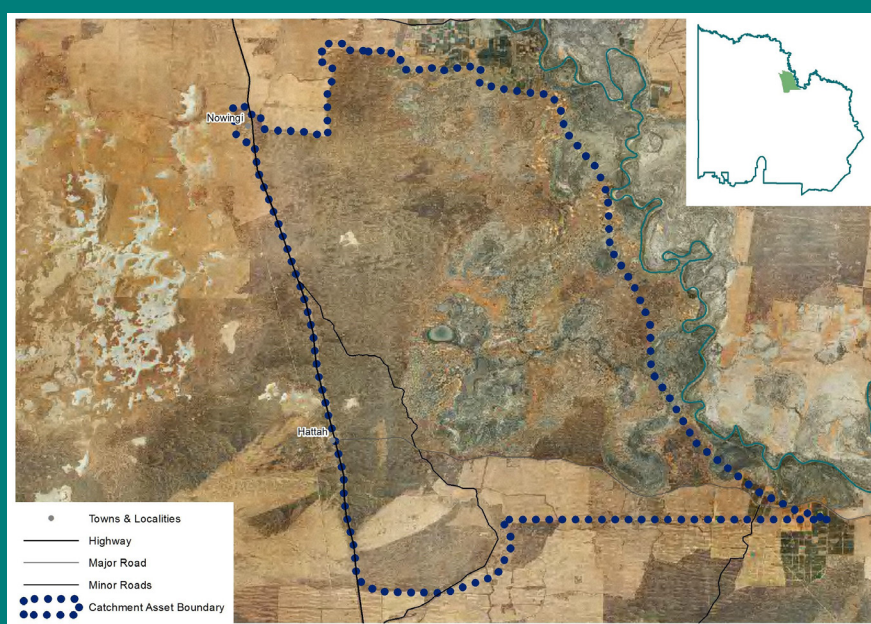


7 – Hattah-Kulkyne Lakes System and National Park

Regional Catchment Strategy Implementation Plan



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Section 1 - Overview

Catchment Asset Significance

Located between Mildura, Robinvale and Ouyen, the Hattah Lakes System is situated within the 48,000 hectare Hattah-Kulkyne National Park.

For much of the last 100 years the country was extensively grazed. In 1915, a sanctuary was formed to protect the beauty of the Hattah lakes. In 1960, the sanctuary became a national park and in 1980 the adjacent Kulkyne State Forest was added to form the Hattah-Kulkyne National Park and Murray Kulkyne Park. The Hattah Lakes System is one of only 11 internationally recognised Ramsar sites in Victoria, and is also a nationally recognised Living Murray Icon Site.

The Hattah Lakes System is a series of 17 perennial and intermittent freshwater lakes fed mainly from the Murray River via Chalka Creek, and 12 of the 17 lakes are declared as wetlands of international significance under the Ramsar Convention.

The Hattah-Kulkyne National Park is listed as a Category II (National Parks) of the IUCN United Nations' List of National Parks and Protected Areas. Category II areas are managed primarily for ecosystem conservation and appropriate recreation. The Park is also a designated Biosphere Reserve under the UNESCO 'Man and the Biosphere' program.

The site supports threatened species, including those recognised nationally and internationally. The site is important for maintaining the ecological diversity of the Robinvale Plains Bioregion by supporting a large number and variety of waterbirds, including breeding habitat for many waterbird species and also representative wetland and floodplain EVCs that are depleted in the Robinvale Plains Bioregion. This includes numerous threatened species such as the Hoary Scurf-pea (*Cullen cinereum*), Major Mitchell's Cockatoo (*Lophochroa leadbeateri*) and the Freckled Duck (*Stictonetta naevosa*). The park also includes areas of hummock-grass Mallee and high priority remnants of Buloke woodlands of the Riverine and Murray-Darling Depression Bioregions and supports four species (Freshwater Catfish, Golden Perch, Murray Cod, Murray Hardyhead and Silver Perch) representing the Lowland Riverine Fish Community of the Southern Murray-Darling Basin.

The lakes are important and popular for recreational and tourism activities such as kayaking, fishing, bush-walking, cycling and camping. Apiarists are also licensed to have bee-boxes in the park. The Hattah-Kulkyne Lakes and Park are significant Indigenous Cultural Heritage sites and this has been recognised by the area being declared as a designated educational centre. The area was an important hunting site for local Indigenous communities due to its abundance of different food types, and a source of bush medicine. There are also a high number of burial sites in the area. During flood periods, indigenous people camped on mounds that formed islands in the high water and moved from place to place in canoes constructed from the bark of River Red Gums. There are scars on trees from where shields and canoes were made and also shell middens in the area.

Catchment Asset Value

This section examines the relative values of the Regional Assets that lie within this Catchment Asset. It provides an overview of the asset analysis in order to inform prioritisation of management actions that are intended to minimise the impact of the threatening processes upon Regional Assets and improve the status or quality of the Regional Assets within the Catchment Asset Area.

The asset value indicates the relative importance of the Regional Asset within the Catchment Asset Area. The valuation is determined from a range of indicators, many specific to each of the Regional Assets that describe the importance of the Asset relative to social, economic and environmental values.

Table 1 below provides a summary of the value of each of the Regional Assets in this Catchment Asset. Greater detail about each of the Regional Assets in this Catchment Asset can be found in Section 2 – Regional Assets in this Catchment Asset

Table 1: Value of Regional Assets in this Catchment Asset

Regional Asset	Value
Rivers	HIGH
Wetlands	VERY HIGH
Threatened Species and Communities	HIGH
Terrestrial Habitat	MEDIUM
Soils	HIGH
Agricultural Land	HIGH
Groundwater	NONE
Cultural Heritage	HIGH
Community Capacity	HIGH

A detailed explanation of how these values were defined and applied can be found in Appendix 1. The Value of Regional Assets within a Catchment Asset.

Threatening Processes

This section examines the threatening processes that may be impacting upon Regional Assets that lie within this Catchment Asset. It provides an overview of each of the threatening processes in order to inform prioritisation of management actions that are intended to minimise their impact upon Regional Assets and improve the status or quality of the Regional Assets within the Catchment Asset Area.

Table 2 below provides a summary of the threat level posed by each of the threatening processes that are active in this Catchment Asset. Greater detail about each of the threatening processes and their scope, scale and relative impact within this Catchment Asset can be found in *Section 3 – Threatening Processes in this Catchment Asset*.

Table 2: Threat Priority across this Catchment Asset

Threatening Process	Priority of Action
Land & Water Salinisation	MEDIUM
Invasive Plants	HIGH
Invasive Animals	HIGH
Altered Hydrological Regimes	HIGH
Soil Erosion	HIGH
Inappropriate Water Use Practices	MEDIUM
Recreational Pressures	HIGH
Land Use Change	HIGH
Direct off-site interactions	LOW
Misaligned community perceptions	MEDIUM
Inappropriate fire regimes	MEDIUM
Constrained regenerative capacity	HIGH

A detailed explanation of how these threat levels were defined and applied can be found in Appendix 2. Categorising Threatening Processes.

Management Plans

This Catchment Asset Area is subject to a diverse range of natural resource management instruments that are intended to protect, preserve and enhance the area's natural resources for the benefit of the Mallee region. These instruments can be either broad in their focus (covering many regional assets), focused on a particular area of interest (such as an individual Regional Asset) or tightly focused on a specific location or species. These management plans are prepared and owned by range of entities such as local government, statutory authorities, community groups and government departments at both State and Federal levels. Responsibility for their implementation can rest with a single entity or it may be divested across a broad range of organisations and groups. Some management plans are prepared to satisfy a legislative requirement while others are prepared to provide direction towards an organisational goal. Regardless of the reason and purpose of the management plan, they all have a common feature – they typically contain specific management direction or actions that are to be delivered through the implementation of the plan.

The identified existing management plans have been listed in Appendix 3. *Management Plans Relevant to this Catchment Asset*

Management Actions

Actions within the management plans in the table above are typically diverse in their wording, structure and complexity. However, they are broadly similar in terms of their intent. As a result, they can usually be easily classified into broad categories. Within each of these categories are a range of common management actions. Each of these common management actions can also be said to target specific threatening processes. These management categories, the management actions within each of them, their definitions and the targeted threatening processes are shown in Appendix 4.

Management Action Definitions

The result of the classification process of the actions within Appendix 3. Management Plans Relevant to this Catchment Asset is contained in Appendix 5. Management Actions from Existing Management Plans. The classification table includes some detail about each action to support the classification. It is advised that if more information about a specific management action within a management plan is required then the original management plan should be consulted rather than relying specifically on the data in that classification table.

Priorities

This section examines the potential management action groups from the management plans relevant to this Catchment Asset Area that are listed in the Management Plans section above and summarised Appendix 5. Management Actions from Existing Management Plans. The intent is to prioritise these potential management actions in terms of:

- The priorities of the regional asset within the catchment asset area (outlined in the Catchment Asset Value section above);
- the priority to address a threatening process (outlined in the Threatening Processes section above);
- the capacity of the management action to address the threatening process; and
- the level of investment (in both of time and money) required to exercise that capacity.

The individual management actions from the plans listed in the Management Plans section were grouped and scored by consensus against agreed criteria and then each potential management

action group within the Catchment Asset was assigned to a category that defines the prospective priority to the implementation. Further information regarding the definition and application of each of these categories can be found in Appendix 6. *Prioritising Potential Management Actions*.

The findings of the analysis are summarised in Table 3 below. The detailed priority matrices from which the summary table is taken can be found in Appendix 7. Management Action Priorities.

Table 3: Summary of the Priority of Potential Management Actions

Management Action	Priority	Threatening Processes Addressed
Pest Plant Control	Medium	Invasive Plants; Constrained Regenerative Capacity
Pest Animal Control	Medium	Invasive Animals; Soil Erosion; Constrained Regenerative Capacity
Habitat Protection	Medium	Invasive Animals; Soil Erosion; Recreational Pressure; Land Use Change; Direct Off-Site Interactions; Constrained Regenerative Capacity
Habitat Restoration	Low	Land & Water Salinisation; Soil Erosion; Recreational Pressure; Direct Off-Site Interactions; Constrained Regenerative Capacity
Revegetation	Low	Land & Water Salinisation; Soil Erosion; Recreational Pressure; Direct Off-Site Interactions; Constrained Regenerative Capacity
Environmental Watering	High	Altered Hydrological Regimes; Constrained Regenerative Capacity
Soil Erosion Control	Medium	Soil Erosion
Threatened Species Interventions	Medium	Constrained Regenerative Capacity
Enhancing Land Management Regimes	Medium	Land & Water Salinisation; Soil Erosion; Inappropriate Water Use Practises; Land Use Change; Direct Off-Site Interactions
Supporting Human Capacity for NRM	Medium	Land & Water Salinisation; Invasive Plants; Invasive Animals; Altered Hydrological Regimes; Soil Erosion; Inappropriate Water Use Practices; Recreational Pressures; Land Use Change; Direct Off-site Interactions; Misaligned Community Perceptions; Inappropriate Fire Regimes; Constrained Regenerative Capacity
Supporting Institutional Capacity for NRM	Medium	Land & Water Salinisation; Invasive Plants; Invasive Animals; Altered Hydrological Regimes; Soil Erosion; Inappropriate Water Use Practices; Recreational Pressures; Land Use Change; Direct Off-site Interactions; Misaligned Community Perceptions; Inappropriate Fire Regimes; Constrained Regenerative Capacity

Supporting Social Capacity for NRM	Low	Land & Water Salinisation; Invasive Plants; Invasive Animals; Altered Hydrological Regimes; Soil Erosion; Inappropriate Water Use Practices; Recreational Pressures; Land Use Change; Direct Off-site Interactions; Misaligned Community Perceptions; Inappropriate Fire Regimes; Constrained Regenerative Capacity
Institutional Planning for NRM	Medium	Land & Water Salinisation; Invasive Plants; Invasive Animals; Altered Hydrological Regimes; Soil Erosion; Inappropriate Water Use Practices; Recreational Pressures; Land Use Change; Direct Off-site Interactions; Misaligned Community Perceptions; Inappropriate Fire Regimes; Constrained Regenerative Capacity
Community Driven Planning for NRM	Low	Land & Water Salinisation; Invasive Plants; Invasive Animals; Altered Hydrological Regimes; Soil Erosion; Inappropriate Water Use Practices; Recreational Pressures; Land Use Change; Direct Off-site Interactions; Misaligned Community Perceptions; Inappropriate Fire Regimes; Constrained Regenerative Capacity
Landholder Driven Planning for NRM	Medium	Land & Water Salinisation; Invasive Plants; Invasive Animals; Altered Hydrological Regimes; Soil Erosion; Inappropriate Water Use Practices; Recreational Pressures; Land Use Change; Direct Off-site Interactions; Misaligned Community Perceptions; Inappropriate Fire Regimes; Constrained Regenerative Capacity
Research to improve knowledge	Medium	Land & Water Salinisation; Invasive Plants; Invasive Animals; Altered Hydrological Regimes; Soil Erosion; Inappropriate Water Use Practices; Recreational Pressures; Land Use Change; Direct Off-site Interactions; Misaligned Community Perceptions; Inappropriate Fire Regimes; Constrained Regenerative Capacity
Asset condition monitoring and assessment	Medium	Land & Water Salinisation; Invasive Plants; Invasive Animals; Altered Hydrological Regimes; Soil Erosion; Inappropriate Water Use Practices; Recreational Pressures; Land Use Change; Direct Off-site Interactions; Misaligned Community Perceptions; Inappropriate Fire Regimes; Constrained Regenerative Capacity

Regional Delivery Partners

The individuals and organisations listed below have various roles to play within the Catchment Asset area in delivering and implementing the management actions described in previous sections that will

in turn contribute to the aims and expected outcomes of the Mallee RCS. This list is not considered exhaustive and can be expected to change over time. More detail about the specific role and responsibilities of these entities with respect to the RCS can be found below.

- Aboriginal Affairs Victoria
- Aboriginal Communities (Traditional Owners & Organisations)
- Birdlife Mildura
- Catchment Management Authorities – Mallee (VIC), Murray(NSW)
- Department of Environment and Primary Industries;
- Far West Anglers Association
- Landcare Groups (Kulkyne Way; Robinvale/Annuello)
- Lower Murray Water
- Mallee Parks Consultative Group
- Mildura RSL Angling Club
- Mildura Rural City Council
- Murray Darling Basin Authority
- Murray Lower Darling Rivers Indigenous Nations
- NSW Department of Primary Industries - Office of Water; Catchments & Lands; Fisheries
- NSW Office of Environment & Heritage
- NSW Transport & Maritime
- Parks Victoria
- Private Land Managers
- Regional Development Australia Loddon Mallee
- Research Bodies – Arthur Rylah Institute, Invasive Animals CRC, Murray Darling Freshwater Research Centre
- Swan Hill Rural City Council
- Victorian Malleefowl Recovery Group
- VicRoads
- VR Fish
- Waterwatch

Community NRM Groups

This section provides a summary of these stakeholder groups that are active within this Catchment Asset. This is not an exhaustive list and will be updated on a regular basis. Further detail on the community NRM groups can be found in Attachment 1 – Mallee NRM Interest Groups.

Landcare Groups

The Landcare movement has been active in the Mallee since the late 1980s, with 23 active Landcare groups operating today. From our first group, Millewa-Carwarp (established 1989), to the newest, Cabarita (established 2012), Landcare has been instrumental in harnessing and promoting the interests of local communities in natural resource management.

Many groups initially formed due to the issues of rabbits and weeds. Salinity, soil conservation and biodiversity issues have evolved and continued to propel the Landcare movement into the 21st century. Our Landcare groups are keen to ensure that the legacy of Landcare continues and actively support a range of Junior Landcare Groups activities across the region.

Northern Mallee Landcare Consortium

- Kulkyne Way

Eastern Mallee Consortium

- Robinvale & District

Other Groups

There are a broad range of community, industry, indigenous and specialist groups that have a role to play in NRM within this catchment asset. The tables in this section provide a listing of the groups currently known to be active within the asset area.

Traditional owner groups provide opportunities for our local indigenous communities to have input into how the regions landscapes are managed; and to enhance regional awareness of the cultural values inherent within these landscapes.

A wide range of special interest groups provide the means for individuals to become engaged in activities and programs which reflect their particular concerns. They also provide the region with a vital source of knowledge and understanding on specific issues.

The region's industry based groups have an important role in developing and promoting best practice for competitive and sustainable agricultural sectors.

Advisory groups to statutory bodies like CMA's and water authorities are important forums for both the community and the authorities involved. These groups provide management advice and community feedback to the convening authority while at the same time communicating with the wider community about the activities of the advisory group and the organisation in general.

Registered Aboriginal Parties

There is currently no registered aboriginal party determined for this catchment asset area

Special Interest and Recreational Groups

- BirdLife Mildura
- Murray Darling Association
- Murray Lower Darling Rivers Indigenous Nations
- Victorian Malleefowl Recovery Group (VMRG)
- Waterwatch

Industry Groups

- Victorian Farmers Federation (VFF)
- Victoria No-Till Farmers Association (VNTFA)
- Australian Table Grape Association Inc (ATGA)
- Dried Fruits Australia (DFA)
- Mallee Sustainable Farming Inc (MSF)
- Murray Valley Citrus Board (MVCB)
- Murray Valley Winegrowers' Inc (MVW)
- Pistachio Growers Association Incorporated (PGAI)
- Sunraysia Branch of the Victorian Apiarists Association
- Sunraysia Citrus Growers Inc (SCG)

Advisory Groups

- Aboriginal Reference Group (ARG)
- Mallee CMA Land and Water Advisory Committee (LWAC)
- Mallee CMA Technical Advisory Committees (TACs)
- Lower Murray Water Customer Service Advisory Committees (Rural)
- Goulburn-Murray Water Services Committees (WSCs)
- The Living Murray (TLM) Icon Site Community Reference Groups

Section 2 – Regional Assets in this Catchment Asset

Regional Assets in the Mallee NRM region were defined and applied in accordance with guidelines provided by DSE to support the Victorian Catchment Management Council RCS Guidelines. Each of the following sub-sections provides a background to these Regional Assets and the available information about their significance within this Catchment Asset. This follows on to an assessment of the relative value of the Regional Asset based on the criteria contained in Appendix 1. *The Value of Regional Assets within a Catchment Asset*

Rivers

The predominate waterway of this catchment asset is Chalka Creek, an ephemeral anabranch of the Murray River that links the river to the Hattah Lakes during periods of high river flows.

The Mallee Waterway Strategy (2014-22) identifies priority reaches for future management using an Asset Based Approach; facilitating targeted planning and implementation processes to deliver greatest social, cultural and economic returns on our efforts. Each River asset occurring within this Catchment Asset is ascribed a priority of 'high', 'medium', 'low', or 'additional' under this framework.

Based on the available data concerning their extent, quality and policy significance within this landscape, the Rivers within this Catchment Asset are considered to be of **high** value.

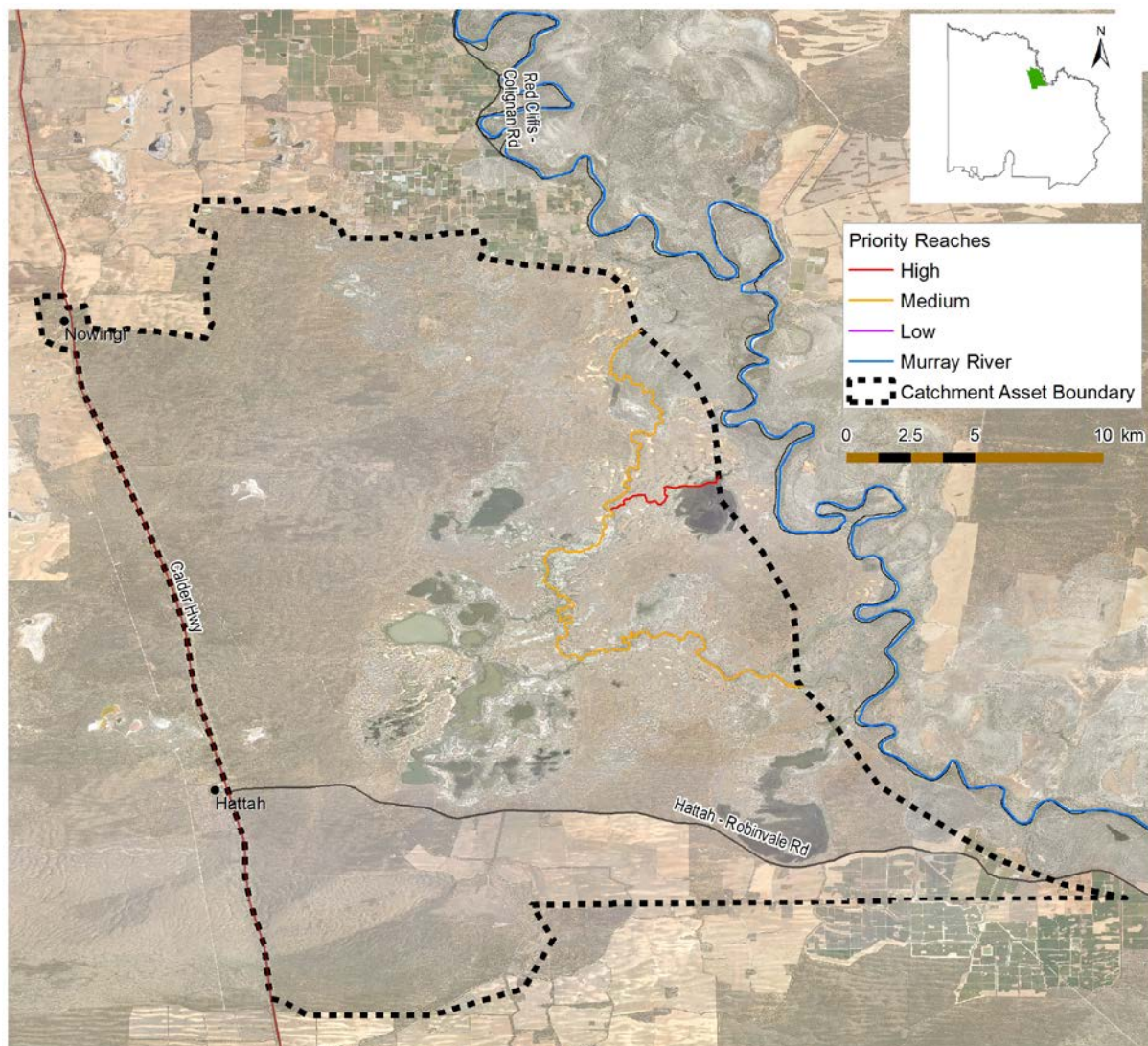


Figure 1: River Reaches

Wetlands

Hattah-Kulkyne Lakes is a system of 17 perennial and intermittent freshwater lakes fed mainly from the Murray River via Chalka Creek. The lakes are located within Hattah-Kulkyne National Park which is recognised as a Biosphere Reserve under the UNESCO Man and Biosphere Program. Twelve of the lakes were declared as Wetlands of International Significance under the RAMSAR Convention in 1982 (Lakes Arawak, Bitterang, Brockie, Bulla, Cantala, Hattah, Konardin, Karmen, Lockie, Mournpall, Yelwell and Yerang). These same lakes are also listed in the national Directory of Important Wetlands. Migratory bird species listed in the JAMBA, CAMBA and ROKAMBA agreements have been observed at the Hattah-Kulkyne Lakes.

