Australian Government

MURRAY–DARLING BASIN AUTHORITY

# Source Murray Model – Method for determining permitted take in the Victorian Murray, Kiewa and Ovens SDL resource units

## Technical Report No. 2018/16

April 2019

Published by the Murray–Darling Basin Authority
MDBA publication no: 0
ISBN (online): ISBN generated by communications
ISBN (print): ISBN generated by communications

**GPO Box 1801, Canberra ACT 2601**
engagement@mdba.gov.au
**1800 230 067**
mdba.gov.au



**Cataloguing data**
**Title:** Source Murray Model – Method for determining permitted take in the Victorian Murray, Kiewa and Ovens SDL resource units, Murray–Darling Basin Authority Canberra, 2019. CC BY 4.0

**Accessibility**
The Murray–Darling Basin Authority makes its documents and information available in accessible formats. On some occasions the highly technical nature of the document means that we cannot make some sections fully accessible. If you encounter accessibility problems or the document is in a format that you cannot access, please contact us.

**Acknowledgement of the Traditional Owners of the Murray–Darling Basin**
The Murray−Darling Basin Authority pays respect to the Traditional Owners and their Nations of the Murray−Darling Basin. We acknowledge their deep cultural, social, environmental, spiritual and economic connection to their lands and waters.

The guidance and support received from the Murray Lower Darling Rivers Indigenous Nations, the Northern Basin Aboriginal Nations and our many Traditional Owner friends and colleagues is very much valued and appreciated.

Aboriginal people should be aware that this publication may contain images, names or quotations of deceased persons.

# Contents

# 1 Introduction

Under the Basin Plan, states must prepare Water Resource Plans (WRPs) that cover each Sustainable Diversion Limit resource unit. These plans need to set out the method for determining the annual permitted take (Clause 6.10 and 10.10), and demonstrate that this method would meet the Sustainable Diversion Limit (SDL) for each SDL resource unit, if applied over a repeat of the historical climate conditions. The Source Murray Model (SMM) has been configured to be the modelling tool to determine some components of the annual permitted take for the Water Resource Plan areas that cover the Murray and Lower Darling River systems.

This document provides an overview of the SMM and its setup for the purposes of WRP accreditation for the Victorian Murray. This includes the assumptions and configuration of BDL and WRP scenarios which are further described in the following sections. It also provides details on a proposed method to determine the annual permitted take for each SDL resource unit. The purpose of this is to assist the states with the development of the method for determining permitted take.

The data included in this report for the South Australian Murray represents the assumptions and behavior submitted as part of their WRP. The data included in this report for NSW is the best available at this stage, however are draft and may be updated as the relevant WRPs for this state are finalised. As part of developing the annual permitted take methods, the Baseline Diversion Limit (BDL) model and estimates are also often reviewed.

*It has been agreed that a review of the SMM, and its use for the purposes set out in this report, will be commenced no later than 31 January 2020 and completed by end June 2021. Further, by 2021 inflows from upstream river systems for updated BDL and accredited WRP's would also be known. Depending on the findings of the review and updated inflows, it may be appropriate to re-accredit the relevant WRPs with reference to an updated SMM.*

## 1.1 SDL resource units

The SMM represents the River Murray system, including the Lower Darling river. The SMM covers the six SDL resource units listed in Table 1 (and shown spatially in Figure 1) and will be used for three Water Resource Plans.

Table 1: Water resource plan areas and SDL resource units represented in the SMM

| Model | Water Resource Plan areas | SDL resource unit |
|---|---|---|
| Source Murray Model (SMM) | New South Wales Murray and Lower Darling (SW8) | New South Wales Murray (SS14) |
| | | Lower Darling (SS18) |
| | Victorian Murray (SW2) and part Northern Victoria (SW3) | Victorian Murray (SS2) |
| | | Kiewa (SS3) |
| | | Ovens (SS4) |
| | South Australian River Murray (SW6) | South Australian Murray (SS11) |

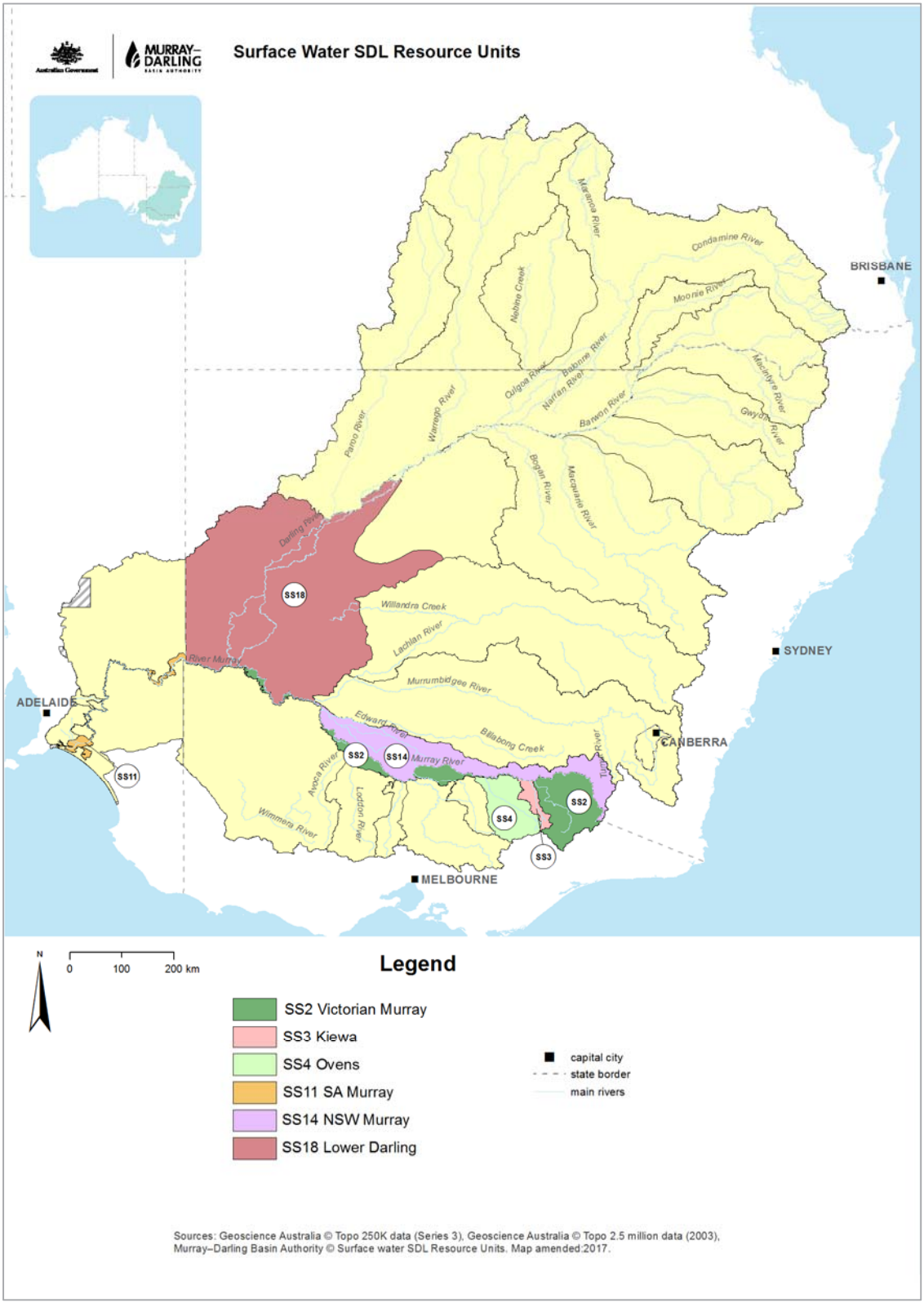


Figure 1 Surface Water SDL resource units modelled in the SMM

## 1.2 Baseline Diversion Limit (BDL)

The BDL is the baseline diversion limit of take from a SDL resource unit (Basin Plan s 1.07). For surface water SDL resource units, this is the quantity of water calculated in accordance with the description set out in Schedule 3 of the Basin Plan. The SMM will be used to update the estimate of the modelled component of the regulated river (NSW) or watercourse (VIC and SA) diversions consistent with the description. It is calculated over the historical climate conditions for the period July 1895 – June 2009 and generally state water management law as at 30 June 2009. The long term average diversions under these conditions will be modelled via a BDL scenario, the configuration of which is described later in this report.

Other forms of take that are part of the BDL are not modelled and are estimated by other methods (i.e. take from watercourses other than regulated rivers in NSW, take under basic rights from a watercourse, and interceptions of take by runoff dams and net take by commercial plantations). Table 2 provides a summary of estimates for regulated river and watercourse diversions (excluding basic rights) as set out in Schedule 3 of the Basin Plan (and further documented in MDBA 2012, Table 26). The SMM will be used to update the modelled diversions component of the BDL estimates. Other components of the BDL estimates may also be updated in conjunction with WRP accreditation.

Table 2: Estimates of modelled and unmodelled diversions that determine the BDL for watercourse diversions as noted in Schedule 3 of the Basin Plan (in GL/y).

| SDL resource unit | modelled diversions component | un-modelled diversions component | total BDL for watercourse diversions (excluding basic rights) |
|---|---|---|---|
| NSW Murray (SS14) | 1680 | 28 | 1708 |
| Lower Darling (SS18) | 55 | | 55 |
| Victorian Murray (SS2) | 1657 | 5.5 | 1662 |
| Kiewa (SS3) | 11 | | 11 |
| Ovens (SS4) | 25 | | 25 |
| SA Murray (SS11) | 665 | | 665 |

## 1.3 Sustainable Diversion Limit (SDL)

The long term average Sustainable Diversion Limit is set out for each surface water SDL resource unit in Schedule 2 of the Basin Plan as:

$$SDL = BDL - \left(\begin{matrix} local\ reduction \\ amount \end{matrix}\right) - \left(\begin{matrix} shared\ reduction \\ amount \end{matrix}\right) + \left(\begin{matrix} SDL\ adjustment \\ amount \end{matrix}\right)$$

Where:

- the local reduction amounts are set in the Basin Plan Schedule 2 for each SDL resource unit
- the shared reduction amounts are determined using the default method set out in the Basin Plan, or re-allocated as requested by the Basin States further to s6.05 of the Basin Plan, subsequently agreed by the MDBA and published on the MDBA website and
- the SDL adjustment amount for the Southern basin is calculated in accordance with Schedule 6A of the Basin Plan. This amount may vary based on the amount of efficiency measures delivered.

