South Australian evaluation of environmental outcomes under the Basin Plan | 2024

Eastern Mount Lofty Ranges Water Resource Plan Area

SOUTH AUSTRALIA

Government of South Australia
Department for Environment and Water

Acknowledgment of Country

We acknowledge and respect the Traditional Custodians whose ancestral lands we live and work upon and we pay our respects to their Elders past and present. We acknowledge and respect their deep spiritual connection and the relationship that Aboriginal and Torres Strait Islanders people have to Country.

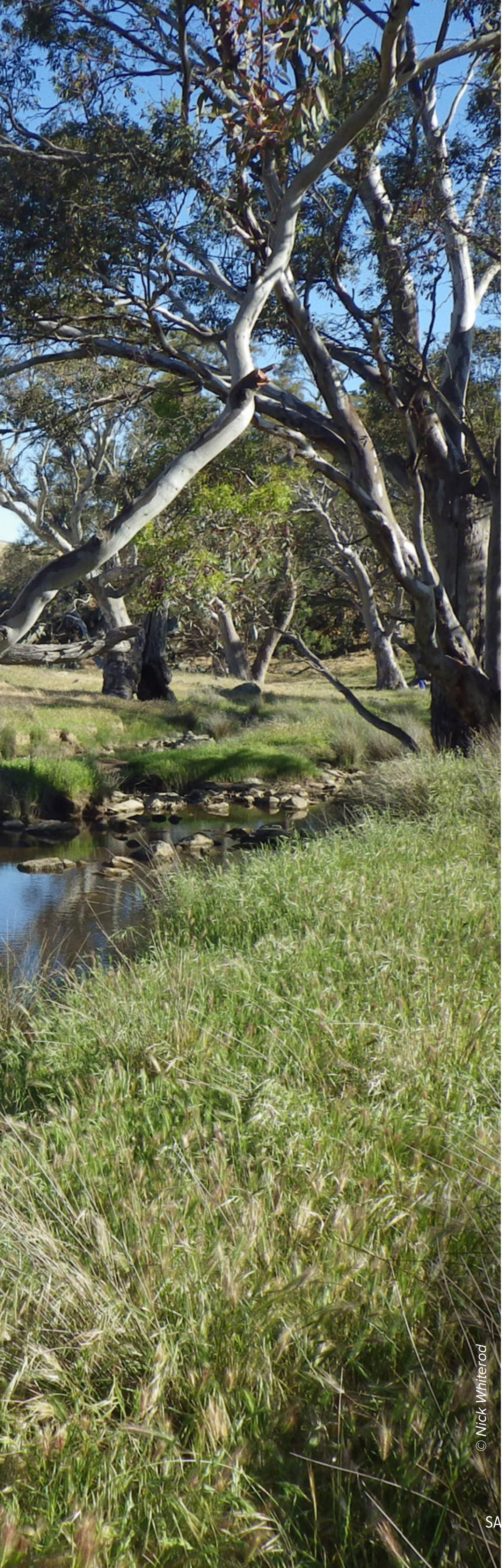
We also pay our respects to the cultural authority of Aboriginal and Torres Strait Islander people and their nations in South Australia, as well as those across Australia.

Acknowledgment of partners

Many individuals and staff from South Australian government agencies and organisations including the Hills and Fleurieu, and the Murraylands and Riverland Landscape Boards, contributed data, information, reports, expert input, and reviews at all stages of this evaluation. This evaluation report is the product of a collaborative effort, and the authors thank all contributors.

This work has relied on a number of monitoring programs for data and information, including the Flows for the Future (F4F) Program, the Waterbug BioBlitz Program, and the South Australia Environment Protection Authority's Aquatic Ecosystem Condition Reports (AECRs) Program.

Thank you to the many Department for Environment and Water staff, past and present, who have made contributions to the evaluation. A special thanks to staff from the Hills and Fleurieu Landscape Board for their contributions along with the following technical experts for their continued support, access to data and ongoing contributions to the evaluation: Nick Whiterod, Chris Madden, Paul McEvoy and Peter Goonan.



Contents

Synopsis

The South Australian evaluation of environmental outcomes under the Basin Plan: 2024 Eastern Mount Lofty Ranges Water Resource Plan Area is one in a suite of reports submitted every five years by South Australia to meet our obligations under the Basin Plan.

The South Australian Government is committed to delivering the Basin Plan in full and ensuring that we have a sustainable, healthy, working river for future generations. This evaluation draws together current evidence from the Eastern Mount Lofty Ranges (EMLR) Water Resource Plan (WRP) Area to provide a summary of progress made towards achievement of environmental outcomes. It highlights key achievements and areas where further sustained effort is required.

This evaluation report comes at an important time in Basin Plan implementation, particularly as we look towards review of the Basin Plan in 2026 which will determine what is needed to best protect the Basin and its values into the future.

In undertaking this evaluation, we have worked closely with technical experts and key stakeholders to evaluate the following questions:

- To what extent have outcomes been achieved?
- If outcomes were not achieved, why not?
- To what extent did the Basin Plan contribute to achieving outcomes?
- Have there been any unanticipated outcomes?

This evaluation report summarises our assessment and evaluation in a simple and accessible format. It communicates environmental outcomes achieved to date and what is still to be done. This report begins with a summary of the EMLR WRP Area, including the two Prescribed Water Resource Area PWRAs, which were used to assess outcomes for the WRP Area. Evaluation findings for key indicators are in the form of set environmental outcomes.