The Mallee Waterway Strategy (2014-22) identifies priority wetlands for future management using an Asset Based Approach; facilitating targeted planning and implementation processes to deliver greatest social, cultural and economic returns on our efforts. Each Wetland asset occurring within this Catchment Asset is ascribed a priority of 'high', 'medium', 'low', or 'additional' under this framework.

Based on the available data concerning their extent, quality and policy significance within this landscape, the Wetlands within this Catchment Asset are considered to be of **very high** value.

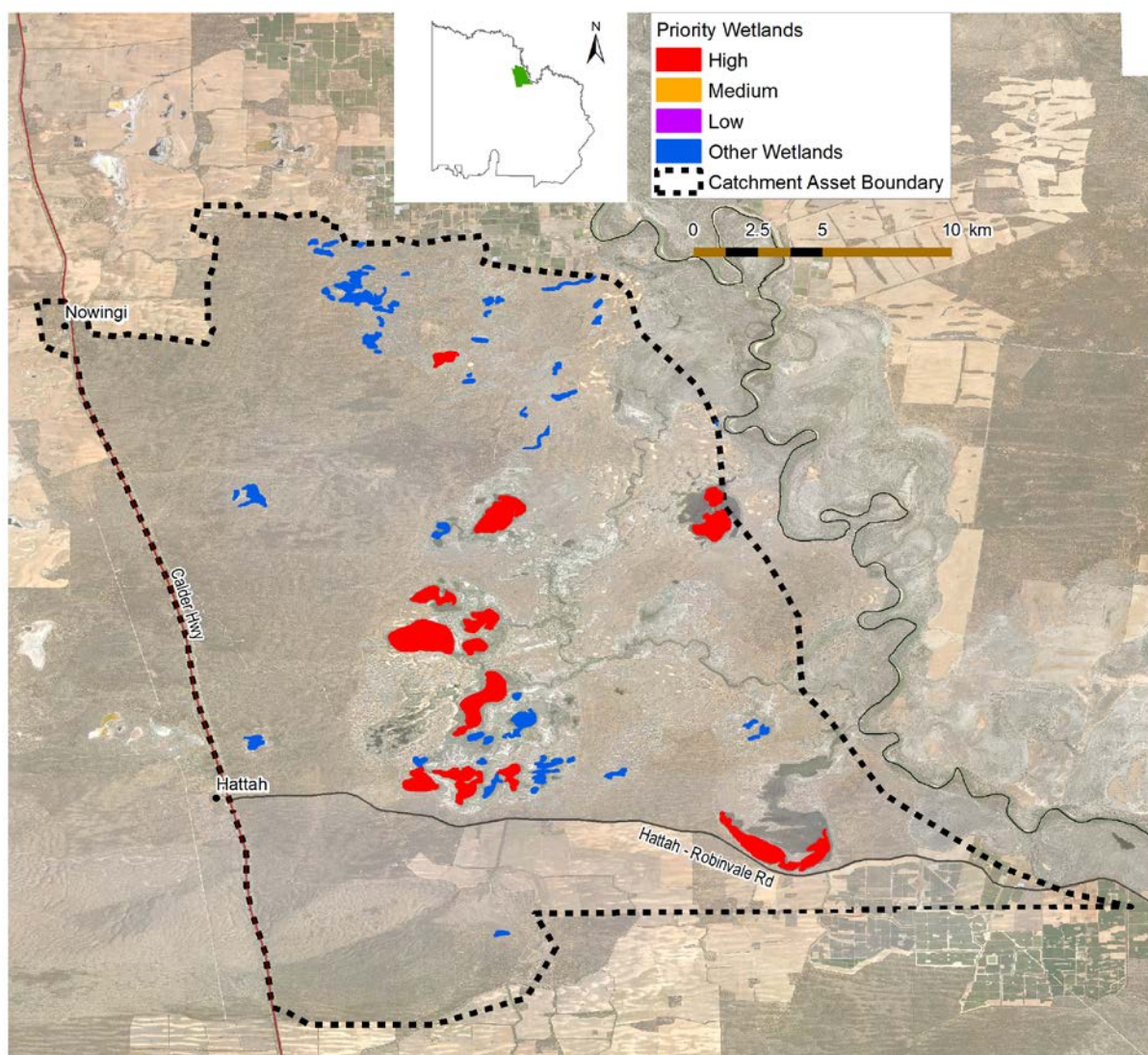


Figure 2: Wetlands

Threatened Species and Communities

A significant range of flora and fauna species that are listed in Federal and State instruments have been observed and recorded within the area of this catchment asset over time. These species are listed in the tables that follow along with their current status as described in the listing instrument. The listing instruments are: Environmental Protection and Biodiversity Conservation (EPBC) Act 1999; Flora and Fauna Guarantee (FFG) Act 1998 and the Victorian Threatened Species Advisory Lists issued by the Department of Environment and Primary Industries (DEPI) (Flora: 2005, Fauna: 2013). The species names included in the following tables (Table 4 & Table 5) may not reflect the full range of threatened flora and fauna species that may inhabit the catchment area. Rather they reflect only species whose presence has been observed and recorded by suitably qualified observers since 1980.

The most notable of these recorded threatened species include the Regent Parrot (*Polytelis anthopeplus monarchoides*); Mallee Fowl (*Leipoa ocellata*); Australasian Bittern (*Pedionomus torquatus*); Mallee Emu-wren (*Stipiturus mallee*); Chariot Wheels (*Maireana cheelii*); Winged Peppergrass (*Lepidium pseudopapillosum*) and the Yellow Swainson Pea (*Swainsona pyrophila*). All of these species are listed in the Federal EPBC Act as 'vulnerable'.

This Catchment Asset is one of a number in the Mallee Region that contain remnant areas of the nationally listed ecological community, 'Buloke Woodlands of the Riverina and Murray-Darling

Depression Bioregions'. This ecological community is listed as 'endangered' under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act).

The Mallee Bird Community is listed under the Victorian FFG Act and so qualifies as a threatened ecological community in this context. All members of this community have been recorded in this Catchment Asset since 1980.

Based on the available data concerning their extent, quality and policy significance within this landscape, the Threatened Species and Communities within this Catchment Asset are considered to be of high value.

Table 4: Threatened Flora Species observed since 1980

Scientific Name	Common Name	EPBC	FFG	DSE Advisory List
<i>Abutilon otocarpum</i>	Desert Lantern			Vulnerable
<i>Acacia victoriae subsp. victoriae</i>	Bramble Wattle			Rare
<i>Allocasuarina luehmannii</i>	Buloke		Listed	
<i>Alternanthera nodiflora</i>	Common Joyweed			Poorly Known
<i>Ammannia multiflora</i>	Jerry-jerry			Vulnerable
<i>Amyema linophylla subsp. orientale</i>	Buloke Mistletoe			Vulnerable
<i>Aristida holathera var. holathera</i>	Tall Kerosene Grass			Vulnerable
<i>Asperula gemella</i>	Twin-leaf Bedstraw			Rare
<i>Atriplex holocarpa</i>	Pop Saltbush		Listed	Vulnerable
<i>Atriplex lindleyi subsp. lindleyi</i>	Flat-top Saltbush			Poorly Known
<i>Atriplex papillata</i>	Coral Saltbush			Rare
<i>Atriplex pseudocampanulata</i>	Mealy Saltbush			Rare
<i>Atriplex spinibractea</i>	Spiny-fruit Saltbush			Endangered
<i>Austrobryonia micrantha</i>	Mallee Cucumber			Rare
<i>Bergia ammannioides</i>	Jerry Water-fire			Vulnerable
<i>Bergia trimera</i>	Small Water-fire			Vulnerable
<i>Brachyscome exilis</i>	Finger-leaved Daisy			Rare
<i>Calandrinia corrigioloides</i>	Strap Purslane			Rare
<i>Calandrinia volubilis</i>	Twining Purslane			Rare
<i>Callistemon brachyandrus</i>	Prickly Bottlebrush			Rare
<i>Calostemma purpureum s.l.</i>	Garland Lily			Rare
<i>Calotis cuneifolia</i>	Blue Burr-daisy			Rare
<i>Centipeda nidiformis</i>	Cotton Sneezeweed			Rare
<i>Centipeda thespidioides s.l.</i>	Desert Sneezeweed			Rare

<i>Ceratogyne obionoides</i>	Wingwort			Rare
<i>Ceratophyllum demersum</i>	Hornwort			Poorly Known
<i>Chenopodium desertorum</i> subsp. <i>desertorum</i>	Frosted Goosefoot			Rare
<i>Comesperma scoparium</i>	Broom Milkwort			Rare
<i>Convolvulus crispifolius</i>	Silver Bindweed			Rare
<i>Corynotheca licrota</i>	Sand Lily			Rare
<i>Cullen cinereum</i>	Hoary Scurf-pea		Listed	Endangered
<i>Cullen pallidum</i>	Woolly Scurf-pea		Listed	Endangered
<i>Cullen patens</i>	Spreading Scurf-pea		Listed	Endangered
<i>Cullen tenax</i>	Tough Scurf-pea		Listed	Endangered
<i>Cyperus flaccidus</i>	Lax Flat-sedge			Vulnerable
<i>Cyperus pygmaeus</i>	Dwarf Flat-sedge			Vulnerable
<i>Dianella porracea</i>	Riverine Flax-lily			Vulnerable
<i>Digitaria ammobila</i>	Silky Umbrella-grass			Vulnerable
<i>Elachanthus pusillus</i>	Small Elachanth			Rare
<i>Eragrostis australasica</i>	Cane Grass			Vulnerable
<i>Eragrostis lacunaria</i>	Purple Love-grass			Vulnerable
<i>Eragrostis setifolia</i>	Bristly Love-grass			Vulnerable
<i>Eremophila divaricata</i> subsp. <i>divaricata</i>	Spreading Emu-bush			Rare
<i>Fimbristylis aestivalis</i>	Summer Fringe-sedge			Poorly Known
<i>Frankenia crispa</i>	Hoary Sea-heath			Rare
<i>Frankenia serpyllifolia</i>	Bristly Sea-heath			Rare
<i>Glycine canescens</i>	Silky Glycine		Listed	Endangered
<i>Gnephosis tenuissima</i>	Dwarf Cup-flower			Rare
<i>Hemichroa diandra</i>	Mallee Hemichroa		Listed	Endangered
<i>Jasminum didymum</i> subsp. <i>lineare</i>	Desert Jasmine			Vulnerable
<i>Lepidium monoplacoides</i>	Winged Peppercress	Endangered	Listed	Endangered
<i>Lepidium papillosum</i>	Warty Peppercress			Poorly Known
<i>Lepidium pseudohyssopifolium</i>	Native Peppercress			Poorly Known
<i>Lipocarpha microcephala</i>	Button Rush			Vulnerable
<i>Lotus australis</i> var. <i>australis</i>	Austral Trefoil			Poorly Known
<i>Maireana georgei</i>	Slit-wing Bluebush			Vulnerable
<i>Maireana oppositifolia</i>	Heathy Bluebush			Rare
<i>Maireana triptera</i>	Three-wing Bluebush			Rare

<i>Malacocera tricornis</i>	Goat Head			Rare
<i>Marsdenia australis</i>	Doubah			Vulnerable
<i>Millotia macrocarpa</i>	Large-fruited Millotia			Rare
<i>Mimulus prostratus</i>	Small Monkey-flower			Rare
<i>Minuria integerrima</i>	Smooth Minuria			Rare
<i>Muehlenbeckia horrida subsp. horrida</i>	Spiny Lignum			Rare
<i>Olearia subspicata</i>	Spiked Daisy-bush			Vulnerable
<i>Ophioglossum polyphyllum</i>	Upright Adder's-tongue			Vulnerable
<i>Orobanche cernua var. australiana</i>	Australian Broomrape			Vulnerable
<i>Phlegmatospermum eremaeum</i>	Spreading Cress			Vulnerable
<i>Phyllanthus lacunarius</i>	Lagoon Spurge			Vulnerable
<i>Phyllanthus lacunellus</i>	Sandhill Spurge			Rare
<i>Pimelea simplex subsp. simplex</i>	Desert Rice-flower			Rare
<i>Pimelea williamsonii</i>	Williamson's Rice-flower			Vulnerable
<i>Poa drummondiana</i>	Knotted Poa			Rare
<i>Podolepis canescens</i>	Grey Podolepis			Rare
<i>Ptilotus sessilifolius</i>	Crimson Tails			Poorly Known
<i>Rhagodia ulicina</i>	Spiny Goosefoot			Rare
<i>Rhyncharrhena linearis</i>	Purple Pentatope			Vulnerable
<i>Rorippa eustylis</i>	Dwarf Bitter-cress			Rare
<i>Scaevola depauperata</i>	Skeleton Fan-flower			Endangered
<i>Sclerolaena divaricata</i>	Tangled Copperburr			Poorly Known
<i>Sclerolaena lanicuspis</i>	Woolly Copperburr			Endangered
<i>Sclerolaena muricata var. muricata</i>	Black Roly-poly			Poorly Known
<i>Sclerolaena patenticuspis</i>	Spear-fruit Copperburr			Vulnerable
<i>Sida ammophila</i>	Sand Sida			Vulnerable
<i>Sida fibulifera</i>	Pin Sida			Vulnerable
<i>Sida intricata</i>	Twiggy Sida			Vulnerable
<i>Stenanthemum notiale subsp. notiale</i>	Trident Spyridium			Endangered
<i>Swainsona microphylla</i>	Small-leaf Swainson-pea			Rare
<i>Swainsona phacoides</i>	Dwarf Swainson-pea		Listed	Endangered
<i>Swainsona pyrophila</i>	Yellow Swainson-pea	Vulnerable		Vulnerable
<i>Swainsona sericea</i>	Silky Swainson-pea		Listed	Vulnerable
<i>Tecticornia nitida</i>	Shining Glasswort			Rare

<i>Tetragonia eremaea</i> s.s.	Desert Spinach			Poorly Known
<i>Tetragonia moorei</i>	Annual Spinach			Poorly Known
<i>Triraphis mollis</i>	Needle Grass			Rare
<i>Velleia connata</i>	Cup Velleia			Rare
<i>Vittadinia condyloides</i>	Club-hair New Holland Daisy			Rare
<i>Zygophyllum compressum</i>	Rabbit-ears Twin-leaf			Vulnerable
<i>Zygophyllum simile</i>	White Twin-leaf			Rare

Table 5: Threatened Fauna Species observed since 1980

Scientific Name	Common Name	EPBC	FFG	DSE Advisory List
<i>Actitis hypoleucos</i>	Common Sandpiper			Vulnerable
<i>Amytornis striatus striatus</i>	Striated Grasswren			Near Threatened
<i>Anas rhynchos</i>	Australasian Shoveler			Vulnerable
<i>Ardea intermedia</i>	Intermediate Egret		Listed	Endangered
<i>Ardea modesta</i>	Eastern Great Egret		Listed	Vulnerable
<i>Arenaria interpres</i>	Ruddy Turnstone			Vulnerable
<i>Aythya australis</i>	Hardhead			Vulnerable
<i>Biziura lobata</i>	Musk Duck			Vulnerable
<i>Botaurus poiciloptilus</i>	Australasian Bittern	Endangered	Listed	Endangered
<i>Burhinus grallarius</i>	Bush Stone-curlew		Listed	Endangered
<i>Cercartetus lepidus</i>	Little Pygmy-possum			Near Threatened
<i>Chlidonias hybridus javanicus</i>	Whiskered Tern			Near Threatened
<i>Chrysococcyx osculans</i>	Black-eared Cuckoo			Near Threatened
<i>Cinclosoma castanotus</i>	Chestnut Quail-thrush			Near Threatened
<i>Circus assimilis</i>	Spotted Harrier			Near Threatened
<i>Climacteris affinis</i>	White-browed Treecreeper		Listed	Vulnerable
<i>Climacteris picumnus victoriae</i>	Brown Treecreeper (south-eastern ssp.)			Near Threatened
<i>Coracina maxima</i>	Ground Cuckoo-shrike		Listed	Vulnerable
<i>Demansia psammophis</i>	Yellow-faced Whip Snake			Near Threatened
<i>Dromaius novaehollandiae</i>	Emu			Near Threatened
<i>Egretta garzetta nigripes</i>	Little Egret		Listed	Endangered
<i>Falco subniger</i>	Black Falcon			Vulnerable

<i>Gelochelidon nilotica macrotarsa</i>	Gull-billed Tern		Listed	Endangered
<i>Grantiella picta</i>	Painted Honeyeater		Listed	Vulnerable
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle		Listed	Vulnerable
<i>Hydroprogne caspia</i>	Caspian Tern		Listed	Near Threatened
<i>Ixobrychus minutus dubius</i>	Little Bittern		Listed	Endangered
<i>Leipoa ocellata</i>	Malleefowl	Vulnerable	Listed	Endangered
<i>Lichenostomus cratitius</i>	Purple-gaped Honeyeater			Vulnerable
<i>Lichenostomus plumulus</i>	Grey-fronted Honeyeater			Vulnerable
<i>Lophocroa leadbeateri</i>	Major Mitchell's Cockatoo		Listed	Vulnerable
<i>Lophoictinia isura</i>	Square-tailed Kite		Listed	Vulnerable
<i>Macquaria ambigua</i>	Golden Perch			Near Threatened
<i>Manorina melanotis</i>	Black-eared Miner	Endangered	Listed	Critically Endangered
<i>Melanodryas cucullata cucullata</i>	Hooded Robin		Listed	Near Threatened
<i>Morelia spilota metcalfei</i>	Carpet Python		Listed	Endangered
<i>Morethia adelaidensis</i>	Samphire Skink		Listed	Endangered
<i>Neophema elegans</i>	Elegant Parrot			Vulnerable
<i>Neophema splendida</i>	Scarlet-chested Parrot		Listed	Vulnerable
<i>Ningau i yvonneae</i>	Mallee Ningau i			Near Threatened
<i>Notomys mitchelli</i>	Mitchell's Hopping-mouse			Near Threatened
<i>Nycticorax caledonicus hillii</i>	Nankeen Night Heron			Near Threatened
<i>Nyctophilus corbeni</i>	South-eastern Long-eared Bat	Vulnerable	Listed	Endangered
<i>Oreoica gutturalis gutturalis</i>	Crested Bellbird		Listed	Near Threatened
<i>Oxyura australis</i>	Blue-billed Duck		Listed	Endangered
<i>Pachycephala rufogularis</i>	Red-lored Whistler	Vulnerable	Listed	Endangered
<i>Pedionomus torquatus</i>	Plains-wanderer	Vulnerable	Listed	Critically Endangered
<i>Phalacrocorax varius</i>	Pied Cormorant			Near Threatened
<i>Platalea regia</i>	Royal Spoonbill			Near Threatened
<i>Plegadis falcinellus</i>	Glossy Ibis			Near Threatened
<i>Polytelis anthopeplus monarchoides</i>	Regent Parrot	Vulnerable	Listed	Vulnerable
<i>Pseudonaja aspidorhyncha</i>	Patch-nosed Brown Snake			Near Threatened
<i>Rostratula benghalensis australis</i>	Australian Painted Snipe	Vulnerable	Listed	Critically Endangered
<i>Sminthopsis murina murina</i>	Common Dunnart			Vulnerable

<i>Stictonetta naevosa</i>	Freckled Duck		Listed	Endangered
<i>Stipiturus mallee</i>	Mallee Emu-wren	Endangered	Listed	Endangered
<i>Struthidea cinerea</i>	Apostlebird		Listed	
<i>Tandanus tandanus</i>	Freshwater Catfish		Listed	Endangered
<i>Tiliqua occipitalis</i>	Western Blue-tongued Lizard			Near Threatened
<i>Todiramphus pyrropygia pyrropygia</i>	Red-backed Kingfisher			Near Threatened
<i>Tringa nebularia</i>	Common Greenshank			Vulnerable
<i>Tringa stagnatilis</i>	Marsh Sandpiper			Vulnerable
<i>Turnix velox</i>	Little Button-quail			Near Threatened
<i>Varanus varius</i>	Lace Monitor			Endangered
<i>Vermicella annulata</i>	Bandy Bandy		Listed	Vulnerable

Table 6: Mallee Bird Community as listed under FFG Act (including individual species listing and number of records since 1980 from Victorian Biodiversity Atlas)

Species Name	Common Name	Records since 1980	EPBC	FFG	DSE Advisory List
<i>Amytornis striatus striatus</i>	Striated Grasswren	25			Near Threatened
<i>Cinclosoma castanotus castanotus</i>	Chestnut Quail-thrush	29			Near Threatened
<i>Drymodes brunneopygia</i>	Southern Scrub-robin	10			
<i>Hylacola cautus cautus</i>	Shy Heathwren	24			
<i>Leipoa ocellata</i>	Malleefowl	23	Vulnerable	Listed	Endangered
<i>Manorina melanotis</i>	Black-eared Miner	11	Endangered	Listed	Critically Endangered
<i>Pachycephala inornata</i>	Gilbert's Whistler	25			
<i>Pachycephala rufogularis</i>	Red-lored Whistler	1	Vulnerable	Listed	Endangered
<i>Stipiturus mallee</i>	Mallee Emu-wren	46	Endangered	Listed	Endangered

Terrestrial Habitat

The Hattah Kulkyne Lakes and National Park Catchment Asset Area has retained some 91% of its terrestrial habitat with agricultural development mostly in the far south and north of the asset area. The catchment asset area is divided in its character with the mallee uplands of the Lowan Mallee and Murray Mallee Interim Biogeographic Regionalisation for Australia (IBRA) subregions in the west and south and the floodplains of the Robinvale Plains IBRA subregion in the east. Both of these Mallee sub-regions are part of the larger Murray Darling Depression IBRA bioregion which extends across north western Victoria, the riverlands of South Australia and most of south western New South Wales.