A re-allocation adjustment request may be made by a Basin State to alter the volume of the shared reduction amount in a SDL resource unit. Such a request was made by South Australia prior to 30 June 2018 and requests were made by New South Wales and Victoria prior to 31 December 2018. South Australia's request has been adopted, whilst the requests from New South Wales and Victoria are awaiting approval from the Authority (as at February 2019). Table 3 shows the requested volume by South Australia and the default shared reduction amounts in NSW and Victoria. When approved by the Authority, Table 3 can be updated with approved volumes for use in the method for determining annual permitted take for NSW and Victoria.

The SDL adjustment amount, as a formula, reflects all supply contributions at commencement and progressively recognises entitlements as they are recovered for efficiency measures. The SDL is increased for the apportioned supply contribution and reduced for efficiency entitlements. The overall size of change is limited to 543 GL/y. Supply measures are delivered over the period to 30 June 2024. The Australian Government is pursuing initiatives to deliver at least 62 GL/y of efficiency measures by 30 June 2019, full implementation of 605 GL/y supply measures, and a total of 450 GL/y of efficiency measures by 30 June 2024.

At 31 December 2018, 0.46 GL/y[1] had been initially reported as recovered in the South Australian Murray (SS11) SDL resource unit for efficiency measures. In total across the Basin, 1.9 GL/y[1] had been contracted in the SA Murray (SS11) for efficiency measures. It is not certain where future efficiency measures will be located, or their specific volume.

Where 62 GL/y of efficiency contributions have not been achieved at any given point in time, the SDL adjustment amount suppresses the amount of apportioned supply contribution that is available to the relevant SDL resource units in the southern Basin (this includes all of the SDL resource units covered by the SMM and this report). The SDL adjustment amount operates to maintain the level of overall Basin change to surface water SDLs to 543 GL/y.

If the total current efficiency contribution across the Basin at 1 July 2019, 1 July 2022 and 1 July 2024 is less than 62 GL/y, the SDL adjustment amount must reduce the apportioned supply contribution in each SDL resource unit (Basin Plan s10.11). The apportioned supply contribution is reduced in proportion to the ratio of the sum of the net of the 5% limit and the total current efficiency contribution at that time (or 543 GL/y plus total current efficiency contribution on 1 July) to

[1] This amount is based on the long term diversion limit equivalence (LTDLE) factor for SA at February 2019. It is noted that this factor is likely to be updated based on improved information prior to end June 2019.

605 GL/y. As these calculations require knowledge of achievement of efficiency contributions in all SDL resource units, the MDBA will publish the SDL volumes for 1 July each year on its web site.

An additional adjustment is also required in the SDL resource units where efficiency measures have been recovered. For example, in the SA Murray (SS11), an additional adjustment for the efficiency contribution that has already been achieved will also be required from 1 July 2019.

The values of each of the parameters for determining the SDL for each relevant SDL resource unit are set out in Table 3.

Table 3 Local reduction, shared reduction and SDL adjustment amounts for SMM SDL resource units (GL/y)

| SDL resource unit | local reduction amount | shared reduction amount[1] | SDL-adjustment amount[2] | total reduction |
|---|---|---|---|---|
| NSW Murray (SS14) | 262.0 | 165.8 | 124.8 | 303.0 |
| Lower Darling (SS18) | 8.0 | 14.3 | - | 22.3 |
| Victorian Murray (SS2) | 253.0 | 210.8 | 72.8 | 391.0 |
| Kiewa (SS3) | 0 | 1.1 | 1.3 | 0[3] |
| Ovens (SS4) | 0 | 2.7 | 3.0 | 0[3] |
| SA Murray (SS11) | 101.0 | 82.8 | 52.0 | 131.8 |

[1] Shared reduction amount for South Australia is as per its request and otherwise the requested shared reduction amounts for NSW and Victoria are as agreed by the Authority (at 12 March 2019)

[2] The SDL adjustment amount included as an example in this table is the apportioned supply contribution; and it assumes that 62 GL/y of efficiency measures have been recovered, but that they have been recovered in other SDL resource units. The effect of 0.5GL/y of efficiency measures currently achieved in SA Murray (SS11) (February 2019) are not included in this table. Efficiency measure entitlements are addressed in Appendix B of this report.

[3] The Victorian shared reduction request (as agreed by the Authority) produces small negative amounts in two valleys totaling 0.5 GL/y (Kiewa 0.2 GL/y and Ovens 0.3 GL/y) for the required reduction from the BDL to the SDL when applied in conjunction with the apportioned supply contribution; which assumes at least 62GL/y of efficiency measures is achieved. The Victorian shared reduction request meets all of the requirements set out in the Basin Plan at s6.05. Resolution of any anomalies will be considered as further recoveries are secured and / or at the 2024 reconciliation of the SDLAM.

To satisfy the requirements of the Basin Plan (s10.10(4)), the annual permitted take method for each SDL resource unit must demonstrate that the long-term average annual diversions would meet the corresponding SDL if applied over a repeat of the historical climate conditions. Volumes for the total reduction can be deducted from the BDL to calculate the SDL for the purposes of this demonstration.

The demonstration that the annual permitted take method will meet the SDL over the long term could be based on either of the following:

- an assumption that 62 GL/y of efficiency measures are delivered (in other SDL resource units), enabling the full effect of the supply contribution to be implemented ; or

- the level of efficiency measures currently recovered (i.e. 0.46 GL/y in the SA Murray).

Regardless of which of these is selected for the purpose of the demonstration, the annual permitted take method must be able to be adjusted as efficiency measures are recovered over time.

## 1.4 Determination of annual permitted take

The SMM will be used to model a WRP scenario (the configuration of this scenario is described in detail in a following section), which is intended to form part of the method of calculating annual permitted take for SDL compliance requirements in the Murray and Lower Darling River system. However, it is important to note upfront that it is not possible at this time to represent all WRP conditions in the WRP scenario. The SMM WRP scenario uses the best available information, but where information is limited, assumptions need to be made.

It is not possible to explicitly model the use of environmental water recovered to bridge the gap at this stage, because approaches for use of environmental water are still evolving and it will be many years of learning and adaptive management before some representative watering approaches can be described. Further complications in implementing long term usage of environmental water also include the inadequate details surrounding key aspects of:

- the implementation of pre-requisite policy measures in each of the states (PPM's)
- the final implementation of SDL adjustment projects, including channel capacity constraints projects.

Therefore, the WRP scenario does *not* include Basin Plan water recovery and the modelled annual average diversions should represent the BDL[2]. The WRP scenario includes some representation of the supply measures, but long term average diversions are *not* adjusted to reflect the SDL adjustment amount (supply contribution and efficiency measures).

To account for water recovery under the Basin Plan, the modelled diversions will be adjusted for the water recovered for the environment in proportion to the various entitlement types recovered and for the SDL adjustment mechanism (further details on the adjustment method have been provided in the chapter *Method to determine annual permitted take*). The annual average diversions after scaling (or post processing) should be equal to or less than the SDL.

The WRP scenario described in this document is the best representation of the rules in the WRPs available at the time of setup of SMM for WRP conditions. The scenario is likely to require updating in future as all upstream WRPs are yet to be accredited. The inflows from upstream tributary catchments will impact on any downstream SDL resource unit BDL estimates as well as the SDL. Similarly, the WRP settings in upstream tributary catchments may also impact on downstream WRP scenarios.

[2] In case of NSW and Victoria, scaling of demands will be applied if the modelled diversions would be less than BDL in order to match the BDL.

# 2 Overview of the Source Murray Model (SMM)

## 2.1 Background

The Basin Plan Implementation Agreement (2013) stated that eWater Source (software) would be adopted for the development of new river system models. The River Murray Basin States agreed that the MDBA would build a Source Murray Model to replace the existing MSM-Bigmod model, given the known limitations of MSM-Bigmod and the key role played by River Murray modelling in determining Basin Plan outcomes.

The MDBA has worked collaboratively with State technical staff in the development of the Source Murray Model and an independent technical review of the model in March 2017 concluded that the model was a suitable candidate to undertake the modelling associated with the Basin Plan (Bewsher, 2017).

The Source Murray Model represents the River Murray and Lower Darling river systems. The model commences with headwater inflows to the Murray River (about 40 km south of Mt. Kosciuszko) and Darling River inflows into Menindee Lakes, and finishes at the barrages which separate the Lower Lakes from the sea.

Inputs to the model include inflows from the Snowy Mountain Hydro-electric Scheme (SMHS) via releases through the Murray 1 Power Station (NSW, 2002). Also input are inflows from a number of tributaries including:

- Kiewa River at Bandiana
- Ovens River at Peechelba
- Goulburn River at McCoy's Bridge
- Campaspe River at Rochester
- Loddon River at Appin South
- Billabong Creek at Darlot
- Murrumbidgee River at Balranald
- Barwon–Darling river upstream of Menindee Lakes

The inflow data used for all tributaries are the same as that used for the BDL legislative model run #871 (MSM-Bigmod) except for:

- Return flows from the ANM Paper Mills at Albury were reduced to zero.
- Volume of water called out from northern Victorian Rivers and the Murrumbidgee River have been updated for the water recovery estimates, as well as call out amount variations due to the change from a monthly time step to a daily time step model.
- Releases from the Snowy have been updated for water recovery associated with the *Water for Rivers* program.

