Transition Period Water Take Report 2016–17

Report on Cap compliance and transitional SDL accounting

June 2018
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Foreword

Sustainable diversions limits (SDLs) are key elements of the Basin Plan. SDLs provide a new balance between consumptive and environmental water uses in the Basin. They come into effect in 2019 through the accreditation of water resource plans for the 110 surface water and groundwater SDL resource units across the Basin.

Critical to implementing and enforcing the SDLs is a system of accounts that keep track of how much water is taken each year from the rivers, valleys and groundwater systems of the Basin. The Commonwealth Water Act 2007 and the Basin Plan 2012 put in place the requirements for such a system of accounts. In essence, the accounts that will be enforceable from 2019 compare the amount of water taken each year in each SDL resource unit with the limits for the year that have been determined under the relevant accredited water resource plan.

This report presents a set of transitional accounts for water use in every SDL resource unit across the Basin during the 2016–17 water year. The accounts represent the fifth year of reporting in the seven year transition (2012–13 to 2018–19) from Cap-based to SDL-based water use accounting and compliance.

The importance of strong water use accounting and compliance to water entitlement holders and communities has been clearly demonstrated over the past 18 months. This includes Parliamentary discussion on recent amendments to the Basin Plan the Matthews Review (2017) and the Murray-Darling Basin Water Compliance Review (2017) revealing just how seriously this issue is taken and how important it is to have credible and transparent water accounting and compliance arrangements in place and enforced.

One of the consequences of the recent discussions about water take compliance was that on 14 February 2018, the Senate voted to disallow amendments to the Basin Plan that gave effect to the Northern Basin Review, groundwater reviews and technical improvements to the Plan. It is not commonly understood that some of the technical improvements incorporated in those amendments related to how SDL accounting and compliance could be improved and streamlined.

Had those amendments been allowed to stand at the time, the MDBA (Murray–Darling Basin Authority) would have prepared the transitional SDL accounts for 2016–17 in a way that demonstrated the associated changes to groundwater compliance arrangements and to the treatment of incomplete water recovery. This would have been consistent with the approach being taken by the Authority to use this transition period as a ‘proof of concept’ for the rules that will be in place from 1 July 2019.

However, as these amendments were not in place at the time of writing, though expected to be within weeks, the Authority has instructed the MDBA to prepare the 2016–17 transitional accounts in accordance with the Basin Plan and associated water take and compliance rules as they stood at 30 June 2017.

The resulting accounts set out in this report make an important contribution to building community trust in our capacity to implement a water use compliance regime from 1 July 2019 in accordance with the rules set out in the Water Act and the Basin Plan. The
accounts are a timely demonstration of how the MDBA and Basin states are working together in preparation for full compliance from 2019.

The accounts show that use of surface water and groundwater in all SDL resource units was within the limits that would have applied given the progress with water recovery. They also show that a New South Wales groundwater issue identified in the Transition Period Water Take Report 2012–13 to 2016–17 has resolved itself as had been forecast in that report. Of course, as with the 2012–13 to 2015–16 report, there are no actual SDL compliance consequences during the transition period.

With respect to the percentage of water use that is metered across the Basin, the Transition Period Water Take Report 2012-13 to 2015-16 set the benchmark for future improvements. While the 2016–17 report reflects little change in the proportion of water use that is metered, I am encouraged by such initiatives as the consultation in New South Wales on the introduction of new minimum requirements for monitoring floodplain harvesting and options for improving measurement and metering more broadly. If implemented, the floodplain harvesting minimum requirements and an effective ‘no meter, no pump’ policy will bring a significant improvement to the reporting of water use.

The report also provides an assessment of current state compliance with the Murray–Darling Basin Cap on surface water diversions. This assessment expands on the Cap Register maintained and published separately by the MDBA.

In considering the cumulative balance method that underpins both the Cap and SDL water take accounting regimes, readers may be interested in the analysis of the cumulative Cap credits that is provided in this report. The MDBA expects that the factors discussed in this analysis will be less pronounced post 2019 as the methods used to determine how much water is permitted to be taken each year under the Basin Plan will reflect current levels of development rather than those that existed in 1993–94, which is the reference level of development for Cap.

Finally, the report adds another year of comprehensive account data on all the held environmental water that was available and used throughout the Basin.

I would like to thank each of the Basin states and the Commonwealth Environmental Water Holder for their contribution to this important work which continues to build our preparedness for SDL water take accounting and compliance as it will stand from 1 July 2019.

The Hon Neil Andrew AO
Chair
Executive summary

This report summarises water take from the Murray–Darling Basin (the Basin) for the 2016–17 water year, as reported by the Basin states1 under two regimes: the existing Cap on water diversions and the sustainable diversion limit (SDL) regime established under the Water Act 2007 (Cth) (Water Act) and the Basin Plan 2012 (Basin Plan).2 It also reports on environmental water held and used for that period.

The report sets out the Murray–Darling Basin Authority’s (MDBA) assessment of Basin state compliance with the Murray–Darling Basin Cap on diversions for the 2016–17 water year. The assessment has been conducted in accordance with the requirements of Schedule E to the Murray–Darling Basin Agreement. In this regard, this report provides the assessment of state compliance with the Cap on diversions previously published by the MDBA in the water audit monitoring (WAM) reports.

The report also sets out the 2016–17 results of an ongoing trial of water accounting and compliance arrangements — including with respect to the reporting of environmental water — that will be in place from 1 July 2019 under the Basin Plan. The trial SDL accounts presented in this report have been prepared consistent with the compliance arrangements set out in the Basin Plan as at 30 June 2017.

The trial has no compliance status as the SDLs on which the trial is based are not enforceable until 1 July 2019. The commencement of the SDLs is subject to the accreditation of Basin state water resource plans.

While the trial SDL accounts have no compliance status, their publication is an important action in providing transparency about how SDL compliance will operate. This is consistent with the commitments the MDBA has made in response to the Murray–Darling Basin Water Compliance Review (2017) and the Basin Plan Evaluation (2017) to improve public communication of SDL compliance and accounting arrangements. Both reports are available from the MDBA website at www.mdba.gov.au.

Water is a limited resource in the Basin. There are many demands on the available water coming from agriculture, industry, towns, individuals and the environment. Robust and transparent water accounting and compliance is essential to ensure:

- the volume of water actually taken from the Basin does not exceed the volume of water permitted to be taken
- water is used in accordance with the relevant rules
- rights to water are protected
- investment certainty for irrigated agriculture
- outcomes from environmental water recovery investments are realised

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1 The term ‘Basin states’ refers to Queensland, New South Wales, the Australian Capital Territory, Victoria, and South Australia.
2 Refers to the version of the Basin Plan that was in force as at 30 June 2017.
the water needs of water dependent ecosystems can be met.

Surface water accounting and compliance has been applied at a Basin-wide scale since 1995.

In 1995, the Murray–Darling Basin Ministerial Council introduced the Murray–Darling Basin Cap on diversions (the Cap) to protect and enhance the riverine environment and protect the rights of water users. The Cap introduced long-term limits on how much surface water could be taken from rivers in 24 designated river valleys (Cap valleys).

The Cap accounting relates to surface water diversions from the main stem of watercourses (regulated and un-regulated rivers and streams). In most cases, the long-term Cap limit for each valley is determined in reference to the 1993–94 level of development in that valley. That is, the diversions through the water infrastructure and rules in place at that time.

The Cap requires Basin states to limit the volume of surface water diverted from Cap valleys so that the relevant long-term Cap limit is not exceeded. States must report annually to the MDBA on the volumes of water that were permitted to be taken under annual Cap targets and the volumes that were actually taken. The annual accounts of use against the Cap limits are formally recorded in a Cap Register which is maintained and published by the MDBA.

The Basin Plan set SDLs in accordance with the Water Act. SDLs represent the maximum long-term average annual volumes of water that can be taken for consumptive use on a sustainable basis from Basin water resources.

To achieve the surface water SDLs, the Basin Plan requires that the baseline diversion limit (BDL) is reduced by a long-term average annual volume of 2,750 GL/y.\textsuperscript{3} In contrast, the overall groundwater SDL is set higher than the BDL as there are some under-utilised groundwater systems where take may be increased sustainably and made available for future use.\textsuperscript{4} Only two groundwater SDL resource units are subject to a reduction from BDL to SDL.

The Australian Government has committed to achieve the surface water and groundwater reductions through investment in water recovery. This recovery, known as ‘bridging the gap’, is being prioritised through investment in irrigation infrastructure projects rather than direct purchase of entitlements from willing sellers.

Importantly, the arrangements for SDL water accounting and compliance under the Water Act and Basin Plan, expand Cap accounting to cover all forms of water take defined in the Basin Plan. That is, for surface water, water take: from watercourses and regulated rivers, by runoff dams, by floodplain harvesting, by commercial plantations (net take) and under basic rights. The SDL water accounting and compliance arrangements, also include all groundwater use in the Basin which was not included under the Cap.

\textsuperscript{3} The accounts in this report apply the SDLs as they stood on 30 June 2017. Amendments to the Basin Plan to give effect to the Northern Basin Review, groundwater reviews and technical improvements and to give effect to the SDL adjustment mechanism are not reflected in this report.

\textsuperscript{4} The methods on how groundwater SDLs were set can be found in report: \textit{The proposed Groundwater Baseline and Sustainable Diversion Limits: Methods report}
The making of the Basin Plan has set in train a seven-year process of transition (2012–13 to 2018–19) from Cap-based to SDL-based water accounting and compliance in the Basin. While some of the reporting components of SDL water accounting and compliance commenced in 2012, the Cap remains the only Basin-wide water take compliance regime that is in force.

SDL water accounting and compliance under the Water Act and Basin Plan puts in place clear limits and establishes a foundation for enforcement to ensure that over the long term, annual actual take of Basin water resources for consumptive use does not exceed the SDLs. The Basin Plan specifies 29 surface water SDLs and 81 groundwater SDLs throughout the Basin. The resources covered by each SDL is known as an SDL resource unit.

The MDBA and Basin states are using the transition period to trial the types of water reporting, accounting and compliance methods and processes that will need to be in place from 1 July 2019 to ensure the arrangements will be fit for purpose on commencement. The trial is necessary because the scope of the change from Cap to SDL is substantial and the new approach is best ‘bedded down’ through a trial ahead of it applying formally.

Because the trial is presenting transitional SDL accounts based on the volume of change from the BDL toward the SDL in a given year, the report uses the term ‘transitional diversion limits’ (TDLs) against which water take is assessed rather than against SDLs. The TDLs generally represent progress on bridging the gap as at the start of each water year (1 July). TDLs are being used because in most cases the water recovery required under the Basin Plan was not complete for the reporting year in question so the SDL cannot be used under the trial.

To illustrate the concept further, if water recovery in an SDL resource unit was complete or was not required, the TDL would equal the SDL. If water recovery had yet to commence, the TDL would equal the BDL. The BDL generally represents 2009 levels of use and was adopted as the baseline for the Basin Plan (specified in Schedules 3 and 4 of the Basin Plan).

The introduction to this report sets out the approach taken, a description of key concepts under both the Cap and the SDL water accounting and compliance regimes, and the objectives of the trial. Appendix 1: Cap Register to 30 June 2017 provides the full reconciliation of diversions under the Cap since 1997–98. The key data used for the trial assessment of water take at SDL resource unit level is included at Appendix 2: Surface water SDL trial water take accounts (surface water) and Appendix 3: Groundwater SDL trial water take accounts (groundwater).
Summary findings

*Cap compliance (refer to Part 2)*

1. All Cap valleys were compliant in 2016–17.

2. Cap compliance is assessed at the valley level. However it is worth noting that at the Basin state scale, all states have maintained cumulative Cap credits.

3. An independent audit into Cap implementation in the Queensland Moonie Cap valley, which was triggered by exceedances of the annual Cap target in 2014–15 and 2015–16, has found that a long-term exceedance of the Cap has not occurred.

4. Ten Cap valleys do not have an accredited Cap model in place. Compliance in these ten valleys is either being assessed against models that were provisionally accredited and have since lapsed or, in the case where a model has not been presented for accreditation, against existing arrangements in accordance with Schedule E of the Murray–Darling Basin Agreement.

5. The MDBA has determined that with the commencement of SDL compliance from 1 July 2019, Basin state modelling resources are best spent preparing methods for determining annual permitted take under accredited water resource plans rather than on preparing or updating Cap models.

6. An analysis of the increase in cumulative Cap credits across the Basin since 2009–10 suggests that this is largely a result of the degree of difference between Cap model reference conditions (generally set at the 1993–94 level of development) and current water sharing policies and operational rules. The effect of these differences was masked during the millennium drought but have been revealed more clearly through several wet years since 2010–11. In the New South Wales / Victorian Murray, two thirds of the cumulative Cap credits have spilled from storage.

**Trial of SDL water accounting and compliance (refer to Part 3)**

*Surface water*

7. In 2016–17, no surface water SDL resource unit recorded a cumulative balance that was greater than the trigger threshold of –20% or more of the relevant transitional diversion limit.

8. Across the Basin in 2016–17, 68% of annual actual consumptive take from all forms of surface water take was metered. For watercourses and regulated rivers, 92% of Basin-scale annual actual take was metered. The reported data does not indicate the type or standard of metering. Reducing the proportion of unmetered take is an area where further improvements in these accounts can be made, recognising the need for cost effectiveness considerations in relation to certain forms of take (e.g., runoff dams).

9. The *Murray–Darling Basin Water Compliance Review (2017)* has recommended that 95% of meterable take in each water resource area is metered using AS4747 compliant meters by 31 December 2022. The Compliance Review has also made a number of recommendations for governments to consider that seek to improve the
standard, consistency and enforcement of water metering and improving the measurement of ‘hard to meter’ water use (e.g. floodplain harvesting).

10. Consistent with the period 2012–13 to 2015–16, 2016–17 saw the levels of metering vary between the northern and southern Basin: between 29% and 53% of all forms of surface water take was metered in the northern Basin, while between 77% and 84% was metered in the southern Basin. Despite this difference in proportion of metered take, the volume of unmetered water take is roughly similar in the northern and southern Basin due to the larger volumes used in the southern Basin.

11. Where actual take is not measured, it is reported using long-term average estimates. In almost all cases, the estimates are those set out in Schedule 3 of the Basin Plan or Water resource assessments for without-development and baseline conditions (MDBA 2011). These estimates give no expression to observed annual weather conditions or water availability for the year in question. This issue is discussed at section 5.2.3. Basin-wide in 2016–17, approximately 26% of combined total actual take was reported using these long-term estimates.

12. In 2016–17, 15,277 GL of water was lawfully accessible for take (allocation or equivalent plus net carryover from 2015–16). Of this volume, net carryover of consumptive allocation from 2015–16 was 2,102 GL. 10,675 GL (or 70% of the lawfully accessible total) was actually taken.

Groundwater

13. In 2016–17, 3,241 GL of groundwater was lawfully accessible for take. Combined total actual take from groundwater across the Basin was 1,198 GL (37% of the lawfully accessible volume).

   The proportion of total annual actual take from groundwater, excluding take under basic rights that was reported as metered was 84% across the Basin.

14. In 2016–17, all groundwater SDL resource units recorded a cumulative balance that was within the trigger threshold of −20% or more of the relevant transitional diversion limit.

   In 2014–15 and 2015–16, the New South Wales Lower Gwydir Alluvium SDL resource unit recorded a cumulative balance that was in debit by more than 20% of the relevant transitional diversion limit. As forecast in the Transition Period Water Take Report 2012–13 to 2015–16, this SDL resource unit has reported a cumulative balance for 2016–17 that brings the unit back within the –20% threshold.

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5 The total volume of water lawfully accessible for take is an estimate based on best available information. It includes: allocations announced against entitlements in regulated systems, volumes that could have been accessed under the rules for entitlements in unregulated systems and estimates of some volumes such as take under basic rights. In some states there is no volumetric limit on take under basic rights and hence an estimate is being used. See Section 6.
Reporting and accounting methods

15. As reported in the Transition Period Water Take Report 2012–13 to 2015–16, improvements have been made to the methods used under Cap to adjust annual permitted take to account for environmental water recovery. These are an important step toward better protection of the long-term value of recovered entitlements.

Further improvements are possible but are unlikely during the transition period. Basin state resources are properly being prioritised toward developing the arrangements for accounting for held environmental water that will be required from 2019.

16. The processes used by Basin states to collect and report water take data and those used by the MDBA to receive and assess that data are predominantly manual, labour intensive, time consuming, and prone to human error. This contributes to the ongoing challenge that Basin states face in providing annual reporting data within the statutory time frames, which in turn delays the timely assessment of that reporting data.

During 2016–17, the MDBA continued with its project to develop an automated SDL accounting platform that will be used to process the water take data provided by Basin states and the Commonwealth Environmental Water Office.

Trial reporting of environmental water availability and use (refer to Part 4)

17. Under section 32 of the Water Act, the MDBA must identify and account for held environmental water in the Murray–Darling Basin each year.

Surface water

18. At a Basin scale, the total volume of available held environmental surface water increased from 1,892 GL/y (in long-term average volume terms) as at 30 June 2012 to 2,870 GL/y as at 30 June 2017.

This volume includes both held environmental water recovered before 30 June 2009 as well as held environmental water that contributes to bridging the gap between the BDL and the SDL.

19. The volume of available held environmental surface water that contributes to bridging the gap and to determining the TDLs increased by 692 GL/y (in long-term average volume terms) between 1 July 2012 (1,099 GL/y) and 1 July 2016 (1,791 GL/y).6

20. With the exception of the Warrego-Paroo-Nebine Water Resource Plan Area, the long-term diversion limit equivalence (LTDLE) factors being used to estimate the long-term average volumes of surface water recovered to bridge the gap as at 30 June 2017 are those adopted by the Murray–Darling Basin Ministerial Council in November 2011. In the Warrego-Paroo-Nebine, factors derived from the water resource plan accredited on 15 June 2017 are used.

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6 The surface water transitional diversion limit in a particular year is determined by subtracting held environmental water that contributes to bridging the gap available at 1 July of that year from the relevant BDL. Noting that for the NSW intersecting Streams, TDL is being set at the SDL until issues with the long-term volume of water entitlements recovered in this resource unit are resolved.
The November 2011 factors were derived from a number of sources and further work is required to ensure a consistent set of factors is used across the Basin. Accordingly, it is anticipated that some of the estimates of the long-term diversion limit equivalence of held environmental water will change based on the assumptions used by Basin states to prepare water resource plans for accreditation.

21. Annual environmental surface water lawfully accessible for use in 2016–17 (allocation plus carryover) was 3,115 GL. The volume of held environmental surface water used was 2,198 GL (71% of the lawfully accessible volume).

22. 635 GL of held environmental water allocation was carried over from 2015–16. 887 GL of held environmental water allocation was carried over into 2017–18.

Groundwater

23. The total volume of held environmental groundwater (bridging the gap and supplementary licences) increased from 8.7 GL/y as at 30 June 2016 to 9.3 GL/y (long term average volume) at 30 June 2017.

24. Bridging the gap is only required in two groundwater SDL resource units: the Queensland Upper Condamine Alluvium (Central Condamine Alluvium) and Upper Condamine Alluvium (Tributaries). The total target recovery volume is 40.4 GL/y (long term average volume) by 30 June 2019.

    The total volume of held environmental groundwater that contributes to bridging the gap was 2.71 GL/y (long term average volume) as at 30 June 2017.\(^7\)

Recommendations

The Transition Period Water Take Report 2012–13 to 2015–16 made several recommendations to improve the integrity of SDL water accounting and compliance. In 2016–17, these recommendations remain unchanged. The recommendations are as follows:

To prepare for the commencement of SDL water accounting and compliance from 1 July 2019, the following actions should be prioritised.

1. Improving the methods for estimating volumes of annual permitted and annual actual take.
2. Increasing the proportion of actual take that is measured across the Basin to an agreed standard.
3. Improving the methods for adjusting annual permitted take to account for environmental water recovery.
4. Adoption of automated reporting tools where possible to improve the timeliness, accuracy and efficiency of reporting and assessment.

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\(^7\) The Transition Period Water Take Report 2012–13 to 2015–16 reported this volume as 2.36 GL. In this report the volume has been adjusted by the appropriate long term diversion limit equivalence (LTDLE) factor to give a long term average annual volume (see section 8.4.2 for further details).
Further to the recommendations of this report, the *Murray–Darling Basin Water Compliance Review* (2017) made a number of recommendations, among others, about improving the metering and measurement of water take. Three such recommendations are that:

- governments require 95% of meterable take in each water resource area to be metered using AS4747 compliant meters by 2022
- governments audit water take by stock and domestic and other rights holders to identify areas of stress on water resources from the exercise of these rights, and put in place measures to monitor compliance
- New South Wales and Queensland include an updated assessment of water take by floodplain harvesting in their annual water accounts commencing immediately, and require that 95% of take by non-metered floodplain harvesting is accurately measured, for example, by calibrated storage level recorders by 30 June 2022 and publish annual milestones towards this objective.

The MDBA reiterates these recommendations. The MDBA commends the commitments made by New South Wales and Queensland to improving the metering and measurement of water take under the NSW Water Reform Action Plan and the Independent audit of Queensland’s non-urban water measurement and compliance.

All Basin states are encouraged to maintain momentum in responding to the recommendations where actions have already commenced or to prioritise activity where actions are yet to begin.
Part 1: Introduction
1 Introduction

1.1 About this report

This report summarises the consumptive take of water from the Murray–Darling Basin during the 2016–17 water year, as reported by the Basin states under two regimes: the existing Cap on diversions and the arrangements for SDL accounting and compliance established under the Water Act and Basin Plan. It also reports on environmental water held, available and used in 2016–17. Table 1.1 provides a comparison of the key features of the two regimes.

The report sets out the results of an assessment by the Murray–Darling Basin Authority (MDBA) of Basin state compliance with the Murray–Darling Basin Cap on diversions.

In addition, this report summarises the results of an ongoing trial of the SDL water accounting and compliance arrangements that will be in place from 1 July 2019 under the Basin Plan. This trial has no compliance status as the SDLs on which it is based are not enforceable until 1 July 2019. The commencement of the SDLs is subject to the accreditation of Basin state water resource plans.

All methods and analysis have been undertaken consistent with the requirements of Schedule E to the Murray–Darling Basin Agreement and/or the Basin Plan (as it stood on 30 June 2017). To avoid doubt, the amendments proposed to the Basin Plan in response to the Northern Basin Review, groundwater reviews and to give effect to the operation of the SDL adjustment mechanism are not incorporated into this report. Such amendments will be incorporated in subsequent reporting.

The purpose of this report is to:

1. Meet MDBA’s ongoing commitment to report on annual Basin state compliance with the Cap in accordance with Schedule E to the Murray–Darling Basin Agreement (Part 2).
2. Document the results of a trial assessment of the availability and take of water for consumptive use since commencement of the Basin Plan.
3. Document the trial reporting of availability and use of held environmental water and planned environmental water (Part 4).
4. Document progress made to date by the MDBA and the Basin states to put in place methods and processes to ensure monitoring and reporting of compliance with the SDL will be fit-for-purpose from 1 July 2019 (Parts 3 and 4).
5. Document the areas where further work is required to ensure SDL water accounting and compliance can be implemented as intended from 1 July 2019 (Part 5).

All views expressed in this report are solely those of the MDBA unless stated otherwise.
This report is set out under five parts:

Part 1: Introduction

Part 2: Current compliance under the Cap on diversions

Part 3: Trial assessment of annual water availability and take under the arrangements for SDL water accounting and compliance

Part 4: Environmental water availability and use

Part 5: Future work
Table 1.1: Comparison of the key features of Cap and SDL water accounting and compliance

<table>
<thead>
<tr>
<th>Key features</th>
<th>Cap on diversions</th>
<th>SDL water accounting and compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Relevant statute</td>
<td>• Schedule E to the Murray–Darling Basin Agreement 2008</td>
<td>• Water Act 2007 (Cth) and Basin Plan 2012</td>
</tr>
<tr>
<td>Commencement</td>
<td>• 1994–95</td>
<td>• 2012–13 for reporting</td>
</tr>
<tr>
<td></td>
<td>• 2012–13 for reporting</td>
<td>• 2019–20 for compliance</td>
</tr>
<tr>
<td>Areas covered</td>
<td>• 24 Cap valleys — not all Basin areas included</td>
<td>• 29 surface water SDL resource units</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• 81 groundwater SDL resource units</td>
</tr>
<tr>
<td>Long-term limit</td>
<td>• limited diversions to 1993–94 levels of development (some exceptions) for each Cap valley</td>
<td>• set at an environmentally sustainable level of take for each SDL resource unit</td>
</tr>
<tr>
<td></td>
<td>• called ‘long-term Cap limit’</td>
<td>• called ‘sustainable diversion limits’ (SDLs).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• for the trial, transitional diversion limits (TDLs) are used</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• surface water TDL is equal to baseline diversion limit (BDL) minus bridging the gap (BtG) water recovery as at 1 July each yearootnote{8}</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• for groundwater TDL is equal to BDL minus any BtG held environmental water or SDL plus NSW supplementary licences.</td>
</tr>
<tr>
<td>Annual limit</td>
<td>• consumptive take limited by ‘annual Cap target’</td>
<td>• consumptive take limited by ‘annual permitted take’</td>
</tr>
<tr>
<td>Type of water use affected</td>
<td>• surface water that is diverted from regulated rivers and watercourses</td>
<td>• all forms of surface water take (watercourses, regulated rivers, runoff dams, floodplain harvesting, commercial plantations (net take) and basic rights)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• groundwater take</td>
</tr>
<tr>
<td>Accredited models/methods</td>
<td>• State Cap models determine annual Cap target</td>
<td>• SDL models/methods to determine annual permitted take developed by Basin states consistent with Basin Plan requirements</td>
</tr>
<tr>
<td></td>
<td>• model independently reviewed</td>
<td>• assessed by MDBA as part of water resource plan (WRP) assessment</td>
</tr>
<tr>
<td></td>
<td>• model approved by MDBA</td>
<td>• WRP accredited by Commonwealth Minister for Water</td>
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<tr>
<td></td>
<td></td>
<td>• for the trial, adjusted Cap models and long-term estimates are used</td>
</tr>
<tr>
<td>Compliance approach</td>
<td>• annual diversions subtracted from annual Cap target</td>
<td>• annual actual take subtracted from annual permitted take</td>
</tr>
<tr>
<td></td>
<td>• annual debits or credits recorded in Cap Register</td>
<td>• annual debits or credits recorded in Register of Take</td>
</tr>
<tr>
<td></td>
<td>• debits/credits added each year to give cumulative balance (in most valleys)</td>
<td>• annual debits/credits added each year to give cumulative balance for all SDL resource units</td>
</tr>
<tr>
<td></td>
<td>• compliance investigation triggered if cumulative balance is a debit of 20% or more of long term Cap (in most valleys)</td>
<td>• compliance investigation triggered if cumulative balance is a debit of 20% or more of SDL and state does not have a ‘reasonable excuse’. Compliance not in effect until 2019–20 water year.</td>
</tr>
</tbody>
</table>

ootnote{8}{For the New South Wales Intersecting Streams SDL resource unit, TDL is being set at the SDL until issues with the long-term volume of water entitlements recovered in this resource unit are resolved.}
This report uses best available data as submitted by Basin states, the River Management Division of the MDBA and the Commonwealth Environmental Water Holder (for held environmental water availability and use). Appendix 1: Cap Register to 30 June 2017 (Cap), Appendix 2: Surface water SDL trial water take accounts (surface water SDL accounts) and Appendix 3: Groundwater SDL trial water take accounts (groundwater SDL accounts) have been prepared using this data and are the primary data sources for this report.
1.2 Explanation of key concepts and terminology used

The following expands on the key features from Table 1.1 to describe in more detail, the fundamental concepts under both the Cap and the arrangements for SDL water accounting and compliance. These concepts will be referred to frequently in the report.

**Specified geographical areas in which management of water resources must be undertaken in accordance with the relevant Basin-scale water accounting and compliance arrangements:**

Referred to as ‘designated river or Cap valleys’ under the Cap and as ‘water resource plan areas’ and ‘SDL resource units’ under SDL water accounting and compliance. These are the geographical areas defined under each regime that contain the water resources that are subject to the relevant arrangements.

There are 24 Cap valleys set out in Schedule E. There are a total of 110 surface water and groundwater SDL resource units across the Basin contained within 36 water resource plan areas. Maps of the surface water and groundwater SDL resource units are provided at Appendix 8: Surface water SDL resource units.
Appendix 8: Surface water SDL resource units and Appendix 9: Groundwater SDL resource units.

**Long-term diversion limits:**

Referred to as the 'long-term diversion Cap' under the Cap and as the 'sustainable diversion limit' under SDL water accounting and compliance. Under Cap the long term limit is generally
set at the level of development in 1993–94. That is, the diversions that would have been
taken using the irrigation infrastructure in place at that time and the water sharing rules that
governed how water was taken.

Under SDL water accounting and compliance, the long-term limit represents the
environmentally sustainable level of consumptive take and is expressed as a long term
average annual volume of consumptive take (10,873 GL/y under the Basin Plan 2012).
Under both regimes the long term limits are the basis for determining annual volumes of
consumptive take that can be taken over a given historical climate sequence so as not to
exceed the long term limit. The historical climate sequence used for the Cap is generally the
climatic conditions experienced over the period 1891 to 1997. For SDLs, the period 1895 to
2009 is used (known as the Basin Plan ‘historical climate conditions’).

It is important to note that the SDL can change over time without necessarily changing the
reduction volume from the BDL to the SDL. As at 30 June 2017, the SDL is 10,813 GL/y\(^9\).
This issue is discussed at section 3.1.1.

**Permitted take:**

Referred to as the ‘annual diversion target’ or ‘annual Cap target’ under the Cap and as
‘annual permitted take’ under the SDL arrangements. Surface water permitted take is the
annual volume of water calculated according to the methods set out under either the Cap or
the relevant water resource plan (for SDLs) that was permitted to be used for consumptive
purposes in a Cap valley or SDL resource unit in a given water year. The volume is
determined after the end of the water year as it needs to take account of things like the
climate conditions of the year in question, water trade and environmental water recovery as
well as the long-term limit and water access rules.

For groundwater, permitted take equals the SDL for most water resource plan areas. For
water resource plans areas where water recovery is bridging the gap between the BDL and
SDL, the permitted take is BDL minus any bridging the gap water. For water resource plan
areas where supplementary water access licences were granted, the permitted take is the
SDL plus the supplementary Achieving Sustainable Groundwater Entitlements (ASGE)
water.

Under both regimes, the annual limit is adjusted to account for the volume of held
environmental water that was available at the start of the relevant water year. For the
purposes of Cap, this adjustment is undertaken in accordance with the methods set out at
Appendix 6: State nominated methods for annualising environmental water recovery under
the Cap on diversions. For the purposes of the transitional SDL accounts, this adjustment is
undertaken in accordance with the methods set out at Appendix 7: Environmental water
adjustment under the trial of SDL water accounting and compliance.

This adjustment ensures that the annual Cap target or the annual permitted take is only
determined with reference to the pool of available consumptive entitlements. The MDBA
expects that the methods for determining annual permitted take in accredited water resource

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\(^9\) The reduction volume changed in February 2018 through adoption by the Commonwealth Minister for Water of an instrument
to amend the Basin Plan. The instrument gives effect to the operation of the SDL adjustment mechanism.
plans will include improvements on the current approach to the adjustment for held environmental water.

It is important to understand that permitted take under these compliance regimes is not the same as the volume of water that is ‘lawfully accessible’ for take each year in each Basin state. The Cap and the SDL are limits on what can actually be taken over the long term, not on what volume can be taken in a given year under the relevant Basin state water sharing arrangements. This is discussed further in section 6.

**Actual take:**

Referred to as ‘diversions’ under the Cap and as ‘annual actual take’ under the SDL arrangements. Actual take is the annual volume of water calculated according to the methods set out under either the Cap or the SDL rules that was actually used for consumptive purposes in a Cap valley or SDL resource unit. It is also calculated after the end of the water year so that all water use in the relevant year can be accounted for.

For Cap, actual take is calculated and reported each year in accordance with the formula for each valley set out in the relevant version of the *Diversion Formula Register for the Murray–Darling Basin*. The current version of this document (version 6, June 2018) is available on the MDBA website.

For SDL accounting, actual take will be determined each year according to the method set out in accredited water resource plans (refer to Basin Plan s.10.15(1)).

**Annual balance:**

The annual balance is the difference between annual permitted take and annual actual take in a particular water year. Depending on whether it is positive or negative, it is referred to as an ‘annual credit’ or an ‘annual debit’ under both regimes. For example, if permitted take for a Cap valley or SDL resource unit was 50 GL in a particular year and actual take in that year was 45 GL, the annual balance would be a credit of 5 GL. If permitted take was 45 GL and actual take was 50 GL the annual balance would be a debit of –5 GL.

**Cumulative balance:**

Referred to as ‘cumulative Cap credits’ or ‘debts’ under the Cap and as the ‘cumulative balance’ under the SDL arrangements. The cumulative balance is the sum of each year’s annual balance over time. For example, if the annual balances for a Cap valley or SDL resource unit over a four year period were 5 GL, 5 GL, –5 GL and 5 GL, the cumulative balance for each year — assuming the cumulative balance commences at zero in the first year — would be 5 GL, 10 GL, 5 GL, and 10 GL. The cumulative balance is an accounting and compliance tool, it does not represent an actual volume of water that is directly available to be allocated for use in subsequent years.

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10 Some Cap valleys do not use a cumulative balance – e.g. Queensland Moonie – and Cap compliance is based on the annual credit/debit. Or, as in the case of the SA Metro-Adelaide and associated country areas Cap valley, compliance is based on a set volume over the most recent five-year period. Different compliance tests also apply for these Cap valleys.
For the Cap, the cumulative balance generally commences at zero in the 1997–98 water year (and thus 2016–17 represents the twentieth year of accounts). For the SDL, the cumulative balance will commence from the 2019–20 water year with a starting balance of zero. For the purpose of the trial Register of Take that is being maintained during the transition period, cumulative balances are calculated from 2012–13 to illustrate how this feature of the accounts will operate from 2019.

Under SDL water accounting and compliance, the cumulative balance for surface water is adjusted each year to reflect the net effect of any acquisition and disposal of held environmental water entitlements. For example, if 10 GL of environmental allocation is traded into the consumptive pool of an SDL resource unit, the cumulative balance for that unit will increase by 10 GL. Conversely, if 10 GL of consumptive allocation is traded to the environment, the cumulative balance for the resource unit that was the source of the trade will decrease by 10 GL.

The cumulative balance is central to the compliance tests under both regimes. In summary, if a Cap valley or SDL resource unit has a cumulative balance volume that is a debit of 20% or more of the long-term limit for that valley or SDL resource unit, it triggers the arrangements for determining if there has been non-compliance with the long-term limit. The different compliance tests are discussed further in Parts 2 and 3 of this report.

It is important to understand that neither the Cap nor the arrangements for SDL water accounting and compliance are designed to identify the illegal take of water by individual water entitlement holders. For example, if an entitlement holder is stealing water by disconnecting their meter when pumping from the river, that water take will not be recorded and will not appear in the data reported to the MDBA by Basin states.

Also, if an entitlement holder is taking water outside their access conditions (for example pumping from the river when a flow trigger has not yet been met) this will not show up explicitly in these accounts as only annual totals are used. It is expected that both such circumstances would be managed under compliance procedures established by the Basin state, complemented by those of the MDBA.

**Water lawfully accessible for take:**

This refers to the volume of water that can be accessed for take by entitlement or rights holders each year under state water sharing frameworks. Terminology for describing how access is granted varies across states and for different forms of take. This report adopts a definition of ‘water lawfully accessible for take’ as meaning:

*The granting of permission, either annually or on a long-term basis, to take water from a water source under a form of take in a Basin state in accordance with that state’s legal frameworks.*

Depending on the relevant Basin state arrangements, water lawfully accessible for take can include things like: the announced annual allocation volume and net carryover from the previous year, entitlements/use in unregulated systems, floodplain harvesting, use of

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11 Due to negotiations associated with establishing the Cap, some cap valleys started later (Murray–Darling Basin Council in 2007 agreed to apply Cap from 2007–08 in Queensland and the Australian Capital Territory’s Cap was agreed by the Council in May 2008).
supplementary entitlements, allowances for losses in diversions from the river to a delivery point, rights to take under riparian or basic rights arrangements, and rights to take by runoff dams and commercial plantations.

Because of the different component parts and different state arrangements, the total combined volume of water lawfully accessible for take recorded in this report is an estimate based on best available information. For example, in some states there is no volumetric limit on take under basic rights and hence long term estimates are used.

Volumes cited in the text of this report are measured in gigalitres (GL) and in most cases have been rounded to the nearest whole number. Annual volumes or volumes at a point in time will appear as 100 GL for example. Long term average volumes will appear as 100 GL/y.

Volumes cited in tables and figures are generally rounded to either one or two decimal places depending on the size of the smallest reported volume. There may be inconsistencies between some totals due to this rounding.

In submitting their data for each water year, Basin states also provided narrative reports. These reports provide the state view of the context for water availability and use for that year. Due to the transitional nature of these accounts and the processes undertaken by the MDBA and Basin states to review the reported data, the volumes in the narrative reports may be different to the final volumes reported in the transition accounts.

The narrative reports associated with the 2016–17 water year can be accessed from the MDBA web site at: https://www.mdba.gov.au/publications/mdba-reports/transitional-sdl-water-take-reports.
1.3 Trial assessment of water take under the arrangements for SDL water accounting and compliance

The trial of SDL water accounting and compliance is discussed in Part 3. The trial is a ‘proof of concept’ to establish and test the types of arrangements that will need to be in place from 1 July 2019 to manage compliance with the SDLs.

The objectives of the trial are to:

1. Develop and test the arrangements that Basin states and the Commonwealth Environmental Water Holder (CEWH) will use to prepare and submit data to the MDBA as required under section 71 and 32 of the Water Act 2007 and Matter 9 of Schedule 12 of the Basin Plan.

2. Develop and test the arrangements that the MDBA will use to receive, assess and report on the data submitted by Basin states and the CEWH. Noting that there are no compliance consequences during the trial.

3. Identify where current gaps or weaknesses in the test arrangements are and the improvements needed to enhance the overall integrity of SDL water accounting and compliance.

4. Demonstrate what SDL compliance reporting might look like in terms of how data can be assessed and presented when the rules are fully in force.

Because the trial is a proof of concept, there may be instances where the data reported and conclusions drawn from that data change between years as better information becomes available. The trial should draw out instances where generating better information can improve reporting during the trial as well as the development of the accredited arrangements that will be applied from 1 July 2019. Consistent with this approach, future transitional water take reports will, where practical to do so, update data from previous years where new or more accurate data becomes available.

1.4 Data reporting methodology

Cap reporting is well established and the data reported by Basin states is usually generated using accredited Cap models and/or the output of observed (metered) or estimated water take. However, Basin states are in the early stages of developing how to collect and report water take data under the SDL water accounting and compliance rules. The SDL water

12 Not all Cap valleys have an accredited Cap model. See section 2.5 for further details.
accounting methods that will apply under accredited water resource plans have — in all but one case — not yet been completed.\textsuperscript{13}

This means that in the trial assessment, the data reported for annual permitted and annual actual take under the SDL water accounting rules may be incomplete, based on estimates of long-term average volumes and/or the outputs of Cap models that have been adjusted as necessary to the relevant BDL. This is particularly so with data on permitted and actual take by interception activities and New South Wales basic landholder rights.\textsuperscript{14} These forms of take have historically not been routinely estimated, modelled or measured. See section 3.1.2 for more information.

MDBA considers that this an appropriate approach during the transition period as Basin states are still developing the SDL models that will be used to determine annual permitted take under accredited water resource plans. This approach represents use of the best available information.

\textsuperscript{13} The Queensland Warrego-Paroo-Nebine Water Resource Plan was accredited by the Commonwealth Minister for Water on 15 June 2017. It includes a method for determining annual permitted and annual actual take under the SDL water accounting and compliance rules.

\textsuperscript{14} Interception activities include water take by runoff dams, floodplain harvesting, and commercial plantations (net take). NSW has estimates of basic landholder rights in all water sharing plans.
1.5 Trial reporting of availability and use of environmental water

Detailed discussion of the assessment of the volumes of environmental water available, lawfully accessible and used over the period is provided at Part 4. There are five ‘headline’ held environmental water volumes dealt with in this report.

**Available held environmental water**

The total volume of entitlements as at 30 June in any year that have actually been transferred to an environmental water holder and are available to receive allocation. This volume includes three components:

1. Entitlements recovered prior to the Basin Plan or entitlements recognised as providing environmental benefits when the BDL was set.
2. Entitlements recovered after the BDL was established that are not gap-bridging because they do not form part of consumptive water.
3. Entitlements recovered to bridge the gap from BDL to SDL.

**Held environmental water that contributes to bridging the gap**

The component of available held environmental water that represents entitlements that have been recovered to bridge the gap between the BDL and the SDL. This is distinct from the volumes of held environmental water jointly reported by the MDBA and the Department of Agriculture and Water Resources as ‘progress toward bridging the gap’. Those volumes include entitlements that have been secured under a contract but have yet to be transferred to the Commonwealth Environmental Water Holder.

**Held environmental water that determines the transitional SDL (TDL)**

For surface water, the component of ‘gap bridging’ held environmental water that was available as at 1 July in each water year. This is the volume that is deducted from the relevant BDL to determine the TDL and hence annual permitted take for the relevant year of the trial.\(^{15}\) For groundwater, held environmental water used to determine the TDL includes gap bridging water at 1 July and any supplementary licence water.

**Held environmental water lawfully accessible for take**

The volume calculated after the end of the water year that could have been used in the water year as a result of all allocations, announced periods of access, net carryover available from the previous year etc.

**Held environment water actual use**

The component of held environmental water lawfully accessible that was actually used during the year in question.

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\(^{15}\) For the New South Wales Intersecting Streams SDL resource unit, TDL is being set at the SDL until issues with the long term volume of water entitlements recovered in this resource unit are resolved.
As discussed earlier, TDLs are the long-term limits being used during the trial of SDL water accounting and compliance. This approach provides for the calculation of the long-term diversion limits appropriate to the water year in question for each SDL resource unit during the trial. In turn, the TDL is then used as the basis for determining the transitional annual permitted take for each SDL resource unit.

Comprehensive reporting of annual data on the availability and use of held environmental water under the requirements of the Water Act 2007 and the Basin Plan was first provided for the 2013–14 water year. For surface water, the total long-term volume of available held environmental water had increased to 2,870 GL/y as at 30 June 2017.

This volume is generally made up of three components:

- The first is the held environmental water that has been modelled as available to the Basin under baseline conditions (that is, levels of development as at 30 June 2009) through a range of state-based and joint recovery programs (927 GL/y).

- The second is the water recovery completed up to the end of the reporting period to ‘bridge the gap’ between the BDL and the SDL (1,890 GL/y being the long term volume of entitlements that had been recovered and that was actually available to receive allocation for environmental purposes at the end of the 2016–17 water year).

- The third is the environmental water that has been recovered up to the end of the reporting period but that does not contribute to bridging the gap (53 GL/y) as it represents volumes of water that were not previously available to the consumptive pool (e.g. volumes recovered as a result of projects that reduce evaporation).

The Basin Plan sets the reduction volume from BDL to SDL and hence the environmental water recovery target at a long term average volume of 2,750 GL/y for surface water diversions. As discussed in earlier sections, this report uses the SDLs and associated compliance arrangements that were in force as at 30 June 2017.

All held environmental water volumes quoted in this report are generally the long-term average volumes estimated using factors adopted by the Murray–Darling Basin Ministerial Council in November 2011. These factors were derived from a number of sources and further work is required to ensure a consistent set of factors is used across the Basin. Accordingly, it is anticipated that some of the estimates of available held environmental water will change based on the assumptions used by Basin states to prepare water resource plans for accreditation. This issue is discussed further at section 8.1.
Part 2: Current compliance arrangements
Implementation of the Murray–Darling Basin Cap on Diversions

2016–17
2 The Murray–Darling Basin Cap on Diversions

Limits on water take at a Basin scale were first introduced in 1995 when the Murray–Darling Basin Ministerial Council agreed to introduce the Murray–Darling Basin Cap on diversions (the Cap). Prior to this, any limits on take were a function of the relevant Basin state water sharing and allocation arrangements.

