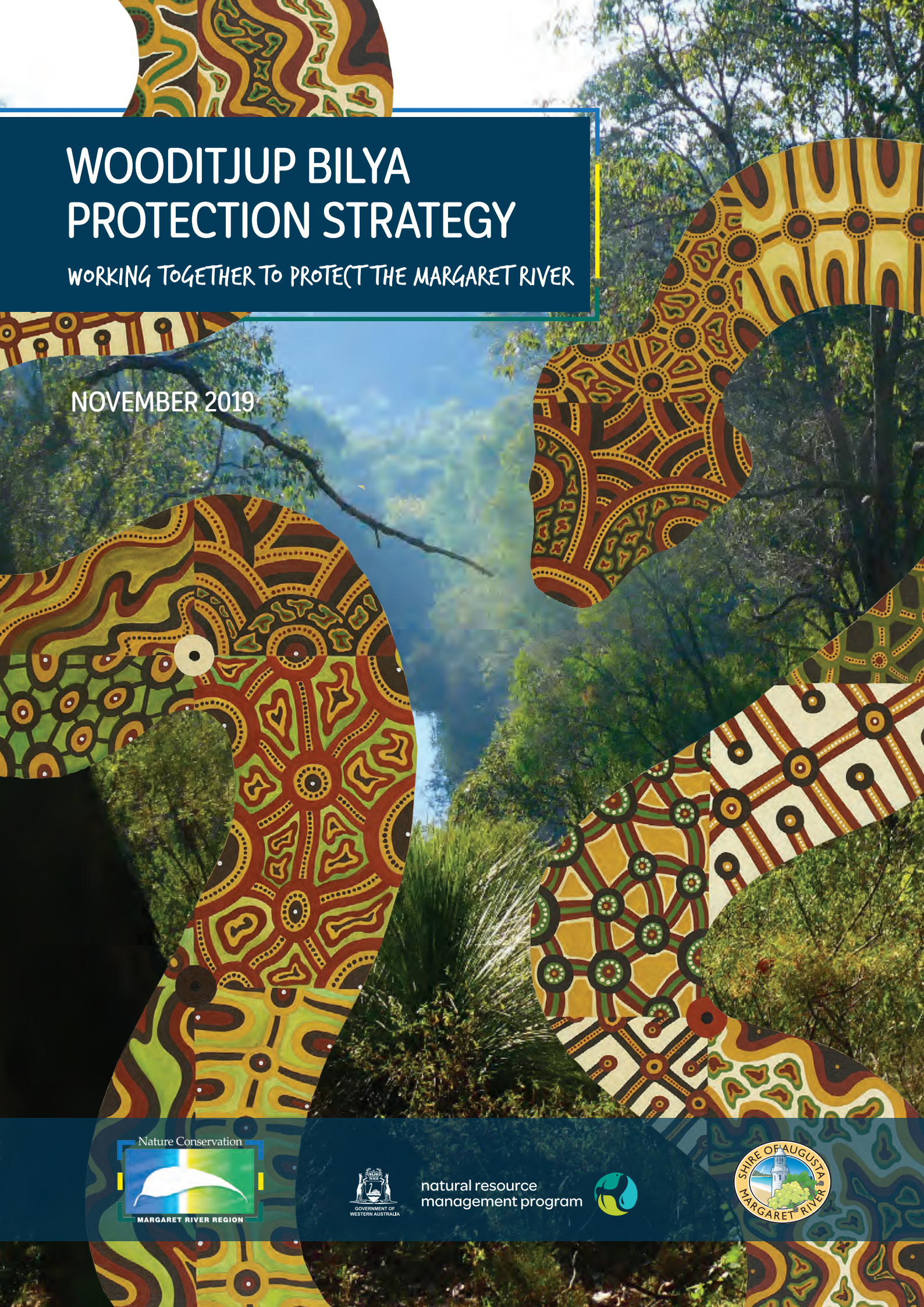
WOODITJUP BILYA PROTECTION STRATEGY

WORKING TOGETHER TO PROTECT THE MARGARET RIVER

NOVEMBER 2019

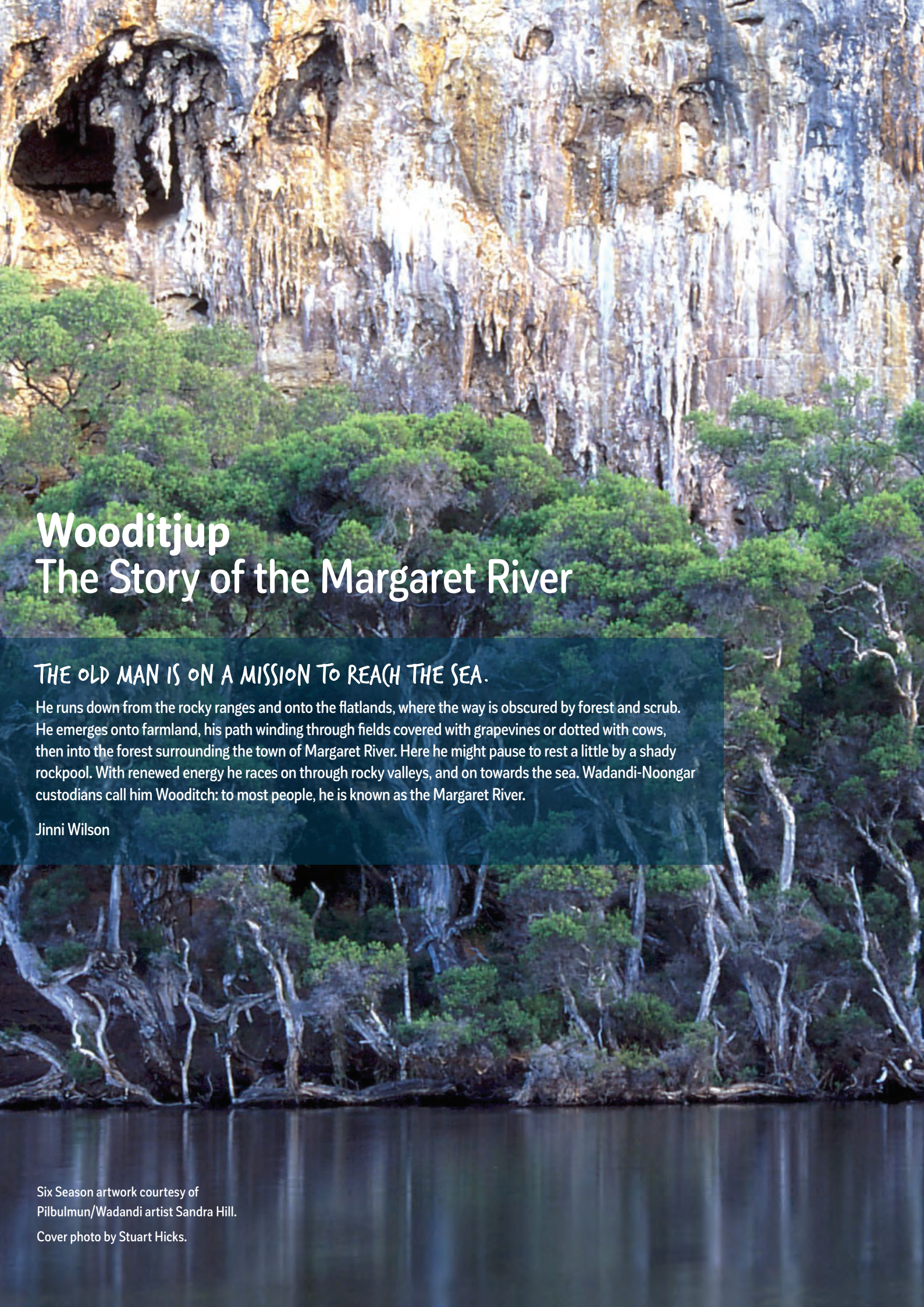


Nature Conservation
MARGARET RIVER REGION

GOVERNMENT OF WESTERN AUSTRALIA

natural resource management program

SHIRE OF AUGUSTA MARGARET RIVER



Wooditjup
The Story of the Margaret River

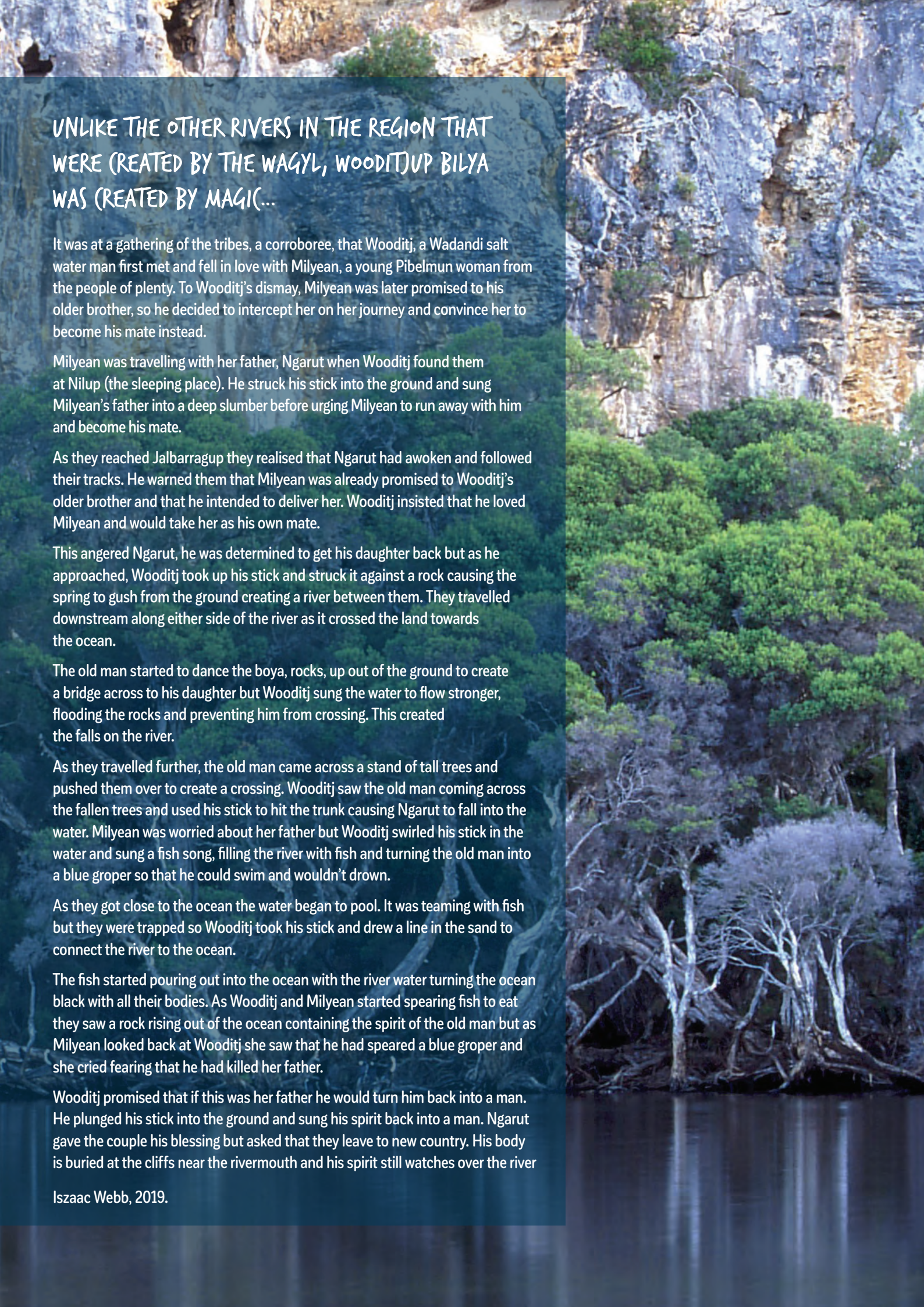
THE OLD MAN IS ON A MISSION TO REACH THE SEA.

He runs down from the rocky ranges and onto the flatlands, where the way is obscured by forest and scrub. He emerges onto farmland, his path winding through fields covered with grapevines or dotted with cows, then into the forest surrounding the town of Margaret River. Here he might pause to rest a little by a shady rockpool. With renewed energy he races on through rocky valleys, and on towards the sea. Wadandi-Noongar custodians call him Wooditch: to most people, he is known as the Margaret River.

Jinni Wilson

Six Season artwork courtesy of
Pilbulmun/Wadandi artist Sandra Hill.

Cover photo by Stuart Hicks.



UNLIKE THE OTHER RIVERS IN THE REGION THAT WERE CREATED BY THE WAGYL, WOODITJUP BILYA WAS CREATED BY MAGIC...

It was at a gathering of the tribes, a corroboree, that Wooditj, a Wadandi salt water man first met and fell in love with Milyean, a young Pibelmun woman from the people of plenty. To Wooditj's dismay, Milyean was later promised to his older brother, so he decided to intercept her on her journey and convince her to become his mate instead.

Milyean was travelling with her father, Ngarut when Wooditj found them at Nilup (the sleeping place). He struck his stick into the ground and sung Milyean's father into a deep slumber before urging Milyean to run away with him and become his mate.

As they reached Jalbarragup they realised that Ngarut had awoken and followed their tracks. He warned them that Milyean was already promised to Wooditj's older brother and that he intended to deliver her. Wooditj insisted that he loved Milyean and would take her as his own mate.

This angered Ngarut, he was determined to get his daughter back but as he approached, Wooditj took up his stick and struck it against a rock causing the spring to gush from the ground creating a river between them. They travelled downstream along either side of the river as it crossed the land towards the ocean.

The old man started to dance the boya, rocks, up out of the ground to create a bridge across to his daughter but Wooditj sung the water to flow stronger, flooding the rocks and preventing him from crossing. This created the falls on the river.

As they travelled further, the old man came across a stand of tall trees and pushed them over to create a crossing. Wooditj saw the old man coming across the fallen trees and used his stick to hit the trunk causing Ngarut to fall into the water. Milyean was worried about her father but Wooditj swirled his stick in the water and sung a fish song, filling the river with fish and turning the old man into a blue groper so that he could swim and wouldn't drown.

As they got close to the ocean the water began to pool. It was teaming with fish but they were trapped so Wooditj took his stick and drew a line in the sand to connect the river to the ocean.

The fish started pouring out into the ocean with the river water turning the ocean black with all their bodies. As Wooditj and Milyean started spearing fish to eat they saw a rock rising out of the ocean containing the spirit of the old man but as Milyean looked back at Wooditj she saw that he had speared a blue groper and she cried fearing that he had killed her father.

Wooditj promised that if this was her father he would turn him back into a man. He plunged his stick into the ground and sung his spirit back into a man. Ngarut gave the couple his blessing but asked that they leave to new country. His body is buried at the cliffs near the rivermouth and his spirit still watches over the river

Iszaac Webb, 2019.

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Acknowledgements

