Long-term environmental watering plan for the South Australian Murray Region Water Resource Plan Area

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Acknowledgement of Country

Aboriginal people are the First Peoples and Nations of South Australia. The lands, waters, and sky of the South Australian Murray region have supported diverse and unique Aboriginal cultures since time immemorial.

We acknowledge and respect the Traditional Custodians of these lands and waters, and pay our respects to their Elders past and present. We recognise their deep and ongoing spiritual, cultural, social, and economic connections to Country, and the responsibilities to care for.

Aboriginal peoples continue to practise their lore, maintain cultural heritage, and share their knowledge and languages, which remain of vital importance to the health of Country today.

This plan supports meaningful and equitable engagement with First Nations peoples and respects their rights, interests, and obligations in the management of land and water across the South Australian Murray region.

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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. This was updated in 2020 following accreditation of the SA Murray Regions Water Resource Plan (WRP). This third revision is the result of an update to the Basin Wide Environmental Watering Strategy (BWS), triggering a review and update of the LTWP.

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 in the Mallee PWA. This is most likely due to the depth to the groundwater in the Mallee.

PEW is limited in the WRP Area, 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 A). The boundary change also alters which Landscape Board may be responsible for setting water affecting activity policies and issuing permits in some cases. However, the policies within the water affecting activity controls remain largely

unchanged. The boundaries of the prescribed water resources and the associated water allocation plans also remain unchanged. Therefore, there is no impact on the priority ecological assets or functions.

2 Context

2.1 Planning area

The SA Murray Region WRP area covers approximately 63,509 square kilometres (Figure 2.1) 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 Murraylands and Riverland (MR) Landscape Region and a portion of the Hills and Fleurieu (HF), Northern and Yorke (NY), SA Arid Lands (SAAL) and Limestone Coast Landscape 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), (Department for Environment and Water, 2025).

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.

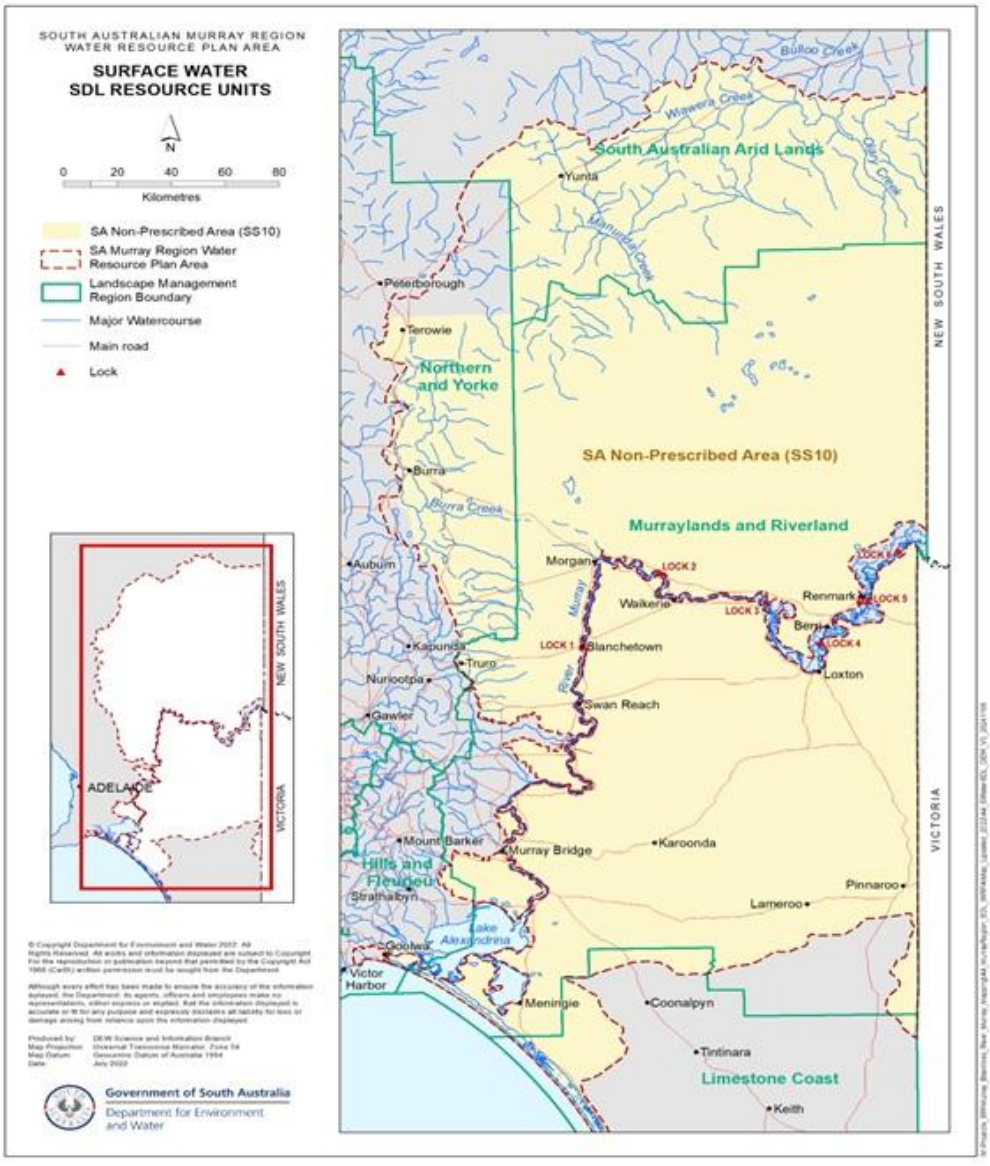

Figure 2.1. SA Murray Region Water Resource Plan Area

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 Control Policies (WAACP) and Water Allocation Plans (WAPs). The third option lies outside the operation of landscape policies and 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 potential risks to the water resources, high level objectives with specific principles related to 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 2.2) and each area has a Water Allocation Plan (South Australian Murray-Darling Basin Natural Resources Management Board, 2017a) (South Australian Murray-Darling Basin Natural Resources Management Board, 2017b) that protect the water resource from overuse. The relevant controls are summarised in Appendix B.