The Cap was introduced in response to increasing levels of surface water take from the Basin’s watercourses. It was recognised at the time that increases in the levels of take could not be sustained over the long term as they were impacting on the health of the riverine environment and undermining the reliability of existing entitlements.

As noted by the Ministerial Council in 2000:

Since the original June 1995 decision of the Murray–Darling Basin Ministerial Council to introduce a Cap on diversions, all forms of consumptive [surface] water use in the Basin have been included under the Cap. However, in the initial phase of Cap implementation the focus was on the development of Cap management arrangements, including accounting of diversions, for the major extractive uses (e.g. river pumpers, gravity diversions).16

The Cap arrangements are set out under Schedule E to the Murray–Darling Basin Agreement 2008 and can only be changed through agreement by all members of the Ministerial Council.

The Cap accounting that has been developed thus far applies only to consumptive surface water diversions from watercourses (regulated and unregulated rivers and streams). Expansion of Cap accounting arrangements to cover all forms of surface water diversions as per the original decision of the Ministerial Council will now be achieved through the implementation of SDL water take accounting and compliance under the Basin Plan.

In most cases, the long-term Cap limit for a designated Cap valley is set as the volume of water that would have been diverted under the 1993–94 level of development. This includes the water sharing rules and infrastructure in place at that time.

2.1 How the Cap works

Schedule E identifies the designated Cap river valleys in each Basin state and the long-term Cap limit for each of those valleys. There are 24 Cap valleys in total.

The Cap arrangements require the Basin states and the MDBA (for the River Murray upstream of South Australia) to develop analytical models that will determine an annual Cap target for each valley. The models must demonstrate that the annual Cap targets, if run over

the relevant historical climate sequence, usually 1 January 1891 to 30 June 1997, will achieve the long-term Cap limit.

The analytical models must be independently reviewed. The MDBA then accredits these models based on the outcomes of the review and the ability of the models to ‘fairly determine the relevant annual diversion [Cap] target given the climate conditions experienced in any year’ (cl 11(5) of Schedule E). Basin states then use the models to inform water sharing arrangements for each Cap valley that aim to ensure that over the long term, annual diversions will not exceed the long-term Cap limit.

Appendix 5: Status of Cap models and section 2.5 provide further information on the status of Cap models.

To enable assessment of Cap compliance, Basin states are required to provide an annual report to the MDBA that includes, for each designated Cap valley, data relating to:

a) diversions made within and to the Cap valley

b) water entitlements, announced allocations of water and declarations which permit use of flows within the Cap valley and

c) trading of water entitlements/allocations within, to or from the Cap valley.

Basin states must also report on their compliance with each annual Cap target for the relevant water year. The annual reporting data is required to be provided within four months of the end of each water year (i.e. by 31 October).

The MDBA uses the data provided by the Basin states to verify the self-assessment of Cap compliance. The MDBA first applies the relevant adjustments for trade in and out of a Cap valley and the agreed adjustments for environmental water recovery in the valley (see Appendix 6: State nominated methods for annualising environmental water recovery under the Cap on diversions) to the annual Cap target for each valley as determined by the relevant Cap model. State data on diversions is then compared against the adjusted annual Cap target.

If annual diversions are less than the adjusted annual Cap target, an annual credit is recorded in the Cap Register. If annual diversions are more than the annual Cap target, an annual debit is recorded.

The Cap Register is the formal record of annual diversions and Cap compliance in the Basin and provides details for every designated Cap valley since 1997–98. The Cap Register for the period up to 30 June 2017 is provided at Appendix 1: Cap Register to 30 June 2017 and is also available on the MDBA website https://www.mdba.gov.au/publications/mdba-reports/cap-compliance-reports.

For most Cap valleys, the compliance assessment works on the basis that the annual debits and/or credits in each valley are added to those from the previous year to create a continuous cumulative balance.17 For example, assuming the cumulative balance in a valley

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17 Some Cap valleys do not use a cumulative balance. For example, in the Queensland valleys of Moonie, Warrego, Paroo and Nebine, Cap compliance is based on an annual credit/debit. Or, as in the
was zero at the start of a four-year period, if the annual credits/debits over that period were 5 GL, 5 GL, −5 GL and 5 GL, then the cumulative balance recorded at the end of year four would be a credit of 10 GL.

The cumulative balance is also recorded in the Cap Register and if that balance is a debit of 20% or more of the long-term Cap limit, Schedule E requires the MDBA to arrange for an independent audit of Cap implementation in the affected valley. If the independent audit confirms that long-term actual take has exceeded the long-term Cap, the MDBA must make a declaration of the exceedance and advise the Murray–Darling Basin Ministerial Council of the breach.

The Minister of the state in which the breach occurred must then advise the Ministerial Council about how it will address the issue.

At the Basin scale, Figure 2.1 shows how annual Cap targets, annual diversions, annual credits/debits and the cumulative balance have progressed over the period 1 July 1997 to 30 June 2017.

Table 2.1 provides a summary of Cap valley compliance as at 30 June 2017. Table 2.2 provides a summary of Cap compliance for the Metropolitan Adelaide and associated country towns Cap valley in South Australia which operates under a five-year limit rather than cumulative or annual targets as is the case for all other Cap valleys.

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case of SA Metro-Adelaide and associated country areas Cap valley, compliance is based on a set volume over the most recent five-year period.
<table>
<thead>
<tr>
<th>Cap valley</th>
<th>Long-term Cap (GL/y)</th>
<th>Un-adjusted annual Cap Target (GL)</th>
<th>Adjustment to Cap target</th>
<th>Adjusted annual Cap target (GL)</th>
<th>Total diversion (GL)</th>
<th>Annual Cap Credit (GL)</th>
<th>Cumulative Cap credit(^5) (GL)</th>
<th>Cap exceedance trigger (GL/y) (^6)</th>
<th>Cap Compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intersecting Streams(^2)</td>
<td>N/A</td>
<td>N/A</td>
<td></td>
<td>N/A</td>
<td>3.3</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Border Rivers</td>
<td>234.0</td>
<td>405.0</td>
<td>-</td>
<td>-</td>
<td>405.0</td>
<td>254.8</td>
<td>150.2</td>
<td>718.6</td>
<td>46.8</td>
</tr>
<tr>
<td>Gwydir</td>
<td>350.2</td>
<td>591.0</td>
<td>-</td>
<td>-24.9</td>
<td>566.1</td>
<td>349.4</td>
<td>216.7</td>
<td>561.2</td>
<td>70.0</td>
</tr>
<tr>
<td>Nami/Peel</td>
<td>363.9</td>
<td>389.7</td>
<td>-</td>
<td>-9.1</td>
<td>380.6</td>
<td>331.2</td>
<td>49.4</td>
<td>533.0</td>
<td>72.8</td>
</tr>
<tr>
<td>Macquarie/Castlereagh/Bogan</td>
<td>491.7</td>
<td>667.1</td>
<td>-</td>
<td>-62.8</td>
<td>604.3</td>
<td>211.4</td>
<td>393.0</td>
<td>1,427.1</td>
<td>98.3</td>
</tr>
<tr>
<td>Barwon-Darling/Lower Darling</td>
<td>322.0</td>
<td>346.4</td>
<td>25.2</td>
<td>-50.7</td>
<td>320.8</td>
<td>306.7</td>
<td>14.2</td>
<td>635.1</td>
<td>64.4</td>
</tr>
<tr>
<td>Lachlan</td>
<td>335.4</td>
<td>308.7</td>
<td>-</td>
<td>-35.7</td>
<td>273.0</td>
<td>186.4</td>
<td>86.6</td>
<td>451.0</td>
<td>67.1</td>
</tr>
<tr>
<td>Murrumbidgee</td>
<td>2,358.4</td>
<td>2,219.7</td>
<td>-47.4</td>
<td>-475.9</td>
<td>1,696.4</td>
<td>1,639.5</td>
<td>57.0</td>
<td>2,517.2</td>
<td>471.7</td>
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<tr>
<td>Murray</td>
<td>1,907.7</td>
<td>2,073.4</td>
<td>-101.6</td>
<td>-504.3</td>
<td>1,467.5</td>
<td>1,175.1</td>
<td>292.3</td>
<td>1,625.6</td>
<td>381.5</td>
</tr>
<tr>
<td>Total New South Wales</td>
<td>6,363.2</td>
<td>7,001.0</td>
<td>-123.7</td>
<td>-1,163.5</td>
<td>5,713.8</td>
<td>4,457.7</td>
<td>1,259.4</td>
<td>8,469.7</td>
<td>1,272.6</td>
</tr>
<tr>
<td>Goulburn/Broken/Loddon Cap Valley</td>
<td>2,033.7</td>
<td>1,629.5</td>
<td>-55.1</td>
<td>-309.3</td>
<td>1,265.0</td>
<td>733.5</td>
<td>531.5</td>
<td>3,245.4</td>
<td>406.7</td>
</tr>
<tr>
<td>Campaspe</td>
<td>121.8</td>
<td>91.9</td>
<td>-</td>
<td>-22.7</td>
<td>69.3</td>
<td>11.2</td>
<td>58.0</td>
<td>526.4</td>
<td>24.4</td>
</tr>
<tr>
<td>Wimmera-Mallee</td>
<td>45.1</td>
<td>45.0</td>
<td>-</td>
<td>-5.0</td>
<td>40.0</td>
<td>14.0</td>
<td>26.0</td>
<td>158.4</td>
<td>9.0</td>
</tr>
<tr>
<td>Murray/Kierra/Ovens Cap valley</td>
<td>1,702.0</td>
<td>1,461.1</td>
<td>227.7</td>
<td>-250.4</td>
<td>1,438.4</td>
<td>1,145.8</td>
<td>292.6</td>
<td>3,152.6</td>
<td>340.4</td>
</tr>
<tr>
<td>Total Victoria</td>
<td>3,902.6</td>
<td>3,227.5</td>
<td>172.6</td>
<td>-587.4</td>
<td>2,812.7</td>
<td>1,904.6</td>
<td>908.1</td>
<td>7,082.8</td>
<td>780.5</td>
</tr>
<tr>
<td>Metro Adelaide and ACA(^2,3)</td>
<td>N/A</td>
<td>N/A</td>
<td>-</td>
<td>-</td>
<td>N/A</td>
<td>34.7</td>
<td>265.0</td>
<td>N/A</td>
<td>Rolling average</td>
</tr>
<tr>
<td>Lower Murray swamps</td>
<td>94.2</td>
<td>94.2</td>
<td>-</td>
<td>-58.3</td>
<td>-9.2</td>
<td>69.3</td>
<td>11.2</td>
<td>58.0</td>
<td>158.7</td>
</tr>
<tr>
<td>Country towns</td>
<td>50.0</td>
<td>50.0</td>
<td>-</td>
<td>-17.0</td>
<td>-33.0</td>
<td>33.0</td>
<td>0.0</td>
<td>75.1</td>
<td>10.0</td>
</tr>
<tr>
<td>All other purposes</td>
<td>449.9</td>
<td>426.7</td>
<td>24.9</td>
<td>-165.6</td>
<td>286.0</td>
<td>344.4</td>
<td>-58.4</td>
<td>972.1</td>
<td>90.0</td>
</tr>
<tr>
<td>Total South Australia</td>
<td>594.1</td>
<td>570.9</td>
<td>-50.4</td>
<td>-174.8</td>
<td>345.6</td>
<td>424.9</td>
<td>220.4</td>
<td>1,205.9</td>
<td>108.8</td>
</tr>
<tr>
<td>Condamine/Balonne</td>
<td>729.0</td>
<td>699.0</td>
<td>-</td>
<td>-46.0</td>
<td>653.0</td>
<td>561.6</td>
<td>91.3</td>
<td>1,400.5</td>
<td>145.8</td>
</tr>
<tr>
<td>Border Rivers</td>
<td>250.3</td>
<td>637.5</td>
<td>-</td>
<td>-30.7</td>
<td>606.8</td>
<td>520.3</td>
<td>86.4</td>
<td>537.0</td>
<td>50.1</td>
</tr>
<tr>
<td>Moonie(^2)</td>
<td>34.9</td>
<td>65.0</td>
<td>-</td>
<td>-1.3</td>
<td>63.7</td>
<td>26.4</td>
<td>37.3</td>
<td>N/A</td>
<td>Annual debit</td>
</tr>
<tr>
<td>Nebine(^2)</td>
<td>6.4</td>
<td>5.8</td>
<td>-</td>
<td>-1.1</td>
<td>4.7</td>
<td>-</td>
<td>4.7</td>
<td>N/A</td>
<td>Annual debit</td>
</tr>
<tr>
<td>Warrego(^2)</td>
<td>47.9</td>
<td>57.8</td>
<td>-</td>
<td>-7.5</td>
<td>50.3</td>
<td>7.1</td>
<td>43.2</td>
<td>N/A</td>
<td>Annual debit</td>
</tr>
<tr>
<td>Parco(^2)</td>
<td>0.2</td>
<td>0.1</td>
<td>-</td>
<td>-</td>
<td>0.1</td>
<td>-</td>
<td>0.1</td>
<td>N/A</td>
<td>Annual debit</td>
</tr>
<tr>
<td>Total Queensland</td>
<td>1,068.7</td>
<td>1,465.3</td>
<td>-</td>
<td>-86.7</td>
<td>1,378.6</td>
<td>1,115.5</td>
<td>263.1</td>
<td>1,937.5</td>
<td>213.7</td>
</tr>
<tr>
<td>Australian Capital Territory</td>
<td>40.5</td>
<td>40.1</td>
<td>-</td>
<td>-</td>
<td>40.1</td>
<td>16.3</td>
<td>23.8</td>
<td>272.7</td>
<td>8.1</td>
</tr>
<tr>
<td>Total Basin</td>
<td>11,969.0</td>
<td>12,304.8</td>
<td>-1.6</td>
<td>-2,012.4</td>
<td>10,290.8</td>
<td>7,919.0</td>
<td>2,883.1</td>
<td>19,242.0</td>
<td></td>
</tr>
</tbody>
</table>
Note: A negative sign in trade indicates water traded out of the valley, while in environmental adjustment this indicates the amount to be taken off the Cap target.

1. Unadjusted Cap Targets - includes 'model component' and 'non-model component'
2. ‘N/A’ denotes that the Cap model is not completed, Cap target has not been able to be determined or the value is not required in a particular Cap valley.
3. Metropolitan Adelaide and Associated Country Areas (see Table 2.2 for more information)
4. Annual Cap credit is reported credit as positive and debit as negative
5. Cumulative Credits since 1997-98 water year
6. Trigger exceedance does not apply to Intersecting Streams, Moonie, Nebine, Warrego, Paroo and Metropolitan Adelaide Cap valleys. If diversions in the Moonie, Nebine, Warrego and Paroo exceed the Cap targets annually, a special audit will be triggered. For Metro Adelaide the cap is assessed against a 5 year rolling average (see Table 2.2 for more information). The Cap target for intersecting streams is currently unable to be assessed.

Table 2.2: Cap assessment of Metropolitan Adelaide and associated country areas as at 30 June 2017

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual diversions (GL)</td>
<td>81.7</td>
<td>42.1</td>
<td>73.2</td>
<td>145.0</td>
<td>34.7</td>
</tr>
<tr>
<td>5-year rolling diversions against 650 GL Cap (GL)</td>
<td>403.5</td>
<td>296.2</td>
<td>312.5</td>
<td>409.4</td>
<td>385.0</td>
</tr>
<tr>
<td>5-year Cap Target (GL)</td>
<td>650.0</td>
<td>650.0</td>
<td>650.0</td>
<td>650.0</td>
<td>650.0</td>
</tr>
<tr>
<td>Difference between rolling diversions and cap target (GL)</td>
<td>246.5</td>
<td>353.8</td>
<td>337.5</td>
<td>240.6</td>
<td>265.0</td>
</tr>
<tr>
<td>Cap assessment</td>
<td>below the 5-year cap target</td>
<td>below the 5-year cap target</td>
<td>below the 5-year cap target</td>
<td>below the 5-year cap target</td>
<td>below the 5-year cap target</td>
</tr>
</tbody>
</table>

2.1.1 The Diversion Formula Register

When Basin states report annual diversions for each Cap valley, they do so in accordance with the formula for each valley as set out in the Diversion Formula Register for the Murray–Darling Basin. The Diversion Formula Register is a protocol established under paragraph 4(1)(b) to Schedule E of the Murray–Darling Basin Agreement. It was established by agreement of the Ministerial Council at meeting 43 on 12 October 2007.

The purposes of the Diversion Formula Register are twofold:

- Qualitative - to define in-principle what a diversion is
- Quantitative - to provide formulas that define how water diversions from the river system of the Murray–Darling Basin are to be determined and reported for the purposes of the Murray–Darling Basin Cap on diversions.

The Diversion Formula Register may be amended from time to time by the MDBA where new information about the nature of diversions in a particular Cap valley becomes available. The diversions recorded in this report have been determined in accordance with version 6 of the Diversion Formula Register.

Version 6 of the Diversion Formula Register was confirmed in June 2018 and incorporates two amendments. The first amendment was formally requested by Victoria to reflect the
outcomes of infrastructure upgrades as part of the Swan Hill Modernisation Project. The second amendment corrects an error in how Beechworth town diversions are accounted.

A copy of the current version of the Diversion Formula Register is available on the MDBA website at: https://www.mdba.gov.au/publications/mdba-reports/cap-compliance-reports.

2.2 Analysis of factors contributing to the accumulation of annual Cap credits

The Cap Register to 30 June 2017 shows that at the Basin state scale, cumulative Cap credits continue to grow (Figure 2.1 and Table 2.1). The Transition Period Water Take Report 2012–13 to 2015–16 sets out a number of factors that are thought to contribute to the growth of cumulative credits, particularly in the period since 2008–09. These include:

1. Water sharing arrangements that set maximum long term levels of take below the long term Cap limit and hence make annual credits more likely
2. Conservative water use decisions by entitlement holders as a response to the Millennium drought
3. The time taken for irrigation enterprises to get back to full production after the Millennium drought
4. The fact that Cap models are generally set at 1993–94 levels of development and do not reflect current rules and policies such as Victorian carryover
5. The methodology used to adjust annual Cap limits to account for the volume of held environmental water that is available

Following release of the 2012–13 to 2015–16 Report, some stakeholders raised questions about why credits are accumulating at the scale they have been, particularly since 2008–09, and have queried whether the credits should or do inform Basin state allocation decisions. Questions have also been asked about what happens to the credits that make up Cap cumulative balances.

The MDBA has undertaken more detailed analysis of the growth in cumulative Cap credits to better understand the factors that may be making a significant contribution to the scale of growth that is being recorded. Because Cap models are also the basis of the transitional SDL accounting arrangements, accumulation of Cap credits and accumulation of transitional surface water SDL credits will be linked but only where they relate to take from watercourses and/or regulated rivers.
At the outset it is important to acknowledge the foundation elements of Cap compliance are:

1. Establishing the long-term Cap limit for Cap valleys. For most valleys the limit is the volume of water that would have been diverted under 1993–94 levels of development.\(^\text{18}\) I.e. diversions that would be achieved under the rules and infrastructure in place at that time.

2. Comparing annual diversions against an annual Cap limit that is modelled based on the 1993–94 level of development adjusted for the climatic sequence and other factors relevant to a given water year. If actual use is less than the annual Cap limit a Cap credit is recorded and if actual use is greater than the annual Cap limit an annual Cap debit is recorded. The annual credits/debits accumulate over time to form a cumulative balance against which overall compliance is measured.

The analytical models that have been developed to determine annual Cap limits in relation to the long term Cap have been designed to reflect these two foundation elements. By comparison, actual annual diversions reflect the behaviour, infrastructure and rules in place in the relevant water year (current conditions).

It is also important to note that an analysis of Basin–scale effects or effects in a limited number of Cap valleys may oversimplify the circumstances in all Cap valleys. Variation of results is to be expected at a valley by valley scale.

Since Cap was established, there have been significant changes in behaviour, rules and infrastructure and a new record low inflow sequence has been establish as a result of the Millennium drought. The more change there is between the reference level of development and climate sequence and current conditions, the more likely it is that the difference between modelled 1993–94 conditions and actual behaviour will increase.

The analysis the MDBA has undertaken focuses on several key Cap valleys that have high volumes of consumptive water take. Consideration of irrigator and/or water market behaviour have not been incorporated into this analysis at this stage. These elements of consumptive water use will be considered as part of ongoing investigations, as will expansion of the analysis to look at other Cap valleys across the Basin.

The analysis to date suggests that there are two ‘structural’ factors that are interacting with each other and that are influencing the accumulation of credits. The factors are:

1. The degree of change between current water sharing policy and operational rules as compared with the 1993–94 level of development.

2. The design of the Cap Register with reference to factor 1. Particularly that the Register records ‘total’ credits/debits and not ‘net’ credits/debits.

In simple terms, the effect of the two factors is that the difference between what the Cap models are designed to determine based on the relevant level of development (generally 1993–94) and climate sequence (generally 1891 to 1997) and what is actually happening under current conditions has grown significantly. The analysis undertaken by the MDBA

\(^{18}\) Noting the reference level of development is different in Queensland and Australian Capital Territory Cap valleys and the cumulative credits/debits work differently in some Queensland and South Australian Cap Valleys.
suggests that it is the degree of change that has increased the likelihood and magnitude of annual credits and hence growth in the cumulative balance.

2.2.1 Change in water sharing policy and operational rules

Actual allocations are less than Cap-modelled allocations

The intent of introducing the Cap was to limit annual actual take from watercourses and regulated rivers so that over the long term, actual take would not exceed the long term Cap limit. The long term Cap limit, in most cases, was deemed to be the volume of take under 1993–94 levels of development. That is diversions that would have been made using the infrastructure in place, based on assumptions about the extent and type of irrigated agriculture that existed and using the water sharing rules that were in place at that time.

One response that has been taken to ensure the Cap is not exceeded has been to change water sharing arrangements so that long term annual diversions remained within the long term Cap limit. For example, in New South Wales, long term average annual extraction limits (LTAAELs) under water sharing plans were generally set below the long term Cap limit.

By definition this resulted in annual allocations being less than those generated by the relevant Cap models. Figure 2.2 shows actual allocation percentages for the New South Wales Murray (general security entitlements) and Victorian Murray (total allocations) for the period 30 June 1980 to 30 June 2017. The effect of the introduction of the Cap can clearly be seen for New South Wales from 1994–95 and for Victoria from 2001–02.

Figure 2.3 and Figure 2.4 compare Cap-modelled percentage allocation and actual percentage allocation for the New South Wales Murray and Victorian Murray to 30 June 2017 against the full period of record (June 1980 to June 2017).

When considering Figure 2.3 and Figure 2.4, it is important to note that the actual allocations are affected by other changes in water sharing policy over time, for example the introduction of carryover. The Cap-modelled allocation is based on the 1993–94 level of development and does not incorporate the carryover rules because they have been established post 1993–94.
Figure 2.2: New South Wales and Victorian actual percentage allocations June 1980 to June 2017

Figure 2.3: New South Wales actual and Cap-modelled percentage allocation (general security) from 30 June 1980 to 30 June 2017
Whenever the Cap-modelled allocations are more than the actual allocations, this will increase the likelihood of annual credits. This is because the Cap modelled allocations contribute to the determination of the annual Cap limit, but actual diversions in a particular water year will be relative to the actual allocation for that year and not the modelled allocation.

Given that average annual actual Cap diversions across the Basin are about 75% of actual allocations, Cap credits become increasingly likely under this scenario.

Figure 2.5 shows annual credits and the cumulative balance for the combined New South Wales and Victorian Murray.
Introduction of carryover provisions post 1993–94

Prior to the inclusion of carryover provisions under Basin state water sharing frameworks, any unused allocation at the end of a water year was socialised. That is it would have become a component of the water in storage that was available to support allocations in the following year, assuming there were no spills from storage. One of the effects of this socialisation was to increase allocation in following years and support the reliability of allocations against the different entitlement classes.

With the introduction of carryover, individual entitlement holders are able to secure their share of any unused allocation – subject to the rules for the relevant Cap valley – as a resource for their sole use in subsequent years. Thus the benefits of socialisation underpinning future allocations have been foregone and have been replaced by the benefits individual entitlement holders receive through having greater control of their allocation between years.

However, these new benefits of greater flexibility of access to water between years for individuals comes at the price of having lower starting allocations as states have to ensure that carryover commitments can be met before new allocations can be announced.

Figure 2.6 compares annual and cumulative carryover in the combined New South Wales and Victorian Murray with annual and cumulative credits.
It is important to note that the cumulative carryover volume shown in Figure 2.6 includes some double counting of volumes between years. This is because water that is carried over from a previous year can be affected in several ways in subsequent years.

1. The entire volume may be used in the year following the carryover
2. A portion of the carryover volume may be used in the following year with the remainder carried over again and so on
3. The entire volume may be carried over for a second year and so on
4. A portion of the volume may be forfeited/spilt with the remainder subject to the effects of 1 to 3
5. The entire volume may be forfeited/spilt

It is not currently possible to adjust the cumulative carryover volume shown in Figure 2.6 for these effects. If it were possible, the plotted volumes would be smaller. MDBA plans to undertake work that will allow future reports to make these adjustments and to separately report on the above aspects of carryover.

**New worst case minimum inflows**

In the same way that actual allocations take account of carryover rules that are not part of the Cap models, changes in the worst case minimum inflows that are used to determine actual allocations, represent another change to water sharing policies and operational rules.
Cap models use the worst case inflow recorded over the relevant climate period, generally 1891 – 1997, as part of the calculation of modelled allocation. However, the Millennium drought established a new record low inflow sequence and this is now generally used by Basin states to provide the worst case inflows that are used to determine allocations. States do this to ensure that allocations that are made will not have to be ‘wound back’ in response to another extreme dry period.

This represents a change in water sharing policy and is another reason why actual allocations are less than Cap-modelled allocations.

For the River Murray System, the Millennium drought worst case inflows now also influence the distribution of water to states by the Murray–Darling Basin Authority. The distribution of the River Murray available water resource to Basin states is a key input to annual state allocation decisions.

So the combined effect of the changes in water sharing policies and rules since about 2006–07 relative to those in 1993–94 has been to increase the likelihood that annual credits will accrue more often and hence that the cumulative balance will increase.

Storage behaviour

Figure 2.7 shows several features relating to how the difference between Cap-modelled behaviour and actual behaviour is reflected in conditions at Hume Reservoir for the period 30 June 1998 to 30 June 2017. E.g. storage at the end of the water year and physical spills from storage.

Actual end-of-year storage volume and spills from storage are an outcome of user behaviour and annual weather conditions. For example, in the four years 2013–14 to 2016–17, allocation carryover as a percentage of Basin-scale actual end-of-year storage has been approximately 30%.

Storage behaviour of itself is not a driver of increasing cumulative Cap credits but it can illustrate how changing water sharing policy and operation rules interact with the design of the Cap Register to increase the size of annual and cumulative Cap credits.

In Figure 2.7 the red bars represent the difference in storage volume at the end of the year when the Cap-modelled storage volume is subtracted from the actual storage volume. As can be seen, this difference has generally been between a positive volume of between about 500 and 1,000 GL over the period up to 30 June 2011 and between 1,000 and 2,000 GL for the period 2013 to 2017. This means that the actual storage volume at the end of the water year is consistently higher than the Cap-modelled volume with the difference most pronounced since 2013.

The grey bars represent the cumulative difference between Cap-modelled spill volumes and actual spill volumes from Hume Dam. There was only one spill prior to 30 June 2010 (in 2000–01) whereas there have been five spills in the seven years to 30 June 2017 (in 2010–11, 2011–12, 2012–13, 2013–14 and 2016–17).
The green line represents the cumulative Cap credits for the combined New South Wales and Victorian Murray. That is, the difference between the combined annual Cap limit and the actual diversions.

![Graph showing cumulative Hume spill difference, change in storage, and combined NSW and Vic Murray cumulative Cap credit from 1997-98 to 2016-17.]

The difference between Cap-modelled allocation and actual allocation discussed above is one of the causes of the difference between Cap-modelled end-of-year storage and actual end-of-year storage volumes.

Given the higher actual end-of-year storage volumes compared to Cap-modelled volumes, it follows that actual spills from storage are likely to be larger than Cap-modelled spills. As can be seen in Figure 2.7, the combined growth in the difference in end-of-year storage volumes and spills appears to be correlated to the rapid increase in cumulative credits for the period since 2010.

The lower Cap-modelled spill volumes means that the associated annual Cap limits in the years where spills occur will be higher than would be the case if the modelled and actual spills were the same. The fact that actual spills have been larger than modelled also suggests that actual diversions may have been lower in those years as spills are often linked to wetter conditions and reduced demand for irrigation water. This in turn is likely to lead to larger Cap credits.

### 2.2.2 The Cap Register
Section 2.2.1 has demonstrated a number of elements that are contributing to the size and frequency of the annual Cap credits that have been recorded, particularly since 2008–09. The second factor affecting how the annual credits have contributed to the extent of the
growth in the cumulative balances across the Basin lies in how annual credits and debits are incorporated in the Cap Register.

The Cap Register is a running tally of total annual Cap credits and debits as determined through the processes set out under Schedule E. The credits or debits have been determined in accordance with the rules set out in Schedule E for the purpose of tracking compliance with the long term Cap limit for each Cap Valley.

The Cap Register is designed to record annual actual water use relative to the modelled annual Cap limit and to provide a trigger to investigate potential breaches of the long term Cap limit. It is not designed to ‘bank’ unused annual allocation (credits) for future use and so gives no consideration to whether the full volume of an annual credit is actually available to support allocation in a subsequent water year.

By comparison, the decisions by states to make allocations available in a particular water year must – among other things – consider the volume of water actually in storage at the start of the water year and then throughout the water year. While an annual Cap credit may represent unused allocation in a particular water year, if some or all of that credit spills from storage, it will no longer be available to support future allocations.

As discussed above, the difference between Cap-modelled and actual allocations and lower Cap-modelled spill volumes compared to actual spills, appear to be significant contributing factors to the size of annual credits and to the rapid increase in cumulative balances since about 2007–08. So, while the annual credits and the cumulative balances are generally growing, Figure 2.7 shows that in the combined New South Wales / Victorian Murray, about two thirds of the cumulative credits (4,779 GL) have actually spilled from Hume Dam (cumulative spill volume of 3,280 GL).

In this context, suggestions from some stakeholders that the cumulative credits recorded in the Cap Register could or should allow Basin states to make larger and earlier allocations, reflects a misunderstanding about the nature and purpose of cumulative Cap credits. What this analysis shows is that the cumulative credits are being driven by the degree of change from the 1993–94 level of development – rules, infrastructure and behaviour – that is the basis for Cap compliance and the current level of development.

It is also worth noting that while the full volume of annual Cap credits may not be available to support future allocations, the full volume is legitimately accounted for in the assessment of Cap compliance. As well as helping to deal with the expected ‘unders’ and ‘overs’ of actual diversions relative to annual Cap limits, cumulative credits also provide a ‘buffer’ for states that allows them to respond to growth-in-use in a measured way. Growth-in-use implies a sustained increase in actual diversions above what is modelled and will usually be evidenced by frequent or consecutive annual debits.

Where this occurs in a Cap valley, the presence of a cumulative Cap credit gives the relevant state time to respond to the growth-in-use based on consideration of best available information rather than having to immediately impose restrictions on allocations that may not be justified in hindsight.
2.2.3 What happens to the annual Cap credits in ‘the real world’

As discussed above, water allocation rules and policies and storage behaviour under the current level of development are resulting in larger spills from storage than are shown under the Cap models, which are based on 1993–94 levels of development. The above sections also demonstrate that some of the annual Cap credits that result from the increasing difference between modelled and actual data are not actually available for allocation in the following year.

The increased annual Cap credits are either spilling and/or are contributing to water available for allocation in the following year. For the volume that has spilled, a portion of the volume may have been re-regulated in downstream weir pools and in Lake Victoria with any remaining portion travelling to South Australia as additional flow. This additional flow is likely to be contributing to the difference between Cap-modelled and actual flows to South Australia as set out at Figure 2.8. Figure 2.9 suggests a correlation between additional flow to South Australia and the increase in the cumulative credits in the combined Murray.

Figure 2.8: Cap-modelled and actual flow to South Australia at 30 June each year for period 1998 to 2017
2.2.4 Relationship to transitional SDL cumulative credits and SDL accounting post 1 July 2019

It is important to re-state that from 1 July 2019 water take compliance will be assessed against the SDLs and not against the Cap. Any cumulative Cap balances will not be transferred across to the arrangements for SDL water take accounting and compliance. The Basin Plan requires that the SDL Register of Take must commence on 1 July 2019 with a starting cumulative balance of zero.

In the context of the transitional SDL accounts, Cap models are the basis for preparing the transitional surface water accounts set out in this report. The models are adjusted to reflect the relevant BDL as required and to account for environmental water in accordance with the transitional SDL methods nominated by Basin states (Appendix 7: Environmental water adjustment under the trial of SDL water accounting and compliance).

Consequently, the factors contributing to the Basin-scale cumulative Cap credits discussed in this section will be influencing the transitional surface water cumulative balance in the SDL accounts. However, given any transitional cumulative credits as at 30 June 2019 will not be carried over into the Register of Take that commences on 1 July 2019, it is reasonable to ask whether the factors at play in this analysis will affect the accumulation of annual credits/debits under the formal arrangements for SDL water take accounting and compliance.

The MDBA considers this is unlikely for the following reasons:

1. The Basin Plan BDLs are estimated using levels of development as at 30 June 2009 and with reference to the historical climate conditions from 1895–2009. This means
the effect of carryover rules, new worst case inflow volumes, actual spills from storage and actual flows to South Australia are represented in the estimates.

2. The Basin Plan requires that the methods for determining annual permitted take that are set out in accredited water resource plans must account for the water sharing rules established under the relevant water resource plan (ss.10.10, 10.11 and 10.12). The MDBA expects that the methods put forward by Basin states will reflect the water sharing rules in the relevant water resource plan and so will result in modelled allocations and actual allocations being more closely aligned.

2.3 Cap compliance reporting

The Cap took full effect from 1 July 1997. However, reporting on Cap implementation has been underway since 1994–95. Up to and including the 2011–12 water year, the outcomes of the annual assessment of Cap compliance by the MDBA (and previously by the Murray–Darling Basin Commission) were presented in annual water audit monitoring reports.

Annual reports on Cap implementation were also prepared by the Independent Audit Group established under Schedule E. Both sets of reports are available through the MDBA website at: https://www.mdba.gov.au/publications/mdba-reports/cap-compliance-reports.

The annual reports of the Independent Audit Group also contain information about any special audits that were conducted and any recommendations for improvements to Cap implementation.

With the commencement of the Basin Plan, transition period water take reports have replaced annual Cap reporting through water audit monitoring reports. Cap compliance will continue to be reported for as long as the Cap is in place but will be combined with reporting on the trial of SDL water accounting and compliance.

In preparation for the transition to SDL water take accounting and compliance, the MDBA has conducted a review of past Cap compliance decisions. This review has found that there are historical breach determinations in two Cap valleys that are no longer current, but which have not been officially revoked in accordance with the requirements of Schedule E. These are breaches in the Gwydir in 2001-02 and the Barwon–Darling – Lower Darling in 2007–08 and 2008–09.

The MDBA has assessed Cap compliance in these two Cap valleys and is satisfied that the cumulative diversions for both Cap valleys have been brought back into compliance with the Cap as evidenced in the Cap Register (Appendix 1: Cap Register to 30 June 2017). Pursuant to clause 19(3) of Schedule E of the Agreement, the Authority has revoked these historical breaches and has reported this fact to the Murray–Darling Basin Ministerial Council.

2.4 Compliance with the Cap

Appendix 1: Cap Register to 30 June 2017 shows that at the valley scale, diversions (annual actual take) have generally been below the annual Cap targets over recent years. There have been some instances where annual actual take has exceeded the annual Cap target. For most valleys, these annual debits have been offset by existing cumulative balance credits.
2.4.1 Queensland

All Queensland Cap valleys were compliant in 2016–17. In the valleys where cumulative balances apply (Condamine/Balonne and Border Rivers) cumulative credits continued to accumulate. Annual credits were recorded in all remaining Queensland Cap valleys (Moonie, Nebine, Warrego and Paroo) where compliance is assessed against annual credits/debits.

The Cap Register for the 2014–15 and 2015–16 water years recorded exceedances of the annual Cap target in the Queensland Moonie Cap valley. In accordance with Schedule E, the MDBA commissioned the Independent Audit Group (IAG) to assess Cap implementation in this valley and to determine whether there had been an exceedance of the long term Cap.

The IAG reported its findings to the MDBA and the Queensland Government in November 2017. The IAG found that a long-term exceedance of the Cap has not occurred. The IAG concluded that the annual exceedance was the result of the Cap model not being well enough aligned with current actual annual water allocation rules, particularly during low flow conditions.

The IAG has recommended that Queensland make improvements to the hydrologic model for the Moonie Cap valley to address this issue and to improve the protection of environmental water during low flows. In response, Queensland has confirmed that it is updating the Moonie hydrologic model as part of the preparation of the Moonie Water Resource Plan, with any potential changes to the model taking into account whether management costs are commensurate with the level of risk to environmental flows and water user reliability.

The MDBA intends to follow up with Queensland in relation to the recommendations made by the IAG as a part of the Moonie Water Resource Plan assessment process. This may include consideration of methods other than modelling to cost-effectively include all forms of take in the annual determination of the permitted take.


2.4.2 New South Wales

All New South Wales valleys were Cap compliant in 2016–17 and continue to accumulate credits. There were no instances where annual diversions in a particular Cap valley were more than the annual Cap target for the year.

Note, the MDBA recently undertook a review of Cap compliance and found historical breach determinations in two Cap valleys that were no longer current but had not been revoked. These breaches were in the Gwydir in 2001-02 and the Barwon-Darling/Lower Darling in 2007-08 and 2008-09. The Basin Officials Committee (BOC) at meeting 60 on 17 May 2018 endorsed that the Authority revoke these historic Cap breach determinations, which the Authority has subsequently done.
2.4.3 Victoria

All Victorian valleys were Cap compliant in 2016–17 and continue to accumulate credits. There were no instances where annual diversions in a particular Cap valley were more than the annual Cap target for the year. In addition to the factors described at section 2.2, it is likely that the significant flooding in late 2016 has contributed to the annual credits that have been recorded for 2016–17.

2.4.4 Australian Capital Territory

Diversions in the Australian Capital Territory Cap valley were within its annual Cap target in 2016–17, and Cap credits continued to accumulate.

2.4.5 South Australia

All South Australian Cap valleys were compliant in 2016–17. There was one valley – the All Other Purposes (AOP) Cap Valley – where annual diversions were more than the annual Cap target in 2016–17 and an annual debit was recorded.

In this instance, existing cumulative credits meant that this valley remained in overall cumulative credit and thus remained compliant with the Cap.

**Metropolitan Adelaide and associated country areas**

Under the Cap arrangements, the Cap limit for the Metropolitan Adelaide and associated country areas Cap valley works differently to all other Cap valleys within the Basin. The Metropolitan Adelaide Cap covers diversions for water supply purposes delivered to Metropolitan Adelaide and associated country areas through the Swan Reach–Stockwell, Mannum–Adelaide and Murray Bridge–Onkaparinga pipeline systems.

This Cap valley operates under a five-year rolling limit. The annual diversion target is calculated as 650 GL minus the sum of diversions of the preceding four years. Diversions for this Cap valley are not to exceed 650 GL within a five-year period.

Further, the annual use and Cap target are adjusted for any water accessed through trade to support water use in this Cap valley. This is known as the ‘First Use Licence’ as it is considered to provide, for Cap purposes, the first water used in each water year. It is also used to account for additional water required for Metropolitan Adelaide on top of the water available under the Metropolitan Adelaide Cap. No water use was recorded against the First Use Licence in 2016–17.

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19 The Cap Register at Appendix 1: Cap Register to 30 June 2017 shows two South Australian systems have recorded annual debits, the All other purposes (AOP) Cap Valley and the Combine AOP + Lower Murray Swamps. As the name suggests, the Combined AOP + Lower Murray Swamps combines data for the AOP Cap Valley and the Lower Murray Swamps Cap Valley. It is not a designated Cap Valley for the purposes of Schedule E but is included in the Register for comparative purposes.
2.5 The status of Cap models

Under Schedule E to the Murray–Darling Basin Agreement, full implementation of the Cap requires Basin states to develop Cap models that are accredited by the MDBA for use in determining annual Cap targets for all relevant Cap valleys. These models are the basis for assessing annual Cap compliance.

There are 24 Cap valleys designated under Schedule E. Schedule E requires that an accredited Cap model is developed for 22 of these valleys. Two valleys in New South Wales (Namoi/Peel and Barwon–Darling/Lower Darling) have two models within them making a total of 24 models that are required to be accredited. The current status of these models is:

- 14 accredited Cap models are in place
- three Cap valleys have an accredited SDL model in place, but Cap compliance continues to be assessed against the relevant Cap models. These Cap models were provisionally accredited but accreditation has since lapsed
- eight models have previously been accredited on a provisional basis and these accreditations have now lapsed
- one Cap valley does not have a Cap target and hence an accredited Cap model has not been developed.
- one Cap valley does not have an accredited Cap model or lapsed provisionally accredited Cap model in place.

Appendix 5: Status of Cap models gives further details on the status of Cap models.

The MDBA recognises that the Cap models or arrangements currently in place will likely remain the best available information to assess compliance under the Cap while the states manage the transition to SDL compliance. Ultimately, a decision to insist on full Cap implementation is a matter for the Murray–Darling Basin Ministerial Council.

Despite the current status of Cap models, Basin states have continued to meet their obligations under the Cap and have provided their determination of the annual diversion targets for each Cap valley for each year since commencement of the Basin Plan.

The MDBA has determined that the modelling resources available during the remainder of the transition period are generally better spent preparing new models to meet the requirements for SDL accounting and compliance. Basin states may however choose to submit new Cap models for (re-accreditation) or to amend existing accredited models. If is the case, the MDBA will provide assistance and support as necessary.

2.6 Annual Cap targets

The annual Cap target is the volume of water that is permitted to be taken from the designated Cap valleys for consumptive purposes. After the end of each water year, the MDBA assesses each Basin state’s determination of the annual Cap target for each Cap valley for that water year. The annual Cap target has two components:

- a) modelled component
- b) un-modelled component
The portion of the annual Cap target determined by Cap models is called the modelled component. The Cap models use observed climatic and hydrologic data, as well as water use patterns to generate the annual Cap target. The diversions from unregulated sections of the river systems for which there are no models are called the un-modelled component. The un-modelled component of the annual Cap target is usually determined based on estimates. The total annual Cap targets are the sum of the modelled and un-modelled components.

With the exception of the model for the Victorian Wimmera–Mallee Cap valley, the available Cap models determine the annual Cap targets that would have applied prior to water recovery efforts commencing. Since the Cap limits have to be calculated as they apply to consumptive use, the annual Cap targets calculated by the models have to be adjusted to remove held environmental water entitlements that were available for use in the relevant Cap valley in the relevant year.

The annual Cap targets are also adjusted to reflect trade that occurs between Cap valleys. The detail of the various adjustments to annual Cap targets for each water year are provided in the Cap Register at Table 10.1 and Table 10.2.

2.6.1 Environmental water adjustment

The need to adjust annual Cap targets to account for held environmental water that is available is a relatively recent development in the history of the Cap. As different programs aimed at recovering water entitlements for environmental use have emerged, the volume of held environmental entitlements in different valleys increased and the need to account for these in determining annual Cap targets for consumptive use became more pressing.

In May 2008, the Murray–Darling Basin Ministerial Council endorsed the ‘Schedule E protocol’ enabling long-term and annual Cap targets to be adjusted for environmental water entitlement recovery. This protocol means that diversions reported under the Cap should exclude held environmental water entitlements, thus enabling the assessment of Cap compliance against consumptive entitlement diversions only.