This strategy has been prepared by Nature Conservation Margaret River Region in partnership with the Margaret River Collaborative Management Group.

The Margaret River Collaborative Management Group was formed in November 2017. Members of the group include Aboriginal representation, Shire of Augusta Margaret River, Nature Conservation Margaret River Region, Department of Water and Environmental Regulation, Department of Biodiversity, Conservation and Attractions, Department of Planning, Lands and Heritage and Margaret River Regional Environment Centre. The purpose of the group is to bring together all stakeholders to share information, improve communications and coordinate future management to protect and enhance ecological and community values of the Margaret River.

The following people have had significant input into the strategy:

Gary Evershed and John McKinney, AMRS
Wayne Elliott, Ben Lullfitz and Andrew Webb, DBCA
David Stapleton, DPLH
Kath Lynch, DWER
Caroline Hughes and Genevieve Hanran-Smith, NCMRR
Wayne and Iszaac Webb, Undalup Association

The strategy has borrowed design and ideas from the Swan Canning River Protection Strategy. Development of the strategy was commenced with support from the South West Catchments Council, through funding from the Australian Government's National Landcare Programme. Further funding support has been provided by the Western Australian Government's State NRM Program and the Shire of Augusta Margaret River's Environmental Management Fund to complete the strategy and develop an Implementation Plan.

Acronyms

AMRS	Shire of Augusta Margaret River
DBCA	Department of Biodiversity, Conservation and Attractions
DPLH	Department of Planning, Lands and Heritage
DPIRD	Department of Primary Industries and Regional Development
DWER	Department of Water and Environmental Regulation
MRCMG	Margaret River Collaborative Management Group
MRREC	Margaret River Regional Environment Centre
NCMRR	Nature Conservation Margaret River Region
UCL	Unallocated Crown Land
WC	Water Corporation

Overview

This strategy

This strategy has been developed to support coordinated and collaborative management of the Margaret River, its tributaries and associated remnant native vegetation with the aim of protecting water quality, streamflow and biodiversity, and managing human impacts.

As many organisations and individuals have management responsibilities for the river system, the protection of water quality and biodiversity in the Margaret River catchment will be most effectively achieved through a shared vision, clear plan of action and coordinated management.

In 2017 the Margaret River Collaborative Management Group was formed with the aim of bringing together all stakeholders to share information, improve communications and coordinate management to protect and enhance the ecological and community values of the Margaret River. Members of the Group include representatives of the Wadandi community, Nature Conservation Margaret River Region, Shire of Augusta Margaret River (AMRS), Department of Water and Environmental Regulation (DWER), Department of Biodiversity, Conservation and Attractions (DBCA), Department of Planning, Lands and Heritage (DPLH) and Margaret River Regional Environment Centre (MRREC).

The Management Group has developed this overarching strategy to provide broad management direction. The recommended actions require further detailed development and consultation with stakeholders and the community. Implementation of the recommendations will in many instances rely on sourcing external funding.

Vision

The shared vision guiding development of this strategy and management of the river is:

> **A healthy, natural and resilient Margaret River safeguarded for present and future generations**

This plan outlines agreed management objectives, strategies and actions to achieve three broad outcomes towards this vision:

- Recognition of Aboriginal heritage and community values
- Best practice coordination and management
- A healthy ecosystem