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 BWS.

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 BWS 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, this was updated in 2020 following accreditation of the SA Murray Region WRP in 2019. This subsequent update is the result of published updates to the BWS in June 2025.

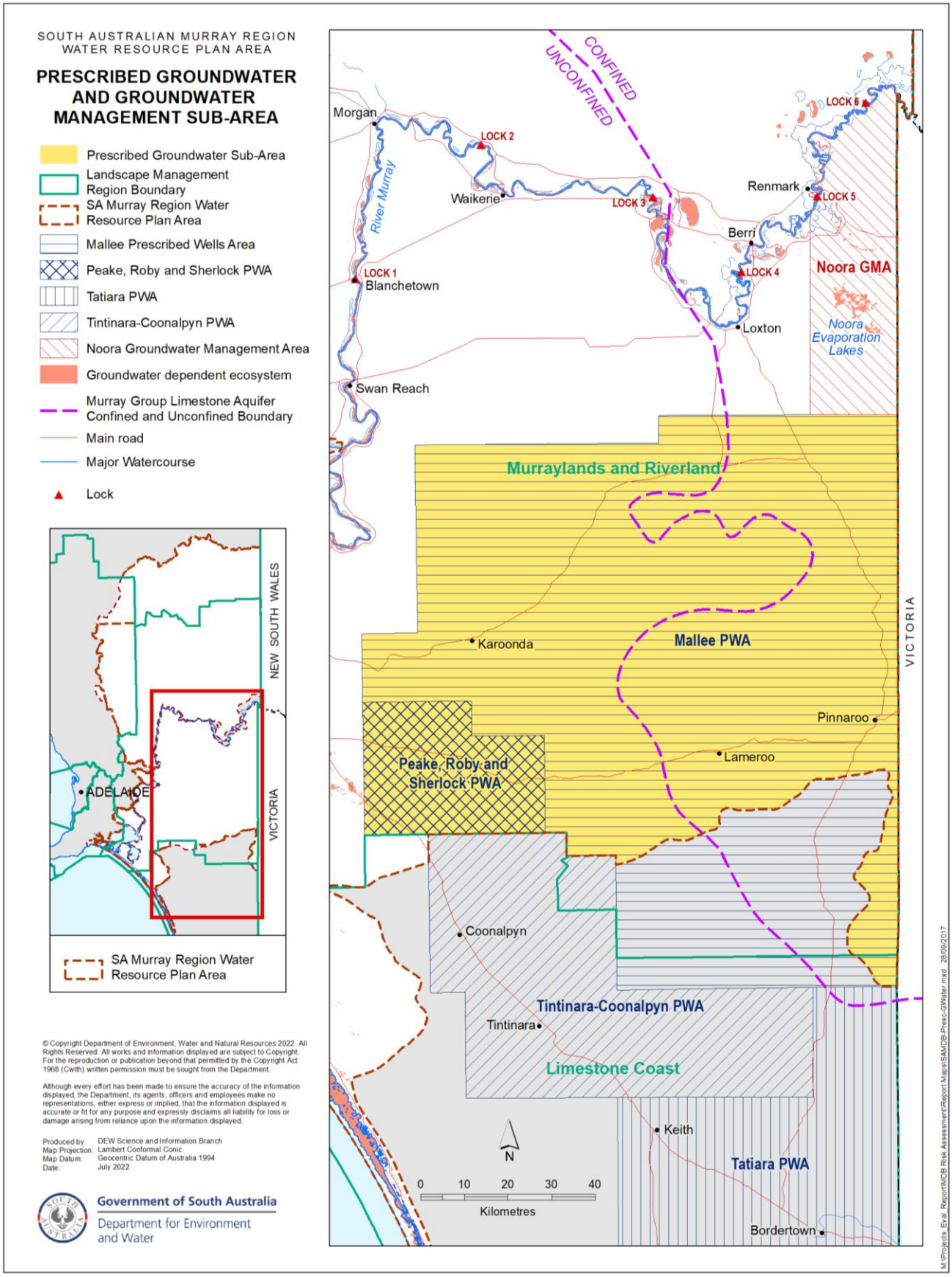

Figure 2.2. Prescribed groundwater and groundwater management sub-area

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 BWS and

c. to not be inconsistent with relevant international agreements.

The Basin Plan requirements for this LTWP are largely covered by other SA statutory instruments including the regional WAACPs and the Mallee WAP, and the Peake, Roby and Sherlock WAP. The section below briefly describes how these policies and plans align with the LTWP requirements.

2.4.1 Consultation

Consultation requirements for the LTWP have been met as part of wider engagement efforts undertaken during the development and review of the water planning framework for the region, including for WAP, WAACP, WRP and Landscape (formerly NRM) Plans.

Significant consultation was undertaken during the development of the three former NRM Plans (containing each the regions water affecting activity policies) and the two WAPs including meeting statutory requirements to consult on draft plans under Section 79 of the former NRM Act.

Since the introduction of the Landscape Act, (resulting in boundary changes), transitional provisions in the Landscape Act applied and consultation was not required in relation to the new WAACP documents as there were no substantial changes in policy. Given there had already been extensive consultation on the WAA policies prior to the introduction of the Landscape Act, the newly formed landscape boards adopted the existing policies of the former NRM board regions without change and incorporated them into their WAACP.

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. The WAPs were amended in 2017 for the purpose of incorporating First Nations water interests. During this time, the Ngarrindjeri Regional Authority (NRA) and First Peoples of the River Murray and Mallee Aboriginal Corporation (RMMAC) contributed valuable content to the WAPs. The consultation approach with First Nations was driven by their advice on how they wanted to engage.

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 engagement with Nations.

In addition to the above, and noting that there are no holders of held environmental water or river operators for the SA Murray Region (with the exception of the Coorong – which is addressed under the River Murray LTWP), there has been consultation specific to this LTWP with the Department for Environment and Water (DEW) staff, relevant Lansdscape Board staff (HF, NY, MR, SAAL and LC) – as managers of PEW, the Landscape Boards of SA's

Chairs forum and the MR Landscape Board Water Advisory Committee – as persons materially affected by the management of e-water and members of local communities.