The protocol enables the annual Cap targets to be adjusted for environmental entitlement recovery through the following approaches:

a) hydrological models
b) estimates: e.g. fixed, allocations, or usage
c) other methods: for example a ‘scaling approach’.

Under both Cap and transitional SDL water accounting and compliance arrangements, the MDBA and Basin states have been working together to improve the methods being used to recognise environmental water recovery. Consistent with the Schedule E protocol, different states are working on different methods as appropriate to their existing water sharing arrangements. Final agreement between the MDBA and each Basin State to these methods was reached in November 2015.

This report uses the current methods agreed with Basin states for the adjustment of annual Cap targets in recognition of environmental water recovery. Appendix 6: State nominated methods for annualising environmental water recovery under the Cap on diversions sets out these agreed methods for annualising environmental water recovery under the Cap.
2.7 Operation of the Cap post 30 June 2019

Any decision to revoke or amend the Cap arrangements set out under Schedule E to the Murray–Darling Basin Agreement is a matter for the Murray–Darling Basin Ministerial Council. It is anticipated that the Ministerial Council may make decisions about the operation of the Cap following the commencement of the SDLs through accredited water resource plans from 1 July 2019.

Any Cap credits or debits that have accrued as at 30 June 2019 will continue for Cap purposes. They will not however transfer over to the new SDL Register of Take which is required to commence on 1 July 2019 with a balance of zero for all SDL resource units. Wherever there are accredited water resource plans in place from 1 July 2019, water take compliance will be reported and assessed under the arrangements for SDL water accounting and compliance.

Any annual credits/debits at SDL resource unit scale and the resulting cumulative balance will be recorded in the Register of Take.

2.8 Cap Register 1 July 1997 to 30 June 2017

The Cap Register to 30 June 2017 is provided at Appendix 1: Cap Register to 30 June 2017. Note that Schedule E of the Murray–Darling Basin Agreement states that for all valleys except the Moonie, Nebine, Warrego and Paroo in Queensland and Metropolitan Adelaide in South Australia, the trigger for assessment of Cap compliance is when the cumulative Cap balance for a valley is a debit amount equal to or more than 20% of the long term Cap (Table 10.6). For the four Queensland valleys, the trigger for assessment of compliance with the Cap is if annual diversion are greater than the annual Cap target (Table 10.5) and for the Metropolitan Adelaide and associate country areas Cap valley, compliance with the Cap is assessed against a five-year rolling balance (Table 10.7).

As Cap models are improved over time and new information on diversions becomes available there can be changes to the cumulative balance calculated in the previous year. Table 10.8 lists the instances where such changes have occurred for the 2015–16 water year and the reason for the change. Through this process an exceedance of Cap shown in a previous years’ Cap Register may no longer appear as an exceedance in the current years’ Cap register.

The format of the Cap Register is based on the approach adopted in Appendixes A to H of the former water audit monitoring reports.
Part 3:
Trial assessment of annual permitted take and annual actual take under the sustainable diversion limit water accounting and compliance rules
3 Purpose of the trial

The making of the Basin Plan has set in train a seven-year process of transition (2012–13 to 2018–19) from Cap-based to SDL-based water accounting and compliance in the Basin. While some of the reporting components of SDL water accounting and compliance commenced in 2012, the Cap remains the only Basin-wide water take compliance regime that is currently in place.

Given the additional forms of water take captured under the new arrangements for SDL water accounting and compliance and the significant investment in water recovery to achieve the SDLs, it is prudent to ensure that all parties subject to the new regime are well prepared to comply with the new arrangements from 1 July 2019. On this basis, the MDBA and Basin states are collaborating to run a trial of the new arrangements during the transition period.

The trial is a ‘proof of concept’ to establish and test the types of arrangements that will need to be in place from 1 July 2019 to ensure compliance with the SDLs.

The objectives of the trial are to:

1. Develop and test the types of arrangements that Basin states and the Commonwealth Environmental Water Holder (CEWH) will use to prepare, self-assess and submit data to the MDBA as required under sections 71 and 32 of the Water Act and Matter 9 of Schedule 12 of the Basin Plan.

2. Develop and test the arrangements that the MDBA will use to receive, assess and report on the data submitted by Basin states and the CEWH.

3. Identify current gaps or weaknesses in the trial arrangements and improvements that need to be made in order to enhance the overall integrity of SDL water accounting and compliance from 2019, noting that there are no compliance consequences during the trial.

4. Provide an indicative demonstration of what SDL compliance reporting may look like in terms of how data will be assessed and presented when the rules are fully in force.

In relation to objectives 1 and 4, the trial assessment is being presented in a way that is consistent with the provisions of s.71(1) of the Water Act as set out below.

Part 2, Division 2, Subdivision F — Reporting obligations

71 Reporting obligations of Basin states

(1) A Basin State must, within 4 months after the end of a water accounting period for a water resource plan area in the Basin State give the Authority a written report that sets out the following:

a) the quantity of water available from the water resources of the water resource plan area during that water accounting period;

b) the quantity of water permitted to be taken from the water resources of the water resource plan area during the water accounting period;

c) the quantity of water actually taken from the water resources of the water resource plan area during the water accounting period;
d) details of the water allocations made in relation to the water resources of that area in relation to that water accounting period;

e) details of any other decisions made by, or under the law of, the Basin State, that permit the taking of water from the water resources of that area during that water accounting period;

f) details of the trading or transfer of tradeable water rights in relation to the water resources of that area during that water accounting period:

(i) within the area; and

(ii) into the area; and

(iii) from the area;

g) an assessment of compliance with any long-term annual diversion limit for the water resources of the area, or for a particular part of those water resources, in accordance with the method specified in the Basin Plan;

h) if there has been non-compliance with any long-term annual diversion limit for the water resources of the area, or for a particular part of those water resources—the actions that the Basin State proposes to take to ensure that the limit is complied with in the future.

With the commencement of the Basin Plan in November 2012, the reporting requirements under this clause commenced for the 2012–13 water year (i.e. the first such ‘water accounting period’ mentioned in s.71).

The structure of this part of the report is drawn from the reporting obligations under s.71. For each report section the connection to the relevant sub-clause(s) of s.71 is provided. In the same way, the requirements of s.32 of the Water Act and Matter 9 of Schedule 12 to the Basin Plan are used as points of reference in Part 4 of this report.

Section 71 requires that data is reported at least at the level of water resource plan (WRP) areas. Each WRP area contains one or more SDL resource units as specified in the Basin Plan. For the purpose of the trial, SDL resource units have been used as the basis of reporting wherever possible.

This is considered to provide the most useful presentation for the purpose of informing the indicative compliance arrangements under the trial. It is also consistent with the forthcoming requirement under Basin Plan s.6.08(2) for the Register of Take to provide from 2019 a record of take and consequent annual and cumulative balances for each SDL resource unit.

Because the trial is a proof of concept, there may be instances where the data that is reported and the conclusions that are drawn from that data change between years as better information becomes available. It is the role of the trial to draw out instances where better information can be generated to inform improvements in reporting during the trial as well as the development of the accredited arrangements that will be applied from 1 July 2019. Consistent with this approach, future transitional water take reports will, where practical to do so, update data from previous years where new/more accurate data becomes available.
The trial seeks to apply all the elements of SDL water accounting and compliance that will operate from 1 July 2019. However, the extent to which this can be done is limited by the information and methods that are currently available.

3.1 How SDL water accounting and compliance operates

3.1.1 The long-term average annual limit

Similar to the Cap, annual SDL water accounting and compliance is determined in reference to long-term annual limits on the volume of water that can be taken for consumptive use in each SDL resource unit. These limits are the SDLs specified in Schedules 2 (surface water) and 4 (groundwater) of the Basin Plan.

It is important to note that the SDLs can change over time. Changes may be as a result of:

   a) an amendment to the Basin Plan, e.g. through the operation of the SDL adjustment mechanism
   b) a revision to the estimated volume of the BDL for an SDL resource unit through the application of best available information
   c) decisions taken by Basin states to re-allocate some or all of the shared reduction target for one SDL resource unit to another SDL resource unit
   d) the apportionment of the supply contribution of SDL adjustment mechanism projects within and/or between Basin states
   e) the recovery of additional water for the environment though SDL adjustment mechanism efficiency measures (sometimes referred to as ‘up water’).

In any water year where change to an SDL has occurred, the SDLs as at 30 June of that year need to be reflected in the water accounting and reporting for that year. As previously discussed for the purposes of the 2016–17 accounts the Basin Plan as at 30 June 2017 is being applied. This means none of the amendments proposed to give effect to the northern Basin Review, groundwater reviews and technical improvement or to give effect to the instrument to adjust the SDLs under the SDL adjustment mechanism have been applied.

Therefore, the reference SDLs for all SDL resource units other than the Queensland Warrego (SS28), Paroo (SS29) and Nebine (SS27) and the South Australian Murray (SS11) and Eastern Mount Lofty Ranges (SS13) SDL resource units are those set out in the Basin Plan 2012 as made in November 2012.

For the Warrego, Paroo and Nebine SDL resource units, the SDLs are those as amended through the revision of the BDLs for these resource units and subsequent accreditation of the Warrego-Paroo-Nebine Water Resource Plan on 15 June 2017. For the South Australian Murray and Eastern Mount Lofty Ranges SDL resource units, the SDLs are those resulting from a 2016 request by South Australia to re-allocate some of the shared reduction amounts in accordance with s.7.23 of the Basin Plan.

Neither circumstance changes the Basin Plan 2012 surface water reduction volume of 2,750 GL as this is a fixed volume set in the Basin Plan. The revision of BDLs and subsequent update of the associated SDLs only affects those estimates and the re-allocation
of shared reduction volumes, simply changes the location of where water recovery to meet the reduction volume is required.

The effect of these changes is that at the Basin scale, the SDL has changed from a long term average of 10,873 GL/y as at 22 November 2012 to a long term average of 10,813 GL/y as at 30 June 2017.  

Having determined the relevant SDL, at the completion of each water year, the method set out in the accredited WRPs will be used to determine the annual permitted take that applied for that year based on the climatic conditions experienced. It is anticipated that this method will often employ long-term hydrological models. These methods translate the long-term average SDL into an annual limit for comparison against annual actual take. This is analogous to the arrangements for the long-term Cap and annual Cap target.

Under the Basin Plan, the concept of water ‘take’ means the removal of water or the reduction in flow from a water resource.

The Basin Plan (s.1.07) defines ‘forms of take’ as:

- take from a watercourse
- take from a regulated river
- take by floodplain harvesting
- take by runoff dams
- net take by commercial plantations
- take from groundwater
- take under basic rights.

For the purposes of the trial, a concept of transitional diversion limits (TDLs) has been established. These operate in essentially the same way as Cap limits or SDLs, however they will reflect the amount of water that has been recovered to bridge the gap at the outset of the each water year during the transition period.

The concept of the TDL is that given the SDLs have not yet been achieved across all SDL resource units it is not appropriate to determine annual permitted take in reference to the SDL. To do so would see actual diversions in the transition period compared to a diversion limit that had not yet necessarily been achieved through water recovery efforts.

To illustrate the concept further, if water recovery in an SDL resource unit was complete or was not required, the TDL would equal the SDL. If water recovery had yet to commence, the TDL would equal the BDL. The BDL generally represents 2009 levels of use and was adopted as the baseline for the Basin Plan (specified in Schedules 3 and 4 of the Basin Plan).

Across the Basin, for each SDL resource unit where water recovery is required, TDL is expected to decrease progressively as water recovery to achieve the SDL continues and is achieved.

### 3.1.2 Determination of annual permitted take

Section 10.10 of the Basin Plan requires Basin states to prepare water resource plans that include methods for determining annual permitted take for each form of take in each SDL

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\(^{20}\) As noted in footnote 9.
resource unit within the water resource plan area. Section 10.12 sets out the things that these methods must account for. Section 7 provides further detail.

These methods are equivalent to the Cap models under the Cap regime. The methods set out in the water resource plans must demonstrate that over a repeat of the Basin Plan historical climate conditions (1895 to 2009) permitted take will achieve the SDL for each SDL resource unit.

It is important to understand that as with the long-term Cap limits, the SDLs are not an annual limit on permitted take for a SDL resource unit. The SDLs are long-term average annual volumes and, by definition, it will be routine for the volume of permitted take in individual years to be above or below the SDL. While annual permitted take methodologies attempt to explain as much of the inter-annual variation as possible (e.g. through relating use to climatic conditions and water availability), it is not always possible to fully explain such variations and thus ‘unders’ and ‘overs’ are expected.

With the exception of the Warrego, Paroo and Nebine SDL resource units where accredited methods are now in place, Basin Plan compliant methods for determining annual permitted take for each form of take are currently under development by Basin states. This means that for the purposes of the trial, transitional methods to determine annual permitted take are being used for all SDL resource units other than the Warrego, Paroo and Nebine.

For surface water annual permitted take from watercourses and regulated rivers these methods are essentially the use of Cap models. These models are adjusted as necessary to reflect the BDL, to account for trade in and out of the relevant SDL resource unit and to account for the volume of environmental water recovery completed at commencement of the water year in question. Adjustment for environmental water recovery is done differently under SDL water accounting and compliance as compared with Cap methods. Appendix 7: Environmental water adjustment under the trial of SDL water accounting and compliance sets out the methods agreed with each Basin state for adjusting transitional annual permitted take to account for environmental water recovery.

Transitional annual permitted take for the other forms of surface water take is being determined based on:

- the estimates in Schedule 3 of the Basin Plan, or
- the estimates in Water resource assessments for without-development and baseline conditions, Murray–Darling Basin Authority technical report 2010/20 Version 2 (MDBA 2011), or
- an alternative estimate provided by the relevant Basin state.

Issues associated with the use of long-term average estimates are discussed at section 5.2.3.

At this point in the transition period, the use of these long-term estimates of take for certain forms of surface water take is necessary as methods are not yet available to provide improved estimates on an annual basis. However, the MDBA is working with the Basin states to develop more appropriate methods to estimate, model or measure annual permitted take wherever these long term estimates are currently being used. The MDBA considers any improvements in this area will enhance the overall integrity of the arrangements for SDL water accounting and compliance that are accredited for use from 1 July 2019.

The determination of annual permitted take for groundwater is a concept that has not previously existed. For the purposes of the trial, transitional annual permitted take is being
set at the TDL for SDL resource units where held environmental water exists, or at the SDL for resource units where there is no held environmental water. Further discussion about the determination of annual permitted take for groundwater is provided at section 7.4.

3.1.3 Determination of annual actual take

Section 10.15 of the Basin Plan requires that water resource plans must set out how the volume of water actually taken each year for consumptive use by each form of take in each SDL resource unit will be determined. This is likely to be a combination of volumes measured by water meters or other means, modelled by hydrological models and/or estimated based on agreed parameters.

For the trial, annual actual take from watercourses and regulated rivers is determined using the same methods as for Cap diversions. For the other forms of surface water take, annual actual take is generally being set as the same long-term average annual estimates as used for permitted take and listed in Schedule 3 of the Basin Plan or the report: Water resource assessments for without-development and baseline conditions, Murray–Darling Basin Authority technical report 2010/20 Version 2 (MDBA 2011) or an alternative estimate determined by the relevant Basin State\(^2\). For groundwater, annual actual take is determined through a combination of metered and estimated take.

As with annual permitted take, annual actual take will vary between years. This variability will be the result of a combination of water availability, the volume of water lawfully accessible and the water use decisions made by individual water entitlement holders. These decisions will be influenced by many factors including the extent of current and planned plantings, announced allocations, access to carryover, in-crop rainfall and commodity prices.

The effect of these decisions will be that annual actual take will rarely be the same as annual permitted take. Annual actual take will routinely be at volumes above or below annual permitted take.

3.1.4 Reporting of annual permitted take, annual actual take and related information

Section 71 of the Water Act requires Basin states to provide a written report to the MDBA by 31 October each year (or other date agreed by the MDBA) that sets out a range of information including about: water availability, annual permitted take, annual actual take, water lawfully accessible and so on. Section 71 has been reproduced in full at the start of this section.

3.1.5 Assessment of compliance with the SDLs

To assist in determining compliance, section 6.08 of the Basin Plan requires the MDBA to establish a Register of Take. As a minimum, the Register of Take must record for each SDL resource unit:

- annual credits where annual actual take is less than annual permitted take
- annual debits where annual actual take is more than annual permitted take

\(^2\) Examples where measurement and not estimates are used is take by runoff dams in the Eastern Mount Lofty Ranges and Marne-Saunders SDL resource units, where a large proportion of actual take is metered.
• a cumulative balance of the annual credits and debits.

The Register of Take may also include other matters that the MDBA considers relevant to determining compliance (s.6.08(4)).

Based on the rules in the Basin Plan as at 30 June 2017, when the SDLs are in force compliance will be assessed against the cumulative balance of annual credits and debits relative to the annual permitted take. If the cumulative balance, adjusted for any acquisition or disposal of held environmental water, for an SDL resource unit is a debit of 20% or more of the SDL and the relevant Basin state does not have a ‘reasonable excuse’ as provided for under s.6.12 of the Basin Plan, then an instance of non-compliance will be confirmed.

Section 6.12(2) of the Basin Plan provides that compliance for some Victorian SDL resource units may be assessed on the basis of an aggregated cumulative balance. These include the Victorian Murray, Kiewa and Ovens SDL resource units as one aggregation and the Goulburn, Broken, Campaspe and Loddon SDL resource units as the other.

For the purposes of the trial of SDL water accounting and compliance, the MDBA is maintaining a trial Register of Take. The trial Register of Take is being operated as would be the case if actual compliance was being assessed. It is being used to give an indicative demonstration of the cumulative balance of take for each SDL resource unit as assessed against the relevant TDL for that resource unit. The trial Register of Take is also being used to generate an aggregated cumulative balance for those Victorian SDL resource units referred to in s.6.12(2).

Given that SDL models are not yet in place and the volume of held environmental water varies over the water years, a method to estimate the annual transitional permitted take that adjusts for the amount of held environmental water available is required. For the purpose of the trial, MDBA and each Basin state have agreed on a nominated method for making this annual adjustment.

These methods are a further improvement on those used for Cap purposes and are set out at Appendix 7: Environmental water adjustment under the trial of SDL water accounting and compliance. The MDBA expects that the methods for determining annual permitted take in accredited water resource plans will include further improvements on the current approach to the adjustment for held environmental water.

Noting that compliance will ultimately apply at SDL resource unit scale, Figure 3.1 and Figure 3.2: Murray–Darling Basin groundwater transitional diversion limit, annual actual take, annual balance and adjusted cumulative balance 2012–13 to 2016–17 provide the Basin scale findings for the above processes for surface water and groundwater.
Figure 3.1: Murray–Darling Basin surface water transitional diversion limit, annual permitted take, annual actual take, annual balance and adjusted cumulative balance 2012–13 to 2016–17

Figure 3.1 shows that a significant annual credit occurred at the Basin scale in 2016–17 and that the transitional cumulative balance increased accordingly. Because take from watercourses and regulated rivers makes up the major portion of the BDL and Cap models are being used to determine annual permitted take during the trial, there is a close link between factors contributing to annual credits under Cap and those contributing to credits under the trial.

The analysis of Cap credits at section 2.2 is likely to be relevant to why large annual credits are occurring at the Basin scale under the trial. It is also important to note that results at the Basin scale will mask the variability at SDL resource unit scale. However, only two surface water SDL resource units registered an annual debit in 2016–17.
Figure 3.2: Murray–Darling Basin groundwater transitional diversion limit, annual actual take, annual balance and adjusted cumulative balance 2012–13 to 2016–17 shows that at the Basin scale the accrual of annual credits for groundwater has been fairly consistent since 2012–13. This has resulted in a large cumulative balance as at 30 June 2017.

In groundwater, this is a function of low levels of actual take in most groundwater SDL resource units compared to the annual permitted take, which during the trial is set at the TDL where the commonwealth has committed to recovering water under Bridging the Gap or where supplementary licences have been granted, and at the SDL for all other resource units.
4 Water Availability

Under s.71 of the Water Act, Basin states must report:

\[\text{s.71(1)(a) the quantity of water available from the water resources of the water resource plan area during that water accounting period}\]

This section provides information on the overall quantity of water available in the Basin. That is, the physical volume of water actually present in the landscape. How much water is available is a function of many components including:

- water held in storages and aquifers
- water flowing in rivers
- inflows from rainfall
- evaporation and
- evapotranspiration

The purpose of reporting this volume is to provide an overall picture of the water available throughout the Basin for surface water and groundwater SDL resource units.

While this is intended to provide useful context for the volumes of water lawfully accessible for take, permitted to be taken and actually taken under SDL water accounting and compliance, it does not represent a controlling element of water planning in its own right (though more localised assessments of water availability inform each of the qualities established for other data reported under s.71).

Over recent years there have been ongoing discussions with Basin states as to how to meaningfully calculate this volume on an annual basis. These discussions have noted the lower priority for settling a method for doing so in light of other work to implement the Basin Plan. The limited utility of an overall assessment of ‘water availability’ to these other elements of Basin Plan implementation have also been a consideration.

Accordingly, for the purpose of this transitional period water take report, long-term annual average volumes are presented at the Basin scale. In future reports, this data is expected to be improved in terms of inter-annual variability and estimates at the SDL resource unit scale.

4.1 Surface water

Basin-wide long-term average surface water availability was assessed in the 2012 Basin Plan as 32,553 GL/y comprising inflows to the Basin and transfers into the Basin (e.g. from the Snowy Hydro-electric Scheme).\(^{22}\) As noted in the Basin Plan, this was the MDBA’s best estimate of surface water runoff generated across the Basin, based on modelled inflows adjusted where necessary to incorporate the effects of interception activities.

\(^{22}\) Basin Plan 2012, Schedule 1, paragraph 34.
4.2 Groundwater

For groundwater, the volume of recharge to groundwater systems is considered the most suitable measure of ‘water available’. Groundwater recharge is the volume of water that infiltrates into a groundwater system from any source including rainfall, irrigation and surface water interactions. This volume is difficult to estimate on a long-term basis and more so on an annual basis. However, the long-term average estimate of groundwater recharge provides an overall context for the scale of development of groundwater resources within the Basin.

Presently, the MDBA is working on how to apply updated and innovative recharge estimation techniques to improve recharge estimates through a strategic groundwater research partnership with the National Centre for Groundwater Research and Training (NCGRT). This improved knowledge may inform the MDBA in better estimating the water available.

Accordingly, based on the long-term average volume of recharge to groundwater, the long-term average Basin-wide groundwater availability was assessed by the MDBA as 23,450 GL/y.23

4.3 Climate and storages

Annual rainfall, temperature conditions and water available in storage are the high-level drivers of annual water availability. A summary of the conditions in the 2016–17 water year is set out below.

4.3.1 Temperature and rainfall

Rainfall in 2016–17 was average to above average across most of the Basin (Figure 4.1). 2016–17 was significantly wetter than 2015–16 and the wettest year Basin-wide since 2011–12. Notably, northern Victorian catchments that flow into the Murray River and the upper Murray region, which provide runoff into the major headwater storages of Dartmouth and Hume, experienced above average rainfall in September. Consistently heavy rainfall in these catchments led to significant increases in storage volumes and flooding in some areas.

In the northern Basin, the upper Darling catchments received generally average to above average rainfall resulting in significant inflows to the Menindee Lakes. This was in contrast to the three preceding years of consecutive failed summer wet seasons, which were the lowest inflow sequence on record for the Menindee Lakes.

Temperatures were above average throughout the Basin in 2016–17 (Figure 4.2). This varied throughout the year, with spring temperatures below average for the Basin while areas of northern New South Wales and southern Queensland experienced the highest mean summer temperatures on record.

The very strong El Niño conditions observed in 2015–16 ceased in late May 2016. This was followed by the development of a strong negative Indian Ocean dipole in early winter 2016. The Indian Ocean dipole is a significant contributor to rainfall variability in Australia and a

23 Basin Plan 2012, Schedule 1, paragraph 8.
negative Indian Ocean dipole is usually associated with above average spring rainfall in south eastern Australia. The development of a strong negative Indian Ocean dipole likely influenced the exceptionally high September rainfall observed in south-eastern Australia in 2016–17 (Figure 4.3).

Inflows to the River Murray System for 2016–17 (including inflows to the Menindee Lakes but excluding releases from the Snowy Mountains Scheme, inter-valley transfers and environmental water inflows) was approximately 16,580 GL, with an annual exceedance probability (AEP) of 17%. That is, 17 years in 100 would see higher volumes of inflows. This is compared to a value of 3,120 GL, with an AEP of 92%, in the previous water year.

Record low inflows to the Menindee Lakes in the three years preceding 2016–17 saw the volume in the Lakes open at 54 GL (3%) on 1 July 2016. Above average rainfall in upstream tributaries of the Darling River resulted in significant inflows to Menindee Lakes and increased the storage volume to 1,582 GL (91%) by mid-December. The total storage level in the Menindee Lakes as at 30 June 2017 was 741 GL or 43% of capacity.
Figure 4.2: Australian maximum temperature deciles 1 July 2016 to 30 June 2017

Figure 4.3: Basin rainfall deciles September 2016
4.3.2 Water in storages

Water availability was generally low across the Basin at the beginning of the water year after very low inflows and drier than average conditions in 2015–16. Water availability improved significantly as the year progressed following above average rainfall, steady inflows and improvements to storage during winter and spring. In the northern Basin, the same trends were apparent, with seasonal rains supplemented later in the water year by rains from ex-tropical cyclone Debbie in March. Basin-wide storage levels finished June 2017 at 15,108 GL or 68% of total active capacity. This is 6,838 GL more than at 1 July 2016.

Table 4.1: Percentage volume of active storage as at 1 July 2016 and 30 June 2017 for the southern and northern Basin and at a Basin scale

<table>
<thead>
<tr>
<th></th>
<th>Northern Basin</th>
<th>Southern Basin</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 July 2016</td>
<td>24%</td>
<td>41%</td>
<td>37%</td>
</tr>
<tr>
<td>30 June 2017</td>
<td>65%</td>
<td>68%</td>
<td>68%</td>
</tr>
</tbody>
</table>

In the southern Basin, River Murray System active storage started 2016–17 with 2,550 GL spread across Dartmouth Reservoir, Hume Reservoir, Lake Victoria and the Menindee Lakes. This improved to 5,374 GL at 30 June 2017.

![River Murray System Active Storage: 30 June 2000 to 30 June 2017](image)

Figure 4.4: River Murray System active storage volumes for the period June 2000 to June 2017. Graph shows the sum of active storage in Dartmouth and Hume Reservoirs, Lake Victoria and the Menindee Lakes Storage.
5  2016–17 Annual actual take

5.1 Actual take

Under s.71 of the Water Act, Basin states must report:

\[s.71(1)(c) \text{ the quantity of water actually taken from the water resources of the water resource plan area during the water accounting period}\]

This section provides information on the reported quantity of water actually taken throughout the Basin at the SDL resource unit level. Appendix 2: Surface water SDL trial water take accounts and Appendix 3: Groundwater SDL trial water take accounts set out the combined total reported volumes of transitional actual take by all forms of take at SDL resource unit level for surface water and groundwater respectively. Table 5.2 lists reported actual take by each form of surface water take at the SDL resource unit scale.

‘Actual take’ refers to water recorded as being removed from rivers, dams, storages, floodplains, groundwater systems and net take by commercial plantations. Actual take relates only to consumptive use and does not include water used for environmental purposes. Part 4 of this report provides information on the use of held environmental water.

The inclusion of forms of take under the SDLs that have not to date been part of the Cap arrangements is one of the key water management and accounting challenges facing Basin states and the MDBA during the transition period. This is because historically, these forms of take have not been routinely or consistently estimated, modelled or measured.

This report documents progress to date in developing methods for reporting on annual actual take for all forms of take set out in the Basin Plan. For both surface water and groundwater, progressively more detailed data on actual take has been reported each year.

In 2016–17 approximately 26% of the reported surface water annual actual take is based on the long-term average estimates used in the Basin Plan or alternative estimates provided by Basin states. The MDBA and Basin states are using the transition period and beyond to improve the arrangements for monitoring and reporting on these forms of take.

For example, commencing in 2013–14, the Australian Capital Territory introduced improvements in annual reporting by including diversions from Lake Burley Griffin (LBG) and water use from surviving allocations. This is an important achievement that aligns with the Basin Plan which requires any water taken from Basin water resources to be accounted. Work is also underway to provide an improved estimate of net take by commercial plantations, though this will likely only take effect with the accreditation of the Australian Capital Territory water resource plan.

Also commencing from 2014–15, Queensland has been reporting annual actual take volumes for floodplain harvesting as discrete volumes rather than a volume combined with take by runoff dams.

New South Wales has reported discrete long-term estimates of actual take under basic rights as determined under the relevant water sharing plan. Victoria is also preparing a revised
model to provide improved estimates of long term average annual actual take by stock and domestic runoff dams.

During the transition period, no compliance consequences apply if there is an instance where the cumulative balance of differences between actual and permitted take is a debit of 20% or more of the relevant surface water or groundwater TDL. However, these instances may inform the development of water resource plans including accredited methods for determining annual permitted take. They may also form contextual information that the MDBA considers when assessing those methods.

5.1.1 Variability of actual take between years
As discussed in section 3.1.3, it is anticipated that annual actual take will fluctuate from year to year based around water availability, water lawfully accessible for take and water use decisions taken by water entitlement holders. Those water use decisions are generally influenced by:

- the water needs of current crops and/or planned plantings
- commodity and water prices and opportunities to trade
- overall water availability, including water in storage, tributary inflows, in-crop rainfall
- annual allocations to entitlements and the timing of such allocations
- the conditions on entitlements or other rights, such as annual use limits or commence-to-pump triggers
- access to carryover
- the ability to purchase additional allocation.

The same area of a particular crop (annual or permanent) can have different water needs over a season or between seasons depending on climate conditions. This will influence water take decisions over the course of a water year. For example, hot, dry and windy conditions will mean higher volumes of actual water take to meet crop needs, while good in-crop rainfall at the right times can significantly reduce actual water take.

While annual permitted take methods will attempt to explain as much of the inter-annual variation as possible (e.g. through relating use to climatic conditions and water availability, and water lawfully accessible by a certain point in time, e.g. November), it is not always possible to fully explain such variations. This is why there will routinely be differences (‘unders and over’) between annual permitted take and annual actual take.

Further information about the differences between volumes of water that are lawfully accessible for take and annual permitted take is provided at section 6.

5.1.2 Annual actual take and the National Water Accounts (Bureau of Meteorology)
Water take in the Murray–Darling Basin is also reported by the Bureau of Meteorology as part of their work in preparing National Water Accounts (refer http://www.bom.gov.au/water/nwa/2017/).
The reported water take in the Basin differs between this report and that published by the Bureau due to different approaches being adopted to collate the data. The data presented in this report is consistent with the definitions and reporting units established by the Basin Plan; in particular the way the SDLs have been specified and the way water recovery amounts have been quantified. These accounts provide the basis for the Register of Take required under the Basin Plan and the compliance arrangements that will apply from 2019.

The volumes reported in the National Water Accounts (NWA) differ from the volumes reported here for several reasons including:

- NWA does not include take by interceptions
- NWA presents data at a gross level for each component of reported take, where the MDBA presents this as a net take. For some SDL resource units, such as the ACT, actual take is net of any diversions returned to the river
- NWA includes some minor adjustments where other data is reported from another agency for the purposes of the NWA. For example, different volumes for basic rights are used
- NWA determines the take in Victoria for the Goulburn at the farm gate, rather than from the river. MDBA accounts for Goulburn diversions to the Waranga Western Chanel at the river, before water is provided to irrigation districts in the Campaspe and Loddon. The movement of water from the Goulburn to these irrigation areas is for Goulburn entitlements.

### 5.2 Surface water annual actual take

Appendix 2: Surface water SDL trial water take accounts (column headed ‘s.6.10, s.10.10, s.10.15: Annual data: Actual take GL’) sets out total reported combined annual actual take by all forms of take for each SDL resource unit. Table 5.2 lists reported annual actual take for each form of surface water take for each SDL resource unit.

The total actual take reported under the SDL accounting arrangements is higher than that published in the Cap Register (Table 10.4). This is because the SDL accounting includes: take from watercourses for areas not previously included under Cap, interception activities, basic rights and floodplain harvesting. For the 2016–17 water year, actual take is 2,756 GL higher as a result of these inclusions.

The 2016–17 water year saw surface water availability increase significantly as compared with 2015–16. Although allocation volumes were low at the beginning of the water year, above average rainfall across many parts of the Basin saw water availability and the volumes of water lawfully accessible for take increase rapidly. However, while allocations were high, actual surface water take in many parts of Victoria was less than in the previous water year when allocations were much lower. This was largely the result of high rainfall and flooding.

The use of trade and carryover was notable. It is likely that entitlement holders sought to benefit from the allocation they had available but did not require by trading on the temporary market or carrying over allocation for use in future years.
Section 6 provides further detail on water lawfully accessible for take including allocations and trade over the reporting period. At a Basin scale, surface water annual actual take during 2016–17 was less than annual permitted take.

Figure 5.1: Murray–Darling Basin surface water transitional diversion limit, annual permitted take, annual actual take, annual balance and adjusted cumulative balance 2012–13 to 2016–17

Table 5.1 sets out the annual volumes for surface water permitted take, actual take, credits/debits and the transitional cumulative balances for each Basin state over the reporting period. The transitional credits/debits and transitional cumulative balance are for the purposes of the trial only. The formal cumulative balance commences at 0 GL from 1 July 2019 subject to the accreditation of water resource plans.

Table 5.2 sets out the reported volumes of actual take (measured and estimated) for each form of surface water take at the SDL resource unit scale. Where actual take reported in this table has been determined through the use of a long-term average estimate used in the Basin Plan, this is indicated through the use of shading. The relative proportions of actual take reported by Basin states using measured volumes (i.e. metered) or alternative estimates to those used in the Basin Plan is also shown in this table.
### Table 5.1: Surface water permitted take, actual take, annual credits and transitional adjusted cumulative balance 2015–16 and 2016–17

<table>
<thead>
<tr>
<th></th>
<th>2015-16</th>
<th></th>
<th></th>
<th></th>
<th>2016-17</th>
<th></th>
<th></th>
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<tr>
<td></td>
<td>Permitted take (GL)</td>
<td>Actual take (GL)</td>
<td>Annual credit (GL)</td>
<td>Cumul. balance (GL)</td>
<td>Permitted take (GL)</td>
<td>Actual take (GL)</td>
<td>Annual credit (GL)</td>
<td>Cumul. balance (GL)</td>
</tr>
<tr>
<td>Queensland</td>
<td>956.0</td>
<td>871.4</td>
<td>84.6</td>
<td>597.6</td>
<td>1,808.3</td>
<td>1,545.2</td>
<td>263.1</td>
<td>860.8</td>
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<tr>
<td>New South Wales</td>
<td>4,990.2</td>
<td>4,649.4</td>
<td>340.8</td>
<td>2,156.9</td>
<td>7,036.5</td>
<td>6,286.7</td>
<td>749.7</td>
<td>2,890.5</td>
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<td>Australian Capital Territory</td>
<td>56.7</td>
<td>32.1</td>
<td>24.6</td>
<td>104.1</td>
<td>46.2</td>
<td>28.3</td>
<td>18.0</td>
<td>122.1</td>
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<tr>
<td>Victoria</td>
<td>2,676.7</td>
<td>2,942.0</td>
<td>-265.4</td>
<td>1,251.4</td>
<td>3,119.9</td>
<td>2,365.2</td>
<td>754.7</td>
<td>2,021.1</td>
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<td>South Australia</td>
<td>680.2</td>
<td>615.0</td>
<td>65.2</td>
<td>160.5</td>
<td>419.4</td>
<td>449.3</td>
<td>-29.9</td>
<td>126.7</td>
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<tr>
<td>Total Basin</td>
<td>9,359.8</td>
<td>9,109.9</td>
<td>249.9</td>
<td>4,270.6</td>
<td>12,430.3</td>
<td>10,674.7</td>
<td>1,755.6</td>
<td>6,021.1</td>
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Table 5.2: Surface water annual actual take by different forms of take and the level of certainty for each SDL resource unit, water year 2016–17

<table>
<thead>
<tr>
<th>SDL resource unit</th>
<th>Take from watercourses and regulated rivers (GL)</th>
<th>Take by floodplain harvesting (GL)</th>
<th>Take under basic rights (GL)</th>
<th>Net take by commercial plantation (GL)</th>
<th>Take by runoff dams (GL)</th>
<th>Total (GL)</th>
<th>% of Reported Take</th>
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<tr>
<td>Paroo</td>
<td>0.0</td>
<td>0.0</td>
<td>0.3</td>
<td>0.0</td>
<td>10.6</td>
<td>10.9</td>
<td>2%</td>
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<tr>
<td>Warrengo</td>
<td>7.1</td>
<td>0.0</td>
<td>0.3</td>
<td>0.0</td>
<td>13.5</td>
<td>20.9</td>
<td>35%</td>
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<tr>
<td>Nebine</td>
<td>0.0</td>
<td>0.0</td>
<td>0.1</td>
<td>0.0</td>
<td>11.0</td>
<td>11.1</td>
<td>1%</td>
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<tr>
<td>Condamine–Balonne</td>
<td>438.9</td>
<td>122.7</td>
<td>-</td>
<td>1.0</td>
<td>264.0</td>
<td>826.6</td>
<td>68%</td>
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<tr>
<td>Moonie</td>
<td>25.6</td>
<td>0.8</td>
<td>-</td>
<td>0.0</td>
<td>51.0</td>
<td>77.4</td>
<td>34%</td>
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<td>Queensland Border Rivers</td>
<td>401.5</td>
<td>118.8</td>
<td>-</td>
<td>1.0</td>
<td>77.0</td>
<td>598.3</td>
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</tr>
<tr>
<td><strong>Total Queensland</strong></td>
<td><strong>873.2</strong></td>
<td><strong>242.3</strong></td>
<td><strong>0.6</strong></td>
<td><strong>2.0</strong></td>
<td><strong>427.1</strong></td>
<td><strong>1,545.2</strong></td>
<td><strong>72%</strong></td>
</tr>
<tr>
<td>NSW Border Rivers</td>
<td>254.8</td>
<td>3.0</td>
<td>9.9</td>
<td>0.0</td>
<td>95.0</td>
<td>362.6</td>
<td>70%</td>
</tr>
<tr>
<td>Intersecting Streams</td>
<td>3.3</td>
<td>-</td>
<td>2.5</td>
<td>-</td>
<td>111.0</td>
<td>116.8</td>
<td>3%</td>
</tr>
<tr>
<td>Gwydir</td>
<td>349.5</td>
<td>17.8</td>
<td>8.0</td>
<td>1.0</td>
<td>124.0</td>
<td>500.3</td>
<td>70%</td>
</tr>
<tr>
<td>Narmi</td>
<td>331.2</td>
<td>14.0</td>
<td>4.7</td>
<td>5.0</td>
<td>160.0</td>
<td>514.9</td>
<td>64%</td>
</tr>
<tr>
<td>Macquarie–Castlereagh</td>
<td>211.4</td>
<td>0.0</td>
<td>7.1</td>
<td>44.0</td>
<td>266.0</td>
<td>528.5</td>
<td>40%</td>
</tr>
<tr>
<td>Lachlan</td>
<td>186.4</td>
<td>0.0</td>
<td>5.6</td>
<td>29.0</td>
<td>287.0</td>
<td>508.0</td>
<td>37%</td>
</tr>
<tr>
<td>Murrumbidgee</td>
<td>1,639.5</td>
<td>-</td>
<td>6.1</td>
<td>116.0</td>
<td>385.0</td>
<td>2,146.5</td>
<td>76%</td>
</tr>
<tr>
<td>Barwon–Darling Watercourse</td>
<td>298.9</td>
<td>11.5</td>
<td>0.8</td>
<td>-</td>
<td>311.2</td>
<td>96%</td>
<td></td>
</tr>
<tr>
<td>Lower Darling</td>
<td>7.8</td>
<td>-</td>
<td>0.5</td>
<td>0.0</td>
<td>5.5</td>
<td>13.7</td>
<td>57%</td>
</tr>
<tr>
<td>NSW Murray</td>
<td>1,175.2</td>
<td>-</td>
<td>5.1</td>
<td>24.0</td>
<td>80.0</td>
<td>1,284.3</td>
<td>92%</td>
</tr>
<tr>
<td><strong>Total New South Wales</strong></td>
<td><strong>4,457.7</strong></td>
<td><strong>46.2</strong></td>
<td><strong>50.3</strong></td>
<td><strong>219.0</strong></td>
<td><strong>1,513.5</strong></td>
<td><strong>6,286.7</strong></td>
<td><strong>71%</strong></td>
</tr>
<tr>
<td>Australian Capital Territory</td>
<td>16.3</td>
<td>-</td>
<td>-</td>
<td>11.0</td>
<td>1.0</td>
<td>28.3</td>
<td>58%</td>
</tr>
<tr>
<td>Victorian Murray</td>
<td>1,127.3</td>
<td>-</td>
<td>-</td>
<td>22.0</td>
<td>23.0</td>
<td>1,172.3</td>
<td>96%</td>
</tr>
<tr>
<td>Kiewa</td>
<td>5.0</td>
<td>-</td>
<td>-</td>
<td>7.0</td>
<td>6.6</td>
<td>18.6</td>
<td>27%</td>
</tr>
<tr>
<td>Ovens</td>
<td>13.5</td>
<td>-</td>
<td>-</td>
<td>32.0</td>
<td>26.0</td>
<td>71.5</td>
<td>19%</td>
</tr>
<tr>
<td>Broken</td>
<td>9.7</td>
<td>-</td>
<td>-</td>
<td>13.0</td>
<td>30.0</td>
<td>52.7</td>
<td>18%</td>
</tr>
<tr>
<td>Goulburn</td>
<td>690.6</td>
<td>-</td>
<td>-</td>
<td>23.0</td>
<td>86.0</td>
<td>799.6</td>
<td>86%</td>
</tr>
<tr>
<td>Campaspe</td>
<td>11.2</td>
<td>-</td>
<td>-</td>
<td>1.0</td>
<td>39.0</td>
<td>51.2</td>
<td>22%</td>
</tr>
<tr>
<td>Lodden</td>
<td>33.3</td>
<td>-</td>
<td>-</td>
<td>5.0</td>
<td>85.0</td>
<td>123.3</td>
<td>27%</td>
</tr>
<tr>
<td>Wimmera–Mallee</td>
<td>14.0</td>
<td>-</td>
<td>-</td>
<td>1.0</td>
<td>61.0</td>
<td>76.0</td>
<td>18%</td>
</tr>
<tr>
<td><strong>Total Victoria</strong></td>
<td><strong>1,904.6</strong></td>
<td><strong>0.0</strong></td>
<td><strong>0.0</strong></td>
<td><strong>104.0</strong></td>
<td><strong>356.6</strong></td>
<td><strong>2,365.2</strong></td>
<td><strong>81%</strong></td>
</tr>
<tr>
<td>South Australian Murray</td>
<td>424.9</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>424.9</td>
<td>100%</td>
</tr>
<tr>
<td>South Australian NPA</td>
<td>0.0</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3.5</td>
<td>3.5</td>
<td>0%</td>
</tr>
<tr>
<td>Marne Saunders</td>
<td>0.1</td>
<td>-</td>
<td>-</td>
<td>0.0</td>
<td>2.0</td>
<td>2.1</td>
<td>100%</td>
</tr>
<tr>
<td>Eastern Mount Lofty Ranges</td>
<td>10.7</td>
<td>-</td>
<td>-</td>
<td>3.2</td>
<td>4.9</td>
<td>18.8</td>
<td>83%</td>
</tr>
<tr>
<td><strong>Total South Australia</strong></td>
<td><strong>435.7</strong></td>
<td><strong>0.0</strong></td>
<td><strong>0.0</strong></td>
<td><strong>3.2</strong></td>
<td><strong>10.4</strong></td>
<td><strong>449.3</strong></td>
<td><strong>97%</strong></td>
</tr>
<tr>
<td><strong>Total reported take MDB</strong></td>
<td><strong>7,687.6</strong></td>
<td><strong>288.5</strong></td>
<td><strong>50.9</strong></td>
<td><strong>339.2</strong></td>
<td><strong>2,308.6</strong></td>
<td><strong>10,674.7</strong></td>
<td><strong>75%</strong></td>
</tr>
<tr>
<td>Proportion of total take</td>
<td>72%</td>
<td>3%</td>
<td>0%</td>
<td>3%</td>
<td>22%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>% Reported Take**</td>
<td>100%</td>
<td>84%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>% Long Term Average</td>
<td>0%</td>
<td>16%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>

*Note: Shaded cells represent long-term average estimates

** Proportion of data that is reported using annual volumes and not long term average estimates
5.2.1 Proportions of surface water annual actual take that are metered

For the volumes of annual actual take that do not use long-term estimates not all volumes reported in an SDL resource unit are measured (i.e. metered). In the absence of metering other forms of estimation are used including use of long term average estimates and hydrological models.