However, the Robinvale Plains are part of the Riverina IBRA bioregion that encompasses the Murray and Murrumbidgee Rivers and their major tributaries, the Lachlan and Goulburn Rivers, as they flow westward across the Riverina plain of New South Wales and Victoria.

The floodplain habitat is integral to the ecological character of the lakes that make up the Ramsar site and supports representative wetland and floodplain EVCs that are depleted in the Robinvale Plains bioregion.

The table below lists each of the Catchment Asset's EVCs along with the IBRA subregion within which they are contained, their Bioregional Conservation Status (BCS) and their area in hectares.

Table 7: Area of Ecological Vegetation Classes and their Bioregional Conservation Status

Ecological Vegetation Class	IBRA Subregion	Conservation Status	Area (hectares)
Chenopod Mallee	Lowan Mallee	Least Concern	30.02
	Murray Mallee	Vulnerable	506.86
	Robinvale Plains	Vulnerable	147.41
Floodway Pond Herbland	Robinvale Plains	Depleted	0.14
Grassy Riverine Forest	Robinvale Plains	Depleted	108.42
Grassy Riverine Forest/Floodway Pond Herbland Complex	Robinvale Plains	Depleted	8.97
Intermittent Swampy Woodland	Robinvale Plains	Depleted	2917.82
	Murray Mallee	Vulnerable	23.48
Lake Bed Herbland	Lowan Mallee	Depleted	6.91
	Murray Mallee	Depleted	2.33
	Robinvale Plains	Depleted	1507.27
Lignum Shrubland	Robinvale Plains	Least Concern	90.88
Lignum Swamp	Robinvale Plains	Vulnerable	47.14
Lignum Swampy Woodland	Robinvale Plains	Depleted	58.45
Loamy Sands Mallee	Lowan Mallee	Least Concern	8504.22
	Murray Mallee	Least Concern	2508.66
	Robinvale Plains	Least Concern	1038.11
Low Chenopod Shrubland	Murray Mallee	Depleted	0.87
Ridged Plains Mallee	Murray Mallee	Endangered	68.65
	Robinvale Plains	Endangered	0.49
Riverine Chenopod Woodland	Lowan Mallee	Depleted	113.58
	Murray Mallee	Depleted	167.34
	Robinvale Plains	Depleted	6420.91
Riverine Grassy Woodland	Lowan Mallee	Depleted	12.35

	Murray Mallee	Depleted	7.37
	Robinvale Plains	Depleted	2469.78
Samphire Shrubland	Murray Mallee	Least Concern	8.84
Semi-arid Chenopod Woodland	Murray Mallee	Vulnerable	2.59
	Robinvale Plains	Vulnerable	4.42
Semi-arid Woodland	Lowan Mallee	Depleted	65.56
	Murray Mallee	Vulnerable	533.09
	Robinvale Plains	Vulnerable	5838
Shallow Freshwater Marsh	Robinvale Plains	Vulnerable	0
Shrubby Riverine Woodland	Robinvale Plains	Least Concern	51.58
Water body - salt	Murray Mallee	Not Applicable	29.43
Woorinen Mallee	Lowan Mallee	Least Concern	2004.86
	Murray Mallee	Vulnerable	2533.47
	Robinvale Plains	Vulnerable	604.38
Woorinen Sands Mallee	Murray Mallee	Depleted	5426.93
	Robinvale Plains	Depleted	1584.73
	Lowan Mallee	Least Concern	3686.15

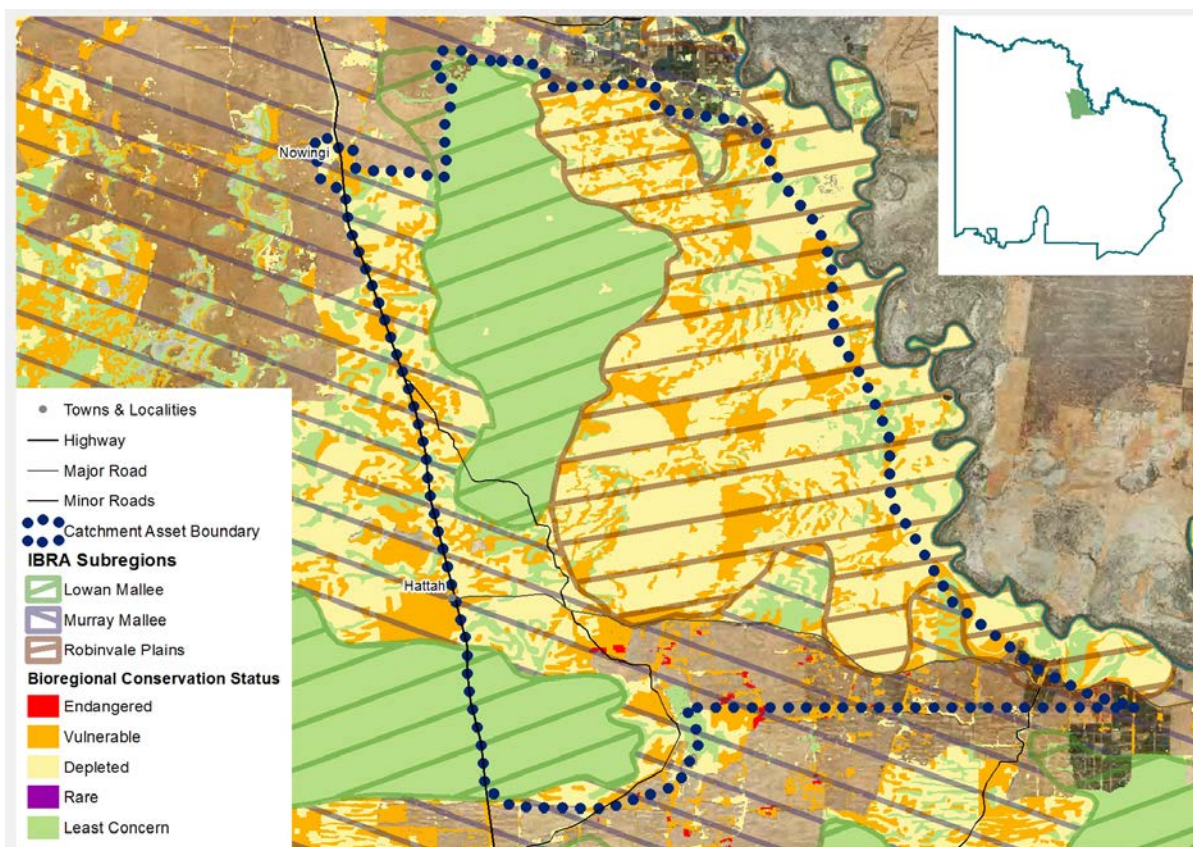


Figure 3: Bioregional conservation status of EVCs and IBRA sub-regions

DEPI's NaturePrint model is a landscape scale spatial planning mechanism that provides an analysis of biodiversity values across Victoria and combines the available information about biodiversity values, threatening processes and ecosystem function. It provides an analysis of the ecological value of a portion of landscape compared across the entire Victorian landscape. It is based on the following measures:

- Mathematical models of species distributions and habitats;
- The condition of these habitats;
- Pathways for connectivity across landscapes;
- Connectivity potential and recoverability;
- Threats to species persistence.

For background information about the model, its output and its significance, refer to:

<http://www.depi.vic.gov.au/environment-and-wildlife/biodiversity/natureprint>.

The NaturePrint model considers that almost 16% (8,186 hectares) of this Catchment Asset contains terrestrial habitat that is of the highest ecological value to Victoria and therefore high priority for protection and conservation.

Based on the available data concerning their extent, quality and policy significance within this landscape, the Terrestrial Habitat within this Catchment Asset is considered to be of **medium** value.

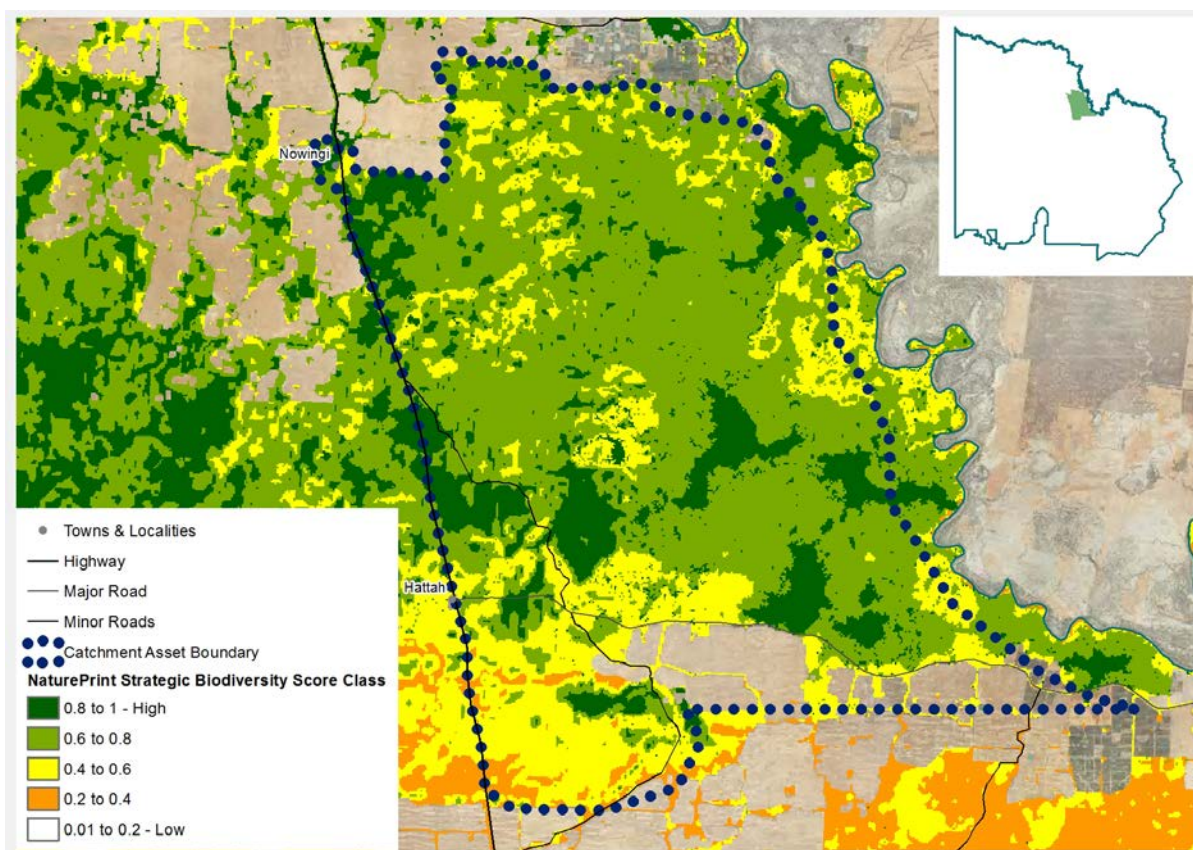


Figure 4: Terrestrial Habitat given high ecological value by NaturePrint Version 3

Soils

The soils of the asset area are primarily Tenesols. These are the loose red-brown sands that form the east-west dune systems that dominate the central parts of the Mallee region. However, the southern end of the asset area contains some higher ground where the slightly heavier Calcarosols predominate. There is also a small portion of Vertosols (somewhat sodic, grey, cracking soils) that predominate around the northern end of Chalka Creek.

The soils of this Catchment Asset area are predominantly valued for their capacity to provide for terrestrial habitat and the support the production of food and fibre. However, there is also an understanding that the structure of the soil and its natural capacity to resist threatening processes such as wind erosion is also of substantial value.

There is currently no accepted framework to categorise our soil asset in terms of value from lower to higher based purely upon the social, economic and environmental values and services they provide. Such a framework has only been considered to date in terms of the threatening processes that may impinge on the capacity of our soils asset to provide the services we have come to expect. This will be discussed later in this document. Despite this limitation, the most appropriate course of action is to consider the relative value of the soil asset according to its intrinsic capacity to support the other regional assets within this catchment asset as the basis for applying a value category.

Therefore, the Soils within this Catchment Asset are considered to be of **high** value.

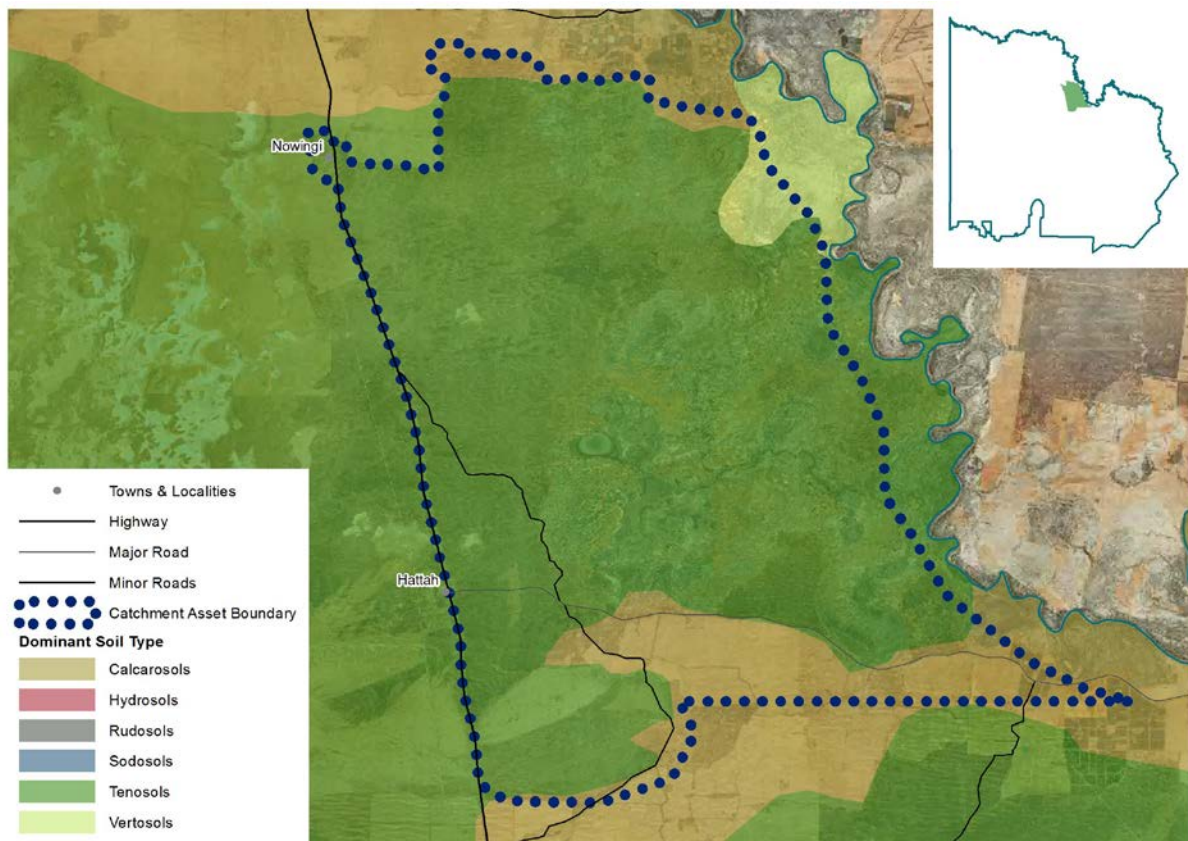


Figure 5: Dominant Soil Types

Agricultural Land

About 11% of the catchment asset area (approximately 6,000 hectares) is given over to agricultural activities, primarily dryland farming (3,900 hectares). Most of this activity occurs in the far south of the asset area to the south of the Murray Valley Highway.

The agricultural land of this Catchment Asset area is mainly valued for its capacity to support the production of food and fibre. This in turn provides for a range of other social and economic services that are important to the Mallee region. In addition, when these services are available, they support the local community in its efforts to maintain and enhance not only their agricultural land but other regional assets.

There is currently no accepted framework to categorise our agricultural land asset in terms of value from lower to higher based purely upon the social and economic values and services they provide. Such a framework has only been considered to date in terms of the threatening processes that may impinge on the capacity of our agricultural land asset to provide the services we have come to expect. This will be discussed later in this document. As a result, the most appropriate course of action is to consider the relative value of the agricultural land asset at a regional scale rather than at a catchment asset scale and in accordance to its capacity to provide and support social and economic values.

Therefore, the Agricultural Land within this Catchment Asset and across the region is considered to be of **high** value.

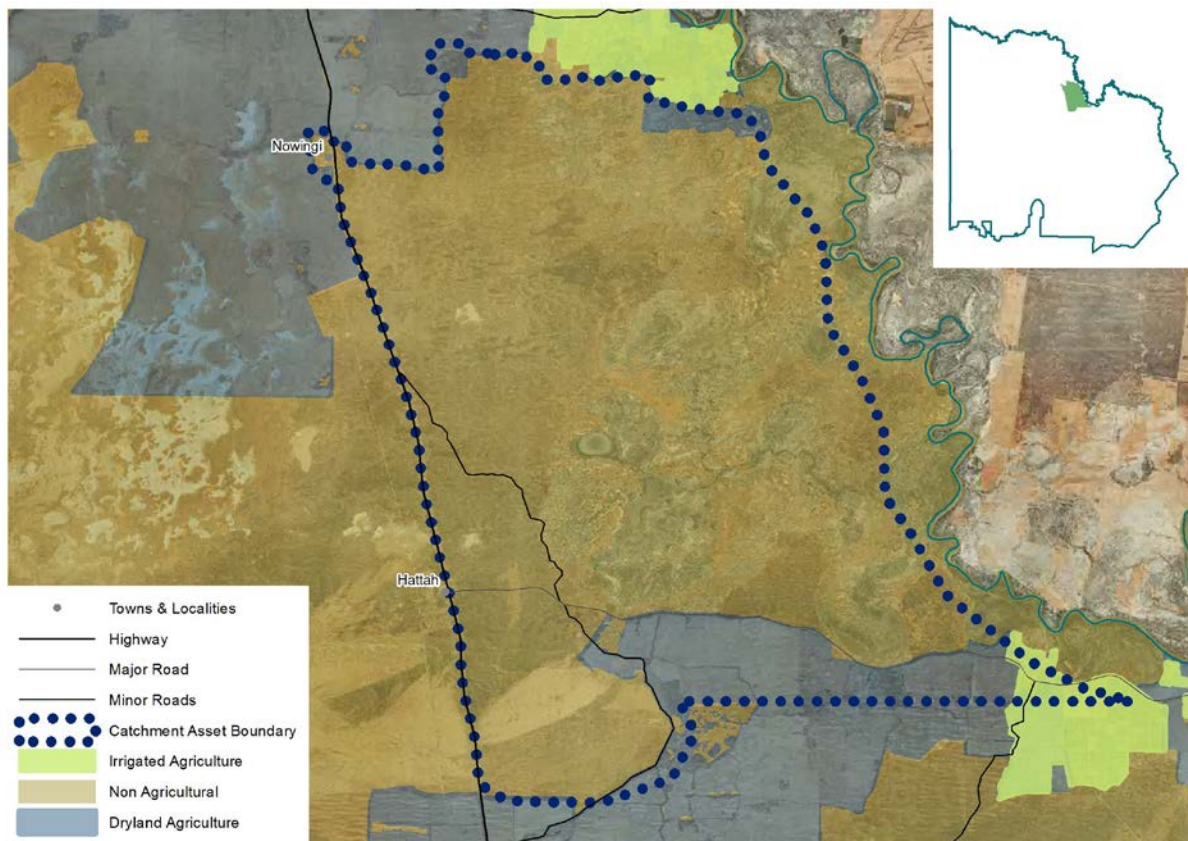


Figure 6: Agricultural land use

Groundwater

Groundwater aquifers that lie underneath this Catchment Asset area are not known to be utilised to provide a water resource for human uses. Therefore, the Mallee's groundwater asset is not of significance to this Catchment Asset.

