pinjarra Plain and the Ridge Hill Shelf (Forrestfield soil system) at the foot of the Darling Scarp.

Banksia woodlands principally occur on deep, low-nutrient Bassendean and Spearwood sands, occasionally on the eastern fringe of the Quindalup sands, and in sandy areas of the Ridge Hill Shelf (Forrestfield soil system). Limited areas can be found on sandy rises in the Pinjarra Plain and some sand flats. Banksia woodlands in the Shire of Serpentine Jarrahdale occur on Bassendean sands and to a lesser extent the Ridge Hill Shelf (Forrestfield soil system).

The coastal plain soil types of the Perth region are shown in Figure 2, and those of the Shire of Serpentine Jarrahdale in Figure 3.

Each general soil type (Bassendean, Forrestfield etc.) can be further subdivided into soil landscape units (Bassendean B1 phase, Bassendean B2 phase etc.). The soil landscape units that occur in each reserve which contains banksia woodland are listed in Table 1, with maps for each reserve included in their action plans.

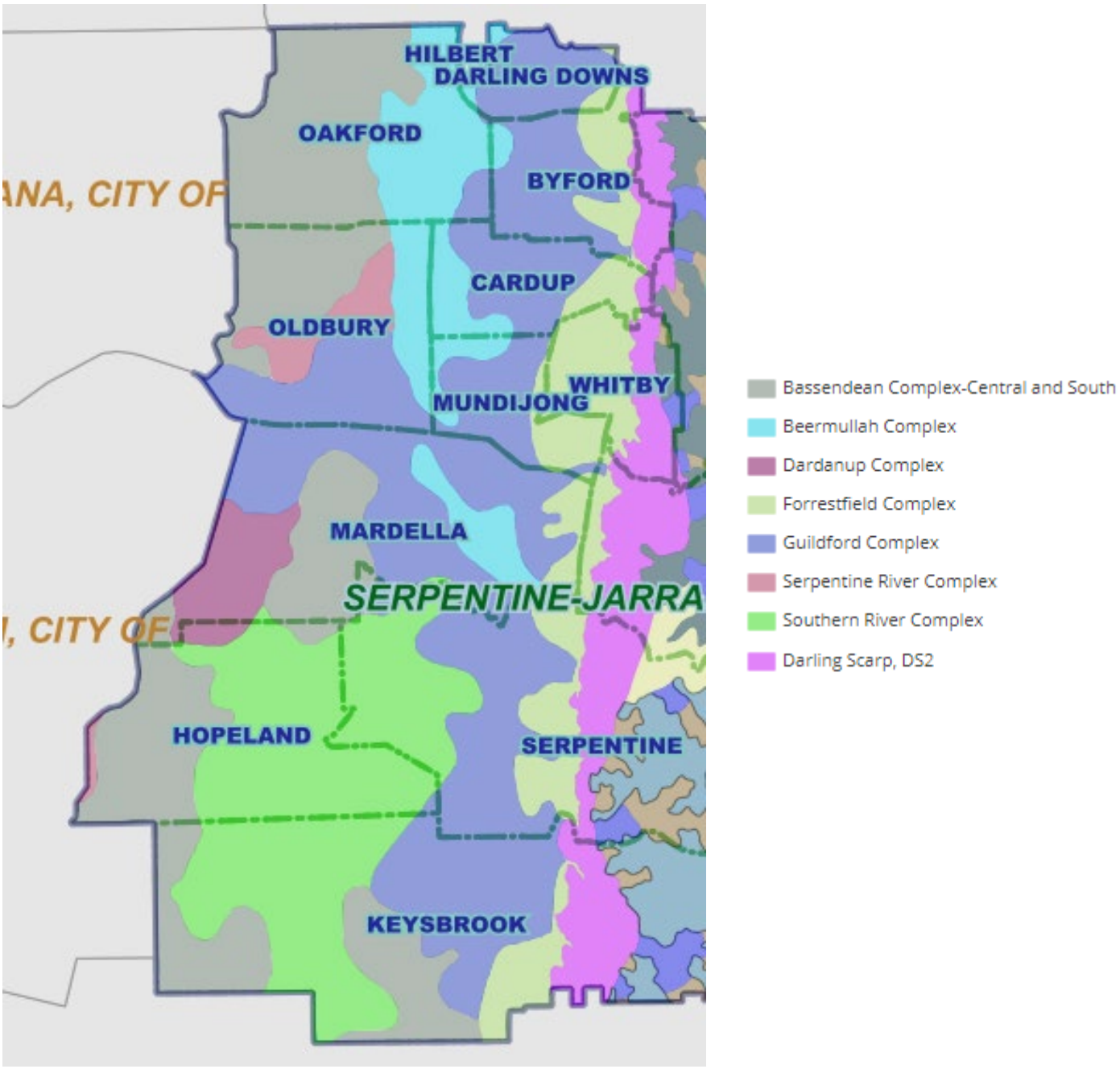

Figure 1: The coastal plain soil types and associated vegetation complexes of the Shire of Serpentine Jarrahdale.

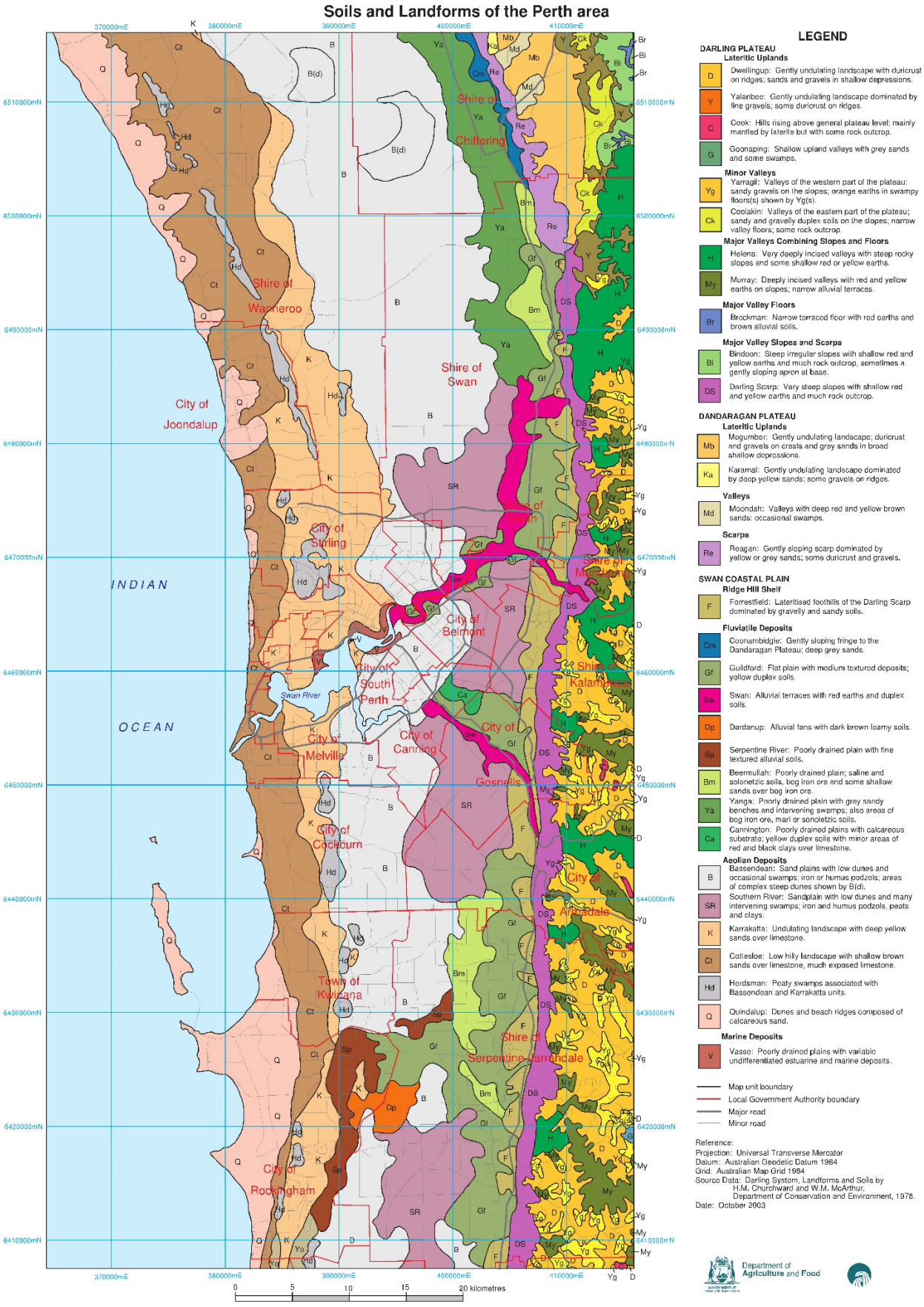

Figure 2: The coastal plain soil types of the Perth region, including the Shire of Serpentine Jarrahdale.

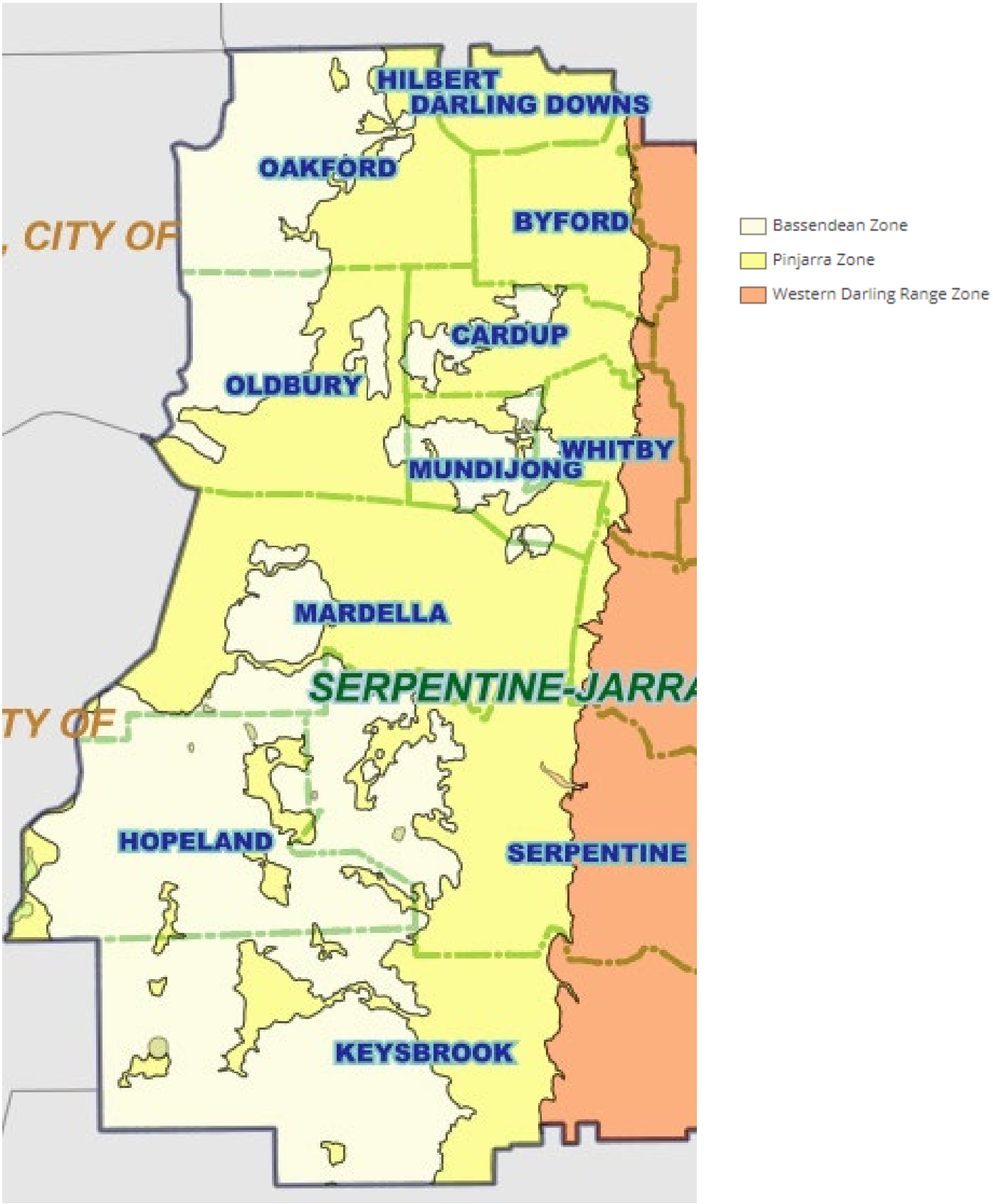

Figure 3: The coastal plain soil type zones of the Shire of Serpentine Jarrahdale.

Table 1: The soil landscape units that occur in each Shire reserve which contains banksia woodland (for maps, refer to reserve action plans).

Reserve	Soil landscape unit	Description	Banksia occurrence
Brickwood Reserve	Forrestfield F5 phase	Poorly defined stream channels on lowest slopes with deep acidic yellow duplex soils and sandy alluvial gradational brown earths.	No
	Pinjarra P1a phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or effective duplex) soils. Shallow pale sand to sandy loam over clay; imperfect to poorly drained and generally not susceptible to salinity.	No
	Pinjarra P1e phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or effective duplex) soils. Shallow pale sand to sandy loam over very gravelly clay; moderately well drained.	No
	Pinjarra B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	Yes
King Road Pony Club Reserve	Bassendean B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	Yes
	Bassendean B2 phase	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m.	Yes
	Bassendean B4 phase	Broad poorly drained sandplain with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan.	Partial
	Bassendean B6 phase	Sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands.	Yes
Serpentine Sports Reserve	Pinjarra B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	Yes
	Pinjarra B3 phase	Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam.	No
	Pinjarra P1b phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or effective duplex) soils. Moderately deep pale sand to loamy sand over clay: imperfectly drained and moderately susceptible to salinity in limited areas.	No
	Pinjarra P8 phase	Broad poorly drained flats and poorly defined stream channels with moderately deep to deep sands over mottled clays; acidic or less commonly alkaline gley and yellow duplex soils to uniform bleached or pale brown sands over clay.	No
Yangedi Airfield Reserve	Bassendean B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	Yes
	Bassendean B3 phase	Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam.	Partial
Bella Cumming Reserve	Bassendean B2a phase	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with an intensely coloured yellow B horizon usually well within 1 m of the surface.	Yes

Reserve	Soil landscape unit	Description	Banksia occurrence
Tonkin Street Flora Reserve	Bassendean B2 phase	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m.	Yes
Craghill Way Reserve	Bassendean B2 phase	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m.	Yes
	Bassendean B6 phase	Sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands.	Yes
Pony Place Reserve	Bassendean B2 phase	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m.	Yes
	Bassendean B3 phase	Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam.	Yes
	Bassendean B4 phase	Broad poorly drained sandplain with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan.	Yes
Wattle Road Nature Reserve	Pinjarra B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	Partial
	Pinjarra P1b phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or ieffective duplexo) soils. Moderately deep pale sand to loamy sand over clay: imperfectly drained and moderately susceptible to salinity in limited areas	Partial

2.3. Biodiversity

2.3.1. Description

Banksia woodland is a characteristic and highly recognisable vegetation type of the Swan Coastal Plain and was formerly the dominant vegetation type of the area. Its main feature is a tree layer of banksias, with scattered eucalypts and other trees within or emerging above the banksia canopy. While the banksia canopy contains at most four species, the understorey is highly diverse and species rich, and varies dramatically even within a short distance.

The principal features of banksia woodland are:

- A distinctive layer of low trees, dominated or co-dominated by one or more banksia species;
- An emergent tree layer of medium or tall *Eucalyptus* or *Allocasuarina* may be present; and
- A highly species-rich understorey of shrubs and an herbaceous ground layer.

Banksia woodlands are also characterised by a high species richness and high species geographic turnover in the shrub and herbaceous layers.

Banksia woodlands lie in the Swan Coastal Plain IBRA region, within which a variety of plant communities occur. The Heddle vegetation classification is based on soil types and landforms with some survey data, under which a vegetation complex contains plant communities that are associated with a single soil landscape system. By the Heddle classification, most banksia woodlands are Bassendean Complex – Central and South (associated with Bassendean Dunes), while others may be Southern River Complex (transitional soils between Pinjarra and Bassendean), Pinjarra Complex (sandy rises within the Pinjarra Plain) or Forrestfield Complex (associated with the Foothills soils).

The Gibson analysis of communities on the Swan Coastal Plain (SCP) used the presence or absence of particular species in standard sample areas to define floristic groupings. Banksia woodlands can fall within a number of floristic communities (sub-communities), of which five occur in the Shire of Serpentine Jarrahdale, on Bassendean sands and to a lesser extent the Ridge Hill Shelf. These five communities are:

- 20b (eastern *Banksia attenuata* and/or *Eucalyptus marginata* woodlands);
- 21a (central *Banksia attenuata* - *Eucalyptus marginata* woodlands);
- 21c (low lying *Banksia attenuata* woodlands or shrublands);
- 22 (*Banksia ilicifolia* woodlands); and
- 23a (central *Banksia attenuata* - *Banksia menziesii* woodlands).

Nine Shire natural area reserves contain banksia woodland. These reserves, their approximate area of banksia woodland, and most likely community, are:

- Brickwood Reserve, Byford (2.13 ha, SCP21a)
- King Road Pony Club Reserve, Oldbury (18.08 ha, SCP21c)
- Serpentine Sports Reserve, Serpentine (3.41 ha, SCP21a)
- Yangedi Airfield Reserve, Hopeland (16.48 ha, SCP21c and SCP22)
- Bella Cumming Reserve, Mundijong (1.72 ha, SCP21a)
- Tonkin Street Flora Reserve, Mundijong (2.05 ha, SCP21a)
- Craghill Way Reserve, Oakford (1.74 ha, SCP21c)
- Pony Place Reserve, Oakford (10.82 ha, SCP22)
- Wattle Road Nature Reserve, Serpentine (0.97 ha, SCP21c)

Three reserves (Brickwood Reserve, Serpentine Sports Reserve and Tonkin Street Flora Reserve) have a greater affinity to SCP20b than SCP21a, but their position in the landscape (on Bassendean sands rather than the Ridge Hill Shelf) and lack of certain species typical of SCP20b indicates that SCP21c is more likely. Yangedi Airfield Reserve contains both SCP21c and SCP22 in different locations, and Wattle Road Nature Reserve has transitional vegetation with a high affinity to both banksia woodland and marri woodland.

Some reserves (Brickwood Reserve, Serpentine Sports Reserve, and Yangedi Airfield Reserve; and to a lesser extent King Road Pony Club Reserve and Craghill Way Reserve) also contain other types of vegetation (marri woodland and/or clay-based wetlands). Wattle Road Nature Reserve has transitional vegetation containing features of both banksia woodland and marri woodland.

2.3.2. Flora

The canopy of banksia woodland is most commonly dominated or codominated by *Banksia attenuata* (candlestick or slender banksia) and/or *B. menziesii* (firewood banksia), and sometimes *B. ilicifolia* (holly-leaved banksia). *B. littoralis* (swamp banksia) may be codominant, but if dominant it indicates a different dampland community (i.e. not part of the “Banksia Woodlands of the Swan Coastal Plain” group of communities).

Other medium trees that may be codominant include *Eucalyptus todtiana* (coastal blackbutt, pricklybark), *Nuytsia floribunda* (WA Christmas tree), *Allocasuarina fraseriana* (western sheoak), *Callitris pyramidalis* (swamp cypress) and *Xylomelum occidentalis* (woody pear). Emergent taller trees that can occur above the banksia canopy may include *Corymbia calophylla* (marri) and *Eucalyptus marginata* (jarrah).

Key species in the shrub layer include members of the families Asteraceae, Dilleniaceae, Ericaceae, Fabaceae, Myrtaceae and Proteaceae. Widespread species include:

- *Adenanthos cygnorum* (woolly bush)

- *Allocasuarina humilis* (dwarf sheoak)
- *Bossiaea eriocarpa* (common brown pea)
- *Conostephium pendulum* (pearl flower)
- *Daviesia* app
- *Eremaea pauciflora*
- *Gompholobium tomentosum* (hairy yellow pea)
- *Hibbertia hypericoides* (yellow buttercups)
- *Jacksonia* spp.
- *Kunzea glabrescens* (spearwood)
- *Petrophile linearis* (pixie mops)
- *Philotheca spicata* (pepper and salt)
- *Stirlingia latifolia* (blueboy)
- *Phlebocarya ciliata*
- *Hypolaena exsulca*
- *Xanthorrhoea preissii* (grasstree, balga)

Key species in the herbaceous ground layer include members of the families Cyperaceae, Droseraceae, Haemodoraceae, Orchidaceae, Restionaceae and "lilies" from various families. Widespread species include:

- *Amphipogon turbinatus* (tufted beard grass)
- *Burchardia congesta* (milkmaids)
- *Caladenia* spp. (spider orchids)
- *Dasypogon bromeliifolius* (pineapple bush)
- *Desmocladus flexuosus*
- *Drosera erythrorhiza* (red ink sun dew)
- *Lepidosperma squamatum* (a tufted sedge)
- *Lomandra hermaphrodita*
- *Lyginia barbata* (southern rush)
- *Lyginia imberbis*
- *Mesomelaena pseudostygia* (semaphore sedge)
- *Patersonia occidentalis* (purple flag)
- *Podolepis* spp.
- *Stylidium brunonianum* (pink fountain trigger plant)
- *Stylidium piliferum* (common butterfly trigger plant)
- *Trachymene pilosa* (dwarf parsnip)
- *Xanthosia huegelii* (heath xanthosia)

Flora and vegetation surveys have identified and mapped vegetation units and floristic communities in some areas of banksia woodland. Shire staff have carried out flora surveys within many Shire reserves, some associated with permanent monitoring quadrats and others as walk-though surveys. A consolidated list of the flora recorded in the Shire's banksia woodland reserves can be found in Appendix 1.

Many areas of banksia woodland contain or are associated with wetlands, which may be Conservation Category, Resource Enhancement or Multiple Use. Conservation Category wetlands are protected by State legislation, have high conservation value and should be managed to preserve wetland attributes and functions, while Resource Enhancement wetlands are partially modified with substantial ecological attributes and functions, and should be managed and restored to improve their conservation category. Weed presence varies in wetlands. They are naturally low nutrient

environments and any increase affects the vigour of the native plants and delivers a competitive advantage to introduced plants.

2.3.3. Fauna

Banksia woodlands support a rich and diverse array of fauna species. Over 70% of native mammals have become regionally extinct, and others have declined in numbers or reduced in range. Larger patches of banksia woodland can still support viable populations of ash-grey mouse and honey possum (which feeds on banksia flowers and is an important pollinator). The quenda (southern bandicoot) occurs in many areas of banksia woodland, where wide-spread and numerous scratchings can indicate that there may be a breeding population present. Kangaroos can be found in larger banksia woodland remnants, particularly those connected to other natural areas.

Banksia species have an extended flowering period and are significant in maintaining nectar feeding bird populations, which rely on year-round flowering. Birds, particularly nectivores, are abundant and diverse. The most iconic bird species are the three species of black cockatoos which are frequently found in banksia woodland feeding on the seed cones. These birds are protected under Commonwealth as well as State legislation. Black cockatoos feed on local species such as marri and banksia. Cockatoo breeding has been recorded on the Swan Coastal Plain, but they require large tree hollows which only form in larger trees, not in banksias.

The Swan Coastal Plain has an exceptional reptile species richness. Some reptile species are endemic, and others are nearly so. There is a distinct change in reptile assemblages across the Plain that reflects the underlying sandy soil structure of the different dune systems and their banksia woodlands. Frog calls are frequent in wetlands, and frogs are likely an important dietary component for snakes and lizards. Some frogs (such as the moaning frog and pobblebonk) depend on banksia woodlands for aestivating habitat.

The invertebrates are less well known, but there are several endemic species and a clear association between some groups and landform types. Pollinating and herbivorous insects are often host-specific, which is likely to contribute to community endemism.

Rabbits are a major threat in banksia woodland, damaging vegetation and introducing weeds. Periodical control of rabbits can occur in larger areas of bushland. Feral cats and foxes predate on native animals.

Fauna surveys, of mammals, reptiles and birds, have occurred in some areas of banksia woodland. A consolidated list of the fauna recorded in the Shire’s banksia woodland reserves can be found in Appendix 2.

2.4. Water Resources

Water is essential to the survival of banksia woodlands. Banksia species are deep-rooted and groundwater dependent, while species that are restricted to lower-lying areas are heavily dependent on subsurface soil moisture. Banksia woodland is usually found in the Bassendean dune system or on sandy rises in the Pinjarra Plain, so is rarely a wetland itself (except for the low-lying areas with seasonally waterlogged soils). The depressions between dunes or the flat plain commonly contain wetlands, however, so banksia woodland is often adjacent to wetland communities.

Water resources provide a variety of ecosystem services and include waterways, drains, wetlands, and superficial and artesian groundwater. Groundwater provides storage that interacts with the surface wetlands. During long dry spells the groundwater supports surface water and wetland ecosystems. This relationship, and the inundation of the wetlands, is threatened by groundwater drawdown from increased usage and reduced recharge.

2.4.1. Surface Water

The majority of the coastal plain portion of the Shire of Serpentine Jarrahdale is low-lying and originally formed a variety of wetlands and seasonally inundated lands. From the 1920s, a network of drains was constructed to reduce inundation and enable agriculture. The drains flow west to the Serpentine River and the Peel Inlet.

The Peel Harvey Estuary is of regional, national and international significance and levels of protection. The estuary has been severely degraded by nutrients from the catchment which cause algal blooms (eutrophication), which reduce oxygen levels in the water and contribute to fish deaths and ecosystem changes. The Dawesville Channel increased estuarine flushing, and water quality has also been improved through better land management to reduce nutrient inputs.

Catchment land use is subject to policies that set nutrient export targets. These include a maximum phosphorus load from the Serpentine River, water management plans for recreation facilities, and maximum nutrient (fertiliser) application rates for nitrogen and phosphorus.

Average annual rainfall has decreased, dominated by reduced winter rainfall, and resulting in decreased annual stream flow. Many waterways from the plateau have reduced flow, or flow seasonally or intermittently rather than permanently.

Many of the Shire reserves containing banksia woodland are associated with surface water features, including waterways, drains, wetlands and water bodies. These features are detailed in Table 2 and maps can be found in the individual reserve action plans. The classification of wetlands as Conservation Category, Resource Enhancement or Multiple Use is described in section 2.6.

Table 2: Surface water features of banksia woodland reserves in the Shire of Serpentine Jarrahdale

Reserve	Surface water features
Brickwood Reserve	A clay-based wetland lies to the northeast of the banksia woodland. A waterway drains the wetland to the west. All of the reserve, except the recreational facilities and the banksia woodland, is a Conservation Category wetland.
King Road Pony Club Reserve	Conservation Category wetlands lie to the east and west of the reserve. A drain runs along the northern boundary. Multiple Use wetlands intersect the western and eastern corners of the reserve, buffering the nearby Conservation Category wetlands.
Serpentine Sports Reserve	A clay based Conservation Category wetland lies to the southeast of the banksia woodland. A drain runs along the boundary between the ovals and the bushland, with a dam towards the western side. The majority of the reserve, except for the northern boundary and the banksia woodland (and some marri to its east) is a Resource Enhancement wetland.
Yangedi Airfield Reserve	A clay-based wetland lies in the northeastern corner of the reserve. A drain runs through the southeastern corner of the reserve. The area southeast of the main runway is Multiple Use wetland, with a Resource Enhancement wetland over the clay-based wetland, and Conservation Category wetlands between the runways and south of the grass runway. A third Conservation Category wetland lies north of the hangars, near the northern boundary of the reserve.
Bella Cumming Reserve	The whole of the reserve, as well as areas to the northeast and southwest, is a Conservation Category wetland.
Tonkin Street Flora Reserve	Multiple Use wetlands lie to the east and west of the reserve. No water features affect the reserve itself.
Craghill Way Reserve	The northern and eastern part of the reserve is a Resource Enhancement wetland, extending to Multiple Use outside the reserve boundaries.
Pony Place Reserve	The majority of the area north of Foxton Drive is a clay-based wetland with associated water body. A drain runs southeast from the wetland along the eastern boundary of the reserve, linking with another drain along the southern boundary. A Resource Enhancement wetland runs from the northwest to the southeast of the reserve, extending to Conservation Category to the northwest and Multiple Use to the southeast.
Wattle Road Nature Reserve	A drain runs along the curve of the northern boundary of the reserve. A Resource Enhancement wetland covers the eastern, northern and western edges of the reserve.

2.4.2. Groundwater

Extensive supplies of groundwater are contained in superficial aquifers. In general, Bassendean sands store more water than the Pinjarra soils. One of the most significant threats to ecosystems in the Swan Coastal Plain is declining water tables due to increased groundwater abstraction, patterns in water regulation and decreased rainfall and subsequent groundwater recharge.

Groundwater decline is not only influenced by extraction but also by declining rainfall and rechange rates as a result of climate change. Average annual rainfall has decreased, dominated by reduced winter rainfall, and resulting in decreased annual stream flow.

The older underlying sediments contain substantial quantities of groundwater in confined (artesian) aquifers. Water leaks down and up between the two aquifers. Groundwater movement is generally from east to west, but flows close to the Serpentine River are more complex. The superficial aquifer discharges to the river (and the artificial surface drains), and water leaks upward to recharge it.

2.5. Heritage

2.5.1. Aboriginal Heritage

Local Aboriginal people are part of the Noongar community, whose territory covers the area southwest of a line from Geraldton to Esperance. Prior to European settlement, family groups in the Serpentine Jarrahdale region were part of the Wadjuk tribe. During the post-European settlement period, forced migration to Aboriginal settlement camps or into areas where labour was required resulted in a shift of tribal groups.

Noongar family groups did not have permanent places of habitation and generally moved along major river systems, such as the Serpentine and Murray, or chains of freshwater bodies. The family groups would camp for short periods of time at favoured points where food and water were reliable.

The water systems are spiritual places for Aboriginal people. Local tradition records that Waugal, the dreaming ancestor, created the Murray and Serpentine river systems. The Waugal is a spiritual force with a physical serpentine manifestation that is widespread throughout the southwest region. Most of the major rivers that drain the Darling Range, and many creeks, springs, pools, swamps and lakes within the Swan Coastal Plain, are associated with the Waugal belief.

The Shire's large expanses of level to undulating plain were mostly inundated swamp land during winter. Wetlands would have been a source of food and may have held spiritual meaning for the local Aboriginal people. The higher sandy rises with banksia woodland provided dry areas to camp.

The Swan Coastal Plain has a high density of Aboriginal archaeological sites, associated with the richness of food resources. The State government currently has 23 heritage sites registered in the Shire, and an additional 63 sites are not (or not yet) registered. All places and objects of Aboriginal importance are protected by State legislation. The Serpentine River is listed on the register of mythological and ceremonial sites and includes a wide buffer to cover all the Aboriginal values in the vicinity.

A Native Title Claim was registered over land including the Shire of Serpentine Jarrahdale, to enable local Aboriginal people to have their rights and interests recognised under Australian law. This claim was resolved as part of the South West Native Title Settlement, the details of which are recorded in six Indigenous Land Use Agreements (ILUAs), including the Gnaala Karla Booja ILUA which covers the Shire. The Native Title Registrar registered the ILUAs in October 2018. Applications for judicial review of the Registrar's decision were rejected by the Federal Court in December 2019, and applications seeking special leave to appeal the decision of the Federal Court were rejected by the High Court in November 2020. Resolution of all legal proceedings has cleared the way for implementation of the Settlement. The Gnaala Karla Booja ILUA is being co-ordinated by the South West Aboriginal Land and Sea Council.

To date no formal consultation has occurred with either the South West Aboriginal Land and Sea Council or local Noongar people regarding management of banksia woodland. A lack of effective consultation with Noongar people and their representatives could lead to poor management decisions, conflict of use and the degradation of Aboriginal values.

2.5.2. European Heritage

In March 1827, Captain James Stirling arrived in the Swan River, and the Swan River Settlement was founded in June 1829. In 1830, Mandurah was established and settlers moved up the Murray River.

Navigational difficulties on the Serpentine River delayed settlement. The area was part of a massive 250,000 acre land grant to Thomas Peel, but the nature of the land and vegetation, and the

availability of good agricultural land elsewhere, ensured that it mostly remained in its natural state for many years.

Some small farms were established below the scarp in 1865. The Serpentine settlement was about 1 km east of its present location, but in 1893, the railway almost complete, the present townsite was gazetted.

Major agricultural development occurred with the group settlement scheme in the early 1920s. Land from the Peel Estate was bought by the Government for settlers from England. The sandy soil and persistent winter inundation made the transition to farmland particularly difficult.

A program to drain the group settlement areas began in 1922. Large drains were cut with the aid of horse-drawn carts and finished by hand, completing 540 km by 1925. The drainage network was later expanded, with administration and management taken over during the 1950s by the Public Works Department, later to become the Water Corporation.

Comprehensive and accurate records of reserve activities and developments should be kept. There are no obvious historical remains on many reserves, but visitor experience could be enriched by signage on site, museum displays, school programs and other publications.

The biodiversity conservation value of reserves is generally not devalued by their historic or current use. Management plans include actions for establishing, monitoring and managing these assets while allowing for their use in such a way that their conservation value is maintained.

2.6. Policy and Legislation

2.6.1 Federal legislation

The key item of Federal legislation is the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) In 2016 the “Banksia Woodlands of the Swan Coastal Plain” were listed as Endangered under this Act. The listing means that banksia woodlands have been assessed as both having undergone a high degree of loss and being under a continued high level of threat. Some of the sub-communities are also listed as Endangered under State legislation.

Federal protection depends on condition and area thresholds, in addition to meeting the criteria relating to environment, soils, structure and composition. To be considered part of the EPBC Act ecological community, the “patch” (discrete and continuous area of banksia woodland) must be in at least Good Condition under the Keighery scale. Different minimum patch sizes apply for consideration of the patch under the EPBC Act, depending on the condition of the vegetation:

- Pristine – no minimum patch size
- Excellent – 0.5 ha (5,000 square metres)
- Very Good – 1 ha (10,000 square metres)
- Good – 2 ha (20,000 square metres)

Of the nine Shire reserves with banksia woodland, all but Craghill Way Reserve (too degraded) and Wattle Road Nature Reserve (too small) meet the condition and area thresholds to be considered as part of the listed ecological community, and therefore protected under the EPBC Act.

As the edges of a patch are particularly sensitive to disturbance, a buffer zone may be appropriate to protect the banksia woodland but is not formally protected under the EPBC Act. The recommended minimum buffer zone is 20-50m, depending on local context and the conservation value of the patch (wider buffers for higher value patches).

The EPBC Act allows for the listing of key threatening processes (as well as threatened communities and species). These are discussed further in section 3.

2.6.2 State legislation

The key item of State legislation is the *Biodiversity Conservation Act 2016* (BC Act). The BC Act allows for the listing of Threatened Ecological Communities, and of Threatened plants and animals. Currently, of the five banksia woodland communities found in the Shire of Serpentine Jarrahdale, SCP20b is listed as Critically Endangered, while SCP22 and SCP21c, and "Banksia Woodlands of the Swan Coastal Plain" (as for the Federal listing) are all Priority 3 communities.

Threatened ecological communities (TECs) are also protected under Western Australian legislation through the *Environmental Protection Act 1986* and *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*. A clearing permit is required for the removal of any native vegetation, with a presumption against the clearing of a TEC.

2.6.3 State policy and guidelines

There are two key items of State policy that provide protection to banksia woodland. The first is *State Planning Policy 2.8 Bushland Policy for the Perth Metropolitan Region* (SPP2.8, often referred to as the Bush Forever policy). It identifies areas of regionally significant bushland and strategies for their protection. Many banksia woodland areas are mapped as Bush Forever, sometimes grouped with vegetation on adjacent properties to form a larger, more significant area. Bush Forever areas are afforded a higher level of protection.

Of the nine Shire reserves with banksia woodland, Brickwood Reserve, Serpentine Sports Reserve, Yangedi Airfield Reserve and Bella Cumming are listed as Bush Forever. SPP2.8 classifies bushland that is outside Bush Forever areas as Local Bushland, which should be protected by a local government under a local biodiversity strategy.

The second item of State policy is *Statement of Planning Policy No. 2 Environment and Natural Resources Policy* (SPP2). The objectives of SPP2 are to integrate environmental management with land use planning, to protect the natural environment, and to promote sustainable use of natural resources. This includes avoiding development that may cause unacceptable environmental damage and considering mechanisms to protect areas of high biodiversity and/or conservation value. There are also measures relating to water resources, air quality, soil and land quality, basic raw materials, and greenhouse gas emissions, all of which aid in the protection of biodiversity.

State guidelines have produced the *Geomorphic Wetlands Swan Coastal Plain* dataset, under which wetlands have been evaluated and assigned a management category to provide guidance on how they should be managed and protected. These management categories are:

- Conservation – wetlands which support a high level of attributes and functions
    - Highest priority wetlands.
    - Objective is to preserve and protect the existing conservation values of the wetlands through various mechanisms including:
        - reservation in national parks, crown reserves and State owned land
        - protection under Environmental Protection Policies
        - wetland covenanting by landowners
    - No development or clearing is considered appropriate. These are the most valuable wetlands and any activity that may lead to further loss or degradation is inappropriate.
- Resource Enhancement – Wetlands which may have been partially modified but still support substantial ecological attributes and functions
    - Priority wetlands
    - Ultimate objective is to manage, restore and protect towards improving their conservation value. These wetlands have the potential to be restored to Conservation category. This can be achieved by restoring wetland function, structure and biodiversity.

  - Protection is recommended through a number of mechanisms.
- Multiple Use – Wetlands with few remaining important attributes and functions
  - Use, development and management should be considered in the context of ecologically sustainable development and best management practice catchment planning through landcare.