Key messages

This evaluation demonstrates that:

- Flow requirements in the EMLR WRP Area were not achieved, despite overall improvements in flow in the EMLR PWRA, most sites in the Marne Saunders declined.
- Macroinvertebrate communities remain in poor condition and have declined in the EMLR and Marne Saunders PWRAs, primarily due to variability in climatic conditions, pressures on water resources (extraction and diversion) and land use, influencing flow regimes and habitat condition.
- Fish communities are variable across catchments but the majority are in poor condition. Declines in fish community condition are likely due to the deterioration of upper-pool riffle and terminal wetland habitat condition, along with large populations of invasive fish species.
- Successful recruitment of native fish species (southern pygmy perch and mountain and obscure galaxias) has maintained populations, despite current low abundances.
- Continued restoration of flow regime is critical to achieve environmental outcomes in the EMLR WRP Area, including through the delivery of solutions to restore low flows whilst minimising impact on water use and security, through programs such as Flows for the Future.
- The continued controls and policies, including through Water Resource Plans and Water Allocation Plans, are critical to ensure sustainable water use, taking into account environmental, social and economic needs.

Eastern Mount Lofty Ranges Water Resource Plan Area

The EMLR WRP Area (Figure 1) extends from the Marne River Catchment in the north (near Keyneton) to Currency Creek Catchment in the south (near Goolwa) and laterally from Mount Barker to Murray Bridge. Catchments are fed from headwater streams in the hills zone (where rainfall is relatively high), flowing towards the plain zone (generally to the east and south-east). The WRP Area is connected to the River Murray through the Marne River (on rare occasions) and to Lake Alexandrina with the Bremer, Angas and Finniss Rivers, Tookayerta and Currency Creeks.

Rivers and streams throughout the EMLR are predominantly intermittent or temporary, with seasonal flows generally commencing in autumn and cease-to-flow in late spring to early-mid-summer. Stream flow varies by location, depending on variability in local rainfall and groundwater discharge. Catchments in the northern parts of the WRPA are generally drier and have shorter flowing seasons than those in the southern parts.

The intermittent flow regime is a defining feature of the region that influences the water-dependent ecosystems they support; with more tolerant species generally found in the north, while the more sensitive species are restricted to the south. The WRP Area also includes catchments with perennial flow (e.g. Tookayerta Creek) and numerous permanent pools which provide important refuge habitats for aquatic plants, macroinvertebrates and fish species.

The EMLR WRP Area is managed as two Prescribed Water Resource Areas (the Eastern Mount Lofty Ranges and Marne Saunders PWRAs) under the *Landscape South Australia Act 2019*. Water-resource development is managed with two Water Allocation Plans (WAPs), which serves as the basis for the EMLR Long-term Watering Plan (LTWP). There is no Held Environmental Water (HEW) in the WRP Area but there is Planned Environmental Water (PEW). Statutory water planning instruments ensure that PEW is provided and protects ecosystem functions.

For more information about the EMLR WRP Area please see the EMLR WRP Area Long-term Environmental Watering Plan.

Figure 1: Location and extent of the Eastern Mount Lofty Ranges Water Resource Plan (WRP) area. Stream order describes the hierarchy of streams within a catchment, with higher orders having a greater number of in-feeding streams.

Priority Environmental Assets

Our report evaluates environmental outcomes based on targets identified in the LTWP and the WAPs for the EMLR WRP Area. The assessment details the outcomes achieved in the two PWRAs within the EMLR WRP Area. However, both PWRAs have several nested Priority Environmental Assets (PEAs), which are the major river and creek systems (Table 1). For more information about the PEAs, please see the Long-term Environmental Watering Plan for the EMLR Water Resource Plan (WRP) Area.

Table 1. The nested PEAs that are identified in the LTWP for the EMLR and the Marne Saunders PWRAs. Note that the PWRAs serve as the overarching assets used to assess environmental outcomes and trend in this report.

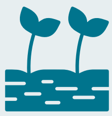
PWRA	PEA
EMLR	Angas River
	Bremer River
	Finniss River
	Reedy Creek
	Tookayerta Creek
	Central Lowlands Group (Angas Plains; Ferries-McDonald; Sandergrove Plains)
	Southern Group (Currency Creek and Deep Creek)
	Northern Group (Bees Knees, Long Gully, Milendella Creek, Preamimma Creek, Long Gully Creek and Salt Creek)
Marne Saunders	Marne River
	Saunders Creek

Eastern Mount Lofty Ranges ecosystem drivers and pressures

Drivers

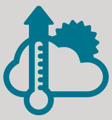
Rainfall in the region is some of the highest in South Australia but fluctuates between years due to climatic conditions. Generally, rainfall increases in a gradient from north to south, with hilly sections receiving more than the plains.

The flow regime (seasonality, timing, frequency, duration, magnitude and rate-of-change of flows) responds to changes in rainfall in the headwaters. The low flow component is critical for maintaining the permanent pools during the non-flowing season. Many watercourses are considered intermittent or temporary within the EMLR.

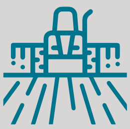


Several sections of rivers and creeks are perennial, with Tookayerta the only catchment considered perennial, supported by groundwater inputs.

