Long-Term Environmental Watering Plan for the South Australian Murray Region Water Resource Plan Area

Updated August 2020

SOUTH AUSTRALIA

Government of South Australia

Department for Environment and Water

Acknowledgement of the Traditional Owners

The First Nations of South Australia, the Aboriginal Traditional Owners, have occupied, enjoyed and managed their customary lands and waters since time immemorial and continue their deep cultural, social, environmental, spiritual and economic connection today. The Government of South Australia acknowledges and pays respect to the Traditional Owners and their Nations. The South Australian government also acknowledges and respects the rights, interests and obligations of Traditional Owners to speak and care for their Country – lands and waters – in accordance with their laws, customs, beliefs and traditions. In acknowledging this history and connection we also recognise the deep and irreversible damage and dislocation that Aboriginal and Torres Strait Islander people have experienced and continue to experience through European colonisation, settlement and displacement. Aboriginal Nations have advocated strongly for a healthier Murray–Darling Basin and just settlement of their land and water rights. This commitment led to a stronger Basin Plan for South Australians and asks us as a State Government to better recognise Traditional Owner interests in our water resource management. The Department for Environment and Water seeks to enable partnerships with Aboriginal Nations built upon mutual respect and trust. We recognise the differences between Nations and their preferred approaches for engagement with Government and will work through these arrangements to support Traditional Owners to meet their customary rights and obligations in natural resource planning and implementation.

Photo front cover: Bimbowrie Conservation Park by Jen Dick

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1 Introduction

This long-term environmental watering plan (LTWP) has been developed for the South Australian (SA) Murray Region Water Resource Plan (WRP) Area in accordance with the environmental water management framework within the Murray-Darling Basin Authority (MDBA) Basin Plan. The first LTWP for the SA Murray Region was produced in December 2017 and this is an update to that document. Chapter 8 of the Basin Plan sets out the requirements for the development of a LTWP for each of the WRP areas that contain surface water. The LTWP also assists in describing the management of environmental water and ecological assets for the SA Murray Region Water Resource Plan as required by Chapter 10 of the Basin Plan.

A LTWP must identify Priority Environmental Assets (PEAs) and Priority Ecosystem Functions (PEFs), environmental objectives and targets for those assets/functions and the environmental watering requirements needed to meet those targets in order to achieve those objectives. To be considered a PEA or PEF, the asset/function must be able to be managed with environmental water (Basin Plan s8.49). The diversity of the region and the general lack of water throughout much of the SA Murray Region means that whilst there may be many ecological assets with unique species, there are few locations that are considered PEAs or considered to have a PEF as defined by the Basin Plan.

There is no capacity for Held Environmental Water (HEW) in the SA Murray Region as under SA legislation, a water resource must be prescribed for a licence to be issued. There are two prescribed wells areas (PWA) in the SA Murray Region namely the Mallee PWA and the Peake, Roby and Sherlock PWA that limit groundwater use in those areas. There is no HEW in either of these areas as no groundwater dependent ecosystems have been found. This is most likely due to the depth to the groundwater and the very high salinity of much of the groundwater.

PEW is limited in the WRPA, as the rules necessary to manage the water resources of the SA Murray Region are minimal due to the highly ephemeral nature of the surface water and the depth and salinity of the groundwater resources. This has meant that the development of the water resources for consumptive use, other than in the two PWAs, is minimal and as such detailed protections have not been considered necessary.

As per the Basin Plan requirements for LTWPs, this document includes the following:

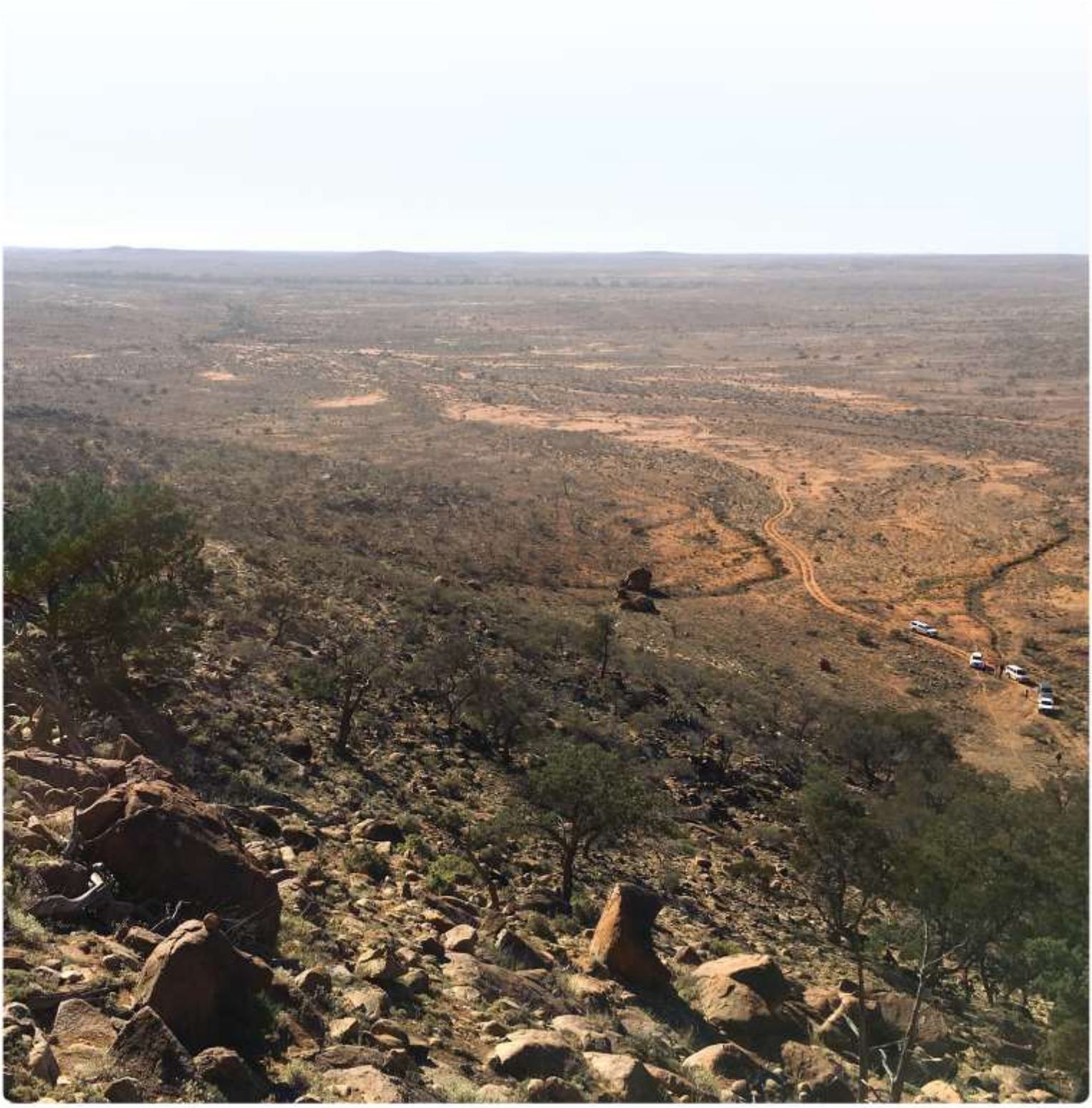
- Assessment of rules and identification of PEW
- Definition of environmental asset categories
- Identification of whether asset categories meet Basin Plan requirements
- Identification of whether environmental assets are PEAS or PEFs
- Identification of existing ecological targets in relevant plans
- Identification of protection measures for PEW

Consistent with the Basin Plan requirements and the available information, a fit-for purpose approach has been taken to develop this LTWP and document the relevant protections for recognised PEAs and PEFs.

Since the first SA Murray Region LTWP was produced in December 2017, SA legislation has changed from the *Natural Resources Management Act 2004* (NRM Act) to the *Landscape South Australia Act 2019* (Landscapes Act), coming into effect on 1 July 2020. The change of legislation alters the boundaries used for water planning purposes and the management Boards (Landscape Board) overseeing the planning (Appendix 1). The boundary change also alters which Landscape Board may be responsible for setting water affecting activity policies and issuing permits. However, these changes are yet to be fully implemented and the water affecting activity controls within regional Natural Resources Management (NRM) Plans remain the current statutory control. The boundaries of the prescribed water resources and the associated water allocation plans remain unchanged. Therefore, there is no impact on the priority ecological assets or functions.

For the purpose of this reviewed LTWP, the remainder of this document refers to the regional NRM Plans that remain as the current statutory control (as per schedule 5 Division 4 section 93 of the Landscapes Act). The regional NRM Plans were prepared by the respective former NRM Boards under the former NRM Act. Once the water affecting activity control policies have been enacted under the Landscapes Act, amendments will be made to the SA Murray Region WRP to reflect the new arrangements. This is likely to trigger a review of this LTWP and during that review, the boundaries, the Boards and the statutory plan references will be updated.

2 Context



2.1 Planning area

The SA Murray Region WRP area covers approximately 63,509 square kilometres (Figure 1) and incorporates all surface water and groundwater resources within this area, excluding those of the SA River Murray Prescribed Watercourse, Lakes Alexandrina and Albert, and the Eastern Mount Lofty Ranges WRP area.

The SA Murray Region incorporates nearly all of the SA Murray-Darling Basin (SAMDB) NRM Region and a portion of the SA Arid Lands (SAAL) NRM and South East (SE) NRM Regions.

The SA Murray Region can be divided into two different landscapes: the hills zone of the Olary Ranges and Mount Lofty Ranges (along the north, north-eastern boundary) and the plains region that characterises the remainder of the WRP area. The surface waters associated with the Coorong have been included as part of the SA Murray Region WRP area as identified in section 3.07(e) of the Basin Plan. However, the Lower Lakes (Lake Albert and Lake Alexandrina) and the River Murray (and associated wetlands) fall outside of the SA Murray Region WRP area. The groundwater underlying these surface water areas is part of the SA Murray Region. As the Coorong has a significant connection with the River Murray and Lower Lakes, it was logical for the Coorong to be included in the River Murray LTWP and annual watering priorities for the connected resource. Therefore, this LTWP does not consider the Coorong as this has been covered in the updated River Murray LTWP (Department for Environment and Water, 2020).

2.1.1 Surface water resources

The surface water of the SA Murray Region WRP area (SS10 in the Basin Plan) is highly ephemeral in nature and watercourses tend to terminate as they fan out across the plains. Annual average rainfall across the region varies from approximately 470 mm at Meningie near the Coorong in the south to approximately 236 mm at Yunta in the north (Barnett, 2015). Annual average evaporation is between 3 and 10 times greater than annual rainfall. South of the River Murray, rainfall tends to be seasonal with higher rainfall through winter and spring. In the northern parts of the SA Murray Region, rainfall is generally unpredictable and when it does rain, it can be local, very heavy and the annual rainfall can fall in a single rainfall event (South Australian Arid Lands Natural Resources Management Board, 2014).

Surface water run-off from the plains region is practically non-existent due to the flat terrain, low rainfall and highly permeable soils. Inflows to the River Murray from the SA Murray Region are almost entirely from groundwater drainage.

Burra Creek is the only tributary from within the SA Murray Region that is considered connected to the River Murray. It is located in the north west of the SA Murray Region WRP area. The Burra Creek catchment has a well-defined channel with the longest section of permanent water commencing south of Burra until just below Burra/Worlds End Gorge. This flow is primarily from groundwater base flows. Further to the east, flow becomes discontinuous, and permanent waterholes are irregularly located before Burra Creek becomes poorly defined and is essentially a flood-out plain, with braided and discontinuous drainage lines (Deane, 2008). This creek has not flowed into the River Murray in over 70 years, with the last known record of water reaching the river being in 1941 (Deane, 2008).

