



Scarp & Plateau Woodland & Forest Management Plan

With Reserve Action Plans:

Korribinjal Brook Reserve

Scrivener Road Gravel Reserve

Rifle Range Reserve

Jarrahdale Oval Reserve

King Jarrah Circle Reserve

Jarrahdale Skate Park Reserve



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1. Executive Summary

1.1 Introduction

The woodlands and forests of the Darling Scarp and Darling Plateau are characteristic and easily recognisable vegetation types commonly grouped together as 'Jarrah Forest'. Scarp and plateau woodlands and forests occur on the Darling Scarp and Darling Plateau, flanked by a narrow coastal plain. Underlain mainly by ancient, stable, rocks with some younger sediments to the west, it forms a major feature of the landscape characterised by old landscape elements, deep and extreme weathering, infertile soils, and a flora and fauna peculiarly adapted to a unique environment.

Scarp and plateau woodland and forest occur in the Darling Range, which consists of two distinct geological zones separated by the Darling Fault, a major tectonic feature. East of the Darling Fault is the Darling Plateau, a relatively stable area composed of metamorphosed sedimentary and volcanic rocks invaded by large areas of granite. Younger sediments are rare and are confined to local depressions on the surface and to drainage channels.

Eleven floristic communities occur in the scarp and plateau of the Shire of Serpentine Jarrahdale, of which five occur in Shire reserves. These five communities are:

- **Darling Scarp DS2** (Mosaic of open forest of *Eucalyptus marginata* – *Corymbia calophylla*, with some *Eucalyptus laeliae* in the north, with occasional *Corymbia haematoxylon* in the south on deeper soils adjacent to outcrops, woodland of *Eucalyptus wandoo*, low woodland of *Allocasuarina huegeliana* on shallow soils over granite outcrops, closed heath of Myrtaceae-Proteaceae species and lithic complex on or near granite outcrops.)
- **Dwellingup D1** (Open forest of *Eucalyptus marginata* – *Corymbia calophylla* on lateritic uplands in wetter areas.)
- **Dwellingup D2** (Open forest of *Eucalyptus marginata* – *Corymbia calophylla* on lateritic uplands in drier areas.)
- **Murray My1** (Open forest of *Eucalyptus marginata* – *Corymbia calophylla* – *Eucalyptus patens* on valley slopes to woodland of *Eucalyptus rudis* – *Melaleuca raphiophylla* on the valley floors.)
- **Yarragil Yg1** (Open forest of *Eucalyptus marginata* – *Corymbia calophylla* on slopes with mixtures of *Eucalyptus patens* and *Eucalyptus megacarpa* on the valley floors.)

In 2017 (the most recent data available), the Darling Scarp DS2 complex was assessed as having 57% remaining in the Shire of Serpentine Jarrahdale, while the other four complexes had 83% to 88%. Despite this high level of retention, these vegetation complexes have been significantly altered almost in their entirety by logging, mining and disease. None of the complexes are considered to be endangered, but are protected by vegetation clearing legislation.

The threats to scarp and plateau woodlands and forests are many and significant, including:

- Landuse history, including clearing and fragmentation

- Altered hydrology
- Climate change
- Minerals and resource development
- Inappropriate fire regimes
- Invasive species (weeds and pest animals)
- Diseases
- Fauna decline
- Unauthorised activities
- Soil degradation

The Shire of Serpentine Jarrahdale has six reserves that contain scarp and plateau woodland and forest. These reserves, their approximate area of remnant vegetation, and most likely community, are:

- Korribinjal Brook Reserve, Jarrahdale (5.16 ha, Darling Scarp DS2)
- Scrivener Road Gravel Reserve, Serpentine (106.53 ha, Dwellingup D1 and Yarragil Yg1)
- Rifle Range Reserve, Byford (7.89 ha, Darling Scarp DS2)
- Jarrahdale Oval Reserve, Jarrahdale (14.70 ha, Dwellingup D2 and Murray My1)
- King Jarrah Circle Reserve, Jarrahdale (2.75 ha, Dwellingup D2)
- Jarrahdale Skate Park Reserve, Jarrahdale (1.26 ha, Dwellingup D2 and Murray My1)

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

- Oval – Jarrahdale Oval Reserve
- Tennis club – Jarrahdale Skate Park Reserve
- Skate park – Jarrahdale Skate Park Reserve
- Mountain biking – Rifle Range Reserve
- Historic and potential gravel extraction – Scrivener Road Gravel 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 scarp and plateau woodland and forest.
- Provide a framework for developing action plans for individual reserves.
- Define specific management objectives for maintaining and improving the conservation values of scarp and plateau woodland and forest.
- Document the actions required to successfully manage scarp and plateau woodland and forest.
- 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 scarp and plateau woodland and forest.

1.3 Report Structure

This management plan is structured into the following sections:

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

2. Background

2.1 Location

The woodlands and forests of the Darling Scarp and Darling Plateau are characteristic and easily recognisable vegetation types commonly grouped together as 'Jarrah Forest'. Scarp and plateau woodlands and forests occur on the Darling Scarp and Darling Plateau, flanked by a narrow coastal plain. Underlain mainly by ancient, stable, rocks with some younger sediments to the west, it forms a major feature of the landscape characterised by old landscape elements, deep and extreme weathering, infertile soils, and a flora and fauna peculiarly adapted to a unique environment.

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

2.2 Soils

The exceptional biodiversity in scarp and plateau woodland and forest is due to long-term geological activity, resulting in variations in soil types within relatively short distances. Scarp and plateau woodland and forest occur in the Darling Range, which consists of two distinct geological zones separated by the Darling Fault, a major tectonic feature. East of the Darling Fault is the Darling Plateau, a relatively stable area composed of metamorphosed sedimentary and volcanic rocks invaded by large areas of granite. Younger sediments are rare and are confined to local depressions on the surface and to drainage channels.

The Darling Fault marks the western margin of the Darling Plateau. The fault is obscured by sediments but is located one to three kilometres west of the Darling Scarp which is its surface expression. Major vertical displacement, which created the Darling Scarp, was relatively recent and associated with the breakup of the ancient supercontinent of Gondwana, although separation did not occur along the Darling Fault.

On the Darling Plateau, the lateritic uplands, which are dominated by duricrust, gravels and sands, form a gently undulating surface dissected by valleys and lowlands of varying scales which run generally from the southeast, and are dominated by sediments of sand and clay. The Darling Scarp is heavily eroded and dominated by shallow gravelly soils and frequent granite outcrops.

The coastal plain and western Darling Range soil types of the Perth region are shown in Figure 2, and those of the Shire of Serpentine Jarrahdale in Figure 3. The soil landscape units that occur in each reserve which contains scarp and plateau woodland and forest are listed in Table 1, with maps for each reserve included in their action plans.

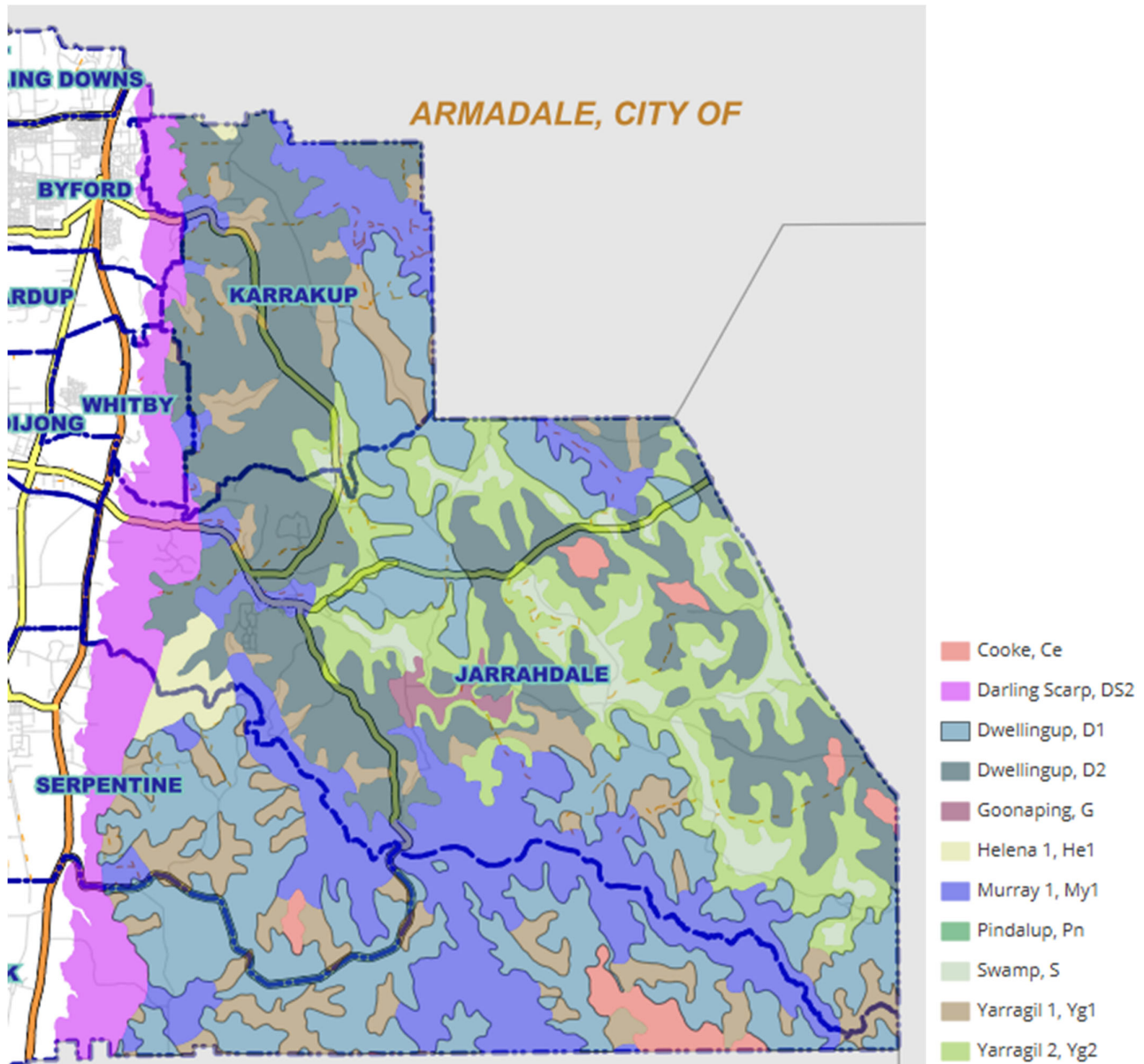


Figure 1: The Darling Range soil types and associated vegetation complexes of the Shire of Serpentine Jarrahdale.

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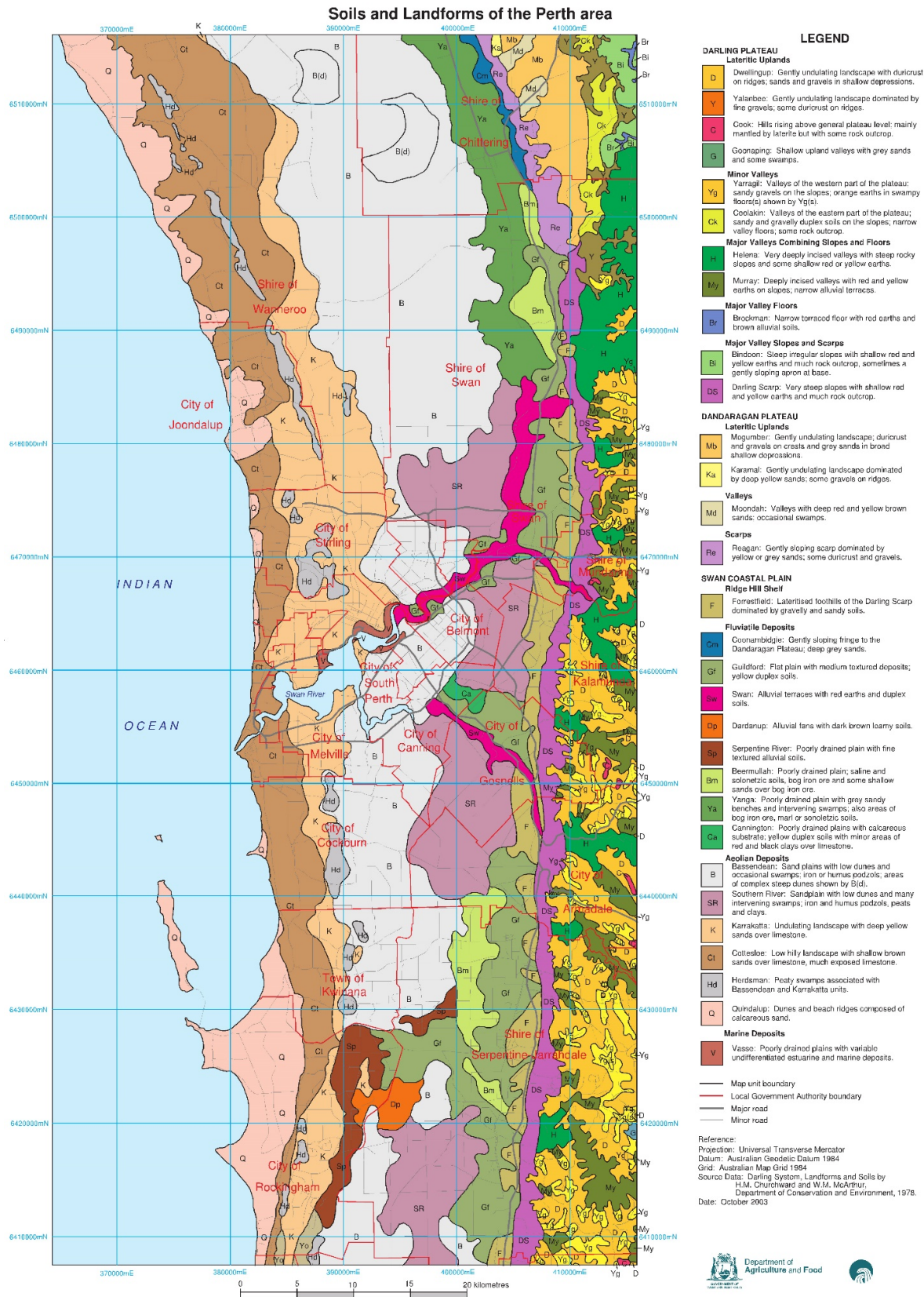


Figure 2: The coastal plain and western Darling Range soil types of the Perth region, including the Shire of Serpentine Jarrahdale.

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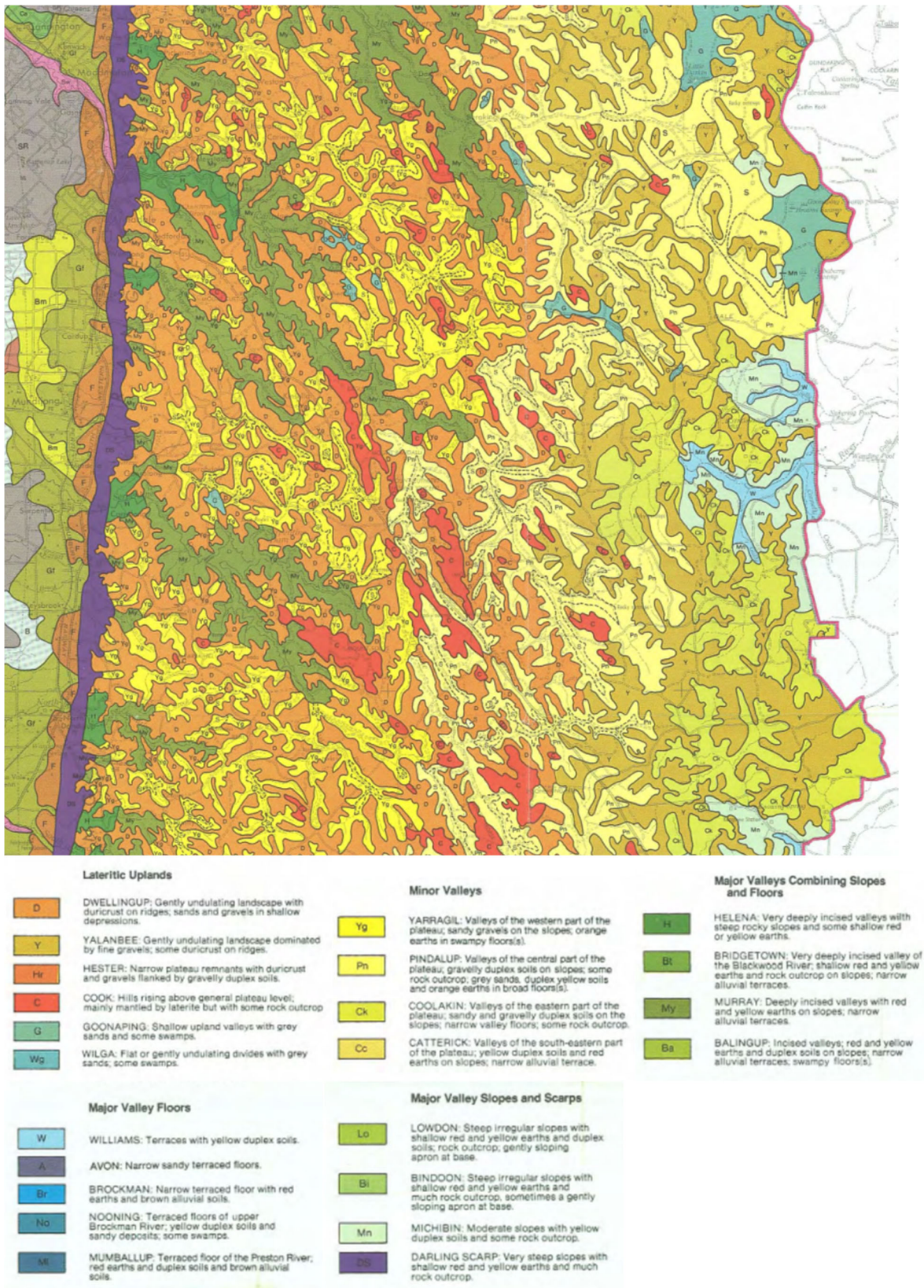


Figure 3: The Darling Range landforms and soil type zones of the southern Perth region (Swan River to Lake Preston), including the Shire of Serpentine Jarrahdale.

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

Soil landscape unit	Description	Reserve occurrence
Darling Scarp 1	Gentle to moderately inclined lower slopes (5-25%). Variable moderately well to well drained duplex and gradational soils. Occasional rock outcrop.	Rifle Range Reserve
Darling Scarp 2	Gentle to moderate upper slopes (5-30%). Variable moderately well to well drained duplex and gradational soils. Common rock outcrop.	Rifle Range Reserve
Dwellingup 2	Very gently to gently undulating terrain (<10%) with well drained, shallow to moderately deep gravelly brownish sands, pale brown sands and earthy sands overlying lateritic duricrust.	Scrivener Road Gravel Reserve Jarrahdale Oval Reserve King Jarrah Circle Reserve Jarrahdale Skate Park Reserve
Forrestfield (D Range) F2	Foot and low slopes < 10%. Well drained gravelly yellow or brown duplex soils with sandy topsoil. Woodland of <i>E. marginata</i> , <i>C. calophylla</i> and some <i>B. grandis</i> .	Rifle Range Reserve
Mambup 1	Gently undulating ridge crests and benches with slopes <20%. Shallow to moderately deep duplex and gradational soils prevail.	Near Rifle Range Reserve
Mambup 2	Gentle to moderately inclined flanks of ridges and spurs (5-25%). Shallow to moderately deep duplex and gradational soils prevail.	Near Scrivener Road Gravel Reserve
Murray 1	Moderate sideslopes (10-30%) and very narrow valley floors, with few to commonly occurring areas of rock outcrop. Variable moderately well to well drained duplex and gradational soils.	Korribinjal Brook Reserve
Murray 2	Gentle to moderately inclined sideslopes (3-25%) and narrow valley floors with few areas of rock outcrop. Variable moderately well to well drained duplex and gradational soils.	Korribinjal Brook Reserve
Murray 3	Very gentle to moderately inclined sideslopes and lower slopes (<15%) with very few areas of rock outcrop. Variable moderately well to well drained duplex and gradational soils.	Korribinjal Brook Reserve
Yarragil 1	Very gentle to moderately inclined concave sideslopes. Moderately well drained yellow duplex soils and yellow and brown massive earths and gravels. Woodland of <i>E. wandoo</i> , <i>E. marginata</i> , <i>E. accedens</i> . <i>Casuarina obesa</i> on salt affected areas.	Scrivener Road Gravel Reserve Near Jarrahdale Oval Reserve Jarrahdale Skate Park Reserve
Yarragil 4	Valley floors with some poorly drained mottled yellow duplex soils and gentle lower slopes with moderately well to well drained loamy and sandy earths, gravels and duplex soils. Low woodland of <i>E. wandoo</i> , <i>E. marginata</i> and <i>Acacia</i> spp.	Scrivener Road Gravel Reserve Jarrahdale Oval Reserve Jarrahdale Skate Park Reserve

2.3 Biodiversity

2.3.1 Description

The woodlands and forests of the Darling Scarp and Darling Plateau are characteristic and easily recognisable vegetation types commonly grouped together as 'Jarrah Forest'. Scarp and plateau woodlands and forests occur on the Darling Scarp and Darling Plateau, flanked by a narrow coastal

plain. Underlain mainly by ancient, stable, rocks with some younger sediments to the west, it forms a major feature of the landscape characterised by old landscape elements, deep and extreme weathering, infertile soils, and a flora and fauna peculiarly adapted to a unique environment.

Scarp and plateau woodlands and forest lie in the Jarrah Forest 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 (refined by Havel), the scarp and plateau woodlands and forests are subdivided into 28 vegetation complexes.

Eleven of these vegetation complexes or floristic communities occur in the scarp and plateau of the Shire of Serpentine Jarrahdale, of which five occur in Shire reserves. These five communities are:

- **Darling Scarp DS2** (Mosaic of open forest of *Eucalyptus marginata* – *Corymbia calophylla*, with some *Eucalyptus laeliae* in the north, with occasional *Corymbia haematoxylon* in the south on deeper soils adjacent to outcrops, woodland of *Eucalyptus wandoo*, low woodland of *Allocasuarina huegeliana* on shallow soils over granite outcrops, closed heath of Myrtaceae-Proteaceae species and lithic complex on or near granite outcrops.)
- **Dwellingup D1** (Open forest of *Eucalyptus marginata* – *Corymbia calophylla* on lateritic uplands in wetter areas.)
- **Dwellingup D2** (Open forest of *Eucalyptus marginata* – *Corymbia calophylla* on lateritic uplands in drier areas.)
- **Murray My1** (Open forest of *Eucalyptus marginata* – *Corymbia calophylla* – *Eucalyptus patens* on valley slopes to woodland of *Eucalyptus rudis* – *Melaleuca raphiophylla* on the valley floors.)
- **Yarragil Yg1** (Open forest of *Eucalyptus marginata* – *Corymbia calophylla* on slopes with mixtures of *Eucalyptus patens* and *Eucalyptus megacarpa* on the valley floors.)

The Shire of Serpentine Jarrahdale has six reserves that contain scarp and plateau woodland and forest. These reserves, their approximate area of remnant vegetation, and most likely community, are:

- Korribinjal Brook Reserve, Jarrahdale (5.16 ha, Darling Scarp DS2)
- Scrivener Road Gravel Reserve, Serpentine (106.53 ha, Dwellingup 1 and Yarragil 1)
- Rifle Range Reserve, Byford (7.89 ha, Darling Scarp DS2)
- Jarrahdale Oval Reserve, Jarrahdale (14.70 ha, Dwellingup D2 and Murray 1)
- King Jarrah Circle Reserve, Jarrahdale (2.75 ha, Dwellingup D2)
- Jarrahdale Skate Park Reserve, Jarrahdale (1.26 ha, Dwellingup D2 and Murray 1)

2.3.2 Flora

The Darling Plateau is subdivided into 28 vegetation complexes, of which 11 occur in the Shire of Serpentine Jarrahdale and five in Shire reserves. The distribution of the communities depends primarily on landform and soils, and climatic gradients (temperature and rainfall).

The Darling Scarp DS2 community is described as a mosaic of:

- Open forest of *Eucalyptus marginata* – *Corymbia calophylla*
- Some admixtures with *Eucalyptus laeliae* in the north
- Occasional *Corymbia haematoxylon* in the south on deeper soils adjacent to outcrops
- Woodland of *Eucalyptus wandoo*
- Low woodland of *Allocasuarina huegeliana* on shallow soils over granite outcrops

- Closed heath of Myrtaceae-Proteaceae species and lithic complex on or near granite outcrops

This complex includes a large variety flora on a unique geological feature. Several features are evident, including the dominance of wandoo (*Eucalyptus wandoo*), the admixture of marri (*Corymbia calophylla*), the occurrence of the rare Darling Range ghost gum (*Eucalyptus laeliae*) and mountain marri (*Corymbia haematoxylon*) and occasionally the salmon barked white gum (*Eucalyptus lane-poolei*), and the variety of both the floristic and structural composition of the vegetation. Other typical and common species include:

- *Borya nitida*
- *Thomasia glutinosa*
- *Verticordia acerosa*
- *Hakea incrassata*
- *Hakea stenocarpa*
- *Grevillea bipinnatifida*
- *Hovea pungens*
- *Goodenia fasciculata*
- *Petrophile biloba*
- *Conospermum huegelii*
- *Grevillea endlicheriana*
- *Hakea elliptica*
- *Hakea undulata*
- *Allocasuarina huegeliana*
- *Adenanthos barbiger*
- *Allocasuarina humilis*
- *Eucalyptus marginata*
- *Hakea lissocarpa*
- *Hypocalymma angustifolium*
- *Lepidosperma leptostachyum*
- *Leptomeria cunninghamii*
- *Leucopogon capitellatus*
- *Leucopogon propinquus*
- *Macrozamia riedlei*
- *Patersonia rudis*
- *Phyllanthus calycinus*
- *Trymalium ledifolium*

The Dwellingup D1 community is described as open forest of *Eucalyptus marginata* – *Corymbia calophylla* on lateritic uplands in wetter areas. The vegetation complex is characteristic of the high rainfall zone, receiving more than 1100mm average rainfall. This complex covers a large area of the uplands of the Darling Plateau and the floristic composition of the understorey reflects the moister conditions. Other typical and common species include:

- *Acacia browniana*
- *Acacia urophylla*
- *Adenanthos barbiger*
- *Banksia grandis*
- *Bossiaea aquifolium*
- *Allocasuarina fraseriana*
- *Daviesia pectinata*

- *Eucalyptus patens*
- *Hakea cyclocarpa*
- *Hakea lissocarpa*
- *Hovea chorizemifolia*
- *Kennedia coccinea*
- *Lasiopetalum floribundum*
- *Lepidosperma leptostachyum*
- *Leptomeria cunninghamii*
- *Leucopogon capitellatus*
- *Leucopogon propinquus*
- *Leucopogon verticillatus*
- *Macrozamia riedlei*
- *Patersonia rudis*
- *Persoonia longifolia*
- *Phyllanthus calycinus*
- *Pteridium esculentum*
- *Styphelia tenuiflora*

The Dwellingup D2 community is described as open forest of *Eucalyptus marginata* – *Corymbia calophylla* on lateritic uplands in drier areas. The significant difference from D1 is that it is restricted to medium-high rainfall areas, receiving 900-1100mm average rainfall with a resultant change in the floristic composition of the understorey. Other typical and common species include:

- *Acacia browniana*
- *Acacia urophylla*
- *Adenanthos barbiger*
- *Banksia grandis*
- *Bossiaea aquifolium*
- *Allocasuarina fraseriana*
- *Daviesia pectinata*
- *Grevillea wilsonii*
- *Hakea cyclocarpa*
- *Hakea lissocarpa*
- *Hakea ruscifolia*
- *Hovea chorizemifolia*
- *Lasiopetalum floribundum*
- *Lepidosperma leptostachyum*
- *Leptomeria cunninghamii*
- *Leucopogon capitellatus*
- *Leucopogon oxycedrus*
- *Leucopogon propinquus*
- *Leucopogon verticillatus*
- *Macrozamia riedlei*
- *Patersonia rudis*
- *Persoonia longifolia*
- *Phyllanthus calycinus*
- *Styphelia tenuiflora*
- *Trymelium ledifolium*

The Murray My1 community is described as open forest of *Eucalyptus marginata* – *Corymbia calophylla* -*Eucalyptus patens* on valley slopes to woodland of *Eucalyptus rudis* – *Melaleuca raphiophylla* on the valley floors. As a result of damming most large areas of this complex are now flooded. Other typical and common species include:

- *Acacia alata*
- *Acacia urophylla*
- *Taxandria linearifolia*
- *Astartea fascicularis*
- *Banksia grandis*
- *Banksia littoralis*
- *Bossiaea aquifolium*
- *Chorizema ilicifolium*
- *Clematis pubescens*
- *Dampiera alata*
- *Dillwynia cinerascens*
- *Eucalyptus megacarpa*
- *Grevillea diversifolia*
- *Hakea lissocarpha*
- *Hibbertia lineata*
- *Hovea chorizemifolia*
- *Hypocalymma angustifolium*
- *Kennedia coccinea*
- *Lasiopetalum floribundum*
- *Lepidosperma leptostachyum*
- *Lepidosperma tetraquetrum*
- *Leptocarpus scariosus*
- *Leptomeria cunninghamii*
- *Leucopogon capitellatus*
- *Leucopogon propinquus*
- *Leucopogon verticillatus*
- *Macrozamia riedlei*
- *Mesomelaena tetragona*
- *Phyllanthus calycinus*
- *Pteridium esculentum*
- *Trymalium spathulatum*

The Yarragil Yg1 community is described as open forest of *Eucalyptus marginata* – *Corymbia calophylla* on slopes with mixtures of *Eucalyptus patens* and *Eucalyptus megacarpa* on the valley floors. Bullich (*Eucalyptus megacarpa*) is restricted to these upper gullies of the high rainfall areas, receiving an average rainfall of more than 1100mm, while yarri (*Eucalyptus patens*) is more widespread. Other typical and common species include:

- *Acacia alata*
- *Acacia extensa*
- *Taxandria linearifolia*
- *Astartea fascicularis*
- *Banksia littoralis*
- *Dampiera alata*

- *Grevillea diversifolia*
- *Hakea lissocarpha*
- *Hypocalymma angustifolium*
- *Kingia australis*
- *Lepidosperma leptostachyum*
- *Lepidosperma tetraquetrum*
- *Leptocarpus scariosus*
- *Leptospermum ellipticum*
- *Mesomelaena tetragona*
- *Synaphea petiolaris*

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

Wetlands within scarp and plateau woodland and forest may be classified as 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. While none of the Shire reserves contain wetlands, all either contain or are in close proximity to waterways and contribute to their catchments.

