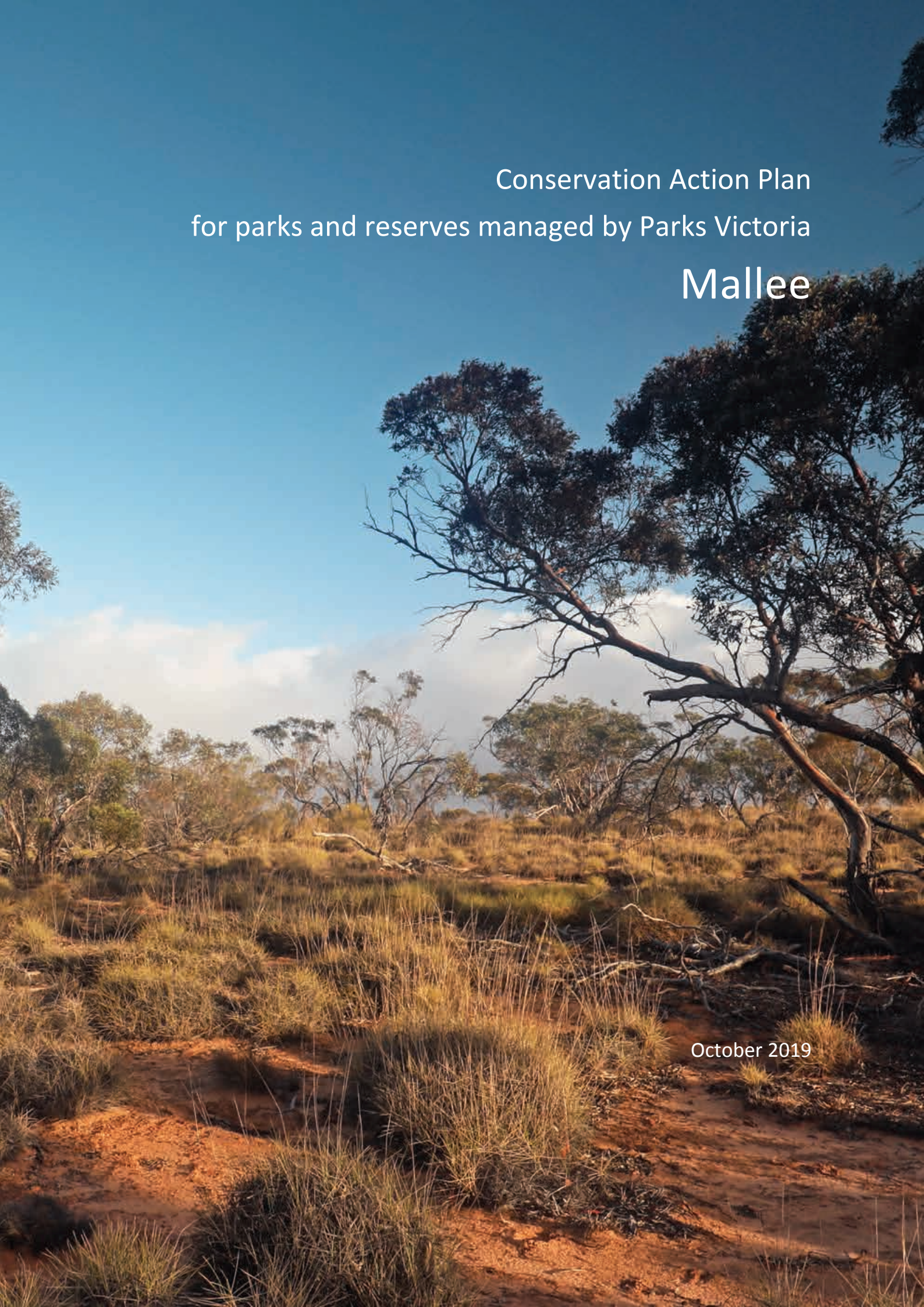

Conservation Action Plan
for parks and reserves managed by Parks Victoria
Mallee

October 2019

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Disclaimer

This plan is prepared without prejudice to any negotiated or litigated outcome of any native title determination applications covering land or waters within the plan's area. It is acknowledged that any future outcomes of native title determination applications may necessitate amendment of this plan; and the implementation of this plan may require further notifications under the procedures in Division 3 of Part 2 of the *Native Title Act 1993* (Cwlth).

The plan is also prepared without prejudice to any future negotiated outcomes between the Government/s and Traditional Owner Communities. It is acknowledged that such negotiated outcomes may necessitate amendment of this plan.

Every effort has been made to ensure that the information in this plan is accurate. Parks Victoria does not guarantee that the publication is without flaw of any kind and therefore disclaims all liability for any error, loss or other consequence that may arise from you relying on any information in the publication.

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Iterations

The first iteration of this plan was approved by Parks Victoria in October 2019.

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Foreword

To realise its vision as a world-class park service ensuring healthy parks for healthy people, Parks Victoria is committed to delivering works on the ground across Victoria's park network to protect, conserve and enhance park values. It is our primary responsibility to ensure that parks are healthy and resilient for current and future generations.

Parks Victoria acknowledges, respects and works closely with Traditional Owners and other Aboriginal communities and organisations in Victoria. We pay our respects to Elders past and present, and to emerging Aboriginal leaders.

Parks Victoria recognises the diversity of cultures, deep connections, rights and responsibilities that Traditional Owners have over the lands and waters covered by the Mallee Conservation Action Plan. We recognise that the ancient landscape we see today has been modified over many thousands of years of occupation and influenced by the skills, knowledge and activities of generations of Aboriginal land managers. We also acknowledge the impacts of more recent land use and the impacts that introduced threats have had on this unique cultural landscape. The plan is a starting place for conversations with Traditional Owners on the importance of the nature and wildlife of this Country.

The plan focuses primarily on the first of Parks Victoria's three strategic themes:

- Conserving Victoria's special places
- Connecting people and parks
- Providing benefits beyond park boundaries.

It is guided by *Protecting Victoria's Environment — Biodiversity 2037*, Victoria's plan to stop the decline of our native plants and animals. It is also guided by the *Environment Protection and Biodiversity Conservation Act 1999* (Cwlth) and the *Flora and Fauna Guarantee Act 1988* (Vic.), which are the key pieces of Commonwealth and State legislation for the conservation of significant places, species and communities, and for the management of ecologically threatening processes.

The plan outlines Parks Victoria's understanding of the major threats to nature and wildlife in this ancient and unique cultural landscape, and the potential actions that we can take together with Traditional Owners and other partners in caring for and improving the health of the Mallee landscape.

Summary

The Mallee Parks Landscape encompasses a stunning and diverse array of natural and cultural values. It includes significant areas of remote wilderness, consisting of mallee and heathlands on sandy dunes, with saline soaks and remnant cypress-pine and buloke woodlands in the lower parts of the landscape that connect ephemeral inland riverine and lake systems, including the Lake Albacutya Ramsar site.

The Parks Landscape includes most of Victoria's largest national park (Murray–Sunset National Park) and several other very large, continuous parks and reserves. These parks and reserves are critical habitat for a suite of threatened flora and fauna. The natural ecological processes occurring in the Park Landscape can be sustained with strategic, targeted management intervention.

This Conservation Action Plan defines and prioritises conservation strategies for the Mallee Parks Landscape for the period to July 2024, and broadly describes the expected outcomes of these strategies. The plan outlines what can be realistically achieved to tackle the threats that pose the most risk to conservation assets. The Conservation Action Plan will support Parks Victoria in achieving our landscape conservatio vision to:

Increase the resilience of natural assets in the Mallee Parks Landscape and maintain ecosystem services in the face of climate change and other stressors.

Parks Victoria is responsible for managing over four million hectares of Victoria's most intact landscapes, and recognises the critical importance of working with Australia's First Peoples to manage parks and reserves in a culturally sensitive and ecologically sympathetic way. Parks Victoria appreciates the importance of long-term, respectful and meaningful partnerships with Traditional Owners, the opportunity to understand, share and celebrate Aboriginal cultural values, and the need for greater accountability and responsibility for managing risks to Aboriginal cultural heritage. It is developing a robust, agency-wide approach that provides a strong foundation for partnerships to grow and evolve, and become integrated with the way Parks Victoria works.

This particular version of the Mallee Parks Landscape Conservation Action Plan may be revised before its scheduled review period to integrate traditional ecological knowledge and input from Traditional Owners, and to further capture their role in managing this highly biodiverse and culturally significant landscape in future conservation strategies. It may also assist in informing a future joint management plan.

The development, implementation and review of the plan follows Parks Victoria's cyclical 10-step conservation action planning process. The plan covers the first seven steps in this process:

1 Scope planning, people and resources.
2 Identify conservation assets.
3 Assess the viability of conservation assets and set conservation outcomes.
4 Identify and assess threats to conservation outcomes.
5 Develop action options from situational analysis.
6 Assess and select preferred strategies and actions.
7 Set performance measures.

Eight terrestrial conservation assets have been identified in the Mallee Parks Landscape: Mallee Triodia, Sunset Plains and Swales, Inland Saline Soaks, Heathlands and Mallee Heathlands, Lowan Broombush and Swales, Semi-arid Woodlands, Inland Riverine Forests, and Lake Albacutya Ramsar Site. Within each of these assets a range of nested assets, such as threatened species and important ecological assemblages, have also been identified.

The plan also identifies a range of key ecological attributes (KEAs) — components that are believed to best reflect the health of the asset. The plan describes their current condition (very good, good, fair, or poor) and the trend in condition (improving, stable, or declining), and sets the anticipated future condition of each attribute. These measures then allow the overall condition of each asset to be assessed.

Mallee Triodia, Sunset Plains and Swales, and the Inland Saline Soak assets are in good condition. Heathlands and Mallee Heathlands, Lowan Broombush and Swales, Semi-arid Woodlands, and Inland Riverine Forest assets are in fair condition. Lake Albacutya Ramsar Site asset is in poor condition.

The desired future status of most assets is good or fair, but depends on the implementation of all the listed strategies. The exceptions are Inland Riverine Forests and Lake Albacutya Ramsar Site, for which the desired future status reflects the expectation that the lack of riverine flows and the continuing trend of a drying climate will not improve these assets.

Seven key threats to the conservation assets in the Parks Landscape are described in the plan:

- extremes of climate and weather
- inappropriate fire regimes and fire management activities
- total grazing, browsing, trampling and wallowing pressure
- predation by introduced predators
- weed invasion
- specific competitive interactions
- habitat degradation from visitor activities.

The following conservation strategies will be undertaken to tackle these threats. They have been selected for their impact, feasibility and cost in achieving the desired conservation outcomes.

- **Collaborate on Country with Traditional Owners, special interest groups and researchers** — strengthen collaboration and partnerships to maintain long-term engagement and guide adaptive management in environmental programs.
- **Manage fire for healthy conservation assets** — Work in partnership with fire management agencies to maintain and improve fire regimes that diversify vegetation age-class mosaics and protect fire-sensitive values.
- **Manage total grazing pressure** — Implement effective and integrated control of key herbivores to improve the regeneration and structural diversity of Semi-arid Woodlands.
- **Restore the Semi-arid Woodlands** — Work with restoration partners to restore structural diversity to the woodlands, and provide habitat for the future.
- **Control introduced predators to support resilient populations of native fauna** — Effectively manage introduced predators at priority locations to support the persistence, movement and increase of native fauna vulnerable to predation.
- **Manage environmental weeds using a biosecurity approach** — Reduce the spread, establishment and impact of weeds, focusing on species that have, or are likely to have, significant impacts on conservation assets and ecological processes.
- **Reduce visitor impacts on natural and cultural assets** — Work with park visitors to limit the impacts of recreational activities at priority locations.
- **Reintroduce locally extinct fauna** — Support projects that will improve ecosystem functioning by reintroducing locally extinct native species.

A results chain has been developed for each strategy to help guide their implementation and the monitoring of indicators. These chains test the ability of Parks Victoria to achieve the conservation outcomes defined for each of the assets.

Contents

Malleefowl (Lauan)

1 Background

1.1 Adaptive management

Conservation action planning is an important component of Parks Victoria's approach to adaptive management and evidence-based decision making. It uses a collaborative approach to identify conservation priorities and develop strategies to address those priorities. These strategies are designed to achieve defined and measurable conservation outcomes.

Through conservation action planning, Parks Victoria identifies and focuses on strategies that target clearly defined elements of the natural environment (conservation assets) for which threats have been identified and for which the success of strategies can be measured. Understanding how to best use the resources available for conservation to achieve the greatest improvement in the overall health of ecosystems is a complex challenge for land managers.

Conservation experience, scientific understanding, local environmental knowledge, traditional ecological knowledge, and strategic thinking are all key components of successful conservation action planning.

Conservation strategies have been developed and prioritised using the best available knowledge, and will enable specific operational activities to be implemented, monitored for success, and further refined. The plan complements the existing park management plans, and may be used to guide the development of a future joint management plan. Conservation strategies detailed in the park management plans have been reviewed during the conservation action planning process, and updated for inclusion where relevant.

The plan's primary purpose is to guide the management of conservation values, but it also articulates Parks Victoria's conservation priorities and strategies to stakeholders, land management partners and the public.

1.2 Park landscapes

Park landscapes are classified according to a combination of ecological attributes, landforms and administrative boundaries. They form a logical unit for conservation action planning and the delivery of specific operational activities in groups of parks and reserves. There are 16 park landscapes in Victoria (Figure 1.1).

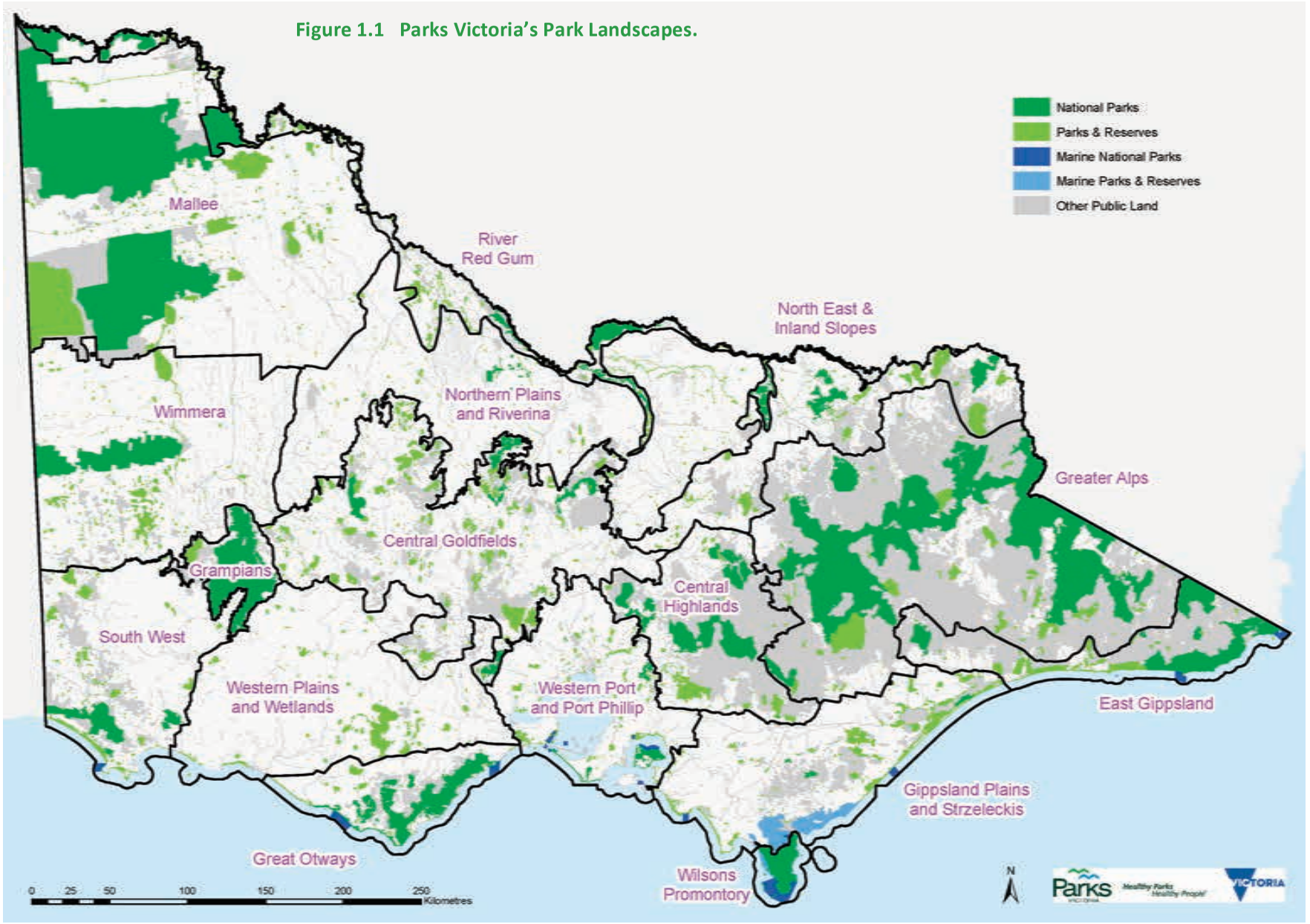
1.3 Planning method

Parks Victoria has adopted the conservation action planning methodology developed by The Nature Conservancy. This methodology is based on the Open Standards for the Practice of Conservation developed by Conservation Measures Partnership, an international partnership of conservation organisations.

Parks Victoria's approach to conservation action planning is suitable for planning conservation projects with joint management partners, in partnership with all stakeholders, for land that it manages. It is consistent with the approach used by numerous other agencies that manage conservation lands in Victoria.

The emphasis is on identifying strategies that tackle the high-risk threats to priority conservation assets and their key ecological attributes, and that will contribute most to meeting the expected conservation outcomes.

Figure 1.1 Parks Victoria's Park Landscapes.



Parks Victoria's conservation action planning process involves a series of conservation action planning workshops, with participants from Parks Victoria and other organisations, and follows 10 sequential steps (Figure 1.2):

1 Scope planning, people and resources.
2 Identify conservation assets.
3 Assess the viability of conservation assets and set conservation outcomes.
4 Identify and assess threats to conservation outcomes.
5 Develop action options from situational analysis.
6 Prioritise conservation strategies.
7 Set performance measures.
8 Plan work.
9 Implement operational plans.
10 Adapt the conservation action plan and operational activities.

This Conservation Action Plan is an output of steps 1 to 7, and will provide directions for environmental conservation management for the next 15 years. The implementation of the conservation strategies (steps 8 and 9) will be undertaken by regional staff at the operational level.

After 5 years the plan will be reviewed (step 10), and progress will be evaluated against outcomes identified for the conservation assets, threat mitigation objectives, and the implementation of identified priority actions.

Figure 1.2 Parks Victoria's conservation action planning: the 10 step process.

Common Fringe-myrtle

2 Scope

2.1 Geographic scope

The Mallee Parks Landscape covers 3.7 million hectares of the semi-arid region of north-western Victoria, including the Big Desert and Sunset Country of north-western Victoria. It encompasses a range of environments in the Murray Mallee and Lowan Mallee bioregions, including dunefields, woodlands and riverine plains. Most of the Mallee has a mantle of sands of marine origin and alluvium over an older land surface, with occasional outcrops of lateritised sediments. The sands were sculpted into dunes by wind action during the Quaternary period. These areas fall in the Murray Mallee and Lowan Mallee bioregions.

Much of north-western Victoria was historically designated as soldier settlement blocks, but a drought between 1913 and 1929 and the Depression of the 1930s made agriculture untenable in the region, and large areas of the Victorian Mallee remained unsettled. Pastoralism was a significant activity during the 1900s throughout the areas that are now the Mallee Parks. The parks were proclaimed relatively late in the creation of Victoria's reserve system, with vast areas added between 1990 and 1992.

The Mallee Parks are of great significance because they protect the largest areas of the least disturbed mallee ecosystems in Australia, contain outstanding areas of semi-arid wilderness, and cover the largest area of highest quality wilderness in the south-eastern mainland (LCC 1991).

This Conservation Action Plan covers only national parks and reserves managed by Parks Victoria, which include the following areas of particular importance for biodiversity conservation:

- Murray Sunset National Park (non-riverine areas)[1]
- Wyperfeld National Park
- Big Desert Wilderness Park
- Hattah–Kulkyne National Park (non-riverine areas)[1]
- Bronzewing Flora and Fauna Reserve
- Annuello Flora and Fauna Reserve
- Wathe Flora and Fauna Reserve
- Lake Albacutya Park
- Lake Tyrrell Wildlife Reserve.

About 1.3 million hectares of the Mallee Parks Landscape is in parks and reserves managed by Parks Victoria (see Appendix A for a full list of parks and reserves). These parks and reserves total around 30% of Victoria's entire parks and reserves estate.

2.2 Significant natural values

The natural values of significance in the parks and reserves of the Mallee Parks Landscape are as follows:

- a diverse range of ecosystems and landscapes, including dunefields, heathlands, woodlands, grasslands, rivers, lakes and wetlands
- state significant examples of the boinka landform complex at Pink Lakes and Raak Plain (boinkas: shallow depressions where groundwater is discharged
- extensive examples of a variety of dune types, significant crescent-shaped lunettes such as those found at Lake Albacutya, Wirrengren Plain and Lake Wallawalla
- seven Wilderness Zones, consisting of continuous and relatively unmodified vegetation, including areas that have been recognised for their intactness and remoteness

1 Sections of Murray–Sunset and Hattah–Kulkyne National Parks are covered by the River Red Gum Conservation Action Plan (in prep.), including the river country ecosystems associated with the Murray River and the Hattah Lakes Ramsar Site.

- two Remote and Natural Areas in Murray–Sunset and Wyperfeld National Parks
- Lake Albacutya Ramsar Site and other wetlands of national significance, including the lower reaches of Wimmera River and Wirrengren Plain, Raak Plain, Pink Lakes, and Lake Tyrrell
- plants, animals and sites that are culturally significant to Traditional Owners
- a large diversity of biota, including many species that are significant at a national level, providing habitat and species assemblages that are unique in Victoria
- more than 1000 species of native plants, and more than 100 floral subcommunities
- FFG-listed Semi-arid Woodlands
- significant fauna species, including 16 species listed under the EPBC Act (twelve birds, a mammal, and three fish), and 66 species listed under the FFG Act (1 mammal, 44 birds and 11 reptiles).
- 270 bird species, including Malleefowl, Mallee Emu-wren, Black-eared Miner and Red-lored Whistler, all considered to be threatened nationally; 23 species of parrots, among them the nationally vulnerable Regent Parrot, and 22 migratory bird species listed under the EPBC Act, including the Rainbow Bee-eater, Eastern Great Egret and White-bellied Sea-Eagle
- Victorian Mallee Bird Community and Victorian Temperate Woodland Bird Community, both listed as threatened under the FFG Act
- critical habitat for nationally threatened species such as the Mallee Emu-wren
- a greater diversity of reptiles than any other region in Victoria, including 11 FFG-listed species.

More than 1300 native animal species have been reported from the Mallee Parks Landscape, including 1327 plants, 38 mammals, 303 birds, 64 reptiles, 13 amphibians, 17 fish, 4 decapod crustaceans, and 6 other invertebrates.

2.3 Cultural significance

Traditional Owners are the custodians of a living cultural heritage. The forest, river, plants and animals are all part of Country and the cultural identity of Traditional Owners. Protecting, managing and enjoying the land are important parts of this connection, and Traditional Owner knowledge and perspectives are important in best practice land and natural resource management to bring benefits to both the parks and the whole community.

Supporting the inclusion of traditional ecological knowledge in land management practices can heal Country and help to achieve conservation outcomes, including environmental drivers such as cultural water flows and the rekindling of cultural burning practices.

Several Traditional Owner and other Aboriginal groups have interests in parts of the Mallee Parks Landscape:

- Barengi Gadjin Land Council Aboriginal Corporation
- First People of the Millewa-Mallee Aboriginal Corporation
- Tati Tati Aboriginal Corporation
- Latji Latji Mumthelang Aboriginal Corporation
- Wadi Wadi Traditional Owner Group
- Wamba Wamba Traditional Owner Group
- Gilbie Aboriginal Corporation
- Murray Valley Aboriginal Co-operative.

The southern portion of the Mallee Parks Landscape is within the Traditional lands of the Wotjobaluk, Jaadwa, Jadawadjali, Wergaia and Jupagulk peoples, who are represented by the Barengi Gadjin Land Council Aboriginal Corporation (BGLC). Wotjobaluk Peoples, through BGLC as a Registered Aboriginal Party under the *Aboriginal Heritage Act 2006* (Vic.), have legislated authority for the protection and management of Aboriginal cultural heritage.

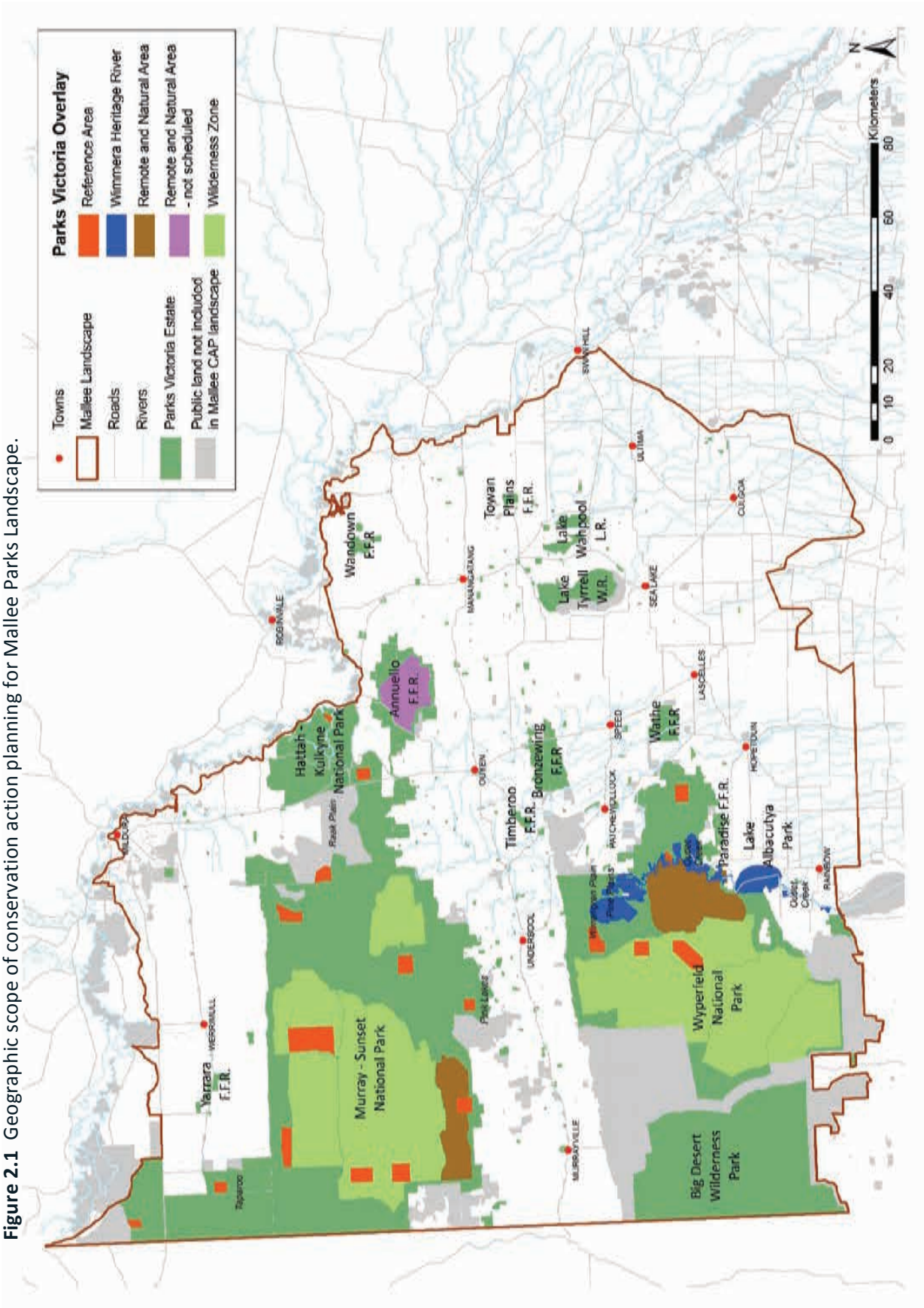


Figure 2.1 Geographic scope of conservation action planning for Mallee Parks Landscape.

Their Country Plan, *Growing What is Good Country Plan — Voices of the Wotjobaluk Nations* (BGLC 2017), highlights traditional connections to Country and outlines Traditional Owner priorities for the coming years, noting the importance of strengthening respectful partnerships to manage and care for Country together as management of public land evolves into joint management arrangements.

Mallee Parks Landscape priority areas and actions for the BGLC include Ngalpakatia/Ngelpagutya (Lake Albacutya) where 'shell middens, oven mounds, scarred trees, artefacts and stories highlight the Wotjobaluk Community's deep and continuous connections' (BGLC 2017). Wirrengren Plain was an important area for large gatherings and the trade of items such as stone axes, spears and possum-skin rugs. The Plan notes the threat that reduced water flows and pest species pose to the condition of the lakes and creek systems, and the importance of traditional ecological knowledge to inform land management practices that heal country and restore native vegetation condition.

Also important is Wyperfeld and Big Desert, where people moved across the landscape 'seasonally, singing the Country, accessing plants and animals for food, fire and medicine and employing cultural burning practices'. Here priority actions include reintroducing cultural healing practices such as traditional burning, re-introducing lost predators to control rabbits, and promoting the cultural use and control of native grazing species.

The northern portion of the Mallee Parks Landscape is within the Traditional lands of the Latji Latji, Nyeri Nyeri and Ngintait (Nintay) Traditional Owners, who are represented by the First People of the Millewa-Mallee Aboriginal Corporation (FPMMAC). Their traditional lands cover the area south of the Murray River, mostly to the west of the Calder Freeway and including northern sections of Murray–Sunset National Park. The Corporation was appointed a Registered Aboriginal Party under the Aboriginal Heritage Act in December 2018 and has legislated authority for the protection and management of Aboriginal cultural heritage.

Examples of culturally important sections of the landscape are also known for other Traditional Owner groups. For instance, for the Wergaia-speaking Boorong Clan, Lake Tyrrell was a gathering place used to interpret the constellations. The night sky was an important tool in Aboriginal culture for reading the changing of the seasons, and for keeping stories and lore alive.

As part of more recent history, post-European contact, exploration and settlement of the land has left its own mark in the form of built structures, diverse past land uses, stories and connections. Everything that has happened in the past is part of the story of the Mallee parks and reserves that exist today.

2.4 Co-operative management agreements

The native title settlement determination for the Wotjobaluk, Jaadwa, Jadawadjali, Wergaia and Jupagulk Peoples in 2005 led to the establishment of a cooperative management agreement associated with an Indigenous Land Use Agreement (ILUA) between the State of Victoria and the Barengi Gadjin Land Council Aboriginal Corporation (BGLC).

The ILUA initiated a process to involve BGLC as partners in planning, management and works programs for certain lands within the determination area through the Winyula Council. The Wotjobulak Peoples also assert interests in land outside the ILUA boundary. As the Winyula Council is not currently operational, interim co-management agreements are enacted annually.

Co-management is facilitated by quarterly meetings between BGLC, Parks Victoria and the Department of Environment, Land, Water and Planning (DELWP). Parks Victoria and DELWP provide a copy of all their programs to BGLC in the form of an engagement calendar, to enable BGLC to understand the entire program of work planned for the co-management area and choose what programs it wishes to be actively involved in as a partner, subject to its interest and capacity.

Under the *Traditional Owner Settlement Act 2010* (Vic.), discussion has started between the Victorian Government and the BGLC to negotiate a Traditional Owner Land Management Agreement that would allow the Wotjobaluk Peoples and the State of Victoria to jointly manage agreed national parks, conservation reserves and other Crown land when they are transferred to BGLC as Aboriginal Title. Parks Victoria is also in early discussions with BGLC about a partnership agreement that would outline shared goals and how Parks Victoria and BLGC can work effectively together to manage cultural landscapes on Wotjobaluk Country.

The First People of the Millewa-Mallee Aboriginal Corporation and Parks Victoria have been working together for several years, and partnership arrangements between the RAP and Parks Victoria for managing the sensitive cultural landscapes of north-western Victoria are now being formalised. The Corporation has also notified the Victorian Government that it is seeking to negotiate a Recognition and Settlement Agreement, under the Traditional Owner Settlement Act, over land that includes its Registered Aboriginal Party area but extending farther south to the Mallee Highway, taking in the remainder of the Murray–Sunset National Park. Such an agreement might include the future transfer of some areas of Crown land as Aboriginal Title, and the subsequent establishment of joint management arrangements.

2.5 Legislative and planning context

Under the *Parks Victoria Act 2018* (Vic.) the first object is to protect conserve and enhance the land it manages, including its natural and cultural values, for the benefit of the environment and current and future generations.

The Mallee Parks Landscape consists of 336 parks and reserves covering almost 1.3 million hectares, which are managed under various Victorian Acts including the *National Parks Act 1975* and the *Crown Lands (Reserves) Act 1978*. The majority of the parks are reserved and managed under the provisions of the National Parks Act (1.02 million hectares), including Murray Sunset National Park, Hattah–Kulkyne National Park, Wyperfeld National Park, Big Desert Wilderness Park and Lake Albacutya Park.

The three national parks all have significant areas designated as Wilderness Zone, Remote and Natural Area (RNA), or Reference Area administered under the *Reference Areas Act 1978* (Vic.). Annuello Flora and Fauna Reserve (FFR) also has an RNA however this is not currently scheduled under the National Parks Act as FFRs are not administered under this Act.