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

2.4.2 Basin-Wide Environmental Watering Strategy

The BWS was published by the MDBA in November 2014 and updated in 2019 and 2025. Its development is a specific requirement of the Basin Plan (s8.13). The purpose of the BWS is to assist environmental water holders and managers to plan and manage environmental watering at the Basin scale. The BWS 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), (Murray-Darling Basin Authority, 2025)

As well as having regard to the BWS during preparation, LTWPs must be consistent with any particular assets or functions, and their requirements, identified within the BWS. Assets considered important for supporting vegetation, waterbirds and fish at the Basin-scale are identified in appendices of the BWS.

The BWS also identifies one Expected Environmental Outcomes for the SA Murray Region LTWP (Table 2.1). The only part of the SA Murray Region included in the listing is the Coorong, Lower Lakes and Murray Mouth (CLLMM). Arrangements for the CLLMM site are addressed in the SA River Murray LTWP.

Table 2.1. Extract of Expected Environmental Outcomes of the 2025 Basin-wide Environmental Watering Strategy relevant to SA Murray Region LTWP.

BWS Region	Outcomes for water-dependant vegetation	Shrublands	Non-woody water-dependant vegetation	Relevant LTWPs
Murray	Maintain extent of water-dependent vegetation near river channels and on low-lying areas of the floodplain. Improve condition of black box and river red gum. Where feasible maintain or improve vegetation that contributes to the ecological character of Ramsar sites along the Murray River corridor including Barmah Forest, NSW Central Murray State Forests, Gunbower Forest, Hattah-Kulkyne Lakes, the South Australian Riverland, and the Coorong and Lakes Alexandrina and Albert sites.	Lignum along the Murray River from the junction with the Wakool River to downstream of Lock 3, including Chowilla and Hattah Lakes	Closely fringing or occurring within rivers and creeks in the Murray region from Hume Dam to the Murray Mouth Forming extensive stands such as Ruppia tuberosa in the Coorong and Moira grasslands in the Barmah–Millewa Forest	SA Murray Region

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.

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 Coorong, Lower Lakes and Murray Mouth (CLLMM) area also located within the SA Murray Region WRP Area. Arrangements for the CLLMM site are addressed in the SA River Murray LTWP.

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 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 C.

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.

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 WAACP for the HF, MR, NY, SAAL and LC Landscape 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 2.2 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 MR and NY WAACP; 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 HF, MR, NY, SAAL and LC Landscape Boards are responsible for administering the WAACP and DEW is responsible for administering WAPs. Management activities include assessing applications and granting, or refusing to grant permits for water affecting activities and compliance with rules in the relevant WAP and licence conditions. There are other stakeholders that manage local environmental sites within the SA Murray Region WRP Area, including:

- Private landholders
- Councils
- Non-government organisations

Table 2.2. 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 (Murraylands and Riverland Landscape Board, 2021), (Northern and Yorke Landscape Board, 2020)	Yes	Dam capacity limits have been set for each sub-catchment based on meeting environmental needs i.e. the total dam capacity limit for a sub-catchment (in ML) cannot be greater than the May to November runoff that would be generated from 30% of the area of that sub-catchment. (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 (Hills and Fleurieu Landscape Board, 2021) (Northern and Yorke Landscape Board, 2020) (Limestone Coast Landscape Board, 2022) (Murraylands and Riverland Landscape Board, 2021) (South Australian Arid Lands Landscape Board, 2021)	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) (Hills and Fleurieu Landscape Board, 2021) (Northern and Yorke Landscape Board, 2020) (Murraylands and Riverland Landscape Board, 2021) (Limestone Coast Landscape Board, 2022)	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.

Policy	Is it PEW?	Comments
(South Australian Arid Lands Landscape Board, 2021)		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 SDL number in each of the WAACP 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.
Requirement to return flows at or below threshold flow rate for new dams and diversions (Hills and Fleurieu Landscape Board, 2021) (Murraylands and Riverland Landscape Board, 2021) (Northern and Yorke Landscape Board, 2020) (Limestone Coast Landscape Board, 2022) (South Australian Arid Lands Landscape Board, 2021)	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 MR Landscape Region and the eastern part of the NY Landscape Region 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 LC WAACP 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 (South Australian Murray-Darling Basin Natural Resources Management Board, 2017b)	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.

Policy	Is it PEW?	Comments
		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 (Hills and Fleurieu Landscape Board, 2021) (Murraylands and Riverland Landscape Board, 2021) (Northern and Yorke Landscape Board, 2020) (Limestone Coast Landscape Board, 2022) (South Australian Arid Lands Landscape Board, 2021)	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

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 wet 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.

3.2 Assessing environmental assets to determine priority

The two 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 3.1 and Table 3.2 outline the assessments against the criteria defined in Schedules 8 and 9 respectively, of the Basin Plan.

In summary, assets 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.

Table 3.1. 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.

Table 3.2. 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

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 3.3 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 3.3. 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 Table 3.1 and Table 3.2)	Can it be managed with PEW?	Is the asset a PEA?	Discussion
Northern Mount Lofty watercourses (include Burra, Baldina, Logan's, Hopkins, Brady Creeks and permanent pools surface water and ground water)	Yes	Yes	Yes	Landscape Act - Section 104(2), 104(3) and 104(4) operate to provide legislation which assist in protecting PEW. MR and NY WAACP – 3.3.4 and 2.3.5 respectively 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. Rules in MR and NY WAACP are sufficient to protect water-dependent ecosystems based on low level of risk. 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. The existing dam capacity rules and well drilling principles are adequate protections.
Watercourses (including waterholes) in Olary Ranges (Yunta, Wiawera, Olary, Manunda Creeks)	Yes	No	No	High level objectives and principles including dam policies in the SAAL WAACP provide broad protections over ecosystems. Considerations include infrastructure, objects/structures and diversions that may affect surface water flow and downstream environments.