In the northern part of the SA Murray Region WRP area, there are a number of watercourses including Olary Creek, Wiawera Creek, Yunta Creek and Manunda Creek. These watercourses have irregular flow and are subject to extreme flood, drought and siltation. There are also some permanent and semi-permanent streams and waterholes in the Olary Ranges. These are primarily fed by groundwater (South Australian Arid Lands Natural Resources Management Board, 2014) .

Surface water take from the region is mostly for stock and domestic purposes with limited industrial use for intensive stock keeping. Due to the climatic conditions and the ephemeral nature of the water resources of the area, it is unlikely that there will be significant change in the use of water from the region.

2.1.2 Groundwater resources

The SA Murray Region has two different aquifer types: the highland fractured rock aquifers of the hills zone with various lithology and of varying yields, and the sedimentary aquifers within the plains zone (Barnett, 2015). Groundwater flows under low hydraulic gradients from the basin margins toward the River Murray, a focus for groundwater discharge. Natural discharge rates are low because of the low flow gradients from the distant recharge areas.

Groundwater dependent ecosystems (GDEs) are limited throughout the region due to the high salinity levels and the depth to groundwater. Where there are known surface water expressions of groundwater, there is a low risk that future development will occur and affect known GDEs because of the rugged and remote terrain in which they occur. For additional information on groundwater, refer to Section 3.4 in this document.

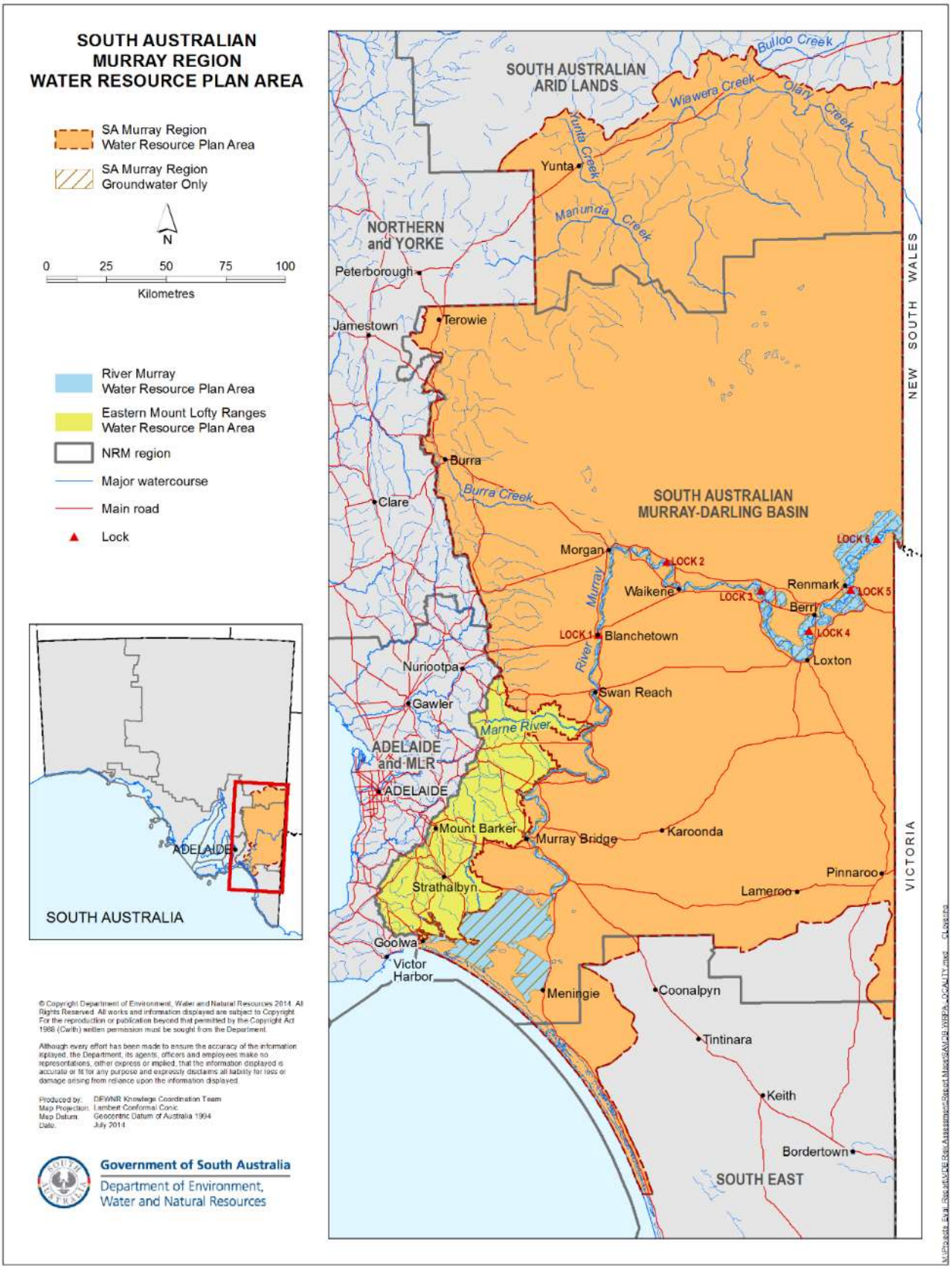


Figure 1. SA Murray Region Water Resource Plan area

2.2 Planning frameworks

2.2.1 State planning

Water resources within SA are currently managed under the *Landscape South Australia Act 2019* (Landscape Act). The Landscape Act provides the statutory framework for the development of water management controls. These are:

- management of activities that can affect water, for example controls around the location and construction of wells and dams;
- control of the taking and use of water through a water licensing regime; and
- authorisation or restriction of water use through a range of means available to the Minister.

The first two controls are undertaken via the water planning functions – primarily water affecting activity policies (currently under the Regional NRM Plans until the water affecting activity control policies are gazetted under the Landscape Act) and Water Allocation Plans (WAPs). The third option lies outside the operation of landscape plans and comprises essentially a number of actions available to the Minister to use at his or her discretion to either allow for or restrict the use of water in certain circumstances.

In areas where there are limited risks to the water resources, high level principles within the regional NRM Plans together with specific principles to guide water affecting activities provide appropriate protection for the resource and dependent ecosystems. Where there are greater risks to the water resources, prescription of the water resource or resources occurs and a corresponding WAP is developed. The WAP provides more complex controls and details water sharing arrangements.

There are two prescribed areas in the SA Murray region (Mallee Prescribed Wells Area, and Peake Roby and Sherlock Prescribed Wells Area) that relate to groundwater only (Figure 2) and each area has a Water Allocation Plan (South Australian Murray-Darling Basin Natural Resources Management Board, 2017) (South Australian Murray-Darling Basin Natural Resources Management Board, 2012) that protect the water resource from overuse. The relevant controls are summarised in Appendix 2.

2.2.2 Murray-Darling Basin planning

The Basin Plan states that a water resource plan must be prepared having regard to the most recent version of the long-term watering plan prepared in accordance with the requirements of Chapter 8. A water resource plan sets out how a water resource may be used. The water resource plan must provide for environmental watering to occur in a way that is consistent with the Basin Plan environmental watering plan (Chapter 8) and the Basin-Wide Environmental Watering Strategy (BWEWS).

2.3 Planning timeframe and review

Chapter 8 of the Basin Plan directs that the SA Murray Region LTWP has an indicative timeframe of five years or until a subsequent LTWP is released. The Basin Plan outlines triggers for the review and updating of a LTWP, and these include the accreditation, amendment or adoption of the water resource plan for the WRP area, or published updates to the BWEWS that materially affect the LTWP. The State may also choose to revise and update the SA Murray Region LTWP at any time.

The first SA Murray Region LTWP was published in 2017 and has now been updated as the SA Murray Region WRP was accredited and adopted in 2019.

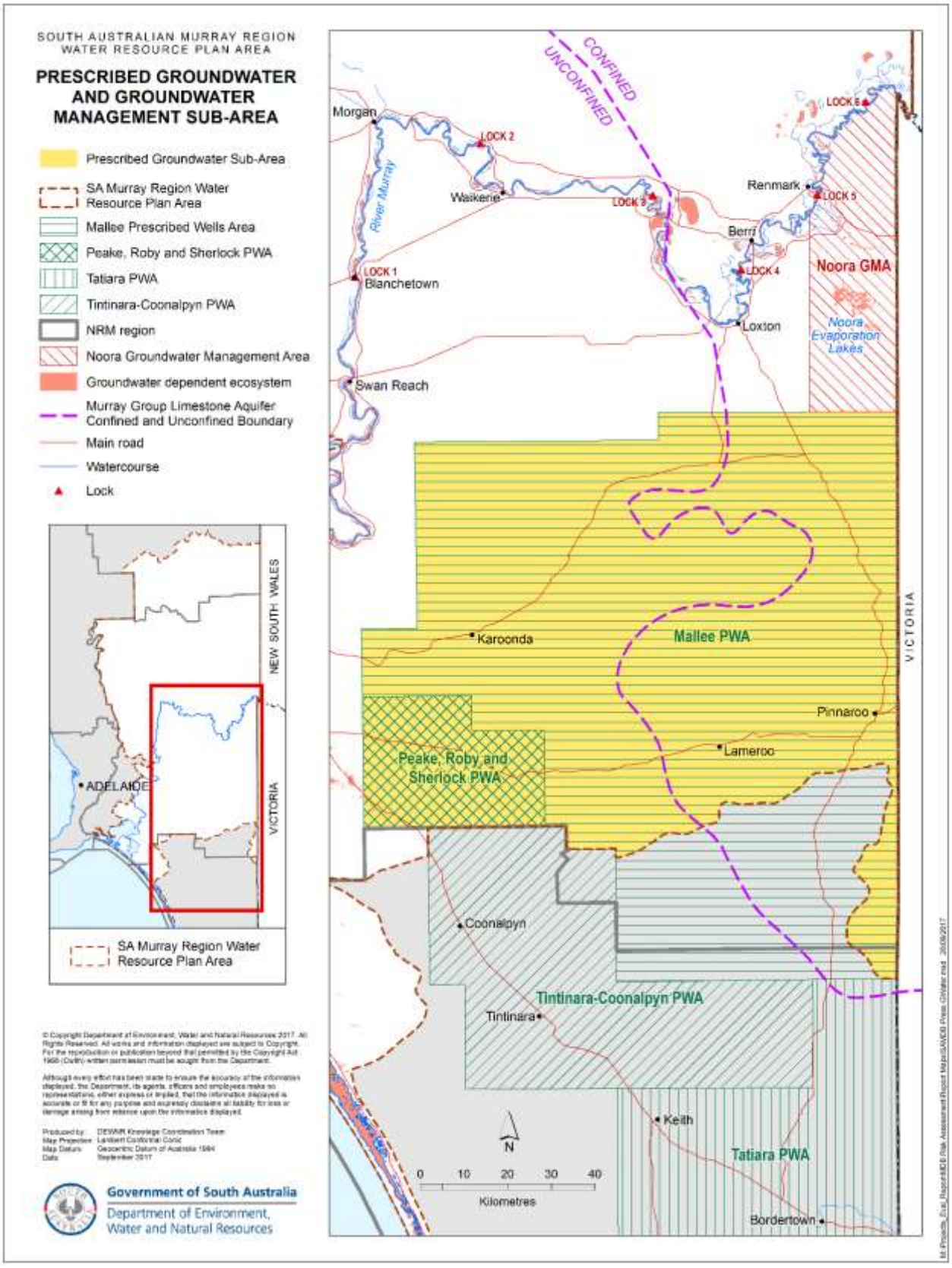


Figure 2. Prescribed groundwater and groundwater management sub-area

2.4 Consistency with preparation requirements

The Basin Plan requirements for the preparation of LTWPs (s8.20) include:

a. consultation requirements
b. having regard to the Murray-Darling Basin Authority's BWEWS and
c. to not be inconsistent with relevant international agreements.