2.6.4 Local legislation and policy

The Shire of Serpentine Jarrahdale has a number of policy measures that assist in the conservation and protection of banksia woodland. These include:

- Local Planning Scheme No. 3 – provides protection to all vegetation by requiring development approval for all vegetation removal
- Local Biodiversity Strategy 2008 – protects areas of bushland that are not protected under other measures such as Bush Forever
- Local Planning Policy 2.8 Biodiversity Planning Policy – incorporates biodiversity protection into planning and development decision-making
- Urban and Rural Forest Strategy 2017 – protects trees and canopy cover throughout the Shire
- State of the Environment Report 2019 – protects the environment in the context of expected growth
- Significant Tree Register – allows for the listing of special and significant trees

3. Threats and Pressures

In 2017 (the most recent data available), the vegetation complex “Bassendean Central and South” (which roughly equates to banksia woodland) was assessed as having 31% remaining. The extent of clearing on the coastal plain portion of the Shire of Serpentine Jarrahdale can be seen by comparison of Figures 4 and 5, and that the majority of the vegetation remaining is Bassendean complex.

The threats to banksia woodland are many and significant, including:

- Clearing and fragmentation:
    - Clearing for urban development
    - Associated urban degradation and disturbance (e.g. rubbish dumping and uncontrolled vehicle access)
    - Clearing for agriculture and horticulture (mainly in the past)
    - Mining for basic raw materials (e.g. road and building materials), mineral sands and silica sands, that require clearing and hydrological impacts
- Dieback diseases (particularly caused by *Phytophthora cinnamomi*)
- Invasive species
- Fire regime change (particularly increased fire frequency, and prescribed burning during late autumn to late spring when plants are actively growing/flowering/seeding and animals are active)
- Hydrological degradation (groundwater abstraction, eutrophication, soil acidification)
- Climate change (increasing temperatures, declining rainfall, changing rainfall timing)
- Grazing (including over-abundance of kangaroos)
- Decline in pollinating and seed dispersing fauna
- Loss of keystone banksia species and fragmenting of nectar/pollen food networks

These threats apply to all areas of banksia woodland to a greater or lesser extent.

The EPBC Act allows for the listing of key threatening processes, as well as threatened communities and species. The listed key threatening processes that are relevant to banksia woodland are:

- Land clearance
- Dieback caused by the root-rot fungus (*Phytophthora cinnamomi*)
- Novel biota and their impact on biodiversity
- Competition and land degradation by rabbits
- Predation by European red fox
- Predation by feral cats
- Predation, habitat degradation, competition and disease transmission by feral pigs
- Fire regimes that cause declines in biodiversity
- Loss of terrestrial climatic habitat caused by anthropogenic emissions of greenhouse gases

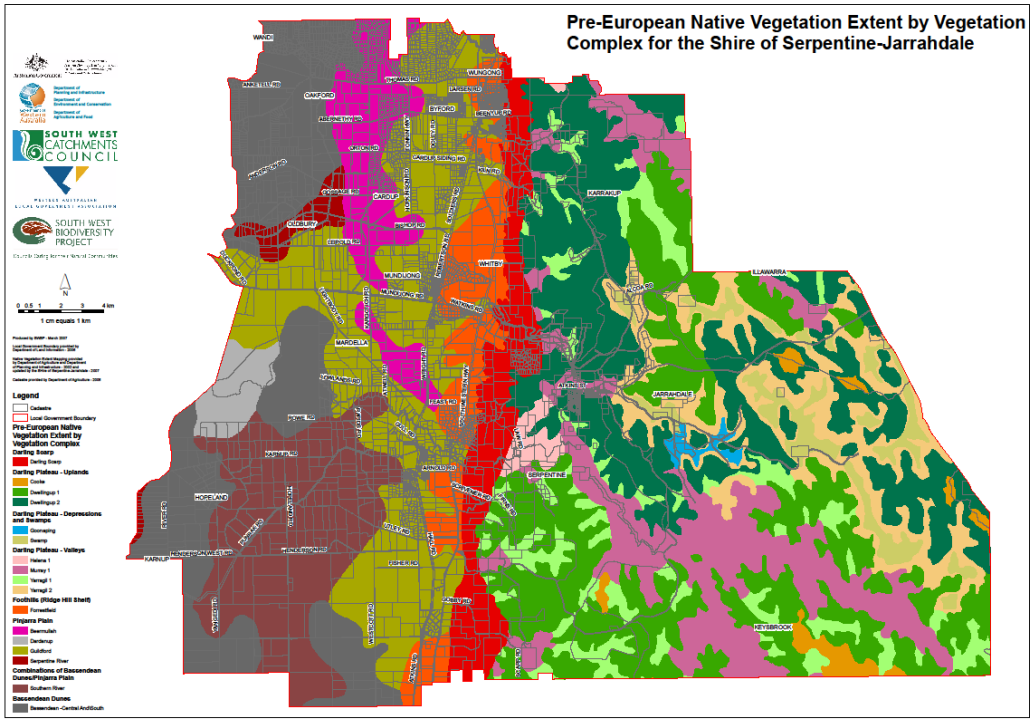

Figure 4: Pre-European Native Vegetation Extent and Complexes for the Shire of Serpentine Jarrahdale (South West Biodiversity Project, 2007).

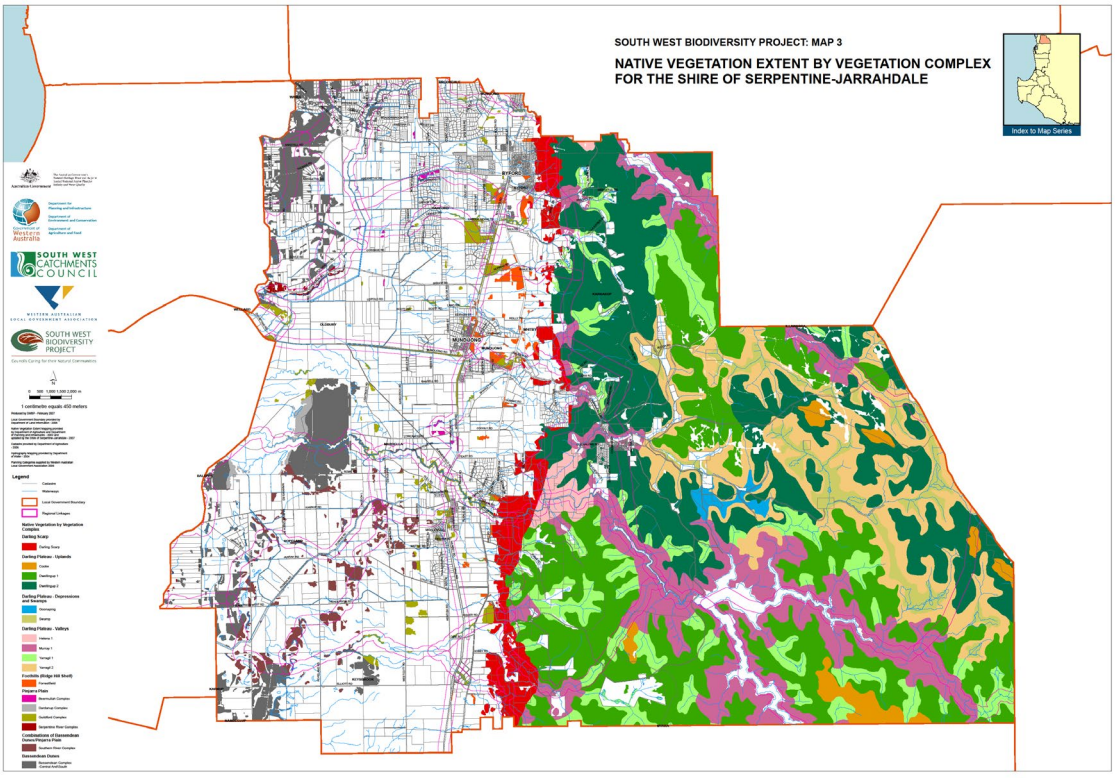

Figure 5: Native Vegetation Extent and Complexes for the Shire of Serpentine Jarrahdale (South West Biodiversity Project, 2007).

3.1. Clearing and Fragmentation

Land clearing, development and intensification of land use results in habitat loss, fragmentation and change. Clearing reduces the amount of vegetation and isolates remaining patches, reducing connectivity. Connectivity is important for landscape scale habitat quality for flora and fauna, as well as condition and persistence of banksia woodland.

Urbanisation has been the main driver of banksia woodland clearing and fragmentation. The Shire of Serpentine Jarrahdale is one of the fastest growing local government areas in Australia, with associated rapid urbanisation and development which drives clearing and fragmentation. Impacts are likely to spread as development encroaches on remnant vegetation.

Fragmentation results in reduced connectivity for flora and fauna, impedes movement and dispersal, and causes greater “edge effects” in remaining patches. Edge effects refer to the penetration of disturbance (human impacts, invasive species etc.) relatively further into the vegetation remnant where the patch is smaller and has a greater edge to area ratio. Disturbance is more likely in urban and peri-urban areas due to the proximity to humans, and these patches are prone to impacts such as rubbish dumping, unauthorised vehicle access, walking paths, vegetation removal (e.g. for firewood), more bare ground, inappropriate fire regimes, and animal invasion.

Many banksia species need both burnt occupied and unoccupied sites for seed dispersal and colonisation. Fragmentation creates barriers to dispersal and fewer opportunities for colonisation. Long distance dispersal is required to adapt to rapid climate change and is less likely in a fragmented landscape. Fragmentation reduces the ability of flora and fauna to escape from or recolonise after disturbances such as fire.

The impacts of fragmentation may take time to become apparent but are generally more rapid in smaller remnants. Plant species richness declines with time since isolation, associated with altered soil properties such as increased litter depth and increased weed invasion. Bird numbers and diversity are related to the amount of other vegetation patches in the immediate surroundings. Reptiles are more common and diverse in larger areas of bushland. Fragmentation into smaller, more degraded patches limits both plant and animal diversity.

The extraction of basic raw materials results in the loss of vegetation, hydrological impacts and the introduction and spread of dieback and weeds. Demand for basic raw materials such as gravel, shale, clay, sand, limestone and rock for construction and infrastructure development will increase in the future to support population growth. Extraction of mineral sands, in particular, can result in the removal of and/or disturbance to banksia woodlands, due to their association with the sand dune systems.

There is evidence of ongoing degradation and fragmentation of native vegetation within the Swan Coastal Plain. Remnants are smaller, closer to highly modified landscapes, have altered vegetation structures and lose species richness. The impacts are greater in the central and southern parts of Perth due to more intensive development. The metropolitan area effectively bisects the Swan Coastal Plain and represents a significant, often impenetrable barrier to the remnant populations of many species that prevents processes necessary for their future survival. There is an ‘extinction debt’ inherent in all smaller fragments that is likely to result in ongoing local extinctions and changes in species assemblages.

Clearing, fragmentation and degradation of banksia woodland are ongoing in the Shire of Serpentine Jarrahdale. Development and expansion of extractive industry (particularly sand mines) often requires the clearing of banksia woodland, and remaining buffer areas are fragmented and impacted by the effects of the excavation, such as declining groundwater. While the Shire endeavours to retain

and protect native vegetation, the applicant can appeal a refusal to the State Administrative Tribunal, and if banksia woodland does not qualify as the Federally protected community the refusal is unlikely to be upheld.

Degradation of banksia woodland in or near urban areas is a continual issue. The rapid growth of the Shire of Serpentine Jarrahdale means that previously isolated reserves are coming under increasing pressure from encroaching urban development. The pressures are most commonly in the form of increased recreational use (with associated trampling, informal path creation, and impacts on wildlife by dogs) and concern about fire hazard (with associated pressure for control burning).

3.2. Dieback Diseases

“Dieback” generally refers to the effects of a plant disease caused by the water mould *Phytophthora cinnamomi* and other *Phytophthora* species. Other common pathogens in banksia woodland include aerial cankers, gall rust and the native parasitic honey fungus.

The consequences of *Phytophthora* infection range in severity and include:

- Localised infection affecting one or more individual plants
- Dramatic modification of the structure and composition of the community
- Significant reduction in primary productivity
- Habitat loss and degradation

For banksia woodland, impacts are typically towards the severe extreme of this range. Banksia species are moderately to highly susceptible to dieback, with up to 100% deaths. Many other plant species that are part of the banksia woodland community, including those in the Proteaceae, Ericaceae, Fabaceae families, and Xanthorrhoea, are susceptible to the disease.

Dieback disease continues to spread and affect the distribution and abundance of many plant species and their associated fauna in southwest Western Australia. This plant pathogen and a number of related *Phytophthora* species present a significant threat to the health and vitality of many ecosystems on the Swan Coastal Plain. It can alter species composition and ecosystem function by impacting susceptible species and vegetation types, and by increasing vulnerability to invasion by weeds.

There is a strong correlation between dieback and soil type. There are far more dieback centres on the Bassendean Dune System than on soils of the Spearwood and Quindalup Dune Systems. This means species that are common on Bassendean Dunes are more affected than those that primarily occur on the Spearwood and Quindalup Dune Systems. Dieback is also less common in areas with lower soil moisture content and higher in the landscape. As approximately 55 % of banksia woodland occurs in the Bassendean land system, much of the community is potentially susceptible to dieback.

In most areas, canopy closure, basal area and number of plant species are significantly lower in diseased compared with healthy areas. Percentage ground cover and total plant species cover can also be significantly lower in diseased areas. Dieback reduces flowering and fruiting of affected plants, therefore also affecting animals that rely on banksia nectar and seeds as food. Decline in these animals affects their pollination services for other plants.

Diseased sites have reduced plant species richness, litter, shrub, tree and canopy cover, high bare ground and significantly lower flowering scores, than healthy sites. Bird community composition differs significantly between diseased and healthy sites, associated with habitat structural changes. Average species richness of birds and the abundance of nectivores is lower in diseased than healthy sites. Dieback is therefore potentially a serious threat to bird biodiversity and especially for nectarivores, with implications for pollination.

Transmission of plant pathogens occurs through movement of infected soil and plant material, and in surface and ground water. Soil is carried by humans and kangaroos (and other animals such as horses), and contaminated vehicles and machinery. Effective hygiene practices can help to manage human and mechanical transmission.

There is no known way to eliminate dieback once it has been introduced. Dieback control therefore involves minimising its spread by controlling the movement of vehicles, people and stock from affected areas into dieback free areas. It is standard management practice to route pathways to avoid crossing boundaries, provide wash-down or other hygiene facilities for vehicles and pedestrians, provide education, and avoid transporting soil and plant material into dieback free areas.

Phosphite (phosphoric acid), sprayed on vegetation and injected into trees, mitigates the intensity of disease and can delay onset. Mapping of boundaries can monitor the spread and invasion of disease, and locate the areas most at risk and therefore most in need of treatment. The Shire's banksia woodland reserves are mapped and treated at three year intervals.

3.3. Invasive Species

3.3.1 Plants

Weeds are a major ongoing problem, particularly in urban areas with significant weed seed banks and ongoing weed invasion from urban boundaries. Most exotic plant species in banksia woodlands are herbs and grasses from the Mediterranean Basin, California and South Africa. Banksia woodland is vulnerable to new weeds.

The main weed families that invade banksia woodland are the Poaceae, Asteraceae, Iridaceae, Caryophyllaceae and Papilionaceae. The most common perennial weeds include:

- Perennial veldt grass (*Ehrharta calycina*)
- Freesia (*Freesia* sp.)
- Hottentot fig (*Carpobrotus edulis*)
- Gladiolus (*Gladiolus caryophyllaceus*)
- Pelargonium (*Pelargonium capitatum*)
- Arum lily (*Zantedeschia aethiopica*)
- Onion grass (*Romulea rosea*)
- Cape tulip (*Moraea flaccida*)

Bulbous weeds are common. The main annual weeds are catsear (*Hypochaeris glabra*), ursinia (*Ursinia anthemoides*), quaking grass (*Briza maxima*), silvery hairgrass (*Aira caryophyllea*) and common sowthistle (*Sonchus oleraceus*).

The weed species with the greatest effect on community composition are African perennial grasses (e.g. perennial veldgrass), and bulbous weeds such as gladiolus, as they not only transform the ecological character of the community but also reduce the diversity of the native shrubs and herbs.

Other weeds can increase fuel loads in bushland, resulting in native remnants becoming more prone to fire, and to more frequent fires (particularly perennial veldt grass, wild oats, ursinia and fleabane). Increased fire frequency creates feedback loops that promote the greater presence of weed species due to their shorter generation lengths, higher seedbanks and faster response to postfire ash-bed nutrients than many native species.

In disturbed areas, banksia woodlands are altered structurally by a perennial grass layer dominated by perennial veldt grass, which is also present in many of the most intact areas. Patches of banksia woodland with an understorey dominated by perennial veldt grass have very low seed production,

seedling recruitment and seedling survival of banksia species despite the presence of a mature canopy of banksia.

The primary means of controlling weeds in remnant vegetation is to avoid disturbance. The second strategy is to reduce the carriers of weed seed, including introduced materials such as soil, and exclude sources such as storm-water runoff that can introduce nutrients and other pollutants. Techniques to control the spread of seed and weed plants range from selective seed head removal to physical or chemical plant removal. Large-scale weed control must be integrated with revegetation, otherwise the bare areas will be recolonised by weeds. The control of weeds that provide significant habitat values also needs to be carefully planned and integrated with revegetation.

3.3.2 Animals

Introduced animals affect biodiversity values through habitat modification, predation, grazing and competition. Common invasive animals include the European rabbit, red fox, cat, black rat, house mouse, long-billed corella, little corella, rainbow lorikeets, laughing kookaburra and the introduced honey bee. There can be many kangaroos in small fragmented reserves, and wild pigs in wetland areas. Feral animals are difficult to control, particularly in urban settings, due to safety considerations for non-target species and the public.

Foxes and cats are now the primary predators on remaining native animals (e.g. quenda) and have contributed to local extinctions of other native animals. Non-native herbivores promote non-native herbaceous species, possibly through the disturbance of topsoil through their digging habits. Given that small to medium native mammals are now largely absent from the community, digging by non-native mammals such as the European rabbit now results in weed invasion, due to the large weed seed banks present at many sites. Disturbance of this thin layer in the ancient and impoverished soils of southwestern Australia is known to promote invasion, as it provides an opportunity for establishment by non-native species, which are abundant in the topsoil seed bank, and germinate and grow faster than native species.

Whilst native herbivores suppress non-native herbaceous species abundance, non-native herbivores such as the European rabbit promote non-native herbaceous species abundance as a result of their digging activities that promote germination of the weed soil seed bank.

3.4. Fire Regime Change

Prior to European settlement, some fires occurred through lightning strikes and Aboriginal burning of the landscape. It is likely that the Swan Coastal Plan had a mosaic of burning regimes from regular burning to long unburnt, although it is unclear what fire regimes applied to banksia woodland.

Some fire regimes are a major threat to the long-term survival, diversity, viability and conservation of communities, habitats and species populations. These are the result of cool-season prescribed burning and high overall frequency of fires. While many plants and ecosystems are resilient to a range of fire regimes, banksia woodlands and some component species respond to fire in ways that require fire-free intervals long enough to build up seed resources and sensitivity of resprouting species to cool season fires.

Recently, fires have occurred as a result of fire management practices, escapes from prescribed burning, arson, and accidental ignition. There has been a change in fire regime in many areas, with a skewed distribution of frequency to less than seven year intervals.

Higher frequency fire regimes and burning during the growing/seeding season (late autumn to late spring) result in the following changes to banksia woodlands:

- Structural change (reduced canopy cover and loss of resprouting shrub cover)

- A shift from native species to introduced species (increased weed abundance and diversity)
- Decrease in native plant cover, richness and diversity
- Changes to ecological function
- Feedback loops that promote weed species and the expense of native plants (e.g. highly flammable veldt grass *Ehrharta calycina* infestations promote further fires, with higher fire frequencies reducing the cover and regeneration capacity of native plants)

The richness and diversity of fauna is generally maximised by avoiding widespread intense fires and maintaining a diversity of vegetation successional stages to provide habitat diversity. The fire responses of fauna vary depending on the extent of, and interaction of fire with, habitat fragmentation and other disturbances. In general, many native fauna groups in banksia woodland prefer long-unburnt areas (more than 16 years fire interval) and become more abundant with increasing time since fire.

Current fire prescriptions reduce the availability of longer unburnt habitats. For banksia woodlands overall, the recommended fire intervals based on life history traits of flora and fauna are:

- Minimum 8-16 years
- Maximum 40 years
- Ideal fire cycle 24-28 years

However, the distribution of post-fire ages of banksia woodland is skewed to 1-6 years from last fire. There are also few unburnt patches within individual burns, indicating that fire patterns are not mosaics. This reduces the chance of an area of suitable habitat being available. Smaller and more isolated remnants that escape frequent burns are increasingly important.

Remnant banksia woodland areas that are small and isolated are particularly sensitive to fire. A high intensity fire that affects the whole area may change the structure of the community, and the loss of populations of rare plants. Small remnants also have more problems with post-fire recovery, such as kangaroo grazing and weed invasion.

The primary objective of fire hazard management in the Shire of Serpentine Jarrahdale is the protection of people and property. It is unfortunate that prescribed burning recommendations produce such poor outcomes for banksia woodland. Recently burnt banksia woodland has a much higher fuel load than long unburnt, due to the elevated presence after fire of highly flammable weedy grasses and native shrubs such as spearwood. Long unburnt banksia woodland tends to have a low understorey dominated by low flammability species, and few larger shrubs. Mature banksia trees are relatively low flammability. Control burning in banksia woodland should be minimised and followed up by weed control.

3.5. Water Availability

One of the most significant threats to ecosystems in the Swan Coastal Plain is declining water tables due to increased groundwater abstraction, patterns in water regulation and decreased rainfall and subsequent groundwater recharge. Banksia species are deep-rooted and groundwater dependent, and therefore particularly susceptible to impacts from groundwater drawdown. Impacts range from a gradual change in structure and composition to sudden and widespread vegetation death.

The risk to banksia woodlands depends on the floristic community type and its dependence on groundwater. Deep-rooted trees and shrubs are more susceptible to water and heat stress than shallow-rooted species, making banksias highly vulnerable to changes in water table elevation. Where impacts result in a change in plant composition and structure, there is a shift in community

composition from deep-rooted to shallow-rooted species as groundwater resources become unavailable.

Groundwater decline is not only influenced by extraction but also by declining rainfall and rechange rates as a result of climate change. Average annual rainfall has decreased, dominated by reduced winter rainfall, and resulting in decreased annual stream flow. Changes in soil temperature and distribution of surface water will impact on banksia species that are restricted to lower-lying areas and thus heavily dependent on subsurface soil moisture and groundwater. Climate change may reduce seasonally waterlogged areas as well as increasing the depth to groundwater, resulting in a decrease in deep-rooted species in these areas.

Groundwater decline may also result in flow-on effects which can impact fauna species dependent on seasonal wetlands. Banksias may be susceptible to death or decline due to increased acidity and aluminium in subsoil water where the water table has rapidly declined. Soils in Bassendean dune areas have a low buffering capacity and contain enough iron compounds to create acid sulfate soil conditions when the water table declines and the soil is exposed to air. The acids leach to groundwater, impacting water quality and causing acidity in seasonal wetlands with associated impacts on fauna.

Inflows to wetlands could disrupt their ecological balance. Drains may import nutrients, weeds and disease, and affect water levels. A wetland is an expression of the water table, and any activities that affect the water table impact on it, including alteration of water levels and leaching of nutrients and other pollutants into the groundwater.

Water availability has, and is likely to continue to, decline across the Swan Coastal Plain. Declining water availability is likely to be having severe detrimental impacts on banksia woodland. Recent studies have determined that groundwater across most of the Shire of Serpentine Jarrahdale is fully allocated, with no more licences available for human uses. This is partly due to the environmental impacts of the declining water table.

3.6. Climate Change

Banksia woodlands occur in a region that has (and is continuing to) undergone major and rapid changes to the climate. Long-term climate change has a trend of increasing temperatures, declining rainfall and altered rainfall timing. Mean annual temperatures have risen by more than 1°C and mean annual rainfall has declined by over 15%. The decline in rainfall is particularly pronounced in late autumn and winter, which is the most important period for native plant growth, as well as for agriculture and horticulture. Further decreases in average rainfall are expected, as are higher temperatures and increased incidence and intensity of extreme events, such as heatwaves, storms and heavy rainfall.

The reduction in rainfall has an increased effect through decreased streamflow in waterways and in reduced recharge of groundwater. Streamflow has declined by more than 50%, impacting on plant reproduction and seedling recruitment. Human populations are becoming more reliant on groundwater (and desalination plants), increasing water table declines and increased stress on vegetation. Extensive mortality of banksia woodlands will become more frequent.

The ecological integrity of banksia woodlands is declining in response to the new climate regimes. Banksias are producing fewer flowers in response to declining rainfall, which results in less food for nectar-feeding birds and mammals, and slower accumulation of smaller seedbanks. Banksia populations are thus less resilient to fires, disease, seed predation and other threats. The drying climate also impacts on seedling recruitment, which is highly sensitive to soil moisture.

Although fire is an important process in banksia woodland, plants whose seeds are stimulated to germinate by fire will be particularly vulnerable to high frequency or unseasonal fires. Resprouters whose adult trees can survive low to medium intensity fires and regenerate from lignotubers may also fail to resprout if fires are too frequent.

Urban heat islands can affect local climate and impact on nearby remnants. Urban heat islands occur when urban areas are hotter than their surrounds due to built materials trapping heat, machinery producing waste heat, and the removal of trees and vegetation (and their cooling effect from shade and transpiration). Ongoing clearing of native remnants is likely to exacerbate urban heat.

The Shire of Serpentine Jarrahdale is managing its response to climate change through implementation of strategies such as the Climate Change Strategy and Action Plan, and the Urban and Rural Forest Strategy.

3.7. Fauna Decline

Threats also have resulted in decline of the fauna of the banksia woodlands. This, in turn, feeds back into the decline of native vegetation because fauna are essential to ecological functions of the community. Many animals have habitat or dispersal requirements that are no longer available due to loss, fragmentation and degradation of the natural vegetation and remnants now occurring amongst highly modified, often unsuitable landscapes. The greatest decline in native fauna has been in urban and peri-urban areas, notably the Perth metropolitan region, and this is likely to worsen with ongoing urban sprawl.

Mammals appear to be the most affected group with 52% of the original mammal fauna of the Perth region now considered regionally extinct. 40 native mammals were once present in the Swan Coastal Plain and ten species are now extinct from the region with another eight in serious decline. Regionally extinct mammals include iconic species such as the numbat, bilby and woylie, but also five species of native mice and rats. The decline of marsupials resulted from a combination of the threats outlined above.

A mammal that has declined due to loss of banksia woodlands is the honey possum. The honey possum is a very important pollinator of banksia and other nectar-rich Proteaceae. They prefer long unburnt banksia woodlands that have been undisturbed for 20 to 25 years or longer and their abundance in these areas is almost double that of recently burnt sites. They are vulnerable to disturbances that affect their key banksia food resources, such as dieback, more frequent fires, groundwater changes and climate change. Their suitable habitat declines when banksia woodland remnants are lost, fragmented or poorly managed. Climate change modelling predicts future declines in the abundance of honey possums.

Native marsupials would have played a key role in trophic interactions, pollination, seed dispersal, decomposition, mineral nutrient cycling and fuel load reduction in banksia woodland (by turnover of the soil and burying of leaf litter through extensive digging). The most common native mammals that now remain in urban bushland remnants are species able to adapt to human presence, such as the western grey kangaroo and common brushtail possum. The quenda is possibly the only medium-sized ground-dwelling native mammal that survives in the Perth metropolitan region, but it is subject to ongoing habitat loss and predation by foxes and cats.

Birds have also been affected by the loss or declining condition of banksia woodlands. Across the Swan Coastal Plain, nearly 50% of the passerines and 40% of the non-passerines have declined or have become locally extinct since European settlement. These include species that are habitat specialists and generalists. The impacts of urbanisation are also demonstrated at a local scale by

the decline or extinction of bird species from the large, isolated bushland remnants at Kings Park and Whiteman Park.

A major concern is the impacts of habitat losses to the black cockatoos of the Swan Coastal Plain. A particular threat is the clearing of feeding habitat, as banksia woodlands and commercial pine plantations provide a significant food resource. On the Swan Coastal Plain, black cockatoos show a strong preference for food resources from banksia and hakea shrubs, so the banksia woodlands provide a key resource. With the decline in banksia woodlands, however, they have adapted to roosting in pine plantations, and are therefore threatened by their removal.

The rate of decline of Carnaby's black cockatoos was estimated as 15% per year of the total number on the Perth-Peel Coastal Plain. This indicates Carnaby's black cockatoo remains in serious decline. The decline of cockatoos will become more severe if remnant banksia woodlands are removed, as well as continuing to reduce the pine plantations. Further removal of pines as feeding habitat will place greater reliance on the remaining (but also declining) patches of banksia woodlands as habitat.

Reptile species assemblages in the Swan Coastal Plain depend on the size of the bushland remnant. The long-term persistence of reptile populations may be affected by the presence of barriers to dispersal and, consequently, a reduced ability to recolonise a patch if local extinction occurs. For many species of reptiles, roads, buildings and other infrastructures are effective barriers to dispersal.

The terrestrial breeding turtle frog is affected by the clearing of the sandy banksia woodland habitats that it occupied throughout the metropolitan region. Their diet consists almost entirely of termites that feed on the wood of banksia trees. Processes that remove these trees or affect the capacity of termites to utilise banksia will affect turtle frogs via a decline in their food source. Groundwater declines also affect turtle frogs by affecting the health of banksia trees and by the potential loss of soil-bound moisture required for the frog's survival and reproduction during dry periods.

Impacts to the invertebrate component of the banksia woodland community are poorly studied. Within the Perth metropolitan region, the native earthworm fauna has been mostly replaced by introduced species in disturbed soils. However, introduced species of earthworm were not found in undisturbed bushland remnants. This suggests that the loss of native vegetation remnants has led to a decline of the native earthworm fauna and that remnant vegetation fragments will continue to provide refuges in the future.

4. Reserves

4.1. Location and Description

The Shire of Serpentine Jarrahdale has nine reserves that contain banksia woodland. These reserves, their approximate area of banksia woodland, and most likely community, are:

- Brickwood Reserve, Byford (2.13 ha, SCP21a)
- King Road Pony Club Reserve, Oldbury (18.08 ha, SCP21c)
- Serpentine Sports Reserve, Serpentine (3.41 ha, SCP21a)
- Yangedi Airfield Reserve, Hopeland (16.48 ha, SCP21c and SCP22)
- Bella Cumming Reserve, Mundijong (1.72 ha, SCP21a)
- Tonkin Street Flora Reserve, Mundijong (2.05 ha, SCP21a)
- Craghill Way Reserve, Oakford (1.74 ha, SCP21c)
- Pony Place Reserve, Oakford (10.82 ha, SCP22)
- Wattle Road Nature Reserve, Serpentine (0.97 ha, SCP21c)

Some reserves (Brickwood Reserve, Serpentine Sports Reserve, and Yangedi Airfield Reserve; and to a lesser extent King Road Pony Club Reserve and Craghill Way Reserve) also contain other types of vegetation (marri woodland and/or clay-based wetlands). Wattle Road Nature Reserve has transitional vegetation containing features of both banksia woodland and marri woodland.

The locations of the reserves are shown in Figures 6 – 9, and the reserves and the location of their banksia woodland are shown in Figures 10 – 18. More detail on the reserves, such as soil types, wetlands, and vegetation management zones can be found in their individual action plans.

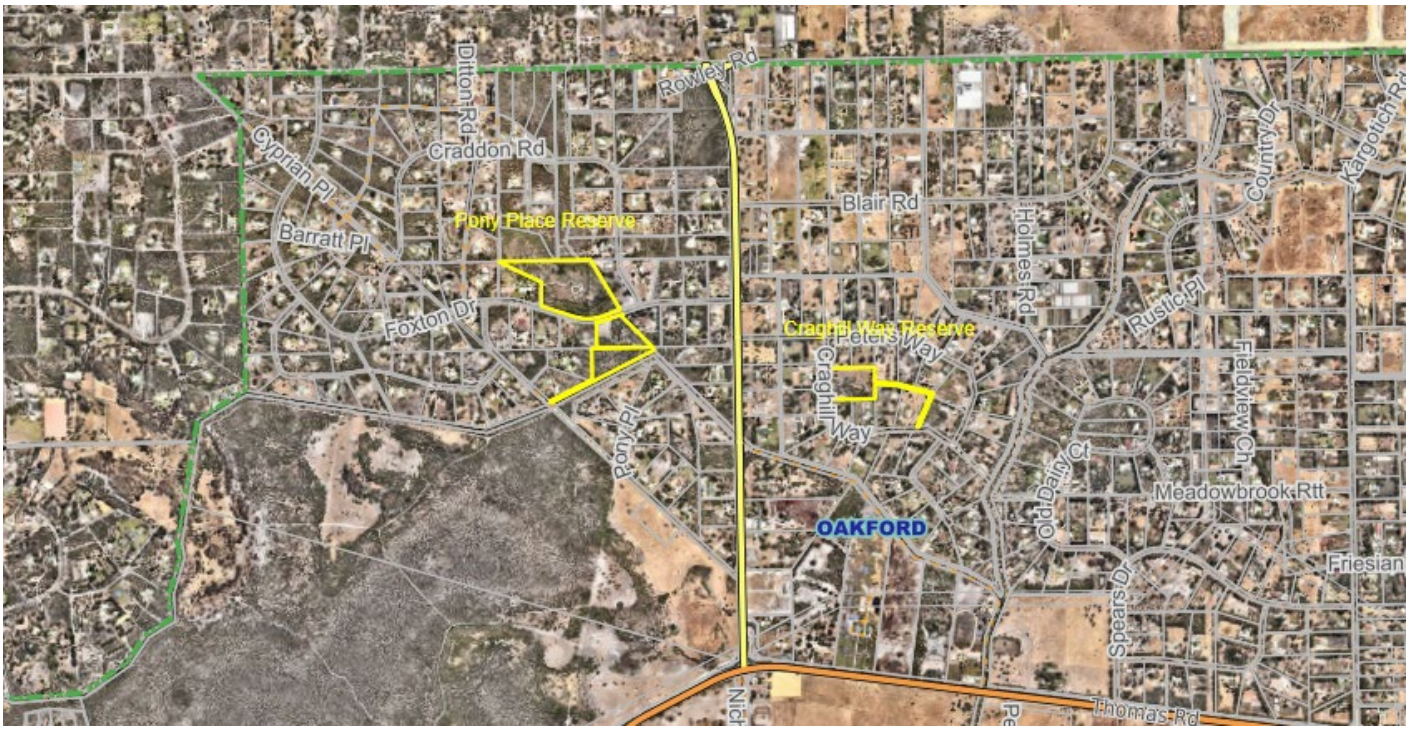

Figure 6: Location of Oakford Reserves – Pony Place Reserve and Craghill Way Reserve.

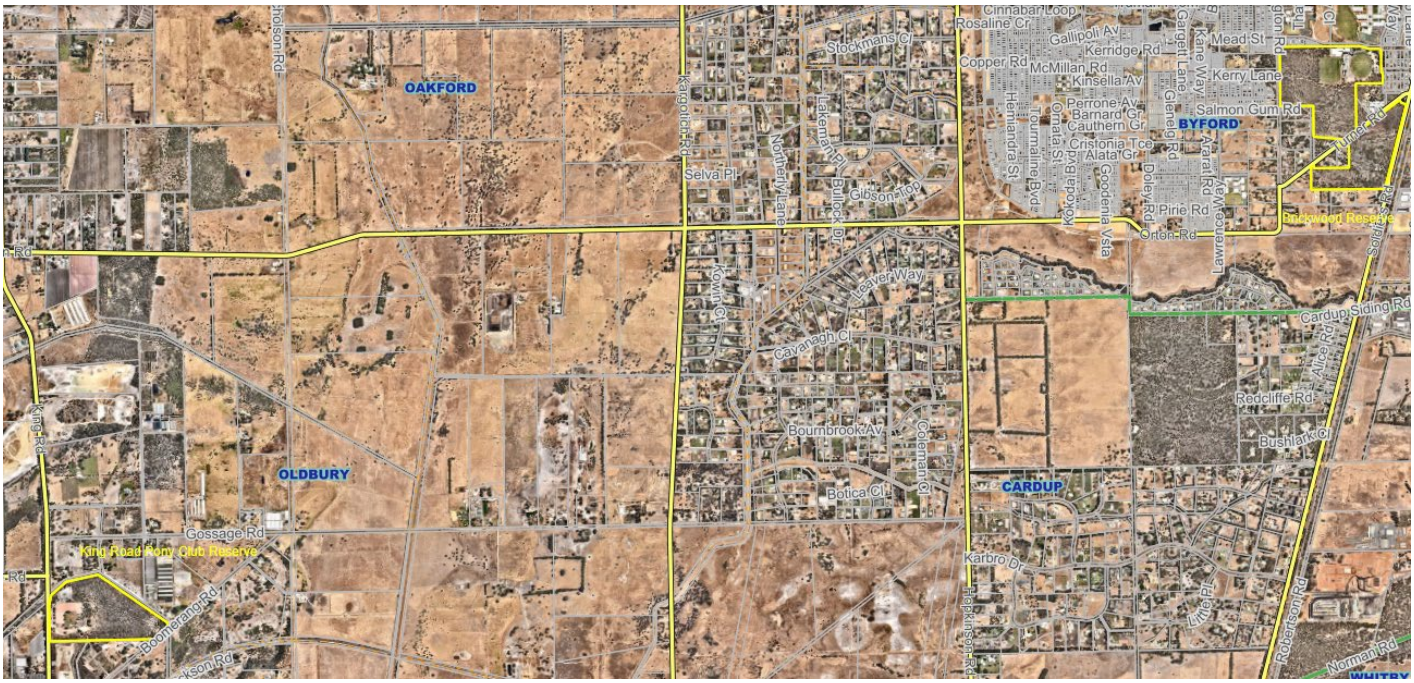

Figure 7: Location of Byford and Oldbury Reserves – Brickwood Reserve and King Road Pony Club Reserve.