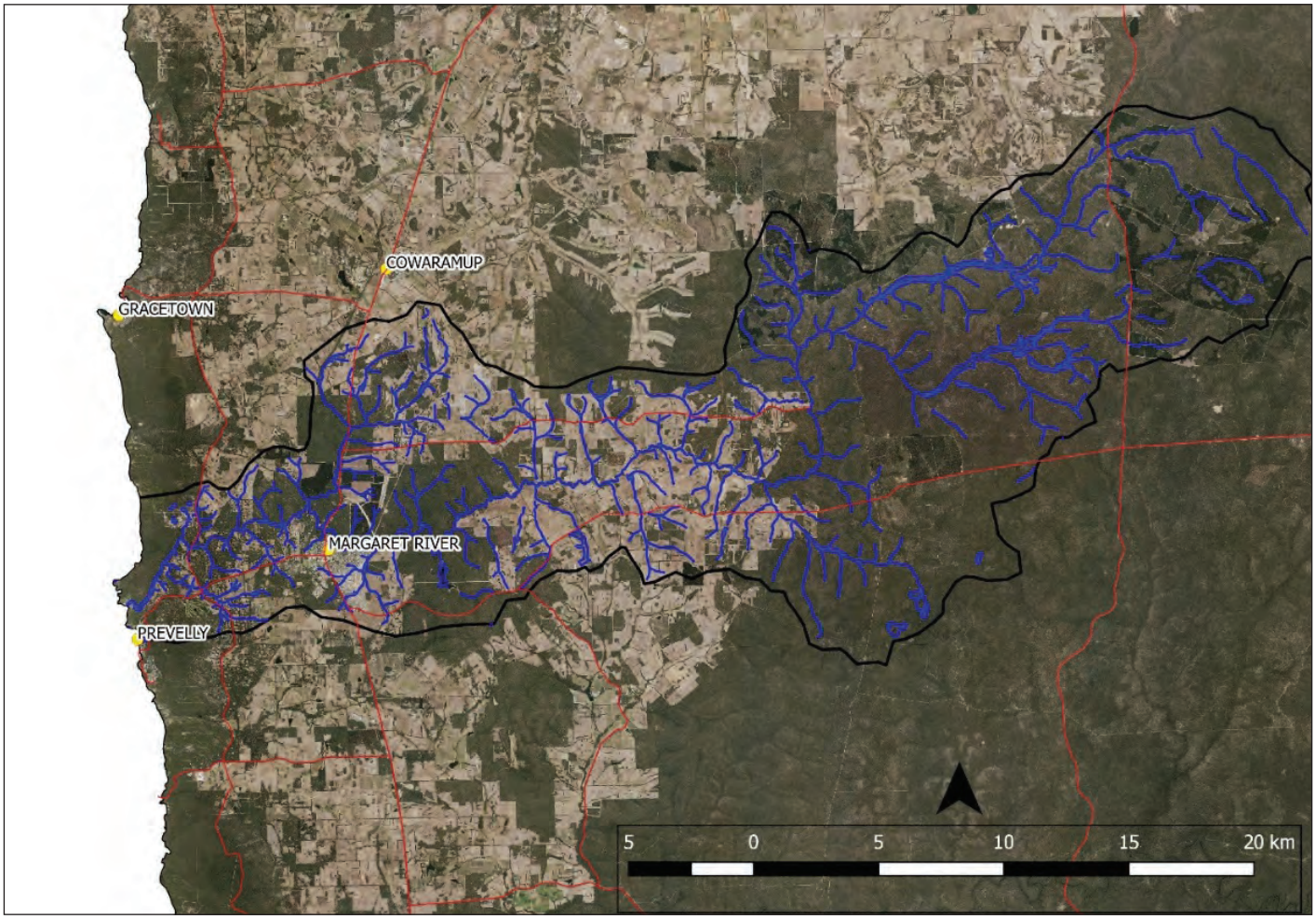


Figure 1: Margaret River catchment

Background information on the Margaret River and catchment

The Margaret River is a small river, approximately 60 km in length with 190 km of tributaries, the largest being Mowen River and Bramley Brook. The river drains a catchment area of 477 km^2.

The river is contained in the Shire of Augusta Margaret River. Significant residential development has occurred within the Shire over the past ten years. The estimated 2016 resident population of the Shire was 14,687 and the average annual growth rate between 2011 and 2016 was 3.7%. An average of 118 dwellings per year were constructed between 1996 and 2011 in the Margaret River township. Land use planning documents indicate that there is long term potential for development of 7,500 additional lots in Margaret River. (AMRS, 2017). The Shire is also a popular tourism destination. The average number of overnight visitors to the Shire in the period 2015 to 2017 was 701,700 (Tourism WA, 2017).

Aboriginal heritage

Aboriginal people have a very long and continuing connection to the Margaret River. Devil's Lair, south of Margaret River, is one of the earliest sites of human occupation in Australia and contains evidence of Wadandi existence dating back at least 48,000 years. Aboriginal people managed the land in a sustainable and productive way over these many thousands of years (Pascoe, 2014, Gammage, 2011).

To Wadandi people, the Margaret River is known as Wooditjup, named after the magic man, Wooditj who created the river in the Nyitting (cold times when the land was soft). The river was of vital importance to Wadandi people for camping, hunting, foraging and fishing, and as a focal point for traditional ceremonial activity (DoW, 2008). Today Aboriginal people continue to highly value the environmental and spiritual significance of the river.

The whole of the Margaret River and foreshore, and the Wallcliffe cliffs and caves are registered Aboriginal sites under the Aboriginal Heritage Act 1972. These areas have been registered as they are recognised as being of importance and special significance to Aboriginal people and the cultural heritage of Western Australia. The Register lists all documented Aboriginal sites. It is very likely that there are significant sites not currently within the Register. Both registered and currently unregistered sites are afforded protection by the Aboriginal Heritage Act.

The recognition and preservation of Aboriginal heritage values is integral to best practice river management. To ensure this is achieved, it is essential that Aboriginal people are involved in planning, management and on-ground activities associated with the Margaret River.

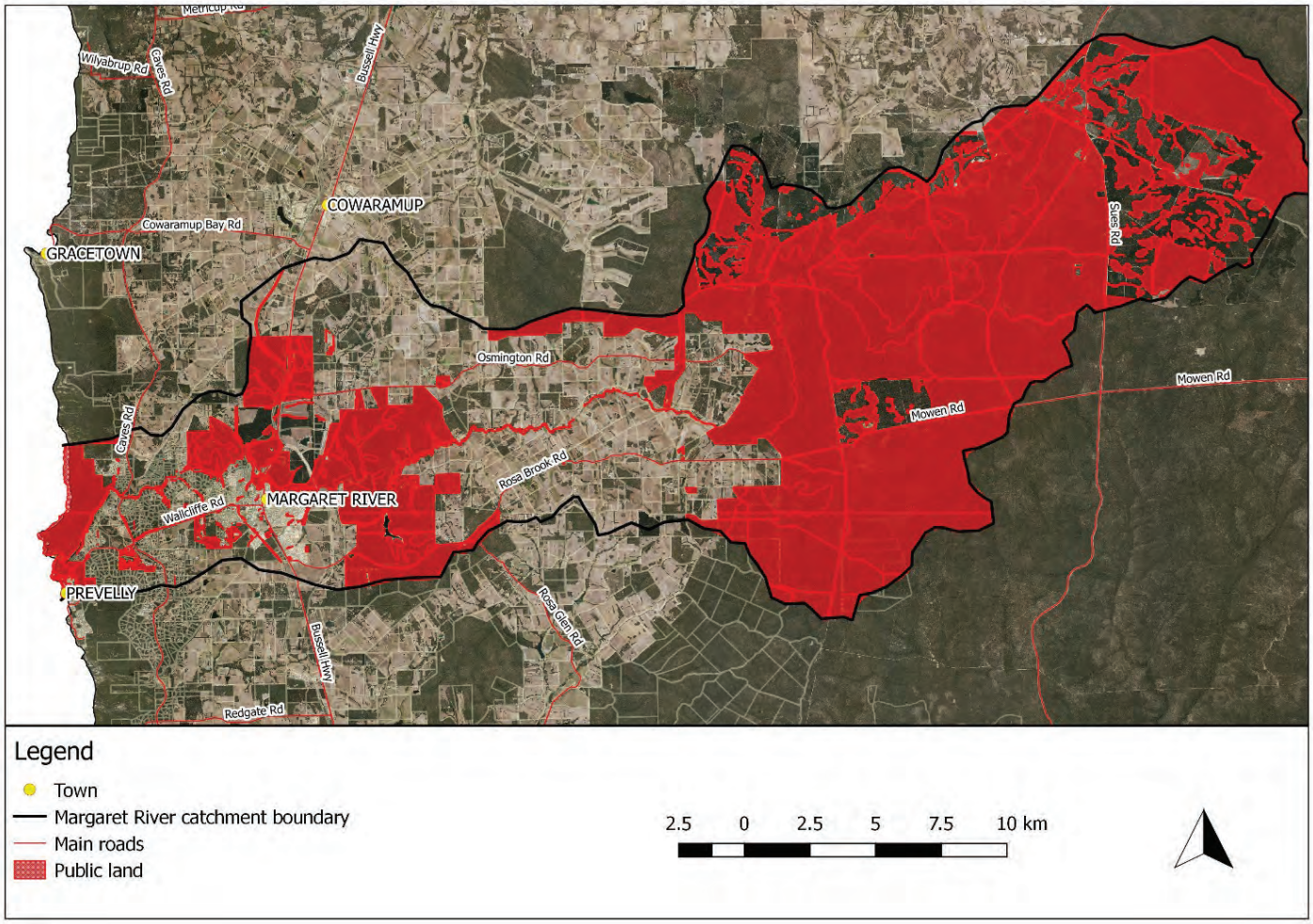


Figure 2: Public land in the Margaret River catchment

River pools of the upper Margaret River

Land Tenure

Public land in the Margaret River catchment is shown on Figure 2.

The headwaters of the river are contained within state forest and the Rapids Conservation Park. From Rapids Conservation Park to Wooditjup National Park the main channel of the river is within a foreshore reserve vested in the Department of Water and Environmental Regulation. The river then flows through the Wooditjup National Park. From the Margaret River township to the coast the river and foreshore are contained within a number of separate reserves. These are mainly Unallocated Crown Land (UCL) or shire reserve where management responsibility is with Department of Planning Lands and Heritage and Shire of Augusta Margaret River. Towards the coast the northern side of the river is within the Leeuwin-Naturaliste National Park. The vesting purposes of the reserves are varied.

Land use

Approximately 67% of the catchment retains native vegetation and a further 13% is plantation forestry. Land use in the remaining 20% is agriculture, residential and rural-residential.

The headwaters are within a large, intact area of native vegetation and pine plantations. As the river flows west it crosses a section of the catchment dominated by agriculture including grazing, dairy, olives, vineyards and tree plantations. The river then flows through the rapidly growing township of Margaret River, the Wooditjup National Park, rural-residential areas, and the Leeuwin-Naturaliste National Park, before reaching the sea. Between the Margaret River township and the coast rural-residential is the dominant land use with further subdivision occurring and land use density increasing in some areas.