Significant reserves in the landscape for biodiversity conservation are Annuello FFR, Bronzewing FFR, Wathe FFR, Yarrara FFR, Paradise FFR, Birdcage FFR, Wandown FFR and Towan Plains FFR. Under the *Heritage Rivers Act 1992* (Vic.) the area in the Mallee Parks Landscape from Lake Albacutya north along Outlet Creek to Wirrengren Plain is a proclaimed Heritage River Area because of its significant environmental and social values.

2.6 Alignment with Regional Catchment Strategies

Most of the Mallee Parks Landscape is within the area of the Mallee Catchment Management Authority, but Lake Albacutya and the Wimmera Heritage River Area are covered by the Wimmera Catchment Authority. The assets and objectives of the two Regional Catchment Strategies are closely aligned, so here we focus on the *Mallee Catchment Management Authority's Regional Catchment Strategy* (RCS).

This conservation action plan aligns with a number of key assets in the Mallee RCS, in particular: wetlands, threatened species and communities, terrestrial habitat, culture and heritage, and community capacity for natural resource management. This plan will support the RCS objectives for these assets by:

- protecting and enhancing the environmental values of the Mallee's watercourses, their associated riparian ecosystems and, in turn, the social, economic and environmental services that they provide to the community

- protecting and enhancing the environmental values of the Mallee's wetlands and, in turn, the social, economic and environmental services that they provide to the community
- protecting and enhancing the present diversity of Mallee threatened species and communities
- protecting and enhancing the extent, condition and ecological connectivity of high value terrestrial habitat across all Mallee land tenures
- protecting the extent and condition of Cultural Heritage (Indigenous and Non-Indigenous) sites
- increasing the community capacity for, awareness of, and participation in efforts to protect the Mallee's natural, cultural and agricultural landscapes.

2.7 Other sources of information

Information sources that have informed the preparation of this plan include (but are not limited to):

- *Protecting Victoria's environment – Biodiversity 2037* (Government of Victoria 2017)
- *Total grazing management plan for the restoration of semi-arid woodland and floodplain vegetation communities in the north-western (Mallee) Parks* (Parks Victoria 2016)
- *Strategic management plan for feral goats on public land in north-west Victoria* (Parks Victoria 2018)
- *Threatened Mallee Birds Conservation Action Plan* (Boulton & Lau 2015)
- *Neds Corner Conservation Action Plan* (Koch 2011)
- *Habitat 141° Landscape Conservation Action Plan* (Koch 2015)
- *Strategic bushfire management plan: Mallee and Murray Goulburn* (DELWP 2015).

Scientific understanding of the fire ecology of Mallee ecosystems was significantly advanced by 10 years of research by the Mallee Fire and Biodiversity Project and the Mallee HawkEye Project (2005–2015), which were collaborative projects between universities and agencies. In the 30 years leading up to these projects, and since they were completed, there have been many other projects in both the mallee and the heathlands, monitoring the recovery of flora, fauna and habitats after fire, on fire ecology, fire behaviour, and other fire management themes that have contributed to a large body of knowledge.

The Strategic Management Prospects (SMP) tool, a component of the Department of Environment, Land, Water and Planning's *NatureKit*, has also been used as a decision support tool, together with field-based evidence, to assist in identifying the relative priority of threats and actions. SMP outputs are focused on modelled biodiversity outcomes and may need to be balanced with organisational and community priorities when implementing conservation strategies.

Where possible, traditional ecological knowledge has been taken into account in the plan, and opportunities to investigate and apply traditional ecological knowledge will be developed further in future iterations of the plan.

2.8 Participation

A series of conservation action planning workshops were held in 2017 to support the planning process for the Mallee Parks Landscape plan. The success of the workshops drew from the great depth of knowledge and experience of participants from Parks Victoria; Department of Environment, Land, Water and Planning; Mallee Catchment Management Authority; Trust for Nature; First People of the Millewa-Mallee Aboriginal Corporation; Murray Valley Aboriginal Corporation; La Trobe University; Arthur Rylah Institute for Enviromental Research; South Australian Department of Environment, Water and Natural Resources; The University of Melbourne; and Birdlife Australia. Contributions by individuals and groups outside the formal workshops also contributed to the development of the plan.

Neds Corner workshop team, 2017

Slender Cypress-pine

3 Conservation assets

3.1 Methodology for identifying conservation assets

For planning and managing the terrestrial environment, Parks Victoria has classified conservation assets in its Park Landscapes according to similarities in biodiversity and natural values, and natural processes. The classification is based on the eight natural ecosystem groups described in Victoria's previous biodiversity strategy (NRE 1997):

- Alps
- Coastal
- Dry Forest and Woodland
- Grassland
- Heathland
- Inland Waters and Wetlands
- Mallee
- Wet Forest and Rainforest.

Within each of these ecosystem groups, a number of sub-ecosystems have also been identified, defined by groupings of Ecological Vegetation Classes and Divisions (EVCs and EVDs) (White 2012).

Conservation assets within the Park Landscapes have been identified by assigning ecosystems, sub-ecosystems and habitats from Parks Victoria's classification system, on the basis that they have similar ecological processes and threats.

Finer-scale assets that are an important focus for conservation have also been identified, to help define each conservation asset more completely. These nested assets are mostly species assemblages and communities, but may also include habitat features, ecosystem services, or species that are of particular significance to Traditional Owners. Individual species are aggregated with others if they occur together across the landscape and have similar attributes that are important in determining their persistence in the landscape. Keystone species and rare, threatened or endemic species may also be included as nested assets if they have unique conservation requirements.

3.2 Conservation assets of the Mallee Parks Landscape

Eight conservation assets were identified for the Mallee Parks Landscape:

Mallee Triodia*	458 742 ha
Heathlands and Mallee Heathlands	340 236 ha
Sunset Plains and Swales*	169 424 ha
Lowan Broombush and Swales	94 371 ha
Semi-arid Woodland*	103 544 ha
Inland Saline Soaks	37 063 ha
Lake Albacutya Ramsar Site	5 300 ha
Inland Riverine Forests	9 844 ha

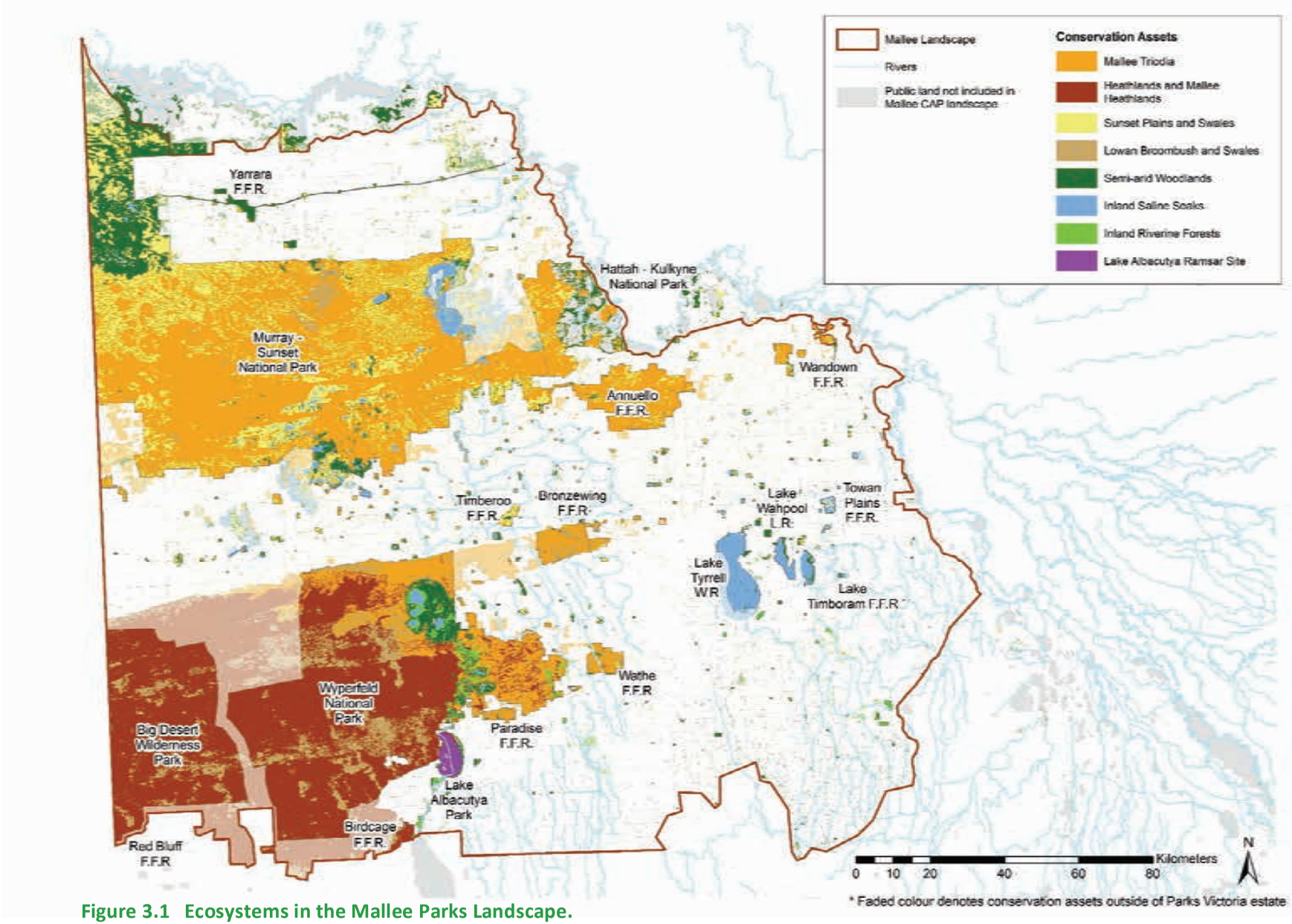
* Several EVCs within the Mallee Parks Landscape also extend into the adjoining River Red Gum Parks Landscape. Despite being in a different landscape, their values, threats, and management strategies are consistent with the adjoining area. The RRG landscape contributes 895 ha to Mallee Triodia, 3284 ha to Sunset Plains and Swales, and 14 339 ha to Semi-arid Woodland conservation assets, respectively. These extents are included in the total areas listed above.

The grouping of vegetation types in Conservation Assets reflects structural and compositional similarities of the constituent vegetation classes, which are related to soil types and primary recruitment drivers of fire, flood and rainfall.

The Lake Albacutya Ramsar site has been identified as a separate asset because of the international importance and Commonwealth legislation associated with Ramsar sites, and to ensure that the values, threats and management strategies can be clearly defined within the plan.

The mapped distribution of these eight conservation assets is presented in Figure 3.1. Their component Ecological Vegetation Classes and Ecological Vegetation Divisions are listed in Appendix B.

Heathland conservation asset in the Mallee



* Faded colour denotes conservation assets outside of Parks Victoria estate

Figure 3.1 Ecosystems in the Mallee Parks Landscape.

4 Conservation outcomes

Setting conservation outcomes involves defining a conservation vision and conservation outcomes for each asset. The conservation vision, based on Parks Victoria's broader vision for conserving its special places, is an aspirational statement that describes what the Park Landscape should be like in the future.

Conservation outcomes are derived from a comparison of the current and desired condition of the conservation asset overall (Where are we now? Where do we want to be?) and are articulated as SMART goals — **S**pecific, **M**easurable, **A**chievable, **R**elevant and **T**ime-bound.

4.1 Viability

Assessing the overall health of a conservation asset involves identifying the critical factors required for its long-term viability, which are called the *key ecological attributes*. These include attributes of structure, composition and process related to the asset. An important characteristic of a key ecological attribute is that it must be readily measurable using one or more indicators. The current and desired condition of the attribute can then be assessed, and the overall viability of the asset assigned to a defined category.

The assessment of the viability (or overall health) of a conservation asset is a five-step process utilising key ecological attributes:

1 Identify a small number of key ecological attributes (typically 3–5) for each conservation asset. Some common key ecological attributes are structure (e.g. remnant size or population abundance, distribution of communities, and configuration of patches or age class), composition (e.g. species diversity), and interactions and biotic and abiotic processes (e.g. hydrological regime or water quality).

2 Identify appropriate indicators for each key ecological attribute. An indicator is a readily measurable parameter that can be used to assess the condition of the key ecological attributes. For example, the presence or absence of a particular habitat-sensitive species may be an appropriate indicator for species diversity or habitat condition.

3 Develop criteria for rating the current value of each indicator. The development of criteria for rating the value of each indicator is an iterative process. It typically starts with a simplified qualitative assessment (e.g. many, some, few) and is progressively developed into more refined and measurable numeric values (e.g. 20% non-Eucalypt species tree canopy cover in Semi-arid Woodlands). A value range for the indicator is defined to correspond with a ranking for poor, fair, good, and very good.

4 Rank the current and desired condition of each indicator to determine the overall viability of the conservation assets. The final step in assessing the viability of the conservation assets is to rank the current condition of each indicator. The rankings used are poor, fair, good, and very good. The desired condition should be assessed over a 15-year period and should consider the role, if any, of management intervention to maintain long term viability. Trend in condition is evaluated over the preceding 15 years.

5 Determine the overall viability of conservation assets. The overall current and desired condition is determined for each conservation asset, using the condition rankings for key ecological attributes and their associated indicators. Each conservation asset is rated for the current and desired condition of its key ecological attributes and overall condition.

These key ecological attributes for each asset, including conservation outcomes and asset descriptions, are presented in the following pages, along with assessments of the current and desired status of each asset and its key ecological attributes. The current condition and trend, and the likely condition under

desired management, have been assessed using the expertise of participants in the conservation action planning workshops. The condition of each asset is considered across its occurrence in Parks and reserves within the landscape. These attributes and outcomes have been used to guide the development and prioritisation of conservation strategies.

4.2 Landscape conservation vision

The vision below is derived from the *Shaping our future* goal for conserving Victoria's special places (Parks Victoria 2013), and describes the intended outcome of management and the future state of the Mallee Parks Landscape.

The resilience of natural assets in the Mallee Parks Landscape is increased and ecosystem services are maintained in the face of climate change and other stressors

The Mallee Parks Landscape comprises several very large, connected public reserves. The natural ecological processes occurring in these reserves can be sustained with strategic, targeted management intervention. The current condition of the conservation assets ranges from fair to good. The implementation of this plan will improve the quality of habitat and its capacity to support existing and new animal populations.

The woodland ecosystems are recovering from a long history of changes caused by historical pastoralism. Recovery has already become evident over the last three decades because of significant management intervention. Woodlands will be restored to a healthy, mature, and self-regenerating state over the next century.

The outlook for the Wimmera riverine and lake ecosystems is more problematic, as they are less likely to receive natural water flows that are required for periodic regeneration. The management of other threats, including grazing pressure and weeds, will allow these systems to evolve as the climate changes.

The mallee and heathland assets include significant areas of remote wilderness that were subject to low levels of pastoralism and are relatively inaccessible and undisturbed. However, bushfires continue to be significant disturbance events that affect the composition and structure of these systems. Although bushfire is a natural process that regenerates vegetation, continuing trends in dry conditions are changing fire regimes, resulting in more frequent and more severe fires that can significantly impact animal populations. Targeted, strategic management of fire and pest animals will ensure the continuing health of these systems.

The Mallee Parks Landscape also includes over 300 smaller reserves containing fragments of woodlands, mallee and heathlands within the broader agricultural landscape. Many of these reserves are important refuges for a variety of local species and will benefit from coordinated activities that minimise habitat degradation from weeds and pest animals.

Major Mitchell's Cockatoo

5 Conservation asset descriptions

The following pages provide a description of the conservation assets within the landscape along with the outcomes sought from management. The descriptions are set out in the following format, and definitions for the terms used are provided below.

Conservation asset name

The ecosystem or habitat type considered to be the overarching value to be managed, including a description of key components, current condition, predominant drivers of condition, and their effects on component nested assets.

Nested assets

Nested assets are a series of values that are either present within the conservation asset, or rely on it for their health. These are often iconic components of the asset and may include threatened species, ecological (faunal) assemblages, vegetation communities or species of particular note. Comprehensive lists of species held on national and Victorian databases are used to inform the selection of nested assets.

Condition

This sets out the key ecological attributes, indicators for those attributes, the current condition and trends in condition of the attribute, and the anticipated goal.

Key ecological attributes	Indicator	Current condition	Current trend	Key ecological attribute goal
Mallee bird diversity	Species richness	Fair	↘	Over 70% of surveyed sites have a richness of bird species representative of the vegetation age-class and expected bird community.
Canopy recruitment	Seedling recruitment	Fair	→	Overstorey recruitment (as evidenced by the presence of small mature trees, juveniles or seedlings) present at more than xx% of surveyed sites

Conservation outcome

This statement reflects the key ecological attributes of the asset and includes key improvements in asset viability that will achieve the desired conservation outcome. An example is shown below.

Riparian	Current condition	Desired trend	Desired condition
By 2034, maintain critical habitat features (e.g. vegetation structure), functions (e.g. hydrology, water quality and quantity) and connectivity of riparian and in-stream ecosystems to provide habitat and refugia.	Good	↗	Very Good

Trends are indicated as follows: Improving ↗ Stable → Declining ↘

The assessment of current condition and desired future status is represented by the following categories. Measures to assess this classification are documented in the Monitoring, Evaluation and Reporting Plan.

VERY GOOD (optimal integrity) — The attribute is functioning at an ecologically desirable status, and requires little human intervention to maintain or improve health.
GOOD (minimum integrity) — The attribute is functioning within its range of acceptable variation; it may require some human intervention.
FAIR (vulnerable) — The attribute is outside its range of acceptable variation and requires human intervention to recover or be restored. If unchecked, the target will be vulnerable to serious degradation.
POOR (imminent loss) — Allowing the attribute to remain in this condition for an extended period of time will make restoration or preventing extinction practically impossible.

Mallee Triodia

The Mallee Triodia conservation asset covers 520 088 hectares, which is almost half of the Mallee Parks Landscape. Most of Murray–Sunset National Park, Hattah–Kulkyne National Park, and the eastern section of Wyperfeld National Park is predominantly Mallee Triodia. This asset also occurs in other reserves, including the large flora and fauna reserves of Annuello, Bronzewing, Wathe, Paradise and Wandown. It is found on sand dunes formed by deep deposits of Lowan and Woorinen sands and consists of two EVCs: Loamy Sands Mallee and Woorinen Sands Mallee.

Mallee Triodia consists of an open woodland with a low canopy of multi-stemmed mallee eucalypts, including Yellow, Slender-leaf, Dumosa and Grey Mallees. *Triodia* species (prickly, ring-forming grasses) are an extensive component of the understorey. Chenopods (drought and salt-tolerant plants commonly referred to as saltbush or bluebush), heathy shrubs, grasses, sub-shrubs and a diverse range of ground-layer forbs are also found below the sparse canopy of mallees.

The fire regime is an important driver of health and regeneration in this system. Many plant species depend on fire, and bushfires caused by lightning strikes are natural events. Changes in vegetation structure in the years following fire affect animal populations by altering the availability of food, shelter and refuge. The relationship between animal diversity, abundance, and fire history was studied intensely in the Mallee Fire and Biodiversity and Mallee HawkEye projects (2005–2015). Some species occur regardless of the post-fire age of the vegetation, but others are more likely to be more prevalent at particular post-fire stages (early, intermediate, or older). Many species utilise more than one post-fire stage. Fires can cause a reduction in the total area of suitable habitat for any given species, which may develop to abundance in another post-fire stage.

The oldest fire ages (more than 80 years since fire) are particularly important for animals, but are under-represented in this system (Haslem et al. 2011). Tree hollows are slow to form in mallee eucalypts, only beginning to develop at more than 35 years post-fire, and large hollows take more than 80 years to develop.

Older vegetation (more than 50 years since fire) also has deep leaf litter beds, accumulated ribbon bark, and large logs on the ground. These provide important nesting, foraging and shelter materials for species such as the Malleefowl, Black-eared Miner, Regent Parrot, Red-lored Whistler, Crested Bellbird, Boulenger's Skink and Southern Spiny-tailed Gecko.

Triodia hummocks are largest during the intermediate post-fire age (20–50 years). These provide forage and critical protective shelter for many species, including the Mallee Emu-wren, Mallee Striated

Grasswren, small mammals such as Mallee Ningaui, Mitchell's Hopping-mouse and Common Dunnart, and reptiles such as Millewa Skink and the Southern Legless Lizard.

A key indicator of condition in this ecosystem is the extent and arrangement of post-fire vegetation age-classes (the spatial mosaic). The intermediate (20–50 years old) and later successional stages (over 50 years old, and even over 80 years old) provide important habitat features for a suite of threatened species. The fire-prone nature of the environment means that it is challenging to maintain vegetation in the older post-fire age-classes. Although fire-induced regeneration happens naturally, the scale of fires must be managed (sometimes through planned burning, sometimes through fire suppression or managed bushfire) to ensure that the resulting mosaic facilitates the movement and recolonisation of plants and wildlife between vegetation patches and fire age-classes.

Some reptile species are more prevalent In younger, more open vegetation, but they can also be found in older vegetation. These include the Mallee Dragon, Painted Dragon, Coral Snake and Desert Skink. Ephemeral plants such as the Yellow Swainson-Pea are also present in the early years after fire. It is important to recognise that in this system recently burnt vegetation is a natural state and does not necessarily imply poor condition. It is likely to be unsuitable as habitat for a range of wildlife species, but over (sometimes extended periods) of time and given appropriate climatic conditions, key habitat features return. With the return of suitable habitat, animals will recolonise if sufficient populations persist nearby and safe movement can occur.

Over the last 30 years, fires have maintained an appropriate age-class distribution and spatial mosaic in Mallee Triodia, particularly in Murray–Sunset National Park, Hattah–Kulkyne National Park and eastern Wyperfeld National Park. Bushfires in the flora and fauna reserves have often been larger than desirable, but appropriately managing the return of fire in these reserves should improve habitat suitability and animal populations. The condition of the asset is therefore generally good, even though it varies across the Park Landscape.

Another factor that influences habitat condition is rainfall, particularly long-term rainfall trends, on vegetation growth rates and site productivity. In the semi-arid climate of the Mallee, rainfall is both seasonally and annually variable, but over the last 20 years there have been many more below average rainfall years than average or above-average years. Lower rainfall and extended periods of drought slow the recovery of habitat following fire. Wildlife populations are impacted for longer while habitat reaches suitability, and may be more susceptible to other threats such as increased grazing pressure, predation and weed encroachment.

In contrast, periods of above-average rainfall have been shown to support a boom in local productivity to which species such as the Malleefowl, Ningaui, Little Pygmy-possum and Western Pygmy-possum can respond and increase in numbers. Plants such as the Desert Greenhood and Club Spear-grass also benefit from good rainfall at the right time of the year. In a drying climate, Triodia Mallee patches in areas of low elevation are becoming critically important for many threatened species. Because they are holding more moisture and nutrients than the surrounding landscape, they might be important drought refuges for species such as the Mallee Emu-wren.

Other important threats to this system include predation by foxes and cats, grazing by feral goats, and Yellow-throated Miners interbreeding with Black-eared Miners.

Nested assets

Nested assets	Examples of components
Victorian Mallee Bird Community	Malleefowl, Black-eared Miner, Mallee Emu-wren, Red-lored Whistler, Chestnut Quail-thrush, Mallee Striated Grasswren, Crested Bellbird
Flora	Triodia species (particularly middle-aged hummocks), Desert Greenhood, Club Spear-grass, Yellow Swainson-pea, large hollow-bearing mallee eucalypts
Reptiles	Bardick, Painted Dragon, Mallee Dragon, Nobbi Dragon, Millewa Skink, legless lizards, Mitchell's Short-tailed Snake, Coral Snake, Bandy Bandy, Beaded Gecko, Samphire Skink, Mallee Worm-lizard
Mammals	Mallee Ningaui, Mitchell's Hopping-mouse, Little Pygmy-possum, Western Pygmy-possum, Common Dunnart, South-eastern Long-eared bat, Yellow-bellied Sheath-tail bat No longer present: Burrowing Bettong, Brush-tailed Bettong, Numbat, Greater Bilby, Western Quoll, Dingo
Cultural	Materials for traditional instruments, bush medicine, bush tucker

Condition

Key ecological attributes	Indicator	Current condition	Current trend	KEA goal
Spatial mosaic	Fire size	Good	↗	Frequency of large fire events (>20,000 ha) is no more than 1 every 20 years in Murray Sunset NP and Wyperfeld NP
	Growth stage distribution	Good	→	Less than 25% deviation from optimal growth stage structure (based on DELWP 2015).
Vegetation composition and structure	EVC benchmark	Good	→	Composition and structure of mature Mallee Triodia stands is representative of benchmark condition.
Mallee bird diversity	Species richness	Good	↘	Over 70% of surveyed sites have a richness of Mallee bird species representative of the surveyed vegetation age-class and the Victorian Mallee Bird Community.
Mallee bird distribution	Habitat extent	Fair	→	Mallee Emu-wren habitat remains at ≥ 85% of the 2018 extent over the next 15 years.
	Habitat extent	Poor	↘	Mallee Striated Grasswren habitat remains at ≥ 85% of the 2018 extent over the next 15 years.
	Habitat extent	Good	→	Malleefowl habitat remains at 85% or greater of the 2018 extent over the next 15 years.
Mallee bird recruitment	Breeding activity	Good	→	Malleefowl annual breeding activity is optimised under variable annual resource availability.
Small mammal distribution	Habitat extent	Fair	→	Mallee Ningaui and Mitchell's Hopping-mouse habitat remains at ≥ 85% of the 2018 extent over the next 15 years.
Habitat	*Triodia* cover	Good	→	Average *Triodia* cover is > 20% in Woorinen Sands Mallee and > 15% in Loamy Sands EVCs.
Reptile diversity	Species richness	Good	→	Over 70% of surveyed sites have a richness of reptile species representative of Mallee Triodia vegetation and the surveyed vegetation age-class

Conservation outcome

Mallee Triodia	Current condition	Desired trend	Desired condition
Over the 15 years to 2034, maintain the range of growth stages and habitat structure to support the occupancy and richness of flora and fauna species, and protect critical areas of refuge or population density of key species.	Good	↗	Good

Mulla Mulla

Sunset Plains and Swales

The Sunset Plains and Swales conservation asset covers 166 140 hectares of the Mallee Parks Landscape. Most of it is in Murray–Sunset National Park, but there is some in Hattah–Kulkyne National Park, Annuello Flora and Fauna Reserve and other smaller reserves. Three EVCs make up this conservation asset: Chenopod Mallee, Parilla Mallee and Woorinen Mallee. They occur in the low-lying swales as open mallee woodland with a sparse understorey, and are often intermingled with the Mallee Triodia conservation asset between dunes, or Semi-arid Woodland conservation asset on the plains.

Sunset Plains and Swales is dominated by a low canopy of mallee eucalypts (Oil Mallee, Dumosa Mallee and Grey Mallee), which become widely spaced as the vegetation matures. It is typically associated with soils that are shallower and more finely textured than soils in the surrounding landscape. The ground layer is mainly low chenopod shrubs such as bluebushes, saltbushes, and twinleaves. Threatened flora in the understorey include Bead Glasswort and Three-wing Bluebush.

The key driver of condition in this asset is rainfall. Over the last 20 years there have been many more below average rainfall years than average or above average years. Lower rainfall and extended periods of drought cause lower growth rates and productivity, and increase the susceptibility and impact of other threats. Important threats include foxes and cats preying on reptiles, birds and small mammals; feral goats grazing regenerating vegetation; and Yellow-throated Miners interbreeding with Black-eared Miners.

Fire is also a driver of condition. Fire triggers regeneration of the eucalypt overstorey, but the recruitment of shrubs and groundcovers primarily occurs when rainfall is sufficient. The heavier soils of the swales support a sparse understorey of more succulent, less flammable species, so these communities can remain unburnt for long periods of time. The frequency and extent of fire events in this asset over the last 30 years have been in an acceptable range.

Tree hollows are a significant habitat feature of Sunset Plains and Swales. They are slow to form, only beginning to develop at more than 35 years post-fire, with large hollows taking more than 80 years to develop. The older vegetation also accumulates deep leaf litter, ribbon bark, and large logs on the ground. These provide important nesting, foraging and shelter materials for species such as the Malleefowl, Black-eared Miner, Regent Parrot, Red-lored Whistler, Crested Bellbird, South-eastern Long-eared Bat, Yellow-plumed honeyeater, Spiny-cheeked honeyeater, and White-browed Babbler. Many animal species move between the different vegetation communities, depending on resource availability.

Nested assets

Nested assets	Examples of components
Victorian Mallee Bird Community	Black-eared Miner, Malleefowl, Red-lored Whistler, Regent Parrot, White-browed Babbler, Southern Scrub Robin, Chestnut-crowned Babbler, Yellow-plumed Honeyeater, Chestnut-rumped Thornbill
Flora	Club Spear-grass, Purple Swainson-pea, Bead Glasswort, Three-wing Bluebush, Orchids, Sandalwood, large hollow-bearing mallee trees
Reptiles	Bandy Bandy, Yellow-faced Whip Snake, Coral Snake, dragon lizards, *Ctenotus* and *Lerista* skink species, geckos, goannas
Mammals	Common Dunnart, Little Pygmy-possum, Western Pygmy-possum, South-eastern Long-eared Bat, Yellow-bellied Sheath-tail Bat *No longer present: Burrowing Bettong, Brush-tailed Bettong, Numbat, Greater Bilby, Western Quoll, Bolam's Mouse, Red-tailed Phascogale, Dingo*
Cultural	Materials for traditional instruments, bush medicine, bush tucker

Condition

Key ecological attributes	Indicator	Current condition	Current trend	KEA goal
Spatial mosaic	Fire size	Good	↗	Frequency of large fire events (> 20 000 ha) is no more than 1 every 20 years in Murray–Sunset NP and Wyperfeld NP.
	Growth stage distribution	Good	→	Less than 25% deviation from optimal (based on DELWP (2015).
Vegetation composition and structure	EVC benchmark	Good	→	Composition and structure of mature vegetation represents benchmark condition.
Mallee bird diversity	Species richness	Good	→	Over 70% of surveyed sites with richness of Mallee birds representative of the surveyed vegetation age-class and the Victorian Mallee Bird Community.
Mallee bird distribution	Habitat extent	Fair	→	Black-eared Miner habitat remains at ≥ 85% of the 2018 extent over the next 15 years.
	Habitat extent	Good	→	Malleefowl habitat remains at ≥ 85% of the 2018 extent over the next 15 years.
Mallee bird recruitment	Breeding activity	Good	→	Malleefowl annual breeding activity is optimised under variable annual resource availability.
Small mammal distribution	Habitat extent	Fair	→	Common Dunnart and Western Pygmy-possum habitat remains at ≥ 85% of the 2018 extent over the next 15 years.
Reptile diversity	Species richness	Good	→	Over 70% of surveyed sites have a richness of reptile species representative of this vegetation and the surveyed vegetation age-class.

Conservation outcome

Sunset Plains and Swales	Current condition	Desired trend	Desired condition
Over the 15 years to 2034, maintain the range of growth stages and habitat structure to support the occupancy and richness of flora and fauna species, and protect critical areas of refuge or population density of key species.	Good	→	Good

Heathlands and Mallee Heathlands

The Heathlands and Mallee Heathlands conservation asset covers 340 237 hectares (about one quarter) of the Mallee Parks Landscape. It extends across the Big Desert Wilderness Park and the western extent of Wyperfeld National Park, on deep sand dunes. Heathlands and Mallee Heathlands are characterised by a dominant shrubby understorey of heathy plants, with or without a canopy of mallee eucalypts, and Triodia is sometimes present. Several EVCs comprise this asset, including Heathy Mallee, Dunefield Heathland and Lowan Sands Mallee.

Treed areas are generally on deep, infertile Lowan sands. The Heathy Mallee EVC typically has an over-storey of Slender-leaf Mallee or Yellow Mallee, with Common Fringe-Myrtle, Desert Hakea and Mallee Tea-tree dominant in the understorey. Lowan Sands Mallee EVC has a canopy of Desert Stringybark and sometimes Yellow Mallee. Silver Banksia, Dwarf She-oak and Cypress-pines often grow among the canopy trees, and heathland shrubs and herbs make up most of the understorey. The treeless heathlands of this conservation asset (Dunefield Heathland EVC) occur in low-nutrient areas, growing on dunes and sand plains. They are typically dominated by a medium shrub layer of Desert Banksia, Dwarf She-oak and either Mallee Tea-tree or Heath Tea-tree. Smaller heathland shrubs and herbs, such as beard heaths and guinea flowers, grow below the shrub layer.

Heathlands and Mallee Heathlands are habitat for a range of well-known fauna, including the FFG-listed Victorian Mallee Bird Community and small mammals (see Nested Assets for examples). The Wyperfeld and Big Desert Wilderness Parks are also renowned for their diverse reptile fauna, including the Heath Skink, Masters Snake, Bardick and Mallee Worm-lizard.

Fire is an important driver of health and regeneration, and many plant species depend on it, since bushfires from lightning ignitions are natural events. The heathlands are very fire-prone but can recover rapidly, even from high-intensity fires. Changes in vegetation structure in the years following fire influences the availability of food, shelter and refuge for wildlife populations. Past studies have shown a range of species prevalent in younger vegetation (up to 20 years post-fire), including the Silky Mouse, Beaded Gecko, Southern Spiny-tailed Gecko, Grey's Skink and Mallee Dragon.