The SMM includes four major storages: Dartmouth Dam on the Mitta Mitta River, Hume Dam on the Murray River, Menindee Lakes on the Lower Darling and Lake Victoria (an off-river storage connected to the Murray River). The Menindee Lakes system is modelled as four major lakes: Wetherell, Pamamaroo, Menindee and Cawndilla Lakes. In addition, a number of weir pools and natural wetlands and floodplains are included in the model.

The SMM simulates:

- water sharing arrangements between the states, as per the Murray–Darling Basin Agreement (Schedule 1 to the Water Act 2007 (Cwlth))
- bulk water accounting as per the Murray–Darling Basin Agreement
- allocation by states to groups of water users
- irrigation water demands in the key regions throughout the system
- the effect of channel capacity constraints
- transfers required between storages to ensure that demands can be met and
- operation of various dams and structures including orders to meet forecast demand and pre-releases from each storage for flood mitigation.

Details of the above processes and model assumptions are described in a number of MDBA technical reports. (Some on these reports are currently in draft and are being finalised progressively). This report summarises key aspects of the configuration of the Source Murray Model for the BDL and WRP scenarios, and includes references to relevant reports for further details. The results for calibration of river flows and losses are described in MDBA (2015/03) and are still relevant.

## 2.2 SMM versus MSM-Bigmod

Previous estimates of the BDL for the SDL Resource Units were calculated using MSM-Bigmod (Basin Plan run #871). The Source Murray Model has some fundamental conceptual differences from MSM-Bigmod, which affect the calculated diversions. Some of the major differences include:

- Transition from a monthly to daily time-step for representation of physical processes such as flow routing, losses, overbank flows, irrigation demands and diversions and also for management decisions such as operation of storages, calculation of water orders, water sharing etc. The calculation of various processes on daily time steps better represents variability and reduces the impact of averaging on water availability, flows, demands and diversions as well as losses.
- In the SMM, a new resource assessment model has been implemented to determine state shares of the available resource. The model is consistent with that used by river operators to calculate state shares (MDBA 2018/16 Attachments G, H, I and J).
- Crop area based models have replaced regression equations to determine consumptive demands (MDBA 2018/16 Attachment D). The demands for the Kiewa, Ovens and SA, are still being determined as previously, as follows:
    - Kiewa BDL is determined using a regression equation between climate variables and diversions (MDBC 2002 and MDBC 2003).
    - The Ovens current published BDL estimate is based on Ovens REALM model results developed by Victoria (SKM 2008 and SKM 2009). For revision of BDL estimate and

inclusion in the SMM, the regression equation based Ovens annual permitted take calculation method, as used for the Cap auditing, has been included.

- SA irrigation diversions are modelled using a regression equation accredited as part of the All Other Purposes cap model and used for Cap compliance.

## 2.3 SMM model provenance

Key details of the provenance of the software and SMM project file (*.rsproj) used to undertake the model runs associated with this report are outlined in Table 4.

The MDBA downloads the Source software releases from eWater via their toolkit website and compiles the plugins required to run the SMM. The Source software and the plugins are then stored by the MDBA in version control software (SVN) in the Formal Release repository. Likewise updates to the SMM project file are stored in the River Murray SVN repository. This allows a detailed record of changes to both the model and software to be maintained. The SMM project file and corresponding data sets are the final authenticated data sets for accredited WRP and have primacy over any other published or unpublished information/data sets for the purposes of estimating annual permitted take and demonstrating compliance with long term SDL.

The version of Source used for the BDL and WRP runs for this report was found to produce numerical differences depending on the type of processor used to make calculations. Specifications of the processor used to calculate the model runs are included in Table 4. It is expected that this fault will be resolved by the time of the review of the SMM.

Table 4 SMM Provenance

| Component | Version | SVN Repository |
|---|---|---|
| **Software** | Source 4.8.1.8559 Beta | http://coresvn/svn/eWaterSource/FormalRelease/Trunk Revision 980 |
| **Plugins** | https://bitbucket.org/ewater/MDBAPlugins Revision 994 | http://coresvn/svn/eWaterSource/FormalRelease/Trunk Revision 980 |
| **Model** | River Murray 4.8.1.rsproj | http://coresvn/svn/eWaterSource/RiverMurray Revision 982 |
| **Run Numbers** | BDL Scenario<br>WRP Scenario | 9484<br>9486 |
| **Processor** | Equivalent to Intel® Xeon® CPU E5-2667 v2 @ 3.30GHz | NA |

# 3 BDL Scenario Configuration

The configuration of the SMM BDL scenario represents the MDBA's best understanding of BDL conditions, as described in Schedule 3 of the Basin Plan, which include the State water management laws of NSW and Victoria in place as at 30 June 2009, and Schedule E of the Agreement (the Cap on diversions) for South Australia. The data included in following sections for NSW and Victoria are best available at this stage and need to be checked for consistency with the BDL definition and may be updated as part of reviews of their WRPs.

This scenario includes water recovery for programs that were already in place at that time, i.e. The Living Murray (TLM) and Water for Rivers (RMIF) programs. The BDL scenario is run over the historical climate conditions defined in the Basin Plan (01/07/1895-30/06/2009) and is used to establish the modelled component of the BDL (i.e. take by entitlement holders from regulated and unregulated water courses excluding take under basic rights). The scenario also includes channel capacity constraints as they were at 30 June 2009.

The SMM includes permanent trade, as well as a representation of temporary trade. For permanent (exchange rate) trade; entitlements were cancelled from the selling state and new entitlements were issued in the purchasing state. The BDLs are based on changed entitlements in both selling and receiving states due to permanent (exchange rate) trade. However, use of temporary traded water is accounted against the SDL resource unit from which it was traded. Hence, the BDL estimate from the model is net of temporary interstate trade and is calculated as the total modelled diversions minus the net temporary interstate trade into the SDL Resource Unit.

The SMM BDL scenario will be used to update the modelled components of the BDL estimates in the Basin Plan.

The un-modelled component of the BDL for various SDL resource units has been identified in Table 2 and is added to the modelled estimate to determine the BDL for the relevant form of take for each SDL resource unit.

## 3.1 New South Wales

Details of the New South Wales Murray assumptions for the BDL scenario are included in the NSW Murray Resource Assessment report (MDBA 2018/16G) and Lower Darling Resource Assessment report (MDBA 2018/16H). The details in these reports and information in this Section are subject to change as a consequence of reviews for consistency with BDL definition in the Basin Plan as part of accreditation of NSW WRP's. Some of the key features based on current best available information are summarised here.

### 3.1.1 Entitlements

The entitlements issued in NSW and included in the modelled component of the BDL are summarised per entitlement type in Table 5 and Table 6 for NSW Murray and Lower Darling respectively.

Table 5: BDL entitlements and water recovery for the NSW Murray (ML)

| Entitlement Type | Total entitlements at baseline | TLM | Water for Rivers - Snowy | Adaptive Environment | Consumptive Entitlement[1] |
|---|---|---|---|---|---|
| Local Water Utility | 35,202 | - | - | - | 35,202 |
| Stock and Domestic | 15,268 | - | - | - | 15,268 |
| High Security | 212,106 | 5,124 | - | 2,027 | 204,955 |
| General Security | 1,672,695 | 83,006 | 31,881 | - | 1,557,808 |
| Conveyance | 330,000 | - | - | 30,000 | 300,000 |
| Supplementary | 252,362 | 100,000[2] | - | - | 152,362 |

[1] After deducting TLM, Water for Rivers – Snowy and Adaptive Environment entitlements from the total entitlements at baseline, the volume of consumptive entitlements is derived (or BDL entitlement volume)

[2] TLM supplementary entitlement is not modelled explicitly

Table 6: BDL entitlements and water recovery for the Lower Darling (ML)

| Entitlement Type | total entitlements at baseline | TLM | Consumptive Entitlement[1] |
|---|---|---|---|
| Local Water Utility | 10,135 | - | 10,135 |
| Stock and Domestic | 1,415 | - | 1,415 |
| High Security | 8,060 | 500 | 7,560 |
| General Security | 79,155 | 47,800 | 31,355 |

[1] After deducting TLM entitlements from the total entitlements at baseline, the volume of consumptive entitlements is derived (or BDL entitlement volume)

## 3.1.2 NSW General Security Carryover

### 3.1.2.1 NSW Murray

NSW Murray General Security entitlement holders have access to carryover (NSW 2003). Carryover at the start of the year in general security accounts is limited to 50% of entitlement. Carryover is credited to users prior to any allocation other than critical human water needs (CHWN) being made to high security, conveyance or general security accounts. A limit is applied to the volume of water that can be allocated to a general security account, defined as the maximum effective allocation. The maximum effective allocation is defined as:

$$Maximum\ effective\ allocation = \frac{Volume\ of\ carryover + Allocation\ to\ account}{Entilement\ of\ acount} \quad (1)$$

The maximum effective allocation is limited to 1.1 per unit share or a 110% of general security entitlement volume.

#### 3.1.2.2 Lower Darling

General Security (GS) entitlement holders in the Lower Darling are entitled to carry over of unused allocation from the previous year. For those without on-farm storages, carryover is limited to 50% of the GS entitlement. For those with on-farm storages (Tandou), carryover is limited to 50% plus the airspace in those storages at the end of the year. The extra allocation of GS entitlement to a user is limited to be the maximum of:

- 50% of the entitlement, and
- 100% GS entitlement less the volume of water carried over from last year.

For users without a storage this limits the sum of carryover plus allocation to 100% of the entitlement. For users with a storage, their limit for carryover plus allocation could be higher than 100%, provided their carryover from last year was greater than 50% of their GS entitlement.

Carried over water can spill if the Menindee Lakes spill and it is also reduced for evaporation losses. The evaporation loss of carried over water is calculated by estimating the increase in surface area caused by the storing of the carryover and by determining the evaporation from that increased area.

Both the total carryover spill and the total carryover evaporation loss are distributed to the users with carryover in proportion to the size of their carryover at the time.