Hydrology and hydrogeology

Streamflow in the Margaret River is seasonal, with 93% of annual flow occurring between June and October. The average annual streamflow in the Margaret River for the period 1975 to 2005 was 86.2 GL. The highest recorded annual flow was 190 GL which occurred in 1973 (Green *et al*, 2010).

Mean annual rainfall in the Margaret River catchment has declined by 11% for the period 2001-2014 compared to the long term record (1975-2000) and there has been an associated significant decrease in streamflow of 50% (Greening cited in Storer *et al*, 2016).

The timing of flow has also changed. Prior to 1985, flow was continuous throughout the year. The flow is now intermittent with the continuous flow period declining by 22% in 2001-2014 compared to the long term record, possibly due to a reduction in groundwater inflow (Greening cited in Storer *et al*, 2016).

The Margaret River is a spatially intermittent system, with more than 20 permanent pools supported by groundwater discharge from the Leederville Aquifer.

The pools occur within the Vasse Shelf where the Leederville aquifer is underlain by the Sue Formation. Similar large permanent pools do not occur east of the Busselton Fault where the Leederville aquifer

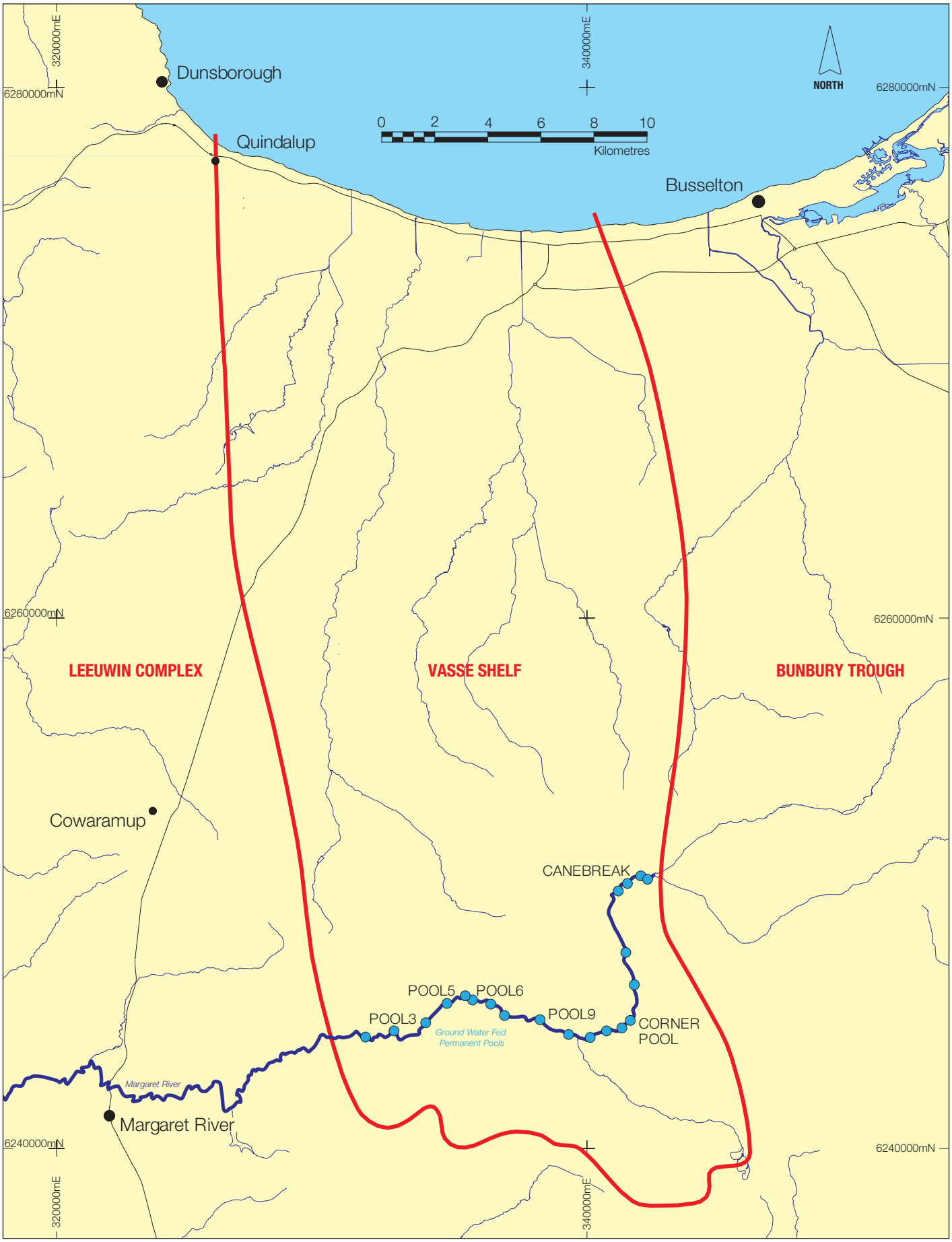


Figure 3: Hydrogeology showing the groundwater fed permanent pools occurring within the Vasse Shelf

is underlain by the relatively permeable Yarragadee Formation. The Leederville Aquifer and the Margaret River are directly connected and the permanent pools are considered to be an important potential groundwater-dependent ecosystem. The Leederville aquifer is a multi-layered aquifer system comprising discontinuous interbedded sequences of sand and clay. It has six distinct members— the Quindalup, Upper Mowen, Lower Mowen, Upper Vasse, Lower Vasse and Yelverton members. The riverine pools in the Margaret River generally occur in the Upper Mowen, Lower Mowen and Upper Vasse Members. (Schafer *et al*, 2008)

An investigation by Schafer, Johnson and Kern in 2006 confirmed the presence of a groundwater-flow divide extending across the Vasse Shelf in the Leederville aquifer north of the Margaret River, separating groundwater flow to the north towards Geographe Bay and a southerly groundwater flow that discharges into the Margaret River. There is an active, shallow groundwater system that maintains the permanent pools along the Margaret River, as well as a deeper groundwater flow.

These riverine pools are considered relatively robust as they occur within the groundwater table. It is likely that they are more vulnerable to direct surface water abstraction than indirect groundwater abstraction. (Schafer *et al*, 2008). Effective management of surface and groundwater abstraction is required to minimise any impact on pool levels.

Water quality

The Margaret River is one of the few major river systems in south-western Australia that has not become impacted by salinisation (Morgan, Thorburn & Gill, 2003).

Ad hoc sampling undertaken over many years at a variety of sites by organisations including DWER, AMRS, Water Corporation (WC) and NCMRR has informed a general understanding that the water quality of the Margaret River is acceptable for the parameters tested. Total nitrogen, nitrates, ammonium, turbidity, dissolved oxygen and bacterial levels have been recorded outside of acceptable ranges on occasions.

There has not been comprehensive, on-going monitoring of the water quality of the Margaret River.

Stream form and habitats

The river retains a large diversity of habitat types including pools, riffles, cascades, low flow channels, floodplains and backwaters, and retains important elements that contribute to a healthy river ecosystem such as fringing vegetation, woody debris, shade, and leaf litter. Native fringing vegetation remains along most of the river, though it is narrow and degraded in places (CCG, 2003). This vegetation is crucial to a healthy river and provides many essential ecosystem functions (Pen, 1999).

Canebrake pool in the upper catchment of the Margaret River provides valuable habitat for aquatic fauna. Photo – Steve Beatty