Cultural Heritage

The catchment asset area has important Indigenous and non-Indigenous cultural value. Aboriginal people have had a connection to this area for tens of thousands of years. A significant number of cultural heritage sites occur in this area, ranging from small sites and earth features to larger sites containing artefacts, ovens and midden sites. From a European perspective, the area contains a number of heritage overlays that encompass sites of historical significance.

Cultural heritage sites in this Catchment Asset area are predominantly valued for the connection they provide to the community between the social and cultural landscape that we currently enjoy and the stories, ideas and history of how that came to be. These sites provide individuals and families with a physical representation of their connection to the Mallee landscape and their place in it. These connections are extremely important to these people and, in turn, can reflect upon how they value and relate to the Mallee landscape that they are familiar with today. Therefore it is important to all that these sites are managed and protected in a manner that is sympathetic to those connections and values. Heritage significance is typically assessed under a three-tier legislative system that determines the local, state, national or commonwealth significance of an item. Heritage items can also be included on non-statutory listings (such as the National Trust classifications). However, there is no single and simple approach to categorise our cultural heritage asset in terms of value to the region. Tradition distinctions between different types of value (such as economic, social and environmental values) can be determined but this data is only patchily available given the number and range of cultural heritage sites across the Mallee. The most appropriate course of action at this point is to give

equal value to all recognised cultural heritage sites in the Mallee regardless of their age, form and historical background.

Therefore, Cultural Heritage within this Catchment Asset and across the region is considered to be of **high** value. Any further processes undertaken to prioritise and target management actions will rely on assessments of risk likelihood and impact to those sites.

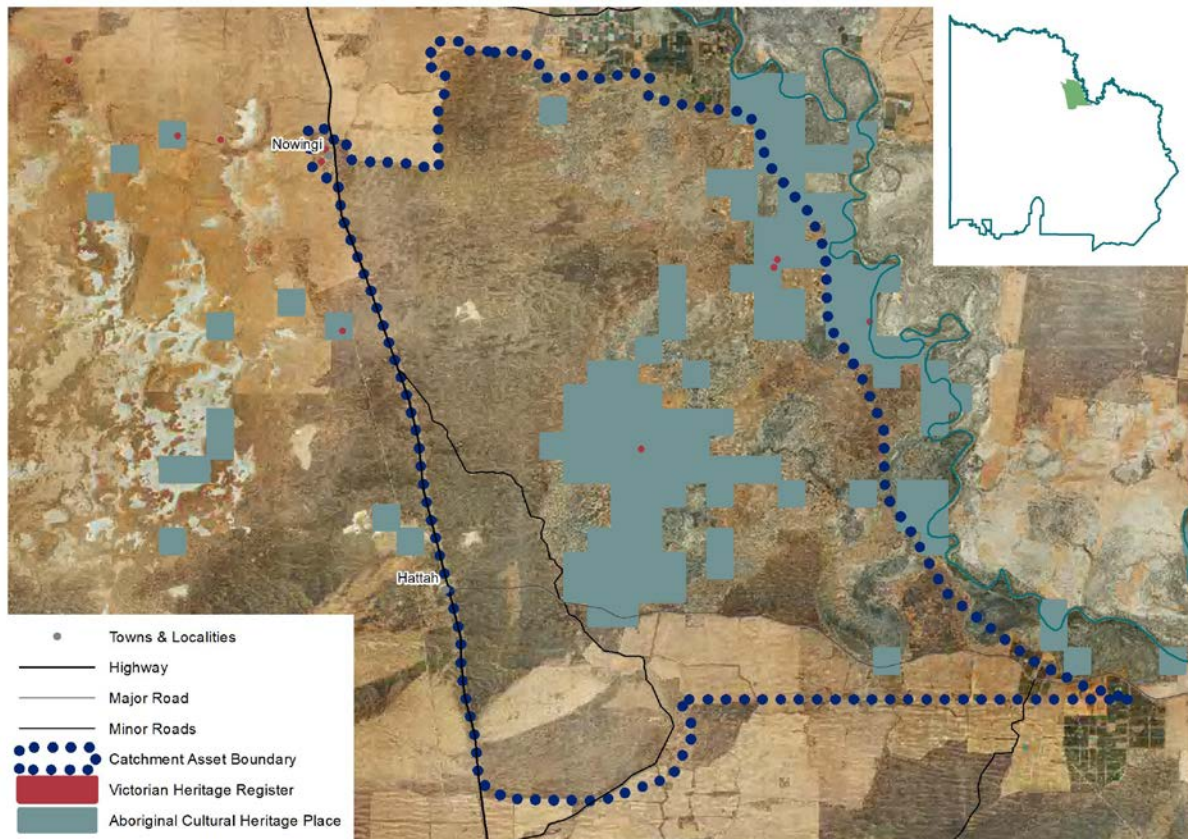


Figure 7: Areas of Cultural Value

Community Capacity

Community capacity is an important asset as positive and long-lasting NRM outcomes are dependent on an active, willing and capable community. In order to achieve regional scale NRM outcomes, people have to play a major role, often in partnership with government and industry, in the ongoing conservation and sustainable use of our Regional Assets. This requires Mallee communities to have the capacity to work cooperatively, apply economic resources, use networks and acquire and use relevant knowledge and information to achieve NRM outcomes. Maintaining and improving this capacity is dependent not only on the financial, physical and natural resources contained within or available to a community but also its social resources.

Community capacity therefore requires ongoing development, conservation and management as its relative condition can influence the achievement of all other biophysical goals and actions outlined within the RCS.

Our communities' capacity is defined by their characteristics and resources which, when combined, determine their ability to identify, evaluate and address key issues.

Characteristics of strong regional community capacity include:

- Individuals within the community being aware of regional NRM issues, and understanding the link between these issues and the long-term viability of the community
- Natural resource managers and users being able and willing to access the necessary information, data and science – biophysical, social and economic – to make sound NRM decisions
- Natural resource managers and users being equipped with or having access to, the necessary technical, people management, project management and planning skills to Social, participate in the development and implementation of sustainable NRM at the property, local and regional scales
- Community being engaged and motivated, and exercising ownership over NRM decision making processes and effectively implementing actions arising from these processes (DAFF 2006).

This catchment asset area is centred on the State Suburb of Hattah but also takes in small parts of Colignan in the north and Walpeup and Wemen in the south. State Suburbs (SSC) are statistical areas that may incorporate one or more gazetted localities. This catchment asset area contains all or part of the following gazetted localities: Hattah; Kulkyn; Colignan; Nowingi; Cramenton and Liparoo.

This catchment asset area is very sparsely populated with only twelve residents identified within the Hattah SSC during the 2011 Census. Population data concerning the fringing SSC within the Catchment Asset is unavailable. However, it is unlikely to significantly add to this population. However, this area is heavily used as a recreation resource and tourism destination by populations both within and external to the Mallee. Therefore, while the resident community is of critical importance to the ongoing management of the catchment asset, it is this wider population of occasional users whose capacity for effective and sustainable natural resource management is potentially quite influential in the long term by virtue of its greater size.

Given the relatively small population, this catchment asset area has few resident, active community driven NRM organisations. There is one active Landcare group (Robinvale & District) whose area of influence includes the southern end of the asset area. However, the asset area is supported by similar groups from outside the asset area such as Birdlife Mildura and the Sunraysia Field Naturalists Club which reflects well on the capacity of the local community to contribute to effective NRM outcomes.

A complete listing of all the known community NRM organisations within the catchment asset can be found in the Community NRM Groups section.

Whilst there are a number of methods available to evaluate the relative 'condition' of our community's capacity for NRM there is currently no accepted framework to categorise the community capacity asset in terms of value from low to high based upon the values and services it may provide. As a result, the most appropriate course of action is to consider the relative value of community capacity for NRM in terms of its potential contribution to NRM outcomes at a regional scale and what those NRM outcomes might be (and how sizeable the resources required to achieve them) if that contribution was not forthcoming. Under those circumstances, it is relatively easy to come to the conclusion that, without the communities' investment into NRM through exercising that community capacity asset, the scale and success of our NRM outcomes will be curtailed while their cost in resources increases. Such a situation would not benefit the Mallee region or its Regional Assets.

Therefore, Community Capacity within this Catchment Asset and across the region is considered to be of **high** value.

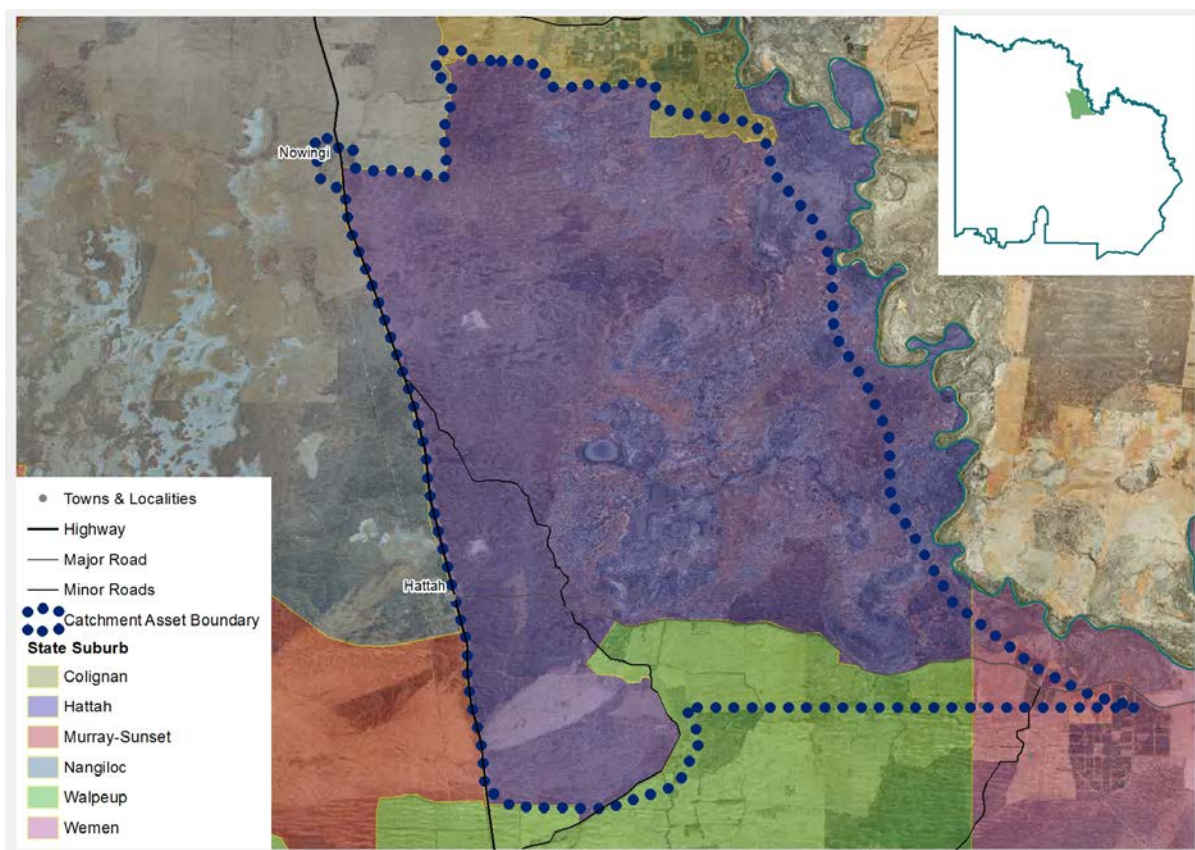


Figure 8: State Suburbs

Section 3 – Threatening Processes in this Catchment Asset

Threatening processes in the Mallee NRM region were defined and applied as part of the development of Mallee Regional Catchment Strategy by the Regional Catchment Strategy Steering Committee. Each of the following sub-sections provides a background to these threatening processes, available information about their form within this Catchment Asset and some discussion regarding the impact of these processes on our regional assets. This follows on to an assessment of the relative threat level posed by each the threatening processes based on the criteria contained in Appendix 2. *Categorising Threatening Processes*.

Land & water salinisation

Land and water salinisation is defined as: “Salinisation of the soil and water resources through the displacement of salt as a result of natural and human induced drivers.”

Salinisation of soils is caused by discharge of groundwater to the atmosphere by direct transpiration of groundwater by vegetation or by capillary rise from the water table through the soil profile to either the soil surface (evaporation) or the bottom of the plant root zone. Salt contained in the water that is evaporated and/or transpired is left behind and accumulates in the soil. High rates of groundwater discharge, and hence salt accumulation, only occur in areas where water tables are shallow (typically less than 10 m, with the most severe effects when the water table is less than 5 m).

There are many naturally saline wetlands and wetland complexes in the Mallee that are situated in areas where the underlying water tables are naturally shallow. Better known examples of these natural systems include the Tyrrell Basin, Raak Plain and the Pink Lakes. These are natural saline systems that have historically developed and been maintained in a balance that provided for stable ecological communities. However, agricultural development in the last century has altered the long term balance of these systems. The removal of much of the Mallee vegetation and the use of land management techniques that were comparatively inefficient users of rainfall (compared to Mallee woodlands) allowed deep drainage past the root zone. Depending on the location, this deep drainage either manifest itself as localised discharge zones in dune swales or contributed to further shallowing of the regional water table. As water tables came closer to the surface, more wetlands and wetland ecosystems were threatened by increasing salinity and increasing areas of salinised landscape.

The incremental improvement in agricultural land management techniques to maximise water use efficiency and minimise through drainage over the last two decades coupled with the broad scale effect of the so-called Millennium Drought have begun to swing the balance back towards a more neutral status. Water table depths have fallen and correspondingly so have salinity impacts in the landscape.

Despite these recent advances, the risks remain. Many of the triggers in the landscape that created the salinisation problem still remain. Most notable of these are the altered flow regimes in our watercourses and wetlands and the large, open areas cleared of perennial Mallee vegetation. These are historical landscape modifications that are not expected to be rectified since they have provided for the bulk of the Mallee’s resultant economic and social activity. Lapses in our current regimes of effective land and water management coupled with a changing climate can easily contribute to the return of a significant period of land and water salinisation.

This catchment asset area contains only two small areas of naturally saline surfaces which are saline wetland systems perched on the higher ground to the west of the Hattah Lakes. The low relief of the Hattah Lakes system means they sit relatively close to the regional groundwater table. Classification of induced and natural saline surfaces in 2009 indicates they cover about 65 hectares (Mock and Grinter 2009). However, one of these wetlands is also impacted by induced salinity. The same classification process found that an additional 19 hectares around the wetland closer to Hattah has been impacted. In total, just 0.15% of the catchment asset area contains saline surfaces.

Depth to the regional watertable and the general trends in groundwater levels were modelled in 2010 throughout the Mallee based on analysis of available groundwater data (Figure 9). Depth to water

table was typically found to be relatively shallow (within 10 metres of ground level) compared to other asset areas due to the low relief of the river corridor. However, truly shallow water tables are uncommon with just 1.7% (almost 910 hectares) of the asset area having the watertable within 2 meters of the ground level. A further 11% of the area (almost 5,900 hectares) has a depth to watertable of less than 5 metres below ground level.

Given the current status of land and water salinisation in the Catchment asset area and consideration of the future potential of this threatening process to produce negative impacts within the area, the priority of action with respect to each Regional Asset has been determined. They are listed in Table 8 below.

Table 8: Prospective Priority of Action to address Land and Water Salinisation upon Regional Assets

Regional Asset	Priority of Action	Summary Logic
Rivers	MEDIUM	To be documented
Wetlands	HIGH	To be documented
Threatened Species and Communities	LOW	To be documented
Terrestrial Habitat	LOW	To be documented
Soils	LOW	To be documented
Agricultural Land	LOW	To be documented
Groundwater	NONE	To be documented
Cultural Heritage	NONE	To be documented
Community Capacity	NONE	To be documented

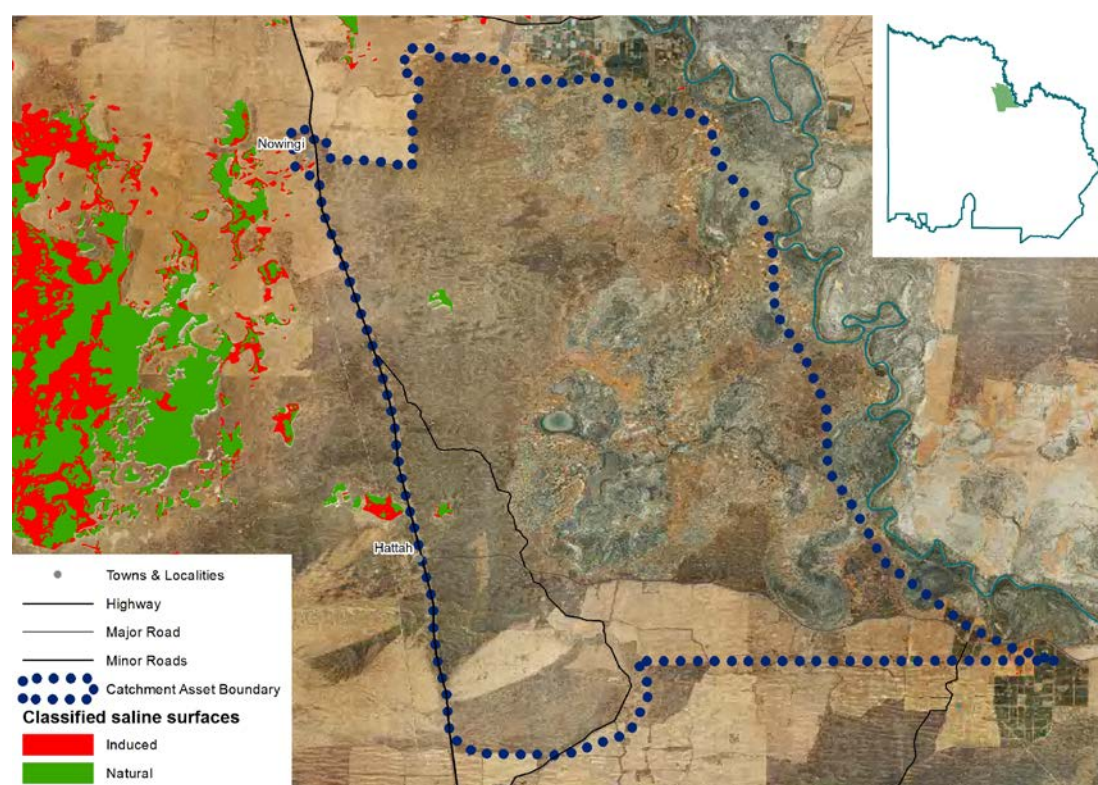


Figure 9: Natural and Induce Saline Surfaces

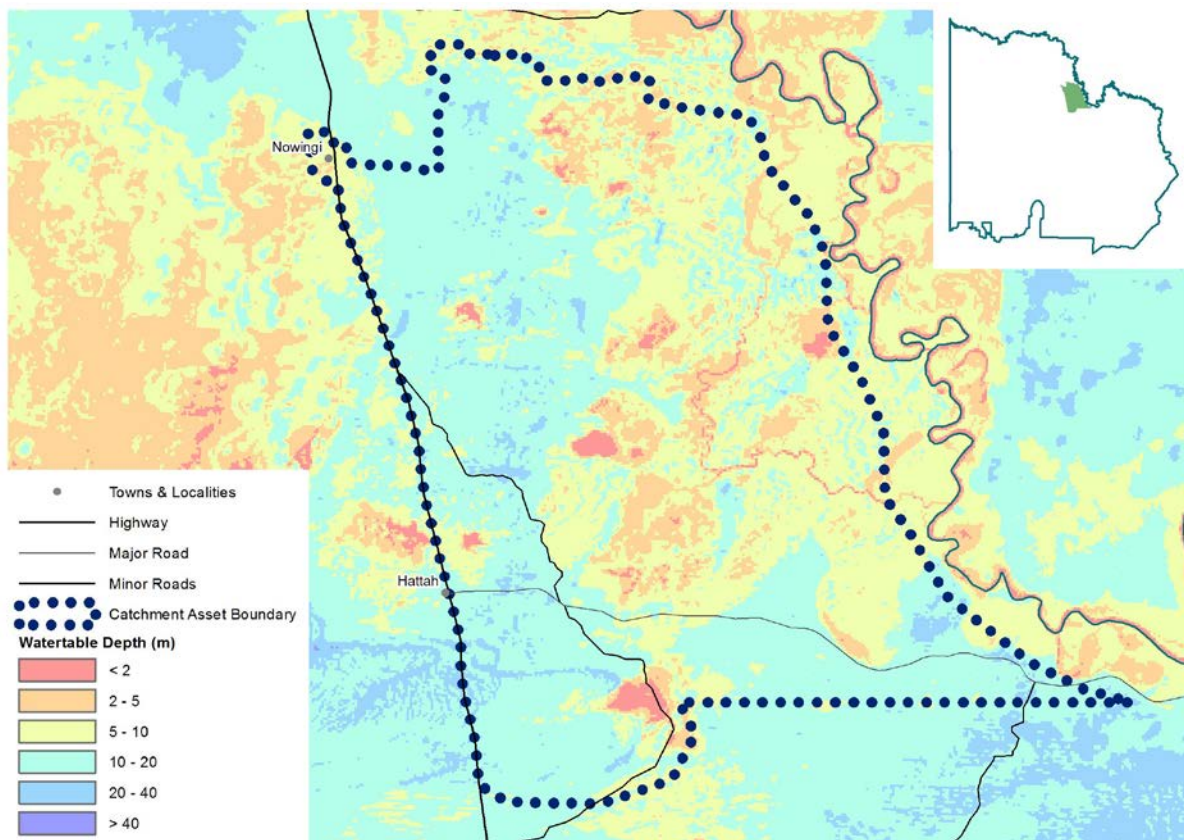


Figure 10: Estimated Depth to the Water table

Invasive Plants

Currently there are 25 State Prohibited Weeds, 4 Regionally Prohibited Weeds and 14 Regionally Controlled Weeds listed under the Catchment and Land Protection (CaLP) Act for the Mallee region. In addition to the conventional ways that weeds spread (e.g. wind and water) in the Mallee, disturbance from pest animals such as rabbits, goats and pigs also create good conditions for weed growth and contribute to weed spread.