### 3.1.3 Supplementary access and non-debit use

The NSW Murray and Lower Darling water sharing plan includes supplementary water access licences (Clause 27 and 40, NSW 2003). An off-allocation system is configured in the SMM to represent access to supplementary water. As part of the sale of supplementary water to TLM, a limit (5000 ML/d) was imposed on Murray Irrigation Limited (MIL) relating to how much supplementary/non-debit use can be extracted daily.

The Water Sharing Plan includes provisions for users with a general security entitlement to access unregulated flows when general security allocations are less than 60% and the taking of water under supplementary access licences is permitted. This use is termed non-debit use. It is not recorded as use against the general security account. Water is assessed as taken without debit and subsequent access to general security allocation in that water year is then limited. When considering further allocations to general security account, allocations, non-debit use and carryover at the start of year must not exceed 100%.

### 3.1.4 Critical human water needs

Critical Human Water Needs (CHWN) and conveyance water are defined in the Water Act 2007 (at s86A). During the millennium drought, the volumes used for CHWN were 75,000 ML/y each for NSW and Victoria and 201,000 ML/y for SA. These volumes were later included in the Murray-Darling Basin Agreement (at clause 102A) as an aggregated number in 2011. As these were in practice at the time, they are the relevant CHWN volumes for the BDL scenario.

Also, States may set aside a CHWN reserve equal to their individual CHWN volume. This volume is reserved to cover CHWN for the next season, once water resources have been allocated to cover the CHWN for the current water year. In the BDL scenario, the CHWN reserve for NSW has been set to 75,000 ML/y.

# 3.2 Victoria

Details of the Victorian assumptions for the BDL scenario are included in the VIC Resource Assessment report (MDBA 2018/16J). The details in this report and information in this Section are subject to change as a consequence of reviews for consistency with BDL definition in the Basin Plan as part of accreditation of Victorian WRP's. Some of the key features based on current best available information are summarised here.

## 3.2.1 Entitlements

Victorian Murray entitlements included in the model are based on the Victorian bulk entitlements and are summarised per entitlement type in Table 7.

Table 7: BDL entitlements and water recovery for the Victorian Murray (ML)

| Entitlement Type | total entitlements at baseline | TLM[2] | Water for Rivers - Snowy | Consumptive Entitlement[1] |
|---|---|---|---|---|
| Initial Loss | 230,932 | - | - | 230,932 |
| High Reliability Water Shares (HRWS) | 1,283,761 | 16,146 | 44,465 | 1223,150 |
| HRWS with extended Carryover | 5,710 | 5,710 | - | 0 |
| HRWS Loss | 38,179 | - | - | 38,179 |
| Low Reliability Water Shares (LRWS) | 285,589 | - | 6,423 | 279,166 |
| LRWS with extended Carryover | 101,850 | 101,850 | - | 0 |
| LRWS Loss | 104,431 | - | - | 104,431 |

[1] After deducting TLM and Water for Rivers – Snowy entitlements from the total entitlements at baseline, the volume of consumptive entitlements is derived (or BDL entitlement volume)

[2] The 34.4 GL unregulated entitlement from Lake Mokoan decommissioning is also represented in the model

## 3.2.2 Carryover

The rules defined for carryover at 30 June 2009 are defined in the terms and conditions for seasonal carryover (DEWLP, 2009). The implementation of Victorian carryover has been undertaken using the Victorian carryover trigger in the Source Resource Assessment functionality. The key aspects of

Victorian carryover applied to high reliability water share (HRWS) and low reliability water share (LRWS) accounts in the BDL are:

- Carryover accounts are non-spillable
- The maximum limit of carryover was 50% of the entitlements.
- The maximum effective allocation (i.e. total of carryover and new allocation) was 100% of the entitlements.
- Carryover water was deemed to be recorded first against entitlement holder's HRWS, any remaining volume could be recorded against the holder's LRWS.
- A 5% deduction was to be made after the carryover to account for evaporation losses.

### 3.2.3 Critical human water needs

In the BDL scenario, the CHWN volume for Victoria has been set to 75,000 ML/y as this was the volume used in practice at the time (refer description for NSW, section 3.1.4). In the BDL scenario, the volume reserved to cover CHWN for Victoria for the next season, once water resources have been allocated to cover the CHWN for the current water year, has been set to 75,000 ML/y.

## 3.3 South Australia

Details of the South Australian settings for the BDL scenario are included in the SA Resource Assessment report (MDBA 2018/16I). Some of the key features are summarised here. Further details are set out in the report prepared by SA on its BDL (DEW, 2019a).

### 3.3.1 Entitlements

The South Australian entitlements in the model per entitlement type are summarised in Table 8.

Table 8: BDL entitlements and water recovery for the South Australian Murray (ML)

| Entitlement Type | total entitlements at baseline | TLM | Consumptive Entitlement[1] |
|---|---|---|---|
| All other Purposes | 630,041 | 43,916 | 586,125 |
| Stock & Domestic & Industrial | 20,000 | - | 20,000 |
| Metropolitan Adelaide Water Supplies | 215,000[2] | - | 215,000 |
| Country Town Water Supplies | 50,000 | - | 50,000 |
| **Total** | **915,041** | **43,916** | **871,125** |

[1] After deducting TLM entitlements from the total entitlements at baseline, the volume of consumptive entitlements is derived (or BDL entitlement volume)

[2] For Metro Adelaide, this represents the maximum allocation based on the BDL scenario, rather than the total entitlements.

### 3.3.2 Critical human water needs

In the BDL scenario, the CHWN volume for SA has been set to 201,000 ML/y as this was the volume used in practice at the time (refer CHWN description for NSW, section 3.1.4).

The SA storage right was included in the MDB Agreement in 2011. While the principle to agree to include a SA storage right had been agreed and included in the Water Act by 2009 (s86D), the arrangements for doing so were not agreed between states until its inclusion in the MDB Agreement in 2011. The SA storage right has therefore not been included in the BDL scenario.

## 3.4 Environmental water that existed at the time of the BDL

The BDL scenario models the full water recovery for TLM (other than 1.11 GL in South Australia that was recovered after 30 June 2009) and Water for Rivers (Snowy River) programs (even where some of this recovery was finalised post 2009). As the BDL is defined as consumptive use only, the use by these environmental entitlements is not included in the reported modelled BDL diversions.

The use of TLM water and operation of the environmental works constructed to assist in the delivery of TLM water and achievement of environmental outcomes is also included and was described in MDBA (2016).

In 2017, generic environmental flow functionality was developed in Source, which includes a new environmental flow node (EFN) for configuration of environmental demands and an overarching Environmental Flow Manager that prioritises demands and accounts for environmental water use. Since then, the implementation of TLM and the Barmah-Millewa Forest Environmental Water Account (BMF EWA) in the SMM have been updated using the new functionality. The assumptions underpinning the implementation of these environmental water demands have been described in MDBA (2018/16E).

In the model, environmental water from the TLM portfolio is not used at the Barmah-Millewa Forest. Environmental water demands for the Barmah-Millewa Forest are met from the BMF-EWA.

## 3.5 Permanent Trade

The model includes trade accounts to model permanent (exchange rate) trade. Permanent trade entitlements are summarised in Table 9. These values are consistent between the BDL and WRP scenarios.

Table 9: Permanent trade between SDL resource units (ML)

| To: / From: | NSW Murray (HS) | VIC Murray (HRWS) | SA Murray (AOP) | Goulburn (HRWS) | Campas-pe (HRWS) | Murrum-bidgee (HS) | **Total Trade Out** | **Net Trade In** |
|---|---|---|---|---|---|---|---|---|
| NSW Murray (HS) | - | 345 | 7,511 | - | - | - | **7,856** | **-2,623** |
| VIC Murray (HRWS) | 5,133 | - | 21,327 | - | - | - | **26,460** | **77,972** |
| SA Murray (AOP) | 100 | 3,797 | - | - | - | - | **3,897** | **35,891** |
| Goulburn (HRWS) | - | 100,187 | 10,950 | - | - | - | **111,137** | **-111,137** |
| Campaspe (HRWS) | - | 103 | - | - | - | - | **103** | **-103** |
| Murrumbidgee (HS) | - | - | - | - | - | - | **0** | **0** |
| **Total Trade In** | **5,233** | **104,432** | **39,788** | **0** | **0** | **0** | **149,453** | **0** |

# 3.6 Tagged Trade

Tagged trade is trade between water access entitlement holders, where the entitlement remains subject to the allocation rules of the water resource plan from where the entitlement was sold, i.e. if water is sold from Victorian Murray to NSW Murray, water will be used in NSW but will be getting the same allocation as Victorian Murray subject to any exchange rate or transfer loss. Currently there is no representation of tagged trade in the SMM. This functionality may be included as updated tributary models are received.

# 3.7 Temporary Trade

Temporary trade (or allocation trade) has been explicitly modelled in the SMM using a Source plugin developed by the MDBA. Documentation of the plugin is provided at the eWater Wiki (https://wiki.ewater.org.au/display/SC/MDBA+Ras+triggers). Water users identified as participating in trade, forecast their expected usage based on their antecedent usage, except for the four South Australia irrigation nodes, which use the scaled regression demand as the forecast demand. If the water user's available water volume in their accounts is not sufficient to meet their forecast usage, then they enter the market as a buyer. Similarly, if the water user has surplus water to their forecast requirements they enter the market as a seller. The plugin then tries to distribute the water in the market equitably between the surplus and debits.

The Temporary Trade plugin executes at the Resource Assessment phase of each model time step. For the set of selected water users, there are various rounds of temporary trade, which occur in sequence each day:

1) *Intrastate temporary trade,* in which NSW, Victoria and South Australia each conduct temporary trade within state boundaries*.*
2) *Trade within the Lower Darling and, separately, trade among all other water users.* These trades can occur at all times, irrespective of whether Menindee Lakes are in MDBA or NSW control.
3) *Trade among all configured water users in the model, regardless of location.* This round of temporary trade only occurs if the Menindee Lakes storage is under MDBA control.

Temporary trade only occurs between the modelled Resource Systems within the SMM. It does not allow for temporary trade between the Murray or Lower Darling with either the Goulburn-Broken-Campaspe-Loddon system of Northern Victoria or the NSW Murrumbidgee system.

