

Draft amended Barossa Water Allocation Plan

The draft amended Barossa Water Allocation Plan (the Plan) takes into account the high level of water use and storage that, combined with a changing climate, is placing pressure on the availability of water resources for all users, including the environment.

The Plan introduces a flexible and adaptable management approach that aims to minimise the risk of decline in water resources, and in the condition of water-dependent ecosystems, while maximizing the water available in a sustainable manner. While the Plan goes some way to manage issues currently facing water resources in the Barossa, further scientific and economic investigations will help inform longer-term management options being considered to improve the long-term sustainability of water resources.

The flexible and adaptable management approach employed in this Plan follows a clear and robust approach to managing the native water resources of the Barossa Prescribed Water Resources Area (PWRA) and is underpinned by monitoring data to provide confidence in the process and transparency for licence holders. The adaptive management framework employs a tiered approach, managing the level of risk to supply equity between all users (including the environment). This is based on a series of flow metrics (for surface water) and trigger levels (for both surface water and groundwater) that will be used to provide recommendations to the Minister regarding necessary variations to the volume of water available to be allocated. Each of the components used in the development of this framework is covered in more detail within the Plan (principally section 6.5) but is summarised below in Table 1.1. taken directly from the Plan. It is important to note that the Minister has discretion over this framework and could vary the framework or employ other processes should it be deemed necessary.

The water monitoring data collected across the Barossa PWRA will be collated and assessed between December and February each year. Based on the assessment, a management response will be recommended to the Minister, following the framework in Table 1.1. Under the framework, the volume of water allocated can be varied by changing the value of a water access entitlement share (further detail is provided in section 6.3. of the Plan).

Tables explained

- 11 High level summary of the adaptive management framework for the prescribed surface water, watercourse water and groundwater resources of the Barossa Prescribed Water Resources Area.
- 31 Flow metrics
- 32 Flow metrics passed for surface water zones during 2020 - 2022
- 6.2 Resource Condition Triggers and Resource Condition Limits for the Upper Aquifer Central Consumptive Pool
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Green, red and yellow shading in Table 1.1 explained on next page. It reflects meeting the assessment criteria and likely impacts on annual allocations.

Table 1.1 High level summary of the adaptive management framework to be implemented at the consumptive pool scale for the prescribed surface water, watercourse water and groundwater resources of the Barossa PWRA

Resource	Applicable trigger	Management response
Surface water and watercourse tier 1	All flow metrics being met	When all flow targets (18 out of 18) are being met within a consumptive pool, it is considered that the risk to equity of supply between users and environmental risk is low, therefore surface water and watercourse allocations will be equivalent to 100% of entitlement value.
	No permanent pool or intermittency triggers reached	- Flow targets are based on the flow observed in the Barossa PWRA over the period 1997 to 2016 (see section 3 of the Plan for details). This will likely require several above average rainfall/flow years in succession to reach this point.

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Table 1.1

Shading explained: **Green** = all required triggers have passed and allocations remain at 100%. **Yellow** = some triggers have not passed and some adaptive management actions are likely. **Red** = further triggers have been breached and additional adaptive management actions are recommended.

Resource	Applicable trigger	Management response
Surface water and watercourse tier 2	Between 8 and 17 flow metrics being met No permanent pool or intermittency triggers reached	- When between 8 and 17 of the 18 flow targets are being met within a consumptive pool, surface water and watercourse allocations will be equivalent to 75% of entitlement value. - The reduction in allocation rate is reflective of the reduction in the average volume of water available across the Barossa PWRA since entitlements were issued (see section 2 of the Plan for details). That is, since entitlements were issued, there is 25% less surface water available on average, therefore under average conditions all water users share this reduction. It is likely that this is the tier the Plan will operate under for most years (i.e., under average conditions).
Surface water and watercourse tier 3	Less than eight flow metrics being met OR Any permanent pool or intermittency triggers reached	- When less than eight of the flow targets are being met or any of the other surface water thresholds are triggered within a consumptive pool (see section 3 of the Plan), surface water and watercourse allocations will be reduced in line with recent water availability conditions. - Reductions will be based on the average reduction in available water over the preceding three years relative to when entitlements were issued. - Allocation rates will be assessed each year and updated based on the number of metrics passing and the inclusion of the most recent full year of flow data.
Groundwater tier 1	Aquifer water/pressure levels show suitable winter recovery	Should no groundwater pressure or level triggers within a consumptive pool have been breached (see section 2 for more details), allocations will be equivalent to 100% of entitlement value.
Groundwater tier 2	Aquifer water/pressure levels do not show suitable winter recovery in a single year	When water/pressure levels in the aquifers do not show sufficient winter recovery in a given year within a consumptive pool, notice will be provided to the relevant licence holders to inform them of the initial breach of the trigger level, though no reductions will be made.
Groundwater tier 3	Aquifer water/pressure levels do not show suitable winter recovery across subsequent years	- If water/pressure levels in the aquifers do not show sufficient recovery in a second year, the volume of water available for allocation will be reduced. The rate of reduction will be based proportionally to a value that results in the total volume of allocations issued for the Consumptive Pool not exceeding the resource extraction limit (see section 6.5 and Table 2.4 in the Plan). - Should subsequent years show sufficient winter recovery in water/pressure levels such that triggers are no longer breached, allocations will return to 100% of entitlement value.