Weed presence varies in wetlands and the riparian zones of waterways. 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

Scarp and plateau woodlands and forests support a diverse array of fauna that depend on different aspects of the vegetation to provide shelter, food and suitable breeding conditions. Some of these animals are present seasonally.

Threatened or priority fauna that use scarp and plateau woodlands and forests include:

- Carnaby's black cockatoo
- Forest red-tailed black cockatoo
- Baudin's black cockatoo
- Chuditch
- Quenda, southern brown bandicoot
- Numbat
- Western ringtail possum
- Quokka
- Brush-tailed phascogale
- Mallee fowl
- Carpet python
- Western brush wallaby
- Water rat

The quenda (southern brown bandicoot) inhabits dense undisturbed shrublands, as occurs in some scarp and plateau woodland and forest, where it seeks protection from predators.

Over 70% of native mammals have become regionally extinct, and others have declined in numbers or reduced in range. Larger patches of scarp and plateau woodland and forest can still support viable populations of small mammals. The quenda (southern bandicoot) occurs in many areas of scarp and plateau woodland and forest, where wide-spread and numerous scratchings can indicate that there may be a breeding population present. Kangaroos can be found in larger remnants, particularly those connected to other natural areas.

The invertebrate fauna of scarp and plateau woodlands and forests is taxonomically rich, however local and regional endemism does not contribute markedly to this taxa richness.

Over 80 bird species have been recorded in the Shire's scarp and plateau woodland and forest reserves.

The most iconic bird species are the three species of black cockatoos which can be found in scarp and plateau woodlands and forests. These birds are protected under Commonwealth as well as State legislation. Black cockatoos feed on local species such as marri, jarrah and banksia. Cockatoo breeding has been recorded on the Darling Scarp and Plateau, requiring large tree hollows which only form in larger trees.

The scarp and plateau woodlands and forests have 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 plateau that reflects the underlying soil structures and their vegetation. Frogs are likely an important dietary component for snakes and lizards.

Rabbits and pigs are major threats in scarp and plateau woodland and forest, damaging vegetation and introducing weeds. Periodical control of rabbits and pigs can occur in larger areas of bushland. Feral cats and foxes predate on native animals.

2.4 Water Resources

Water resources provide a variety of ecosystem services and include waterways, drains, wetlands, and superficial and artesian groundwater. Groundwater provides storage that interacts with some surface wetlands and waterways. During long dry spells the groundwater supports surface water and wetland ecosystems. This relationship is threatened by groundwater drawdown from increased usage and reduced recharge. In some areas of the plateau, waterways have disconnected from the groundwater, running seasonally rather than permanently with consequent changes of aquatic life.

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. Waterways in the plateau mostly flow into the Serpentine River, although many of them have been dammed.

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.

The quality of the water in the surface catchments of the plateau may be adversely affected by clearing of the forest, particularly in the lower rainfall areas in the east. Soluble salts, originally brought in with the winter rains, are held in the deeper layers of the lateritic soils in the drier areas. The salts tend to move towards surface seepages or into the streams when the water balance of the landscape is disturbed by the removal of the deep rooting, perennial native vegetation, or its replacement by shallow rooting annual crop and pasture plants. In the plateau the runoff water from the Dwellingup uplands and the associated minor Yarragil valleys is of good quality. However, with distance east, the incidence of saline seepages increases. Reservoirs are usually established in the Murray or Helena units where the deep narrow valleys cut in unweathered granite are well suited to dam construction.

Many of the Shire reserves containing scarp and plateau woodland and forest are associated with other surface water features, including waterways, drains 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 scarp and plateau woodland and forest reserves in the Shire of Serpentine Jarrahdale.

Reserve	Surface water features
Korribinjal Brook Reserve	A major natural waterway runs through the majority of the reserve
Scrivener Road Gravel Reserve	Natural waterways run to the north and west of the reserve
Rifle Range Reserve	Natural waterways run to the north and south of the reserve
Jarrahdale Oval Reserve	A major waterway (Gooralong Brook) runs to the south of the reserve and through its southeastern corner
King Jarrah Circle Reserve	Natural waterways run to the south of the reserve
Jarrahdale Skate Park Reserve	A major waterway (Gooralong Brook) runs to the north of the reserve

2.4.2 Groundwater

On the Swan Coastal Plain, extensive supplies of groundwater are contained in superficial aquifers. 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.

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.

The hydrogeology of the Darling Plateau is highly variable. The occurrence of groundwater varies considerably over short distances. The ancient rocks are generally deeply weathered but may be partly covered by a thin veneer of younger sediments. The old rocks are poor groundwater producers, but small local supplies of potable water may be found in the weathering profile of the granite or the overlying soil. Other small supplies, some brackish, occur in fractured rocks where the groundwater is stored in joints or fault zones.

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

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 scarp and plateau woodland and forest. 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.

The settlement of Jarrahdale was established after timber concessions were granted in 1872. A timber transport railway was constructed from Jarrahdale through Mundijong to Rockingham, with some of the timber processed locally and some exported around the world. Farmland along the foot of the Scarp, from Byford to Serpentine in particular, provided food for the timber workers. Following a fire that destroyed the town of Jarrahdale in 1895, the townsite was moved west and officially gazetted in 1913.

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). While none of the scarp and plateau woodlands and forests are considered to be threatened under this Act, they provide habitat for a number of Federally protected threatened species, such as black cockatoos.

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. While none of the scarp and plateau woodlands and forests are considered to be threatened under this Act, they provide habitat for numerous threatened species.

All remnant vegetation is 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 habitat for threatened species.

2.6.3 State Policy and Guidelines

There are two key items of State policy that provide protection to scarp and plateau woodland and forest. 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. This policy only applies to the coastal plain, however. 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 scarp and plateau woodland and forest. 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 Darling Scarp DS2 complex was assessed as having 57% remaining in the Shire of Serpentine Jarrahdale, while the other four complexes had 83% to 88%. The extent of clearing can be seen by comparison of Figures 4 and 5.

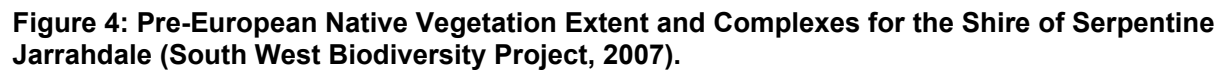
Despite the high level of retention of scarp and plateau woodlands and forests, these vegetation complexes have been significantly altered almost in their entirety by logging, mining and disease. The threats to scarp and plateau woodlands and forests are many and significant, including:

- Landuse history, including clearing and fragmentation
- Altered hydrology
- Climate change
- Minerals and resource development
- Inappropriate fire regimes
- Invasive species (weeds and pest animals)
- Diseases
- Fauna decline
- Unauthorised activities
- Soil degradation

These threats apply to all areas of scarp and plateau woodlands and forests 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 scarp and plateau woodland and forest 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



3.1 Landuse History, Including Clearing and Fragmentation

The gravelly soils of the scarp and plateau are relatively unproductive agricultural soils and the vast majority of the woodlands and forests remain uncleared. The loamy soils of the waterway valleys are more productive and many were cleared soon after settlement, mostly for food production for the timber mills. Nearly all of the jarrah forest has been heavily modified by logging for the timber industry. Large areas have been (and are still being) impacted and fragmented by extractive industry. On the scarp this mostly consists of clay for brick and tile manufacture and bluemetall (crushed granite) for road construction. Plateau extractive industries include gravel for roadbase and bauxite for aluminium production, which impacts large areas of the jarrah forest.

Fencing off blocks of natural bushland generally ameliorates active threats such as rubbish dumping and off-road vehicle use. However, construction of tracks and new fence lines within remnant patches degrades the ecological community by direct damage, increasing fragmentation, and providing easier pathways for weeds and feral animals to access parts previously protected by patch size. Some areas of the woodland and forest communities occur where there is recreational use, such as horse riding, mountain bike riding and bushwalking that can introduce weed species or have other adverse impacts such as trampling.

The majority of the scarp and plateau woodlands and forests occur in conservation reserves and State forest which are generally large in scale. The conservation reserves have formal approved management plans or interim management guidelines, and are patrolled by staff to provide protection from vandalism, illegal off-road access and driving, or refuse/garden waste dumping. The State forests have a lower level of protection and are frequently impacted by activities such as firewood collection, control burning and extractive industry.

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 woodland and forest ecosystems.

Urbanisation has been the main driver of 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.

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. Many invertebrates are short range endemics (i.e. species that occur in small areas and nowhere else) and can be significantly impacted by broad scale disturbance within a patch.

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 bauxite, in particular, can result in the removal of and/or disturbance to scarp and plateau woodland and forest.

Clearing, fragmentation and degradation of scarp and plateau woodlands and forests are ongoing in the Shire of Serpentine Jarrahdale. Development often results in hydrological impacts, and remaining buffer areas are fragmented and impacted by the effects of the development, 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.

Degradation of woodland and forest 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 Altered Hydrology

Changes to the natural hydrology are potentially a significant threat to the community. Many waterways in the scarp and plateau have altered flow regimes from permanent to seasonal, with consequent impacts on (in particular) aquatic ecosystems and water-dependent flora and fauna. Some waterways have disconnected from the declining water table, and the overall flow is a fraction of the previous situation. Reduced recharge and increased abstraction lowering water tables, urban land clearing resulting in a decline in evapotranspiration and a subsequent increase in surface runoff, and declining water quality are all likely to increasingly impact on the current hydrologic regimes of the community.

Given the reduced recharge and increased abstraction of groundwater and the highly reduced flow of surface water, the management of and maintenance of the natural hydrological regimes will continue to be a challenge.

One of the most significant threats to ecosystems is declining water tables due to increased groundwater abstraction, patterns in water regulation and decreased rainfall and subsequent groundwater recharge. Impacts range from a gradual change in structure and composition to sudden and widespread vegetation death. Where impacts result in a change in plant composition and structure, there is a shift in community composition.

Groundwater decline is not only influenced by extraction but also by declining rainfall and recharge rates as a result of climate change. Average annual rainfall has decreased, dominated by reduced winter rainfall, and resulting in decreased annual stream flow. Reservoirs for drinking water in the plateau often no longer fill from the diminishing stream flow, a small fraction of previous flows into the reservoirs, which are often now used to store desalinated seawater than collect surface water. Changes in soil temperature and distribution of surface water will impact on water-dependent ecosystems. Climate change may reduce seasonally waterlogged areas as well as increasing the depth to groundwater.

Groundwater decline may also result in flow-on effects which can impact fauna species dependent on wetlands and waterways. Vegetation may be susceptible to death or decline due to increased acidity and aluminium in subsoil water where the water table has rapidly declined. Soils may 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. Rising groundwater following land clearing can introduce salinity from the soil into ground and surface water.

Inflows to wetlands and waterways could disrupt their ecological balance. Drains may import nutrients, weeds and disease, and affect water levels. Wetlands and waterways are linked to 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 scarp and plateau. Declining water availability is likely to be having severe detrimental impacts on woodlands and forests. Reservoirs for drinking water in the plateau often no longer fill from the diminishing stream flow, a small fraction of previous flows into the reservoirs, which are often now used to store desalinated seawater than collect surface water.

Inundation from rising saline groundwater is evident in the eastern parts of the jarrah forest. In the medium term, it may prove to be a serious threat to the western areas of the community as well. Due to the widespread clearance of native perennial vegetation and its replacement with annual agricultural regimes and urbanisation, rising groundwater may carry salt into surface water. Salinity risk mapping indicates that almost all of the scarp and plateau woodlands and forests occur on susceptible land.

Protection of these land systems may require replanting 30–70% of the cleared lands across the landscape and involve a lag of up to 30 years. Groundwater management plans and resources will be needed to mitigate this risk.

3.3 Climate Change

There has been an observed significant change in rainfall in south-west Western Australia. A sharp drop in rainfall occurred in the mid–1970s, with some of the driest years on record occurring since 1975. This drop in rainfall was most apparent in late autumn and winter, with fewer winter storms and less rainfall per storm. Temperatures in Western Australia have also risen since 1910.

South-western Australia's significant drying trend is forecast to worsen under climate change. If current climate trends continue, there will be up to 80 per cent more droughts in south-western Australia by 2070.

The Intergovernmental Panel on Climate Change has identified the northern jarrah forest to be particularly at risk of collapse or ecological transition due to climate change.

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.

The effect of increased moisture stress on vegetation is variable, depending on the individual species, the magnitude of drought and heat, and competition from other plants. Net primary production and vegetation cover is declining, and communities are changing as species shift to cooler and wetter areas. Canopy die-off events have occurred in particularly hot, dry conditions. Some

species, including jarrah, have narrow temperature ranges for seed germination, which will affect future recruitment. Climate change has also been implicated in the spread of marri canker, wandoo decline and canopy die-off events in tuart and banksias. Widescale defoliation events by insects such as leaf miner have been linked to rainfall fluctuations.

Impacts on fauna are also variable, with amphibians such as frogs most vulnerable. South-west forests and woodlands are already refuges for many animals whose ranges have contracted, and habitat changes will increase impacts on these species. Particularly vulnerable species include the western swamp tortoise, ringtail possum and quokka, whose ranges are predicted to contract significantly. Food resources will be affected, including during the breeding season of black cockatoos. Aquatic species such as pygmy perch, burrowing crayfish and freshwater mussels will become more threatened. Maintenance of vegetation connectivity along waterways is essential for the survival and movement of fauna.

Climate change is also predicted to increase landscape dryness and fuel, and therefore frequency and intensity of fires. Bushfire seasons will become longer, with more frequent severe fire danger days and a reduced window for prescribed burning. Plant regeneration may be reduced by drought impacting seed set pre-fire and seedling survival afterwards. Moist areas such as riparian zones, swamps and peat systems will become more vulnerable to burning, and more intense fires reduce the availability of unburnt refugia. Increased fire occurrence can also enhance the spread of invasive weed species.

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.

3.4 Minerals and Resource Development

Commercial mining operations have been occurring in the south-west woodlands and forests since the 19th century. The total area of forest directly cleared for mining purposes is estimated at tens of thousands of hectares, with larger areas subject to indirect impacts. Petroleum exploration and development activities such as drilling and seismic surveys have also occurred historically but have had limited long-term effects, particularly in regard to vegetation clearing and disturbance.

While mining for a variety of minerals has occurred, the commodities being extracted influence the level of direct and indirect impacts on the forest environment during and following mining operations.

Mining of coal, tin and certain other minerals often leads to deep and large-scale excavations, and the need for storage of tailings at each site. Deep mining of coal over many years has resulted in deep mine voids and large waste landforms which are difficult and expensive to return to a state resembling natural ecosystems and uses. This leads to challenges in carrying out progressive rehabilitation and achieving mine closure outcomes that are both economically feasible and allow the return of the forest landform, soil profile, vegetation, and pre-mining land use.

Conversely, mining of bauxite and mineral sands has occurred since the 1960s and involves extensive but relatively shallow excavation. While directly and indirectly affecting more areas of forest than open cut mining, these operations more readily permit progressive rehabilitation. In areas affected by these operations it may also be possible to establish post-mining landform and soil

conditions that enable establishment of vegetation and fauna habitat elements with similarities to those occurring in natural forests. Despite intensive rehabilitation efforts, full return of the pre-existing soils, landforms vegetation and ecosystem functions after major disturbances may take hundreds of years or may never occur.

Mineral and petroleum exploration, extraction, and rehabilitation activities currently occur in southwest forests and are primarily managed by government agencies under legislation such as the *Environmental Protection Act 1986* (EP Act), *Mining Act 1978* (Mining Act), *Petroleum and Geothermal Energy Resources Act 1967* (PGER Act) and various State Agreement Acts. This legislation includes requirements for resource tenure and consent for activities in reserves as well as assessment, approval, management of environmental and other impacts, and rehabilitation and closure.

Each year, approximately 1,000 hectares of State forests and timber reserves are subject to mining and petroleum operations, principally for extraction of bauxite, coal and gold. This could increase in the future with the expansion of existing operations, and if new mineral or petroleum deposits are identified and additional resource development proposals are approved. The Shire of Serpentine Jarrahdale will be particularly impacted by expanded bauxite mining east of Jarrahdale.

While many areas affected by resource development activities are rehabilitated following disturbance, there may be enduring impacts on landform, habitat and biodiversity, ecosystem connectivity, soils, water, carbon, forest produce, and recreation values. In certain soil types, activities that alter groundwater levels have the potential to cause soil acidification, commonly through exposure of iron sulphides to air.

Where mining that is subject to environmental approval results in residual impacts on conservation values, there is generally a requirement for environmental offsets. These may include activities on reserves and State forest, provided the land is being managed for conservation purposes and the proposed activities are regarded as complementary and additional to standard management activities.

3.5 Inappropriate Fire Regimes

The south-west forest landscapes have evolved in the presence of fire. The forest and woodland ecosystems are resilient to a range of fire frequency, and most species have adapted to coexist with fire to some extent. Species have a range of mechanisms to either survive through fire or recolonise into recovering habitat after fire. Fire becomes a threat to biodiversity and forest health if it lies outside the normal range of fire regimes.

Fire at varying frequency and intensity has been a periodic disturbance to these ecosystems, contributing to essential nutrient cycling, germination and habitat regeneration processes.

Warmer, drier conditions will influence the flammability of vegetation, particularly during periods of extended drought. An increased frequency of drought and heatwave events may increase the likelihood of bushfires starting and decrease the likelihood of their rapid suppression.

Large, high-intensity bushfires can be a threat to many values, including human communities and forest health. The short-term impacts of high-severity fires include the loss of greater numbers of animals, changed plant composition, and loss of refugia for wildlife and habitat features, such as tree hollows. Fauna recolonisation and vegetation recovery times, including replacement of tree crowns, may be relatively delayed in areas affected by high-severity fire, while increased loss of vegetation can cause soil erosion and sedimentation of waterways. Recovery can also be significantly

hampered by weeds and feral animals. All of these can result in the ecosystem sometimes not returning to the pre-fire state.

Increased drought and heatwaves also influence the resilience of populations and ecosystems to fire. These conditions affect pre-fire seedbanks, resprouting resources for plants, condition of fauna, and make conditions for recovery of seedlings and young animals after fire more challenging.

Ecological fire regimes are designed to ensure that fire intervals are sufficient for plants to mature and replenish the soil seed bank. For this reason, fire intervals should be at least twice the juvenile period for the slowest maturing species, or 6-8 years for most jarrah forest communities. To provide a variety of habitats for fauna with different requirements, longer fire intervals of 9-16 years are required in patches to create a mosaic pattern. Fire sensitive habitats (lowlands, swamps, creek lines, granite outcrops etc.) should only be burnt infrequently, with a fire interval of 24-30 years.

Fire regimes based on biodiversity outcomes are generally absent, and deliberately lit fires can and do occur frequently, depending on the proximity of a reserve to urbanisation. Planned fire regimes are often dominated by the requirement to protect adjoining assets and land values.

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. 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.

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 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. 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. Short-range endemic species (such as many invertebrates) can be significantly impacted by broad scale fires with reduced refugia.

The primary objective of fire hazard management in the Shire of Serpentine Jarrahdale is the protection of people and property. Control burning should be minimised and followed up by weed control.

3.6 Invasive Species

3.6.1 Plants

Weeds are transforming Western Australia's landscapes, including the south-west forests and woodlands. They pose a serious threat to ecosystem health, resilience and vitality. Many weeds are successfully invading natural areas, where they can disrupt or modify ecosystem processes, adversely impacting biological diversity at genetic, species and community levels.

Competition from weeds impacts many threatened flora and ecological communities, particularly those restricted to small, disturbed areas highly vulnerable to invasion. Weeds can also increase fuel loads, affecting both the occurrence and frequency of bushfires.

There are 67 high priority weed species identified in the southwest forests and woodlands. Of these, six species are common – bridal creeper (*Asparagus asparagoides*), gladioli (*Gladiolus* spp.),

narrowleaf cottonbush (*Gomphocarpus fruticosus*), blackberry (*Rubus* spp.), cape tulip (*Moraea* spp.), Victorian tea tree (*Leptospermum laevigatum*) and arum lily (*Zantedeschia aethiopica*). Land managers, including the Shire of Serpentine Jarrahdale, prioritise the identification, monitoring and management of priority weed species.

Bulbs of South African origin that naturally occur in similar habitats and climates are some of the most invasive weeds. *Watsonia* is frequently seen invading riparian and other moist areas. *Watsonia* can disperse via cormels (tiny corms that develop along the flowering stem at the end of the flowering season) into relatively undisturbed bush remnants, forming dense stands that effectively displace the herbaceous understorey.

Other invasive plants, include arum lily (*Zantedeschia aethiopica*) and bridal creeper (*Asparagus asparagoides*), are very difficult to manage because of underground corms, tuber mats or stolon networks. Annual and perennial alien grasses also pose a threat.

Annual and perennial grasses can increase fuel loads in bushland, resulting in native remnants becoming more prone to fire, and to more frequent fires. 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.

Several native species outside their natural range can be invasive, including eucalypts such as the river red gum (*Eucalyptus camaldulensis*), Victorian tea tree (*Leptospermum laevigatum*) and eastern Australian wattles (e.g. *Acacia melanoxylon*, *Acacia baileyana*).

Weed invasion is a significant threat not only because of the actual presence of weeds, but more importantly, because of the potential for weed invasion once the community is disturbed. Remnant vegetation close to weed sources such as urban or agricultural areas are vulnerable to weed invasion following any disturbance. However, even small remnants often exhibit surprising resistance to weed invasion, particularly if left undisturbed. In general, the larger the patch size the more resistant it is to weed invasion.

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.

3.6.2 Animals

Pest animals can present major threats to the health, resilience and vitality of forest ecosystems.

Vertebrate pest animals are often exotic species but may also include native Australian animals outside their natural range (for example, kookaburras) or native species that can have an undesirable impact on the ecosystem (such as grazing by kangaroos).

The European red fox and feral cat are the major causes of the decline or extinction of many Australian mammal species. Feral cat and fox activity is greatest, and native species most vulnerable, following disturbances such as fire and vegetation clearing.

The arrival of the fox in the south-west region in the late 1920s coincided with a steep decline in the numbers of smaller native mammals. Areas baited for foxes have three times more animals than areas not subject to fox management.

Feral cats have a broad diet, taking prey up to the size of a brushtail possum and quokka. Mammal, bird, frog, reptile and fish species are vulnerable to predation by feral cats. Key native species that have experienced declines due to feral cat predation include the woylie, brushtail possum, chuditch, quenda, numbat, western ground parrot, Gilberts potoroo and quokka.

Feral pigs have multiple impacts on biodiversity values such as destroying vegetation leading to erosion along watercourses and siltation of waterways, outcompeting native animals for food, eating eggs of native species and spreading *Phytophthora* dieback. Those impacts are particularly evident along watercourses and in swampy areas. Due to habitat requirements the movement and dispersal of feral pigs occurs primarily along water courses, and from their illegal movement, presumably by recreational hunters.

Feral goats and horses have established across the Western Australian landscape, although populations are restricted in the southwest forests and woodlands. Feral goats and horses impact the natural environment by spreading disease, weeds and degrading waterways. If uncontrolled, they may spread to the Shire of Serpentine Jarrahdale.

Three species of deer have established free-ranging populations in Western Australia. Distribution and abundance of feral deer in the southwest forests and woodlands are believed to be small and localised but includes populations in the Perth Hills. They can significantly impact vegetation communities, spread weeds, and cause soil erosion.

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.

Invertebrate threats to forest ecosystem health arise from two sources: endemic insects which outbreak, or invasion by exotic pests.

The two most notable endemic insect pests of forest and woodland trees are jarrah leaf miner and gum leaf skeletoniser, which can cause widespread, temporary canopy defoliation. Drier, warmer winters and autumn drought expected with climate change may lead to more frequent outbreaks of gum leaf skeletoniser but may result in reduced impacts from jarrah leaf miner.

Other endemic invertebrate pests with consequences for tree health include endemic longicorn borers. These species are known to be responsive to physiological stress in trees induced by extremes of temperature and drought. Some tree decline syndromes such as wandoo decline result from an interaction of both pathogen and insect responses to a drying climate.

Feral bees compete with native bees, can displace native fauna from tree hollows, and can disrupt pollination mechanisms of native flora. Competition for hollows by introduced birds and other species such as feral bees may limit their availability for native species. Feral bee colonies can also occupy recreation infrastructure and aggregate at water sources, disrupting their amenity for recreation and tourism.

There are numerous other potential pest species not yet detected in Australia that have the potential to damage forest health if introduced. Biosecurity is essential to protect forest ecosystems from potential future pest outbreaks.

The ability to undertake feral animal control programs in urban and semi-urban environments is significantly impeded by the need to protect the surrounding residents from potentially negative physical and social impacts (e.g. the use of toxins and trapping and shooting).

3.7 Diseases and Pathogens

The agents of plant disease and tree decline can be biotic, abiotic, or a combination of both. Abiotic plant diseases occur when plants are exposed, often over extended periods, to sub-optimal conditions. Under a changing climate, these conditions are predicted to increase in intensity and duration in the south-west region, placing additional stress on plant communities. Plant pathogens, which are biotic factors, are known to contribute to tree declines that have been observed for several decades, affecting a range of key species including tuart, flooded gum, wandoo and marri.

Phytophthora dieback attacks the roots of plants, cutting off water and nutrients to the crown, resulting in plant death. In southwest Western Australia, more than 40% of native plant species are susceptible to the disease, including many banksia, hakea, eucalypt and grass-tree species. Threatened flora are at even greater risk with around 56% being susceptible. A drying climate is likely to increase pressures on ecosystems, which could increase the impact *Phytophthora* and other plant diseases have on the vegetation assemblages.