The total net interstate temporary trade into an SDL resource unit is subtracted from the total modelled diversions of the SDL resource unit to estimate the BDL.

# 4 WRP scenario configuration

The WRP scenario represents the operational rules and policies that are included in the relevant WRPs, noting that there are some changes relative to the BDL conditions (which generally represent state water management law as at 30 June 2009). Since there has been no significant water recovery or changes in water management arrangements post 30 June 2009 for the Kiewa and Ovens, the WRP scenario for these SDL resource units is the same as for the BDL scenario.

As mentioned in Section 1.4, the WRP model scenario does not include any Basin Plan water recovery, thus the long term annual average diversions due to inclusion of post 2009 WRP policies should lead to diversions that are smaller or equal to the BDL under historical climate conditions[3]. As a result of the changes to the model, the *pattern* of annual diversions in the WRP model could be different from the BDL model.

The changes in management and policies of the river system for the WRP scenario (relative to the BDL scenario) are summarised in Table 10. Note that the BDL scenario, and thus WRP scenario, includes explicit representation of TLM water use, temporary trade and permanent trade.

Some SDL adjustment supply projects have been included in the WRP scenario as the projects are detailed clearly enough to enable this to occur at this point in time. These measures are listed in Table 10 and details are in Appendix A. The details of the manner in which the remaining supply projects will be implemented are still being finalised, and therefore they have not yet been specifically incorporated into the WRP scenario.

The WRP scenario is used to determine the annual permitted take for the assessment of SDL compliance (s6.10 and 10.10 of the Basin Plan) and to demonstrate that the annual permitted take will meet the SDL over the long term (s10.10(4)). The modelled permitted take will be adjusted for water recovered for the environment. These and a number of further adjustments are described in the next section.

[3] In case of Victoria and NSW, scaling of demands may be applied if the modelled diversions were to be less than BDL due to post June 2009 policies in order to match the BDL.

Table 10 Changes to policy and data settings for the WRP model scenario

| | BDL model scenario | WRP model scenario |
|---|---|---|
| **Tributary inflows and allocations** | Major tributary inflows to the SMM are obtained from the model Run 871 for BDL estimate for the Basin Plan.<br>*Note: This can only be finalised when all tributary BDL models have been submitted, therefore a review of SMM in 2020 and updating of BDL SMM model based on completed models of upstream catchments in 2021 is being considered.* | Major tributary inflows to the SMM are obtained from model Run 871 for BDL estimate for the Basin Plan.<br>*Note: This can only be finalised when all tributary WRP models have been submitted. Therefore a review of SMM in 2020 and updating of WRP SMM model based on completed models of upstream catchments in 2021 is being considered.* |
| **System rules** | Channel capacity downstream of Yarrawonga is 10,600 ML/d | Channel capacity downstream of Yarrawonga reduced to 9,300 ML/d (based on new channel capacity ratings) |
| | Minimum Flow at Swan Hill is 1,600 ML/d | Minimum Flow at Swan Hill increased to 1,880 ML/d (MDBA, 2018b) |
| | Edward River Offtake regulated capacity is 1,660 ML/d | Edward River Offtake regulated capacity reduced to 1,600 ML/d (MDBA, 2018b) |
| | No conveyance reserve | Conveyance reserve of 225,000 ML as per the amendment to the MDB agreement in 2011 (clause 102d) (MDBA 2018/16F) |
| | MIL channel capacity/infrastructure available for transfers of 3020 ML/d for June to December and 2720 ML/d for other months. | Usage of MIL infrastructure by MDBA as per September 2018 agreement |
| **NSW Murray** | Yallakool Escape operational | Closure of Yallakool Escape |
| | NSW CHWN volume and reserve set to 75,000 ML | NSW CHWN volume and reserve set to 61,000 ML (as per Basin Plan 2012, s11.03) (MDBA2018/16G) |
| **NSW Lower Darling** | | No change |
| **Victorian Murray** | Carryover rules:<br>• Carryover accounts are non-spillable.<br>• The maximum limit of carryover is 50% of the entitlements.<br>• The maximum effective allocation is 100% of the entitlements. | Carryover rules:<br>• Carryover accounts are spillable.<br>• The maximum limit of carryover is 100% of the entitlements.<br>• Allocations above 100% of entitlements are deemed spillable. |

| | BDL model scenario | WRP model scenario |
|---|---|---|
| | • Carryover water was deemed to be recorded first against entitlement holder's HRWS any remaining volume could be recorded against the holder's LRWS.<br>• A 5% deduction was to be made after the carryover to account for evaporation losses.<br>(VIC, 2009) | • Carryover water was deemed to be recorded first against entitlement holder's LRWS any remaining volume could be recorded against the holder's HRWS.<br>• A 5% deduction was to be made after the carryover to account for evaporation losses.<br>(VIC 2012; MDBA 2018/16J) |
| | No Northern Rivers Sustainable Water Strategy (NRSWS) reserve | The maximum size of the NRSWS reserve is 297,751 ML (MDBA 2018/16J)<br><br>The rules for the Northern Rivers Sustainable Water Strategy reserve are that, once the HRWS allocation reaches 30%, additional water would be allocated half to diversion and half to the new reserve until the HRWS allocation reaches 50%. This rule came into operation on 30 June 2013. |
| | Torrumbarry loss allowance (for details refer BE, 1999 Clause 13):<br>• Allowance of is 100 GL.<br>• The trigger for reduction of the allowance is a flow in the Loddon River at Appin South of 1000 ML/month. | Torrumbarry loss allowance (for details refer BE, 2015 Clause 13):<br>• Allowance of is reduced to 77 GL.<br>• The trigger for reduction of the allowance is increased to 2100 ML/month.<br>For details on how the allowance is allocated and reduced see MDBA (2018/16J). |
| | Victorian CHWN reserve is 75,000 ML | Victorian CHWN reserve is 77,000 ML (as per Basin Plan 2012, s11.03) (MDBA 2018/16J). |
| **South Australian Murray** | No SA Storage Right. | Includes SA storage right (MDBA 2018/16I)[1]. |
| | The CHWN volume is 201 GL. | SA CHWN volume is 204GL (as per Basin Plan 2012, s11.03) (MDBA 2018/16I). |

| | BDL model scenario | WRP model scenario |
|---|---|---|
| | Allocation priorities as set out in DEW (2019). | Changes to allocation priorities as described in DEW (2019) and MDBA (2018/16I). |
| | | Changed metro Adelaide demand time series (MDBA 2018/16I). Refer SA Water, 2019 for details of how the time series is determined. |
| **SDL adjustment projects** | NA | The following the SDL adjustment supply projects have been included:<br>19. Barmah-Millewa Forest Environmental Water Allocation (refer Appendix A) |
| | NA | 20. Flexible Rates of Fall in River Levels Downstream of Hume Dam (refer Appendix A) |
| | NA | 28. Partial representation of Snowy Hydro Corporation changes (refer Appendix A) |

[1]Currently the SMM does not allocate water to the dry year reserve as specified in the second dot point of the "Delivery" subsection of Section 4.4 of *Methods Document for the Implementation of the Sustainable Diversion Limit for the South Australian Murray SDL Resource Unit (SS11)* (DEW, 2019b). This will be included in the SMM by the time of the 2020/21 model review.

# 5 Method to determine annual permitted take

## 5.1 Determination of the annual permitted take

Consistent with the requirements of the Basin Plan s10.10(1), the WRP model will be used each year to calculate the modelled component of the annual permitted take for the preceding water year, using the method in the accredited WRP (i.e. 'APT' run).

### 5.1.1 Annual Permitted Take (APT) Run

The annual permitted take number will be based on the climate for 12 month periods starting from 1 July 2019 and would respond to water availability in each year of assessment.

From 2019-20 onwards, the climate data, un-modelled inflows and modelled inflows (where they exist, for example from upstream SDL resource units) for the most recent year will be added to the model input time series. The model will then be run from 2019-20 to the end of the most recent water year (i.e. each year, one extra year is added to the modelled sequence).

Model parameters such as storage volumes and flows, state accounts, carryover volumes and special accounts will be initialised to actual conditions and volumes at 1 July 2019. From 1 July 2019 onwards, there will be continuous accounting for modelled annual permitted take, such that these parameters will be determined by the model.

The output of this APT run is described here as the unadjusted annual modelled diversion.

### 5.1.2 Post processing adjustments

Ideally, the annual permitted take should be calculated by including held environmental water in the model as a separate entitlement holder and use of this water to meet environmental outcomes. However, as mentioned earlier, the environmental water recovered to bridge the gap, and its use have not been included in the SMM WRP scenario. The annual permitted take is calculated by reducing the modelled diversions as a post process to the 'APT' run assuming environmental water is utilised in the same manner as the equivalent consumptive entitlements, as specified by the long term diversion limit equivalent (LTDLE) factors[4].

[4] LTDLE factors have been established to assess how much water has been recovered for the environment. They are a method of comparing across different classes of water entitlements, so that they can be considered on equal terms. In 2015, Ministers agreed to update the original 2011 factors. The updated factors are being developed by each State and are expected to be finalised later in 2019. The factors will be used for efficiency measures as well as for water recovered to bridge the gap between the BDL and the SDL.

In addition, there are other aspects that require the SDL to be adjusted (Basin Plan Schedule 6A), for example: applying the apportioned supply contribution to each SDL resource unit (increasing the SDL); adjusting the apportioned supply contribution if at least 62 GL/y of efficiency measures (which reduce the SDL) are not attained; and reflecting the efficiency measures that have delivered environmental entitlements in an SDL resource unit. It is proposed that these adjustments are also dealt with as post-processing adjustments.

To determine the annual permitted take for an SDL resource unit, post processing adjustments to unadjusted annual modelled diversions will be undertaken. This adjustment consists of potentially four parts, to account for:

- actual water recovery (representing the sum of the local and shared reduction amount i.e. only up to the reduction target),
- incomplete water recovery (where applicable, representing any local and shared reduction amounts that have not yet been met),
- either the apportioned supply contribution or the reduced supply contribution (required until the initial 62 GL/y of efficiency measures are delivered) and
- any registered environmental entitlements reflecting efficiency measures.