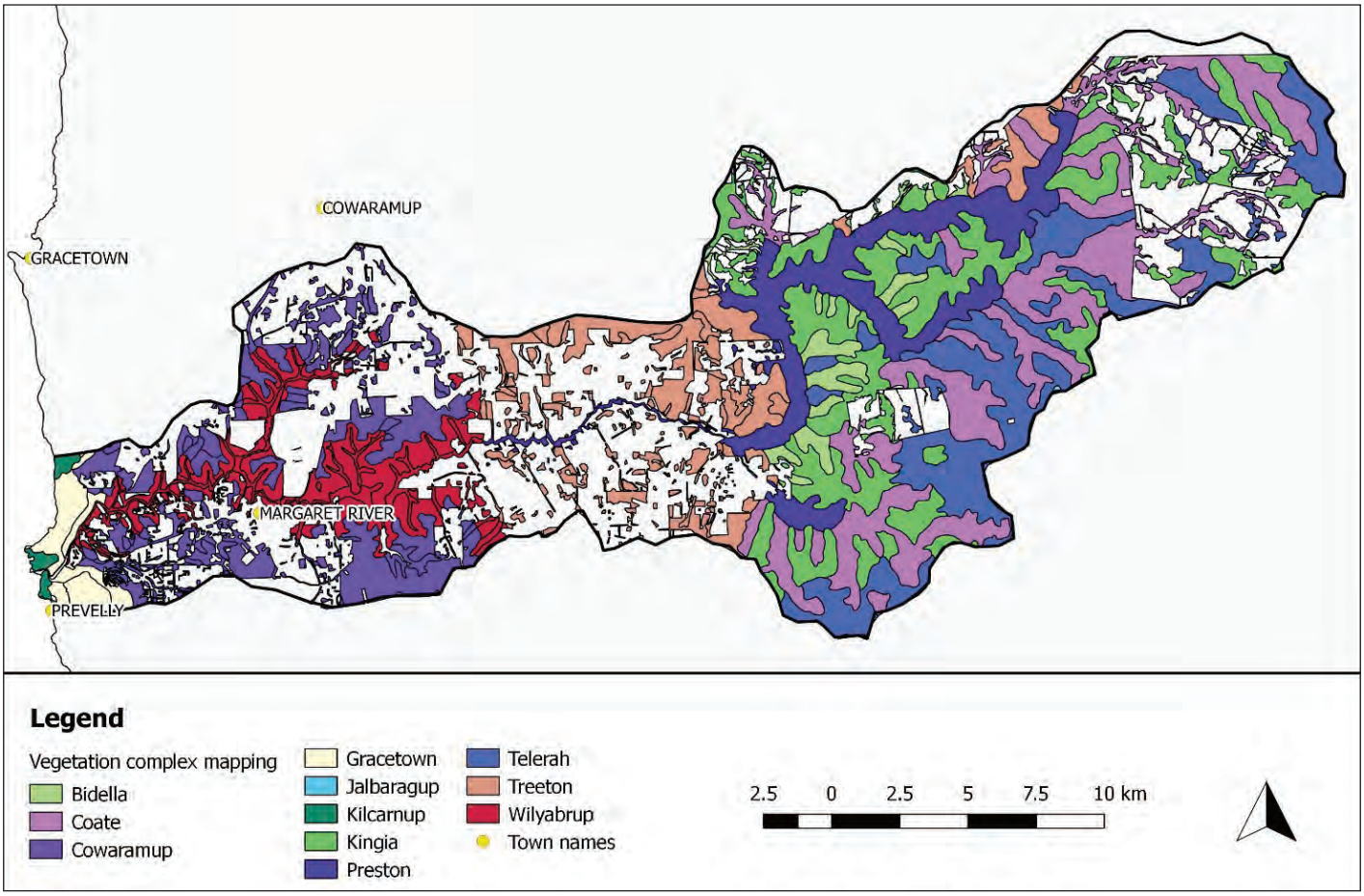


Figure 4: Broadscale mapping of vegetation complexes in the Margaret River catchment

Large parts of the river are dry during summer and autumn. The remaining permanent pools provide a drought refuge for aquatic fauna including waterbirds, turtles, water rats, pouched lamprey, frogs, fish, crayfish, shrimp, mussels and aquatic insects, and are essential to the survival of many aquatic species. The four permanent refuge pools in the headwaters have been identified by Allen *et al*, 2015 as collectively forming one of the most significant hotspots for aquatic biodiversity in the entire south west region. Permanent pools are of critical importance to the Margaret River, particularly given declining streamflow, and building their resilience and habitat values has been identified as a high priority (Tim Storer, pers. comm. 2017).

Within the township there are a series of pools created as a water source for the town by three weirs. Two of these weirs were identified as barriers to fish migration and have had fishways constructed on them to address this issue.

Downstream of town, large sections of the river dry out during summer and autumn. A series of significant pools remain with the largest area of permanent water on the river beginning at the elbow bend west of Caves Rd. During winter and spring the waterfall, rapids, and riffles provide important ecological functions, oxygenating the water and providing microhabitats.

The Margaret River has a small estuary about 2 km long with an area of 200 ha, connected to the ocean during winter and spring. The estuary is in good natural condition with the area to the north being well vegetated and within the Leeuwin-Naturaliste National Park.

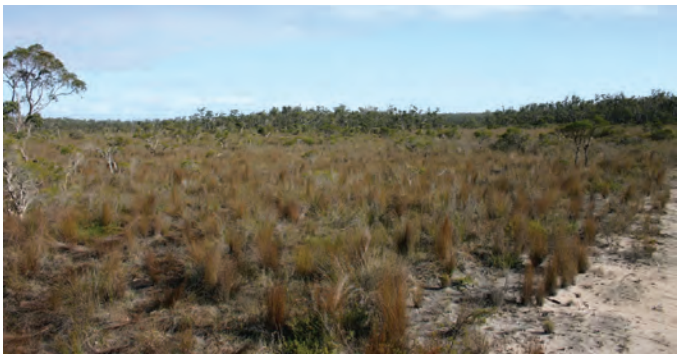
The 190 km of tributaries throughout the catchment are of variable condition. River action plans developed for Bramley Book and the tributaries to the west of Bramley Brook indicate that nearly 45% are very degraded and erosion prone (CCG, 2009, CCG, 2011). A desktop survey using aerial photography indicates that this figure would be a lot higher for the tributaries in the agricultural zone of the catchment.

Vegetation

29,895 ha of native vegetation remains within the Margaret River catchment with approximately 80% of this public land within state forest, national park and reserves.

Mattiske and Havel, 1998 mapped 11 broad vegetation complexes in the catchment (Figure 3). These vegetation complexes are further refined into 27 vegetation associations of which 9 have less than 35% of their original extent remaining.

The vegetation in the headwaters in the Blackwood Plateau is intact and of a significant size. The headwaters contain several different wetland types that offer refugial habitat to typically south coast species. The river supports at least 18 conservation listed taxa and 11 yet to be described species. The majority of the listed and significant flora is known from the upper river. These flora records are currently known from isolated collections and additional field data is needed to understand the significance of these large wetland areas. They are likely to be the only wetland assemblages of their type, particularly within the Blackwood Plateau landform.



Wetlands in the Margaret River headwaters support many conservation listed species. Photo – Andrew Webb

Excellent quality foreshore through Wooditjup National Park

Narrow, degraded fringing vegetation within the upper Margaret River foreshore reserve

The critically endangered hairy marron (*Cherax tenuimanus*) and Margaret River burrowing crayfish (*Engaewa pseudoreducta*)

The wetland systems in the headwaters include:

Areas of permanent groundwater seepage – generally at the point of tributary origin, these are very dense and characterised by species associated with permanent moisture such as bullich (*Eucalyptus megacarpa*), blackbutt (*Eucalyptus patens*) and wetland species including *Cyathochaeta teretifolia* (P3), *Gahnia decomposita, Lepidosperma tetraquetrum, Baumea rubiginosa, B. vaginalis*

These seepages become two broad channels with a series of wetlands.

The centre of the main channel is a permanent to near permanent wet flat on clay soils. These areas are dominated by *Meeboldina/ Leptocarpus* sedges with shrubs such as *Hakea linearis, Callistemon glaucus, Homalospermum firmum.*

Still within the broad channels but away from the main drainage lines are seasonally inundated areas of a particularly restricted type of wetland with clay soils dominated by the sedge *Anarthria laevis.*

Fringing the broad channels and intermingling with the above *Anarthria* wetland are very restricted damplands of organic rich grey sand over clay; these are dominated by a low shrubland and the sedge *Melanostachya ustulata.*

The majority of the listed and significant flora is recorded in the *Anarthria* and *Melanostachya* dominated wetlands.

The agricultural zone of the catchment has been heavily cleared. Foreshore vegetation on the river is retained though the condition varies and it is often narrow and degraded.

The foreshore vegetation and surrounding vegetation in Wooditjup National Park is in excellent condition. Plant communities in Wooditijup National Park (some rare and restricted) have been identified as important for conservation. These communities include regionally significant granite outcrop communities. These areas of granite outcropping are highly restricted in extent. They support a diversity of microhabitats and soil moisture regimes that have allowed disjunct populations from the Darling Plateau granites to persist and speciate. Some of the flora species are highly restricted and may be known from solitary rock outcrops. In addition to specific floristic value, the granite outcrops provide significant habitat for lichens, moss, algae, invertebrates and some reptiles. Granite outcrop communities are fragile habitats and susceptible to disturbance and degradation (DPaW, 2015).

The vegetated creeklines and associated seeps within Wooditjup National Park have been identified as containing a variety of geographically significant flora populations, and as providing important refugial habitat for native fauna species including some threatened and conservation dependent critical weight range mammals that have populations in decline such as western ringtail possum (*Pseudocheirus occidentalis*), chuditch (*Dasyurus geoffroii*) and brush-tailed phascogale (*Phascogale tapoatafa subsp. wambenger*) (DPaW, 2015).

The value of the remnant vegetation corridor along the river from Wooditjup National Park to Cape Mentelle has been identified as significant on a landscape scale (DPaW, 2015).

West of the Margaret River township the foreshore vegetation is generally in better condition than east of town. Some areas have been protected within the National Park and other areas by their unsuitability for agriculture due to their rocky nature or steep terrain. Foreshore assessments in 2017 determined that riparian vegetation was mostly in good condition. Approximately 50% of the adjoining upland vegetation within the foreshore reserve however, was assessed as degraded. Areas of granite outcrop communities occur within the foreshore.

Along the lower river and at the estuary the fringing vegetation is dominated by *Melaleuca rhaphiophylla* and associated sedges and rushes. This *M. rhaphiophylla* vegetation community is extremely restricted within the Capes region and is very limited in extent on the Margaret River. Given its restricted nature, all areas of this vegetation community are regarded as highly significant.

Fauna

The Margaret River is a unique and critically important riverine ecosystem, highlighted by a remarkable aquatic biodiversity (Tim Storer 2019, pers. comm.). The permanent pools in the upper catchment have been identified by Murdoch University's Freshwater Fish Group and Fish Health Unit as one of the most important conservation priority areas for freshwater fishes and crayfishes in the south west region (Allen *et al*, 2015).

The river is home to five of the six native freshwater crayfish species and nine of the 15 native fish that have been identified across the south-west of Western Australia. Threatened species known from the upper river and catchment include Balston's pygmy perch (*Nannatherina balstoni*), western mud minnow (*Galaxiella munda*), the critically endangered hairy marron (*Cherax tenuimanus*) and Margaret River burrowing crayfish (*Engaewa pseudoreducta)*.

The Margaret River also provides habitat for other priority aquatic species including the pouched lamprey (*Geotria australis*), Carter's freshwater mussel (*Westralunio carteri*) and rakali (*Hydromys chrysogaster*) with recent genetic work indicating that populations in the south west may be distinct enough to separate them as a unique species, which may result in an elevation of their threatened status. Populations of both the western pygmy perch (*Nannoperca vittata*) and nightfish (*Bostockia porosa*) in the Margaret River may also be distinctive enough to warrant recognition as separate species that are endemic to the Margaret River (Allen *et al*, 2015).