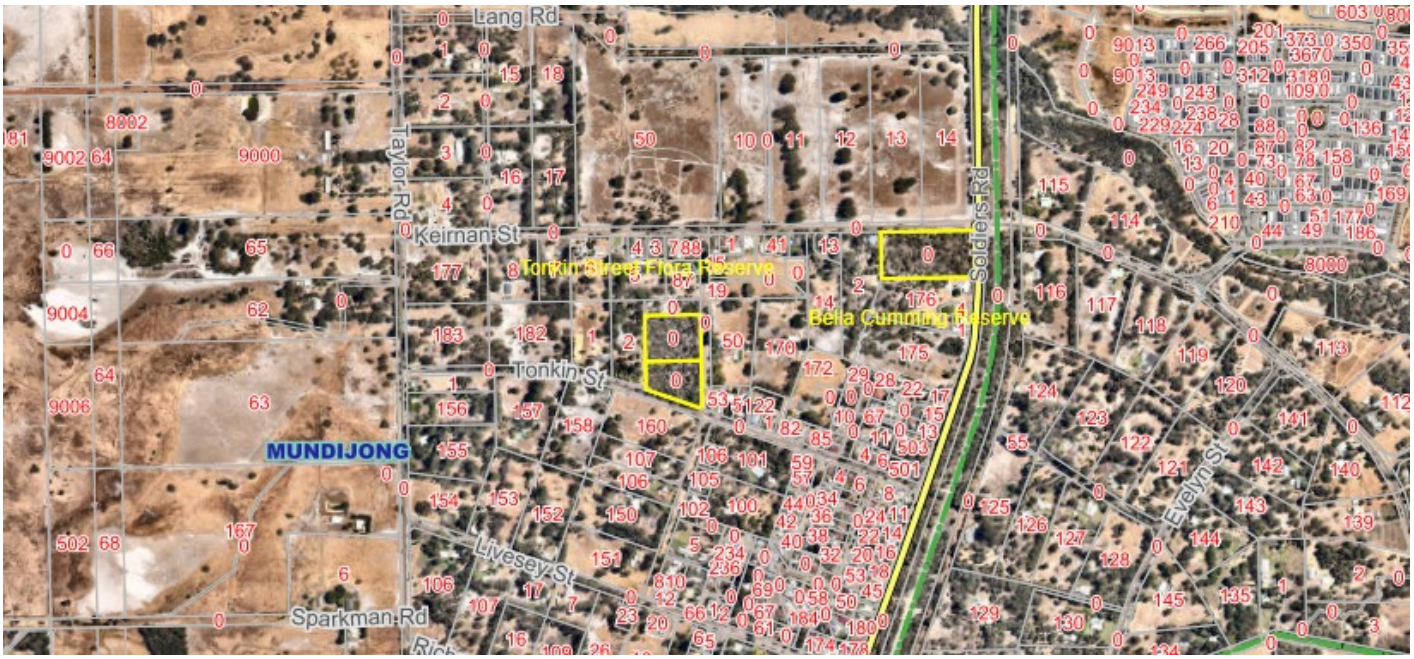

Figure 8: Location of Mundijong Reserves – Bella Cumming Reserve and Tonkin Street Flora Reserve.

Figure 9: Location of Serpentine and Hopeland Reserves – Serpentine Sports Reserve, Wattle Road Nature Reserve and Yangedi Airfield Reserve.

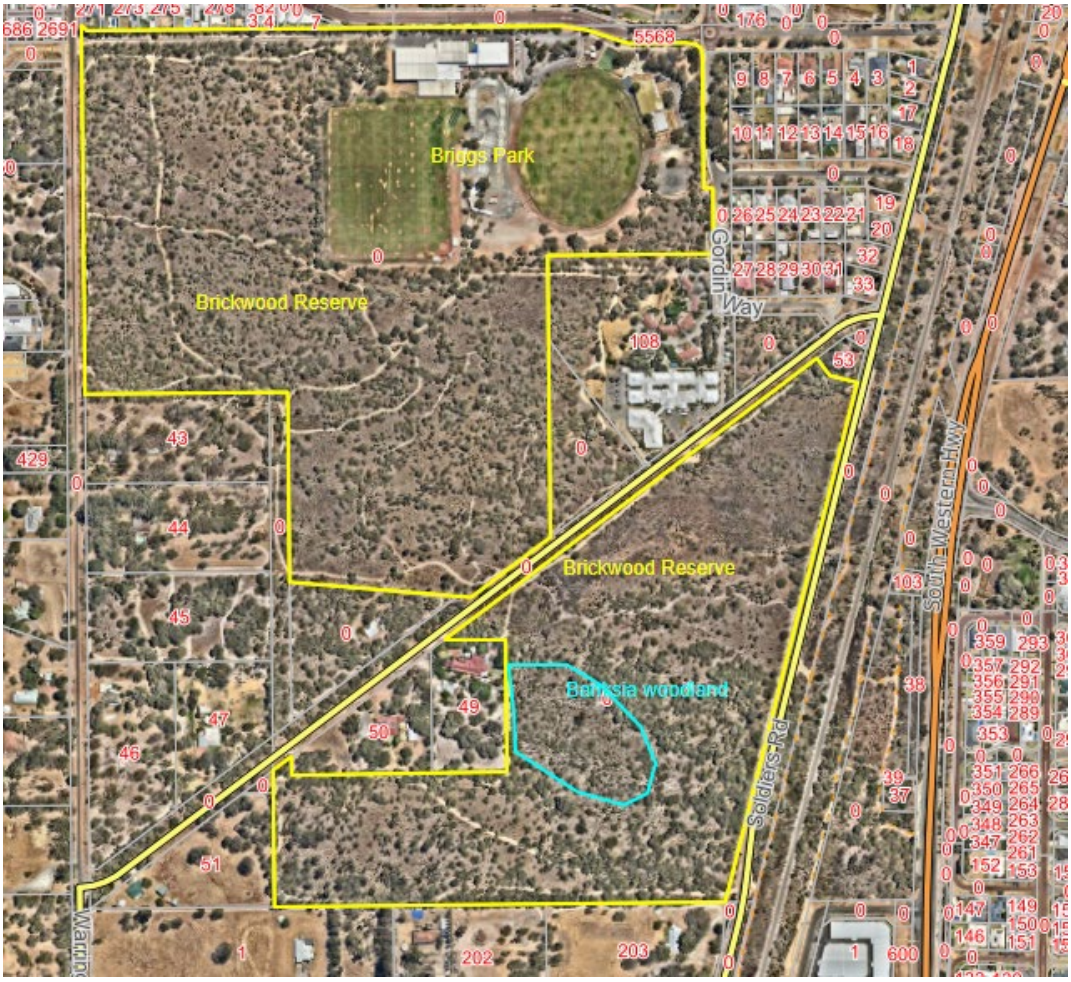

Figure 10: Brickwood Reserve, Byford and the location of its area of Banksia Woodland.

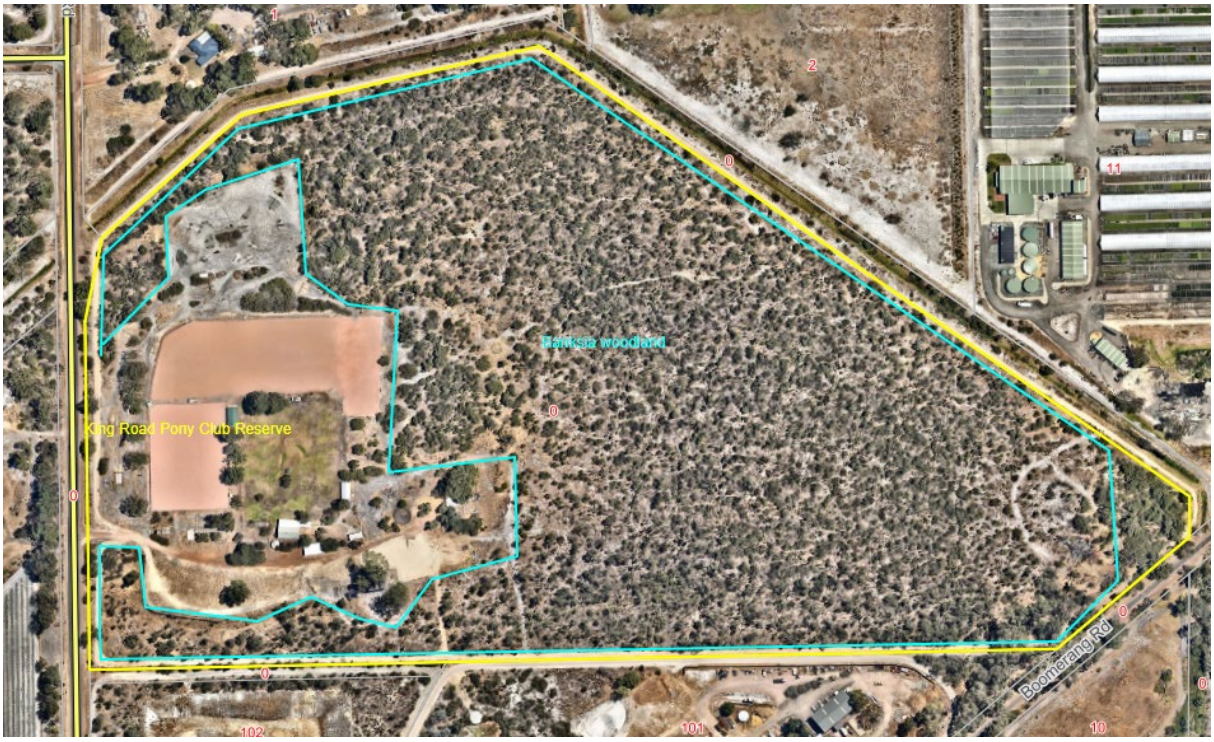

Figure 11: King Road Pony Club Reserve, Oldbury and the location of its area of Banksia Woodland.

Figure 12: Serpentine Sports Reserve, Serpentine and the location of its area of Banksia Woodland.

Figure 13: Yangedi Airfield Reserve, Hopeland and the location of its areas of Banksia Woodland.

Figure 14: Bella Cumming Reserve, Mundijong and the location of its area of Banksia Woodland.

Figure 15: Tonkin Street Flora Reserve, Mundijong and the location of its area of Banksia Woodland.

Figure 16: Craghill Way Reserve, Oakford and the location of its area of Banksia Woodland.

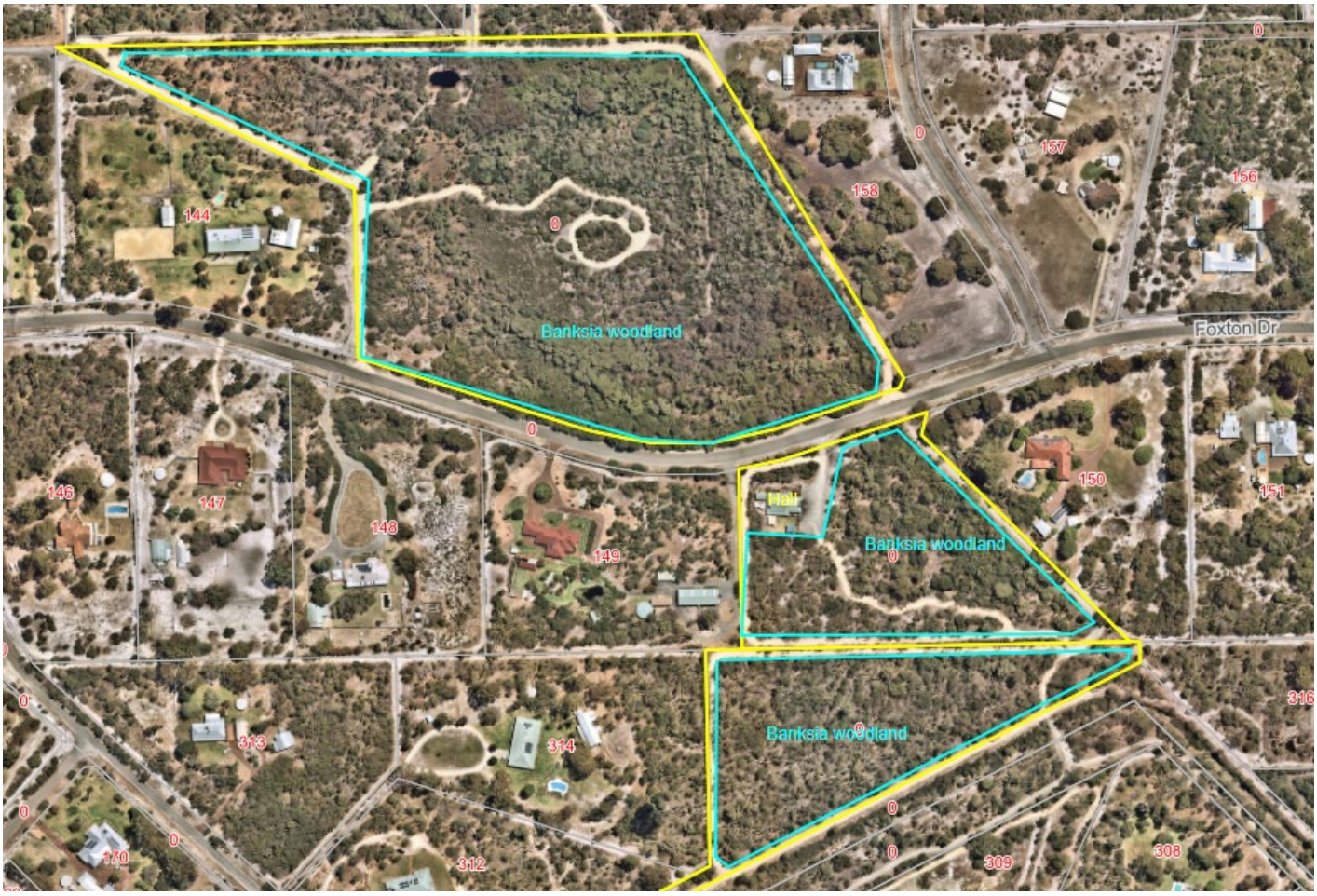

Figure 17: Pony Place Reserve, Oakford and the location of its area of Banksia Woodland.

Figure 18: Wattle Road Nature Reserve, Serpentine and the location of its area of Banksia Woodland.

4.2. Vesting and Land Tenure

Most of the Shire reserves containing banksia woodland are Crown land vested with the Shire of Serpentine Jarrahdale for the purpose of recreation, but their use now includes conservation. Changes to the vesting purpose of the reserves would give greater protection to their banksia woodland, but this is being kept in reserve for future offsets for unavoidable clearing by the Shire. The vested purpose and current use of the reserves is listed in Table 3. For reserves that cover more than one lot, only the lot containing the banksia woodland is listed.

Table 3: Vesting and Land Use of Shire Reserves.

Reserve	Reserve and Lot Number	Vested Purpose	Current Uses
Brickwood Reserve	R17490 L5567, L111 and L112 Mead Street, Byford	Recreation	Recreation and Conservation
	R51101 L48 Turner Road, Byford	Environmental Conservation, Recreation, Community Centre and Purposes Ancillary Thereto	Recreation and Conservation
BaptistCare Graceford Aged Care Home (Brickwood)	R37404 L106 Turner Road, Byford	Aged Persons Homes	Buffer Zone and Conservation
Brickwood Reserve	R17490 L111 Mead Street, Byford	Recreation	Recreation and Conservation
King Road Pony Club Reserve	R36950 L427 King Road, Oldbury	Recreation	Recreation (Pony Club) and Conservation
Serpentine Sports Reserve	R19134 L778 Karnup Road, Serpentine	Recreation, Racecourse and Showground	Recreation (Pony Club, Polocrosse Club, Golf Club) and Conservation
Yangedi Airfield Reserve	R25911 L164 Yangedi Road, Hopeland	Recreation	Recreation (Airfield, DFES Helipad, BOM tower) and Conservation
Bella Cumming Reserve	R6168 L59 Keirnan Street, Mundijong	Recreation and Parklands	Conservation
Tonkin Street Flora Reserve	R22020, R36369 L205, L180, L213 Baskerville Road, Mundijong	Protection of Indigenous Vegetation, Hall	Recreation and Conservation Men's Shed
Craghill Way Reserve	R34460 L1374 Craghill Way, Oakford	Public Recreation	Recreation and Conservation
Pony Place Reserve	R41485 L1401, L1393, L1402, L1367 Foxton Drive, Oakford	Public Recreation and Community Hall	Community Hall, Recreation and Conservation
Wattle Road Nature Reserve	R36433 L2597 Wattle Road, Serpentine	Conservation of Flora	Conservation

4.3. User Groups

4.3.1. User Groups

The user groups of each Shire reserve are related to the current uses, as listed above in Table 3. These range from informal users, for walking and enjoyment of nature, to the three major users of

Yangedi Airfield Reserve. The user groups for each reserve are listed in Table 4. More detail is provided in the individual action plans.

Table 4: User Groups of Shire Reserves

Reserve	User groups
Brickwood Reserve	Recreation Centre – gym, courts, function rooms etc. Sports fields users, e.g. cricket, football and diamond sports groups BMX track Friends of Brickwood Informal users, particularly walking and dog exercise
King Road Pony Club Reserve	Peel Horse and Pony Club
Serpentine Sports Reserve	Serpentine Horse and Pony Club Polocrosse Club Golf Club Irregular oval hire, e.g. Southside Jumps Club Community events Informal users, particularly walking and dog exercise Community conservation groups, including Landcare SJ Inc., Serpentine Environmental Group
Yangedi Airfield Reserve	Sports Aircraft Builders Club DFES (helipad) BOM (radar tower)
Bella Cumming Reserve	Informal users, infrequent
Tonkin Street Flora Reserve	Men's Shed Informal users, particularly local children
Craghill Way Reserve	Informal users, infrequent Equestrian (connected to bridle trail network)
Pony Place Reserve	Community hall users – regular and irregular Informal users, infrequent Equestrian (connected to bridle trail network)
Wattle Road Nature Reserve	Informal users, infrequent

4.3.2. Threats and Pressures

4.3.2.1. Risk Management

Increasing insurance premiums and stricter attitudes to liability have made risk management plans mandatory for recreational facilities and clubs. Formal risk management plans must be developed by each user group of a reserve in cooperation with the Shire to avoid exposing participants to unacceptable levels of risk.

4.3.2.2. Membership and Member Involvement

Any community group has a general problem with attracting and maintaining motivated volunteers to fill positions and undertake other tasks. A few people tend to do most of the work.

4.3.2.3. Conflict Among User Groups

Conflict among user groups can lead to a lack of cooperation in management of reserves, and conflicts over the use of resources can lead to ineffective use and possibly degradation. The main conflicts tend to be between user groups' desire to expand, and protection of the conservation values of the remnant vegetation. Nearby residents are frequently concerned about fuel loads in bushland and fire risk, which can lead to pressure for regular control burns and the potential for degradation of the bushland.

Management plans are intended to facilitate broad community input, provide an acceptable level of certainty for all stakeholders, and ensure that Council is fully informed.

4.3.2.4. Compliance with Legislation

The use of reserves and their facilities is subject to health regulations and legislation. Some reserves also host events during which camping occurs. The Shire assesses compliance with legislation, and ensures that the locations used, management of pets, numbers of people per ablution facility during events, litter and other waste management issues are considered.

Compliance with Federal, State and Local environmental legislation and policies is also essential. Many user groups may be unaware of the legislative requirements, or the environmental values they are intended to protect. It is the Shire's responsibility to ensure that user groups are informed of and comply with relevant requirements.

4.3.2.5. Security of Tenure

Ongoing long-term lease agreements for user groups are essential to ensure that private investment in reserves is supported. User groups and their facilities are mostly developed and maintained entirely by volunteers.

4.4. Infrastructure

4.4.1. Infrastructure

The infrastructure present on each Shire reserve is related to the current uses and user groups, as listed above in Tables 3 and 4. These range from basic fencing to the highly valuable infrastructure of the three major users of Yangedi Airfield Reserve. The main infrastructure present at each reserve is listed in Table 5. More detail is provided in the individual action plans.

4.4.2. Threats and Pressures

4.4.2.1. Facility Maintenance

Most user groups maintain their buildings and other infrastructure by volunteer labour from their members. Other reserve facilities are public and maintained by the Shire, such as sports fields and irrigation systems. Inadequate maintenance would lead to accelerated deterioration and increased risk. Poorly maintained facilities also tend to attract vandalism.

4.4.2.2. Vandalism and Theft

Vandalism and theft are constant but low-level threats. The design of buildings and other structures may incorporate vandalism-resistant features. Use of tough materials, protection of vulnerable surfaces with resistant barriers, visibly high maintenance, removal of objects likely to be used by vandals, high security and appropriate lighting all decrease the likelihood of theft and damage. Surveillance is an effective deterrent. The highly valuable infrastructure and property on Yangedi Airfield Reserve is protected by on-site caretakers.

4.4.2.3. Fire Damage

Fire can threaten people, property and conservation values. Prevention and resistance should be incorporated into the design and management of buildings, other structures and their surrounds. Fires can start inside or adjacent to buildings and structures, and are often the result of vandalism, kitchen accidents or electrical faults. Bush or grass fires threaten buildings and structures through embers, radiant heat and direct contact.

Cleared areas around buildings limit the opportunity for bush and grass fires to reach them. No flammable material should be stored close to buildings, and gutters kept clear. Strategies to limit the

frequency and severity of vandalism will reduce the likelihood of arson. Fire in nearby bushland has the potential to damage infrastructure.

4.4.2.4. Public Access

The use of club facilities by the public may lead to conflict with the user group. Some clubs hire out their facilities to other users but may not be satisfied with the level of care taken. Public access to other infrastructure, such as jumps and cross-country courses, may lead to liability issues in the case of injury, leading clubs to limit public access as far as possible and erect warning signage.

Table 5: Infrastructure present at Shire Reserves

Reserve	Infrastructure
Brickwood Reserve	Recreation Centre – gym, courts, function rooms etc. Sports pavilion Sports fields BMX track and pavilion Car parks Firebreaks and walking paths Fences and gates Signage Dilapidated building intended for community uses Irrigation systems and bores
King Road Pony Club Reserve	Clubhouse Storage sheds Car parking area Arenas with fencing Cross-country course with permanent jumps Dilapidated, unused infrastructure, e.g. dog pens for Peel Hunt Club hounds Firebreaks, fences and gates Signage
Serpentine Sports Reserve	Equestrian clubhouse and storage sheds Two equestrian sports fields (pony club and polocrosse club) Cross-country course Golf Clubhouse and storage sheds Golf course fairways and greens Firebreaks and walking paths Irrigation systems and bores Fences and gates Signage
Yangedi Airfield Reserve	SABC clubhouse and ablution facilities Hangars with stored aircraft and taxiways Two runways Fuel storage DFES helipad and heli-tankers BOM radar tower Firebreaks, fences and gates Signage Irrigation systems and bores
Bella Cumming Reserve	Firebreaks, fences and gates
Tonkin Street Flora Reserve	Men’s Shed clubhouse and storage sheds Firebreaks, fences and gates Signage
Craghill Way Reserve	Firebreaks, fences and gates
Pony Place Reserve	Community hall Firebreaks and walking paths Fences and gates
Wattle Road Nature Reserve	Firebreaks, fences and gates

5. Action Plan

5.1. Introduction

An implementation plan is provided in this section. Various divisions within the Shire are responsible for implementation and it is anticipated that the actions will be implemented over several years. All actions arising from this plan are presented below, along with priorities, responsibilities and requirements.

5.2. Priorities and Status

Priorities for implementation of the actions have been classified as follows:

- Key – an essential action for successful management of banksia woodland
- High – a significant action which should be implemented in the short term
- Medium – a secondary, longer-term action
- Low – a desired action that is funding dependent

The status of each action has been assessed as Implemented, Implemented in Part, Not Yet Implemented, and Ongoing. In addition, each action has been classified as:

- Business as Usual – an ongoing action that occurs as a matter of course
- Short Term – to be implemented within three years of adoption of the management plan
- Medium Term – to be implemented within seven years of adoption of the management plan
- Long Term – a desired action that is funding dependent and may be implemented within ten years of adoption

5.3. Responsibilities, Monitoring and Review

The Shire of Serpentine Jarrahdale is responsible for actions within this plan. In some instances, the Shire may be assisted in implementing a strategy by a partner who has an interest or responsibility, and there may be opportunities for grants to implement strategies. The management plan actions will be monitored and reviewed, and the management plan will be revised every three years.

The best single point of contact will be the Natural Reserves Specialist. Divisions within the Shire with responsibilities for implementation, sometimes in collaboration with user groups, include:

- Natural Reserves Specialist
- Strategic Environmental Specialist
- Emergency Services
- Community Development
- Development Services
- Environmental Health

Resources are designated as staff time, budget dependent and/or funding (grant) dependent. Costs are not estimated here as they are highly context dependent (particularly on vegetation condition and patch size) but will be estimated for each reserve.

Table 4: Banksia Woodland Action Plan

No.	Action	Priority	Timing	Status	Responsibility	Resources
1	**Utilise the planning system to retain and protect remnant banksia woodland.**	**Key**	**Business as Usual**	**Ongoing**	**Statutory Planning**	**Staff Time**
2	Formalise access to banksia woodland in high use areas through establishment of walking paths that reduce trampling.	Medium	Medium Term	Not Yet Implemented	Operations	Budget Dependent
3	Erect signage in high use areas to inform users of the values of the banksia woodland.	Medium	Short Term	Implemented in Part	Operations	Budget Dependent
4	**Map and treat dieback every three years.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent**
5	Control access to banksia woodland through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations	Budget Dependent
6	Work with user groups to protect and minimize impacts to the remnant vegetation.	High	Business as Usual	Ongoing	Natural Reserves, User Groups	Staff Time
7	Implement measures to exclude motorised vehicles from bridle trails, and/or the remnant vegetation.	High	Medium Term	Implemented in Part	Operations	Budget Dependent
8	Erect fences or other structures to delineate user group areas.	Low	Long Term	Not Yet Implemented	Natural Reserves, User Groups	Budget Dependent
9	Ensure that formalised paths and other access routes cross dieback fronts to the lowest degree possible.	Medium	Medium Term	Not Yet Implemented	Natural Reserves	Staff Time
10	Establish dieback hygiene policies, including vehicle washdown points and foot baths for pedestrians with appropriate signage.	High	Long Term	Implemented in Part	Natural Reserves	Budget Dependent
11	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environmental Specialist	Budget Dependent
12	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves	Budget Dependent
13	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves	Staff Time
14	**Establish and implement a weed control program that utilises best practice methods.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves, Landcare SJ**	**Budget Dependent**
15	Establish and implement a control program for woody weeds.	High	Business as Usual	Ongoing	Natural Reserves	Budget Dependent
16	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ	Budget and/or Funding Dependent
17	**Minimise burning and other disturbance of banksia woodland.**	**Key**	**Short Term**	**Implemented in Part**	**Emergency Services**	**Staff Time**
18	Avoid disturbance to the Conservation Zone of a reserve and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves	Staff Time

No.	Action	Priority	Timing	Status	Responsibility	Resources
19	Maintain fire intervals of 16-40 years.	High	Long Term	Not Yet Implemented	Emergency Services	Staff Time
20	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Staff Time
21	Restrict any essential fuel load management to the Vegetation Management Zone of a reserve.	High	Short Term	Not Yet Implemented	Emergency Services	Budget Dependent
22	Ensure that any essential fuel load management utilises weed control as a priority, with control burning as a last resort.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves	Budget Dependent
23	Ensure that any control burning is restricted to vegetation boundaries, providing a mosaic of vegetation ages including long unburnt.	High	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Budget Dependent
24	**Follow any burning or other disturbance with weed control for at least two years post-fire.**	**Key**	**Business as Usual**	**Implemented in Part**	**Emergency Services, Natural Reserves**	**Budget Dependent**
25	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations	Staff Time
26	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves	Funding Dependent
27	Monitor implementation of the management plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time
28	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time
29	Review and revise the management plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time

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Appendix 1 – Flora Surveys and Lists

The Shire's banksia woodland reserves have been surveyed, up to five times, by Shire staff. Some reserves were surveyed by quadrat, supplemented by nearby species, and some by a walk-through survey.

The following table includes all of the species recorded in the banksia woodland reserves, and which reserve(s) they have been recorded in.

A total of 271 species were recorded across the nine banksia woodland reserves, comprising 236 native species and 35 weeds.

Demonstrating the diversity and variability of banksia woodland, only ten species were recorded in all nine reserves (six native and four weeds), 26 in eight reserves (22 native and four weeds), 20 in seven (18 native and two weeds), and 97 species were recorded in only one reserve (82 native and 15 weeds).

Small scale diversity is demonstrated by Bella Cumming and Tonkin Street reserves, which are separated by less than 400m, but more than half of their cumulative species were only recorded in one reserve. 65 species were recorded in both reserves, 44 only in Bella Cumming, and 25 only in Tonkin Street.

Wattle Road Nature Reserve, being transitional between banksia and marri woodlands, recorded 33 species (24 native and nine weeds) which were not recorded in any other reserve. Many of these species were more typical of marri woodland.

Species (* denotes an introduced/weedy species)	**Brickwood**	**King Road**	**Serpentine Sports**	**Yangedi**	**Bella Cumming**	**Tonkin Street**	**Craghill Way**	**Pony Place**	**Wattle Road**
Acacia alata									X
Acacia applanata									X
Acacia huegelii				X					
**Acacia iteaphylla*			X	X		X	X		X
Acacia lasiocarpa				X				X	
**Acacia longifolia*							X	X	X
Acacia pulchella					X		X	X	
Acacia saligna									X
Acacia sessilis			X						
Acacia stenoptera				X		X			
Acacia teretifolia					X				
Acacia willdenowiana			X	X					
Actinostrobus pyramidalis									X
Adenanthos cygnorum		X		X			X	X	X
Adenanthos meisneri	X		X		X	X			X
Adenanthos obovatus								X	
**Agonis flexuosa*									X
Agrostocrinum hirsutum			X		X	X			X
**Aira cupaniana*		X	X						
Allocasuarina fraseriana		X		X	X	X		X	X
Allocasuarina humilis	X		X	X	X	X			X
Amphipogon turbinatus	X	X	X	X	X	X			X
**Anagallis arvensis*						X			X
Andersonia caerulea									X
Anigozonthos manglesii	X	X	X	X	X	X		X	X

Species (* denotes an introduced/weedy species)	**Brickwood**	**King Road**	**Serpentine Sports**	**Yangedi**	**Bella Cumming**	**Tonkin Street**	**Craghill Way**	**Pony Place**	**Wattle Road**
**Arctotheca calendula*	X		X					X	
Arnocrinum preissii				X					
Astartea fascicularis									X
Astroloma pallidum					X				X
Austrodanthonia acerosa	X			X	X	X			
Austrostipa compressa			X	X	X			X	
Austrostipa elegantissima				X					
Austrostipa semibarbata	X								
**Avena barbata*			X	X			X		X
Baeckea camphorosmae	X		X	X	X				X
Banksia attenuata	X	X	X	X	X	X		X	X
Banksia grandis			X		X	X			
Banksia ilicifolia		X		X			X	X	
Banksia menziesii	X	X	X	X	X	X			
Banksia nivea	X		X		X	X			X
Bansia telmatiaea									X
Baumea juncea									X
Billardiera bicolor									X
Billardiera heterophylla									X
Billardiera sp.			X		X				
Boronia ramosa									X
Boronia spathulata					X				
Bossiaea eriocarpa	X	X	X	X	X	X	X		X
Brachyloma preissii		X					X		
**Briza maxima*	X	X	X	X	X	X	X	X	X
**Briza minor*			X	X					X
**Bromus diandrus*									X
Burchardia congesta	X	X	X	X	X	X	X		X
Caesia micrantha			X	X	X	X		X	X
Caladenia discoidea			X						
Caladenia flava	X	X	X	X	X	X		X	X
Caladenia longicauda						X			
Calectasia grandiflora	X		X		X				
**Callistemon* sp.									X
Calytrix angulata				X					
Calytrix flavescens		X	X				X	X	
Calytrix fraseri		X	X	X					
**Carpobrotus edulis*		X		X				X	
Cassytha glabella					X				X
Cassytha ramosa									X
Cassytha sp.		X		X					
Centrolepis drummondiana		X		X					
Chamaescilla corymbosa	X	X	X	X	X	X			X
**Cicendia filiformis*			X						
Clematis pubescens									X
Comesperma calymega			X		X			X	X
Conospermum stoechadis	X		X		X				X
Conostephuim pendulum	X	X		X	X		X		
Conostephium preissii		X	X	X					
Conostylis aculeata	X	X		X	X	X			X
Conostylis juncea			X	X		X		X	X
Conostylis setigera	X		X		X	X			X

Species (* denotes an introduced/weedy species)	**Brickwood**	**King Road**	**Serpentine Sports**	**Yangedi**	**Bella Cumming**	**Tonkin Street**	**Craghill Way**	**Pony Place**	**Wattle Road**
Corymbia calophylla							X		X
Corynotheca micrantha		X			X				
**Cotula turbinata*			X						
Craspedia variabilis						X			
Crassula colorata		X		X					
Crassula exserta	X				X				
Cyathochaeta avenacea	X		X	X	X	X			X
Cyathochaeta clandestina			X						
**Cynodon dactylon*									X
Dampiera linearis		X		X	X			X	X
Dampiera teres									X
Dasypogon bromeliifolius	X	X	X	X	X	X	X	X	X
Daviesia decurrens					X				
Daviesia nudiflora			X		X	X			
Daviesia physodes			X		X				X
Daviesia preissii	X			X	X			X	X
Daviesia triflora						X			X
Desmocladus fasciculatus	X	X	X		X	X	X		X
Desmocladus flexuosus	X	X		X	X		X	X	X
Dianella revoluta		X	X						
**Disa bracteata*				X			X	X	X
Diuris magnifica					X				
Drakaea glyptodon	X			X					
Drosera erythrorhiza	X	X	X	X	X	X			X
Drosera gigantea	X								
Drosera glanduligera	X								
Drosera menziesii	X	X	X	X	X				X
Drosera nitidula				X					X
Drosera porrecta						X			
**Ehrharta calycina*		X	X	X	X	X	X	X	X
**Eragrostis curvula*				X			X		X
Eremaea asterocarpa				X					
Eremaea pauciflora	X	X	X	X					X
Eriochilus sp.						X			
**Eucalyptus maculata*							X		
Eucalyptus marginata	X		X		X	X			X
**Eucalyptus* sp.									X
Eucalyptus todtiana							X		
Euchilopsis linearis				X					
Gastrolobium capitatum		X	X	X	X	X			X
**Gladiolus caryophyllaceus*		X		X	X		X	X	
Gnephosis angianthoides		X	X						
**Gomphocarpus fruticosus*									X
Gompholobium capitatum	X			X					
Gompholobium knightianum									X
Gompholobium polymorphum			X		X	X			
Gompholobium tomentosum	X	X	X	X	X	X	X	X	X
Gonocarpus pithyoides		X			X				X
Haemodorum laxum	X		X	X	X	X			X
Haemodorum loratum									X
Haemodorum simulans					X	X			
Haemodorum sparsiflorum						X		X	

Species (* denotes an introduced/weedy species)	**Brickwood**	**King Road**	**Serpentine Sports**	**Yangedi**	**Bella Cumming**	**Tonkin Street**	**Craghill Way**	**Pony Place**	**Wattle Road**
Haemodorum spicatum		X		X				X	
Hakea lissocarpha						X			
Hakea prostrata									X
Hakea ruscifolia			X			X			
Hakea stenocarpa					X	X			
Hakea trifurcata	X								
Hardenbergia comptoniana									X
Hibbertia acerosa	X								
Hibbertia diamesogenos	X		X						
Hibbertia ferruginea				X					
Hibbertia huegelii	X		X	X		X			X
Hibbertia hypericoides	X			X	X	X			
Hibbertia racemosa		X							
Hibbertia spicata	X								
Hibbertia subvaginata				X					
Hibbertia vaginata	X		X	X				X	
Homalosciadium homalocarpum								X	
Hovea chorizemifolia					X				
Hovea trisperma	X		X	X	X	X			X
Hyalosperma cotula		X	X		X	X		X	
Hybanthus calycinus					X	X			
Hypocalymma angustifolium		X						X	X
Hypocalymma robustum	X			X	X	X			
**Hypochaeris glabra*		X	X	X	X	X		X	X
**Hypochaeris radicata*	X	X	X	X	X	X		X	X
Hypolaena exsulca			X	X			X		X
Isolepis cernua		X		X					
Isopogon asper	X								
Jacksonia furcellata		X		X				X	
Jacksonia lehmannii									X
Jacksonia sternbergiana	X				X				
Johnsonia pubescens				X	X				
Kennedia prostrata	X		X		X	X			X
Kingia australis	X								X
Kunzea glabresens		X		X			X	X	X
Kunzea micrantha			X						
Kunzea recurva		X		X					X
Labichea punctata	X		X		X	X			X
Lachnagrostis filiformis			X	X					
Lagenophora huegelii	X				X				
Laxmannia squarrosa	X	X		X					
Lechenaultia biloba	X	X			X	X			X
Lechenaultia floribunda				X					
Lepidobolus preissianus						X			X
Lepidosperma leptostachyum	X		X		X	X			X
Lepidosperma pubisquameum	X	X	X	X	X	X		X	X
Lepidosperma scabrum	X		X		X				X
Lepidosperma squamatum	X	X	X	X	X	X			X
Lepidosperma sp. E Perth Flora			X						
Leporella fimbriata	X								
Leucopogon sp.		X	X	X			X		
Levenhookia pusilla	X							X	