Pressures

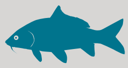


Changes in climate and increased climate extremes have influenced rainfall, temperatures and the surface water regime. Extreme weather events including droughts and floods pose challenges for infrastructure, community and industry as well as influencing the availability of surface and groundwater.



Agriculture, horticulture and urban development has led to clearance of native vegetation and diffuse land use pressure, impacting sediments and biota.

Dams in the region divert and capture runoff, preventing it from flowing to downstream environments and losing water to evaporation.



Invasive and predatory species can comprise more than a third of the catch in some years during EMLR monitoring.

How we evaluated environmental outcomes

This report provides our five-year evaluation of progress towards achieving environmental outcomes under the Basin Plan in South Australia. South Australia is required to report on the achievement of environmental outcomes at the asset scale every five years in accordance with Schedule 12 of the Basin Plan.

Our report evaluates environmental outcomes for the EMLR and Marne Saunders PWRAs, which are the overarching areas containing the PEAs. Environmental outcomes were developed based on macroinvertebrate and fish targets in the EMLR LTWP, originating from the two WAPs. Outcomes for flow regime were based on Environmental Watering Requirements (EWRs) in the WAPs. These are considered short-term outcomes (2020–2025) for flow regime and longer term for outcomes macroinvertebrate and fish (2020–2048).

What have we assessed?

We have assessed the achievement of environmental outcomes in relation to flow regime, macroinvertebrate and fish targets in the EMLR LTWP and the EMLR WRP Area WAP (Table 2). Broadly, these outcomes seek to maintain a suitable flow regime that can support the condition and health of macroinvertebrate and fish communities.

Table 2. The environmental outcome indicators, measures and data sources used to assess environmental outcomes for the EMLR and Marne Saunders PWRAs in the EMLR WRPA.

Indicator	Environmental outcome	Measure
Flow regime	Maintain or improve the number of flowing days.	Number of flowing days per year.
Macroinvertebrate condition within sampling sites	A condition score of moderate or better, considered ≥3.	Condition scores (range: 1 – 6) in sampled sites in the WRPA.
Fish	Moderate or better community condition, considered ≥3.	Condition scores (range: 0–10) in sampled sites in the WRPA.
	Better-than-marginal recruitment in ≥7 out of 10 years for southern pygmy perch and mountain (and obscure) galaxias.	The presence and evidence of recruitment.

Eastern Mount Lofty Ranges Water Resource Plan Area

Environmental Outcomes report

Trend

The change over time, calculated using all available data for an indicator across the assessment period.

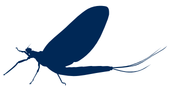
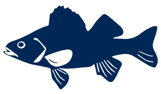
↗	Trend **Improved**	**Improved:** The indicator has improved over the period of assessment.
—	Trend **Stable**	**Stable:** The indicator has neither improved nor declined over the period of assessment.
↙	Trend **Declined**	**Declined:** The indicator has declined over the period of assessment.
NA	Trend **Not Applicable**	**Not Applicable:** Data were not sufficient to determine any trend in the status of the indicator.

Summary of outcomes at an asset scale

The assessment of environmental outcomes presents the trend for each indicator along with an evaluation of the following:

- Did we achieve what we expected we would achieve?
- If not, why not?
- How did the Basin Plan contribute to the achievement of environmental outcomes?

For further information on the evaluation please see the technical information.

Theme	Indicator	Trend	Information reliability	Key findings
Flow & Ecosystem Function 	Flow regime: the number of flowing days	Trend **Improved** EMLR PWRA Trend **Declined** Marne Saunders PWRA	Reliability **Fair**	**Outcome not achieved** – improved in EMLR PWRA but declined in the Marne Saunders PWRA.
Macroinvertebrates 	Community condition	Trend **Declined**	Reliability **Poor**	**Outcome not achieved** – only 4 of the 42 sampled sites with moderate or better condition.
Fish 	Community condition	Trend **Declined** EMLR PWRA Trend **Stable** Marne Saunders PWRA	Reliability **Good**	**Outcome not achieved** – only 3 of 9 catchments with moderate or better condition.
	Recruitment success (in key species)	NA Trend **Not Applicable**	Reliability **Good**	**Outcome achieved** –continuing persistence of key species across the prescribed area, despite lower abundances and less sites where detected.

Expected outcome report: Flow & Ecosystem Function

Flow regime: Number of flowing days

Trend **Improved**

EMLR PWRA

Trend **Declined**

Marne Saunders PWRA

Reliability **Fair**

The number of flowing days has been maintained or improved at most sites in the EMLR PWRA, however, most sites in the Marne Saunders PWRA have declined.

What are we trying to achieve:

The LTWP ecological objective is to *"Maintain water-dependent ecosystems at an acceptable level of risk for meeting the overall objective of maintaining/ restoring self-sustaining populations of aquatic/riparian flora/fauna that are resilient to drought".*

The number of flowing days helps to describe the length of the flowing season, supporting ecosystem function in the region's streams.

Why is flow regime important?

The flow regime encompasses the seasonality, timing, frequency, duration, magnitude and rate-of-change of flow, supporting many ecosystem processes. The timing and duration of the flowing season keep permanent pool habitats wet, which are refugia for macroinvertebrates and fish during dry phases. There is a natural variability in the flow regime between years, dependent on rainfall; however, it is important to ensure that there is not a consistent decline in the length of the flowing season (defined as the number of flowing days).