Asset	Environmental asset/function? (Linked to Table 3.1 and Table 3.2)	Can it be managed with PEW?	Is the asset a PEA?	Discussion
Saline (groundwater fed) wetlands in Peake Roby Sherlock	No	Yes	No	Buffer zones for saline wetlands Peake Roby Sherlock WAP: Section 5.2 Objectives for allocation and principles 3, section 6.1 Objectives for transfer and principle 18 and section 7.1 Objectives for permits and principle 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 acknowledges, 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	High level principles in the HF, MR, NY, SAAL and LC WAACPs – not specific to water but general ecosystem protections.
Banrock Station buffer zone	Yes	No	No	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 3.4 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 3.5, which has been taken from Deane (2008).

Table 3.4. Environmental Water Requirements of the Northern Mount Lofty Ranges watercourses (Deane, 2008)

Priority environmental asset	Ecological objectives / targets	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 3.5. 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[1] (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

[1] Stage refers to gauged depth in metres above a datum; depth refers to depth of water above cease to flow.

Flow band	Discharge (m3/s)	Discharge (ML/d)	Stage[1] (depth)	Frequency
Overbank flow	2.5 – 17	220 – 1500	1.614–2.12 (0.6–1.2 m)	4–6 years
Maximum daily gauged flow[2]	125	10 866	3.544 (3.54m)	Estimated at 1 in 50–100

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 2.2, 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

Highland fractured rock aquifers

The permanent and semi-permanent waterholes within the Rangelands and Burra catchments are considered environmental assets. Rules within the NY, MR and SAAL WAACPs 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).

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 3.1) 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

[2] Note that instantaneous peaks would be considerably higher than the daily peak.

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 3.2) 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.