Species (* denotes an introduced/weedy species)	**Brickwood**	**King Road**	**Serpentine Sports**	**Yangedi**	**Bella Cumming**	**Tonkin Street**	**Craghill Way**	**Pony Place**	**Wattle Road**
Levenhookia stipitata	X	X						X	
Lobelia tenuior	X	X							
Lomandra caespitosa		X	X						
Lomandra nigricans				X					
Lomandra preissii				X		X			X
Lomandra sp.	X	X		X	X	X		X	
Lomandra suaveolens				X					
**Lotus angustissimus*									X
Loxocarya cinerea		X		X		X			X
**Lupinus* sp.									X
Lyginia barbata		X	X	X			X		X
Lyginia imberbis	X	X	X	X	X		X	X	X
Lysinema ciliatum	X			X					
Macarthuria australis		X		X		X			
Macrozamia riedlei	X	X		X			X		
Melaleuca preissiana				X			X	X	
Melaleuca thymoides				X					X
Melaleuca trichophylla		X							X
Mesomelaena pseudostygia	X		X		X	X			X
Mesomelaena tetragona	X		X		X	X			X
Microtis media				X					X
Monotaxis grandiflora	X								X
Monotaxis occidentalis					X	X			
Neurachne alopecuroidea	X	X	X	X	X	X			X
Nuytsia floribunda				X			X	X	X
Opercularia vaginata	X				X	X			
**Ornithopus sativus*									X
**Orobanche minor*				X					X
Patersonia juncea	X				X				
Patersonia occidentalis	X	X	X	X		X	X	X	X
Pericalymma ellipticum			X						
Persoonia elliptica					X	X			
Persoonia saccata				X					
Petrophile linearis	X	X	X	X	X	X		X	X
Petrophile macrostachya			X		X				
Philotheca spicata		X		X	X			X	X
Phlebocarya ciliata		X	X	X		X		X	X
Phlebocarya filifolia									X
Pimelea sp.					X				X
Pimelea sulphurea			X						
**Pinus radiata*				X					
Phyllandium paradoxum	X								
Podotheca angustifolia					X				
Podotheca chrysantha		X		X					
Podotheca gnaphalioides				X					
Poranthera gnaphalioides								X	
Poranthera microphylla								X	
Prasophyllum parvifolium	X	X		X					
Pterochaeta paniculata	X		X		X				
Pterostylis nana				X					
Pterostylis recurva		X						X	X
Pterostylis vittata		X	X	X		X		X	X

Species (* denotes an introduced/weedy species)	**Brickwood**	**King Road**	**Serpentine Sports**	**Yangedi**	**Bella Cumming**	**Tonkin Street**	**Craghill Way**	**Pony Place**	**Wattle Road**
Pyrorchis nigricans	X		X	X	X	X			
Quinetia urvillei	X			X					
Ranunculus pumilio					X		X		
Regelia ciliata				X					
Rhodanthe citrina		X							
**Romulea rosea*		X		X	X	X			X
Scaevola calliptera					X	X			
Scaevola repens									X
Schoenus clandestinus	X				X				
Schoenus curvifolius	X	X	X	X					X
Schoenus pedicellatus									X
Scholtzia involucrata		X		X					X
Senecio hispidulus			X						
Siloxerus humifusus		X	X	X					
**Solanum nigrum*							X		
**Sonchus oleraceus*	X	X		X	X				X
Sowerbaea laxiflora	X	X		X		X			
Stachystemon vermicularis	X		X	X	X	X			
Stirlingia latifolia			X	X	X	X	X		X
Stylidium brunonianum	X	X	X	X					X
Stylidium carnosum								X	
Stylidium ciliatum						X			X
Stylidium hirsutum					X				X
Stylidium piliferum	X		X						
Stylidium repens		X		X					
Stylidium schoenoides				X					
Synaphea sp.			X						
Tetraria australiensis									X
Tetraria octandra	X		X	X	X	X		X	X
Tetratheca hirsuta			X		X				
Thelymitra crinita		X	X			X			
Thelymitra macrophylla			X	X	X			X	X
Thelymitra vulgaris									X
Thysanotus arenarius		X							
Thysanotus manglesianus		X		X				X	X
Thysanotus multiflorus						X			
Thysanotus sparteus		X	X	X			X		
Thysanotus thyrsoideus					X				
Thysanotus triandrus			X	X				X	X
Trachymene pilosa	X	X	X	X	X	X		X	X
Tricoryne elatior	X	X	X	X	X	X		X	X
Tricoryne humilis		X						X	
Tripterococcus brunonis			X						
**Ursinia anthemoides*	X	X	X	X	X	X	X	X	X
Verticordia plumosa									X
**Wahlenbergia capensis*					X	X			X
**Watsonia meriana*			X	X	X		X		X
Xanthorrhoea brunonis			X	X			X		X
Xanthorrhoea gracilis			X			X		X	X
Xanthorrhoea preissii	X	X	X	X	X	X	X	X	X
Xanthosia huegelii	X		X	X	X			X	X
Xylomelum occidentale	X		X		X	X			X

Species (* denotes an introduced/weedy species)	**Brickwood**	**King Road**	**Serpentine Sports**	**Yangedi**	**Bella Cumming**	**Tonkin Street**	**Craghill Way**	**Pony Place**	**Wattle Road**
**Zantedeschia aethiopica*		X		X			X	X	

Appendix 2 – Fauna Surveys and Lists

The primary source of information on fauna inhabiting Shire reserves is Harvey *et al.* (1997) *Ground Fauna of the Bushland Remnants on the Ridge Hill shelf and Pinjarra Landforms Perth.* The reserves have not been surveyed in detail for fauna more recently. While the original document has not been located, individual lists can be found in some reserve management plans, which form the basis for the following table.

Species (*denotes an introduced species)	**Brickwood**	**King Road**	**Serpentine Sports**	**Yangedi**	**Bella Cumming**	**Tonkin Street**	**Craghill Way**	**Pony Place**	**Wattle Road**
Mammals									
Quenda (southern brown bandicoot)	X	X	X	X					
Western grey kangaroo	X			X					
*House mouse	X		X						
*Rabbit	X	X		X					
*Cat	X	X		X					
*Fox	X	X		X					
*Rat			X						
Amphibians									
Red-thighed froglet	X								
Sandplain froglet	X		X						
Moaning frog	X		X						
Pobblebonk	X		X						
Guenther's toadlet	X								
Glauert's froglet			X						
Reptiles									
South-western sandplain worm lizard	X								
Western bearded dragon	X								
South-western cool skink	X		X						
Fence skink	X		X						
South-western odd striped ctenotus	X								
West coast four-toed lerista	X								
Common dwarf skink	X		X						
Southern pale-flecked morethia	X								
Bobtail	X		X						
Racehorse goanna	X		X						
Southern blind snake	X		X						
Dugite	X			X					
Gould's hooded snake	X								
Two toed earless skink			X						
Tiger snake			X	X					
Burton's legless lizard									
Marbled gekko				X					
Black-tailed monitor				X					
Birds									
Australian magpie	X		X	X					
Australian raven	X		X	X					
Australian sittella	X								
Baudin's black cockatoo				X					
Black swan				X					
Black-faced cuckoo-shrike	X		X	X					
Black-faced woodswallow	X								

Species (*denotes an introduced species)	Brickwood	King Road	Serpentine Sports	Yangedi	Bella Cumming	Tonkin Street	Craghill Way	Pony Place	Wattle Road
Brown goshawk	X								
Brown honeyeater	X		X	X					
Brown thornbill				X					
Buff-banded rail				X					
Carnaby's black cockatoo	X			X					
Common bronzewing			X	X					
Crested pigeon				X					
*Domestic pigeon	X								
Dusky woodswallow	X			X					
Elegant parrot	X			X					
Fan-tailed cuckoo				X					
Galah	X		X	X					
Great egret				X					
Grey butcherbird				X					
Grey fantail	X		X	X					
Grey-breasted white-eye	X								
*Laughing dove	X								
*Laughing kookaburra	X		X	X					
Little eagle	X								
Magpie-lark	X								
Misteltoebird	X								
Nankeen kestrel				X					
New holland honeyeater				X					
Painted button-quail	X								
Pallid cuckoo	X								
Rainbow bee-eater	X		X	X					
Red wattlebird	X			X					
Red-capped parrot	X		X	X					
Red-capped robin				X					
Red-tailed black cockatoo	X								
Richard's pipit				X					
Ringnecked parrot	X		X	X					
Rufous whistler	X		X	X					
Sacred kingfisher	X			X					
Shining bronze-cuckoo			X						
Silvereye	X		X	X					
Singing honeyeater			X						
Splendid fairy wren			X	X					
Southern boobook owl				X					
*Spotted turtle-dove				X					
Straw-necked ibis				X					
Striated pardalote	X								
Swamp harrier				X					
Tree martin	X			X					
Welcome swallow	X			X					
Western gerygone	X		X	X					
Western rosella	X								
Western spinebill	X			X					
Western thornbill				X					
White-browed scrub wren				X					
White-cheeked honeyeater				X					
White-faced heron				X					

Species (*denotes an introduced species)	Brickwood	King Road	Serpentine Sports	Yangedi	Bella Cumming	Tonkin Street	Craghill Way	Pony Place	Wattle Road
White-fronted chat	X								
Willy wagtail	X			X					
Yellow-rumped thornbill			X	X					

Appendix 3 – Threatened and Priority Flora and Fauna

Threatened and priority flora and fauna have been recorded in the Shire's banksia woodland reserves. The species listed in official records from the Department of Biodiversity, Conservation and Attractions are listed in the table below. Anecdotal or informal records are not listed.

Species	Status T (Threatened) P1-4 (Priority 1-4)	Brickwood	King Road	Serpentine Sports	Yangedi	Bella Cumming	Tonkin Street	Craghill Way	Pony Place	Wattle Road
Flora										
Acacia oncinophylla	P3			X						
Drosera occidentalis	P4	X		X						
Morelotia australiensis	T			X						
Schoenus pennisetis	P3	X								
Fauna										
Birds										
Calyptorhynchus banksii naso (Forest red-tailed black cockatoo)	T			X						
Calyptorhynchus baudinii (Baudin's black cockatoo)	T	X		X						
Calyptorhynchus latirostris (Carnaby's black cockatoo)	T	X		X	X					
Mammals										
Isoodon fusciventer (quenda)	P4	X		X	X				X	
Reptiles										
Acanthophis antarcticus (common death adder)	P3	X								

Appendix 4 – Fire Management Strategy for Banksia Woodland

Principles of Fire Management for Banksia Woodland

1. **For fuel load management, weed control is preferable to control burning and should be the method of choice.**

2. **All fire in banksia woodland, whether wildfire or control burning, must be followed by at least two years of thorough weed control.**

3. **Burning of banksia woodland dramatically increases fire hazard, through regrowth of highly flammable shrubs such as spearwood.**

4. **Burning of banksia woodland increases fire hazard and rate of spread through increased growth and invasion of flammable grassy weeds.**

5. **Any disturbance of banksia woodland results in regrowth of highly flammable shrubs such as spearwood and grassy weeds, leading to increased fire hazard.**

6. **Fire hazard in banksia woodland reduces when it is more than ten years since the last fire, and significantly reduces when more than 20 years since the last fire.**

7. **The fire interval for banksia woodland should be 16 – 40 years, and the ideal cycle is 24 – 28 years between fires.**

8. **Fire control in banksia woodland should consider dieback and avoid spread into uninfected areas by movement of machinery across dieback fronts and other hygiene methods.**

Brickwood Reserve Action Plan

R17490, R51101, R37404

1. Background

1.1. Location

Brickwood Reserve is located in Byford, associated with the Briggs Park recreation centre and surrounded by urban development (Figure 1). It is also adjacent to the BaptistCare Graceford Aged Care Home.

Brickwood Reserve contains three main vegetation communities: marri woodland, banksia woodland and clay-based wetlands. The reserve is 53.1 ha with 45.5 ha remnant vegetation, of which approximately 2.13 ha is banksia woodland. This action plan specifically deals with the banksia woodland area, while the other communities are addressed in the marri woodland management plan.

The majority of the reserve (including the banksia woodland) is vested with the Shire for the purpose of Recreation, but current uses also include Conservation. There are numerous user groups for the reserve, particularly associated with the Briggs Park recreation centre, and significant infrastructure.

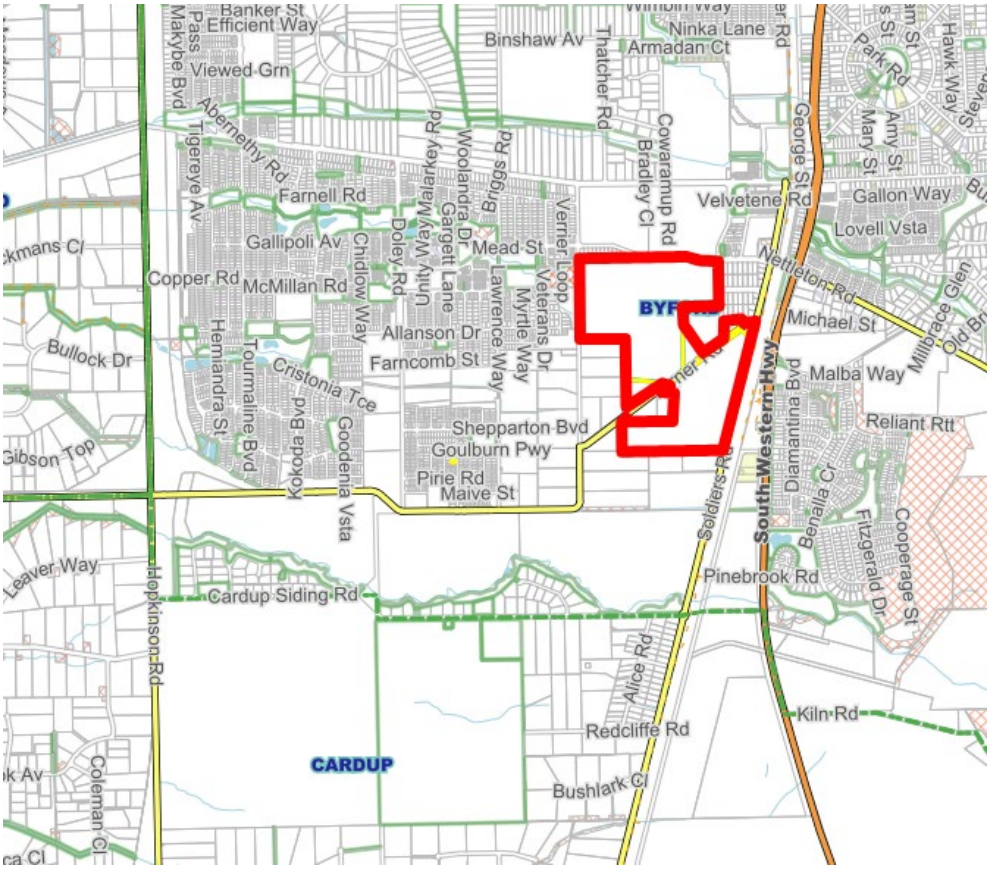


Figure 1: Location of Brickwood Reserve.

Brickwood Reserve is classified into four main management zones (Figure 2). These are:

Conservation Zone (green): Areas of remnant vegetation of high biodiversity and scientific reference value which include both dieback free and dieback infected areas. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must utilise dieback hygiene procedures such as clean-down and take extreme care to prevent spread of dieback from infected to uninfected areas.

Vegetation Management Zone (red): Areas of remnant vegetation of biodiversity and scientific reference value which may be disturbed, or dieback or weed infested. This is a buffer zone and may receive fuel load management for protection of people, property and conservation values by weed control or control burning on assessment by officers as required and appropriate. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must consider movement and reduce spread of dieback from infected to uninfected areas through clean down procedures.

Recreation Zone (yellow): This is largely the areas of Briggs Park used for active and passive recreation. Management of this zone is principally for the purpose of recreation, while minimising impacts on the adjacent remnant vegetation.

Community Zone (blue): This zone contains the BaptistCare Graceford Aged Care Home. The high vulnerability of the residents means that management of the adjacent vegetation prioritises the protection of people and property.

This Action Plan applies to the Conservation and Vegetation Management Zones.

1.2. Soils

Four soil types occur in Brickwood Reserve: Forrestfield F5, Pinjarra P1a, Pinjarra P1e and Pinjarra B1 (Table 1 and Figure 3). Banksia woodland only occurs on the Pinjarra B1 soil type.

Table 1: Soil Types of Brickwood Reserve.

Reserve	Soil landscape unit	Description	Banksia occurrence
Brickwood Reserve	Forrestfield F5 phase	Poorly defined stream channels on lowest slopes with deep acidic yellow duplex soils and sandy alluvial gradational brown earths.	No
	Pinjarra P1a phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or effective duplex) soils. Shallow pale sand to sandy loam over clay; imperfect to poorly drained and generally not susceptible to salinity.	No
	Pinjarra P1e phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or effective duplex) soils. Shallow pale sand to sandy loam over very gravelly clay; moderately well drained.	No
	Pinjarra B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	Yes

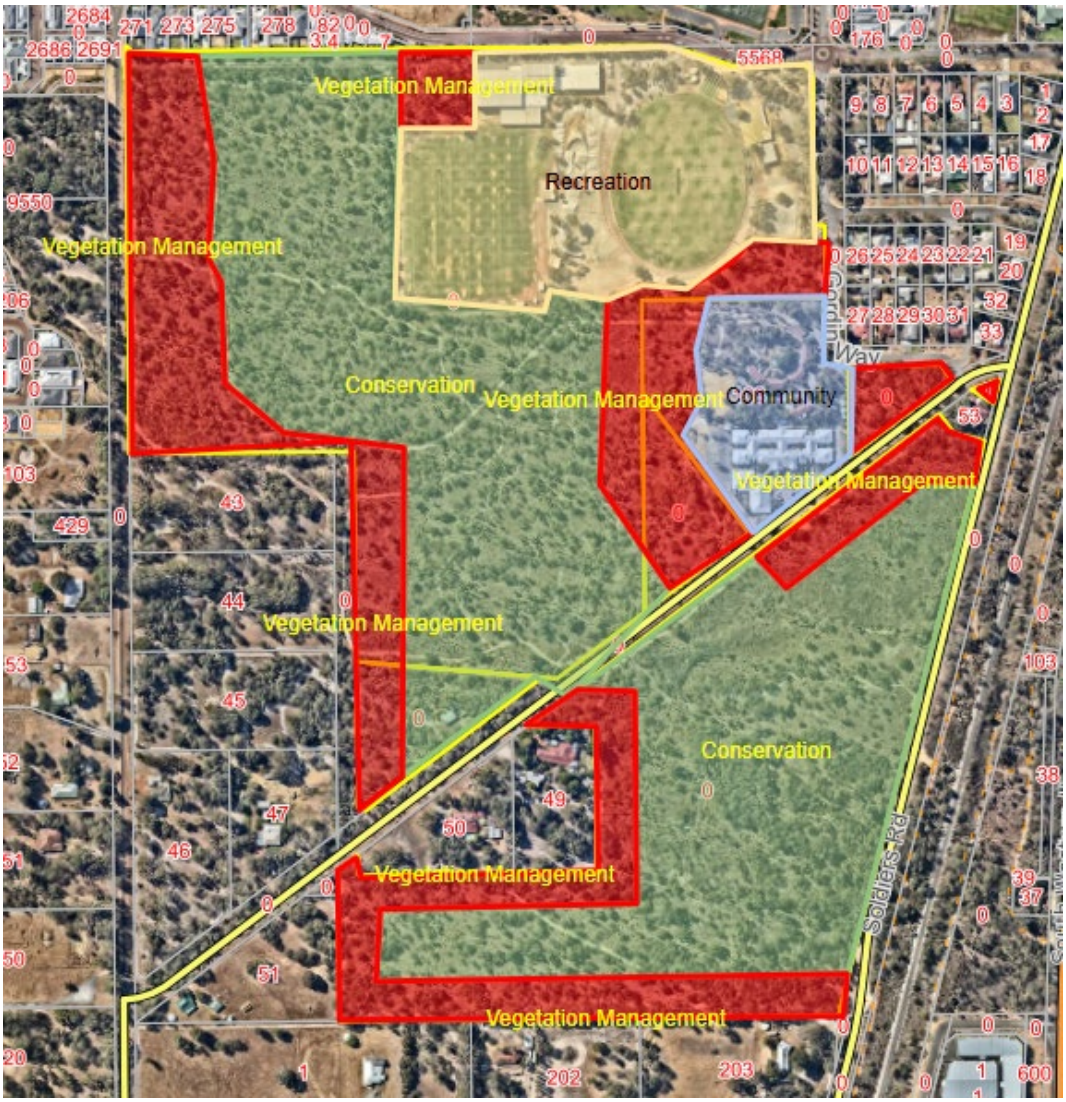


Figure 2: Uses and Management Zones of Brickwood Reserve.

1.3. Biodiversity

Brickwood Reserve contains three main vegetation communities: marri woodland, banksia woodland and clay-based wetlands. The banksia woodland is approximately 2.13 ha in area (Figure 4) and belongs to the vegetation complex SCP21a (central *Banksia attenuata* - *Eucalyptus marginata* woodlands).

The entire reserve belongs to Threatened Ecological Communities and is an Environmentally Sensitive Area. Bush Forever site 321 includes the reserve and adjacent vegetated corridors.

The vegetation in Brickwood Reserve is in Very Good to Excellent condition overall, although the banksia woodland is in poorer condition (Good to Very Good) in parts due to dieback infestation.

The flora of Brickwood Reserve has been frequently surveyed and is diverse. A number of Threatened and Priority flora species have been recorded in the area.

The fauna of Brickwood Reserve has not been thoroughly surveyed since 1997. The fauna recorded at the time was diverse, and anecdotal evidence suggests that the majority are still present. A number

of Threatened and Priority fauna species have been recorded, including all three species of black cockatoos, and quenda (southern brown bandicoot).

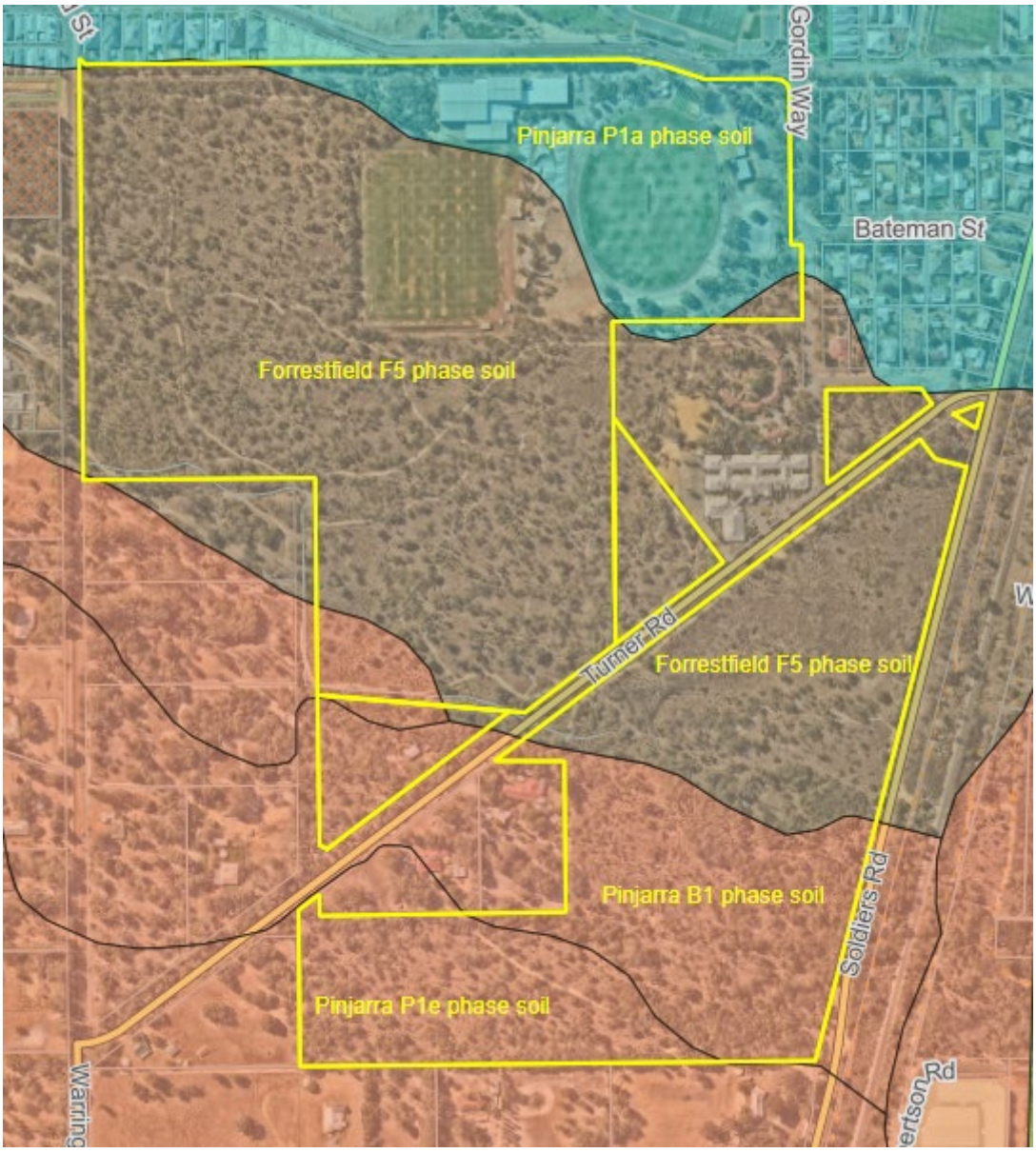


Figure 3: Soil types of Brickwood Reserve.

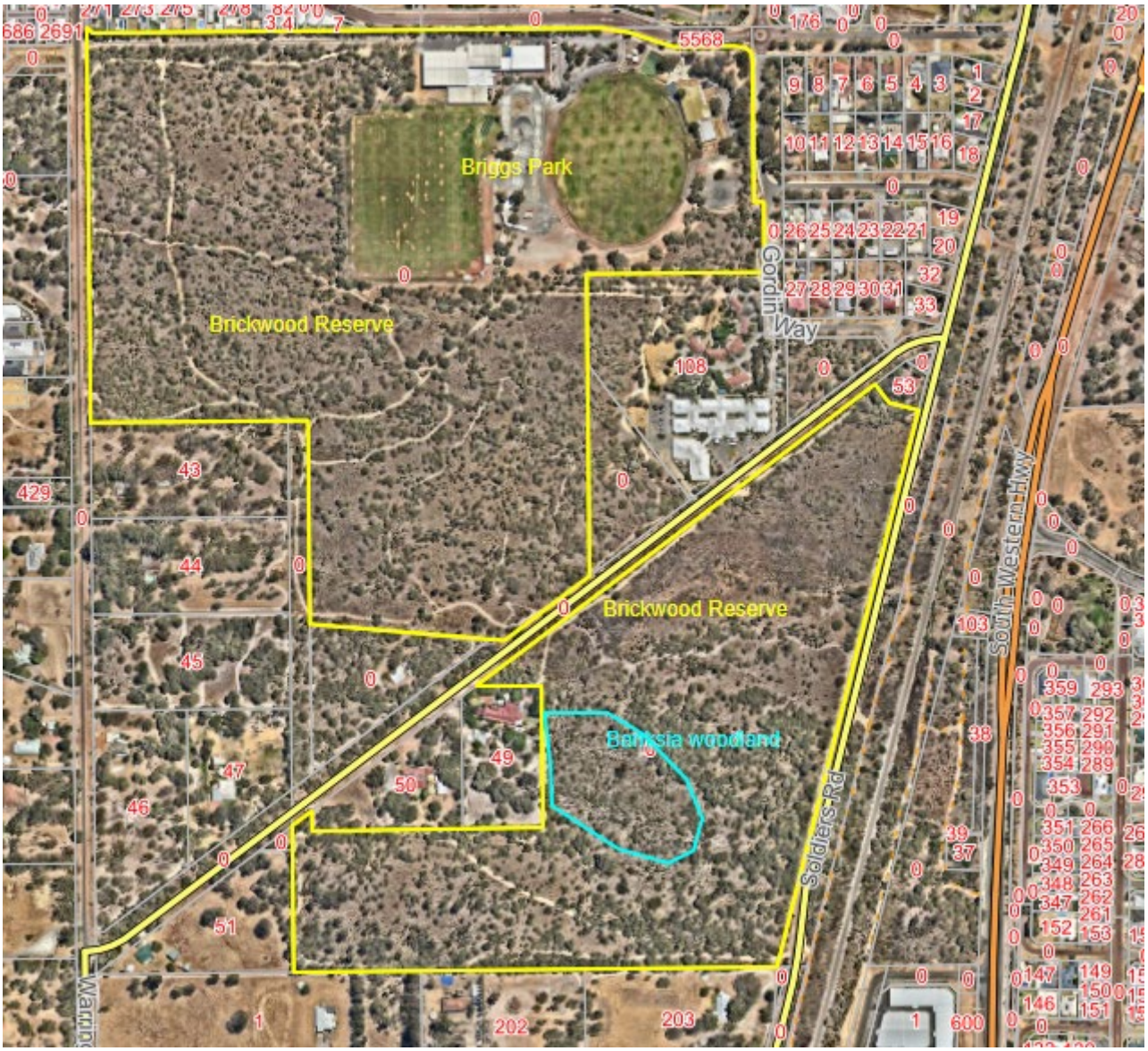


Figure 4: Location of Banksia Woodland in Brickwood Reserve.

1.4. Water Resources

Brickwood Reserve is generally low-lying, and as such much of it is seasonally waterlogged, except for the banksia woodland area. A clay-based wetland lies to the northwest of the banksia woodland, with a watercourse (drain) running from the wetland along the boundary of the reserve to discharge across Warrington Road to the west.

The entire reserve, except for the recreational facilities and the banksia woodland, is a Conservation Category wetland. A small area of Resource Enhancement wetland lies between the reserve and the BaptistCare Graceford Aged Care Home, while the recreational facilities and the land surrounding the reserve is classified as a Multiple Use wetland.

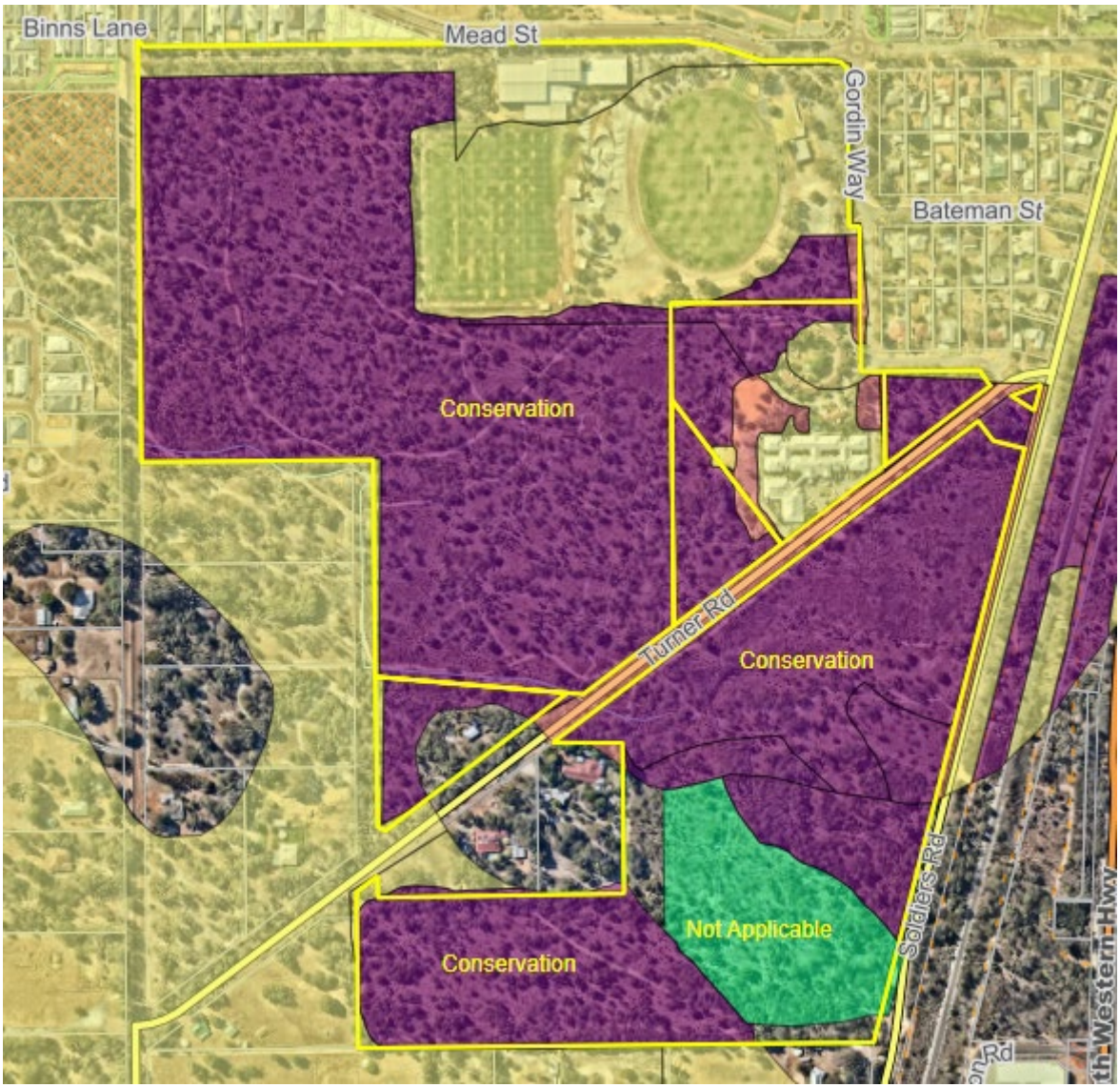


Figure 5: Geomorphic Wetland Types of Brickwood Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of Brickwood Reserve include:

- Recreational pressure from surrounding urban areas
- Community anxiety about fire hazard and pressure for control burning
- Arson, vandalism and degradation
- Illegal dumping of rubbish and garden waste
- Illegal access by motorised vehicles and associated damage to fences and vegetation
- Weed invasion, from ovals, dumping, surrounding urban areas, and carried in by users
- Feral and domestic animals (foxes, rabbits, cats) predating fauna and damaging vegetation
- Dieback disease (*Phytophthora cinnamomi*), particularly in the banksia woodland
- Nutrient runoff from ovals

3. Reserve Usage

3.1. Vesting and Land Tenure

The vesting purpose, land tenure and current uses of the various lots that make up Brickwood Reserve are listed below in Table 2, and the land parcels shown in Figure 6. While R37404 (L106, in two parcels on either side of Graceford) is not vested with the Shire, it is traditionally managed as part of Brickwood Reserve and so is included here.

Table 2: Vesting Purpose, Land Tenure and Uses of Brickwood Reserve.

Reserve	Reserve and Lot Number	Vesting Purpose and Land Tenure	Current Uses
Brickwood Reserve	R17490 L5567, L111 and L112 Mead Street, Byford	Shire of Serpentine Jarrahdale – Recreation	Recreation and Conservation
	R51101 L48 Turner Road, Byford	Shire of Serpentine Jarrahdale – Environmental Conservation, Recreation, Community Centre and Purposes Ancillary Thereto	Recreation and Conservation
BaptistCare Graceford Aged Care Home	R37404 L106 Turner Road, Byford	WA Baptist Hospital and Homes Trust Inc. – Aged Persons Homes	Buffer Zone and Conservation

3.2. User Groups

The principal users of Brickwood Reserve are:

- Users of the recreation centre's facilities (gym, courts and function rooms), including school children in out of school hours care and coaching
- Sports groups, including cricket, football and diamond sports groups
- BMX club
- Friends of Brickwood
- Landcare SJ Inc.
- Informal users, particularly for walking and dog exercise
- BaptistCare Graceford Aged Care Home management, for R37404 vegetation management

Conflict between user groups with differing priorities can cause issues for management of the reserve. Informal users, particularly as pressure grows with the expanding urban development around the reserve, can degrade the vegetation and conflict with the conservation groups. BaptistCare's management of the vegetation around Graceford for protection of people and property can also conflict with conservation.

Figure 6: Reserve Numbers and Locations of Brickwood Reserve.

3.3. Infrastructure

The infrastructure located in Brickwood Reserve includes:

- Recreation centre (gym, courts and function rooms) managed by The Y (formerly YMCA)
- Sports pavilions and associated storage sheds
- Cricket nets
- Tennis courts (dilapidated and unused)
- Skate park
- BMX track
- Car parks
- Dilapidated building intended for community uses (R51101)
- Sports fields
- Bores and irrigation systems
- Fences and gates
- Signage, relating to entry and use, and conservation
- Firebreaks, some surfaced with limestone for trafficability
- Informal walking paths

The infrastructure is mostly maintained by the Shire. Despite a high standard of maintenance. good lighting and high community use and surveillance, vandalism and theft are constant but low-level threats.

Fire can threaten people, property and conservation values. Fires can start inside or adjacent to buildings and structures, and are often the result of vandalism, kitchen accidents or electrical faults. Bush or grass fires threaten buildings and structures through embers, radiant heat and direct contact. Cleared areas around buildings limit the opportunity for bush and grass fires to reach them. Fire in nearby bushland has the potential to damage infrastructure.

4. Action Plan

Table 3: Action Plan for Brickwood Reserve.