The Basin Plan requirements for this LTWP are largely covered by other SA statutory plans including the SAAL NRM Plan, the South East NRM Plan, the SAMDB NRM Plan, the Mallee WAP, and the Peake, Roby and Sherlock WAP. The section below briefly describes how these plans align with the LTWP requirements.

2.4.1 Consultation

Significant consultation was undertaken during the development of the three relevant NRM Plans and the two WAPs including meeting statutory requirements to consult on draft plans under Section 79 of the former NRM Act.

There were multiple rounds of consultation throughout the development of the WAPs, which involved:

- the establishment and use of water resources planning advisory committees consisting of community representatives
- advertising in local papers
- community meetings with information and discussion sessions
- distribution of discussion papers and
- distribution of the draft WAPs for comment.

Stakeholders engaged during the development of the WAPs included industry groups and other water users, environmental groups, local councils and the broader community. There has been consultation on this Plan with the Department for Environment and Water (DEW) staff.

Information relating to Aboriginal water interests to fulfil chapter 10, part 14 of the Basin Plan for the SA Murray Region WRP has been obtained from a range of sources including a review of literature and through a combination of workshops, meetings and on-country visits with Nations.

There are ongoing conversations with Aboriginal nations regarding country-based planning and other approaches to ensure that Aboriginal objectives and outcomes are identified and are considered in the development and implementation of water plans.

Photo: Bimbowrie Conservation Park (Olary Ranges) by Vincent van Uitregt

2.4.2 Basin-Wide Environmental Watering Strategy

The Basin-Wide Environmental Watering Strategy (BWEWS) was published by the MDBA in November 2014 and updated in 2019. Its development is a specific requirement of the Basin Plan (s8.13). The purpose of the BWEWS is to assist environmental water holders and managers to plan and manage environmental watering at the Basin scale. The BWEWS identifies expected environmental outcomes for four environmental components or 'themes': river flows and connectivity; native vegetation; waterbirds and fish (Murray-Darling Basin Authority, 2014; Murray-Darling Basin Authority, 2019).

As well as having regard to the BWEWS during preparation, LTWPs must be consistent with any particular assets or functions, and their requirements, identified within the BWEWS. Assets considered important for supporting vegetation, waterbirds and fish at the Basin-scale are identified in appendices of the BWEWS (Table 1). The parts of the SA Murray Region included in the listing are:

1. Noora Evaporation Basin; and
2. The Coorong and Murray Mouth

Table 1. Summary of expected outcomes in the BWEWS 2019 (Appendices 3, 4 and 5) relating to the SA Murray Region WRP Area

Theme	Region/WRPA	Asset	Expected outcome
Waterbirds	SA River Murray/ SA Murray Region/ Eastern Mount Lofty Ranges	Coorong, Lower Lakes and Murray Mouth; Noora Evaporation Basin	Total abundance and diversity; colonial waterbird breeding; shorebird abundance
Fish	SA River Murray/ SA Murray Region/ Eastern Mount Lofty Ranges	Coorong, Lower Lakes and Murray Mouth;	Increased abundance via spawning and recruitment

Note: The Coorong, Lower Lakes and Murray Mouth site is addressed in the SA River Murray LTWP.

2.1.1.1 Noora Evaporation Basin

The Noora Evaporation Basin has been identified in the BWEWS (Murray-Darling Basin Authority, 2019) as an environmental asset for the purpose of supporting an abundance and diversity of waterbirds. Whilst the basin does provide habitat, it is an artificially wet area created by the disposal of highly saline water through salt interception and drainage schemes. The pumping of water for salt interception is considered to be take from groundwater and not environmental water (MDBA position statement 6D) and as such, the Noora Evaporation Basin is not considered a priority environmental asset in South Australia, as it is not able to be managed with environmental water from the water resources of the SA Murray Region.

The values of this site will be maintained through the ongoing disposal of salt interception scheme water but it has no access to environmental water from the MDB Region.

It should be noted that the small-bodied native fish Murray hardyhead (Craterocephalus fluviatilis), which are listed as endangered under the *Environment Protection and Biodiversity Conservation Act 1999,* have been found at this site.

2.4.3 International agreements

The Basin Plan requires that a LTWP must not be inconsistent with relevant international agreements (s8.20 (5)), which include the Ramsar Convention, the Bonn Convention, Japan-Australia Migratory Bird Agreement (JAMBA), China-Australia Migratory Bird Agreement (CAMBA) and Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA). All these agreements, except for the Ramsar Convention, are not relevant for the SA Murray Region LTWP because the WRP area does not include species and habitats protected under these agreements.

2.1.1.2 Ramsar Convention

Within the SA Murray Region WRP Area there is one wetland and floodplain complex that is included in the Ramsar List of Wetlands of International Importance, part of the Banrock Station Wetland complex. This area includes a mallee shrubland buffer zone of the site approximately 40-50m above the floodplain (Butcher, 2009).This area is fully reliant on rainfall.

The inclusion of a site in the Ramsar List involves a commitment to ensure that the ecological character of the site is maintained (where ecological character is the combination of the ecosystem components, processes and benefits/services

that characterise the wetland). This document does not however replace or supersede the work that is being undertaken on these wetlands specifically in association with their Ramsar listing but seeks to support the maintenance of ecological character by informing the management of environmental water.

2.5 Environmental water availability and management

The Basin Plan defines ***priority*** environmental assets and ***priority*** ecosystem functions as environmental assets and ecosystem functions that can be managed with environmental water (s8.49 and s8.50). It is therefore important to understand the availability of environmental water in the SA Murray Region.

2.5.1 Types of environmental water

Environmental water consists of both 'held' and 'planned' environmental water. Below is a brief description of Held and Planned environmental water with full definitions, per the *Water Act 2007* (Water Act), provided in Appendix 3.

2.1.1.3 Held environmental water (HEW)

HEW is water available under a water access right or held on a water licence for the purpose of achieving environmental outcomes (Water Act). There is no HEW in the SA Murray Region WRP area.

2.1.1.4 Planned environmental water (PEW)

PEW is water that is committed or preserved for achieving environmental outcomes through a plan or legislation and cannot be used for any other purpose. There are a number of State instruments that may provide for PEW in the SA Murray Region:

- the regional NRM plans for the SAMDB, SAAL and SE NRM regions that include principles governing water affecting activities, permits for activities such as dam construction or modification and well drilling.
- The WAPs for the Mallee, and Peake, Roby Sherlock prescribed wells areas which govern how groundwater can be allocated and transferred, and rules for water affecting activities and permits for well drilling.

Table 2 provides an assessment as to whether the policies in these State instruments meet the Water Act definition of PEW, which has three key requirements:

1 Water is set aside for the environment
2 Water is committed or preserved for the purposes of achieving environmental outcomes and
3 Water cannot, to the extent to which it is committed or preserved for such purposes, be taken or used for any other purposes.

Two sources of PEW rules have been identified:

- Dam capacity limits in the northern Mount Lofty Ranges in the SAMDB NRM Plan; and
- Well buffer zones around groundwater dependent ecosystems in the Peake, Roby Sherlock WAP.

2.5.2 Environmental water holders in the SA Murray Region WRP Area

There is no HEW and therefore no environmental water holders in the SA Murray Region.

2.5.3 Managers of Planned Environmental Water in the SA Murray Region WRP Area

A summary of PEW arrangements in the SA Murray Region WRP area is provided in the SA Murray Region WRP section 5.3.2.

DEW and the Murraylands and Riverland Landscape Board (former SAMDB regional NRM Board) are responsible for administering the NRM Plans and WAPs. Management activities include managing water affecting activities and enforcing dam capacity limits, well drilling limits and wetland buffer zones. There are other stakeholders that manage local environmental sites within the SA Murray Region WRP Area, including:

- Private landholders
- Councils
- Non-government organisations

Table 2. Assessment of relevant plans for identification of planned environmental water (PEW) in the SA Murray Region

Policy	Is it PEW?	Comments
Sub-catchment development limits for Northern Mount Lofty Ranges SA Murray-Darling Basin NRM Plan: Volume B - Board Business and Operational Plan 2019/20-2021/22	Yes	Dam capacity limits have been set for each sub-catchment based on meeting environmental needs i.e. no more than 30% of catchment taken (Sinclair Knight Merz, 2004). Dam capacity limits preserve the remaining water for system and environmental provisions and therefore meet the definition of PEW.
Dam capacity limits at property scale South East Natural Resources Management Plan - Part Four 2017: NRM Policy SA Murray-Darling Basin NRM Plan: Volume B - Board Business and Operational Plan 2019/20-2021/22	No	Property-scale or allotment dam capacity limits are based on a percentage of runoff from the property or allotment Property-scale limits are generally understood to be a social policy that allows for more equitable sharing of the resource Not considered ecological limits as the property limit does not consider ecological assets that may be downstream, the total dam capacity in a catchment area or upstream of an environmental asset e.g. an under-developed property could lie within an area that from an ecological perspective is over-developed – assuming the sub-catchment limit wasn't reached, the dam development would be allowed to proceed.
Dam development limit for each NRM region as a result of apportioning the sustainable diversion limit (SDL) for the SA Non-Prescribed Areas SDL unit (SS10) South East Natural Resources Management Plan - Part Four 2017: NRM Policy SA Murray-Darling Basin NRM Plan: Volume B - Board Business and Operational Plan 2019/20-201821/22 SA Arid Lands Regional NRM Plan (Volume 2), Board Business and Operational Plan 2017/18-2019/20, Appendix 1: Water Affecting Activities Policy	No	South Australia did not see the need for limits on dam development throughout the SA Murray Region other than in the Northern Mount Lofty Ranges due to the low level of risk posed by surface water development. The SDL limit for the non-prescribed surface water (SS10) is not based on defined ecological water requirements for this area. The ecosystems that are in the SA Murray Region were in their current state prior to the Basin Plan and will not change or improve as a result of the dam capacity limits that were established to manage the SDL. Land management issues such as grazing pressures from stock and pests pose a greater threat than take from the water resource i.e. beyond the scope of the Basin Plan. There is still significant development capacity within the SS10 SDL unit and further development in this area was considered, as part of the risk assessment report (Department of Environment, Water and Natural Resources, 2017) to pose only a low risk to the water dependent ecosystems of the area. The apportioned SDL number in each of the NRM Plans is purely for administrative purposes and Basin Plan compliance. The total SDL volume is 55.2 GL. The surface waters of the region do not contribute to the adjacent SA River Murray WRP area.

Policy	Is it PEW?	Comments
Requirement to return flows at or below threshold flow rate for new dams and diversions South East Natural Resources Management Plan - Part Four 2017: NRM Policy SA Murray-Darling Basin NRM Plan: Volume B - Board Business and Operational Plan 2019/20-2021/22	No	The Water Affecting Activity permit rules only apply to new dams and diversions, which may be upstream of existing dams and diversions that are not required to return low flows. The requirement to return low flows in the SA Murray Region are considered to be social policy for equity and consistency across the planning region rather than for ecological outcomes. There are no ecological assets that have been specifically targeted by this policy. In the northern part of the SAMDB there tend not to be low flows rather than larger more sporadic rainfall events Low flow bypass rules cannot be retrospectively applied. The rules are not considered to specifically set water aside for the environment or preserve the water for ecological outcomes in the SA Murray Region. The SE regional NRM Plan includes a requirement that 'any overflow from a dam, or flows that bypass a dam must not be recaptured or diverted.' This requirement could only be applied to the permit holder (and subsequent owners of that property), and not to any downstream dam owners on a different property. It only applies to new developments and cannot be retrospectively applied.
Well buffer zones around groundwater dependent ecosystems Peake Roby Sherlock WAP 2017	Yes	Distance buffers from groundwater dependent ecosystems have been established to manage and limit allocations and transfers of groundwater. Ensures that the buffer zone around the wetland is preserved for the benefit of the wetland. Meets first part of PEW definition. There are no existing wells within these buffer distances, and no new ones allowed, so the water cannot be used for any other purpose. Meets second part of PEW definition.
General environmental principles associated with the issuing of water affecting activities South East Natural Resources Management Plan - Part Four 2017: NRM Policy SA Murray-Darling Basin NRM Plan: Volume B - Board Business and Operational Plan 2019/20-2021/229 SA Arid Lands Regional NRM Plan (Volume 2), Board Business and Operational Plan 2017/18-2019/20, Appendix 1: Water Affecting Activities Policy	No	Principles require that water affecting activities should maintain not impact on water-dependent ecosystems, habitats, water quality, etc. The principles are only for new water affecting activity permits and cannot be retrospectively applied. Protections are qualitative and reduce likelihood of negative impacts but they do not specifically set water aside or specifically preserve water, therefore, they do not meet the PEW definition of committing or preserving water to achieve environmental outcomes.