What is the trend and current status of the flow regime?

Flow regime was assessed as the number of flowing days observed at 33 gauging stations. Overall, the environmental outcome for flow regime in the EMLR WRPA was not met, due to the decline in the number of flowing days at most sites in the Marne Saunders PWRA.

Most gauging sites in the EMLR PWRA displayed either a stable or improving number of flowing days. Two sites in the Bremer River demonstrated a decline but responded positively to higher rainfall in 2022–23. By contrast, the number of flowing days at all sites, except one in the Marne Saunders PWRA, declined.

Since the last evaluation in 2019, approximately 85% of gauging sites assessed in the EMLR PWRA have achieved the environmental outcome. Only one site in the headwater areas for the Marne River has achieved the environmental outcome and this was only in 2021–22 and 2022–23.

It is important to note that although a greater intermittency of flow is expected in the Marne Saunders PWRA, this may not be its natural flow regime. One site (with sufficient data) demonstrates that its current average number of flowing days (99 days since 2000) is well below its long-term average (201 days since 1973).

There has been a consistent decline in flow within the Marne Saunders PWRA, due to a combination of long-term reduction in rainfall and water resource development.

Why are we seeing these results?

The number of flowing days in the EMLR is strongly influenced by climate and rainfall. There is annual variability in stream flow and seasonal deviations leading to flowing and non-flowing phases, which are a natural part of the flow regime.

Rainfall patterns exhibit a natural climate variability, but most sites indicate a long-term decline (since 1900 or 1908) in total annual rainfall (Figure 2 and Figure 3). Since 2000, there has been some notable periods of reduced rainfall, including the Millennium Drought (1996–2010). More recently, wetter periods have re-emerged, though they have been interspersed with drier-than-average water years. Considering that there is a distinct north-to-south gradient of increasing rainfall in the EMLR WRP Area, a long-term decline in rainfall and some notable recent dry years (e.g. 2018, 2019), were likely influences for a consistent decline in the number of flowing days for the Marne Saunders PWRA.

While total annual rainfall is an important driver in the EMLR, so too is the seasonality or spread of rainfall across a year. Rainfall in the region has likely reduced in spring and autumn, being condensed into winter, impacting the length of the flowing season and thus, the number of flowing days.

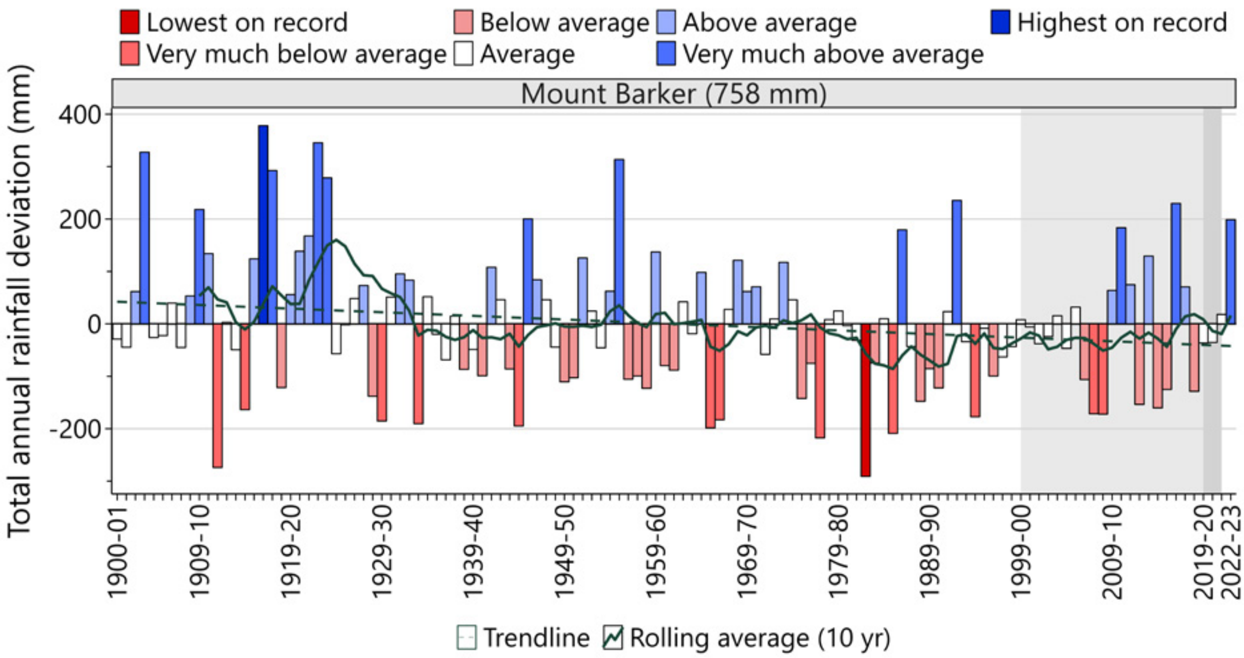


Figure 2: Long-term rainfall patterns (deviation from the average: since 1900-01) from the Mount Barker (Bremer River) station (23733) in the Eastern Mount Lofty Ranges (EMLR) Prescribed Water Resource Area (PWRA). Data Source: Bureau of Meteorology (2023).

A contributing factor for the environmental outcome being achieved in the EMLR PWRA was an overrepresentation of perennial sites (having maintained the maximum number of flowing days) in the data.