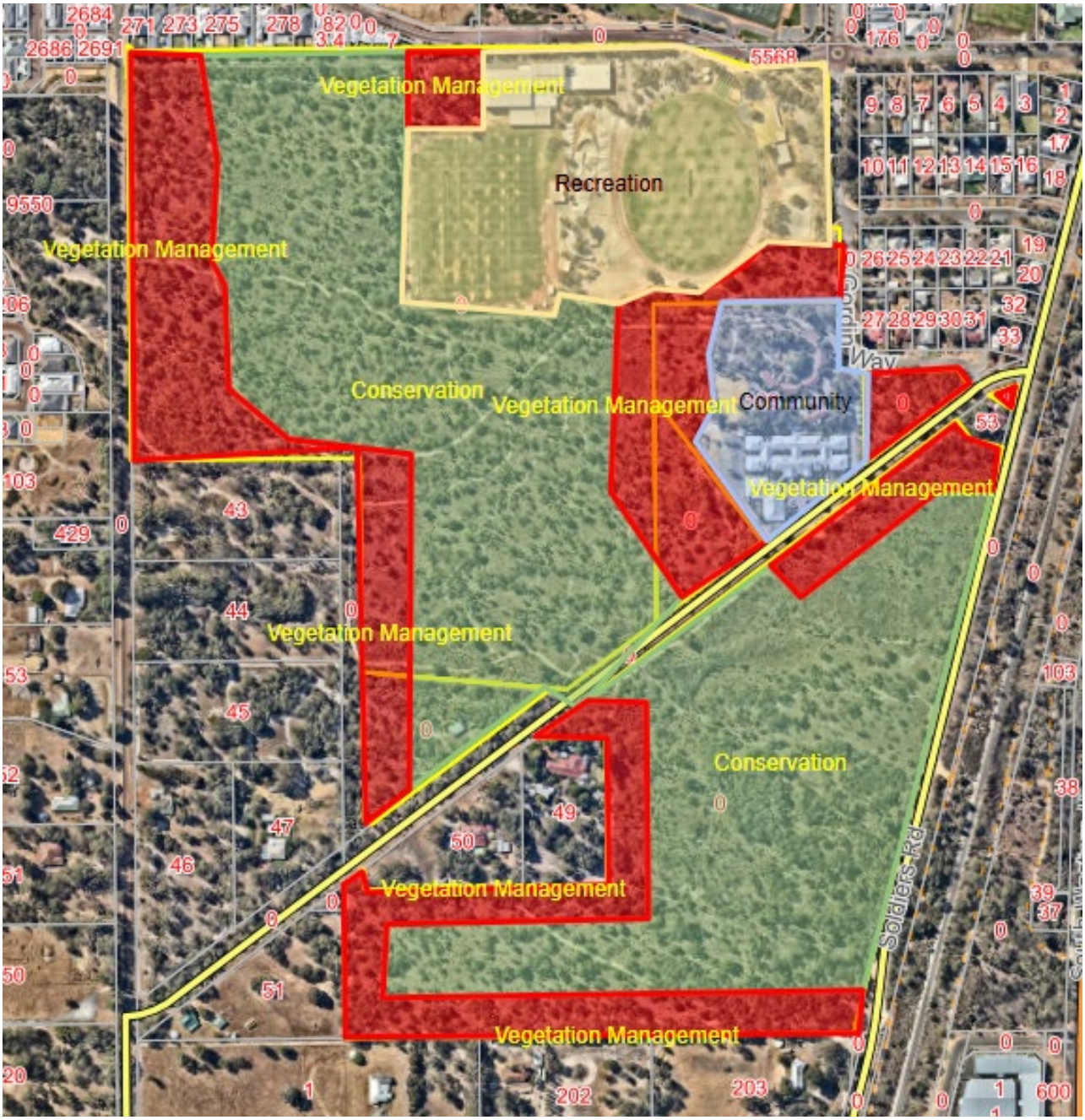
No.	Action	Priority	Timing	Status	Responsibility	Cost
1	**Utilise the planning system to retain and protect remnant banksia woodland.**	**Key**	**Business as Usual**	**Ongoing**	**Statutory Planning**	**Staff Time**
2	Formalise access to banksia woodland in high use areas through establishment of walking paths that reduce trampling.	Medium	Medium Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
3	Erect signage in high use areas to inform users of the values of the banksia woodland.	Medium	Short Term	Implemented in Part	Operations	Budget Dependent - $2,000
4	**Map and treat dieback every three years.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $6,000**
5	Control access to banksia woodland through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
6	Work with user groups to protect and minimize impacts to remnant vegetation.	High	Business as Usual	Ongoing	Natural Reserves, User Groups	Staff Time
7	Implement measures to exclude motorised vehicles from the remnant vegetation.	High	Medium Term	Implemented in Part	Operations	Budget Dependent - $2,000
8	Ensure that formalised paths and other access routes cross dieback fronts to the lowest degree possible.	Medium	Medium Term	Not Yet Implemented	Natural Reserves	Staff Time
9	Establish dieback hygiene policies, including vehicle washdown points and foot baths for pedestrians with appropriate signage.	High	Long Term	Implemented in Part	Natural Reserves	Budget Dependent - $2,000
10	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environmental Specialist	Budget Dependent - $3,000
11	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves	Budget Dependent - $3,000
12	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves	Staff Time

No.	Action	Priority	Timing	Status	Responsibility	Cost
13	**Establish and implement a weed control program that utilises best practice methods.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves, Landcare SJ**	**Budget Dependent - $3,000**
14	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ	Budget and/or Funding Dependent - $1,500
15	**Minimise burning and other disturbance of banksia woodland.**	**Key**	**Short Term**	**Implemented in Part**	**Emergency Services**	**Staff Time**
16	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves	Staff Time
17	Maintain fire intervals of 16-40 years.	High	Long Term	Not Yet Implemented	Emergency Services	Staff Time
18	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Staff Time
19	Restrict any essential fuel load management to the Vegetation Management Zone.	High	Short Term	Not Yet Implemented	Emergency Services	Budget Dependent - $1,500
20	Ensure that any essential fuel load management utilises weed control as a priority, with control burning as a last resort.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves	Budget Dependent - $3,000
21	Ensure that any control burning is restricted to vegetation boundaries, providing a mosaic of vegetation ages including long unburnt.	High	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Budget Dependent - $1,500
22	**Follow any burning or other disturbance with weed control for at least two years post-fire.**	**Key**	**Business as Usual**	**Implemented in Part**	**Emergency Services, Natural Reserves**	**Budget Dependent - $3,000**
23	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations	Staff Time
24	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves	Funding Dependent - $2,500
25	Monitor implementation of the management plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time
26	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time
27	Review and revise the management plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time

5. Fire Management Strategy for Brickwood Reserve

Conservation Zone (green) – works exclusion; avoid disturbance

Vegetation Management Zone (red) – fuel load management if deemed appropriate and necessary by weed control and/or control burning followed by weed control



Dieback – present in some areas

Weeds – control required following disturbance

Firebreaks – present along boundaries

King Road Pony Club Reserve Action Plan
R36950

1. Background

1.1. Location

King Road Pony Club Reserve is located in Oldbury (Figure 1). The reserve is dominated by banksia woodland, with a small pocket of marri woodland in the east. The reserve is 25.7 ha with 18.08 ha remnant vegetation. This action plan specifically deals with the banksia woodland area.

The reserve is vested with the Shire for the purpose of Recreation, but current uses also include Conservation. The principal user group for the reserve is the Peel Horse and Pony Club, which maintains significant infrastructure.

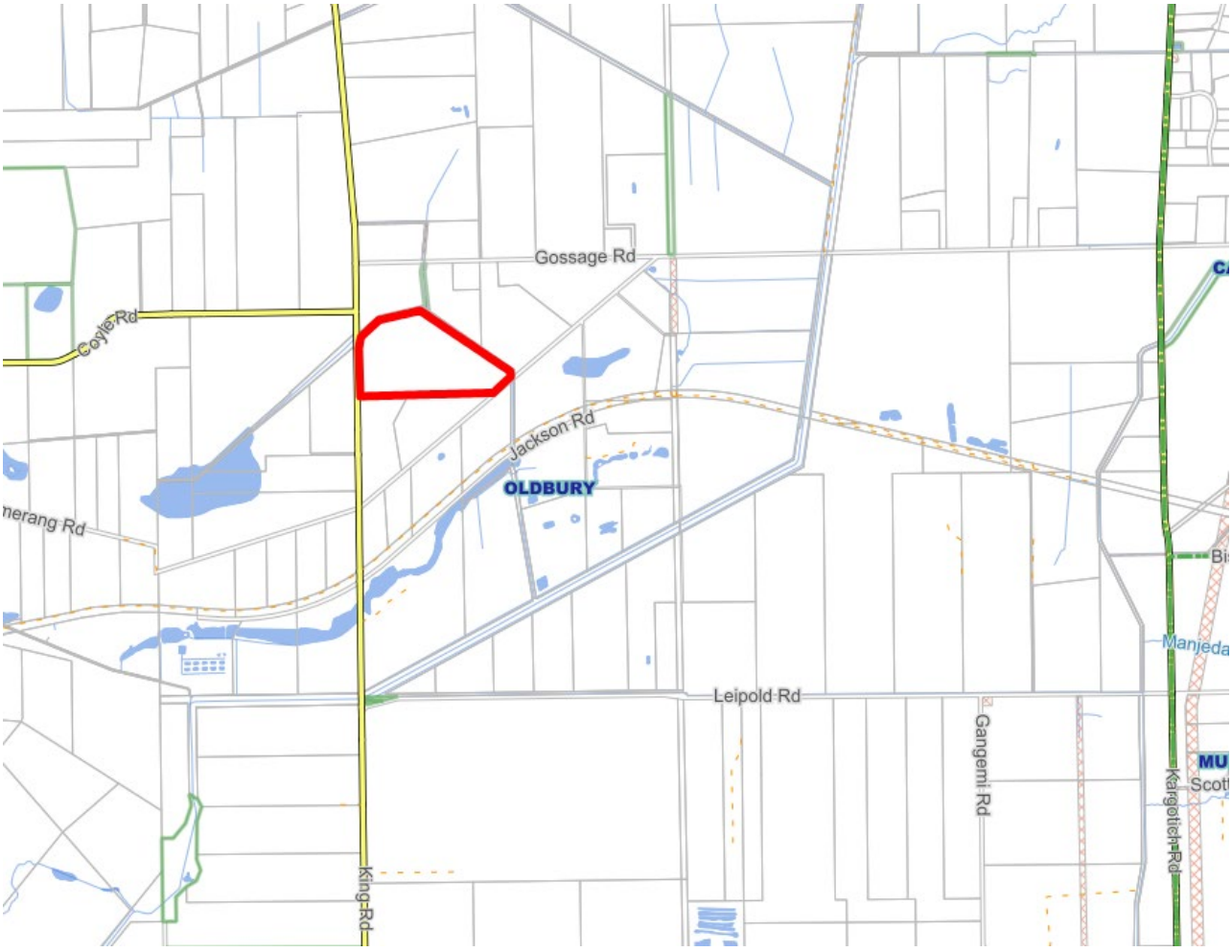


Figure 1: Location of King Road Pony Club Reserve.

King Road Pony Club Reserve is classified into three main management zones (Figure 2). These are:

Conservation Zone (green): Areas of remnant vegetation of high biodiversity and scientific reference value which include both dieback free and dieback infected areas. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must utilise dieback hygiene procedures such as clean-down and take extreme care to prevent spread of dieback from infected to uninfected areas.

Vegetation Management Zone (red): Areas of remnant vegetation of biodiversity and scientific reference value which may be disturbed, or dieback or weed infested. This is a buffer zone and may receive fuel load management for protection of people, property and conservation values by weed control or control burning on assessment by officers as required and appropriate. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must consider movement and reduce spread of dieback from infected to uninfected areas through clean down procedures.

Recreation Zone (yellow): This is the area in use by the Peel Horse and Pony Club. Management of this zone is principally for the purpose of recreation, while minimising impacts on the adjacent remnant vegetation.

This Action Plan applies to the Conservation and Vegetation Management Zones.

Figure 2: Management Zones of King Road Pony Club Reserve.

1.2. Soils

Four soil types occur in King Road Pony Club Reserve: Bassendean B1, Bassendean B2, Bassendean B4 and Bassendean B6 (Table 1 and Figure 3). Banksia woodland occurs on all four soil types, grading into marri woodland on the Bassendean B4 soils.

Table 1: Soil types of King Road Pony Club Reserve.

Reserve	Soil landscape unit	Description	Banksia occurrence
King Road Pony Club Reserve	Bassendean B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	Yes
	Bassendean B2 phase	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m.	Yes
	Bassendean B4 phase	Broad poorly drained sandplain with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan.	Partial
	Bassendean B6 phase	Sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands.	Yes

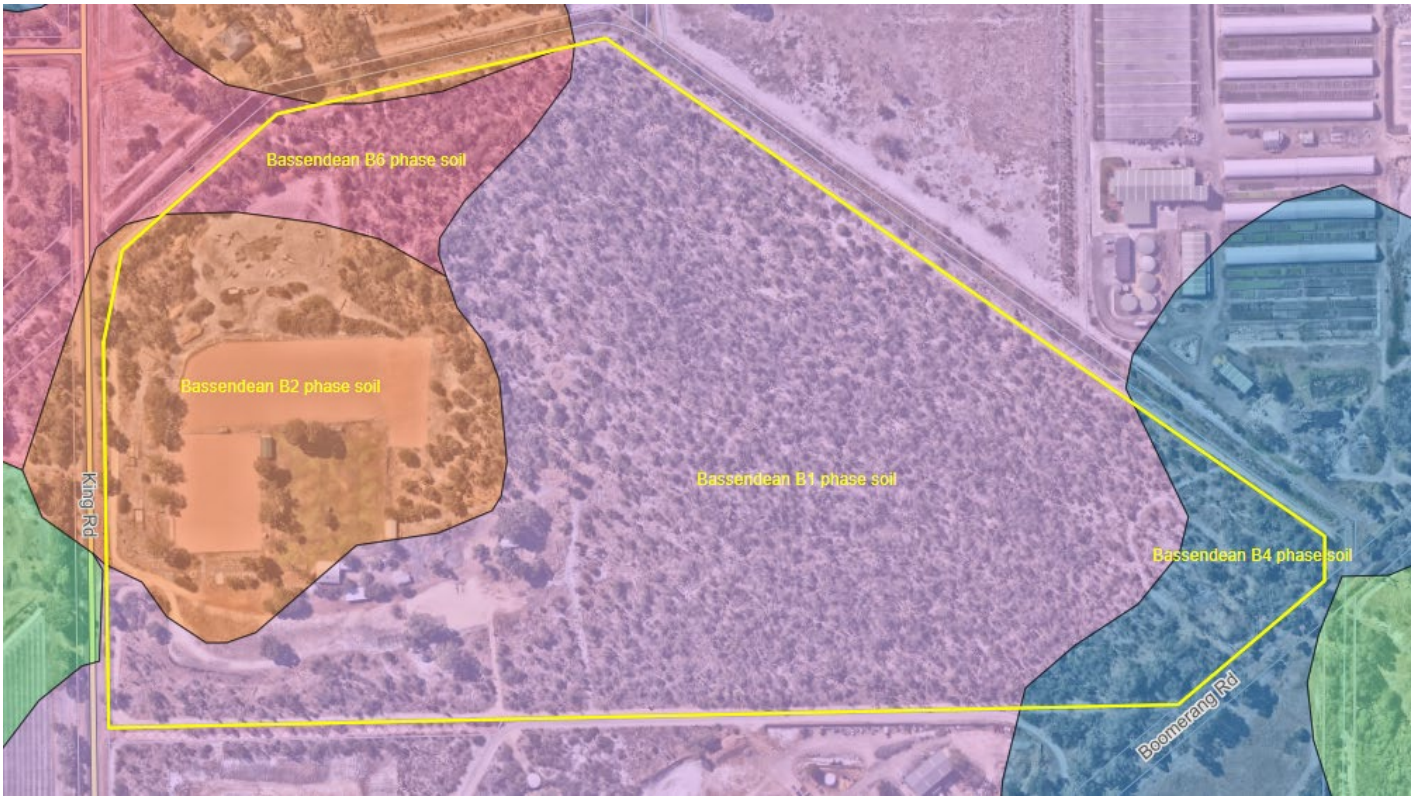


Figure 3: Soil Types of King Road Pony Club Reserve.

1.3. Biodiversity

King Road Pony Club Reserve contains one dominant vegetation community, banksia woodland, with a small area of marri woodland at the eastern end. The banksia woodland is approximately 18.08 ha in area (Figure 4) and belongs to the vegetation complex SCP21a (central *Banksia attenuata - Eucalyptus marginata* woodlands).

The entire reserve belongs to a Threatened Ecological Community. The vegetation is in Very Good to Good condition overall.

The flora of King Road Pony Club Reserve has been frequently surveyed and is diverse. No Threatened and Priority flora species have been recorded in the area. The fauna has never been formally surveyed, although anecdotally some Threatened and Priority fauna species may occur, such as black cockatoos, and quenda (southern brown bandicoot).

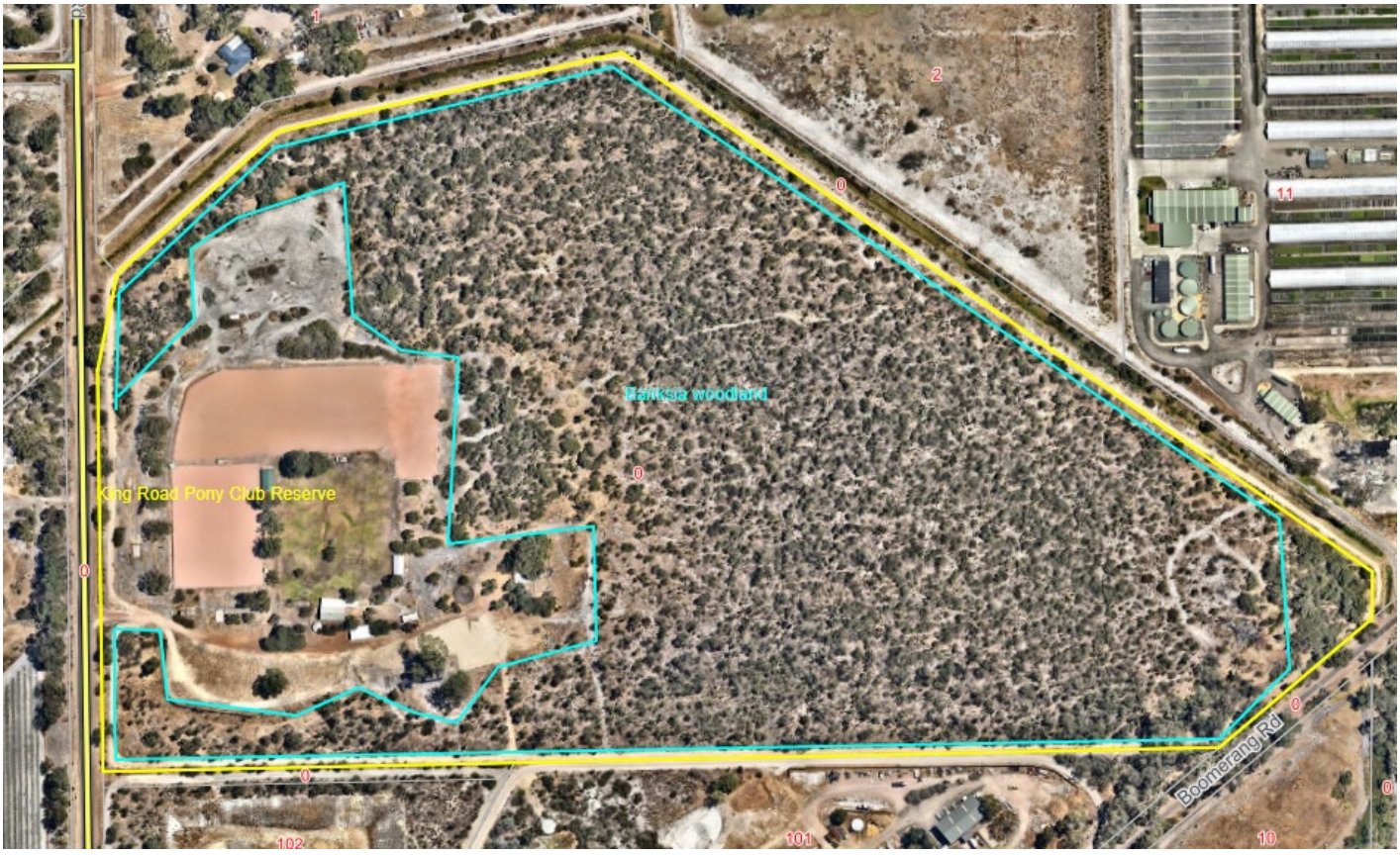


Figure 4: Location of Banksia Woodland in King Road Pony Club Reserve.

1.4. Water Resources

King Road Pony Club Reserve is high in the landscape, sitting on top of a sand dune, with lower-lying areas in the north and east. A major watercourse (drain) runs along the northern boundary of the reserve to discharge eventually into the Serpentine River.

Multiple Use wetlands intersect the western and eastern corners of the reserve (Figure 5), and act as buffers to Conservation Category wetlands further away from the reserve.

Figure 5: Geomorphic Wetlands of King Road Pony Club Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of King Road Pony Club Reserve include:

- Recreational pressure from users
- Community anxiety about fire hazard and pressure for control burning
- Illegal access by motorised vehicles and associated damage to fences and vegetation
- Weed invasion, from surrounding land and carried in by users
- Feral and domestic animals (foxes, rabbits, cats) predating fauna and damaging vegetation
- Dieback disease (*Phytophthora cinnamomi*)
- Pony club's cross-country course, which passes through infected and dieback free zones

3. Reserve Usage

3.1. Vesting and Land Tenure

The vesting purpose, land tenure and current uses of King Road Pony Club Reserve are listed below in Table 2.

Table 2: Vesting Purpose, Land Tenure and Current Uses of King Road Pony Club Reserve.

Reserve	Reserve and Lot Number	Vesting Purpose and Land Tenure	Current Uses
King Road Pony Club Reserve	R36950 L427 King Road, Oldbury	Shire of Serpentine Jarrahdale – Recreation	Recreation and Conservation

3.2. User Groups

The principal user group of King Road Pony Club Reserve is the Peel Horse and Pony Club. Historically the reserve was also used by the Peel Hunt Club, and periodically other users such as the Mundijong Poultry Club have used areas of the reserve. Landcare SJ Inc. has held a National Tree Day planting event in the reserve.

Threats and pressures for the user group include:

- Risk management and insurance, with stricter liability and higher premiums.
- Membership and member involvement, as any community group has a general problem with attracting and maintaining motivated volunteers to fill positions and undertake other tasks, with a few people tending to do most of the work.
- Conflict among user groups with differing priorities, such as potential conflict between the pony club's activities and protection of the conservation values of the remnant vegetation.
- Compliance with legislation, such as health regulations.
- Security of tenure with ongoing long-term lease agreements essential to ensure that private investment in reserves is supported. User groups' facilities are mostly developed and maintained entirely by volunteers.

3.3. Infrastructure

The infrastructure located in King Road Pony Club Reserve includes:

- Clubhouse, toilets and associated storage sheds
- Car parking area
- Horse riding arenas with fences and jumps
- Horse yards
- Bore and water tanks
- Cross-country course with permanent jumps
- Dilapidated, unused infrastructure such as the dog pens once used by the Peel Hunt Club
- Firebreaks, fences, gates and signage

The infrastructure is almost entirely maintained by the Peel Horse and Pony Club, with the Shire maintaining firebreaks and other public infrastructure. Despite fences and locked gates, vandalism and theft are constant but low-level threats.

Fire can threaten people, property and conservation values. Fires can start inside or adjacent to buildings and structures, and are often the result of vandalism, kitchen accidents or electrical faults. Bush or grass fires threaten buildings and structures through embers, radiant heat and direct contact. Cleared areas around buildings limit the opportunity for bush and grass fires to reach them. Fire in nearby bushland has the potential to damage infrastructure.

4. Action Plan

Table 3: Action Plan for King Road Pony Club Reserve.

No.	Action	Priority	Timing	Status	Responsibility	Cost
1	**Utilise the planning system to retain and protect remnant banksia woodland.**	**Key**	**Business as Usual**	**Ongoing**	**Statutory Planning**	**Staff Time**
2	Formalise access to banksia woodland in high use areas through establishment of walking paths that reduce trampling.	Medium	Medium Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
3	Erect signage in high use areas to inform users of the values of the banksia woodland.	Medium	Short Term	Implemented in Part	Operations	Budget Dependent - $2,000
4	**Map and treat dieback every three years.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $10,000**
5	Control access to banksia woodland through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
6	Work with the Peel Horse and Pony Club to protect and minimize impacts to vegetation, particularly along the cross-country course.	High	Business as Usual	Ongoing	Natural Reserves, Pony Club	Staff Time
7	Implement measures to exclude motorised vehicles from the remnant vegetation.	High	Medium Term	Implemented in Part	Operations	Budget Dependent - $2,000
8	Ensure that formalised paths and other access routes cross dieback fronts to the lowest degree possible.	Medium	Medium Term	Not Yet Implemented	Natural Reserves	Staff Time
9	Establish dieback hygiene policies, including vehicle washdown points and foot baths for pedestrians with appropriate signage.	High	Long Term	Implemented in Part	Natural Reserves	Budget Dependent - $2,000
10	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environmental Specialist	Budget Dependent - $3,000
11	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves	Budget Dependent - $3,000

No.	Action	Priority	Timing	Status	Responsibility	Cost
12	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves	Staff Time
13	**Establish and implement a weed control program that utilises best practice methods.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves, Landcare SJ**	**Budget Dependent - $5,000**
14	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ	Budget and/or Funding Dependent - $1,500
15	**Minimise burning and other disturbance of banksia woodland.**	**Key**	**Short Term**	**Implemented in Part**	**Emergency Services**	**Staff Time**
16	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves	Staff Time
17	Maintain fire intervals of 16-40 years.	High	Long Term	Not Yet Implemented	Emergency Services	Staff Time
18	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Staff Time
19	Restrict any essential fuel load management to the Vegetation Management Zone.	High	Short Term	Not Yet Implemented	Emergency Services	Budget Dependent - $1,500
20	Ensure that any essential fuel load management utilises weed control as a priority, with control burning as a last resort.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves	Budget Dependent - $5,000
21	Ensure that any control burning is restricted to vegetation boundaries, providing a mosaic of vegetation ages including long unburnt.	High	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Budget Dependent - $1,500
22	**Follow any burning or other disturbance with weed control for at least two years post-fire.**	**Key**	**Business as Usual**	**Implemented in Part**	**Emergency Services, Natural Reserves**	**Budget Dependent - $5,000**
23	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations	Staff Time
24	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves	Funding Dependent - $2,500
25	Monitor implementation of the management plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time
26	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time
27	Review and revise the management plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time

5. Fire Management Strategy for King Road Pony Club Reserve

Conservation Zone (green) – works exclusion; avoid disturbance

Vegetation Management Zone (red) – fuel load management if deemed appropriate and necessary by weed control and/or control burning followed by weed control

Dieback – present in some areas

Weeds – control required following disturbance

Firebreaks – present along boundaries

Serpentine Sports Reserve Action Plan
R19134

1. Background

1.1. Location

Serpentine Sports Reserve is located in Serpentine (Figure 1). It consists of two land parcels, one on each side of Karnup Road. The northern side contains holes 10-18 of the golf course, while the southern side contains the first nine holes, the David Buttfield Equestrian Park, the John Lyster Polocrosse Ground and a small area leased for a communications tower (Figure 2). It also includes regionally significant areas of remnant vegetation in the Paul Robinson Reserve and nearby banksia woodland. This action plan applies to the southern land parcel only.

The reserve contains three main vegetation complexes: banksia woodland, marri woodland and a clay-based wetland. The reserve is 46.4 ha with 10.1 ha remnant vegetation of which 3.41 ha is banksia woodland. This action plan specifically deals with the banksia woodland area.

The reserve is vested with the Shire for the purpose of Recreation, Racecourse and Showground, but current uses also include Conservation. The principal user groups for the reserve are the Serpentine Horse and Pony Club, the Serpentine/Foothills Polocrosse Club, the Serpentine and Districts Golf Club, and the Serpentine Environmental Group. Each user group uses and maintains significant infrastructure.

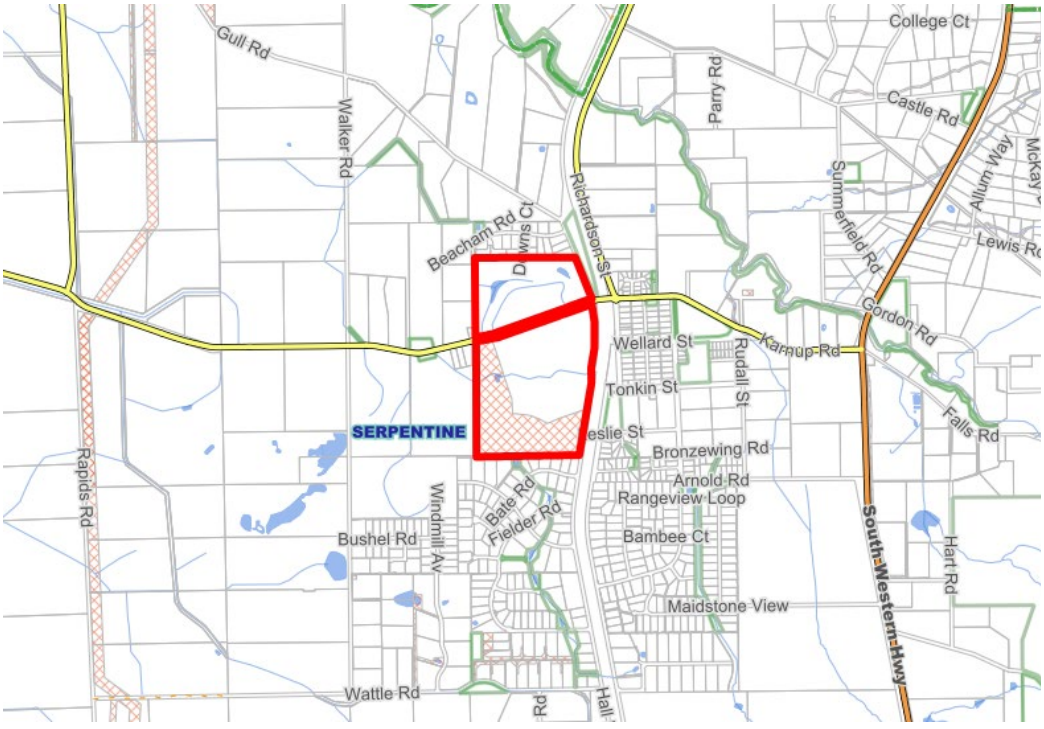


Figure 1: Location of Serpentine Sports Reserve.

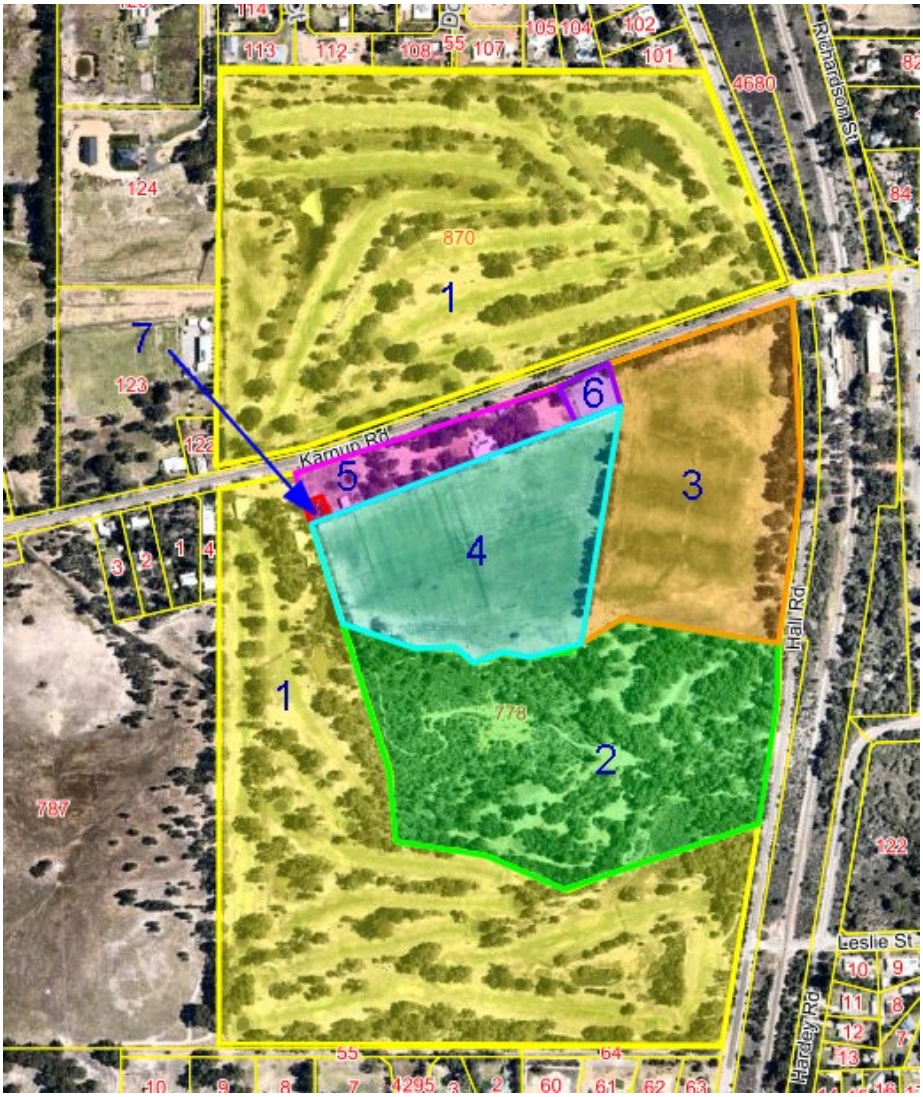


Figure 2: Land Uses of Serpentine Sports Reserve.

1 – Golf course
2 – Conservation area
3 – John Lyster Polocrosse Ground
4 – David Buttfield Equestrian Park
5 – Equestrian clubhouses and parking
6 – Netball courts (disused)
7 – Communications tower

Serpentine Sports Reserve is classified into three main management zones (Figure 3). These are:

Conservation Zone (green): Areas of remnant vegetation of high biodiversity and scientific reference value which include both dieback free and dieback infected areas. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must utilise dieback hygiene procedures such as clean-down and take extreme care to prevent spread of dieback from infected to uninfected areas.

Vegetation Management Zone (red): Areas of remnant vegetation of biodiversity and scientific reference value which may be disturbed, or dieback or weed infested. This is a buffer zone and may receive fuel load management for protection of people, property and conservation values by weed control or control burning on assessment by officers as required and appropriate. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must consider movement and reduce spread of dieback from infected to uninfected areas through clean down procedures.

Recreation Zone (yellow): This is the area in use by the Serpentine Horse and Pony Club, the Serpentine/Foothills Polocrosse Club, and the Serpentine and Districts Golf Club. Management of this zone is principally for the purpose of recreation, while minimising impacts on the adjacent remnant vegetation.

This Action Plan applies to the Conservation and Vegetation Management Zones.

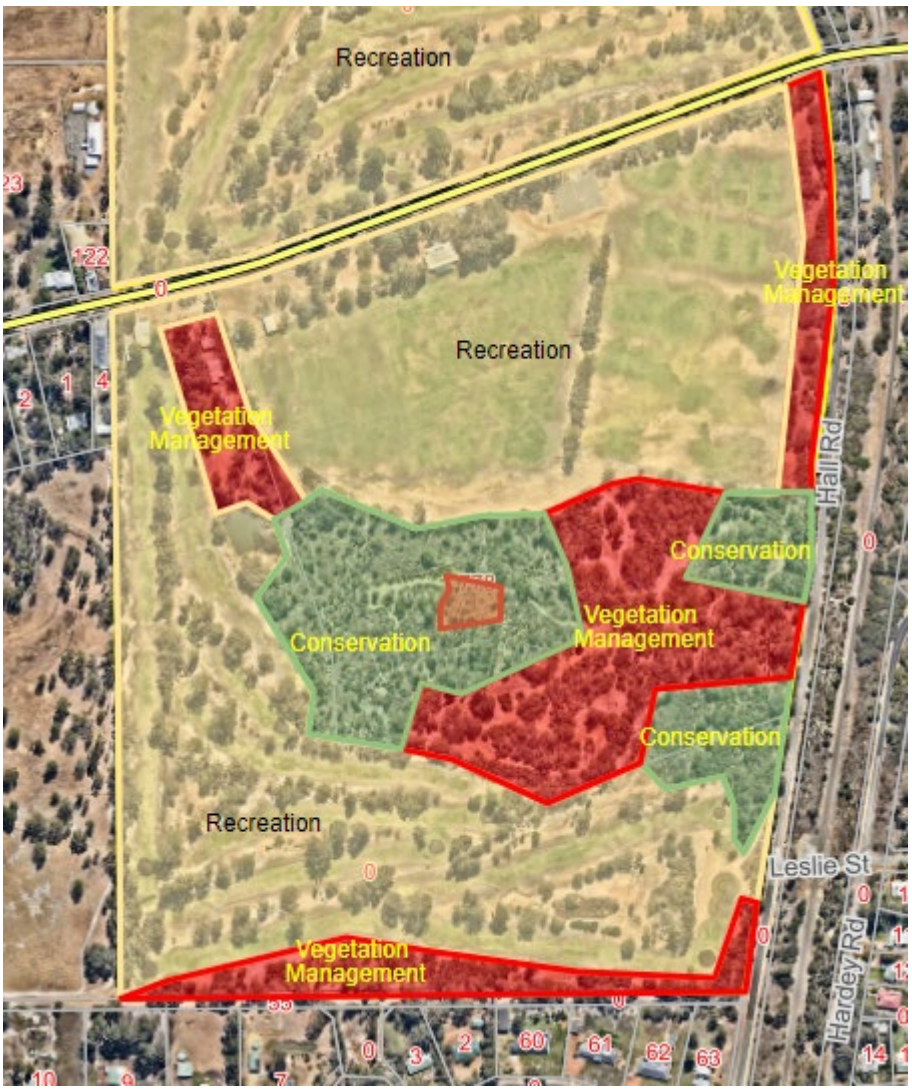


Figure 3: Management Zones of Serpentine Sports Reserve.