Recent monitoring (Allen *et al*, 2015, Storer *et al*, 2016) identified concern regarding a decline in the presence of populations of western mud minnow, lamprey, Balston's pygmy perch and gilgie (*Cherax quinquecarinatus*). Changes in hydrology and streamflow, and impacts of the introduced eastern gambusia (*Gambusia holbrooki*) are implicated.

When sampling in the estuary in February 2016 the DWER found black bream (*Acanthopagrus butcheri*), sea mullet (*Mugil cephalus*), western hardyhead (*Leptatherina wallacei*), Swan River goby (*Pseudogobius olorum*), water rats, long-necked turtles (*Chelodina colliei*) and freshwater shrimps (*Palaemontes australis*). Sampling indicated that the area is an important nursery for black bream.

Conservation listed terrestrial fauna species known from the area include the western ringtail possum, Baudin's black cockatoo (*Calyptorhynchus baudinii*), red-tailed black cockatoo (*Calyptorhynchus banksii naso)*, Carnaby's black cockatoo (*Calyptorhynchus latirostris*), western brush wallaby (*Notamacropus irma*), chuditch and south-western brush-tailed phascogale.

Human use

The Margaret River, its tributaries and associated remnant native vegetation are a valuable economic and social resource.

The river and tributaries provide a valuable water resource. In 2009 there were 670 dams recorded in the Margaret River catchment, most with a storage capacity of less than 8 ML and used primarily for stock and domestic purposes. There were 43 commercial dams recorded with a storage of between 8 and 282 ML. These dams are used to irrigate crops, such as olives, grapes and nuts. The Water Corporation has a 1.7 GL capacity dam on Ten Mile Brook. (Bennett & Donohue 2009 cited in Green *et al*, 2010).

Licenced water abstraction occurs from the river year round. There are also many landholders who pump water from the river as a riparian or other right.

In 2009 the Shire of Augusta Margaret River implemented the Margaret River recycled water scheme. The Shire now uses treated water from

the Water Corporation wastewater treatment plant for irrigation. Prior to the implementation of the scheme the Shire was licenced to extract up to 105,000 kL per annum from the river with water taken predominantly in summer months for irrigation. The Shire now draws on average 5,000 kL per annum in non-summer periods used only to undertake flushing and maintenance of the recycled water system.

The river was previously used for direct stock watering. In 2003 the Margaret River Action Plan (CCG, 2003) identified stock access as the biggest threat to foreshore condition. Since then 23 km of fencing has been completed on the river and over 90% of the foreshore is now protected from stock access. Stock still have access to 2.5 km of foreshore in the vicinity of Treeton-Jindong Road.

The river is increasingly used for recreation. Rapids Conservation Park in the headwaters has a well-used camping area and is a popular recreational site. Wooditjup National Park is very popular for recreation and there is extensive, on-going development of mountain bike trails in the Park. From town to the coast the river and foreshore are increasingly used for recreation including swimming, canoeing, walking, horseriding and mountain bike riding. The waterfall off Kevill Rd is a key attraction.

The foreshore reserves in town have active management plans and Friends of Reserve groups established to contribute to management.

The Margaret River estuary and rivermouth area are also well used for recreation. Swimming, kayaking and paddleboarding in the river are common. The area is used for tours and canoe hire and is regularly visited by school groups from Perth in the region on school camps. The Rowing Club is situated on the southern bank of the river in the estuary.

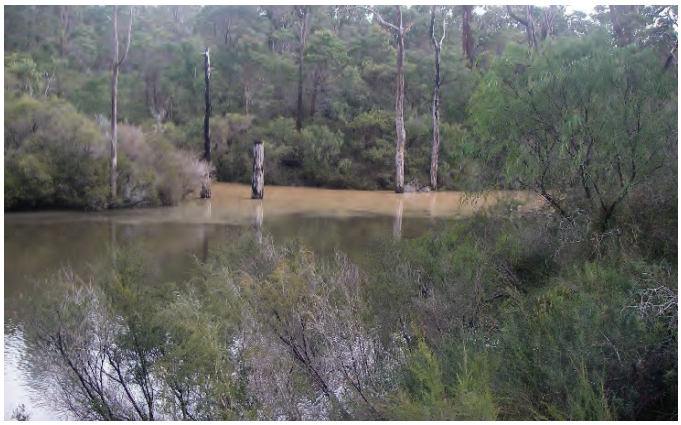
Threats to the environmental condition of the Margaret River

Climate change, and associated decline in streamflow and changes to flow regimes, are a threat to the ecology of the river (Morrongiello *et al.* 2100, Allen *et al*, 2015, Tim Storer, pers. comm. 2017). As well as directly affecting flora and fauna, declining streamflow exacerbates the impacts of all stresses on the river, many of them interrelated and accumulative.

In regard to the impact of declining streamflow on fish populations Allen *et al*, 2015 state:

> Many of the native fishes in the Margaret River utilise seasonally inundated habitats (small creeks, wetlands, flooded riparian vegetation) for breeding and nursery areas. Declines in rainfall and stream discharge limit the availability of these important habitats both spatially and temporally which in turn affects the reproductive success and strength of recruitment of native fishes.

Canoeing on the Margaret River



Sediment washed into Darch Brook and the Margaret River from subdivision and development

Year round water abstraction directly from the river occurs by licensed water users and landholders accessing riparian and other rights under the Rights in Water and Irrigation Act 1914 (WA). The impacts of abstraction from permanent pools during summer and autumn is a potential threat to river ecology especially in light of climate change and declining streamflow. At the estuary unauthorised opening of the rivermouth occurs each year and the impacts of this are unknown.

The water quality of the Margaret River is threatened by run off from agricultural and urban landuse. Many tributaries are degraded and actively eroding which exacerbates water quality risks. Urban and rural-residential subdivision and development in the Margaret River catchment is placing additional pressure on the water quality of the river. Impacts include sediment export during the development and construction stage, and on-going runoff of stormwater containing organic and inorganic pollutants.

Many of the tributaries of the Margaret River are in poor condition and continue to be threatened by stock access, on-going erosion, loss of vegetation and weeds. Degradation and loss of native vegetation on the river and across the catchment continues to occur as a result of grazing, established and emerging environmental weeds, fire management, forestry, firewood collection, dieback and other plant diseases, and increasing recreational pressures.

Sections of the river foreshore have become degraded and revegetation is required to improve the condition and resilience of the river. The vegetation condition at river pools in the mid to upper catchment is of particular concern as these pools represent increasingly important summer refuges (Storer *et al.* 2016).

As well as changes to hydrology, threats to native fauna also include introduced animals including smooth marron, gambusia, foxes and cats, and illegal marroning.

There is much we still don't know about the river and this lack of knowledge impedes better management. Careful management is more important than ever if we are to address threats and maintain the condition of the Margaret River in light of climate change and rapid population growth.

Previous management actions

Many organisations have management interests related to the Margaret River and considerable work has been undertaken to protect and enhance the condition of the river system and remnant vegetation in the catchment. Many of these actions have been collaborative, involving landholders, community groups, local and state government agencies and research institutions. State and federal government funding has supported the implementation of many of these projects.

Organisations with relevant statutory responsibilities and management interests in the Margaret River are described in Appendix 1.

Action to date includes:

- A study of ecological water requirements of the Margaret River (DWER)
- Hydrogeological investigations of local groundwater systems and their connectivity to the Margaret River pools (DWER)
- Water allocation planning and licensing of surface and groundwater under the *Rights in Water and Irrigation Act 1914* (DWER)
- Monitoring and measurement of stream flows, pool levels and groundwater levels and the 2016 review of river condition (DWER)
- Development of river action plans for the Margaret River, Bramley Brook and the lower tributaries of the Margaret River (NCMRR)
- Margaret River Recycled Water Scheme (AMRS)
- Management plan development and implementation for foreshore reserves vested in AMRS (AMRS, NCMRR)
- Management plan development and implementation for reserves vested with Conservation Commission of WA (Leeuwin-Naturaliste capes area parks and reserve, 2015) (DBCA)
- Flora and fauna surveys (DBCA)
- Fencing to restrict stock access to the river foreshore, tributaries and remnant vegetation (NCMRR, WC, DWER, SWCC)
- Coordinated, on-going control of invasive environmental weeds (NCMRR, WC, AMRS, DBCA)
- Strategic revegetation (NCMRR, AMRS, SWCC)
- Fishway establishment (MRREC, NCMRR, DWER)
- Stormwater management (AMRS, NCMRR)

- Upgrading dairy effluent systems (NCMRR, WC, DWER)
- Water quality monitoring of the Margaret River estuary (NCMRR, SWCC, DWER)
- Research and strategic planning to protect aquatic biodiversity including conservation actions to protect threatened species such as the Margaret River hairy marron, pouched lamprey and native freshwater fish species (NCMRR, DPIRD, Murdoch University, SWCC)
- On ground rehabilitation through the coordination of the Capes Volunteer Team, support to local Friends of Reserves and community volunteer events (NCMRR, AMRS)
- Delivery of an environmental education program at all local primary schools fostering environmental stewardship for the river and its environment (NCMRR, Rotary Club, AMRS)
- Community awareness raising through events, workshops, and presentations (NCMRR, DWER, AMRS)

Strategic Management Program

The Collaborative Management Group developed a shared vision to guide the development of the Protection Strategy and the management of the river. The vision is supported by objectives under three broad outcomes.