A key indicator of condition in this ecosystem is the extent and arrangement of post-fire vegetation age-classes (the spatial mosaic). Two characteristics of the spatial mosaic are the frequency of fire events at any given location and the scale of fire events. Repeated fires at intervals that are too short can hinder the vegetation community reaching maturity, compromising long-term persistence and the development of important habitat values. Conversely, a long-term absence of fire can result in significant changes to

vegetation composition and structure when single species rise to prominence and exclude floristic diversity.

In recent times, large extents of Big Desert Wilderness Park and Wyperfeld National Park have been subjected to very large bushfires every 10 years on average, and therefore have been frequently in young post-fire age classes. It is important to recognise that in this asset recently burnt vegetation is a natural state, and does not necessarily imply poor condition. It is likely to be unsuitable as habitat for a range of wildlife species, but over (sometimes extended periods) of time and given appropriate climatic conditions, key habitat features return. With the return of suitable habitat, animals will recolonise if sufficient populations persist nearby and safe movement can occur. However, the scale and frequency of bushfires in this system over the last 50–100 years is likely to have impacted existing populations of species and hindered their ability to move around the landscape and recolonise areas. Species such as the Mallee Emu-wren, Mallee Striated Grasswren, Master's Snake and Bardick are likely to have declined in range because of the fire history.

In other parts of the landscape it appears that fires (and the regeneration of heath species they bring) have been historically absent for very long-time periods of time. The vegetation (and therefore habitat suitability) of these areas has now changed, possibly forever, into dense stands of Scrub Cypress-pine. Scrub Cypress-pine also dominates the understorey of extensive areas of Heathy Mallee.

Rainfall, particularly long-term rainfall trends, is also a key driver of vegetation growth rates and site productivity. In the semi-arid climate of the Mallee, rainfall is both seasonally and annually variable, but over the last 20 years there have been many more below average rainfall years than average or above average years. Lower rainfall and extended periods of drought slow the recovery of habitat following fire. Animal populations are impacted for longer while habitat reaches a suitable state, and may be more susceptible to other threats to this system, including predation by foxes and cats, grazing by feral goats, and illegal recreation activities that degrade vegetation.

Nested assets

Nested assets	**Examples of components**
Victorian Mallee Bird Community	Victorian Mallee Bird Community (including Malleefowl, Australian Bustard, Mallee Emu-wren, Red-lored Whistler, Western Whipbird, Chestnut Quail-thrush, Striated Grass-wren) and Purple-gaped Honeyeater and Shy Heathwren
Mammals	Silky Mouse, Little Pygmy-possum, Western Pygmy-possum, Mitchell's Hopping-mouse, Mallee Ningaui, Common Dunnart *No longer present: Burrowing Bettong, Brush-tailed Bettong, Dingo, Western Quoll*
Reptiles	Rosenberg's Goanna, Western Blue-tongued Lizard, Coral Snake, Bardick, Masters' Snake, Mallee Worm-lizard, Heath Skink, Painted & Mallee Dragons, Nobbi Dragons, Mitchell's Short-tailed Snake, Beaded Geckos, Southern Leg-less Lizard, *Ctenotus* species (skinks).
Flora	Lowan Phebalium, orchids, Desert Stringy-bark, Dwarf She-oak, Scrub Pine, *Acacia* species, serotinous species* (e.g. Silver Banksia, Desert Banksia, *Calytrix tetragona* and *C. alpestris, Baeckea crassifolia*, *Hakea* species)
Cultural	Cultural fire

* Plants that release their seeds in response to an environmental trigger, such as fire or rainfall.

Condition

Key ecological attributes	Indicator	Current condition	Current trend	KEA goal
Spatial mosaic	Fire size	Fair	→	Frequency of large fire events (> 20 000 ha) is no more than 1 every 20 years and the number of medium-size fire events (5000–15 000 ha) increases in Wyperfeld NP and Big Desert WP.
	Growth stage distribution	Fair	→	Less than 25% deviation from optimal (based on DELWP 2015).
Vegetation composition and structure	EVC benchmark	Fair	→	Composition and structure of mature heathlands is representative of benchmark conditions.
	Cover	Fair	→	Banksia dominated heathlands have 5–10% cover of seed-producing Banksia.
Reptile diversity	Species richness	Fair	→	Over 70% of surveyed sites have a richness of reptile species representative of heathland vegetation and surveyed vegetation age-class.
Heathland bird diversity	Species richness	Fair	→	Over 70% of surveyed sites have a richness of Mallee birds representative of the surveyed vegetation age-class and the Victorian Mallee Bird Community.
Heathland bird distribution	Habitat extent	Fair	→	For Purple-gaped Honeyeater and Shy Heathwren suitable habitat remains at ≥ 85% of 2018 extent over the next 15 years.
Small mammal diversity	Species richness	Fair	→	Over 70% of surveyed sites have a richness of small mammal species representative of heathland vegetation and the surveyed vegetation age-class.
Small mammal distribution	Occupancy	Fair	→	Silky Mouse habitat remains at ≥ 85% of the 2018 extent over the next 15 years.

Conservation outcome

Heathlands and Mallee Heathlands	Current condition	Desired trend	Desired condition
By the year 2034, improve the diversity of vegetation growth stages to support the occupancy and richness of flora and fauna species, and protect critical areas of refuge or population density of key species.	Fair	↗	Good

Lowan Broombush and Swales

The Lowan Broombush and Swales conservation asset covers 94 372 hectares of the Mallee Parks Landscape. It consists of three EVCs: Sandstone Ridge Shrubland, Red Swale Mallee and Shallow Sands Woodland. These EVCs are scattered across the landscape, often on soils that are shallower and more finely textured than the soils of the surrounding sand dunes. Many of the patches are small, and they are mainly intermingled among the Heathlands and Mallee Heathlands asset in Wyperfeld National Park and Big Desert Wilderness Park. They are also scattered in north-central Murray–Sunset National Park.

The Sandstone Ridge Shrubland EVC is dominated by a canopy of Broombush, and the understorey includes grasses, sub-shrubs and a diverse range of forbs. The low-growing Yellow Mallee, Slender-leaf Mallee and Grey Mallee eucalypts typically form the canopy of Red Swale Mallee EVC, which has a well-developed to sparse shrub layer often including Small Hop Bush and Broombush. In Shallow Sands Woodland, Yellow Gums dominate but other trees such as Buloke and Slender Cypress-pine may also be present. Lowan Broombush and Swales has not been studied as comprehensively as the other Mallee assets. It is likely that the patches are well utilised by animals for forage and shelter, and they are likely to be important refuge areas.

The key driver of condition in this system is rainfall, and the long-term rainfall trend is particularly likely to be affecting these patches. Red Swale Mallee and Shallow Sands Woodlands are found at lower points in the landscape, where run-off can accumulate because the soil contains more clay. Over the last 20 years there have been many more below-average rainfall years than average or above average years. Lower rainfall and extended periods of drought, and consequent low growth rates and productivity may make the community more susceptible to other threats, such as increased grazing pressure, predation by foxes and cats, and weed encroachment.

Fire is also a driver of condition. Although natural (lightning-ignited) fires occur in Lowan Broombush and Swales, its composition, structure and position in the landscape make it less prone to carry fire than the surrounding vegetation. Fire triggers regeneration of the eucalypt overstorey, but the recruitment of shrubs and ground covers depends mainly on rainfall. The heavier soils of the swales support a sparse understorey of more succulent, less flammable species. Hence these communities can remain unburnt for long periods and consequently develop very old mallee trees with significant habitat features. The Wood Gecko and Mitchell's Hopping-mouse are more prevalent as vegetation ages.

The large and relatively frequent bushfires that have impacted Wyperfeld National Park and Big Desert Wilderness Park over the last 20 years have affected this conservation asset and the ability of animal populations to recolonise the patches. Although fire is a natural event and does impact these patches, it is

generally more likely (and desirable) that they remain unburnt for extended periods. Other important threats to this system include predation by foxes and cats, grazing by feral goats, and illegal recreation activities that degrade vegetation.

Nested assets

Nested assets	Examples of components
Victorian Mallee Bird Community	Redthroat, Purple-gaped Honeyeater, Malleefowl, Black-eared Miner
Mammals	Silky Mouse, Mallee Ningaui, Western Pygmy-possum, Little Pygmy-possum, Mitchell's Hopping-mouse, micro-bats (forest, freetail and wattled bats) *No longer present: Burrowing Bettong, Brush-tailed Bettong, Dingo, Western Quoll*
Flora	Silver Banksia, Desert Banksia, Lowan Phebalium, orchids, Buloke, Scrub Cypress-pine, Yellow Gum patches
Reptiles	Rosenberg's Goanna, Western Blue-tongue Lizard, Coral Snake, Masters' Snake, Mallee Worm-lizard, *Ctenotus* species (skinks), Norris's Dragon

Condition

Key ecological attributes	Indicator	Current condition	Current trend	KEA goal
Spatial mosaic	Fire Size	Fair	→	Frequency of large fire events (> 20 000 ha) is no more than 1 every 20 years and the number of medium sized fire events (5000–15 000 ha) increases in Wyperfeld NP and Big Desert WP.
	Growth Stage Distribution	Fair	→	Less than 25% deviation from optimal (based on DELWP 2015).
Vegetation composition and structure	EVC benchmark	Fair	→	Composition and structure is representative of benchmark conditions.
Reptile diversity	Species richness	Fair	→	Over 70% of surveyed sites have a richness of reptile species representative of the vegetation and the surveyed vegetation age-class.
Mallee bird diversity	Species richness	Fair	→	Over 70% of surveyed sites have a richness of Mallee birds representative of the surveyed vegetation age-class and the Victorian Mallee Bird Community.
Small mammal diversity	Species richness	Fair	→	Over 70% of surveyed sites have a richness of small mammal species representative of the vegetation and the surveyed vegetation age-class.

Conservation outcome

Lowan Broombush and Swales	Current condition	Desired trend	Desired condition
Over the 15 years to 2034, maintain the range of growth stages and habitat structure to support the occupancy and richness of flora and fauna species, and protect critical areas of refuge or population density of key species.	Fair	↗	Good

Semi-arid Woodlands

Semi-arid Woodlands consist mainly of three Semi-arid Woodland EVCs and the grassy woodland EVCs, and cover 89 210 hectares of the Mallee Parks Landscape. The EVCs with Buloke are part of the Buloke Woodlands of the Riverina and Murray-Darling Depression Bioregions, which are listed as nationally threatened under the Environment Protection and Biodiversity Conservation Act. In addition, four of the flora communities in the Semi-arid Woodlands Asset have been listed as threatened in Victoria under the Flora and Fauna Guarantee Act: Semi-arid Herbaceous Pine Woodland Community, Semi-arid Herbaceous Pine-Buloke Woodland Community, Semi-arid Northwest Plains Buloke Grassy Woodland Community, and Semi-arid Shrubby Pine-Buloke Woodland Community.

Semi-arid Woodlands are open woodland or forest on heavy loams and clay loams that are more fertile than most soils in the Mallee Parks Landscape. They is found between the floodplain and mallee vegetation communities, including on lunettes (crescent dunes on the margins of lake basins) and near stream channels and lake beds. The lunettes, and the adjacent river or lake country hold many important cultural sites for Traditional Owners, as they have often been areas with a long history of occupation and traditional use.

There are significant areas of Semi-arid Woodlands in Murray–Sunset National Park (in the north-west around Taparoo, in the north-east around Rocket Lake and the Raak Plain, and in the south around Pink Lakes), Hattah–Kulkyne National Park (around the Hattah Lakes), Wyperfeld National Park (throughout Pine Plains and along the Outlet Creek system), Lake Albacutya Park, and many of the small reserves including Yarrara Flora and Fauna Reserve.

Semi-arid Woodlands typically have a canopy of non-eucalypt tree species, often Buloke, Slender Cypress-pine, or Belah in the north of the Park Landscape. Mature canopy trees with large tree hollows provide important shelter and nesting sites for hollow-dependent animals such as the Major Mitchell's Cockatoo, White-browed Treecreeper, Regent Parrot, and South-eastern Long-eared Bat. A shrubby understorey below the canopy can include species such as Sugarwood, Cattle Bush and Hop Bush. The ground cover can be sparse and dominated by a biological soil crust of lichens, algae and bryophytes, or it may consist of annuals, of which a substantial component can be weeds. After summer rains it may be dominated by perennial native grasses such as Club Spear-grass.

Most Semi-arid Woodlands in the Mallee Parks are now in recovery. European settlement in the early 20th century resulted in widespread clearing for agriculture and pastoralism, timber harvesting,

and domestic stock grazing. The grazing pressure of domestic stock, combined with the invasion of rabbits and hares and increasing numbers of Red and Western Grey Kangaroos (due to the creation of stock watering points), resulted in significant degradation of Semi-arid Woodland over subsequent decades, and the extinction of many small and medium-sized mammal species (e.g. bettongs and quolls). Tree removal and domestic stock grazing favoured an increasingly grassy understorey of native and exotic species, particularly exotic annuals.

These structural changes led to very high grazing pressure from stock, rabbits and kangaroos during much of the late 19th century and most of the 20th century. This combined pressure strongly impeded natural regeneration of canopy trees for subsequent decades, and further reinforced the dominance of the open pasture structure. At the time stock grazing ceased, these woodlands were left with extensive areas of bare wind-blown soil, a sparse tree cover that was often isolated and very old Buloke, Belah, or Slender Cypress-pine trees, and a ground layer consisting of many annual weed species.

The declaration of the national parks in the early 1990s brought significant investment in land management programs. These aimed to reduce grazing pressure of both introduced and native species to very low levels, and maintain them at low levels, to allow natural regeneration to occur. This is still a key objective of management today. Years of investment have improved the condition of Semi-arid Woodlands, as evidenced by widespread stabilisation of soils and dunes, local natural regeneration of species such as Hop Bush, Sugarwood, Cattle-bush and, to a lesser extent, native cypress-pines. In recent years revegetation has commenced in areas with limited capacity to naturally regenerate, especially in relation to Buloke and Belah.

The condition of Semi-arid Woodlands varies considerably across the landscape. Large areas remain in generally poor to fair condition, but there are also areas that are in very good condition. Despite this relatively low condition assessment, it is a significant improvement from the condition 30 years ago. Change has been slow, and will continue to be slow, and it will be many decades before today's young canopy trees form tree hollows that are suitable shelter and nesting sites for hollow-dependent animals.

The primary drivers of the condition are total grazing pressure and rainfall. Grazing and browsing pressure requires ongoing management to support seedling establishment and growth. However, rainfall is also important because recruitment of Buloke has been linked to periods of high annual rainfall, and rainfall is also likely to drive the recruitment of native understorey shrubs and forbs. Although fire is likely to have influenced the composition of the ground cover historically, today the recovering communities are regarded as fire sensitive and protected from fire where possible.

Other important threats to this system include predation by foxes and cats on ground-dwelling animals, illegal recreation activities that degrade vegetation, and competition between Galahs and Major Mitchell's Cockatoos for nesting hollows.

Nested assets

Nested assets	Examples of components
Temperate Woodland Bird Community	Major Mitchell's Cockatoo, Regent Parrot, Hooded Robin, Diamond Firetail, Peregrine Falcon, Superb Fairy-wren, Blue Bonnet, White-browed Tree-creeper, White-browed Babbler, Chestnut-crowned Babbler
Flora, including the FFG and EPBC listed Semi-arid Woodland communities	Semi-arid Woodland canopy species (Buloke, Belah, Slender Cypress-pine, Cattle Bush, Sugarwood), Quandong, Inland Pomaderris, Mallee Bitter-bush, Chariot Wheels, Winged Peppercress, Club Spear-grass, Silky Glycine, Straggly Lantern-bush, *Swainsona* species, Desert New Holland Daisy
Reptiles	Beaked Gecko, Bynoe's Gecko, Boulenger's Skink

Nested assets	Examples of components
Mammals	South-eastern Long-eared Bat, Little Pied Bat, other micro-bats *No longer present: Bridled Nail-tailed Wallaby, bettongs, Western Quoll, Numbat, Red-tailed Phascogale, Bolam's Mouse, Dingo*
Cultural	Red Kangaroo, bush medicine and bush tucker

Condition

Key ecological attributes	Indicator	Current condition	Current trend	KEA goal
Canopy	Extent with projected canopy	Poor	→	Projected canopy cover of non-eucalypt species averages greater than 10% at monitoring sites by 2100.
Vegetation growth stage	Number of cohorts	Poor	↗	At least 2 cohorts per overstorey species present at more than 30% of surveyed sites by 2100.*
Canopy recruitment	Seedling recruitment	Fair	↗	Overstorey recruitment (as evidenced by the presence of small mature trees, juveniles or seedlings) present at more than 30% of surveyed sites by 2034.*
Vegetation composition and structure	Seedling damage	Good	→	80% of surveyed sites with little to no browse damage to unprotected seedlings from herbivores.*
	Shrub diversity	Poor	→	Over 30% of surveyed sites with a richness of mid-shrub species representative of woodland vegetation.*
	Native ground cover	Poor	→	Cryptogamic crust or native ground cover species dominate over weed cover at 30% of surveyed sites.*
Woodland bird diversity	Species richness	Fair	→	Over 70% of surveyed sites have a richness of bird species representative of the surveyed vegetation age-class and the Temperate Woodland Bird Community.
Woodland bird distribution	Occupancy	Poor	↘	White-browed Tree-creeper presence in woodland reserves stable or improved since the last survey.
Small/medium mammal size distribution	Presence	Poor	→	Small or medium-sized native mammals present at priority sites.
Major Mitchell's Cockatoo recruitment	Hollow availability	Fair	↘	At least 50 tree hollows in Slender Cypress-pine available to breeding pairs of Major Mitchell's Cockatoos at Pine Plains in Wyperfeld NP.
	Hollow occupancy	Poor	↘	At least 40 Major Mitchell's Cockatoo pairs occupy hollows at Pine Plains in Wyperfeld NP.

*KEA goal based on Kenny & Moxham (2017).

Conservation outcome

Semi-arid Woodlands	Current condition	Desired trend	Desired condition
Over the 15 years to 2034, maintain ongoing healthy regeneration of woodland overstorey and mid-storey shrubs to increase the area with multiple age-cohorts, vegetation diversity, and habitat features for fauna.	Fair	↗	Fair

Inland Saline Soaks

Inland Saline Soaks are scattered saline wetlands totalling 37 065 hectares of the Mallee Parks Landscape. They occur on saline soils, and are associated with salt lakes and ephemerally or seasonally flooded areas. Individual wetlands range in size from less than a hectare to over 4000 hectares. The patchy distribution of Inland Saline Soaks provides scattered water sources across a vast and very dry landscape. During warm periods when water is present in the lakes, they become a vibrant pink because of the alga *Dunaliella salina*, which secretes a beta-carotene pigment.

The vegetation fringing these saline wetlands is characterised by low, open shrublands of chenopods and succulents and is represented by several EVCs, notably Saline Lake Aggregate, Samphire Shrubland, Low Chenopod Shrubland and Chenopod Grassland. The presence of Mallee Hemichroa and Purple Swainson-pea is associated with these areas. These areas are seldom affected by bushfires because the open vegetation and succulent shrubs do not burn readily. In fact, patches of high-quality mallee often occurs on nearby dunes and between the wetlands, where they have been protected from bushfires, and provide important habitat and refuges in the landscape.

Inland Saline Soaks of high conservation significance are found throughout the Mallee, including at Pink Lakes (an important wetland for JAMBA and CAMBA listed species), Rocket Lake, Raak Plain, Lake Agnes, Wirrengren Plain and Lake Tyrrell. Inland Saline Soaks also provide habitat for significant reptile species such as the Lined Earless Dragon and Samphire Skink.

The main driver of the condition of Inland Saline Soaks is groundwater condition, because they discharge groundwater into the landscape. The timing, intensity and frequency of rainfall and flooding is critical because they all influence groundwater condition. Since 2010, following a significant drought period, rainfalls across the Mallee are likely to have improved the health of Inland Saline Soaks. Today they are considered to be generally in good condition.

As climate changes the cycles of drought and inundation that drive the health of Inland Saline Soaks, active management of other major threats will be necessary to maintain the resilience of the system. Other major threats to this system are soil compaction and erosion caused by off-road driving, and predation by foxes and cats on ground-dwelling animals.

Nested assets

Nested assets	Examples of components
Woodland birds	White-winged Fairy-wren, Rufous Fieldwren
Waterbirds/waterfowl	Blue-billed Duck, Black Swan, Grey Teal
Shorebirds	Banded Stilt, Caspian Tern, Gull-billed Tern, Whiskered Tern, Marsh Sandpiper, Red-capped Plover, Red-kneed Dotterel
Flora	Small Podolepis, Salt Paperbark, Spiked Pigweed, Bead Glasswort, Mallee Hemichroa, Purple Swainson-pea, Diosma Rice-flower, Brilliant Sunray, Two-spined Copperburr
Reptiles	Lined Earless Dragon, Samphire Skink

Condition

Key ecological attributes	Indicator	Current condition	Current trend	KEA goal
Vegetation condition and extent — significant flora	Recruitment	Good	→	Mallee Hemichroa recruiting at ≥ 90% of surveyed sites.
Surface water	Extent and salinity	Good	→	Surface water extent and salinity is reflective of annual climatic conditions.
Vegetation composition and structure	EVC benchmark	Good	→	At least 80% of surveyed sites meet EVC benchmarks for number of species in each critical lifeform group.
	Ground layer diversity	Good	→	At least 80% of surveyed sites have little to no browse damage to unprotected forbs from herbivores.
Waterbird distribution	Occupancy	Good	→	Waders, shorebirds, and migratory species present occasionally.
Landscape values	Visual impacts	Good	→	Off-road and illegal vehicle tracks are minimal and not highly visible

Conservation outcome

Inland Saline Soaks	Current condition	Desired trend	Desired condition
Over the 15 years to 2034, maintain the vegetation condition and flora diversity and support the persistence of animals that depend on this habitat.	Good	→	Good

Inland Riverine Forests

Inland Riverine Forests cover 9848 ha of the Mallee Parks Landscape. They includes the riparian and floodplain forests and woodlands of Outlet Creek, from Lake Hindmarsh north to Lake Albacutya and continuing to Wirrengren Plain, and the Yallum channel that extends into the east of Wyperfeld National Park. Small reserves along Tyrrell and Lalbert Creeks also contain this asset. Lake Albacutya also supports Inland Riverine Forest, but this area is captured in the Lake Albacutya Ramsar conservation asset.)

Inland Riverine Forests are characterised by open eucalypt woodlands and forests growing along creek, lake and floodplain edges. The typical canopy species are River Red Gum and Black Box, and there is an open to sparse sub-canopy of wattles (often River Coobah). Some areas of River Red Gum consist of a local subspecies that is both salt and drought tolerant. Scattered, dense patches of shrubs (including Three-nerved Wattle and Desert Jasmine), chenopods, grasses and herbs grow below the canopy. Riverine Chenopod Woodland is the most common EVC in this conservation asset, growing on heavy clay soils at the edge of floodplains where flooding is infrequent. These woodlands are important habitat for the nationally threatened Regent Parrot. Other fauna present include the Bush Stone-curlew and Brown Treecreeper. Plants in the ground layer include Grey Podolepis, Dwarf Swainson-pea, and Finger-leaved Daisy.

The watercourses that support the Inland Riverine Forests of this landscape are ephemeral, remaining dry for significant periods of time. Outlet Creek, which flows north from Lake Hindmarsh to Lake Albacutya, then continues up to Wirrengren Plain is part of the Wimmera Heritage River. Lake Albacutya, the small lakes along Outlet Creek, and Wirrengren Plain are terminal lakes of this system. Today flooding north of Lake Hindmarsh is exceptional. Wirrengren Plain was last flooded in 1874, and Outlet Creek last contained water in 1975 (which is also the last time that Lake Albacutya was full). Lake Albacutya last held water in 1995, but at that time Outlet Creek and streams farther north remained dry. This illustrates how water availability in this system has been retreating south for over a century. Regulation of the Wimmera River and Lake Hindmarsh has also contributed to altered natural flows. There is a progressive decline in tree condition downstream (north) as a result of this reduction in frequency and duration of inundation events and an associated increase in salinity.

The main drivers of health in Inland Riverine Forests are rainfall and flooding regimes. Inland Riverine Forests experience infrequent and shallow flooding, but these events are key to the health and regeneration of the system. Alterations to natural hydrology caused by upstream modifications, together with reduced rainfall and more frequent droughts, has changed surface water flows, disrupting the flooding cycles these forests require. Although storms can bring much-needed water to the system, the damaging winds can also cause trees to drop limbs. Environmental watering of the Outlet Creek system is

considered unfeasible because of the scale of watering that would be required and its remoteness. As its hydrological regime cannot be managed with environmental water, the management goal is to actively manage other threats. Managing these will support the system to persist for as long as possible, or to transition to another vegetation community over the coming century.

Other important threats to Inland Riverine Forests are associated with its popularity as a camping and recreational area, and include soil compaction, erosion and destruction of vegetation as a result of off-road driving, the collection of firewood for campfires and domestic use, and the invasion of weeds. A moderate threat is grazing of native forbs by rabbits and kangaroos, and predation by foxes and cats on ground-dwelling animals.

Nested assets

Nested assets	Examples of components
Woodland birds	Redthroat, Regent Parrot, Bush Stone-curlew, Brown Treecreeper
Mammals	Brush-tailed Possum
Flora	Three-nerved Wattle, Grey Podolepis, Dwarf Swainson-pea, Finger-leaved Daisy, Desert Jasmine, River Red Gum (Albacutya subspecies), Black Box
Reptiles	Carpet Python, Tessellated Gecko, Lace Monitor
Cultural	Bush tucker, materials for traditional instruments, medicine plants, burial sites, middens, artefact scatters, scar trees

Condition

Key ecological attributes	Indicator	Current condition	Current trend	KEA goal
Vegetation condition	Species richness	Fair	→	At least 80% of surveyed sites meet EVC benchmark for the number of species in each critical life-form group
	Canopy health	Fair	→	For woodland systems, at least 80% of surveyed sites meet EVC benchmark for % canopy cover
Vegetation recruitment	Seedling success	Poor	↘	At least one successful recruitment event of River Red Gum or Black Box within 15 years
Regent Parrot recruitment	Breeding pairs	Fair	→	Breeding pairs of Regent Parrot sighted in at least 6 of the 7 wetlands along Outlet Creek

Conservation outcome

Inland Riverine Forests	Current condition	Desired trend	Desired condition
Over the 15 years to 2034, maintain the vegetation diversity and condition to support critical habitat features (e.g. canopy and hollows) that provide habitat connectivity and refugia for fauna across the landscape.	Fair	→	Fair

Lake Albacutya Ramsar Site

Lake Albacutya is a Ramsar-listed open freshwater wetland and a terminal lake of the Wimmera River system. The lake has filled periodically, historically on an approximately 20-year cycle. During very wet periods it can hold water for many years, gradually drying into a lake bed until the next episode of high rainfall in the upper catchment. At full capacity, the lake holds 290 000 megalitres of water, covering 5850 hectares. It last held water in 1995, and was last full in 1975.

When it holds water the lake can support more than 20 000 waterbirds (Cibilic and White 2010). The Ramsar listing was based on an assessment of its importance for waterbirds, including Caspian Tern, Red-necked Stint and Ruddy Turnstone. At the time, Lake Albacutya supported 10% of the Victorian population of Freckled Ducks. It also supports populations of freshwater turtles and yabbies when water is present.

When not in flood, Lake Bed Herbland EVC covers the lake bed. Species that colonise the ground after flood events make up a treeless vegetation community consisting mainly of grasses, herbs and saltbushes.

Woodlands (primarily Intermittent Swampy Woodland EVC) fringe the lake bed, dominated by a salt-tolerant form of River Red-gum (known as the Albacutya River Red Gum), often with Black Box. The understorey is sedgy or grassy, with a shrubby mid-storey of reduced species diversity and poor regeneration. These fringing woodlands are key habitat for the EPBC-listed Regent Parrot and significant flora species include Three-nerved Wattle and Native Scurf-pea. Beyond the boundary of the Ramsar site, the lunette supports Semi-arid woodland.

The health of the Lake Albacutya Ramsar Site is poor overall, reflecting altered water regimes, infrequent flooding, and continuing grazing pressure from rabbits, kangaroos and intermittent sheep grazing under licence. Widespread eucalypt dieback has been caused by alterations to the Wimmera River system (resulting in less flooding of the woodlands) and a changing climate (causing a reduced annual average rainfall). Environmental watering of Lake Albacutya is considered unfeasible because its size and remoteness. Since the hydrological regime cannot be managed with environmental water, the management goal is to actively manage the other major threats, particularly grazing pressure and weeds. This will maintain the resilience and support of the Ramsar site, which might help it can transition into a different vegetation type without the iconic River Red Gum, over the coming century.

The lake is a popular destination for day visitors, campers and tourists, and visitor impacts (including illegal off-road driving by trail-bikes and four-wheel drives) and firewood collection are other causes of habitat degradation.

Nested assets

Eight nested assets have been identified for Lake Albacutya Ramsar Site. A number of 'critical components and processes' from the ecological character description for the Ramsar site (Cibilic & White 2010) have also been incorporated into the list below. The key ecological attributes and measures of condition have been prepared with reference to the limits of acceptable change established in Cibilic & White (2010). Some of these are present only when Lake Albacutya is holding a substantial volume of water.

Nested assets	Examples of components
Migratory birds	Bar-tailed Godwit, Black-tailed Godwit, Caspian Tern, Curlew Sandpiper, Marsh Sandpiper, Red-necked Stint, Ruddy Turnstone
Wetland birds	Freckled Duck, Blue-billed Duck
Woodland birds	Redthroat, Regent Parrot, Major Mitchell's Cockatoo, Hooded Robin, Diamond Firetail, Peregrine Falcon, Splendid Fairy-wren, Superb Fairy-wren, Blue Bonnet, White-browed Tree-creeper
Mammals	Brush-tailed possum, Red Kangaroo, Western Grey Kangaroo
Flora	Three-nerved Wattle, Velvet Thread-petal, Fine-hairy Spear-grass, Albacutya River Red Gum, Black Box, Quandong, Inland Pomaderris, Downy Swainson-pea, Mallee Bitter-bush, Native Scurf-pea
Aquatic fauna	Turtles, frogs, yabbies
Lake morphology	Lunettes
Cultural	bush tucker, traditional instruments, medicine plants, burial sites, middens, artefact scatters, scar trees

Condition

Key ecological attributes	Indicator	Current condition	Current trend	KEA goal
Habitat features	Morphology of lake bed	Poor	↘	Lake bed morphology retained without significant change from human interference.*
Functioning and connectivity	Hydrological regime	Poor	→	Average return period for shallow floods < 8 months duration not exceeding 8 years.* Average return period for lake-full overflow events of 24 months duration, no more than 20 years.*
Waterbird abundance	Number of individuals	Poor	→	Supports 20 000 or more waterbirds 1 in 3 occasions when the lake holds water for a period of at least nine months.*
	Population size	Poor	→	Supports 1% of the individuals in a population of one waterbird species, or subspecies, on 1 in 3 occasions when the lake holds water for a period of at least 9 months.*
Woodland recruitment	Seedling success	Poor	→	At least 1 successful River Red-gum recruitment event every 20 years on average.*
Vegetation structure and composition	Canopy distribution	Poor	↘	At least 75% of the 1993 extent of River Red-gum is maintained.*
Regent Parrot recruitment	Breeding pairs	Fair	→	Lake Albacutya Regent Parrot population has a minimum of 10 breeding pairs annually.

*KEA goal based on Cibilic & White (2010).

Conservation outcome

Lake Albacutya Ramsar Site	Current condition	Desired trend	Desired condition
Over the 15 years to 2034, maintain the vegetation diversity and condition to support critical habitat features (e.g. canopy, hollows), that provide habitat connectivity and refugia for fauna across the landscape.	Poor	→	Poor

Regent Parrot

Western Pygmy-possum

6 Threats to conservation outcomes

6.1 Methodology for assessing threats

Parks Victoria's method for assessing threats broadly follows the process outlined in the current standard for risk management (AS/NZS ISO 31000: 2009). Threats to conservation assets are assessed against their impact on achieving the defined conservation outcome for each asset and their direct impact on key ecological attributes. The assessment is a three-step process.

1 Identify threats to conservation outcomes

Threats to conservation assets are identified by assessing the threat agents as well as the impact of the threatening process on key ecological attributes. For example, the effect of foxes (agent) is predation (process), which reduces the abundance and diversity of small ground-dwelling fauna (impact).

2 Classify threats

Threats are classified according to a risk assessment matrix that defines both the likelihood and ecological consequence of the identified threats impacting on key ecological attributes (Carey et al. 2007) over a defined period of 15 years. Threats are ranked as extreme, high, moderate or low risk. Priority areas for the risk abatement of threats are mapped.

3 Develop threat management objectives

Threat management objectives are developed to mitigate the impact of the threats that are the greatest risk to conservation assets. Threat management objectives specify the change in high-risk threats required to achieve a particular conservation outcome for a conservation asset.

6.2 Threats to conservation assets

A broad range of key threats to the conservation assets of the Mallee Parks Landscape were identified by participants in the conservation action planning workshops. These threats have been assessed using the methodology described above. The highest-ranked threats identified from this process are discussed in the following sections and will be addressed directly through this plan.

The key threats to the conservation assets relate to impacts on the key ecological attributes, and are generally considered to be those with the greatest impact on the regeneration, recruitment and restoration of species and ecological communities. This focuses management on the need to ensure that species and ecological communities are functioning within acceptable bounds to maintain key species and threatened flora and fauna populations (e.g. Buloke and Malleefowl). Climate change was not assessed as a specific threat; instead it was considered when assessing the trend in impacts of other threatening processes over 15 years.