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Surface/watercourse water adaptive management

To assess the environmental water requirements (EWRs) for the surface water-dependent ecosystems (WDEs), flow metrics were developed to quantify the different parts of the flow regime that are ecologically relevant. The six metrics used in this Plan (see Table 3.1. below) were developed specifically for the Barossa PWRA. The relevant bounds for these flow metrics were then defined using a baseline period of 1997 to 2016 as this was identified as a period where the WDEs of the Barossa PWRA were considered to be in a stable state. Each year there are six metrics assessed per consumptive pool zone. Given that the WDEs of the Barossa PWRA are adapted to a variable climate, assessing the metrics over a three-year rolling period provides a more ecologically relevant insight into the condition of the flow regime, and the likely impacts to the WDEs. Thereby a total of 18 metrics (6 metrics over the rolling 3-year period) are assessed for each of the consumptive pool zones.

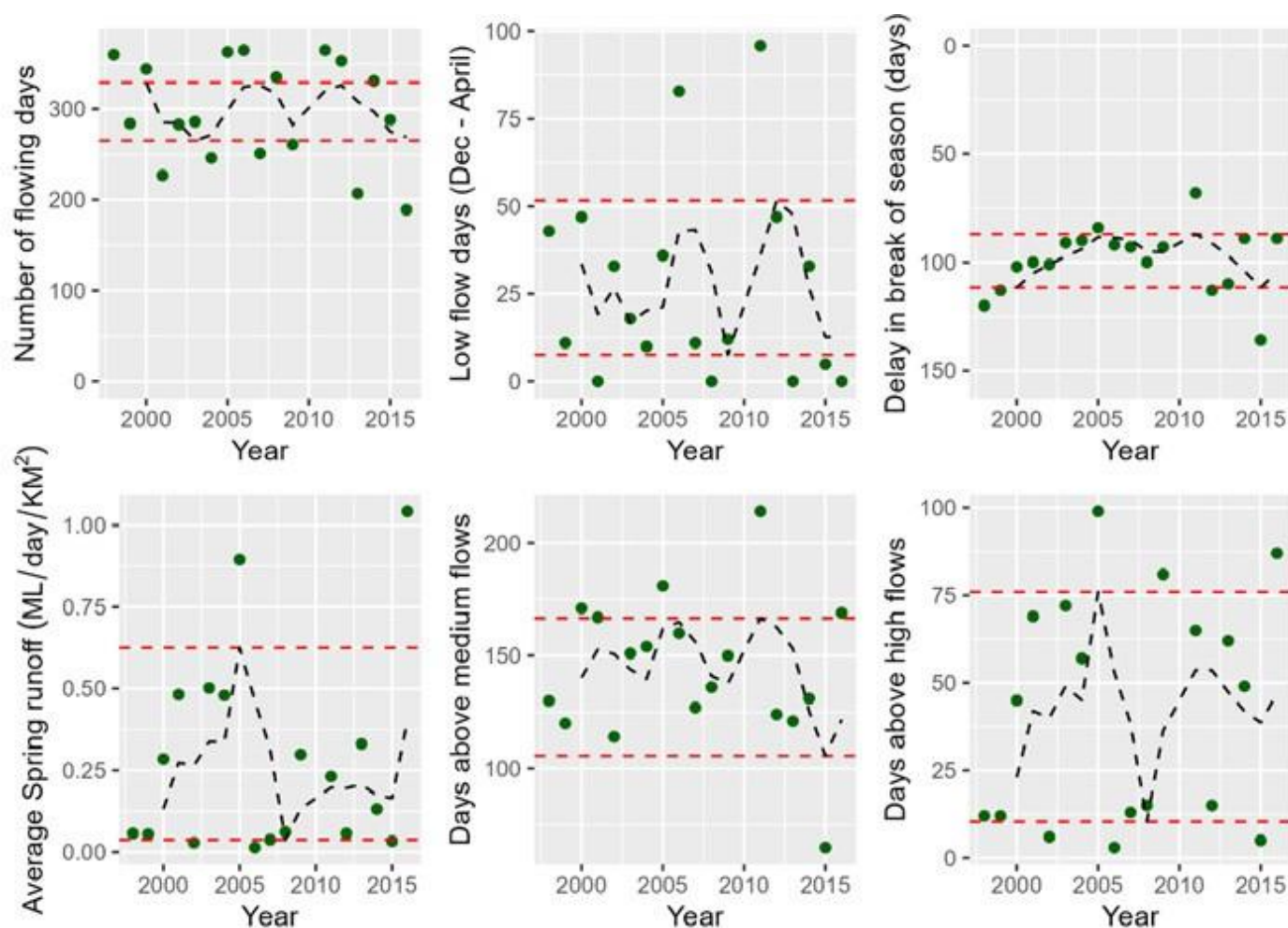
Table 3.1 Description of the key flow metrics used to determine the environmental water requirements of the Barossa PWRA