VISION

A healthy, natural and resilient Margaret River safeguarded for present and future generations

VISION

OBJECTIVES

- Protect Aboriginal heritage
- Recognise and consider community values
- Provide sustainable access to the river environment
- Improve community connection to and knowledge of the Margaret River

- Improve management arrangements to protect and enhance ecological and community values of the Margaret River

- Ensure management decisions are based on appropriate knowledge
- Protect water quality and flows
- Protect, manage and enhance biodiversity

OBJECTIVES

Management recommendations

The timeframe for this management program is 2019 to 2029. Following finalisation of this plan a three year implementation plan will be prepared.

It is important to note that external funding sources will be required in many instances to achieve implementation of recommended actions.

Recognition of Aboriginal heritage and community values

Objective: Protect Aboriginal heritage

	Key Agencies	Support Agencies
Maintain a collaborative approach to protecting Aboriginal heritage values		
Undertake regular consultation and engagement with Aboriginal custodians regarding the health and management of the river, Wallcliffe cliffs and caves and other Aboriginal heritage sites in the catchment.	MRCMG NCMRR	
Meet ethical and legal requirements in regard to Aboriginal heritage issues		
Undertake early consultation and engagement with relevant Aboriginal people regarding any activity that may impact on the Margaret River, Wallcliffe cliffs and caves, and other Aboriginal heritage sites in the catchment.	MRCMG	
Recognise the South West Aboriginal Land and Sea Council, the South West Boojarah Working Party and Undalup Association as key organisations to consult on Aboriginal heritage.	MRCMG	
Seek consent or authorisation from the Department of Planning, Lands and Heritage for activities that may impact on the Margaret River, Wallcliffe cliffs and caves, and other heritage sites in the catchment.	MRCMG	

Objective: Recognise and consider community values

	Key Agencies	Support Agencies
Consider diverse community values in relation to the Margaret River and other public land in the catchment.		
Undertake community and stakeholder consultation regarding development and management of the Margaret River and other public land in the catchment.	AMRS DBCA DWER	

Objective: Provide sustainable access to the river environment

	Key Agencies	Support Agencies
Manage the publicly accessible foreshore from Ten Mile Brook to the coast to provide for community use whilst protecting environmental, cultural and Aboriginal heritage values		
Formalise access within the foreshore reserve and undertake on-going management of uncontrolled access.	AMRS	DBCA
Develop and install trail maps and trail markers to provide clear direction regarding formalised access.	AMRS	DBCA
Arrange removal of unauthorised private infrastructure from within the foreshore reserve from Bussell Hwy to the coast.	AMRS	

Objective: Improve community connection to and knowledge of the Margaret River

	Key Agencies	Support Agencies
Facilitate opportunities for engagement with the river and foreshore reserves		
Provide opportunities for community groups, students and individuals to be involved in monitoring and on-ground conservation activities in the Margaret River foreshore reserves.	AMRS	NCMRR
Improve community knowledge of the Margaret River and associated values and threats		
Undertake a schools education program focused on improving understanding and connection with the Margaret River.	NCMRR	
Deliver events to improve community understanding and connection to the Margaret River.	NCMRR MRREC TMR	AMRS
Use interpretative signage where appropriate to provide information to the community about river values and threats.	AMRS DBCA	
Undertake an annual community update on the health of the river system and the implementation of this strategy.	MRCMG	
Undertake community education programs about threats to foreshore condition, habitat values and aquatic biodiversity including about feral fish, dumping garden refuse, garden escapees and control of domestic animals.	AMRS	NCMRR
Provide information to the community following DWER's regular review of river condition using the South West Index of River Condition.	DWER	

Best practice coordination and management

Objective: Improve management arrangements to protect and enhance ecological and community values of the Margaret River

	Key Agencies	Support Agencies
Improve management coordination and collaboration between organisations with responsibilities for the Margaret River, its tributaries, associated groundwater and remnant native vegetation		
Develop collaborative partnership projects to protect the Margaret River and its catchment, and leverage funding available for management.	MRCMG	
Consider long term resourcing of the Margaret River Collaborative Management Group and the implementation of this strategy.	MRCMG	
Enable the community to access information on the management of the Margaret River via an annual community update on the health of the river system and the implementation of this strategy.	AMRS NCMRR	
Investigate formal protection measures for the Margaret River such as Rights of Nature law.	MRREC	
Establish appropriate vesting and tenure arrangements for public land		
Review the vesting and purpose of the Margaret River foreshore reserves. Instigate appropriate changes to the vesting and purpose and/or management arrangements to enable the vision and objectives of this strategy to be efficiently and effectively met.	DPLH AMRS	
Collate resource information to support a review of the tenure and purpose of public land in the Margaret River headwaters with the aim of improving long term protection of the biodiversity values in this area.	DBCA	

A healthy river ecosystem

Objective: Ensure management decisions are based on appropriate knowledge

	Key Agencies	Support Agencies
Improve knowledge and understanding of Margaret River hydrology and hydrogeology		
Continue to monitor groundwater levels and annually assess streamflow using stream gauging data	DWER	
Implement a no take zone for groundwater 1km either side of the Margaret River and a deep bore (>40m) only approach for the rest of the Margaret River valley	DWER	
Undertake a groundwater review to assess aquifer performance and response to the increased allocation limits.	DWER	
Review surface water allocation limits to address the over-allocation in the upper Margaret River. Consider reviewing surface water licences that abstract through summer from ground water fed pools as ground water licences.	DWER	
Improve knowledge and understanding of the water quality of the Margaret River		
Establish on-going river and catchment based environmental water quality monitoring and evaluation program including expansion of the current monitoring of water quality for recreational use.	AMRS	NCMRR DWER
Improve knowledge and understanding of the ecological condition of the Margaret River		
Continue to review river condition using the South West Index of River Condition every three to five years or following any significant changes to water allocation or environmental conditions. Report results to the community.	DWER	
Undertake a comprehensive study of priority river pools to better understand ecological values and impacts of water extraction, sedimentation, feral aquatic fauna and riparian vegetation degradation	DWER	NCMRR
Investigate the value of a macroinvertebrate sampling program to better understand the taxonomic richness and abundance of this important bio-indicator group.	NCMRR	DWER
Collect data on the timing, duration and frequency of the breaching of the sand bar at the river mouth to improve understanding of pouched lamprey populations and estuary health.	NCMRR	AMRS
Improve knowledge and understanding of biodiversity values of the Margaret River headwaters		
Undertake flora surveys and mapping of wetland types in the Margaret River headwaters.	DBCA	NCMRR
Undertake fauna surveys to better understand biodiversity values in the Margaret River headwaters.	DBCA	NCMRR
Regularly update information on Margaret River foreshore condition to ensure appropriate management is undertaken to protect and improve environmental condition		
Undertake regular assessments and mapping of the Margaret River foreshore and adjacent remnant vegetation to enable monitoring of condition and impacts of human use and invasive pest plants.	NCMRR	AMRSC DBCA
Improve knowledge about condition of the tributaries of the Margaret River within the agricultural area of the upper catchment		
Develop a river action plan for the tributaries within the agricultural zone of the Margaret River.	NCMRR	
Improve knowledge about conservation listed aquatic and terrestrial fauna		
Undertake surveys and monitoring to better understand populations of conservation listed species including Baudin's black cockatoo (*Calyptorhynchus baudinii*), forest red-tailed black cockatoo (*Calyptorhynchus banksia naso*), Carnaby's black cockatoo (*Calyptorhynchus latirostris*), Australasian bittern (*Botaurus poiciloptilus*), chuditch (*Dasyurus geoffroii*), western ringtail possum (*Pseudocheirus occidentalis*), rakali (*Hydromys chrysogaster*), Margaret River hairy marron (*Cherax tenuimanus*), Margaret River burrowing crayfish (*Engaewa pseudoreducta*), lamprey (*Geotria australis*), Balston's pygmy perch (*Nannatherina balstoni*), Western mud minnow (*Galaxiella munda*), and Carter's freshwater mussels (*Westralunio carteri*).	DBCA	NCMRR AMRS DWER
Encourage reporting of community sightings of threatened and priority fauna.	DBCA	NCMRR

Objective: Protect water quality and quantity to support ecological health and recreational use

	Key Agencies	Support Agencies
Deliver best practice urban water management		
Review the Margaret River Townsite District Water Management Strategy to ensure best practice urban water management.	AMRS	DWER
Reduce pollutants entering the Margaret River		
Develop a long term water quality management plan that identifies current and potential water quality issues, potential pollution sources and appropriate mitigation strategies.	AMRS	DWER NCMRR
Continue to implement best practice foreshore management strategies such as fencing and revegetation to improve stability and filtering capacity of the Margaret River foreshore and tributaries.	NCMRR AMRS DBCA	
Continue to address sediment issues from development and building sites following the recommendations from the Best Practice Sediment Management for Development Scoping Report.	AMRS	DPLH DEWR
Manage water abstraction to protect ecological health		
Continue evaluation of surface water allocation to ensure acceptable environmental flows are maintained to protect the ecological health of the river.	DWER	
Undertake closer monitoring and review of surface water 'pump in stream' licences due to their potential impact on the ecological health of the Margaret River pools.	DWER AMRS	

Objective: Protect, manage and enhance biodiversity

	Key Agencies	Support Agencies
Foster landowner engagement in biodiversity protection		
Develop a stewardship program to encourage and support landowners to implement best practice biodiversity management to increase ecological connectivity and resilience on the river and in the catchment including fencing to control stock access and strategic revegetation to improve habitat values and ecological linkages.	NCMRR	
Protect and enhance biodiversity values through planning and development processes		
Increase the size of the foreshore reserve where appropriate through the planning and development process.	DPLH	AMRS
Investigate planning mechanisms to be used to improve biodiversity outcomes for the river and catchment.	AMRS	
Investigate and utilise environmental offsets to protect biodiversity values in the Margaret River catchment.		DPLH AMRS BDCA

A healthy river ecosystem (cont.)