3 Ecology

3.1 Asset scale

The large planning area for the SA Murray Region spans different bioregions and topography and varying levels of annual rainfall. For the purposes of identifying PEW, environmental assets, PEAs and PEFs in the SA Murray Region, and considering the absence of opportunities for active management of water in the SA Murray Region**,** the following assets were identified:

a. Ranges – Northern Mount Lofty, Olary
b. Plains
c. Noora Evaporation Basin (Noora)

3.1.1 Ranges – Northern Mount Lofty and Olary

Watercourses in the northern and eastern ranges of the SA Murray Region WRP area drain onto the flat Mallee country and rarely if ever reach the River Murray. Other minor watercourses with indistinguishable end points are also present in the landscape.

In the Olary Ranges and Northern Mt Lofty Ranges in the north and north-west of the WRP area there are numerous creek lines; some with rocky gorges. Their hydrology is characterised by occasional surface flows and the largest and most well-known of these are Burra Creek, Olary Creek, Wiawera Creek, Yunta Creek and Manunda Creek. Surface and groundwater in these catchments are not prescribed and the vast majority of water use is for stock and domestic purposes.

The Burra Creek catchment is in the northwest corner of the SAMDB. It arises to the north of Mt Bryan and has been cleared and is grazed. It flows to Burra Gorge/Worlds End Gorge which has a number of vulnerable and/or threatened plants. It largely has River Red Gums (*Eucalyptus camaldulensis*), native and introduced grasses. Burra to Burra Gorge is 17 km of base flow creek with large deep permanent waterholes – these are unique and provide refugia and habitats for macro-invertebrates, frogs, waterbirds and aquatic plants (Deane, 2008). The permanent water is sustained by the groundwater from the Skillogalee fractured rock dolomite aquifer (Goyder Regional Council, 2012). The permanent water in the catchment is maintained by groundwater and is moderately saline i.e. 2000-3000 mg/L (3000-5000 EC). This exerts a strong influence on the ecology limiting the range of possible species that can persist (Deane, 2008).

There are approximately 600 farm dams within the Burra Creek catchment, with a combined total storage of approximately 985 ML. While modelling indicates that this is having a major impact on localised streamflow in all but extreme years, at the catchment scale this level of storage appears to fall within the original SA MDB NRM Plan criteria of 30% of average winter runoff (Deane, 2008). Further dam development is possible.

Olary Creek and Wiawera Creek are ephemeral creeks that provide water to wetlands and River Red Gums (South Australian Arid Lands Natural Resources Management Board, 2014) during flow events. Flows in Yunta Creek are irregular and water is diverted for Yunta township. Manunda Creek provides water to a drainage line that supports River Red Gums (South Australian Arid Lands Natural Resources Management Board, 2014) .

The semi-arid nature of the ranges and their watercourses mean that water reliant fauna species are not always restricted to drainage lines although they provide significant habitat and dispersal corridors. Fauna composition and structure is determined more by adjacent vegetation types in the landscape (Department for Environment and Heritage and South Australian Arid Lands Natural Resources Management Board, 2009). These systems are just as important to terrestrial fauna.

Plant communities along watercourses reliant on surface flows are Coolabah (*Eucalyptus coolabah*), River Red Gum, Elegant Wattle (*Acacia victoriae*) and *Acacia salicina* woodlands in the north as well as Mallee Box (*Eucalyptus porosa*) south of the River Murray. The presence of River Red Gum also indicates that groundwater persists.

Watercourses connect waterholes and recharge shallow water tables and confined aquifers that can later discharge to springs. Most run-off events are capable of filling waterholes to their maximum cease-to-flow level (Bonifacio, 2015).

Springs, soaks and waterholes can be reflections of groundwater rising to the surface or near the surface, usually in watercourses, wetlands, upper gullies and hillsides. The quality of water depends on the quality of the local

groundwater. There have been no detailed investigations into springs in the SA Murray Region although they are known to exist (DEWNR unpublished data). In the Ranges, spring hydrology is related to groundwater discharge and sub-surface flow related to fault-lines and fractured rock aquifers (White, 2008).

Although the ephemeral nature of the watercourses suggests that associated waterbodies are ephemeral as well, the watercourses or creek lines are often left with semi-permanent pools and rock holes after flow ceases. Any permanent waterhole in the Ranges is important as a refuge for invertebrates. After rainfall, the persistence of water depends on evaporation rate, size and depth of the waterhole, animal and human use of the water and subsequent rainfall events.

Some springs are referred to as a soakage. A soakage is usually permanent but not always visible. Certain vegetation types will indicate the presence of this underground water (Agriculture Victoria, 2009). The vegetation is greener, taller and usually a sedge or grass. River Red Gums and Coolabah can be nearby.

Due to the low rainfall and paucity of freshwater in the landscape, users have needed to harvest and mine water. This has been through dam construction and drilling of wells into the underlying aquifers. Dams can be on-stream or off-stream and function in similar ways to waterholes or rock holes, eventually supporting water dependent flora and fauna. None of the dams are known to be of environmental importance, especially from a regional perspective (South Australian Arid Lands Natural Resources Management Board, 2014).

Photo: Burra Creek Gorge by Strabane Photos

3.1.2 Plains

Ephemeral watercourses in the ranges terminate in diverging channels throughout the Mallee. In the flood-out country, water soaks into the ground, evaporates or is transpired by plants. Only major rainfall and flow events will result in recharge of the shallow unconfined groundwater systems. Indiscrete terminal swamp systems occur on the South Olary Plain. Underlain by clay soils, they retain moisture and likely support higher levels of biodiversity than drier parts of the landscape.

Critical to the functioning of a watercourse is maintenance of the flow regime and water quality. Local rainfall events are important for keeping small waterholes inundated and maintaining their role as refuges for wildlife.

Larger rainfall events flood many channels across a wider area and can result in recharge in the Mallee as well as the dispersal of aquatic fauna. Water quality is related to flow and associated with the function of systems.

Flood-out inundation in the Mallee will support germination of grasses and forbs that rely on ephemeral storm events to grow and set seed (Capon, 2003). Old-man saltbush (*Atriplex nummularia ssp nummularia)* shrublands can occur on clay soils and the more waterlogged the clay the more likely the transition to Tangled Lignum (*Muehlenbeckia florulenta*), Ruby Saltbush (*Enchylaena tomentose var. tomentosa*) and other chenopod species.

There are no significant watercourses on the plains. The relevant assets include wetlands away from watercourses and a mallee shrubland section of the Banrock Station Ramsar site. There are saline wetlands through parts of the plains which vary in plant structure depending on the extent to which the depressions intersect the water table and the salinity of the underground water.

3.1.3 Noora Evaporation Basin

In the lower Murray-Darling Basin, most groundwater discharges to the River Murray. Whilst salinity levels are highly variable, in the upper reaches of SA, much of the groundwater is highly saline (greater than sea water) and therefore can transfer significant salt loads into the river. To mitigate saline drainage water and groundwater intrusion into the river, drainage networks were established. These were followed by salt interception schemes (SIS) which have been commissioned since the early 1990s. Saline water from a network of bores running parallel to the River Murray is intercepted and pumped to a number of evaporation basins in the SA Murray Region. The SIS stops significant amounts of saline water from entering the River Murray and having costly socio-economic and environmental impacts. The SIS bores are in the SA Murray Region WRP Area.

The Noora Evaporation Basin is one of a number of sites that were chosen in the early 1980s to dispose of excess irrigation drainage water and later as irrigation efficiencies improved, as a site to dispose of water from the network of salt interception schemes from Loxton to the Border. The area is a natural low point in the landscape where the local groundwater discharges and the underlying clay means the rate of return of saline water to the river is extremely slow.

The site has changed from consisting of saline depressions, ephemeral salt lakes and clay pans to also include areas of permanent and semi-permanent inundation depending on the management of the site. The artificially wet conditions of the evaporation ponds now attract significant bird life as identified in the BWEWS. Over the years, more than 800,000 trees have been planted there and it has become valued locally as an important terrestrial flora and fauna site with over 120 recorded bird species. The Australian Government "Species Profile and Threats Database" lists the migratory birds for each state of Australia, the international agreement with which they are associated and threat status. Opportunistic sightings of bird species from this list observed at Noora Evaporation Basin include: Marsh Sandpiper, Common Sandpiper – Rare (SA National Parks and Wildlife Act) and Curlew Sandpiper - Critically endangered (EPBC Act). Consistent with the Murray-Darling Basin Authority's Basin Plan Position Statement 3A, the drainage water delivered to the Noora Evaporation Basin is not considered to be Planned Environmental Water.

3.2 Assessing environmental assets to determine priority

The three assets have been assessed against the five Basin Plan criteria to identify whether they are environmental assets as per Section 8.49. Environmental assets should meet at least one of the five assessment criteria. Table 3 and Table 4 outline the assessments against the criteria defined in Schedules 8 and 9 respectively, of the Basin Plan.

In summary, assets[1] and functions that meet Schedule 8 and Schedule 9 criteria of the Basin Plan are:

- Watercourses (including waterholes) in the north-east Mount Lofty Ranges and in the Olary Ranges and
- Groundwater fed wetlands on the plains.

[1] Note: as identified in section 2.4.2, the Noora Evaporation Basin, whilst identified in the BWEWS as an ecological asset, does not meet the Basin Plan definition of a PEA or PEA as it cannot be managed with environmental water from within the SA Murray Region or the SA River Murray Region.