Invasive plants in the Mallee threaten both biodiversity and the productive capacity of land. In many cases, weed infestation has changed the composition and character of the ecological landscape. Weed infestations also impact on the use of popular recreational spots in riparian areas, affecting aesthetic values and limiting access. Environmental weeds compete with established and regenerating indigenous species, threatening the quality and extent of native vegetation and reducing the diversity and availability of habitat. Environmental weeds present a significant risk to remnant roadside vegetation, as the 'edge effect' is particularly difficult to manage in these long, thin areas.

Agricultural weeds cause significant losses for horticulture and dryland farming through competition with crops and by reducing the quality of produce. Their control increases the cost of production and, in extreme cases, can diminish the productive capability of the land.

While the presence of recognised weed species in the asset area is almost certain, there is insufficient data available to adequately describe the current scope and scale of pest plant populations for the purposes of effective regional control. The available spatial data on invasive plant infestations dates back to 2007 and was generated as part of the Priority Weed Mapping project in 2008. This information is obviously now far out of date. The current information and response capacity

relies heavily on local activity at a local scale in response to local weed infestations. This approach, while often very successful, tends to preclude centralised management and control at a regional scale. Therefore, the priority of action to address invasive plants is strongly influenced by local scale data derived from local planning instruments and informal community consultation at the local level. On the other hand, limited knowledge and understanding of the vulnerability of the Mallee landscape to future weed incursions is available given the current listing of known invasive plants, the current understanding of their biological requirements and the planning and response framework provided by regional scale plans such as the Mallee Invasive Plants and Animals Management Strategy (IPAWS).

The IPAWS identifies 21 regional assets (based on geographic areas) across the Mallee region. This Catchment Asset area aligns with two of them: Hattah Kulkyn Lakes System and National Park; and Agricultural Land. The Hattah regional asset was considered by IPAWS to be of high priority for on-ground action to manage invasive plants and animals.

Using this combination of information gathering approaches and the application of a complimentary consultative process, the priority of action for dealing with invasive plants with respect to each Regional Asset has been determined. They are listed in the Table 9 below.

Table 9: Prospective Priority of Action to address Invasive Plants upon Regional Assets

Regional Asset	Priority of Action	Summary Logic
Rivers	HIGH	To be documented
Wetlands	HIGH	To be documented
Threatened Species and Communities	HIGH	Buloke woodlands are an endangered ecological community and lie within the high priority IPAWS asset area
Terrestrial Habitat	HIGH	To be documented
Soils	MEDIUM	To be documented
Agricultural Land	MEDIUM	To be documented
Groundwater	NONE	This regional asset is not present within this catchment asset
Cultural Heritage	HIGH	To be documented
Community Capacity	NONE	Invasive plants do not pose a significant threat to community capacity at this time

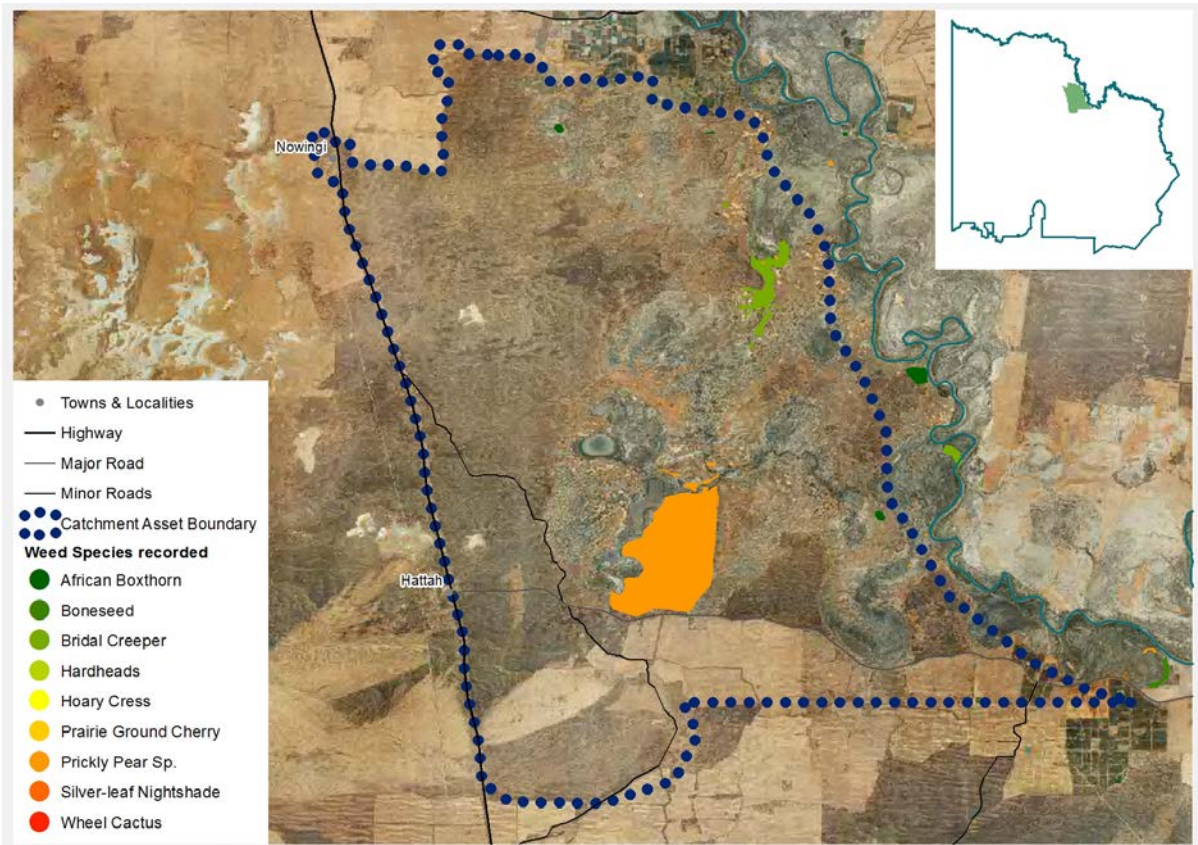


Figure 11: Priority Weed Infestations Recorded Between 2005 and 2007

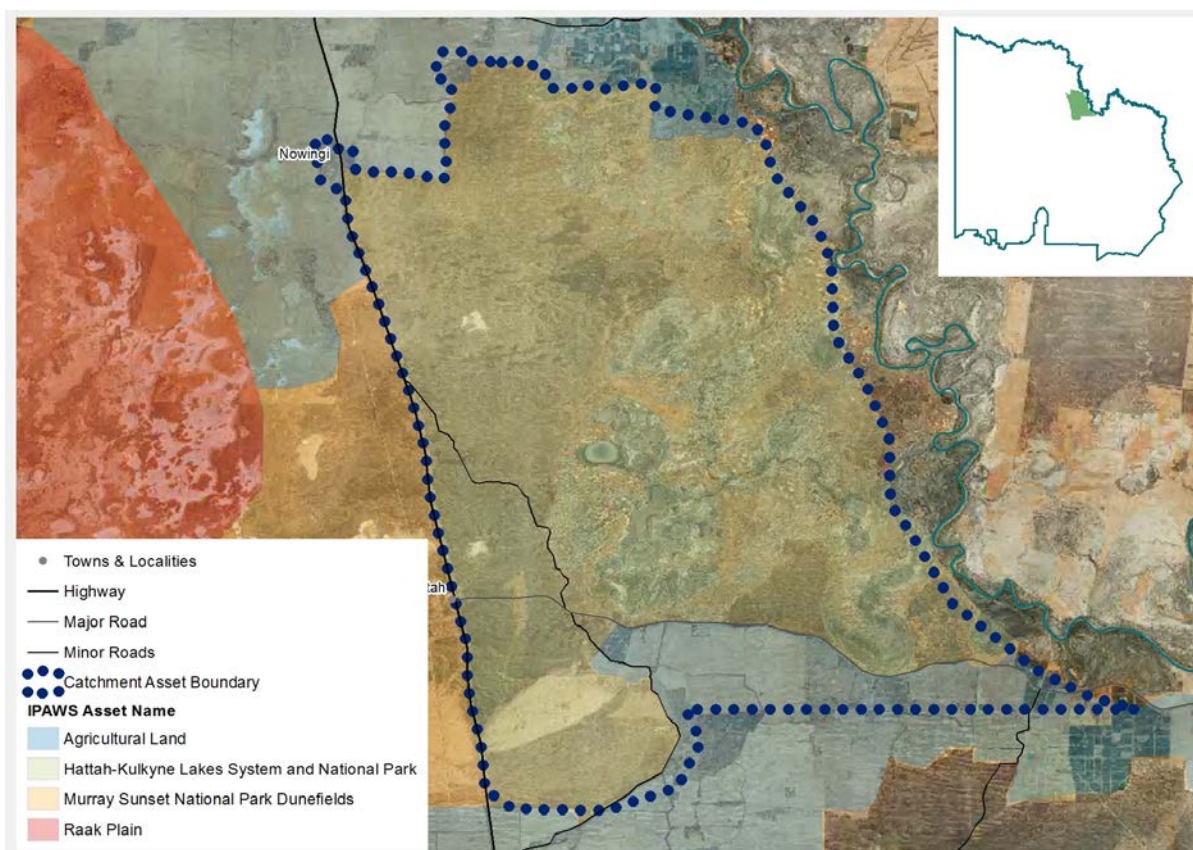


Figure 12: Regional Assets from the Mallee Invasive Plants and Animal Strategy

Invasive Animals

Invasive animals in terms of the Mallee RCS are regarded as those established invasive pest animals as defined in Part 8 of the CaLP Act 1994

Australia is host to 56 invasive vertebrate animal species. Of these, the ones with the most impact (in order of damage estimates) are: European Red Fox, feral cats, rabbits, feral pigs, wild dogs, the house mouse, carp and goats. The Mallee region hosts populations of all of these species. However, of most significance to the Mallee is the European Red Fox and Rabbits – both are declared under the Catchment and Land Protection (CaLP) Act 1994.

Invasive species are considered to be pests when they have, or have the potential to have, an undesirable economic, environmental or social/cultural impact. Such impacts may include damage to agricultural crops, livestock predation, indigenous fauna predation, soil erosion and land degradation, spread of weeds, pasture/food and habitat competition, and the potential spread of disease. Gong et al. (2009) estimated the overall direct economic impact of several pest animal species (foxes, rabbits, wild dogs, feral pigs, birds and mice) in Australia to be \$740 million annually. This included \$620.8 million of production losses in agriculture (including horticulture) and \$122.7 million on expenditure on pest animal management, administration and research in Australia. Some of the social impacts of pest animals include damage to infrastructure or cultural/historical sites, being 'a nuisance', causing traffic accidents, as well as significant social/psychological impacts on primary producers; for example, through distress of wild dog predation on livestock.

Other non-declared pest animals present in the Mallee include feral Bees, European Wasps, Hares, Starlings, Snails, Rats, Mice and Locusts.

The dune systems around the Hattah Lakes system coupled with their close proximity to potential water and food sources mean that much of the remnant vegetation that immediately surrounds the

wetland system is susceptible to rabbit activity. 6,445 hectares (12%) of the catchment asset area is considered highly susceptible to rabbit activity. A further 11,766 hectares is considered susceptible to rabbit activity. However, there is little available data to describe the impact rabbits are currently having on the asset area.

The asset area is also known to be home to populations of foxes, pigs, goats and cats. As with rabbits, there is little concrete data available to scale of threat these populations pose this asset.

As with invasive plants, the presence of invasive animals like rabbits and foxes in the asset area is recognised. However, there is only limited data available to adequately describe the current scope and scale of pest animal populations for the purposes of effective regional control. The current information and response capacity relies heavily on local activity at a local scale. This approach, while often very successful, tends to preclude centralised management and control at a regional scale. Therefore, the priority of action to address invasive animals is strongly influenced by local scale data derived from local planning instruments and informal community consultation at the local level. On the other hand, knowledge and understanding of the vulnerability of the Mallee landscape to future incursions or outbreaks is available for some species given the current understanding of their biological requirements and the planning and response framework provided by regional scale plans such as the Mallee Invasive Plants and Animals Management Strategy (IPAMS).

The IPAMS identifies 21 regional assets (based on geographic areas) across the Mallee region. This Catchment Asset area aligns with two of them: Hattah Kulkyne Lakes System and National Park; and Agricultural Land. The Hattah regional asset was considered by IPAMS to be of high priority for on-ground action to manage invasive plants and animals.

Using this combination of information gathering approaches and the application of a complimentary consultative process, the priority of action for dealing with invasive plants with respect to each Regional Asset has been determined. They are listed in Table 10 below.

Table 10: Prospective Priority of Action to address Invasive Animals upon Regional Assets

Regional Asset	Priority of Action	Summary Logic
Rivers	HIGH	To be documented
Wetlands	HIGH	To be documented
Threatened Species and Communities	HIGH	Buloke woodlands are an endangered ecological community and lie within the high priority IPAWS asset area
Terrestrial Habitat	HIGH	To be documented
Soils	MEDIUM	To be documented
Agricultural Land	MEDIUM	To be documented
Groundwater	NONE	This regional asset is not present within this catchment asset
Cultural Heritage	HIGH	To be documented
Community Capacity	NONE	Invasive animals do not pose a significant threat to community capacity at this time

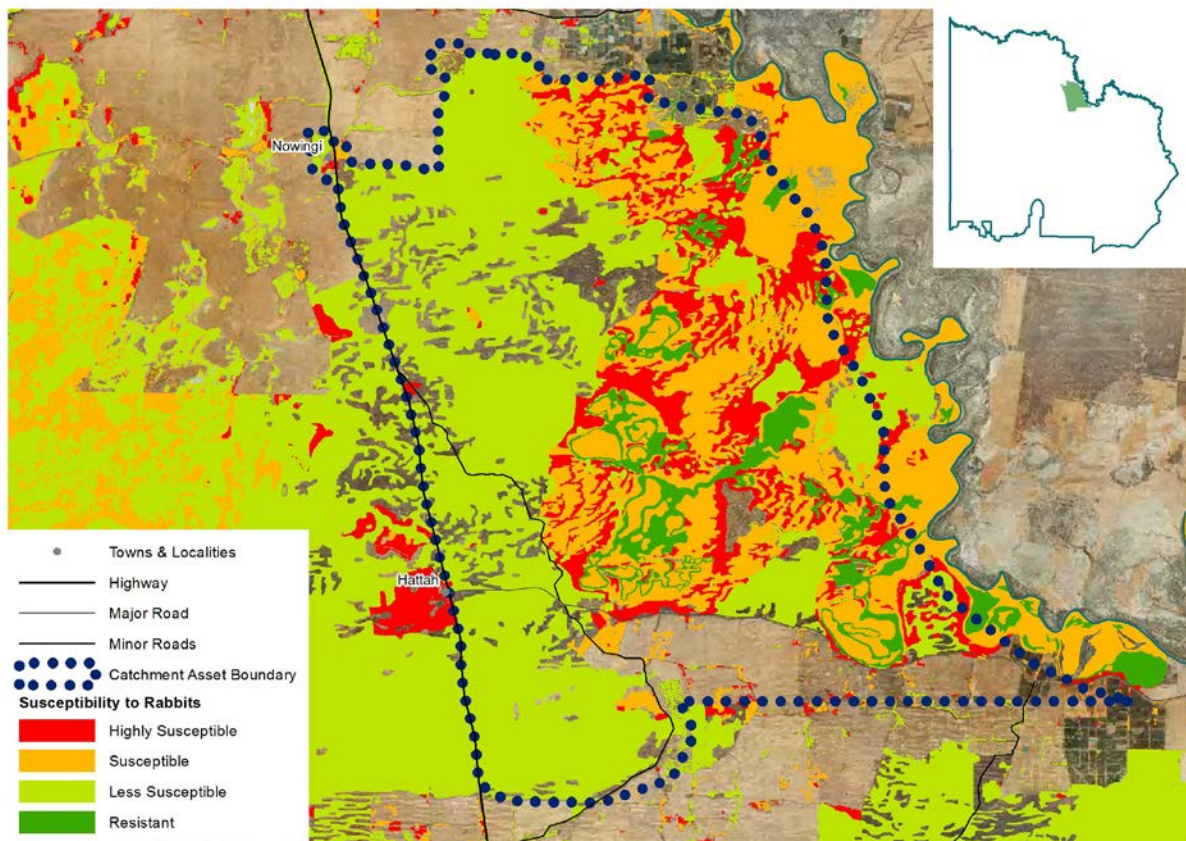


Figure 13: Susceptibility of Remnant Native Vegetation to Rabbits

Altered Hydrological Regimes

Modification of the natural flow regimes in our river systems has occurred over time to meet the various needs of navigation, agriculture and urban water use. Flow regulation has resulted in changes in the frequency, magnitude and duration of flows, and the restriction of small to medium flood events. River regulation, including the effect of locks, weirs and dams, has altered wetting and drying phases of many wetlands and ephemeral anabranches, by either permanently inundating the area, or restricting flows. Engineering works, such as the building of levees, have alienated large areas of floodplain which alters flood conveyance and flood storage. These changes have great significance for: fringing and floodplain forest communities; populations of fish, macroinvertebrates, algae, macrophytes; nutrient cycling; water quality; and channel shape and form.

Wetlands across the Mallee region have also been subject to modification of natural flow regimes which poses a threat to all priority wetland units. The flow regime, or hydrology, of a wetland is typically determined by climactic conditions and the inflows and outflows of surface and groundwater. Changes in hydrology affect most aspects of wetland ecology, including nutrient cycling; water quality; wetland shape and form; biodiversity; vegetation health, type and extent; and the composition and size of faunal communities. A wetland's flow regime has three main components: frequency, duration and seasonality of inundation. Any activity that changes one or more of these components will alter the natural hydrological regime of a wetland. Examples of these activities include: changes the flow regime of the wetland's water source; interference with flows in and out of, or even within, the wetland; water disposal to or extraction from the wetland; and modification of wetland depth (which alters evaporation rates and affects inundation duration).

The river system adjacent to and anabranch system within this asset area has been subject to extensive modification of hydrological regimes to the influence of weirs and locks and alteration of seasonal flow patterns to benefit irrigated agriculture. Index of Stream Condition analysis in 2004

indicates that, of the 21 river reaches in the asset area, 10 are considered to be in moderate condition and 11 are in a poor condition, primarily due to the typically poor scores for hydrology.

The Chalka Creek and Hattah Lakes System have recently received major engineering works that aim to provide a more natural hydrological process by allowing the system to be partially or fully flooded on an appropriate seasonal cycle regardless of the prevailing flow conditions within the Murray River. The ongoing management of these new water control measures is informed by the Hattah Lakes Environmental Water Management Plan. This document describes the ecological objectives and targets and the site-specific watering regimes, works and water delivery arrangements. This is a relatively new regime that will require considerable input and action over the next few years to ensure that the aims of the plan are supported and delivered and done so in a way that does not compromise the health and well-being of important Regional Assets within this Catchment Asset.

Using this combination of information gathering approaches and the application of a complimentary consultative process, the priority of action for dealing with altered hydrological regimes with respect to each Regional Asset has been determined. They are listed in Table 11 below.

Table 11: Prospective Priority of Action to address Altered Hydrological Processes

Regional Asset	Priority of Action	Summary Logic
Rivers	HIGH	To be documented
Wetlands	HIGH	To be documented
Threatened Species and Communities	HIGH	To be documented
Terrestrial Habitat	HIGH	To be documented
Soils	HIGH	To be documented
Agricultural Land	HIGH	To be documented
Groundwater	NONE	To be documented
Cultural Heritage	HIGH	To be documented
Community Capacity	NONE	To be documented

Soil Erosion

Soil erosion in the Mallee is primarily confined to two processes: wind erosion and water erosion. Wind erosion is typically a regional scale process whereas water erosion primarily occurs in discrete locations on the sides and banks of some watercourses.