The modelled component of annual permitted take for each SDL resource unit (*apt*) is therefore calculated as:

$$\begin{aligned} \begin{pmatrix} Annual \\ permitted \\ take \end{pmatrix} = & \left( \begin{matrix} Unadjusted \\ annual\ modelled \\ diversions \end{matrix} \right) - \left( \begin{matrix} Adjustment\ for \\ actual\ water\ recovery \\ up\ to\ the \\ reduction\ target \end{matrix} \right) - \left( \begin{matrix} Adjustment\ for \\ incomplete\ water \\ recovery \end{matrix} \right) + \\ & \left( \begin{matrix} Adjustment\ for \\ supply \\ contribution \end{matrix} \right) - \left( \begin{matrix} Adjustment\ for \\ efficiency\ measures \end{matrix} \right) \pm Trade \end{aligned} \qquad (2)$$

*where:*

*Unadjusted annual modelled diversions = consumptive diversions output from annual permitted take model run for the relevant water year in the SDL resource unit (note that this value has any temporary trade, that is included in the model, removed from the output value)*

*Adjustment for actual water recovery up to the reduction target = unadjusted annual modelled diversions multiplied by [the lesser of long term volume of actual recovered entitlements in the SDL resource unit (LTDLE volume at 1 July of relevant water year) or total reduction amount in the SDL resource unit] divided by BDL.*

*This calculation would be based on modelled diversions for different entitlement types and water recoveries corresponding to these entitlement types.*

*Actual recovered entitlements = entitlements recognised that contribute to 'bridging the gap' and form part of the modelled take i.e. where an entitlement does not reflect consumptive take within the model it is not deducted from the modelled diversions.*

*BDL = modelled BDL diversions for the SDL resource unit*

*Adjustment for incomplete water recovery = unadjusted annual modelled diversions multiplied by long term volume of incomplete water recovery in the SDL resource unit (LTDLE volume at 1 July of relevant water year) divided by the BDL*

*Adjustment for supply contribution = unadjusted annual modelled diversions multiplied by [either apportioned supply contribution (where total current efficiency contribution is at least 62 GL/y) or reduced supply contribution (where total current efficiency contribution is less than 62 GL/y) (as at 1 July for the relevant water year)] divided by BDL for the SDL resource unit*

*Adjustment for efficiency measures = unadjusted annual modelled diversions multiplied by current efficiency contribution in the SDL resource unit (as at 1 July for the relevant water year) divided by BDL.*

*This calculation would be based on modelled diversions for different entitlement types and water recoveries corresponding to these entitlement types.*

*Trade = actual net temporary trade volume into the SDL resource unit*

As the components of the above adjustments may continue to vary each year till 30 June 2024 (after a WRP is accredited), these adjustments will be performed outside of the model in an excel spreadsheet.

Each of the components of the equation are further described in *Appendix B – Suggested practice for out of model adjustments,* however states may choose to employ other methods to adjust the APT run output for the above variables.

In the case of calculation of annual permitted take, water recovery (including efficiency measures) will reflect the entitlement volume available to the environmental water holders on 1 July of that water year. Accordingly, these adjustments mean that annual permitted take will continue to reflect the SDL over time.

For the purposes of the compliance assessment, any incomplete 'bridging the gap' recovery will be taken into account in the Register of Take as per s6.11 (5) of the Basin Plan and consistent with the MDBA's *Sustainable Diversion Limit reporting and compliance framework*.

## 5.1.3 A changing SDL

Basin Plan s10.10(5) requires that where an amendment to a SDL has been made under section 23B of the *Water Act 2007 (Cwth)*, and the SDL is a formula that changes over time, the SDL will be determined on 30 June 2019, 30 June 2022 and 30 June 2024. The *Basin Plan Amendment (SDL Adjustments) Instrument 2017* was an amendment to the SDLs under section 23B. This amendment applies to the SDL for all six SDL resource units in this report.

A single APT model run, with the ability to adjust the annual permitted take to reflect possible changes in the SDL as post-processing adjustments (as set out in formula (2) above), is intended to meet this requirement.

The reconciliation of the SDL adjustment projects required by 30 June 2024, may result in a proposal to change the SDL further. In this event, there are two options: expand the detail covered by the above formula (for example providing for a reduction in supply contribution within the element *adjustment for reduced supply contribution*); or providing an updated method for annual permitted take and seeking re-accreditation of the WRP. The MDBA will work with relevant Basin states to agree the best way forward in such circumstances.

## 5.2 Demonstration that the annual permitted take meets the SDL

Consistent with the requirements of the Basin Plan s10.10(4), the method for determining annual permitted take must demonstrate that, over a repeat of the historical climate conditions, it would result in meeting the SDL for the SDL resource unit, as amended under section 23B of the *Water Act 2007 (Cwth)*.

The approach of using the APT run with post-processing adjustments to the unadjusted annual modelled diversions (as presented in formula (2) above), is adopted to meet this requirement for the relevant component of the SDL, for each individual SDL resource unit.

The following assumptions are also made:

- full water recovery as required for local and shared reduction amounts for each SDL resource unit and
- either of the following, as specified by the state:
  - full apportioned supply contribution for each SDL resource unit (605 GL/y in total), assuming that at least 62 GL/y of efficiency measures will have been achieved in the Basin by 30 June 2019 or
  - a reduced supply contribution level based on the level of efficiency measures recovered at the time the WRP is submitted (i.e. 0.46 GL/y in the SA Murray).

# 6 Results

## 6.1 Updated BDL estimates (BDL scenario)

The Basin Plan 2012 (extracted from the Federal Register of Legislation on 7 October 2018) includes estimates of the BDL as presented in Table 2. The modelled component of these BDL estimates was estimated with the MSM-Bigmod model (run #871), referred to as '2012 estimate' in Table 11. The results from the SMM BDL scenario (9484) will be used to update the estimate of the modelled diversions (updated estimate, Table 11). Adding the unmodelled watercourse diversions the updated modelled diversions gives the revised estimate for total regulated river/watercourse diversions (Table 11).

Table 11: Modelled and unmodelled diversions that determine the total regulated river/watercourse diversions of the BDL (GL/y). (NSW and Victorian estimates will be updated as relevant WRP's are developed)

| SDL resource unit | modelled BDL diversions (2012 estimate) | modelled BDL diversions (updated estimate)[1] | unmodelled watercourse diversions[2] | total BDL regulated river / watercourse diversions (updated) |
|---|---|---|---|---|
| NSW Murray | 1680 | | | |
| Lower Darling | 55 | | | |
| Victorian Murray | 1657 | 1667.7 | 5.5 | 1673.2 |
| Kiewa | 11 | 11.2 | | 11.2 |
| Ovens | 25 | 25.4 | | 25.4 |
| SA Murray[3] | 665 | 681.1 | 0 | 681.1 |

[1] Numbers will change when all tributary BDL models are finalised

[2] May be updated by a separate review process

[3] This SA BDL estimate comes from an earlier SMM Run (Run 9354) used for SA Murray WRP submission

These results for the SA Murray are consistent with the BDL report prepared by SA (DEW, 2019a). An explanation for the increase in the BDL, relative to the 2012 Basin Plan estimate, is set out in the SA BDL report.

## 6.2 WRP scenario

The SDL for each SDL resource unit is calculated from the BDL as specified in Equation 1. The SDLs for each SDL resource unit, for the purposes of the demonstration, are included in Table 12.

Table 12 Sustainable Diversion Limits for SMM SDL resource units – with assumed full 605 GL/y of supply contribution and nil efficiency measures achieved in these SDL resource units(NSW and Victorian estimates will be updated as relevant WRP's are developed)

| SDL resource unit | Regulated Rivers or water course diversions under BDL | total reduction amount[1] | Regulated Rivers or water course diversions under SDL |
|---|---|---|---|
| NSW Murray | 1685.5 | 303.0 | |
| Lower Darling | 51.8 | 22.3 | |
| Victorian Murray | 1667.7 | 391.0 | 1276.7 |
| Kiewa | 11.2 | 0[2] | 11.2 |
| Ovens | 25.4 | 0[2] | 25.4 |
| SA Murray | 681.1 | 131.8 | 549.3 |

[1] From Table 3, assumes requested SA shared reduction amount and that 62 GL/y of efficiency measures have been recovered, but that they have been recovered in other SDL resource units.

[2] The Victorian shared reduction request (as agreed by the Authority) produces small negative amounts in two valleys totaling 0.5 GL/y (Kiewa 0.2 GL/y and Ovens 0.3 GL/y) for the required reduction from the BDL to the SDL when applied in conjunction with the apportioned supply contribution; which assumes at least 62GL/y of efficiency measures is achieved. The Victorian shared reduction request meets all of the requirements set out in the Basin Plan at s6.05. Resolution of any anomalies will be considered as further recoveries are secured and / or at the 2024 reconciliation of the SDLAM.

For compliance purposes, the diversions from the WRP scenario over the historical climate period (1895-2009), after post-processing, have to be equal to or less than the relevant SDL specified in Table 12. Results from the WRP scenario are presented in Table 13.

Table 13 Sustainable Diversion Limits for SMM SDL resource units (GL/y)

| SDL resource unit | BDL scenario diversions | WRP scenario diversions | Required reduction amount | SDL to be met by the model and post-processing |
|---|---|---|---|---|
| NSW Murray | 1685.5 | | 303.0 | |
| Lower Darling | 51.8 | | 22.3 | |
| Victorian Murray | 1667.7 | 1666.9 | 391.0 | 1282.2[2] |
| Kiewa | 11.2 | 11.2 | 0 | 11.2 |
| Ovens | 25.4 | 25.4 | 0 | 25.4 |
| SA Murray | 681.1 | 681.1[1] | 131.8 | 549.3 |

[1] Modelled number for WRP scenario was 681.6 GL/y which is within the accuracy limit of the modelling, and in the case of South Australia the BDL and SDL limits are fixed estimates as described in BDL report prepared by SA (DEW, 2019). This WRP scenario will be scaled to the BDL scenario diversions to ensure consistency.