Table 6.1 Key threats to the conservation assets of the Mallee Parks Landscape.

Threatening process	Threat agent	Mallee Triodia	Sunset Plains and Swales	Heathlands and Mallee Heathlands	Lowan Broombush and Swales	Semi-arid Woodland	Inland Saline Soaks	Inland Riverine Forests	Lake Albacutya Ramsar Site
Habitat degradation	Extremes of climate and weather	High	High	High	High	Extreme	Moderate	Extreme	Extreme
Alteration to natural hydrology	Harvesting or diversion and barriers to water movement			Moderate	Moderate	Moderate	Moderate	Extreme	Extreme
Fire regimes and management	Planned burning / bushfire*	High	High	Extreme	High	High	Low	Moderate	Moderate
Fire regimes and management	Mechanical fuel management and suppression activities	High	High	High	High	High	Low	Moderate	Moderate
Grazing / browsing	Introduced herbivores	Moderate	Moderate	Moderate	Moderate	Extreme	Moderate	High	High
Overgrazing / overbrowsing	Over-abundant native herbivores	Moderate	Moderate			Extreme	Low	Moderate	High
Trampling and wallowing	Introduced herbivores					Moderate	Moderate		
Predation	Introduced predators	High	High	High	High	High	High	Moderate	Moderate
Weed invasion	Weed species — terrestrial	Low	Low	Low	Low	Extreme	Low	High	High
Habitat degradation	Recreational activities — legal / illegal	Moderate	High	High	High	High	High	High	High
Competitive interactions	Native and introduced fauna	High	High			High		Low	Low
Natural resource extraction	legal / illegal	Low	Low	Low	Low	Moderate	Moderate	High	High
Habitat fragmentation	Internal infrastructure and development	Low	Low	Low	Low	Moderate	Low	Low	Low
Pollution	Internal and external sources						Moderate	Moderate	Moderate
Sedimentation	Human-induced activities						Low		

* Workshop participants considered bushfire to be a higher threat to fire regimes than planned burning.

Extremes of climate and weather

Threat description

Extremes of climate and weather, including drought, high temperatures and large storms, are major threats to Semi-arid Woodlands, Inland Riverine Forests and Lake Albacutya Ramsar Site. They are also a high threat to all other assets except Inland Saline Soaks.

Vegetation productivity, which creates the habitat structure and food resources for animals, can vary significantly with seasonal conditions and events in the semi-arid zone, where some annual climate variability is the norm, particularly in rainfall. Over the last 20 years it has become increasingly apparent that long-term climate and weather trends are influencing the character and function of the Mallee Parks Landscape.

Current climate change projections for 2070 indicate that regional temperatures are likely to increase by 3.3°C and there will be more hot and very hot days (CSIRO & BoM 2015). Rainfall patterns will remain dominated by natural variability, but by 2070 averages may fall by 40%, and winter and spring rains in particular are likely to be less. As a result, drought cycles are likely to be longer and harsher, and fire weather days will increase. (Fire weather days are those days when warm temperatures combine with strong winds that may change direction, and when thunderstorms bring the risk of lightning.) The risk of bushfires may be further exacerbated by seasonal conditions that produce dry fuels, which burn more readily, increase the likelihood of ignition, increase fire severity and reduce suppression ability. Although the overall the trend is for drier conditions, these are likely to be interspersed with extreme storms and rainfall.

In the Mallee Parks Landscape over the last 20 years, there have been more below-average rainfall years than average (or above average). This includes the drought of 2001–2009 that culminated in the heatwave that led to the Black Saturday bushfires. This was followed by La Niña conditions in 2010 and 2011, which resulted in widespread and record-breaking summer rainfall and flooding. There were extensive bushfire events in the Mallee Parks Landscape during the summer of 2002–2003 and in 2014. In 2014, lightning strikes from a single storm started 17 bushfires, which burnt more than 110 000 ha in Wyperfeld National Park, Big Desert Wilderness Park, Murray–Sunset National Park, and Paradise and Bronzewing Flora and Fauna Reserves.

Evidence of a drying landscape is apparent throughout the Mallee Parks. Lake Albacutya, Outlet Creek, and the other terminal lakes of the Wimmera Heritage River have not seen flowing water for decades, Wirrengren Plain for over a century. The River Red Gum and Black Box communities at these locations are persisting but show signs of canopy stress and tree mortality. The change in surface water flows is also

impacting the flow of groundwater through the landscape. Without the recharge of rainfall into groundwater, particular areas of vegetation in the Mallee parks are showing signs of deteriorating condition, including *Triodia* hummocks on the tallest dune systems. Conversely, the value of Mallee Triodia patches in areas of low elevation are being shown to be critically important for many threatened species, as it is likely they are holding more moisture and nutrients than the surrounding landscape and so may be important drought refuges for species such as the Mallee Emu-wren.

Low rainfall, particularly during autumn and winter is also likely to be a significant limiting factor in woodland overstorey regeneration in the Semi-arid Woodlands (particularly of Buloke). Decreasing rainfall in autumn and winter is especially significant in this the driest and hottest part of Victoria, as these are the primary growing seasons. Revegetation is also targeted for autumn, to capitalise on the primary growing season of winter-spring; if the rains fail, so do the plants.

Lower rainfall totals and extended periods of low rainfall and drought cause lower growth rates and productivity, and slow the recovery of habitat following fire. Wildlife populations are impacted for longer while habitat reaches a suitable state, and may be more susceptible to other threats such as increased grazing pressure, predation and weed encroachment. Poor rainfall in spring is also likely to affect wildlife populations. Fewer resources (e.g. water, nectar, invertebrates) available in spring affects breeding success and the potential for subsequent dispersal, which limits the recovery of ecosystems and species particularly after summer bushfire events. Significant extended heat waves (as in 2009 and 2018–2019) have resulted in noticeable deaths and the reduction of populations of birds and kangaroos. Conversely, very cold and dry winter nights can result in severe frosts. In the 1980s these were linked to the widespread dieback of banksias in the heathlands of Wyperfeld National Park.

Heavy rainfall and strong winds during severe storms in recent years have caused significant damage to very old Bulokes and Slender Cypress-pines from limb loss or tree collapse. These trees are critical sources of large nesting hollows for a variety of species, including Major Mitchell's Cockatoos and Regent Parrots. The slow growth rate of trees in this environment means it can take 100 or more years for trees to develop suitable tree hollows to replace those lost. However, periods of above-average rainfall can also provide a significant opportunity for recovery of vegetation, habitat and species. Recent La Niña years supported a boom in local productivity, and in response the population size and distribution of animals such as Malleefowl, pygmy-possums and Ningaui increased within one or two years, but then declined with less favourable conditions. This is typical of the boom-and-bust cycles apparent in other areas of Australia's arid and semi-arid zone.

Extreme events such as multi-year droughts, widespread floods and extensive bushfires are often incidental events that occur at intervals of decades, and are by themselves not devastating. It is the concomitant landscape and climatic variables that may have the greatest long-term impacts — the frequency of events that compromises recovery, ongoing low rainfall that compounds slow recovery rates, and destabilisation of flora and fauna populations by other threats such as predators and weeds.

The increase in fire weather days is also likely to increase the incidence of multiple bushfire ignitions during a single storm, resulting in an increased scale of bushfires in the Park Landscape. Such events can have devastating outcomes for local habitat supply, which in turn may affect the longer-term persistence of populations of threatened species. Where possible, species refuge areas and areas of the highest-quality habitat need to be protected from these impacts. Risks to the persistence of species and communities must be considered after the events, and management programs may need to be reviewed.

Threat objectives

By 2024, identify triggers for the adaptation of management activities at times of extreme climate or weather.

Inappropriate fire regimes and fire management activities

Threat description

Fire management

Fire is a natural event in the Mallee Parks Landscape, and many habitats depend on fire for regeneration and persistence, particularly the mallee and heathland assets. It is an important factor in the maintaining suitable habitat for a range of species.

Bushfires, planned burning and fire management activities (particularly the use of heavy machinery in suppression and preparedness activities) are elements of a well-managed fire program. This program could pose a significant threat to all conservation assets in the Mallee Parks Landscape if it is not managed appropriately, but it is a high to extreme threat in the fire-dependent vegetation communities and the fire-sensitive Semi-arid Woodlands.

Conservation assets that include mallee and heathland species (Mallee Triodia, Sunset Plains and Swales, Lowan Broombush and Swales, and Heathlands and Mallee Heathlands) are particularly at risk from large-scale bushfires, because they are fire-prone and occur across vast, remote areas. Their susceptibility to fire also means they are a key focus for the planned burning program.

The Inland Saline Soaks, Inland Riverine Forests and Lake Albacutya Ramsar Site assets are less fire-prone and less of a focus for the fire management program. These lakes, wetlands and river systems require floods to regenerate, so fire in these systems can be particularly damaging if recovery is compromised by poor climatic conditions or the invasion of undesirable species.

The Semi-arid Woodlands are also at risk from inappropriate fire management. The non-eucalypt trees are sensitive to fire, whereas grassy understoreys are likely to benefit from fire when conditions are suitable. However, much of this conservation asset is the subject of long-term restoration programs, so planned burning is very limited and priority stands of woodland are protected during fire suppression.

Fire management activities, such as track and control line establishment for planned burning and bushfire suppression and the application of fire retardants, can impact habitat (particularly remote wilderness), key threatened species populations, and sites of Indigenous and European cultural heritage. Infrastructure constructed during fire suppression may facilitate the introduction of pest plants and animals to wilderness areas. Vehicles can transfer weed seeds, and access tracks may facilitate the movement of introduced predators and native competitors. Some of these impacts may go unnoticed because of their remoteness. Where possible, existing roads and tracks should be used to manage and limit the physical impacts of fire management, as well as the spread of pathogens and weeds.

Rehabilitation of newly created tracks is also important to discourage off-road driving and minimise the spread of pest plants and animals.

Vegetation age (post-fire) and its spatial arrangement

In this landscape the key threat from fire is the amount (or extent) of fire in the landscape. ('Fire in the landscape' refers to the combination of both bushfires and planned burning, which determine the age of post-fire vegetation and the type of vegetation mosaic that is created.) The primary threat to fire-dependent conservation assets is large-scale bushfires. Bushfires that create very large areas of a single age vegetation that will remain immature for 10–20 years, thus reducing the diversity of ages and habitat structures. Extensive areas of this nature can result from a fire that begins at a single ignition point, or from multiple fires that converge; or when several bushfires or planned burns occur in the same general area within a few years.

Such large areas affect the ability of fauna to survive (their ability to avoid predators, and their access to food or shelter), disadvantage species that depend on medium-age to old-age vegetation (because of habitat loss that takes decades to replace), and can later hinder the ability of species to recolonise the fire area when habitat does become suitable (because of the distances required to disperse). These areas are not necessarily in poor condition, but they are unsuitable as habitat for many species. In the last 20 years the heathlands of Wyperfeld National Park and Big Desert Wilderness Park have been affected by extensive fires (2002 and 2014). Bushfires in smaller reserves, such as the fire in Bronzewing FFR in 2014, can result in similarly challenging outcomes.

Large fires reduce both existing fauna population sizes and resource availability for any surviving animals, which can have a severe impact on threatened species populations. In the longer-term, direct and indirect effects of large-scale fires can exacerbate other potential threats. For example, the loss of sheltering vegetation after fire can lead to an increase in predation of local species by introduced predators; increased grazing pressure from herbivores may affect the regeneration of vegetation; and the removal of natural barriers between previously isolated native species may enable closely related species to hybridise.

Fires create a patchwork of variously aged vegetation across the landscape. This variety provides a range of food, shelter and refuge options that are suitable for different species at different times after fire. Their proximity to each other also affects the ease with which species can forage or disperse through the landscape to find new areas of suitable habitat as it develops in the years after fire.

Vegetation ages are usually categorised into age classes (e.g. young, mature, old, senescent). The statistical distribution of age classes is determined by the amount of fire in the landscape that accumulates over many decades. The ideal (or desired) age-class distribution is a benchmark. One way to define this is by using the geometric mean abundance of animal species to guide the amount of vegetation needed in each age class. However, this approach is its infancy, with much still to be learnt about how fire regime elements and climatic conditions impact species abundances in the years and decades following fire events. Tolerable fire interval (TFI) — the interval needed to avoid long-term declines in species populations as a result of too-frequent fires — is also used to manage fire frequency. Fires at short intervals, below the minimum TFI, may result in some plants being unable to mature and produce seed before the next fire, which increases the potential of local extinction.

Research has highlighted the importance of older vegetation in the fire-dependent assets of the Mallee Parks Landscape, where critical habitat elements such as large tree hollows, large fallen logs and deep leaf litter occur. These elements can be lost in a day during a fire, and take many decades without fire to replace. This is a challenging prospect in a fire-prone environment that is becoming more susceptible to damaging fire events as the climate becomes drier. However, extensive areas of very old vegetation can also be unsuitable habitat for many species.

The very long-term absence of fire (intervals of over 100 years) may result in simplification of the vegetation composition and structure, and allow individual species such as Scrub Pine to dominate

heathlands. Both extensive areas of young vegetation and extensive areas of very old vegetation may cause a reduction in medium-age vegetation, which is favoured by species that utilise large *Triodia* hummocks. This highlights the need to maintain fire as a natural process in the landscape, but also to also manage the fire patch sizes to ensure an ongoing supply of appropriately aged habitat over decades between which animal species are able to move.

The fire history of Murray–Sunset and Hattah–Kulkyne National Parks has maintained an appropriate mosaic of age classes, but in the future very large fires could reduce extensive areas to a young age class. In contrast, the fire history of Wyperfeld National Park and Big Desert Wilderness Park has created large areas of very old and very young vegetation. There are also large areas of heathlands nearing 15 years post-fire, but dry climatic conditions and the widespread 2002 bushfires have resulted in a slow recovery of vegetation and recolonisation.

To support variability of vegetation growth stages and habitats, fire must be strategically managed across the Mallee Parks Landscape to ensure that conservation assets are managed within tolerable fire intervals and that fire occurs at the appropriate intensity, timing and season for the vegetation type. It is also very important to know where populations of key threatened species occur so that inadvertent damage can be avoided. Understanding the factors that threaten the persistence of these species will also inform recovery actions after fires.

Threat objectives

By 2024, reduce the extent and impact of severe large-scale bushfires, and minimise impacts on high-priority locations of key species from planned burning and fire management activities.

Heathland bushfire

Total grazing, browsing, trampling and wallowing pressure

Threat description

Total grazing and browsing pressure is a moderate to extreme threat across the conservation assets in the Mallee Parks Landscape. European rabbits cause the greatest grazing damage, but feral goats, pigs, and deer add to the grazing or browsing pressure. Native herbivores, particularly Western Grey and Red Kangaroos, compound grazing pressure where vegetation recovery is occurring. Grazing and browsing reduces the health of vegetation by lowering floristic diversity, altering the structure of vegetation, and compromising the ability of the habitat to recover from disturbances such as tree clearing and fire. Rabbits, feral goats and feral pigs also cause damage to cultural heritage sites through their burrowing and trampling habits.

The soil profile of Semi-arid Woodlands makes them particularly prone to high rabbit densities. A long history of domestic stock grazing has also contributed to its poor to fair vegetation condition. The non-eucalypt trees of Semi-arid Woodlands are long-lived, and recruitment (during periods of above-average rainfall) is episodic and uncommon. Without active rabbit management, seedlings and saplings can be severely compromised by selective grazing; seedlings can be killed by being bitten off at the base, and saplings can be stripped of leaves and small branches. Eventually the soil seed bank may be exhausted, and the canopy will then be lost entirely as adult trees senesce and die without replacement. Large tree hollows that support threatened bird species, including Major Mitchell's Cockatoo, are also lost. Unless they are kept at low densities, kangaroos also reduce seedling survival. Understorey species also suffer from grazing and browsing pressure, and this is compounded by competition with weedy plant species.

Feral goats also impact the Semi-arid Woodland conservation asset, and they also often move through and occupy mallee and heathland vegetation. Their browsing compromises canopy and shrub regeneration, especially after bushfire. Habitat suitability for goats has decreased since Parks Victoria closed most of the tanks (previous pastoral dams) holding water in Murray–Sunset National Park in the 1990s. Feral goats are also present in Inland Riverine Forests.

Pigs are present mainly in the areas closest to the Murray River, particularly northern Murray–Sunset National Park and Annuello Flora and Fauna Reserve. They are also in localised pockets near Pink Lakes and the Raak Plain. The pig population can move farther from the river in favourable seasons. As well as the impact of grazing, pugging causes significant soil disturbance where soils are soft, especially in Inland Saline Soaks.

The distributions and abundances of Sambar and Fallow Deer are very low in both Murray–Sunset and Wyperfeld National Parks, although there have been sightings in recent years. As well as grazing and browsing, deer degrade the water quality of wetland assets by excreting and wallowing in shallow water.

Annual climatic conditions and disturbances such as bushfires or floods may affect feral herbivore populations. Extended periods of good rainfall or floods can cause a boom in grazing animal density because feed becomes readily available. In contrast, droughts and heatwaves can significantly reduce population densities because food becomes scarce. Populations of grazing and browsing animals can increase rapidly when conditions improve, and at these times, when population numbers are low, it is critical to continue grazing and browsing control programs at high-priority sites. Maintaining management focus in periods of poor rainfall will ensure grazing impacts are controlled when vegetation is already under stress, and mitigate the risk of large population increases and heightened grazing pressure when conditions become more favourable. Grazing pressure can also impact natural vegetation regeneration after bushfires because new shoots and seedlings are preferred by herbivores. However, the openness of vegetation soon after fire may enable more efficient control of species such as rabbits and feral goats.

Managing grazing and browsing is necessary to support the successful regeneration of canopy species, increase species diversity and improve overall vegetation cover and complexity. To manage total grazing and browsing pressure effectively, introduced herbivores populations need to be maintained at very low levels, and kangaroo numbers need to be managed at high-priority locations.

Threat objectives

By 2024, reduce rabbit and feral goat densities across the Park Landscape, manage kangaroo numbers at priority locations, and maintain surveillance and control of pigs and deer as necessary.

Red Kangaroo

Predation by introduced predators

Threat description

Predation by foxes and feral cats is a threat to a range of ground-dwelling birds, small mammals and reptiles. Feral cats and foxes are widespread throughout the Mallee Parks Landscape. Wild dogs prey mostly on larger mammals and are mainly in the Big Desert Wilderness Park and Wyperfeld National Park. Predation by introduced predators is a high threat across most conservation assets in the Park Landscape and is likely to have contributed to declines in sensitive fauna populations.

Predation pressure may reduce species diversity and abundance, reduce the ability of a species to move through the landscape, and cause local extinctions. A reduction in the diversity and abundance of native animal species also affects the ecosystems they inhabit, especially when species such as small mammals that dig or pollinate are affected. Changes in the composition of native animal populations can also modify food chains and disrupt the behaviour of native predators.

The contribution of native predators to local predation pressure is not well understood. Their ecological role and their impact on local food webs and prey species is important, including extant species such as goannas and birds of prey as well as those no longer present such as Dingos and Western Quolls. Recent research in Big Desert Wilderness Park and Wyperfeld National Park suggests wild dogs (which behaviour similarly to Dingos) influence the structure and composition of local medium and large mammal fauna communities by preying on goats and kangaroos, which limits and alters the predatory behaviour of foxes (Geary 2014). Building upon this knowledge will support and improve make the management of predation pressure more effective.

Introduced predators that roam widely across private and public land may also be vectors for weeds and diseases. Predation can also compound the impacts of drought and bushfire on animal populations. Research in other parts of Australia has found that foxes and cats have the greatest impact on the native fauna directly after fire, when there is little vegetation for animals to use as refuges from predators (Hradsky et. al. 2017). Predation pressure can also hinder the movement of animals across the landscape and the ability for individuals to recolonise habitat while it recovers and become suitable after fire, which might be decades after the event.

Monitoring of fox and feral cat control programs in other parts of Australia has shown that reducing the abundance of a single predator species is often associated with an increase in the abundance of another predator species; for example, controlling foxes can result in an increase in feral cat numbers. Therefore, integrated control of predator species is required to reduce the threat to prey species. Recent changes to policies and legislation regulating feral cat control in Victoria will improve the ability to effectively manage

predation pressure across the Park Landscape, especially when techniques for the landscape-scale control of feral cats are better established.

The size and remoteness of the Mallee Parks make broad-scale feral animal control difficult. To be effective and benefit a broad range of assets, vast remote areas need to be managed. Over the life of this plan it is more likely that only localised control will be applied while knowledge is built on the location and relative density of foxes and feral cats, and on how to apply integrated programs effectively.

Managing a predator's preferred prey species can help decrease the density and impact of a predator population. For instance, early grazer management programs in Murray–Sunset National Park indicated that when rabbit numbers were controlled a corresponding reduction in of fox numbers also occurred, and the abundance of both species continued to remain low. This is supported by an analysis of fox scats collected from Malleefowl mounds by the Victorian Malleefowl Recovery Group, which showed that rabbits are a preferred dietary item of foxes. In parts of the Mallee Parks Landscape where rabbits are scarce, fox scats are also less abundant, and while they eat more vegetation, bird eggs, and small reptiles, the risk to native animals from a consistently small fox population is lower than from a booming population underpinned by abundant rabbits.

The Mallee Parks also share long boundaries with private land, thus requiring a collaborative predator management approach to increase the health of native animal populations effectively. Challenges to collaboration include the large number of landowners and often contrasting attitudes towards pest animal control among the community.

Threat objectives

By 2024, improve the understanding of predator interactions and the management effectiveness of fox and feral cat control methods at a landscape scale, and reduce introduced predators at key locations and times to support increasing populations of priority native animal species.

Feral Cat

Weed invasion

Threat description

The risk posed by weeds varies across the Mallee Parks Landscape. The vast areas of Mallee Triodia, Sunset Plains and Swales, Heathlands and Mallee Heathlands and Lowan Broombush and Swales have a low weed load. However, Buffel Grass is a new and emerging weed that poses an extreme threat to these environments. In Semi-arid Woodlands the ground layer composition often consists largely of introduced species. Weeds such as Ward's Weed, Horehound, Onion Weed and exotic grasses have come to dominate because the long period of pastoralism has resulted in a highly modified vegetation structure and soil disturbance.

Weeds compete with native plants for resources and alter the structure and function of habitat. Many weeds present a particular challenge at revegetation and restoration sites because they colonise degraded and disturbed locations. They can also degrade sites of cultural significance. Weeds on private land can be a significant source of weed infestation and reinfestation to public parks and reserves, requiring a collaborative approach to management across land tenures to be effective in increasing the health of vegetation assets.

Fire and floods can cause soil disturbance and weed propagule spread, creating conditions where weeds can rapidly establish and expand their populations. Mechanical works such as fire prevention, suppression and management activities also create opportunities for weed invasion through soil disturbance and the spread of seeds on equipment. Animals also spread weeds through the landscape, particularly feral predators and herbivores that travel long distances.

Ward's Weed, Horehound, Paterson's Curse, Bridal Creeper, African Boxthorn, cacti and exotic annual grasses are the priority environmental weeds in the Mallee Parks Landscape. Several introduced grasses, including African Love-grass, are especially prevalent along sections of reserve boundaries. Buffel Grass has recently entered Victoria and is now at the interface of the north-western edge of Murray–Sunset National Park. Considered one of Australia's worst environmental weeds, it is an aggressive grass that has already altered the structure and function of much of arid, semi-arid and tropical Australian parks, and as a result has changed environmental management programs and cultural practices.

The profile of weeds of Inland Riverine Forests and the Lake Albacutya Ramsar Site are different from those of the Mallee Woodlands and Heathlands. Notable species found during the development of the Albacutya Ecological Character Description (Cibilic & White 2010) included Stinkwort, Variegated Thistle, Saffron Thistle, Bathurst Burr, Asparagus, Horehound, Onion Weed, Spear Thistle, Malta Thistle, Skeleton

Weed, Slender Thistle, Stemless Thistle and Five-spined Saltbush. Some remain species of concern in these assets and in the Semi-arid Woodlands.

Focusing surveillance on high-threat emerging weeds such as Buffel Grass, and control on other established weed species that are degrading ecosystems, will result in a significant improvement in the health of the Mallee Parks Landscape.

Threat objectives

By 2024, eradicate new and emerging weeds, contain the spread of identified established weed populations, and eradicate high-priority weeds from high-value locations.

Specific competitive interactions

Threat description

Declining long-term habitat conditions can be exacerbated by competitive interactions, which have been identified as a high threat to the health of Mallee Triodia, Sunset Plains and Swales, and Semi-arid Woodlands. In the Mallee Parks Landscape, two specific situations that developed over the last 20 years have triggered management intervention at certain times: the loss of tree hollows large enough to support nesting pairs of Major Mitchell's Cockatoos at Wyperfeld National Park (Pine Plains), and the inter-breeding of Yellow-throated Miners with Black-eared Miners.

Large tree hollows are essential for the breeding of a suite of mallee fauna, including the threatened Regent Parrot and Major Mitchell's Cockatoo. At Pine Plains in Wyperfeld National Park a significant population of breeding Major Mitchell's Cockatoos has been at risk because of the declining number of suitable tree hollows. Historic land clearing and grazing pressure has left a legacy of a limited numbers of trees with large hollows, which are senescing and subsequently being lost to age, storm damage and bushfires. Although management of grazing pressure and active revegetation over the last 30 years has seen a resurgence of young trees, these are decades away from having hollows large enough to support breeding Major Mitchell's Cockatoos. In the interim, the small number of suitable hollows available and competition for their use have affected breeding success.

After the 2014 bushfires a speciality nest box program funded the replacement of nesting hollows lost during the bushfire using local fallen timber. There have also been Galah control programs to free tree hollows for Major Mitchell's Cockatoo breeding. Galahs and Little Corellas compete directly for tree hollows with Major Mitchell's Cockatoos and Regent Parrots. Galahs and Corellas nest earlier than Major Mitchell's Cockatoos, so when the cockatoos come to find nest hollows they may be already occupied, thereby reducing breeding success. These programs aim to help this significant population to continue breeding at the site.

The occupation of tree hollows by feral honeybees is also a source of competition to parrots and is a listed potentially threatening process under the Flora and Fauna Guarantee Act. It can take up to six years after the removal of bees for Regent Parrots to again use those tree hollows. Feral bees may also compete for resources with native nectar feeders.

Competition from the Yellow-throated Miner is one of the greatest threats to the closely related Black-eared Miner, which is considered to be nationally threatened. Yellow-throated Miners compete for habitat and interbreed with Black-eared Miners, causing genetic modification of the rare species. Yellow-

throated Miners also behave aggressively towards other birds, so their presence reduces bird species richness.

At the time of European settlement Yellow-throated Miners were not present in much of the Mallee, but landscape changes since then have favoured their proliferation. They prefer to use open tracks to move into vegetated areas, so the creation of fire access tracks and control lines is thought to facilitate their movement into high-quality areas where Black-eared Miners are established.

Threat objectives

By 2024, limit the persistence of temporary access tracks that might facilitate Yellow-throated Miner movement, and increase tree hollows that can be used for breeding by Major Mitchell's Cockatoos and Regent Parrots.

A Major Mitchell's Cockatoo at its nest in a tree hollow

Habitat degradation from visitor activities

Threat description

The Mallee Parks Landscape contains high-quality habitat for significant populations of threatened species, including some of the most remote wilderness landscapes in Victoria. It is also popular for scenic driving, trailbike riding, nature study, camping, and experiencing wilderness and solitude.

Off-road trailbike riding and four-wheel driving is a frequent illegal activity, particularly in the eastern and southern Murray–Sunset National Park, Big Desert Wilderness Park, Lake Albacutya and Outlet Creek. Vehicles driven off-track create new tracks that are reinforced when others use the same route. This damages vegetation structure, soil crusts and sites of cultural significance, and is especially concerning when the tracks provide access to the remotest areas of the parks and areas of high-quality habitat for threatened species. These incursions also increase the risk of introducing highly invasive plants and animals that can transform ecosystems and food webs before they are detected.

Rubbish dumping reduces the aesthetic values of the Park Landscape. Discarded organic matter can become incorporated into the local food web, and toxic or poisonous products may leach into soils, groundwater and waterways. Environmental weeds may also be introduced and then spread by scavenging animals. Rubbish dumping is prevalent throughout many of the small reserves, and dumped household waste can include hazardous materials such as asbestos.

Firewood collection is a concern around both designated and illegal campsites, especially at Lake Albacutya, Outlet Creek and Lake Tyrrell. The removal of logs reduces important habitat for ground-dwelling animals such as small mammals and reptiles. Rubbish is also commonly left behind or dumped at these camping areas.

Illegal hunting of native and introduced animals and poaching of wildlife and eggs adversely affects reproductive populations of threatened species, destroys habitat features such as logs and *Triodia* hummocks, and threatens the safety of park visitors. The capture and treatment of animals is also an animal welfare concern. Illegal hunting is believed to occur in northern and eastern Murray–Sunset National Park, Hattah–Kulkyne National Park, Annuello Flora and Fauna Reserve and in Wyperfeld National Park (particularly at Pine Plains and Albacutya).

Threat objectives

By 2024, reduce illegal visitor impacts on priority conservation and cultural assets.

Mallee Striated Grass-wren

7 Conservation strategies

7.1 Prioritising conservation strategies

A broad range of conservation strategies have been considered, including those in existing park management plans and regional catchment strategies as well as additional actions identified by regional staff and conservation partners. The following strategies and their component actions have been designed to achieve the desired conservation outcomes identified in this plan. The Strategic Management Prospects decision support tool (DELWP 2018) will be used to help determine the priority areas for implementing these strategies along with other assessments of impact, feasibility and cost. Each strategy may be suitable for further refinement or development with conservation partners and stakeholders who wish to further support conservation outcomes in the Mallee Parks Landscape.

Strategies prioritised through this process are:

- Collaborate on Country with Traditional Owners, special interest groups and researchers
- Manage fire for healthy conservation assets
- Manage total grazing pressure
- Restore the Semi-arid Woodlands
- Control introduced predators to support resilient populations of native fauna
- Manage environmental weeds using a biosecurity approach
- Reduce visitor impacts on natural and cultural assets
- Reintroduce locally extinct fauna.

7.2 Priority strategies

Priority strategies have been further developed and were tested through the development of results chains, which test the logic of the strategy in a stepwise manner for delivering the desired outcomes. These results chains were used to develop key implementation milestones for each strategy, which include measurable outputs and outcomes that help managers to understand the impacts of management on improving the viability of conservation assets and managing threats.

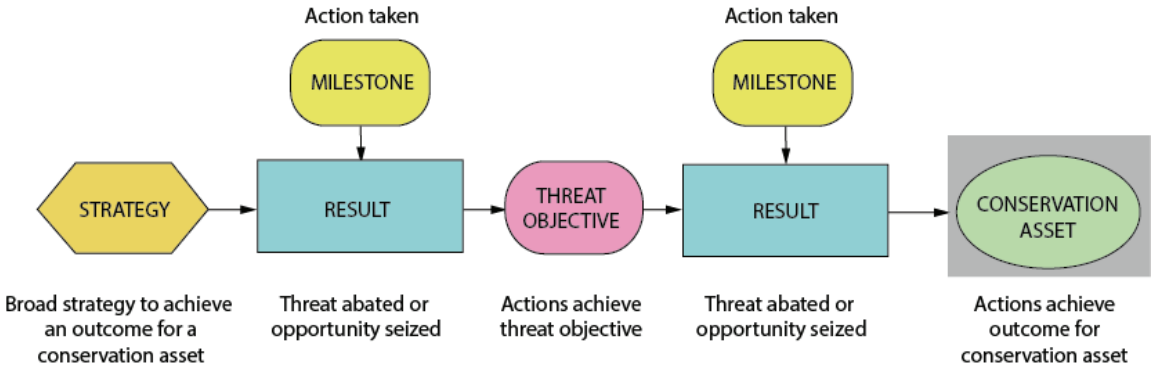
Conservation strategy

Conservation strategy development has focused on either addressing key threats or improving the health of key conservation assets or both. The development of these priority strategies has been undertaken using results chains to ensure that the actions that are defined within the strategy are those that will lead directly to addressing the objectives and conservation outcomes of this plan. Each strategy is captured in a statement which defines:

- the impacts of the strategy on key threats
- the approaches to be applied
- the measures of success
- the impact of the strategy on conservation outcomes.

Results chain

Results chains have been developed for all conservation strategies. They express the relationship between the conservation strategy, identified threats and an improvement in the desired state of conservation assets, as well as the assumptions that underpin how we think a conservation strategy will contribute to maintaining one or more conservation assets. The results chain helps visualise and identify some initial monitoring indicators and milestones. Below is a simple example of a results chain.



Implementation milestones

Result	Action
Statement of what implementation success looks like	• Milestone from results chain

Collaborate on Country with Traditional Owners, special interest groups and researchers

Community groups, stakeholders, universities and partner agencies have all had long associations with the Mallee Parks, and have participated in a variety of environmental management programs for many years. These groups include Traditional Owners, threatened species recovery groups, environmental volunteer groups, ecological researchers and Friend's groups.

The aim of this strategy is to support community activities that contribute effectively to Parks Victoria's management programs in the Mallee Parks Landscape. By working together, the health of the Park Landscape can be improved more efficiently and effectively, and the resilience of habitats and their constituent significant species can be improved.