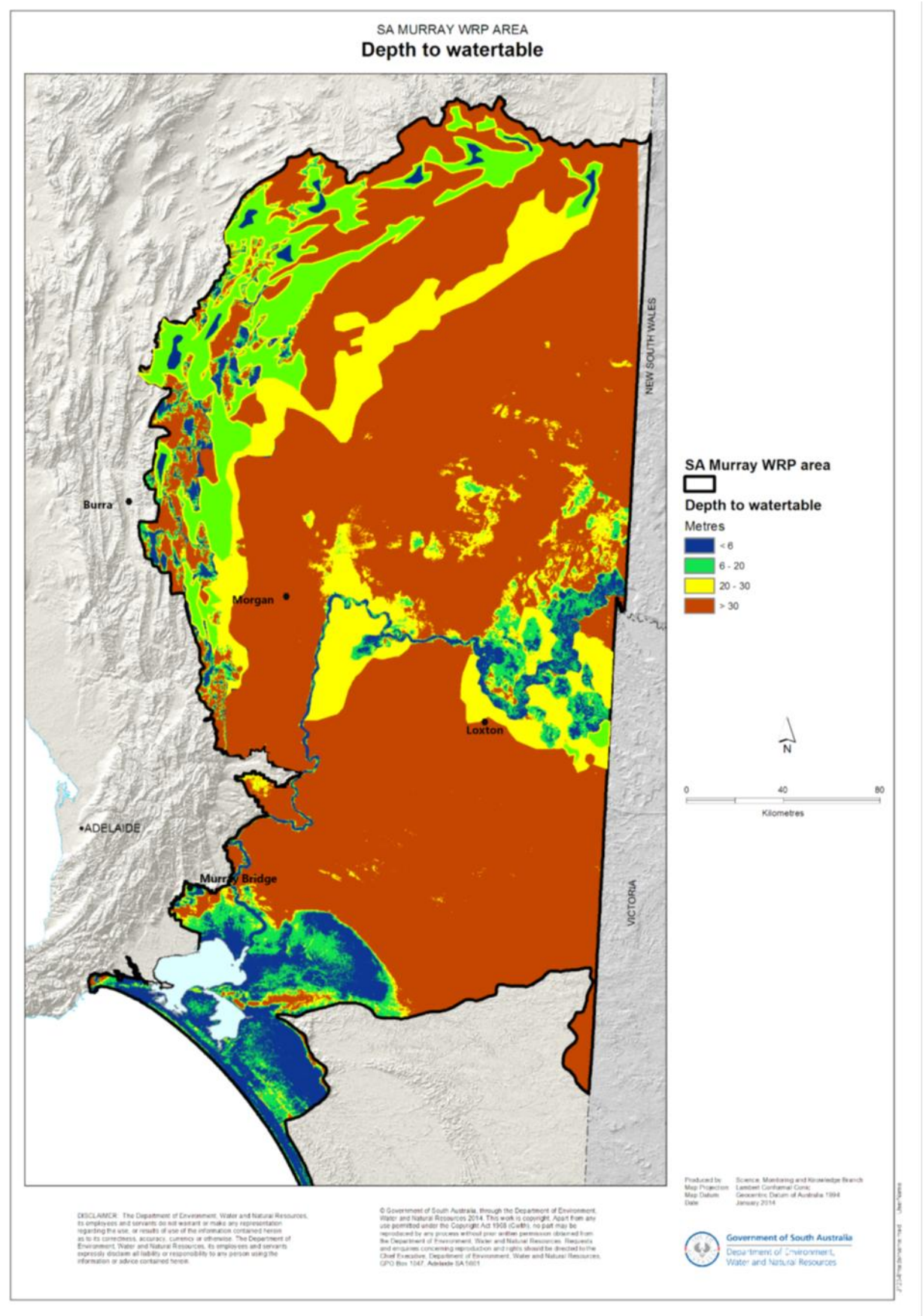

Figure 3.1. Depth of groundwater in the SA Murray Region

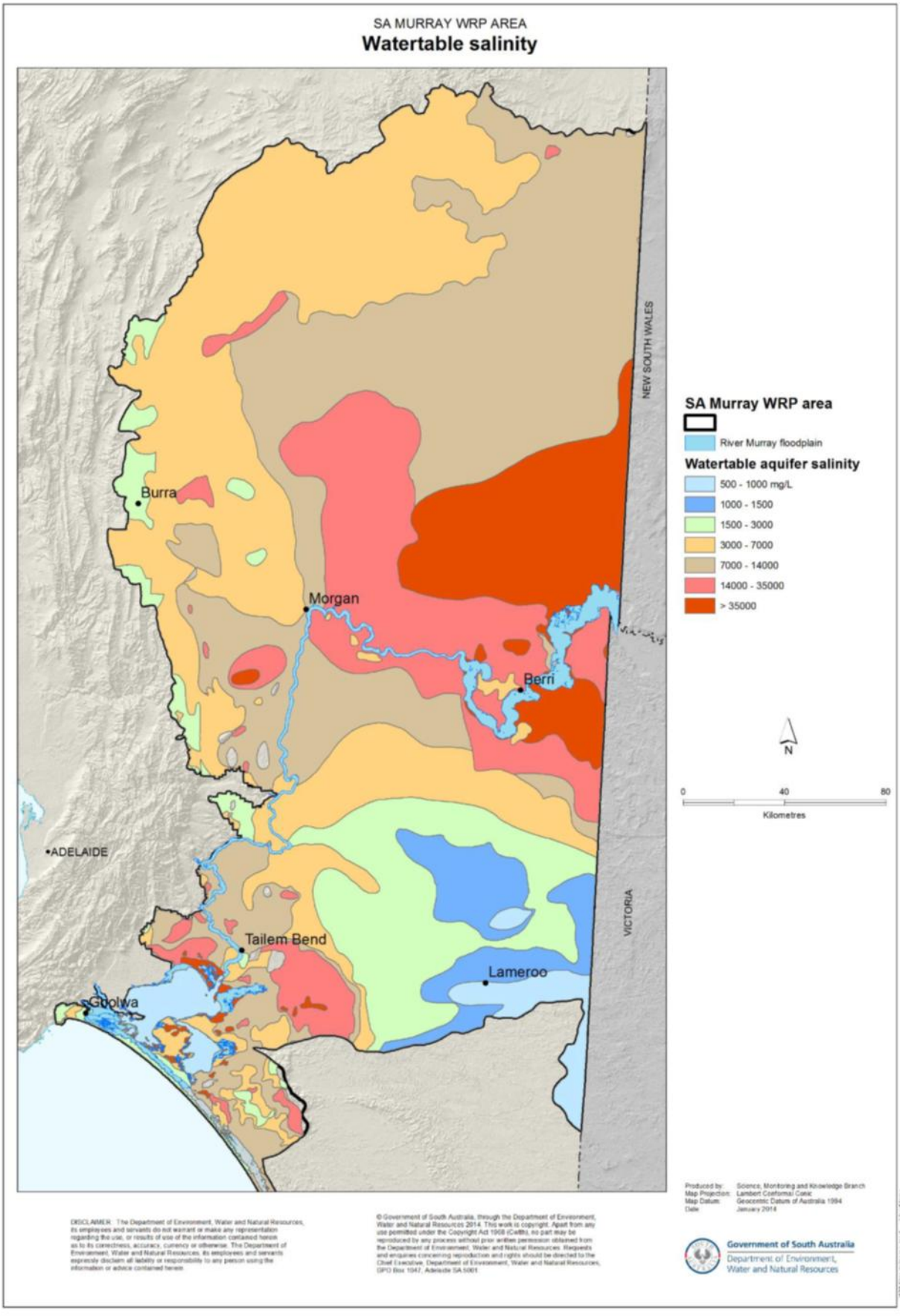

Figure 3.2. Groundwater salinities in the SA Murray Region

4 Management considerations

4.1 Integration of Aboriginal 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 Aboriginal nations with Country in the SA Murray Region (Table 4.1).

Table 4.1. 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 Aboriginal Corporation	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).

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.

Identified outcomes for Aboriginal Nations– taken from (SA RM WRP, 2019)

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

Engagement with Aboriginal nations including country-based planning and other approaches to ensure that Aboriginal objectives and outcomes are identified and achieved, is undertaken as part of the development and implementation of water planning activities on a continuing basis. South Australia will continue to engage meaningfully with SA Murray Region Aboriginal Nations at all stages of water resource planning and in the development, review and amendment of environmental water planning instruments. Additional information on Aboriginal values and uses is included in the Murray Region Water Resource Plan Section 5.14.

4.2 Cooperative arrangements within the WRP area

The SA Murray Region has a boundary that crosses over five landscape board regions within South Australia (HF, NY, MR, SAAL and LC) which the regional WAACPs align. There is limited opportunity for cooperative arrangements within the WRP area due to the nature of the resources. The Presiding Members of the Landscape 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.

4.3 Cooperative arrangements between WRP 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.

Eastern Mount Lofty Ranges Water Resource Plan Area

There is no active management of water for the environment within Eastern Mount Lofty Ranges (EMLR) WRP area and as such, long-term cooperative arrangements have been established through policies within the relevant water planning documents (i.e. WAPs). The EMLR WRP area has two prescribed water resource areas within its boundary: EMLR and Marne Saunders.

Flows from the EMLR tributaries (average 78 GL per year) are received into the River Murray (Department for Environment and Water, 2019a). The Water Allocation Plan (WAP) development process for the EMLR assessed whether taking or using water from the prescribed resource of the EMLR has an impact on adjacent water resource areas. It was concluded that the EMLR contributes small volumes to the lower River Murray and Lake Alexandrina and ultimately to Lake Albert, the Murray Mouth and the Coorong. The consumptive use limits for the EMLR have been set to provide water to the local environment (Section 2.4 of the EMLR WAP), including the terminal wetlands where the EMLR streams meet the River Murray and Lake Alexandrina (Natural Resources SA Murray-Darling Basin, 2013). Protecting low flows has been identified as a key tool for support achieving the EWRs in the Eastern Mount Lofty Ranges (Natural Resources SA Murray-Darling Basin, 2019) and is being addressed through the Flows for the Future Program Department for Environment and Water - Flows for the Future. Additional flows provided to Lake Alexandrina through this program are recognised as a Sustainable Diversion Limit Adjustment Mechanisms project. The monitoring and reporting arrangements for WAP policies are described in Section 8 of the EMLR WAP.