1.2. Soils

Four soil types occur in Serpentine Sports Reserve: Pinjarra B1, Pinjarra B3, Pinjarra P1b and Pinjarra P8 (Table 1 and Figure 4). Banksia woodland only occurs on the Pinjarra B1 soil types.

Table 1: Soil Types of Serpentine Sports Reserve.

Reserve	Soil landscape unit	Description	Banksia occurrence
Serpentine Sports Reserve	Pinjarra B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	Yes
	Pinjarra B3 phase	Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam.	No
	Pinjarra P1b phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or effective duplex) soils. Moderately deep pale sand to loamy sand over clay: imperfectly drained and moderately susceptible to salinity in limited areas.	No
	Pinjarra P8 phase	Broad poorly drained flats and poorly defined stream channels with moderately deep to deep sands over mottled clays; acidic or less commonly alkaline gley and yellow duplex soils to uniform bleached or pale brown sands over clay.	No

1.3. Biodiversity

Serpentine Sports Reserve contains three vegetation communities: banksia woodland, marri woodland and a clay-based wetland. The reserve is 46.4 ha with 10.1 ha remnant vegetation of which 3.41 ha is banksia woodland (Figure 5) that belongs to the vegetation complex SCP21a (central *Banksia attenuata* - *Eucalyptus marginata* woodlands).

The areas classified as Conservation Zone for management (Figure 3) belong to Threatened Ecological Communities, and the entire reserve is an Environmentally Sensitive Area. The remnant vegetation in the reserve forms part of Bush Forever site 375, along with adjoining vegetation which forms a corridor along the railway to other reserves. The vegetation is in Very Good to Good condition overall.

The flora of Serpentine Sports Reserve has been frequently surveyed and is diverse. A number of Threatened and Priority flora species have been recorded in the area.

The fauna of Serpentine Sports Reserve has not been thoroughly surveyed since 1997. The fauna recorded at the time was diverse, and anecdotal evidence suggests that the majority are still present. A number of Threatened and Priority fauna species have been recorded, including black cockatoos and quenda (southern brown bandicoot).

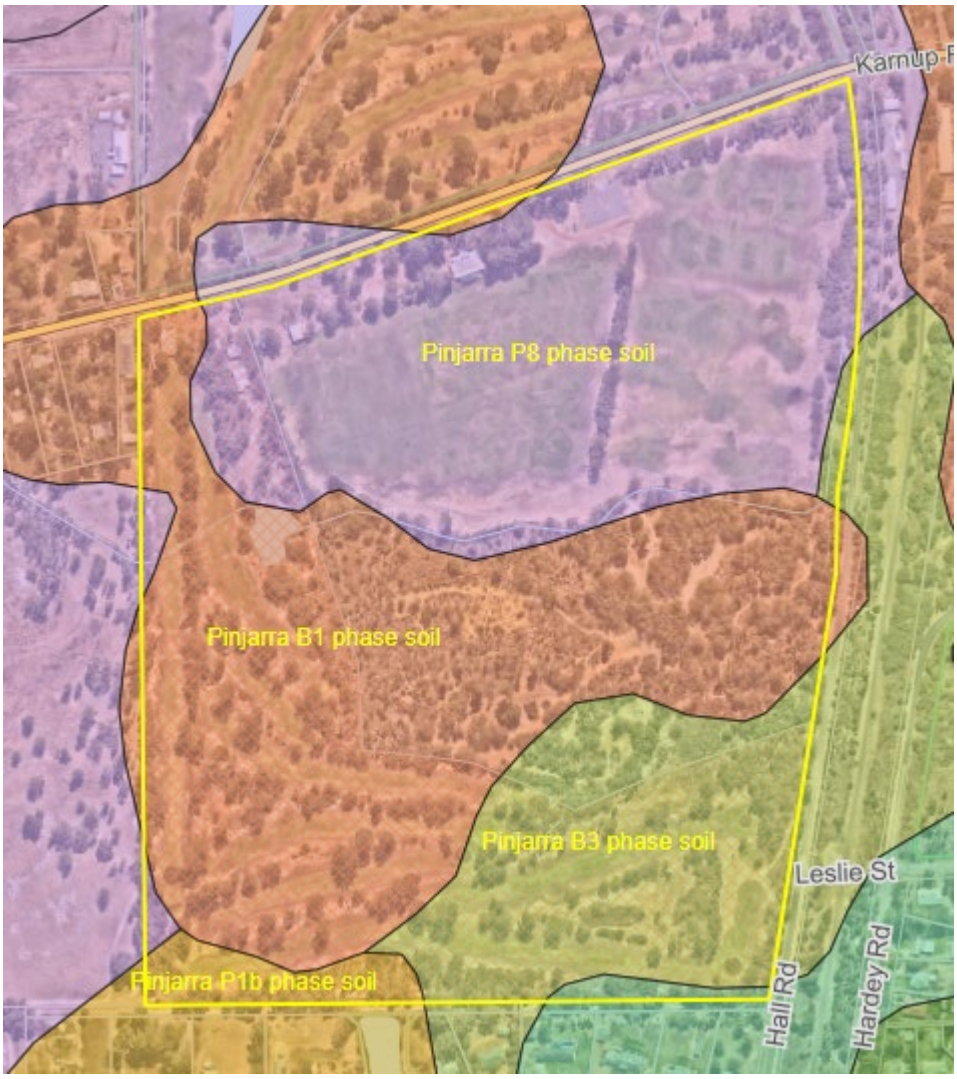


Figure 4: Soil Types of Serpentine Sports Reserve.

1.4. Water Resources

The banksia woodland of Serpentine Sports Reserve is high in the landscape, sitting on top of a sand dune, with the other vegetation types occupying lower-lying areas that are frequently waterlogged in winter (and inundated in the case of the wetland). A major watercourse (drain) runs along the boundary between the equine areas and the bushland, flowing from east to west to a dam, and then across the golf course to discharge eventually into the Serpentine River.

The clay-based wetland in the east of the reserve is classified as Conservation Category, while the majority of the reserve (other than the banksia woodland and the northern boundary) is a Resource Enhancement wetland (Figure 6).

Figure 5: Location of Banksia Woodland in Serpentine Sports Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of Serpentine Sports Reserve include:

- Recreational pressure from users
- Community anxiety about fire hazard and pressure for control burning
- Illegal access by motorised vehicles and associated damage to fences and vegetation
- Arson and vandalism, to vegetation and infrastructure
- Weed invasion, from surrounding land and carried in by users
- Nutrient rich drainage from ovals and golf course, particularly into the wetland
- Feral and domestic animals (foxes, rabbits, cats) predating fauna and damaging vegetation
- Dieback disease (*Phytophthora cinnamomi*)
- Pony club's cross-country course, which passes through infected and dieback free zones

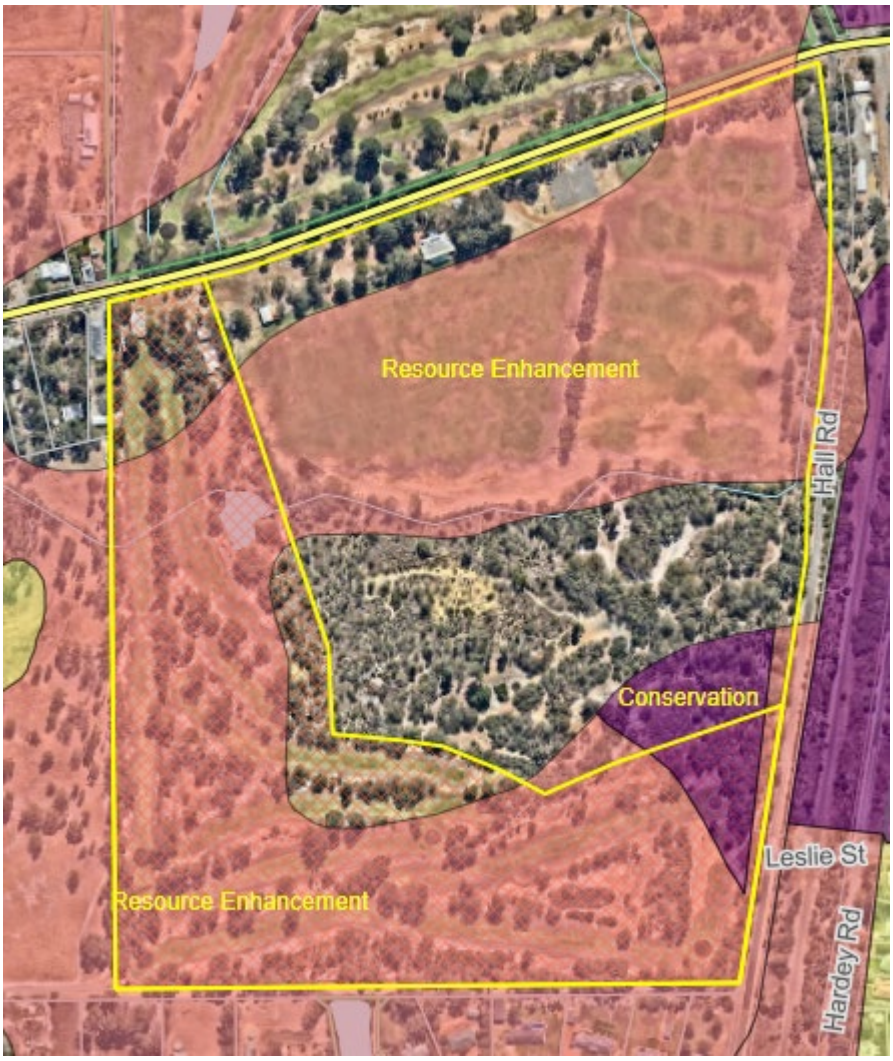


Figure 6: Geomorphic Wetlands of Serpentine Sports Reserve.

3. Reserve Usage

3.1. Vesting and Land Tenure

The vesting purpose, land tenure and current uses of Serpentine Sports Reserve are listed below in Table 2.

Table 2: Vesting Purpose, Land Tenure and Current Uses of Serpentine Sports Reserve.

Reserve	Reserve and Lot Number	Vesting and Land Tenure	Current Uses
Serpentine Sports Reserve	R19134 L778 Karnup Road, Serpentine	Shire of Serpentine Jarrahdale – Recreation, Racecourse and Showground	Recreation and Conservation

3.2. User Groups

The user groups of Serpentine Sports Reserve include:

- Serpentine and Districts Golf Club
- Serpentine Horse and Pony Club
- Serpentine/Foothills Polocrosse Club
- Serpentine Environmental Group
- Landcare SJ Inc., with frequent revegetation planting events
- Serpentine Primary School historically participated in planting events
- Occasional oval hire, e.g. Southside Jumps Club
- Facility hire (pony club and golf club clubhouses)
- Community events
- Informal users, particularly walking, dog exercise and horse riders

Conflict between user groups with differing priorities can cause issues for management of the reserve. Clubs who use the same facilities (e.g. pony club, polocrosse camping around both ovals, oval and clubhouse hire) can experience conflict around dates of use, or expectations of facility maintenance. Clubs can feel proprietorial about public facilities, with associated reluctance to allow other users. Liability issues over the use of jumps makes the pony club reluctant to allow casual riders onto the reserve.

Many users of the reserve can conflict with conservation groups. The golf club has historically discharged nutrient-rich water into the wetland. The pony club's cross-country course passes through the banksia woodland, with potential to spread dieback into clean areas. The polocrosse club historically camped and tethered horses within the marri woodland. Informal users have created new footpaths through the banksia woodland, degrading the vegetation and increasing the potential for the spread of dieback. There has even been conflict between conservation groups, with local enthusiasts believing that Landcare's weed control had killed orchid populations.

Other threats and pressures for the user groups include:

- Risk management and insurance, with stricter liability and higher premiums.
- Membership and member involvement, as any community group has a general problem with attracting and maintaining motivated volunteers to fill positions and undertake other tasks, with a few people tending to do most of the work.
- Compliance with legislation, such as health regulations.
- Security of tenure with ongoing long-term lease agreements essential to ensure that private investment in reserves is supported. User groups' facilities are mostly developed and maintained entirely by volunteers.

3.3. Infrastructure

The infrastructure located in Serpentine Sports Reserve includes:

- Communications tower
- Clubhouses for the pony club, golf club and polocrosse club, with associated storage sheds and a shared ablution facility
- Car parking areas

- Two equestrian sports fields and one fenced arena
- Horse yards, wash bays, stock ramp and manure bay
- Bores, water tanks, dams and irrigation systems
- Cross-country course with permanent jumps
- Golf course fairways and greens
- Dilapidated, unused netball courts
- Firebreaks and informal walking paths
- Fences and gates
- Signage, for conditions of entry and environmental education
- Drainage network

The golf club has built and maintains its own infrastructure by volunteer labour from members. The pony club and polocrosse club clubhouses (Eric Senior and Ivan Elliott Pavilions respectively) are public facilities and maintained by the Shire. The sports fields are maintained by the Shire, but the equine clubs maintain their other infrastructure. Despite fences and locked gates, good lighting and high usage providing surveillance, vandalism and theft are constant but low-level threats.

Fire can threaten people, property and conservation values. Fires can start inside or adjacent to buildings and structures, and are often the result of vandalism, kitchen accidents or electrical faults. Bush or grass fires threaten buildings and structures through embers, radiant heat and direct contact. Cleared areas around buildings limit the opportunity for bush and grass fires to reach them. Fire in nearby bushland has the potential to damage infrastructure.

4. Action Plan

Table 3: Action Plan for Serpentine Sports Reserve.

No.	Action	Priority	Timing	Status	Responsibility	Cost
1	**Utilise the planning system to retain and protect remnant banksia woodland.**	**Key**	**Business as Usual**	**Ongoing**	**Statutory Planning**	**Staff Time**
2	Formalise access to banksia woodland in high use areas through establishment of walking paths that reduce trampling.	Medium	Medium Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
3	Erect signage in high use areas to inform users of the values of the banksia woodland.	Medium	Short Term	Implemented in Part	Operations	Budget Dependent - $2,000
4	**Map and treat dieback every three years.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $6,000**
5	Control access to banksia woodland through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
6	Work with user groups to protect and minimize impacts to remnant vegetation.	High	Business as Usual	Ongoing	Natural Reserves, User Groups	Staff Time
7	Implement measures to exclude motorised vehicles from the remnant vegetation.	High	Medium Term	Implemented in Part	Operations	Budget Dependent - $2,000

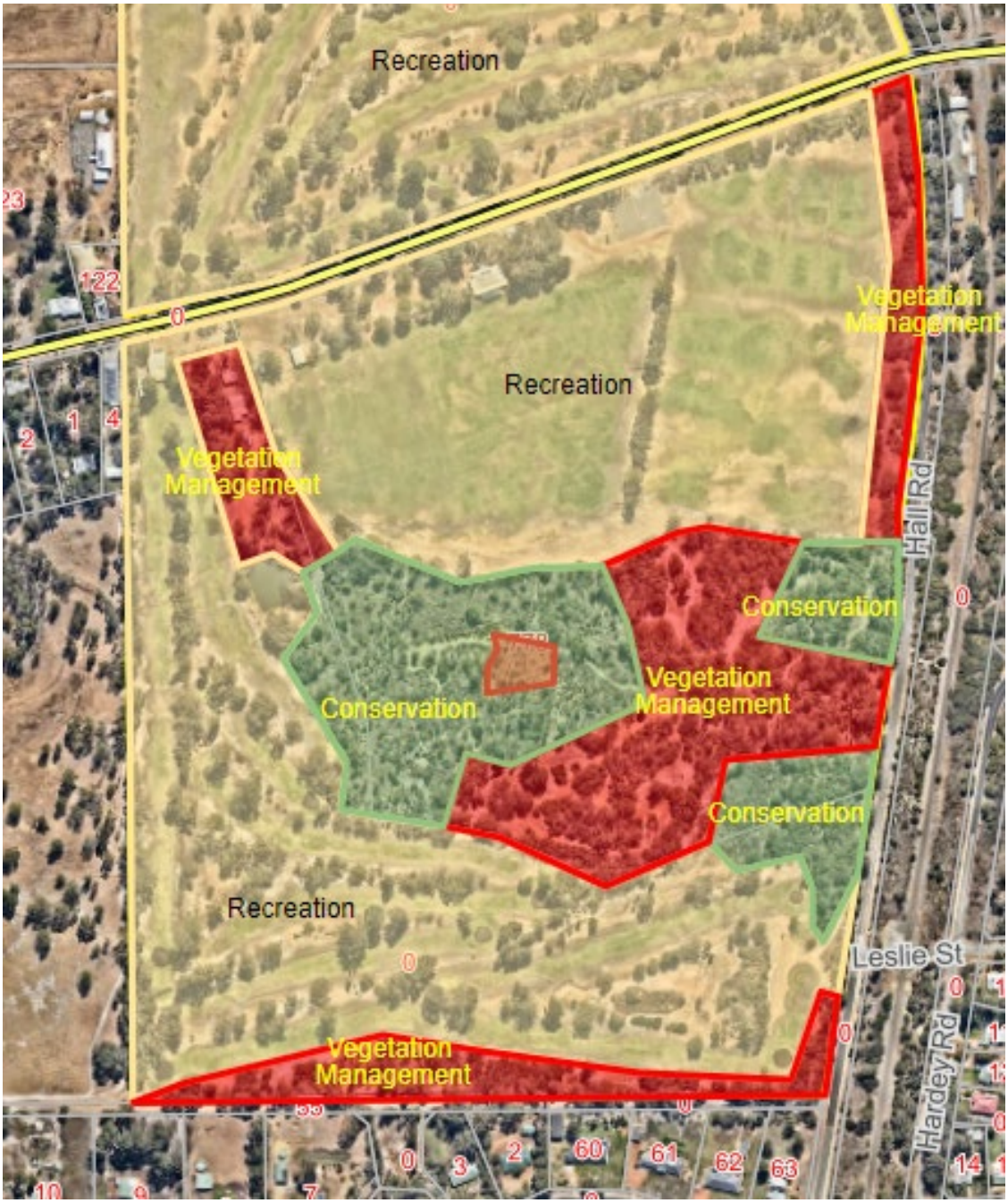
No.	Action	Priority	Timing	Status	Responsibility	Cost
8	Work with the Serpentine Horse and Pony Club to protect vegetation along the cross-country course.	High	Business as Usual	Ongoing	Natural Reserves, Pony Club	Staff Time
9	Ensure that formalised paths and other access routes cross dieback fronts to the lowest degree possible.	Medium	Medium Term	Not Yet Implemented	Natural Reserves	Staff Time
10	Establish dieback hygiene policies, including vehicle washdown points and foot baths for pedestrians with appropriate signage.	High	Long Term	Implemented in Part	Natural Reserves	Budget Dependent - $2,000
11	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environmental Specialist	Budget Dependent - $3,000
12	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves	Budget Dependent - $3,000
13	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves	Staff Time
14	**Establish and implement a weed control program that utilises best practice methods.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves, Landcare SJ**	**Budget Dependent - $3,000**
15	Establish and implement a control program for woody weeds.	High	Business as Usual	Ongoing	Natural Reserves	Budget Dependent - $2,000
16	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ	Budget and/or Funding Dependent - $1,500
17	**Minimise burning and other disturbance of banksia woodland.**	**Key**	**Short Term**	**Implemented in Part**	**Emergency Services**	**Staff Time**
18	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves	Staff Time
19	Maintain fire intervals of 16-40 years.	High	Long Term	Not Yet Implemented	Emergency Services	Staff Time
20	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Staff Time
21	Restrict any essential fuel load management to the Vegetation Management Zone.	High	Short Term	Not Yet Implemented	Emergency Services	Budget Dependent - $1,500
22	Ensure that any essential fuel load management utilises weed control as a priority, with control burning as a last resort.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves	Budget Dependent - $3,000
23	Ensure that any control burning is restricted to vegetation boundaries, providing a mosaic of vegetation ages including long unburnt.	High	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Budget Dependent - $1,500
24	**Follow any burning or other disturbance with weed control for at least two years post-fire.**	**Key**	**Business as Usual**	**Implemented in Part**	**Emergency Services, Natural Reserves**	**Budget Dependent - $3,000**
25	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations	Staff Time

No.	Action	Priority	Timing	Status	Responsibility	Cost
26	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves	Funding Dependent - $2,500
27	Rehabilitate and revegetate unused infrastructure such as the old horse yards and sand pit.	Medium	Medium Term	Implemented in Part	Natural Reserves, Landcare SJ, Friends Group	Funding Dependent - $2,500
28	Monitor implementation of the management plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time
29	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time
30	Review and revise the management plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time

5. Fire Management Strategy for Serpentine Sports Reserve

Conservation Zone (green) – works exclusion; avoid disturbance

Vegetation Management Zone (red) – fuel load management if deemed appropriate and necessary by weed control and/or control burning followed by weed control



Dieback – present in some areas

Weeds – control required following disturbance

Firebreaks – present along boundaries

Yangedi Airfield Reserve Action Plan

R25911

1. Background

1.1. Location

Yangedi Airfield Reserve is located in Hopeland (Figure 1). The reserve contains three vegetation types: banksia woodland, marri woodland and a clay-based wetland. The reserve is 64.7 ha with 32.9 ha remnant vegetation, of which 16.48 ha is banksia woodland. This action plan specifically deals with the banksia woodland area.

The reserve is vested with the Shire for the purpose of Recreation, but current uses also include Conservation. The principal user groups for the reserve are the Sport Aircraft Builders Club, the Bureau of Meteorology and the Department of Fire and Emergency Services, which all maintain significant infrastructure. The areas used by each group are shown in Figure 2.

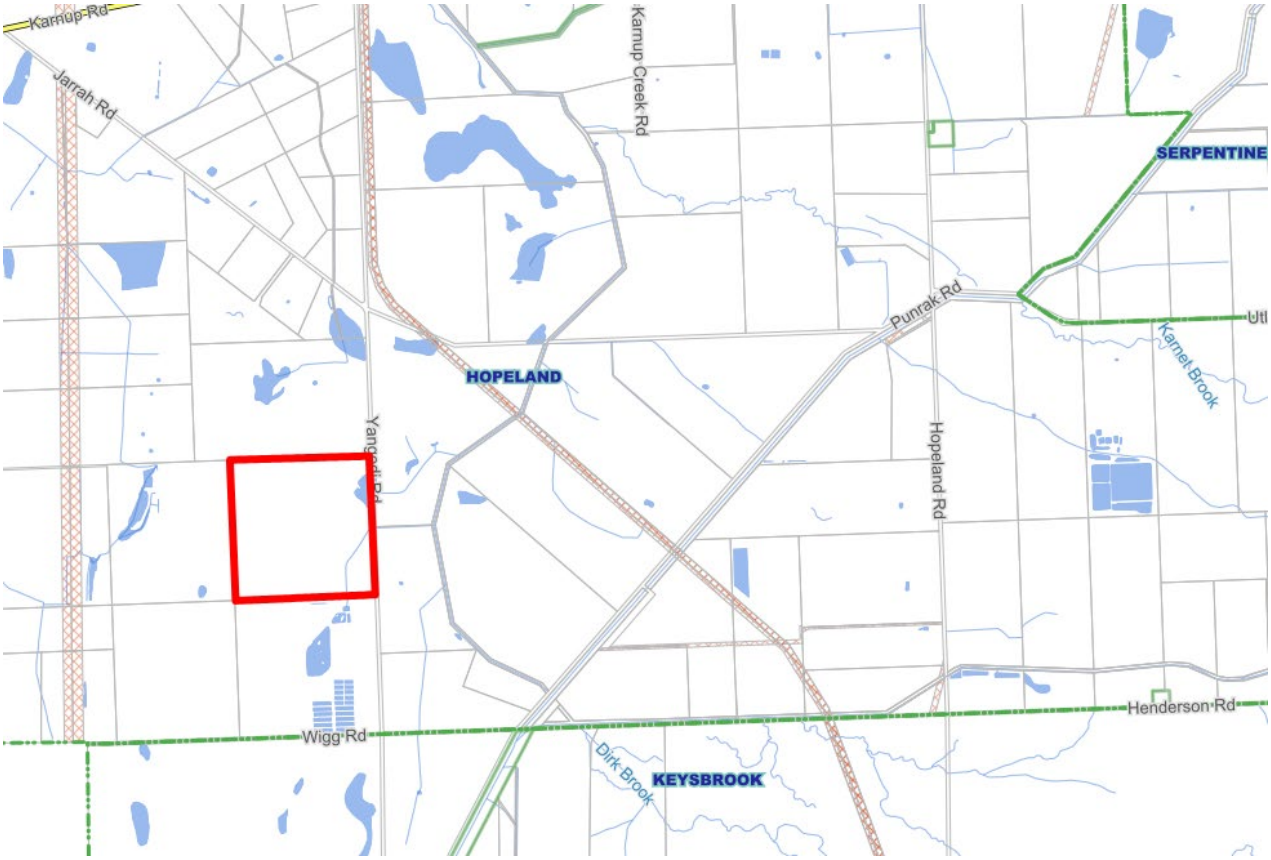


Figure 1: Location of Yangedi Airfield Reserve.

Yangedi Airfield Reserve is classified into four main management zones (Figure 2). These are:

Conservation Zone (green): Areas of remnant vegetation of high biodiversity and scientific reference value which include both dieback free and dieback infected areas. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must utilise dieback hygiene procedures such as clean-down and take extreme care to prevent spread of dieback from infected to uninfected areas.

Vegetation Management Zone (red): Areas of remnant vegetation of biodiversity and scientific reference value which may be disturbed, or dieback or weed infested. This is a buffer zone and may receive fuel load management for protection of people, property and conservation values by weed control or control burning on assessment by officers as required and appropriate. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must consider movement and reduce spread of dieback from infected to uninfected areas through clean down procedures.

Recreation Zone (yellow): This is the area in use by the Sport Aircraft Builders Club. Management of this zone is principally for the purpose of recreation and aviation safety, while minimising impacts on the adjacent remnant vegetation. Access to this zone must be negotiated with the SABC to maintain safety of aircraft and visitors.

Leased Zone (purple and blue): Areas leased by the Bureau of Meteorology (purple) and the Department of Fire and Emergency Services (blue). Management of these areas is principally for maintenance of infrastructure and protection of people and property.

This Action Plan applies to the Conservation and Vegetation Management Zones.

1.2. Soils

Two soil types occur in Yangedi Airfield Reserve: Bassendean B1 and Bassendean B3 (Table 1 and Figure 3). Banksia woodland occurs on the Bassendean B1 soil type, grading into marri woodland on the Bassendean B3 soil.

Table 1: Soil Types of Yangedi Airfield Reserve.

Reserve	Soil landscape unit	Description	Banksia occurrence
Yangedi Airfield Reserve	Bassendean B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	Yes
	Bassendean B3 phase	Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam.	Partial

Figure 2: Land Uses and Management Zones of Yangedi Airfield Reserve.

1.3. Biodiversity

Yangedi Airfield Reserve contains three vegetation communities: banksia woodland in the northwest and southwest, a clay-based wetland in the east, and marri woodland in the southeast. The banksia woodland is approximately 16.48 ha in area (Figure 4) and belongs to the vegetation complexes SCP21c (low lying *Banksia attenuata* woodlands or shrublands) and SCP22 (*Banksia ilicifolia* woodlands).

The vegetated areas of the reserve belong to Threatened Ecological Communities, and all but the northeastern corner is an Environmentally Sensitive Area. The majority of the reserve (except for the northeastern corner belongs to Bush Forever site 378, which extends into several neighbouring properties to provide a larger area of habitat. The vegetation is in Very Good to Good condition overall.

The flora of Yangedi Airfield Reserve has been frequently surveyed and is diverse. No Threatened and Priority flora species have been recorded in the area. The fauna has not been formally surveyed since 1997, although anecdotally most species still remain, including Threatened and Priority fauna such as black cockatoos and quenda (southern brown bandicoot). Kangaroos have also been observed in the reserve.

Figure 3: Soil Types of Yangedi Airfield Reserve.

1.4. Water Resources

Yangedi Airfield Reserve is generally low in the landscape, containing the more low-lying types of banksia woodland and wetlands. A watercourse (drain) runs through the southeastern corner of the reserve to discharge southwards into the water bodies on the adjacent property.

The southeastern half of the reserve, southeast of the main runway, is classified as a Multiple Use wetland (Figure 5), with a Resource Enhancement classification on the clay-based wetland on the eastern boundary and Conservation Category wetlands between the runways and south of the secondary grass runway. A third Conservation Category wetland lies north of the hangars, near the northern boundary of the reserve.

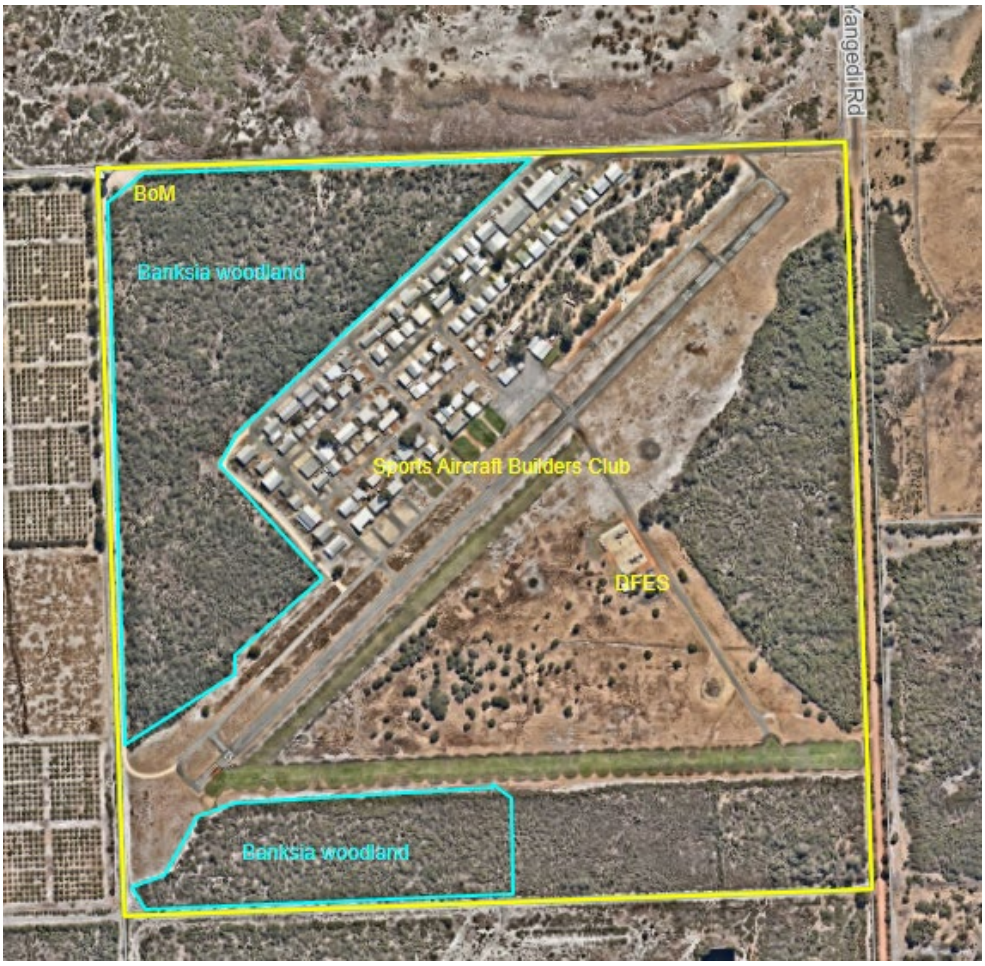


Figure 4: Location of Banksia Woodland in Yangedi Airfield Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of Yangedi Airfield Reserve include:

- Recreational and development pressure from users, including pressure for expansion into bushland for more aircraft hangars
- Community anxiety about fire hazard and pressure for control burning, particularly considering the high value of the aircraft and the BoM tower
- Fire threat of highly flammable aircraft fuel
- Weed invasion, from surrounding land and carried in by users
- Feral and domestic animals (foxes, rabbits, cats) predating fauna and damaging vegetation
- Dieback disease (*Phytophthora cinnamomi*)
- Contaminated runoff from runways, aircraft hangars, helipad etc. entering wetland and other bushland areas

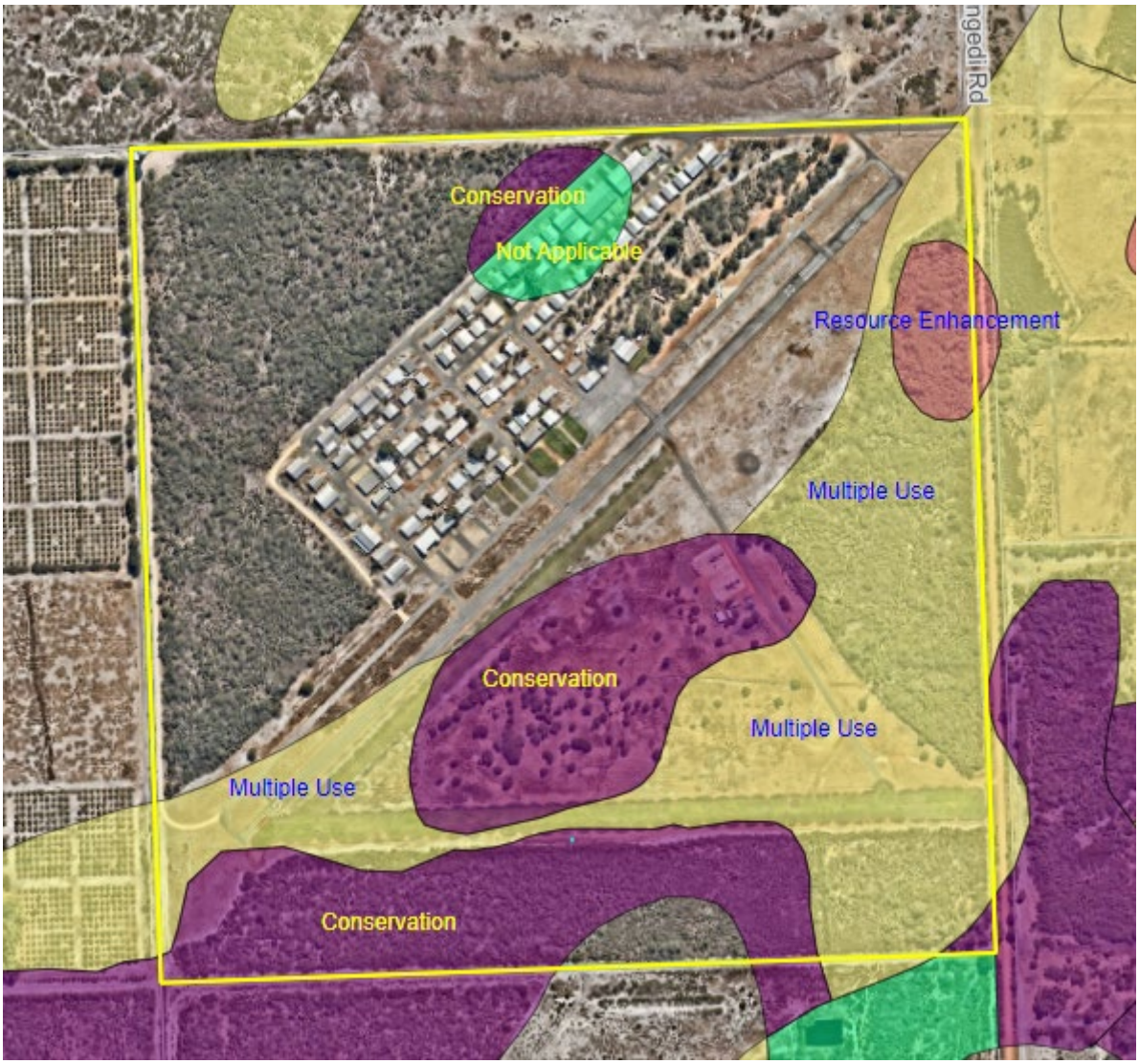


Figure 5: Geomorphic Wetlands of Yangedi Airfield Reserve.

3. Reserve Usage

3.1. Vesting and Land Tenure

The vesting purpose, land tenure and current uses of Yangedi Airfield Reserve are listed below in Table 2.

Table 2: Vesting Purpose, Land Tenure and Current Uses of Yangedi Airfield Reserve.

Reserve	Reserve and Lot Number	Vesting and Land Tenure	Current Uses
Yangedi Airfield Reserve	R25911 L164 Yangedi Road, Hopeland	Shire of Serpentine Jarrahdale – Recreation	Recreation (Airfield, DFES Helipad, BoM tower) and Conservation

3.2. User Groups

The principal user groups of Yangedi Airfield Reserve are the Sport Aircraft Builders Club, the Bureau of Meteorology and the Department of Fire and Emergency Services. Casual usage is negligible, as the reserve has an electronic gate to control access due to the valuable infrastructure and public safety concerns. Maintenance of conservation values is limited to Shire staff.