Flow regime area	Flow metric	Ecological functions
Intermittency	Number of flowing days per year	• Considered the master variable for intermittent rivers • Longer cease to flow periods leads to deteriorating water quality in refuge habitat • Length of flow period dictates habitat availability and expected lifecycle completion
Low flows over the low flow season (Dec – April)	Number of days above the low flow threshold over the low flow season per year	• Flushing of permanent pools • Maintenance of habitat • Watering of in channel riparian vegetation over low flow season • Opportunities for dispersal
Break of season	Number of days past 1 April that the watercourse commenced substantive flow	• Cues for migration and breeding • Increased stress on refuge habitats • Likelihood of lifecycle completion
Spring flows	Mean daily runoff (ML/day/KM2) for August – November (inclusive)	• Promotes resilience leading into the low flow/cease to flow period • Promotes fish recruitment success • Migration of obligate aquatic fauna • Discourages exotic fish species
Medium flows	Number of days above the median flow (50th percentile) per year	• Promotes large-scale fish migration • Discourages exotic fish species • Expand riffle habitat for macroinvertebrate species • Inundate vegetation on benches and lower banks • Control terrestrial vegetation in channel
High flows	Number of days above the high flow threshold (80th percentile) per year	• Inundate vegetation higher on banks • Habitat maintenance including silt removal and algae scouring • Entrain organic material from banks • Plant propagule transport • Management of reed beds

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Figure 3.1 Visualisation of an example of the application of upper and lower EWR bounds for each flow metric

In Figure 3.1 below, the **green dots** represent the value for the metric recorded for each year. The black dashed line represents the three-year moving average (average of the current year and the preceding two years). The **red lines** represent the EWR bounds for the moving average (i.e. the target range to maintain environmental condition).



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As shown in Table 3.2, over the period 2020 - 2022, the maximum number of EWRs met was 15 out of 18 in Lyndoch Creek, while the lowest was one out of 18 metrics at both Upper and Lower Jacob Creek.

The number of metrics passed was compared to the thresholds identified in Green and Savadamuthu (2024b). The shading on the total column reflects whether the consumptive pool condition is above or below the threshold (eight or more metrics passing in the three-year window). Red indicates below minimum acceptable

condition. Yellow means zone is meeting minimum acceptable condition. This evidence suggests that the resource capacity based on the current level and nature of water resource development is variable and may be insufficient to meet EWRs in all consumptive pools in every rolling three-year period. It is acknowledged that the dry conditions experienced in the Barossa PWRA over the 2018 - 2020 period have impacted on the environment and that the current flow conditions are insufficient to meet the surface water EWRs (see section 3.4 in the Plan).

Table 3.2: Summary of the number of EWR metrics passed over the period 2020 – 2022

Each year there are six metrics assessed per zone, therefore the maximum passing in any given year is six. Shading on the total column reflects meeting the ecological threshold assessment. **Red** means zone is below minimum acceptable condition, thereby Tier 3 management approach (Table 1.1) is recommended. **Yellow** means zone is meeting minimum acceptable condition, thereby Tier 2 management approach (Table 1.1) is recommended.