Table 3. Assessment of whether the asset categories meet any of the Basin Plan criteria under schedule 8 for environmental asset

Schedule 8 criteria for environmental assets (summary only – see Schedule on page 224-225 in Basin Plan for details)					
Proposed asset	International agreement	Natural, rare or unique	Vital habitat	Listed species/ communities	Significant biodiversity
Ranges	No	No	Yes. Permanent pools provide dry season refuges; streams provide pathways for dispersal. From a practical point of view, this only includes watercourses of a reasonable size and sufficient frequency of flow.	Yes	No – ephemeral to seasonal nature and small scale of the systems means this is unlikely. Impacts from grazing and pest plants and animals
Plains	No	No	Yes. Saline seeps and wetlands maintained by groundwater or rainfall pooling away from watercourses are essential for maintaining and preventing decline of Water Dependent Ecosystems. Note: the saline wetlands in the Peake, Roby and Sherlock area are significantly degraded and not considered vital as they are not known to be refugia during dry periods; pathways for dispersal, migration or movement; or important feeding, breeding or nursery sites.	None listed in the Biological Database	No – large scale grazing and clearing has occurred, impacts from pest plants and animals
Noora	No	No	No. Noora provides artificially maintained habitat for waterbirds. (Kingsford, 2013) states that there are no records of waterbird breeding. There is anecdotal evidence of swans breeding but no data from the last 10 years. There is evidence of the presence of Murray hardyhead at this site.	Yes	Yes

Table 4. Assessment of whether the asset categories meet any of the Basin Plan criteria under schedule 9 for ecosystem function

Schedule 9 criteria for environmental functions (summary only – see Schedule on page 226 of Basin Plan for details)				
Proposed asset	Vital habitats and populations (require environmental watering)	Transportation and dilution of matter	Longitudinal connectivity	Lateral connectivity
Ranges	Yes - Permanent pools provide dry season refuges. From a practical point of view, this only includes watercourses of a reasonable size and sufficient frequency of flow.	Yes Streams provide pathways for dispersal.	Yes but temporary	No
Plains	Yes - Saline seeps and wetlands are maintained by groundwater or rainfall pooling away from watercourses. These are essential for preventing decline of Water Dependent Ecosystems and they provide drought refuge. Note: the saline wetlands in the Peake, Roby and Sherlock area are significantly degraded and not considered vital as they are not known to be refugia during dry periods; pathways for dispersal, migration or movement; or important feeding, breeding or nursery sites.	No	No. It is static, unconnected habitat	No
Noora	No - Noora Evaporation Basin provides artificially waterbird habitat. As stated in Table 3, there are no records of waterbird breeding. Water pumped to the site is not considered environmental water.	No	No	No

3.3 Identification of environmental objectives, targets and environmental water requirements for the priority environmental assets

3.3.1 Priority Environmental Assets and Priority Ecosystem Functions

Once the environmental assets and functions have been identified, it is necessary to determine if any of them are Priority Environmental Assets (PEAs) or Priority Ecosystem Functions (PEFs). Particular habitat can only be considered a PEA if it meets both the criteria that it is an ecological asset consistent with the criteria in Schedule 8 and it can be managed with environmental water. This is taken to mean that the nature of water resources in the area, and the way they are used and regulated, can be managed in a way to provide environmental outcomes at the scale of the environmental asset or function. Table 5 identifies which of the identified habitats are considered to be Murray Region PEAs based on meeting both the environmental asset and PEW criteria.

In summary, one PEA has been identified in the SA Murray Region WRP area:

- Watercourses in the Northern Mount Lofty Ranges.

Photo: Zebra finches by Martin Stokes

Table 5. Assessment to identify Priority Environmental Assets within the Murray Region WRPA and assessment of whether existing control are adequate protection

Asset	Environmental asset/function? (Linked to Tables 3 and 4)	Can it be managed with PEW?	Is the asset a PEA?	Link to environmental objectives and targets	Discussion
Ranges					
Northern Mount Lofty watercourses (include Burra, Baldina, Logan's, Hopkins, Brady Creeks and permanent pools surface water and ground water)	Yes	Yes	Yes	SAMDB NRM Regional Action Plan – vision and values. SAMDB NRM Plan: Environmental objectives and targets - Section 3.4.1	SAMDB NRM Plan – Volume A, Section 3.4.1, and Volume B, Section 8.2 and the SE NRM Plan – Part 4 Section 4.3.1 prevent water-affecting activity (WAA) permits in ecologically sensitive areas (i.e. Coorong). NRM Act - Section 127(2), 127(3), and 127(5) operate to provide legislation which assist in protecting PEW. SAMDB NRM Plan – Volume 3 – 2.3.3 outlines sub-catchment dam development limits in the Northern Mount Lofty Ranges. Dam capacity limits preserve the remaining water for system and environmental provisions. Also the general well drilling principle that requires no adverse impacts on water-dependent ecosystems. Distance buffers from groundwater dependent ecosystems have been established for both allocations and transfers. Ensures that the buffer zone around the wetland is preserved for the benefit of the wetland. Rules in SAMDB NRM Plan are sufficient to protect water-dependent ecosystems based on low level of risk. Locally important systems identified. Low level of development overall and no significant issues identified – rules that manage new development considered adequate. Unreliable water availability (low variable rainfall and fractured rock groundwater) and generally poor water quality means use is limited to stock and domestic requirements so demand expected to remain low – considered sufficient to manage dam and well construction (via WAA permits) without managing volume taken from them. Retain existing dam capacity rules and well drilling principles.
Watercourses (including waterholes) in Olary Ranges (Yunta,	Yes	No	No	n/a	High level principles and dam policies in the SA Arid Lands NRM Plan provide broad protections over ecosystems.

Asset	Environmental asset/function? (Linked to Tables 3 and 4)	Can it be managed with PEW?	Is the asset a PEA?	Link to environmental objectives and targets	Discussion
Wiawera, Olary, Manunda Creeks)					
Plains					
Saline (groundwater fed) wetlands in Peake Roby Sherlock	No	Yes	No	SAMDB NRM Plan: Environmental objectives and targets - Section 3.4.1 Peake Roby Sherlock WAP objectives	Buffer zones for saline wetlands Peake Roby Sherlock WAP: Section 5.2 Objectives for allocation and principles 3, 18 and 25. The rules in the Peake, Roby and Sherlock WAP result in the groundwater associated with the saline wetlands being PEW for the purposes of the Basin Plan. The WAP acknowledged, when adopted in 2001, that there was little known about the value of the wetlands and their dependence on groundwater. A recent review of the State's datasets including the biological databases has not indicated the presence of any listed flora or fauna. The layer 'salinity – water table induced' indicated that a number of the depressions or wetlands identified in the WAP were considered to have very high or extreme salinity. Very high salinity (70%) was land dominated by halophytes like samphire or bare areas and extreme salinity (30%). The land use mapping layer has the northern wetlands as degraded land rather than categorised as marsh/wetland – saline like the wetlands to the south. Given the high salinity of the wetlands, their location in the landscape and the widespread occurrence of dryland salinity through parts of the landscape, it is likely that the saline wetlands in the area have been created or affected by rising water tables and may have been opportunistically colonised by water-dependent species. They are not considered to provide 'vital habitat'. Consistent with the section 10.28 of Basin Plan not to reduce the protection of planned environmental water, the saline wetland buffers should be retained in the Peake, Roby and Sherlock WAP.
Saline wetlands throughout remainder of region	Yes	No	No	n/a	High level principles in the SA Arid Lands, SAMDB, and South East NRM Plans – not specific to water but general ecosystem protections.

Asset	Environmental asset/function? (Linked to Tables 3 and 4)	Can it be managed with PEW?	Is the asset a PEA?	Link to environmental objectives and targets	Discussion
Banrock Station buffer zone	Yes	No	No	n/a	n/a
Noora Evaporation Basin	Yes	No	No	n/a	n/a

3.3.2 Environmental water requirements

Environmental water requirements (EWRs) are considered to be the water requirements to maintain a water dependent ecosystem at a low level of risk. For the area covered by this LWTP, all risks to ecosystems were considered to be low (Department of Environment, Water and Natural Resources, 2017).

The use of a single umbrella or iconic species that represents the EWRs of the system as a whole for the SA Murray Region is not possible as the area is diverse and there is no comprehensive biodiversity data upon which to base an assessment. The EWRs outlined in Table 6 below are qualitative EWRs that are considered fit for purpose based on the low risk determined by the risk assessment (Department of Environment, Water and Natural Resources, 2017) and the low likelihood of significant further development of the water resources.

An assessment of the impacts of water resource development on Burra Creek Catchment (Deane, 2008) included information on the ecological characteristics and relationship to flow. The flow bands thought to support these ecological processes in the Burra Creek Catchment are further defined in Table 7, which has been taken from Deane (2008).

Table 6. Environmental Water Requirements of the Northern Mount Lofty Ranges watercourses (Deane, 2008)

Priority Environmental Asset	Ecological Objective/Target	Environmental Water Requirement
Northern Mount Lofty Ranges Watercourses	Aquatic fauna and flora supported within permanent pools	Maintenance of the existing baseflow to permanent pools.
		Maintenance of occasional overbank and higher flows to scour and maintain pool depths and assist in maintaining salinity levels.

Table 7. Flow band description and ranges, Burra Creek at Worlds End (Copied from Table 12 in Deane 2008, p89)

Flow band	Discharge (m3/s)	Discharge (ML/d)	Stage[2] (depth)	Frequency
Baseflow	0–0.04	0–3.0	0.962–1.1112 (<20 cm)	Annual
Freshes	0.04–0.4	3.0–33	1.12–1.32 (20–40 cm)	1–3 pulses per year
Bankfull flow	0.4–2.5	33–220	1.32–1.614 (40–60 cm)	1–2 years
Overbank flow	2.5–17	220–1500	1.614–2.12 (0.6–1.2 m)	4–6 years
Maximum daily gauged flow[3]	125	10 866	3.544 (3.54 m)	Estimated at 1 in 50–100

2 Stage refers to gauged depth in metres above a datum; depth refers to depth of water above cease to flow.
3 Note that instantaneous peaks would be considerably higher than the daily peak.

3.3.3 Application of environmental watering requirements

The area covered by this SA Murray Region LTWP, is not part of a connected river system and there is limited ability to manage environmental water. As discussed in section 2.5.1, there is no HEW water in the SA Murray Region and the instances of PEW as outlined in Table 2, are limited. PEW is not actively managed; rather the controls in the relevant statutory water planning instruments ensure that PEW is provided and PEAs and PEFs are protected.

It is therefore, not considered applicable to provide the following information in the SA Murray Region LTWP:

- EWRs and annual planning
- EWRs and management levers

3.4 Having regard for groundwater

3.1.1.1 Highland fractured rock aquifers

The permanent and semi-permanent waterholes within the Rangelands and Burra catchments are considered environmental assets. Rules within the SA Arid Lands NRM Plan (Volume 2, Appendix 1) and SAMDB NRM Plan (volume B, section 5) outline that water affecting activities must be undertaken in a manner that does not have adverse impact on dependent ecosystems, and preserves water dependent ecosystems.

There is a low risk that future development in the highland aquifers would affect known groundwater dependent ecosystems (GDEs) in the Burra area because they occur in rugged terrain which is unlikely to be further developed (Barnett, 2015).

3.1.1.2 Sedimentary aquifers of the Murray-Darling Basin

The existence of GDEs is largely determined by two factors: the depth to the groundwater below the ground surface and the salinity of the groundwater. As the depth to groundwater increases, the reliance on groundwater by vegetation decreases and alternative sources of water are required. It has been suggested (Eamus, 2006) that there is reduced reliance on groundwater where water table depths exceed 10 m, negligible use in terms of total plant water use from depths of 10-20 m, and a low probability of groundwater use below 20 m.

The depth to the groundwater throughout the vast majority of the SA Murray Region WRP area is greater than 30 m especially in the Murraylands (Figure 3) south of the River, except for patches amongst irrigation drainage induced areas. The minority area would be in the northern Mount Lofty Ranges and westerly plains area adjacent to the Ranges. It can therefore be reasonably assumed that there are no GDEs in this area of the SA Murray Region. For the sedimentary aquifers, the exceptions are the aquifers beneath the River Murray floodplain (and adjacent areas of highland irrigation), the saline groundwater discharge areas around Noora, to the east of Loxton and the low-lying Coastal Plain to the southwest. In the highlands to the north and west, there is little information but at the lowest points in the broad valleys, depths to the water table of about 5 m would be expected (Barnett, 2015) .