Apart from the direct impacts of *P. cinnamomi*, the indirect effects of loss of canopy and understorey and increased area of bare ground extend to fauna and non-susceptible flora, heritage values, carbon stores, soil microbial profiles, site hydrology, susceptibility to fire, and weed invasion. These effects are likely to be exacerbated with a drying climate.

At least 242,100 hectares of State reserves and State forests are infested with *P. cinnamomi*. Several other *Phytophthora* species contribute to the decline in health of forest ecosystems.

There are other key biosecurity threats of significance should they spread to the forests and woodlands. One example is the polyphagous shot-hole borer, a tiny beetle native to south-east Asia which has a symbiotic relationship with *Fusarium* fungus. Polyphagous shot-hole borer is known to cause *Fusarium* dieback in more than 400 host species, and is recognised as a significant environmental, forestry and agricultural pest.

Myrtle rust is another threat which is established in eastern Australia and detected in northern Western Australia in 2022. Myrtle rust could have major impacts in south-west forests and woodlands if it is introduced, causing dieback and death of Myrtaceous plants, which include eucalypts, bottlebrushes, peppermint trees and melaleucas. It is unknown what the impact of Myrtle rust will be as the climate changes.

There are several tree declines in the south-west of Western Australia that have been in progress for several decades, affecting tuart, flooded gum and wandoo as well as marri canker and blight. Several plant pathogens are implicated as contributing factors in tree declines: *P. multivora* in tuart decline, *P. multivora* and several other *Phytophthora* species in flooded-gum decline. The native fungal plant pathogen *Quambalaria coyrecup* is the main contributing and highly visible factor in marri canker, and where *Phytophthora* species are present the incidence of marri canker is greater. Human disturbance appears to be a consistent predisposing factor in tree decline.

In most areas, canopy closure, basal area and number of plant species are significantly lower in *Phytophthora* infected 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, higher bare ground and significantly lower flowering, 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.

3.8 Fauna Decline

Threats also have resulted in decline of fauna in forests and woodlands. This, in turn, feeds back into the decline of native vegetation because fauna are essential to ecological functions. 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.

Native marsupials would have played a key role in trophic interactions, pollination, seed dispersal, decomposition, mineral nutrient cycling and fuel load reduction (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 remnant vegetation. Across the metropolitan area, 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.

Reptile species assemblages 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.

Impacts to the invertebrate component of the 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 are 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. Many invertebrates are short range endemics (occurring in a small area and nowhere else), making them vulnerable to broad scale disturbance despite their vital roles in ecosystems and food webs.

3.9 Unauthorised Activities

Unauthorised activities can cause environmental degradation, destruction or degradation of cultural heritage sites, affect visitor experience and satisfaction, and impact visual quality and amenity.

The most common unauthorised activities in south-west forests and woodlands are illegal dumping, illegal or inappropriate use of motorised vehicles (including motorcycles), construction and use of unsanctioned tracks and trails and collection of firewood in unsanctioned areas. Unlawful vegetation clearing, illegal campfires, and large gatherings and parties, have also been identified as management challenges.

The community is concerned about the level of illegal dumping and littering in forests and woodlands and also highlights the need to restrict vehicles off-road, particularly in disease-risk areas and sensitive sites. In other locations, there may be a need to identify designated areas for off-road vehicle users.

Unauthorised and illegal activities in natural areas close to Perth are more prevalent due to the proximity to major population centres, as larger populations often lead to increased demand for access, facilities and services. This leads to a greater likelihood of unauthorised activity in parks, reserves and forest areas close to Perth.

3.10 Soil Degradation

Soils degraded through erosion, compaction or salinisation have altered chemical properties which can adversely affect ecosystem and hydrologic processes and water quality. Activities which result in major soil disturbance include the use of heavy vehicles, road construction and maintenance, planned and unplanned fire, and excavation of acid sulphate soils. Chemical contamination of soil can result from the misuse or spills of solvents, pesticides, herbicides and fuel spills. Disturbance to vegetation from mining, prescribed burning, pest animals, grazing, roading, and other activities can cause erosion and may result in decreased soil fertility, increased surface water flows and sediment delivery to streams and rivers.

While climate-induced lowering of groundwater may reduce salinity risks within forested catchments, salinisation of valley floors and stream salinity remains a problem originating from cleared areas.

In certain soil types, activities that alter groundwater levels have the potential to cause soil acidification, commonly through exposure of iron sulphides to air. Activities that may activate acid sulphate soils include mining, road construction, and excavation, as well as direct drawdown of groundwater by pumping.

4. Reserves

4.1 Location and Description

The Shire of Serpentine Jarrahdale has six reserves that contain scarp and plateau woodland and forest. These reserves, their approximate area of remnant vegetation, and most likely community, are:

- Korribinjal Brook Reserve, Jarrahdale (5.16 ha, Darling Scarp DS2)
- Scrivener Road Gravel Reserve, Serpentine (106.53 ha, Dwellingup D1 and Yarragil Yg1)
- Rifle Range Reserve, Byford (7.89 ha, Darling Scarp DS2)
- Jarrahdale Oval Reserve, Jarrahdale (14.70 ha, Dwellingup D2 and Murray My1)
- King Jarrah Circle Reserve, Jarrahdale (2.75 ha, Dwellingup D2)
- Jarrahdale Skate Park Reserve, Jarrahdale (1.26 ha, Dwellingup D2 and Murray My1)

The locations of the reserves are shown in Figures 6 – 8, and the reserves and the location of their scarp and plateau woodland and forest are shown in Figures 9 – 14. More detail on the reserves, such as soil types and vegetation management zones, can be found in their individual action plans.

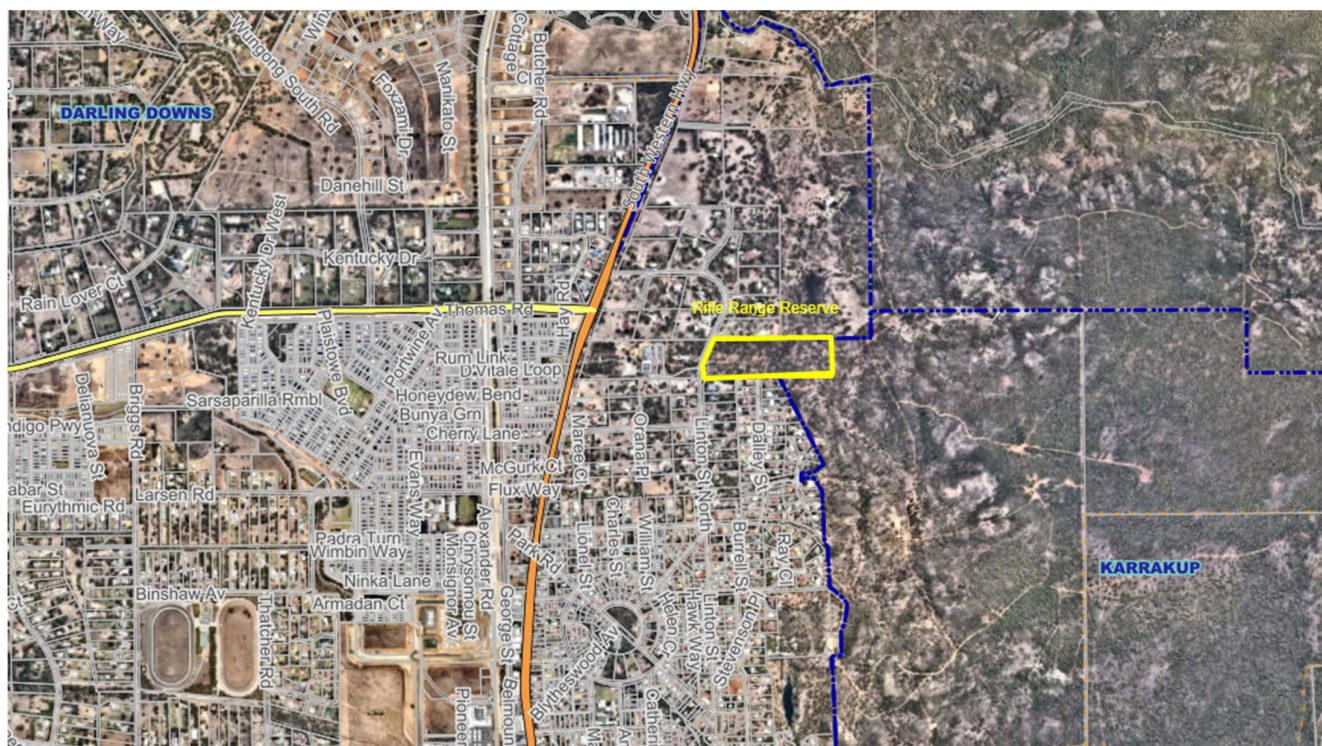


Figure 6: Location of Byford Reserves – Rifle Range Reserve.

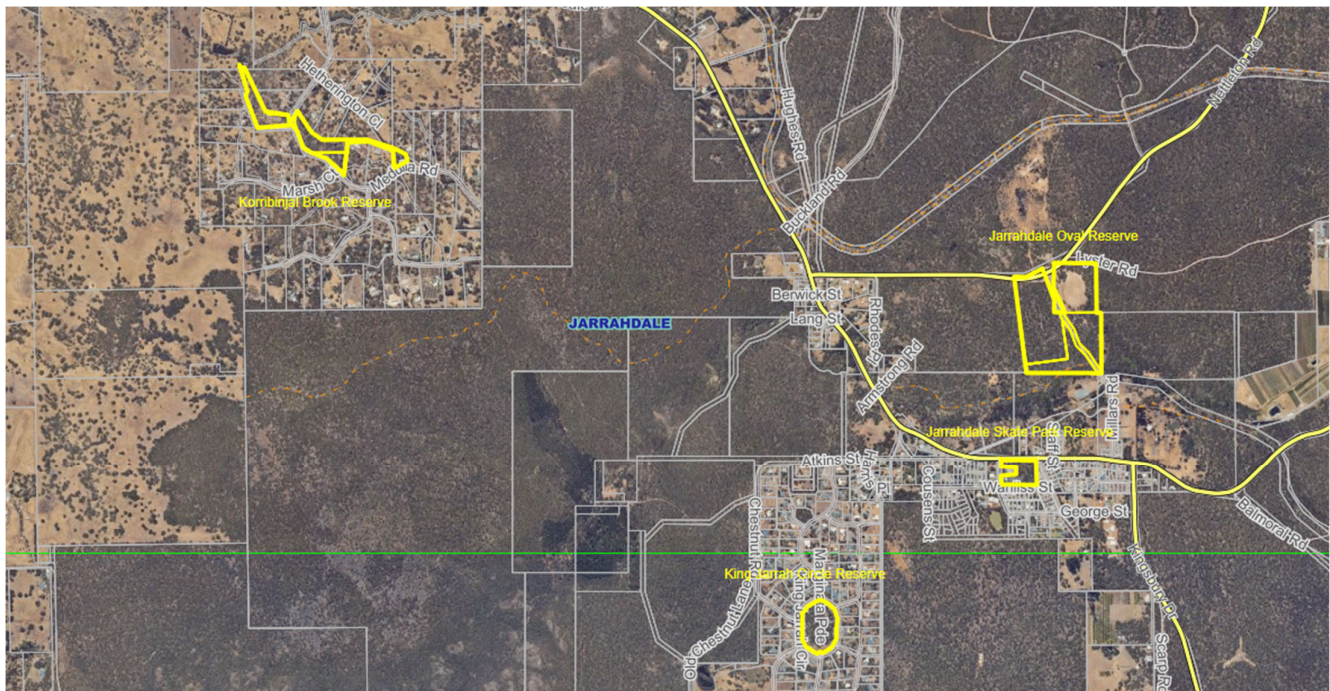


Figure 7: Location of Jarrahdale Reserves – Korribinjal Brook Reserve, Jarrahdale Oval Reserve, King Jarrah Circle Reserve and Jarrahdale Skate Park Reserve.

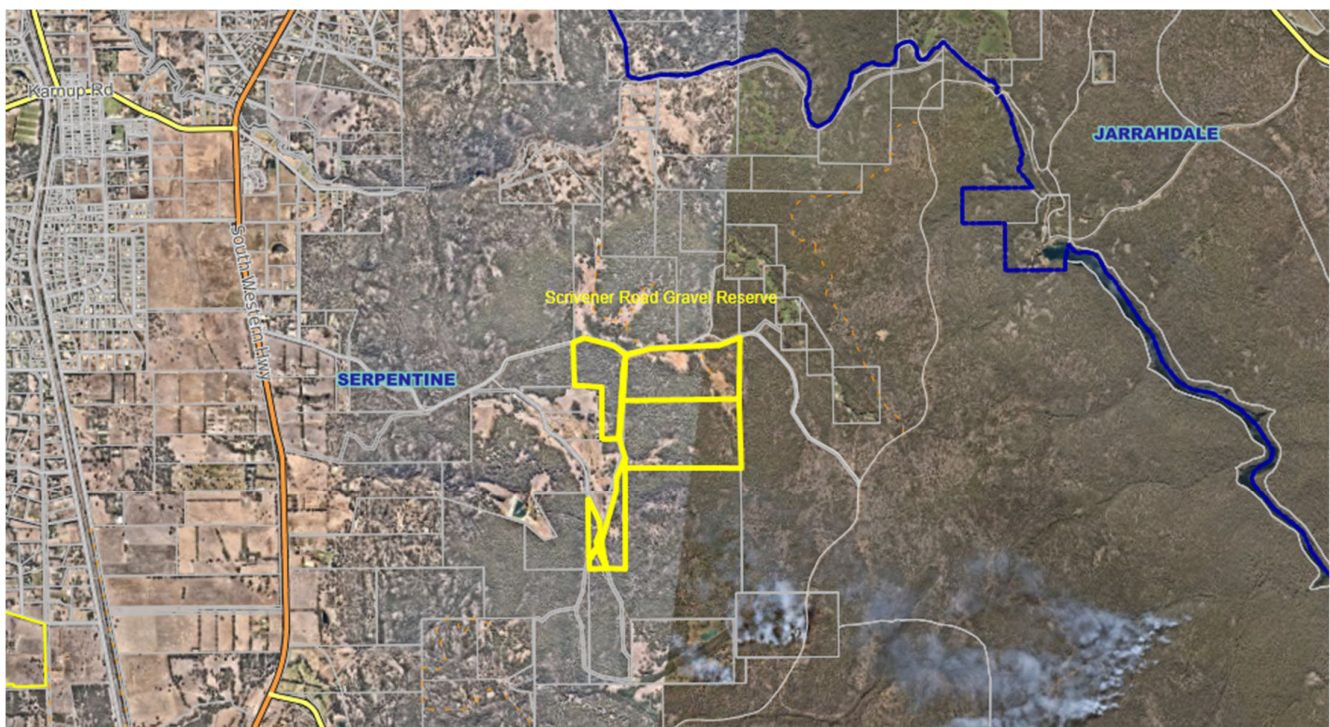


Figure 8: Location of Serpentine Reserves – Scrivener Road Gravel Reserve.

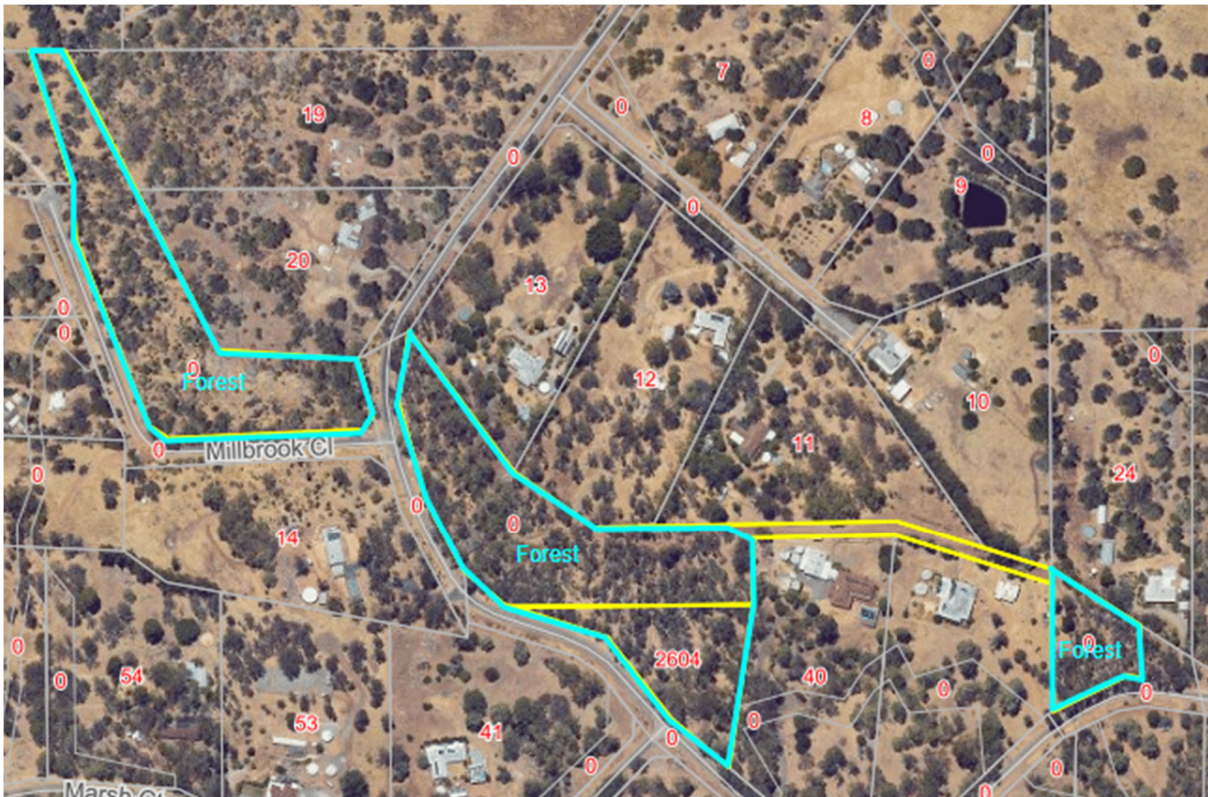


Figure 9: Korribinjal Brook Reserve, Jarrahdale and the location of its area of Scarp Woodland and Forest.

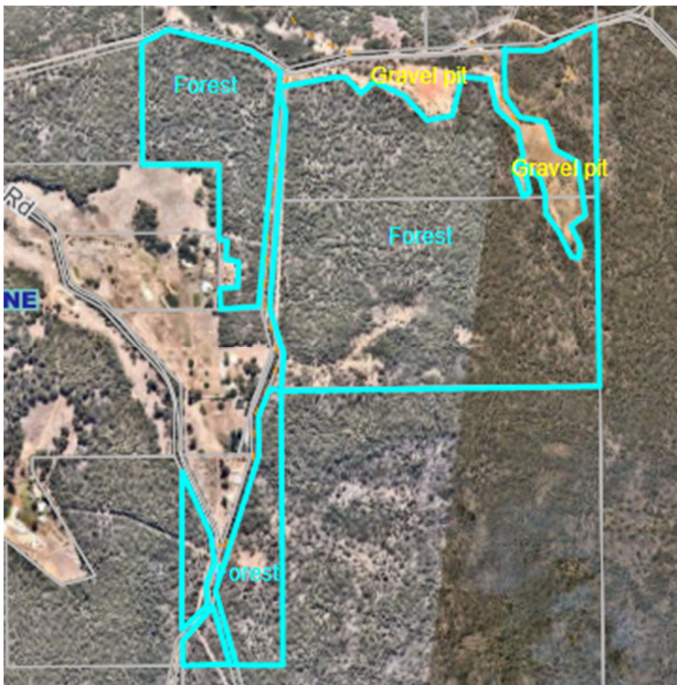


Figure 10: Scrivener Road Gravel Reserve, Serpentine and the location of its area of Plateau Forest.



Figure 11: Rifle Range Reserve, Byford and the location of its area of Scarp Woodland and Forest.

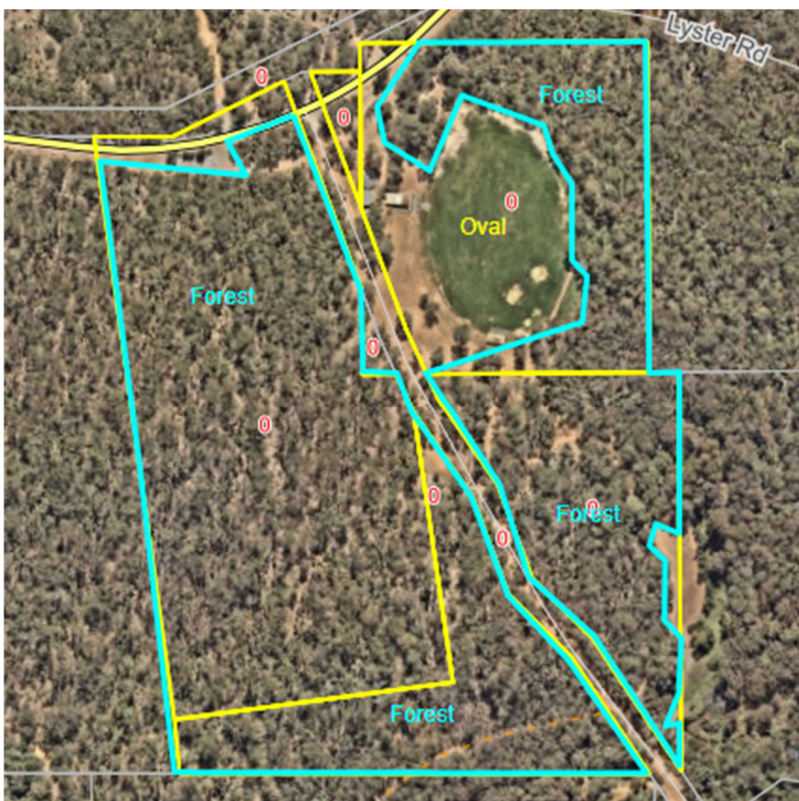


Figure 12: Jarrahdale Oval Reserve, Jarrahdale and the location of its area of Plateau Forest.

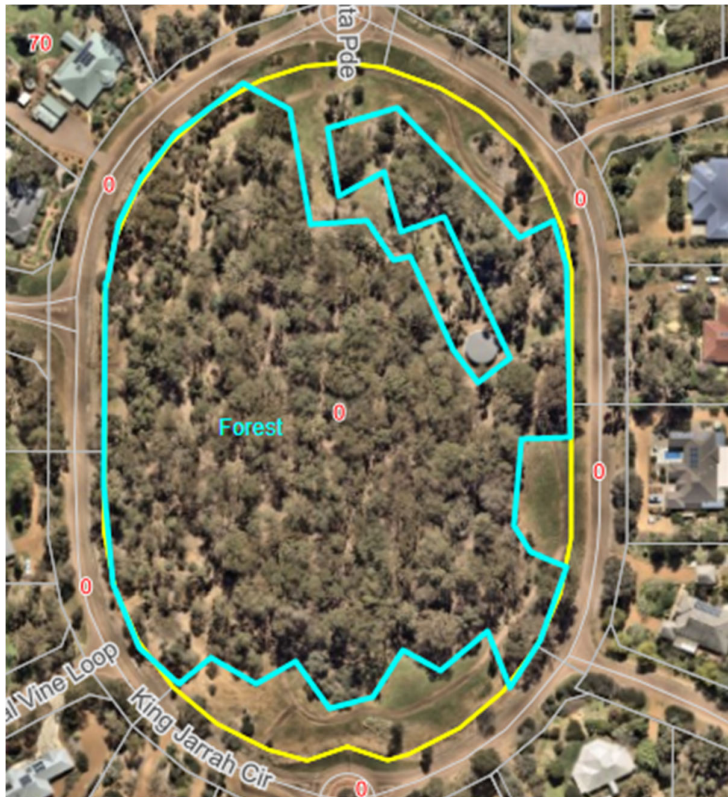


Figure 13: King Jarrah Circle Reserve, Jarrahdale and the location of its area of Plateau Forest.



Figure 14: Jarrahdale Skate Park Reserve, Jarrahdale and the location of its area of Plateau Forest.

4.2 Vesting and Land Tenure

Most of the Shire reserves containing scarp and plateau woodland and forest 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 scarp and plateau woodland and forest, 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 scarp and plateau woodland and forest is listed.

Table 3: Vesting Purpose, Land Tenure and Uses of Shire Reserves.

Reserve	Reserve and Lot Number	Vesting Purpose and Land Tenure	Current Uses
Korribinjal Brook Reserve	R36434, R36436, R42251 L2604, L2603, L4022, L4017 Medulla Road, Jarrahdale	Shire of Serpentine Jarrahdale – Public Recreation	Recreation and Conservation
Scrivener Road Gravel Reserve	R26079, R26080 L303, L304 Firns Road, Serpentine L2272, L1913 Scrivener Road, Serpentine	Shire of Serpentine Jarrahdale - Gravel	Gravel Extraction, Conservation
Rifle Range Reserve	R10164 L2857 Linton Street North, Byford	Shire of Serpentine Jarrahdale – Recreation and Community Uses	Recreation and Conservation
Jarrahdale Oval Reserve	R6428 L2658, L4438, L4434, L2657 Millars Road, Jarrahdale	Shire of Serpentine Jarrahdale – Recreation and Camping	Recreation and Conservation
King Jarrah Circle Reserve	R45659 L4490 King Jarrah Circle, Jarrahdale	Shire of Serpentine Jarrahdale – Public Recreation	Recreation and Conservation
Jarrahdale Skate Park Reserve	Freehold land L437 Munro Street, Jarrahdale	Shire of Serpentine Jarrahdale – Freehold Land	Recreation and 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 formal user groups of Jarrahdale Skate Park 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
Korribinjal Brook Reserve	Informal users, particularly walking and dog exercise
Scrivener Road Gravel Reserve	Past and potential gravel extraction by the Shire of Serpentine Jarrahdale Informal, infrequent walkers and enjoyment of nature
Rifle Range Reserve	Mountain bikes Informal users, particularly walking and dog exercise
Jarrahdale Oval Reserve	Community events Irregular oval hire Informal users, particularly walking and dog exercise Trail users, including equestrian, mountain bikes and hikers
King Jarrah Circle Reserve	Informal, infrequent walkers and enjoyment of nature
Jarrahdale Skate Park Reserve	Skateboard, scooter etc riders Tennis club Wraps around fire station reserve Informal, infrequent walkers and enjoyment of nature

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 more valuable infrastructure of Jarrahdale Skate Park 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.

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 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
Korribinjal Brook Reserve	Firebreaks, fences, gates and signage
Scrivener Road Gravel Reserve	Firebreaks, fences and gates along road frontage Historical gravel pits
Rifle Range Reserve	Firebreaks, fences and gates Informal mountain bike track
Jarrahdale Oval Reserve	Sports field Clubhouse and sheds Car parking area Irrigation system, bores and water tanks Elevated log-chopping platform Firebreaks, fences, gates and signage
King Jarrah Circle Reserve	Footpaths Water tank
Jarrahdale Skate Park Reserve	Skate park Tennis club – clubhouse, sheds and four courts Car parking area Water tanks

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 clay-based wetlands
- 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.