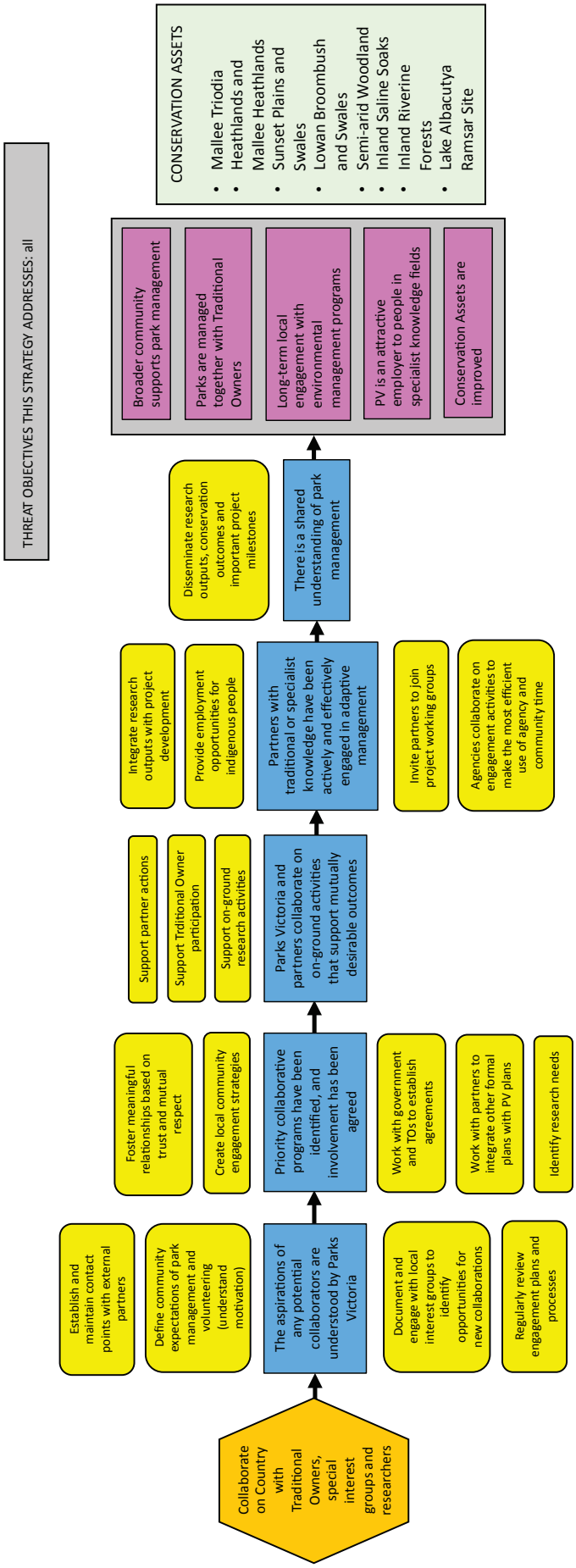
Parks Victoria will identify groups that are willing to work together, their areas of interest, and their desired level of participation. Collaborative programs already support adaptive management of the total grazing management and Semi-arid Woodlands restoration programs, and the fire ecology program. Other current and future areas of development include effective landscape-scale predator monitoring and control, vegetation condition assessments, drought refuge identification, and the incorporation of traditional ecological knowledge.

Parks Victoria manages areas of Wyperfeld National Park cooperatively with the Barengi Gadjin Land Council through a formal agreement (see Section 2.3). A formal agreement is also being developed with the First People of the MillewaMallee Aboriginal Corporation. Several other local Traditional Owner groups are not Registered Aboriginal Parties but can contribute actively to the management of various areas and programs. Parks Victoria can support these groups to build capacity and establish their goals for the ongoing management of the Mallee Park Landscape. Their involvement may include management planning, supporting on-ground works, providing employment and cadetship opportunities, and working to establish traditional use rights on public land.

Conservation outcomes

Managing Parks with Traditional Owner groups, and supporting long-term local engagement with environmental management programs builds broader community support for park management, and guides the adaption of programs for increased effectiveness and efficiency.

Results chain



Implementation milestones

Result	Action
The aspirations of any potential collaborators are understood by Parks Victoria.	• Establish and maintain contact points with external partners. • Define community expectations of park management and volunteering (understand motivation). • Document and engage with local interest groups to identify opportunities for new collaborations in the fields of traditional ecological knowledge and research. • Regularly review engagement plans and processes.
Priority collaborative programs have been identified, and involvement has been agreed.	• Foster meaningful relationships based on trust and mutual respect. • Create local community engagement strategies. • Work with government and Traditional Owners to establish agreements. PV is in early discussion with the BGLC on a Partnership Agreement that will outline shared goals and future arrangements for working together. Such an agreement is also likely to be entered into with the FPMM. • Work with partners to integrate other formal plans with PV plans, including Healthy Country Plans, Conservation Action Plans, Threatened Species Recovery Plans, Regional Catchment Strategies, Waterway strategies, and Ramsar plans. • Identify research needs, particularly those involving managing priority threats and improving the condition of habitat for all species.
Parks Victoria and partners collaborate on on-ground activities that support mutually desirable outcomes.	• Support partners to implement actions from their conservation action plans and from threatened species recovery plans. • Support TOs to participate in threat monitoring and to undertake traditional resource use. • Support research activities on on-ground projects.
Partners with traditional or specialist knowledge have been actively and effectively engaged in adaptive management.	• Integrate research outputs with project development. • Provide employment opportunities for Indigenous people, including cadetships, business and fire management. • Invite partners to join project working groups. • Agencies collaborate on engagement activities to make the most efficient use of agency and community time. • Engage with Traditional Owners in the design of cultural fire practices.
There is a shared understanding of park management.	• Disseminate research outputs, conservation outcomes and important project milestones through media channels, interpretation materials and activities.

Manage fire for healthy conservation assets

This strategy involves working in partnership with relevant fire management agencies, particularly DELWP, to manage the ecological health of the Mallee Parks Landscape through fire management. It involves a risk-mitigation and cross-tenure approach for the largest Mallee Parks. It aims to maintain appropriate fire regimes in the landscape with strategically planned burning while managing natural bushfires. It will minimise impacts on environmental and cultural values and reduce the incidents of large-scale bushfires.

Fire management is a high-priority program in the fire-dependent Heathlands and Mallee Heathlands, Mallee Triodia, Sunset Plains and Swales, and Lowan Broombush and Swales. In these systems the siting and timing of planned burns, how bushfires are managed, and the way that habitat disturbance from associated practices is managed contributes to the application of appropriate fire management. Appropriate fire management is also important in the conservation assets where fire does not drive recruitment, including the Semi-arid Woodlands, Inland Riverine Forests, Inland Saline Soaks, and Lake Albacutya Ramsar Site.

DELWP, as the lead agency for fire management on public land in Victoria, works with Parks Victoria and Traditional Owners to develop and deliver fire management programs that are based on risk mitigation and include ecological objectives. The DELWP program sets objectives for bushfire management on public land and develops associated strategies across the prevention, preparedness, fuel management (including planned burning and non-burning fuel treatments), and response and recovery spectrum (DELWP 2012). Parks Victoria works to ensure our landscapes are managed in the most ecologically sustainable and culturally respectful way, supporting the persistence of high quality habitat and healthy threatened flora and fauna populations.

In the more extensive areas of fire-dependent vegetation in the larger parks, both bushfires and planned burning contribute to fire in the landscape, and create the temporal (time since fire) and spatial (patch arrangement) mosaic. To support ecological and risk-mitigation objectives, our fire management must aim to protect high-priority sites and assets whilst ensuring that the spatial and temporal mosaic that is created year-on-year will supply suitable habitat, connect patches to facilitate movement, and protect refuge areas of high priority populations during times of stress (e.g. drought). The program must also balance the current political, social and environmental situation with the future needs of good habitat and strong faunal populations.

To apply appropriate fire management in the landscape and implement an integrated and strategic fire management programs, Parks Victoria works closely with DELWP on several elements:

- **Maintaining appropriate fire regimes in the fire dependent ecosystems based on the combination of bushfire and planned burning**

  Bushfire events and planned burning in vegetation communities that have regeneration events promoted by fire triggers (e.g. temperature, smoke) are important for the continuing long-term health of the system. Bushfires are natural disturbances that cannot be prevented or replaced by planned burning, so the management of natural fires and planned burning must be integrated and complementary. Planned burning is guided by bushfire history and aims to apply ecologically sensitive fire in fire-dependent ecosystems, based on our knowledge of tolerable fire intervals, to maintain (or restore) the appropriate growth stage structure for each vegetation type. An optimal growth stage structure is informed by the geometric mean abundance of local species, and identifies an area goal for each age-class (e.g. young, mature, old) specific to the vegetation type. However, old (long unburnt) takes decades to redevelop once burnt, so the retention and development of important areas of long unburnt is a key consideration. Also important is the spatial arrangement of vegetation age-classes to support the supply of future habitat and connectivity between patches.

  Long-term planning is required to ensure the future provision of habitat. Planned burning programs in these systems must consider habitat connectivity, maintaining habitat complexity, and the effects of various types of fire on growth stage composition across the Park Landscape.

- **Using strategic planned burning to mitigate the risk of bushfires having undesirable impact on built, ecological and cultural assets**

  Planned burning can be a highly effective risk mitigation tool when it is applied appropriately. Targeted fuel management can support the protection of built, cultural and ecological assets during bushfires by providing a barrier to fire spread.

  In the large Mallee Parks, planned burning over the last 15 years has focused on creating and maintaining a framework of fuel-reduced corridors. These corridors moderate fire behaviour and size, reducing the extent of high-severity bushfires and the risk that they will burn beyond the large public land blocks. They also allow bushfires to be managed using minimum-impact suppression strategies, i.e. minimal on-ground impact (e.g. control line construction by heavy machinery) by using aircraft or allowing fires to burn into a strategic fuel reduced corridor under desirable weather conditions to halt the forward spread.

  Decisions regarding the locations of planned burns and the implementation of managed bushfire can involve difficult trade-offs. Sometimes areas of mature habitat may need to be reduced to a young age, acknowledging impacts to their constituent animal populations. These decision aim to safely, sensitively (culturally or ecologically) and effectively support bushfire suppression.

  Fire management in the small reserves differs significantly from that applied in the large parks. The small size of many reserves limits the ability to create fire mosaics, use strategic corridors, and implement a managed bushfire approach. In these reserves, and along the boundaries of the large Mallee Parks, cross-tenure management is key component of the program. Fire planning and management is carried out with DELWP, the CFA, neighbours and the community to protect private land from bushfires that could otherwise burn beyond the park boundaries, and protecting park values from bushfires coming from private land.

- **Protecting key sites by excluding fire or implementing minimum impact suppression strategies, including the managed bushfire approach, where and when appropriate**

  Machinery working to create bushfire control lines or poorly sited planned burns can cause significant damage to local natural and cultural values, and cause long-term environmental impacts. Hence it is a priority to protect known high-priority sites (as far as practicable) from this type of disturbance.

In Wilderness Parks and Zones, Remote and Natural Areas, Reference Areas and other areas of high conservation significance, preferred suppression strategies are described in planning documents such as the *Loddon Mallee Region Bushfire Readiness and Response Plan* (DELWP 2017). The use of local planning tools that identify key biodiversity and refuge sites, and the input of natural and cultural values officers in the early stages of bushfires or into planned burning programs, are important to ensure the risk of inadvertent damage to identified assets is prevented or mitigated. Options for minimal impact suppression strategies (including managed bushfire) must also be considered and incorporated early. Managed bushfire involves relying on using areas of reduced fuel and moderating weather conditions to halt the spread of a bushfire, supplemented where necessary by the use of hand tools and aircraft, but avoiding the use of heavy ground machinery to construct control lines.

High priority areas include known populations of important or iconic threatened species, such as the Black-eared Miner, Mallee Emu-wren and Heath Skink. They are species that have very limited distributions and specific actions have been identified that will support their persistence.

- **Using cultural practices and fire ecology research to support ecological outcomes**

  This strategy also aims to increase the knowledge and appreciation of traditional burning practices. Parks Victoria will support local Traditional Owners to input cultural and ecological knowledge into fire plans and strategies developed by DELWP and Parks Victoria. Parks Victoria will also support training and mentoring of indigenous rangers as forest firefighters to implement traditional burn practices, advocate for community cultural understanding and achieve healthy conservation assets.

  A key element of the fire management program has been the history of fire ecology research that has contributed to planning and development for over 20 years. In 2017 DELWP began a large-scale study into the species, their habitats, and fire associations of Wyperfeld National Park and Big Desert Wilderness Park. This study will examine how small native animals respond to changes in the landscape, such as the availability of food and habitat, due to fire. As with the previous studies, it will develop models that illustrate which fire age classes provide the most appropriate habitat for local species.

- **Implementing post-bushfire rehabilitation and supporting ecological recovery**

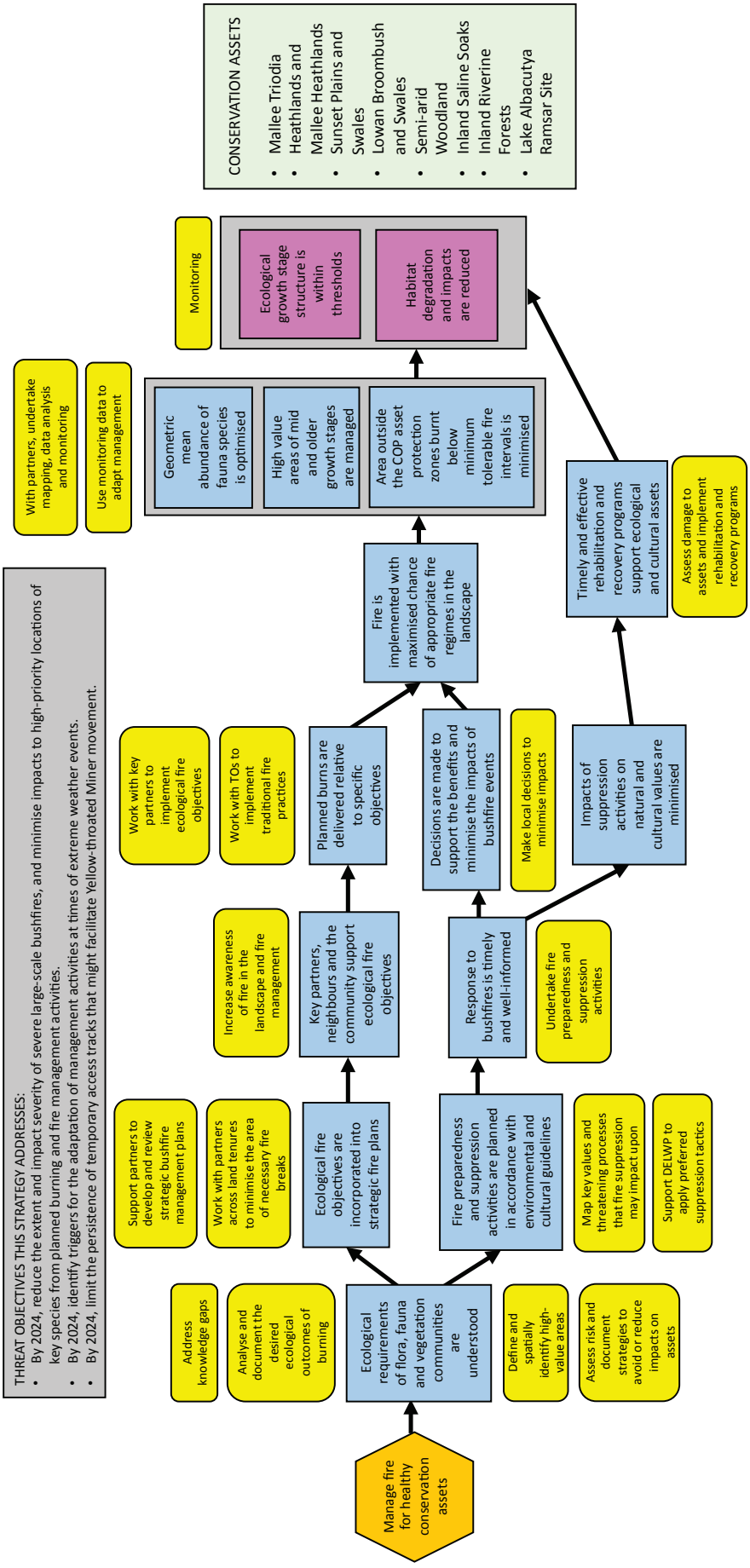
  Parks Victoria has a key role in supporting the rehabilitation planning, implementation, and ecological recovery of ecosystems after fire events. These include, the effective closure and rehabilitation of constructed control lines in the short-term, and over subsequent years supporting habitat and species to re-establish by mitigating the risks of over-grazing/browsing, predation by introduced predators, or the degradation of wilderness areas by illegal users or pest plant and animal establishment.

  A key factor in ecosystem recovery post-fire are local climatic conditions (particularly rainfall), so not every fire is likely to result in the same recovery outcomes, nor recover at the same rates. Environmental management programs around fire areas may need the flexibility to escalate at different times post-fire to mitigate risks to persistence and recolonisation of local species.

Conservation outcomes

Maintain the structural diversity and distribution of growth stages in the fire dependent vegetation communities, with an age-class distribution informed by the optimal geometric mean abundance of local species, and protect key nested assets that are sensitive to inappropriate fire management activities.

Results chain



Implementation milestones

Result	Action
Ecological requirements of flora, fauna and vegetation communities are understood.	• Address knowledge gaps to allow better implementation of sound, risk-mitigation based fire management. • Analyse and document the desired ecological outcomes of burning. This will be related to and informed by the optimal geometric mean abundance and growth stage structure. Tolerable fire intervals and expert opinion may also inform development. • Define and spatially identify high-value areas. • Assess risk and document strategies to avoid or reduce impacts on assets, including identifying areas where bushfires may benefit ecosystems.
Ecological fire objectives are incorporated into strategic fire plans.	• Support partners (DELWP and CFA) to develop and review strategic bushfire management strategies with the community. • Work with partners across land tenures to minimise the area of necessary fire breaks.
Key partners, neighbours and the community support ecological fire objectives.	• Increase awareness of fire in the landscape and fire management. This will be achieved using the Joint Fuel Management Program (DELWP) as a public communication tool to communicate the role of fire in the landscape, considerations of management and the use of non-burn fuel treatments.
Planned burns are delivered relative to specific objectives, e.g. high-intensity, low-intensity, mosaic or cultural burns.	• Work with key partners to implement ecological fire objectives, including strategies to reduce the incidence of large-scale, high-severity bushfires and manage for continuing habitat for key species. • Work with Traditional Owners to implement traditional fire practices.
Fire preparedness and suppression activities are planned in accordance with environmental and cultural guidelines.	• Map key values (both natural and cultural) and threatening processes (including weeds, pests and pathogens) that fire suppression will impact. Maintain currency of locally developed tools e.g. Values Risk Analysis and Management Tool • Support DELWP to apply preferred suppression tactics in environmentally and culturally sensitive areas, including Wilderness Park, Wilderness Zones, and Remote and Natural Areas.
Response to bushfires is timely and well-informed.	• Undertake fire preparedness and suppression activities in accordance with strategies, guidelines and legislation. • Response considers managing the bushfire response to promote ecological outcomes (actively limiting or halting suppression activities).
Decisions are made to support the benefits and minimise the impacts of bushfire events.	• Make local decisions that minimise impacts, such as placing mechanical breaks and fire retardants to avoid priority areas, and where appropriate allow bushfires to burn naturally to promote ecological outcomes. • Where appropriate, allow bushfires to burn naturally to promote ecological outcomes.

Result	Action
Impacts of suppression activities on natural and cultural values are minimised.	
Fire is implemented with maximised chance of appropriate fire regimes in the landscape.	
Geometric mean abundance of fauna species is optimised. High value areas of mid and older growth stages are managed. Area outside of the asset protection zones (as per the Code of Practice) burnt below minimum tolerable fire intervals is minimised.	With partners, undertake mapping, data analysis and monitoring. Ensure that monitoring data is used to adapt management; the optimised GMA is used to inform the most appropriate growth stage distribution and ensure a continuous long-term supply of appropriately aged vegetation to support habitats. When competing objectives must be managed, use monitoring data to support decision-making, e.g. some high value areas of threatened species may require active fire exclusion contrary to risk-minimisation needs.
Timely and effective rehabilitation and recovery programs support ecological and cultural assets.	Assess damage to assets and implement rehabilitation and recovery programs. Ensure that risks to impacted threatened species populations can be managed effectively, with assistance from partners.

Manage total grazing pressure

Managing total grazing is one of the largest and longest-running Parks Victoria programs. The program is based on the need for integrated management and control of priority grazing and browsing species that can compromise restoration success in Semi-arid Woodlands, degrade native vegetation communities, and degrade cultural assets.

Semi-arid Woodlands are the focus of a long-term restoration program in the Mallee Parks. The first step has been to reduce grazing pressure to very low levels that allow native vegetation to recruit and tree seedlings to survive and mature trees to thrive, and eventually develop large tree hollows that support threatened bird species, including Major Mitchell's Cockatoo. Managing total grazing pressure requires an integrated approach in which introduced rabbits and feral goats are heavily controlled to very low densities and, to complement this, native herbivores are also managed. Working with neighbours across boundaries is also a key element in the success of the program.

Grazing and browsing animals in Semi-arid Woodland, Inland Riverine Forests, Lake Albacutya Ramsar Site and Inland Saline Soaks will be managed in accordance with the *Total Grazing Management Plan for the restoration of Semi-arid Woodland and Floodplain Vegetation Communities in North-western (Mallee) Parks 2016–2021* (Parks Victoria 2017).

Parks Victoria will continue to carry out humane and safe rabbit control in conservation assets where grazing and browsing are a significant threat, particularly focusing on very high standards of control at natural regeneration and revegetation sites. Control of rabbit populations aims to achieve site specific targets for the numbers of rabbits per kilometre of spotlight transect, the density of active warren entrances, and evidence of browse damage.

Some areas of Semi-arid Woodlands also contain significant cultural sites, particularly Aboriginal ancestral remains. In these areas, Parks Victoria will work with local Traditional Owner groups to reduce or eliminate the presence of rabbits and restore damage to sites. Parks Victoria will also work with Traditional Owner groups to identify and implement control methods that are appropriate for the landscape and the cultural values present.

Feral goats will be managed based on the *Strategic Action Plan for Feral Goats on public land in North-west Victoria* (Parks Victoria, 2017). This involves integrating control across the range of habitats that feral goats occupy in the Mallee Parks Landscape, including ground shooting, aerial shooting, and fenced traps where appropriate. While most tanks (previous pastoral dams) on Parks Victoria estate have now been closed, Parks Victoria will consider closing any remaining water points, and will support the closure of watering points on nearby freehold land where they may be increasing habitat suitability for feral goats in

the parks. Shooting of feral goats is done in partnership with the Sporting Shooters Association of Australia.

Western Grey and Red Kangaroos are managed where the management of introduced rabbits and feral goats is at a high standard, and where restoration success also dependent on minimising native grazer impacts. At these locations kangaroo densities will be maintained at or below identified site and species-specific target levels. Annual census and culling programs will be continued as required. Parks Victoria is committed to humane and safe culling standards in accordance with the *National Code of Practice for the Humane Shooting of Kangaroos and Wallabies for Non-Commercial Purposes* (CoA 2008).

Table 7.1 Priority pest species, locations and management targets for managing total grazing pressure.

Species	High-priority locations	Implementation milestones	Potential control methods
ASSET PROTECTION			
European Rabbit, hares	Semi-arid Woodlands throughout parks and reserves Priority Bounceback/ Biofund areas (Taparoo, Pink Lakes, Hattah, Pine Plains, Albacutya)	Review and update rabbit management strategies for priority Bounceback/Biofund areas, and establish or maintain rabbit densities of less than one per spotlight kilometre, and less than one active entrance per hectare	Fumigation, baiting, shooting, ripping, biocontrol
Feral goats	Zones identified in the feral goat strategy (2017) – five high-priority control zones in Murray Sunset NP and Hattah–Kulkyne NP. – two surveilance zones identified in Wyperfeld NP.	Reduce and maintain densities of feral goats in the priority control zones as low as possible through implementation of the feral goat strategy. Understand the distribution, abundance (or density), and potential impact within the surveillance zones of the strategy. Undertake surveillance to better understand goat movement and impacts in Annuello FFR and Wandown BR.	Aerial / ground shooting, trapping, partnership with SSAA
Pigs	Wandown BR, Murray–Sunset SNP (Rocket Lake, Raak Plain, Trinita-Wymlet area), Wemen BR, Annuello FFR	Reduce and maintain populations as low as possible. Identify corridors of movement and consider prevention options	Baiting, trapping, shooting
MONITORING			
Fallow Deer	Hattah–Kulkyne NP and Wyperfeld NP (Molls Rd-boundary), one or two sightings annually, small numbers.	Understand the distribution and potential impacts by 2024.	Shooting

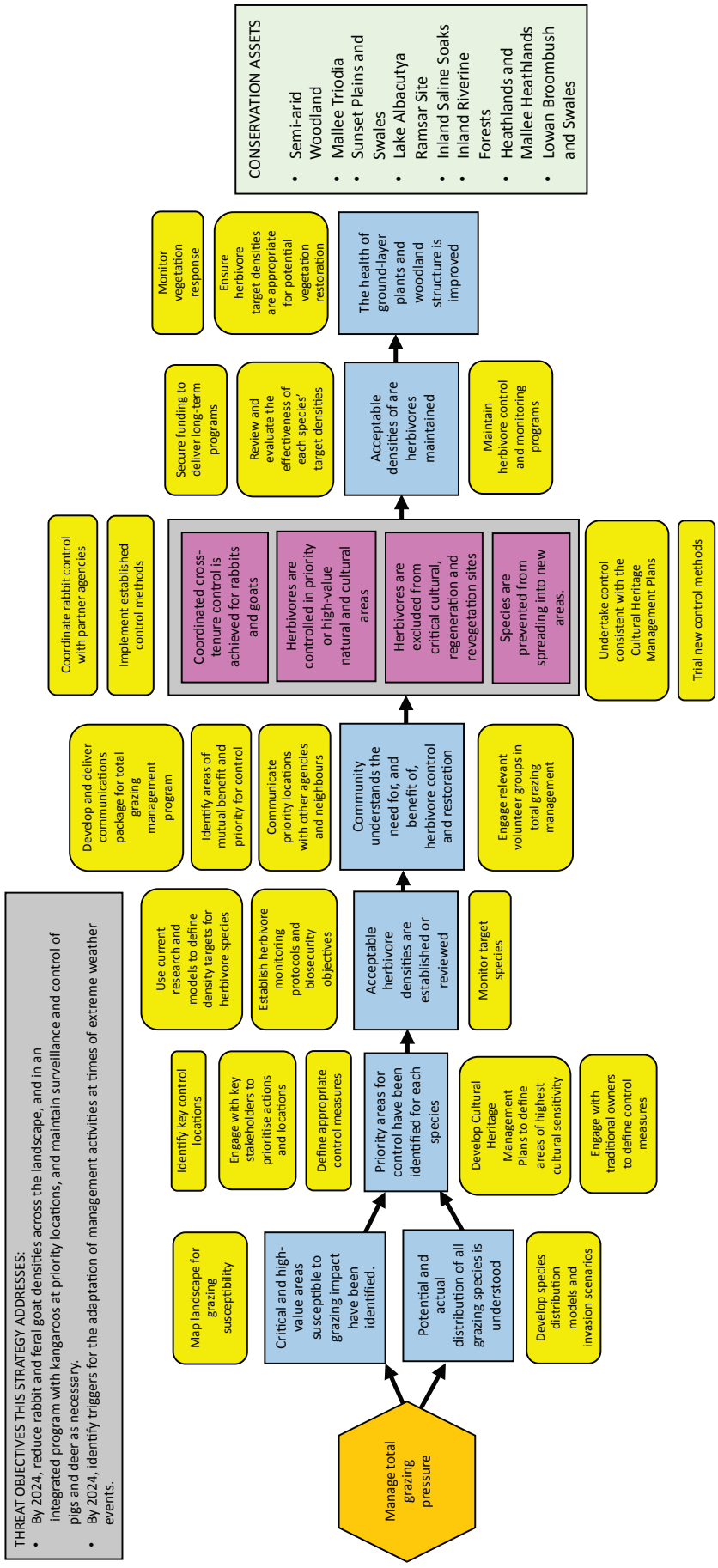
Table 7.2 Priority over-abundant species, locations and management targets for managing total grazing pressure.

Species	High-priority locations	Implementation milestones	Potential control methods
ASSET PROTECTION			
Red and Western Grey Kangaroos	Semi-arid woodland regeneration and revegetation areas	Control kangaroo populations as part of the Total Grazing Management program where enhanced grazing management protects natural regeneration and revegetation of the Pine–Buloke threatened community	Professional contract shooting

Conservation outcomes

The health and structural diversity of habitats is increased so that Semi-arid Woodlands are naturally regenerating, with a full representation of age-classes of Slender Cypress-pine, Buloke and Belah, including tree hollows, and dependent threatened flora and fauna are supported.

Results chain



Implementation milestones

Result	Action
Critical and high-value areas susceptible to grazing impact have been identified.	• Map the Park Landscape for grazing susceptibility with research partners.
Potential and actual distributions of all grazing species are understood.	• Develop species distribution models and invasion scenarios with research partners.
Priority areas for control have been identified for each species.	• Identify key control locations. • Engage with key stakeholders to prioritise actions and locations. • Define appropriate control measures. • Develop Cultural Heritage Management Plans to define areas of highest cultural sensitivity. • Engage with Traditional Owners to define control measures on an area basis that are appropriate for the areas' cultural sensitivity.
Acceptable herbivore densities are established or reviewed.	• Use current research and models to define density targets for herbivore species. • Establish herbivore monitoring protocols and biosecurity objectives. • Monitor target species.
Community understands the need for, and benefit of, herbivore control and restoration	• Develop and deliver a communications package for the total grazing management program. • Identify areas of mutual benefit and priority for control. • Communicate priority locations with other agencies and neighbours. • Engage relevant volunteer groups in total grazing management, e.g. Sporting Shooters Association.
Coordinated cross-tenure control is achieved for rabbits and goats. Herbivores are controlled in priority or high-value natural and cultural areas. Herbivores are excluded from critical cultural, regeneration and revegetation sites. Species are prevented from spreading into new areas.	• Coordinate rabbit control with LandCare and DEDTJR. • Implement established control methods • Undertake control consistent with the Cultural Heritage Management Plans, and work with Traditional Owners work to monitor control treatments where agreed. • Trial new control methods.
Acceptable densities of herbivores are maintained.	• Secure funding to deliver long-term programs, and prioritise investment to maintaining effective management of priority areas. • Review and evaluate the effectiveness of each species' target densities. • Maintain herbivore control and monitoring programs.
The health of ground-layer plants and woodland structure is improved.	• Monitor vegetation response. • Ensure herbivore target densities are appropriate for potential vegetation restoration.

Restore the Semi-arid Woodlands

Semi-arid Woodlands in the Mallee Parks Landscape have been the focus of restoration programs for almost 30 years. The current program has evolved from one of rangeland restoration focused on destocking, removing water points and reducing rabbit populations, to a program of building on the success of total grazing management and restoring the Semi-arid Woodlands flora diversity and habitat structure. The priority areas for this are the non-eucalypt woodlands of Hattah–Kulkyne NP, north-west Murray–Sunset NP (Taparoo area and Yarrara FFR) and southern Murray–Sunset NP (Pink Lakes), and Wyperfeld NP from Pine Plains along Outlet Creek to Lake Albacutya Park.

The restoration program today forms the largest and longest-running restoration project undertaken by Parks Victoria. Its aim has been the re-establishment of canopy species, particularly Buloke, Slender Cypress-pine, Belah and Sugarwood. These woodlands support a bird community that includes species completely dependent upon this community. For instance, Major Mitchell's Cockatoos are particularly reliant on tree hollows for nesting, while White-browed Tree-creepers prefer a diverse, dense shrub layer under the canopy of non-eucalypt species.

When the Mallee Parks were reserved, much of the Semi-arid Woodlands were classified as severely degraded, having been heavily clear-felled and grazed by domestic stock. Canopy trees were (and largely still are) very old, understorey shrubs were largely absent or sparse, and the ground layer predominantly annual weeds. The initial focus was, and still is, active control of grazers (rabbits, feral goats, western grey and red kangaroos) and habitat protection (e.g. waterpoint closures and fencing) to support natural regeneration and revegetation. Today, natural recovery from the last 20 years is evident in the recruitment of the key woody perennials, including cypress-pines, Cattlebush, Sugarwood and Hopbush, albeit patchily distributed in both time and space. In some areas, hopbush will grow in dense stands too thick to easily access the rabbit warrens for control. In areas of dense rabbit harbour, a select program of harbour destruction has been implemented previously and may be warranted in the future.

Despite recruitment of cypress-pine resuming, a decades-long legacy of lack of tree recruitment means that trees in some areas are senescing, and highly susceptible to damage during severe weather (wind or rain). This is particularly true at Pine Plains in Wyperfeld National Park, where tree hollows large enough to support breeding of Major Mitchell's Cockatoo are now very limited because of the recent loss of old trees. New hollows are developing but will take many decades to reach a size that is suitable for Major Mitchell's Cockatoos. In the meantime, active measures such as the installation of nest boxes and the control of Galahs, which compete with Major Mitchell's Cockatoo's for nest hollows, can support the persistence of fauna in this area.

Over recent years, low grazing pressure across the Semi-arid Woodlands has enable extended the program to b into active revegetation. Where there are no longer fertile canopy trees or large shrubs to provide natural regeneration sources, Parks Victoria and partners have begun an active rehabilitation program, targeting revegetation of significant areas of woodland habitat. In 2012 Parks Victoria received a funding grant from the Australia Government that allowed the extension of these activities to 2017, revegetating 1500 ha of Semi-arid Woodlands. This program, and others undertaken by the Mallee CMA and CO_2 Australia, have focused on re-establishing canopy and shrub species in areas where one or both are no longer present or the surviving vegetation community is species-poor.