High-salinity or brackish groundwater (Figure 4) may reduce the likelihood of ecosystems using groundwater, although salt tolerance varies between different species. It is reported that groundwater salinities greater than 3,500 mg/L are likely to adversely affect salt-intolerant plants (Bell, 2001). Moderately salt- tolerant plants may tolerate salinities up to 7,000 mg/L, while salt-tolerant plants may tolerate salinities up to 10,500 mg/L. However, River Red Gums are known to tolerate salinities up to around 8-16,000 mg/L (Agriculture Victoria, 2009)

Areas of good quality groundwater where extractions are occurring are covered by WAPs which require the assessment of the needs of water dependent ecosystems (Landscape SA Act 2019, Section 53(1)(a)(i)). Investigations for the Mallee WAP found no stygofauna or aquifer dependent ecosystems, mainly due to the large depth to the water table. The Peake, Roby and Sherlock WAP identified only saline wetlands on the low-lying Coastal Plain that are connected to the shallow saline Quaternary Limestone aquifer (which is not used for extraction). These saline wetlands are likely to be due to vegetation clearance and the resulting elevation of groundwater levels.

The likelihood of future development or expansion of development of the groundwater within the SA Murray Region WRP area is low and applications would require approval under legislation.

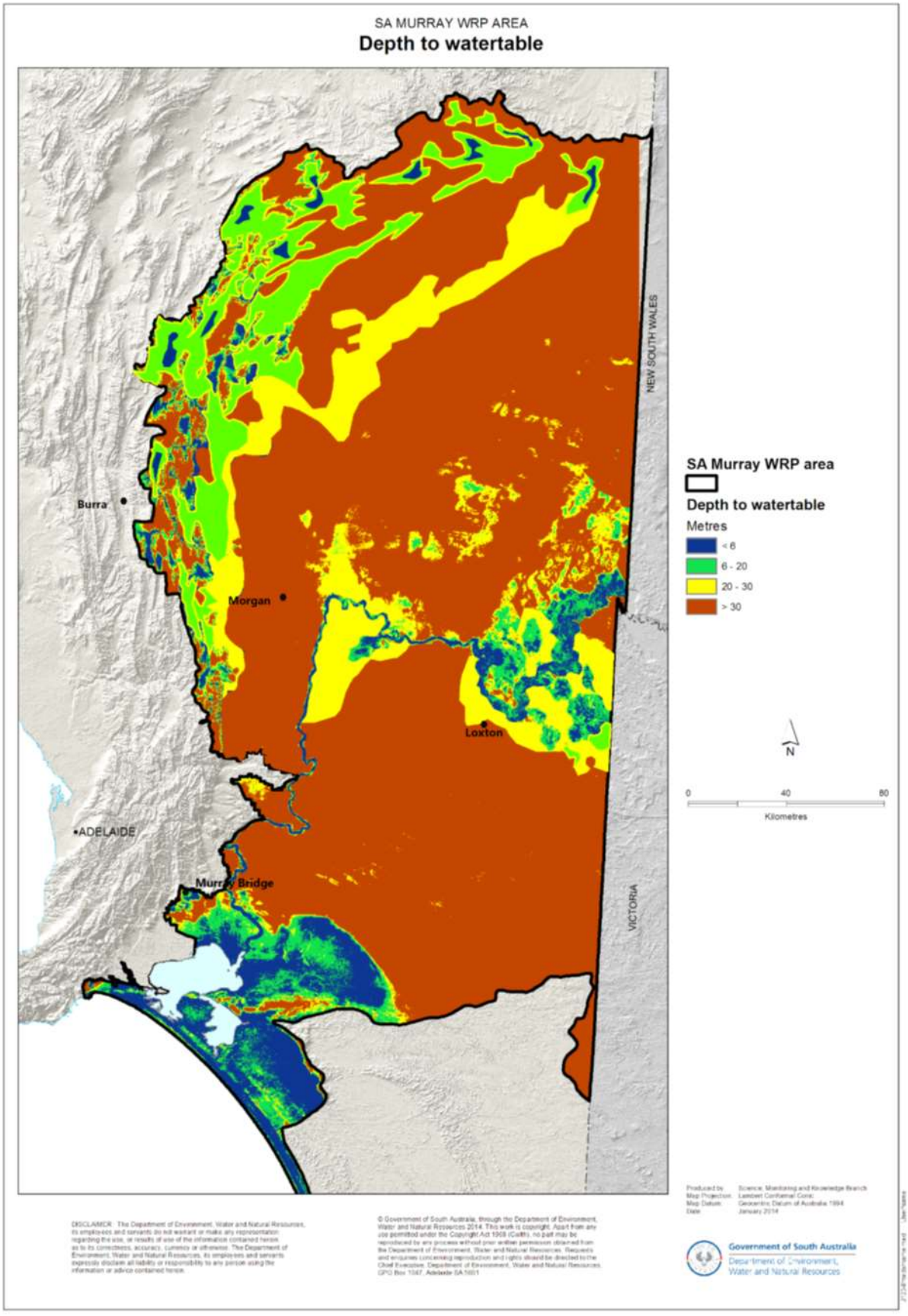


Figure 3. Depth to groundwater in the SA Murray Region

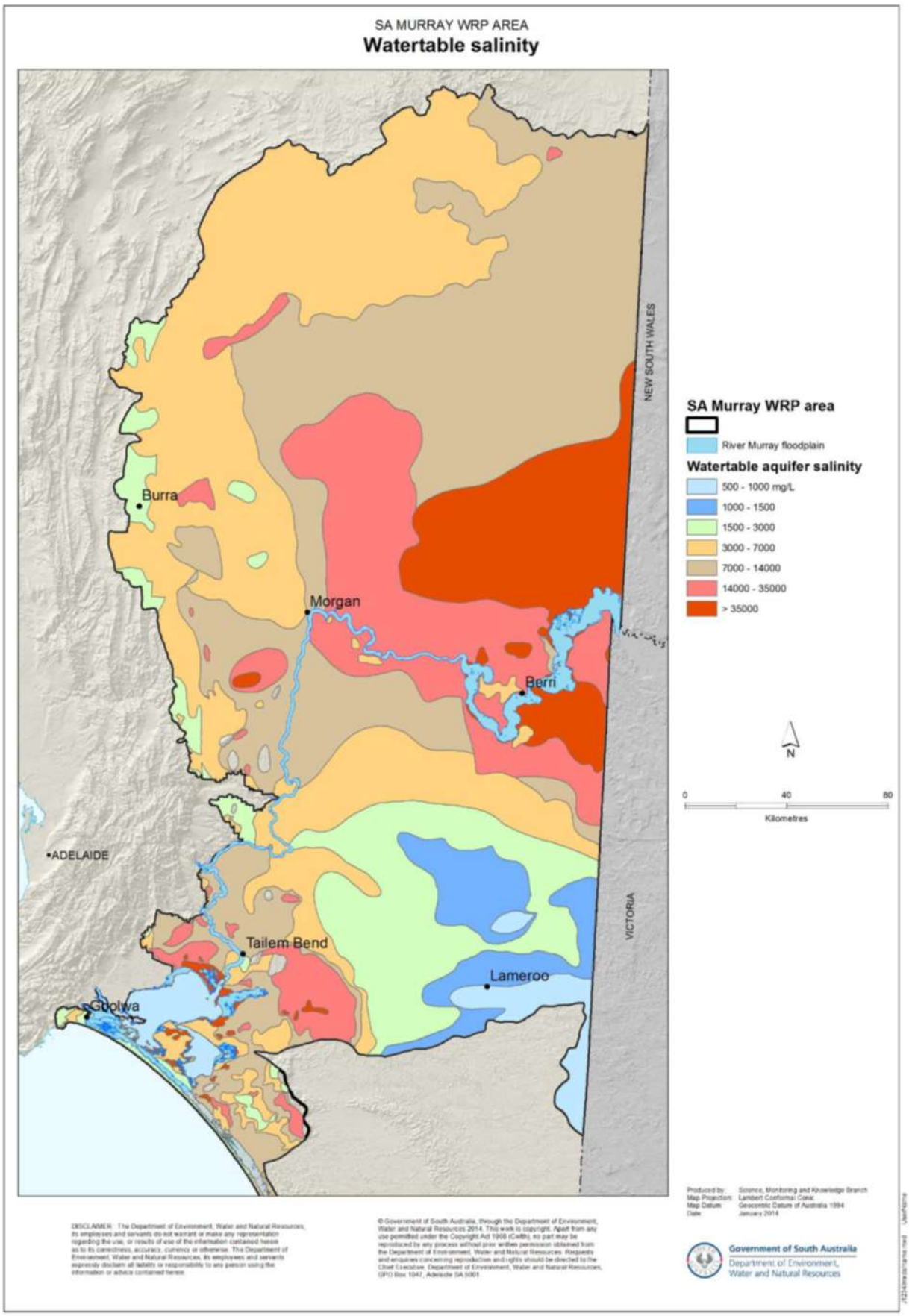


Figure 4. Groundwater salinities in the SA Murray Region

3.5 Integration of Indigenous knowledge

Freshwater systems are considered the lifeblood of Country for Aboriginal people and are central to the unique cultures and identities of South Australia's Aboriginal Nations. Aboriginal epistemologies are characterised by holistic conceptions of Country where water, land and all living things are inextricably connected. The South Australian Government engages with the Aboriginal Nations in the SA Murray Region through various mechanisms based on the needs, interests and capacity of each Nation. Engagement in water resource planning and management is progressed for those nations closely associated with Murundi (the River Murray) given the significant Commonwealth and State investment in restoring environmental flows to the River as well as the profound cultural significance of Murundi to these River Nations, which include the First Peoples language groups, Peramangk, Ngunguraku, and Ngarrindjeri. For those Nations that are not so closely associated with Murundi, engagement in, and representation of their interests in water resource planning and management varies, and in some cases has been non-existent until recently. There are eight Indigenous nations with Country in the SA Murray Region (Table 8).

Table 8. Nations and relevant WRP areas in the SA Murray-Darling Basin

Nation/group	Organisation	SA Murray Region	EMLR	River Murray
Adnyamathanha	Adnyamathanha Traditional Lands Association	X		
First Peoples (Ngaiawang, Ngawait, Nganguraku, Erawirung, Ngintait, Ngaralte, and Ngarkat)	River Murray Mallee Aboriginal Corporation	X		X
Kaurna	Kaurna Nation Cultural Heritage Association		X	
Ngadjuri	Ngadjuri Nation Aboriginal Corporation	X		
Nganguraku / Peramangk	Mannum Aboriginal Community Association Inc	X	X	X
Ngarrindjeri	Ngarrindjeri Regional Authority; Ngarrindjeri Aboriginal Corporation	X	X	X
Peramangk	Peramangk Heritage Committee	X	X	X
Tanganekald	South East Aboriginal Focus Group	X		
Wilyakali	Wilyakali Native Title claimants	X		

SA Murray Region Aboriginal Nations were engaged in the development of the Murray Region Water Resource Plan primarily to identify their objectives and outcomes for water resource management in the SA Murray Region. The State has regard to the values and uses of SA Murray Region Aboriginal Nations to varying degrees in all levels of water resource planning processes and instruments based on the needs and interests of the Nations and their opportunities to engage in water resource management. Having full and proper regard to Aboriginal values and uses is an iterative process that will require investment in Aboriginal Nation capacity over time. The intent is to have regard to Aboriginal values and uses by committing to continued meaningful engagement with Nations (Department for Environment and Water, 2019).

3.1.1.3 Identified objectives of Aboriginal Nations – taken from (SA RM WRP, 2019)

SA Murray Region Aboriginal Nations have identified the following objectives for management of water on their Country:

- To see our lands and waters healthy
- To maintain our cultural connections between Nations and to the lands and waters and all living things
- To achieve a just settlement of our a priori Aboriginal rights to water resources
- To achieve the social and economic outcomes and wellbeing desired by the Nation
- To establish and maintain strong and productive relationships and partnerships built on mutual respect and agreement-making
- To secure long-term support and resources for Aboriginal Nations to engage and take a major role in water resource management, development and implementation
- To expand Aboriginal decision-making jurisdictions through greater control and decision making authority over water resources
- To have our own Nation-based plans that identify our priorities and long-term strategies relating to Country, including water resource management.
- To ensure Aboriginal water interests are equitably recognised along with other stakeholders in water resources plans, research and policy
- To build professional and culturally appropriate skills and capacity of our people and our organisations in caring for Country, including water resource management.