The EMLR WAP notes that conditions in the River Murray and Lake Alexandrina can also directly affect the environmental condition of the lower reaches of the EMLR streams as occurred during the millennium drought. To minimise this impact, the Water Allocation Plan for the River Murray Prescribed Watercourse (River Murray WAP) incorporates principles that prevent increased extractions from the tributaries of Lake Alexandrina (Natural Resources SA Murray-Darling Basin, 2020).

There are two additional mechanisms that will assist with minimising the impacts of low water levels in Lake Alexandrina on the lower reaches of the EMLR streams. The first mechanism is the inclusion of an objective in the Basin Plan (section 8.06) to maintain water levels in the Lower Lakes above 0.4 m AHD for 95% of the time and above 0.0 m AHD all of the time. The second mechanism is a documented decision-making framework for the management of the Lower Lakes during extreme drought (Murray-Darling Basin Authority, 2014a).

The Marne River and Saunders Creek begin in the high rainfall hills zone, flowing east down the hills, through gorges and then out onto the low rainfall plains zone to eventually meet the River Murray. Flow from the Upper Marne River to its mouth at the River Murray is now uncommon, with most outflows from the hills zone recharging the groundwater on the plains zone instead in most years. Flow from the Upper Saunders to its mouth is even more uncommon given the smaller discharge volumes from this area to the point it is unknown when this last occurred (Department for Environment and Water, 2019a). The WAP for the Marne Saunders PWRA includes policies to protect the spring flow for the Marne Mouth Wetland, which is located at the junction of the Marne River with the River Murray.

South Australian River Murray Water Resource Plan Area

Potential inflows from the south-east into the CLLMM PEA are low (median 42 GL per year) when compared to the flows from the River Murray (average 5,685 GL per year) (Department for Environment and Water, 2019a). The South Lagoon of the Coorong has been historically impacted by the redirection of water (both floodwater and saline groundwater) into the South East drainage system and out to sea rather than into the Coorong (Department for Environment and Water, 2019a). The DEW South East Flows Restoration Project was established to manage water release from Morella Basin via Salt Creek, improve outcomes for en-route South East wetlands, and increase flows to the Coorong when required for salinity management. The pattern of releases at Morella Basin and Salt

Creek can be altered in consideration of potential outcomes and impacts within the South Lagoon of the Coorong, including salinity, nutrients and biotic responses (particularly *Ruppia tuberosa*).

Decisions on the release volume, flow rate and timing of releases are made each year by the South Eastern Water Conservation and Drainage Board (SEWCDB) following the objectives, procedures and governance structures outlined in the *South East Flows Restoration Project Operations Manual* (Department for Environment and Water, 2019) and advice from DEW and SEWCDB staff. The Board will receive a recommendation on proposed operations via the Director, Water Infrastructure and Operations, DEW, who is accountable for decisions regarding Morella and Salt Creek releases to the Coorong. The SEWCDB consists of an eight member statutory body established under the *South Eastern Water Conservation and Drainage Act 1992*. The SEWCDB staff use a digital elevation model and seasonal weather conditions to provide advice to the Director, Water Infrastructure and Operations and the Board. DEW staff seek advice from the Lower Lakes, Coorong and Murray Mouth Scientific Advisory Group and Community Advisory Panel on the potential risks and benefits to the Coorong of the proposed release patterns and provide advice to the Barrage Operations Advisory Group on Morella and Salt Creek operations. The development of a policy and procedure to guide decisions on the release of water from the South East into the Coorong is underway.

4.4 Social and economic outcomes

Consistent with the 2025 BWS, and section 8.35(b)(v) of the Basin Plan, environmental watering is to be undertaken is such a way that it maximises its benefits and effectiveness by having regard to complimentary social and economic outcomes. Given there is no HEW or active environmental water delivery in the SA Murray Regions WRP area, active consideration of and planning for of complementary social and economic outcomes is not applicable.

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.

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) noted that risks were found to be inherently low due to the characteristics of the SA Murray Region WRP area. The risk assessment notes that there is little in the way of surface water resources over much of the area and relatively few environmental values that are dependent on these resources, for example, risks to Northern Mount Lofty Ranges water dependant ecosystems as a result of climate change were rated as being low.

The risk assessment did identify two significant risks, however both of these risks were associated with the Coorong. Risks to the Coorong are addressed as part of the SA River Murray LTWP, and therefore they have not been duplicated in this LTWP.

5.2.2 Potential risk mitigation strategies

The South Australian Murray Region Risk Assessment Report (Department of Environment, Water and Natural Resources, 2017) identified a number of risks that were assessed as low due to implementation of effective legislative and policy controls. Section 5.4.4 of the South Australian Murray Region Water Resource Plans recognises the role that existing legislative and policy controls play in managing these risks.

As there were no specific significant risks identified for the part of the SA Murray Region covered by this LTWP, no further 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