Data used	Zone ^	2020	2021	2022	Total
Actual	Barossa Valley Gorge	0	2	3	5
Actual	Lower Flaxman Valley	1	N/A	3	4*
Actual	Upper Flaxman Valley	5	5	4	14
Actual	Upper Tanunda Creek	2	3	6	11
Modelled	Barossa Valley Floor	2	4	6	12
Modelled	Duck Ponds Creek	2	3	4	9
Modelled	Lower Angaston Creek	1	1	5	7
Modelled	Lower Jacob Creek	0	0	1	1
Modelled	Lower Tanunda Creek	1	1	5	7
Modelled	Lyndoch Creek	5	5	5	15
Modelled	Mid Flaxman Valley	2	3	4	9
Modelled	Stone Chimney Creek	1	2	5	8
Modelled	Transition Zone	2	4	6	12
Modelled	Upper Angaston Creek	1	1	5	7
Modelled	Upper Jacob Creek	0	0	1	1
Modelled	Greenock Creek	3	4	5	12
Modelled	Saltwater Creek	2	5	6	13

* Flow data for 2021 from the Penrice flow station (Lower Flaxman Valley zone) has missing data and therefore metrics were not accessed at this site for this year, so this assessment is out of a possible 12 metrics passing. ^ Stockwell Creek zone is not included in the metric assessment due to the limited surface water features and its disconnection with the catchments of the other zones.

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Groundwater adaptive management

Groundwater allocations in many of the consumptive pools far exceed the current extraction regime or the average extraction rate over the period 2006-2015, i.e. groundwater use is generally significantly less than allocated volumes. As such, only in areas where the resource has been identified as being at risk of unacceptable impacts (the Upper Aquifer Central and Lower Aquifer Consumptive Pools) an adaptive management approach will be implemented.

This approach will trigger an adaptive response including initial notification followed by reduced allocation in subsequent years in the event that the combination of climate and extraction level occurs that would likely result in unacceptable impacts to the resource.

The Resource Condition Limits and Triggers for the Upper Aquifer Central and Lower Aquifer Consumptive Pools are described in detail in section 6.5 of the Plan. Should these triggers be breached, the Minister may seek to reduce allocations commensurate with established Resource Extraction Limits (see Table 2.4 in the Plan).

An adaptive trigger management approach results in flexibility of water use by the licensee, by enabling extraction of water at a higher rate when the resource is deemed to be in good condition. However, it also acknowledges that sustained extraction of the water resource at the 'maximum volume of water able to be allocated annually' is likely to result in adverse impacts to the resource and therefore requires a restriction to the volume of water that can be taken (allocation). The resource is likely to be able to sustain short-term increased extraction occasionally – as long as a management approach has the ability to restrict extraction should the increased extraction pose a risk to the resource.

Resource Condition Indicators (RCI) are typical parameters which can be directly monitored such as groundwater level and pressure.

Resource Condition Limits (RCL) are quantifiable limits for these RCIs that represent a state beyond which the impact on the physical condition of the resource becomes unacceptable. RCLs are therefore defined for the different RCIs. For example, a groundwater pressure RCL may be a defined groundwater

pressure which, if it falls below, would likely result in negative impacts to the confining layer of the aquifer.

To minimise the risk that the licensed extraction of water from a consumptive pool will result in the RCL to be breached, **Resource Condition Triggers** (RCT) need to be developed. A RCT acts as an early warning system that the RCL is at risk of being breached and provides guidance on a management response that minimises the risk of this occurring.

The Plan suggests that the groundwater management response is a staged process and, while the Minister maintains discretion regarding the volume of water which can be allocated from the relevant consumptive pool, the following adaptive approach is provided for consideration:

1. The first water-use year that the end of winter groundwater level/pressure does not rise above the RCT level for the wells specified in Tables 6.2/6.3, the triggered condition is breached and a notice will be issued to all licensees within the relevant consumptive pool advising that future allocations may be reduced.
2. If the end of winter groundwater level/pressure recovery in the second water-use year remains below the trigger level for the wells, to minimise the risk of breaching the resource condition limit, restrictions to the volume of water that can be taken may be announced for the relevant consumptive pool, commencing 1 July of the next (third) water-use year.
3. If restrictions have been announced, in the third water use-year, the value of the entitlement shares may not be determined at the rate of 1 share = 1 kL and may instead be reduced proportionally to a value that results in the total volume of allocations issued for the relevant consumptive pool not exceeding the resource extraction limit for the consumptive pool as defined in Table 2.4.
4. Whilst the end of winter groundwater level/pressure recovery remains below the trigger level for the wells, the value of the entitlement share will remain reduced. However, when the end of winter groundwater level/pressure recovers to above the trigger level for the wells, the value of the entitlement share will revert to 1 share = 1 kL for the following water-use year.