3.1.1.4 Identified outcomes for Aboriginal Nations

SA Murray Region Aboriginal Nations have identified the following desired outcomes from management of water on their Country:

- Availability and flow of water of appropriate quantity and quality is returned to our water sources to support Aboriginal culture, economy and wellbeing.
- Legal recognition of Aboriginal Nations sovereign water rights
- Nations owning water entitlements for cultural, spiritual and economic use
- Increased number of Aboriginal owned enterprises that utilise or manage water resources are established
- Increased numbers of Aboriginal people employed in the caring for Country sector, including water resources management
- Nations own the water allocation to wetlands of cultural significance on their Country
- Water resource plans and planning processes, including for natural resources management, water allocation, environmental water management, and wetland and floodplain management recognise Aboriginal Nations cultural values and worldviews
- Agreements are established between Aboriginal Nations and water planning authorities to guide engagement, outline Aboriginal Nation priorities and partnership activities
- Future legislative reforms better recognise and promote Aboriginal interests, including the social, spiritual and economic benefits associated with water resource management
- Aboriginal Nations Cultural Knowledge and Intellectual Property recognised and protected in water resource management and planning
- Aboriginal Nations are represented and their members are participating on governance structures relating to water management and planning on their Country
- Nation-based caring for Country programs established and their core operating capacity funded to engage in water planning and management
- Regional Natural Resources Management and key Water Resource business plans investing in Aboriginal Nation engagement in water resource planning and management
- Increased number of Aboriginal Nation-led water resource projects that support Nation-led planning and management
- The contribution of Aboriginal Nations to caring for Country, including water resources management is valued
- Aboriginal rangers and associated training programs are engaged in on-ground water management and planning activities
- The Aboriginal cultural heritage values and sacred water sites are protected and enhanced in the planning and implementation of water resource management activities

Additional information on Indigenous values and uses is included in the Murray Region Water Resource Plan Section 5.14.

4 Cooperative arrangements

4.1 Cooperative arrangements within the WRP area

The SA Murray Region has a boundary that crosses over three former NRM Regions within South Australia (South Australian Arid Lands, South East and SA Murray-Darling Basin) which the regional NRM plans align with. There is limited opportunity for cooperative arrangements within the WRP area due to the nature of the resources. The Presiding Members of the former NRM Boards met regularly to discuss common issues and developed a Memorandum of Understanding for the sharing of dam development capacity that will ensure SA is able to meet the sustainable diversion limit in the Basin Plan for the SA non-prescribed area described in Schedule 3 of the Basin Plan.

4.2 Cooperative arrangements between Water Resource Planning areas

The SA Murray region is adjacent to:

- the Eastern Mount Lofty Ranges region
- the SA River Murray region
- the NSW Murray and Lower Darling region
- the Lachlan and South Western Fractured Rock
- the Western Porous Rock
- the Wimmera-Mallee surface water and groundwater

There is no surface water connection between New South Wales and South Australia except for the River Murray.

4.1.1.1 Eastern Mount Lofty Ranges Water Resource Plan Area

Cooperative arrangements between the SA Murray Region WRP area and the Eastern Mount Lofty Ranges (EMLR) WRP area are described in the EMLR WAP in Section 3: Assessment of Effect on Other Water Resources (pp86-91), and also in the Marne Saunders WAP in Section 5: Effects on Other Water Resources (pp102-104).

4.1.1.2 South Australian River Murray Water Resource Plan Area

The cooperative watering arrangements between the South Australian River Murray Water Resource Plan Area and the Murray Mouth and Coorong are discussed in the River Murray LTWP.

5 Constraints and long-term risks to providing environmental water

5.1 Operational constraints and management strategies

As there is no held environmental water in this region, there are no relevant operational constraints and management strategies except for Noora Evaporation Basin. The Basin only receives highly saline groundwater that is intercepted before entering the River Murray. This can be variable and is linked to flows in the river and climatic conditions. During high flow the bores may be switched off, removed or water is disposed directly into the river if there is sufficient dilution flow.

5.2 Long-term risks to providing environmental water requirements

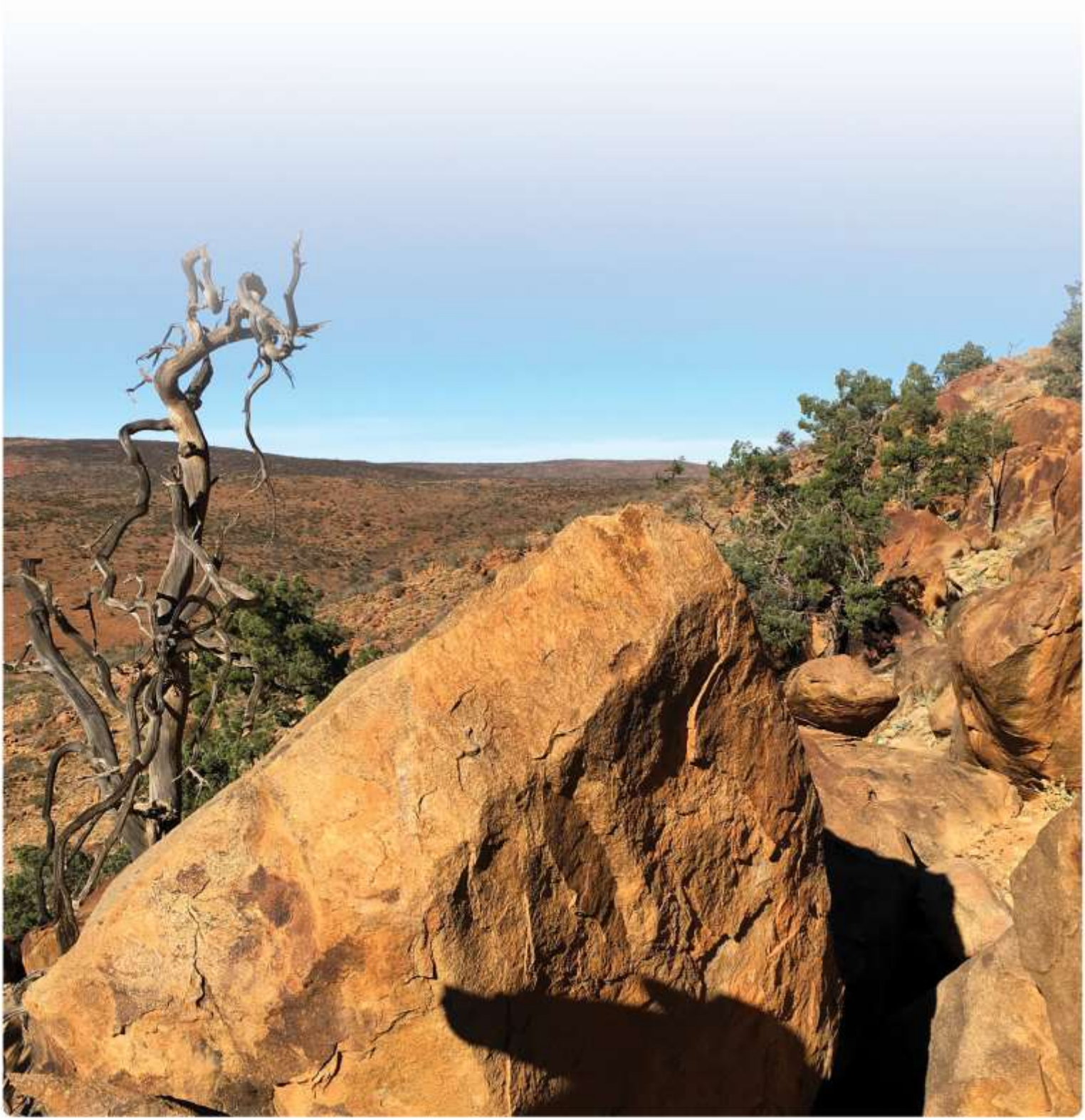
5.2.1 Identification of risks

A two-phase risk assessment was undertaken to identify, assess and evaluate risks to the water resources of the SA Murray Region. The risk assessment incorporated all surface water and groundwater resources excluding the surface water of the Lower Lakes and the River Murray. The South Australian Murray Region Risk Assessment Report (Department of Environment, Water and Natural Resources, 2017) identified two risks. Both of these risks were associated with the Coorong and therefore not included in this LTWP.

5.2.2 Potential risk mitigation strategies

As there were no risks identified for the part of the SA Murray Region covered by this LTWP, no risk mitigation strategies are considered necessary for inclusion in this LTWP.

6 Monitoring, evaluation, reporting and improvement



6.1 Monitoring and evaluation

There are monitoring and evaluation requirements in the existing WAPs. Irrigation extractions are metered in the prescribed areas and groundwater depth and salinity monitoring is undertaken across the region as part of the State monitoring network. Results from this work contribute to reviews, and any subsequent amendments, of WAPs and to the South Australian Government water status reports.

There is very little water-focussed ecological monitoring across the region and this is unlikely to change in the short term due to a lack of funding. The Environment Protection Agency undertakes stream condition monitoring in the northern Mount Lofty Ranges. The sites are already altered from commercial and pest grazing. As such, a fit for purpose approach has been taken as the area is remote and with the given controls, the ecological health in unlikely to change significantly. Large operations such as mining that could pose a risk are required under legislation to minimise impacts and rehabilitate land affected by the activity.

6.2 Basin Plan reporting requirements

Schedule 12 of the Basin Plan lists four 'Matters' that relate to reporting against the implementation of the Environmental Watering Plan (Basin Plan Chapter 8), three of which South Australia is required to report on. The MDBA and Commonwealth Environmental Water Holder (CEWH) are responsible for reporting against the fourth Matter (Matter 7 - the achievement of environmental outcomes at a Basin-scale) and information provided by the Basin States will contribute to Matter 7 reporting.

Annual reporting against Matters 9 and 10 is required each year by 31 October. Five-yearly reporting against Matter 8 is required.

Matter 8: the achievement of environmental outcomes at an asset scale.

Matter 9: the identification of environmental water and the monitoring of its use.

Matter 10: the implementation of the environmental management framework.

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8 Glossary

Basin State	Defined in the *Water Act 2007* to mean (a) New South Wales; (b) Victoria; (c) Queensland; (d) South Australia; (e) the Australian Capital Territory.
Bonn Convention	The Convention on the Conservation of Migratory Species of Wild Animals - an environmental treaty aimed at conserving terrestrial, aquatic and avian migratory species throughout their range.
BWEWS	Basin-Wide Environmental Watering Strategy – published by the Murray-Darling Basin Authority, a legislative requirement under Chapter 8 of the Basin Plan.
CAMBA	China-Australia Migratory Bird Agreement – a bilateral agreement to protect and conserve migratory birds and their habitat.
CEWH	Commonwealth Environmental Water Holder.
DEW	South Australian Department for Environment and Water
DEWNR	South Australian Department of Environment, Water and Natural Resources.
Discharge	The volumetric flow rate of water i.e. volume of streamflow over a given time. In South Australia, this is often represented as ML/day.
EMLR	Eastern Mount Lofty Ranges
EPBC Act	Environment Protection and Biodiversity and Conservation Act 1999.
EWR	Environmental Water Requirement - the water regime needed to sustain the ecological values of aquatic ecosystems and biological diversity at a low level of risk.
GDE	Groundwater dependent ecosystem
HEW	Held Environmental Water – defined in Section 4 of the *Water Act 2007*.
JAMBA	Japan-Australia Migratory Bird Agreement – a bilateral agreement to protect and conserve migratory birds and their habitat.
Lower Lakes	Lakes Alexandrina and Albert.
LTWP	Long-Term Environmental Watering Plan – a legislative requirement under Chapter 8 of the Basin Plan.
MDBA	Murray-Darling Basin Authority.
ML/day	Megalitres per day – a measure of flow or discharge, where a megalitre equals 1,000,000 litres.
NRM	Natural resource management

PEA	Priority Environmental Asset – defined in s8.49 of the Basin Plan as an environmental asset that can be managed with environmental water.
PEF	Priority Environmental Function - defined in s8.50 of the Basin Plan as an ecosystem functions that can be managed with environmental water.
PEW	Planned Environmental Water – defined in Section 6 of the *Water Act 2007*.
PWA	Prescribed wells areas
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement – a bilateral agreement to protect and conserve migratory birds and their habitat.
SAAL	South Australian Arid Lands
SA River Murray LTWP	The Long-Term Environmental Watering Plan for the South Australian River Murray Water Resource Plan Area.
SA River Murray WRP Area **Also SARM**	South Australian River Murray Water Resource Plan Area – defined in Chapter 3 of the Basin Plan.
SDL	Sustainable Diversion Limit – defined in the Basin Plan as the long-term average sustainable diversion limit.
SIS	Salt interception scheme
WAA	Water affecting activity
WAP	Water allocation plan
WRP Area	Water Resource Plan Area – water planning units identified for the purpose of implementing the Basin Plan. The water resource plan areas are listed in Chapter 3 of the Basin Plan.