Objective: Protect, manage and enhance biodiversity (cont.)

	Key Agencies	Support Agencies
Protect and rehabilitate the foreshore and adjacent native vegetation		
Implement existing management plans for Shire managed foreshore reserves. Protect and rehabilitate degraded and/or heavily used sites in the foreshore reserve.	AMRS	
Continue to work with landholders to encourage and support fencing of the Margaret River and tributaries to control stock access with the remaining grazed, unfenced sections of Margaret River foreshore the highest priority.	NCMRR	
Control public vehicle access in National Parks and State Forest including: • Excluding vehicle access to Wooditjup National Park south-west of Carters Rd (Gan, Mott and Umberto roads) to reduce degradation being caused by illegal camping, firewood collection and rubbish dumping; and • Closing Adelaide Road in Molloy and Rapids forest blocks in the Margaret River headwaters to reduce degradation to high conservation areas as a result of four wheel driving.	DBCA	
Reduce the adverse impacts of pest plants		
Undertake control of priority invasive plant species in the foreshore reserve and remnant vegetation in public ownership. Implement the Capes Regional Environmental Weed Strategy and the management plans for priority weed species in relation to the Margaret River catchment.	NCMRR AMRS DBCA	WC
Coordinate and assist control of priority invasive plant species on private land in the catchment.	NCMRR	
Coordinate weed control with fuel reduction burns on public land where possible.	AMRS DBCA	
Deliver a community education program aimed at reducing further introduction and spread of invasive introduced plants	AMRS	NCMRR
Reduce the adverse impacts of pest animals		
Develop and implement a strategic pest animal control program for the public and private land in the Margaret River and catchment.	AMRS NCMRR DBCA DPIRD	
Implement the Western Shield program in the upper catchment of the Margaret River.	DBCA	
Deliver a community education program aimed at reducing the impact of domestic animals on native fauna	AMRS	NCMRR
Recovery of threatened native fauna species		
Coordinate implementation of relevant actions from recovery plans for threatened species in the Margaret River catchment including Baudin's black cockatoo (*Calyptorhynchus baudinii*), forest red-tailed black cockatoo (*Calyptorhynchus banksia naso*), Carnaby's black cockatoo (*Calyptorhynchus latirostris*), Australasian bittern (*Botaurus poiciloptilus*), chuditch (*Dasyurus geoffroii*), western ringtail possum (*Pseudocheirus occidentalis*), rakali (*Hydromys chrysogaster*), Margaret River hairy marron (*Cherax tenuimanus*), Margaret River burrowing crayfish (*Engaewa pseudoreducta*), lamprey (*Geotria australis*), Balston's pygmy perch (*Nannatherina balstoni*), Western mud minnow (*Galaxiella munda*), and Carter's freshwater mussels (*Westralunio carteri*).	DBCA	DPIRD DWER
Undertake strategic revegetation to improve habitat for the western ringtail possum.	AMRS NCMRR	DBCA

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**Denotes references used in the development of the management recommendations*

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Appendix 1: Management roles and responsibilities

Organisations with relevant statutory responsibilities and management interests in the Margaret River catchment are briefly described below.

Stakeholder	Roles and Responsibilities
Shire of Augusta Margaret River	The Shire of Augusta Margaret River has responsibilities under the *Local Government Act* (1995), local laws and community expectations in relation to the Margaret River including the following: • Infrastructure and property services, including local roads, bridges, footpaths, drainage, waste collection and management; • Provision of recreation facilities, such as parks, reserves and trails; • Health services such as recreational water sampling and management of wastewater treatment; • Planning and development approval including building services; • Ranger services; and • On-ground reserve management services such as weed control and rehabilitation.
Department of Biodiversity, Conservation and Attractions	The Department of Biodiversity, Conservation and Attractions (DBCA) has legislative responsibilities under the *Conservation and Land Management Act* (1984) and *Biodiversity Conservation Act* (2016). DBCA manages sections of National Park, State Forest and Conservation Park adjacent to the Margaret River and its catchment. This includes Wooditjup National Park, Leeuwin Naturaliste National Park, Rapids Conservation Park and Molloy, Rapids, Treeton, Punch and McGregor State Forest Blocks. DBCA has legislative responsibilities for the following: • Protection of flora and fauna, including threatened species and ecological communities; • Managing threats and undertaking recovery actions for threatened species and communities; • Managing fire on DBCA managed lands, including fuel loads, bushfire and undertaking research into fire behaviour and its effects; • Managing sustainable use of state forest under the forest management plan 2014-2023; and • Undertaking control and mitigation strategies for pests and diseases on DBCA managed lands.
Department of Planning, Lands and Heritage	Broad roles and responsibilities of the Western Australian Planning Commission (WAPC) and Department of Planning, Lands and Heritage (DPLH) relating to the Margaret River catchment area: **Regional strategic planning – Leeuwin Naturaliste Sub-regional Planning Strategy** The strategy promotes: • Urban infill and urban consolidation (landuse efficiency); • Sustainable implementation of future urban greenfield areas; • Water Management: water use efficiency, provision of land and corridors for access; and • Water quality and dams: support landuse planning and urban/agricultural stages. **Local Planning Strategy (Shire/DPLH/WAPC) including:** • The SPP2.0: Environment and Natural Resources Policy & SPP2.7: Public drinking water source. • Directions of the Leeuwin Naturaliste Sub-regional Planning Strategy. **Statutory planning** • Shire of Augusta Margaret River (Town Planning Scheme No1 & Local Planning Policies eg. LPP16: Subdivision for Conservation – Feb.2012). • The Local Planning Scheme Amendment process. • Subdivision process (eg. foreshore reserve widening, corridor creation). **Crown Land** DPLH is responsible for unallocated Crown land (UCL) and unmanaged reserves (UMR's). Memorandums of Understanding or a Letter of Authority (access) can be sought with DPLH in relation to responsibility/ management of certain functions (fire, weeds, vermin and other hazards) on UCL and UMR's. Crown land can be subject to a 'Crown land Management Order' (M/O) (reserved) or lease (Land Administration Act 1997). This type of land would be the responsibility of the M/O holder or lessee. Dedicated roads are Crown land and are the responsibility of the Local Government Authority. **Managing Aboriginal lands and heritage** The Department provides a range of services to Government and the wider community to manage, guide and support Aboriginal affairs, heritage and land.

Stakeholder	Roles and Responsibilities
Department of Primary Industries and Regional Development	The former Departments of Fisheries, and Food and Agriculture, have been amalgamated into the Department of Primary Industries and Regional Development. This department is responsible for administering the Biosecurity and *Agriculture Management Act 2007*. Legislative responsibilities under the *Fish Resources Management Act 1994* (FRMA) continue to be met by the Fisheries Division, DPIRD. The Fisheries Division of DPIRD has a legislative role in managing recreational fishing, aquaculture, commercial fishing, biosecurity and biodiversity issues within the freshwater environment. This includes the protection of native freshwater fish and fish habitat in the Margaret River. In meeting this obligation, there is a focus on a range of extractive as well as non-extractive activities as follows: • conserving native freshwater fish and habitats; • sustainable freshwater aquaculture; • managing recreational freshwater fishing experiences; • providing the community support for recreational fishing experiences; and • managing pests and diseases to preserve aquaculture industries and vulnerable ecosystems. The Division has policies on recreational trout stocking; restocking and enhancement; translocation assessments of non-native fish; and biosecurity management arrangements for freshwater pest fish. DPIRD work collaboratively with other state agencies including the Departments of Biodiversity, Conservation and Attractions and Water and Environmental Regulation as part of a 'Freshwater Ecosystems Working Group' to maximise synergies and align management priorities in the area of conserving native freshwater fish and habitats.
Department of Water and Environmental Regulation	On July 1 2017, the Department of Water and Environmental Regulation was established which amalgamated the Department of Environmental Regulation, the Office of the Environmental Protection Authority and the Department of Water. The Department of Water and Environmental Regulation supports Western Australia's community, economy and environment by managing and regulating the state's environment and water resources. The Department is responsible for environment and water regulation, serving as a 'one stop shop' for industry and developers, with the aim of streamlining and simplifying regulation and statutory referrals. The Department supports the development of the Margaret River Protection Strategy and undertakes a range of activities to help protect the Margaret River including allocation planning under the Whicher area surface water allocation plan, licensing of surface and groundwater under the *Rights in Water and Irrigation Act 1914*. The Department also administers *Environmental Protection Act 1986* regulating the clearing of native vegetation, emissions and discharges, prescribed premises, contaminated sites and serious pollution incidents. The Department monitors surface water flows, undertakes scientific investigations of river health and environmental flows and provides technical advice on the Margaret River.
Nature Conservation Margaret River Region	Nature Conservation is a community-based, not-for-profit organisation established in 2002. Formally the Cape to Cape Catchment Group (CCG) the organisation works in partnership with the community to protect the natural environment of the Margaret River region. Using the best available conservation science, Nature Conservation partners with local and state government, research institutions and local community groups to achieve effective and sustainable environmental outcomes for the region. Nature Conservation has no legislative powers to manage the Margaret River or the natural environment of the Margaret River region, however relies on strong partnership with local government, state government agencies and community support to achieve environmental outcomes. Since 2002 Nature Conservation (formally CCG) has worked in partnership with a range of stakeholders to protect and enhance the environmental condition of the Margaret River. CCG developed the Margaret River Action Plan (2003), the Margaret River Lower Tributaries Action Plan (2009) and the Bramley Brook Action Plan (2011) to assess foreshore condition and develop recommendations for management. In accordance with these plans, Nature Conservation has coordinated conservation work in partnership with many stakeholders.