7 Appendices

A. Regional landscape boundaries under the *Landscape South Australia Act 2019*

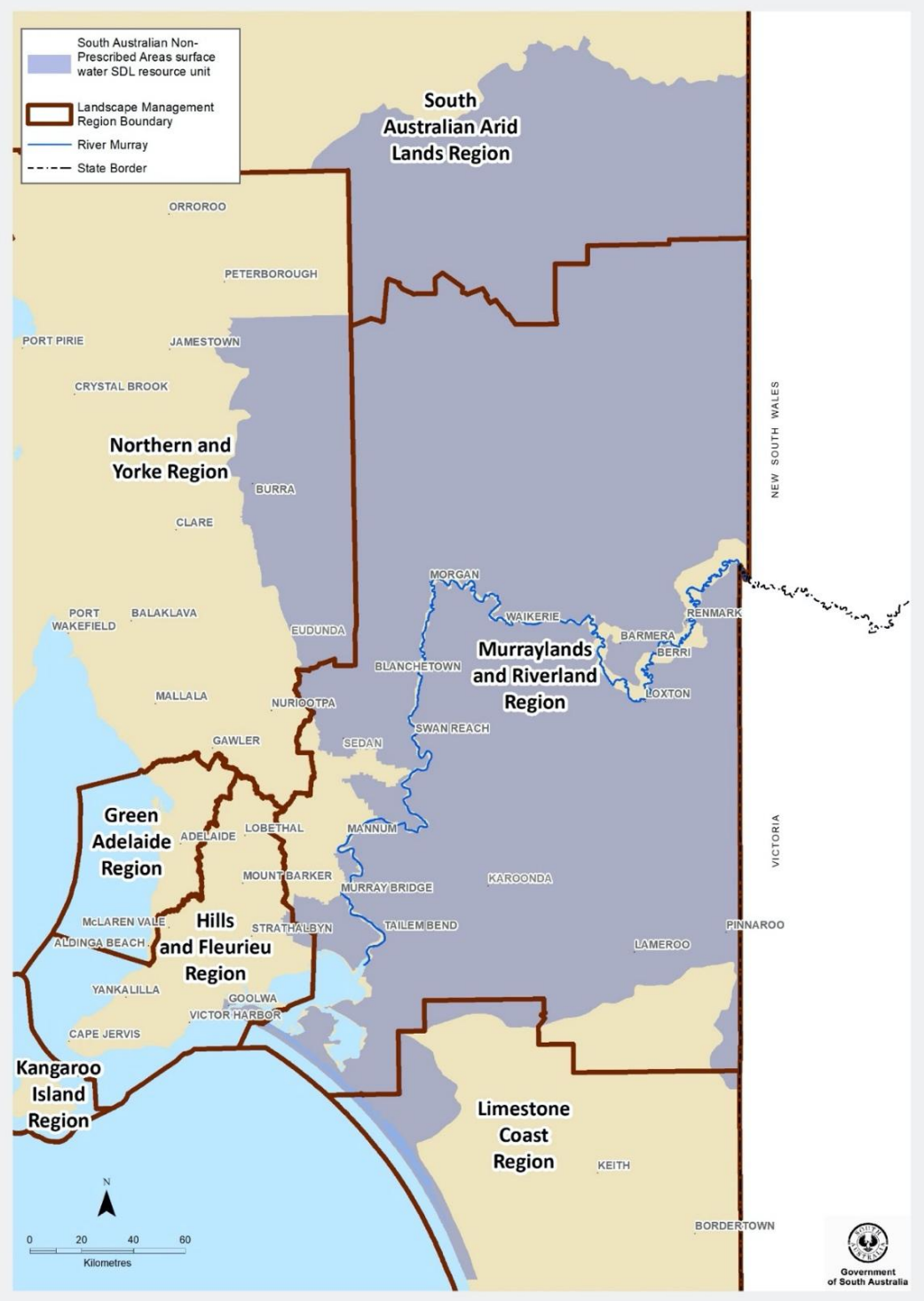

Figure 7.1. Landscape SA boundaries within the Basin Plan's South Australian Murray Region water resource plan area

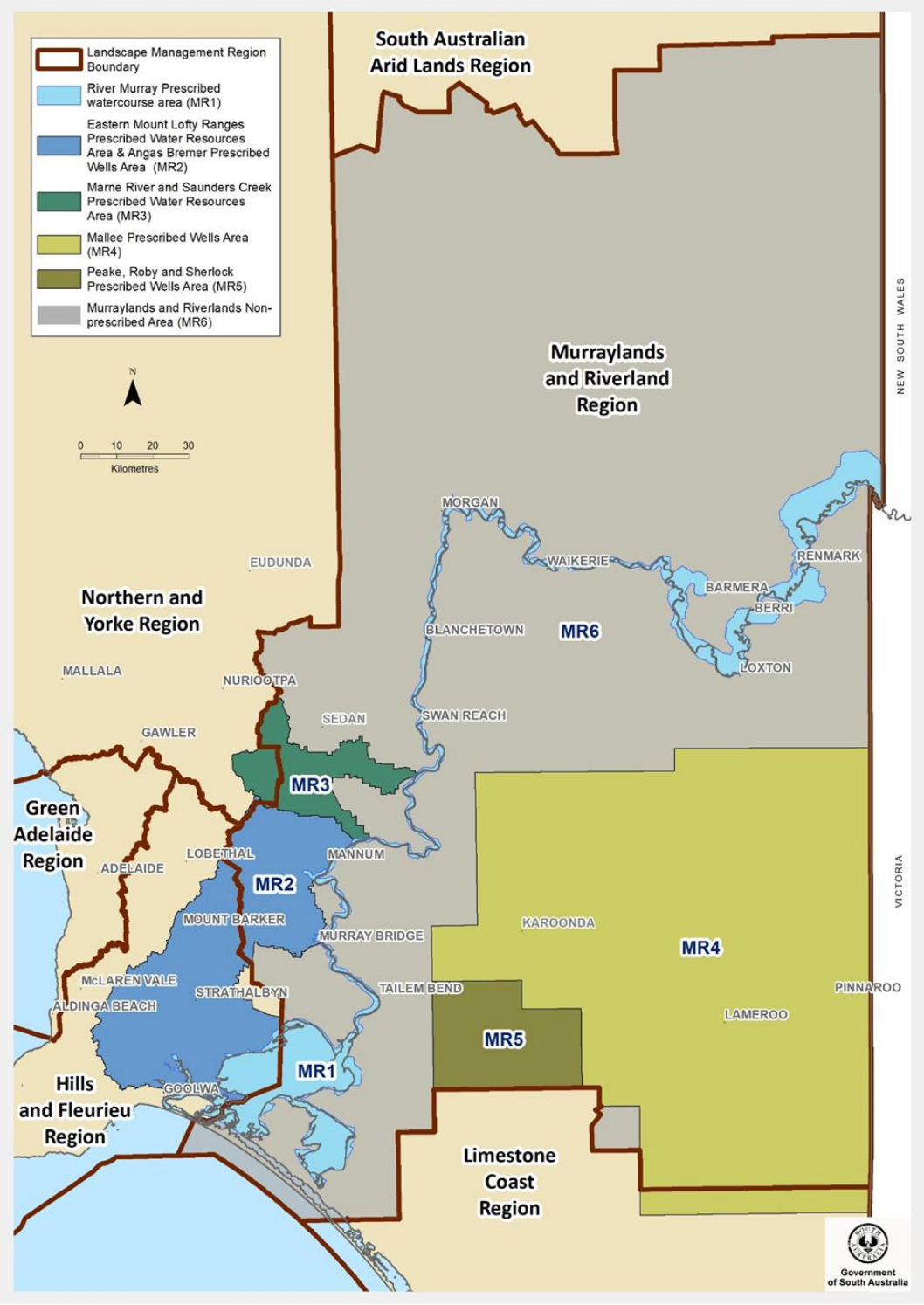

Figure 7.2. Water planning zones within the Murraylands and Riverland landscape management region