Threats and pressures for the user groups include:

- Risk management and insurance, with stricter liability and higher premiums.
- Membership and member involvement, as any community group has a general problem with attracting and maintaining motivated volunteers to fill positions and undertake other tasks, with a few people tending to do most of the work.
- Conflict among user groups with differing priorities, such as potential conflict between the SABC's desire to expand and the conservation values of the bushland.
- Compliance with legislation, such as health regulations.
- Security of tenure with ongoing long-term lease agreements essential to ensure that private investment in reserves is supported. User groups' facilities are mostly developed and maintained entirely by volunteers.

An airfield is an inherently hazardous place to which public access must be restricted. On a day-to-day basis, visitors can only access the reserve in the company of a club member, or by prior arrangement to be let through the electric gate. Aircraft have right of way on the taxiways, which may not be apparent to visitors. Public access is only granted on open days, and even then is strictly controlled. Public access protocols are under continuous improvement as more people become aware of the airfield.

3.3. Infrastructure

The infrastructure located in Yangedi Airfield Reserve includes:

- SABC clubhouse, ablution facilities and associated storage sheds
- SABC centralised fuel storage facility
- Aircraft hangars (about 100) with stored aircraft, parts and tools
- Hangar living quarters, toilets and treatment units, and water tanks
- Taxiways (bitumised) and two runways (one bitumised, one irrigated grass)
- Airfield-associated infrastructure such as wind socks
- Car parking area
- BoM communications tower (providing rain radar data) with maintenance access
- DFES helipad for water bombing aircraft and associated facilities
- Bores, storage dams, water tanks and irrigation
- Firebreaks and fences
- Electronic gate
- Signage, including conditions of entry and safety precautions, and bushland entry prohibition

The airfield infrastructure is maintained by the SABC, with each hangar maintained by its owner. As the hangars contain valuable aircraft, tools and spare parts, maintenance tends to be regular and focused on security and safety. Inadequate maintenance would lead to accelerated deterioration and increased risk. Poorly maintained facilities also tend to attract vandalism. The BoM and DFES also

have valuable facilities which require regular maintenance and security, assisted by access to the reserve being restricted by the SABC's electronic gate. The Shire manages the bushland and maintains the firebreaks.

Despite fences and locked gates, vandalism and theft are constant but low-level threats. Surveillance is an effective deterrent. The SABC has a roster system for its members to ensure a constant presence on site for security purposes. This also assists in protection of the BoM and DFES facilities.

Fire can threaten people, property and conservation values. Fires can start inside or adjacent to buildings and structures, and are often the result of vandalism, kitchen accidents or electrical faults. Bush or grass fires threaten buildings and structures through embers, radiant heat and direct contact. Cleared areas around buildings limit the opportunity for bush and grass fires to reach them. Fire in nearby bushland has the potential to damage infrastructure.

An additional hazard at the airfield is the storage of highly flammable aircraft fuel, which greatly increases the risks and consequences of fire. Fuel is stored in a central location with the hangars only containing fuel within the aircraft. A fire within a hangar or from the bushland could quickly spread if fuel ignited and cause significant damage to or destruction of valuable property.

4. Action Plan

Table 3: Action Plan for Yangedi Airfield Reserve.

No.	Action	Priority	Timing	Status	Responsibility	Cost
1	**Utilise the planning system to retain and protect remnant banksia woodland.**	**Key**	**Business as Usual**	**Ongoing**	**Statutory Planning**	**Staff Time**
2	Formalise access to banksia woodland in high use areas through establishment of walking paths that reduce trampling.	Medium	Medium Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
3	Erect signage in high use areas to inform users of the values of the banksia woodland.	Medium	Short Term	Implemented in Part	Operations	Budget Dependent - $2,000
4	**Map and treat dieback every three years.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $9,500**
5	Control access to banksia woodland through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
6	Work with user groups to protect and minimize impacts to remnant vegetation.	High	Business as Usual	Ongoing	Natural Reserves, User Groups	Staff Time
7	Erect fences or other structures to delineate user group areas.	Low	Long Term	Not Yet Implemented	Natural Reserves, User Groups	Budget Dependent - $2,000
8	Ensure that formalised paths and other access routes cross dieback fronts to the lowest degree possible.	Medium	Medium Term	Not Yet Implemented	Natural Reserves	Staff Time
9	Establish dieback hygiene policies, including vehicle washdown points and foot baths for pedestrians with appropriate signage.	High	Long Term	Implemented in Part	Natural Reserves	Budget Dependent - $2,000

No.	Action	Priority	Timing	Status	Responsibility	Cost
10	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environmental Specialist	Budget Dependent - $3,000
11	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves	Budget Dependent - $3,000
12	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves	Staff Time
13	**Establish and implement a weed control program that utilises best practice methods.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves, Landcare SJ**	**Budget Dependent - $8,000**
14	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ	Budget and/or Funding Dependent - $1,500
15	**Minimise burning and other disturbance of banksia woodland.**	**Key**	**Short Term**	**Implemented in Part**	**Emergency Services**	**Staff Time**
16	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves	Staff Time
17	Maintain fire intervals of 16-40 years.	High	Long Term	Not Yet Implemented	Emergency Services	Staff Time
18	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Staff Time
19	Restrict any essential fuel load management to the Vegetation Management Zone.	High	Short Term	Not Yet Implemented	Emergency Services	Budget Dependent - $1,500
20	Ensure that any essential fuel load management utilises weed control as a priority, with control burning as a last resort.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves	Budget Dependent - $8,000
21	Ensure that any control burning is restricted to vegetation boundaries, providing a mosaic of vegetation ages including long unburnt.	High	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Budget Dependent - $1,500
22	**Follow any burning or other disturbance with weed control for at least two years post-fire.**	**Key**	**Business as Usual**	**Implemented in Part**	**Emergency Services, Natural Reserves**	**Budget Dependent - $8,000**
23	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations	Staff Time
24	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves	Funding Dependent - $2,500
25	Monitor implementation of the management plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time
26	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time

No.	Action	Priority	Timing	Status	Responsibility	Cost
27	Review and revise the management plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time

5. Fire Management Strategy for Yangedi Airfield Reserve

Conservation Zone (green) – works exclusion; avoid disturbance

Vegetation Management Zone (red) – fuel load management if deemed appropriate and necessary by weed control and/or control burning followed by weed control

Dieback – present in some areas

Weeds – control required following disturbance

Firebreaks – present along boundaries

Bella Cumming Reserve Action Plan

R6168

1. Background

1.1. Location

Bella Cumming Reserve is located in Mundijong (Figure 1). The reserve is dominated by banksia woodland, with emergent jarrah trees. The reserve is 2.03 ha with 1.72 ha remnant vegetation. This action plan specifically deals with banksia woodland.

The reserve is vested with the Shire for the purpose of Recreation and Parkland, but the current use includes Conservation. Users are casual and infrequent.

Figure 1: Location of Bella Cumming Reserve.

Bella Cumming Reserve is classified into two main management zones (Figure 2). These are:

Conservation Zone (green): Areas of remnant vegetation of high biodiversity and scientific reference value which include both dieback free and dieback infected areas. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must utilise dieback hygiene procedures such as clean-down and take extreme care to prevent spread of dieback from infected to uninfected areas.

Vegetation Management Zone (red): Areas of remnant vegetation of biodiversity and scientific reference value which may be disturbed, or dieback or weed infested. This is a buffer zone and may receive fuel load management for protection of people, property and conservation values by weed control or control burning on assessment by officers as required and appropriate. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must consider movement and reduce spread of dieback from infected to uninfected areas through clean down procedures.

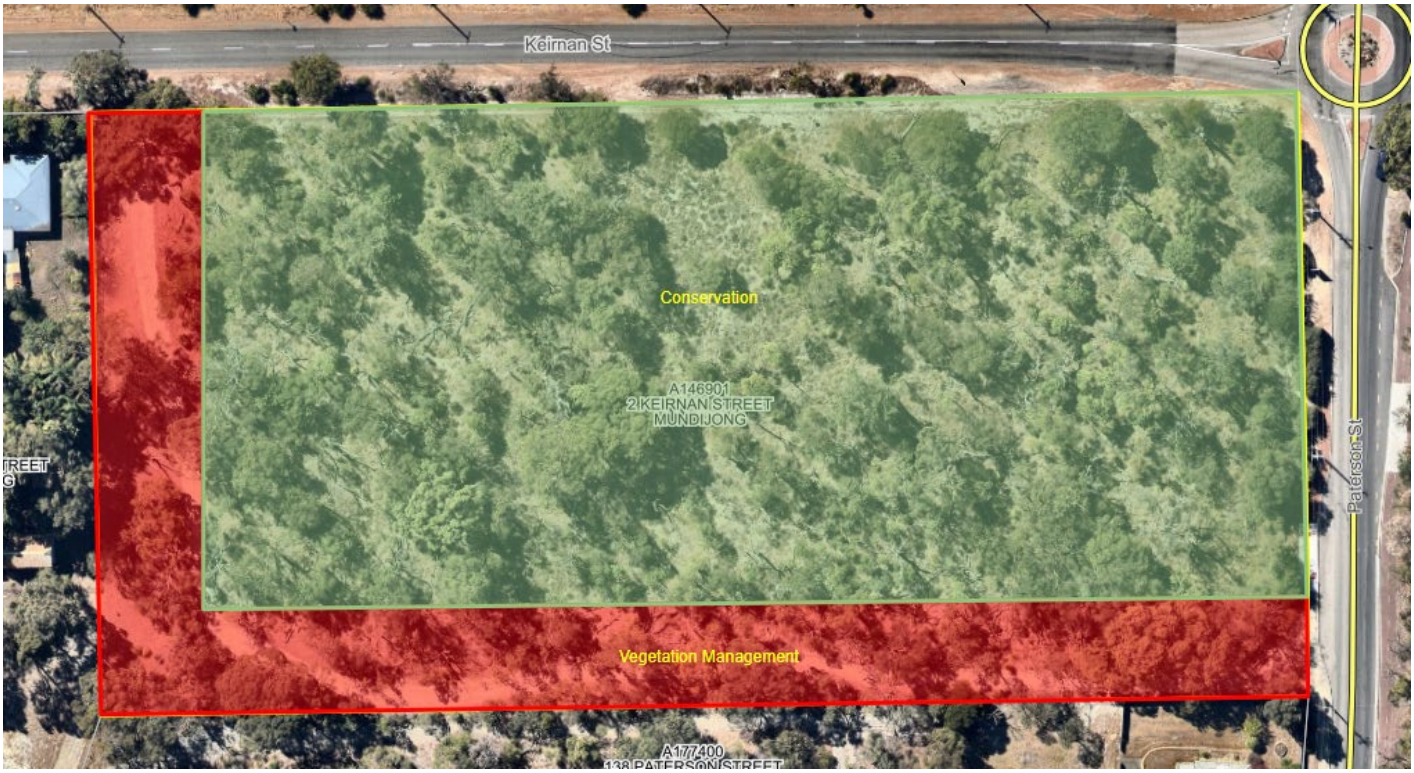


Figure 2: Management Zones of Bella Cumming Reserve.

1.2. Soils

One soil type occurs in Bella Cumming Reserve, Bassendean B2a (Table 1 and Figure 3).

Table 1: Soil Type of Bella Cumming Reserve.

Reserve	Soil landscape unit	Description	Banksia occurrence
Bella Cumming Reserve	Bassendean B2a phase	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with an intensely coloured yellow B horizon usually well within 1 m of the surface.	Yes

Figure 3: Soil Types of Bella Cumming Reserve.

1.3. Biodiversity

Bella Cumming Reserve contains one dominant vegetation community, banksia woodland with emergent jarrah trees. The banksia woodland is approximately 1.72 ha in area (Figure 4) and belongs to the vegetation complex SCP21a (central *Banksia attenuata* - *Eucalyptus marginata* woodlands).

The entire reserve belongs to a Threatened Ecological Community and is an Environmentally Sensitive Area. The reserve forms part of Bush Forever site 350, along with the adjacent railway

corridor which provides habitat connections to other reserves. The vegetation is in Very condition overall.

The flora of Bella Cumming Reserve has been frequently surveyed and is diverse. No Threatened and Priority flora species have been recorded in the area. The fauna has never been formally surveyed, although anecdotally some Threatened and Priority fauna species may occur, such as black cockatoos, and quenda (southern brown bandicoot).

Figure 4: Location of Banksia Woodland of Bella Cumming Reserve.

1.4. Water Resources

Bella Cumming Reserve is located on a relatively elevated sand plain. A major watercourse runs to the north of the reserve.

The whole of the reserve, as well as areas to the northeast and southwest, is classified as a Conservation Category wetland (Figure 5). Areas to the north and south are Multiple Use wetlands which act as buffers to the Conservation Category wetland.

Figure 5: Geomorphic Wetlands of Bella Cumming Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of Bella Cumming Reserve include:

- Community anxiety about fire hazard and pressure for control burning
- Arson and vandalism
- Illegal access by motorised vehicles and associated damage to fences and vegetation
- Weed invasion, from surrounding land and carried in by users
- Feral and domestic animals (foxes, rabbits, cats) predating fauna and damaging vegetation
- Dieback disease (*Phytophthora cinnamomi*)
- Increasing recreational pressure as Mundijong is developed

3. Reserve Usage

3.1. Vesting and Land Tenure

The vesting purpose, land tenure and current uses of Bella Cumming Reserve are listed below in Table 2.

Table 2: Vesting Purpose, Land Tenure and Current Uses of Bella Cumming Reserve

Reserve	Reserve and Lot Number	Vesting and Land Tenure	Current Uses
Bella Cumming Reserve	R6168 L59 Keirnan Street, Mundijong	Shire of Serpentine Jarrahdale – Recreation and Parklands Historically reserved as a cemetery	Recreation and Conservation

3.2. User Groups

The users of Bella Cumming Reserve are informal and infrequent, mostly for walking and dog exercise, and enjoyment of nature.

Threats and pressures for the user include increasing recreational pressure as Mundijong is developed.

3.3. Infrastructure

The infrastructure located in Bella Cumming Reserve includes firebreaks, fences, gates and signage.

The infrastructure is maintained by the Shire. Despite fences and locked gates, vandalism to fences and vegetation is a constant but low-level threat.

Fire can threaten people, property and conservation values. Bush or grass fires threaten buildings and structures through embers, radiant heat and direct contact. Fire in the reserve's bushland has the potential to damage nearby infrastructure.

4. Action Plan

Table 3: Action Plan for Bella Cumming Reserve.

No.	Action	Priority	Timing	Status	Responsibility	Cost
1	**Utilise the planning system to retain and protect remnant banksia woodland.**	**Key**	**Business as Usual**	**Ongoing**	**Statutory Planning**	**Staff Time**
2	Erect signage in high use areas to inform users of the values of the banksia woodland.	Medium	Short Term	Implemented in Part	Operations	Budget Dependent - $2,000

No.	Action	Priority	Timing	Status	Responsibility	Cost
3	**Map and treat dieback every three years.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $3,000**
4	Control access to banksia woodland through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
5	Ensure that formalised paths and other access routes cross dieback fronts to the lowest degree possible.	Medium	Medium Term	Not Yet Implemented	Natural Reserves	Staff Time
6	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environmental Specialist	Budget Dependent - $3,000
7	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves	Budget Dependent - $3,000
8	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves	Staff Time
9	**Establish and implement a weed control program that utilises best practice methods.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves, Landcare SJ**	**Budget Dependent - $2,000**
10	Establish and implement a control program for woody weeds.	High	Business as Usual	Ongoing	Natural Reserves	Budget Dependent - $2,000
11	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ	Budget and/or Funding Dependent - $800
12	**Minimise burning and other disturbance of banksia woodland.**	**Key**	**Short Term**	**Implemented in Part**	**Emergency Services**	**Staff Time**
13	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves	Staff Time
14	Maintain fire intervals of 16-40 years.	High	Long Term	Not Yet Implemented	Emergency Services	Staff Time
15	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Staff Time
16	Restrict any essential fuel load management to the Vegetation Management Zone.	High	Short Term	Not Yet Implemented	Emergency Services	Budget Dependent - $1,500
17	Ensure that any essential fuel load management utilises weed control as a priority, with control burning as a last resort.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves	Budget Dependent - $2,000
18	Ensure that any control burning is restricted to vegetation boundaries, providing a mosaic of vegetation ages including long unburnt.	High	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Budget Dependent - $1,500
19	**Follow any burning or other disturbance with weed control for at least two years post-fire.**	**Key**	**Business as Usual**	**Implemented in Part**	**Emergency Services, Natural Reserves**	**Budget Dependent - $2,000**

No.	Action	Priority	Timing	Status	Responsibility	Cost
20	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations	Staff Time
21	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves	Funding Dependent - $2,500
22	Monitor implementation of the management plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time
23	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time
24	Review and revise the management plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time

5. Fire Management Strategy for Bella Cumming Reserve

Conservation Zone (green) – works exclusion; avoid disturbance

Vegetation Management Zone (red) – fuel load management if deemed appropriate and necessary by weed control and/or control burning followed by weed control

Dieback – present in some areas

Weeds – control required following disturbance

Firebreaks – present along boundaries

Tonkin Street Flora Reserve Action Plan

R22020, R36369

1. Background

1.1. Location

Tonkin Street Flora Reserve is located in Mundijong (Figure 1). The reserve is dominated by banksia woodland, with emergent jarrah and sheoak trees. The reserve is 2.6 ha with 2.05 ha remnant vegetation. This action plan deals with the banksia woodland.

The reserve is vested with the Shire for the purpose of Protection of Indigenous Vegetation, Hall, but current uses include Recreation and Conservation. The principal user group for the reserve is the Men's Shed, which maintains the infrastructure.

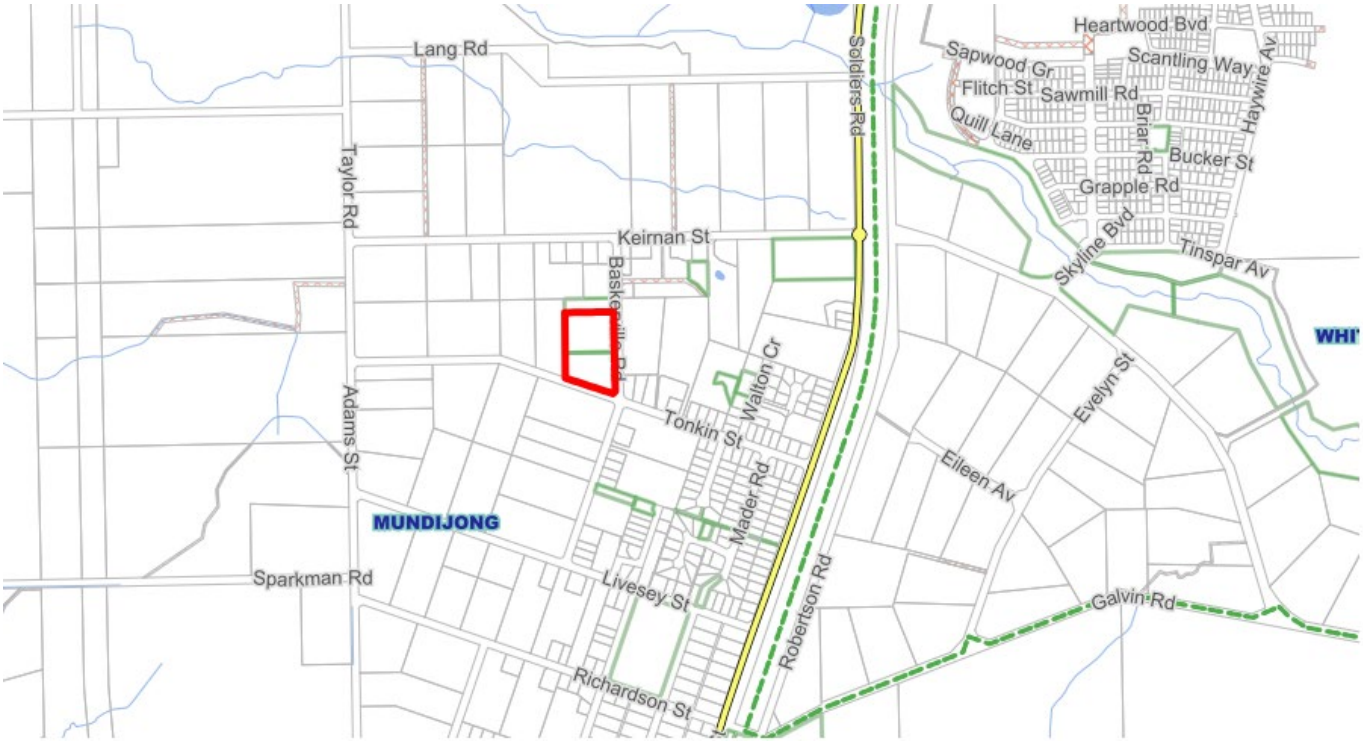


Figure 1: Location of Tonkin Street Flora Reserve.

Tonkin Street Flora Reserve is classified into three main management zones (Figure 2). These are:

Conservation Zone (green): Areas of remnant vegetation of high biodiversity and scientific reference value which include both dieback free and dieback infected areas. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must utilise dieback hygiene procedures such as clean-down and take extreme care to prevent spread of dieback from infected to uninfected areas.

Vegetation Management Zone (red): Areas of remnant vegetation of biodiversity and scientific reference value which may be disturbed, or dieback or weed infested. This is a buffer zone and may receive fuel load management for protection of people, property and conservation values by weed control or control burning on assessment by officers as required and appropriate. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must consider movement and reduce spread of dieback from infected to uninfected areas through clean down procedures.

Recreation Zone (yellow): This is the area in use by the Men's Shed. Management of this zone is principally for the purpose of recreation, while minimising impacts on the adjacent remnant vegetation.

This Action Plan applies to the Conservation and Vegetation Management Zones.

1.2. Soils

One soil type occurs in Tonkin Street Flora Reserve, Bassendean B2, (Table 1 and Figure 3). Banksia woodland occurs throughout.

Table 1: Soil Types of Tonkin Street Flora Reserve.

Reserve	Soil landscape unit	Description	Banksia occurrence
Tonkin Street Flora Reserve	Bassendean B2 phase	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m.	Yes

1.3. Biodiversity

Tonkin Street Flora Reserve contains one dominant vegetation community, banksia woodland, with emergent jarrah and sheoak trees. The banksia woodland is approximately 2.05 ha in area (Figure 4) and belongs to the vegetation complex SCP21a (central *Banksia attenuata - Eucalyptus marginata* woodlands).

The reserve is not mapped as a Threatened Ecological Community or Bush Forever, but the eastern half is classified as an Environmentally Sensitive Area. The vegetation is in Very Good to Good condition overall.

The flora of Tonkin Street Flora Reserve has been frequently surveyed and is diverse. No Threatened and Priority flora species have been recorded in the area. The fauna has never been formally surveyed, although anecdotally some Threatened and Priority fauna species may occur, such as black cockatoos, and quenda (southern brown bandicoot).

Figure 2: Management Zones of Tonkin Street Flora Reserve.

1.4. Water Resources

Tonkin Street Flora Reserve is high in the landscape, sitting on top of a sand dune, with lower-lying areas to the north and east. No water features affect the reserve itself.

Multiple Use wetlands lie to the east and west of the reserve (Figure 5), and act as buffers to Conservation Category wetlands further away from the reserve.

Figure 3: Soil Types of Tonkin Street Flora Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of Tonkin Street Flora Reserve include:

- Pressure from the Men's Shed for clearing for expansion and fire protection
- Community anxiety about fire hazard and pressure for control burning
- Arson and vandalism
- Weed invasion, from surrounding land and carried in by users
- Feral and domestic animals (foxes, rabbits, cats) predating fauna and damaging vegetation
- Dieback disease (*Phytophthora cinnamomi*)
- Recreational pressure will increase as Mundijong is developed

Figure 4: Location of Banksia Woodland of Tonkin Street Flora Reserve.

3. Reserve Usage

3.1. Vesting and Land Tenure

The vesting purpose, land tenure and current uses of Tonkin Street Flora Reserve are listed below in Table 2.

Table 2: Vesting Purpose, Land Tenure and Current Uses of Tonkin Street Flora Reserve.

Reserve	Reserve and Lot Number	Vesting and Land Tenure	Current Uses
Tonkin Street Flora Reserve	R22020, R36369 L205, L180, L213 Baskerville Road, Mundijong	Shire of Serpentine Jarrahdale – Protection of Indigenous Vegetation, Hall	Recreation and Conservation Men's Shed

Figure 5: Geomorphic Wetlands of Tonkin Street Flora Reserve.

3.2. User Groups

The principal user group of Tonkin Street Flora Reserve is the Men's Shed. Historically the building on the reserve was used as a scout hall. Informal uses include walking and dog exercise, enjoyment of nature, and nature play by local children.

Threats and pressures for the user group include:

- Risk management and insurance, with stricter liability and higher premiums.
- Membership and member involvement, as any community group has a general problem with attracting and maintaining motivated volunteers to fill positions and undertake other tasks, with a few people tending to do most of the work.
- Conflict among user groups with differing priorities, such as potential conflict between the Men's Shed's activities or the activities of children and protection of the conservation values of the remnant vegetation.
- Compliance with legislation, such as health regulations.
- Security of tenure with ongoing long-term lease agreements essential to ensure that private investment in reserves is supported. User groups' facilities are mostly developed and maintained entirely by volunteers.

3.3. Infrastructure

The infrastructure located in Tonkin Street Flora Reserve includes:

- Men's Shed clubhouse/hall and storage sheds/sea containers
- Car parking area
- Firebreaks, fences, gates and signage

The infrastructure is maintained principally by the Men's Shed, with the Shire maintaining firebreaks and other public infrastructure. Despite fences and locked gates, vandalism and theft are constant but low-level threats.

Fire can threaten people, property and conservation values. Fires can start inside or adjacent to buildings and structures, and are often the result of vandalism, kitchen accidents or electrical faults. Bush or grass fires threaten buildings and structures through embers, radiant heat and direct contact. Cleared areas around buildings limit the opportunity for bush and grass fires to reach them. Fire in nearby bushland has the potential to damage infrastructure.

4. Action Plan

Table 3: Action Plan for Tonkin Street Flora Reserve.

No.	Action	Priority	Timing	Status	Responsibility	Cost
1	**Utilise the planning system to retain and protect remnant banksia woodland.**	**Key**	**Business as Usual**	**Ongoing**	**Statutory Planning**	**Staff Time**
2	Formalise access to banksia woodland in high use areas through establishment of walking paths that reduce trampling.	Medium	Medium Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
3	Erect signage in high use areas to inform users of the values of the banksia woodland.	Medium	Short Term	Implemented in Part	Operations	Budget Dependent - $2,000
4	**Map and treat dieback every three years.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $2,500**
5	Control access to banksia woodland through boundary fencing, convenient formal access points, and path	Low	Long Term	Not Yet Implemented	Operations	Budget Dependent – $3,000

No.	Action	Priority	Timing	Status	Responsibility	Cost
	construction that discourages deviation.					
6	Work with the Men's Shed to fence and delineate their area of use.	High	Short Term	Not Yet Implemented	Natural Reserves, Men's Shed	Budget Dependent - $1,000
7	Work with user groups to protect and minimize impacts to remnant vegetation.	High	Business as Usual	Ongoing	Natural Reserves, User Groups	Staff Time
8	Ensure that formalised paths and other access routes cross dieback fronts to the lowest degree possible.	Medium	Medium Term	Not Yet Implemented	Natural Reserves	Staff Time
9	Establish dieback hygiene policies, including vehicle washdown points and foot baths for pedestrians with appropriate signage.	High	Long Term	Implemented in Part	Natural Reserves	Budget Dependent - $2,000
10	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environmental Specialist	Budget Dependent - $3,000
11	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves	Budget Dependent - $3,000
12	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves	Staff Time
13	**Establish and implement a weed control program that utilises best practice methods.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves, Landcare SJ**	**Budget Dependent - $1,500**
14	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ	Budget and/or Funding Dependent - $1,000
15	**Minimise burning and other disturbance of banksia woodland.**	**Key**	**Short Term**	**Implemented in Part**	**Emergency Services**	**Staff Time**
16	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves	Staff Time
17	Maintain fire intervals of 16-40 years.	High	Long Term	Not Yet Implemented	Emergency Services	Staff Time
18	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Staff Time
19	Restrict any essential fuel load management to the Vegetation Management Zone.	High	Short Term	Not Yet Implemented	Emergency Services	Budget Dependent - $1,500
20	Ensure that any essential fuel load management utilises weed control as a priority, with control burning as a last resort.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves	Budget Dependent - $1,500
21	Ensure that any control burning is restricted to vegetation boundaries, providing a mosaic of vegetation ages including long unburnt.	High	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Budget Dependent – $1,500
22	**Follow any burning or other disturbance with weed control for at least two years post-fire.**	**Key**	**Business as Usual**	**Implemented in Part**	**Emergency Services, Natural Reserves**	**Budget Dependent - $1,500**

No.	Action	Priority	Timing	Status	Responsibility	Cost
23	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations	Staff Time
24	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves	Funding Dependent - $2,500
25	Monitor implementation of the management plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time
26	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time
27	Review and revise the management plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time

5. Fire Management Strategy for Tonkin Street Flora Reserve

Conservation Zone (green) – works exclusion; avoid disturbance

Vegetation Management Zone (red) – fuel load management if deemed appropriate and necessary by weed control and/or control burning followed by weed control

Dieback – present in some areas

Weeds – control required following disturbance

Firebreaks – present along boundaries

Craghill Way Reserve Action Plan

R34460

1. Background

1.1. Location

Craghill Way Reserve is located in Oakford (Figure 1). The reserve is dominated by somewhat degraded banksia woodland with a small pocket of marri woodland in the south, and is notable as the only Shire reserve to contain pricklybark (*Eucalyptus todtiana*). The reserve is 3.3 ha with 2.2 ha remnant vegetation, of which 1.74 ha is banksia woodland. This action plan specifically deals with the banksia woodland area.

The reserve is vested with the Shire for the purpose of Public Recreation, but current uses also include Conservation. The principal users of the reserve are informal, infrequent walkers and horse riders.

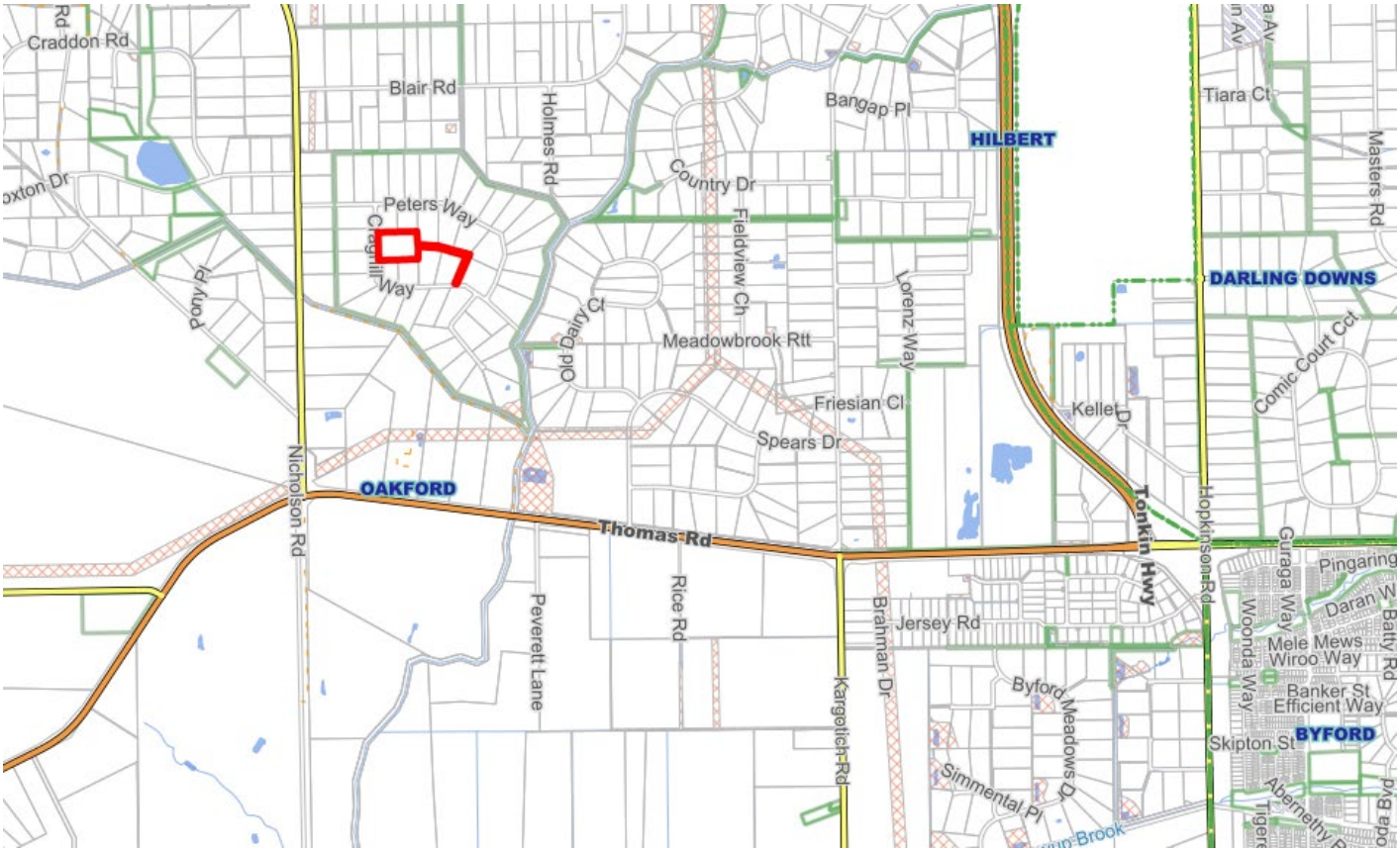


Figure 1: Location of Craghill Way Reserve.

Craghill Way Reserve is classified into two main management zones (Figure 2). These are:

Conservation Zone (green): Areas of remnant vegetation of high biodiversity and scientific reference value which include both dieback free and dieback infected areas. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must utilise dieback hygiene procedures such as clean-down and take extreme care to prevent spread of dieback from infected to uninfected areas.

Vegetation Management Zone (red): Areas of remnant vegetation of biodiversity and scientific reference value which may be disturbed, or dieback or weed infested. This is a buffer zone and may receive fuel load management for protection of people, property and conservation values by weed control or control burning on assessment by officers as required and appropriate. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must consider movement and reduce spread of dieback from infected to uninfected areas through clean down procedures.

This Action Plan applies to the Conservation and Vegetation Management Zones.

Figure 2: Management Zones of Craghill Way Reserve.

1.2. Soils

Two soil types occur in Craghill Way Reserve: Bassendean B2 and Bassendean B6 (Table 1 and Figure 3). Banksia woodland occurs on both soil types, grading into marri woodland on the Bassendean B6 soils.

Table 1: Soil Types of Craghill Way Reserve.

Reserve	Soil landscape unit	Description	Banksia occurrence
Craghill Way Reserve	Bassendean B2 phase	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m.	Yes
	Bassendean B6 phase	Sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands.	Yes

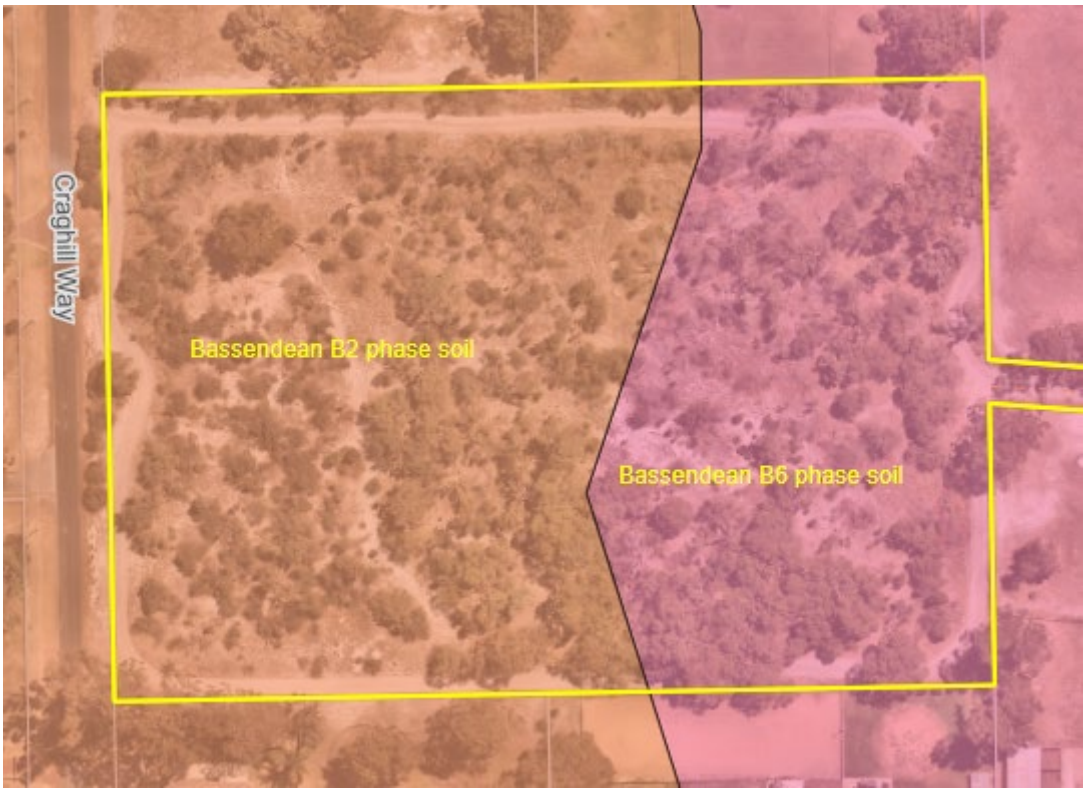


Figure 3: Soil Types of Craghill Way Reserve.