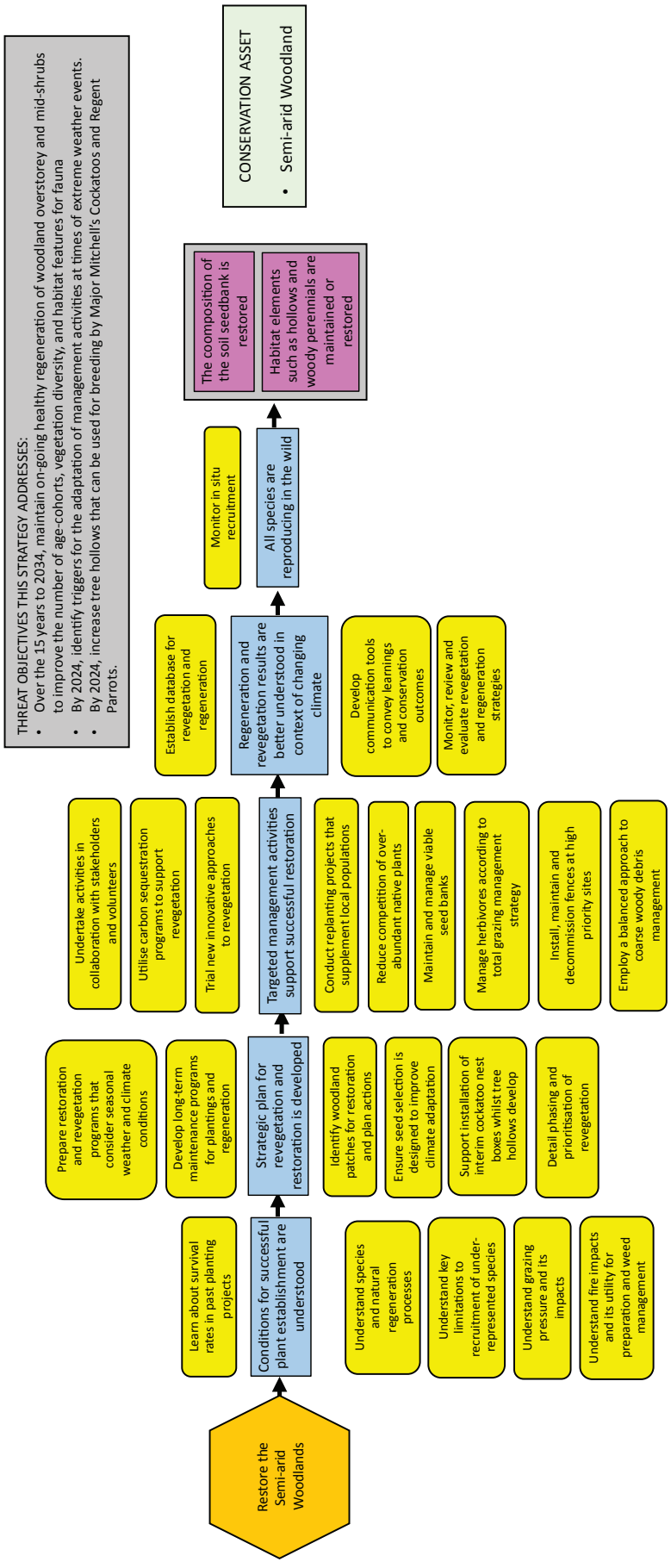
Restoration sites are chosen for strategic importance in the landscape, ease of access for maintenance, and consideration of the works to be done. The selection of plants for restoring sites continues to focus on overstorey and shrub species whose seeds have been lost from the soil seed bank and are unable to recolonise woodlands even in the absence of grazing and browsing pressure. Where possible, species selection will also help Semi-arid Woodlands to adapt to a changing climate. Priority species for reinstate include Buloke, Bleah, Slender Cypress-pine, Sugarwood, *Acacia* species, and *Senna* species. To maximise the survival of revegetation, the timing and composition of plantings will be flexible to take advantage of favourable weather conditions. Parks Victoria will restore sites in partnership with other agencies and community volunteers.

A key tool for assessing progress towards restoration and identifying sites for future investment has been ongoing monitoring of grazer abundance and woodland condition. The continuation of these monitoring programs and the analysis of their data are fundamental for continuing the adaptive management that has been a key component of the long-term success of this program. New opportunities to add direction to the program come from evaluating the revegetation successes (and failures) of the last five years, reviewing the contribution that the fenced exclosure plots can make to the restoration, and improving the understanding of the preferences of different grazers and the seasonality of their impacts.

Conservation outcomes

The vegetation and fauna of Semi-arid Woodlands increase, and critical habitat elements are maintained and restored resulting in improved habitat quality and canopy extent.

Results chain



Implementation milestones

Result	Action
Conditions for successful plant establishment are understood.	• Learn about survival rates in past planting projects. • Understand species and natural regeneration processes. • Understand key limitations to recruitment of under-represented species. • Understand grazing pressure and its impacts. • Understand fire impacts and its utility for preparing and promoting plant establishment and weed management.
Strategic plan for revegetation and restoration is developed.	• Design restoration and revegetation programs that consider seasonal weather and climate conditions. • Develop long-term maintenance programs for plantings and regeneration, including reviews of fencing. • Identify woodland patches for restoration and plan actions, e.g. maintain existing elements, supplementing plantings, or revegetation. • Ensure seed selection is designed to improve climate adaptation. • Support installation of interim nest boxes for Major Mitchell's Cockatoo whilst tree hollows develop, and manage competition by galahs for nesting hollows at high priority sites. • Detail phasing and prioritisation of revegetation required.
Targeted management activities support successful restoration.	• Undertake activities in collaboration with stakeholders, volunteers and Traditional Owners. • Utilise carbon sequestration programs to support revegetation. • Trial new innovative approaches to revegetation, e.g. aerial seeding. • Conduct replanting projects that supplement local populations. • Reduce competition of over-abundant native plants where necessary, e.g. hop-bush. • Maintain and manage viable seed banks. • Manage herbivores according to total grazing management strategy. • Install, maintain and decommission fences at high priority sites. • Install protective measures for seedlings and young trees as necessary, e.g. tree guards. • Employ a balanced approach to coarse woody debris management that minimises rabbit harbour while retaining habitat for existing species.
Regeneration and revegetation. results are better understood in the context of changing climate.	• Establish database for revegetation and regeneration. • Develop communication tools to convey learnings and conservation outcomes. • Monitor, review and evaluate revegetation and regeneration strategies.
All species are reproducing in the wild.	• Monitor recruitment in the wild.
The composition of the soil seedbank is restored. Habitat elements such as hollows and woody perennials are maintained or restored.	

Control introduced predators to support resilient populations of native fauna

The control of introduced predators (foxes and feral cats) will support the persistence and abundance of predator-prone native animals. It may also enable animals to move through the landscape and colonise suitable habitat as it becomes available in response to seasonal and disturbance events.

The Mallee Parks are very large and access into the remote areas is difficult. Although our knowledge of native species' habitat preferences and key locations is improving, much remains unknown. Understanding the key locations of threatened species populations that are vulnerable to predation, and targeting control to those areas is an important step in managing predation pressure. Understanding whether species are more at risk to predation during specific times (e.g. nesting or fledging) or after particular events (e.g. large-scale fires) will support more targeted, integrated and effective programs. These programs may include pulsed (short and regular) predator control after events such as fires.

Baiting can be an effective broad-scale technique for managing fox populations; shooting and trapping are useful complementary techniques at smaller scales. However, the vast remoteness of large areas of the Mallee Parks makes it difficult to implement landscape-scale programs. New techniques are needed to complement traditional methods and increase their effectiveness. Localised control for specific circumstances is the most implemented management strategy at present. Knowledge gaps about integrating feral cat control effectively with fox control, and the application of both in extensive remote landscapes, need to be resolved. Aerial baiting is a potential solution, but its feasibility and effectiveness need to be tested.

Feral cats have recently been declared as an established pest animal on specified Crown land under the *Catchment and Land Protection Act 1994* (Vic.). This will enable Parks Victoria to more effectively control predation pressure from feral cats at a landscape scale. The support and engagement of key agencies is needed to develop effective and humane approaches to feral cat control, including targeted baiting programs.

Integrated predator control programs need to consider where and when predators are most active, which may be influenced by seasonal factors or disturbances. These programs are therefore likely to require collaboration with other land managers in the region.

Predator control programs may also be integrated with other strategies that improve the structure and extent of suitable habitat for native fauna, e.g. fire management, semi-arid woodland restoration, and weed management.

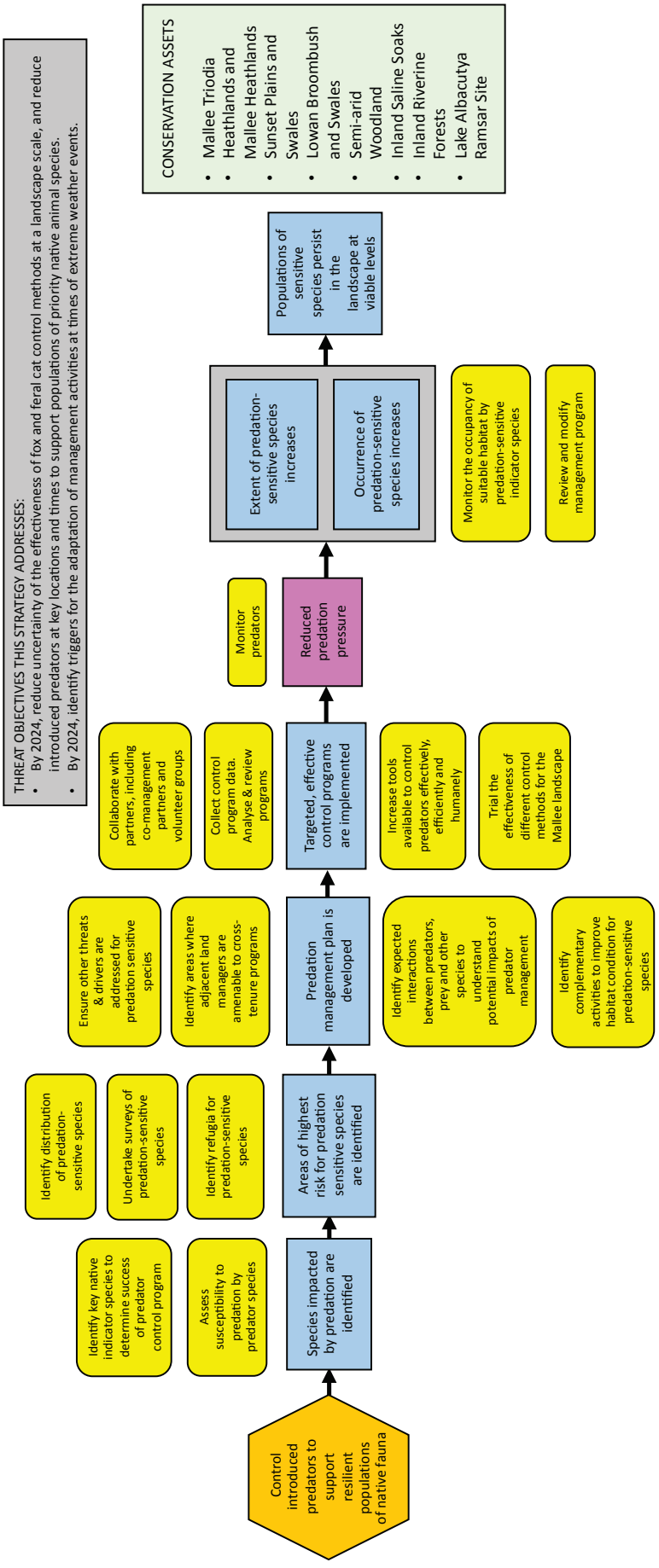
In some situations it may be necessary to establish exclusion fences around existing or reintroduced populations of vulnerable species, and then implement enhanced control programs within the exclusion area. A novel technique being investigated elsewhere is the deployment of artificial animal refuges after fire.

Monitoring the presence and abundance of foxes and feral cats is critical for regularly evaluating the effectiveness of the control program and the long-term success of this strategy. Other species (including potential prey and competitors) must also be monitored to assess impacts on the faunal community structure and food webs. Introduced predators may be more abundant and more effective hunters than their native counterparts, having moved into niches previously occupied by native predators. The activity of native predators such as goannas, snakes and raptors are important for the effective functioning of food webs. The Mallee Parks Landscape was once also home to predatory native mammals such as Western Quolls and Dingos, which would have exerted their own predation pressures. This is demonstrated by the wild dog population in Big Desert Wilderness Park and Wyperfeld National Park. Wild dogs have existed in the remote park areas for decades, yet are generally scarce and rarely seen. While their presence is perceived as a threat by some nearby private landholders with stock, it is believed their ecological effect is similar to that of Dingos in that they keep feral goat numbers low and deter foxes and feral cats.

Conservation outcomes

Predation-sensitive fauna will increase in distribution and occurrence at high-priority locations.

Results chain



Implementation milestones

Result	Activities
Species impacted by predation are identified.	• Identify key native indicator species to determine the success of the predator control program. • Assess susceptibility to predation by predator species, particularly cats and foxes.
Areas of highest risk for predation sensitive species are identified.	• Identify distribution of predation-sensitive species such as Malleefowl, Beaked Gecko, Ningaui and other small mammals and reptiles. • Undertake surveys of predation-sensitive species. • Identify refugia for predation-sensitive species.
Predation management plan is developed.	• Ensure other threats and drivers are addressed for predation-sensitive species. • Identify areas where adjacent land manager (private and public) are most amenable to cross-tenure programs. • Identify expected interactions between predators, prey and other species to understand potential impacts (including prey switching) and triggers for changes to management focus. • Identify complementary activities to improve habitat condition (weed control, corridors, restoration) and support predation sensitive species to persist.
Targeted, effective control programs are implemented.	• Collaborate with partners, Traditional Owners and volunteer groups. • Collect control program data. Analyse and review programs. • Increase tools available to control introduced predators effectively, efficiently and humanely. • Trial the effectiveness of different control methods, such as aerial baiting for foxes and feral cats.
Reduced predation pressure.	• Monitor foxes and feral cats.
Extent of predation-sensitive species increases. Occurrence of predation-sensitive species increases.	• Monitor the occupancy of suitable habitat by predation-sensitive indicator species. • Review and modify management program to best support the persistence of predation-sensitive species.
Populations of sensitive species persist in the landscape at viable levels	

Manage environmental weeds using a biosecurity approach

This strategy involves a range of actions for reducing the spread, establishment and impacts of non-native plants. The strategy focuses on species that have, or are likely to have, significant impacts on the health of conservation assets and ecological processes in the Mallee Parks Landscape.

A biosecurity approach to pest plant management is the Victorian Government standard for determining appropriate management interventions. There are four general management responses to controlling weeds: prevention, eradication, containment and asset protection (see Appendix D). The management responses to weeds in this strategy are based on their current extent and the level of risk they present to the Mallee Parks Landscape.

To reduce the potential spread and establishment of new and emerging weeds, sufficient resources are needed for surveillance and rapid response. The most likely invasion points and pathways are often vehicle access and parking sites, as well as locations where incursions have been observed previously.

Weed species that are already established also need to be controlled or eradicated. A focus on species that alter ecological processes is likely to result in greater gains in the health of assets. Working with neighbouring land managers to control regulated weeds on private land will increase the effectiveness of this program.

Bushfires and planned burns can result in significant weed invasion. Incorporating weed management into fire management planning and practices by working with authorities, departments and contractors involved in fire management is an important part of integrated weed control across the Mallee Parks Landscape. Standards will be developed and adopted for best-practice hygiene procedures, techniques and equipment for Parks Victoria, DELWP and other fire management staff.

Weed management responses have been categorised using the groupings below.

Containable woody weeds

Woody weeds with a localised distribution are more likely to be controlled or eradicated from parks using manual removal or chemical applications (or both). African Boxthorn, Peppercorn Trees and cacti are some of the species included in this category. Here, the asset protection approach outlined below is appropriate. Effective control and localised eradication where feasible will contain the impacts of this group of weeds.

New and emerging weeds

For weeds at the early stages of invasion, initial control and surveillance are priorities. The objective of control is generally eradication of new populations to limit the potential for establishment. The process of addressing new and emerging weed threats should follow the following six steps outlined in the Weeds at the Early Stages of Invasion framework (Blood et al. 2019).

1 Search and detect.
2 Name and notify.
3 Assess the risk.
4 Delimit the invasion.
5 Decide the response.
6 Implement eradication.

Three significant new and emerging weeds are Buffel Grass (invading from the north and west); Boneseed, which could invade if water flowed from Lake Hindmarsh to Lake Albacutya; and Gazania, which is becoming established in Hattah–Kulkyne National Park. Eradication is the recommended objective for this group of weeds.

Weeds of disturbed areas

A range of herbaceous weeds associated with agriculture can also be significant weeds of parks and reserves. High densities of these weeds are generally associated with areas of higher disturbance, such as roadsides, camping areas, and park boundaries adjoining agricultural land. Prioritising weed control in areas with higher levels of disturbance will reduce the spread of these species. The objective is to contain weeds of disturbed areas through control along roadsides and within areas of higher disturbance (e.g. visitor areas and boundaries). Species in this group include Paterson's Curse, Caltrop, Bathurst Burr, Paddy Melon and Camel Melon.

Priority established weeds for asset protection

A range of weeds are well established and widespread in the Mallee Parks Landscape. Eradication or containment of these species across the landscape is unlikely without the development of novel control agents or methods. The management of these species is therefore generally limited to reducing their impact on high-priority assets. Species in this group include Horehound, Ward's Weed, Bridal Creeper and African Love-grass.

Because widespread control of these species across the Mallee Parks Landscape is not feasible at present, control to reduce their abundance and to prevent invasion into priority areas is the objective for these species.

Biological control options

In the past, a range of biological control options have been applied to the landscape in an effort to control significant weed species. Biological controls have generally resulted in a reduction in target weed species, but long term decrease in weed populations have often been unsuccessful. The persistence of biological control agents is often limited, with reintroduction required for ongoing results. Working closely with Agriculture Victoria to help reintroduce persistent biological control agents may prove an effective control option for widespread, established weeds. Ongoing biological control options may be effective on weed species such as Bridal creeper, Paterson's Curse, *Opuntia* species (e.g. Prickly Pear), and Horehound.

The objective for this group of weeds is containment and asset protection across the Mallee Parks Landscape.

Table 7.3 Priority species, locations and management targets for weeds.

Species and risk rating*	Invasion pathway	Priority areas	Management approach
NEW AND EMERGING WEEDS			
Buffel Grass Very High	From major highway roadsides: Sturt Hwy, Mallee Hwy and other main roads	All assets.	Watch and hygiene, especially during and after fire events. Maintain communication with VicRoads.
Gazania Very High	Widespread in the agricultural landscape. Seed blows in, or is carried in by animals	Northern Mallee only: minor infestation in Hattah–Kulkyne NP and Annuello FFR, particularly interface of Semi-arid woodlands.	Watch and locally eradicate, removal by hand.
African Boneseed High	Transfer along waterways	Northern Mallee: small patch in Werrimull BR. Southern Mallee: Lake Albacutya Ramsar Site (not yet present), small patch in Birdcage FFR with small number of plants in the creekbed, small patches in Kangaroo Tank BR and Yetmans FFR. Eradicated several years ago from Timberoo BR.	Post-flood watch at Albacutya and Birdcage, surveillance and remove by hand as necessary at Werrimull BR, containment to reserves and eradication over time.
CONTAINABLE WOODY WEEDS			
Hudson's Pear High	Localised area in adjoining reserve and along entrance road	Northern Mallee: Natya BR, Hattah–Kulkyne NP roadsides (has been eradicated, but watching). Southern Mallee: Gunners BR.	Hygiene, watch and locally eradicate. Containment and eradication over time.
African Box-thorn High	Along tracks, throughout private land	Northern Mallee: Scattered isolated plants in Murray–Sunset NP (NE section: Nowingi Line and Boundary Tracks), Hattah– Kulkyne NP, and throughout many smaller reserves (more than parks). Southern Mallee: Scattered isolated plants in Lake Albacutya Park and throughout many smaller reserves (more than parks).	Search and locally eradicate.
Pepper Tree Very High	Escaped ornamental	Northern Mallee: scattered plants at old homestead sites. Southern Mallee: Scattered isolated plants in LAP, scattered elsewhere at old homesteads sites.	Low priority; locally eradicate small plants.
Opuntia sp. (prickly pears) Very High		Northern Mallee: small isolated populations throughout Hattah–Kulkyne NP. Southern Mallee: Wyperfeld NP — scattered plants along Outlet Creek to Albacutya and Leg of Mutton (Inland Riverine Forest asset), small areas around edges of many reserves. Northern Murray Grasslands: Wood Wood FFR.	Search and contain spread with physical removal or spraying in Hattah–Kulkyne NP and WNP. Containment and locally eradicate over time, especially in reserves.

Species and risk rating*	Invasion pathway	Priority areas	Management approach
Wheel Cactus High		Northern Mallee: Hattah–Kulkyne NP (eradicated), scattered plants in few reserves. Southern Mallee: scattered plants in few reserves.	Contain and locally eradicate over time.
Century Plant High	Escaped ornamental	Northern Mallee: small isolated patches in few reserves. Southern Mallee: small isolated patches in few reserves.	Eradicate when found.
Wild Tobacco		Northern Mallee only: Murray–Sunset NP and Hattah–Kulkyne NP in box woodlands and on copi rises.	Contain and locally eradicate where possible.
WEEDS OF DISTURBED AREAS			
Bathurst Burr Medium	Widespread in the agricultural landscape	Southern Mallee only: small isolated populations in disturbed areas bordering agricultural areas in Lake Albacutya Park.	Watch, contain and physically remove and locally eradicate over time.
Caltrop Medium	Widespread in the agricultural landscape, tracks and boundaries, especially after summer rains	Northern Mallee: widespread in localised areas in Murray–Sunset NP, Hattah–Kulkyne NP, and many reserves, particularly in woodlands and disturbed areas. Southern Mallee: widespread in localised areas in Murray–Sunset NP, Wyperfeld NP, Lake Albacutya Park, and many reserves, particularly in woodlands and disturbed areas.	Particularly after summer rain, contain spread and limit infestations to roads and tracks.
Spiny Emex / Three-corner Jack High	Spread along tracks	Northern Mallee only: Minor localised infestations in Hattah–Kulkyne KNP along roads and tracks, Murray–Sunset NP (Pink Lakes campground).	Contain spread and limit infestations to roads and tracks.
Paddy and Camel Melons Medium	Widespread in the agricultural landscape, via tracks.	Northern Mallee: Scattered infestations along boundaries and tracks, and in campgrounds in Murray–Sunset NP, particularly disturbed areas and semi-arid woodlands. Southern Mallee: Scattered infestations along boundaries and tracks, and in campgrounds in Wyperfeld NP, Lake Albacutya Park, Wathe FFR and Murray–Sunset NP, particularly disturbed areas and semi-arid woodlands.	Contain spread and limit infestations to roads and tracks, and campgrounds.
Two-leaf Cape-tulip Moderately High	Reserve to south of Lake Albacutya Park.	Southern Mallee only: Scattered small isolated patches along Outlet Creek, Albacutya Reserve (Bullocks Bottom), Rainbow Common.	Watch and locally eradicate over time.
Crown Beard Medium		Northern Mallee only: localised minor infestations in Hattah–Kulkyne NP, scattered between lake margins, box and mallee interface.	Containment, spray before goes to seed or manually remove.

Species and risk rating*	Invasion pathway	Priority areas	Management approach
Hairy Fiddle-neck/ Yellow Burweed Medium	Widespread in the agricultural landscape.	Northern Mallee: localised minor infestation in Hattah–Kulkyne NP (although not seen in recent years due to seasonal conditions). Southern Mallee: Localised patches in Semi-arid Woodlands in Wyperfeld NP (Pine Plains).	Watch and locally eradicate.
Silver-leaf Nightshade Moderately High		Northern Mallee: Localised infestations along boundaries of Yarrara FFR. Southern Mallee: Localised infestations in fire breaks along Yarto BR and Wathe FFR boundaries.	Contain and locally eradicate.
Spiny Burr-grass High		Southern Mallee only: Minor localised infestations in fire breaks along Wyperfeld NP southern boundary, and Wathe FFR boundary.	Containment to fire breaks and fence lines.
Onion Weed Medium		Widespread in Semi-arid Woodlands of all parks.	Limited. Effective techniques are not available at the scale required.
Skeleton Weed Medium		Widespread in Semi-arid Woodlands of all parks.	Limited. Effective techniques are not available at the scale required.
Thistles		Scattered plants/infestations in Semi-arid Woodlands and along roadsides	Contain spread and limit infestations to roads and tracks.
Common Heliotrope (potato weed) Medium		Northern Mallee: Murray–Sunset NP, Hattah–Kulkyne NP and reserves, particularly in Semi-arid Woodlands, along roadsides, and disturbed areas. Southern Mallee: Murray–Sunset NP, Wyperfeld NP, Lake Albacutya Park and reserves, particularly in Semi-arid Woodlands, along roadsides, and disturbed areas.	Contain spread and limit infestations to roads and tracks.
Recurved Thorn-apple Medium		Northern Mallee only: Hattah–Kulkyne NP, particularly in semi-arid woodlands. Scattered patches but prolific after rains.	Contain spread using chemical treatment.
St Johns Wort		Northern Mallee only: Hattah–Kulkyne NP along two drainage lines.	Contain and locally eradicate using chemical treatment.

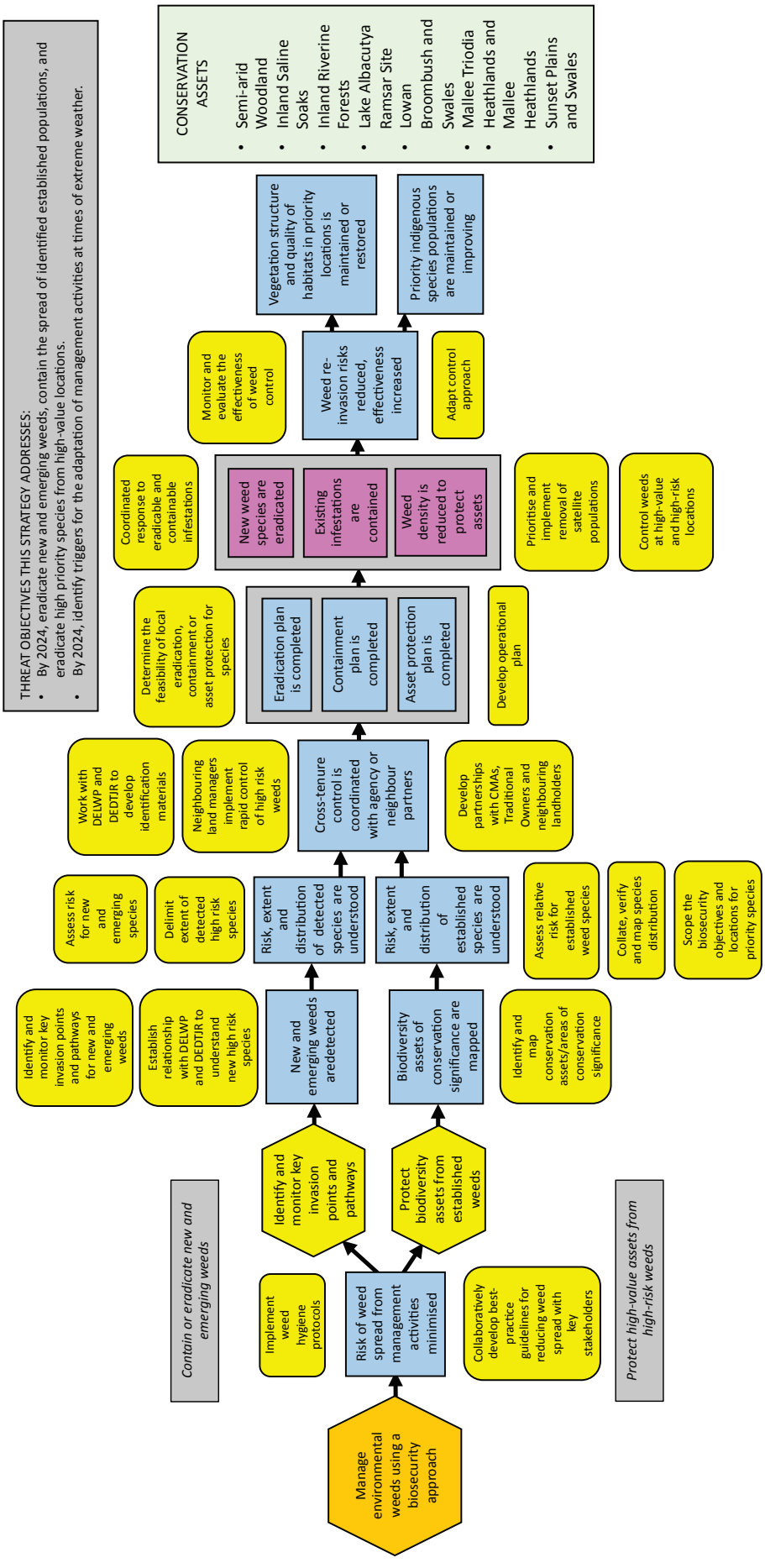
Species and risk rating*	Invasion pathway	Priority areas	Management approach
PRIORITY ESTABLISHED WEEDS			
Ward's Weed Very High	Widespread in the agricultural landscape	Northern Mallee only: widespread in north-west Murray–Sunset NP semi-arid woodlands.	Limited. Effective techniques are not available at the scale required.
Horehound High	Widespread in the agricultural landscape	Northern Mallee: localised infestations around visitor sites and tracks in Hattah–Kulkyne NP, Murray–Sunset NP, particularly in Semi-arid Woodlands. Southern Mallee: localised infestations around visitor sites and tracks in Murray–Sunset NP, Wyperfeld NP, Lake Albacutya Park, particularly in Semi-arid Woodlands and Inland Riverine Forests.	Contain or eradicate small infestations where possible. Contain to roads and tracks and other public use areas.
African Love-grass Very High	Control lines, roads, and disturbed areas	Southern Mallee only: small number of localised, scattered infestations along south-east Wyperfeld NP boundary.	Low priority; containment.
Paterson's Curse HIgh	Widespread in the agricultural landscape	Northern Mallee: large patches throughout Hattah–Kulkyne NP and Murray–Sunset NP in disturbed areas. Southern Mallee: large patches throughout Murray–Sunset NP, Wyperfeld NP and Lake Albacutya Park in disturbed areas. Muray–Sunset NP (Pink Lakes), three isolated patches treated annually.	Contain spread and limit infestations to roads and tracks.
Bridal Creeper High	Spread from private property/farms	Northern Mallee: small isolated populations in Hattah–Kulkyne NP and patches in many reserves and roadsides. Southern Mallee: small isolated populations in Wyperfeld NP (one section), Lake Albacutya Park, and patches in many reserves and roadsides.	Contain infestations and locally eradicate over time.

* White et al. (2018)

Conservation outcomes

In partnership with neighbouring land managers, priority weed species are effectively managed in partnership with neighbours to encourage species and structural diversity of native flora and habitats.

Results chain



Implementation milestones

Result	Actions
Risk of weed spread from management activities is minimised.	• Implement weed hygiene protocols. • Collaborate with DELWP, DEDJTR and other key stakeholders to develop best-practice guidelines for reducing the spread of weeds.
New and emerging weeds are detected.	• Identify and monitor key invasion points and pathways for new and emerging weeds. Priority local actions include monitoring roadside infestations of Buffel Grass, implementing vehicle hygiene protocols, and monitoring Boneseed invasion at Lake Albacutya after floods. • Work with DELWP and DEDJTR to understand new high-risk species, including pasture species.
Risk, extent and distribution of detected species are understood.	• Assess risks for new and emerging species using the biosecurity approach. • Delimit the extent of detected high-risk weed species within parks and reserves.
Biodiversity assets of conservation significance are mapped.	• Identify and map conservation assets and areas of conservation significance.
Risk, extent and distribution of established species are understood.	• Assess relative risks for established weed species. • Collate, verify and map the distributions of weed species. • Scope the biosecurity objectives and locations for priority species across the landscape.
Cross-tenure control is coordinated with agency or neighbour partners.	• Develop and maintain partnerships with CMAs, Traditional Owners and neighbouring land managers. • Work with DELWP and DEDJTR to develop weed identification materials, especially to help land managers identify young plants. • Work with neighbouring land managers to quickly control established and new and emerging high-risk weeds.
Eradication plan is completed. Containment plan is completed. Asset protection plan is completed.	• Determine the feasibility of eradication, containment or asset. protection objectives for species and sites. • Develop operational plans, including local eradication plans for African Box-thorn and *Opuntia* species, asset protection plans for priority established weeds, including Horehound and Wards weed. Work with park neighbours to develop containment plans.
New weed species are eradicated. Existing infestations are contained. Weed density is reduced to protect assets.	• Carry out a coordinated, cross-tenure response to eradicable and containable infestations. • Prioritise and implement the removal of satellite weed populations. • Control weeds at high-value and high-risk locations.
Weed reinvasion risks are reduced, and effectiveness of control is increased.	• Monitor and evaluate the effectiveness of weed control • Adapt control approach.
Vegetation structure and quality of habitat in priority locations is maintained or restored. Priority indigenous species populations are maintained.	