B. State planning in the Murray Region WRP area

Landscape Regions	Heading??	Relevant Legislation /Plans / Reports
All Regions		*Landscape South Australia Act 2019* *Water Act 2007* (Commonwealth)
Hills and Fleurieu (HF)	Non-prescribed water area	HF Water Affecting Activities Control Policy
Northern and Yorke (NY)	Non-prescribed water area including North East Mt Lofty Ranges sub-catchments	NY Water Affecting Activities Control Policy
SA Arid Lands (SAAL)	Non-prescribed water area	SAAL Water Affecting Activities Control Policy SAAL Biodiversity Strategy
Murraylands and Riverland (MR)	North East Mt Lofty Ranges sub-catchments	MR Water Affecting Activities Control Policy
	Prescribed Wells Area	Peake Roby and Sherlock WAP Mallee WAP *Groundwater (Border Agreement) Act 1985* (SA)
	Non-prescribed water area	MR Water Affecting Activities Control Policy
Limestone Coast (LC)	Non-prescribed water area	LC Water Affecting Activities Control Policy *South Eastern Water Conservation and Drainage Act 1992 (*SA)

C. 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.

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.

BWS — 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*.

HF — Hills and Fleurieu.

JAMBA — Japan-Australia Migratory Bird Agreement – a bilateral agreement to protect and conserve migratory birds and their habitat.

Landscape Act — *Landscape South Australia Act 2019*.

LC — Limestone Coast.

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.

MR — Murraylands and Riverland.

NY — Northern and Yorke.

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.

WAACP — Water affecting activity control policy - means a water affecting activities control policy prepared by a regional landscape board under section 102 of the Landscape Act.

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.

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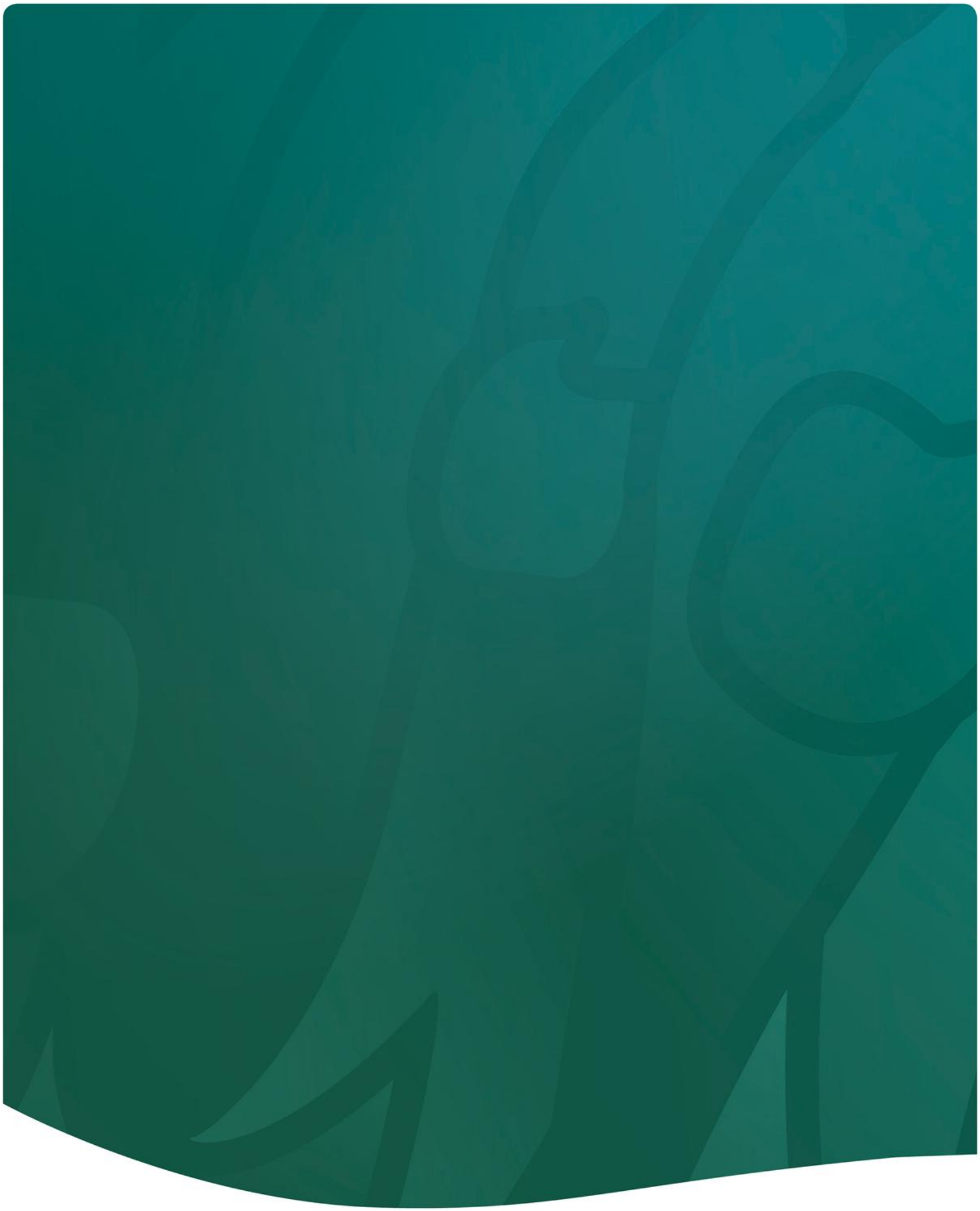

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