It is important to note that in this report, a change in the proportion of metered surface water take (for all forms of take) does not represent a reduction in metering. Rather it generally reflects a change in the volume of actual take from watercourses and regulated rivers. This is because actual take from watercourses and regulated rivers is mostly reported from measured data (i.e. meters) whereas take from the other forms of take is mostly being reported using constant long term average estimates (i.e. unmetered).24

This means that the unmetered portion of total actual take will generally remain the same each year but the metered portion will change in response to water availability and user behaviour. As a result the proportion of total actual take that is metered will change. For example, in dry or very wet conditions the proportion of total actual take that is metered is likely to decrease as less water is taken from watercourses and regulated rivers.

At the Basin scale, over the five years of the transition period, between 64% and 73% of annual actual consumptive take from all forms of surface water take was metered. For watercourses and regulated rivers, between 89% and 92% of Basin scale annual actual take was metered. The reported data does not indicate the type or standard of metering. Examples of different types of metering may include measuring depth through a regulator, use of a magnetic flow meter, measurement through a flume gauge, measurement through a Dethridge wheel or measurement based on pump hours.

Reducing the proportion of unmetered take is an area where further improvements in these accounts can be made, recognising the need for cost-effectiveness considerations in relation to certain forms of take (e.g. runoff dams). As discussed in earlier sections and in section 5.4, this report reiterates recommendations made on this issue as set out in the Transition Period Water Take Report 2012–13 to 2015–16 and in the Murray–Darling Basin Water Compliance Review (2017).

The MDBA commends the actions taken by New South Wales and Queensland to improving the metering and measurement of water take under the NSW Water Reform Action Plan and the Independent audit of Queensland’s non-urban water measurement and compliance.

The proportions of metered actual take vary between the northern and southern Basin. For all forms surface water take between 26% and 53% is metered in the northern Basin and between 77% and 84% in the southern Basin. Despite this difference in proportion of metered take, the volume of unmetered water take is similar in the northern and southern Basin due to the larger volumes used in the southern Basin. That is, the average unmetered

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24 Queensland reports annual estimates of take by floodplain harvesting and South Australia reports annual estimates and measurement for take by run off dams in some SDL resource units.
take since 2012–13 in the northern Basin was 2,423 GL/y while in the southern Basin the average was 1,955 GL/y.

In generating these statistics, the MDBA has assumed that:

- In Victoria, unmetered take from watercourses in 2014–15 and 2015–16 used the same categories of reliability as reported by Victoria in the previous two years where data was provided.
- In the Australian Capital Territory and the South Australian Eastern Mount Lofty Ranges and Marne–Saunders SDL resource units, all watercourse diversions are metered.
- Water taken for environmental benefits is not included in these estimates.

<table>
<thead>
<tr>
<th>State / Basin</th>
<th>Metered actual take from watercourses and regulated rivers (%)</th>
<th>Metered actual take for all forms of take (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Queensland</td>
<td>58%</td>
<td>31%</td>
</tr>
<tr>
<td>New South Wales</td>
<td>94%</td>
<td>92%</td>
</tr>
<tr>
<td>Australian Capital Territory</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>Victoria</td>
<td>99%</td>
<td>98%</td>
</tr>
<tr>
<td>South Australia</td>
<td>98%</td>
<td>98%</td>
</tr>
<tr>
<td>Total Basin</td>
<td>91%</td>
<td>89%</td>
</tr>
</tbody>
</table>

5.2.2 Actual take from watercourses

Data on actual take from watercourses has been reported since the 1983–84 water year. Cap reporting on watercourse diversions from designated Cap valleys commenced on an interim basis in 1994–95 and under the ongoing Cap arrangements from 1997–98. Reporting on annual actual take from watercourses and regulated rivers under the 29 surface water SDL resource units covered by the arrangements for SDL water accounting and compliance commenced with the 2012–13 water year.

The volumes of actual take from watercourse and regulated rivers (7,688 GL) cited in Table 5.2 effectively represent Cap annual diversions (7,919 GL) less floodplain harvesting in Queensland (242 GL), plus annual actual take from the surface water SDL resource units not covered by Cap in the Eastern Mount Lofty Ranges water resource plan area of South Australia (11 GL). As a result of these changes the net difference between Cap annual diversions (Table 10.4) and annual actual take for watercourses and regulated rivers is 231 GL.

Of the total 2016–17 watercourse actual take volume in Table 5.2, New South Wales accounted for 58% at 4,458 GL, Victoria accounted for 25% at 1,905 GL, Queensland
accounted for 11% at 873 GL, South Australia accounted for 6% at 436 GL, and the
Australian Capital Territory accounted for 0.2% at 16 GL.

Figure 5.2 shows annual actual take in the form of watercourse diversions over the period of
record (1983–84 to 2016–17). Figure 5.3 shows the same data for Queensland, South
Australia and the Australian Capital Territory to more clearly illustrate the variation in annual
actual take in those states over the reporting period.

Please note that while Figure 5.2 and Figure 5.3 give a record of actual take from the 1983–
84 water year, the data collection methods underpinning these figures changed under the
Basin Plan (2012–13 onwards). The actual take reported under cap (pre 2012–13) includes
some floodplain harvesting and basic rights values as part of take from watercourses due to
a difference in definitions. These values have been excluded from Figure 5.2 and Figure 5.3
from 2012–13 onward as they are discrete forms of take in their own right under the Basin
Plan.
Figure 5.2: Annual actual take from watercourses and regulated rivers, 1983–84 to 2016–17

Figure 5.3: Annual actual take from watercourses and regulated rivers for Queensland, Australian Capital Territory and South Australia only, 1983–84 to 2016–17
5.2.3 Take by floodplain harvesting and runoff dams, net take by commercial plantations and take under basic rights

As discussed in earlier sections, the Basin Plan aims to manage forms of water take not fully accounted for to date under Cap water accounting and compliance arrangements. For surface water these include take by floodplain harvesting, take by runoff dams, net take by commercial plantations and take under basic rights.

For the purpose of the trial of SDL water accounting and compliance, with limited exceptions, both annual actual take (Table 5.2) and annual permitted take for these forms of take at SDL resource unit level are being determined as the long-term estimates as listed in Schedule 3 of the Basin Plan or in the report: Water resource assessments for without-development and baseline conditions, Murray–Darling Basin Authority technical report 2010/20 Version 2 (MDBA 2011) or an alternative volume as reported by the relevant Basin state.

Approaches adopted for the purpose of this report are:

- **Queensland:**
  - floodplain harvesting (known as ‘take by overland flow’) was measured and reported annually and these have been used in the accounts in preference to the estimates in Schedule 3 of the Basin Plan.

- **New South Wales:**
  - floodplain harvesting estimates used were those incorporated in the estimates in Schedule 3 of the Basin Plan. There is work underway to better quantify these estimates. Once this work has been completed and reviewed by the MDBA, it will be incorporated in future reports.
  - take under basic rights is reported using the estimated volumes as determined under the relevant water sharing plan.

- **South Australia:**
  - runoff dam actual take was reported as a combination of metered and estimated data for the Marne Saunders and Eastern Mount Lofty SDL resource units. These have been used in the accounts in preference to the estimates in Schedule 3 of the Basin Plan.

- **Australian Capital Territory**
  - Commercial plantation estimate used was that incorporated in the estimates in Schedule 3 of the Basin Plan. There is work underway to better quantify this estimate as part of the WRP being prepared by the ACT.

The use of the same long-term average (or where available annual) estimates to determine transitional annual permitted take and annual actual take for these forms of take means that these forms of take do not impact on the annual calculation of credits and/or debits or on the consequent cumulative balance and compliance assessment. For example, if the floodplain harvesting component of annual permitted take and annual actual take in an SDL resource unit is always 5 GL the annual balance arising from this component will always be 0 GL.
The current use of long-term average estimates for up to 30% of actual take provides a benchmark from which improvements can be made. Improvements in this area will enhance the integrity of SDL water accounting and compliance.

New methods that either give some expression to annual weather conditions and water availability in the relevant SDL resource unit and/or apply other lines of evidence to provide some ability to identify any growth in these forms of take should be investigated over the remainder of the transition period so that they can be applied from 1 July 2019 wherever possible.

MDBA notes that in March 2018, New South Wales proposed a minimum requirement for monitoring of floodplain harvesting under its Water Reform Action Plan that will introduce measurement of floodplain harvesting under the new licencing framework rather than using estimates as is currently the case. Once implemented, this proposal will provide an important improvement to the overall accuracy of SDL water take accounting.
5.3 Groundwater annual actual take

Groundwater take occurs across the entire Murray–Darling Basin with annual average extraction estimated to be 1,399 GL over the 14 years to 2017. Groundwater represents approximately 10% of the total water take in the Basin over the 2016–17 reporting period with the remainder attributed to surface water take.

The use of groundwater varies greatly across the Basin. During drier periods, the relative importance of groundwater becomes greater and is especially important for regional economies during these times. In particular, communities in north-western New South Wales and south-western Queensland have a high reliance on groundwater.

Furthermore, most groundwater annual actual take is concentrated on a small number of large alluvial groundwater systems in New South Wales, Queensland and Victoria and most of this groundwater use is for irrigation. Ten out of the 81 groundwater SDL resource units represent two thirds or 66% of all groundwater take across the Basin. There are also several cities and towns across the Basin that rely on groundwater for most of their water supply.

Figure 5.4 shows that at a Basin scale, there was a gradual increase in groundwater annual actual take over the first three years of the transitional reporting period from 1,231 GL in 2012–13 to 1,556 GL in 2014–15. This trend steadied with annual actual take reducing slightly from 1,556 GL to 1,535 GL between 2014–15 and 2015–16, and was lower than average with 1,198 GL of annual actual take in 2016–17.

In 2016–17, all states reported lower annual actual take in comparison to 2015–16. New South Wales is the major groundwater user in the Murray–Darling Basin accounting for 62% of total groundwater take during this reporting period. This was followed by Victoria accounting for 18%, Queensland 16% and South Australia 4% of total annual actual take. The Australian Capital Territory accounts for less than 1% of the Basin’s total annual actual take.
5.3.1 Groundwater take under basic rights

Groundwater take under basic rights covers water used for stock and domestic purposes in all Basin states as well as groundwater used for native title rights in some Basin states. While the licencing requirements vary across states, a licence or approval is generally required to construct a bore for stock and domestic purposes, but not always to extract water from it.

Basin states use estimation methods to determine reportable groundwater take under basic rights as volumes extracted are not limited or reportable. In 2016–17, Basin states estimated the total take of groundwater extracted under basic rights to be 239 GL or 20% of total annual actual take from groundwater.

In some parts of the Basin, groundwater is the only reliable source of water for stock and domestic purposes. In 32% of groundwater systems (26 out of 81 SDL resource units) over the reporting period, take under basic rights was the only or main form of take. These SDL resource units accounted for approximately 11% (60 GL) of all groundwater take under basic rights across the Basin. In contrast, in 60% of groundwater systems or 49 SDL resource units, take under basic rights represents less than 10% of total actual take in that SDL resource unit.

Data reporting on groundwater take under basic rights has improved since 2012–13 as states have improved their estimation methods. Due to this improvement, only the estimated figures for 2015–16 and 2016–17 have been reported in the detailed groundwater data set at
Appendix 3: Groundwater SDL trial water take accounts. It is unlikely that groundwater taken under basic rights will fluctuate significantly in quantity between water years as there is unlikely to be significant growth in this form of groundwater use. Over the past two reporting years, estimated groundwater take under basic rights has increased by a total of 1 GL/y across the Basin.

5.3.2 Proportions of groundwater annual actual take that are metered

The proportion of groundwater take that is metered varies between the different states across the Basin. In 2016–17, Basin states reported that 84% of the total annual actual take from groundwater was metered, while 100% of take under basic rights is unmetered. Take under basic rights accounts for approximately 20% of the total Basin-wide annual actual take from groundwater and is not likely to be metered in the future due to the nature of the take.

In the 2016–17 reporting year, the Australian Capital Territory and South Australia reported 100% of take from groundwater as metered. This figure is 99.7% in New South Wales, 72% in Victoria and 36% in Queensland.

5.3.3 Managed aquifer recharge

Managed aquifer recharge (MAR) is the intentional recharge of an aquifer, either by injection or infiltration of treated or untreated surface water into a groundwater system for subsequent recovery by planned extraction or for environmental benefit. One of the inherent benefits of MAR is the ability to use the groundwater system as a storage system to ‘bank’ injected waters for use at another time (e.g. recharge water during wet years for extraction during drier years).

A number of MAR schemes are proposed within the Basin. However, MAR is currently practiced in only two groundwater SDL resource units: one in South Australia and the other in the Australian Capital Territory.

In South Australia, water from the River Murray SDL resource unit and from the tributaries of the River Murray in the Eastern Mount Lofty Ranges surface water SDL resource unit is recharged into the Angas Bremer (Murray Group Limestone) SDL resource unit. In the 2016–17 reporting year, 1.3 GL was added to this groundwater system via MAR with 0.3 GL extracted over the same period.

MAR was first used in the Australian Capital Territory in 2014–15 to test and evaluate the suitability of an aquifer within the Australian Capital Territory (groundwater) SDL resource unit. This forms part of a pilot program by the Australian Capital Territory Government to use MAR to store stormwater harvested and filtered at a neighbourhood-scale for future irrigation of urban green spaces. Over the 2016–17 reporting year, 0.3 GL was added to this groundwater system with 0.1 GL extracted for use over the same period.
The Basin Plan requires that MAR is accounted for in determining annual permitted take.²⁵ MAR volumes are being accounted for in a way that avoids double-counting the extraction of water against an SDL in both the source and receiving SDL resource units.

The use of water extracted from surface water (source) for the purpose of MAR water storage is accounted as actual take for the relevant surface water SDL resource unit. The later extraction of the MAR from the groundwater system (receiver) is then separately accounted for in a way that it does not impact on annual allocations or the determination of annual permitted take or annual actual take from the relevant groundwater SDL resource unit. MAR extraction is not included in the annual permitted take, annual actual take and allocation while reporting these components of take from groundwater.

Table 5.4: Managed aquifer recharge volumes 2015–16 and 2016–17 shows in 2016–17, 1.6 GL was added to groundwater systems across the Basin via MAR, an increase from the 2015–16 reporting year. Over the same period, 0.4 GL was extracted, a decrease from the previous year.

Table 5.4: Managed aquifer recharge volumes 2015–16 and 2016–17

<table>
<thead>
<tr>
<th>SDL resource unit</th>
<th>2015–16</th>
<th>2016–17</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stored (GL)</td>
<td>Extracted (GL)</td>
</tr>
<tr>
<td>Australian Capital Territory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australian Capital Territory (groundwater) (GS52)</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>South Australia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Angas Bremer (Murray Group Limestone) (GS1)</td>
<td>1.0</td>
<td>0.5</td>
</tr>
<tr>
<td>Basin total</td>
<td>1.1</td>
<td>0.6</td>
</tr>
</tbody>
</table>

²⁵ Basin Plan 2012, s10.12(1)(i)
5.4 Recommendations

As noted on page 19, the *Transition Period Water Take Report 2012–13 to 2015–16* made several recommendations to improve the integrity of SDL water accounting and compliance. In 2016–17, these recommendations remain unchanged. The recommendations are as follows:

Recommendation 1:

Improving the methods for estimating volumes of annual actual and annual permitted take.

The current use of long-term average estimates for up to 30% of take (i.e. take by floodplain harvesting, runoff dams, commercial plantations (net take) and under basic rights) provides a benchmark from which improvements can be made. Improvements in this area will enhance integrity of SDL water accounting and compliance.

New methods that give some expression to annual weather conditions and water availability in the relevant SDL resource unit should be investigated over the remainder of the transition period so that they can be applied from 1 July 2019 wherever possible. Similarly, other lines of evidence that provide the ability to identify any growth in these forms of take should also be developed.

The MDBA notes that Victoria has reported in its 2016–17 narrative report that it is preparing a new model for take by runoff dams that will be used to provide updated estimates of long term average take by this form of take.

Recommendation 2:

Increasing the proportion of actual take that is measured across the Basin to an agreed standard.

The integrity of the SDL water accounting and compliance regime is enhanced wherever actual take is measured rather than modelled or estimated. Identifying and taking advantage of cost effective ways of increasing the proportion of measured take, particularly where that measurement is consistent with an agreed national standard, will increase the overall integrity of the regime as well the levels of public confidence in the accounting and compliance arrangements.

Further to the recommendations of this report, the *Murray–Darling Basin Water Compliance Review (2017)* made a number of recommendations about improving the metering and measurement of water take, among others. Three such recommendations are that:

- governments require 95% of meterable take in each water resource area to be metered using AS4747 compliant meters by 2022
- governments audit water take by stock and domestic and other rights holders to identify areas of stress on water resources from the exercise of these rights, and put in place measures to monitor compliance
- New South Wales and Queensland include an updated assessment of water take by floodplain harvesting in their annual water accounts commencing immediately,
and require that 95% of take by non-metered floodplain harvesting is accurately measured, for example, by calibrated storage level recorders by 30 June 2022 and publish annual milestones towards this objective.

The MDBA reiterates these recommendations. The MDBA commends the commitments made by New South Wales and Queensland to improving the metering and measurement of water take under the NSW Water Reform Action Plan and the Independent audit of Queensland’s non-urban water measurement and compliance.

MDBA notes that in March 2018, New South Wales proposed a minimum requirement for monitoring of floodplain harvesting and options for improving measurement and metering more broadly under its Water Reform Action Plan. If implemented, the floodplain harvesting minimum requirements and an effective ‘no meter, no pump’ policy will bring a significant improvement to the reporting of water use. Once implemented, this proposal will provide an important improvement to the overall accuracy of SDL water take accounting.

All Basin states are encouraged to maintain momentum in responding to the recommendations where actions have already commenced or to prioritise activity where actions are yet to begin.
6 Water lawfully accessible for take

Under s.71 of the Water Act, Basin states must report:

s.71(1)(d) details of the water allocations made in relation to the water resources of that area in relation to that water accounting period

s.71(1)(e) details of any other decisions made by, or under the law of, the Basin state, that permit the taking of water from the water resources of that area during that water accounting period

This section provides information on the estimated total volume of water that was lawfully accessible for take throughout the Basin at the SDL resource unit level as reported under s.71(1)(d) and (e) of the Water Act. The formal arrangements under which water is made lawfully accessible for take are often different for each form of take within a Basin state and are also different between Basin states.

This includes the terminology used to describe how access to water is granted, which has specific and different meanings depending on the relevant Basin state framework. This report adopts a definition of ‘water lawfully accessible for take’ as meaning:

The granting of permission, either annually or on a long-term basis, to take water from a water source under a form of take in a Basin state in accordance with that state’s legal frameworks.

For both surface water and groundwater, the combined annual total estimated volume of water lawfully accessible for take is not the same as annual permitted take. They are different concepts and further explanation is provided at section 7.1.

Reporting on water lawfully accessible for take is an important part of the overall water take accounting ‘story’. Particularly, reporting on this lawfully accessible volume supports the fundamental concept that in the case where annual actual take exceeds annual permitted take in a given year, the exceedance is likely to be within the amount lawfully accessible in the given period. Actual take being less than the lawfully accessible volume differs from non-compliance for the purposes of SDL accounting, which is determined based on the cumulative difference between annual permitted take and annual actual take (see Section 7). Instances of ‘illegal’ water take are separately identified and progressed (see Section 1.2).

In this context and consistent with the ‘proof of concept’ role of the transitional SDL accounts, the MDBA is committed to reporting on the total estimated annual volume of water that is lawfully accessible for take based on the data submitted by Basin states in accordance with s.71(1)(d) and (e) or through reference to the estimates used in the Basin Plan (see sections 3.1.3 and 5.1). The challenge for the future of water take accounting and reporting is to improve the accuracy, completeness, efficiency and transparency of the data on which these annual volumes are based.

The estimated annual volumes of water that are lawfully accessible for take set out in this report are not used to assess compliance against the relevant SDLs and are not required to be recorded in the Register of Take under s.6.08 of the Basin Plan. This is reflected in
Appendix 2: Surface water SDL trial water take accounts and Appendix 3: Groundwater SDL trial water take accounts by listing this data separately under the heading ‘Other aspects of s.71 reporting’. The inclusion of this data provides greater context to the differences between the trial SDL accounts and the processes outlined under state legislation.

The total estimated volume of water that was lawfully accessible for take is also different to the total volume of water that was available. Water available refers to the volume of water that was physically in the landscape in a particular year (section 4) whereas water lawfully accessible for take is a volume that can be taken as a result of legal arrangements that grant access to take water.

In general terms, lawful access to Basin water resources is granted through frameworks based around several fundamental arrangements. These include:

- volumetric allocations against water entitlements
- access to allocation volumes carried over from previous water years
- trade of annual allocations within and between SDL resource units
- rights to take surface or groundwater or capture flows in runoff dams for domestic and stock purposes (excluding under intensive farming conditions)
- rights to intercept surface water for commercial plantations
- rights to harvest overland flows.

### 6.1 Estimating the volume of water lawfully accessible for take

The determination and reporting of the annual volumes of water that are lawfully accessible for take is subject to similar challenges as the determination and reporting of annual permitted take and annual actual take.

That is, identifying the annual volumes of water that were lawfully accessible for take as irrigation diversions from regulated systems and some unregulated systems is comparatively simple and has been well-established under Cap reporting arrangements. In contrast, determining annual volumes of water that are lawfully accessible for take by floodplain harvesting, by runoff dams and commercial plantations and under basic rights and from groundwater is not well established.

For example, some forms of granting lawful access to take water, e.g. basic rights including stock and domestic or riparian rights, do not include an annual volumetric limit on take. However, capacity to take may be limited by conditions on the right or the water management rules in the relevant catchment.

In the same way that estimates are being used to determine some components of annual actual take and annual permitted take (see sections 3.1.3 and 5.1) estimates are being used to determine some components of the annual volumes of water lawfully accessible for take. Specifically, estimates are used where formal announcements via annual determinations (allocations) or similar arrangements are not made.
In this report, the surface water annual combined total estimated volume of water lawfully accessible for take consists of: annual allocations including use limits where applicable, plus net carryover, plus allocation trade, plus estimates of lawful access to take water by all other forms of take (e.g. interceptions). These volumes are reported as ‘Annual lawfully accessible water including interceptions’ in the second last column of Appendix 2: Surface water SDL trial water take accounts. They are also provided at Table 6.1.

To separate out the more certain annual allocation component of the combined estimated volume of water lawfully accessible for take, Table 6.2 sets out the total volumes of water lawfully accessible for take through explicit allocation decisions (i.e., s.71(1)(d) data only) and excludes take by interceptions (take by runoff dams and net take by commercial plantations), unless annual allocations are specifically made.

For groundwater, the annual combined total estimated volume of water lawfully accessible for take consists of annual allocation, plus carryover, plus allocation trade, plus estimates of authorisations for take under basic rights. These volumes are reported as ‘Water lawfully accessible for take’ in the fourth last column of Appendix 3: Groundwater SDL trial water take accounts. They are also provided, aggregated to Basin state level, at Table 6.3.

6.2 Volumetric allocations

Annual volumetric allocations are the volumes of water determined by Basin states as accessible for take by water entitlement holders in a given year. These determinations may be expressed as a percentage or share component of the total share value of the entitlements held.

Allocations for each of the different classes of entitlements in a particular valley or water source are determined by Basin states under the terms of the relevant water sharing arrangements. Allocations are made in response to factors such as available water in storage, minimum expected stream flows, forecast rainfall and other seasonal conditions.

For example, a 50% allocation against an entitlement with a 100 megalitre (ML) share value grants the holder of the entitlement access to take 50 ML of water. Annual allocations are referred to differently across the Basin. For example, in New South Wales they are known as ‘available water determinations’, in the Victorian Murray they are ‘seasonal determinations’ and in South Australia they are ‘allocations’.

Allocations can also be used as a mechanism to reduce growth in use.

The annual volume of water lawfully accessible for take through allocation is the most ‘certain’ component of the total combined estimated annual volume of water lawfully accessible for take. This is because it is a function of explicit annual ‘announcements’ made by Basin states that can be easily recorded and quantified.
The annual allocation volume, subject to any use limits and/or periods of access, is one of the key factors influencing the total volume of water that is actually taken during a water year. However, it is important to note that in most water years, entitlement holders do not take their full allocation (on average about 75% of the water allocated at the Basin scale is taken).

Allocation not taken is often traded during the year or carried over for use in future years, depending on market activity and local management rules. Allocation that is carried over is at risk of forfeiture and/or spill depending on the rules in the relevant SDL resource unit.
6.2.1 Surface water lawfully accessible for take

As discussed above, the volumes reported in Table 6.1 and Table 6.2 include water allocated in the year in question along with any net carryover available in the relevant systems. As some water can be carried over across multiple years it is not possible to sum volumes allocated across years as this would involve some double counting.

In some unregulated surface water systems (e.g. the Barwon–Darling) water allocated is only available to be taken under certain conditions such as when the flow in the river reaches a designated height. The data in Table 6.1 and Table 6.2 is the overall volume lawfully accessible but access to this water is subject to the relevant licence conditions and/or management rules being met.

Table 6.1 also shows the proportion of the total combined volume lawfully accessible for take that was actually taken in 2015–16 and 2016–17. As can be seen from the data in the table, across the Basin around 75% of the water lawfully accessible for take in 2015–16 was taken, falling to 70% in 2016–17.

Table 6.2 shows the volume of actual take, excluding interceptions as a proportion of water lawfully accessible for take, excluding interceptions fell from 67% in 2015–16 to 64% in 2016–17. Appendix 2: Surface water SDL trial water take accounts shows the same data for the full period since 2012–13.

In both cases, this drop in take may be due to a multitude of factors including cropped area, land use, climatic conditions and the take up of carryover. For example, as noted in sections 4.3.1 and 4.3.2, 2016–17 saw high rainfall and flooding across parts of the southern Basin and this may have reduced actual take in many of the affected surface water areas.
Table 6.1: Estimated surface water lawfully accessible for take (WLA), including interceptions, and estimated actual take (AT) as a proportion of water lawfully accessible for take 2015–16 and 2016–17

<table>
<thead>
<tr>
<th>SDL resource unit</th>
<th>2015-16</th>
<th></th>
<th>2016-17</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water legally accessible (GL)</td>
<td>Actual take (GL)</td>
<td>AT as proportion of WLA (%)</td>
<td>Water legally accessible (GL)</td>
</tr>
<tr>
<td>Queensland</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paroo</td>
<td>9.7</td>
<td>9.7</td>
<td>100%</td>
<td>10.9</td>
</tr>
<tr>
<td>Warrego</td>
<td>86.7</td>
<td>85.9</td>
<td>99%</td>
<td>21.9</td>
</tr>
<tr>
<td>Nebine</td>
<td>26.4</td>
<td>26.4</td>
<td>100%</td>
<td>11.1</td>
</tr>
<tr>
<td>Condamine–Balonne</td>
<td>539.6</td>
<td>530.2</td>
<td>98%</td>
<td>833.3</td>
</tr>
<tr>
<td>Moonie</td>
<td>51.8</td>
<td>51.8</td>
<td>100%</td>
<td>77.4</td>
</tr>
<tr>
<td>Queensland Border Rivers</td>
<td>192.7</td>
<td>167.4</td>
<td>87%</td>
<td>653.0</td>
</tr>
<tr>
<td><strong>Total Queensland</strong></td>
<td>906.9</td>
<td>871.4</td>
<td>96%</td>
<td>1,607.6</td>
</tr>
<tr>
<td>New South Wales</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSW Border Rivers</td>
<td>276.5</td>
<td>222.4</td>
<td>80%</td>
<td>517.3</td>
</tr>
<tr>
<td>Intersecting Streams</td>
<td>131.3</td>
<td>116.8</td>
<td>89%</td>
<td>131.4</td>
</tr>
<tr>
<td>Gwydir</td>
<td>308.2</td>
<td>271.4</td>
<td>88%</td>
<td>733.4</td>
</tr>
<tr>
<td>Namoi</td>
<td>388.5</td>
<td>348.0</td>
<td>90%</td>
<td>765.4</td>
</tr>
<tr>
<td>Macquarie–Castlereagh</td>
<td>737.9</td>
<td>448.6</td>
<td>61%</td>
<td>1,122.7</td>
</tr>
<tr>
<td>Lachlan</td>
<td>741.6</td>
<td>488.1</td>
<td>66%</td>
<td>938.3</td>
</tr>
<tr>
<td>Murrumbidgee</td>
<td>2,163.0</td>
<td>1,828.1</td>
<td>85%</td>
<td>2,923.7</td>
</tr>
<tr>
<td>Barwon–Darling Watercourse</td>
<td>511.1</td>
<td>88.0</td>
<td>17%</td>
<td>504.1</td>
</tr>
<tr>
<td>Lower Darling</td>
<td>60.7</td>
<td>16.5</td>
<td>27%</td>
<td>89.9</td>
</tr>
<tr>
<td>NSW Murray</td>
<td>1,291.6</td>
<td>821.5</td>
<td>64%</td>
<td>1,981.2</td>
</tr>
<tr>
<td><strong>Total New South Wales</strong></td>
<td>6,610.5</td>
<td>4,649.4</td>
<td>70%</td>
<td>9,707.5</td>
</tr>
<tr>
<td>Australian Capital Territory</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australian Capital Territory</td>
<td>87.7</td>
<td>32.1</td>
<td>37%</td>
<td>87.4</td>
</tr>
<tr>
<td>Victoria</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Victorian Murray</td>
<td>1,908.9</td>
<td>1,363.9</td>
<td>71%</td>
<td>1,234.1</td>
</tr>
<tr>
<td>Kiewa</td>
<td>20.8</td>
<td>19.8</td>
<td>95%</td>
<td>19.9</td>
</tr>
<tr>
<td>Ovens</td>
<td>106.2</td>
<td>74.7</td>
<td>70%</td>
<td>105.0</td>
</tr>
<tr>
<td>Broken</td>
<td>58.7</td>
<td>53.8</td>
<td>92%</td>
<td>67.2</td>
</tr>
<tr>
<td>Goulburn</td>
<td>1,243.7</td>
<td>1,154.5</td>
<td>93%</td>
<td>990.7</td>
</tr>
<tr>
<td>Campaspe</td>
<td>149.8</td>
<td>79.3</td>
<td>53%</td>
<td>250.9</td>
</tr>
<tr>
<td>Loddon</td>
<td>194.3</td>
<td>114.3</td>
<td>59%</td>
<td>348.2</td>
</tr>
<tr>
<td>Wimmera–Mallee</td>
<td>191.3</td>
<td>81.8</td>
<td>43%</td>
<td>241.6</td>
</tr>
<tr>
<td><strong>Total Victoria</strong></td>
<td>3,873.8</td>
<td>2,942.0</td>
<td>76%</td>
<td>3,257.5</td>
</tr>
<tr>
<td>South Australia</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA Murray</td>
<td>672.2</td>
<td>597.5</td>
<td>89%</td>
<td>585.4</td>
</tr>
<tr>
<td>SA Non-Prescribed Areas</td>
<td>3.5</td>
<td>3.5</td>
<td>100%</td>
<td>3.5</td>
</tr>
<tr>
<td>Marne Saunders</td>
<td>3.3</td>
<td>2.0</td>
<td>62%</td>
<td>2.7</td>
</tr>
<tr>
<td>Eastern Mount Lofty Ranges</td>
<td>27.8</td>
<td>12.0</td>
<td>43%</td>
<td>25.7</td>
</tr>
<tr>
<td><strong>Total South Australia</strong></td>
<td>706.8</td>
<td>615.0</td>
<td>87%</td>
<td>617.3</td>
</tr>
<tr>
<td><strong>Total Basin</strong></td>
<td>12,185.7</td>
<td>9,109.9</td>
<td>75%</td>
<td>15,277.3</td>
</tr>
</tbody>
</table>

Note: Volumetric allocations or authorisations are not made in the SDL resource unit. In the absence of authorisations/allocations, the permitted take values have been used.
<table>
<thead>
<tr>
<th>SDL resource unit</th>
<th>2015-16</th>
<th>2016-17</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water Lawfully Accessible (excluding interceptions) (GL)</td>
<td>Actual Take (excluding interceptions) (GL)</td>
</tr>
<tr>
<td>Queensland</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paroo</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Warrego</td>
<td>3.7</td>
<td>2.9</td>
</tr>
<tr>
<td>Nebine</td>
<td>1.4</td>
<td>1.4</td>
</tr>
<tr>
<td>Condamine–Balonne</td>
<td>274.6</td>
<td>265.2</td>
</tr>
<tr>
<td>Moonie</td>
<td>0.8</td>
<td>0.8</td>
</tr>
<tr>
<td>Queensland Border Rivers</td>
<td>114.7</td>
<td>89.5</td>
</tr>
<tr>
<td>Queensland Total</td>
<td>395.2</td>
<td>359.7</td>
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<tr>
<td>New South Wales</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSW Border Rivers</td>
<td>181.5</td>
<td>127.4</td>
</tr>
<tr>
<td>Intersecting Streams</td>
<td>20.3</td>
<td>5.8</td>
</tr>
<tr>
<td>Gwydir</td>
<td>183.2</td>
<td>146.4</td>
</tr>
<tr>
<td>Namo</td>
<td>223.5</td>
<td>183.0</td>
</tr>
<tr>
<td>Macquarie–Castlereagh</td>
<td>427.9</td>
<td>138.6</td>
</tr>
<tr>
<td>Lachlan</td>
<td>425.6</td>
<td>172.1</td>
</tr>
<tr>
<td>Murrumbidgee</td>
<td>1,662.0</td>
<td>1,327.1</td>
</tr>
<tr>
<td>Barwon–Darling Watercourse</td>
<td>511.1</td>
<td>88.0</td>
</tr>
<tr>
<td>Lower Darling</td>
<td>55.2</td>
<td>11.0</td>
</tr>
<tr>
<td>NSW Murray</td>
<td>1,187.6</td>
<td>717.5</td>
</tr>
<tr>
<td>Total New South Wales</td>
<td>4,878.0</td>
<td>2,916.9</td>
</tr>
<tr>
<td>Australian Capital Territory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australian Capital Territory Total</td>
<td>75.7</td>
<td>20.1</td>
</tr>
<tr>
<td>Victoria</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Victorian Murray</td>
<td>1,863.9</td>
<td>1,318.9</td>
</tr>
<tr>
<td>Kiewa</td>
<td>7.2</td>
<td>6.2</td>
</tr>
<tr>
<td>Ovens</td>
<td>48.2</td>
<td>16.7</td>
</tr>
<tr>
<td>Broken</td>
<td>15.7</td>
<td>10.8</td>
</tr>
<tr>
<td>Goulburn</td>
<td>1,134.7</td>
<td>1,045.5</td>
</tr>
<tr>
<td>Campaspe</td>
<td>109.8</td>
<td>39.3</td>
</tr>
<tr>
<td>Loddon</td>
<td>104.3</td>
<td>24.3</td>
</tr>
<tr>
<td>Wimmera–Mallee</td>
<td>129.3</td>
<td>19.8</td>
</tr>
<tr>
<td>Total Victoria</td>
<td>3,413.2</td>
<td>2,481.4</td>
</tr>
<tr>
<td>South Australia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Australian Murray</td>
<td>672.2</td>
<td>597.5</td>
</tr>
<tr>
<td>South Australian Non-Prescribed Areas</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Marne Saundersb</td>
<td>0.2</td>
<td>-</td>
</tr>
<tr>
<td>Eastern Mount Lofty Rangesb</td>
<td>17.1</td>
<td>1.6</td>
</tr>
<tr>
<td>Total South Australia</td>
<td>689.5</td>
<td>599.1</td>
</tr>
<tr>
<td>Basin Total</td>
<td>9,451.6</td>
<td>6,377.2</td>
</tr>
</tbody>
</table>

*a Actual take excluding interceptions is the sum of take from regulated rivers, take from watercourses, take by floodplain harvesting and take under basic rights.
6.2.2 Surface water carried over from the previous year

Methods of determining surface water annual permitted take have to account for the volume of water that is available as carryover from the previous year. Over recent years Basin states have developed rules that allow entitlement holders to carryover unused annual allocation volumes. This has been in part a response to the Millennium drought. The arrangements seek to increase the capacity of individual entitlement holders to manage their water portfolio, including for risks with respect to securing access to water across water years.

The rules affecting access to carryover volumes vary from state to state. Subject to these rules and usually depending on the volume of water available during a water year, access to carryover may be cancelled or forfeited. This often occurs in association with the water that had been carried over spilling from the storages in which it was held. The available carryover (often referred to as ‘net carryover’) is the volume carried over from the previous water year less any carryover cancelled or forfeited during the water year in question.

During 2016–17, carryover of surface water allocations was available in all Basin states except the Australian Capital Territory. Carryover has been a prominent factor in water use and hence on determining the annual volume of water lawfully accessible for take. A number of factors may be contributing to the use of carryover by entitlement holders. These include allocation price volatility and the experience of water shortages during the Millennium Drought.

It is also likely that there is a relationship between how well carryover behaviour is being reflected in the determination of annual permitted take and the subsequent annual credits that have accrued each year as transitional cumulative balances (Figure 5.1) The Cap models being used to determine transitional annual permitted take for watercourses and regulated rivers are generally set at 1993–94 levels of development and hence do not incorporate representations of current carryover rules or carryover use.

Consequently, transitional determinations of annual permitted take are not as closely aligned to current levels of development as they could be. They do however, usefully serve as a proof of concept as to the nature and extent of SDL accounting that will apply from 2019. This issue is discussed in more detail at section 2.2.

6.2.3 Groundwater allocation

All Basin states have the ability to make groundwater allocation announcements based on rules within state water management plans. States take into account many factors when making allocations which may include current or expected levels of recharge to a groundwater system, risk of water level changes influencing water quality, water mixing between groundwater systems or changes in groundwater pressure levels causing irreversible impact to the system or risk to existing infrastructure such as bores or wells.
Over the 2016–17 reporting year, only New South Wales, Queensland and Victoria have made allocation announcements affecting a specific groundwater SDL resource unit or sub-areas within SDL resource units.

Table 6.3 shows the total volume of groundwater allocated by states each reporting year. Take under basic rights is not generally subject to allocation announcements. Broadly, allocation over the last two reporting periods has remained at similar levels.

### 6.2.4 Groundwater carried over from the previous water years

Carryover enables groundwater users to carryover unused available groundwater at the end of a water year. This carryover water becomes available in the next water year within the limits and subject to the conditions and rules that the relevant Basin state has in place for each SDL resource unit. The rules affecting access to carryover volumes vary from state to state due to different licence categories and varied hydrogeology across the SDL resources units. In most groundwater systems, towns, domestic and stock and supplementary licence categories cannot carryover.

During the reporting period, carryover of groundwater allocations were available in selected resource units within all Basin states except the Australian Capital Territory. Table 6.3 shows Basin scale groundwater lawfully accessible for take (allocation, carryover and basic rights) as reported by states for the 2015–16 and 2016–17 reporting years.

Generally, carryover volumes are calculated as the unused volumes from the previous water year that are further adjusted to reflect the carryover conditions and rules under the relevant state water management framework.

Appendix 3: Groundwater SDL trial water take accounts shows the data for allocation and carryover at the SDL resource unit scale (column headed ‘Water lawfully accessible for take’. At the Basin scale, 37% of water lawfully accessible for take was used in the 2016–17 reporting year.

<table>
<thead>
<tr>
<th>Basin state</th>
<th>2015–16</th>
<th>2016–17</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Water lawfully accessible for take (GL)</td>
<td>Actual take (GL)</td>
</tr>
<tr>
<td>Queensland</td>
<td>276.9</td>
<td>187.2</td>
</tr>
<tr>
<td>New South Wales</td>
<td>2,317.1</td>
<td>1,043.0</td>
</tr>
<tr>
<td>Australian Capital Territorya</td>
<td>1.48</td>
<td>0.96</td>
</tr>
<tr>
<td>Victoria</td>
<td>499.4</td>
<td>241.9</td>
</tr>
<tr>
<td>South Australia</td>
<td>141.8</td>
<td>62.2</td>
</tr>
<tr>
<td>Basin total</td>
<td>3,236.8</td>
<td>1,535.3</td>
</tr>
</tbody>
</table>

a Carryover is not enabled for groundwater in the Australian Capital Territory
6.3 Water trade within the Basin

Under s.71 of the Water Act, Basin states must report:

\[ s.71(1) (f) \text{ details of the trading or transfer of tradeable water rights in relation to the water resources of that area during that water accounting period.} \]

The Basin Plan water trading rules came into effect on 1 July 2014. Trade of water allocations continues as a major feature of annual water use. This underlines the importance of minimising restrictions on trade and building security and certainty into water sharing frameworks.

This section provides information on the volume of annual allocation water traded at Basin-wide and Basin state scales. Data on trade at the SDL resource unit scale can be provided on request.

Data on water trade in the Basin is recorded by many governments and agencies and for a range of purposes. In the context of the trial of SDL water take accounting and compliance, data on trade is required for two purposes.

The first purpose is in the determination of transitional annual permitted take. Trade of consumptive entitlements and/or allocation into or out of an SDL resource is used to adjust the annual permitted take for that resource unit.

This is done to ensure that the full volume of any consumptive allocation that moved into or out of an SDL resource unit in a water year is reflected in determining the transitional annual permitted take. A simplified example would be if 20 GL of consumptive allocation was traded out of an SDL resource unit and 30 GL of consumptive allocation was traded into that same resource unit, a net volume of 10 GL would be added to the transitional annual permitted take for that SDL resource unit. This is a separate adjustment to annual permitted take as that performed to account for held environmental water entitlements that are available in the SDL resource unit (see section 3.1.2 and Appendix 7: Environmental water adjustment under the trial of SDL water accounting and compliance).

The second purpose is in the determination of the transitional cumulative balance for an SDL resource unit. In accordance with s.6.12(1)(a) of the Basin Plan, the acquisition or disposal of held environmental water allocation, i.e. trade of consumptive allocation to an environmental water entitlement holder or environmental allocation to a consumptive water entitlement holder adjusts the cumulative balance for that SDL resource unit.

As with the adjustment of annual permitted take to account for movement of consumptive allocation, the adjustment to the cumulative balance to account for the acquisition or disposal of held environmental water allocation uses a simple 1:1 ratio. That is, 20 GL of environmental allocation traded to the consumptive pool will increase the cumulative balance by 20 GL. This ensures that compliance is tested against a cumulative balance that accounts for any movement of allocation between the consumptive and environmental pools and vice versa.

Due to the small volumes of trade and use of environmental water in groundwater systems and the ongoing work to establish an agreed method for determining groundwater annual permitted take, adjustments for trade and environmental water availability are not yet being applied in
groundwater SDL resource units. MDBA and Basin states are actively working to establish agreed methods for these purposes.

Similar adjustments for trade and environmental water availability are undertaken for the purpose of Cap compliance. The methods for Cap adjustment for environmental water availability are set out at Appendix 6: State nominated methods for annualising environmental water recovery under the Cap on diversions.