Wind erosion is the process by which soil particles are detached from the land surface and transported by the wind. Wind erosion occurs when the forces exerted by the wind overcome the gravitational and cohesive forces of soil particles on the surface of the ground. Wind erosion degrades the soil, reducing its capacity to sustain biodiversity and to support agricultural production. It can also have significant off-site impacts on infrastructure, air quality and respiratory health.

The movement of soil particles by the wind occurs in three ways, each of which is dependent on the size of the particles in question. The first method is known as creep. Larger particles (like sand) are generally too heavy to be lifted by the wind, so they are rolled along the surface by wind drag or moved by bombardment by other moving particles. The next method is known as saltation and this is when middling sized soil particles (typically 0.1 to 0.5 mm) are lifted by the wind, and then fall back to the ground, so they move in a hopping or bouncing fashion. This abrades the soil surface and as they hit other particles they break into smaller particles. It is these smaller particles (typically less than 0.1

mm) that form the suspended dust that is carried away from the erosion site by the wind and is typical of a Mallee dust event.

The susceptibility of a soil to erosion is dependent on its erodibility; its exposure to erosive winds; and on its moisture content. Soil erodibility refers to the inherent properties of the soil that make it susceptible to movement should the soil be exposed to strong winds (for example when they have been completely cleared or cultivated). These properties include: surface texture, organic matter content and stability of soil aggregates. The most erodible soil types are those with single grained structure and poor aggregate stability, such soils commonly comprising a large proportion of fine sand particles.

Soil erosion susceptibility in the Mallee can be spatially described due to a recognised relationship between soil type and the terrain. Landform component mapping took advantage of the relationship and served as a basis for predicting soil properties that determine erodibility based on prevailing terrain and soil types. It is an extension of the description and mapping of Mallee land systems in 1963 by Rowan and Downes which provides information about the land, its capabilities and its susceptibilities. The mapping used soil texture as the measure of erodibility and considered the frequency and direction of erodible winds (from south-west to westerly) to be consistent across the study area. The erosion susceptibility map for this Catchment Asset area is presented in Figure 14 below.

Wind erosion susceptibility mapping does not reflect the actual threat (or likelihood) of erosion occurring. Whilst a soil's inherent susceptibility to wind erosion is important, the actual likelihood of erosion occurring also depends on how the land is managed. Land management (such as vegetation cover) and climatic conditions (such as wind strength) play an important role in the occurrence of erosion. Where inappropriate management occurs severe wind erosion can be initiated on soils with low susceptibility and conversely erosion can be minimised on soils with high susceptibility with good management practises (Lorimer, 1985). When predicting the threat of erosion, both the landform component's inherent susceptibility to erode and its current state of management must be considered.

Given that the area is dominated by sandy dune systems interwoven with floodplain lakes, most of the soil types and landforms in the catchment asset area are quite vulnerable to wind erosion should the correct precursors (such as reduced groundcover) for such erosion exist. Some 18,860 hectares (35%) of the catchment asset area is considered very highly susceptible to wind erosion. A further 12,120 hectares (22%) is considered highly susceptible to wind erosion.

It should be pointed out that almost 90% of this catchment asset area is public land and therefore not intensively managed for agricultural purposes. It is considered that the soils of these lands are less likely to be exposed to wind erosion through the removal of ground cover as is seasonally the case with much agricultural land, especially those lands given over to cropping. While most of the agricultural land in this catchment asset area is given over to dryland agriculture, most of the soils used for this purpose are typically considered to be only moderately susceptible to wind erosion. The scattered dune tops that are highly susceptible are certainly present in the agricultural portions of the asset area but account for less than 1,000 hectares. Most of this highly susceptible soil lies under an area now utilised for permanent irrigated horticulture and is thus typically protected by vegetation and other infrastructure. Therefore, the actual area of soil within this catchment asset area that might be exposed and conducive to wind erosion at any particular time is likely to be comparatively small and a relatively localised threat to regional assets within this catchment asset area.

Using this combination of information gathering approaches and the application of a complimentary consultative process, the priority of action for dealing with soil erosion with respect to each Regional Asset has been determined. They are listed in Table 12 below.

Table 12: Prospective Priority of Action to address Soil Erosion

Regional Asset	Priority of Action	Summary Logic
Rivers	MEDIUM	To be documented
Wetlands	MEDIUM	To be documented
Threatened Species and Communities	MEDIUM	To be documented
Terrestrial Habitat	MEDIUM	To be documented
Soils	MEDIUM	To be documented
Agricultural Land	LOW	To be documented
Groundwater	NONE	To be documented
Cultural Heritage	HIGH	To be documented
Community Capacity	NONE	To be documented

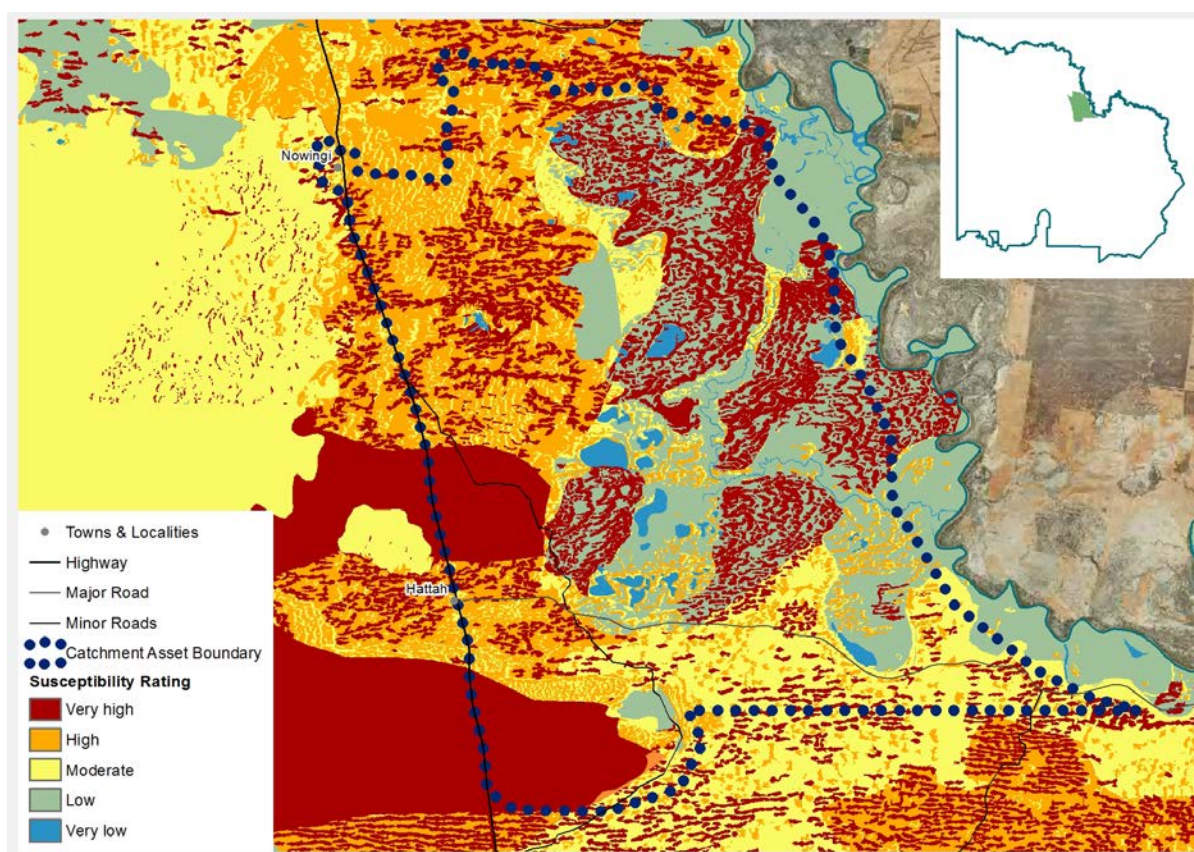


Figure 14: Wind Erosion Susceptibility

Inappropriate Water Use Practices

Inappropriate water use practices in agricultural activities in both the irrigation and dryland zones have been demonstrated to result in excessive volumes of deep drainage past the root zone of crops and pasture and therefore contribute to the raising of local and regional water tables.

Considerable effort has been expended by land managers and support agencies in recent years to substantially improve water management practices in irrigated agriculture throughout the region. This

catchment asset area has been one of the major beneficiaries of the improvement process. However, the capacity to adequately describe the extent to which inappropriate water use practises remain in place currently remains elusive. The complexity of irrigated crop types, irrigation systems, water use and practises and the application of best practise benchmarks has, to date, constrained the capacity to reliably and meaningfully determine irrigation efficiency at a district scale and therefore determine the scale of inappropriate water use practises. However, measures are underway to rectify this inadequacy in the life of this RCS.

Using this combination of information gathering approaches and the application of a complimentary consultative process, the priority of action for dealing with inappropriate water use practices with respect to each Regional Asset has been determined. They are listed in Table 13 below.

Table 13: Prospective Priority of Action to address Inappropriate Water Use Practices

Regional Asset	Priority of Action	Summary Logic
Rivers	MEDIUM	To be documented
Wetlands	MEDIUM	To be documented
Threatened Species and Communities	MEDIUM	To be documented
Terrestrial Habitat	MEDIUM	To be documented
Soils	MEDIUM	To be documented
Agricultural Land	MEDIUM	To be documented
Groundwater	NONE	To be documented
Cultural Heritage	MEDIUM	To be documented
Community Capacity	NONE	To be documented

Recreational Pressures

Recreational pressure can contribute to impacts including littering, track proliferation, fishing pressures, firewood collection, soil compaction and site erosion. The nature of the impacts is typically localised around the particular site and is highly dependent on the accessibility, popularity and sensitivity of the site along with the level of management that the location receives.

This catchment asset is an extremely popular area for day use recreation and camping. The State of the Parks survey identifies a range of potential impacts arising from this recreational use. However, the scope, scale and extent of the impacts that results from this recreational pressure have not been quantified.

Using this combination of information gathering approaches and the application of a complimentary consultative process, the priority of action for dealing with recreational pressures with respect to each Regional Asset has been determined. They are listed in Table 14 below.

Table 14: Prospective Priority of Action to address Recreational Pressures

Regional Asset	Priority of Action	Summary Logic
Rivers	HIGH	To be documented
Wetlands	HIGH	To be documented
Threatened Species and Communities	HIGH	To be documented
Terrestrial Habitat	HIGH	To be documented

Soils	NONE	To be documented
Agricultural Land	NONE	To be documented
Groundwater	NONE	To be documented
Cultural Heritage	HIGH	To be documented
Community Capacity	NONE	To be documented

Land Use Change

Land use change as a threatening process in this context is considered to be the change of land management or use practices from either a steady state or from accepted best practice management system. Examples include the removal of native vegetation, conversion of dryland property to irrigation development (or the reverse), change from no-till cropping to traditional fallow techniques, conversion from perennial pasture to cropping (or the reverse)

There is insufficient quality and quantity of data available to adequately describe the nature and level of impact resulting from this threatening process on this catchment asset at this time.

Using this combination of information gathering approaches and the application of a complimentary consultative process, the priority of action for dealing with land use change with respect to each Regional Asset has been determined. They are listed in Table 15 below.

Table 15: Prospective Priority of Action to address Land Use Change

Regional Asset	Priority of Action	Summary Logic
Rivers	MEDIUM	To be documented
Wetlands	MEDIUM	To be documented
Threatened Species and Communities	MEDIUM	To be documented
Terrestrial Habitat	MEDIUM	To be documented
Soils	MEDIUM	To be documented
Agricultural Land	MEDIUM	To be documented
Groundwater	NONE	To be documented
Cultural Heritage	HIGH	To be documented
Community Capacity	NONE	To be documented

Direct Off-site Interactions

Direct off-site interactions are the direct physical impacts from land management activities on neighbouring off-site assets such as areas of remnant native vegetation or wetlands. Such interactions may include chemical spray drift; parking or storage of machinery and equipment; or incremental drift of cultivation into the asset.

There is insufficient quality and quantity of data available to adequately describe the nature and level of impact resulting from this threatening process on this catchment asset at this time.

Using this combination of information gathering approaches and the application of a complimentary consultative process, the priority of action for dealing with direct off-site interactions with respect to each Regional Asset has been determined. They are listed Table 16 below.

Table 16: Prospective Priority of Action to address Direct Off-site Interactions

Regional Asset	Priority of Action	Summary Logic
Rivers	LOW	To be documented
Wetlands	LOW	To be documented
Threatened Species and Communities	LOW	To be documented
Terrestrial Habitat	LOW	To be documented
Soils	LOW	To be documented
Agricultural Land	LOW	To be documented
Groundwater	NONE	To be documented
Cultural Heritage	MEDIUM	To be documented
Community Capacity	NONE	To be documented

Misaligned Community Perceptions

Misaligned community perceptions are community opinions, approaches & values that run counter to the messages & knowledge available about natural resource management AND threaten the success of the wider communities' efforts to enhance their environment. Such perceptions include 'right of unfettered access' that results in removal of traffic management infrastructure installed near river banks; and 'we are doing no harm' where individuals are not aware of the cumulative and incremental harm of some of their actions (along with those of the rest of the community) when they are making use of our assets

There is insufficient quality and quantity of data available to adequately describe the nature and level of impact resulting from this threatening process on this catchment asset at this time. However, there is a range of anecdotal information from a range of sources that suggest the threat is present and ongoing.

Using this combination of information gathering approaches and the application of a complimentary consultative process, the priority of action for dealing with misaligned community perceptions with respect to each Regional Asset has been determined. They are listed in Table 17 below.

Table 17: Prospective Priority of Action to address Misaligned Community Perceptions

Regional Asset	Priority of Action	Summary Logic
Rivers	MEDIUM	To be documented
Wetlands	MEDIUM	To be documented
Threatened Species and Communities	MEDIUM	To be documented
Terrestrial Habitat	MEDIUM	To be documented
Soils	MEDIUM	To be documented
Agricultural Land	MEDIUM	To be documented
Groundwater	NONE	To be documented

Cultural Heritage	MEDIUM	To be documented
Community Capacity	MEDIUM	To be documented

Inappropriate Fire Regimes

Fire is an ongoing challenge for land managers and communities alike. Fire is also a major force determining the structure, function and sustainability of Australia's ecosystems. A substantial proportion of Australia's unique biota is dependent, to varying degrees, on fire and the variety of fire regimes for its continued existence and development. In this context, inappropriate fire regimes can mean either too little or too much fire

Fire management within this catchment asset area is heavily controlled and determined by the North West Region Mildura Fire District Fire Protection Plan and the Mallee Parks Management Plan. Under such a management regime, the risk posed by inappropriate fire regimes to the habitat and ecology of this catchment asset area is considered to be substantially constrained at this time. The continuation of an appropriate adaptive management regime that rapidly responds to new information and changes in on-ground reality should work to minimise the risk posed by this threatening process over the life of the RCS.

Using this combination of information gathering approaches and the application of a complimentary consultative process, the priority of action for dealing with inappropriate fire regimes with respect to each Regional Asset has been determined. They are listed in Table 18 below.

Table 18: Prospective Priority of Action to address Inappropriate Fire Regimes

Regional Asset	Priority of Action	Summary Logic
Rivers	NONE	To be documented
Wetlands	NONE	To be documented
Threatened Species and Communities	LOW	To be documented
Terrestrial Habitat	LOW	To be documented
Soils	NONE	To be documented
Agricultural Land	NONE	To be documented
Groundwater	NONE	To be documented
Cultural Heritage	NONE	To be documented
Community Capacity	NONE	To be documented

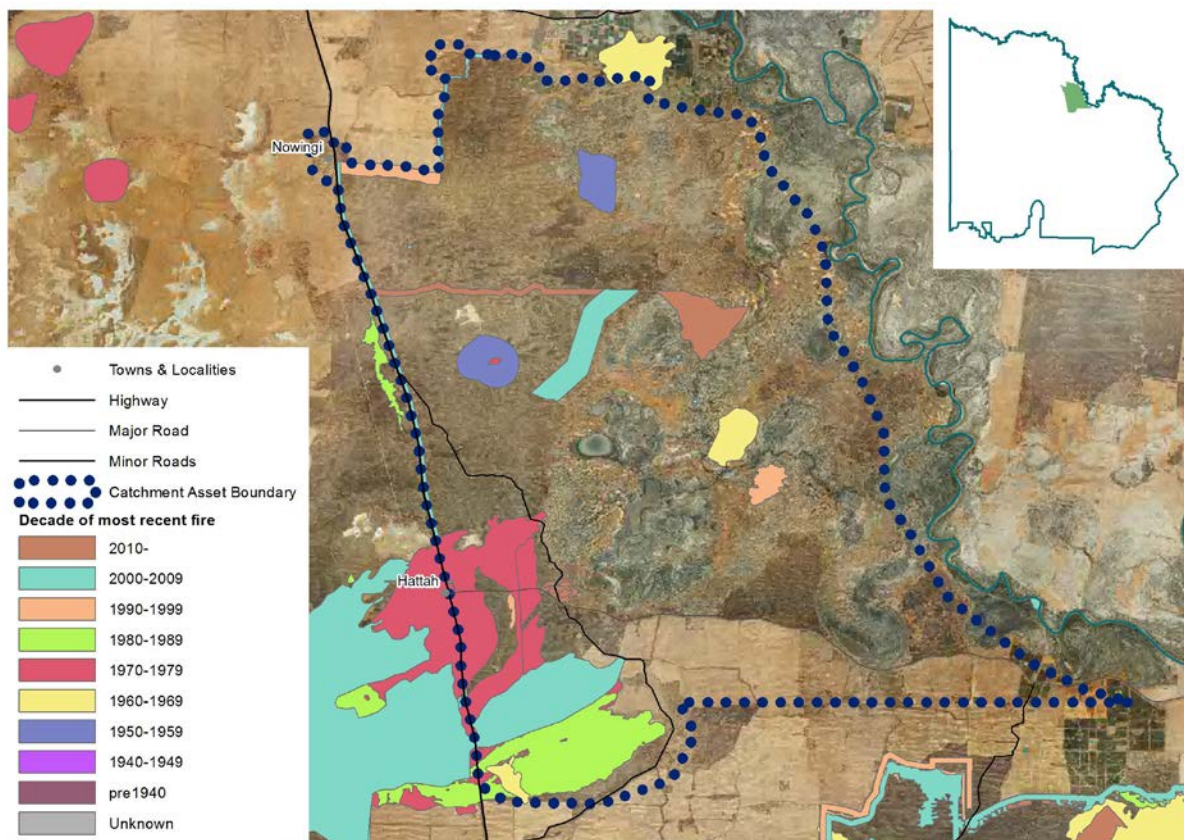


Figure 15: Fire History

Constrained Regenerative Capacity

The decline in vegetation cover and habitat complexity within remnant native vegetation can constrain or prevent regeneration which can lead to loss of habitat in the longer term. There are many contributors to this threatening process including weed invasion, excess grazing pressure, and habitat fragmentation. Loss of understorey flora and associated fauna are a possible outcome, also leading to a reduction in the capacity of the remnant to support flora and fauna species or maintain current population numbers, thus impacting on the biodiversity value of the asset.

Habitat fragmentation is one useful indicator of constrained regenerative capacity. A high level of fragmentation will severely limit the capacity of a vegetation community and the ecology it supports to maintain its health and reproductive capacity. It will also hamper our efforts to improve the health and condition of remnant landscapes at a broad scale due to the level of additional resources that each remnant patch would require (such as restoration or revegetation) rather than being able to simply protect the remnant (through fencing and invasive species control) and then rely upon its own internal regenerative resources to bring about an improvement in health and condition.

Modelling of habitat fragmentation using a spatial tool (Vogt, et al. 2007) demonstrates that this catchment asset area is largely unfragmented. Only small areas within the agricultural areas outside the National Park in the far north and south have heavily fragmented habitats. Most significantly, there appears to be substantial unfragmented connectivity between this catchment asset area and its neighbours to the west which implies that the threat of constrained regenerative capacity in this landscape is diminished compared to other parts of the Mallee region.

Using a combination of information gathering approaches and the application of a complimentary consultative process, the priority of action for dealing with constrained regenerative capacity with respect to each Regional Asset has been determined. They are listed in Table 19 below.