Scarp & Plateau Woodland & Forest Management Plan

Table 4: Scarp and Plateau Woodland and Forest Action Plan

No.	Action	Priority	Timing	Status	Responsibility
1	Utilise the planning system to retain and protect scarp and plateau woodland and forest.	Key	Business as Usual	Ongoing	Statutory Planning
2	Keep up to date with the latest research trends and integrate into reserve management.	High	Long Term	Ongoing	Natural Reserves, Emergency Services
3	Formalise access to scarp and plateau woodland and forest in high use areas through establishment of walking paths that reduce trampling.	Medium	Medium Term	Not Yet Implemented	Operations
4	Erect signage in high use areas to inform users of the values of the scarp and plateau woodland and forest.	Medium	Short Term	Implemented in Part	Operations
5	Survey for dieback presence, and map and treat dieback every three years if present.	Key	Business as Usual	Ongoing	Natural Reserves
6	Monitor and manage new and emerging pests and diseases such as polyphagous shot hole borer.	High	Medium Term	Ongoing	Natural Reserves
7	Control access to scarp and plateau woodland and forest through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations
8	Work with user groups to protect and minimize impacts to the remnant vegetation.	High	Business as Usual	Ongoing	Natural Reserves, User Groups
9	Liaise with other landholders to work together and integrate management of all scarp and plateau woodland and forest.	Medium	Medium Term	Not Yet Implemented	Natural Reserves, Strategic Environmental Specialist
10	Implement measures to exclude motorised vehicles from the remnant vegetation.	High	Medium Term	Implemented in Part	Operations
11	Erect fences or other structures to delineate user group areas.	Low	Long Term	Not Yet Implemented	Natural Reserves, User Groups
12	Ensure that formalised paths and other access routes cross dieback fronts to the lowest degree possible.	Medium	Medium Term	Not Yet Implemented	Natural Reserves
13	Establish dieback hygiene policies, including vehicle washdown points and foot baths for pedestrians with appropriate signage where appropriate.	High	Long Term	Implemented in Part	Natural Reserves
14	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environmental Specialist
15	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves
16	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves
17	Establish and implement a weed control program that utilises best practice methods.	Key	Business as Usual	Ongoing	Natural Reserves, Landcare SJ
18	Establish and implement a control program for woody weeds.	High	Business as Usual	Ongoing	Natural Reserves
19	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ
20	Minimise burning and other disturbance of scarp and plateau woodland and forest.	Key	Short Term	Implemented in Part	Emergency Services

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No.	Action	Priority	Timing	Status	Responsibility
21	Avoid disturbance to the Conservation Zone of a reserve and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves
22	Manage fire frequency in scarp and plateau woodland and forest according to best practice.	High	Long Term	Not Yet Implemented	Emergency Services
23	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves
24	Restrict any essential fuel load management to the Vegetation Management Zone of a reserve.	High	Short Term	Not Yet Implemented	Emergency Services
25	Carry out fuel load management on adjacent road verges to avoid fire entering the reserve from the verge.	High	Medium Term	Not Yet Implemented	Emergency Services
26	Ensure that any essential fuel load management utilises weed control as a priority, with control burning only according to best practice.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves
27	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
28	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
29	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations
30	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves
31	Monitor implementation of the management plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environmental Specialist
32	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environmental Specialist
33	Review and revise the management plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environmental Specialist

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Appendix 1 – Flora Surveys and Lists

The Shire's scarp and plateau woodland and forest 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 scarp and plateau woodland and forest reserves, and which reserve(s) they have been recorded in.

A total of 280 species were recorded across the six scarp and plateau woodland and forest reserves, comprising 228 native species and 52 weeds.

Demonstrating the diversity and variability of scarp and plateau woodland and forest, only one native species and two weeds were recorded in all six reserves, four native species in five reserves and 15 in four. More than half of the species (125 native and 32 weeds) were only recorded in one reserve, and 54 native species and 13 weeds in two reserves. The low number of species common to four or more reserves reflects both the relatively low diversity (poor condition and high disturbance) in Korribinjal Brook Reserve and King Jarrah Circle Reserve (and to a lesser extent Jarrahdale Skate Park Reserve) and the high diversity in Scrivener Road Gravel Reserve and Rifle Range Reserve.

Species (* denotes an introduced/weedy species)	Korribinjal	Scrivener	Rifle Range	Jarrahdale Oval	King Jarrah	Jarrahdale Skate Park
<i>Acacia alata</i>		X		X		
<i>Acacia celastrifolia</i>	X		X	X		
* <i>Acacia decurrens</i>				X		X
<i>Acacia dentifera</i>	X					
* <i>Acacia drummondii</i> ssp. <i>elegans</i>				X		
<i>Acacia extensa</i>		X				
* <i>Acacia iteaphylla</i>					X	
<i>Acacia lasiocarpa</i>		X				
<i>Acacia lateriticola</i>		X				
<i>Acacia pulchella</i>	X	X	X	X		X
<i>Acacia saligna</i>	X	X				X
<i>Acacia urophylla</i>				X		X
<i>Adenanthos barbiger</i>		X		X		X
<i>Agrostocrinum hirsutum</i>		X				
* <i>Aira caryophylla</i>				X		
* <i>Aira cupaniana</i>			X			
<i>Allocasuarina fraseriana</i>		X				
<i>Allocasuarina huegeliana</i>			X			
<i>Allocasuarina humilis</i>			X			
<i>Amyema miquelii</i>			X			
<i>Amyema preissii</i>	X					
* <i>Anagallis arvensis</i>	X		X	X		
<i>Anigozanthos</i> sp.			X			
* <i>Arctotheca calendula</i>			X			
* <i>Asparagus asparagoides</i>	X				X	
<i>Asplenium trichomanes</i>		X				
<i>Astartea scoparia</i>		X				
<i>Astroloma pallidum</i>		X	X	X		X

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Species (* denotes an introduced/weedy species)	Korribinjai	Scrivener	Riffe Range	Jarrahdale Oval	King Jarrah	Jarrahdale Skate Park
<i>Astroloma</i> sp.				X		
<i>Austrodanthonia acerosa</i>		X	X			
<i>Austrodanthonia caespitosa</i>	X					
<i>Austrostipa elegantissima</i>			X			
* <i>Avena barbata</i>	X		X			X
<i>Baeckea camphorosmae</i>		X	X	X		
<i>Banksia dallanneyi</i>			X			
<i>Banksia grandis</i>	X	X		X	X	X
<i>Banksia littoralis</i>		X				
<i>Banksia nivea</i>		X	X	X		
<i>Banksia sessilis</i>		X		X	X	
<i>Billardiera heterophylla</i>		X		X		
<i>Billardiera</i> sp.						X
<i>Boronia fastigiata</i>		X				
<i>Borya sphaerocephala</i>			X			
<i>Bossiaea eriocarpa</i>				X		
<i>Bossiaea ornata</i>		X		X		
* <i>Brassica tournefortii</i>	X					
* <i>Briza maxima</i>	X		X	X		X
* <i>Briza minor</i>			X			
* <i>Bromus diandrus</i>	X					
* <i>Bromus hordeaceus</i>	X		X			
<i>Burchardia congesta</i>		X	X	X		X
<i>Caesia micrantha</i>		X	X	X		
<i>Caladenia flava</i>		X	X			
<i>Caladenia longicauda</i>		X	X			
<i>Calothamnus quadrifidus</i>			X			
<i>Cassytha glabella</i>			X			
<i>Cassytha pomiformis</i>		X				
* <i>Centaurium tenuiflorum</i>			X			
* <i>Chamaecytisus palmensis</i>				X		X
<i>Chamaescilla corymbosa</i>		X	X			
<i>Chorizema cordatum</i>				X		X
<i>Chorizema ilicifolium</i>	X					
<i>Chorizema rhombeum</i>		X				
<i>Clematis pubescens</i>		X		X		X
<i>Conostylis aculeata</i>			X	X		
<i>Conostylis setigera</i>		X	X	X		
<i>Conostylis setosa</i>		X	X	X		X
<i>Corymbia calophylla</i>	X	X	X	X	X	X
* <i>Cotula turbinata</i>			X			
<i>Craspedia variabilis</i>		X		X		
<i>Cyathochaeta avenacea</i>			X			X
<i>Cyrtostylis huegelii</i>		X				
<i>Dampiera alata</i>		X	X			
<i>Dampiera linearis</i>		X	X	X		
<i>Darwinia citriodora</i>	X					
<i>Daucus glochidiatus</i>		X		X		
<i>Daviesia decurrens</i>			X			X
<i>Daviesia preissii</i>		X				
<i>Desmoclados fasciculatus</i>			X	X		
<i>Desmoclados flexuosus</i>			X			

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Species (* denotes an introduced/weedy species)	Korribinjai	Scrivener	Riffe Range	Jarrahdale Oval	King Jarrah	Jarrahdale Skate Park
<i>Dianella revoluta</i>			X	X		X
<i>Dichopogon capillipes</i>			X	X		
* <i>Disa bracteata</i>			X			
<i>Diuris</i> sp.		X				
<i>Drosera erythrorhiza</i>		X	X			X
<i>Drosera gigantea</i>		X				
<i>Drosera glanduligera</i>		X				
<i>Drosera menziesii</i>		X	X			X
<i>Drosera nitidula</i>			X			
<i>Drosera pallida</i>		X	X	X		
<i>Drosera porrecta</i>			X			
<i>Drosera</i> sp.				X		
* <i>Echium plantagineum</i>	X					
* <i>Ehrharta calycina</i>	X		X			
<i>Elythranthera brunonis</i>		X				
* <i>Eragrostis curvula</i>	X					
<i>Eremaea pauciflora</i>			X			
<i>Eriochilus</i> sp.		X				
<i>Eucalyptus laeliae</i>			X			
<i>Eucalyptus marginata</i>		X	X	X	X	X
<i>Eucalyptus patens</i>				X		
<i>Eucalyptus rudis</i>	X	X				
<i>Eucalyptus wandoo</i>	X		X			
* <i>Euphorbia terracina</i>	X					
* <i>Ficus carica</i>	X			X		
* <i>Freesia alba</i> x <i>leichtlinii</i>			X			X
* <i>Fumaria</i> spp.	X					
<i>Gastrolobium capitatum</i>		X	X			
* <i>Gomphocarpus fruticosus</i>	X			X	X	
<i>Gompholobium knightianum</i>		X				
<i>Gompholobium marginatum</i>		X	X	X		
<i>Gompholobium polymorphum</i>		X				
<i>Gompholobium preissii</i>		X				
<i>Gonocarpus pithyoides</i>		X	X			
<i>Goodenia pulchella</i>		X				
<i>Grevillea bipinnatifida</i>			X			
<i>Grevillea pilulifera</i>		X				
<i>Grevillea wilsonii</i>				X		
<i>Haemodorum laxum</i>		X	X			
<i>Haemodorum simplex</i>		X	X			
<i>Haemodorum spicatum</i>			X			
<i>Hakea amplexicaulis</i>		X				
<i>Hakea lissocarpa</i>	X	X	X	X		
<i>Hakea prostrata</i>	X	X	X			
<i>Hakea stenocarpa</i>		X	X			
<i>Hakea trifurcata</i>	X		X			
<i>Hakea varia</i>	X					
<i>Hardenbergia comptoniana</i>	X					
<i>Hemigenia incana</i>			X			X
<i>Hibbertia amplexicaulis</i>		X		X		X
<i>Hibbertia commutata</i>		X	X	X		
<i>Hibbertia diamesogenos</i>		X				

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Species (* denotes an introduced/weedy species)	Korribinjai	Scrivener	Riffe Range	Jarrahdale Oval	King Jarrah	Jarrahdale Skate Park
<i>Hibbertia hypericoides</i>		X	X	X		
<i>Hibbertia lasiopus</i>		X				
<i>Hibbertia</i> sp.				X		
<i>Homalosciadium homalocarpum</i>		X				
<i>Hovea chorizemifolia</i>		X				
<i>Hovea trisperma</i>		X		X		X
<i>Hyalosperma cotula</i>		X				
<i>Hypocalymma angustifolium</i>		X	X	X		
<i>Hypocalymma robustum</i>		X	X			
* <i>Hypochoeris glabra</i>	X	X	X	X	X	X
* <i>Hypochoeris radicata</i>	X	X	X	X	X	X
<i>Hypolaena exsulca</i>		X				
<i>Isopogon sphaerocephalus</i>		X				
<i>Isotoma hypocrateriformis</i>		X	X			
<i>Jacksonia sternbergiana</i>	X					
<i>Juncus</i> sp.				X		
<i>Kennedia coccinea</i>				X		X
<i>Kennedia prostrata</i>		X		X		
<i>Kingia australis</i>			X			
<i>Kunzea micrantha</i>		X				
<i>Labichea punctata</i>		X	X			
<i>Lachnagrostis filiformis</i>				X		
<i>Lagenophora huegelii</i>		X	X	X		
<i>Lambertia multiflora</i>			X			
<i>Lasiopetalum bracteatum</i>		X				
* <i>Lavandula stoechas</i>					X	
<i>Laxmannia squarrosa</i>		X	X			
<i>Lechenaultia biloba</i>		X	X	X		X
<i>Lepidosperma leptostachyum</i>		X	X	X		X
<i>Lepidosperma pubisquameum</i>		X	X			
<i>Lepidosperma scabrum</i>		X	X			
<i>Lepidosperma</i> sp. E Perth Flora		X	X			
<i>Lepidosperma tuberculatum</i>			X			
<i>Leptospermum erubescens</i>		X				
<i>Leucopogon capitellatus</i>		X				
<i>Leucopogon</i> sp.		X				X
<i>Leucopogon verticillatus</i>				X		
<i>Levenhookia pusilla</i>		X	X			
<i>Lobelia tenuior</i>			X			
* <i>Lolium rigidum</i>	X					
<i>Lomandra capitellatus</i>		X				
<i>Lomandra integra</i>						X
<i>Lomandra purpurea</i>		X				
<i>Lomandra</i> sp.			X	X		
* <i>Lotus angustissimus</i>	X					
<i>Loxocarya</i> sp.		X				
* <i>Lupinus luteus</i>	X					
<i>Macrozamia riedlei</i>		X	X	X		X
<i>Melaleuca acerosa</i>	X					
<i>Melaleuca preissiana</i>	X	X				
<i>Melaleuca radula</i>			X			
<i>Melaleuca rhapsiophylla</i>	X					

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Species (* denotes an introduced/weedy species)	Korribinjai	Scrivener	Riffe Range	Jarrahdale Oval	King Jarrah	Jarrahdale Skate Park
<i>*Melinis repens</i>	X					
<i>Mesomelaena tetragona</i>			X			
<i>Millotia tenuifolia</i>		X				
<i>Mirbelia dilatata</i>	X	X		X		X
<i>*Moraea flaccida</i>			X			
<i>*Moraea miniata</i>			X			
<i>Neurachne alopecuroidea</i>		X	X			X
<i>Nuytsia floribunda</i>		X	X			
<i>*Olea europaea</i>	X					
<i>Opercularia hispidula</i>		X		X		X
<i>Opercularia vaginata</i>		X	X			
<i>Orthrosanthus laxus</i>	X	X				
<i>Oxalis perennans</i>				X		
<i>*Oxalis purpurea</i>				X		
<i>*Oxalis sp.</i>				X	X	
<i>*Parentucellia latifolia</i>			X			
<i>Patersonia occidentalis</i>		X	X	X		X
<i>Pentapeltis peltigera</i>		X				X
<i>Pericalymma ellipticum</i>		X				
<i>Persoonia elliptica</i>		X		X		
<i>Persoonia longifolia</i>		X		X		
<i>Philothea spicata</i>			X			
<i>Phyllanthus calycinus</i>		X	X	X		X
<i>*Phytolacca octandra</i>					X	
<i>Pimelea preissii</i>		X				
<i>Pimelea suaveolens</i>		X				
<i>*Plantago lanceolata</i>				X		
<i>*Plantago major</i>				X		
<i>Platysace filiformis</i>		X				
<i>Pteridium esculentum</i>	X			X		X
<i>Pterostylis barbata</i>		X				
<i>Pterostylis nana</i>		X				
<i>Pterostylis recurva</i>		X				
<i>Pterostylis vittata</i>			X			
<i>Ptilotus drummondii</i>			X			
<i>Ptilotus manglesii</i>		X	X	X		X
<i>Pyrorchis nigricans</i>		X				
<i>Ranunculus pumilio</i>			X			
<i>*Romulea rosea</i>			X	X	X	
<i>*Rubus sp.</i>	X			X		
<i>Scaevola calliptera</i>		X		X		X
<i>Schoenus clandestinus</i>			X			
<i>Schoenus pedicellatus</i>			X			
<i>Schoenus sp.</i>		X				
<i>Senecio hispidulus</i>		X				
<i>*Solanum nigrum</i>	X				X	
<i>*Sonchus oleraceus</i>	X		X			
<i>Sowerbaea laxiflora</i>			X			
<i>Sphaerolobium aff. macranthum</i>		X				
<i>Stackhousia monogyna</i>			X			
<i>Stylidium brunonianum</i>		X	X			
<i>Sylidium bulbiferum</i>		X	X	X		

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Species (* denotes an introduced/weedy species)	Korribinjai	Scrivener	Riffe Range	Jarrahdale Oval	King Jarrah	Jarrahdale Skate Park
<i>Stylidium calcaratum</i>			X			
<i>Stylidium hispidum</i>		X		X		
<i>Stylidium junceum</i>		X				
<i>Stylidium petiolare</i>			X			
<i>Stylidium piliferum</i>		X	X			
<i>Stylidium repens</i>			X			
<i>Stylidium schoenoides</i>		X				
<i>Stylidium</i> spp.						X
<i>Stylidium striatum</i>		X	X			
<i>Synaphea petiolaris</i>		X	X			
<i>Taxandria linearifolia</i>		X		X		
<i>Tetraria octandra</i>		X	X			
<i>Tetrarrhena laevis</i>		X	X	X		X
<i>Tetradlea hirsuta</i>		X		X		
<i>Thelymitra antennifera</i>		X				
<i>Thelymitra crinita</i>		X	X	X		
<i>Thelymitra macrophylla</i>		X				
<i>Thelymitra</i> sp.				X		
<i>Thelymitra vulgaris</i>		X	X			
<i>Thomasia triphylla</i>			X			
<i>Thysanotus manglesianus</i>		X	X	X		X
<i>Thysanotus tenellus</i>		X				
<i>Thysanotus thyrsoides</i>		X				
<i>Trachymene pilosa</i>		X	X	X		
<i>Tribonanthes australis</i>			X			
<i>Trichocline spathulata</i>		X	X			
<i>Tricoryne elatior</i>		X				
* <i>Trifolium angustifolium</i>	X					
* <i>Trifolium campestre</i>			X	X		
* <i>Trifolium subterraneum</i>			X			
<i>Tripterococcus brunonis</i>			X			
<i>Trymalium angustifolium</i>				X		
<i>Trymalium ledifolium</i>		X				
<i>Trymalium odoratissimum</i>			X			
<i>Typha orientalis</i>	X					
* <i>Ursinia anthemoides</i>			X			X
<i>Verticordia huegelii</i>		X				
<i>Viminaria juncea</i>		X				
<i>Wahlenbergia preissii</i>			X			
* <i>Watsonia meriana</i>				X		
<i>Xanthorrhoea gracilis</i>		X	X	X		X
<i>Xanthorrhoea preissii</i>		X	X	X	X	X
<i>Xanthosia huegelii</i>		X	X	X		
* <i>Zantedeschia aethiopica</i>					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.

General fauna surveys are only known to have occurred in Korribinjal Brook Reserve. The other reserves have been omitted here for the sake of simplicity.

Species (* denotes an introduced species)	Korribinjal Brook Reserve
Mammals	
Quenda (southern brown bandicoot)	X
Western grey kangaroo	X
*House mouse	X
*Rabbit	X
*Fox	X
Amphibians	
Granite froglet	X
Reptiles	
Barking gecko	X
Swamp skink	X
Fence skink	X
Southern pale-flecked morethia	X
Bobtail	X
Dugite	X
Birds	
Australian Ringneck Parrot	X
Red-Capped Parrot	X
Western Rosella	X
*Laughing Kookaburra	X
Splendid Fairy-Wren	X
Spotted Pardalote	X
Striated Pardalote	X
Western Gerygone	X
Broad-Tailed Thornbill	X
Western Thornbill	X
Brown Honeyeater	X
Western White-Naped Honeyeater	X
New Holland Honeyeater	X
Western Spinebill	X
Little Wattlebird	X
Scarlet Robin	X
Rufous Whistler	X
Willie Wagtail	X
Grey Fantail	X
Black-Faced Cuckoo-Shrike	X
Australian Magpie	X
Australian Raven	X
Mistletoe Bird	X
Grey-Breasted White-Eye	X

Appendix 3 – Threatened and Priority Flora and Fauna

Threatened and priority flora and fauna have been recorded in the Shire's scarp and plateau woodland and forest reserves, and in nearby national parks (denoted as NP). 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.

Targeted surveys for threatened and priority fauna are only known to have occurred in Korribinjal Brook Reserve and Scrivener Road Gravel Reserve. The other four reserves have been omitted here for the sake of simplicity.

Species	Status T (Threatened) P1-4 (Priority 1-4)	Korribinjal Brook Reserve	Scrivener Road Gravel Reserve
Flora			
<i>Acacia horridula</i>	P3		NP
<i>Lasiopetalum pterocarpum</i>	T		NP
<i>Pimelea rara</i>	T		NP
Fauna			
Birds			
<i>Calyptorhynchus banksii naso</i> (Forest red-tailed black cockatoo)	T	X	X
<i>Calyptorhynchus baudinii</i> (Baudin's black cockatoo)	T	X	X
<i>Calyptorhynchus latirostris</i> (Carnaby's black cockatoo)	T	X	X
Mammals			
<i>Isodon fusciventer</i> (quenda)	P4	X	X

Appendix 4 – Fire Management for Scarp & Plateau Woodland & Forest

Key Scientific Principles for Fire Management

(from Burrows 2002)

1. The vegetation and climate of the south-west forest region make it highly prone to bushfire. Fire should be regarded as an environmental factor that has and will continue to influence the nature of south-west landscapes and is integral to land management.
2. Species and communities vary in their adaptations to, and reliance on, fire. Knowledge of the temporal and spatial scales of fires in relation to the life histories of organisms or communities involved underpins the use of fire in natural resource management.
3. Following fire, environmental factors such as landform, topography and species' life history attributes, and random events such as climatic events, often drive ecosystems towards a new transient state with respect to species composition and structure. This may preclude the identification of changes specifically attributable to fire.
4. Fire management is required for two primary reasons, which are not necessarily mutually exclusive: a) to protect and conserve the biota and b) to reduce the occurrence of large, damaging wildfires. The biological impact of a single fire event and the rate of recovery are directly proportional to the intensity and size of the fire.
5. Fire management should be precautionary and consider both ecological and protection objectives in order to optimise outcomes.
6. Fire diversity promotes biodiversity. An interlocking mosaic of patches of vegetation representing a range of fire frequencies, intervals, seasons, intensities and scales need to be incorporated into ecologically-based fire regimes if they are to optimise the conservation of biodiversity.
7. Avoid applying the same fire regime over large areas for long periods of time and avoid seral and structural homogenisation by not treating large areas with extreme regimes such as very frequent or infrequent fire intervals.
8. The scale, or grain-size, of the mosaic should a) enable natal dispersal b) optimise boundary habitat (interface between two or more seral states) and c) optimise connectivity (ability of fauna to cross).

9. All available knowledge, including life histories, vital attributes of the flora and fauna and knowledge of Noongar fire regimes should be utilised to develop ecologically-based fire regimes for a landscape unit or a vegetation complex.
10. Fire history, vegetation complexes and landscape units should be used to develop known and ideal fire age class distributions.
11. Wildfire can damage and destroy both conservation and societal values, hence risk management must be based on a systematic and structured approach to identifying and managing the consequences of such an event.
12. Fire management should adapt to changing community expectations and to new knowledge gained through research, monitoring and experience.

Fire Management Strategy for Scarp & Plateau Woodland & Forest

- 1. For fuel load management, weed control is preferable to control burning and should be the method of choice.**
- 2. All fire in scarp and plateau woodland and forest, whether wildfire or control burning, must be followed by at least two years of thorough weed control.**
- 3. Burning of scarp and plateau woodland and forest increases fire hazard and rate of spread through increased growth and invasion of flammable grassy weeds.**
- 4. Any disturbance of scarp and plateau woodland and forest results in growth and invasion of highly flammable grassy weeds, leading to increased fire hazard.**
- 5. Fire intervals in scarp and plateau woodland and forest should be a minimum of 6-8 years and ideally 9-16 years in drier (upland) communities, and 24-30 years in fire sensitive habitats (lowlands, swamps, creek lines, granite outcrops etc.).**
- 6. Fires in scarp and plateau woodland and forest, particularly control burning, should endeavour to create an interlocking mosaic of patches of vegetation with different fire intervals.**
- 7. Fire control in scarp and plateau woodland and forest should consider dieback disease and avoid spread into uninfected areas by movement of machinery across dieback fronts and other hygiene methods.**
- 8. Some wetlands within scarp and plateau woodland and forest contain peat (partially decayed plant matter) which may continue to burn underground for long periods.**

Korribinjal Brook Reserve Action Plan

R36434, R36436, R42251

1. Background

1.1 Location

Korribinjal Brook Reserve is located in Jarrahdale (Figure 1). The reserve is dominated by Scarp woodland and riparian vegetation. The reserve is 5.42 ha with 5.16 ha remnant vegetation. This action plan specifically deals with the 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 include casual walkers and Landcare groups.

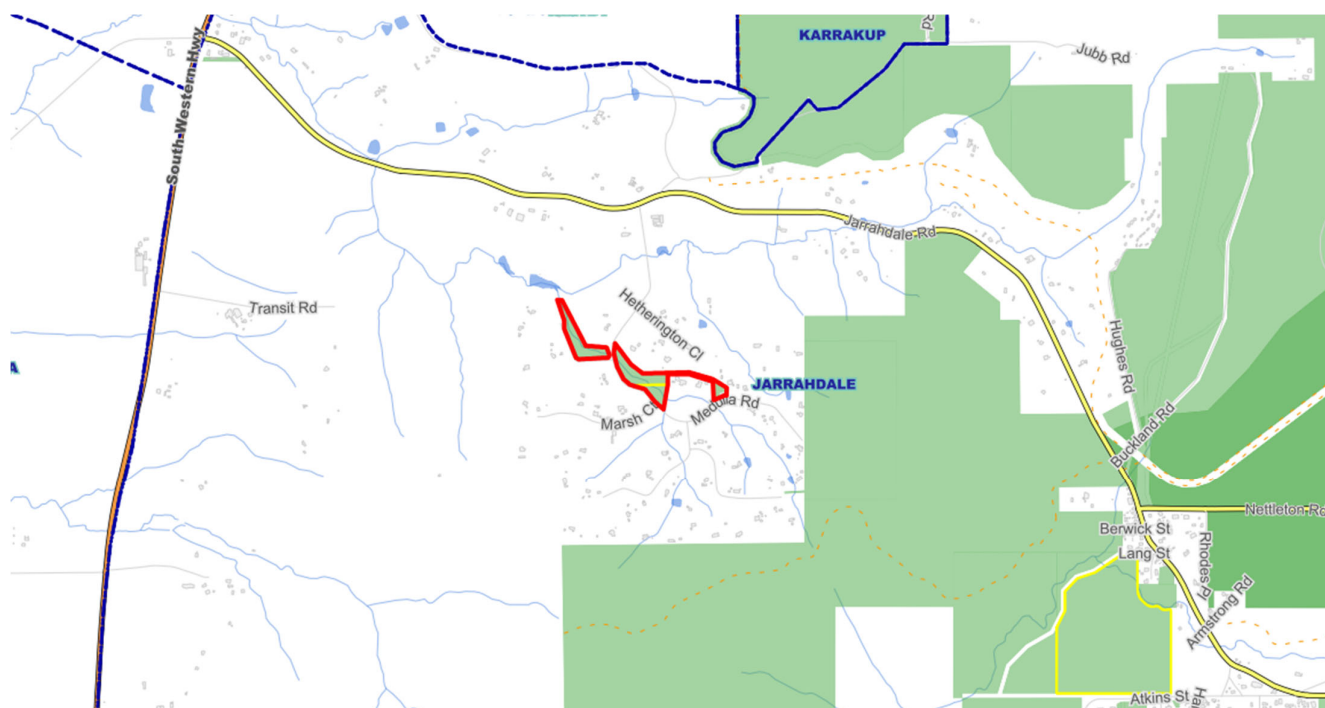


Figure 1: Location of Korribinjal Brook Reserve.

Korribinjal Brook 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 may be dieback infected. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. If mapping confirms

that dieback is present, then 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. If mapping confirms that dieback is present, then 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 both the Conservation and Vegetation Management Zones.