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Upper Aquifer Central Consumptive Pool

The Upper Aquifer Central Consumptive Pool includes the area of concentrated extraction along the North Para River where reducing extractions would likely have immediate benefit to the groundwater resource. Table 6.2 presents a watertable elevation RCL (resource condition limit) for six monitoring wells (Figure 6.1 in the Plan) with a decline in storage of 25% below the current level (i.e. unacceptable impacts are likely to be observed if water levels reach this limit, such as yield declines as well as some bores becoming dry). The RCT (resource condition trigger) is set above this limit to trigger a management action within a sufficient time for it to be successful.

Table 6.2 Resource Condition Triggers (RCT) and Resource Condition Limits (RCL) for the Upper Aquifer Central Consumptive Pool of the Barossa PWRA

Observation well	NTP 10	MOR 80	MOR 83	MOR 102	MOR 199	MOR 212
Current Water Level (mAHD)	260.7	265.5	264.9	269.0	268.0	269.3
RCT Water Level (mAHD) - 10% decline	259.5	263.3	262.4	266.16	265.4	266.9
RCL Water Level (mAHD) - 25% decline	257.7	260.1	258.7	261.9	261.4	263.3
Base of aquifer	248.7	243.82	240.1	240.6	241.7	245.3

Red or green shading in Table 6.2 above reflects meeting the RCT/RCL assessment. **Red** means level is **below** the RCT/RCL. **Green** means level is **above** the RCT. If annual monitoring shows that the level of **two or more of the wells** has breached the RCT, the Tier 2 management approach (Table 1.1) is recommended. If the following year of annual monitoring shows this breach has continued, the Tier 3 management approach (Table 1.1) is recommended.

Lower Aquifer Central Consumptive Pool

A pressure level RCI (resource condition indicator) related to depressurisation is recommended for the central part of the valley where extractions are concentrated and where the confining bed is deep and the risk from depressurisation is highest. Given the consistency of the pressure level variations across approximately 50 years of monitoring data any change in this variation should be considered statistically significant and warrant a management response.

Table 6.3 presents a groundwater pressure elevation RCL (resource condition limit) for three monitoring wells (Figure 6.2 in the Plan) of 5 m above the confining layer (i.e. unacceptable impacts are likely to be observed if water levels reach this limit, such as depressurisation of the aquifer). The RCL is set 5 m above the confining layer rather than at the height of the confining layer itself to account for a sufficient margin for error and any local variations in the location of the confining layer. The RCT (resource condition trigger) is set 4 m above this RCL (at 9m) to trigger a management action within a sufficient time for it to be successful.

Following winter recovery, if groundwater pressure levels do not rise above the RCT for any of the three monitoring wells (as has occurred for MOR 202 in Table 6.3), then a management response is recommended to be initiated for the entire consumptive pool.

Table 6.3 Resource Condition Triggers (RCT) and Resource Condition Limits (RCL) for the Lower Aquifer Consumptive Pool of the Barossa PWRA

Observation well	MOR 92	MOR 202	MOR 205
Current Groundwater Pressure Level (mAHD)	260.74	246.6	264.2
RCT Groundwater Pressure Level (mAHD) - 9m above confining layer	244.4	250.8	245.4
RCL Groundwater Pressure Level (mAHD) - 5m above confining layer	240.4	246.8	241.4
Top of confining layer	235.4	241.8	236.4

Red or green shading in Table 6.3 above reflects meeting the RCT/RCL assessment. **Red** means level is **below** the RCT/RCL. **Green** means level is **above** the RCT. If annual monitoring shows that the level of **any of the wells** has breached the RCT, the Tier 2 management approach (Table 1.1) is recommended. If the following year of annual monitoring shows this breach has continued, the Tier 3 management approach (Table 1.1) is recommended.