Table 19: Prospective Priority of Action to address Constrained Regenerative Capacity

Regional Asset	Priority of Action	Summary Logic
Rivers	LOW	To be documented
Wetlands	LOW	To be documented
Threatened Species and Communities	LOW	To be documented
Terrestrial Habitat	LOW	To be documented
Soils	NONE	To be documented
Agricultural Land	NONE	To be documented
Groundwater	NONE	To be documented
Cultural Heritage	NONE	To be documented
Community Capacity	NONE	To be documented

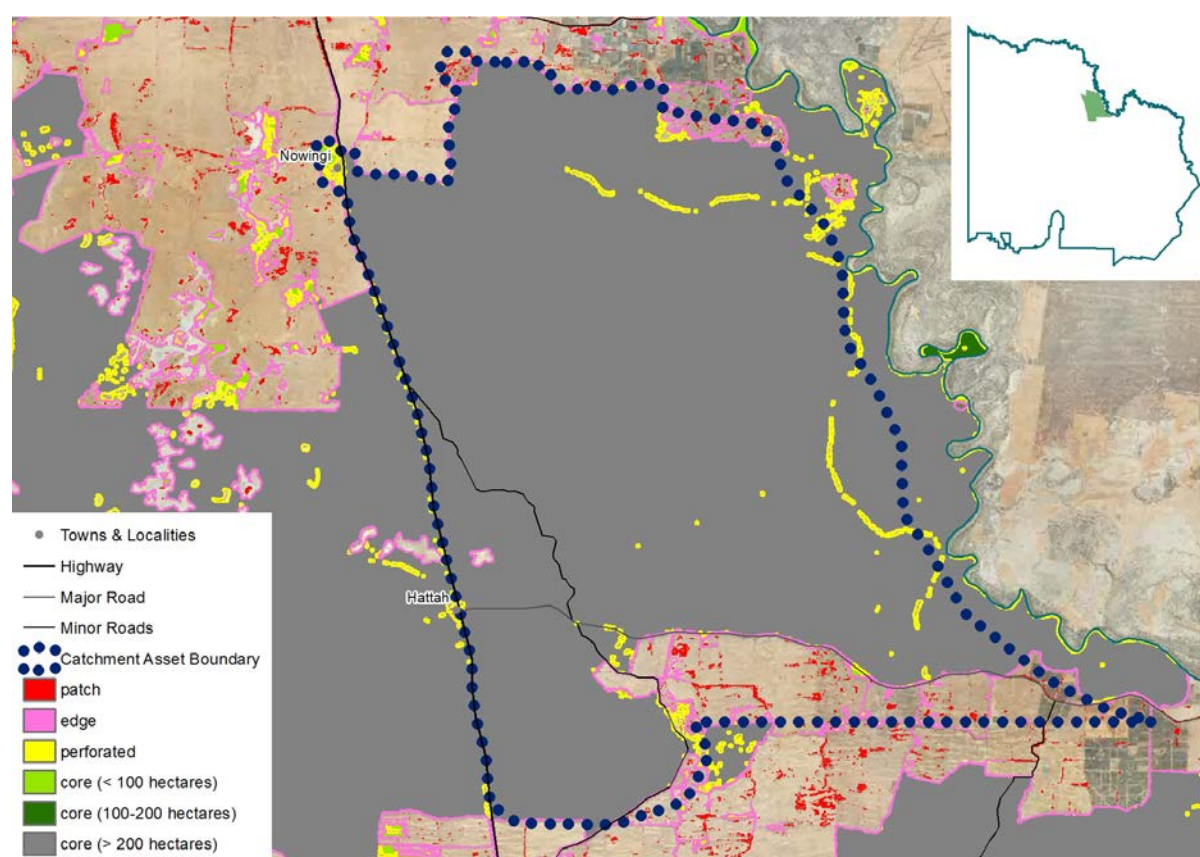


Figure 16: Habitat Fragmentation

Section 4 – References & Appendices

References

Department of Agriculture, Fisheries and Forestry. National Natural Resource Management Capacity Building Framework. Canberra: Department of Agriculture, Fisheries and Forestry, 2005.

Gong, W., J. Sinden, M. Braysher, and R. Jones. The economic impacts of vertebrate pests in Australia. Canberra: Invasive Animals Cooperative Research Centre, 2009, 59.

Lorimer, M. S. "Estimating the susceptibility of soil to wind erosion in Victoria." *Journal of Australian Institute for Agricultural Science*, 51 (2), 1985: 122-127.

Mock, I., and V. Grinter. Mapping the Mallee's Saline Land. Stage 3: Classifying Mapped Salinity. Final Report, Irymple: Mallee Catchment Management Authority, 2009.

Vogt, P., K. Riitters, C. Estreguil, J. Kozak, T. Wade, and J. Wickham. "Mapping spatial patterns with morphological image processing." *Landscape Ecology* 22, 2007: 171-177.

1. The Value of Regional Assets within a Catchment Asset

The Regional Asset value indicates the relative importance of the Regional Asset within the Catchment Asset Area. The valuation is determined from a range of indicators, many specific to each of the Regional Assets, that describe the importance of the Asset relative to social, economic and environmental values. One common example of an indicator of asset value is legislative significance which provides an indication of whether part or all of a Regional Asset is of significance at a local, regional, State, National or international level. These indicators were grouped and scored by consensus against agreed criteria and then each Regional Asset within the Catchment Asset was assigned a category that defines the prospective asset value and relative importance of and priority for maintaining or improving the value of the Asset.

Five category levels were identified:

None – indicates that the Regional Asset is unknown or not present within the Catchment Asset area.

Low – indicates that the Regional Asset is of relatively low status or importance within the Catchment Asset area. It may also indicate that there is insufficient knowledge or data available to define or quantify the asset value and therefore prioritise it with confidence. Further research may be required to rectify this situation.

Medium – indicates that the Regional Asset is locally or regionally important but relatively well known or secure at the Catchment Asset scale. This may be due in part to previously successful management interventions. Ongoing monitoring may be required as will some level of intervention (particularly at a local scale) to ensure previous management gains are not lost.

High – indicates that the Regional Asset within the Catchment Asset Area is of significance at a regional, State or National scale and that action is likely required over the life of the RCS in order to maintain or improve the value of the Regional Asset within the Catchment Asset Area.

Very High - indicates that the Regional Asset within the Catchment Asset Area is of significance at a National or international scale and that action is likely required over the life of the RCS in order to maintain or improve the value of the Regional Asset within the Catchment Asset Area.

2. Categorising Threatening Processes

The categorisation of the threatening processes in order to prioritise management actions was based on the current scope and scale of the impacts arising from the threatening process along with consideration of potential future impact of the threatening process. The categorisation was based on consensus against agreed criteria. Each threatening process acting upon each Regional Asset was assigned a category that defines the prospective priority of action to address that threatening process.

Four category levels were identified:

None – indicates that either the threatening process, or the regional asset itself, is unknown or not present within the catchment Asset area.

Low – indicates that, while the threatening process is known to be present, it is at a low level or the Regional Asset itself is not overly susceptible to or impacted by the threat. It may also indicate that there is insufficient knowledge or data available to define or quantify the interaction between the asset and the threatening process and therefore prioritise it with confidence. Further research may be required to rectify this situation.

Medium – indicates that the threatening process is real but that the Regional Asset is not under immediate threat at the Catchment Asset scale. This may be due to previously successful

interventions. Ongoing monitoring will be required as will some level of intervention (particularly at a local scale) to ensure previous management gains are not lost.

High – indicates that: there is a high level of potential harm to the Asset as a result of the threatening process; there are a variety of management actions available that are known to be successful at reducing harm and which are generally supported by land managers; and that action is required over the life of the RCS in order to prevent further impact as a result of the threatening process.

3. Management Plans Relevant to this Catchment Asset

Table 20: Management Plans Relevant to this Catchment Asset

Name	Type	Author/Owner	Year
Hattah-Kulkyne Lakes Ramsar Site Strategic Management Plan	Management Plan	Department of Sustainability & Environment	2003
North West Region Mildura Fire District Fire Protection Plan	Management Plan	Department of Sustainability & Environment	2008
Victorian Mallee Irrigation Area Land and Water Management Plan (Draft)	Management Plan	Mallee Catchment Management Authority	2011
Hattah Lakes Environmental Water Management Plan 2012	Management Plan	Murray Darling Basin Authority	2012
Mallee Parks Management Plan	Management Plan	Parks Victoria	1996
Northern Region Sustainable Water Strategy	Strategy	Department of Sustainability & Environment	2009
Mallee River Health Strategy 2005	Strategy	Mallee Catchment Management Authority	2006
Mallee Wetland Strategy 2006-2011	Strategy	Mallee Catchment Management Authority	2006
Native Fish Strategy for the Murray-Darling Basin 2003-2013	Strategy	Murray Darling Basin Authority	2003
Mallee Invasive Plants and Animals Management Strategy	Strategy	Mallee Catchment Management Authority	2011
Robinvale-Annuello Landcare Group Action Plan 2012-2017	Action Plan	Robinvale-Annuello Landcare Group	2012
National Recovery Plan for Buloke Woodlands of the Riverina and Murray Darling Depression Bioregions	National Recovery Plan	Department of Sustainability & Environment (Victoria)	2011
National Recovery Plan for Malleefowl <i>Leipoa ocellata</i>	National Recovery Plan	Department of Environment and Heritage (South Australia)	2007
National Recovery Plan for the Winged Peppercress <i>Lepidium monoplacoides</i>	National Recovery Plan	Department of Sustainability & Environment (Victoria)	2010
Recovery Plan for the Black-eared Miner <i>Manorina melanotis</i> 2002 - 2006: Conservation of old-growth dependent mallee fauna	National Recovery Plan	Department of Environment and Heritage (South Australia)	2003
National Recovery Plan for the Yellow Swainson-pea <i>Swainsona pyrophila</i>	National Recovery Plan	Department of Sustainability & Environment (Victoria)	2010

National Recovery Plan for the Regent Parrot (eastern subspecies) <i>Polytelis anthopeplus monarchoides</i>	National Recovery Plan	Department of Sustainability & Environment (Victoria)	2011
Approved Conservation Advice for <i>Stipiturus mallee</i> (Mallee Emu-wren)	National Conservation Advice	Department of Sustainability, Environment, Water, Population and Communities (Australia)	2008
Flora & Fauna Guarantee Action Statement Black-eared Miner <i>Manorina melanotis</i>	Action Statement	Department of Sustainability & Environment (Victoria)	2003
Flora & Fauna Guarantee Action Statement Malleefowl <i>Leipoa ocellata</i>	Action Statement	Department of Sustainability & Environment (Victoria)	2003
Flora & Fauna Guarantee Action Statement White-bellied Sea-eagle <i>Haliaeetus leucogaster</i>	Action Statement	Department of Sustainability & Environment (Victoria)	2003
Flora & Fauna Guarantee Action Statement Spotted Bowerbird <i>Chlamydera maculata</i>	Action Statement	Department of Sustainability & Environment (Victoria)	2003
Flora & Fauna Guarantee Action Statement Plains Wanderer <i>Pedionomus torquatus</i>	Action Statement	Department of Sustainability & Environment (Victoria)	2003
Flora & Fauna Guarantee Action Statement White-browed Treecreeper <i>Climacteris affinis</i>	Action Statement	Department of Sustainability & Environment (Victoria)	2003
Flora & Fauna Guarantee Action Statement Bush Stone-Curlew <i>Burhinus grallarius</i>	Action Statement	Department of Sustainability & Environment (Victoria)	2004
Flora & Fauna Guarantee Action Statement Major Mitchell's Cockatoo <i>Cacatua leadbeateri</i>	Action Statement	Department of Sustainability & Environment (Victoria)	2004
Flora & Fauna Guarantee Action Statement Freckled Duck <i>Stictonetta naevosa</i>	Action Statement	Department of Sustainability & Environment (Victoria)	2004
Flora & Fauna Guarantee Action Statement Barking Owl <i>Ninox connivens</i>	Action Statement	Department of Sustainability & Environment (Victoria)	2004
Flora & Fauna Guarantee Action Statement Great Egret <i>Ardea alba</i> Intermediate Egret <i>Ardea intermedia</i> Little Egret <i>Egretta garzetta</i>	Action Statement	Department of Sustainability & Environment (Victoria)	2001
Flora & Fauna Guarantee Action Statement Twelve threatened Swainson-peas and Darling-peas (<i>Swainsona</i> species)	Action Statement	Department of Sustainability & Environment (Victoria)	2003
Flora & Fauna Guarantee Action Statement Five threatened Victorian Sunmoths (<i>Synemon</i> species)	Action Statement	Department of Sustainability & Environment (Victoria)	2003
Flora & Fauna Guarantee Action Statement Mildura Ogyris <i>Ogyris subterrestis</i>	Action Statement	Department of Sustainability & Environment (Victoria)	2003
Flora & Fauna Guarantee Action Statement Blue-billed Duck <i>Oxyura australis</i>	Action Statement	Department of Sustainability & Environment (Victoria)	2003
Flora & Fauna Guarantee Action Statement Inland Carpet Python <i>Morelia spilota metcalfei</i>	Action Statement	Department of Sustainability & Environment (Victoria)	2003
Flora & Fauna Guarantee Action Statement Painted Honeyeater <i>Grantiella picta</i>	Action Statement	Department of Sustainability & Environment (Victoria)	2003

Flora & Fauna Guarantee Action Statement Freshwater Catfish <i>Tandanus tandanus</i>	Action Statement	Department of Sustainability & Environment (Victoria)	2005
Flora & Fauna Guarantee Action Statement Silver Perch <i>Bidyanus bidyanus</i>	Action Statement	Department of Sustainability & Environment (Victoria)	2005
Flora & Fauna Guarantee Action Statement Winged Peppercress <i>Lepidium monoplocoides</i>	Action Statement	Department of Sustainability & Environment (Victoria)	2009

4. Management Action Definitions

Management Action Category	Management Action	Definition	Threatening Processes Addressed
On-ground Works	Pest Plant Control	Control and eradication of pest plant species	Invasive Plants; Constrained Regenerative Capacity
	Pest Animal Control	Control and eradication of pest animal species	Invasive Animals; Soil Erosion; Constrained Regenerative Capacity
	Habitat Protection	Habitat protection through exclusion fencing or other physical means	Invasive Animals; Soil Erosion; Recreational Pressure; Land Use Change; Direct Off-Site Interactions; Constrained Regenerative Capacity
	Habitat Restoration	Restoration of degraded terrestrial habitat by planting vegetation	Land & Water Salinisation; Soil Erosion; Recreational Pressure; Direct Off-Site Interactions; Constrained Regenerative Capacity
	Revegetation	Re-creation of terrestrial habitat by planting vegetation (e.g. new wildlife corridor plantings)	Land & Water Salinisation; Soil Erosion; Recreational Pressure; Direct Off-Site Interactions; Constrained Regenerative Capacity
	Environmental Watering	Delivering environmental water to wetlands and floodplains; maintaining appropriate watering regimes	Altered Hydrological Regimes; Constrained Regenerative Capacity
	Soil Erosion Control	Control of soil erosion through engineering works and other structures	Soil Erosion
	Threatened Species Interventions	Interventions to improve outcomes for threatened species and ecological communities	Constrained Regenerative Capacity
	Enhancing Land Management Regimes	Interventions to enhance land management regimes on both public and private land (e.g. water use efficiency on irrigated land; maintaining appropriate soil cover in dryland agriculture; improved management or protection regimes)	Land & Water Salinisation; Soil Erosion; Inappropriate Water Use Practises; Land Use Change; Direct Off-Site Interactions
Capacity Building	Supporting Human Capacity for NRM	Provision of new skills and training in NRM; Delivery of publicity and awareness raising paraphernalia	All
	Supporting Institutional Capacity for NRM	Development and support of regional partnerships between institutions with a stake in NRM	All
	Supporting Social Capacity for NRM	Supporting community organisations that have a stake in NRM by aiding	All

		governance and provision of material	
NRM Planning	Institutional Planning for NRM	Development and implementation of NRM planning by regional institutions. Examples include institutional NRM plans, regional asset plans and sub-strategies	All
	Community Driven Planning for NRM	Development and implementation of NRM planning by community based organisations. Examples include Landcare Group Action Plans.	All
	Landholder Driven Planning for NRM	Development and implementation of NRM planning by landholders. Examples include property management plans and conservation agreements	All
Knowledge Building	Research to improve knowledge	Any research or other work delivered to improve or expand current knowledge or fill knowledge gaps in any NRM topic relevant to regional assets	All
Asset Assessment	Asset condition monitoring and assessment	Monitoring and collection of data concerning indicators of regional asset condition and/or threatening processes impacting on regional assets; Efforts to determine and/or evaluate trends in the condition of assets or the scope and scale of threatening processes impacting on regional assets.	All

5. Management Actions from Existing Management Plans

Table 21: Management Actions from Existing Management Plans

Instrument	Management Action	Details
Hattah-Kulkyne Lakes Ramsar Site Strategic Management Plan 2003	Pest Plant Control	Control priority pest plants; Coordinate pest plant control efforts with adjacent landholders
	Pest Animal Control	Control priority pest animals; Coordinate pest animal control efforts with adjacent landholders; Undertake fox baiting and control programs to protect resident waterbirds; Investigate the effectiveness of mechanisms to restrict entry of carp, while allowing native fish to enter Hattah Lakes;
	Habitat Restoration	Protect, and where appropriate enhance, ecosystem processes, habitats and species

	Environmental Watering	Maintain or seek to restore appropriate water regimes
	Threatened Species Interventions	Locate and where appropriate protect and enhance the habitat of threatened flora and fauna species
	Enhancing Land Management Regimes	
	Supporting Human Capacity for NRM	Promote community awareness and understanding and provide opportunities for involvement in management.
	Supporting Institutional Capacity for NRM	Establish appropriate communication and links between all relevant management agencies of the Hattah-Kulkyne Lakes Ramsar site
	Supporting Social Capacity for NRM	
	Institutional Planning for NRM	Complete the Hattah Lakes Water Management Plan; Manage site within an integrated catchment management framework.
	Research to improve knowledge	Assist and encourage surveys and research into key flora and fauna species and their habitat requirements, and other high priority areas including monitoring ecological character of the Ramsar site, impacts of recreational fishing, campers and annual visitors and impact of feral goats.
	Asset condition monitoring and assessment	Develop ongoing consistent programs to monitor ecological character
North West Region Mildura Fire District Fire Protection Plan	Supporting Institutional Capacity for NRM	Investing in integrated fire management to balance community needs with ecological requirements
	Research to improve knowledge	Determining appropriate ecological fire regimes
Victorian Mallee Irrigation Area Land and Water Management Plan (Draft)	Enhancing Land Management Regimes	improving water use efficiency; modernising infrastructure
	Supporting Human Capacity for NRM	Education and community awareness development on a range of land, water and biodiversity management issues
	Supporting Institutional Capacity for NRM	Maintaining partnerships and communication channels amongst regional and State partners
	Institutional Planning for NRM	Considerable (and diverse) planning and policy development to enhance water trading rules, improve efficiency of water use and incorporate environmental watering into the water management process
	Landholder Driven Planning for NRM	Whole farm planning for irrigation properties

	Research to improve knowledge	Various research topics on water use efficiency improvements and the potential impacts of irrigation on biodiversity and land use management
	Asset condition monitoring and assessment	waterway salinity, groundwater and irrigation drainage monitoring
Hattah Lakes Environmental Water Management Plan 2012	Habitat Restoration	Protect, and where appropriate enhance, ecosystem processes, habitats and species
	Environmental Watering	Maintain or seek to restore appropriate water regimes
	Threatened Species Interventions	maintain habitat for Freckled Duck, White bellied Sea-Eagle and Murray Hardyhead
Mallee Parks Management Plan	Pest Plant Control	reducing the impact of pest plants on native species and communities
	Pest Animal Control	reducing the impact of pest animals on native species and communities
	Habitat Protection	the existing diversity of native flora and fauna will be maintained, and a management regime of minimal disturbance adopted. Significant natural and cultural features will be given special protection
	Habitat Restoration	active revegetation in areas of localised extinction and rarity; adopting manipulative fire regimes where they can be demonstrated to be of value to the Parks' environments and ecosystems
	Revegetation	Wildlife corridors between the Parks and other major blocks of public land in the region will be established
	Environmental Watering	Restoring a more natural hydrological regime within all Parks
	Threatened Species Interventions	Manage Flora and Fauna Guarantee listed species and communities according to approved action statements
	Supporting Human Capacity for NRM	Numerous actions to assist visitors to discover, enjoy and appreciate the natural and cultural features of the Mallee Parks, and the value of National Parks and their management
	Supporting Institutional Capacity for NRM	Liaise with local community groups and land holders and, as appropriate, involve them in relevant aspects of planning and managing the Parks
	Research to improve knowledge	Encourage research on Mallee ecosystems, vegetation communities, and significant flora and fauna species
Northern Region Sustainable Water Strategy	Asset condition monitoring and assessment	Monitor control and rehabilitation programs
	Environmental Watering	A range of policies and actions at a regional scale that are intended to support environmental water actions
	Supporting Institutional Capacity for NRM	A range of policies and actions that support institutional partnership arrangements to improve bulk water

		management for irrigators, consumers and the environment
	Asset condition monitoring and assessment	Water quality and quantity monitoring in surface and groundwater resources; ecological monitoring of rivers and wetlands
Mallee River Health Strategy 2005	Habitat Protection	prepare an action plan for Chalka Creek to protect environmental values
	Habitat Restoration	manage the habitat of Carpet Python and other threatened flora and fauna along Chalka Creek in accordance with respective Action Statements, conservation guidelines, relevant legislation and policies
	Supporting Institutional Capacity for NRM	Partnerships between organisations to improve knowledge and management of Hattah Lakes
	Supporting Social Capacity for NRM	Community education via schools, Landcare and Waterwatch groups
	Research to improve knowledge	Numerous research topics to improve knowledge of Hattah Lakes
Mallee Wetland Strategy 2006-2011	Pest Plant Control	Focus on willows and aquatic weeds
	Pest Animal Control	Focus on rabbits & carp
	Habitat Protection	Identification of priority sites; protection from stock grazing
	Habitat Restoration	Identification of priority sites with works to occur at five of them across the region
	Environmental Watering	Determine appropriate water regimes
	Threatened Species Interventions	Identify three priority species and implement key recommendations from their Action Statements or Recovery Plans as relevant to wetlands
	Supporting Human Capacity for NRM	Raising awareness and improving knowledge of wetland values and threats in the community; improving knowledge of indigenous wetland values
	Institutional Planning for NRM	preparation and implementation of local planning overlays and wetland management plans
	Research to improve knowledge	improve knowledge of wetland values and threats to those values
Native Fish Strategy for the Murray-Darling Basin 2003-2013	Asset condition monitoring and assessment	Determine wetland condition; monitor responses arising from interventions
	Pest Animal Control	Control of carp and other alien fish
	Habitat Protection	protect key aquatic and riparian habitat; protect key linkages between floodplains and aquatic habitats
	Habitat Restoration	improve fish passage/water quality/key aquatic & riparian habitats