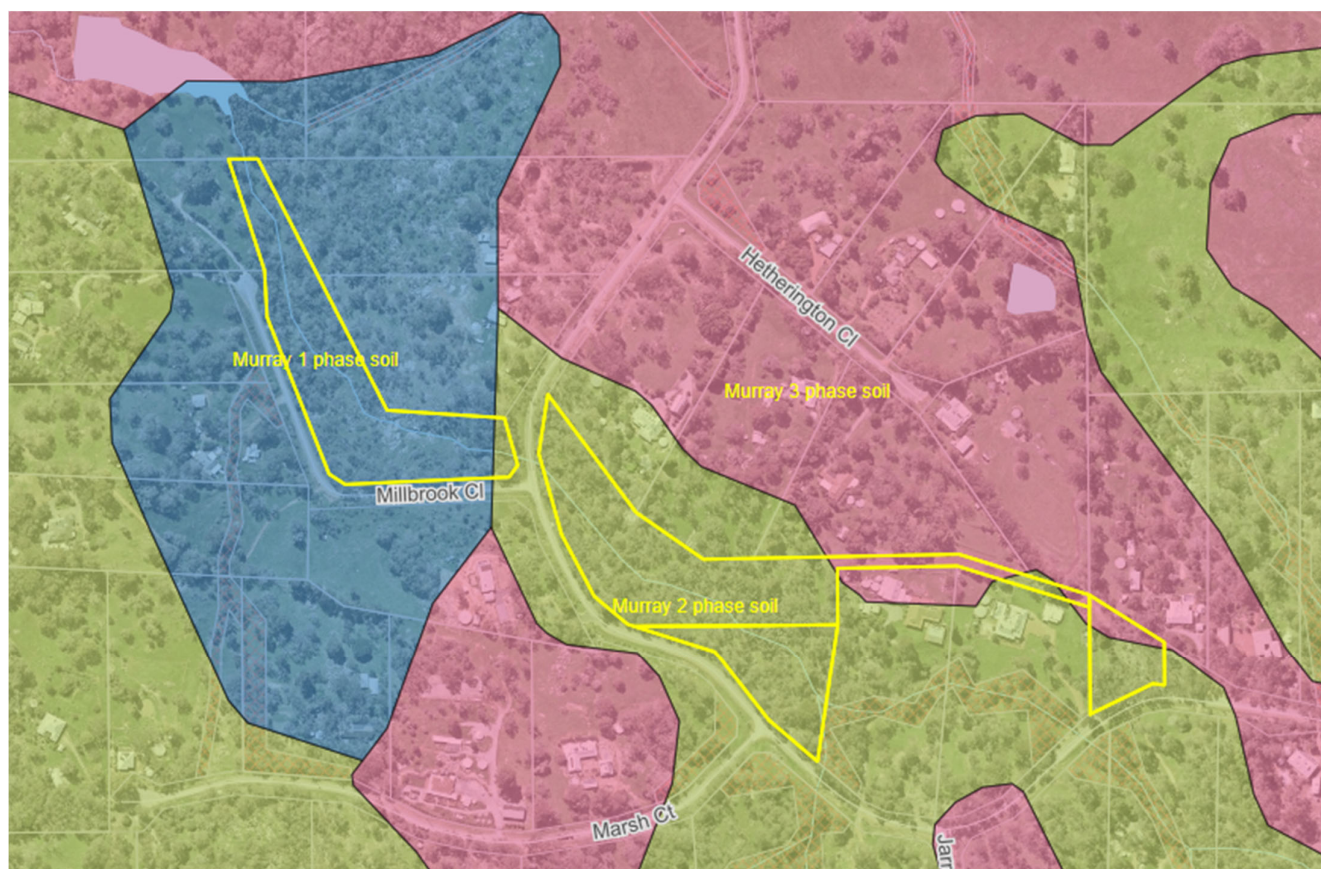
Figure 2: Management Zones of Korribinjal Brook Reserve.

1.2 Soils

Three soil types occur in Korribinjal Brook Reserve: Murray 1, Murray 2 and Murray 3 (Table 1 and Figure 3). Scarp woodland occurs on all three soil types.

Table 1: Soil types of Korribinjal Brook Reserve.

Reserve	Soil landscape unit	Description	Vegetation classification
Korribinjal Brook Reserve	Murray 1 phase	Moderate sideslopes (10-30%) and very narrow valley floors, with few to commonly occurring areas of rock outcrop. Variable moderately well to well drained duplex and gradational soils.	Darling Scarp Woodland
	Murray 2 phase	Gentle to moderately inclined sideslopes (3-25%) and narrow valley floors with few areas of rock outcrop. Variable moderately well to well drained duplex and gradational soils.	Darling Scarp Woodland
	Murray 3 phase	Very gentle to moderately inclined sideslopes and lower slopes (<15%) with very few areas of rock outcrop. Variable moderately well to well drained duplex and gradational soils	Darling Scarp Woodland

**Figure 3: Soil Types of Korribinjal Brook Reserve.**

1.3 Biodiversity

Korribinjal Brook Reserve contains one dominant vegetation community, Scarp woodland. The woodland is approximately 5.16 ha in area (Figure 4) and belongs to the vegetation complex DS2 (Darling Scarp).

The vegetation is in Good to Degraded condition overall. The flora has been frequently surveyed and lacks diversity. No Threatened and Priority flora species have been recorded in the area.

The fauna was surveyed in 1997, and included Threatened and Priority fauna species, such as black cockatoos and quenda (southern brown bandicoot). A diverse range of bird species was recorded.

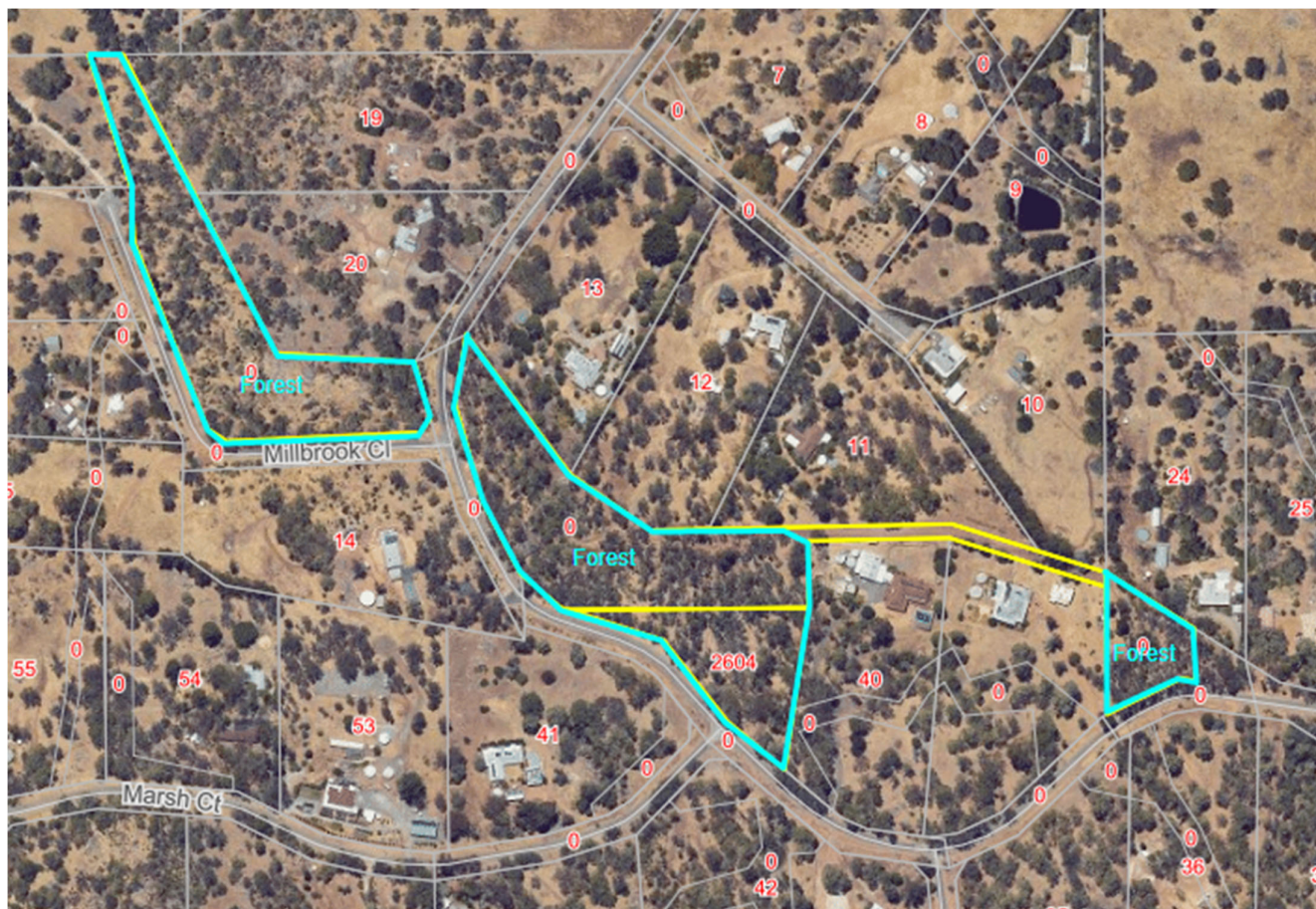


Figure 4: Location of Scarp Woodland in Korribinjal Brook Reserve.

1.4 Water Resources

Korribinjal Brook Reserve is high in the landscape, on the steep slopes of the Darling Scarp. A major natural waterway runs through the majority of the reserve (Figure 5) to discharge eventually into the Serpentine River.

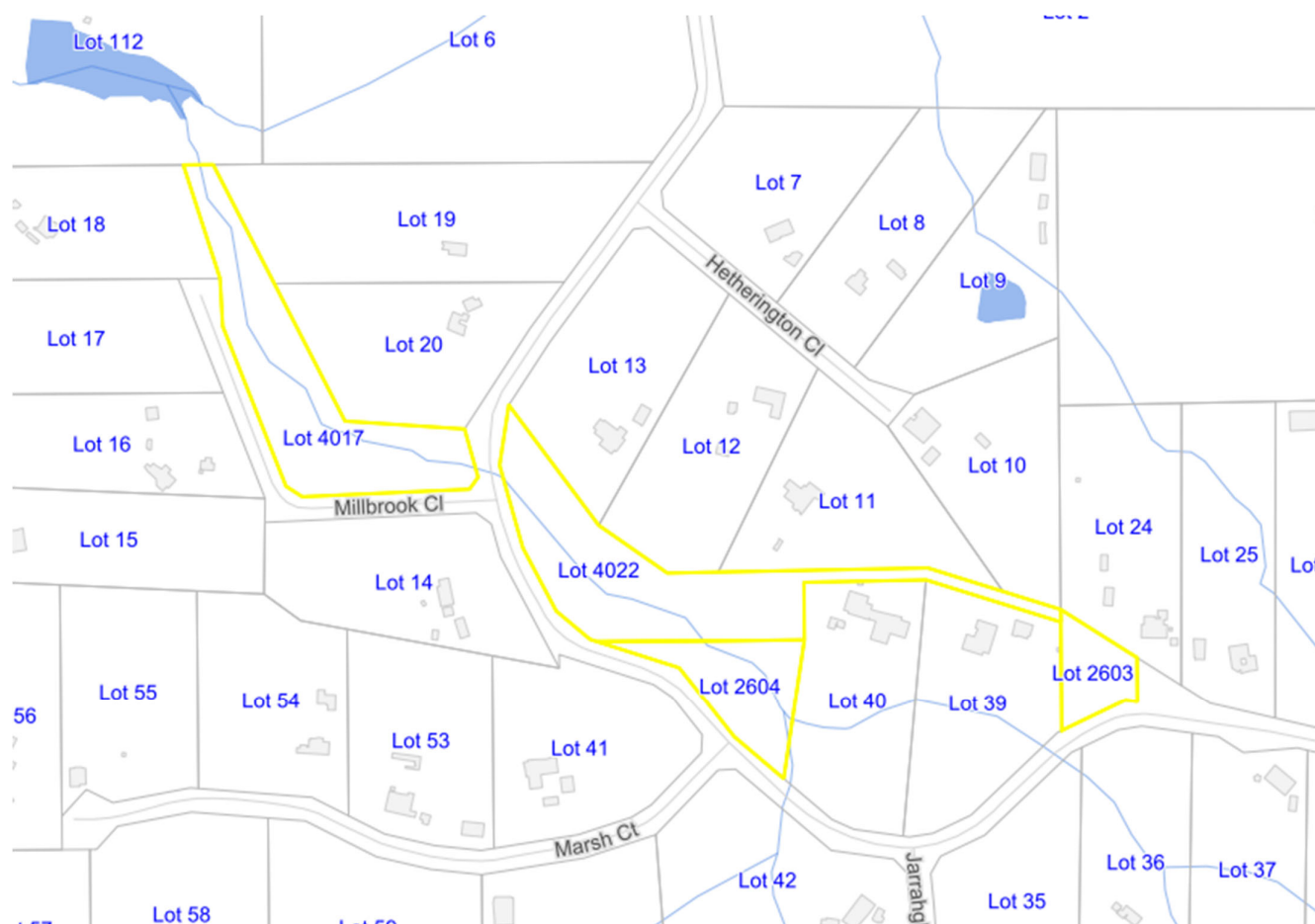


Figure 5: Water Features (Waterways and Water Bodies) of Korribinjal Brook Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of Korribinjal Brook Reserve include:

- Recreational pressure from users
- Community anxiety about fire hazard and pressure for control burning
- Use of grazing animals such as sheep for weed and fire hazard control
- 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*)

3. Reserve Usage

3.1 Vesting and Land Tenure

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

Table 2: Vesting Purpose, Land Tenure and Current Uses of Korribinjal Brook Reserve.

Reserve	Reserve and Lot Number	Vesting Purpose and Land Tenure	Current Uses
Korribinjal Brook Reserve	R36434, R36436, R42251 L2604, L2603, L4022, L4017 Medulla Road, Jarrahdale	Shire of Serpentine Jarrahdale – Public Recreation	Recreation and Conservation

3.2 User Groups

The principal users of the reserve include casual walkers and Landcare groups. Historically the local residents carried out revegetation activities with Landcare SJ Inc.

Threats and pressures for the user groups include:

- Risk management.
- 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 fire hazard management and protection of the conservation values of the remnant vegetation.

3.3 Infrastructure

The infrastructure located in Korribinjal Brook Reserve includes firebreaks, fences, gates and signage.

The Shire maintains the firebreaks and other public infrastructure. Despite fences, vandalism and illegal access by motorised vehicles 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 Korribinjal Brook Reserve

No.	Action	Priority	Timing	Status	Responsibility
1	Utilise the planning system to retain and protect scarp woodland.	Key	Business as Usual	Ongoing	Statutory Planning
2	Keep up to date with the latest research trends and integrate into reserve management.	High	Long Term	Ongoing	Natural Reserves, Emergency Services
3	Formalise access to scarp woodland in high use areas through establishment of walking paths that reduce trampling.	Medium	Medium Term	Not Yet Implemented	Operations
4	Erect signage in high use areas to inform users of the values of the scarp woodland.	Medium	Short Term	Implemented in Part	Operations
5	Survey for dieback presence, and map and treat dieback every three years if present.	Key	Business as Usual	Ongoing	Natural Reserves
6	Monitor and manage new and emerging pests and diseases such as polyphagous shot hole borer.	High	Medium Term	Ongoing	Natural Reserves
7	Control access to scarp woodland through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations
8	Liaise with other landholders to work together and integrate management of all scarp woodland.	Medium	Medium Term	Not Yet Implemented	Natural Reserves, Strategic Environmental Specialist
9	Implement measures to exclude motorised vehicles from the remnant vegetation.	High	Medium Term	Implemented in Part	Operations
10	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environmental Specialist
11	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves
12	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves
13	Establish and implement a weed control program that utilises best practice methods.	Key	Business as Usual	Ongoing	Natural Reserves, Landcare SJ
14	Establish and implement a control program for woody weeds.	High	Business as Usual	Ongoing	Natural Reserves
15	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ
16	Minimise burning and other disturbance of scarp woodland.	Key	Short Term	Implemented in Part	Emergency Services
17	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves
18	Manage fire frequency in scarp woodland according to best practice.	High	Long Term	Not Yet Implemented	Emergency Services
19	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves
20	Restrict any essential fuel load management to the Vegetation Management Zone.	High	Short Term	Not Yet Implemented	Emergency Services

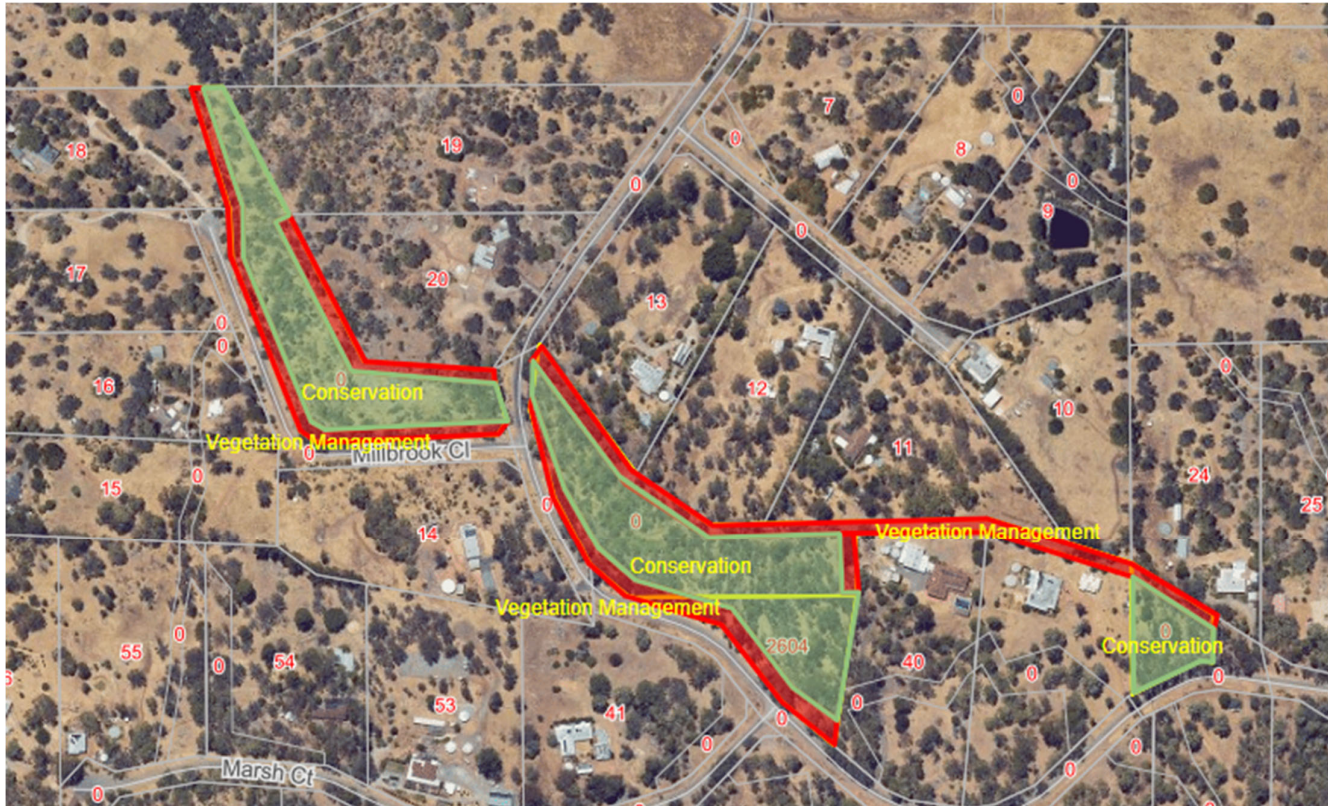
Scarp & Plateau Woodland & Forest Management Plan

No.	Action	Priority	Timing	Status	Responsibility
21	Carry out fuel load management on adjacent road verges to avoid fire entering the reserve from the verge.	High	Medium Term	Not Yet Implemented	Emergency Services
22	Ensure that any essential fuel load management utilises weed control as a priority, with control burning only according to best practice.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves
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
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
25	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations
26	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves
27	Monitor implementation of the management plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environmental Specialist
28	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environmental Specialist
29	Review and revise the management plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environmental Specialist

5. Fire Management Strategy for Korribinjal Brook 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 – absent along most boundaries; present along northern boundary of lots east of Medulla Road

Scrivener Road Gravel Reserve Action Plan

R26079, R26080

1. Background

1.1 Location

Scrivener Road Gravel Reserve is located in Serpentine (Figure 1). The reserve is dominated by Plateau Forest (commonly known as jarrah forest). The reserve is 119.94 ha with 106.53 ha of remnant vegetation. This action plan specifically deals with the forested area.

The reserve is vested with the Shire for the purpose of Gravel, but current uses also include Conservation. The principal users of the reserve include casual walkers, with the potential for future Shire use for gravel extraction.

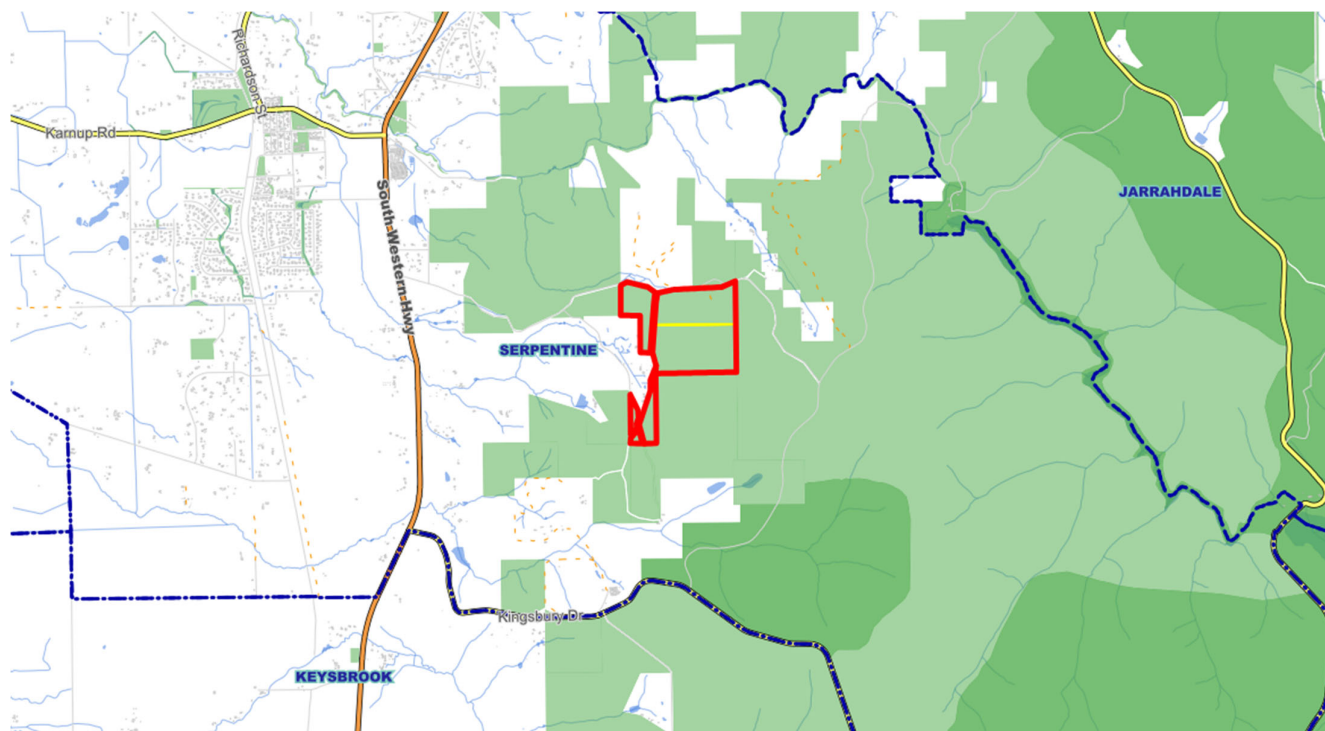


Figure 1: Location of Scrivener Road Gravel Reserve.

Scrivener Road Gravel 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 may be dieback infected. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. If mapping confirms that dieback is present, then 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, 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. If mapping confirms that dieback is present, then access within this area must consider movement and reduce spread of dieback from infected to uninfected areas through clean down procedures.

Gravel Pit Zone (yellow): This is the area subject to historical gravel extraction. Management of this zone is principally for potential future gravel extraction and some revegetation, while minimising impacts on the adjacent remnant vegetation.

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

1.2 Soils

Three soil types occur in Scrivener Road Gravel Reserve, with a fourth nearby: Dwellingup 2, Yarragil 1, Yarragil 4 and Mambup 2 (Table 1 and Figure 3). Jarrah (Plateau) Forest occurs on all four soil types.

Table 1: Soil types of Scrivener Road Gravel Reserve.

Reserve	Soil landscape unit	Description	Vegetation classification
Scrivener Road Gravel Reserve	Dwellingup 2 phase	Very gently to gently undulating terrain (<10%) with well drained, shallow to moderately deep gravelly brownish sands, pale brown sands and earthy sands overlying lateritic duricrust.	Dwellingup D1 Plateau Forest
	Yarragil 1 phase	Very gentle to moderately inclined concave sideslopes. Moderately well drained yellow duplex soils and yellow and brown massive earths and gravels. Woodland of <i>E. wandoo</i> , <i>E. marginata</i> , <i>E. accedens</i> . <i>Casuarina obesa</i> on salt affected areas.	Dwellingup D1 Plateau Forest
	Yarragil 4 phase	Valley floors with some poorly drained mottled yellow duplex soils and gentle lower slopes with moderately well to well drained loamy and sandy earths, gravels and duplex soils. Low woodland of <i>E. wandoo</i> , <i>E. marginata</i> and <i>Acacia</i> spp.	Yarragil 1 Plateau Forest
	Mambup 2 phase	Gentle to moderately inclined flanks of ridges and spurs (5-25%). Shallow to moderately deep duplex and gradational soils prevail.	Dwellingup D1 Plateau Forest

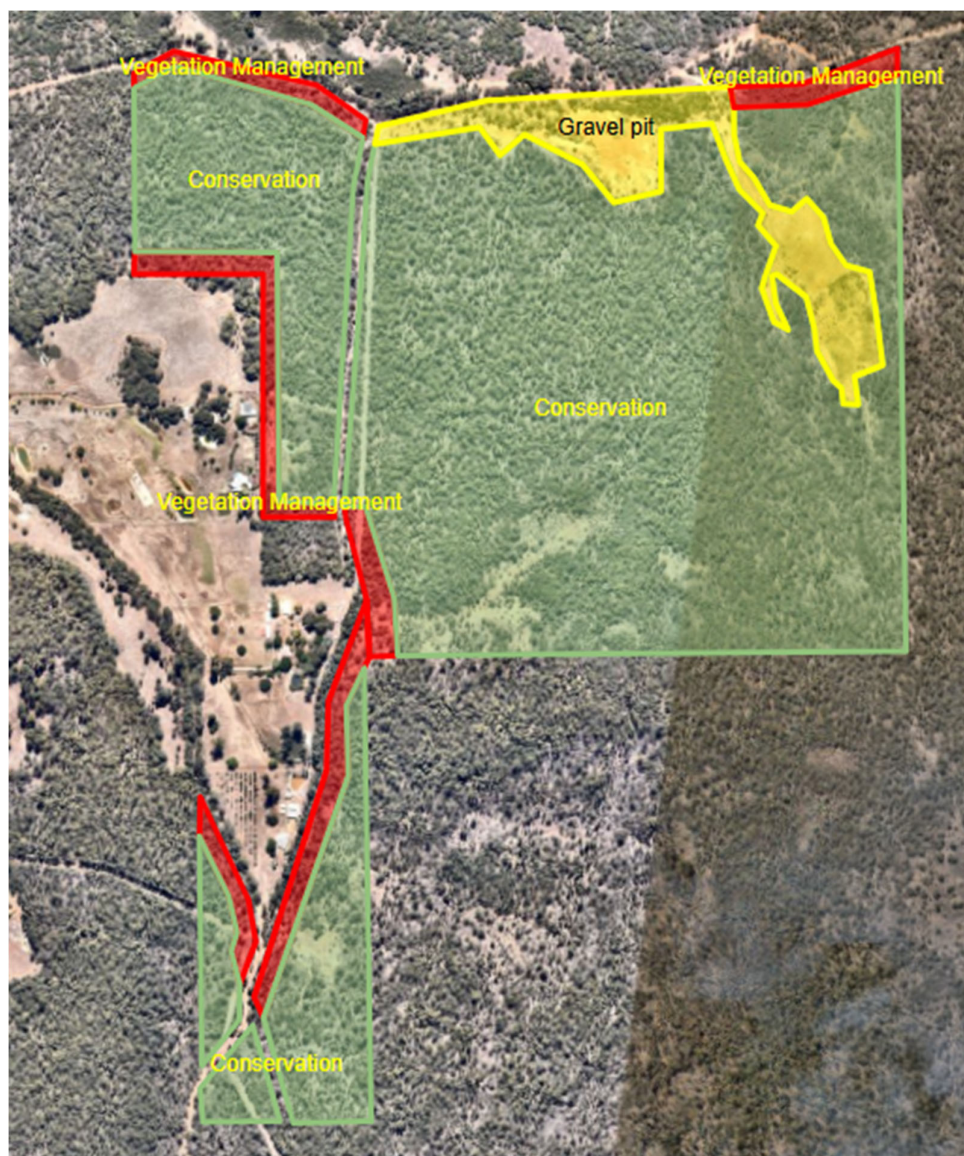


Figure 2: Management Zones of Scrivener Road Gravel Reserve.