Appendix 1: Regional landscape boundaries under the *Landscape South Australia Act 2019*

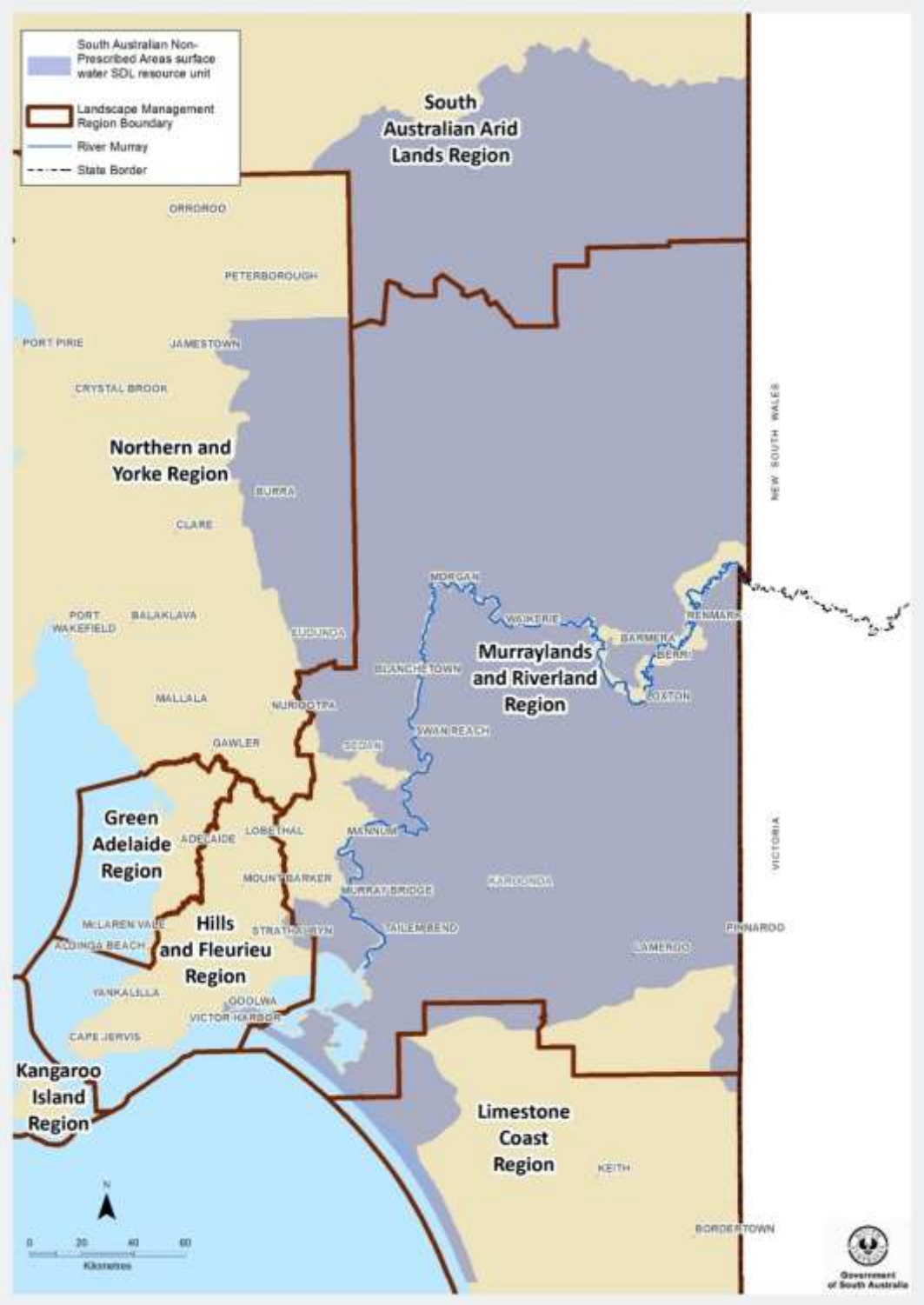

Figure A1.5. Landscape SA boundaries within the Basin Plan's South Australian Murray Region water resource plan area.

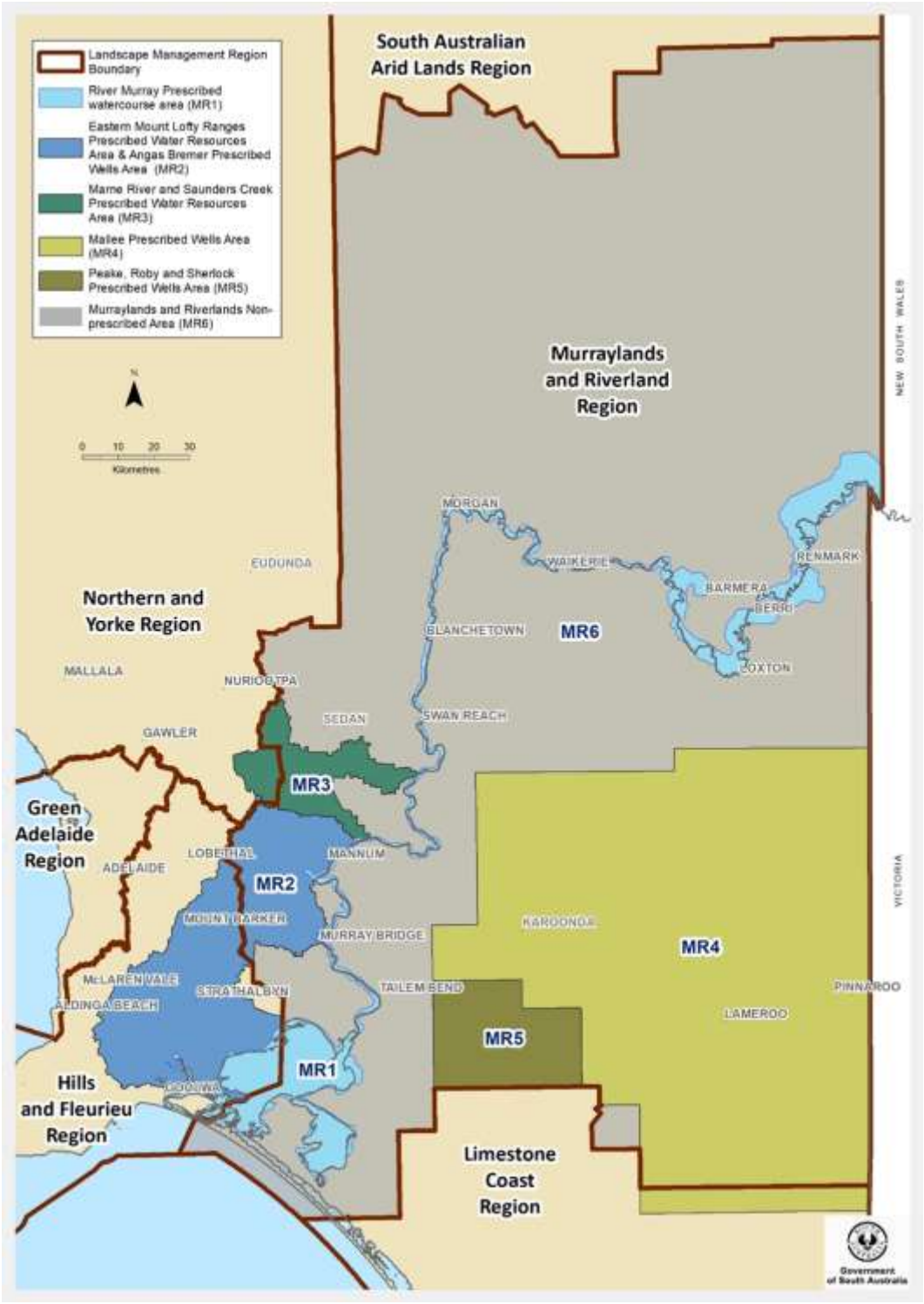

Figure A1.6. Water planning zones within the Murraylands and Riverland Landscape Management region

Appendix 2. State planning in the Murray Region WRP area

NRM Regions		Relevant Legislation /Plans / Reports
All Regions		*Natural Resources Management Act 2004* (SA) *Water Act 2007* (Commonwealth)
SAAL	Non-prescribed water area	SAAL NRM Plan SAAL Biodiversity Strategy
SAMDB	North East Mt Lofty Ranges sub-catchments	SAMDB NRM Plan
	Prescribed Wells Area	Peake Roby and Sherlock WAP Mallee WAP *Groundwater (Border Agreement) Act 1985* (SA) SAMDB NRM Plan
	Non-prescribed water area	SAMDB NRM Plan
SE NRM	Non-prescribed water area	SE NRM Plan *South Eastern Water Conservation and Drainage Act 1992 (*SA)

Appendix 3. Definitions of held and planned environmental water

The following definitions of held and planned environmental water are taken from Sections 4 and 6 of the *Water Act 2007*.

Held environmental water means water available under:

(a) a water access right; or

(b) a water delivery right; or

(c) an irrigation right;

for the purposes of achieving environmental outcomes (including water that is specified in a water access right to be for environmental use).

Planned environmental water

(1) For the purposes of this Act, ***planned environmental water*** is water that:

(a) is committed by:

(i) the Basin Plan or a water resource plan for a water resource plan area; or

(ii) a plan made under a State water management law; or

(iii) any other instrument made under a law of a State;

to either or both of the following purposes:

(iv) achieving environmental outcomes

(v) other environmental purposes that are specified in the plan or the instrument; and

(b) cannot, to the extent to which it is committed by that instrument to that purpose or those purposes, be taken or used for any other purpose.

(2) For the purposes of this Act, ***planned environmental water*** is water that:

(a) is preserved, by a law of a State or an instrument made under a law of a State, for the purposes of achieving environmental outcomes by any other means (for example, by means of the setting of water flow or pressure targets or establishing zones within which water may not be taken from a water resource); and

(b) cannot, to the extent to which it is preserved by that instrument for that purpose or those purposes, be taken or used for any other purpose.

(3) The water may be committed to, or preserved for, the purpose or purposes referred to in paragraph (1)(a) or (2)(a) either generally or only at specified times or in specified circumstances.

(4) Without limiting paragraph (1)(b) or (2)(b), the requirements of paragraph (1)(b) or (2)(b) are taken to have been met even if the water is taken or used for another purpose in emergency circumstances in accordance with:

(a) the instrument referred to in that paragraph; or

(b) the law under which the instrument is made; or

(c) another law.

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