Reduce visitor impacts on natural and cultural assets

The Mallee Parks Landscape contains some of the most remote areas in Victoria. These vast areas of wilderness provide high-quality habitat and refuge for a suite of threatened plants and animals. Significant areas have been scheduled as Wilderness Park, Wilderness Zone, Remote and Natural Area, and Reference Area, in recognition of their natural values. In these areas, any management intervention is carefully considered to avoid or minimise environmental damage (including the choice and placement of machinery used in bushfire suppression and rehabilitation). The Annuello Remote and Natural Area was defined by the Wilderness Special Investigation (LCC 1991), but has not been scheduled under the National Parks Act. There are also over 300 reserves scattered throughout the Park Landscape, providing important areas of habitat and refuge for many native plant and animal species.

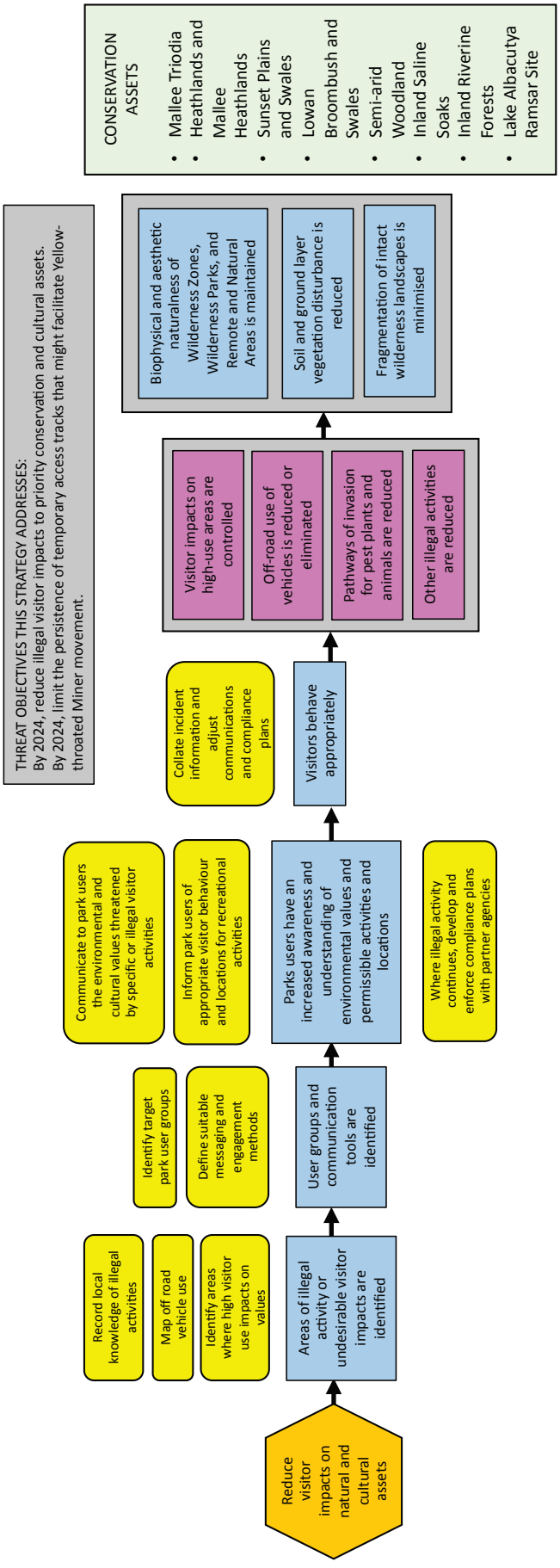
This strategy aims to retain the ecological and aesthetic naturalness of these areas in the face of pressure from park users. It addresses the impacts associated with illegal uses such as off-road driving, as well as concentrated legal behaviour that results in environmental impacts. The development of opportunities for visitor experience and recreation are managed through Parks Victoria's Visitor Experience Framework.

The strategy outlines a reactive management strategy that identifies where ongoing impacts threaten the broader integrity of areas. At these locations Parks Victoria will work to reduce identified threats by developing communication tools and strategies to increase awareness of understanding of the environmental values and permissible activities and locations. Where necessary Parks Victoria will work with other enforcement agencies (e.g. DELWP and Victoria Police) to enforce park regulations in areas of high infringement.

Conservation outcomes

The biophysical and aesthetic naturalness will be maintained by minimising illegal activities that disrupt the soil and ground layer and fragment wilderness.

Results chain



Implementation milestones

Result	Activities
Areas of illegal activity or undesirable visitor impacts are identified.	• Map off-road vehicle use. • Record local knowledge of illegal activities, e.g. wildlife poaching, rubbish dumping, etc. • Identify areas where high visitor use impacts values.
User groups and communication are tools identified.	• Identify target groups, appropriate messaging and engagement methods. • Define suitable messaging and engagement methods.
Parks users have an increased awareness and understanding of environmental values and permissible activities and locations.	• Communicate to park users the environmental and cultural values threatened by specific or illegal visitor activities using appropriate tools (e.g. park information brochures, signage), including the special role of Wilderness Zones and Remote and Natural Areas. • Inform park users of appropriate visitor behaviour and locations for off-road driving and other recreational activities, including alternative locations. • Where illegal activity continues, develop and enforce compliance plans with partner agencies (DELWP and Victoria Police).
Visitors behave appropriately.	• Collect incident information and adjust communications and compliance plans. • Change permissible activities in consultation with community and stakeholders, e.g. addressing firewood collection at Albacutya/outlet creek.
Visitor impacts on high-use areas are controlled. Off-road use of vehicles off-road is reduced or eliminated. Pathways of invasion for pest plants and animals are reduced. Other illegal activities are reduced.	
Biophysical and aesthetic naturalness of Wilderness Zones, Wilderness Parks, and Remote and Natural Areas is maintained. Soil and ground layer vegetation disturbance is reduced. Fragmentation of intact wilderness landscapes is minimised.	

Reintroduce locally extinct fauna

In some circumstances, species with small home ranges or sedentary behaviours might not readily recolonise suitable habitat as it develops bushfires. Capture and translocation might be necessary if the distances between suitable habitat exceeds the dispersal capacity, or if historical habitat connectivity is compromised by highly modified private land. For example, in the early 2000s Black-eared Miners were translocated from healthy populations in South Australia to supplement populations in Murray–Sunset and Hattah–Kulkyne National Parks. These birds became established in the local populations, and their offspring are part of the Victorian mallee bird community today.

In 2018 Mallee Emu-wren birds were translocated from the Victorian Mallee to Ngarkat Conservation Park in South Australia, because large bushfires in 2014 had wiped out the remaining South Australian populations and other populations were too far away for natural recolonisation. These activities are proposed and prioritised through conservation planning processes led by other organisations, including threatened species recovery plans and Birdlife Australia's Threatened Mallee Birds Conservation Action Plan (Boulton and Lau 2015).

Since European settlement, animals such as the Brush-tailed Bettong, Bolam's Mouse, Greater Bilby, Bridled Nail-tail Wallaby, Western Quoll and Western Whipbird have become locally extinct in the Mallee Parks Landscape. Habitat loss, competition from introduced herbivores, predation pressure from introduced predators, and changes to climate, water and fire regimes have all contributed to this loss. The purpose of this strategy is to investigate reintroducing these species into the Park Landscape, with the long-term vision for self-sustaining populations.

The aim of restoring the Semi-arid Woodlands includes the return of locally extinct fauna, such as bettongs, bilbies and the Western Quoll. Their return is likely to benefit the local ecology by re-establishing native diggers, seed dispersers, fungivores and predators.

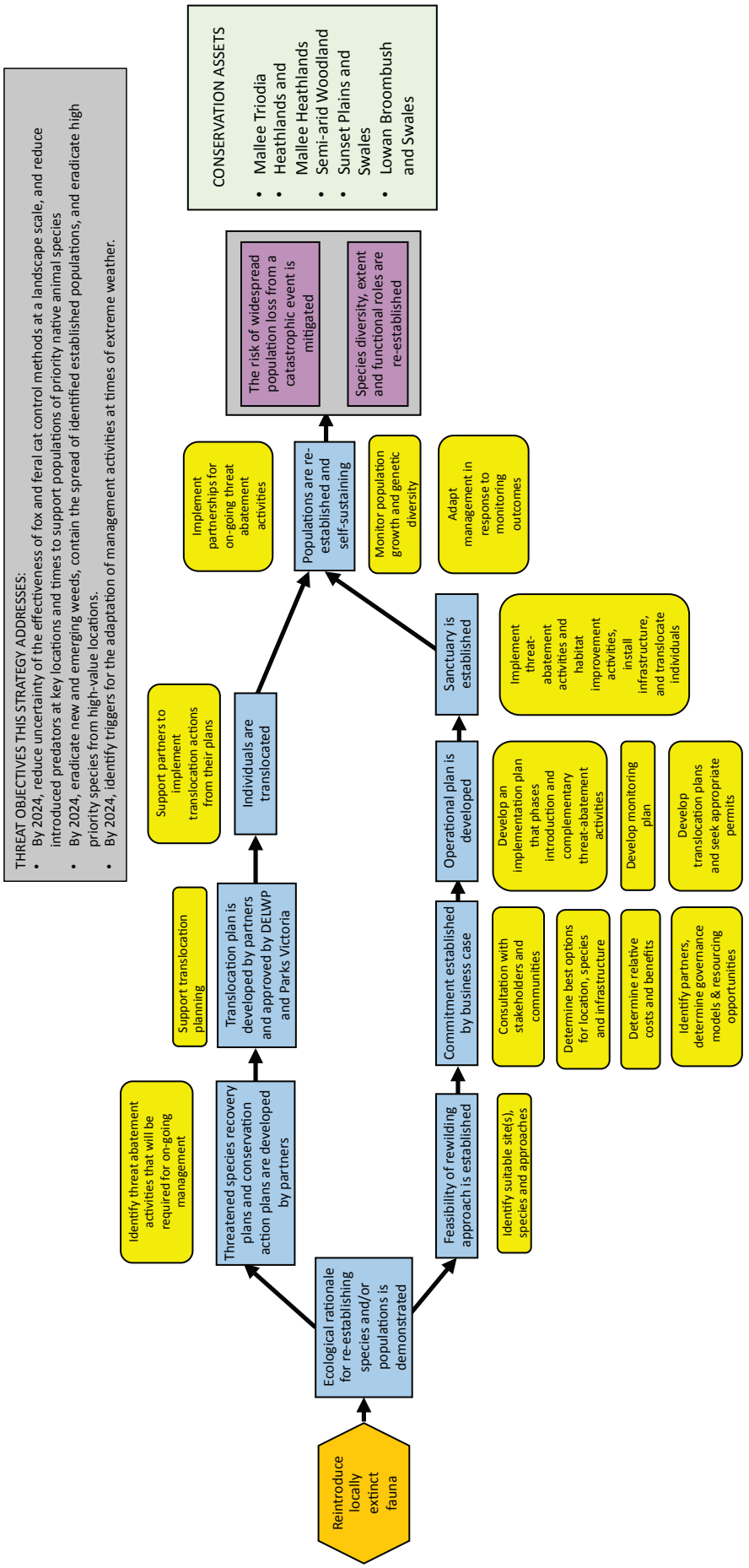
This type of ecological restoration project is a long-term endeavour, involving a high standard of predator control within a fenced enclosure and a staged translocation of species. Such an enclosure would serve as a demonstration site for the restoration of Semi-arid Woodlands of the Mallee Parks. It requires initial approval from DELWP and a long-term commitment of resources, establishing partnerships and governance models, detailed planning and design for infrastructure, habitat restoration and species management, and a better understanding of ecological processes in the landscape, such as nutrient cycling and food webs. The aim should be to establish self-sustaining animal populations that do not require further intensive intervention.

Conservation outcomes

Ensure the survival of locally threatened species, and reintroduce locally extinct species to restore ecological processes, including soil disturbance (digging, burrowing), seed and fungi dispersal, and predation by native animals.

Mallee Emu-wren

Results chain



Implementation milestones

Result	Activities
Ecological rationale for re-establishing species and/or populations is demonstrated	
Threatened species recovery plans and conservation action plans are developed by partners	Identify threat abatement activities that will be required for ongoing management of newly established populations.
Translocation plan is developed by partners and approved by DELWP and Parks Victoria	Support translocation planning.
Individuals are translocated	Support partners to implement translocation actions from their plans.
Feasibility of rewilding approach is established	Identify suitable sites, species and approaches.
Commitment established by business case	Consultation with stakeholders, Traditional Owners, and communities. Determine best options for location, species and infrastructure. Determine relative costs and benefits. Identify partners, determine governance models and resourcing opportunities.
Operational plan is developed	Develop an implementation plan that phases introduction and complementary threat-abatement activities. Develop monitoring plan. Develop translocation plans and seek permits.
Sanctuary is established	Implement threat-abatement and habitat improvement activities, install infrastructure, and translocate individuals.
Populations are re-established and self-sustaining	Monitor population growth and genetic diversity. Adapt management in response to monitoring outcomes.
Risk of widespread population loss from a catastrophic event is mitigated Species diversity, extent and functional roles are re-established	

Coral Snake

8 Measuring performance

Monitoring, evaluation and reporting allows Parks Victoria to quantify the effectiveness of implementing the prioritised conservation strategies, and supports continuous improvement through value-based and evidence-informed decision-making.

Measuring performance in conservation action planning involves the assessment of the effects of management actions in relation to the desired state of key ecological attributes and conservation assets. In developing an effective Conservation Action Plan, agreeing on what will be measured and how measurement will be made before works are implemented is a critical step. Performance measures enable an integrated assessment of:

- the quantity and quality of management actions (activity measures)
- the impacts of an activity on threats (threat measures)
- the results of management on the conservation asset (outcome measures).

The following performance measures, developed in collaboration with experts in this field, provide a useful starting point for developing a Monitoring, Evaluation and Reporting Plan for the Mallee Parks Landscape. This can be used to guide interim assessments of performance until a detailed plan is established.

Collaborate on Country with Traditional Owners, special interest groups and researchers

Implementing this strategy will improve the health of all conservation assets by forging and strengthening partnerships with groups that work to increase the health of the Mallee Parks Landscape.

Activity measures for the strategy are:

- number of partner groups contacted
- number of on-ground activities carried out with partner groups
- number of on-ground activities carried out with Traditional Owner groups
- number of research projects supported
- number of volunteer days spent undertaking park management
- number of community partners represented on project working groups.

Conservation outcomes of the strategy can be measured by:

- level of satisfaction with Parks environmental management
- longevity of cross tenure or community based environmental management programs .

Manage fire for healthy assets

Implementing this strategy will improve the health of all conservation assets by including ecological objectives in fire planning, preparedness, application, suppression and recovery.

Activity measures for the strategy are:

- map of fire history, tolerable fire intervals and vegetation growth-stages prepared
- effectiveness of liaison undertaken with DELWP on strategic fire plans and the joint fuel management program
- timeliness of bushfire recovery and rehabilitation programs.

The key threat managed under this strategy is inappropriate fire regimes and management, for which the following **threat measures** can be used:

- extent and timing of all planned burning and bushfires
- percentage of the Park Landscape burnt below the minimum tolerable fire intervals
- distribution of ecological growth stages of fire-prone ecosystems in the Park Landscape
- deviation from the ideal growth-stage distributions
- effectiveness (extent and type) of rehabilitation implemented after fire events
- loss of high-value locations of threatened or culturally important species.

Conservation outcomes of the strategy can be measured by:

- age-class structure of canopy species
- spatial and temporal vegetation growth stage structure
- vegetation species composition
- occurrence and diversity of ground-dwelling mammals
- occurrence and diversity of reptiles
- occurrence and diversity of bird assemblages.

Manage total grazing pressure

Implementing this strategy will improve the health of all conservation assets by managing animals that limit vegetation regeneration and affect vegetation structure by grazing and browsing.

Activity measures for the strategy are:

- extent and intensity of herbivore control
- extent of good neighbour rabbit projects
- number of volunteer group days
- frequency of communication to the public about control activities.

The key threats managed under this strategy are total grazing, browsing, trampling and wallowing, for which the following **threat measures** can be used:

- herbivore densities in high-value natural and cultural areas
- successful exclusion of rabbits and goats from critical cultural, regeneration and revegetation sites
- no new species established within the park landscape.

Conservation outcomes of the strategy can be measured by:

- successful recruitment and regeneration of native mid-storey and overstorey species
- projected crown cover of canopy species
- shrub and native ground cover species diversity
- vegetation life-stage distribution (cohorts)
- seedling survival and damage rates
- number of tree hollows occupied by breeding Major Mitchell's Cockatoos.

Restore the Semi-arid Woodlands

Implementing this strategy will improve the health of Semi-arid Woodlands by revegetating lost habitat elements and reducing predation pressure on regenerating vegetation.

Activity measures for the strategy are:

- the preparation of a strategic revegetation and restoration plan
- extent of replanting projects
- number of joint revegetation projects
- number of volunteer days.

The key threats managed under this strategy are total grazing, browsing, trampling and wallowing, and historic natural resource extraction (and the legacy of seed bank depletion), for which the following **threat measures** can be used:

- extent and composition of successful revegetation and regeneration
- survival rate of plantings.

Conservation outcomes of the strategy can be measured by:

- successful recruitment and regeneration of native overstorey species
- projected canopy extent
- shrub diversity and native ground cover
- vegetation life stage
- composition of soil seedbank
- hollow count.

Control introduced predators to support resilient populations of native fauna

Implementing this strategy will improve the health of the all conservation assets by reducing predation pressure on native fauna.

Activity measures for the strategy are:

- extent, frequency and method of fox control (e.g. number of fox baits laid) in identified high-risk areas
- extent, frequency and method of cat control in identified high-risk areas.

The key threat managed under this strategy is predation, for which the following **threat measures** can be used:

- cat activity in identified high-risk areas
- fox activity in identified high-risk areas.

Conservation outcomes of the strategy can be measured by:

- population extent of predation-sensitive species
- population size of predation-sensitive species.

Manage environmental weeds using a biosecurity approach

Implementing this strategy will improve the health of all conservation assets by using a biosecurity approach to manage environmental weeds, reducing the modification of ecological systems caused by invasive plants.

Activity measures for the strategy are:

- surveillance for new and emerging weeds (area surveyed, person-days)
- treatment of new and emerging weeds (species, area treated, person-days)
- area of woody weeds treated (species, area treated, person-days)
- area of weeds of disturbed areas treated (species, area treated, person-days)
- area of priority established weeds treated (species, area treated, person-days)
- area of good neighbour weed projects
- plans developed for high-priority species.

The key threat managed under this strategy is weed invasion, for which the following **threat measures** can be used:

- number of new weed infestations identified
- number of newly identified weed infestation that are eradicated
- extent and cover of locally eradicable weeds
- extent and cover of weeds controlled for asset protection or containment.

Conservation outcomes of the strategy can be measured by:

- vegetation structure and composition at priority locations.

Reduce visitor impacts on natural and cultural assets

Implementing this strategy will improve the health of all conservation assets by using targeted communication and compliance to manage the impacts of visitors.

Activity measures for the strategy are:

- user groups and communications approaches identified and developed
- numbers of user groups targeted with relevant communications
- number of compliance operations.

The key threat managed under this strategy is habitat degradation, for which the following **threat measures** can be used:

- number of records of off-road vehicle use
- number of records of other illegal activities by park users (e.g. poaching of wildlife, rubbish dumping, firewood collection).

Conservation outcomes of the strategy can be measured by:

- number and length of informal tracks that continue to be used
- area damaged by cross-country off-road driving.

Reintroduce locally extinct fauna

Implementing this strategy will improve the health of all conservation assets by translocating threatened species, reintroducing locally extinct species and reinstating the ecological processes that threatened species perform.

Activity measures for the strategy are:

- suitable reintroduction site(s) identified
- business case prepared
- operational plan approved
- number of translocated individuals.

The key threats managed under this strategy is predation, for which the following **threat measures** can be used:

- the threat measures listed for introduced predator control, total grazing management, weed management, and fire management at fenced and unfenced sites.

Conservation outcomes of the strategy can be measured by:

- distribution and abundance of threatened or locally extinct species, or species performing specific functional roles, e.g. soil disturbance (digging, burrowing), seed and spore dispersal, and predation.

Chestnut Quail-thrush

9 Plan implementation

A Monitoring, Evaluation and Reporting Plan will be developed from the interim performance indicators in this Conservation Action Plan. It will include key evaluation questions, more specific monitoring questions, and appropriate metrics, measures and reporting standards. It will be a key component of adaptive management and a more outcomes-focused approach to managing for conservation in parks and reserves. Specifically, the Monitoring, Evaluation and Reporting Plan is essential for:

- determining whether the combined activities of the conservation strategies have been adequately implemented and whether they are resulting in achieving the desired conservation outcomes
- monitoring and demonstrating trends in the level of threat and the consequent condition of conservation assets
- evaluating the effectiveness and efficiency of resources invested in the Conservation Action Plan
- supporting the review and adaptation of conservation strategies.

The plan will address the collection, storage and collation of data as well as its analysis and interpretation. The analysis and interpretation of data is the cornerstone of applying a 'learning by doing' approach, in which knowledge gaps are identified and addressed through targeted scientific research. The evaluation of the Conservation Action Plan is an important step in documenting lessons learnt and communicating ideas around the improvement of policy, planning and management within Parks Victoria and to external audiences.

Steps 8, 9 and 10 of the 10-step process for conservation planning follow on from implementing the strategies outlined here, and are beyond the scope of this Conservation Action Plan. Steps 8 and 9 will be carried out at an operational level within Parks Victoria's Northern Region that has responsibility for the Mallee Parks Landscape. Step 10 will involve a review of the Conservation Action Plan in the light of what is learnt during implementation.

Step 8: Plan work

In planning the work program, prioritised conservation strategies will be converted into operational conservation projects in specific locations. Quality maps generated by Parks Victoria in the conservation action planning process are critical for planning on-ground conservation activities, targeting key threats to conservation assets. They provide a greater understanding of the potential spread or overlap of operational conservation activities physically and in terms of their geographic impact. They also support the detailed consideration of logistic issues including access, cultural heritage and areas of high visitation. Engaging with Traditional owners and investigating opportunities for collaboration will be investigated during this phase. During the organisation of work, local and organisation-wide resource allocation processes should be followed. Detailed project planning within the Parks Victoria North West District, Northern Rivers District, and Northern Region, including the refinement of resource requirements, will be undertaken using standard procedures.

Step 9: Implement operational plans

The Conservation Action Plan will be implemented by the Northern regional team, often in collaboration with Traditional Owners, other agencies, Friends groups and volunteers. Operational conservation activities will be implemented in accordance with relevant Parks Victoria policies and procedures and legislative obligations.

Step 10: Adapt the Conservation Action Plan and operational activities

In the context of adaptive management, the evaluation of the Conservation Action Plan is important in determining and communicating whether or not the conservation strategies and specific on- ground activities have abated threats and achieved the desired conservation outcomes. The Conservation Action Plan is not a static document. It will be revised in response to the outcomes of the Monitoring, Evaluation and Reporting Plan and in response to emerging issues. Revision of this Conservation Action Plan may lead to a restructure of conservation strategies, including the amendment of results chains and their underlying assumptions and a refinement of specific on- ground activities. The review and revision of the plan is likely to be undertaken in part through a small workshop process involving a similar representation of people involved in the development of the original plan.

Bandy Bandy

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Appendices

Appendix A: Protection categories

Levels of Protection (LoP) for natural values management

Levels of Protection is a tool to aid planning and resource allocation by placing individual parks in a statewide context. Parks have been classified (or grouped) according to composition and representation of attributes classified at the EVC and species scale (Table A.1). A key principle of the framework is that protected area planning is conducted in a bioregional context. The bioregional value, and hence management priority, of biodiversity attributes in parks and reserves has been assessed on the basis of:

- conserving the range of ecosystems and existing biotic diversity
- the occurrence of attributes that depend on a particular park for their security.

The Protected Areas Category System

The protected area management categories of the International Union for Conservation of Nature and Natural Resources (IUCN) classify protected areas according to their management objectives. The categories are recognised by international bodies such as the United Nations and by many national governments as the global standard for defining and recording protected areas, and as such are increasingly being incorporated into government legislation. For further information, see the IUCN website: http://www.iucn.org/theme/protected-areas/about/categories

Category Ia Strict Nature Reserve — strictly protected area set aside to protect biodiversity and also possibly geological/geomorphological features, where human visitation, use and impacts are strictly controlled and limited.

Category Ib Wilderness Area — usually large unmodified or slightly modified area, retaining its natural character and influence without permanent or significant human habitation.

Category II National Park — large natural or near natural area set aside to protect large-scale ecological processes, along with the complement of species and ecosystems characteristic of the area.

Category III Natural Monument or Feature — set aside to protect a specific natural monument, which can be a landform, sea mount, submarine cavern, geological feature such as a cave or even a living feature such as an ancient grove.

Category IV Habitat/Species Management Area — aims to protect particular species or habitats and management reflects this priority.

Category V Protected Landscape/ Seascape — protected area where the interaction of people and nature over time has produced an area of distinct character with significant, ecological, biological, cultural and scenic value.

Category VI Protected area with sustainable use of natural resources — conserves ecosystems and habitats together with associated cultural values and traditional natural resource management systems.

Table A.1 Park groups and their attributes.

Park group	General description of park group attributes
A1	All parks represent at least 2 bioregions. Parks generally greater than 10000 ha (up to 660 000 ha), all scheduled under the *National Parks Act*. Most parks very large or have contiguity with state forest areas (or both), and have very high area to boundary ratios. All have very high diversity in terms of both vegetation communities and species, & represent a high proportion of the bioregions species diversity (about 40–60%). Very large number of threatened species present and important for protecting a relatively high proportion of those species. Internal fragmentation is highly variable across the scale of these parks as is areas of highly disturbing previous land use.
A2	With Park Group A1, captures representation of all bioregions. Park size generally greater than 1000 ha (up to 21 600 ha), mostly parks scheduled under the *National Parks Act* but also includes high value nature conservation reserves. All have relatively high diversity in terms of both vegetation communities and species, and represent a high proportion of the bioregions species diversity (about 40–60%). Large number of threatened species present and important for protecting a relatively high proportion of those species. A greater degree of exposure to threatening processes at their edge (than A1), as well as from previous disturbing land uses.
A – Marine	Marine National Parks scheduled under the *National Parks Act*.
B	Represents full range of bioregions, except for 3 bioregions completely conserved within parks in A1 and A2. Park size ranges from 50 ha to 40 000 ha, majority of nature conservation reserves. Parks are protecting vegetation communities largely of moderate significance and well represented in the parks system. Parks have relatively lower species diversity, representing a moderate proportion of the bioregions species diversity (about 20–40%). Moderate number of threatened species present and important for protecting a small number of those species.
B – Marine	Marine Sanctuaries scheduled under the *National Parks Act*
C	Park size ranges from 1 ha to 142 300 ha, predominantly nature conservation reserves, with a small number of parks scheduled under the *National Parks Act* that have relatively low or common biodiversity values. Parks are protecting vegetation communities largely of low to moderate significance and that are well represented in the parks system. Generally, have moderate to high levels of internal fragmentation and adjacency to non-native vegetation. Parks have relatively lower species diversity, representing a moderate proportion of the bioregions species diversity (about 10–30%). Moderate but variable number of threatened species present and important for protecting a small number of those species.
D	Park sizes range from 10 ha to 15 000 ha, and are conservation reserves. Parks have relatively lower species diversity, representing a moderate proportion of the bioregions species diversity (about 2–15%). Relatively small number of threatened species present.
E	Generally have very low or nil recorded values of low biodiversity conservation significance.

Table A.2 List of parks and reserves in the Mallee Landscape

Note that Murray –Sunset and Hattah-Kulkyne National Parks are only partially covered by this Conservation Action Plan, although the hectares reflect the entire park. The ecosystems associated with the Murray River and its floodplains, and the Hattah Ramsar site, are covered by the River Red Gum Landscape Conservation Action Plan (in preparation).

PV area codes:
NM = Northern Mallee, SM = Southern Mallee, NMG = Northern Murray Grasslands, W = Wimmera

Reserve ID	Name	Area (ha)	Level of protection	PV area
National Parks – Schedule 2, National Parks Act				
3309	Wyperfeld National Park	359 966	A1	SM
3320	Murray–Sunset National Park (southern section)	349 124	A1	SM
3320	Murray–Sunset National Park (northern section)	259 910	A1	NM
3296	Hattah–Kulkyne National Park	50 060	A1	NM
National Parks – Schedule 2A, National Parks Act				
3322	Big Desert Wilderness Park	141 749	B	SM
National Parks – Schedule 3, National Parks Act				
3364	Lake Albacutya Park	8 334	A2	SM
3367	Murray–Kulkyne Park	777	B	NM
Nature Conservation Reserves – Flora and Fauna Reserves				
7	Annuello FFR	35 284	B	NM
37	Bronzewing FFR	12 369	B	SM
326	Wathe FFR	5 998	B	SM
253	Red Bluff FFR	3 840	C	SM
23	Birdcage FFR	2 643	C	SM
322	Wandown FFR	2 531	C	NM
150	Lake Timboram FFR	2,456	C	NMG
234	Paradise FFR	2 368	C	SM
352	Yarrara FFR	2 268	C	NM
291	Timberoo FFR	1 229	C	SM
301	Towan Plains FFR	1 181	C	NMG
168	Mallanbool FFR	517	C	NM
237	Dering FFR	362	C	SM
8	Moss Tank FFR	327	D	NM
76	Lianiduck FFR	307	D	NMG
226	Torrita FFR	252	D	SM
101	Turriff FFR	250	D	SM
52	Chillingollah FFR	244	D	NMG
235	Yetmans (Patchewollock) FFR	241	D	SM
172	Welshmans Plain FFR	234	D	SM
214	Bolton FFR	218	D	NM
75	Chinkapook FFR	204	D	NMG
329	Wemen FFR	202	D	NM
170	Manangatang (Lulla) FFR	200	D	NMG
319	Walpeup FFR	179	D	SM
323	Wangie FFR	175	E1	SM
148	Kulwin FFR	170	D	SM
74	Cocamba FFR	134	D	NMG
25	Dunstans FFR	127	D	SM
169	Meringur FR	98	D	NM
315	Waitchie FFR	97	E1	NMG
47	Cambacanya FFR	95	E1	SM

Reserve ID	Name	Area (ha)	Level of protection	PV area
242	Wood Wood FFR	36	D	NMG
183	Mildura FFR	2	E1	NM
	Nature Conservation Reserves			
4026	Bell NCR	1 050	No Group	SM
4745	Menzies NCR	378	No Group	NM
392	Nurnurnemal NCR	251	E1	NM
4258	Cardross NCR	3	E2	NM
Nature Conservation Reserves – Flora Reserves				
143	Koonda FR	506	C	SM
173	Manya FR	465	D	SM
59	Murrayville FR	255	D	SM
26	Boinka FR	142	D	SM
96	Gnarr FR	122	D	SM
149	Kulwin FR	109	D	SM
64	Degraves Tank FR	108	D	NMG
355	Yatpool FR	33	D	NM
290	Tiega FR	24	E1	SM
300	Yarraby FR	23	E1	NMG
137	Kattyoong FR	16	E1	SM
133	Angels Rest FR	5	E1	SM
181	Merbein South FR	2	E1	NM
Nature Conservation Reserves – Wildlife Reserves (no hunting)				
506	Brimy Bill (5 Mile Lake) WR	235	D	NMG
544	Wangie WR	107	D	SM
507	Bulls Swamp WR	21	D	SM
Natural Features Reserves				
3680	Red Cliffs (Ovens Av) NFR	6	E2	NM
3734	Culgoa NFR	5	E1	SM
3694	Walpeup NFR	3	E1	SM
3681	Red Cliffs NFR	1	E2	NM
3686	Wilhelmina NFR	1	E2	SM
Natural Features Reserves – Bushland Reserves				
1294	Manya BR	851	D	SM
1162	Bronzewing BR	622	C	SM
1368	Morkalla – Red Cliffs Railway BR	565	D	NM
1229	Broken Bucket Tank BR	531	D	SM
1369	Dennying Channel BR	443	E1	SM
1302	Mamemgorook I236 BR	433	D	SM
1159	Yellimjip BR	368	C	SM
1184	Mittyack Prange Road BR	279	E1	SM
1321	Dattuck BR	276	E1	SM
1185	Wagant I129A BR	262	D	SM
1123	Tutye BR	233	D	SM
1098	Annuello BR	196	D	NM
1220	Balmers Tank BR	184	D	SM
1319	Baring I253 BR	181	E1	SM
1337	Bailey Plain BR	178	E1	NM
1348	Ryanby BR	166	D	NMG
1077	Paignie I23 BR	163	E1	SM
1194	Box Flat BR	161	D	NMG
1318	Baring I252 BR	160	D	SM
1060	Yatpool I6 BR	155	D	NM