Water resource development (e.g. diversions) is another key factor, which can intensify the stress on water-dependent ecosystems, especially when climate variability is also having an impact on runoff. The construction of new dams in the EMLR WRP Area require that low flows are returned (either through non-capture and, or bypasses) to the catchment. However, an issue remains with larger, oversized, existing dams that passively capture rainfall and runoff.

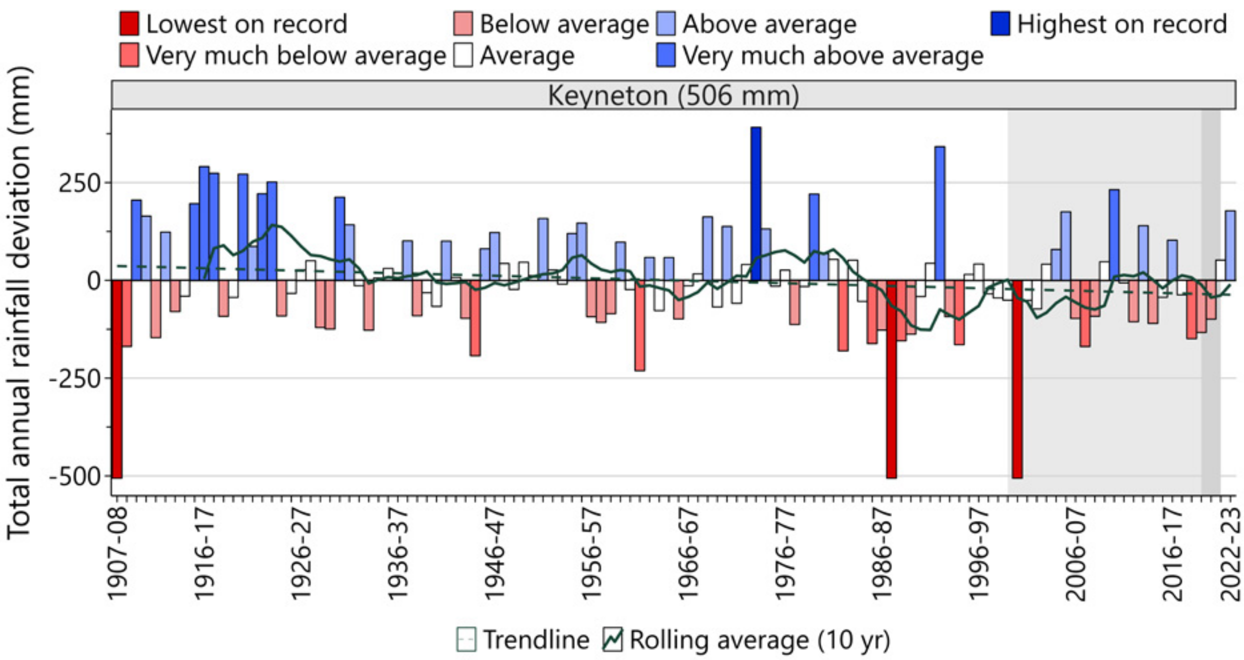


Figure 3: Long-term rainfall patterns (deviation from the average: since 1907-08) from the Keyneton Station (North Rhyne - Marne River) station (23725). Data Source: Bureau of Meteorology (2023).

What has the Basin Plan delivered?

Planned Environmental Water (PEW) is established through principles and rules in the EMLR and Marne Saunders WAPs that limit the take or consumptive use of water. These principles and rules include setting consumptive use limits for management zones, a requirement to return low flows and the protection of baseflows.

This supports the ecological objectives and needs of water-dependent ecosystems and achievement of the EWRs. These principles continue to be supported through Basin Plan mechanisms.

What is still to be done?

Implementation of low-flow bypasses in the EMLR continues. Additional targeted delivery of water is currently being considered in some locations (see the Flows for the Future Case Study). This will provide opportunities for assessing direct evidence of the influence of bypasses on downstream ecological communities, including the number of flowing days in a stream.

Protection of low flows and the progression towards restoration of low flows, will further the ecological objective to '*maintain water-dependent ecosystems at an acceptable level of risk for meeting the overall objective of maintaining/restoring self-sustaining populations of aquatic/riparian flora/ fauna that are resilient to drought.*'

What do we expect to see in the future?

Prevailing climatic conditions in southern South Australia will have the strongest effect on stream flow in the EMLR. Therefore, fluctuations in the various atmospheric circulations (e.g. El Niño-Southern Oscillation or Indian Ocean Dipole) that affect the Australian continent will ultimately impact the future and long-term outcomes for this indicator.

Progression towards the restoration of low flows continues, through Basin Plan implementation.

Expected outcome report: Macroinvertebrates

Macroinvertebrates

Trend
Declined

Reliability
Poor

Macroinvertebrate communities continue to be in a degraded state, impacted by land use and water resource development.

What are we trying to achieve?

The LTWP ecological objective is to *'maintain water-dependent ecosystems at an acceptable level of risk for meeting the overall objective of maintaining/ restoring self-sustaining populations of aquatic/riparian flora/fauna that are resilient to drought'.*

The LTWP ecological target is 'moderate to good macroinvertebrate community condition'. A "moderate" condition was considered here as 50% of the maximum condition score possible.

Why are macroinvertebrates important?