[2]This number includes the 5.5 GL of unmodelled take. So the SDL is calculated as 1667.7 + 5.5 – 391 = 1282.2

For the Victorian Murray, demands were scaled in the WRP scenario by a factor of 1.005 to achieve the average annual diversions of 1666.9 GL/y. This was considered sufficiently close to the BDL estimate of 1667.7 GL/y. The Victorian Murray BDL and WRP estimate includes the assumptions and policies submitted for the SA Murray WRP, but as the NSW Murray and Lower Darling WRP's are still being finalised, any changes may have an impact on the Victorian Murray estimates. This will be resolved as part of the 2020/21 review of the SMM. In the interim, the post-processing undertaken will ensure that despite this, the SDL will be maintained (also refer DEW, 2019b). Accordingly, if water recovery equal to the reduction amount required is achieved, the WRP scenario diversions post scaling will be the same as the long term SDL, and will demonstrate that the SDL is met over a repeat of the historical climate conditions.

# 7 References


Basin Plan Implementation Agreement (2012) Murray-Darling Basin Plan 2012 - Implementation Agreement, 7 August 2013, available at https://www.mdba.gov.au/publications/policies-guidelines/basin-plan-implementation-agreement

BE (1999) Bulk Entitlement (River Murray - Goulburn-Murray Water) Conversion Order 1999 - Victorian Water Register, available at https://waterregister.vic.gov.au/water-entitlements/bulk-entitlements

BE (2015) Bulk Entitlement (River Murray - Goulburn-Murray Water) Conversion Order 1999 - Consolidated Version at 21 May 2015 Victorian Water Register, available at https://waterregister.vic.gov.au/water-entitlements/bulk-entitlements

Bewsher (2017) Independent Review of the Source Model of the Murray and Lower Darling Rivers (SMM) as a candidate for use as the future BDL/BSM2030/WRP Model(s), March 2017, Bewsher Consulting Pty Ltd

Carryover rules (2018), Victorian Water Register, available at https://waterregister.vic.gov.au/water-entitlements/carryover/carryover-rules

DEW (2019a) Baseline Diversion Limit for the South Australian Murray SDL Resource Unit (SS11), Department for Environment and Water, Government of South Australia, Adelaide.

DEW (2019b) Methods Document for the Implementation of the Sustainable Diversion Limit for the South Australian Murray SDL Resource Unit (SS11), Department for Environment and Water, Government of South Australia, Adelaide.

DEWLP (2009) Terms and Conditions for Carryover of Seasonal Allocation, Date of Issue 19 February 2009, available at http://waterregister.vic.gov.au/images/documents/Terms%20and%20conditions%20for%20carryover_2009.pdf

DELWP (2018) Verification of Entitlements in the GSM Baseline Diversion Model, Draft Report, may 2018, Department of Environment, Land, Water and Planning, Victoria State Government.

MDBA (2013), 'Updated Cap Model Report for the NSW Murray, Victorian Murray and Lower Darling Cap Valleys', Technical Report 2011/18, Murray Darling Basin Authority, February 2013.

MDBA (2009) Review of Cap Implementation 2008-09. MDBA Publication No. 45/09.

MDBA (2011) Comparison of Water Course Diversions Estimates in the Proposed Basin Plan with other Published Estimates, Murray-Darling Basin Authority, Technical Report 2011/01 – version 2, available at https://www.mdba.gov.au/sites/default/files/pubs/1111-BPKid-comparison-watercourse-diversion-estimates_0.pdf

MDBA (2012) Water resource assessments for without-development and baseline conditions, Supporting information for the preparation of the proposed Basin Plan. MDBA Technical Report 2010/20 (version 2), November 2011.

MDBA (2015) Source Model for the Murray and lower Darling System. MDBA Technical report 2015/03, version 2, November 2016, Murray-Darling Basin Authority.

MDBA (2016) Environmental demands in the Source IMS model of the River Murray and Lower Darling system. MDBA Technical report 2016/02, Murray-Darling Basin Authority.

MDBA (2018a) Diversions Formula Register for the Murray-Darling Basin. A protocol established under paragraph 4(1) (b) to Schedule E (former Schedule F) of the Murray-Darling Agreement for the recording of water diversions from the river system of the Murray-Darling Basin. Version 6, Approved 18 June 2018.

MDBA (2018b) Objectives and Outcomes for river operations in the River Murray System, Murray-Darling Basin – Basin officials Committee, MDBA Publication no 23/17. May 2018 (updated June 2018). Available at: https://www.mdba.gov.au/sites/default/files/pubs/objectives-outcomes-river-operations-river-murray-system.pdf

MDBA (2018/16C) Urban and stock and domestic demands on the Murray and Lower Darling rivers. Technical report 2018/16 Attachment G, Murray-Darling Basin Authority.

MDBA (2018/16D) Irrigation demands on the Murray and Lower Darling rivers, MDBA Technical Report 2018/16, Attachment F, Murray-Darling Basin Authority.

MDBA (2018/16E) Modelling environmental flows in the Source Murray Model, MDBA Technical Report 2018/16 Attachment H, May 2018, Murray-Darling Basin Authority.

MDBA (2018/16F) River Murray Resource Assessment in the Source Murray Model, MDBA Technical Report 2018/16 Attachment A, Murray-Darling Basin Authority, September 2018.

MDBA (2018/16G) New South Wales Murray Resource Assessment in the Source Murray Model, MDBA Technical Report 2018/16 Attachment B, Murray-Darling Basin Authority, September 2018.

MDBA (2018/16H) Lower Darling Resource Assessment in the Source Murray Model, MDBA Technical Report 2018/16 Attachment C, Murray-Darling Basin Authority, September 2018.

MDBA (2018/16I) South Australian Resource Assessment in the Source Murray Model, MDBA Technical Report 2018/16 Attachment E, Murray-Darling Basin Authority, September 2018.

MDBA (2018/16J) Victorian Murray Resource Assessment in the Source Murray Model, MDBA Technical Report 2018/16 Attachment D, Murray-Darling Basin Authority, September 2018.

MDBC 2002, Derivation of Kiewa Catchment Inflows, MDBC Technical Report 2002/6.

MDBC 2003. Generation of Diversion Demands for the monthly simulation model, Technical Report 2003/3, Murray Darling Basin Commission, March.

MDBC (2006a) Review of the Interim Operating Rules for the Barmah-Millewa Forest Environmental Water Allocation: Part 1, MDBC Technical Report No. 2006/4.

MDBC (2006b) Revised Operating Rules for the Barmah-Millewa Forest Environmental Water Allocation, MDBC Technical Report No. 2006/13.

MDBC (2007) Setting up of the Murray Simulation Model (MSM) for Auditing the CAP in the Murray and Lower Darling River Systems, Murray Darling Basin Commission, Technical Report No. 2006/11.

NSW (2002) Snowy Water Licence, Issued under Part 5 of the Snowy Hydro Corporatisation ACT 1997 (NSW), available at https://www.industry.nsw.gov.au/__data/assets/pdf_file/0008/144278/Snowy-water-licence-October-2011.pdf

NSW (2003) Water Sharing Plan for the New South Wales Murray and Lower Darling Regulated Rivers Water Sources 2003, New South Wales Government, NSW Legislation, available at http://www.legislation.nsw.gov.au/viewtop/inforce/subordleg+186+2003+cd+0+N.

NSW (2003) Water Sharing Plan for the New South Wales Murray and Lower Darling Regulated Rivers Water Sources 2003, New South Wales Government, NSW Legislation, Repealed version for 28 August 2015 to 30 June 2016. Available at http://www.legislation.nsw.gov.au/viewtop/inforce/subordleg+186+2003+cd+0+N.

NSW (2016) Water Sharing Plan for the New South Wales Murray and Lower Darling Regulated Water Sources 2016. New South Wales Government, NSW Legislation - Current version for 27 June 2018 to date. Available at: https://legislation.nsw.gov.au/#/view/subordleg/2016/366

SA Water (2019) Methodology to determine annual permitted take for metropolitan Adelaide from the River Murray, 11 February 2019, SA Water Corporation.

SKM (2008) Ovens REALM Model Review — Model review and revision report, Sinclair Knight Merz.

SKM (2009) Ovens River REALM model, 2009 Update of Inputs. Sinclair Knight Merz.

VIC (2009) Terms and Conditions for Carryover of Seasonal Allocation, Victorian Water Register, 19 February 2009, Available at: https://waterregister.vic.gov.au/images/documents/Terms%20and%20conditions%20for%20carryover_2009.pdf

VIC (2012) How carryover works on the Murray, Goulburn & Campaspe - Carryover Review Committee fact sheet 1, Department of Sustainability and Environment Melbourne, Victorian Water Register, November 2012, Available at: http://waterregister.vic.gov.au/images/documents/CRC%20Fact%20Sheet%201_How%20carryover%20works%20on%20the%20Murray,%20Goulburn%20&%20Campaspe.pdf

# Appendix A – SDL Adjustment Projects

Further details of all supply and efficiency projects are set out on the Register of Measures available at: https://www.mdba.gov.au/basin-plan-roll-out/sustainable-diversion-limits/sdl-adjustment-proposals-state-projects

Provided below are specific supply projects for which the details are articulated clearly enough that they have been incorporated into SMM WRP model. The details of the manner in which the other supply projects will be implemented are still being finalised, and therefore they have not yet been specifically incorporated into the SMM.

## Barmah-Millewa Forest Environmental Water Allocation

Listed as measure 19 on the Register of Measures.

Victoria's proposal to alter the operating rules for the Barmah Millewa Forest Environmental Water Allocation (BMF EWA) is aimed at reducing the use of the BMF EWA account, whilst maintaining equivalent ecological outcomes, thereby 'saving' water. This proposal has been through a number of iterations and has been included in SMM.