6.3.1 Net trade

For the purposes of determining surface water annual permitted take and adjusting the cumulative balance for a surface water SDL resource unit, the arrangements for SDL accounting and compliance are only concerned with the net volume of change in water lawfully accessible for take from the consumptive pool in an SDL resource unit. Because there can be a lot of trade activity within and across SDL resource units, correctly identifying the net volume of change due to trade can be complex.

For example, a trade of 100 ML of allocation between two consumptive water entitlement holders within the same SDL resource unit would have no effect on the determination of annual permitted take or on the adjustment of the cumulative balance in that SDL resource unit. This is referred to as a ‘within’ SDL resource unit trade and it results in no net change in the volume of consumptive water that is lawfully accessible in the SDL resource unit.

However, if 100 ML consumptive allocation is traded into an SDL resource unit from a neighbouring resource unit, and there were no other trades into or out of that SDL resource unit, there would be a net increase of 100 ML to the volume of consumptive allocation lawfully accessible in that resource unit. This is referred to as an ‘across’ SDL resource units trade and would increase the transitional annual permitted take for the example SDL resource unit by 100 ML.

Extending the example, if 50 ML is traded out of that same SDL resource unit, the net impact on the volume of consumptive allocation that was lawfully accessible would be 50 ML (100 ML sold in – 50 ML sold out = net increase of 50 ML). This would mean that the transitional annual permitted take would be adjusted to increase by 50 ML.

Trades between the consumptive and environmental pools operate slightly differently. Here a trade within the same SDL resource unit has the same effect as a trade across SDL resource units. Both types of trade will change the volume of consumptive allocation that is lawfully accessible in the relevant SDL resource unit.

For example, if a consumptive entitlement holder sold 100 ML of surface water allocation to an environmental water entitlement holder in either the same SDL resource unit or a neighbouring resource unit and there were no other trades, there would be a 100 ML reduction in the total volume of consumptive allocation that is lawfully accessible in the SDL resource unit. Both the transitional annual permitted take and the cumulative balance for the SDL resource unit would be reduced by 100 ML.
6.3.2 Surface water trade

Surface water is traded within and between Basin states, and also within and between the pool of consumptive water entitlements (for irrigation of crops and town water supplies etc.) and environmental water entitlements. Water trade has enabled water entitlement holders to maximise the value of their entitlement by being able to buy and sell water when required.

Trade also provides an important risk management tool. When individual allocation is not enough to meet crop or environmental watering needs entitlement holders can purchase additional allocation to make up part or all of the shortfall.

The volumes of water traded throughout the Basin on an annual basis is set out at Table 6.4. The total volume represents total allocations sold (due to short term and long term water trades) including ‘within’ (i.e. in-valley) and to other SDL resource units (i.e. across or ‘inter-valley’) in each state. This data is provided for both consumptive and environmental holdings.

Volumes of entitlement (or permanent) trade across the Basin are published separately by the Bureau of Meteorology.

The overall volumes of allocation trade are also partitioned into source (i.e. origin) of the water traded (consumptive or environmental) and its destination (consumptive or environmental) in Table 6.4 (see also Figure 6.1 and Figure 6.2). The bulk of environmental allocation trade occurs as the mechanism to deliver and account for the movement of environmental water from one SDL resource unit to another as part of environmental watering actions.

Table 6.4: Total surface water allocation trade (allocation sold) across the Basin: consumptive and environmental uses

<table>
<thead>
<tr>
<th>Year</th>
<th>Total volume (GL/%)</th>
<th>Consumptive to consumptive (GL/%)</th>
<th>Environmental to environmental (GL/%)</th>
<th>Consumptive to environmental (GL/%)</th>
<th>Environmental to consumptive (GL/%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015-16</td>
<td>5,619.1</td>
<td>2,543.9</td>
<td>3,040.8</td>
<td>6.9</td>
<td>27.5</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>45%</td>
<td>54%</td>
<td>0.12%</td>
<td>0.49%</td>
</tr>
<tr>
<td>2016-17</td>
<td>6,421.9</td>
<td>3,425.6</td>
<td>2,943.6</td>
<td>28.9</td>
<td>23.8</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>53%</td>
<td>46%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>
Figure 6.1: Surface water trade (allocation sold) volumes 2012–13 to 2016–17, including total trade, consumptive to consumptive, environment to environment, consumptive to environment and environment to consumptive.

Figure 6.2: Surface water trade (allocation sold) volumes 2012–13 to 2016–17, consumptive to environment and environment to consumptive only.
Table 6.5: Surface water total trade (allocation sold) between consumptive and environmental users

<table>
<thead>
<tr>
<th>Year</th>
<th>Basin state</th>
<th>Allocation trade: total (GL)</th>
<th>Consumptive to consumptive (GL)</th>
<th>Environmental to environmental (GL)</th>
<th>Consumptive to environmental (GL)</th>
<th>Environmental to consumptive (GL)</th>
<th>Net environmental to consumptive (GL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015-16</td>
<td>Queensland</td>
<td>114.1</td>
<td>114.1</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>New South Wales</td>
<td>2,201.9</td>
<td>1,197.8</td>
<td>1,002.0</td>
<td>0.0</td>
<td>2.1</td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td>Australian Capital Territory</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>Victoria</td>
<td>2,405.9</td>
<td>1,033.3</td>
<td>1,350.2</td>
<td>0.0</td>
<td>22.4</td>
<td>22.3</td>
</tr>
<tr>
<td></td>
<td>South Australia</td>
<td>897.1</td>
<td>198.6</td>
<td>688.6</td>
<td>6.9</td>
<td>3.0</td>
<td>-3.9</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>5619.1</td>
<td>2543.9</td>
<td>3040.8</td>
<td>6.9</td>
<td>27.5</td>
<td>20.6</td>
</tr>
<tr>
<td>2016-17</td>
<td>Queensland</td>
<td>267.9</td>
<td>267.9</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>New South Wales</td>
<td>3,018.7</td>
<td>1,473.8</td>
<td>1,521.1</td>
<td>20.0</td>
<td>3.8</td>
<td>-16.2</td>
</tr>
<tr>
<td></td>
<td>Australian Capital Territory</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td>Victoria</td>
<td>2,641.4</td>
<td>1,425.8</td>
<td>1,190.6</td>
<td>5.0</td>
<td>20.0</td>
<td>15.0</td>
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<td></td>
<td>South Australia</td>
<td>493.9</td>
<td>258.1</td>
<td>231.9</td>
<td>3.9</td>
<td>0.0</td>
<td>-3.9</td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
<td>6421.9</td>
<td>3425.6</td>
<td>2943.6</td>
<td>28.9</td>
<td>23.8</td>
<td>-5.1</td>
</tr>
</tbody>
</table>
6.3.3 Groundwater trade

Groundwater allocations and entitlements across the Basin that are traded must be consistent with the Basin Plan Chapter 12 water trading rules. Groundwater trading must meet conditions set out in Chapter 12, which are implemented through accredited water resource plans. Groundwater trade is divided into three categories in the Basin Plan, noting that trade between states is not currently enabled:

- between locations within an SDL resource unit (s.12.24)
- between two SDL resource units (s.12.25)
- between a groundwater SDL resource and a surface water SDL resource unit (s.12.26)

Rules governing groundwater trade vary between Basin states and SDL resource units and are based on individual aquifer properties and demand for the water source. There are a number of SDL resource units where trade is not enabled, commonly where the water quality is not suitable for use or the water in the groundwater system is too difficult to access. States may choose to enable trade in these SDL resource units in the future as long as the Basin Plan trade conditions are met in the water resource plan for those SDL resource units.

Across the Basin, 99% of all trade occurred as trade within the same SDL resource unit and the remaining 1% was trade between SDL resource units in Victoria. There was no trade reported between surface water and groundwater in any state.

During the 2016–17 reporting period, Victoria was the only state to report trade between SDL resource units. This trade in Victoria occurred between SDL resource units in the Goulburn–Murray water resource plan area and water resources outside the Murray–Darling Basin in 2015–16 and 2016–17. The volumes of water traded totalled less than 1.4 GL in each of those years.

Under SDL water take accounting and compliance, volumes of trade between SDL resource units should be taken into account and annual permitted take adjusted accordingly; however due to the small volumes involved, permitted take volumes in these SDL resource units were not adjusted over this reporting period. Improved accounting for the effects of trade on permitted take will be included in future reports.

The majority of groundwater trade, approximately 94% in the 2016–17 reporting period, occurred in New South Wales with over 50% of total trade accounted for in the Lower Murrumbidgee Alluvium (deep) SDL resource unit (GS28) and Lower Lachlan Alluvium SDL resource unit (GS25) combined. South Australian rules allow trade between two groundwater SDL resource units, dependent on relevant conditions being met. State rules in New South Wales currently do not allow for trade between SDL resource units.

As groundwater availability is not dependent on weather conditions in the short term, users commonly turn to groundwater to supplement needs when surface water availability is low. Across the Basin, 2016–17 reporting data shows that decreases in both groundwater trade and groundwater take correspond with increased surface water allocations.

Total groundwater allocation volume traded across the Basin was 185 GL in 2016–17 which is a decrease from 2015–16 where 248 GL of allocation volume was traded. This correlates
with the wetter climatic conditions seen in 2016–17 and subsequent increased surface water availability.

Table 6.6: Total groundwater allocation trade volumes 2015–2016 and 2016–2017. Total includes trade within, into and out of SDL resource units

<table>
<thead>
<tr>
<th>State</th>
<th>Allocation Trade (GL)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2015–16</td>
</tr>
<tr>
<td>Queensland</td>
<td>5.5</td>
</tr>
<tr>
<td>New South Wales</td>
<td>221.5</td>
</tr>
<tr>
<td>Australian Capital Territory</td>
<td>0.0</td>
</tr>
<tr>
<td>Victoria</td>
<td>17.5</td>
</tr>
<tr>
<td>South Australia</td>
<td>3.1</td>
</tr>
<tr>
<td><strong>Basin Total</strong></td>
<td><strong>247.6</strong></td>
</tr>
</tbody>
</table>

Detailed trade volumes at SDL resource unit scale are available from MDBA upon request. This includes a list of SDL resource units where trade was not enabled.
7 Annual permitted take and indicative compliance

Under s.71 of the Water Act, Basin states must report:

s.71(1)(b) the quantity of water permitted to be taken from the water resources of the water resource plan area during the water accounting period

This section provides information on the quantity of water permitted to be taken throughout the Basin at the SDL resource unit level.

Appendix 2: Surface water SDL trial water take accounts (surface water) and Appendix 3: Groundwater SDL trial water take accounts (groundwater) detail the combined total reported volumes of transitional annual permitted take, as determined against the TDL, from each SDL resource unit over the reporting period.

Importantly, annual permitted take is different to the volume of water lawfully accessible for take (see section 6). For surface water, annual permitted take is broadly analogous to the annual Cap target under the Cap on diversions. For groundwater, permitted take is equal to the SDL for most SDL resource units, except where water recovery or supplementary licences occur.

Annual permitted take is defined in the Basin Plan s.6.10(1) as:

For a water accounting period, sum the maximum quantity of water permitted to be taken by each form of take for consumptive use from the SDL resource unit, determined in accordance with the method for section 10.10 (annual permitted take).

Water resource plans are required under section 10.10(1) to set out the method for determining the annual permitted take. To this end, section 10.10(4) states that water resource plans must demonstrate:

…that the method relates to the SDL of each resource unit in such a way that, if applied over a repeat of the historical climate conditions, it would result in meeting the SDL for the resource unit …

In addition to demonstrating that they can achieve the SDLs over the Basin Plan historical climate conditions (1895–2009), the methods for determining annual permitted take that Basin states incorporate into accredited water resource plans must consider a range of other matters (refer Basin Plan s.10.12). These include:

- the climate conditions experienced during the year in question
- all forms of take (from watercourses, regulated rivers, groundwater, by runoff dams, by floodplain harvesting, by commercial plantations (net take) and under basic rights) and all classes of water entitlement in the SDL resource unit
- carryover of allocation from the previous year
- return flows (for surface water)
• trade in and out of the SDL resource unit
• water resources used for managed aquifer recharge (for groundwater)
• accounting separately for the movement of water between the consumptive and environmental pools.

Accordingly, the annual permitted take is the annual expression of the limit on actual take that would, over a repeat of the historical climatic conditions, meet the SDL. So, upon the completion of each water year, the method that would deliver the SDL over the long-term is applied to the year just ended, for example incorporating the climatic conditions experienced, to determine the annual permitted take.

The key component of each accredited surface water resource plan will be the ‘SDL model’ that will generate annual permitted take for each form of take for the purposes of SDL compliance.

During the transition period, most surface water SDL models are not yet available so existing modelling platforms are used and then adjusted as necessary to produce an estimate of the permitted take for the purpose of the transitional accounts. These are generally the Cap models, adjusted as necessary to the BDL, then further adjusted to account for trade and for water recovery that bridges the gap to the SDLs as at the outset of each water.

While permitted take methodologies attempt to explain as much of the inter-annual variation as possible (e.g. through relating use to existing rules, climatic conditions and water availability), it is not always possible to fully explain such variations and so ‘unders’ and ‘overs’ with respect to observed conditions are expected. This is further accentuated in the transition period as the models in use were generally not specifically developed to assist in this task.

The MDBA expects that the methods for determining annual permitted take in accredited water resource plans will include further improvements on the current approach to the adjustments for trade and for held environmental water.

7.1 Water lawfully accessible versus annual permitted take

Appendix 2: Surface water SDL trial water take accounts (surface water) and Appendix 3: Groundwater SDL trial water take accounts (groundwater) also provide data about the reported volumes of water lawfully accessible for take in each SDL resource unit over each year during the transition period. These volumes are generally higher than the reported total volumes of annual permitted take for the same SDL resource unit in the same year.

The question ‘how can the annual volume of water lawfully accessible for take be more than annual permitted take’ requires some explanation. At its simplest, the Cap and SDL regimes are limits on actual take not, directly, on the amount of water made lawfully accessible in a particular year.

Basin states grant access to water based on the sharing arrangements set out in the water resource management instruments developed in each state. Some underuse of water that is
lawfully accessible is expected for a range of reasons (e.g. mid-summer rainfall suppressing demand). Since the introduction of the Cap, Basin states have moderated the amount of water allocated as necessary to ensure Cap compliance. In 2016–17, the amount of water actually taken is around 70% of that made lawfully accessible for take across the Basin (Table 6.1).

7.2 Surface water annual permitted take

Surface water annual permitted take is calculated after the end of each water year. It is the volume of take for the relevant SDL resource unit that reflects the SDL for that year as determined by the method described in the accredited water resource plan. The method will consider factors such as: the rules for water sharing, weather conditions, announced allocations, available carryover, and trade. Appendix 2: Surface water SDL trial water take accounts sets out the transitional annual permitted take for each SDL resource unit as it relates to the long-term average TDL for that year. See Appendix 2: Surface water SDL trial water take accounts, column headed ‘Transitional permitted take (GL) (s.71(1)(b))’.

For the purposes of the trial, the adjustment to annual permitted take to account for held environmental water is being undertaken using a scaling approach as nominated and agreed with each Basin state (Appendix 7: Environmental water adjustment under the trial of SDL water accounting and compliance). These methods improve on those currently being used under the Cap but are a temporary measure to accommodate TDL reporting in advance of fully developed methods that will be defined in Basin state water resource plans.

The use of models for this purpose is a critical function in SDL compliance and perhaps the key component to the overall integrity of the accounts. It should be emphasised that attention to this aspect of water resource plan accreditation will be thorough and the MDBA looks forward to improvements in model performance for this purpose.

At the time of writing only one water resource plan – for the Warrego-Paroo-Nebine water resource plan area – has so far been accredited. Hence for the transitional accounts, adjustments to annual permitted take to account for held environmental water for almost all SDL resource units continues to be undertaken in accordance with the methods nominated by each Basin state.

The methods adopted for the purpose of transition period water accounting better align with Basin Plan arrangements. In New South Wales and Victorian SDL resource units, this results in a larger adjustment to the raw estimates of annual permitted take. Accordingly, the annual and cumulative credits over the five years to date of the transition accounting period differ under the TDL and Cap reporting processes. There is no difference in the methodologies in Queensland and South Australia. In the Australian Capital Territory, a difference only applies in 2015–16 reflecting progress in water recovery at that time.

In overall terms, over the five elapsed years of the transition period, the TDL permitted take volumes are less than the comparable annual Cap targets by an average of around 120 GL per year.

Further, a number of specific approaches were adopted for determining the annual permitted take for some surface water SDL resource units that are described here for completeness:
• New South Wales Barwon–Darling:
  o A number of improvements have been investigated to address long-term issues associated with the hydrological modelling, in particular the ‘trunk’ streams of the Barwon–Darling and River Murray systems. An important issue for modelling such streams is the selection of inflows to be used to generate annual permitted take targets. For the purpose of this report, the annual permitted take targets in the trunk streams have been calculated based on the methodology used for the annual Cap target (i.e. under Cap reporting arrangements).
  o The independent audit reports of Cap models provide a number of recommendations for improving these models including in relation to the choice of inflows and improved estimation for the end of system flows (i.e. Menindee inflows).
  o These issues are identified as areas of future improvement and are expected to be addressed through the accreditation of water resource plans by 2019.

• Australian Capital Territory
  o The water recovery to meet the ACT reduction target (4.9 GL) has been achieved through the purchase of entitlements in the NSW Murrumbidgee. In order for this recovery to be reflected in the annual permitted take in the ACT, an interstate trade account between NSW and the ACT is required. This is not yet in place though both NSW and the ACT have committed to establishing the necessary arrangements.

  For the purpose of this report, it has been assumed that this arrangement is already in place. This was considered the best way to report water use and permitted take for the transition period.

• South Australian Murray
  o For the Metropolitan Adelaide water use component of the SA Murray SDL resource unit annual permitted take, actual use for each of the five years has been used. In the absence of a climate adjusted model for this component of water use, this was seen to provide the most useful surrogate, noting that the actual take for Metropolitan Adelaide has been lower due to the operation of the Adelaide Desalination Plant. A climate adjusted approach for this component is expected to form part of the water resource plan under preparation for this area.

Figure 7.1 presents transitional annual permitted take for surface water over the past five water years by Basin state. The increase in permitted take for 2016–17 when compared to the previous four years is a consequence of increased water availability due to weather conditions experienced during the year.
7.2.1 Recommendations

As reported in the *Transition Period Water Take Report 2012–13 to 2015–16*, states are encouraged to improve the methods for adjusting annual permitted take to account for environmental water recovery.

During the transition period, an improved methodology — as compared with that used for Cap purposes — has been developed to account for environmental water recovery in the annual permitted take volume. This methodology will be superseded through more sophisticated methods that are expected to be developed by Basin states in the preparation of their WRPs.

MDBA will work with Basin states throughout the transition period so that the best available methods for environmental water adjustment are incorporated into water resource plans.

This is fundamental to maintaining the long-term value of water that has been recovered to bridge the gap and hence achieving the SDLs. It is also essential in providing certainty to consumptive and environmental entitlement holders.
7.3 Surface water transitional diversion limits (TDLs)

The TDL for surface water is the BDL reduced each year by the estimated water recovery\(^{26}\) (bridging the gap), which is determined at the beginning of the water year (i.e. as at 1 July). The process and resulting decreasing TDL reflects the progressive reduction in water available for consumptive use.

The Basin’s TDL has been gradually decreasing from the BDL of 13,623 GL/y towards the SDL of 10,813 GL/y (Table 7.1). Accounting for water recovery already achieved at the start of the transition period, the Basin’s TDL was 11,868 GL/y in 2015–16 and 11,772 GL/y in 2016–17.

The TDL for the Warrego, Paroo and Nebine SDL resource units has changed between 2015–16 and 2016–17 as a function of continued water recovery to bridge the gap and as a result of a change to the BDL through accreditation of the Warrego-Paroo-Nebine water resource plan on 15 June 2017.

The TDL for the Intersecting Streams SDL resource unit is BDL minus the water recovery estimate that contributes to the BDL figure in the Basin Plan. A revised BDL for the Intersecting Streams is expected to emerge through the water resource plan (WRP) and accreditation process.

The TDL in the Barwon–Darling SDL resource unit is less than the SDL because all held environmental water (HEW) recovered is higher than the required reduction amount. However, the HEW recovered amount contributes to the BDL. Once the shared reduction amount is agreed by states, a revised TDL will be incorporated in the next reporting period.

In the Australian Capital Territory, the determination of the TDL assumes ACT–NSW trade occurs and water recovery of 4.9 GL/y is considered from 1 July 2015. This is not yet in place, though both NSW and the ACT have committed to addressing this issue.

\(^{26}\) Water recovery refers to entitlements held and available for use by environmental water holders. The volumes cited do not include water recovery that is ‘contracted’, that is, entitlements secured under contracts but not yet transferred from the current owner to the relevant environmental water holder.
Table 7.1: Surface water BDLs, bridging the gap (BtG) recovery at 1 July and transitional diversion limits (GL) 2015–16* and 2016–17

<table>
<thead>
<tr>
<th></th>
<th>2015-16</th>
<th>2016-17</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BDL (GL/y)</td>
<td>BtG as at July 1 (GL/y)</td>
</tr>
<tr>
<td><strong>Queensland</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paroo</td>
<td>11.8</td>
<td>-</td>
</tr>
<tr>
<td>Warreng</td>
<td>75.6</td>
<td>9.5</td>
</tr>
<tr>
<td>Nebine</td>
<td>20.9</td>
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</tr>
<tr>
<td>Condamine–Balonne</td>
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<td>Moonie</td>
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</tr>
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<td>Queensland Border Rivers</td>
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<td>8.5</td>
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<td>76.7</td>
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<td><strong>New South Wales</strong></td>
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<tr>
<td>NSW Border Rivers</td>
<td>302.6</td>
<td>0.2</td>
</tr>
<tr>
<td>Intersecting Streams</td>
<td>114.0</td>
<td>0.2</td>
</tr>
<tr>
<td>Gwydir</td>
<td>450.2</td>
<td>46.9</td>
</tr>
<tr>
<td>Namoi</td>
<td>508.3</td>
<td>7.6</td>
</tr>
<tr>
<td>Macquarie–Castlereagh</td>
<td>734.3</td>
<td>75.4</td>
</tr>
<tr>
<td>Lachlan</td>
<td>618.4</td>
<td>49.6</td>
</tr>
<tr>
<td>Murrumbidgee</td>
<td>2,501.1</td>
<td>325.6</td>
</tr>
<tr>
<td>Barwon–Darling Watercourse</td>
<td>198.0</td>
<td>25.8</td>
</tr>
<tr>
<td>Lower Darling</td>
<td>60.5</td>
<td>1.0</td>
</tr>
<tr>
<td>NSW Murray</td>
<td>1,811.7</td>
<td>288.9</td>
</tr>
<tr>
<td><strong>NSW Total</strong></td>
<td>7,299.1</td>
<td>821.1</td>
</tr>
<tr>
<td><strong>Australian Capital Territory</strong></td>
<td>52.5</td>
<td>4.9</td>
</tr>
<tr>
<td><strong>Victoria</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Victorian Murray</td>
<td>1,707.1</td>
<td>314.4</td>
</tr>
<tr>
<td>Kiewa</td>
<td>24.6</td>
<td>-</td>
</tr>
<tr>
<td>Ovens</td>
<td>83.4</td>
<td>0.1</td>
</tr>
<tr>
<td>Broken</td>
<td>56.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Goulburn</td>
<td>1,689.4</td>
<td>291.5</td>
</tr>
<tr>
<td>Campaspe</td>
<td>152.6</td>
<td>29.0</td>
</tr>
<tr>
<td>Loddon</td>
<td>178.6</td>
<td>11.9</td>
</tr>
<tr>
<td>Wimmera–Mallee</td>
<td>128.5</td>
<td>22.6</td>
</tr>
<tr>
<td><strong>Vic Total</strong></td>
<td>4,020.4</td>
<td>669.7</td>
</tr>
<tr>
<td><strong>South Australia</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Australian Murray</td>
<td>665.0</td>
<td>122.4</td>
</tr>
<tr>
<td>South Australian Non-Prescribed Areas</td>
<td>3.5</td>
<td>-</td>
</tr>
<tr>
<td>Marne Saunders</td>
<td>2.9</td>
<td>-</td>
</tr>
<tr>
<td>Eastern Mount Lofty Ranges</td>
<td>28.3</td>
<td>-</td>
</tr>
<tr>
<td><strong>SA Total</strong></td>
<td>699.7</td>
<td>122.4</td>
</tr>
<tr>
<td><strong>MDB Total</strong></td>
<td>13,562.6</td>
<td>1,694.8</td>
</tr>
</tbody>
</table>
7.4 Groundwater permitted take

In the case of groundwater systems in the Basin, most of the 81 SDL resource units have use levels below 75% of the SDL, and for more than two thirds of the SDL resource units, use is below half of the SDL. Accordingly for such systems, Basin states may choose to use the average SDL as a surrogate in the absence of a more sophisticated method for the determination of annual permitted take.

However, SDLs are not yet in effect and water recovery to bridge the gap from the BDL to the SDLs is not complete. Consequently, the transitional SDL water accounts use TDLs as the annual permitted take for groundwater. This is the approach adopted for all groundwater SDL resource units in this report.

For most groundwater SDL resource units, the TDL is the same as the current SDL because the majority of SDL resource units have the same or higher SDL than the associated BDL. Over the reporting period, TDL is different than the SDL only for:

- two SDL resource units in Queensland (Upper Condamine Alluvium (Central Condamine Alluvium) and Upper Condamine Alluvium (Tributaries) where the Basin Plan set water recovery targets
- one SDL resource unit in New South Wales (Lower Lachlan Alluvium), which is associated with the Achieving Sustainable Groundwater Entitlements (ASGE) Program that was still progressively coming into effect during the year covered by this report.

The MDBA is currently undertaking a project to assist Basin states in the determination of a method(s) for groundwater annual permitted take. Future methods may potentially be more complex than annual permitted take being equivalent to the SDL, but they will be designed to reduce the incidence of SDL exceedances that are falsely positive. Such methods could link the determination of annual permitted take to the relationship between annual actual take and rainfall and/or other factors.

7.5 Groundwater transitional diversion limits (TDLs)

For most groundwater SDL resource units, the TDL is the same as the current SDL. This is because the majority of SDL resource units are not subject to water recovery to bridge the gap between the BDL and the SDL.

Water recovery to bridge a gap between the BDL and SDL is only required in two groundwater SDL resource units, the Queensland Upper Condamine Alluvium (Central Condamine Alluvium) and Upper Condamine Alluvium (Tributaries). Table 7.2 shows as of 1 July 2016, 2.1 GL (rounded long term average) had been recovered to bridge the gap in...
the Queensland Upper Condamine Alluvium (Central Condamine Alluvium). This volume has been used to adjust the TDL in the 2016–17 reporting period.

Table 7.2: Groundwater transitional diversion limits (TDLs) in SDL resource units subject to water recovery of HEW under ‘bridging the gap’ for 2015–16 and 2016–17

<table>
<thead>
<tr>
<th>SDL resource unit</th>
<th>BDL (GL/y)</th>
<th>SDL (GL/y)</th>
<th>2015-16</th>
<th>2016-17</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper Condamine Alluvium (Central Condamine Alluvium)</td>
<td>81.4</td>
<td>46.0</td>
<td>0.0</td>
<td>81.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>79.3</td>
</tr>
<tr>
<td>Upper Condamine Alluvium (Tributaries)</td>
<td>45.5</td>
<td>40.5</td>
<td>0.0</td>
<td>45.5</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.0</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>45.5</td>
</tr>
</tbody>
</table>

The other SDL resource unit in which the TDL is different to the SDL over the reporting period is the Lower Lachlan Alluvium. This is associated with a progressive reduction of groundwater allocations.

In 2005, New South Wales introduced the Achieving Sustainable Groundwater Entitlements (ASGE) Program, which aims to ensure the long-term sustainability of a number of groundwater sources, which largely but not wholly correspond to seven SDL resource units:

- Upper Namoi Alluvium
- Lower Namoi Alluvium
- Lower Murrumbidgee Alluvium (deep; Calivil Formation and Renmark Group)
- Lower Gwydir Alluvium
- Lower Lachlan Alluvium
- Lower Macquarie Alluvium and
- Lower Murray Alluvium (deep; Renmark Group and Calivil Formation)

At the commencement of the water sharing plans, the entitlements for these systems were reduced. Where a licence holder previously extracted more than their new reduced entitlement, a supplementary water access licence was issued to allow adjustment to the reduction by provision of extra water. The allocation of water under these supplementary water access licences was progressively reduced over a 10-year adjustment period allowing licence holders to adapt. Table 7.3 shows the amount of supplementary water and resulting decreasing TDL from 2015–16 to 2016–17.

In 2015–16, supplementary volumes had reduced to zero in all these areas with the exception of the Lower Lachlan Alluvium, which was reduced to zero on 1 July 2017.

Groundwater TDLs at the SDL resource unit level for the last five reporting years have been reported in the detailed groundwater data set at Appendix 3: Groundwater SDL trial water take accounts. See column headed ‘TDL (GL) s.71(1)(b) – permitted take’.
Table 7.3: Groundwater transitional diversion limits (TDLs) in SDL resource units that had entitlements reduced under the NSW ASGE Program for 2015–16 and 2016–17

<table>
<thead>
<tr>
<th>SDL resource unit</th>
<th>BDL (GL/y)</th>
<th>SDL (GL/y)</th>
<th>2015-16</th>
<th>2016-17</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Supplementary water (GL)</td>
<td>TDL (GL)</td>
</tr>
<tr>
<td>Upper Namoi Alluvium</td>
<td>123.4</td>
<td>123.4</td>
<td>0.0</td>
<td>123.4</td>
</tr>
<tr>
<td>Lower Namoi Alluvium</td>
<td>88.3</td>
<td>88.3</td>
<td>0.0</td>
<td>88.3</td>
</tr>
<tr>
<td>Lower Murrumbidgee Alluvium (deep; Calivil Formation and Renmark Group)</td>
<td>273.6</td>
<td>273.6</td>
<td>0.0</td>
<td>273.6</td>
</tr>
<tr>
<td>Lower Gwydir Alluvium</td>
<td>33.0</td>
<td>33.0</td>
<td>0.0</td>
<td>33.0</td>
</tr>
<tr>
<td>Lower Lachlan Alluvium</td>
<td>123.4</td>
<td>117.0</td>
<td>4.2</td>
<td>121.2</td>
</tr>
<tr>
<td>Lower Macquarie Alluvium*</td>
<td>70.7</td>
<td>70.7</td>
<td>0.0</td>
<td>70.7</td>
</tr>
<tr>
<td>Lower Murray Alluvium (deep; Renmark Group and Calivil Formation)</td>
<td>88.9</td>
<td>88.9</td>
<td>0.0</td>
<td>88.9</td>
</tr>
</tbody>
</table>

*The BDL, SDL and TDL in this table have not been adjusted to exclude take from the Jurassic Sandstone of the Great Artesian Basin (GAB) as per Schedule 4 in the Basin Plan. The MDBA is working with New South Wales to define GAB resources and agree on a volume to use for this adjustment.

7.6 Transitional assessment of actual take against permitted take and the TDL

Under s.71 of the Water Act, Basin states must report:

> s.71(1)(g) an assessment of compliance with any long-term annual diversion limit for the water resources of the area, or for a particular part of those water resources, in accordance with the method specified in the Basin Plan

This section provides an indicative assessment of water take throughout the Basin at the SDL resource unit level. While there are no formal compliance arrangements in operation during the trial, this assessment uses the provisions set out in the Water Act and the Basin Plan that will apply from 1 July 2019.

As described in earlier sections of this report, the TDL represents the progress of water recovery against the BDL for each year of the transition period (2012–13 to 2018–19). As each year of the transition period progresses, the TDL will approach the SDL in those SDL resource units where water recovery is required until the SDL is achieved by 2019.

During the transition period, annual permitted take is determined with reference to the TDL for that year through a process that accounts for the recovery of water entitlements from the consumptive pool to ‘bridge the gap’ as at the start of the relevant year. The annual permitted take is then determined based on the best available method for this purpose.

As already discussed, annual actual take in 2016–17 was less than annual permitted take at the Basin scale for both surface water and groundwater and hence an annual credit is recorded. When added to the cumulative balance as at 30 June 2016, the transitional cumulative balance at the end of 2016–17 had risen to 6,021 GL for surface water and 10,067 GL for groundwater. The transitional cumulative balances will not carryover to the
formal SDL compliance regime as the Basin Plan requires the Register of Take to commence on 1 July 2019 with a zero balance.

The pattern of cumulative credits evident in these transitional accounts are broadly similar to that observed in the Cap Register. This in part reflects the ongoing use of Cap models for the purpose of calculating the annual permitted take amounts during the transitional period. This issue is discussed further at section 2.2.

The methods for determining surface water annual permitted take that are developed by Basin states in the water resource plans currently under preparation will be based on planning assumptions with respect to utilisation and use of carryover. The planning assumptions adopted will influence the annual permitted take amounts from 2019. Accordingly, any discernible patterns in the accumulation of annual actual take credits or debits will not be apparent for some years after the SDLs take effect from 2019.

The MDBA is preparing guidance material for Basin states about how it will approach the regulation of possible instances of non-compliance with the SDLs under section 6.12 of the Basin Plan. This guidance material will be set out in the SDL Reporting and Compliance Framework and will include information on what will be considered a ‘reasonable excuse’ under this section. The guidance material and MDBA’s approach to such matters will be consistent with the MDBA Compliance Strategy as it is updated over time.

7.6.1 Transitional assessment — Surface water

Appendix 2: Surface water SDL trial water take accounts shows the transitional annual credits/debits and the transitional adjusted cumulative balance for each surface water SDL resource unit.
Table 7.4 and Figure 7.2 show Basin scale TDL, annual permitted take, annual actual take, annual credits and the adjusted cumulative balance for each of the five years to date of the transition period.

The Basin Plan requires that the effect of the disposal or acquisition of environmental water not be included in the annual permitted take estimates (refer section 10.12(3)) but that the net effect of such activity is used to adjust the cumulative balance of credits/debits that is calculated in the Register of Take (refer section 6.12(1)(a)). This adjustment for each year for each SDL resource unit is shown in Appendix 2: Surface water SDL trial water take accounts. The overall effect at the Basin scale is presented in Figure 7.2.

It should be noted that the accumulation of Cap credits may be a result of the use of Cap models for the determination of permitted take during the transition period. It is unlikely to be repeated post 2019 due to the use of updated SDL models. This is explained in section 2.2.4 of this report.
Table 7.4: Murray–Darling Basin surface water transitional diversion limit, transitional annual permitted take, annual actual take, transitional annual credits and cumulative balance for 2012–13 to 2016–17

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TDL (GL)</td>
<td>12,471.8</td>
<td>12,258.8</td>
<td>11,970.4</td>
<td>11,867.8</td>
<td>11,771.5</td>
</tr>
<tr>
<td>Permitted take (GL)</td>
<td>16,011.1</td>
<td>13,167.7</td>
<td>10,685.3</td>
<td>9,359.8</td>
<td>12,430.3</td>
</tr>
<tr>
<td>Actual take (GL)</td>
<td>14,092.8</td>
<td>11,656.1</td>
<td>10,135.8</td>
<td>9,109.9</td>
<td>10,674.7</td>
</tr>
<tr>
<td>Annual balance (GL)</td>
<td>1,918.4</td>
<td>1,511.6</td>
<td>549.5</td>
<td>249.9</td>
<td>1,755.6</td>
</tr>
<tr>
<td>Adjustment for disposal or acquisition of environmental water (GL)</td>
<td>-0.2</td>
<td>25.2</td>
<td>-4.3</td>
<td>20.6</td>
<td>-5.1</td>
</tr>
<tr>
<td>Adjusted cumulative balance (GL)</td>
<td>1,918.1</td>
<td>3,455.0</td>
<td>4,000.1</td>
<td>4,270.6</td>
<td>6,021.1</td>
</tr>
</tbody>
</table>
At the SDL resource unit scale, there were 17 instances among the 116 assessments of take over the reporting period where surface water annual actual take exceed annual permitted take and an annual debit was recorded in the trial Register of Take. Noting that compliance against the TDL does not apply during the transition period, there were no instances where these annual debits resulted in a cumulative balance debit of 20% or more of the TDL.

### 7.6.2 Transitional assessment — Groundwater

Appendix 3: Groundwater SDL trial water take accounts shows the transitional annual credits and the transitional adjusted cumulative balance for each groundwater SDL resource unit.

As discussed in section 7.5, for the purpose of the trial of SDL water accounting and compliance, annual permitted take for groundwater is being set at the relevant TDL. Table 7.5 and Figure 7.3 show Basin scale TDL / annual permitted take, annual actual take, annual balance and adjusted cumulative balance for groundwater across the past five reporting years.

Annual actual take in all groundwater SDL resource units was below TDL for the 2016–17 reporting period.
In the New South Wales Lower Gwydir Alluvium SDL resource unit, annual actual take was greater than the permitted take in 2013–14, 2014–15 and 2015–16. This created a transitional cumulative debit of 23% in 2014–15 and 32% in 2015–16, which, if it were to occur under the Register of Take after 2019, would require NSW to provide a reasonable excuse or be found to be non-compliant with the SDL. Details of this situation can be found in the *Transition Period Water Take Report 2012–13 to 2015–16* on the MDBA website.

In the 2016–17 water year, annual actual take in this SDL resource unit was 23.8 GL and permitted take was 33.0 GL, resulting in a cumulative debit of 4% (refer to Appendix 3: Groundwater SDL trial water take accounts, column headed ‘Indicative compliance test (non-binding) 20% with long-term TDL’). This means that, as forecast in the *Transition Period Water Take Report 2012–13 to 2015–16*, the transitional cumulative balance has returned to within the notional compliance trigger for this SDL resource unit.

This situation is evidence that, in some circumstances following implementation of the Basin Plan’s SDL compliance provisions, it may be inappropriate to instigate non-compliance actions immediately following a breach. It may be more appropriate to gather further information regarding the cause of the breach and revise the model for the determination of permitted take. The decision-making process for these situations will be detailed in the MDBA’s *SDL Reporting and Compliance Framework*, due to be completed later in 2018.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>TDL/Permitted take (GL)</td>
<td>3,446.6</td>
<td>3,422.3</td>
<td>3,398.0</td>
<td>3,373.3</td>
<td>3,345.7</td>
</tr>
<tr>
<td>Annual actual take (GL)</td>
<td>1,231.4</td>
<td>1,397.6</td>
<td>1,556.5</td>
<td>1,535.3</td>
<td>1,198.2</td>
</tr>
<tr>
<td>Annual balance (GL)</td>
<td>2,215.2</td>
<td>2,024.7</td>
<td>1,841.6</td>
<td>1,838.0</td>
<td>2,147.4</td>
</tr>
<tr>
<td>Adjusted cumulative balance (GL)</td>
<td>2,215.2</td>
<td>4,239.9</td>
<td>6,081.5</td>
<td>7,919.5</td>
<td>10,067.0</td>
</tr>
</tbody>
</table>
Figure 7.3: Murray–Darling Basin groundwater transitional diversion limit, annual actual take, annual balance and adjusted cumulative balance 2012–13 to 2016–17
Part 4: Environmental water availability and use
8 Environmental water

In line with objective 1 of the trial of SDL water accounting and compliance, Part 4 of this report sets out information about environmental water as reported to the MDBA in accordance with s.32 of the Water Act 2007 (Cth) and Matter 9 of Schedule 12 of the Basin Plan. These provisions are reproduced in full below and the relevant sub-provision appears at the beginning of the section that presents the information reported against it.

Water Act 2007—Part 2—Division 1 Subdivision C—Environmental management

s.32 Authority to identify and account for held environmental water

The Authority must identify and account for held environmental water in the Murray–Darling Basin for each financial year.

Basin Plan 2012—Schedule 12—Matters for evaluation and reporting requirements

Matter 9 – The identification of environmental water and the monitoring of its use

Matter 9.1 Volume of water available for the identification and accounting of held environmental water (HEW)

Matter 9.1.1 Volume of HEW entitlements by SDL resource unit

Matter 9.1.2 Carryover and forfeiture of HEW by SDL resource unit

Matter 9.1.3 Volume of HEW used by SDL resource unit

Matter 9.2 – volume of planned environmental water available

Matter 9.2.1 Volume of PEW by WRP Area

This part of the report (Part 4) identifies and accounts for held environmental water in the Murray–Darling Basin. Information for some components such as progress of water recovery is provided for each year of the transition period to date, with detailed reporting commencing with the 2013–14 water year. The rest of this part reports on held environmental water available, lawfully accessible for use and actually used in 2016–17 as compared with 2015–16. Part 4 also makes general reference to the identification of planned environmental water in the Basin.

Water used for environmental purposes is referred to as environmental water. The Water Act (sections 4 and 6) and the Basin Plan recognise two types of environmental water: held environmental water (HEW) and planned environmental water (PEW).

HEW is defined as water available under water access rights, water delivery rights and irrigation rights that is used for environmental purposes. Typically, water rights owned by an environmental water holder, such as the Commonwealth Environmental Water Holder.
(CEWH), are referred to as HEW entitlements and contribute to the majority of the HEW available.

By distinction, PEW is environmental water that is generally not callable or associated with any water access rights. There are some exceptions in New South Wales where PEW exists in the form of environmental water allowances in particular valleys. These exist as volumes in storage that may be called in certain circumstances. PEW is discussed in more detail at the end of Part 4.

The Basin Plan required a reduction in long-term average consumptive surface water diversions to achieve the Basin-wide sustainable diversion limit (SDL) estimate of 10,873 GL/y. This estimate was determined at the reference time when the Basin Plan commenced on 24 November 2012. The reduction amount at the reference time was a long-term average volume of 2,750 GL/y and is in addition to HEW that has been recovered for environmental use prior to 30 June 2009. The volume of the reduction amount is to be made available to achieve the environmental objectives of the Basin Plan.

In 2016, South Australia made a request to re-allocate the default shared reduction amount in the southern Basin South Australia zone, in accordance with Basin Plan s.6.05. This results in the estimate of the SDL for South Australian Murray (SS11) decreasing by 1.9 GL/y from 483.1 GL/y to 481.2 GL/y and for the Eastern Mount Lofty Ranges (SS13) increasing by 1.9 GL/y from 26.4 GL/y to 28.3 GL/y. Re-allocating the default shared reduction amount changes the location of water recovery, not the volume.

Section 3.1.1 of this report describes the reasons for the estimate of the SDL changing. It is important to note that only an amendment to the SDL through the SDL adjustment mechanism can lead to a change in the recovery target. In other words, despite changes to the estimate of the SDL, the reduction target remains 2,750 GL/y at 30 June 2017.

The Australian Government has committed to secure the reduction amount to achieve the SDL through the recovery of water entitlements that will be registered as HEW and owned by the Commonwealth Environmental Water Holder. This commitment has been made to avoid any impacts on consumptive entitlement holders associated with the reduction in the size of the consumptive pool.

The recovery of entitlements has been prioritised through investment in on- and off-farm irrigation infrastructure projects rather than through the purchase of entitlements. As part of this approach, non-strategic entitlement purchase has been capped at 1,500 GL/y worth of entitlements (long term average).

It is important to note that registered HEW entitlements retain the same characteristics as the consumptive entitlements from which they are sourced. For example, a New South Wales Murray general security entitlement registered as HEW will have the same characteristics in terms of access rules, fees, charges and tradability as the original New South Wales Murray general security entitlement previously registered as a consumptive entitlement.

Like consumptive water, a portion of HEW is held in the storages and represents the water allocated to water entitlements that are owned by the various environmental water holders.

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27 As noted in section 1.2 footnote 9.
Like irrigation water, this HEW remains in storage until called upon by the relevant Basin state to meet orders submitted by its owners for use at environmental sites. This water is subject to the same storage rules, storage losses, carryover and forfeit rules as consumptive water held in the storage.

The HEW accounts presented herein represent progress to date in assembling these data in a useful and accurate way. A number of potential further improvements have been identified during this year’s process and these will be further investigated and, where improved treatments are confirmed, included in the 2017-18 water take report. This further work will include consideration of improved ways of accounting for return flows from HEW watering activities.