Aquatic macroinvertebrates are a diverse group (including insects, crustaceans, worms, snails and mites) that are vital to freshwater ecosystems. Macroinvertebrates respond to changes in water quality (e.g. salinity, nutrients, or fine sediment) and habitat conditions (e.g. riparian health), with some relying on flowing (riffle) waters, whereas others are more common in still or slow-flowing pools. Therefore, they are important biological indicators of stream and catchment health.

Aquatic macroinvertebrates are useful indicators in aquatic monitoring since they are an important link in food webs and reflect water quality and habitat conditions.

What is the trend and current status of macroinvertebrates?

Community condition scores are underpinned by attributes related to ecological composition and the health of the surrounding habitat. The scores from each metric are averaged to provide a final overall score.

Macroinvertebrate community condition was not achieved as there were only four sites with a moderate or better condition score in the most recent assessment (2022). Most sites are in a degraded state and have had a condition score of poor or fair since 2016.

The overall trend since 2016 when monitoring began has slightly declined (Figure 4). Between 2016 and 2019, an average of 16% of sampled sites had macroinvertebrate communities in moderate or better condition. In each year since 2019, the average percentage of sites with moderate or better macroinvertebrate community condition declined to 11%.

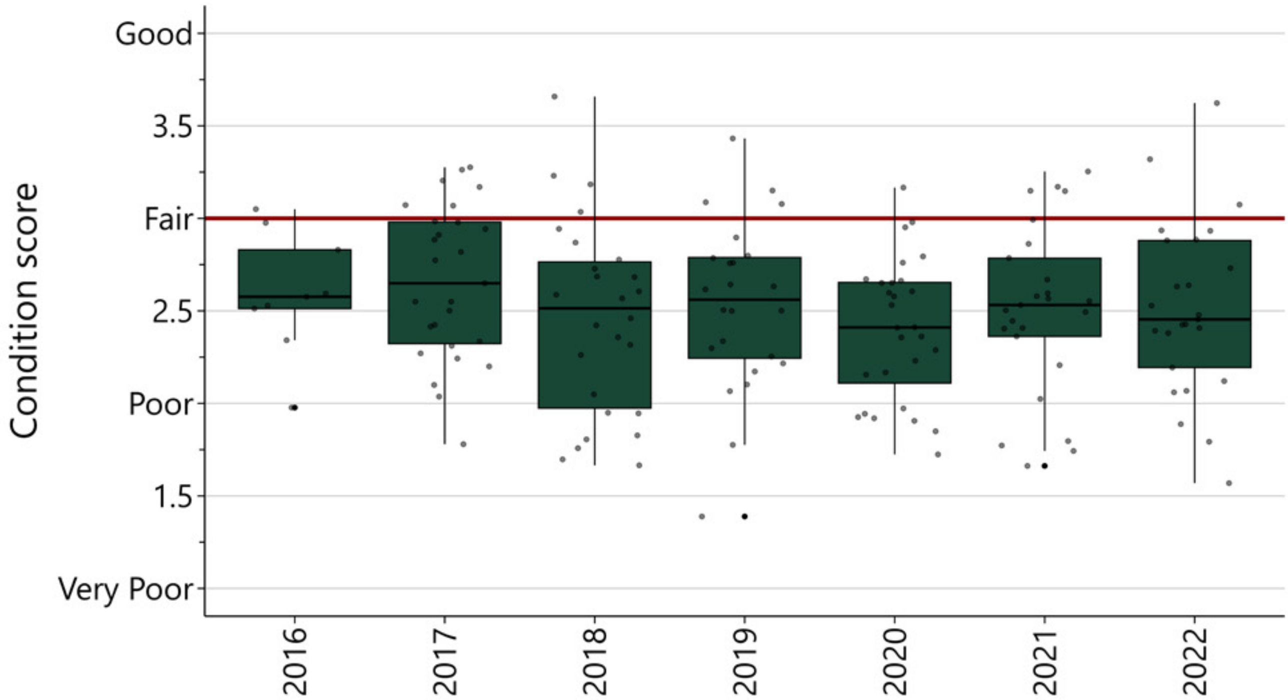


Figure 4: The distribution of macroinvertebrate community condition scores in the EMLR WRP Area between 2016 and 2022. Fair condition as shown in the graph is equivalent to moderate community condition score of 3.

Why are we seeing these results?

Condition scores indicating an already degraded state (between poor and fair) were expected, due to the impacts of long-term land use and water resource development. This is supported by the South Australian Environment Protection Authority's Aquatic Ecosystem Condition Reports (AECRs).

Water quality and habitat condition strongly impact macroinvertebrates by influencing the composition of sensitive and tolerant species (impacting community condition scores). Flow regime is a key driver of water quality and habitat conditions. Sufficient flows during peak season can improve water quality through flushing stream reaches and supporting riffle habitats (a flowing section over a rocky bottom) which are relied upon by many flow sensitive species. Low flows help keep permanent pools wet during critical dry phases, which are used as refuge by a wide variety of macroinvertebrates.

Climate and rainfall will strongly dictate the prevailing flow regime in the EMLR, with water quality and habitat conditions subsequently responding. Some notable dry years (e.g. 2018 and 2019) may have contributed to the minor decline in condition scores (Figure 4).

Progression towards moderate or better community condition is a long-term outcome (2020–2048). Whilst current environmental outcomes are not being met, a reduction of broad-scale land use pressures, as well as supporting the flow regime through management of water resource development and returning low flows, is expected to improve the progression towards the environmental outcome and the LTWP target of "moderate to good condition".