1.3. Biodiversity

Craghill Way Reserve contains one dominant vegetation community, somewhat degraded banksia woodland with a small pocket of marri woodland in the south and is notable as the only Shire reserve to contain pricklybark (*Eucalyptus todtiana*). The banksia woodland is approximately 1.74 ha in area (Figure 4) and belongs to the vegetation complex SCP21c (low lying *Banksia attenuata* woodlands or shrublands).

The majority of the vegetated part of the reserve belongs to a Threatened Ecological Community. The vegetation is in Good to Degraded condition overall.

The flora of Craghill Way Reserve has been surveyed and contains a low number of species, being somewhat degraded. No Threatened and Priority flora species have been recorded in the area. The fauna has never been formally surveyed, although anecdotally some Threatened and Priority fauna species may occur, such as black cockatoos.

Figure 4: Location of Banksia Woodland in Craghill Way Reserve.

1.4. Water Resources

Craghill Way Reserve is low in the landscape, sitting on a sandplain and containing a vegetation type associated with low-lying areas.

The northern and eastern part of the reserve is a Resource Enhancement wetland (Figure 5), extending to Multiple Use wetlands outside the reserve boundaries.

Figure 5: Geomorphic Wetlands of Craghill Way Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of Craghill Way Reserve include:

- Recreational pressure from users, being connected to the bridle trail network and originally intended as an equestrian reserve
- Community anxiety about fire hazard and pressure for control burning
- Arson and vandalism
- Weed invasion, from surrounding land and carried in by users
- Feral and domestic animals (foxes, rabbits, cats) predating fauna and damaging vegetation

3. Reserve Usage

3.1. Vesting and Land Tenure

The vesting purpose, land tenure and current uses of Craghill Way Reserve are listed below in Table 2.

Table 2: Vesting Purpose, Land Tenure and Current Uses of Craghill Way Reserve.

Reserve	Reserve and Lot Number	Vesting and Land Tenure	Current Uses
Craghill Way Reserve	R34460 L1374 Craghill Way, Oakford	Shire of Serpentine Jarrahdale – Public Recreation	Recreation and Conservation

3.2. User Groups

The principal users of Craghill Way Reserve informal, infrequent walkers and horse riders. The reserve is connected to the bridle trail network and was originally intended as an equestrian reserve.

There are minimal threats and pressures for the users.

3.3. Infrastructure

The infrastructure located in Craghill Way Reserve includes firebreaks, fences and gates. The infrastructure is maintained by the Shire. Vandalism is a constant but low-level threat.

Fire can threaten people, property and conservation values. Bush or grass fires threaten buildings and structures through embers, radiant heat and direct contact. Cleared areas around buildings limit the opportunity for bush and grass fires to reach them. Fire in the reserve's bushland has the potential to damage nearby infrastructure.

4. Action Plan

Table 3: Action Plan for Craghill Way Reserve.

No.	Action	Priority	Timing	Status	Responsibility	Cost
1	**Utilise the planning system to retain and protect remnant banksia woodland.**	**Key**	**Business as Usual**	**Ongoing**	**Statutory Planning**	**Staff Time**
2	**Map and treat dieback every three years.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $2,500**
3	Control access to banksia woodland through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations	Budget Dependent - $3,000

No.	Action	Priority	Timing	Status	Responsibility	Cost
4	Ensure that formalised paths and other access routes cross dieback fronts to the lowest degree possible.	Medium	Medium Term	Not Yet Implemented	Natural Reserves	Staff Time
5	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environmental Specialist	Budget Dependent - $3,000
6	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves	Budget Dependent - $3,000
7	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves	Staff Time
8	**Establish and implement a weed control program that utilises best practice methods.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves, Landcare SJ**	**Budget Dependent - $3,000**
9	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ	Budget and/or Funding Dependent - $800
10	**Minimise burning and other disturbance of banksia woodland.**	**Key**	**Short Term**	**Implemented in Part**	**Emergency Services**	**Staff Time**
11	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves	Staff Time
12	Maintain fire intervals of 16-40 years.	High	Long Term	Not Yet Implemented	Emergency Services	Staff Time
13	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Staff Time
14	Restrict any essential fuel load management to the Vegetation Management Zone.	High	Short Term	Not Yet Implemented	Emergency Services	Budget Dependent - $1,500
15	Ensure that any essential fuel load management utilises weed control as a priority, with control burning as a last resort.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves	Budget Dependent - $3,000
16	Ensure that any control burning is restricted to vegetation boundaries, providing a mosaic of vegetation ages including long unburnt.	High	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Budget Dependent – $1,500
17	**Follow any burning or other disturbance with weed control for at least two years post-fire.**	**Key**	**Business as Usual**	**Implemented in Part**	**Emergency Services, Natural Reserves**	**Budget Dependent - $3,000**
18	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations	Staff Time
19	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves	Funding Dependent - $3,000
20	Monitor implementation of the management plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time

No.	Action	Priority	Timing	Status	Responsibility	Cost
21	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time
22	Review and revise the management plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time

5. Fire Management Strategy for Craghill Way Reserve

Conservation Zone (green) – works exclusion; avoid disturbance

Vegetation Management Zone (red) – fuel load management if deemed appropriate and necessary by weed control and/or control burning followed by weed control

Dieback – present in some areas

Weeds – control required following disturbance

Firebreaks – present along boundaries

Pony Place Reserve Action Plan

R41485

1. Background

1.1. Location

Pony Place Reserve is located in Oakford (Figure 1). The reserve is dominated by banksia woodland, with a large clay-based wetland towards the north. The reserve is 20.1 ha with 17.7 ha remnant vegetation, of which 10.82 ha is banksia woodland. This action plan specifically deals with the banksia woodland area.

The reserve is vested with the Shire for the purpose of Public Recreation and Community Hall, but current uses also include Conservation. The principal user groups for the reserve include regular and infrequent users of the community centre, and horse riders on the connected bridle trail network.

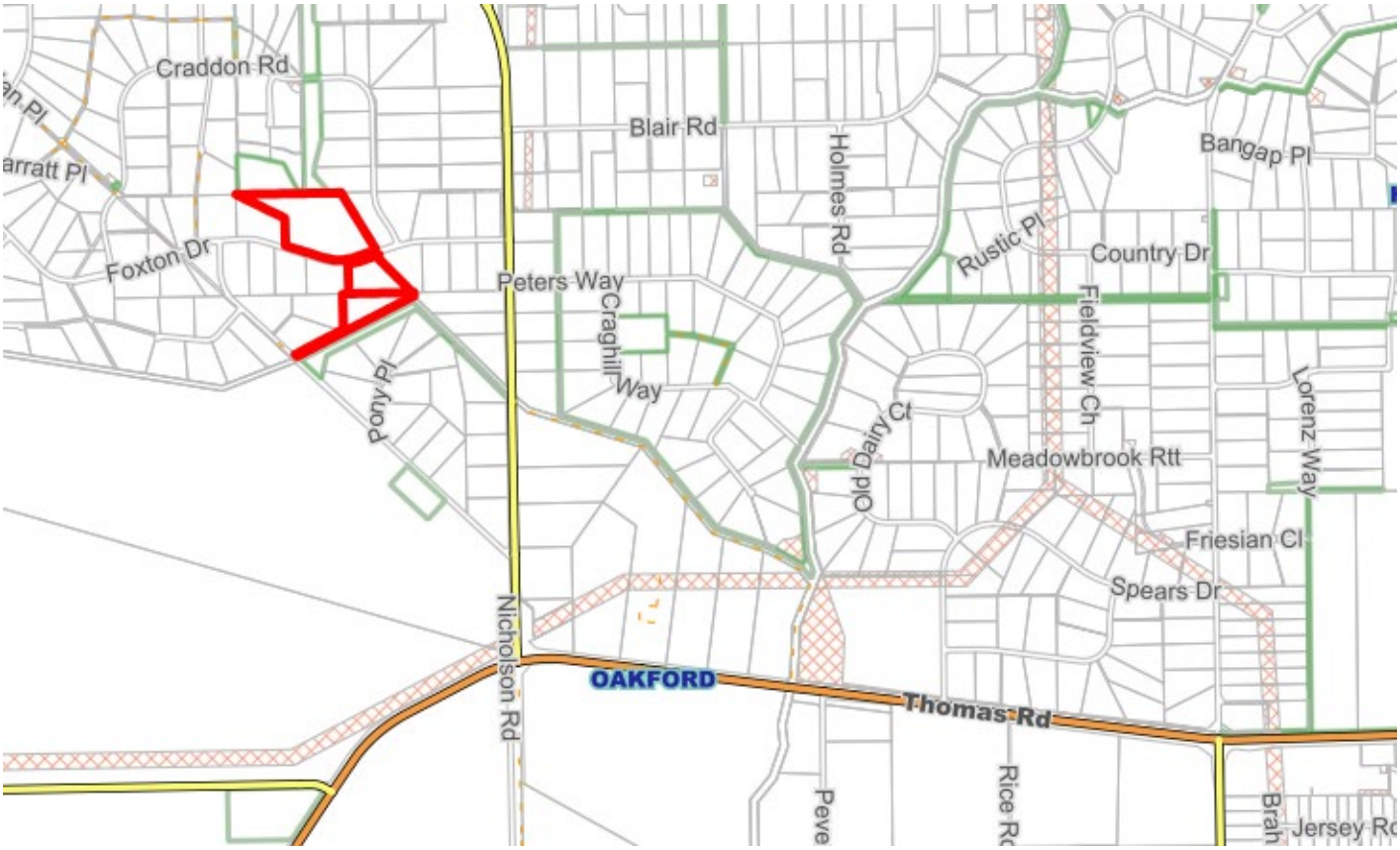


Figure 1: Location of Pony Place Reserve.

Pony Place Reserve is classified into three main management zones (Figure 2). These are:

Conservation Zone (green): Areas of remnant vegetation of high biodiversity and scientific reference value which include both dieback free and dieback infected areas. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must utilise dieback hygiene procedures such as clean-down and take extreme care to prevent spread of dieback from infected to uninfected areas.

Vegetation Management Zone (red): Areas of remnant vegetation of biodiversity and scientific reference value which may be disturbed, or dieback or weed infested. This is a buffer zone and may receive fuel load management for protection of people, property and conservation values by weed control or control burning on assessment by officers as required and appropriate. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must consider movement and reduce spread of dieback from infected to uninfected areas through clean down procedures.

Recreation Zone (yellow): This is the area containing the community hall. Management of this zone is principally for the purpose of recreation, while minimising impacts on the remnant vegetation.

This Action Plan applies to the Conservation and Vegetation Management Zones.

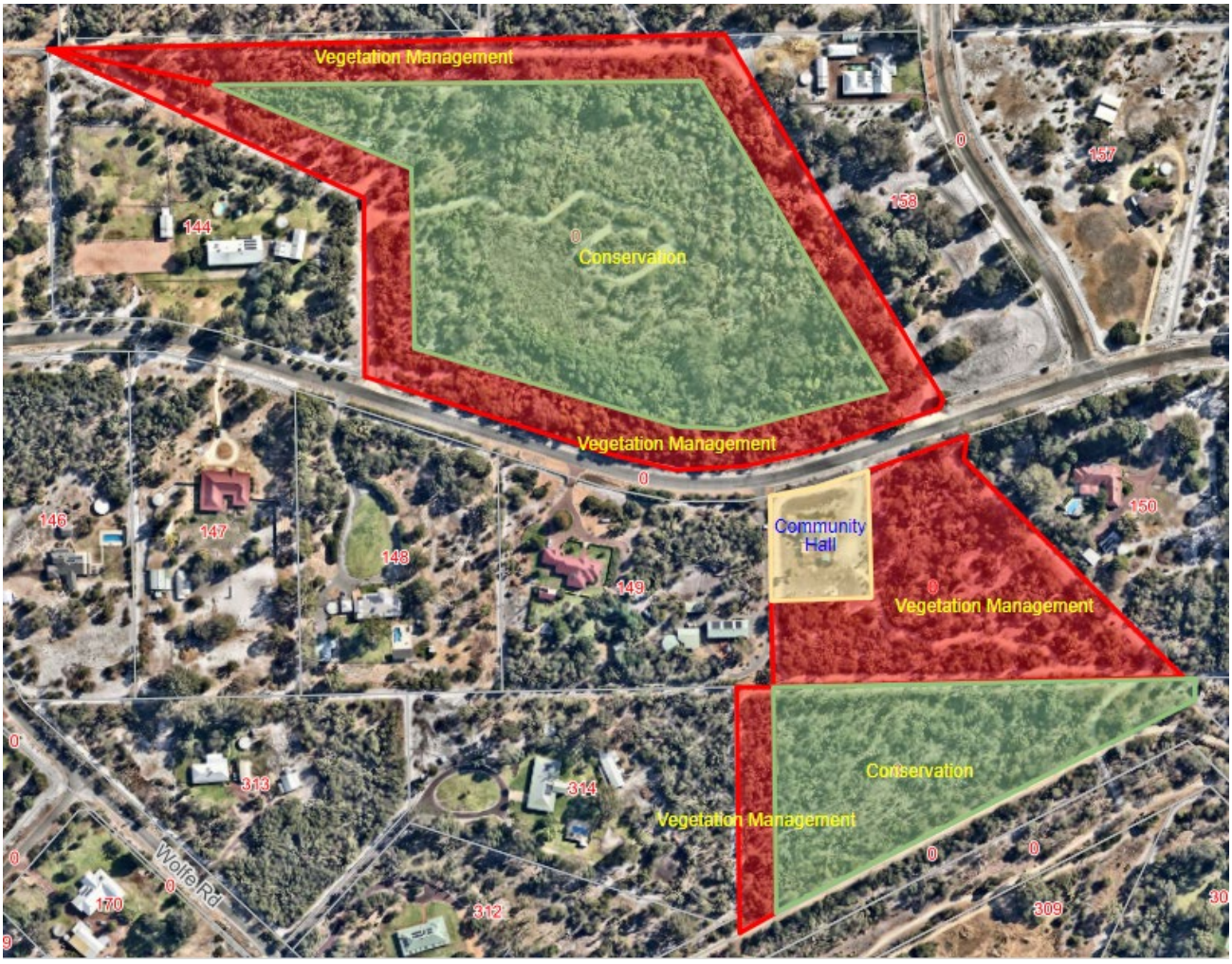


Figure 2: Management Zones of Pony Place Reserve.

1.2. Soils

Three soil types occur in Pony Place Reserve: Bassendean B2, Bassendean B3 and Bassendean B4 (Table 1 and Figure 3). Banksia woodland occurs on all three soil types, with the wetland within the Bassendean B3 soil type.

Table 1: Soil Types of Pony Place Reserve.

Reserve	Soil landscape unit	Description	Banksia occurrence
Pony Place Reserve	Bassendean B2 phase	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale yellow B horizon or a weak iron-organic hardpan 1-2 m.	Yes
	Bassendean B3 phase	Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam.	Partial
	Bassendean B4 phase	Broad poorly drained sandplain with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan.	Yes

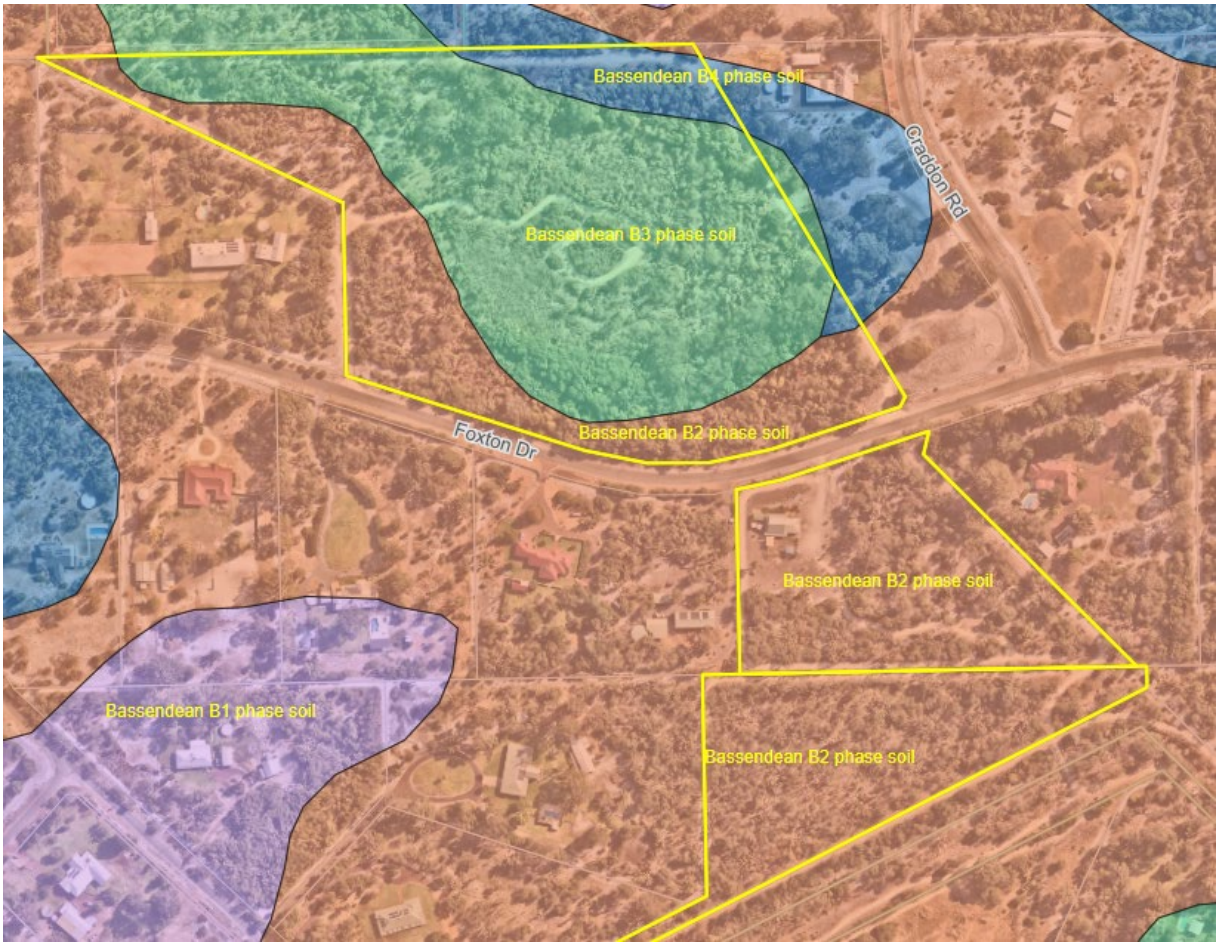


Figure 3: Soil Types of Pony Place Reserve.

1.3. Biodiversity

Pony Place Reserve contains one dominant vegetation community, banksia woodland, with a large clay-based wetland towards the north. The banksia woodland is approximately 10.82 ha in area (Figure 4) and belongs to the vegetation complex SCP22 (*Banksia ilicifolia* woodlands).

The vegetated parts of the reserve belong to Threatened Ecological Communities, and the western half of the reserve is an Environmentally Sensitive Area. The vegetation is in Very Good to Good condition overall.

The flora of Pony Place Reserve has been frequently surveyed and is diverse. No Threatened and Priority flora species have been recorded in the area. The fauna has never been formally surveyed, although anecdotally some Threatened and Priority fauna species may occur, such as black cockatoos, and quenda (southern brown bandicoot).

Figure 4: Location of Banksia Woodland in Pony Place Reserve.

1.4. Water Resources

Pony Place Reserve is low in the landscape and sometimes waterlogged in winter, with a vegetation type associated with lower areas. A major watercourse (drain) runs southeast from the wetland along the eastern boundary of the reserve, linking with another drain along the southern boundary. The majority of the area north of Foxton Drive is a clay-based wetland.

A Resource Enhancement wetland runs from the northwest to the southeast of the reserve (Figure 5), extending to Conservation Category to the northwest and Multiple Use to the southeast, both beyond the reserve boundaries.

Figure 5: Geomorphic Wetlands of Pony Place Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of Pony Place Reserve include:

- Recreational pressure from users
- Community anxiety about fire hazard and pressure for control burning
- Illegal access by motorised vehicles, associated damage to fences, vegetation and bridle trails, and public safety concerns
- Arson and vandalism
- Weed invasion, from surrounding land and carried in by users
- Feral and domestic animals (foxes, rabbits, cats) predating fauna and damaging vegetation
- Dieback disease (*Phytophthora cinnamomi*)
- Pony club's cross-country course, which passes through infected and dieback free zones

3. Reserve Usage

3.1. Vesting and Land Tenure

The vesting purpose, land tenure and current uses of Pony Place Reserve are listed below in Table 2.

Table 2: Vesting Purpose, Land Tenure and Current Uses of Pony Place Reserve.

Reserve	Reserve and Lot Number	Vesting and Land Tenure	Current Uses
Pony Place Reserve	R41485 L1401, L1393, L1402, L1367 Foxton Drive, Oakford	Shire of Serpentine Jarrahdale – Public Recreation and Community Hall	Community Hall, Recreation and Conservation

3.2. User Groups

The principal user groups for the reserve include both regular and infrequent users of the community centre, and horse riders on the connected bridle trail network.

Threats and pressures for the user groups include:

- Conflict among user groups with differing priorities, including potential conflict between:
  - the horse riders and protection of the conservation values of the remnant vegetation, such as weed introduction and degradation of the vegetation.
  - the community centre users and protection of the conservation values of the remnant vegetation, such as clearing for fire protection around the building.
- Compliance with legislation, such as health regulations.

3.3. Infrastructure

The infrastructure located in Pony Place Reserve includes:

- Community centre / hall and associated water tanks and outdoor facilities
- Car parking area
- Firebreaks and walking paths
- Fences, gates and signage
- Bridle trails

The infrastructure is maintained by the Shire. Despite fences and locked gates, vandalism and theft are constant but low-level threats.

Fire can threaten people, property and conservation values. Fires can start inside or adjacent to buildings and structures, and are often the result of vandalism, kitchen accidents or electrical faults. Bush or grass fires threaten buildings and structures through embers, radiant heat and direct contact. Cleared areas around buildings limit the opportunity for bush and grass fires to reach them. Fire in nearby bushland has the potential to damage infrastructure.

4. Action Plan

Table 3: Action Plan for Pony Place Reserve.

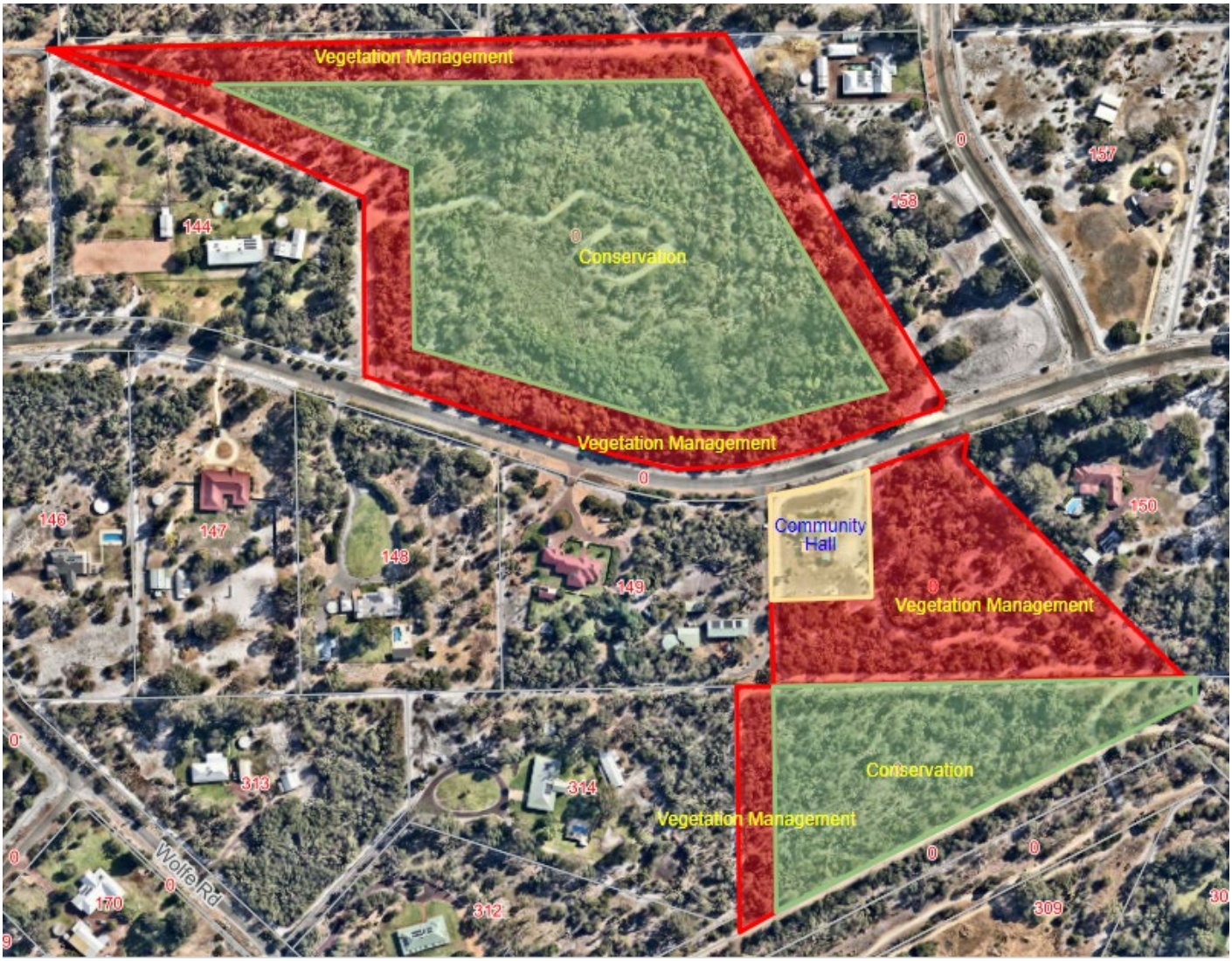
No.	Action	Priority	Timing	Status	Responsibility	Cost
1	**Utilise the planning system to retain and protect remnant banksia woodland.**	**Key**	**Business as Usual**	**Ongoing**	**Statutory Planning**	**Staff Time**
2	Formalise access to banksia woodland in high use areas through establishment of walking paths that reduce trampling.	Medium	Medium Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
3	Erect signage in high use areas to inform users of the values of the banksia woodland.	Medium	Short Term	Implemented in Part	Operations	Budget Dependent - $2,000
4	**Map and treat dieback every three years.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $8,000**
5	Control access to banksia woodland through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
6	Work with user groups to protect and minimize impacts to remnant vegetation.	High	Business as Usual	Ongoing	Natural Reserves, User Groups	Staff Time
7	Implement measures to exclude motorised vehicles from bridle trails.	High	Medium Term	Implemented in Part	Operations	Budget Dependent - $2,000
8	Ensure that formalised paths and other access routes cross dieback fronts to the lowest degree possible.	Medium	Medium Term	Not Yet Implemented	Natural Reserves	Staff Time
9	Establish dieback hygiene policies, including vehicle washdown points and foot baths for pedestrians with appropriate signage.	High	Long Term	Implemented in Part	Natural Reserves	Budget Dependent - $2,000
10	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environmental Specialist	Budget Dependent - $3,000

No.	Action	Priority	Timing	Status	Responsibility	Cost
11	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves	Budget Dependent - $3,000
12	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves	Staff Time
13	**Establish and implement a weed control program that utilises best practice methods.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves, Landcare SJ**	**Budget Dependent - $3,000**
14	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ	Budget and/or Funding Dependent - $1,500
15	**Minimise burning and other disturbance of banksia woodland.**	**Key**	**Short Term**	**Implemented in Part**	**Emergency Services**	**Staff Time**
16	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves	Staff Time
17	Maintain fire intervals of 16-40 years.	High	Long Term	Not Yet Implemented	Emergency Services	Staff Time
18	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Staff Time
19	Restrict any essential fuel load management to the Vegetation Management Zone.	High	Short Term	Not Yet Implemented	Emergency Services	Budget Dependent - $1,500
20	Ensure that any essential fuel load management utilises weed control as a priority, with control burning as a last resort.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves	Budget Dependent - $3,000
21	Ensure that any control burning is restricted to vegetation boundaries, providing a mosaic of vegetation ages including long unburnt.	High	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Budget Dependent - $1,500
22	**Follow any burning or other disturbance with weed control for at least two years post-fire.**	**Key**	**Business as Usual**	**Implemented in Part**	**Emergency Services, Natural Reserves**	**Budget Dependent - $3,000**
23	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations	Staff Time
24	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves	Funding Dependent - $2,500
25	Monitor implementation of the management plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time
26	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time
27	Review and revise the management plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time

5. Fire Management Strategy for Pony Place Reserve

Conservation Zone (green) – works exclusion; avoid disturbance

Vegetation Management Zone (red) – fuel load management if deemed appropriate and necessary by weed control and/or control burning followed by weed control



Dieback – present in some areas

Weeds – control required following disturbance

Firebreaks – present along boundaries

Wattle Road Nature Reserve Action Plan

R36433

1. Background

1.1. Location

Wattle Road Nature Reserve is located in Serpentine (Figure 1). The reserve's vegetation is transitional between banksia woodland and marri woodland. The reserve is 0.97 ha in area with 0.97 ha of remnant vegetation. This action plan deals with the banksia woodland aspects of the remnant vegetation.

The reserve is vested with the Shire for the purpose of Conservation of Flora, which is the current use. The principal users of the reserve are informal, infrequent walking and enjoyment of nature. Access is restricted due to the deep drain along the northern (road) boundary.

Figure 1: Location of Wattle Road Nature Reserve.

Wattle Road Nature Reserve has only one management zone (Figure 2). This is:

Conservation Zone (green): Areas of remnant vegetation of high biodiversity and scientific reference value which include both dieback free and dieback infected areas. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. Access within this area must utilise dieback hygiene procedures such as clean-down and take extreme care to prevent spread of dieback from infected to uninfected areas.

Figure 2: Management Zones of Wattle Road Nature Reserve.

1.2. Soils

Two soil types occur in Wattle Road Nature Reserve: Pinjarra B1 and Pinjarra P1b (Table 1 and Figure 3). Banksia woodland occurs on both soil types, transitional with marri woodland.

Table 1: Soil Types of Wattle Road Nature Reserve.

Reserve	Soil landscape unit	Description	Banksia occurrence
Wattle Road Nature Reserve	Pinjarra B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	Partial
	Pinjarra P1b phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or ieffective duplexo) soils. Moderately deep pale sand to loamy sand over clay: imperfectly drained and moderately susceptible to salinity in limited areas	Partial

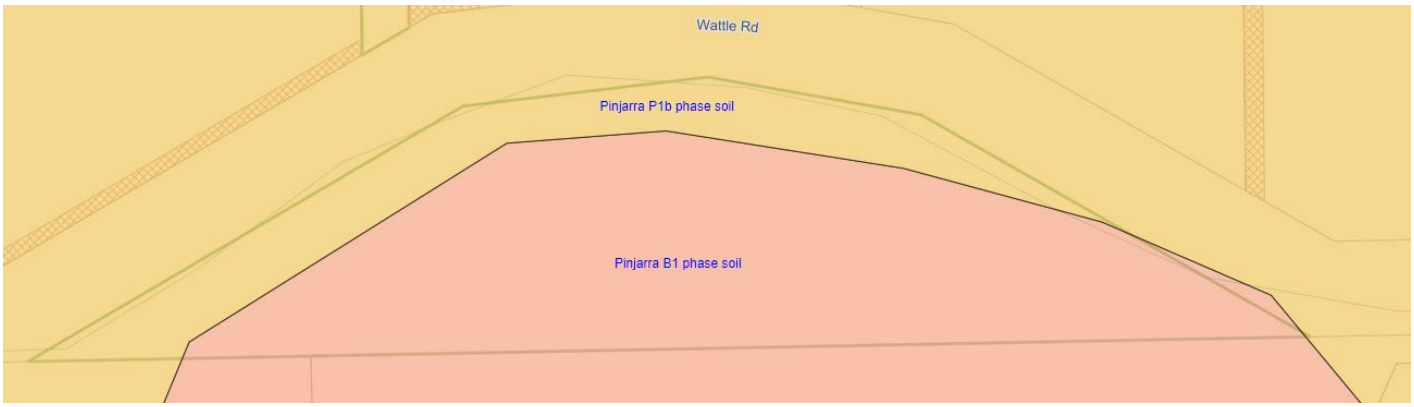


Figure 3: Soil Types of Wattle Road Nature Reserve.

1.3. Biodiversity

Wattle Road Nature Reserve contains one transitional vegetation community, which is a combination of banksia woodland and marri woodland. The banksia woodland is approximately 0.97 ha in area (Figure 4) and belongs to the vegetation complex SCP21c (low lying *Banksia attenuata* woodlands or shrublands).

The reserve is not mapped as a Threatened Ecological Community. The vegetation is in Very Good condition overall.

The flora of Wattle Road Nature Reserve has been frequently surveyed and is diverse. No Threatened and Priority flora species have been officially recorded in the area, but anecdotally the Threatened species *Morelotia australiensis* has been observed. The fauna has never been formally surveyed, although anecdotally some Threatened and Priority fauna species may occur, such as black cockatoos, and quenda (southern brown bandicoot).

Figure 4: Location of Banksia Woodland of Wattle Road Nature Reserve.

1.4. Water Resources

Wattle Road Nature Reserve is low in the landscape, sitting on a sandplain, with a vegetation type associated with low-lying areas. A deep watercourse (drain) runs along the northern (road) boundary of the reserve which restricts access.

A Resource Enhancement wetland covers the eastern, northern and western edges of the reserve (Figure 5).

Figure 5: Geomorphic Wetlands of Wattle Road Nature Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of Wattle Road Nature Reserve include:

- Recreational pressure from users
- Community anxiety about fire hazard and pressure for control burning
- Arson and vandalism (removal of grasstrees has occurred)
- Weed invasion, from surrounding land and carried in by users
- Feral and domestic animals (foxes, rabbits, cats) predating fauna and damaging vegetation
- Dieback disease (*Phytophthora cinnamomi*)

3. Reserve Usage

3.1. Vesting and Land Tenure

The vesting purpose, land tenure and current uses of Wattle Road Nature Reserve are listed below in Table 2.

Table 2: Vesting Purpose, Land Tenure and Current Uses of Wattle Road Nature Reserve.

Reserve	Reserve and Lot Number	Vesting and Land Tenure	Current Uses
Wattle Road Nature Reserve	R36433 L2597 Wattle Road, Serpentine	Shire of Serpentine Jarrahdale – Conservation of Flora	Conservation

3.2. User Groups

The principal users of Wattle Road Nature Reserve are informal, infrequent walking and enjoyment of nature. Access is restricted due to the deep drain along the northern (road) boundary.

Threats and pressures for the users are minimal.

3.3. Infrastructure

The infrastructure located in Wattle Road Nature Reserve includes firebreaks, fences, gates and signage.

The infrastructure is maintained by the Shire. Vandalism and theft are constant but low-level threats.

Fire can threaten people, property and conservation values. Bush or grass fires threaten buildings and structures through embers, radiant heat and direct contact. Cleared areas around buildings limit the opportunity for bush and grass fires to reach them. Fire in the reserve's bushland has the potential to damage nearby infrastructure.

4. Action Plan

Table 3: Action Plan for Wattle Road Nature Reserve.

No.	Action	Priority	Timing	Status	Responsibility	Cost
1	**Utilise the planning system to retain and protect remnant banksia woodland.**	**Key**	**Business as Usual**	**Ongoing**	**Statutory Planning**	**Staff Time**
2	**Map and treat dieback every three years.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves**	**Budget Dependent - $3,000**
3	Control access to banksia woodland through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations	Budget Dependent - $3,000
4	Ensure that formalised paths and other access routes cross dieback fronts to the lowest degree possible.	Medium	Medium Term	Not Yet Implemented	Natural Reserves	Staff Time
5	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environmental Specialist	Budget Dependent - $3,000
6	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves	Budget Dependent - $3,000

No.	Action	Priority	Timing	Status	Responsibility	Cost
7	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves	Staff Time
8	**Establish and implement a weed control program that utilises best practice methods.**	**Key**	**Business as Usual**	**Ongoing**	**Natural Reserves, Landcare SJ**	**Budget Dependent - $1,500**
9	Establish and implement a control program for woody weeds.	High	Business as Usual	Ongoing	Natural Reserves	Budget Dependent - $1,500
10	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ	Budget and/or Funding Dependent - $800
11	**Minimise burning and other disturbance of banksia woodland.**	**Key**	**Short Term**	**Implemented in Part**	**Emergency Services**	**Staff Time**
12	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves	Staff Time
13	Maintain fire intervals of 16-40 years.	High	Long Term	Not Yet Implemented	Emergency Services	Staff Time
14	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Staff Time
15	Ensure that any essential fuel load management utilises weed control as a priority, with control burning as a last resort.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves	Budget Dependent - $1,500
16	Ensure that any control burning is restricted to vegetation boundaries, providing a mosaic of vegetation ages including long unburnt.	High	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves	Budget Dependent - $1,500t
17	**Follow any burning or other disturbance with weed control for at least two years post-fire.**	**Key**	**Business as Usual**	**Implemented in Part**	**Emergency Services, Natural Reserves**	**Budget Dependent - $1,500**
18	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations	Staff Time
19	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves	Funding Dependent – $2,500
20	Monitor implementation of the management plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time
21	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time
22	Review and revise the management plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environmental Specialist	Staff Time

5. Fire Management Strategy for Wattle Road Nature Reserve

Conservation Zone (green) – works exclusion; avoid disturbance

Vegetation Management Zone (red) – fuel load management if deemed appropriate and necessary by weed control and/or control burning followed by weed control

Dieback – present in some areas

Weeds – control required following disturbance

Firebreaks – present along boundaries