1.3 Biodiversity

Scrivener Road Gravel Reserve contains one dominant vegetation community, Jarrah (Plateau) Forest. The forest is approximately 106.53 ha in area (Figure 4) and belongs to the vegetation complexes Dwellingup D1 (in the majority of the site) and Yarragil Yg1 (on the Yarragil 4 soils).

The vegetation is in Very Good to Excellent condition overall. The flora has been frequently surveyed and is diverse, with very few weeds recorded. No Threatened and Priority flora species have been recorded within the site, although three have been recorded in nearby areas of national park.

The fauna has never been formally surveyed, with the exception of habitat surveys for Threatened black cockatoos, which found that all three species occurred and nested in the reserve. Anecdotally some Priority fauna species may occur, such as quenda (southern brown bandicoot).

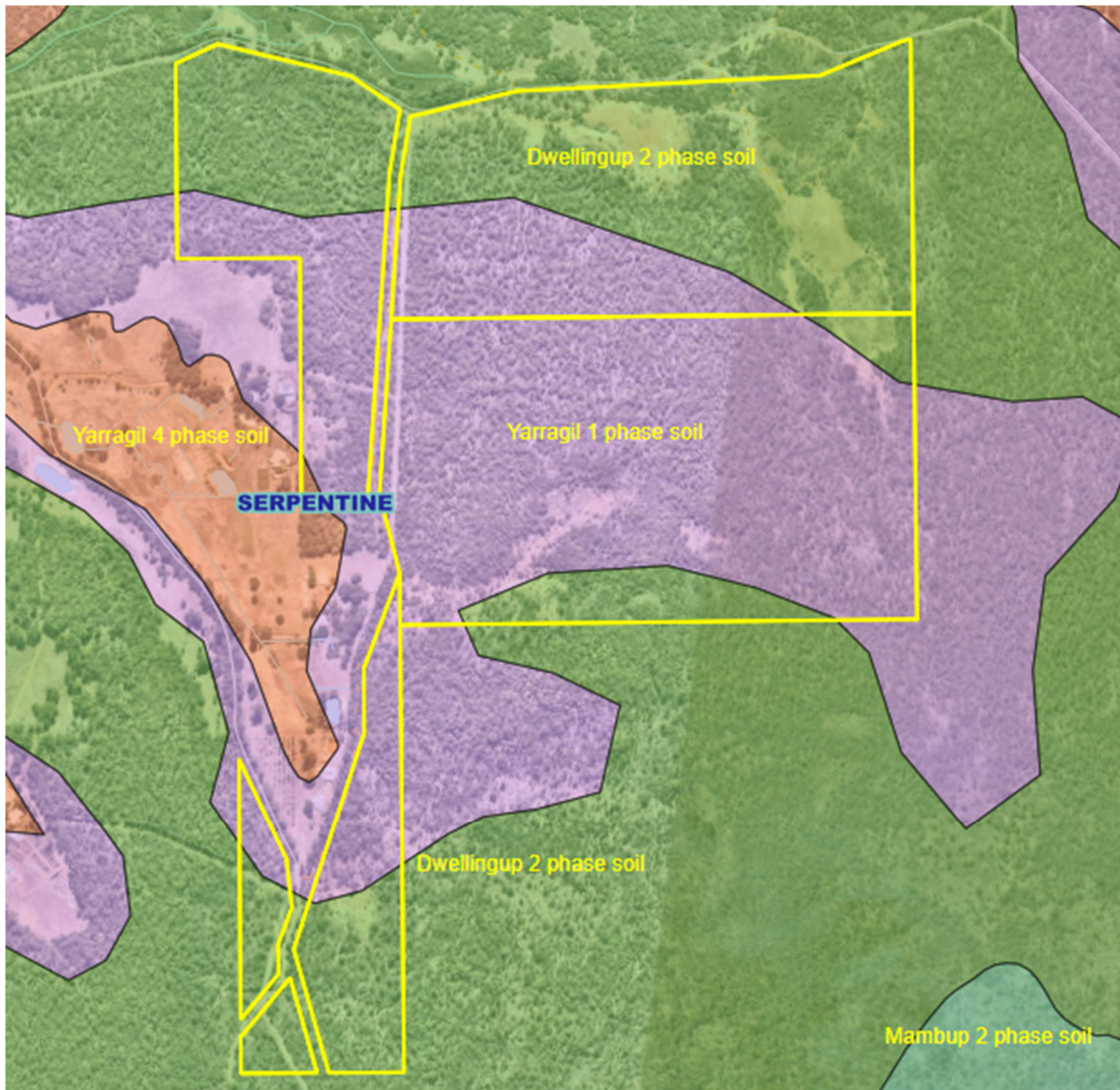


Figure 3: Soil Types of Scrivener Road Gravel Reserve.

1.4 Water Resources

Scrivener Road Gravel Reserve is high in the landscape, sitting on the Darling Plateau. Natural waterways run to the north and west of the reserve (Figure 5), which contributes to the catchments of the waterways. Both waterways have been dammed in multiple locations downstream.

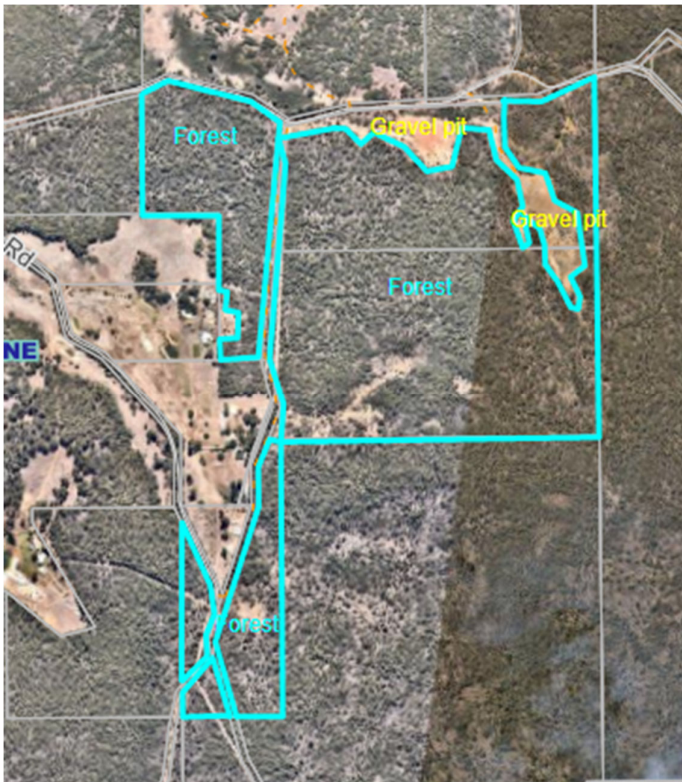


Figure 4: Location of Plateau Forest in Scrivener Road Gravel Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of Scrivener Road Gravel 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*)
- Potential future gravel extraction

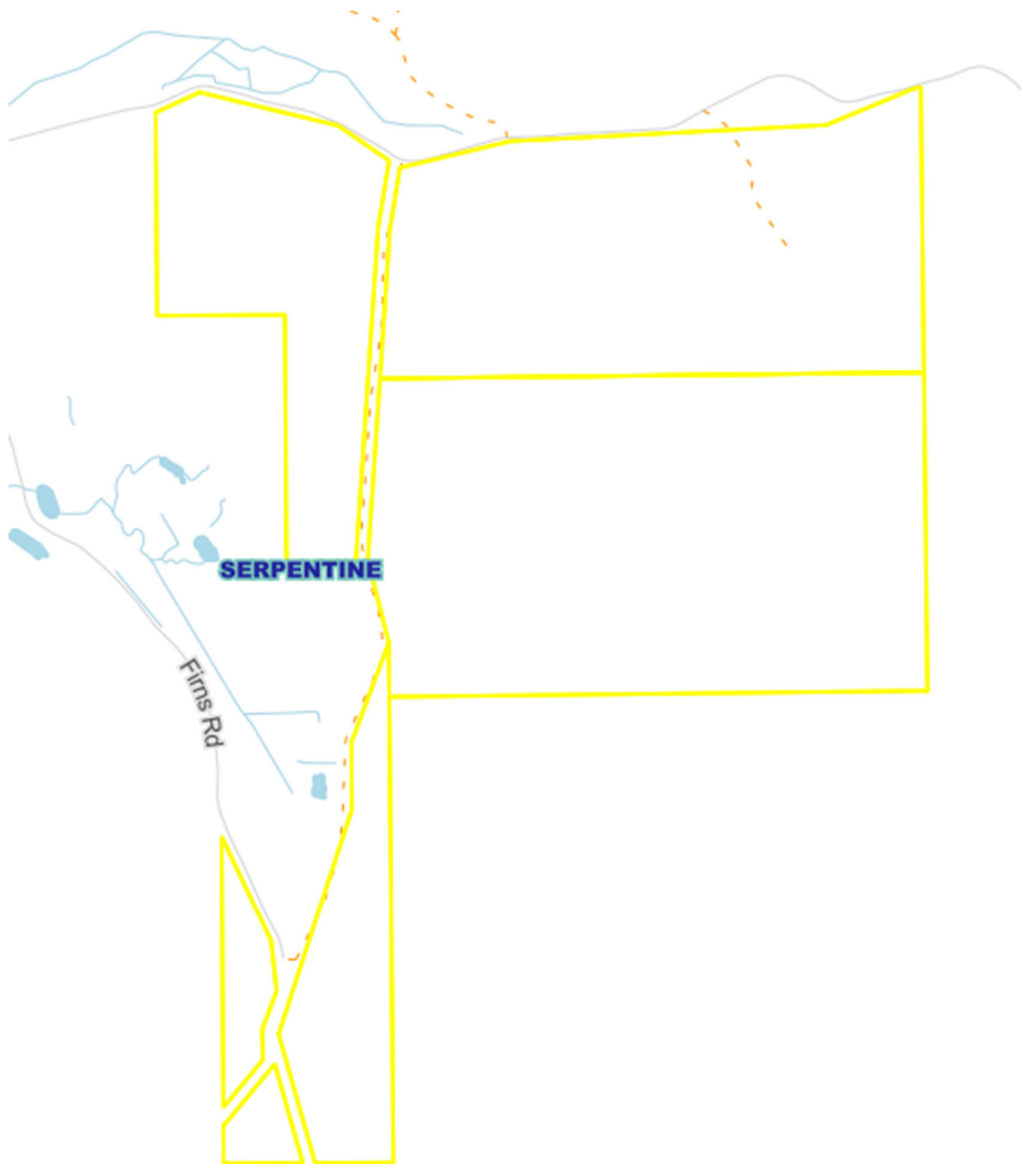


Figure 5: Water Features (Waterways and Water Bodies) of Scrivener Road Gravel Reserve.

3. Reserve Usage

3.1 Vesting and Land Tenure

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

Table 2: Vesting Purpose, Land Tenure and Current Uses of Scrivener Road Gravel Reserve.

Reserve	Reserve and Lot Number	Vesting Purpose and Land Tenure	Current Uses
Scrivener Road Gravel Reserve	R26079, R26080 L303, L304 Firns Road, Serpentine L2272, L1913 Scrivener Road, Serpentine	Shire of Serpentine Jarrahdale – Gravel	Gravel Extraction, Conservation

3.2 User Groups

The principal users of the reserve include casual walkers, with the potential for future Shire use for gravel extraction. Historically the reserve was primarily used for gravel extraction.

Threats and pressures for the users include conflict among user groups with differing priorities, such as potential conflict between potential gravel extraction and protection of the conservation values of the remnant vegetation.

3.3 Infrastructure

The infrastructure located in Scrivener Road Gravel Reserve includes minimal firebreaks and fences (mostly along the Scrivener Road frontage) and historical gravel pits.

The Shire maintains the firebreaks and other public infrastructure. Despite fences, vandalism and illegal access by motorised vehicles 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 Scrivener Road Gravel Reserve

No.	Action	Priority	Timing	Status	Responsibility
1	Utilise the planning system to retain and protect plateau forest.	Key	Business as Usual	Ongoing	Statutory Planning
2	Keep up to date with the latest research trends and integrate into reserve management.	High	Long Term	Ongoing	Natural Reserves, Emergency Services
3	Formalise access to plateau forest in high use areas through establishment of walking paths that reduce trampling.	Medium	Medium Term	Not Yet Implemented	Operations
4	Erect signage in high use areas to inform users of the values of plateau forest.	Medium	Short Term	Implemented in Part	Operations
5	Survey for dieback presence, and map and treat dieback every three years if present.	Key	Business as Usual	Ongoing	Natural Reserves

Scarp & Plateau Woodland & Forest Management Plan

No.	Action	Priority	Timing	Status	Responsibility
6	Monitor and manage new and emerging pests and diseases such as polyphagous shot hole borer.	High	Medium Term	Ongoing	Natural Reserves
7	Control access to plateau forest through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations
8	Ensure that any future gravel mining is conducted according to best practice and protects the remnant vegetation in accordance with this management plan.	High	Long Term	Not Yet Implemented	Operations
9	Liaise with other landholders to work together and integrate management of all plateau forest.	Medium	Medium Term	Not Yet Implemented	Natural Reserves, Strategic Environmental Specialist
10	Implement measures to exclude motorised vehicles from the remnant vegetation.	High	Medium Term	Implemented in Part	Operations
11	Establish dieback hygiene policies, including vehicle washdown points and foot baths for pedestrians with appropriate signage where appropriate.	High	Long Term	Implemented in Part	Natural Reserves
12	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environmental Specialist
13	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves
14	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves
15	Establish and implement a weed control program that utilises best practice methods.	Key	Business as Usual	Ongoing	Natural Reserves, Landcare SJ
16	Establish and implement a control program for woody weeds.	High	Business as Usual	Ongoing	Natural Reserves
17	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ
18	Minimise burning and other disturbance of plateau forest.	Key	Short Term	Implemented in Part	Emergency Services
19	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves
20	Manage fire frequency in plateau forest according to best practice.	High	Long Term	Not Yet Implemented	Emergency Services
21	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves
22	Restrict any essential fuel load management to the Vegetation Management Zone.	High	Short Term	Not Yet Implemented	Emergency Services
23	Carry out fuel load management on adjacent road verges to avoid fire entering the reserve from the verge.	High	Medium Term	Not Yet Implemented	Emergency Services
24	Ensure that any essential fuel load management utilises weed control as a priority, with control burning only according to best practice.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves
25	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

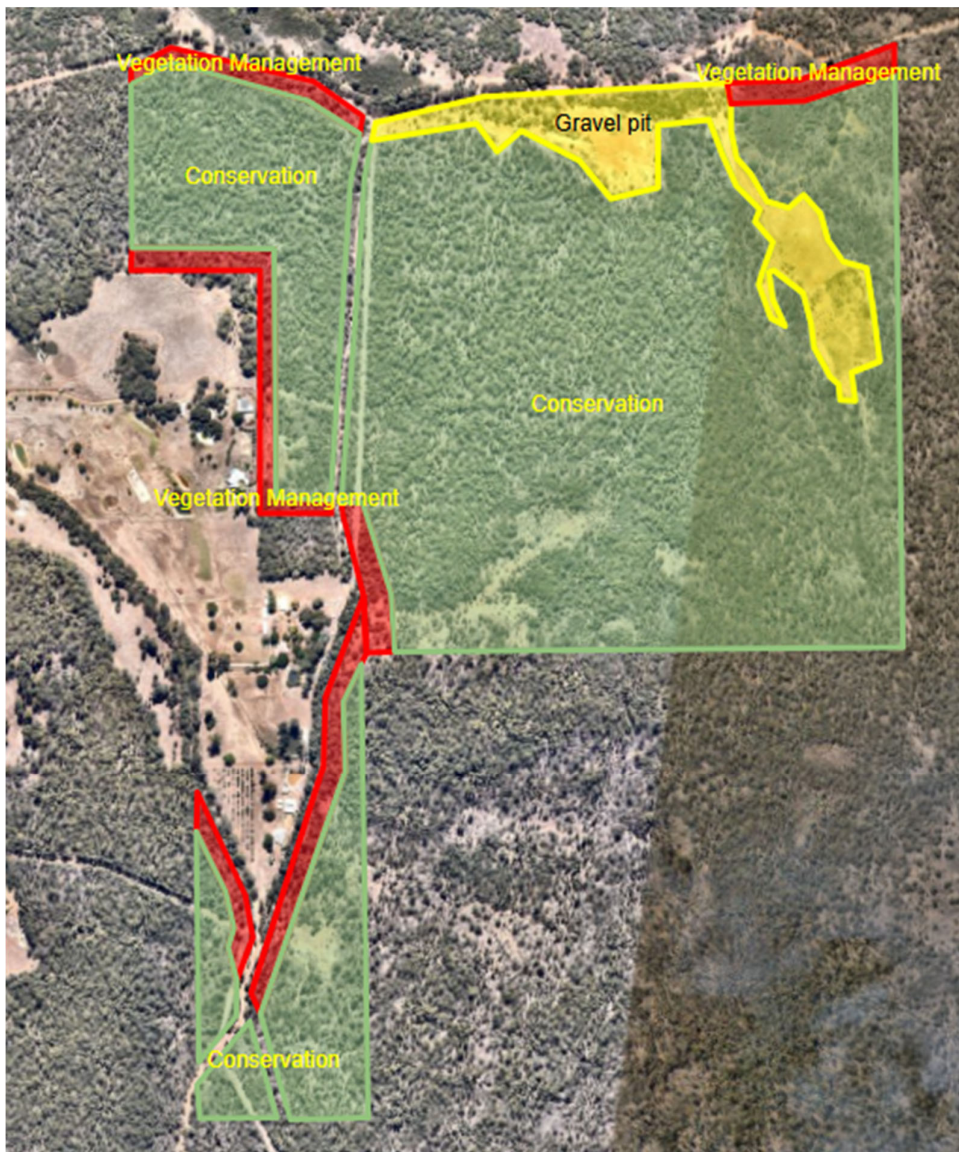
Scarp & Plateau Woodland & Forest Management Plan

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

5. Fire Management Strategy for Scrivener Road Gravel 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 – absent along most boundaries

Rifle Range Reserve Action Plan

R10164

1. Background

1.1 Location

Rifle Range Reserve is located in Byford (Figure 1) and adjoins the Wungong Regional Park to the east. The reserve is dominated by Scarp woodland. The reserve is 7.95 ha with 7.95 ha remnant vegetation. This action plan specifically deals with the woodland area.

The reserve is vested with the Shire for the purpose of Recreation and Community Uses, but current uses also include Conservation. The principal users of the reserve include casual walkers and mountain bike riders.

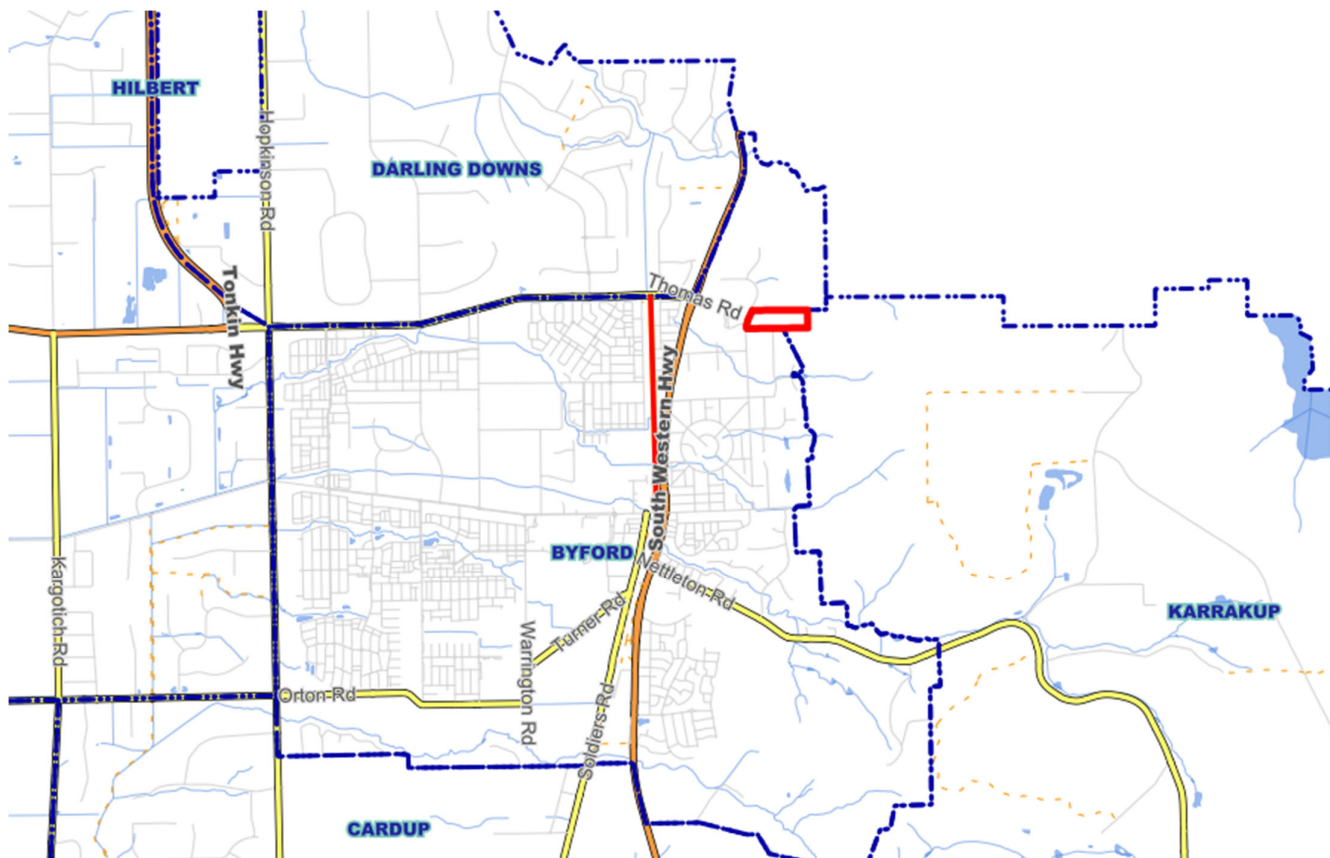


Figure 1: Location of Rifle Range Reserve.

Rifle Range 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 both the Conservation and Vegetation Management Zones.



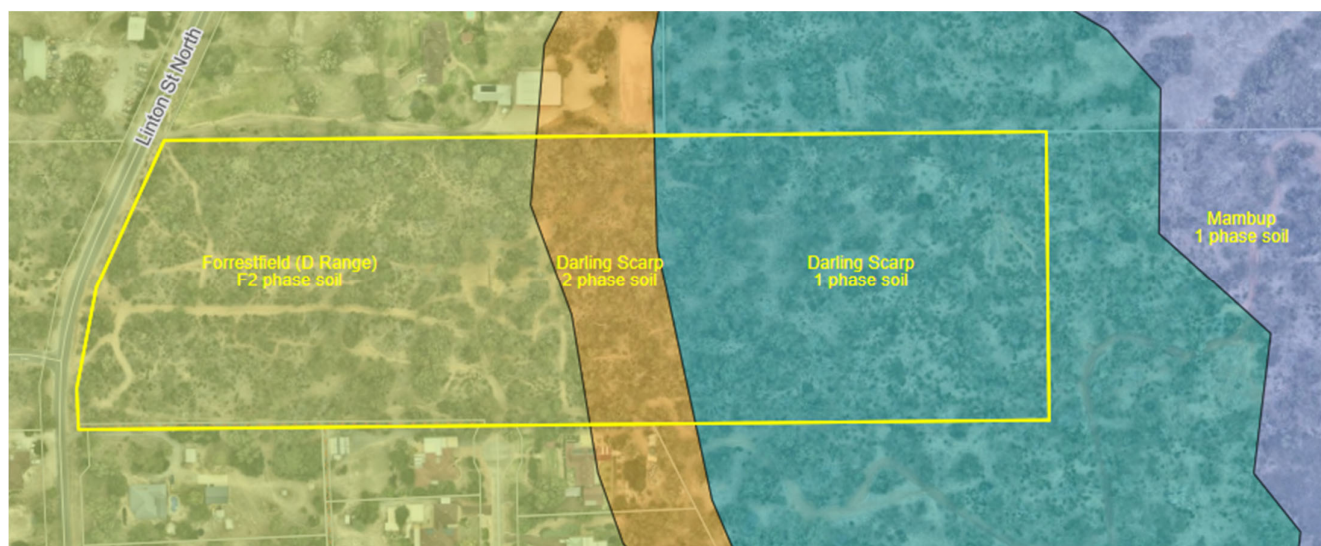
Figure 2: Management Zones of Rifle Range Reserve.

1.2 Soils

Three soil types occur in Rifle Range Reserve, with a fourth close to the east: Forrestfield (D Range) F2, Darling Scarp 2, Darling Scarp 1 and Mambup 1 (Table 1 and Figure 3). Darling Scarp woodland occurs on all four soil types, grading into marri woodland on the Forrestfield (D Range) F2 soils.

Table 1: Soil types of Rifle Range Reserve.

Reserve	Soil landscape unit	Description	Vegetation classification
Rifle Range Reserve	Forrestfield (D Range) F2 phase	Foot and low slopes < 10%. Well drained gravelly yellow or brown duplex soils with sandy topsoil. Woodland of <i>E. marginata</i> , <i>C. calophylla</i> and some <i>B. grandis</i> .	Darling Scarp Woodland
	Darling Scarp 2 phase	Gentle to moderately inclined lower slopes (5-25%). Variable moderately well to well drained duplex and gradational soils. Occasional rock outcrop.	Darling Scarp Woodland
	Darling Scarp 1 phase	Gentle to moderate upper slopes (5-30%). Variable moderately well to well drained duplex and gradational soils. Common rock outcrop.	Darling Scarp Woodland
	Mambup 1 phase	Gently undulating ridge crests and benches with slopes <20%. Shallow to moderately deep duplex and gradational soils prevail.	Darling Scarp Woodland

**Figure 3: Soil Types of Rifle Range Reserve.**

1.3 Biodiversity

Rifle Range Reserve contains one dominant vegetation community, Scarp woodland, although the lower area tends towards marri woodland. The woodland is approximately 7.95 ha in area (Figure 4) and belongs to the vegetation complex DS2 (Darling Scarp).

The vegetation is in Good to Degraded condition overall. The flora has been frequently surveyed and is diverse, particularly in the upper areas where the condition is better. 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 Scarp Woodland of Rifle Range Reserve.

1.4 Water Resources

Rifle Range Reserve is high in the landscape, on the steep slopes and foothills of the Darling Scarp. Natural waterways run to the north and south of the reserve (Figure 5), which contributes to the catchments of the waterways.