It should be noted that since monitoring programs target selected sites and these tend to have a greater representation of permanent pools, community condition scores largely apply only to the sampled sites.

What has the Basin Plan delivered?

Planned Environmental Water (PEW) is established through principles and rules in the EMLR and Marne Saunders WAPs, limiting the take or consumptive use of water. The Basin Plan ensures that consumptive use limits for management zones are in place, as well as requirements to return low flows to the environment and to protect baseflows.

What is still to be done?

Restoration of low flows will help maintain permanent pools in the EMLR. Supporting the continued protection of low flows will reduce the impact of water-resource development on the length of the flowing season, critical for macroinvertebrate life cycles.

Managing high water demand in catchments to further support Sustainable Diversion Limits (SDLs) set for the WRP Area, as well as reducing broad and diffuse land use pressures (including through the restoration of native vegetation), will lessen the impacts on water quality and habitat condition.

What do we expect to see in the future?

The environmental outcome for macroinvertebrates is long-term (2020–2048). Considering the strong influence of climate and rainfall on prevailing streamflow, it is difficult to assess the long-term trajectory. However, improvements in protecting low flows, as well as improved management of water-resource development and diffuse land use pressures, is expected to help improve macroinvertebrate community condition.

Progression towards the restoration of low flows continues through implementation of the Basin Plan.

Expected outcome report: Fish

Fish: Community condition and recruitment success

Trend
Declined

EMLR PWRA

Trend
Stable

Marne Saunders PWRA

Reliability
Good

Community condition has declined in the EMLR PWRA, Stable in the Marne Saunders PWRA

What are we trying to achieve?

The LTWP ecological objective is to *“maintain water-dependent ecosystems at an acceptable level of risk for meeting the overall objective of maintaining/ restoring self-sustaining populations of aquatic/riparian flora/fauna that are resilient to drought”.*

The LTWP ecological target for fish recruitment is “better-than-marginal recruitment in ≥7 out of 10 years for southern pygmy perch and mountain galaxias”, based on natural adaptations and relatively short-life spans of these species.

Fish community condition in the Eastern Mount Lofty Ranges is considered poor in 2023, despite several above-average years since 2019.

Why are fish important?

Habitats in the EMLR support a diversity of fishes that are of both regional and national importance. The region provides critical habitats used by native riverine fish (especially smaller-bodied species), including resident species like southern pygmy perch, mountain (and obscure) galaxias, the regionally or nationally threatened or endangered Murray hardyhead and river blackfish, as well as migratory freshwater species like congolli and climbing galaxias.

Approximately 60% of all small-bodied fishes recorded in the MDB are found in the EMLR.

What is the trend and current status of fish community?

The fish condition outcome was not achieved in this assessment, as the latest monitoring (summer 2023) indicated poor condition at the EMLR WRP scale.

In 2023, six of nine catchments were in poor condition (Table 2). The lower overall condition score observed in 2023, compared to 2022, was likely due to a deterioration in the condition scores of upper pool-riffle and terminal wetlands.

The environmental outcome has been achieved in every year apart from 2014 and 2023 and recent years (2020-2022) with better-than-moderate condition scores.

Trend assessment indicated a minor decline in condition scores for the EMLR PWRA. By contrast, the Marne Saunders was considered stable, although in poor condition.

Table 2. Median fish community condition scores for the nine catchments and for the EMLR WRP Area. Cells colours represent catchments classed as either Poor (<3), Moderate (3–6), or Good (>6).

Catchment	Condition score									
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Angas	5.1	3.4	3.9	2.5	3.3	2.9	3.5	3.4	3.5	3.3
Bremer	3.0	3.0	1.0	2.3	3.0	2.0	3.0	3.0	1.0	2.0
Currency	4.0	5.5	2.5	3.5	3.8	3.3	4.8	4.3	1.0	1.5
Finniss	5.0	5.3	5.5	4.8	5.0	3.0	4.4	4.5	4.9	3.5
Reedy	1.0	3.0	9.0	3.0	3.3	4.8	3.5	2.0	7.5	4.3
Salt, Premimma & Rocky Gully	1.0	3.0	3.0	2.0	2.0	3.5	10.0	5.0	4.0	0.5
Tookayerta	2.3	3.0	3.3	2.0	4.5	3.3	5.0	4.0	6.0	2.0
Marne	0.8	1.5	0.0	3.8	2.8	1.0	1.0	2.0	1.0	2.5
Saunders	2.0	5.0	0.0	4.0	0.0	0.0	0.0	1.0	0.0	2.0
Overall	2.3	3.0	3.0	3.0	3.3	3.0	3.5	3.4	3.5	2.0

An assessment of fish recruitment over the past decade concluded that populations of southern pygmy perch and mountain (and obscure) galaxias were mostly meeting their recruitment targets, considering their ongoing presence in the EMLR. However, there has been an overall decline in abundance of these species since 2014 and southern pygmy perch and mountain (and obscure) galaxias have been rarely found in the Angas River and Bremer River catchments.

Why are we seeing these results?

Climate variability affects fish communities through its influence on rainfall and flow regime. For example, periods of shorter cease-to-flow periods and more bankfull days over the spring-summer period have been shown to increase the abundance of mountain galaxias. The timing and duration of seasonal low flows affects water quality in permanent pools, which impacts the dispersal and migration capabilities of mountain galaxias.