8.1 Determining the long-term average annual volume of HEW

For reporting of HEW entitlements, both the water share volume and a long-term annual average use volume is shown in tables in this section of this report.

The long-term annual average use volume is derived using long-term diversion limit equivalence (LTDLE) factors (also known as ‘Cap factors’). To derive the long-term annual average volume of an entitlement, the water share value is multiplied by the LTDLE factor to give the long-term annual average volume.

For example, if an entitlement has a 50 ML water share value and a LTDLE factor of 0.9, the long-term annual average volume of the entitlement is 50 x 0.9 = 45 ML/y.

LTDLE factors enable differing entitlements across the Basin to be converted into a common currency to allow for direct comparison between products with differing reliability and expected usage under the rules of the relevant water sharing arrangements. LTDLE factors are used to estimate the volume of water recovered to ‘bridge the gap’.

In surface water, there is a unique LTDLE factor for each class of entitlement in each SDL resource unit. In groundwater, most entitlements associated with HEW have been assumed for the purpose of this report to have an LTDLE factor of 1.00. Therefore the entitlement volume equals the long-term diversion limit equivalent volume. In the Upper Condamine-Alluvium (Central Condamine Alluvium) SDL resource unit (GS64a), the LTDLE factor is estimated to be 0.875.

The LTDLE factors that are currently being used to estimate the volume of water recovery to bridge the gap and that have been used to determine the LTDLE volumes in this report, are those adopted by the Murray–Darling Basin Ministerial Council in November 2011. The MDBA expects that LTDLE factors will change due to refinements in their estimation that emerge as Basin states bring forward their water resource plans for accreditation or earlier, through the ‘planning assumptions’ process agreed by Ministerial Council in 2015. This will in turn change the estimates of progress in water recovery towards bridging the gap.

Changes to LTDLE factors may occur because the water resource plans will reflect the best available information about such things as the forecast utilisation of entitlements by various
users and the forecast impact of any new or changed water sharing rules introduced by Basin states. Water resource plans must also use the Basin Plan historical climate conditions (1895 to 2009) as the basis for modelling water availability and this differs from the periods used for some of the 2011 factors.

The ‘planning assumptions’ process agreed by Ministerial Council allowed each state to identify and provide to the MDBA relevant ‘planning assumptions’ that would support each state’s proposed water resource plans. The assumptions include proposed methods that would be used to inform the demonstration of SDL compliance in each SDL resource unit. The planning assumptions enable the calculation of a set of LTDLE factors for the period that the water resource plan operates, and this in turn informs the Australian Government’s water recovery strategy.

The Minister for Agriculture and Water Resources accredited the Warrego-Paroo-Nebine Water Resource Plan on 15 June 2017. As a result of improved information about the estimate of the BDL, this led to an improved set of LTDLE factors applying to water recovery for this water resource plan. The new LTDLE factors increased the estimate of water recovery by 3.3 GL/y in the Nebine and the Warrego SDL resource units.

8.2 Available held environmental water entitlements

Matter 9.1 Volume of water available for the identification and accounting of held environmental water (HEW)

Total available HEW is made up of three components of water recovery:

1. Entitlements recovered prior to the Basin Plan and/or entitlements recognised as providing environmental benefits when the BDL was set.

2. Entitlements recovered after the BDL was established that are not gap-bridging because they were not previously part of consumptive water (e.g. evaporation savings).

3. Entitlements recovered to bridge the gap from the BDL to the SDL (a long-term average annual target of 2,750 GL/y as at 30 June 2017).

Due to the nature of water recovery projects, especially those incorporating significant infrastructure upgrades or renewals, progress in water recovery does not proceed in a regular pattern. From investment to realisation of the savings takes time, sometimes in the order of five or more years. There are a number of water recovery projects still underway which are expected to deliver HEW entitlements in the near future. These projects will contribute to bridging the gap.

In terms of describing total HEW recovery and progress towards achieving the required Basin Plan reduction amount of 2,750 GL/y, the following terms are used:

- HEW ‘contracted’, and
- HEW ‘available’.
HEW ‘contracted’ refers to entitlements secured under contracts but not yet transferred from the current owner to the relevant environmental water holder.

HEW ‘available’ refers to entitlements that have been transferred to the ownership of the relevant environmental water holder and are available for use.

Contracted HEW is reported by the MDBA in conjunction with the Department of Agriculture and Water Resources on a quarterly basis. Information on these quarterly updates are available at http://www.mdba.gov.au/managing-water/environmental-water/progress-water-recovery. These impending HEW entitlements are listed in the HEW register maintained by the MDBA when the entitlement becomes ‘available’.

This part of the report discusses HEW available and not HEW contracted.

8.3 Surface water HEW

8.3.1 Surface water HEW available

Section 32 of the Water Act requires the MDBA to identify and account for all HEW in the Murray–Darling Basin. To meet this obligation, Basin states and the Commonwealth Environmental Water Holder report annually on existing and newly obtained HEW entitlements.

Over the reporting period, total surface water HEW available has increased by 81 GL/y in long-term diversion limit equivalence (LTDLE) terms from 2,789 GL/y at 30 June 2016 to 2,870 GL/y at 30 June 2017.

The HEW register is a formal database, maintained by the MDBA to meet the requirements of the Water Act and the Basin Plan. It records all HEW entitlements registered in the Basin and is the source of all volumes presented in this report.

The total volume of surface water HEW entitlements held at 30 June for 2016 and 2017 is shown in Table 8.1. This table shows all surface water HEW entitlements in the Basin including those entitlements that were HEW before the Basin Plan commenced and those that have been acquired since it commenced.

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<th>2017</th>
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<td>Long-term HEW (GL/y - LTDLE)</td>
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<td>---------------------------</td>
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<tr>
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</table>
Table 8.1 shows the NSW Intersecting Streams SDL resource unit has an estimated recovery of 17 GL/y LTDLE. This figure is based on the entitlements recovered and a LTDLE factor of 1.00. There is some doubt about this value, as the reported diversions over the Cap reporting period remained static at 3 GL/y for over 20 years. In addition, the Authority estimated the baseline watercourse diversions as 3 GL/y in determining the SDLs for the Basin Plan.

Therefore, whilst there are entitlements that can be utilised by the HEW owner, the long-term value associated with these entitlements will require further work by New South Wales. These values are not used in calculations to determine the TDL or permitted take in this report. Further work is required to improve the understanding of actual diversions in this SDL resource unit and determine an appropriate LTDLE to recognise recoveries in the NSW Intersecting Streams.

HEW entitlements are largely generated from water recovery programs funded by the Australian Government and/or Basin state governments. Water recovery programs commenced in the early 2000s and include:

- **Pre-Basin Plan water recovery programs or pre-existing environmental water**
  - Water for Rivers – 228 GL/y LTDLE HEW. This returns 158 GL/y to the Snowy River and 70 GL/y HEW for the River Murray
  - The Living Murray initiative – 488 GL/y LTDLE HEW for the River Murray
  - Victorian government initiatives – 76 GL/y LTDLE HEW (75 GL/y for Wimmera–Mallee and 1 GL/y for the Loddon)
  - South Australian class 9 wetlands entitlement – 34 GL/y LTDLE HEW
  - New South Wales initiatives – 99 GL/y LTDLE HEW (72 GL/y for the Murrumbidgee, 25 GL/y for the Murray and 2 GL/y for the Macquarie)
  - NSW Murrumbidgee pre-existing environmental water – 40 GL/y LTDLE
  - establishing consumptive limits, lower than Cap, in some NSW water sharing plans – contributing 241 GL/y LTDLE for a lower consumptive limit rather than creating HEW

- **Bridging the gap programs under the Basin Plan**
  - Australian Government led Sustainable Rural Water Use and Infrastructure Program (SRWIUP)
  - Other initiatives including water gifted to the Australian Government and state based recovery programs

As shown in Figure 8.1, HEW entitlements have been progressively recovered since 2004 to meet the requirements of state based programs and those of the Basin Plan recovery target. With the commencement of reporting HEW entitlements for the purpose of this report from 2013–14, data from this time forward incorporates pre-existing HEW that was captured in this data.

The rate of increase in HEW entitlements has slowed over the last four years as the remaining gap to achieving the water recovery target draws closer.
Figure 8.1: Total available surface water held environmental water (HEW) entitlements as at 30 June by recovery program for the period 2004 to 2017

SRWUIP refers to the Australian Government Sustainable Rural Water Use and Infrastructure Program. State recoveries include programs such as New South Wales Riverbank and other small recoveries.

HEW entitlements are typically transferred or recognised once the program or stages of the program are finished and the water savings or purchases are confirmed and the HEW entitlement is owned by an environmental manager, for example Commonwealth Environmental Water Holder or Victorian Environmental Water Holder.

There are a range of owners of HEW entitlements, reflecting the investment history in environmental water. HEW entitlement holders in the Basin include:

- Commonwealth Environmental Water Holder (CEWH)
- State governments
  - Victorian Environmental Water Holder (VEWH)
  - various New South Wales state government agencies
  - South Australian Minister for Water and the River Murray
- other private organisations
*Various New South Wales state government agencies
** HEW volume held by other private organisations is 1 GL/y LTDLE and is too small to appear in this chart

Figure 8.2: Proportions of total surface water HEW available as owned by the different environmental water holders as at 30 June 2017

As shown in Figure 8.2 the CEWH holds the largest volume of HEW entitlements in the Basin (62%). This reflects the significant Australian Government investment in water recovery. The CEWH holds HEW entitlements in all Basin states, including HEW recovered for meeting the shared reduction target of 4.9 GL/y in the ACT. The Queensland government does not own any HEW entitlements, instead HEW in Queensland is owned and managed by the CEWH.

Figure 8.3 shows that as at 30 June 2017, the majority of the HEW entitlements are located in New South Wales and Victoria.
The variation of the volume of HEW entitlements across the states shown in Figure 8.3 is a function of several things. Firstly, investment in HEW can only occur where there are opportunities to generate water savings for conversion to HEW entitlements or where there have been water purchases.

Secondly, the water recovered is aimed at meeting the local reduction target and then, once that has been met, the shared reduction target. New South Wales and Victoria have the highest volumes of HEW entitlements, which reflect the larger water recovery targets for these states set out in the Basin Plan. Finally, but not exhaustively, the water must be available within a system that is able to facilitate the delivery of this water to the agreed environmental sites.

### 8.3.2 Surface water HEW that contributes to bridging the gap

As of 30 June 2017:

- 2,083 GL/y LTDLE of contracted HEW was estimated to have been secured towards surface water ‘bridge the gap’. This represents 76% of the Basin Plan water recovery target of 2,750 GL/y; and

- 1,891 GL/y LTDLE of this amount was HEW available to environmental water holders at that time.

The difference between these two values is explained by HEW available entitlements becoming available later than HEW contracted, that is, the transfer of the entitlement occurs after the contract to exchange is recognised. When water recovery programs are completed the difference in these values will disappear as all contracted water is recovered and available for environmental watering.
Figure 8.4 shows the proportion of available ‘bridging the gap’ HEW as a compared to all HEW available in long-term average annual volume terms.

Table 8.2 shows the total available volumes of surface water HEW that contribute to bridging the gap at the SDL resource unit level.

![Figure 8.4: Bridging the gap ‘available’ surface water HEW as compared to the of total ‘available’ surface water HEW as at 30 June 2012–13 to 2016–17](image-url)
Table 8.2: Total surface water HEW that contributes to ‘bridging the gap’ as at 30 June for the period 2015 to 2017

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<th>30 June 2016</th>
<th>30 June 2017</th>
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<td>Paroo</td>
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<td>0.0</td>
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<tr>
<td>Warrego</td>
<td>16.1</td>
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<td>16.1</td>
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<tr>
<td>Nebeine</td>
<td>5.9</td>
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<td>17.8</td>
<td>17.8</td>
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<td>7.6</td>
<td>10.8</td>
</tr>
<tr>
<td>Macquarie-Castlereagh</td>
<td>184.4</td>
<td>75.4</td>
<td>184.4</td>
</tr>
<tr>
<td>Lachlan</td>
<td>114.2</td>
<td>49.6</td>
<td>114.2</td>
</tr>
<tr>
<td>Murrumbidgee</td>
<td>601.0</td>
<td>325.6</td>
<td>613.6</td>
</tr>
<tr>
<td>Barwon-Darling Watercourse</td>
<td>25.8</td>
<td>25.8</td>
<td>28.3</td>
</tr>
<tr>
<td>Lower Darling</td>
<td>1.2</td>
<td>1.0</td>
<td>2.7</td>
</tr>
<tr>
<td>NSW Murray</td>
<td>354.1</td>
<td>288.9</td>
<td>367.3</td>
</tr>
<tr>
<td>NSW total</td>
<td>1,440.9</td>
<td>838.7</td>
<td>1,474.2</td>
</tr>
<tr>
<td>New South Wales</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australian Capital Territory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australian Capital Territory (Surface Water)</td>
<td>7.7</td>
<td>4.9</td>
<td>7.7</td>
</tr>
<tr>
<td>Australian Capital Territory total</td>
<td>7.7</td>
<td>4.9</td>
<td>7.7</td>
</tr>
<tr>
<td>Victoria</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Victorian Murray</td>
<td>346.0</td>
<td>314.4</td>
<td>374.4</td>
</tr>
<tr>
<td>Kiewa</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Ovens</td>
<td>0.1</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Broken</td>
<td>0.3</td>
<td>0.2</td>
<td>0.3</td>
</tr>
<tr>
<td>Goulburn</td>
<td>321.3</td>
<td>291.5</td>
<td>350.2</td>
</tr>
<tr>
<td>Campaspe</td>
<td>30.6</td>
<td>29.0</td>
<td>30.6</td>
</tr>
<tr>
<td>Loddon</td>
<td>12.9</td>
<td>11.9</td>
<td>12.9</td>
</tr>
<tr>
<td>Wimmera-Mallee (Surface Water)</td>
<td>28.0</td>
<td>22.6</td>
<td>28.0</td>
</tr>
<tr>
<td>Victoria total</td>
<td>739.0</td>
<td>669.7</td>
<td>796.3</td>
</tr>
<tr>
<td>South Australia</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA Murray</td>
<td>136.0</td>
<td>122.4</td>
<td>153.5</td>
</tr>
<tr>
<td>SA Non-Prescribed Areas</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Marne Saunders</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Eastern Mount Lofty Ranges</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>South Australia total</td>
<td>136.0</td>
<td>122.4</td>
<td>153.5</td>
</tr>
<tr>
<td>Basin total</td>
<td>2,455.6</td>
<td>1,712.4</td>
<td>2,577.5</td>
</tr>
</tbody>
</table>

\(^a\) As mentioned in section 8.3.1, the water listed as HEW in the Intersecting Streams is not used to determine TDL and permitted take, as the long-term value of these entitlements is not clear.
8.3.3 Surface water HEW to determine the transitional diversion limit

As discussed in earlier sections, total available HEW is made up of three components of water recovery:

1. Entitlements recovered prior to the Basin Plan and/or entitlements recognised as providing environmental benefits when the BDL was set.

2. Entitlements recovered after the BDL was established that are not gap-bridging because they were not previously part of consumptive water (e.g. evaporation savings).

3. Entitlements recovered to bridge the gap between BDL and the SDL (a long-term average annual target of 2,750 GL/y as at 30 June 2017).

The HEW entitlements used to determine the transitional diversional limit (TDL) are only those associated with that component of total HEW available that is associated with water recovery to bridge the gap.

The concept of the TDL is that it represents how much water recovery progress has been made in an SDL resource unit toward bridging the gap from BDL to SDL as at 1 July of the water year in question. Expressed as a formula in its simplest form this means:

\[ \text{TDL} = \text{BDL} - \text{gap-bridging HEW available at 1 July} \]

However, as noted in discussions on Table 8.1 in section 8.3.1, gap-bridging HEW available recovered from the New South Wales Intersecting Streams SDL resource unit is not deducted from BDL for TDL calculation purposes due to unresolved issues about the long-term average volume of these entitlements. For this SDL resource unit the TDL is set at the SDL.

Prior to calculating the TDL any difference between the 30 June and 1 July available HEW volumes that contribute to bridging the gap is identified. There may be difference in 30 June and 1 July volumes as some water recovery programs give effect to water recovery on 1 July each year.

For example, Victorian bulk entitlements are amended at the start of the water year to reflect the outcomes of the previous year’s recovery progress. For the purpose of the trial, these volumes are added to the preceding 30 June (the day prior) HEW entitlements to determine what HEW entitlements that contribute to bridging the gap are available as at 1 July.

In 2016–17 there is no difference between the 30 June and 1 July HEW available volumes that contribute to bridging the gap. This has not been the case in previous years.

Table 8.3 shows the final HEW available volumes that contribute to bridging the gap that are deducted from the BDL, to determine the TDL at the Basin scale. The HEW adjustment to BDL to determine TDL can also be found by SDL resource unit in Table 7.1.
### Table 8.3: Held environmental water (HEW) deducted from BDL to determine surface water TDL as at 1 July 2015 and 2016

<table>
<thead>
<tr>
<th>Year</th>
<th>All HEW available 30 June (GL/y - LTDLE)</th>
<th>Deduct Non gap bridging HEW (GL/y - LTDLE)</th>
<th>Add HEW for 1 July (GL/y - LTDLE)</th>
<th>HEW recoveries to deduct from BDL (GL/y - LTDLE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 July 2015&lt;sup&gt;a&lt;/sup&gt;</td>
<td>2,690.8</td>
<td>995.8</td>
<td>0.0</td>
<td>1,695.0</td>
</tr>
<tr>
<td>1 July 2016</td>
<td>2,789.2</td>
<td>997.8</td>
<td>0.0</td>
<td>1,791.4</td>
</tr>
</tbody>
</table>

<sup>a</sup> Please note that the values appearing in Table 8.3 for 2015–16 will not necessarily match those reported in the *Transitional Water Take Report 2012–13 to 2015–16* due to improvements in HEW data and changes from the accreditation of the Warrego–Paroo–Nebine WRP.
8.4 Groundwater HEW

8.4.1 Groundwater HEW available

Table 8.4 shows the increase in groundwater HEW LTDLE volumes across the Basin. By 30 June 2017, groundwater HEW had increased to 9.3 GL/y compared to 8.7 GL/y at 30 June 2016. This increase is due to ‘gap-bridging’ recovery in the Queensland Upper Condamine Alluvium.

Table 8.4: Total available groundwater HEW as at 30 June for 2016 and 2017

<table>
<thead>
<tr>
<th>Groundwater SDL resource unit</th>
<th>30 June 2016</th>
<th>30 June 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HEW entitlements (GL/y)</td>
<td>long-term HEW (GL/y - LTDLE)</td>
</tr>
<tr>
<td>Queensland</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Condamine Alluvium (Central Condamine Alluvium)</td>
<td>2.4</td>
<td>2.1</td>
</tr>
<tr>
<td>Upper Condamine Alluvium (Tributaries)</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Queensland total</td>
<td>2.4</td>
<td>2.1</td>
</tr>
<tr>
<td>New South Wales</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Billabong Creek Alluvium</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Lachlan Fold Belt</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Lower Murray Alluvium (shallow; Shepparton Formation)</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Lower Murray Alluvium (deep; Renmark Group and Calivil Formation)</td>
<td>1.3</td>
<td>1.3</td>
</tr>
<tr>
<td>Lower Murrumbidgee Alluvium (deep; Calivil Formation and Renmark Group)</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>Upper Murray Alluvium</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>New South Wales total</td>
<td>6.6</td>
<td>6.6</td>
</tr>
<tr>
<td>Total</td>
<td>9.0</td>
<td>8.7</td>
</tr>
</tbody>
</table>

Groundwater HEW in New South Wales is the result of HEW entitlements acquired in six groundwater SDL resource units under the NSW Metering Project, a New South Wales-led state priority project under the Australian Government Sustainable Rural Water Use and Infrastructure Program (SRWUIP). These water savings were offered in return for funding and are not part of ‘bridging the gap’ under the Basin Plan. For this report, this water has not been used to determine the TDLs.

8.4.2 Groundwater HEW that contributes to bridging the gap

Section 8.4.1 sets out the amount of available groundwater HEW throughout the Basin. This section describes the amount of groundwater HEW that contributes to bridging the gap.

As previously noted, the Basin Plan only requires groundwater extractions to be reduced to meet the SDL in two SDL resource units in Queensland, within the Condamine–Balonne water resource plan area (GW21).
The Australian Government has committed to recovering the 40.4 GL/y required to bridge the gap to the SDL in this water resource plan area. The required reduction is 35.4 GL/y in the Upper Condamine Alluvium (Central Condamine Alluvium) SDL resource unit and 5 GL/y in the Upper Condamine Alluvium (Tributaries) SDL resource unit.

Since February 2014, a number of tenders for entitlement purchase have been held in the Upper Condamine Alluvium. These have recovered 2.7 GL/y as at 30 June 2017, or 6.7% of the required 40.4 GL/y target that is to be reached by 2019. A new request for tender to purchase entitlements from all four sub-areas of the Central Condamine Alluvium and tradable groundwater licences in the Dalrymple Creek Alluvium Groundwater Management Area and Oakey Creek Groundwater Management Area was issued Department of Agriculture and Water Resources on 19 April 2018. The tender closes on 31 July 2018.

Table 8.5: Total groundwater HEW that contributes to ‘bridging the gap’ as at 30 June for 2016 and 2017

<table>
<thead>
<tr>
<th>Groundwater SDL resource unit</th>
<th>30 June 2016</th>
<th>30 June 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HEW entitlements (GL/y)</td>
<td>long-term HEW (GL/y - LTDLE)</td>
</tr>
<tr>
<td>Queensland</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Condamine Alluvium (Central Condamine Alluvium)</td>
<td>2.4</td>
<td>2.1</td>
</tr>
<tr>
<td>Upper Condamine Alluvium (Tributaries)</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Queensland total</td>
<td>2.4</td>
<td>2.1</td>
</tr>
<tr>
<td>Total</td>
<td>2.4</td>
<td>2.1</td>
</tr>
</tbody>
</table>

8.4.3 Groundwater HEW to determine the transitional diversion limit

Similar to surface water, ‘gap-bridging’ HEW available at 1 July each water year is deducted from the groundwater BDL for affected Queensland SDL resource units to determine the TDL for that year. Table 8.6 shows the final groundwater HEW available volumes that contribute to bridging the gap and that are deducted from the BDL to determine the TDL for these units.
Table 8.6: Groundwater held environmental water (HEW) a to determine TDL as at 1 July 2015 and 2016

<table>
<thead>
<tr>
<th>Groundwater SDL resource unit</th>
<th>1 July 2015 (GL/y – LTDLE)</th>
<th>1 July 2016 (GL/y – LTDLE)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>All HEW available 30 June 2015</td>
<td>Deduct Non gap bridging HEW</td>
</tr>
<tr>
<td>Queensland</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Upper Condamine Alluvium (Central Condamine Alluvium)</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Upper Condamine Alluvium (Tributaries)</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Queensland total</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>New South Wales</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Billabong Creek Alluvium</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Lachlan Fold Belt</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Lower Murray Alluvium (shallow; Shepparton Formation)</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Lower Murray Alluvium (deep; Renmark Group and Calivil Formation)</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Lower Murrumbidgee Alluvium (deep; Calivil Formation and Renmark Group)</td>
<td>0.0</td>
<td>0.0</td>
</tr>
<tr>
<td>Upper Murray Alluvium</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>New South Wales total</td>
<td>1.3</td>
<td>1.3</td>
</tr>
<tr>
<td>Total</td>
<td>1.3</td>
<td>1.3</td>
</tr>
</tbody>
</table>
8.5 Held environmental water lawfully accessible for use and actual use

**Matter 9.1.2 Carryover and forfeiture of HEW by SDL resource unit**

**Matter 9.1.3 Volume of HEW used by SDL resource unit**

As with consumptive entitlements (refer to section 6), the amount of HEW lawfully accessible for use each year varies depending on the climatic conditions and allocations, carryover from previous years, trade of allocations and allocation adjustments reflecting applicable rules in state water resource plans (or forfeitures). The net volume of allocations that may be used in an SDL resource unit after accounting for these variables is presented in this report as the HEW lawfully accessible for use.

Basin states, the Commonwealth Environmental Water Office (CEWO) and The Living Murray (TLM - as reported by the MDBA) commenced reporting HEW allocation lawfully accessible and used against Matter 9.1.2 and Matter 9.1.3 in the 2013–14 water year. More detailed accounts on HEW lawfully accessible and used can be found in Appendix 4.

**8.5.1 Surface water lawfully accessible for use**

The volume of HEW lawfully accessible for use is a combination of allocations made to HEW entitlements in the year, HEW allocation carryover from the previous year, trade of HEW allocations between SDL resource units, net trade of HEW allocations for consumptive use, net transfer of HEW allocations to outside the Murray-Darling Basin, any unregulated or supplementary HEW use and return flows from HEW watering activities.

The total volume lawfully accessible for use may not be finalised until the end of year, as trades may influence whether the allocation is available in one SDL resource unit or another. For example, Table 8.1 shows South Australia with long-term surface water HEW lawfully accessible for both 2015–16 and 2016–17 at a little over 222 GL/y LTDLE, whilst Table 8.7 shows HEW lawfully accessible as 918 GL and 549 GL for 2015–16 and 2016–17 respectively.

The difference between the long-term value of HEW entitlements and the HEW lawfully accessible for any year is attributable to the climatic conditions in that year and in South Australia’s case, trade from other SDL resource units. For a more detailed breakdown of surface water HEW lawfully accessible for use see Table 10.9.

Also, in unregulated surface water systems, HEW lawfully accessible for use reflects HEW actually recorded as used, not the volume that may be allocated to an account. In unregulated systems allocation is only available to be taken when conditions such as flow height are met. A Basin state practice developed under Cap arrangements is for environmental water used, or more specifically water extracted or diverted, to be reported as environmental use. This same value is also reported as HEW lawfully accessible for use.
Therefore, HEW lawfully accessible for use in unregulated systems and for supplementary access water rights reflects only the actual HEW use that has occurred. For example, Table 8.7 shows zero HEW lawfully accessible for use in the Barwon–Darling as no HEW was used in this period. It is noted that this differs from the way water allocated has been reported for NSW unregulated consumptive users, where the entitlement volume is reported for surface water lawfully accessible for consumptive use. This will be rectified in future reports and the following year.

The volume of surface water HEW lawfully accessible for use each year, influences the timing and location of environmental watering activities for that year.

Each year, the HEW lawfully accessible can be used for the following purposes:

- Undertaking environmental watering actions—such as delivering environmental flows to specific river reaches, wetlands, floodplains and other important ecological sites; or
- Traded, on a temporary basis to the consumptive pool.

At a Basin scale, HEW lawfully accessible for use increased from 2,607 GL in 2015–16 to 3,115 GL in 2016–17. The volumes of HEW lawfully accessible, used and HEW used as a proportion of HEW lawfully accessible over this period are shown in Table 8.7. In 2016–17, HEW lawfully accessible for use continued to increase as a function of the increasing volume of HEW entitlements and greater water availability in 2016–17.
Table 8.7: HEW lawfully accessible, HEW used and the percentage of HEW lawfully accessible used for 2015–16 and 2016–17

<table>
<thead>
<tr>
<th>SDL resource unit</th>
<th>2015–16</th>
<th>2016–17</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HEW lawfully accessible (GL)</td>
<td>HEW used (GL)</td>
</tr>
<tr>
<td>Queensland</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paroo</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Warrego</td>
<td>0.9</td>
<td>0.9</td>
</tr>
<tr>
<td>Nebine</td>
<td>1.0</td>
<td>1.0</td>
</tr>
<tr>
<td>Condamine–Balonne</td>
<td>9.5</td>
<td>9.5</td>
</tr>
<tr>
<td>Moonie</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Queensland Border Rivers</td>
<td>9.7</td>
<td>1.1</td>
</tr>
<tr>
<td>Queensland total</td>
<td>21.2</td>
<td>12.6</td>
</tr>
<tr>
<td>New South Wales</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSW Border Rivers</td>
<td>0.2</td>
<td>-</td>
</tr>
<tr>
<td>Intersecting Streams</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Gwydir</td>
<td>35.6</td>
<td>7.1</td>
</tr>
<tr>
<td>Namoi</td>
<td>6.4</td>
<td>-</td>
</tr>
<tr>
<td>Macquarie–Castlereagh</td>
<td>27.3</td>
<td>19.2</td>
</tr>
<tr>
<td>Lachlan</td>
<td>103.4</td>
<td>48.0</td>
</tr>
<tr>
<td>Murrumbidgee</td>
<td>210.9</td>
<td>115.2</td>
</tr>
<tr>
<td>Barwon–Darling Watercourse</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lower Darling</td>
<td>25.0</td>
<td>-</td>
</tr>
<tr>
<td>NSW Murray</td>
<td>324.8</td>
<td>186.1</td>
</tr>
<tr>
<td>New South Wales total</td>
<td>733.6</td>
<td>375.6</td>
</tr>
<tr>
<td>Australian Capital Territory</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Australian Capital Territory total</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Victoria</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Victorian Murray</td>
<td>521.0</td>
<td>375.5</td>
</tr>
<tr>
<td>Kiewa</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ovens</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>Broken</td>
<td>0.6</td>
<td>0.5</td>
</tr>
<tr>
<td>Goulburn</td>
<td>355.6</td>
<td>242.6</td>
</tr>
<tr>
<td>Campaspe</td>
<td>26.6</td>
<td>13.7</td>
</tr>
<tr>
<td>Loddon</td>
<td>14.1</td>
<td>7.4</td>
</tr>
<tr>
<td>Wimmera–Mallee</td>
<td>16.4</td>
<td>8.1</td>
</tr>
<tr>
<td>Victoria total</td>
<td>934.3</td>
<td>647.8</td>
</tr>
<tr>
<td>South Australia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA Murray</td>
<td>917.6</td>
<td>917.6</td>
</tr>
<tr>
<td>SA Non-Prescribed Areas</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Marne Saunders</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Eastern Mount Lofty Ranges</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>South Australia total</td>
<td>917.6</td>
<td>917.6</td>
</tr>
<tr>
<td>Basin total</td>
<td>2,606.6</td>
<td>1,953.5</td>
</tr>
</tbody>
</table>

NA – means that either no HEW was lawfully accessible for use in the year or in unregulated systems flow conditions did not provide an opportunity for HEW to be used.
8.5.2 Surface water HEW use

Table 8.7 shows the use of HEW lawfully accessible over the period 2015–16 to 2016–17. This table shows an increase in the volume of HEW used over the period from 1,954 GL in 2015–16 to 2,198 GL in 2016–17. This is an increase of 244 GL or approximately 12%.

Table 8.7 also shows HEW used as a percentage of the HEW lawfully accessible. This shows that at the Basin scale HEW use is increasing, and as proportion of HEW lawfully accessible for use there has been a decrease.

This proportional decrease from 75% in 2015–16 to 71% in 2016–17 may reflect that opportunities may not have been available in that year to use the water for environmental outcomes. This may in part be due to the increase in HEW entitlements over the period, a higher level of water available within the basin, or management decisions by environmental water holders to carry supply over for the next water year.

Following the commencement of reporting of Matter 9.1.2 and 9.1.3, HEW use is also reported by CEWO and TLM. The MDBA has identified that reporting of HEW use by CEWO and TLM may differ from that reported by Basin states. For this report, the volumes of HEW use are those reported by Basin states.

Initial investigation of these differences suggests that it is due to different reporting practices of HEW used, particularly where it arises from estimates of use, rather than metered use. CEWO derives an estimate of HEW use and provides this to Basin states. CEWO’s estimate of HEW use is based on prevailing flow conditions of the environmental watering event and associated limits on daily extraction on the licence.

Other reasons for differences include the treatment of returns flows from watering events. For example, a watering event may be estimated, and an estimate is made of the return flow from the event. The return flow may be reported by CEWO as having been used again in a subsequent watering event. This results in one volume of HEW being used multiple times.

Figure 8.5 shows the surface water HEW lawfully accessible for use since the Basin Plan commenced in 2012, and how it was utilised each year. Overall, as shown in this figure, the volume of HEW lawfully accessible and use has increased each year. Whilst HEW forfeited or adjusted in accounts has decreased, there was a small increase in 2016–17 of 12 GL.

This may reflect a lack of opportunity to use the HEW or changing management of the HEW account water. Over the period, the volume of HEW carried over had been declining, and in 2016–17 the volume increased by 252 GL to 887 GL at June 2017. A similar pattern of increased use of carryover of consumptive allocation is also observed between 2015–16 and 2016–17 (refer to Figure 8.6).
The use of HEW to deliver environmental watering actions is often co-ordinated among the different owners of the entitlements. Further information about use of HEW under the Basin Plan is available from the MDBA website at: https://www.mdba.gov.au/managing-water/environmental-water and from the websites of the environmental water holders.

If HEW is not used or extracted it may be:

- carried over to the next water year (if carryover provisions apply) or
- forfeited or deducted from the account if there are no carryover provisions or carryover limits are reached or there is a spill from the storage.

As shown in Figure 8.5 and Figure 8.6 the annual volume of HEW carried over follows the trends in water availability, with the total volume of HEW carried over to 2017–18 being 887 GL.

A small amount of water was forfeited, largely due to storage spill rules. More information about the use of carryover by environmental water holders can be accessed from their respective websites.

Even though owners of HEW have the same set of rights and obligations as other owners of the same class of entitlement, concern has previously been raised that the volume of HEW carried over may be impacting on storages and the rights of other users to that storage. Table 8.8 and Figure 8.6 show that at a Basin scale, HEW carryover as a proportion of actual dam storage was 7% at 30 June 2016 and dropped to 6% at 30 June 2017, as actual dam storage volumes increased over this period.
Table 8.8: HEW and consumptive carryover as a percentage of actual storage and total carryover as at 30 June 2012–13 to 2016–17

<table>
<thead>
<tr>
<th>Year</th>
<th>HEW carryover as proportion of actual storage</th>
<th>Consumptive carryover as a proportion of actual storage</th>
<th>HEW carryover as proportion of total carryover</th>
<th>Consumptive carryover as a proportion of total carryover</th>
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</thead>
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<tr>
<td>2012-13</td>
<td>-*</td>
<td>25%</td>
<td>-*</td>
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<tr>
<td>2013-14</td>
<td>6%</td>
<td>23%</td>
<td>20%</td>
<td>80%</td>
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<tr>
<td>2014-15</td>
<td>7%</td>
<td>25%</td>
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<td>77%</td>
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<tr>
<td>2015-16</td>
<td>7%</td>
<td>24%</td>
<td>23%</td>
<td>77%</td>
</tr>
</tbody>
</table>
| 2016-17 | 6%                                          | 23%                                                    | 20%                                           | 80%#                                                     

*Carryover data unavailable
# Indicative value only – data not available for Condamine-Balonne, Barwon-Darling Watercourse, Wimmera-Mallee and Marne-Saunders SDL resource units

By comparison, consumptive carryover as a proportion of actual dam storage was 24% at 30 June 2016 and fell to 23% at 30 June 2017. Carryover as a percentage of actual storage for a single storage may be different to the figures in Table 8.8 and can vary across the Basin.

Comparing HEW and consumptive carryover, as a proportion of total carryover, HEW carryover was 23% of total carryover at 30 June 2016, with the balance of carryover of 77% for consumptive use. At 30 June 2017, HEW carryover was 20% of total carryover, with the balance of carryover of 80% for consumptive use. This suggests that annual HEW usage, as a proportion of the long term entitlement volume may be slightly higher than for consumptive use. A longer period of time is needed to determine if this trend is sustained.

This analysis suggests, at a Basin scale, the volume of HEW carryover is not impacting on storage volumes and represents a small proportion of total carryover. Even so, if a storage was to fill to capacity, the same rules would apply to both HEW carryover and any consumptive carryover.
In Figure 8.6, dam capacity (the total storage available across the basin) varies across water years due to:

- enlargement of Cotter Dam in the Australian Capital Territory increasing total storage by 70 GL in 2013–14
- works at Lake Burrendong in New South Wales and other minor adjustments decreasing total storage by 490 GL in 2014–15
- The removal of Lake Mokoan in Victoria from reporting after decommissioning, resulting in a decrease in total storage of 365 GL in 2015–16 and
- improvements to Chaffey Dam in NSW increasing total storage by 39 GL in 2016–17.

*HEW carryover data is unavailable for 30 June 2013
*Indicative value only – data not available for Condamine–Balonne, Barwon–Darling Watercourse, Wimmera–Mallee and Marne-Saunders SDL resource units
8.5.3 Groundwater HEW lawfully accessible for use and used

In groundwater systems, the allocation provided for groundwater HEW entitlements is not extracted or used. Groundwater HEW is expected to remain in the groundwater system to provide environmental outcomes, rather than being extracted.

8.6 Planned Environmental Water

*Matter 9.2 – volume of planned environmental water available*

*Matter 9.2.1 Volume of PEW by SDL resource unit*

Section 6 of the Water Act defines planned environmental water (PEW) for the purpose of Basin Plan implementation. There are PEW arrangements throughout the Basin.

PEW is rules-based environmental water that is not associated with any water access rights and is generally not callable, though there are some exceptions to this, particularly in New South Wales.

This rules-based water may maintain minimum flows, ensure a proportion of water flowing into a storage is passed through the storage and released from the dam, or be the residual water that is prevented from being taken as consumptive use.

In unregulated surface water systems and groundwater SDL resource units, PEW is most often created by a rule that limits the volume of water that can be taken for consumptive use.

As PEW is often an operating rule in a water resource plan, it may provide both environmental and non-environmental benefits. For example, PEW may assist in managing in-stream water quality whilst also meeting conveyance losses or providing minimum flows in a reach to enable take under basic rights.

The Water Act and the Basin Plan require that there be no net reduction in the protection of pre-existing PEW in the water resource plans that are being prepared by Basin states. The setting of the Basin Plan SDLs assumed this continued protection. PEW is required to be identified in water resource plans and, once accredited, Basin states will be required to report annually on their compliance on delivering PEW.

Reporting of PEW is a new requirement under the Basin Plan. The MDBA considers that further work is required over the transition period to enable Basin states to improve their reporting of this important element of environmental water from 1 July 2019.
9 Data improvements to date and future work

9.1 Data improvements over the period and ongoing limitations

2016–17 is the fifth completed water year in the transition period (2012–13 to 2018–19) from Cap-based to SDL-based water take accounting and compliance. Basin states and the MDBA continue to work to improve the completeness and accuracy of the data that is used to apply SDL water take accounting and compliance in ways that are consistent with the requirements under the Water Act and the Basin Plan.

Prior to the commencement of the Basin Plan, data for groundwater take, floodplain harvesting, runoff dams, net take by commercial plantations and take under basic rights was not routinely or consistently collected. As a consequence, Basin states and the MDBA have worked together to make sure that the best available information can be provided each year for all forms of take as required by the Basin Plan.

Improvements are being made and include:

- Reporting by SDL resource unit
- Expanding reporting data on actual water taken from watercourses and regulated rivers to include estimates of actual water taken from basic rights, floodplain harvesting, runoff dams, net take by commercial plantations and groundwater.
- Development by some states of new models on which to base estimates of actual take by runoff dams
- Separately reporting actual water taken by each form of take.

However, as was reported in the Transition Period Water Take Report 2012–13 to 2015–16 released in 2017, the improvements have not been implemented across all Basin states or for all forms of take.

It is also true that important limitations on the data that is reported remain. One example of this is the continued use of the long-term average estimates for some forms of take set out in Schedule 3 of the Basin Plan when reporting annual actual take. While this may currently be the best available information, it does not reflect levels of annual take that will vary in response to climate conditions. This applies particularly to actual take from basic rights, runoff dams and net take by commercial plantations.

This issue is likely to continue until improved methods of estimating actual take for these forms of take are developed but at present it represents a key opportunity to improve the overall integrity of SDL water accounting and compliance. The quality of this data may also have a bearing on how water resource plans meet the requirements of s.10.13 of the Basin Plan. This section limits the level of actual take by some forms of take (basic rights, runoff dams and commercial plantations) unless any growth is offset by reductions in take by other...
forms of take (e.g. from watercourses). As such, accurate data on actual take by these forms of take will be an important consideration.

9.2 Improving data collection and handling

There are opportunities for all Basin states and the MDBA to improve data collection and handling. Current arrangements are labour intensive, subject to delays (for example bad weather preventing access to water meters), and prone to inaccuracy through the use of multiple spreadsheets that do not have appropriate controls in place to prevent unintended data errors.

MDBA encourages the Basin states to continue to improve the efficiency, effectiveness and timeliness of data collection and handling.

For its own part, the MDBA aims to complete the HEW assessment module of its new water take data storage and reporting tool in 2018 so that it can be used to assess HEW reporting data for the 2018–19 water year. The new tool will adopt best information management practice to ensure the integrity and accuracy of the processing and assessment of reporting data submitted by the Basin states.

9.3 Developing suitable models

The water resource plans that Basin states develop for surface water SDL resource units are expected to contain hydrological models that represent some forms of take. These models will be the new standard upon which formal SDL accounting is based.

The models used for the Cap are representative of water use and water resources available under state rules in place as at 1993–94 and do not cover many requirements needed to determine annual permitted take under the Basin Plan. Basin states are, accordingly, currently looking into different ways to move from Cap models to SDL models for water resource plans.

As an interim step, Basin states are updating their models to reflect the level of development used to determine the BDL — that is, the water use and state water resource management rules in place as at 30 June 2009.

The MDBA standard for water resource plan accreditation is eWater Source for water resource planning and operations, having regard to the modelling practices of Basin states and the nature of water resource plan areas and operational readiness of the model as it relates to a water resource plan area.

The MDBA will consult on the development of eWater Source for hydrological models used as part of the method for determining annual permitted take with the Basin Plan Implementation Committee (BPIC) and the Water Resource Planning Working Group (WWRPG) and agree separately with each Basin state on the timeframes for its adoption. However, Basin states are concerned that it may take some years to be confident of the new

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28 For Queensland Cap valleys, Cap models represent the water use that is permitted under a Resource Operations Plan. The Murray–Darling Basin Ministerial Council agreed to apply the Cap to Queensland from 2007–08. For the Australian Capital Territory the Council agreed to apply the Cap from 2008–09.

29 Basin Plan Implementation Agreement, task 25.1.
model platform and it may not be sufficiently developed and proven in time to be incorporated into the water resource plans that are due to be place by 1 July 2019.

9.4 Recommendations

Recommendation 4:

Adoption of automated reporting tools where possible to improve the timeliness, accuracy and efficiency of reporting and assessment.

MDBA continue to develop a new automated SDL reporting tool that will enhance the timeliness, accuracy and reporting outputs available from the annual assessment of state water take and HEW reporting data.
## Appendix 1: Cap Register to 30 June 2017

### Table 10.1: Annual Cap adjustments for trade (GL)

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</table>

Table 1 details the volumes of allocations traded from one Cap valley to another Cap valley. It also includes an adjustment for entitlements permanently traded between three valleys, primarily from Victorian Murray and NSW Murray to SA Murray. This value adjusts the annual Cap target for each Cap valley. Sign convention follows positive (+) value as volume traded in and negative (-) value as volume traded out.
### Table 10.2: Annual Cap adjustments for environmental water (GL)

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Table 2 details the values for adjustment of annual Cap targets for environmental water. An annual Cap target as determined by hydrological models includes both consumptive and environmental use. The models do not usually remove environmental water from the annual Cap target. Since compliance with Cap is confined to consumptive use, the adjustment is made to remove environmental use.
### Table 10.3: Annual Cap targets adjusted for trade and environmental water (GL)

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### Notes
* Modelled inter-valley trade (IVT) is deducted from annual cap target for Lower Darling. Further work by NSW and MDBA may amend this approach.