Reserve ID	Name	Area (ha)	Level of protection	PV area
1352	Wewin BR	150	E1	NMG
1173	Lackeys BR	145	D	SM
1126	Mamengoroock I72 BR	144	D	SM
1121	Cowangie BR	142	D	SM
1164	Woornack I110 BR	142	D	SM
1293	Nowingi BR	138	E1	NM
1317	Frasers BR	138	E1	SM
1232	Albacutya I171 BR	133	D	SM
1122	Drendles BR	122	E1	SM
1107	Bransons BR	114	E1	NM
1153	Gunners Tank BR	112	D	SM
1240	Bellevue Tank BR	112	D	SM
1276	Yaapeet BR	112	D	SM
1297	Murrayville BR	105	E1	SM
1105	Kulwyne Swamp BR	102	E1	NM
1115	Underbool I61 BR	98	D	SM
1343	Soaks BR	98	D	NMG
1167	Baring I113 BR	97	D	SM
1176	Whitehorse BR	96	D	SM
1152	Daalko BR	92	E1	SM
1111	Duddo BR	87	E1	SM
1114	Purnya BR	86	E1	SM
1336	Ryans BR	85	D	NM
1132	Walpeup I78 BR	84	E1	SM
1207	Pooks BR	84	E1	SM
1171	Hynams BR	83	E1	SM
1130	Kattyoong BR	80	E1	SM
1113	Boinka BR	79	D	SM
1133	Carters Tank BR	79	D	SM
1280	Werrimull BR	79	E1	NM
1279	Karween BR	78	E1	NM
1134	Tiega I80 BR	78	D	SM
1192	Eureka West BR	78	E1	NMG
1102	Kodoonong BR	76	D	NM
1136	Ouyen I82 BR	76	E1	SM
1183	Mittyack Blue Hills BR	73	E1	SM
1078	Tiega I24 BR	72	E1	SM
1117	Danyo I63 BR	72	D	SM
1187	Leitpar BR	69	E1	SM
1141	Underbool I87 BR	67	E1	SM
1062	Carwarp BR	67	D	NM
1209	Chillingollah BR	67	E1	NMG
1166	Baring I112 BR	66	E1	SM
1370	Piangil – Yungera Railway BR	63	E1	NM
1120	Cowangie Railway BR	61	E1	SM
1353	Lang Plain BR	61	E1	SM
1222	Stony Plain BR	61	E1	SM
1201	Clarks Tank BR	61	E1	NMG
1303	Gnarr I237 BR	60	E1	SM
1061	Yatpool Tank BR	59	D	NM
1145	Harrisons Basin BR	57	E1	SM
1182	Yarto BR	56	E1	SM

Reserve ID	Name	Area (ha)	Level of protection	PV area
1278	Morkala BR	56	D	NM
1180	Speed BR	54	D	SM
1076	Nulkwyne I22 BR	54	E1	SM
1087	Kia I33 BR	53	E1	SM
1218	Burupga BR	53	E1	SM
1157	Walpeup I103 BR	52	D	SM
1056	Bambill BR	51	E1	NM
1281	Merrinee BR	51	E1	NM
1292	Nurnurnemal BR	50	E1	NM
1144	Underbool BR	49	E1	SM
1091	Wagant I37 BR	49	D	NM
1284	Benetook BR	48	E1	NM
1142	Kangaroo Tank BR	48	D	SM
1080	Nulkwyne I26 BR	47	E1	SM
1210	Turoar I150 BR	46	E1	NMG
1283	Pirlta BR	46	E1	NM
1211	Waitchie Tank BR	44	E1	NMG
1202	Towan BR	44	E1	NMG
1079	Nulkwyne I25 BR	44	E1	SM
1155	Walpeup I101 BR	43	E1	SM
1158	O'Shannessy BR	42	D	SM
1314	Pirro BR	41	E1	SM
1058	Ginquam I4 BR	41	E1	NM
1148	Blue Mountain BR	41	E1	SM
1170	Patchewollock North BR	40	E1	SM
1154	Robinsons Tank BR	40	D	SM
1119	Danyo I65 BR	40	E1	SM
1075	Wymlet I21 BR	40	E1	SM
1063	Carwarp West I9 BR	39	D	NM
1118	Danyo I64 BR	39	E1	SM
1252	Marlbed I191 BR	39	D	SM
1307	Wymlet I241 BR	39	E1	SM
1088	Ouyen I34 BR	37	D	NM
1583	Plants BR	35	E1	NMG
1196	Kookoombo West BR	35	E1	NMG
1195	Chinkapook North BR	35	E1	NMG
1147	Hopkins Tank BR	35	E1	SM
1064	Yatpool I10 BR	34	E1	NM
1217	Bourka I156 BR	32	E1	SM
1108	Possum Flat BR	31	E1	NM
1346	Lake Wahpool West BR	31	E1	SM
1109	Natya BR	31	E1	NM
1169	McLeans BR	31	E1	SM
1156	Symes BR	30	D	SM
1257	Torneys Tank BR	30	D	SM
1085	Kia I31 BR	30	E1	SM
1151	Woornack I97 BR	30	D	SM
1083	Nulkwyne I29 BR	29	E1	SM
1172	Sparas BR	28	E1	SM
1095	Yungera BR	27	E1	NM
1090	Burnell I36 BR	26	E1	NM
1301	Linga BR	25	E1	SM

Reserve ID	Name	Area (ha)	Level of protection	PV area
1193	Christmas Tank BR	25	E1	NMG
1137	Ouyen I83 BR	24	D	NM
1371	Mildura I220A BR	24	E1	NM
1139	Ouyen I85 BR	24	E2	SM
1255	Karyrie I194 BR	24	D	SM
1127	Mamengoroock I73 BR	24	E1	SM
1057	Karawinna BR	24	E1	NM
1334	Larundel I268 BR	24	E1	NMG
1112	Pallarang BR	23	E1	SM
1212	Polisbet BR	22	E1	NMG
1197	Prooinga School BR	21	E1	NMG
1341	Mittyack BR	21	E1	SM
1320	Dering I254 BR	21	E1	SM
1190	Daytrap BR	21	E1	NMG
1074	Wymlet I20 BR	21	E1	SM
1208	Timboram West Tank BR	21	E1	NMG
1165	Baring North I111 BR	20	E1	SM
1308	Kia I242 BR	20	E1	NM
1233	Cookies Plain BR	20	E1	SM
1181	Turriff East School BR	20	E1	SM
1179	Turriff West School BR	20	E1	SM
1315	McBains BR	20	E1	SM
1316	Lads Tank BR	20	D	SM
1188	Gerahmin BR	20	E1	NMG
1084	Nulkwyne I30 BR	20	E1	SM
1243	Berriwillock BR	20	E1	SM
1199	Beabush Tank BR	20	E1	NMG
1146	Pidgeon Tank BR	18	E1	SM
1168	Spindles BR	18	E1	SM
1309	Kiamal BR	18	E1	NM
1198	Piangil West BR	17	E1	NMG
1071	Gayfield BR	17	E1	NM
1355	Goschen BR	17	E1	NMG
1072	Mamengoroock I18 BR	17	D	SM
1213	Bulgei BR	17	E1	NMG
1138	Wild Dogs Tank BR	16	E1	SM
1135	Tiega I81 BR	16	D	SM
1347	Chillingollah West BR	16	E1	SM
1186	Gerahmin North BR	16	E1	NMG
1364	Cokam BR	16	E1	SM
1150	Boulka I96 BR	15	E1	SM
1296	Carina BR	15	E1	SM
1104	Kulwin I50 BR	15	D	NM
1204	Turoar South BR	15	E1	NMG
1295	Panitya BR	15	E1	SM
1125	Underbool I71 BR	15	E1	SM
1239	Double Yards BR	15	D	SM
1110	Coonimur I56 BR	15	E1	NM
1149	Nunga BR	14	E1	SM
1312	Woornack I246 BR	14	E1	SM
1140	Boorongie BR	14	D	SM
1216	Wortongie BR	14	E1	SM

Reserve ID	Name	Area (ha)	Level of protection	PV area
1584	Wangie BR	14	E1	SM
1290	Carwarp West I224 BR	14	E1	NM
1221	Waitchie BR	14	E1	NMG
1101	Myall BR	13	E1	NM
1227	Magpie Tank BR	13	E1	NMG
3420	Patchewollock I117A BR	13	E1	SM
1189	Larundel I131A BR	13	E1	NMG
1363	Karyrie I297 BR	12	E1	SM
1143	Mossop BR	12	E1	SM
1106	Millers Tank BR	12	E1	NM
1298	Cowangie School BR	12	E1	SM
3285	Rainbow BR	12	E1	SM
1238	Chiprick I177 BR	12	E1	SM
1287	Mildura I221 BR	12	E1	NM
1246	Watchupga I185 BR	11	E1	SM
1331	Winnambool BR	11	E1	NM
1241	Banyan BR	11	E1	SM
1258	Carapugna BR	11	D	SM
1103	Bower Tank BR	11	E1	NM
1285	Merbein BR	11	E1	NM
1178	State Gully BR	11	D	SM
1174	Beer Can Corner BR	11	E1	SM
1160	Timberoo I106 BR	11	E1	SM
1089	Burnell I35 BR	10	E1	NM
1214	Bitchigal BR	10	E1	SM
1082	Tiega I28 BR	10	E1	SM
1219	Boigbeat I158 BR	10	E1	SM
1359	Woomelang BR	10	E2	SM
1163	Woornack I109 BR	10	D	SM
1059	Ginquam I5 BR	10	E2	NM
1242	Boigbeat Tank BR	10	E1	SM
1335	Manangatang BR	9	E1	NM
1362	Karyrie I296 BR	9	E1	SM
1260	White Gate BR	9	E1	NMG
1235	Carori I174 BR	9	E1	SM
1300	Linga School South BR	9	E1	SM
1067	Mildura I13 BR	8	E1	NM
1372	Kia I242A BR	8	E1	NM
1354	14 Mile BR	8	E1	NMG
1273	Kangaroo Dam BR	8	E1	NMG
1291	Boonoonar BR	7	E1	NM
1068	Mildura I14 BR	7	E1	NM
1129	Gnarr I75 BR	7	E1	SM
1585	Lake Danaher BR	7	E1	SM
1332	Bolton BR	7	E1	NM
1131	Paignie BR	7	E1	SM
1191	Grants BR	7	E1	NMG
1333	Larundel I267 BR	6	E1	NMG
1175	Watseys BR	6	E1	SM
1325	Gutcha BR	6	E2	SM
1161	Boulka I107 BR	6	E1	SM
1256	Nullawill West BR	6	E1	SM

Reserve ID	Name	Area (ha)	Level of protection	PV area
1066	Carwarp West I12 BR	5	D	NM
1311	Ouyen I245 BR	5	E1	SM
1926	Narraport BR	5	E1	SM
1305	Nyang I239 BR	5	E1	SM
1323	Albacutya I257 BR	4	E1	SM
1226	Company Dam BR	4	E1	NMG
1356	Clear Tank BR	4	E1	NMG
1177	Julians BR	4	E1	SM
1313	Woornack I247 BR	4	E1	SM
1349	Pira BR	4	E1	NMG
1224	Nowie BR	4	E1	NMG
1306	Galah BR	3	E1	SM
1244	Twin Dams BR	3	E1	SM
1236	Carori I175 BR	3	E1	SM
1324	Yaapeet I258 BR	3	E1	SM
1339	Miralie BR	2	E1	NMG
1200	Turoar I142 BR	2	E1	NMG
1096	Piambie BR	2	E1	NM
1234	Goyura BR	2	E1	SM
1299	Worooa BR	2	E1	SM
1340	Cocamba BR	2	E1	NMG
1237	Beulah BR	2	E1	SM
1304	Nyang I238 BR	2	E1	SM
3634	Eureka BR	2	E1	NMG
1310	Ouyen I244 BR	1	E2	SM
1326	Byanga BR	1	E2	SM
1289	Mildura I223 BR	1	E1	NM
1360	Watchupga I294 BR	1	E2	SM
1342	Eureka School BR	1	E1	NMG
1288	Mildura I222 BR	1	E2	NM
1344	Pier Millan BR	1	E1	SM
1345	Nandaly BR	1	E2	SM
1229	Broken Bucket Tank BR	0	D	W
Natural Features Reserves – Lake Reserves				
3120	Lake Wahpool LR	2 644	C	SM
3119	Lake Daytrap LR	103	D	NMG
3065	Tcham Lakes LR	98	C	SM
Natural Features Reserves – Streamside Reserves				
5026	Wimmera River Heritage Area Park	701	No Group	SM
2513	Tyrrell Creek SSR	14	E1	SM
Natural Features Reserves – Wildlife Reserve (State Game Reserve classification pending reservation)				
529	Lake Tyrrell WR	12 759	B	SM
Education Areas				
2600	Koorlong Education Area	660	No Group	NM
2598	Timberoo Education Area	322	No Group	SM
Other Reserves				
5044	Rainbow Depot	0	No Group	SM

Appendix B: Conservation assets

This appendix provides an overview of the area of ecosystems (aligned to EVDs and EVCs) within the Mallee Parks Landscape.

Ecological Vegetation Class	Ecological Vegetation Division	Bioregion	Bioregional Conservation Status	Total (ha)
MALLEE TRIODIA				
Loamy Sands Mallee	Hummock-grass Mallee	Lowan Mallee	Least Concern	244 988
		Murray Mallee	Least Concern	89 334
		Robinvale Plains	Least Concern	1235
Woorinen Sands Mallee	Hummock-grass Mallee	Lowan Mallee	Least Concern	62 240
		Murray Mallee	Depleted	120 124
		Robinvale Plains	Depleted	2 167
Total				**520 088**
HEATHLANDS AND MALLEE HEATHLANDS				
Dunefield Heathland	Heathland (sands)	Lowan Mallee	Least Concern	110 644
		Murray Mallee	Least Concern	25
Heathy Mallee	Lowan Mallee	Lowan Mallee	Least Concern	209 838
		Murray Mallee	Least Concern	257
		Wimmera	Least Concern	1
Lowan Sands Mallee	Lowan Mallee	Lowan Mallee	Least Concern	19 455
		Murray Mallee	Least Concern	18
Total				**340 237**
SUNSET PLAINS AND SWALES				
Chenopod Mallee	Saltbush Mallee	Lowan Mallee	Least Concern	17 964
		Murray Mallee	Vulnerable	21 696
		Robinvale Plains	Vulnerable	146
Parilla Mallee	Broombush Whipstick	Lowan Mallee	Endangered	443
		Murray Mallee	Endangered	7 185
Woorinen Mallee	Saltbush Mallee	Lowan Mallee	Least Concern	19 603
		Murray Mallee	Vulnerable	98 461
		Robinvale Plains	Vulnerable	642
Total				**166 140**
LOWAN BROOMBRUSH AND SWALES				
Red Swale Mallee	Broombush Whipstick	Lowan Mallee	Least Concern	28 958
		Murray Mallee	Least Concern	13
		Wimmera	Least Concern	0
Sandstone Ridge Shrubland	Broombush Whipstick	Lowan Mallee	Least Concern	54 758
		Murray Mallee	Least Concern	9 299
Shallow Sands Woodland	Heathland (sands)	Lowan Mallee	Depleted	1 344
		Murray Mallee	Endangered	0
Total				**94 372**

Ecological Vegetation Class	Ecological Vegetation Division	Bioregion	Bioregional Conservation Status	Total (ha)
SEMI-ARID WOODLANDS				
Low Rises Woodland	Dry Woodland (non-eucalypt)	Lowan Mallee	Endangered	2
		Murray Mallee	Endangered	143
Plains Grassland	Basalt Grassland	Lowan Mallee	Endangered	36
		Murray Mallee	Endangered	12
Plains Savannah	Dry Woodland (non-eucalypt)	Lowan Mallee	Endangered	57
		Murray Mallee	Endangered	122
Plains Woodland	Inland Plains Woodland	Lowan Mallee	Endangered	7
		Murray Mallee	Endangered	91
Ridged Plains Mallee	Inland Plains Woodland	Lowan Mallee	Endangered	500
		Murray Mallee	Endangered	833
		Robinvale Plains	Endangered	0
Semi-arid Chenopod Woodland	Dry Woodland (non-eucalypt)	Lowan Mallee	Vulnerable	14
		Murray Mallee	Vulnerable	5 536
		Murray Scroll Belt	Depleted	0
		Robinvale Plains	Vulnerable	9
Semi-arid Parilla Woodland	Dry Woodland (non-eucalypt)	Murray Mallee	Vulnerable	3 203
Semi-arid Woodland	Dry Woodland (non-eucalypt)	Lowan Mallee	Depleted	19 427
		Murray Mallee	Vulnerable	53 029
		Murray Scroll Belt	Vulnerable	0
		Robinvale Plains	Vulnerable	6 188
Total				**89 210**
INLAND SALINE SOAKS				
Chenopod Grassland	Alluvial Plains Grassland	Lowan Mallee	Depleted	4 362
		Murray Mallee	Endangered	320
Low Chenopod Shrubland	Chenopod Shrubland	Murray Mallee	Depleted	3354
Saline Lake Aggregate	Saline Wetland	Murray Mallee	Least Concern	11 216
Salt Paperbark Woodland/Samphire Shrubland Mosaic	Saline Wetland	Lowan Mallee	Vulnerable	477
Samphire Shrubland	Saline Wetland	Lowan Mallee	Least Concern	40
		Murray Mallee	Least Concern	13 823
Samphire Shrubland/Saline Lake Mosaic	Saline Wetland	Murray Mallee	Least Concern	2 108
Water body - salt	Saline Wetland	Lowan Mallee	Not Applicable	11
		Murray Mallee	Not Applicable	1 353
Total				**37 065**

Ecological Vegetation Class	Ecological Vegetation Division	Bioregion	Bioregional Conservation Status	Total (ha)
INLAND RIVERINE FORESTS				
Intermittent Swampy Woodland	Treed Swampy Woodland	Murray Mallee	Vulnerable	602
		Robinvale Plains	Depleted	44
Intermittent Swampy Woodland/Riverine Grassy Woodland Complex	Treed Swampy Woodland	Lowan Mallee	Vulnerable	794
		Murray Mallee	Vulnerable	1
Lake Bed Herbland	Freshwater Wetland (ephemeral)	Murray Mallee	Depleted	75
Lignum Swampy Woodland	Treed Swampy Woodland	Murray Mallee	Vulnerable	269
		Robinvale Plains	Depleted	99
Riparian Woodland	Riverine Woodland/Forest	Murray Mallee	Vulnerable	12
Riverine Chenopod Woodland	Riverine Woodland/Forest	Lowan Mallee	Depleted	3 046
		Murray Mallee	Depleted	1 526
		Murray Scroll Belt	Depleted	0
		Robinvale Plains	Depleted	166
Tea-tree Scrub	Heathland (sands)	Lowan Mallee	Least Concern	3 214
Total				**9 848**
LAKE ALBACUTYA RAMSAR SITE				
Intermittent Swampy Woodland	Treed Swampy Woodland	Lowan Mallee	Vulnerable	60
		Murray Mallee	Vulnerable	1 129
Intermittent Swampy Woodland/Riverine Grassy Woodland Complex	Treed Swampy Woodland	Murray Mallee	Vulnerable	2
Lake Bed Herbland	Freshwater Wetland (ephemeral)	Lowan Mallee	Depleted	6
		Murray Mallee	Depleted	3 766
Low Chenopod Shrubland	Chenopod Shrubland	Murray Mallee	Depleted	12
Low Rises Woodland	Dry Woodland (non-eucalypt)	Murray Mallee	Endangered	38
Parilla Mallee	Broombush Whipstick	Lowan Mallee	Endangered	1
		Murray Mallee	Endangered	105
Plains Grassland	Basalt Grassland	Murray Mallee	Endangered	2
Plains Savannah	Dry Woodland (non-eucalypt)	Murray Mallee	Endangered	3
Plains Woodland	Inland Plains Woodland	Murray Mallee	Endangered	0
Red Swale Mallee	Broombush Whipstick	Lowan Mallee	Least Concern	3
Ridged Plains Mallee	Inland Plains Woodland	Lowan Mallee	Endangered	0
		Murray Mallee	Endangered	24
Riparian Woodland	Riverine Woodland/Forest	Murray Mallee	Vulnerable	6
Riverine Chenopod Woodland	Riverine Woodland/Forest	Murray Mallee	Depleted	27
Sandstone Ridge Shrubland	Broombush Whipstick	Lowan Mallee	Least Concern	2
		Murray Mallee	Least Concern	17
Semi-arid Chenopod Woodland	Dry Woodland (non-eucalypt)	Murray Mallee	Vulnerable	21
Semi-arid Woodland	Dry Woodland (non-eucalypt)	Lowan Mallee	Depleted	2
		Murray Mallee	Vulnerable	66
Shallow Sands Woodland	Heathland (sands)	Lowan Mallee	Depleted	0
		Murray Mallee	Endangered	4
Woorinen Mallee	Saltbush Mallee	Murray Mallee	Vulnerable	1
Total				**5 300**

Appendix C: Scientific names of species mentioned in the plan

Common Name	Scientific Name
African Boxthorn	*Lycium ferocissimum*
African Love-grass	*Eragrostis curvula*
Australian Bustard	*Ardeotis australis*
Banded Stilt	*Cladorhynchus leucocephalus*
Bandy Bandy	*Vermicella annulata*
Bar-tailed Godwit	*Limosa lapponica*
Bardick	*Echiopsis curta*
Bathurst Burr	*Xanthium spinosum*
Bead Glasswort	*Tecticornia flabelliformis*
Beaked Gecko	*Rhynchoedura ornata*
Belah	*Casuarina pauper*
Brush-tailed Bettong (Woylie)	*Bettongia pensillata*
Burrowing Bettong (Boodie)	*Bettongia lesueur*
Greater Bilby	*Macrotis lagotis*
Black Box	*Eucalyptus largiflorens*
Black Swan	*Cygnus atratus*
Black-eared Miner	*Manorina melanotis*
Black-tailed Godwit	*Limosa limosa*
Blue Bonnet	*Northiella haematogaster*
Blue-billed Duck	*Oxyura australis*
Bolam's Mouse	*Pseudomys bolami*
Bridal Creeper	*Asparagus asparagoides*
Bridled Nail-tail Wallaby	*Onychogalea fraenata*
Brilliant Sunray	*Rhodanthe polygalifolia*
Broombush	*Melaleuca uncinata*
Brown Treecreeper	*Climacteris picumnus*
Brush-tailed Bettong	*Bettongia penicillata*
Brush-tailed Possum	*Trichosurus vulpecula*
Buffel Grass	*Cenchrus ciliaris*
Buloke	*Allocasuarina luehmannii*
Burrowing Bettong	*Bettongia lesueur*
Bush Stone-curlew	*Burhinus grallarius*
Caltrop	*Tribulus terrestris*
Carpet Python	*Morelia spilota*
Caspian Tern	*Hydroprogne caspia*
Cat	*Felis catus*
Cattle Bush	*Alectryon oleifolius* subsp. *canescens*
Century Plant	*Agave americana*
Chariot Wheels	*Maireana cheelii*
Chestnut Quail-thrush	*Cinclosoma castanotum*
Chestnut-crowned Babbler	*Pomatostomus ruficeps*
Club Spear-grass	*Austrostipa nullanulla*

Common Name	Scientific Name
Common Dunnart	*Sminthopsis murina*
Common Fringe-myrtle	*Calytrix tetragona*
Coral Snake	*Brachyurophis australis*
Crown beard	*Verbesina encelioides*
Curlew Sandpiper	*Calidris ferruginea*
Desert Baeckea	*Baekea crassifolia*
Desert Banksia	*Banksia ornata*
Desert Greenhood	*Pterostylis xerophila*
Desert Hakea	*Hakea mitchellii*
Desert Jasmine	*Jasminum didymum subsp. lineare*
Desert Stringy-bark	*Eucalyptus arenacea*
Diamond Firetail	*Stagonopleura guttata*
Dingo	*Canis lupus dingo*
Diosma Rice-flower	*Pimelea flava subsp. dichotoma*
Downy Swainson-pea	*Swainsona swainsonioides*
Dragon lizards	*Ctenophorus* species
Dumosa Mallee	*Eucalyptus dumosa*
Dunaliella salina	*Dunaliella salina*
Dwarf Sheoak	*Allocasuarina pusilla*
Dwarf Swainson-pea	*Swainsona phacoides*
Eastern Great Egret	*Ardea modesta*
European Hare	*Lepus europaeus*
European Rabbit	*Oryctolagus cuniculus*
Fallow Deer	*Dama dama*
Fine-hairy Spear-grass	*Austrostipa puberula*
Finger-leaved Daisy	*Brachyscome exilis*
Five-spined Saltbush	*Sclerolaena muricata*
Red Fox	*Vulpes vulpes*
Freckled Duck	*Stictonetta naevosa*
Freetail bat, eg. Southern free-tailed bat	*Mormopterus planiceps*
Galah	*Eolophus roseicapilla*
Gazania	*Gazania linearis*
Goat	*Capra aegagrus hircus*
Greater Bilby	*Macrotis lagotis*
Green Mallee Mantis	*Sphodropoda dentifrons*
Grey Mallee	*Eucalyptus socialis*
Grey Podolepis	*Podolepis canescens*
Grey Teal	*Anas gracilis*
Gull-billed Tern	*Gelochelidon nilotica*
Hairy Fiddle-neck	*Amsinckia calycina*
Heath Skink	*Egernia multiscutata*
Heath Tea-tree	*Leptospermum myrsinoides*
Common Heliotrope	*Heliotropium europaeum*

Common Name	Scientific Name
Hooded Robin	*Melanodryas cucullata*
Hop Bush	*Dodonaea viscosa*
Horehound	*Marrubium vulgare*
Hudsons Pear	*Cylindropuntia rosea*
Inland Pomaderris	*Pomaderris paniculosa*
Lace Monitor	*Varanus varius*
legless lizards	*Pygopodidae* species
Lined Earless Dragon	*Malurus leucopterus*
Little Corellas	*Cacatua sanguinea*
Little Forest Bat	*Vespadelus vulturnus*
Little Pied Bat	*Chalinolobus picatus*
Little Pygmy-possum	*Cercartetus lepidus*
Lowan Phebalium	*Phebalium lowanense*
Major Mitchell's Cockatoo	*Lophochroa leadbeateri*
Mallee Bitter-bush	*Adriana tomentosa* var. *hookeri*
Mallee Dragon	*Ctenophorus fordi*
Mallee Emu-wren	*Stipiturus mallee*
Mallee Hemichroa	*Hemichroa diandra*
Mallee Ningaui	*Ningaui yvonneae*
Mallee Striated Grass-wren	*Amytornis striatus striatus*
Mallee Tea-tree	*Leptospermum coriaceum*
Mallee Worm-lizard	*Aprasia aurita*
Malleefowl	*Leipoa ocellata*
Malta Thistle	*Centaurea melitensis*
Marsh Sandpiper	*Tringa stagnatilis*
Masters Snake	*Drysdalia mastersii*
Millewa Skink	*Hemiergis millewae*
Mitchell's Hopping-mouse	*Notomys mitchellii*
Mitchell's Short-tailed Snake	*Parasuta nigriceps*
Mulla Mulla	*Ptilotus exaltata*
Native Scurf-pea	*Cullen australasicum*
Nobbi Dragon	*Amphibolurus nobbi coggeri*
Norris's Dragon	*Amphibolurus norrisi*
Numbat	*Myrmecobius fasciatus*
Oil Mallee	*Eucalyptus oleosa*
Onion Weed	*Asphodelus fistulosus*
Paddy Melon	*Cucumis myriocarpus*
Painted Dragon	*Ctenophorus pictus*
Paterson's Curse	*Echium plantagineum*
Peppercorn Tree	*Schinus molle*
Peregrine Falcon	*Falco peregrinus*
Pig	*Sus scrofa*
Pink-nosed Worm-lizard	*Aprasia inaurita*

Common Name	Scientific Name
Purple Swainson-pea	*Swainsona purpurea*
Purple-gaped Honeyeater	*Lichenostomus cratitius*
Quandong	*Santalum acuminatum*
Rainbow Bee-eater	*Merops ornatus*
Recurved Thorn-apple	*Datura inoxia*
Red Kangaroo	*Macropus rufus*
Red-capped Plover	*Charadrius ruficapillus*
Red-kneed Dotteral	*Erythrogonys cinctus*
Red-lored Whistler	*Pachycephala rufogularis*
Red-necked Stint	*Calidris ruficollis*
Red-tailed Black-cockatoo	*Calyptorhynchus banksii*
Red-tailed Phascogale	*Phascogale calura*
Redthroat	*Pyrrholaemus brunneus*
Regent Parrot	*Polytelis anthopeplus*
River Coobah	*Phyllanthus maderaspatensis*
River Red Gum	*Eucalyptus camaldulensis*
Rosenberg's Goanna	*Varanus rosenbergi*
Ruddy Turnstone	*Arenaria interpres*
Rufous Fieldwren	*Calamanthus campestris*
Saffron Thistle	*Carthamus lanatus*
Salt Paperbark	*Melaleuca halmaturorum*
Samphire Skink	*Morethia adelaidensis*
Scrub Cypress-pine	*Callitris verrucosa*
Sheep	*Ovis aries*
Shy Heathwren	*Hylacola cauta*
Silky Glycine	*Glycine canescens*
Silky Mouse	*Pseudomys apodemoides*
Silver Banksia	*Banksia marginata*
Silver-leaf Nightshade	*Solanum elaeagnifolium*
Skeleton Weed	*Chondrilla juncea*
skinks	*Ctenotus* species
Slender Cypress-pine	*Callitris gracilis*
Slender Thistle (winged)	*Carduus tenuiflorus*
Slender-leaf Mallee	*Eucalyptus leptophylla*
Small Hop Bush	*Dodonaea bursariifolia*
Small Podolepis	*Podolepis muelleri*
South-eastern Long-eared bat	*Nyctophilus corbeni*
Southern Leg-less Lizard	*Delma australis*
Southern Scrub Robin	*Drymodes brunneopygia*
Spear Thistle	*Cirsium vulgare*
Spiked Pigweed	*Dysphania simulans*
Spiny Emex	*Emex australis*
Splendid Fairy-wren	*Malurus splendens*

Common Name	Scientific Name
Stemless Thistle	*Onopordum acaulon*
Stinkwort	*Dittrichia graveolens*
Straggly Lantern bush	*Abutilon oxycarpum*
Sugarwood	*Myoporum platycarpum*
Superb Fairy-wren	*Malurus cyaneus*
Tessellated Gecko	*Diplodactylus tessellatus*
Three-nerved Wattle	*Acacia trineura*
Three-wing Bluebush	*Maireana triptera*
Two-leaf Cape-tulip	*Moraea miniata*
Two-spined Copperburr	*Sclerolaena uniflora*
Variegated Thistle	*Silybum marianum*
Velvet Thread-petal	*Stenopetalum velutinum*
Wards Weed	*Carrichtera annua*
wattled bats	*Chalinolobus* species
Western Blue-tongue Lizard	*Tiliqua occipitalis*
Western Grey Kangaroo	*Macropus fuliginosus*
Western Pygmy-possum	*Cercartetus concinnus*
Western Quoll	*Dasyurus geoffroii*
Western Whipbird	*Psophodes nigrogularis*
Wheel Cactus	*Opuntia robusta*
Whiskered Tern	*Chlidonias hybrida*
White-bellied Sea-Eagle	*Haliaeetus leucogaster*
White-browed Babbler	*Pomatostomus superciliosus*
White-browed Treecreeper	*Climacteris affinis*
White-winged Fairy-wren	*Malurus leucopterus*
Wild Tobacco/Tree Tobacco	*Solanum mauritianum*
Winged Peppercress	*Lepidium monoplocoides*
yabbies	*Cherax* species
Yellow Gums	*Eucalyptus leucoxylon*
Yellow Mallee	*Eucalyptus incrassata*
Yellow Swainson-pea	*Swainsona pyrophila*
Yellow-bellied Sheath-tail Bat	*Saccolaimus flaviventris*
Yellow-throated Miner	*Manorina flavigula*

Appendix D: Biosecurity principles

Prevention

Prevention is a pre-emptive action to managing the risk of introducing weeds into the Park Landscape and ensuring works or disturbance events do not provide an opportune environment for weed establishment. This is achieved by identifying the most likely invasion points, which are often vehicle access and parking sites and locations where animals are likely to act as vectors. Pre-emptive action includes measures such as maintaining vehicle and equipment hygiene, avoiding the introduction of soils, gravels and other materials which may carry seed and ensuring that appropriate site preparation and risk identification before planned disturbance events such as planned burning and environmental watering.

Eradication of new and emerging weeds

The initial part of the strategy is to ensure that resources are available to address the threat of new and emerging weeds before they can become established. Any new weed species identified within the Park Landscape should be eradicated as a management priority and the area of infestation monitored for re-emergence. Once a species has become established, its potential for eradication becomes less feasible and more resource intensive.

DELWP have designed a decision-making framework to managing Weeds of Early Stages of Invasion (WESI). This framework will guide and support the management of new and emerging weeds. The WESI principles are based on a landscape approach to identifying new and emerging species. The process to address new and emerging weed threats should follow the six-step approach outlined in the Weeds of Early Stages of Invasion framework. Eradication is the objective for new and emerging weeds where feasible.

Containment

Containment is an ongoing maintenance approach to managing the spread of established weeds. Management tracks, ridgelines and other landscape features are useful in defining containment boundaries. Containment is used when a species is not considered feasibly eradicable in the short-medium term, however a strategy establishing containment lines and constricting the containment area over time may have a long-term eradication goal.

It is important to inspect a buffer around an established containment area to ensure efforts are effective and new populations are not establishing beyond containment boundaries. Where there are pathways of spread through a containment area (e.g. vehicles, walkers, river corridors) a concerted effort should be made to undertake control works along tracks and waterways to decrease the likelihood of spread. Containment includes the eradication of satellite or local populations of weeds outside the containment area.

Asset protection

A range of weeds are well established and wide spread within the Mallee Parks Landscape. If a weed species presents a specific threat to a specific value, an asset protection approach to weed management may be undertaken. Examples of assets include riparian corridors, threatened species, cultural heritage sites, visitor sites and infrastructure. Asset protection will generally involve specifying a buffer around the asset and treating weeds within its perimeter. Biological controls can assist with containment for established weeds, but are limited to species with an available control agent.


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