During periods of low flows, river systems in EMLR are naturally high in salt and, therefore, salinity can impact fish communities during low flows periods. For example, some reduced flow events (including cease-to-flow events) in the Marne Saunders catchments since 2019 may have impacted fish community condition. Lower dissolved oxygen levels can also be a concern during cease-to-flow periods and in some areas (e.g. Rodwell Creek) intervention strategies are in place to protect populations of river blackfish.

Invasive species such as eastern gambusia or common carp can impact the overall condition of the fish community. For example, eastern gambusia (the most prevalent fish in the EMLR) is a small-bodied live bearer that can recruit quickly and is adapted to still or low flow conditions and poor water quality, which impact native fish through competition for food and resources and predation of juveniles and eggs.

What has the Basin Plan delivered?

Planned Environmental Water (PEW) is established through principles and rules in the EMLR and Marne Saunders WAPs, limiting the take or consumptive use of water. The Basin Plan ensures that consumptive use limits for management zones are in place, as well as requirements to return low flows to the environment and to protect baseflows.

What is still to be done?

Fish communities in the EMLR are naturally adapted to environmental variability and stress. However, further improvements in delivering low flows are still required so that populations can persist over the non-flowing season during summer. Supporting permanent pools in this way provides critical refugia for fishes and may improve water quality.

Continuing to lessen the barriers to dispersal, such as on-stream dams or barriers across the Angas and Bremer Rivers, will help maintain connectivity, important for migrating fish like common congolli and climbing galaxias. Additionally, continued fishway passage through operating fishways on the Lower Lakes barrages and enhanced passages already developed through the Sea to Hume Fishway Program will also improve community condition.

Reducing invasive fish populations will lessen the resource pressure and competition for native fishes.

Progression towards the restoration of low flows continues, through implementation of the Basin Plan.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Case study: Flows for the Future

Streams in the EMLR are predominantly intermittent or temporary and the flowing season generally begins at the end of autumn and ends in summer. Seasonal and climatic variability in flow volume and duration are a natural part of flow regimes in the EMLR.

Water resource development is a major risk to ecosystems in the EMLR. Water diversions such as farm dams prevent flows to the downstream environment until they are at capacity and spilling. This has a significant impact on the flow regime and environment. There are approximately 8,000 dams in the EMLR WRP Area, which has a major influence on flow through the system.

The Flows for the Future (F4F) program aims to return these low flows to the environment. To achieve this, gravity low flow devices have been installed above pre-existing dams.

Water is passively diverted from entering dams up to a certain flow threshold, representative of low flows in that area, whilst higher flows are captured. This has minimal impacts on annual water storage volumes but returns critical low flows, having a cumulative impact across catchments. Newer siphon systems are also being trialled that manually release water for the environment to facilitate low flow releases.

Low flows are currently being returned voluntarily from many pre-existing dams and low flow bypass devices have been installed at over 440 sites in the EMLR WRP Area. Low flow bypass devices are a requirement for new dams in the Marne Saunders PWRA and all licensed dams and watercourse extractions plus priority stock and domestic dams over 5 ML in EMLR PWRA.

F4F is a $33-million joint initiative between the Australian Government and Government of South Australia, contributing to the adjustment of SDLs as a 'notified supply measure' project under the Basin Plan.



Abbreviations

AECRs – Aquatic Ecosystem Condition Reports

EMLR – Eastern Mount Lofty Ranges

EWRs – Environmental Watering Requirements

F4F – Flows for the Future

HEW – Held Environmental Water

LTWP – Long-term Watering Plan

MDB – Murray–Darling Basin

ML – Megalitre

PEW – Planned Environmental Water

PWRA – Prescribed Water Resource Area

SDLs – Sustainable Diversion Limits

WAPs – Water Allocation Plans

WRP – Water Resource Plan

Glossary

Basin Plan	Adopted in 2012, the Basin Plan is a partnership, across governments, to share water between all users and the environment in a sustainable way.
Dissolved oxygen	The amount of oxygen that is dissolved, or carried, in water.
Ecosystem	A group of living organisms that live in and interact with each other in a specific environment.
El Niño-Southern Oscillation	Is a recurring climate pattern involving changes in the temperature of waters in the central and eastern tropical Pacific Ocean.
Indian Ocean Dipole	An irregular oscillation of sea surface temperatures in which the western Indian Ocean becomes alternately warmer (positive phase) and then colder (negative phase) than the eastern part of the ocean.
Macroinvertebrates	An invertebrate that is large enough to be seen without a microscope.
Millennium Drought	From late 1996 to mid 2010, much of southern Australia (except parts of central Western Australia) experienced a prolonged period of dry conditions, known as the Millennium Drought. The drought conditions were particularly severe in the more densely populated southeast and southwest and severely affected the Murray–Darling Basin and virtually all of the southern cropping zones. The period from 2007–2010 was particularly extreme with extended periods of no flow through the barrages to the Coorong.
Murray–Darling Basin	An area of about 1 million km^2 in the south-east of Australia, it is almost 1,400 km long and about 800 km wide.
Riparian	The interface between the land and a body of water such as a river.
Salinity	Measure of the concentration of salt in the water. Commonly reported as PPT (parts per thousand) equivalent to $g\ L^{-1}$.

Government of South Australia
Department for Environment and Water