	Institutional Planning for NRM	preparation and implementation of species and fish community recovery plans
	Supporting Institutional Capacity for NRM	enhance knowledge of and partnership support for the Strategy
	Supporting Human Capacity for NRM	enhance knowledge of and support for the Strategy and native fish in general
Mallee Invasive Plants and Animals Management Strategy 2011	Pest Plant Control	prevent new introductions; contain high risk weed species
	Pest Animal Control	prevent new introductions; contain high risk pest animal species
	Habitat Protection	protect remnant Buloke woodlands in this CA from rabbits
	Supporting Human Capacity for NRM	improve knowledge and awareness of invasive plants and animals and methods of control
	Supporting Institutional Capacity for NRM	support partnership arrangements between organisations with responsibilities for control and management of invasive plants and animals
	Supporting Social Capacity for NRM	Support community organisations carrying out targeted invasive plant and animal management with information, education, extension, enforcement and the identification of funding opportunities; Actively seek community participation and create partnerships with community groups in all IPA management project and programs
	Research to improve knowledge	techniques for control of Elodea spp. (Arrowhead)
National Recovery Plan for Buloke Woodlands of the Riverina and Murray Darling Depression Bioregions	Asset condition monitoring and assessment	monitor invasive plants and animals against both past interventions and for future actions
	Pest Plant Control	Weed management in critical habitat for species likely to significantly alter character of Buloke Woodland
	Habitat Restoration	in planting within degraded remnants; re-introduction of keystone community species
	Supporting Human Capacity for NRM	Raise community awareness of Buloke woodland community; encourage community participation in restoration activities
	Institutional Planning for NRM	prepare and implement management plans for public reserves containing Buloke community
	Landholder Driven Planning for NRM	encourage and support the creation of covenants to protect remnants on private land
National Recovery Plan for Malleefowl <i>Leipoa ocellata</i>	Research to improve knowledge	improve knowledge of ecological requirements
	Pest Animal Control	fox management

	Habitat Protection	fencing habitat
	Revegetation	corridors to reduce isolation
	Threatened Species Interventions	reduce threats; captive breeding
	Supporting Human Capacity for NRM	publicity
	Supporting Institutional Capacity for NRM	partnerships
	Landholder Driven Planning for NRM	covenants
	Research to improve knowledge	ecology; population dynamics; threatening processes
	Asset condition monitoring and assessment	
National Recovery Plan for the Winged Peppercreep <i>Lepidium monoplocoides</i>	Pest Plant Control	weed management as required
	Pest Animal Control	rabbit management as required
	Habitat Protection	Various measures to protect from grazing animals and other physical disturbances
	Threatened Species Interventions	establishment of seed bank
	Supporting Human Capacity for NRM	increase community knowledge/support for conservation
	Landholder Driven Planning for NRM	conservation agreements with landholders for populations on private land
	Research to improve knowledge	improve knowledge of ecological requirements/potential habitat/recovery techniques
Recovery Plan for the Black-eared Miner <i>Manorina melanotis</i> 2002 - 2006: Conservation of old-growth dependent mallee fauna	Threatened Species Interventions	captive breeding; translocations; control genetic introgression
	Supporting Human Capacity for NRM	increase community knowledge/support for conservation
	Institutional Planning for NRM	Revise FFG Action Statement; update relevant Fire Plans

	Research to improve knowledge	
	Asset condition monitoring and assessment	
National Recovery Plan for the Yellow Swainson-pea <i>Swainsona pyrophila</i>	Threatened Species Interventions	ex-situ seedbank
	Supporting Human Capacity for NRM	increase community knowledge/support for conservation
	Landholder Driven Planning for NRM	encourage use of covenants or similar to protect populations found on private land
	Research to improve knowledge	
	Asset condition monitoring and assessment	
National Recovery Plan for the Regent Parrot (eastern subspecies) <i>Polytelis anthopeplus monarchoides</i>	Revegetation	filling gaps in and expanding width of known flyways
	Threatened Species Interventions	
	Supporting Human Capacity for NRM	Increase community involvement in the eastern Regent Parrot recovery program
	Supporting Institutional Capacity for NRM	
	Institutional Planning for NRM	
	Research to improve knowledge	
	Asset condition monitoring and assessment	
Approved Conservation Advice for <i>Stipiturus mallee</i> (Mallee Emu-wren)	Supporting Human Capacity for NRM	increase community knowledge/support for conservation
	Supporting Institutional Capacity for NRM	partnerships to improve management and planning of interventions
	Institutional Planning for NRM	primary focus of most actions is on new and modified planning instruments to better describe current status and actions to reduce threats

	Research to improve knowledge	ecology; population dynamics; threatening processes; appropriate management and population recovery options
Flora & Fauna Guarantee Action Statement Black-eared Miner <i>Manorina melanotis</i>	Threatened Species Interventions	captive breeding; translocation
	Institutional Planning for NRM	prepare or modify planning instruments to reflect species requirement
	Research to improve knowledge	ecology; population dynamics; threatening processes; appropriate management and population recovery options
Flora & Fauna Guarantee Action Statement Malleefowl <i>Leipoa ocellata</i>	Pest Animal Control	fox control
	Threatened Species Interventions	
	Supporting Social Capacity for NRM	volunteer involvement in monitoring and pest control
	Institutional Planning for NRM	refine fire plan and other relevant interests to reflect malleefowl needs
	Research to improve knowledge	ecology; population dynamics; threatening processes; appropriate management and population recovery options
	Asset condition monitoring and assessment	annual population monitoring
Flora & Fauna Guarantee Action Statement White-bellied Sea-eagle <i>Haliaeetus leucogaster</i>	Habitat Protection	buffers/barriers to protect nest sites from disturbance
	Supporting Human Capacity for NRM	community education
	Institutional Planning for NRM	incorporate suitable habitat into appropriate management plans in order to protect such habitat
	Research to improve knowledge	improve knowledge of ecological requirements/potential habitat/recovery techniques
	Asset condition monitoring and assessment	Species population monitoring; threat status monitoring
Flora & Fauna Guarantee Action Statement Spotted Bowerbird <i>Chlamydera maculata</i>	Supporting Human Capacity for NRM	Extension and awareness raising to raise profile of species
	Asset condition monitoring and assessment	Monitor for presence in catchment asset
Flora & Fauna Guarantee Action Statement Plains	Supporting Human Capacity for NRM	Raise community awareness of species

Wanderer Pedionomus torquatus	Landholder Driven Planning for NRM	Encourage and support a) fencing of remnant habitat; and/or b) the creation of covenants; to protect species on private land
	Research to improve knowledge	improve knowledge of ecological requirements/potential habitat/recovery techniques
	Asset condition monitoring and assessment	Species population monitoring; threat status monitoring
Flora & Fauna Guarantee Action Statement White-browed Treecreeper Climacteris affinis	Pest Animal Control	rabbit control in pine-buloke woodlands
	Habitat Restoration	restoration of degraded pine-buloke woodland core species habitat
	Supporting Human Capacity for NRM	training and extension to improve staff and community identification of species
	Research to improve knowledge	improve knowledge of ecological requirements/potential habitat/recovery techniques
Flora & Fauna Guarantee Action Statement Bush Stone-Curlew Burhinus grallarius	Pest Animal Control	Fox control in and near key habitat
	Supporting Human Capacity for NRM	Raise community awareness of species; target golf courses with remnant habitat with specific education and land management material
	Institutional Planning for NRM	Develop or amend planning scheme regulations to protect key habitat areas
	Landholder Driven Planning for NRM	Encourage and support a) fencing of remnant habitat; and/or b) the creation of covenants; to protect species on private land
Flora & Fauna Guarantee Action Statement Major Mitchell's Cockatoo Cacatua leadbeateri	Habitat Restoration	conserve and enhance species preferred habitat
	Supporting Human Capacity for NRM	Raise community awareness of species; training and extension to improve staff and community knowledge of species requirements
	Research to improve knowledge	improve knowledge of ecological requirements/potential habitat/recovery techniques
Flora & Fauna Guarantee Action Statement Freckled Duck Stictonetta naevosa	Threatened Species Interventions	wetland closures to hunting
	Supporting Human Capacity for NRM	hunter education
	Research to improve knowledge	improve knowledge of ecological requirements/potential habitat/recovery techniques
	Asset condition monitoring and assessment	targeted searches

Flora & Fauna Guarantee Action Statement Barking Owl <i>Ninox connivens</i>	Supporting Human Capacity for NRM	Raise community awareness of species
	Supporting Institutional Capacity for NRM	Support municipal councils and other agencies responsible for land management in effectively managing species habitat
	Institutional Planning for NRM	Alter and update appropriate plans to reflect species ecology and habitat requirements
	Landholder Driven Planning for NRM	Encourage and support the creation of covenants to protect species on private land
	Research to improve knowledge	improve knowledge of ecological requirements/potential habitat/recovery techniques
	Asset condition monitoring and assessment	targeted searches
Flora & Fauna Guarantee Action Statement Great Egret <i>Ardea alba</i> Intermediate Egret <i>Ardea intermedia</i> Little Egret <i>Egretta garzetta</i>	Environmental Watering	Maintain appropriate water regimes in wetlands and creeks systems
	Asset condition monitoring and assessment	Species population monitoring; threat status monitoring
Flora & Fauna Guarantee Action Statement Twelve threatened Swainson-peas and Darling-peas (<i>Swainsona</i> species)	Pest Plant Control	Control competing weeds in known populations
	Habitat Protection	Exclusion of stock and vehicular access to known habitat/populations
	Supporting Human Capacity for NRM	Raise community awareness of species
	Institutional Planning for NRM	prepare and implement management plans for public reserves containing species
	Landholder Driven Planning for NRM	Encourage and support a) fencing of remnant habitat; and/or b) the creation of covenants; to protect species on private land
	Research to improve knowledge	improve knowledge of ecological requirements/potential habitat/recovery techniques
	Asset condition monitoring and assessment	Species population monitoring; threat status monitoring
Flora & Fauna Guarantee Action Statement Five threatened Victorian Sunmoths (<i>Synemon</i> species)	Pest Plant Control	weed monitoring and control
	Habitat Protection	fencing to protect habitat
	Supporting Human Capacity for NRM	Raise community awareness of species; training and extension to improve staff and community knowledge of species requirements

	Institutional Planning for NRM	Ensure that regional strategies, municipal planning controls and other management plans relevant to species habitat reflects target species ecological requirements
	Asset condition monitoring and assessment	targeted searches etc
Flora & Fauna Guarantee Action Statement Mildura Ogyris Ogyris subterrestis	Habitat Protection	fencing to protect known habitat
	Habitat Restoration	restoration of degraded species habitat
	Threatened Species Interventions	reintroduction of species to Mildura Cemetery
	Supporting Human Capacity for NRM	Raise community awareness of species; training and extension to improve staff and community knowledge of species and its requirements
	Institutional Planning for NRM	Alter and update appropriate plans to reflect species ecology and habitat requirements
	Research to improve knowledge	improve knowledge of ecological requirements/potential habitat/recovery techniques
	Asset condition monitoring and assessment	survey known populations annually
Flora & Fauna Guarantee Action Statement Blue-billed Duck Oxyura australis	Pest Animal Control	Fox control in and near key habitat
	Habitat Protection	Exclusion of stock and vehicular access to known habitat/populations; minimise disturbance through wetland closure etc.
	Supporting Human Capacity for NRM	Raise community awareness of species; target golf courses with remnant habitat with specific education and land management material
	Landholder Driven Planning for NRM	Encourage and support a) fencing of remnant habitat; and/or b) the creation of covenants; to protect species on private land
	Research to improve knowledge	improve knowledge of ecological requirements/potential habitat/recovery techniques
	Asset condition monitoring and assessment	Species population monitoring; threat status monitoring
Flora & Fauna Guarantee Action Statement Inland Carpet Python Morelia spilota metcalfei	Habitat Protection	Exclusion of stock and vehicular access to habitat; management of recreation activities in preferred habitat
	Pest Animal Control	Rabbit and fox control
	Threatened Species Interventions	Numerous interventions to manage known populations

	Supporting Human Capacity for NRM	Raise community awareness of species
	Research to improve knowledge	Numerous research topics to improve knowledge on species and its requirements
	Asset condition monitoring and assessment	Species population monitoring
Flora & Fauna Guarantee Action Statement Painted Honeyeater <i>Grantiella picta</i>	Supporting Human Capacity for NRM	awareness raising to improve reporting rates
	Institutional Planning for NRM	update regional planning instrument to reflect species habitat requirements
	Research to improve knowledge	encourage university and other institutions to conduct appropriate ecological research
	Asset condition monitoring and assessment	survey known habitats
Flora & Fauna Guarantee Action Statement Freshwater Catfish <i>Tandanus tandanus</i>	Environmental Watering	provide for appropriate water regimes to suit species requirements
	Threatened Species Interventions	reintroductions
	Supporting Human Capacity for NRM	awareness raising of species status and means to minimise harm to species
	Institutional Planning for NRM	planning and prioritisation tools developed or modified
	Research to improve knowledge	improve knowledge of ecological requirements/potential habitat/recovery techniques
	Asset condition monitoring and assessment	routine species population survey
Flora & Fauna Guarantee Action Statement Silver Perch <i>Bidyanus bidyanus</i>	Environmental Watering	provide for appropriate water regimes to suit species requirements
	Threatened Species Interventions	reintroductions
	Supporting Human Capacity for NRM	awareness raising of species status and means to minimise harm to species
	Institutional Planning for NRM	planning and prioritisation tools developed or modified
	Research to improve knowledge	improve knowledge of ecological requirements/potential habitat/recovery techniques

	Asset condition monitoring and assessment	routine species population survey
Flora & Fauna Guarantee Action Statement Winged Peppercress <i>Lepidium monoplocoides</i>	Habitat Protection	Fencing populations and habitat
	Supporting Human Capacity for NRM	awareness raising of species status and means to minimise harm to species
	Institutional Planning for NRM	adjust Mallee Parks Plan to reflect species importance and ecological needs of the various populations
	Research to improve knowledge	improve knowledge of ecological requirements/potential habitat/recovery techniques
Robinvale-Annuello Landcare Group Action Plan 2012-2017	Pest Plant Control	Wheel Catcus control
	Pest Animal Control	Rabbit and fox control; rabbit control in priority assets
	Habitat Restoration	restoration works in priority areas
	Supporting Human Capacity for NRM	Improve local knowledge about sustainable farming & NRM techniques
	Supporting Institutional Capacity for NRM	improve partnerships with local organisations eg Annuello CFA

6. Prioritising Potential Management Actions

Potential management action categories are prioritised in terms of:

- the value of a regional asset within the catchment asset area;
- the priority to address a threatening process to those values;
- the capacity of the management action to address the threatening process; and
- the level of investment (in both of time and money) required to exercise that capacity.

Individual management actions are grouped and scored by consensus against agreed criteria and then each potential management action group within the Catchment Asset is assigned to a category that defines the prospective priority to the implementation.

Four category levels were identified:

None – indicates that either the management action group not contained in management plans relevant to the Catchment Asset area or the targeted threatening processes that it addresses is unknown or not present within the Catchment Asset area.

Low – typically indicates either that the targeted threatening processes are of low priority within this Catchment Asset area or the management action category is known to be generally not effective at mitigating the threatening process. It may also indicate that there is insufficient knowledge or data available to define or quantify the effectiveness of the management action to mitigate the threatening process and therefore prioritise it with confidence. Further research may be required to rectify this situation.

Medium – typically indicates that the targeted threatening processes are of medium priority within this Catchment Asset area and the management action category is known to be generally effective at mitigating the threatening process and is within the region's capacity to implement over the life of the RCS. It may also indicate that there is some uncertainty with the effectiveness of the potential management action upon a high priority threatening process in terms of either the scale of the threat, the known capacity of the action or the investment required to exercise that capacity.

High – indicates that the targeted threatening processes are of high priority within this Catchment Asset area and the management action category is known to be effective at mitigating the threatening process and is within the region's capacity to implement over the life of the RCS and that action is required urgently in order to prevent further impact as a result of the threatening process.

7. Management Action Priorities

Threatening Processes Priority of Action

Table 22 below represents the findings of a group based analysis in June 2013 of the threat level posed by threatening processes upon Regional Assets within this Catchment Asset based on the criteria contained in Appendix 2. *Categorising Threatening Processes*. The bottom row of the table contains a median 'score' for the threat level posed by each of the threatening processes across the Catchment Asset. These 'scores' are the same as those shown in Table 2.

Table 22: Threatening Process Priority of Action Summary

	Land & water salinisation	Invasive Plants	Invasive Animals	Altered Hydrological Regimes	Soil Erosion	Inappropriate Water Use Practices	Recreational Pressures	Land Use Change	Direct off-site interactions	Misaligned community perceptions	Inappropriate fire regimes	Constrained regenerative capacity
Rivers	medium	high	high	high	medium	medium	high	high	low	medium	none	high
Wetlands	high	high	high	high	high	medium	high	medium	low	medium	none	high
Threatened Species	low	high	high	high	high	medium	high	high	low	medium	medium	high
Terrestrial Habitat	low	high	high	high	high	medium	high	high	low	medium	medium	high
Soils	low	medium	medium	high	high	medium	none	high	low	medium	none	none
Agricultural Land	low	medium	medium	high	high	medium	none	high	low	medium	none	none
Groundwater	none	none	none	none	none	none	none	none	none	none	none	none
Cultural Heritage	none	high	high	high	high	medium	high	high	medium	medium	none	none
Community Capacity	none	none	none	none	none	none	none	none	none	medium	none	none
ALL REGIONAL ASSETS	Medium	High	High	High	high	Medium	High	High	Low	Medium	Medium	High

Management Action Priority Matrix

The table below represents the findings of an integration and analysis of the following components:

- the threatening processes priority of action table shown above;
- the management actions from existing management plans shown in Table 21;
- knowledge and evidence supporting past successes (or otherwise) of various management actions in the Mallee or in this Catchment Asset area; and
- the likelihood of implemented management actions addressing or mitigating threatening processes over the life of the RCS.

The criteria used to apply a value to each management action against each Regional Asset is contained in Appendix 6. *Prioritising Potential Management Actions*. The far right column of the table contains a median 'score' for each the management action priority across the Catchment Asset. These 'scores' are the same as those shown in Table 3.

Table 23: Management Action Priority Summary

	Rivers	Wetlands	Threatened Species	Terrestrial Habitat	Soils	Agricultural Land	Groundwater	Cultural Heritage	Community Capacity	Across All Assets
Pest Plant Control	High	High	High	High	Medium	Medium	None	High	None	High
Pest Animal Control	High	High	High	High	High	Medium	None	High	None	High
Habitat Protection	High	Medium	High	High	Medium	Medium	None	High	None	High
Habitat Restoration	Medium	Medium	Medium	Medium	Low	Low	None	Medium	None	Medium
Revegetation	Low	Medium	Low	Medium	Low	Low	None	Medium	None	Low
Environmental Watering	High	High	High	High	High	Medium	None	Medium	None	High
Soil Erosion Control	Medium	Medium	Medium	Medium	High	High	None	High	None	Medium
Threatened Species Interventions	High	High	High	High	None	None	None	None	None	High
Enhancing Land Management Regimes	Medium	High	Medium	Medium	Medium	High	None	High	None	Medium
Supporting Human Capacity for NRM	Medium	Medium	Medium	Medium	Low	Medium	None	Medium	Medium	Medium
Supporting Institutional Capacity for NRM	Medium	Medium	Medium	Medium	Medium	Medium	None	Medium	Low	Medium
Supporting Social Capacity for NRM	Low	Medium	Medium	Medium	Low	Low	None	Medium	Medium	Medium
Institutional Planning for NRM	High	High	High	High	Medium	Medium	None	High	Medium	High

Community Driven Planning for NRM	Medium	Medium	Low	Low	Medium	Low	None	Medium	Low	Medium
Landholder Driven Planning for NRM	Medium	High	Medium	Medium	Medium	High	None	Medium	Medium	Medium
Research to improve knowledge	High	High	Medium	High	Medium	Medium	None	High	Medium	High
Asset condition monitoring and assessment	High	High	Medium	High	Medium	Medium	None	High	Medium	High

Therefore, the highest priority management actions within this Catchment Asset over the life of the Regional Catchment Strategy should be:

- Pest Plan Control;
- Pest Animal Control;
- Habitat Protection;
- Environmental Watering;
- Threatened Species Interventions;
- Institutional Planning for NRM
- Research to improve knowledge;
- Asset condition monitoring and assessment.

Implementation of these actions should provide the greatest impact on the mitigation of the most concerning threatening processes within this Catchment Asset and make a significant contribution to the achievement of the expected outcomes of the Mallee Regional Catchment Strategy.

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