*Table 3 details the annual Cap target for consumptive water after adjusting for trade and environmental water in Table 1 and Table 2.*
### Table 10.4: Annual diversion (GL)

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Table 4 details the actual diversions that occurred in each year for each Cap valley. Diversions are defined by the diversion formula register.
### Table 10.5: Annual Cap credits (GL)

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*Table 5 details the annual balance in credit or debit after deducting actual divergences in Table 4 from annual Cap targets in Table 3 for each Cap valley.*
Table 10.6: Cumulative credits (GL)

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Table 6 details the values from Table 5 on a cumulative basis since Cap commenced.
### Table 10.7: Cap Register for Metropolitan Adelaide South Australia (GL)

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Table 10.7 details the Cap target for Metropolitan Adelaide. It is 650 GL each year minus the actual diversions for previous four years. A model is not used to determine the Cap target in the Metropolitan Adelaide.
Table 10.8: Difference in cumulative Cap credits between Cap Register 2015–16 and Cap Register 2016–17 (GL)

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<th>Cumulative Cap credit up to year 2015–16 in TPWT Report 2016–17</th>
<th>Difference in cumulative Cap credit</th>
<th>Cumulative Cap credit difference due to:</th>
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</table>

*TPWT Report = Transition Period Water Take Report

Table 8 is a comparison of the cumulative Cap credits with the previous year. Variations could be due to a more current model run, changes in trade and environmental adjustments and improvements in accuracy of actual diversions. Models are run each year to determine the annual Cap target. Where the model run produces a different target for the cumulative period than was obtained the previous year, a correction is made to the prior year’s annual targets which results in variations in the cumulative balance.
## Appendix 2: Surface water SDL trial water take accounts

<table>
<thead>
<tr>
<th>SDL Res. Unit code</th>
<th>SDL Resource Unit</th>
<th>WRP Area</th>
<th>State</th>
<th>Long-term averages¹</th>
<th>Long-term averages as HEW⁴ recovery progresses (TDL⁵ reduces to SDL by 2019)</th>
</tr>
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<tbody>
<tr>
<td></td>
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<td></td>
<td>BDL² (GL/y)</td>
<td>SDL³ (GL/y)</td>
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<td>SS29</td>
<td>Paroo</td>
<td>Warrego-Paroo-Nebine</td>
<td>Qld</td>
<td>11.8</td>
<td>11.8</td>
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<tr>
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<td>65.1</td>
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<td>NSW Border Rivers</td>
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<td>Intersecting Streams</td>
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<td>Macquarie –Castlereagh</td>
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<td>Lachlan</td>
<td>NSW</td>
<td>618.4</td>
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<td>Murumbidgee</td>
<td>Murumbidgee</td>
<td>NSW</td>
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<td>1,938.1</td>
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<td>Barwon–Darling Watercourse</td>
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<td>198.0</td>
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<td>Lower Darling¹¹</td>
<td>New South Wales Murray and Lower Darling</td>
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<td>SS14</td>
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<td>Australian Capital Territory</td>
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<td>Victorian Murray</td>
<td>Vic</td>
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<td>Broken</td>
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<td>SDL Res. Unit code</td>
<td>SDL Resource Unit</td>
<td>WRP Area</td>
<td>State</td>
<td>Long-term averages¹</td>
<td>Long-term averages as HEW4 recovery progresses (TDL5 reduces to SDL by 2019)</td>
</tr>
<tr>
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<td>Loddon</td>
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<tr>
<td>SS9</td>
<td>Wimmera–Mallee</td>
<td>Wimmera-Mallee</td>
<td>Vic</td>
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<td>105.5</td>
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<tr>
<td>SS11</td>
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<td>South Australia River Murray</td>
<td>SA</td>
<td>665.0</td>
<td>481.2</td>
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<tr>
<td>SS10</td>
<td>South Australian Non-Prescribed Areas</td>
<td>South Australian Murray Region</td>
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<tr>
<td>SS12</td>
<td>Mame Saunders</td>
<td>Eastern Mount Lofty Ranges</td>
<td>SA</td>
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<td>2.9</td>
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<td><strong>TOTALS</strong></td>
<td><strong>MDB</strong></td>
<td></td>
<td></td>
<td><strong>13,562.6</strong></td>
<td><strong>10,812.6</strong></td>
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</tbody>
</table>

<p>|                  | Qld                               |                  |       | 1,490.9      | 1,315.4    | 1,449.1  1,436.1 1,429.6 1,414.2 1,407.1 | 1,407.1 |
|                  | NSW                               |                  |       | 7,299.1      | 5,988.6    | 6,801.8  6,689.1 6,514.6 6,478.0 6,452.8 | 6,452.8 |
|                  | ACT                               |                  |       | 52.5         | 47.6       | 52.5    52.5 52.5 47.6 47.6 | 47.6   |
|                  | Vic                               |                  |       | 4,020.4      | 2,945.1    | 3,558.8  3,479.6 3,382.8 3,350.7 3,302.5 | 3,302.5 |
|                  | SA                                |                  |       | 699.7        | 515.9      | 609.5    601.5 590.8 577.3 561.6 | 561.6   |
|                  | <strong>MKO</strong>                           | Murray-Kiewa-Ovens| BP s6.12(2)(a) | Vic | 1,815.1      | 1,355.3    | 1,581.1  1,563.9 1,517.4 1,500.6 1,476.4 | 1,476.4 |
|                  | <strong>GBCL</strong>                          | Gbn-Bkn-Camp-Lodd | BP s6.12(2)(b) | Vic | 2,076.8      | 1,484.3    | 1,849.3  1,809.8 1,759.5 1,744.2 1,720.2 | 1,720.2 |</p>
<table>
<thead>
<tr>
<th>SDL Resource Unit</th>
<th>Transitional Permitted Take&lt;sup&gt;6&lt;/sup&gt; (GL) (s71(1)(b))</th>
<th>Actual Take&lt;sup&gt;7&lt;/sup&gt; (GL) (s71(1)(c))</th>
<th>Annual balance (GL)</th>
<th>Actual Take / Transitional Permitted Take (%)</th>
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</thead>
<tbody>
<tr>
<td>Paroo</td>
<td>9.8 9.8 9.8 9.8 10.9</td>
<td>9.7 9.7 9.7 9.7 10.9</td>
<td>0.0 0.0 0.1 0.1 0.1 100% 100% 99% 99% 99%</td>
<td></td>
</tr>
<tr>
<td>Warrego</td>
<td>88.8 86.5 111.3 100.8 64.1</td>
<td>85.7 83.8 90.3 85.9 20.9</td>
<td>3.1 2.7 21.0 14.8 43.2 96% 97% 81% 85% 33%</td>
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<tr>
<td>Nebine</td>
<td>25.9 26.2 29.2 30.6 15.8</td>
<td>25.0 25.0 25.1 26.4 11.1</td>
<td>0.9 1.2 4.1 4.2 4.7 96% 95% 86% 86% 70%</td>
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<tr>
<td>Condamine-Balonne</td>
<td>1,507.1 891.2 683.6 606.8 918.0</td>
<td>1,269.8 876.1 619.1 530.2 826.6</td>
<td>237.3 15.2 64.5 78.4 91.3 84% 98% 91% 87% 90%</td>
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</tr>
<tr>
<td>Moonie</td>
<td>92.6 64.6 52.4 51.5 114.7</td>
<td>84.6 63.9 54.7 51.8 77.4</td>
<td>8.0 0.8 -2.3 -0.3 37.3 91% 99% 104% 101% 67%</td>
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<tr>
<td>Queensland Border Rivers</td>
<td>598.3 226.4 192.7 154.8 684.8</td>
<td>456.4 223.7 180.9 167.4 598.3</td>
<td>141.9 2.7 11.8 -12.6 86.4 76% 99% 94% 106% 87%</td>
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<tr>
<td>NSW Border Rivers</td>
<td>446.4 359.5 203.0 295.0 510.3</td>
<td>328.4 300.2 170.5 222.4 362.6 118.0 59.2 32.5 72.5 147.7 74% 84% 84% 75% 71%</td>
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<td></td>
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<tr>
<td>Intersecting Streams&lt;sup&gt;8&lt;/sup&gt;</td>
<td>116.8 116.8 116.8 116.8 116.8</td>
<td>116.8 116.8 116.8 116.8 116.8</td>
<td>0.0 0.0 0.0 0.0 0.0 100% 100% 100% 100% 100%</td>
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<tr>
<td>Gwydir</td>
<td>555.8 644.7 331.3 308.1 629.7</td>
<td>575.4 571.5 291.4 271.4 500.3</td>
<td>-19.6 73.2 39.9 36.7 129.5 104% 89% 88% 88% 79%</td>
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<tr>
<td>Namoi</td>
<td>595.7 556.7 398.4 383.4 547.2</td>
<td>583.5 589.2 372.1 348.0 514.9 12.1 -32.5 26.4 35.4 32.3 98% 106% 93% 91% 94%</td>
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<td></td>
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<tr>
<td>Macquarie–Castlereagh</td>
<td>873.1 576.6 517.2 437.3 807.3</td>
<td>773.5 609.2 431.6 448.6 528.5 99.6 -32.6 85.6 -11.3 278.8 89% 106% 83% 103% 65%</td>
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<tr>
<td>Lachlan</td>
<td>773.6 686.8 533.1 534.2 509.7</td>
<td>664.8 562.3 509.4 488.1 508.0 108.8 124.5 23.7 46.0 1.8 86% 82% 96% 91% 100%</td>
<td></td>
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<tr>
<td>Murrambidgee</td>
<td>3,278.6 2,726.2 2,270.5 1,829.2 2,060.3</td>
<td>2,789.7 2,340.7 2,195.7 1,828.1 2,146.5</td>
<td>489.1 385.5 74.8 1.0 -86.2 85% 86% 97% 100% 104%</td>
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<tr>
<td>Barwon–Darling Watercourse&lt;sup&gt;10&lt;/sup&gt;</td>
<td>208.8 121.3 54.4 92.7 266.2</td>
<td>201.6 90.8 44.0 88.0 311.2</td>
<td>7.1 30.6 10.4 4.7 -45.0 97% 75% 81% 95% 117%</td>
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<tr>
<td>Lower Darling&lt;sup&gt;11&lt;/sup&gt;</td>
<td>145.4 113.9 60.7 29.2 50.4</td>
<td>102.6 109.6 49.9 16.5 13.7 42.8 4.3 10.8 12.7 36.7 71% 96% 82% 56% 27%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSW Murray</td>
<td>2,324.3 1,663.7 1,011.9 964.8 1,538.5</td>
<td>2,012.3 1,601.3 1,379.5 821.5 1,284.3 311.9 62.3 -367.8 143.1 254.3 87% 96% 136% 85% 83%</td>
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<td></td>
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<tr>
<td>Australian Capital Territory&lt;sup&gt;12&lt;/sup&gt;</td>
<td>57.3 57.2 55.4 56.7 46.2</td>
<td>30.7 30.8 29.0 32.1 28.3</td>
<td>26.6 26.5 26.4 24.6 18.0 54% 54% 52% 57% 61%</td>
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</tr>
<tr>
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<td></td>
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<tr>
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<td>21.3 21.3 21.5 22.1 20.4</td>
<td>20.3 16.2 19.4 19.8 18.6</td>
<td>1.0 5.0 2.0 2.3 1.8 95% 76% 90% 90% 91%</td>
<td></td>
</tr>
<tr>
<td>Ovens</td>
<td>83.8 82.4 80.7 82.4 81.5</td>
<td>78.1 75.6 76.3 74.7 71.5 5.6 6.8 4.4 7.8 10.0 93% 92% 95% 91% 88%</td>
<td></td>
<td></td>
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<tr>
<td>Broken</td>
<td>65.4 62.8 59.8 58.8 55.1</td>
<td>55.2 54.9 58.0 53.8 52.7</td>
<td>10.2 8.0 1.8 5.0 2.4 84% 87% 97% 91% 96%</td>
<td></td>
</tr>
<tr>
<td>Goulburn</td>
<td>1,538.2 1,591.0 1,340.5 810.8 1,263.6</td>
<td>1,262.5 1,227.3 1,189.8 1,154.5 799.6</td>
<td>275.7 363.8 150.7 -343.6 464.0 82% 77% 89% 142% 63%</td>
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</tr>
<tr>
<td>SDL Resource Unit</td>
<td>Transitional Permitted Take&lt;sup&gt;a&lt;/sup&gt; (GL) (s71(1)(b))</td>
<td>Actual Take&lt;sup&gt;b&lt;/sup&gt; (GL) (s71(1)(c))</td>
<td>Annual balance (GL)</td>
<td>Actual Take / Transitional Permitted Take (%)</td>
</tr>
<tr>
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<td>103.5</td>
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<td>93.7</td>
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<td>208.4</td>
<td>108.9</td>
<td>99.0</td>
<td>102.2</td>
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<td>524.0</td>
<td>656.9</td>
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<td>3.5</td>
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<td>23.9</td>
<td>25.1</td>
<td>19.9</td>
<td>16.7</td>
</tr>
</tbody>
</table>

| MDB                              | 16,011.1 | 13,187.7 | 10,685.3 | 9,359.8 | 12,430.3 | 14,092.8 | 11,656.1 | 10,135.8 | 9,109.9 | 10,674.7 | 1,918.4 | 1,511.6 | 549.5 | 249.9 | 1,755.6 | 88% | 89% | 95% | 97% | 86% |

| Qld                              | 2,322.5  | 1,304.7 | 1,078.9 | 956.0   | 1,808.3  | 1,931.2  | 1,282.2  | 979.8    | 871.4   | 1,545.2  | 391.3  | 22.5   | 99.2   | 84.6   | 263.1  | 83%    | 98%    | 91%    | 91%    | 85%    |
| NSW                              | 9,318.6  | 7,566.1 | 5,497.2 | 4,990.2 | 7,036.5  | 8,148.8  | 6,891.6  | 5,560.7  | 4,649.4 | 6,286.7  | 1,169.8 | 674.5  | -63.5  | 340.8  | 749.7  | 87%    | 91%    | 101%   | 93%    | 89%    |
| ACT                              | 57.3     | 57.2    | 55.4    | 56.7    | 46.2     | 30.7     | 30.8     | 29.0     | 32.1     | 28.3     | 26.6   | 26.5   | 26.4   | 24.6   | 18.0   | 54%    | 54%    | 52%    | 57%    | 61%    |
| Vic                              | 3,700.5  | 3,727.0 | 3,503.3 | 2,676.7 | 3,119.9  | 3,430.6  | 2,978.0  | 3,039.7  | 2,942.0  | 2,365.2  | 269.9  | 749.0  | 463.6  | -265.4 | 754.7  | 93%    | 80%    | 87%    | 110%   | 76%    |
| SA                               | 612.3    | 512.6   | 550.5   | 680.2   | 419.4    | 551.6    | 473.6    | 526.7    | 615.0   | 449.3    | 60.7    | 39.0   | 23.8   | 65.2   | -29.9  | 90%    | 92%    | 96%    | 90%    | 107%   |

<p>| Murray-Kiewa-Ovens               | 1,631.9  | 1,755.1 | 1,820.2 | 1,536.2 | 1,438.8  | 1,790.9  | 1,427.3  | 1,516.4  | 1,458.4  | 1,262.4  | -158.9 | 327.8 | 303.7 | 77.8   | 176.4  | 110%   | 81%    | 83%    | 95%    | 88%    |
| Gbn-Bkn-Camp-Lodd                | 1,960.8  | 1,866.3 | 1,587.5 | 1,065.4 | 1,574.1  | 1,560.0  | 1,473.2  | 1,441.9  | 1,401.8  | 1,026.8  | 400.7  | 393.1  | 145.5  | -336.4 | 547.3  | 80%    | 79%    | 91%    | 132%   | 65%    |
|-----------------------------------|---------|---------|---------|---------|---------|---------------------------------|---------|---------|---------|---------|---------|---------------------------------|---------|---------|---------|---------|---------|---------------------------------|
| Paroo                             | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0                             | 0.0     | 0.0     | 0.1     | 0.2     | 0.3     | 0.0                             | 0.0     | 0.0     | 0.1     | 0.2     | 0.3     | 0.0                             |
| Warrego                           | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 3.1                             | 5.8     | 26.8    | 41.6    | 84.8    | 0.0     | 5%                             | 9%      | 41%     | 63%     | 128%    | 0%      | 2%                             |
| Nebine                            | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.9                             | 2.2     | 6.2     | 10.5    | 15.2    | 0.0     | 6%                             | 13%     | 37%     | 61%     | 89%     | 0%      | 2%                             |
| Condamine–Balonne                 | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 237.3                           | 252.5   | 317.0   | 395.4   | 486.7   | 0.0     | 25%                            | 27%     | 34%     | 43%     | 53%     | 0%      | 2%                             |
| Moonie                            | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 8.0                             | 8.8     | 6.4     | 6.1     | 43.5    | 0.0     | 10%                            | 11%     | 8%      | 7%      | 52%     | 0%      | 2%                             |
| Queensland Border Rivers          | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 141.9                           | 144.6   | 156.5   | 143.8   | 230.3   | 0.0     | 45%                            | 46%     | 50%     | 46%     | 75%     | 0%      | 2%                             |
| NSW Border Rivers                 | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 118.0                           | 177.2   | 209.7   | 282.3   | 430.0   | 0.0     | 39%                            | 59%     | 69%     | 93%     | 143%    | 0%      | 2%                             |
| Intersecting Streams9             | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0.0                             | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 0%                             | 0%      | 0%      | 0%      | 0%      | 0%      | 0%                             |
| Gwydir                            | 0.0     | 15.0    | 0.0     | 0.5     | 1.0     | -19.6                           | 68.6    | 108.5   | 145.7   | 276.1   | -9%     | 17%                            | 27%     | 36%     | 68%     | 0%      | 0%      | 0%                             |
| Namoi                             | 0.0     | 0.3     | 0.0     | 0.0     | 0.0     | 12.1                            | -20.1   | 6.3     | 41.7    | 74.0    | 2%      | 4%                             | 1%      | 8%      | 15%     | 0%      | 0%      | 0%                             |
| Macquarie –Castlereagh            | 0.0     | 3.0     | 0.0     | 0.0     | 0.0     | 90.6                            | 70.0    | 155.6   | 144.2   | 423.0   | 15%     | 10%                            | 24%     | 22%     | 64%     | 0%      | 0%      | 0%                             |
| Lachlan                           | 0.0     | 3.4     | 0.0     | 1.0     | 0.0     | 108.8                           | 236.7   | 260.4   | 307.4   | 392.2   | 19%     | 42%                            | 46%     | 54%     | 54%     | 0%      | 0%      | 0%                             |
| Murrumbidgee                      | 10.1    | 8.8     | -0.3    | 0.6     | -18.6   | 499.2                           | 893.5   | 968.0   | 969.7   | 864.8   | 21%     | 38%                            | 44%     | 45%     | 40%     | 0%      | 0%      | 0%                             |
| Barwon–Darling Watercourse10      | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 7.1                             | 37.7    | 48.1    | 52.7    | 7.8     | 4%      | 21%                            | 28%     | 31%     | 5%      | 0%      | 0%      | 0%                             |
| Lower Darling11                   | 0.0     | 10.0    | 0.0     | 0.0     | 0.0     | 42.8                            | 57.1    | 68.0    | 80.7    | 117.3   | 71%     | 95%                            | 114%    | 135%    | 201%    | 0%      | 0%      | 0%                             |
| NSW Murray                        | -4.1    | -8.2    | -4.8    | 0.0     | 1.5     | 307.8                           | 361.9   | -10.5   | 132.6   | 388.4   | 19%     | 23%                            | -1%     | 9%      | 26%     | 0%      | 0%      | 0%                             |
| Australian Capital Territory12    | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 26.6                            | 53.1    | 79.5    | 104.1   | 122.1   | 51%     | 101%                           | 151%    | 219%    | 256%    | 0%      | 0%      | 0%                             |
| Victorian Murray                  | 13.9    | 3.4     | -6.9    | 0.0     | 4.0     | -151.7                          | 167.6   | 458.1   | 525.8   | 694.4   | -10%    | 12%                            | 33%     | 38%     | 51%     | 0%      | 0%      | 0%                             |
| Kiewa                             | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 1.0                             | 6.1     | 8.1     | 10.4    | 12.2    | 4%      | 25%                            | 33%     | 42%     | 50%     | 0%      | 0%      | 0%                             |
| Ovens                             | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 5.6                             | 12.4    | 16.8    | 24.5    | 34.5    | 7%      | 15%                            | 20%     | 29%     | 41%     | 0%      | 0%      | 0%                             |
| Broken                            | 0.0     | 0.0     | 0.0     | 0.0     | 0.0     | 10.2                            | 18.1    | 20.0    | 25.0    | 27.4    | 18%     | 32%                            | 36%     | 45%     | 49%     | 0%      | 0%      | 0%                             |</p>
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<th>Basin Plan s6.12(1)(a): Transitional adjusted cumulative balance after disposal or acquisition of HEW (if any)</th>
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#### SDL Resource Unit

- **s6.10, s10.10, s10.15: Annual data**: determined each year:
- **Water Lawfully Accessible for Take**: (GL) (s71(1)(d))
- **Actual Take**: (GL) (s71(1)(c))
- **Actual Take / Water Lawfully Accessible for Take (%)**

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<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>71%</td>
<td>43%</td>
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</table>

| MDB             | 14,092.8 | 11,656.1 | 10,135.8 | 9,109.9 | 10,874.7 | 18,825.2 | 15,144.8 | 13,189.4 | 12,185.7 | 15,277.3 | 75%     | 77%     | 77%     | 75%     | 70%     |

| Qld             | 1,931.2   | 1,282.2   | 979.8    | 871.4    | 1,545.2   | 1,992.4   | 1,321.8   | 1,006.3   | 906.9    | 1,607.6   | 97%     | 97%     | 97%     | 96%     | 96%     |
| NSW             | 8,148.8   | 6,891.6   | 5,560.7  | 4,649.4  | 6,286.7   | 11,246.4  | 9,254.5   | 7,757.3   | 6,610.5  | 9,707.5   | 72%     | 74%     | 72%     | 70%     | 65%     |
| ACT             | 30.7      | 30.8      | 29.0     | 32.1     | 28.3      | 85.1      | 86.7      | 88.7      | 87.7     | 87.4      | 36%     | 35%     | 33%     | 37%     | 32%     |
| Vic             | 3,430.6   | 2,978.0   | 3,039.7  | 2,942.0  | 2,365.2   | 4,811.3   | 3,840.4   | 3,697.7   | 3,873.8  | 3,257.5   | 71%     | 78%     | 82%     | 76%     | 73%     |
| SA              | 551.6     | 473.6     | 526.7    | 615.0    | 449.3     | 689.9     | 641.4     | 639.5     | 706.8    | 617.3     | 80%     | 74%     | 82%     | 87%     | 73%     |

| Murray-Kiewa-Ovens | 1,790.9 | 1,427.3   | 1,516.4  | 1,458.4  | 1,262.4   | 2,671.8   | 1,654.2   | 1,869.1   | 2,036.0  | 1,359.0   | 67%     | 86%     | 81%     | 72%     | 93%     |
| Gbn-Bkn-Camp-Lodd  | 1,560.0   | 1,473.2   | 1,441.9  | 1,401.8  | 1,026.8   | 1,927.1   | 1,902.7   | 1,621.6   | 1,646.5  | 1,656.9   | 81%     | 77%     | 89%     | 85%     | 62%     |
Notes to surface water SDL accounts

1. Long-Term averages figures are based on the 114 year historical climate sequence over the period 1895-2009. BDL as per BP 2012 Schedule 3 to 1 decimal place.
2. BDL is Baseline Diversion Limit- the estimated baseline limit of take from a sustainable diversion limit (SDL) resource unit as per BP 2012 Schedule 3 or from accredited water resource plans.
3. SDL is Sustainable Diversion Limit: The maximum long-term annual average quantity of water that can be taken by each form of take in an SDL resource unit. Estimated according to BP 2012 Schedule 2 or from accredited water resource plans, or as a result of decisions by states on re-allocation of shared reduction amounts.
4. In relation to TDL, HEW is Held Environmental Water recovered to "Bridge the Gap" at 1 July each water year (i.e. increasing towards 2750 GL). For adjustments to permitted take and the cumulative balance HEW is held environmental water available for use by entitlement holders.
5. TDL is the Transitional Diversion Limits - BDL minus bridging the Gap HEW at 1 July each water year. TDL represents an indicative non-binding limit during the Transition Period (i.e. 2012–19)
6. Permitted Take is an annual volume determined by a model (where available) after the end of the water year, using the climate for that year plus estimates for floodplain harvesting, interceptions and basic rights less the effect of environmental water recovery.
7. Actual Take is an Annual Volume, the amount of water physically taken out of river system + Interceptions for Consumptive Use
8. Water Lawfully Accessible for Take is the sum of: net carryover volume from previous year; allocations in regulated systems; unregulated entitlements and actual use of supplementary water for NSW; actual use of unregulated streams and losses in diversions for Victoria; actual use of floodplain harvesting, unsupplemented and urban water for Queensland; SA water allocations in EMLR region and authorised water for SA non-prescribed Murray region; Commonwealth and Lake Burley Griffin diversions for the ACT. For the NSW Barwon-Darling this reflects account access moderated by annual use limits and is subject to the actual flows being available to meet pumping thresholds.
9. Water recovery that has occurred in the intersecting streams is limited to 0.2 GL based on estimated BDL in Basin Plan.
10. Northern Basin Review considered the water recovery achieved when recommending changes to the local and shared reduction targets. In the Barwon-Darling SDL resource unit, HEW over-recovery was considered in the proposed Basin Plan Amendments 2016. At the time of preparation of this report, the Basin Plan Amendments are not adopted by the Commonwealth Minister for Water.
11. Modelled Inter-valley trade (IVT) is deducted from Permitted Take for Lower Darling. Further work by NSW and the MDBA may amend this approach in future reporting.
12. Water recovery to meet ACT's shared amount has occurred in NSW Murrumbidgee SDL resource unit.
### Appendix 3: Groundwater SDL trial water take accounts

**Groundwater SDL trial water take account at SDL resource unit level.**

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¹s71(1)(b) - annual permitted take, Basin Plan s6.10(1)

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Groundwater SDL trial water take account at SDL resource unit level.

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\(^3\) SDL resource unit code
\(^4\) GW HEW at 1 July 2016 (GL)
\(^5\) Take under Basic Rights (GL)
\(^6\) Transitional Diversion Limit (GL)
\(^7\) Basin Plan s6.10(1)
Groundwater SDL trial water take account at SDL resource unit level.

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1. BDL = Basic Diversion Limit
2. SDL = Supplementary Diversion Limit
3. State Planning Limit = Limit set by the State Planning Body
4. GW HEW = Groundwater HEW
5. Basic Rights = Basic Rights set by the Murray-Darling Basin Commission
6. Transitional Diversion Limit = Limit set by the Murray-Darling Basin Commission
7. All units except NSW are specified in GL (giga litres).

Source: Murray–Darling Basin Authority
Groundwater SDL trial water take account at SDL resource unit level.

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## Basin Plan Chapter 6 Part 4 - Trial compliance arrangements

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## Basin Plan Chapter 6 Part 4 - Trial compliance arrangements

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### Notes
- **Annual Actual Take**: GL (s7(1)(c) - annual actual take, Basin Plan s6.10(2))
- **Actual Take/TDL (%):**
- **Annual Balance**: TDL - annual actual take (GL)
### Basin Plan Chapter 6 Part 4 - Trial compliance arrangements

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| | TOTALS | | | | | | | | | | | | | | | | | | | |
| | 1,231.4 | 1,397.6 | 1,556.5 | 1,535.3 | 1,198.2 | 36% | 41% | 46% | 46% | 36% | 2,215.2 | 2,024.7 | 1,841.6 | 1,838.0 | 2,147.4 |

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## Basin Plan Chapter 6 Part 4 - Trial compliance arrangements

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<td>378%</td>
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<tr>
<td>Lower Murray Alluvium (deep; Renmark Group and Calivil Formation)</td>
<td>61.8</td>
<td>124.9</td>
<td>156.1</td>
<td>159.5</td>
<td>211.7</td>
<td>52%</td>
<td>115%</td>
<td>158%</td>
<td>179%</td>
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<td>1.81</td>
<td>5.25</td>
<td>9.48</td>
<td>12.4</td>
<td>17.8</td>
<td>13%</td>
<td>37%</td>
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### Basin Plan Chapter 6 Part 4 - Trial compliance arrangements

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<td>140.6</td>
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<td>56%</td>
<td>49%</td>
<td>51%</td>
<td>96%</td>
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<td>66%</td>
<td>91%</td>
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<td>9.94</td>
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<td>121%</td>
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<td>49%</td>
<td>52%</td>
<td>72%</td>
<td>97%</td>
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<td>138.9</td>
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<td>147%</td>
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<td>138%</td>
<td>207%</td>
<td>276%</td>
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<td>297%</td>
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<td>1.61</td>
<td>2.15</td>
<td>2.69</td>
<td>86%</td>
<td>173%</td>
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<td>2.23</td>
<td>2.85</td>
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<td>81%</td>
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<td>34.7</td>
<td>65.5</td>
<td>90.6</td>
<td>114.2</td>
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<td>92%</td>
<td>128%</td>
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<td>227%</td>
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<td>Upper Macquarie Alluvium</td>
<td>4.21</td>
<td>8.05</td>
<td>10.6</td>
<td>12.6</td>
<td>17.0</td>
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<td>45%</td>
<td>59%</td>
<td>70%</td>
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<td>163.8</td>
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<td>196%</td>
<td>294%</td>
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<td>174%</td>
<td>261%</td>
<td>347%</td>
<td>434%</td>
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<td>Lower Namoi Alluvium</td>
<td>33.5</td>
<td>21.7</td>
<td>7.05</td>
<td>2.39</td>
<td>39.5</td>
<td>35%</td>
<td>23%</td>
<td>8%</td>
<td>3%</td>
<td>45%</td>
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### Basin Plan Chapter 6 Part 4 - Trial compliance arrangements

<table>
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<tr>
<th>SDL resource unit</th>
<th>Cumulative Balance (GL)</th>
<th>Indicative Compliance Test (Non-binding) 20% with Long-term TDL (GL)</th>
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<tr>
<td>Manilla Alluvium</td>
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<td>Upper Namoi Alluvium</td>
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<td>Upper Namoi Tributary Alluvium</td>
<td>1.22</td>
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<td>Lower Gwydir Alluvium</td>
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<tr>
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<td>Sydney Basin MDB</td>
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<td>5.28</td>
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<td>Goulburn-Murray: Shepparton Irrigation Region</td>
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<td>411.4</td>
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<td>Goulburn-Murray: Sedimentary Plain**</td>
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<td>Goulburn-Murray: deep</td>
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<td>40.0</td>
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</table>
### Basin Plan Chapter 6 Part 4 - Trial compliance arrangements

#### Cumulative Balance

- **Basin Plan s6.11(4)(b)**
  - (Cumulative annual TDL - annual actual take)
  - (GL)

#### Indicative Compliance Test (Non-binding) 20%

- **with Long-term TDL**
- (Cumulative Balance / TDL)
- **Basin Plan s6.12(1)(a)**

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<td>Mallee (Pliocene Sands)</td>
<td>41.4</td>
<td>82.8</td>
<td>124.2</td>
<td>165.6</td>
<td>207.0</td>
<td>100%</td>
<td>200%</td>
<td>300%</td>
<td>400%</td>
<td>500%</td>
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<tr>
<td>Mallee (Murray Group Limestone)</td>
<td>24.7</td>
<td>55.8</td>
<td>83.8</td>
<td>114.5</td>
<td>151.9</td>
<td>38%</td>
<td>85%</td>
<td>128%</td>
<td>174%</td>
<td>231%</td>
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<tr>
<td>Mallee (Renmark Group)</td>
<td>2.00</td>
<td>4.00</td>
<td>6.00</td>
<td>8.00</td>
<td>10.0</td>
<td>100%</td>
<td>200%</td>
<td>300%</td>
<td>400%</td>
<td>500%</td>
</tr>
<tr>
<td>Peake–Roby–Sherlock (unconfined)</td>
<td>3.22</td>
<td>6.44</td>
<td>9.66</td>
<td>12.9</td>
<td>16.1</td>
<td>94%</td>
<td>189%</td>
<td>283%</td>
<td>378%</td>
<td>472%</td>
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<tr>
<td>Peake–Roby–Sherlock (confined)</td>
<td>0.78</td>
<td>2.25</td>
<td>4.22</td>
<td>6.30</td>
<td>7.90</td>
<td>30%</td>
<td>87%</td>
<td>163%</td>
<td>244%</td>
<td>306%</td>
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<tr>
<td>SA Murray</td>
<td>63.0</td>
<td>126.0</td>
<td>189.0</td>
<td>252.0</td>
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<td>194%</td>
<td>292%</td>
<td>389%</td>
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<td>55.0</td>
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<td>89.7</td>
<td>65%</td>
<td>126%</td>
<td>192%</td>
<td>251%</td>
<td>314%</td>
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<tr>
<td>Angas Bremer (Quaternary Sediments)</td>
<td>1.09</td>
<td>2.18</td>
<td>3.27</td>
<td>4.36</td>
<td>5.45</td>
<td>100%</td>
<td>200%</td>
<td>300%</td>
<td>400%</td>
<td>500%</td>
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<tr>
<td>Angas Bremer (Murray Group Limestone)</td>
<td>4.51</td>
<td>9.34</td>
<td>14.5</td>
<td>19.8</td>
<td>25.7</td>
<td>69%</td>
<td>142%</td>
<td>220%</td>
<td>302%</td>
<td>392%</td>
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<tr>
<td>Eastern Mount Lofty Ranges</td>
<td>36.4</td>
<td>72.7</td>
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<td>138.0</td>
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<td>94%</td>
<td>189%</td>
<td>283%</td>
<td>359%</td>
<td>440%</td>
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<tr>
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<td>1.60</td>
<td>3.33</td>
<td>4.99</td>
<td>6.49</td>
<td>8.24</td>
<td>76%</td>
<td>159%</td>
<td>239%</td>
<td>310%</td>
<td>394%</td>
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<td>0.78</td>
<td>1.63</td>
<td>2.81</td>
<td>3.66</td>
<td>4.81</td>
<td>33%</td>
<td>77%</td>
<td>118%</td>
<td>154%</td>
<td>202%</td>
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<td>0.50</td>
<td>1.00</td>
<td>1.50</td>
<td>2.00</td>
<td>2.50</td>
<td>100%</td>
<td>200%</td>
<td>300%</td>
<td>400%</td>
<td>500%</td>
</tr>
</tbody>
</table>

| TOTALS                                                 | 2,215.2 | 4,239.9 | 6,081.5 | 7,919.5 | 10,067.0 | 64%     | 124%    | 179%    | 235%    | 301%    |

| Qld                                                    | 409.5    | 787.5   | 1,181.7 | 1,566.4 | 1,944.7   | 72%     | 138%    | 207%    | 274%    | 341%    |
| NSW                                                    | 1,041.6  | 1,903.8 | 2,631.6 | 3,401.3 | 4,471.2   | 55%     | 102%    | 143%    | 188%    | 247%    |
| ACT                                                    | 2.58     | 5.28    | 7.68    | 9.88    | 12.2     | 81%     | 167%    | 243%    | 313%    | 387%    |
| Vic                                                    | 563.0    | 1,139.6 | 1,652.5 | 2,136.6 | 2,648.5   | 78%     | 157%    | 228%    | 294%    | 365%    |
| SA                                                     | 198.6    | 403.7   | 608.0   | 805.4   | 1,013.9   | 77%     | 155%    | 234%    | 310%    | 391%    |
|------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
| Queensland Border Rivers Alluvium | 20.6 | 20.6 | 20.6 | 20.6 | 20.6 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 20.6 | 20.6 | 20.6 | 20.6 | 20.6 |
| Queensland Border Rivers Fractured Rock | 10.2 | 10.2 | 10.2 | 10.2 | 10.2 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 10.2 | 10.2 | 10.2 | 10.2 | 10.2 |
| Sediments above the Great Artesian Basin: Border Rivers | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.04 | 0.04 | 0.04 | 0.04 | 0.04 |
| Sediments above the Great Artesian Basin: Moonie | 0.10 | 0.10 | 0.32 | 0.32 | 0.32 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.10 | 0.32 | 0.32 | 0.32 |
| St George Alluvium: Moonie | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Condamine Fractured Rock | 0.81 | 0.81 | 1.07 | 1.07 | 1.07 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.81 | 0.81 | 1.07 | 1.07 | 1.07 |
| Queensland MDB: deep | 0.00 | 0.00 | 0.00 | 0.10 | 0.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.10 | 0.10 | 0.10 |
| Sediments above the Great Artesian Basin: Condamine–Balonne | 0.66 | 0.66 | 0.66 | 0.66 | 0.85 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.66 | 0.66 | 0.66 | 0.66 | 0.85 |
| St George Alluvium: Condamine–Balonne (shallow) | 0.77 | 0.77 | 0.77 | 1.12 | 1.10 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.77 | 0.77 | 0.77 | 1.12 | 1.10 |
| St George Alluvium: Condamine–Balonne (deep) | 10.2 | 12.6 | 12.6 | 11.6 | 11.4 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 10.2 | 12.6 | 12.6 | 11.6 | 11.4 |
| Upper Condamine Alluvium (Central Condamine Alluvium) | 60.9 | 60.9 | 60.9 | 60.9 | 60.9 | 43.1 | 29.5 | 37.9 | 34.0 | 33.4 | 104.0 | 90.4 | 98.8 | 94.9 | 94.4 |
| Upper Condamine Alluvium (Tributaries) | 43.0 | 41.7 | 41.7 | 41.8 | 40.9 | 7.80 | 7.80 | 8.50 | 9.30 | 8.41 | 50.8 | 49.5 | 50.2 | 51.1 | 49.3 |
| Upper Condamine Basalts | 79.0 | 79.0 | 78.8 | 79.0 | 79.0 | 3.70 | 3.70 | 3.80 | 4.10 | 3.68 | 82.7 | 82.7 | 82.6 | 83.1 | 82.7 |
| Sediments above the Great Artesian Basin: Warrego–Paroo–Nebine | 1.32 | 1.32 | 1.24 | 1.24 | 0.89 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.32 | 1.32 | 1.24 | 1.24 | 0.89 |
| St George Alluvium: Warrego–Paroo–Nebine | 0.12 | 0.12 | 0.12 | 0.12 | 0.11 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.12 | 0.12 | 0.12 | 0.12 | 0.11 |
| Warrego Alluvium | 0.64 | 0.64 | 0.72 | 0.72 | 0.68 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.64 | 0.64 | 0.72 | 0.72 | 0.68 |
| Western Porous Rock | 59.0 | 59.0 | 62.3 | 62.6 | 62.6 | 5.37 | 5.68 | 5.39 | 5.39 | 5.38 | 64.4 | 64.7 | 67.7 | 68.0 | 68.0 |
| Upper Darling Alluvium | 5.58 | 5.80 | 5.80 | 5.81 | 6.29 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 5.58 | 5.80 | 5.80 | 5.81 | 6.29 |
| Lower Darling Alluvium | 1.66 | 1.66 | 1.66 | 1.66 | 1.66 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 1.66 | 1.66 | 1.66 | 1.66 | 1.66 |
| Billabong Creek Alluvium | 7.16 | 7.22 | 7.24 | 7.57 | 7.22 | 0.00 | 2.87 | 5.67 | 0.00 | 6.81 | 7.16 | 10.1 | 12.9 | 7.57 | 14.0 |
| Lower Murray Alluvium (shallow; Shepparton Formation) | 83.4 | 80.3 | 80.3 | 78.7 | 78.7 | 31.2 | 33.4 | 29.6 | 29.3 | 28.7 | 114.6 | 113.7 | 109.9 | 108.0 | 107.5 |
| Lower Murray Alluvium (deep; Renmark Group and Calivil Formation) | 113.9 | 105.2 | 95.5 | 86.0 | 86.3 | 41.8 | 41.5 | 41.9 | 41.9 | 41.1 | 155.6 | 146.6 | 137.4 | 127.9 | 127.5 |
| Upper Murray Alluvium | 41.6 | 41.6 | 41.6 | 41.6 | 41.6 | 15.0 | 13.7 | 15.5 | 14.1 | 14.2 | 56.7 | 55.3 | 57.1 | 55.7 | 55.8 |
## Other aspects of s71 reporting

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## Basin Plan Chapter 6 Part 4 - Trial compliance arrangements

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(Cumulative annual TDL - annual actual take) (GL)

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(Cumulative balance / TDL)
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The Lower Macquarie BDL and SDL is equal to 70.7 minus the portion of the limit under the Water Sharing Plan for the Lower Macquarie Groundwater Sources 2003 of New South Wales that applies to water taken from the Jurassic Sandstone of the Great Artesian Basin (GAB) as per Schedule 4 in the Basin Plan. The MDBA is working with NSW to define what defines GAB resources and to agree on a volume to use for this adjustment. For 2012-13 to 2016-17 reporting years, the BDL and SDL have not been adjusted as NSW have reported annual actual take figures that also include take from the GAB.

The BDL and SDL for the Wimmera-Mallee: Sedimentary Plain SDL resource unit have been adjusted down by 4.4 GL. This is to account for groundwater take from the Victorian West Wimmera Groundwater Management Area as per Schedule 4 in the Basin Plan.

1 BDL is Baseline Diversion Limit as in Schedule 4 of the Basin Plan
2 SDL is Sustainable Diversion Limit as in Schedule 4 of the Basin Plan
3 State plan limit or entitlement Volume
4 HEW is Held Environmental Water recovered to "Bridge the Gap" or acquired under the Sustainable Rural Water Use and Infrastructure Program (SRWUIP) as at 1 July 2016
5 Basic Rights -Groundwater take under basic rights generally covers water used for stock and domestic purposes. Basin States use estimation methods to determine this volume annually.

6 Permitted Take - the use of annual permitted take is a new concept in accounting for groundwater resources. The MDBA has been working with the states to determine how the permitted take will be incorporated into the Basin Plan accounting and compliance that will come into effect after 2019. For the purpose of the transition period field test, annual permitted take for groundwater is being set at the TDL.