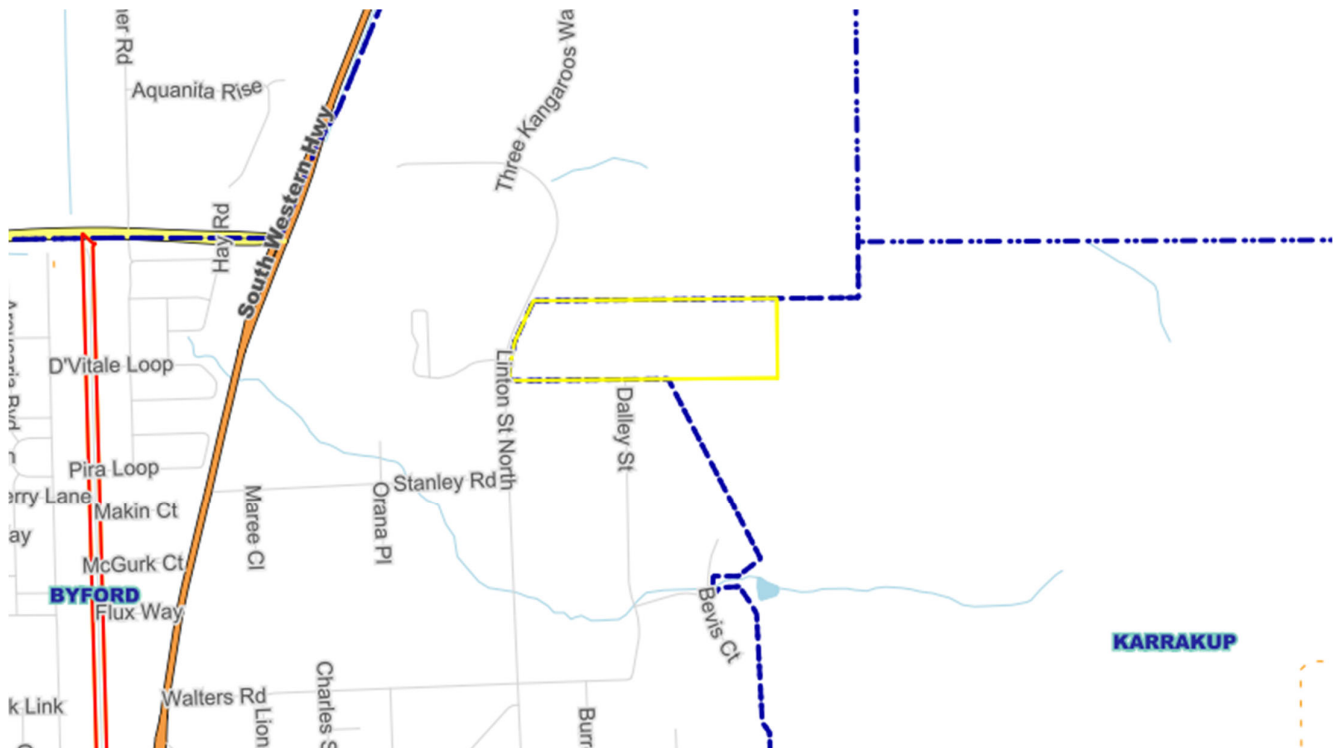


Figure 5: Water Features (Waterways and Water Bodies) of Rifle Range Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of Rifle Range 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*)
- Mountain bike downhill track

3. Reserve Usage

3.1 Vesting and Land Tenure

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

Table 2: Vesting Purpose, Land Tenure and Current Uses of Rifle Range Reserve.

Reserve	Reserve and Lot Number	Vesting Purpose and Land Tenure	Current Uses
Rifle Range Reserve	R10164 L2857 Linton Street North, Byford	Shire of Serpentine Jarrahdale – Recreation and Community Uses	Recreation and Conservation

3.2 User Groups

The principal users of the reserve include casual walkers and mountain bike riders.

Threats and pressures for the user group include conflict among user groups with differing priorities, such as potential conflict between the mountain bikers and protection of the conservation values of the remnant vegetation.

3.3 Infrastructure

The infrastructure located in Rifle Range Reserve includes firebreaks, fences, gates and signage, and the informal mountain bike track.

The Shire maintains the firebreaks and other public infrastructure. Despite fences and locked gates, vandalism and illegal access by motorised vehicles 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 Rifle Range Reserve

No.	Action	Priority	Timing	Status	Responsibility
1	Utilise the planning system to retain and protect scarp woodland.	Key	Business as Usual	Ongoing	Statutory Planning
2	Keep up to date with the latest research trends and integrate into reserve management.	High	Long Term	Ongoing	Natural Reserves, Emergency Services
3	Formalise access to scarp woodland in high use areas through establishment of walking paths that reduce trampling.	Medium	Medium Term	Not Yet Implemented	Operations
4	Erect signage in high use areas to inform users of the values of the scarp woodland.	Medium	Short Term	Implemented in Part	Operations
5	Survey for dieback presence, and map and treat dieback every three years if present.	Key	Business as Usual	Ongoing	Natural Reserves
6	Monitor and manage new and emerging pests and diseases such as polyphagous shot hole borer.	High	Medium Term	Ongoing	Natural Reserves
7	Control access to scarp woodland through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations
8	Liaise with other landholders to work together and integrate management of all scarp woodland.	Medium	Medium Term	Not Yet Implemented	Natural Reserves, Strategic Environmental Specialist
9	Implement measures to exclude motorised vehicles from the remnant vegetation.	High	Medium Term	Implemented in Part	Operations
10	Ensure that formalised paths and other access routes cross dieback fronts to the lowest degree possible.	Medium	Medium Term	Not Yet Implemented	Natural Reserves
11	Establish dieback hygiene policies, including vehicle washdown points and foot baths for pedestrians with appropriate signage where appropriate.	High	Long Term	Implemented in Part	Natural Reserves
12	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environmental Specialist
13	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves
14	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves
15	Establish and implement a weed control program that utilises best practice methods.	Key	Business as Usual	Ongoing	Natural Reserves, Landcare SJ
16	Establish and implement a control program for woody weeds.	High	Business as Usual	Ongoing	Natural Reserves

Scarp & Plateau Woodland & Forest Management Plan

No.	Action	Priority	Timing	Status	Responsibility
17	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ
18	Minimise burning and other disturbance of scarp woodland.	Key	Short Term	Implemented in Part	Emergency Services
19	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves
20	Manage fire frequency in scarp woodland according to best practice.	High	Long Term	Not Yet Implemented	Emergency Services
21	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves
22	Restrict any essential fuel load management to the Vegetation Management Zone.	High	Short Term	Not Yet Implemented	Emergency Services
23	Carry out fuel load management on adjacent road verges to avoid fire entering the reserve from the verge.	High	Medium Term	Not Yet Implemented	Emergency Services
24	Ensure that any essential fuel load management utilises weed control as a priority, with control burning only according to best practice.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves
25	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
26	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
27	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations
28	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves
29	Monitor implementation of the management plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environmental Specialist
30	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environmental Specialist
31	Review and revise the management plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environmental Specialist

5. Fire Management Strategy for Rifle Range 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 in the lower part of the reserve

Jarrahdale Oval Reserve Action Plan

R6428

1. Background

1.1 Location

Jarrahdale Oval Reserve is located in Jarrahdale (Figure 1). The reserve is dominated by Plateau forest (commonly known as jarrah forest). The reserve is 17.98 ha with 14.7 ha remnant vegetation. This action plan specifically deals with the forested area.

The reserve is vested with the Shire for the purpose of Recreation and Camping, but current uses also include Conservation. The principal users of the reserve include sporting clubs, community events, trails users (including equestrian, mountain bikers and hikers) and casual walkers.

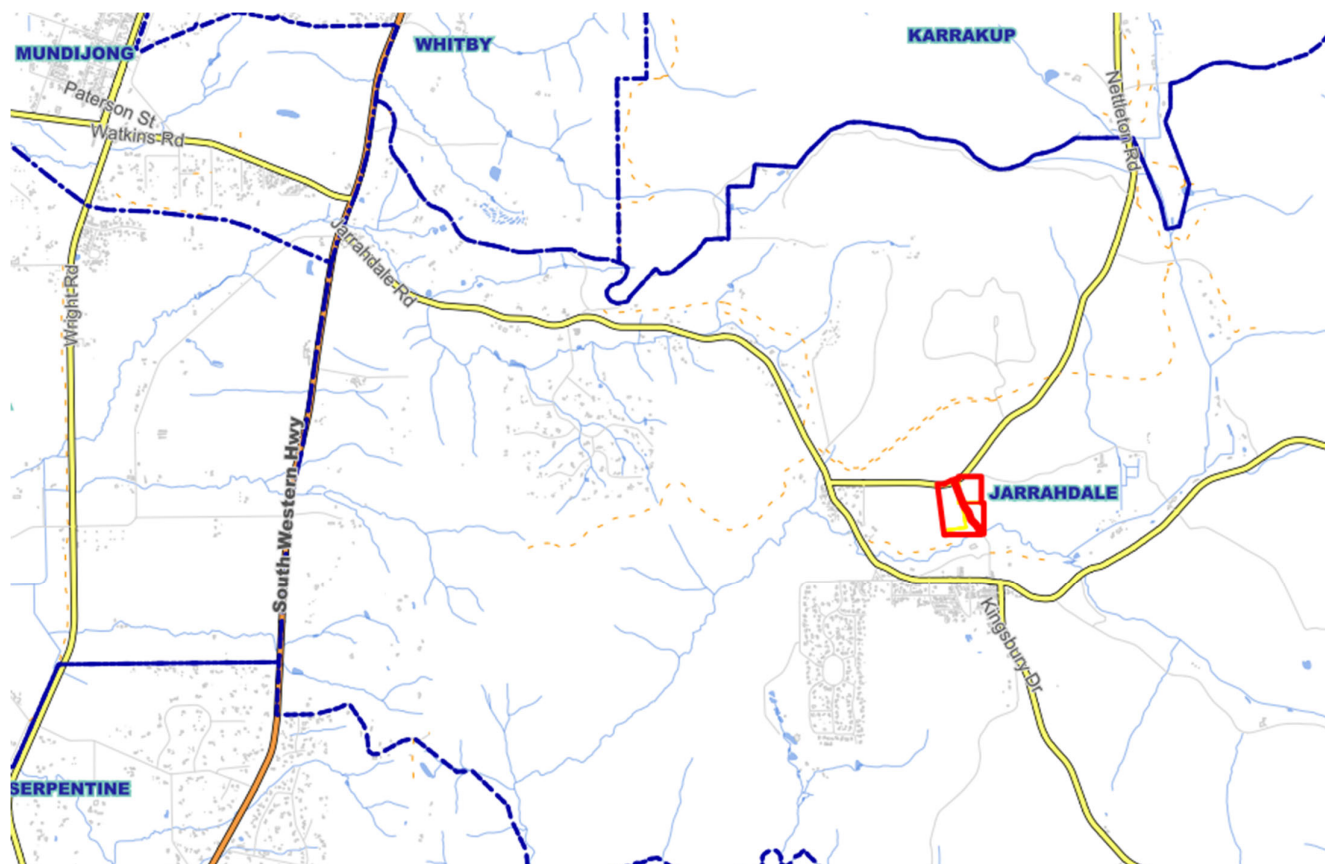


Figure 1: Location of Jarrahdale Oval Reserve.

Jarrahdale Oval 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 may be dieback infected. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. If mapping confirms that dieback is present, then 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. If mapping confirms that dieback is present, then 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 oval and associated parking areas. 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 Jarrahdale Oval Reserve.

1.2 Soils

Two soil types occur in Jarrahdale Oval Reserve and a third nearby: Dwellingup 2, Yarragil 4 and Yarragil 1 (Table 1 and Figure 3). Jarrah (Plateau) Forest occurs on all three soil types.

Table 1: Soil types of Jarrahdale Oval Reserve.

Reserve	Soil landscape unit	Description	Vegetation classification
Jarrahdale Oval Reserve	Dwellingup 2 phase	Very gently to gently undulating terrain (<10%) with well drained, shallow to moderately deep gravelly brownish sands, pale brown sands and earthy sands overlying lateritic duricrust.	Dwellingup D2 Plateau Forest
	Yarragil 4 phase	Valley floors with some poorly drained mottled yellow duplex soils and gentle lower slopes with moderately well to well drained loamy and sandy earths, gravels and duplex soils. Low woodland of <i>E. wandoo</i> , <i>E. marginata</i> and <i>Acacia</i> spp.	Murray 1 Plateau Forest
	Yarragil 1 phase	Very gentle to moderately inclined concave sideslopes. Moderately well drained yellow duplex soils and yellow and brown massive earths and gravels. Woodland of <i>E. wandoo</i> , <i>E. marginata</i> , <i>E. accedens</i> . <i>Casuarina obesa</i> on salt affected areas.	Murray 1 Plateau Forest

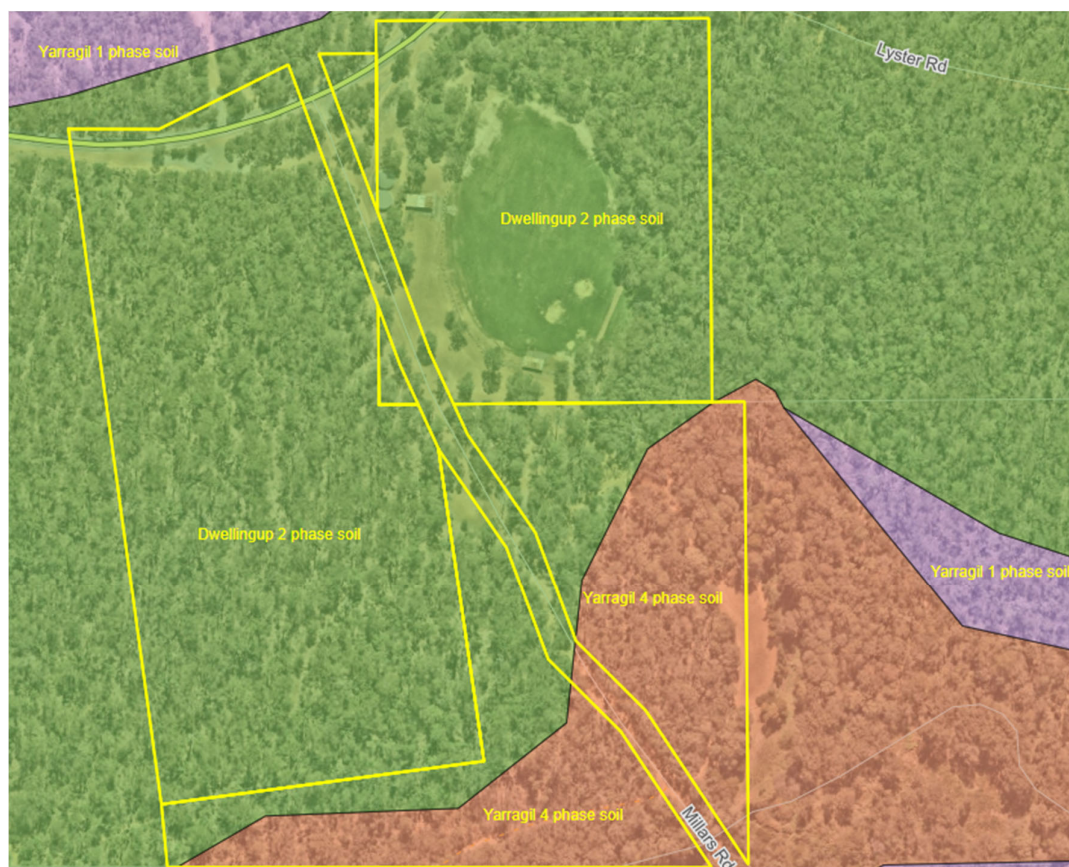


Figure 3: Soil Types of Jarrahdale Oval Reserve.

1.3 Biodiversity

Jarrahdale Oval Reserve contains one dominant vegetation community, Jarrah (Plateau) Forest. The forest is approximately 14.7 ha in area (Figure 4) and belongs to the vegetation complexes Dwellingup D2 (in the majority of the site) and Murray My1 (on the Yarragil 4 soils).

The vegetation is in Very Good to Excellent condition overall. The flora of has been frequently surveyed and is diverse, with few weeds recorded. 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), and mainland quokkas along the brook to the south of the reserve.

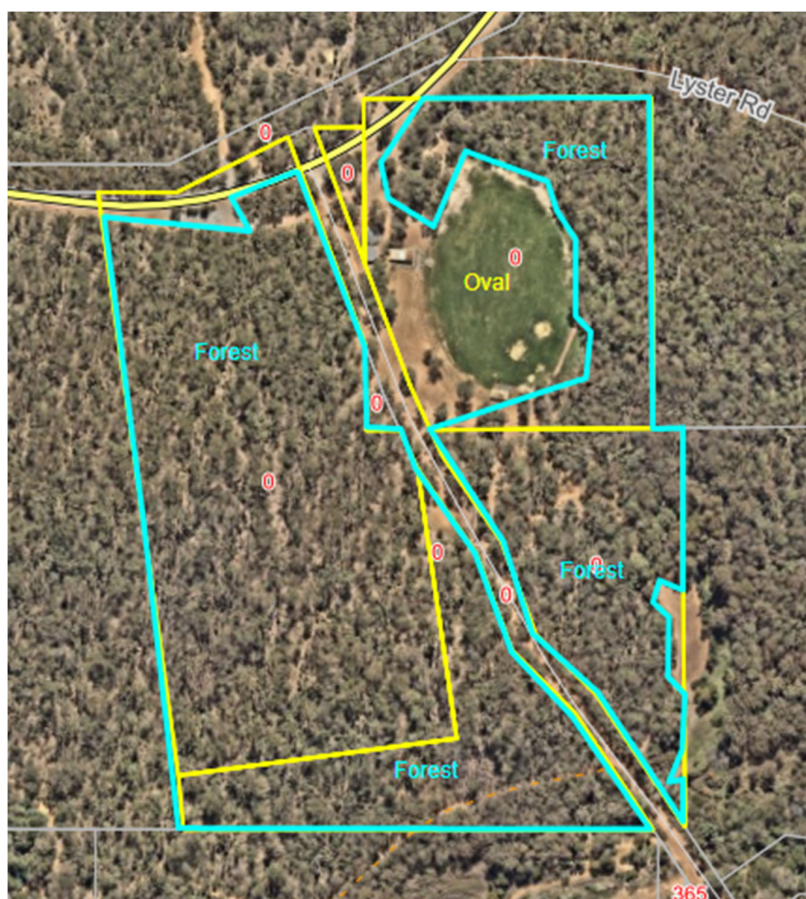


Figure 4: Location of Plateau Forest in Jarrahdale Oval Reserve.

1.4 Water Resources

Jarrahdale Oval Reserve is high in the landscape, sitting on the Darling Plateau. A major waterway (Gooralong Brook) runs to the south of the reserve and through its southeastern corner (Figure 5), with the reserve contributing to the brook's catchment.

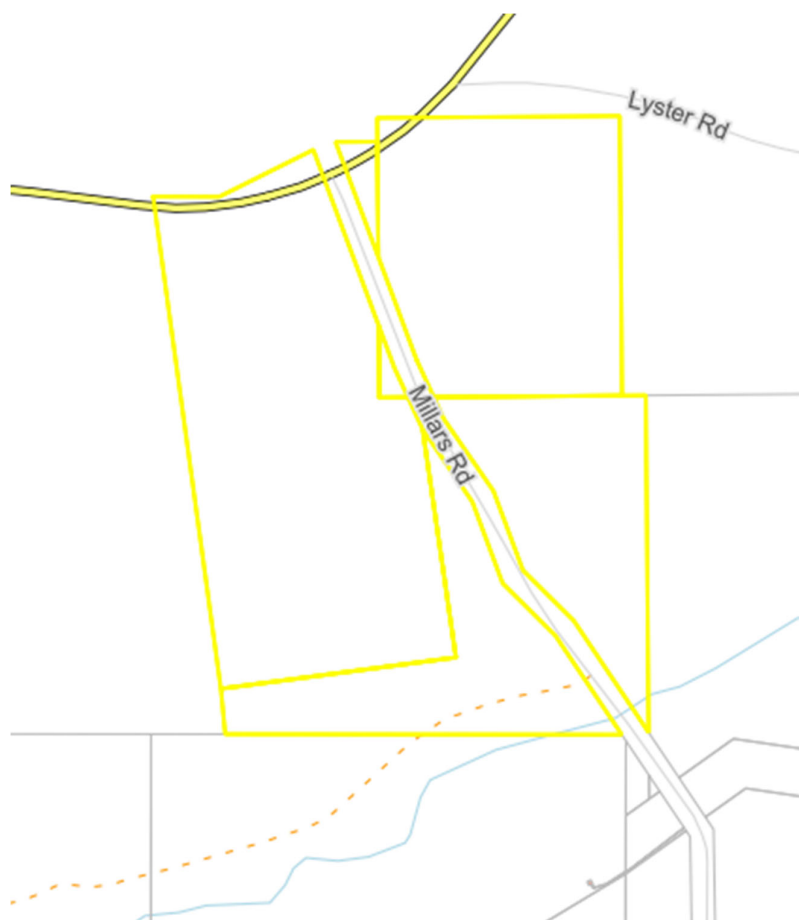


Figure 5: Water Features (Waterways and Water Bodies) of Jarrahdale Oval Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of Jarrahdale Oval Reserve include:

- Recreational pressure from users
- Community anxiety about fire hazard and pressure for control burning
- Illegal access by motorised vehicles to the trail network
- 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 Jarrahdale Oval Reserve are listed below in Table 2.

Table 2: Vesting Purpose, Land Tenure and Current Uses of Jarrahdale Oval Reserve.

Reserve	Reserve and Lot Number	Vesting Purpose and Land Tenure	Current Uses
Jarrahdale Oval Reserve	R6428 L2658, L4438, L4434, L2657 Millars Road, Jarrahdale	Shire of Serpentine Jarrahdale – Recreation and Camping	Recreation and Conservation

3.2 User Groups

The principal users of the reserve include sporting clubs, community events, trails users (including equestrian, mountain bikers and hikers) and casual walkers.

Threats and pressures for the user groups include:

- Risk management and insurance, with stricter liability and higher premiums.
- Conflict among user groups with differing priorities, such as potential conflict between the recreational users and protection of the conservation values of the remnant vegetation.
- Compliance with legislation, such as health regulations.

3.3 Infrastructure

The infrastructure located in Jarrahdale Oval Reserve includes:

- Clubhouse and sheds
- Car parking area
- Oval
- Bore and water tanks
- Elevated log-chopping platform
- Firebreaks, fences, gates and signage

The Shire maintains the firebreaks and other public infrastructure.

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 Jarrahdale Oval Reserve

No.	Action	Priority	Timing	Status	Responsibility
1	Utilise the planning system to retain and protect plateau forest.	Key	Business as Usual	Ongoing	Statutory Planning
2	Keep up to date with the latest research trends and integrate into reserve management.	High	Long Term	Ongoing	Natural Reserves, Emergency Services
3	Formalise access to plateau forest in high use areas through establishment of walking paths that reduce trampling.	Medium	Medium Term	Not Yet Implemented	Operations
4	Erect signage in high use areas to inform users of the values of the plateau forest.	Medium	Short Term	Implemented in Part	Operations
5	Survey for dieback presence, and map and treat dieback every three years if present.	Key	Business as Usual	Ongoing	Natural Reserves
6	Monitor and manage new and emerging pests and diseases such as polyphagous shot hole borer.	High	Medium Term	Ongoing	Natural Reserves
7	Control access to plateau forest through boundary fencing, convenient formal access points, and path construction that discourages deviation.	Low	Long Term	Not Yet Implemented	Operations
8	Work with user groups to protect and minimize impacts to the remnant vegetation.	High	Business as Usual	Ongoing	Natural Reserves, User Groups
9	Liaise with other landholders to work together and integrate management of all plateau forest.	Medium	Medium Term	Not Yet Implemented	Natural Reserves, Strategic Environmental Specialist
10	Implement measures to exclude motorised vehicles from the remnant vegetation.	High	Medium Term	Implemented in Part	Operations
13	Establish dieback hygiene policies, including vehicle washdown points and foot baths for pedestrians with appropriate signage where appropriate.	High	Long Term	Implemented in Part	Natural Reserves
14	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environmental Specialist
15	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves
16	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves
17	Establish and implement a weed control program that utilises best practice methods.	Key	Business as Usual	Ongoing	Natural Reserves, Landcare SJ
18	Establish and implement a control program for woody weeds.	High	Business as Usual	Ongoing	Natural Reserves
19	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ
20	Minimise burning and other disturbance of plateau forest.	Key	Short Term	Implemented in Part	Emergency Services
21	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves
22	Manage fire frequency in plateau forest according to best practice.	High	Long Term	Not Yet Implemented	Emergency Services

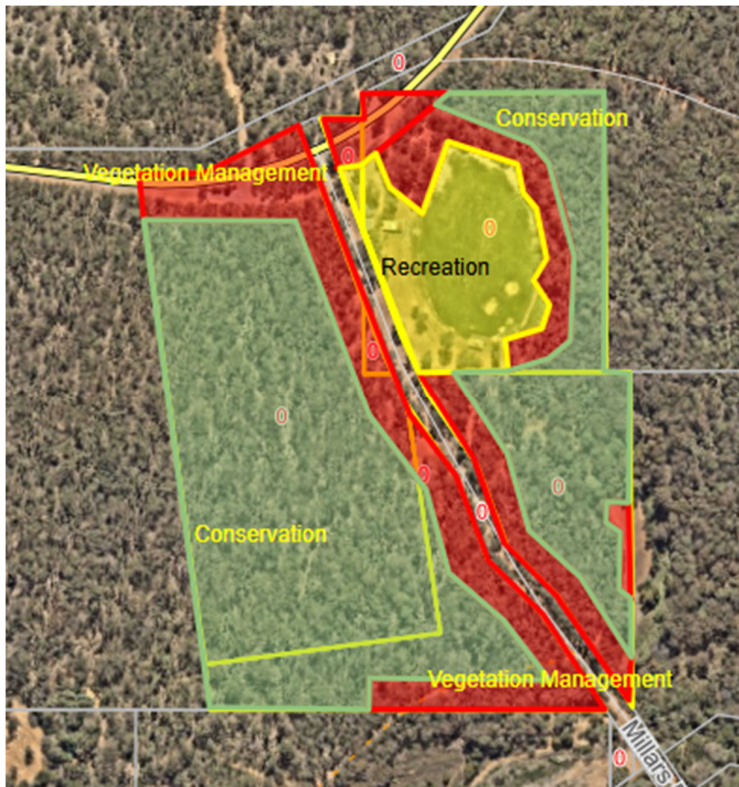
Scarp & Plateau Woodland & Forest Management Plan

No.	Action	Priority	Timing	Status	Responsibility
23	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves
24	Restrict any essential fuel load management to the Vegetation Management Zone.	High	Short Term	Not Yet Implemented	Emergency Services
25	Carry out fuel load management on adjacent road verges to avoid fire entering the reserve from the verge.	High	Medium Term	Not Yet Implemented	Emergency Services
26	Ensure that any essential fuel load management utilises weed control as a priority, with control burning only according to best practice.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves
27	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
28	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
29	Manage water use and allocations to ensure that environmental water requirements are considered and met.	Medium	Medium Term	Not Yet Implemented	Operations
30	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves
31	Monitor implementation of the management plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environmental Specialist
32	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environmental Specialist
33	Review and revise the management plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environmental Specialist

5. Fire Management Strategy for Jarrahdale Oval 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 – absent along boundaries other than adjacent to road reserves

King Jarrah Circle Reserve Action Plan

R45659

1. Background

1.1 Location

King Jarrah Circle Reserve is located in Jarrahdale (Figure 1). The reserve is dominated by Plateau forest (commonly known as jarrah forest). The reserve is 3.53 ha with 2.75 ha remnant vegetation. This action plan specifically deals with the forested 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 include casual walkers.