7 TDL is Transitional Diversion Limits. Groundwater TDL is the same as the SDL for majority of the SDL resource units except for the Queensland Upper Condamine Alluvium where water recovery to bridge a gap between the BDL and SDL is required and for the SDL resource units that are associated with an ongoing reduction of groundwater entitlements in NSW. TDL represent an indicative non-binding limit during the Transition Period (i.e. 2012–19)

8 Annual actual take is the total volume of water actually taken by each form of take from the SDL resource unit during a water accounting period which includes take from groundwater and take under basic rights

9 Annual Balance is the transitional diversion limit minus the annual actual take, an annual credit or debit is recorded on the register of take

10 Water lawfully accessible for take is further described in chapter 6

11 Carry over - Volume of carry over that is available for take

12 The volumes in these columns may have been adjusted by the MDBA as required based on data provided by states ie NSW did not provide the data as it is for all columns for their SDL resource units
## Appendix 4: Detailed HEW accounts

Table 10.9: Surface water HEW that was lawfully accessible for used in 2016–17 at an SDL resource unit level

<table>
<thead>
<tr>
<th>SDL resource unit</th>
<th>Allocated in 2016-17 (GL)</th>
<th>HEW carryover from 2015-16 (GL)</th>
<th>Allocation forfeiture during year (GL)</th>
<th>Supplementary access and unregulated entitlement used in 2016-17 (GL)</th>
<th>Net trade between SDL resource units (GL)</th>
<th>Net Trade to and from Consumptive use (GL)</th>
<th>Net transfer (out of MDB) (GL)</th>
<th>Return flows (GL)</th>
<th>HEW lawfully accessible for use 2016-17 (GL)</th>
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<td>238.83</td>
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<td>0.00</td>
<td>0.00</td>
<td>305.83</td>
<td>3.94</td>
<td>0.00</td>
<td>0.00</td>
<td>548.60</td>
</tr>
<tr>
<td>Basin total</td>
<td>2,543.96</td>
<td>635.10</td>
<td>-115.19</td>
<td>155.14</td>
<td>0.00</td>
<td>3.26</td>
<td>-225.08</td>
<td>117.43</td>
<td>3,114.62</td>
</tr>
</tbody>
</table>
### Table 10.10: Use of surface water HEW for the 2016–17 water year at SDL resource unit level

<table>
<thead>
<tr>
<th>SDL resource unit</th>
<th>HEW lawfully accessible for use 2016–17 (GL)</th>
<th>Gross use (GL)</th>
<th>2016–17 forfeiture (GL)</th>
<th>Closing carryover (GL)</th>
<th>Percentage of available HEW used (%)</th>
<th>Percentage of available HEW forfeited (%)</th>
<th>Percentage of available HEW carried over (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Queensland</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paroo</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Warrego</td>
<td>9.51</td>
<td>9.51</td>
<td>0.00</td>
<td>0.00</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Nebeine</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Condamine-Balonne</td>
<td>45.58</td>
<td>45.53</td>
<td>0.00</td>
<td>0.05</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Moonie</td>
<td>1.42</td>
<td>1.42</td>
<td>0.00</td>
<td>0.00</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Queensland Border Rivers</td>
<td>37.62</td>
<td>24.35</td>
<td>0.82</td>
<td>12.45</td>
<td>65%</td>
<td>2%</td>
<td>33%</td>
</tr>
<tr>
<td><strong>Queensland total</strong></td>
<td>94.13</td>
<td>80.81</td>
<td>0.82</td>
<td>12.50</td>
<td>86%</td>
<td>1%</td>
<td>13%</td>
</tr>
<tr>
<td><strong>New South Wales</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NSW Border Rivers</td>
<td>2.30</td>
<td>0.00</td>
<td>1.16</td>
<td>1.13</td>
<td>0%</td>
<td>50%</td>
<td>49%</td>
</tr>
<tr>
<td>Intersecting Streams</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Gwydir</td>
<td>123.46</td>
<td>25.85</td>
<td>0.00</td>
<td>97.61</td>
<td>21%</td>
<td>0%</td>
<td>79%</td>
</tr>
<tr>
<td>Namoi</td>
<td>20.02</td>
<td>9.11</td>
<td>1.75</td>
<td>9.16</td>
<td>46%</td>
<td>9%</td>
<td>46%</td>
</tr>
<tr>
<td>Macquarie-Castlereagh</td>
<td>183.36</td>
<td>62.78</td>
<td>0.00</td>
<td>120.58</td>
<td>34%</td>
<td>0%</td>
<td>66%</td>
</tr>
<tr>
<td>Lachlan</td>
<td>165.51</td>
<td>35.74</td>
<td>0.00</td>
<td>129.76</td>
<td>22%</td>
<td>0%</td>
<td>78%</td>
</tr>
<tr>
<td>Murrumbidgee</td>
<td>451.49</td>
<td>364.78</td>
<td>0.00</td>
<td>86.70</td>
<td>81%</td>
<td>0%</td>
<td>19%</td>
</tr>
<tr>
<td>Barwon-Darling Watercourse</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Lower Darling</td>
<td>183.62</td>
<td>183.30</td>
<td>0.00</td>
<td>0.32</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>NSW Murray</td>
<td>423.08</td>
<td>362.60</td>
<td>0.00</td>
<td>60.48</td>
<td>86%</td>
<td>0%</td>
<td>14%</td>
</tr>
<tr>
<td><strong>New South Wales total</strong></td>
<td>1,552.84</td>
<td>1,044.16</td>
<td>2.91</td>
<td>505.74</td>
<td>67%</td>
<td>0%</td>
<td>33%</td>
</tr>
<tr>
<td><strong>Australian Capital Territory</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Australian Capital Territory</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Australian Capital Territory total</strong></td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Victoria</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Victorian Murray</td>
<td>446.42</td>
<td>252.04</td>
<td>9.23</td>
<td>185.14</td>
<td>56%</td>
<td>2%</td>
<td>41%</td>
</tr>
<tr>
<td>Kiewa</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Ovens</td>
<td>0.07</td>
<td>0.07</td>
<td>0.00</td>
<td>0.00</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Broken</td>
<td>0.25</td>
<td>0.00</td>
<td>0.14</td>
<td>0.11</td>
<td>0%</td>
<td>56%</td>
<td>44%</td>
</tr>
<tr>
<td>Goulburn</td>
<td>370.62</td>
<td>240.28</td>
<td>5.95</td>
<td>124.39</td>
<td>65%</td>
<td>2%</td>
<td>34%</td>
</tr>
<tr>
<td>SDL resource unit</td>
<td>HEW lawfully accessible for use 2016–17 (GL)</td>
<td>Gross use (GL)</td>
<td>2016–17 forfeiture (GL)</td>
<td>Closing carryover (GL)</td>
<td>Percentage of available HEW used (%)</td>
<td>Percentage of available HEW forfeited (%)</td>
<td>Percentage of available HEW carried over (%)</td>
</tr>
<tr>
<td>-----------------------------------------</td>
<td>-----------------------------------------------</td>
<td>----------------</td>
<td>-------------------------</td>
<td>------------------------</td>
<td>-------------------------------------</td>
<td>------------------------------------------</td>
<td>--------------------------------------------</td>
</tr>
<tr>
<td>Campaspe</td>
<td>18.56</td>
<td>5.55</td>
<td>3.26</td>
<td>9.76</td>
<td>30%</td>
<td>18%</td>
<td>53%</td>
</tr>
<tr>
<td>Loddon</td>
<td>15.27</td>
<td>12.43</td>
<td>0.04</td>
<td>2.80</td>
<td>81%</td>
<td>0%</td>
<td>18%</td>
</tr>
<tr>
<td>Wimmera-Mallee (Surface Water)</td>
<td>67.86</td>
<td>13.58</td>
<td>8.14</td>
<td>46.14</td>
<td>20%</td>
<td>12%</td>
<td>68%</td>
</tr>
<tr>
<td><strong>Victoria total</strong></td>
<td><strong>919.05</strong></td>
<td><strong>523.95</strong></td>
<td><strong>26.76</strong></td>
<td><strong>368.34</strong></td>
<td><strong>57%</strong></td>
<td><strong>3%</strong></td>
<td><strong>40%</strong></td>
</tr>
<tr>
<td>South Australia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SA Murray</td>
<td>548.60</td>
<td>548.60</td>
<td>0.00</td>
<td>0.00</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>SA Non-Prescribed Areas</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Marne Saunders</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Eastern Mount Lofty Ranges</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>0.00</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>South Australia total</strong></td>
<td><strong>548.60</strong></td>
<td><strong>548.60</strong></td>
<td><strong>0.00</strong></td>
<td><strong>0.00</strong></td>
<td><strong>100%</strong></td>
<td><strong>0%</strong></td>
<td><strong>0%</strong></td>
</tr>
<tr>
<td>Basin total</td>
<td>3,114.82</td>
<td>2,197.52</td>
<td>30.49</td>
<td>886.58</td>
<td>71%</td>
<td>1%</td>
<td>28%</td>
</tr>
</tbody>
</table>
## Appendix 5: Status of Cap models

<table>
<thead>
<tr>
<th>Cap Valley</th>
<th>Status of Cap models and Cap compliance to 30 June 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Queensland</strong></td>
<td></td>
</tr>
<tr>
<td>Condamine – Balonne</td>
<td>An IQQM Cap model was provisionally accredited by the Authority in 2013 for use until 2015. Though accreditation has lapsed, the model remains the best available information with which to determine Cap compliance. Since 1997–98 there have been no special audits triggered in the Condamine–Balonne Cap valley. As at 30 June 2017, the valley has recorded a cumulative credit of 1,400.54 GL.</td>
</tr>
<tr>
<td>Queensland Border Rivers – Macintyre Brook</td>
<td>An IQQM Cap model was provisionally accredited by the Authority in 2013 for use until 2015, on the condition that Queensland and NSW would work to develop a common Cap model. Though this accreditation has lapsed, the model remains the best available information with which to determine Cap compliance. Since 1997–98 there have been no special audits triggered in the Border Rivers–Macintyre Brook Cap valley. As at 30 June 2017, the valley has recorded a cumulative credit of 536.99 GL.</td>
</tr>
<tr>
<td>Moonie</td>
<td>An IQQM Cap model was provisionally accredited by the Authority in 2010 for use until 2012. Though accreditation has lapsed, the model remains the best available information with which to determine Cap compliance. Since 1997–98 there have been two special audits triggered in the Moonie Cap valley, in water years 2014–15 and 2015–16. The Moonie Cap valley does not operate under a cumulative cap, with the annual balance not entering deficit for the reporting period.</td>
</tr>
<tr>
<td>Nebine</td>
<td>An IQQM Cap model was provisionally accredited by the Authority in 2010 for use until 2012. An SDL model is available through the accredited Warrego–Paroo–Nebine Water Resource Plan. Cap compliance under Schedule E will continue to be assessed against the Cap model until 2019. Since 1997–98 there have been no special audits triggered in the Nebine Cap valley. The Nebine Cap valley does not operate under a cumulative cap, with the annual balance not entering deficit for the reporting period.</td>
</tr>
<tr>
<td>Warrego</td>
<td>An IQQM Cap model was provisionally accredited by the Authority in 2010 for use until 2012. An SDL model is available through the accredited Warrego–Paroo–Nebine Water Resource Plan. Cap compliance under Schedule E will continue to be assessed against the Cap model until 2019. Since 1997–98 there have been no special audits triggered in the Warrego Cap valley. The Warrego Cap valley does not operate under a cumulative cap, with the annual balance not entering deficit for the reporting period.</td>
</tr>
<tr>
<td>Paroo</td>
<td>An IQQM Cap model was provisionally accredited by the Authority in 2010 for use until 2012. An SDL model is available through the accredited Warrego–Paroo–Nebine Water Resource Plan. Cap compliance under Schedule E will continue to be assessed against the Cap model until 2019. Since 1997–98 there have been no special audits triggered in the Paroo Cap valley. The Paroo Cap valley does not operate under a cumulative cap, with the annual balance not entering deficit for the reporting period.</td>
</tr>
<tr>
<td><strong>New South Wales</strong></td>
<td></td>
</tr>
<tr>
<td>Intersecting Streams</td>
<td>There was no Cap target in the Intersecting Streams for the reporting period.</td>
</tr>
</tbody>
</table>
### Cap Valley Status of Cap models and Cap compliance to 30 June 2017

<table>
<thead>
<tr>
<th>Cap Valley</th>
<th>Status of Cap models and Cap compliance to 30 June 2017</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW Border Rivers</td>
<td>An IQQM Cap model was provisionally accredited by the Authority in 2013 for use until 2015, on the condition that Queensland and NSW would work to develop a common Cap model. Though this accreditation has lapsed, the model remains the best available information with which to determine Cap compliance. Since 1997–98 there has been one special audit triggered in the NSW Border Rivers Cap valley, for the water year 1999–00. As at 30 June 2017, the valley has recorded a cumulative credit of 718.60 GL.</td>
</tr>
<tr>
<td>Gwydir</td>
<td>An IQQM Cap model was accredited by the Authority in 2009 and was available to determine Cap compliance for the reporting period. Since 1997–98 there have been two special audits triggered in the Gwydir Cap valley — these occurred for the water years 1999–00 and 2001–02. As at 30 June 2017, the valley has recorded a cumulative credit of 561.24 GL.</td>
</tr>
<tr>
<td>Namoi – Peel</td>
<td>The Namoi–Peel Cap valley features two models. An IQQM Cap model for the Namoi was accredited in 2005 and was available to determine Cap compliance within the valley. An IQQM Cap model for the Peel was accredited by the Authority in 2009 and was available to determine Cap compliance within the valley. Since 1997–98 there has been one special audit triggered in the Namoi–Peel Cap valley for the water year 2000–01. As at 30 June 2017, the valley has recorded a cumulative credit of 532.97 GL.</td>
</tr>
<tr>
<td>Macquarie – Castlereagh – Bogan</td>
<td>An IQQM Cap model was accredited by the Authority in 2012 and was available to determine Cap compliance for the reporting period. Since 1997–98 there has been one special audit triggered in the Macquarie–Castlereagh–Bogan Cap valley for the water year 2002–03. As at 30 June 2017, the valley has recorded a cumulative credit of 1,427.08 GL.</td>
</tr>
<tr>
<td>Barwon – Darling – Lower Darling</td>
<td>The Barwon–Darling–Lower Darling Cap valley features two models. An IQQM model for the Barwon–Darling was provisionally accredited by the Authority in 2014 for use until 2015. Though accreditation has lapsed, the model remains the best available information with which to determine Cap compliance within the Barwon–Darling component of this Cap valley. An MSM Cap model for the Lower Darling was accredited by the Authority in 2015 and was available for use to determine Cap compliance within the Lower Darling component of this Cap valley. The Barwon–Darling–Lower Darling have been combined for assessment purposes since the 1999–00 water year. From 1997–98 to 1999–00 the Barwon–Darling triggered two special audits, in 1997–98 and in 1998–99. Since 1999–00 there have been six special audits triggered in the Barwon–Darling–Lower Darling Cap valley, in waters years 2000–01, 2003–04, 2004–05, 2005–06, 2007–08 and 2008–09. As at 30 June 2017, the valley has recorded a cumulative credit of 635.13 GL.</td>
</tr>
<tr>
<td>Lachlan</td>
<td>An IQQM Cap model was accredited in 2002 and was available to determine Cap compliance for the reporting period. Since 1997–98 there have been four special audits triggered in the Lachlan Cap valley. These occurred for the water years 1998–99, 2000–01, 2001–02 and 2002–03. As at 30 June 2017, the valley has recorded a cumulative credit of 451.04 GL.</td>
</tr>
<tr>
<td>Murrumbidgee</td>
<td>An IQQM model was accredited by the Authority in 2011 and was available to determine Cap compliance for the reporting period. Since 1997–98 there have been no special audits triggered in the Cap valley.</td>
</tr>
</tbody>
</table>

---

30 This decision was ratified at Murray–Darling Basin Ministerial Council Meeting 29 (August 2000)
## Status of Cap models and Cap compliance to 30 June 2017

<table>
<thead>
<tr>
<th>Cap Valley</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Murrumbidgee</td>
<td>As at 30 June 2017, the valley has recorded a cumulative credit of 2,517.21 GL.</td>
</tr>
<tr>
<td>Murray</td>
<td>An MSM Cap model was accredited in 2008 and was available to determine Cap compliance for the reporting period. Since 1997–98 there have been no special audits triggered in the Murray Cap valley. As at 30 June 2017, the valley has recorded a cumulative credit of 1,626.45 GL.</td>
</tr>
<tr>
<td>Australian Capital Territory</td>
<td>A Regression Cap model was accredited by the Authority in 2013 for use until 2019 and was available to determine Cap compliance for the reporting period. Since 1997–98 there have been no special audits triggered in the Australian Capital Territory Cap valley. As at 30 June 2017, the valley has recorded a cumulative credit of 272.74 GL.</td>
</tr>
<tr>
<td>Victoria</td>
<td></td>
</tr>
<tr>
<td>Goulburn–Broken–Loddon</td>
<td>A GSM REALM Cap model was accredited in 2007 and was available to determine Cap compliance for the reporting period. Since 1997–98 there have been no special audits triggered in the Goulburn–Broken–Loddon Cap valley. As at 30 June 2017, the valley has recorded a cumulative credit of 3,245.43 GL.</td>
</tr>
<tr>
<td>Campaspe</td>
<td>A GSM REALM Cap model was originally accredited in 2007. Amendments made to the GSM REALM Cap model were also accredited in 2012 and were available to determine Cap compliance for the reporting period. Since 1997–98 there have been no special audits triggered in the Campaspe Cap valley. As at 30 June 2017, the valley has recorded a cumulative credit of 526.38 GL.</td>
</tr>
<tr>
<td>Wimmera–Mallee</td>
<td>A W-M REALM Cap model was accredited by the Authority in 2013 and was available to determine Cap compliance for the reporting period. Since 1997–98 there have been no special audits triggered in the Wimmera–Mallee Cap valley. As at 30 June 2017, the valley has recorded a cumulative credit of 158.38 GL.</td>
</tr>
<tr>
<td>Murray–Kiewa–Ovens</td>
<td>An MSM Cap model was accredited in 2008 and was available to determine Cap compliance for the reporting period. Since 1997–98 there have been no special audits triggered in the Murray–Kiewa–Ovens Cap valley. As at 30 June 2017, the valley has recorded a cumulative credit of 3,152.57 GL.</td>
</tr>
<tr>
<td>South Australia</td>
<td></td>
</tr>
<tr>
<td>Metro Adelaide &amp; Associated Country Areas</td>
<td>There is currently no model available to determine Cap compliance within the Metro Adelaide &amp; Associated Country Areas Cap Valley. In the absence of an accredited model, this Cap valley operates under the existing five year rolling cap arrangement outlined in the Murray Darling Basin Agreement. Since 1997–98 there have been no special audits triggered in the Metro Adelaide &amp; Associated Country Areas Cap valley. As at 30 June 2017, the five year rolling cap was 385.01 GL against a target of 650 GL.</td>
</tr>
<tr>
<td>Lower Murray Swamps</td>
<td>No Cap model is required in the Lower Murray Swamps Cap valley as the annual Cap target is a fixed volume limit adjusted for trade and environmental water. Since 1997–98 there have been no special audits triggered in the Lower Murray Swamps Cap valley. As at 30 June 2017, the valley has recorded a cumulative credit of 158.71 GL.</td>
</tr>
<tr>
<td>Country Towns</td>
<td>No Cap model is required for the Country Towns Cap valley as the annual Cap target is a fixed volume limit adjusted for trade and environmental water. Since 1997–98 there have been no special audits triggered.</td>
</tr>
</tbody>
</table>

---

31 Goulburn Simulation Model- Resource Allocation Model
### Notes to Appendix 5:

#### Model Accreditation

A requirement of Schedule E of the *Murray–Darling Basin Agreement* is the development of models for determining the annual Cap targets in each designated Cap valley. These models must be accredited by the Authority before use. Once complete, these models are given to an independent auditor to assess their suitability to meet requirements for models listed in Schedule. The Authority takes on board recommendations from the independent auditor before accrediting models for use. In some cases this has led to provisional accreditation pending further work from the relevant body. Prior to 2009, models were accredited by the Ministerial Council.

#### Compliance and Special Audits

For each water year, states must monitor and report to the MDBA on the compliance of each designated Cap valley with the Cap targets. Using this information, the MDBA maintains a Cap Register tracking the cumulative balance of annual actual diversions and Cap targets. If an apparent exceedance of the Cap is found during this process the Authority must direct the Independent Audit Group (IAG) to conduct a special audit of that Cap valley.

An apparent exceedance may be:

- The diversions for the Metro Adelaide & Associated Country Areas exceeding 650 GL over a five year period.
- The diversions in the Warrego, Paroo, Moonie or Nebine exceeding the annual diversion target within those valleys.
- The cumulative debit recorded in the Cap Register exceeding 20% of the average annual diversion in all other valleys.

If called upon to perform a special audit, the IAG will consider a range of evidence before reporting their determination within six months of receiving direction. If the IAG determines that the state has exceeded the Cap, the Authority will declare the state in breach of the Cap and report the matter to the Ministerial Council.

With the declaration of breach, a state must report to the next Ministerial Council stating the reasons why the breach occurred, the action proposed or taken to return the Cap Register to balance and the period that the Cap valleys model predicts it will take to return to balance. When the Authority is satisfied that the Cap valley has returned to balance and complying

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33 Excludes NSW Intersecting Streams
with the Cap, the Authority will revoke the declaration of breach and report this to the next Ministerial Council meeting.
## Appendix 6: State nominated methods for annualising environmental water recovery under the Cap on diversions

<table>
<thead>
<tr>
<th>Cap valley</th>
<th>Nominated method</th>
<th>Method Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>New South Wales</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intersecting Streams</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Border Rivers</td>
<td><strong>Usage Method</strong></td>
<td>1. The usage method adjusts the annual targets by the volume of environmental allocation used (that is physically taken out of the river system) for environmental benefits. 2. The adjustment also includes an estimate of water traded for environmental use of a non-environmental (consumptive) allocation or any environmental allocation traded back to consumptive pool. 3. For Cap valleys in NSW and Victoria, adjustment is made for Snowy transfers where applicable.</td>
</tr>
<tr>
<td>Gwydir</td>
<td></td>
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<tr>
<td>Namoi/Peel</td>
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<tr>
<td>Macquarie/Castlereagh/Bogan</td>
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<tr>
<td>Barwon–Darling/Lower Darling</td>
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<tr>
<td>Lachlan</td>
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<tr>
<td>Murrumbidgee</td>
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<tr>
<td>Murray</td>
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<tr>
<td><strong>Victoria</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Goulburn/Broken/Loddon Cap valley</td>
<td><strong>Usage Method</strong></td>
<td>1. The usage method adjusts the annual targets by the volume of environmental allocation used (that is physically taken out of the river system) for environmental benefits. 2. The adjustment also includes an estimate of water traded for environmental use of a non-environmental (consumptive) allocation or any environmental allocation traded back to consumptive pool. 3. For Cap valleys in NSW and Victoria, adjustment is made for Snowy transfers where applicable.</td>
</tr>
<tr>
<td>Campaspe</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Murray/Kiewa/Ovens Cap valley</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>South Australia</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metropolitan Adelaide &amp; associated country areas</td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Lower Murray swamps</td>
<td><strong>Simple or Bundled Scaling</strong></td>
<td>1. The long-term diversion limit equivalent (LTDLE) volume of environmental water recovered for all classes together is scaled by the ratio of annual diversion target to the total long-term diversion limit before recovery. The LTDLE HEW recovered is annualised. 2. Subtract it from pre-adjusted annual permitted take to determine annual permitted take for consumptive use.</td>
</tr>
<tr>
<td>Country towns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>All other purposes</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Queensland</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condamine/Balonne</td>
<td><strong>Use of Model</strong></td>
<td>The model is run with all entitlements including HEW to give total Cap target, then the target under individual HEW entitlements is deducted from the total.</td>
</tr>
<tr>
<td>Border Rivers</td>
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<tr>
<td>Moonie</td>
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<tr>
<td>Nebine</td>
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<tr>
<td>Warrego</td>
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<tr>
<td>Paroo</td>
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<tr>
<td><strong>Australian Capital Territory</strong></td>
<td>Not applicable</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>
### Appendix 7: Environmental water adjustment under the trial of SDL water accounting and compliance

<table>
<thead>
<tr>
<th>SDL resource unit</th>
<th>State’s nominated method</th>
<th>Method Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Queensland</strong></td>
<td></td>
<td></td>
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</tbody>
</table>
| Paroo                             | Use of Model: The model of an SDL resource unit is configured to the long-term diversion limit to determine the annual permitted take for consumptive use. | 1. A model is run in an annual mode from the start of the accounting period with the climatic input for the water year added. The determination of annual modelled environmental water is based on the assumption of 100% utilisation of environmental entitlements.  
2. The model determines a combined number of annual permitted take for both consumptive and environmental pools.  
3. In post process, the modelled limit for environmental entitlements is subtracted from the combined number to determine annual permitted take for consumptive use. |
| Warrego                           |                                            |                                                                                                                                                                                                                  |
| Nebine                            |                                            |                                                                                                                                                                                                                  |
| Condamine–Balonne                 |                                            |                                                                                                                                                                                                                  |
| Moonie                            |                                            |                                                                                                                                                                                                                  |
| Queensland Border Rivers          |                                            |                                                                                                                                                                                                                  |
| **New South Wales**               |                                            |                                                                                                                                                                                                                  |
| NSW Border Rivers                 | Scaling by Allocations: The environmental water recovery (HEW) for each class of entitlements is separately annualised based on their annual announced allocations and long-term modelled allocations. The annualised amount is removed from the pre-adjusted annual permitted take to determine the annual permitted take for consumptive use. | As an initial Step, modelled annual Cap targets are scaled down to the relevant NSW plan limit (as it compares to the long-term average Cap for that area).  
1. The long-term diversion limit equivalent (LTDLE) volume of high security, general security and conveyance environmental water (HEW) is separately scaled by the ratio of annual announced % allocation to the long-term modelled % allocation for that category of entitlement before recovery. The LTDLE HEW recovered is annualised.  
2. The long-term diversion limit equivalent (LTDLE) volume of supplementary and unregulated system environmental water (HEW) is scaled by the ratio of annual access period (days or months) to the long-term access period (days or months) made for that category of entitlement before recovery. The LTDLE HEW recovered is annualised.  
3. Make sum total of annualised environmental water volume for all categories of entitlement.  
4. Subtract it from pre-adjusted annual permitted take to determine annual permitted take for consumptive use. |
<p>| Intersecting Streams              |                                            |                                                                                                                                                                                                                  |
| Gwydir                            |                                            |                                                                                                                                                                                                                  |
| Namoi                             |                                            |                                                                                                                                                                                                                  |
| Macquarie–Castlereagh             |                                            |                                                                                                                                                                                                                  |
| Lachlan                           |                                            |                                                                                                                                                                                                                  |
| Murrumbidgee                      |                                            |                                                                                                                                                                                                                  |
| Barwon–Darling Watercourse        |                                            |                                                                                                                                                                                                                  |
| Lower Darling                     |                                            |                                                                                                                                                                                                                  |
| NSW Murray                        |                                            |                                                                                                                                                                                                                  |
| Australian Capital Territory      | The environmental water recovery (HEW) is made from NSW Murrumbidgee for the shared reduction amount of the Australian Capital Territory. Adjustment to determination of annual permitted take is made using Scaling by Allocation method because of similar hydrologic conditions to NSW Murrumbidgee. | The long-term diversion limit equivalent (LTDLE) volume of general security environmental water (HEW) is separately scaled by the ratio of annual announced % allocation to the long-term modelled % allocation for that type of entitlement before recovery. The LTDLE HEW recovered is annualised. |</p>
<table>
<thead>
<tr>
<th>SDL resource unit</th>
<th>State’s nominated method</th>
<th>Method Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Victoria</td>
<td></td>
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</tbody>
</table>
| Victorian Murray       | **Scaling by Entitlement Types:** The environmental water recovery (HEW) for each class of entitlements (high and low reliability) is separately annualised based on their modelled entitlement volume. The annualised amount is removed from the pre-adjusted annual permitted take to determine the annual permitted take for consumptive use. | 1. The long-term diversion limit equivalent (LTDLE) volume of environmental water (high reliability and general reliability) is separately scaled by the ratio of annual modelled diversion target to the long-term modelled limit for that type of entitlement before recovery. The LTDLE HEW recovered is annualised.  
2. Make sum total of annualised environmental water volume for all classes.  
3. Subtract it from pre-adjusted annual permitted take to determine annual permitted take for consumptive use. |
| Kiewa                  |                                                                                          |                                                                                                                                                                                                                                                                                                                                                       |
| Ovens                  |                                                                                          |                                                                                                                                                                                                                                                                                                                                                       |
| Broken                 |                                                                                          |                                                                                                                                                                                                                                                                                                                                                       |
| Goulburn               |                                                                                          |                                                                                                                                                                                                                                                                                                                                                       |
| Campaspe               |                                                                                          |                                                                                                                                                                                                                                                                                                                                                       |
| Loddon                 |                                                                                          |                                                                                                                                                                                                                                                                                                                                                       |
| Wimmera–Mailee         | **Use of Model:** The model of an SDL resource unit is configured to the long-term diversion limit as set out by the Basin Plan to determine annual permitted take. | A model configured to new diversion limit post environmental water recovery is used to determine annual permitted take for consumptive use.                                                                                                                                                                                                      |
| South Australia        |                                                                                          |                                                                                                                                                                                                                                                                                                                                                       |
| SA Murray              | **Simple or Bundled Scaling:** The environmental water recovery (HEW) for all classes/entitlements is annualised based on their sum total of modelled volume. The annualised amount is removed from the pre-adjusted annual permitted take to determine the annual permitted take for consumptive use. | 1. The long-term diversion limit equivalent (LTDLE) volume of environmental water recovered for all classes together is scaled by the ratio of annual diversion target to the total long-term diversion limit before recovery. The LTDLE HEW recovered is annualised.  
2. Subtract it from pre-adjusted annual permitted take to determine annual permitted take for consumptive use. |
| SA Non-Prescribed Areas| No environmental water held within SA Non-Prescribed Areas in 2016–17 – no adjustment to determination of annual permitted take required | N/A                                                                                                                                                                                                                                                                                                                                                  |
| Marne Saunders         | No environmental water held within Marne Saunders in 2016–17 – no adjustment to determination of annual permitted take required | N/A                                                                                                                                                                                                                                                                                                                                                  |
| Eastern Mount Lofty Ranges | No environmental water held within Eastern Mount Lofty Ranges in 2016–17 – no adjustment to determination of annual permitted take required | N/A                                                                                                                                                                                                                                                                                                                                                  |
Appendix 8: Surface water SDL resource units

Figure 10.1 Map of Surfacewater SDL resource units

Sources: Geoscience Australia © Topo 250K data (Series 3), Geoscience Australia © Topo 2.5 million data (2003), Murray–Darling Basin Authority © Surface water SDL Resource Units
Appendix 9: Groundwater SDL resource units

Figure 10.2 Groundwater SDL resource units excluding deep groundwater resource units

Sources: Geoscience Australia © Topo 250K data (Series 3), Geoscience Australia © Topo 2.5 million data (2003), Murray–Darling Basin Authority © Groundwater SDL Resource Units.
Figure 10.3 Legend for Groundwater SDL resource units excluding deep groundwater resource units
Figure 10.4 deep groundwater SDL resource units

Sources: Geoscience Australia © Topo 250K data (Series 3), Geoscience Australia © Topo 2.5 million data (2003), Murray–Darling Basin Authority © Groundwater SDL Resource Units
Appendix 10: Core concepts and useful links

1 Legislative background

The Water Act 2007 (Cth) and the Basin Plan 2012 provide the legislative background that informs the requirements of this water take report.

A.1.1 Water Act 2007 (Cth)

Section 71

Section 71 sets out reporting obligations of the Basin states to provide the MDBA with information regarding the use and management of all Basin water resources for an annual water accounting period.

Section 32

Section 32 requires the MDBA to identify and account for all held environmental water on an annual basis, including all water access entitlements recovered for the environment through reforms prior to the Basin Plan.

Schedule 1

Schedule 1 of the Water Act contains the Murray–Darling Basin Agreement. Schedule E of this agreement establishes a long-term Cap on surface water use in river valleys across the Basin. Schedule 1 also requires each Basin State to report to the MDBA on a range of matters.


A.1.2 The Basin Plan 2012

Schedule 2 of the Basin Plan sets out the long-term average sustainable diversion limits (SDLs) for each surface-water SDL resource unit within the 20 water resource plan areas for surface water. It also includes estimates by the MDBA of the quantity of water represented by the SDLs. Long-term average sustainable diversion limits (SDLs) are the maximum long-term annual average quantities of water that can be taken on a sustainable basis from Basin water resources as a whole, and from each SDL resource unit, from 2019. They are the means for ensuring that consumption of water is maintained at an environmentally sustainable level.

Schedule 3 of the Basin Plan sets out the baseline diversion limits (BDL) for each surface water SDL resource unit within the 20 surface-water water resource plan areas, and includes estimates by the MDBA of the quantity of water represented by the BDL, in Gigalitres per year. BDLs define a baseline from which to measure reductions in diversions. A surface water baseline diversion limit is the sum of the long-term annual average limits (or where
there is currently no limit, the long-term annual average take) for all forms of take from a surface water SDL resource unit.

Schedule 4 of the Basin Plan sets out the baseline diversion limits (BDLs) and the long-term average sustainable diversion limits (SDLs) for each groundwater SDL resource unit within the 23 groundwater water resource plan areas. Groundwater BDLs are the best estimates of the MDBA of the quantity of water that could be taken under the state planning regimes when the Basin Plan was made. Groundwater SDLs are the maximum long-term average annual average quantities of water that can be taken on a sustainable basis from each SDL resource unit. They are the means for ensuring that consumption of water is maintained at an environmentally sustainable level of take.

Schedule 12 of the Basin Plan sets out reporting requirements for MDBA, Basin states and the Commonwealth. As part of this reporting, under Matter 9 of Schedule 12, MDBA, Basin states and the Commonwealth are required to identify environmental water, both held and planned environmental water and monitor its use. Matter 9 reporting is broken up into 3 areas, these are:

- Matter 9.1 Identification and accounting of held environmental water;
- Matter 9.2 Identification and accounting of planned environmental water; and
- Matter 9.3 Monitoring the use of environmental water.


Reporting on planned environmental water has occurred for the 2013–14 water year. However, as reporting annually on planned environmental water is in its infancy, the results of these reports are not yet published. The MDBA is working with Basin states on providing better ways of reporting estimates on the amount of planned environmental water in the Basin.


A.2 Core concepts with regard to take

A.2.1 What is take?

The term ‘take’ means the take of water from a water resource. Take includes taking the water by means of:

- diverting it from a main river system into an irrigation district or other distribution network
- pumping water directly from the river or aquifer
- diverting water as the water flows across the land into a dam
- intercepting water before it reaches a river to grow a commercial forestry plantation.

A.2.2 Forms of take

The Basin Plan defines forms of take as:
• take from a watercourse/unregulated river
• take from a regulated river
• take by floodplain harvesting
• take by runoff dams
• net take by commercial plantations
• take from groundwater
• take under basic rights.

A.2.3 Sustainable diversion limits

The Basin Plan establishes sustainable diversion limits (SDLs) for surface and groundwater. The SDL is the limit on how much water can be sustainably taken for consumptive uses (including domestic, urban and agricultural use) from an SDL resource unit. The SDL includes all forms of take and is a volume in Gigalitres per year (GL/y). The SDL is also a long-term annual average limit.

There is an SDL volume for each SDL resource unit and take is reported for each SDL resource unit in a water resource plan (WRP) area.

The SDLs take effect from 1 July 2019 through accredited water resource plans.

A.2.3.1 Surface water SDL resource units

The boundaries of the 29 surface water SDL resource units as defined by the Murray–Darling Basin Plan can be found on the MDBA website http://www.mdba.gov.au/

A.2.3.2 Groundwater SDL resource units

The boundaries of the 66 groundwater SDL resource units as defined by the Murray–Darling Basin Plan can be found on the MDBA website http://www.mdba.gov.au/

This includes 7 groundwater SDL resource units for deep groundwater that can be found on the MDBA website http://www.mdba.gov.au/

Note that there are six WRP areas that apply to both surface water and groundwater, therefore the total number of WRP areas is 36. The WRP areas incorporate a total of 110 SDL resource units.

A number of other maps and alternative formats for the above maps are available on the MDBA website http://www.mdba.gov.au/

A.2.4 Reporting Take

Take is accounted for over a water accounting period, which follows the 12 month period 1 July to 30 June. The Basin states report take of surface water and groundwater to the MDBA. The MDBA is responsible for assessing the data before recording it on a register of take for each SDL resource unit. The purpose of this register is to record compliance by Basin states with the SDL for each SDL resource unit. Compliance commences in the first water accounting period after 30 June 2019 following the commencement of an accredited water resource plan.

A.2.5 Annual actual take and annual permitted take
For a water accounting period, annual permitted take is the sum of the maximum quantities of water permitted to be taken by each form of take for consumptive use from an SDL resource unit. The water resource plan must have a method to determine annual permitted take for each form of take in each SDL resource unit in the WRP area. This method must be designed to be applied at the end of each water accounting period. The water resources available during the accounting period are a very important consideration in the method.

Because of varying water availability between water accounting periods, annual permitted take will vary and will rarely, if ever, equal the SDL. Importantly, while annual permitted take can vary, the SDL of each resource unit in the WRP area must be complied with over the term of the water resource plan.

For the same water accounting period, annual actual take is the sum of the quantities of water actually taken by each form of take for consumptive use from the SDL resource unit.

A water resource plan must have rules to ensure that annual actual take does not exceed annual permitted take. If applicable, water allocation rules need to be included.

Data provided annually by Basin states comes from a range of sources including: state registers and databases; outputs from state river models; estimates from surveys and other methods. Therefore, data may range from very accurate and reliable to potentially limited or with high levels of uncertainty. This range of data sources is acceptable to be added together to calculate either the annual permitted take or actual take. The Basin Plan provides some flexibility with this data uncertainty by allowing the Basin State to have a cumulative balance of actual take over permitted take of up to 20% of the SDL before the Basin State would be considered non-compliant, for an SDL resource unit.

A.2.6 Roles and responsibilities

The Basin Plan has established two main roles with regards to the plan: the MDBA as the regulator of the Basin Plan and the Basin states as the implementers.

Basin states are responsible for managing the water activities within their state, in accordance with the accredited water resource plans. Each year the states report the water take and the MDBA records the Basin State’s assessment of compliance with SDLs.

A.2.7 Implementation process

The Basin Plan’s management arrangements implement SDLs in each SDL resource unit, which are within a water resource plan area. A water resource plan area may include several SDL resource units. Basin states are responsible for preparing water resource plans for these water resource plan areas. A water resource plan has to ensure that the SDL of each resource unit in the water resource plan area is complied with over the term of the water resource plan.

Basin states are developing water resource plans during this transition period to 1 July 2019. Basin states propose water resource plans to the MDBA, who then assess them and provide recommendations to the Commonwealth Water Minister whether a water resource plan should be accredited or not. The Commonwealth Water Minister considers the recommendations and makes a decision whether to accredit a water resource plan or not. Accredited water resource plans will have effect until either it ceases to have effect or until
three years after an amendment to the Basin Plan that affects water resource plan accreditations.

A.3 Useful links

This section includes links to key legislation, reports, maps and other information sources referred to throughout this report. While this report is intended to standalone, the links below may be useful for readers seeking further information for context, background, or as a starting point to explore this report in more detail.

A.3.1 Reports

MDBA Annual Reports:


**Glossary**

**Actual take**
Total quantity of water actually taken from the water resources of a water resource plan area during a water accounting period.

**Allocation**
The annual volume of water to which the holder of an access licence is entitled as recorded in the water allocation account for the licence.

**Baseline Diversion Limit**
Baseline diversion limit (BDL) means the baseline limit of take from a sustainable diversion limit (SDL) resource unit. The baseline limit is:

- for a surface water SDL resource unit — the quantity of water calculated in accordance with column 2 of the table in Basin Plan Schedule 3 for that SDL resource unit.
- for a groundwater SDL resource unit — quantity of water calculated in accordance with column 3 of the table in Basin Plan Schedule 4 for that SDL resource unit.

The baseline reflects the level of take at 30 June 2009 generally. It is a combination of limits established by state law (e.g. existing water resource plan limits) or limits established by the Cap arrangements, and defined levels of take where there are no established limits.

The BDL establishes a baseline from which to determine required reductions in diversions to achieve the SDL.

**Basin Plan, the**
Legislation that sets out the BDL and SDL for each resource unit and the reporting requirements (see section A.1.2 for more information).

**Basin states**
The states and territories within the Murray–Darling Basin, namely, New South Wales, Victoria, Queensland, South Australia and the Australian Capital Territory.

**Bulk entitlement**
A perpetual entitlement of water granted to water authorities by the Crown of Victoria under the *Water Act 1989* (Vic).

**Carryover**
A way to manage water resources and allocations that allows entitlement holders to take a portion of unused water from one water year into a new water year.

**Cap, The**
A limit, implemented in 1997, on the volume of surface water that can be diverted for consumptive use.
CEWH Commonwealth Environmental Water Holder

CEWO Commonwealth Environmental Water Office

Class of entitlement Water entitlements are divided into differing ‘classes’ of security, where ‘security’ refers to the frequency with which water allocated under that entitlement is able to be supplied in full. Higher security entitlements have higher average and less variable yields than lower security entitlements.

Consumptive use Use of water for irrigation, industry, urban, stock and domestic use, or for other private consumptive purpose.

Diversion The removal of water from a river system by means of pumping or gravity channels.

Diversion licence Specified licences issued for a specified annual volume and diversion rate.

Water entitlement The volume of water authorised to be taken and used by an irrigator or water authority. It includes bulk entitlements, environmental entitlements, water rights, sales water and surface-water and groundwater licences.

Environmentally sustainable level of take Average level of take that allowing environmental needs to be met.

Environmental water Held environmental water or planned environmental water.

Floodplain harvesting The taking of water from a floodplain, including after it leaves a watercourse during a flood.

Gigalitre (GL) One billion or $10^9$ litres.

Groundwater Water occurring naturally below ground level (in an aquifer or otherwise).

Held environmental water 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).

Inflow Source of the water that flows into a specific body of water — for a lake, inflow could be a stream or river, and inflow for a stream or river could be rain.

Interception The interception of surface water or groundwater that would otherwise flow, directly or indirectly, into a watercourse, lake,
wetland, aquifer, dam or reservoir that is a Basin water resource.

**IQQM** Integrated quantity quality model

**Irrigation** The application of water to land to grow crops, usually through supplying water by means of channels or pipes

**Long-term diversion limit** Ratio used by water planners to represent the expected use of water in the various water access entitlements of a given river system.

**Megalitre (ML)** One million or $10^6$ litres

**MSM** Murray Simulation Model


**Murray–Darling Basin Agreement** The Agreement between the governments of four Basin states and the Commonwealth. The current Agreement is the 2008 Agreement.

**On-farm storage** Privately-owned storage used to harvest surplus flow or to store unused allocation for use in the following season.

**Overdraw** Water diverted in one season against a prospective allocation in the subsequent year.

**Overland flow** A term used by Queensland for floodplain harvesting, see definition for floodplain harvesting

**Permitted take** Total quantity of water permitted to be taken during a water accounting period in a water resource plan area, varying from year to year according to the interaction of climate, inflows and water resource plan rules (e.g. allocation rules, access rules).

**Planned Environmental Water** Water used for environmental outcomes which is not associated with an entitlement but is managed through with rules set out in water management plans or laws.

**REALM** Resource Allocation Model

**Regulated system** A surface water system in which water in a watercourse can be stored or flow levels are controlled, through the use of structures such as large dams and large weirs.

**Salinity** The concentration of dissolved salts in water usually expressed in EC units. Applies to both surface and groundwater

**Surface water** Includes water in a watercourse, lake or wetland, and any water flowing over or lying on the land after having precipitated
naturally or after having risen to the surface naturally from underground.

**Sustainable diversion limit (SDL)**
The maximum long-term annual average quantity of water that be taken, on a sustainable basis, from the Basin water resources as a whole, and the water resources, or particular parts of the water resources, of each water resource plan area. Take is the removal of water, or the reduction in flow of water, from a water resource for consumptive purposes. See ‘Actual Take’ and ‘Permitted Take.’

**Transitional diversion limit (TDL)**
The TDL represents progress from current diversion limits (defined in the Basin Plan as the baseline diversion limit – BDL) to the SDL. It is a mechanism to assist with the development, testing and trialling of Basin Plan arrangements until June 2019.

**Unregulated streams**
Streams that are not controlled or regulated by releases from major storages.

**Utilisation**
The amount of water available for diversion that is actually diverted.

**Water accounting**
A systematic process of identifying, recognising, quantifying, reporting and assuring information about water, the rights or other claims to water, and the obligations against water. Water accounting applies Australian Water Accounting Standards

**Water audit monitoring (WAM) Report**
MDBA prepared annual reports providing a comprehensive overview of water use and management in the Basin. The Cap method precursor to Water Take Reporting.

**Water quality**
The condition of water and its related suitability for different purposes. It refers to a combination of physical, chemical and/or biological characteristics of water in the context of the proposed use of that water.

**Water resource**
Groundwater — water that occurs naturally beneath the ground level (whether in an aquifer or otherwise), or water that has been pumped, diverted or released to an aquifer for the purpose of being stored there. Murray–Darling Basin groundwater resources exclude groundwater in the Great Artesian Basin.

Surface water — includes water in a watercourse, lake or wetland, and any water flowing over or lying on land after having precipitated naturally, or after having risen to the surface naturally from beneath the ground level.
Water resource plans (WRPs) Statutory management plans developed for particular surface water and groundwater systems. Currently these plans known by different names throughout the Murray–Darling Basin (such as ‘water sharing plans’ in New South Wales and ‘water allocation plans’ in SA).

Water year A continuous 12-month period, usually starting 1 July, or any other month as prescribed under the water regulation or a resource operations plan, but usually selected to begin and end during a relatively dry season. Used as a basis for processing streamflow and other hydrologic data.