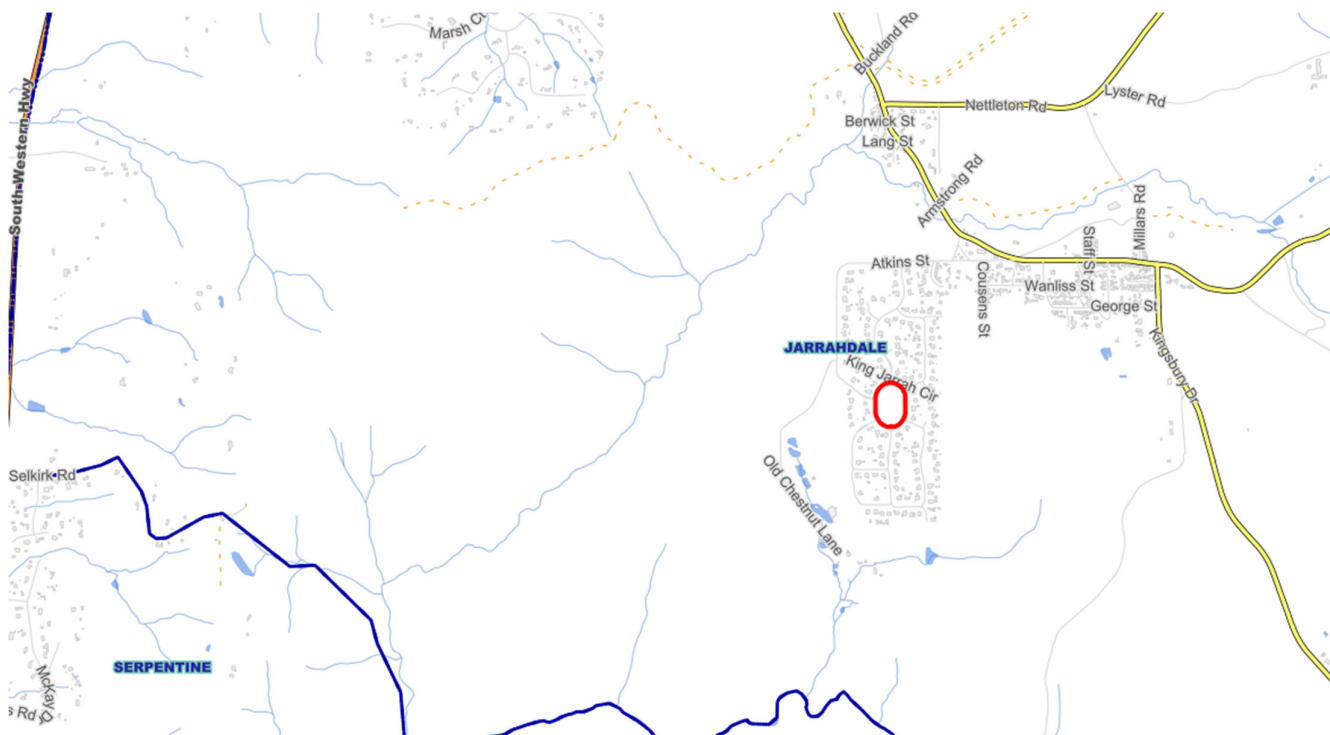


Figure 1: Location of King Jarrah Circle Reserve.

King Jarrah Circle Reserve is classified into two main management zones (Figure 2). These are:

Conservation Zone (green): Areas of remnant vegetation which may be dieback infected. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. If mapping confirms that dieback is present, then 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 which are presumed 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. If mapping confirms that dieback is present, then 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 both the Conservation and Vegetation Management Zones.



Figure 2: Management Zones of King Jarrah Circle Reserve.

1.2 Soils

One soil type occurs in King Jarrah Circle Reserve: Dwellingup 2 (Table 1 and Figure 3). Jarrah (Plateau) forest occurs throughout.

Table 1: Soil types of King Jarrah Circle Reserve.

Reserve	Soil landscape unit	Description	Vegetation classification
King Jarrah Circle Reserve	Dwellingup 2 phase	Very gently to gently undulating terrain (<10%) with well drained, shallow to moderately deep gravelly brownish sands, pale brown sands and earthy sands overlying lateritic duricrust.	Dwellingup D2 Plateau Forest

**Figure 3: Soil Types of King Jarrah Circle Reserve.**

1.3 Biodiversity

King Jarrah Circle Reserve contains one dominant vegetation community, Jarrah (Plateau) Forest. The forest is approximately 2.75 ha in area (Figure 4) and belongs to the vegetation complex Dwellingup D2.

The vegetation is in Degraded condition overall. The flora has been frequently surveyed and understorey is mostly absent. 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).

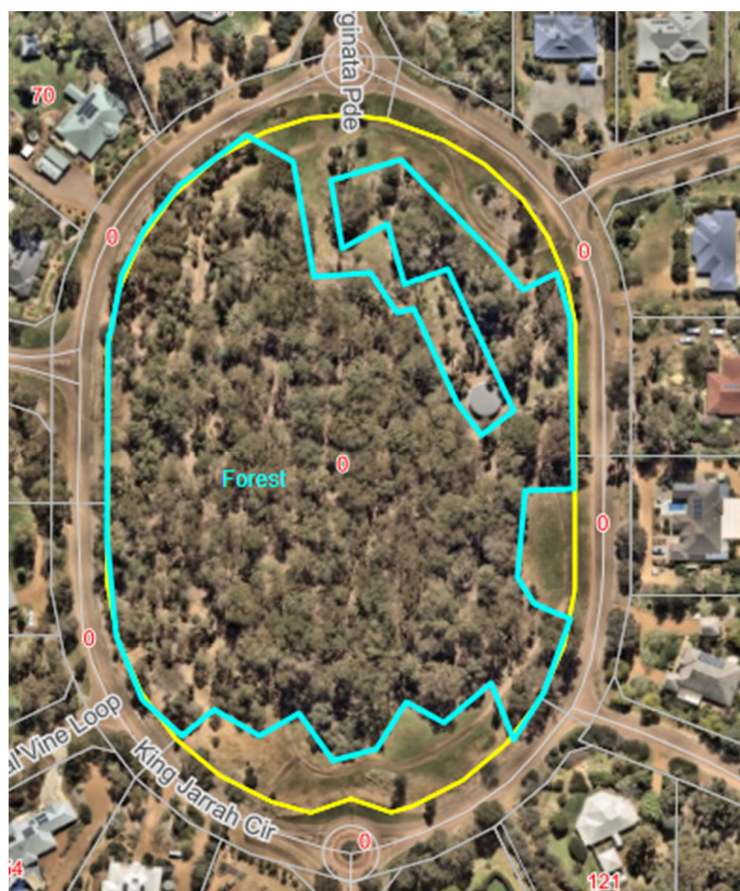


Figure 4: Location of Plateau Forest in King Jarrah Circle Reserve.

1.4 Water Resources

King Jarrah Circle Reserve is high in the landscape, sitting on the Darling Plateau. Natural waterways run to the south of the reserve (Figure 5), which contributes to the catchments of the waterways.

2. Threats and Pressures

Threats and pressures to the conservation values of King Jarrah Circle Reserve include:

- Recreational pressure from users
- Community anxiety about fire hazard and pressure for control burning
- 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*)
- Marri canker (*Quambalaria coyrecup*)

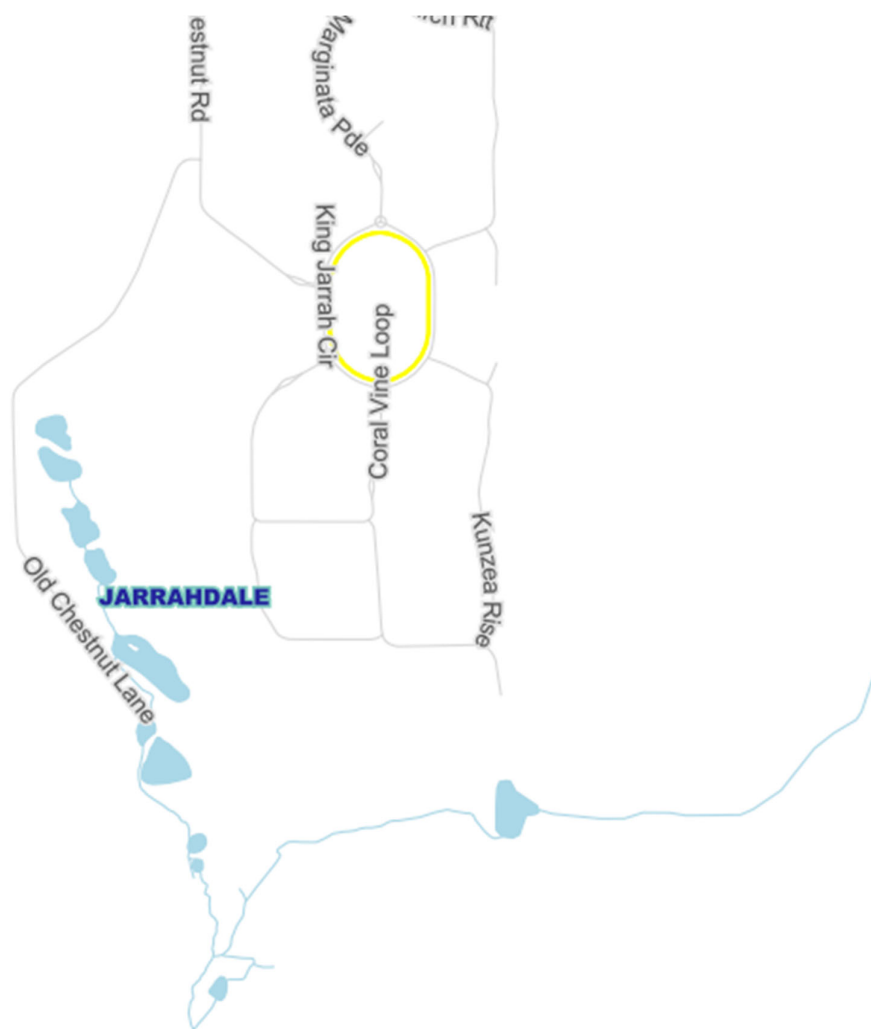


Figure 5: Water Features (Waterways and Water Bodies) of King Jarrah Circle Reserve.

3. Reserve Usage

3.1 Vesting and Land Tenure

The vesting purpose, land tenure and current uses of King Jarrah Circle Reserve are listed below in Table 2.

Table 2: Vesting Purpose, Land Tenure and Current Uses of King Jarrah Circle Reserve.

Reserve	Reserve and Lot Number	Vesting Purpose and Land Tenure	Current Uses
King Jarrah Circle Reserve	R45659 L4490 King Jarrah Circle, Jarrahdale	Shire of Serpentine Jarrahdale – Public Recreation	Recreation and Conservation

3.2 User Groups

The principal users of King Jarrah Circle Reserve include casual walkers.

Threats and pressures for the users include:

- Risk management
- Conflict among user groups with differing priorities, such as potential conflict between recreation and protection of the conservation values of the remnant vegetation.

3.3 Infrastructure

The infrastructure located in King Jarrah Circle Reserve includes footpaths and a water tank.

The Shire maintains the public infrastructure.

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 Jarrah Circle Reserve

No.	Action	Priority	Timing	Status	Responsibility
1	Utilise the planning system to retain and protect plateau forest.	Key	Business as Usual	Ongoing	Statutory Planning
2	Keep up to date with the latest research trends and integrate into reserve management.	High	Long Term	Ongoing	Natural Reserves, Emergency Services
3	Formalise access to plateau forest in high use areas through establishment of walking paths that reduce trampling.	Medium	Medium Term	Not Yet Implemented	Operations
4	Erect signage in high use areas to inform users of the values of the plateau forest.	Medium	Short Term	Implemented in Part	Operations
5	Survey for dieback presence, and map and treat dieback every three years if present.	Key	Business as Usual	Ongoing	Natural Reserves
6	Survey for marri canker and treat affected trees.	High	Business as Usual	Ongoing	Natural Reserves
6	Monitor and manage new and emerging pests and diseases such as polyphagous shot hole borer.	High	Medium Term	Ongoing	Natural Reserves
7	Liaise with other landholders to work together and integrate management of all plateau forest.	Medium	Medium Term	Not Yet Implemented	Natural Reserves, Strategic Environmental Specialist
8	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environmental Specialist

Scarp & Plateau Woodland & Forest Management Plan

No.	Action	Priority	Timing	Status	Responsibility
9	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves
10	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves
11	Establish and implement a weed control program that utilises best practice methods.	Key	Business as Usual	Ongoing	Natural Reserves, Landcare SJ
12	Establish and implement a control program for woody weeds.	High	Business as Usual	Ongoing	Natural Reserves
13	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ
14	Minimise burning and other disturbance of plateau forest.	Key	Short Term	Implemented in Part	Emergency Services
15	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves
16	Manage fire frequency in plateau forest according to best practice.	High	Long Term	Not Yet Implemented	Emergency Services
17	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves
18	Restrict any essential fuel load management to the Vegetation Management Zone.	High	Short Term	Not Yet Implemented	Emergency Services
19	Carry out fuel load management on adjacent road verges to avoid fire entering the reserve from the verge.	High	Medium Term	Not Yet Implemented	Emergency Services
20	Ensure that any essential fuel load management utilises weed control as a priority, with control burning only according to best practice.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves
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
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
23	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Friends Groups, Landcare SJ, Natural Reserves
24	Monitor implementation of the management plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environmental Specialist
25	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environmental Specialist
26	Review and revise the management plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environmental Specialist

5. Fire Management Strategy for King Jarrah Circle 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 – presumed present in some areas

Weeds – control required following disturbance

Firebreaks – absent, access from surrounding roads

Jarrahdale Skate Park Reserve Action Plan

Freehold land

1. Background

1.1 Location

Jarrahdale Skate Park Reserve is located in Jarrahdale (Figure 1). The reserve is dominated by Plateau forest (commonly known as jarrah forest). The reserve is 1.74 ha with 1.26 ha remnant vegetation. This action plan specifically deals with the forested area.

The reserve is freehold land owned by the Shire of Serpentine Jarrahdale for Recreation, but current uses also include Conservation. The principal user groups for the reserve include skaters (skateboards, scooters etc.) and the tennis club. The reserve surrounds the Jarrahdale fire station on three sides.



Figure 1: Location of Jarrahdale Skate Park Reserve.

Jarrahdale Skate Park 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 may be dieback infected. Management may include dieback treatment, weed control and revegetation as considered appropriate by officers and as required. If mapping confirms that dieback is present, then 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. If mapping confirms that dieback is present, then 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 areas in use by the skate park and tennis 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 Jarrahdale Skate Park Reserve.

1.2 Soils

Three soil types occur in Jarrahdale Skate Park Reserve: Yarragil 4, Yarragil 1 and Dwellingup 2 (Table 1 and Figure 3). Jarrah (Plateau) Forest occurs on all three soil types.

Table 1: Soil types of Jarrahdale Skate Park Reserve.

Reserve	Soil landscape unit	Description	Vegetation classification
Jarrahdale Skate Park Reserve	Yarragil 4 phase	Valley floors with some poorly drained mottled yellow duplex soils and gentle lower slopes with moderately well to well drained loamy and sandy earths, gravels and duplex soils. Low woodland of <i>E. wandoo</i> , <i>E. marginata</i> and <i>Acacia</i> spp.	Murray 1 Plateau Forest
	Yarragil 1 phase	Very gentle to moderately inclined concave sideslopes. Moderately well drained yellow duplex soils and yellow and brown massive earths and gravels. Woodland of <i>E. wandoo</i> , <i>E. marginata</i> , <i>E. accedens</i> . <i>Casuarina obesa</i> on salt affected areas.	Murray 1 Plateau Forest
	Dwellingup 2 phase	Very gently to gently undulating terrain (<10%) with well drained, shallow to moderately deep gravelly brownish sands, pale brown sands and earthy sands overlying lateritic duricrust.	Dwellingup D2 Plateau Forest

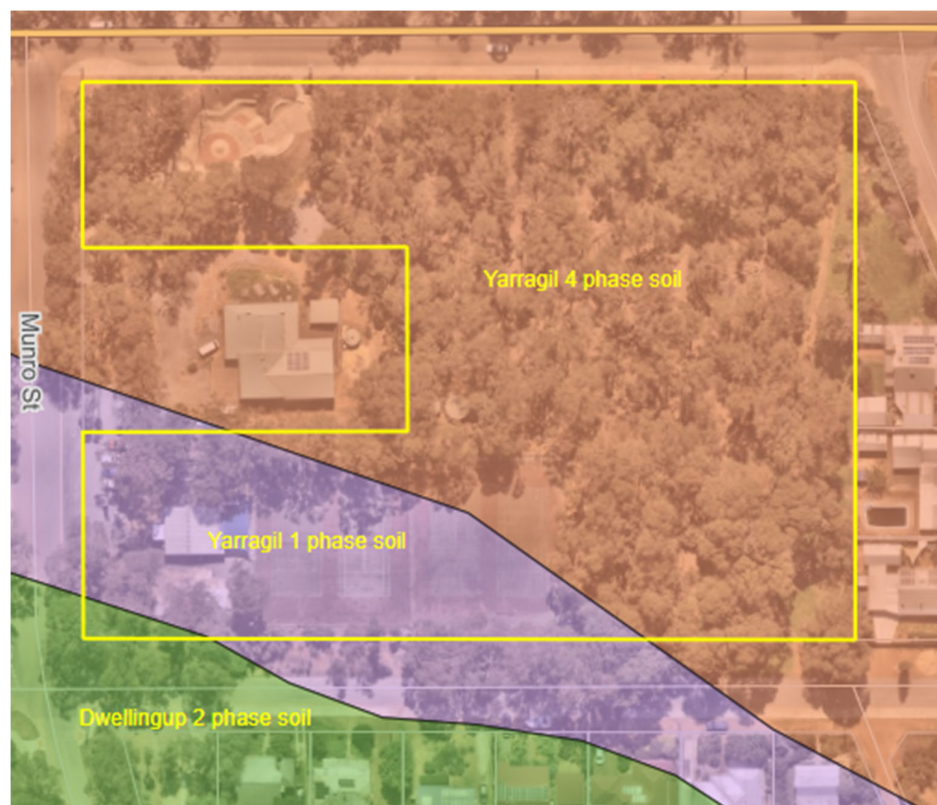


Figure 3: Soil Types of Jarrahdale Skate Park Reserve.

1.3 Biodiversity

Jarrahdale Skate Park Reserve contains one dominant vegetation community, Jarrah (Plateau) Forest. The forest is approximately 1.26 ha in area (Figure 4) and belongs to the vegetation complexes Murray My1 (on the Yarragil 4 and 1 soils) and Dwellingup D2 (on the Dwellingup 2 soils).

The vegetation is in Very Good to Good condition overall. The flora 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), and there is a nearby record for the Western brush wallaby.



Figure 4: Location of Plateau Forest in Jarrahdale Skate Park Reserve.

1.4 Water Resources

Jarrahdale Skate Park Reserve is high in the landscape, sitting on the Darling Plateau. A major waterway (Gooralong Brook) runs to the north of the reserve (Figure 5), which contributes to the brook's catchment.

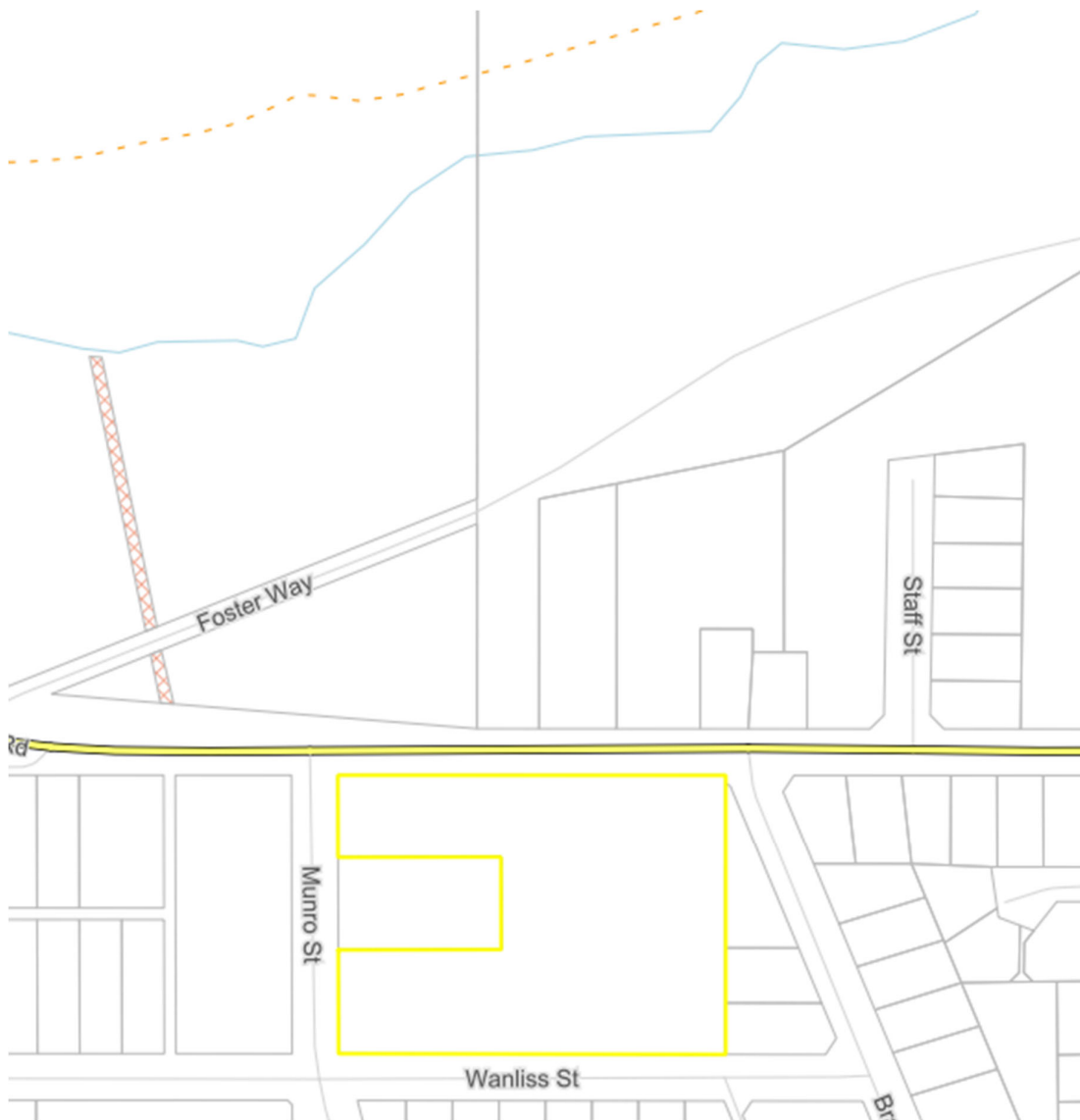


Figure 5: Water Features (Waterways and Water Bodies) of Jarrahdale Skate Park Reserve.

2. Threats and Pressures

Threats and pressures to the conservation values of Jarrahdale Skate Park Reserve include:

- Recreational pressure from users
- Community anxiety about fire hazard and pressure for control burning
- 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*)
- Freehold status of the reserve, and consequent development potential

3. Reserve Usage

3.1 Vesting and Land Tenure

The vesting purpose, land tenure and current uses of Jarrahdale Skate Park Reserve are listed below in Table 2.

Table 2: Vesting Purpose, Land Tenure and Current Uses of Jarrahdale Skate Park Reserve.

Reserve	Reserve and Lot Number	Vesting Purpose and Land Tenure	Current Uses
Jarrahdale Skate Park Reserve	Freehold land L437 Munro Street, Jarrahdale	Shire of Serpentine Jarrahdale – Freehold Land	Recreation and Conservation

3.2 User Groups

The principal users of Jarrahdale Skate Park Reserve include skaters (skateboards, scooters etc.) and the tennis club. The reserve surrounds the Jarrahdale fire station on three sides.

Threats and pressures for the user groups include:

- Risk management and insurance, with stricter liability and higher premiums.
- Membership and member involvement.
- Conflict among user groups with differing priorities, such as potential conflict between skate park, tennis club or fire brigade 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.
- Freehold status of the reserve, and consequent development potential.

3.3 Infrastructure

The infrastructure located in Jarrahdale Skate Park Reserve includes:

- Tennis clubhouse and sheds
- Car parking area
- Water tanks
- Skate park

The Shire maintains the public infrastructure.

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 Jarrahdale Skate Park Reserve

No.	Action	Priority	Timing	Status	Responsibility
1	Utilise the planning system to retain and protect plateau forest.	Key	Business as Usual	Ongoing	Statutory Planning
2	Keep up to date with the latest research trends and integrate into reserve management.	High	Long Term	Ongoing	Natural Reserves, Emergency Services
3	Formalise access to plateau forest in high use areas through establishment of walking paths that reduce trampling.	Medium	Medium Term	Not Yet Implemented	Operations
4	Erect signage in high use areas to inform users of the values of the plateau forest.	Medium	Short Term	Implemented in Part	Operations
5	Survey for dieback presence, and map and treat dieback every three years if present.	Key	Business as Usual	Ongoing	Natural Reserves
6	Monitor and manage new and emerging pests and diseases such as polyphagous shot hole borer.	High	Medium Term	Ongoing	Natural Reserves
7	Work with user groups to protect and minimize impacts to the remnant vegetation.	High	Business as Usual	Ongoing	Natural Reserves, User Groups
8	Liaise with other landholders to work together and integrate management of all plateau forest.	Medium	Medium Term	Not Yet Implemented	Natural Reserves, Strategic Environmental Specialist
9	Conduct flora surveys and vegetation condition monitoring and mapping every five years.	Low	Business as Usual	Ongoing	Natural Reserves, Strategic Environmental Specialist
10	Conduct fauna surveys every five years.	Low	Medium Term	Not Yet Implemented	Natural Reserves
11	Monitor weed diversity and distribution annually.	High	Business as Usual	Ongoing	Natural Reserves
12	Establish and implement a weed control program that utilises best practice methods.	Key	Business as Usual	Ongoing	Natural Reserves, Landcare SJ

Scarp & Plateau Woodland & Forest Management Plan

No.	Action	Priority	Timing	Status	Responsibility
13	Establish and implement a control program for woody weeds.	High	Business as Usual	Ongoing	Natural Reserves
14	Conduct feral animal control when required, following all relevant health and safety regulations.	Medium	Business as Usual	Ongoing	Natural Reserves, Landcare SJ
15	Minimise burning and other disturbance of plateau forest.	Key	Short Term	Implemented in Part	Emergency Services
16	Avoid disturbance to the Conservation Zone and to dieback-free areas.	High	Short Term	Not Yet Implemented	Natural Reserves
17	Manage fire frequency in plateau forest according to best practice.	High	Long Term	Not Yet Implemented	Emergency Services
18	Avoid fuel load management unless considered appropriate and necessary.	Medium	Business as Usual	Implemented in Part	Emergency Services, Natural Reserves
19	Restrict any essential fuel load management to the Vegetation Management Zone.	High	Short Term	Not Yet Implemented	Emergency Services
20	Carry out fuel load management on adjacent road verges to avoid fire entering the reserve from the verge.	High	Medium Term	Not Yet Implemented	Emergency Services
21	Ensure that any essential fuel load management utilises weed control as a priority, with control burning only according to best practice.	Medium	Short Term	Not Yet Implemented	Emergency Services, Natural Reserves
22	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
23	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
24	Revegetate with local provenance seedlings as necessary and appropriate.	Medium	Medium Term	Implemented in Part	Landcare SJ, Natural Reserves
25	Monitor implementation of the management plan every three years.	High	Short Term	Not Yet Implemented	Strategic Environmental Specialist
26	Update actions according to best practice management and monitoring outcomes.	High	Medium Term	Not Yet Implemented	Strategic Environmental Specialist
27	Review and revise the management plan every ten years.	High	Long Term	Not Yet Implemented	Strategic Environmental Specialist

5. Fire Management Strategy for Jarrahdale Skate Park 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 – may be present in some areas

Weeds – control required following disturbance

Firebreaks – absent, access from adjacent and nearby roads