Originally, in its "phase 2 business case" proposal, March 2015, Victoria had proposed that no watering from the account occur in December. After negotiations with the MDBA, Victoria has submitted an addendum[5] to the proposal in January 2017. The addendum instead proposes to:

> *"… trigger releases from the BMFEWA in December when the October and November triggers are achieved, provided that a 4+ month flood has not already occurred from June – November."*
>
> *"All other BMFEWA rules remain as they are..."*

This proposal has been included in the Source Murray Model (SMM) using logic is as follows:

1. Identify flow targets for months June–Nov that constitute a 'flood' for each month
2. In any year, count the number of flood months between June–Nov
3. If the number of flood months achieves the target (4+ months), do not water in December

[5] Addendum: Enhanced BMFEWA SDL Adjustment Proposal (Feb 2017)

# Flexible rates of fall in river levels downstream of Hume

Listed as measure 20 on the Register of Measures.

This rule change allows Hume releases to be reduced more quickly during the period of January to May. The current operating rule of maximum allowable fall in water level along the River Murray below Hume Dam. The rule is defined at two locations as stated below:

- maximum eight inch (200 mm) per day at Heywoods
- maximum six inch (150 mm) per day at Doctors Point.

In SMM WRP, consistent with the SDL adjustment project this rule has been changed so that from January to May (does not apply in other months and when flows at Doctors Point are less than 12,000 ML/d):

1. maximum rate of fall allowed is nine inch (225 mm) per day at Heywoods and Doctors Point
2. average rate of fall over four days retained at existing limit, as eight inch (200 mm) per day at Heywoods and six inch (150 mm) at Doctors Point.

# Snowy-Hydro Corporation changes

Listed as measure 28 on the Register of Measures.

The SMM WRP scenario has been configured to include amendments to Snowy Hydro licence in 2011. Previously the release of the water was at the discretion of Snowy Hydro and was generally at times suited to Snowy Hydro's commercial outcomes. The SDL proposal intends to provide a means to control the timing of RMIF water releases from the Snowy Scheme, allowing more flexibility to achieve environmental outcomes targeted in the Murray River below Hume Dam.

In absence of inclusion of all environmental demands in the model, there is no explicit representation of call out from RMIF and use of RMIF is considered in the delivery of Above Target Water as in the BDL scenario. This is a limitation of the modelling and may be underestimating the benefit due to this operational change.

The following changes from the October 2011 amendment to the Snowy Water License are included in the SMM WRP scenario:

1. The removal of the requirement to release, as soon as the inflows to the Snowy Scheme allow, any accumulated Dry Inflow Sequence Volume (DISV).
2. The establishment of a "Drought Account" of 225 GL for the Murray Valley. The water in these accounts can be used if inflows again reach critically low levels. The accounts are credited with water when a recovery occurs following a period when a dry inflow sequence volume is triggered (and at other times at the discretion of the NSW DPI Water).

3. An option each year for Snowy Hydro Limited to release water in excess of the Required Annual Release (also known as “Flexibility Release” or “Flex”) and have the additional release treated as an early delivery of the next year’s required annual release.
4. A requirement for Snowy Hydro Limited to release some above target water if any flexibility release results in additional release or spill of water from downstream storages in the following water year and does not contribute to consumptive use. This is also known as “wet sequence protection”.

# Appendix B – Suggested practice for out of model adjustments

The modelled component of annual permitted take for watercourses/regulated rivers for each SDL resource unit (*apt*) is calculated using Equation (2) set out in Section 5.1.2 of the report.

Further details about the calculation of each of the four post-processing adjustments are provided in the following sections.

## Adjustment for actual water recovery up to reduction target

Since June 2009, water has been progressively recovered through both water purchases and infrastructure projects. This water is largely held and managed by the Commonwealth Environmental Water Office (CEWO) for the objective of achieving ecological outcomes. Other gap-bridging water has been recovered through direct basin state initiatives. Water recovered by basin states is managed directly by the responsible agency in that state, in collaboration with the MDBA and CEWO.

As at 30 September 2018, the estimated volume of water recovery in the River Murray and Lower Darling is 903 GL of long term diversion limit equivalent (LTDLE). This includes water recovery that has been completed, as well as water recovery that has been contracted (but not yet completed). An overview of water recovery per SDL resource unit is provided in **Error! Reference source not found.**.

Table 14. Basin Plan water recovery in River Murray system per state and SDL resource unit as at 30 September 2018

| State | SDL resource unit | water recovery for SDL resource unit (ML/y)[1] |
|---|---|---|
| **NSW** | Lower Darling | 20,044 |
| | NSW Murray | 348,666 |
| **SA** | SA Murray | 143,870 |
| **VIC** | Kiewa | - |
| | Ovens | 117 |
| | Vic Murray | 390,304 |

[1] Water recovery figures expressed in LTDLE terms and calculated using v2.05 factors agreed to be Ministerial Council in November 2011. Note that these factors are currently being updated by Basin States.

Modelled diversions under the WRP model scenario will be adjusted for water recovery based on the assumption that the utilisation rate of environmental water will be the same as the utilisation rate of consumptive water holders for each entitlement type recovered.

For each SDL resource unit, the annual adjustment for actual water recovery up to the reduction target is calculated as:

*Adjustment for actual water recovery up to the reduction target = unadjusted annual modelled diversions multiplied by [the lesser of long term volume of actual recovered entitlements in the SDL resource unit (LTDLE volume at 1 July of relevant water year) or total reduction amount in the SDL resource unit] divided by BDL.*

where:

*This calculation would be based on modelled diversions for different entitlement types and water recoveries corresponding to these entitlement types.*

*actual recovered entitlements = entitlements recognised that contribute to 'bridging the gap' and form part of the modelled take i.e. where an entitlement does not reflect consumptive take within the model it is not deducted from the modelled diversions*

*BDL = modelled BDL diversions for the SDL resource unit*

On this basis, the modelled diversions will only be adjusted for water recovery as far as it meets the reduction targets specified by the Basin Plan. Therefore the modelled diversions will not be adjusted for any over recovery in a SDL resource unit.

# Adjustment for incomplete water recovery

For the purpose of demonstrating SDL compliance, it is assumed that all contracted water recovery is fully delivered. However, the water recovered to date (as provided above) may not fully 'bridge the gap' between the BDL and SDL. In that case, an adjustment is required for incomplete water recovery, to account for circumstances where the gap has not been fully bridged.

The adjustment will apply a scaling factor to the total modelled long-term annual average diversions for the SDL resource unit, as the entitlement types from which the incomplete water recovery will be recovered is not yet known. For the same reason, the scaling will be based on the total LTDLE volume required to complete the water recovery. The adjustment for incomplete water recovery is calculated as:

*Adjustment for incomplete water recovery = unadjusted annual modelled diversions multiplied by long term volume of incomplete water recovery in the SDL resource unit (LTDLE volume at 1 July of relevant water year) divided by the BDL*

where:

*unadjusted annual modelled diversions = output from annual permitted take model run*

*incomplete water recovery in the SDL resource unit = long term diversion limit equivalent volume of incomplete water recovery in SDL resource unit at 1 July for the relevant water year*

*BDL = modelled BDL diversions for the SDL resource unit*

# Adjustment for supply contribution

For the purposes of demonstrating the SDL under s10.10(4) of the Basin Plan, an assumption needs to be made about the delivery of efficiency measures by 30 June 2019. In this example, it is assumed that the 62 GL of efficiency measures will be delivered by that time. This allows for the full volume of supply measures (605 GL/y) to be given effect within relevant SDL resource units.

For the post-processing adjustment of the APT run, an adjustment to account for supply measures may be necessary. This adjustment will depend upon the total current efficiency contribution. Where less than an initial 62 GL/y of efficiency measures has been delivered, a reduced supply contribution is applied. After the initial 62 GL/y of efficiency contribution is achieved, the formula reverts to an adjustment for the apportioned supply contribution or the full supply contribution.

The supply contribution adjustment recognises that supply measures are available for consumptive use, increasing the SDL.

The adjustment for supply contributions is calculated as:

*Adjustment for supply contribution = unadjusted annual modelled diversions multiplied by [either apportioned supply contribution (where total current efficiency contribution is at least 62 GL/y) or reduced supply contribution (where total current efficiency contribution is less than 62 GL/y) (as at 1 July for the relevant water year)] divided by BDL, for the SDL resource unit*

*where:*

*apportioned supply contribution = as specified in Basin Plan Schedule 6A*

*reduced supply contribution = calculated as specified in Basin Plan Schedule 6A and as published annually by the Authority on its web site*

*BDL = modelled BDL diversions for the SDL resource unit*

# Adjustments for efficiency measures

For the purposes of demonstrating the SDL under s10.10(4) of the Basin Plan, this example assumes that the initial 62 GL/y of efficiency measures will be delivered by 30 June 2019. This allows for the full volume of supply measures to be used within relevant SDL resource units.

For the post-processing adjustment of the APT run, an adjustment may be required to account for efficiency measures that have delivered an environmental entitlement within a given SDL resource unit. When efficiency measures are delivered, the SDL is decreased as environmental entitlements are generated from these projects, using the same LTDLE factors as applied to the water recovery estimates. The adjustments for efficiency measures will be calculated as:

*Adjustment for efficiency measures = unadjusted annual modelled diversions multiplied by current efficiency contribution in the SDL resource unit (as at 1 July for the relevant water year) divided by BDL.*

*This calculation would be based on modelled diversions for different entitlement types and water recoveries corresponding to these entitlement types.*

*where:*

*current efficiency contribution = as specified in Basin Plan Schedule 6A and as published annually by the Authority on its web site*

*BDL = modelled BDL diversions for the SDL resource unit*

# **Appendix C –** Basin Plan s.10.12 requirement - Matters relating to accounting for water in the Source Murray Model

| Basin Plan s.10.12 requirements | | SDL Resource Unit | | | | | |
|---|---|---|---|---|---|---|---|
| | | **NSW Murray (SS14)** | **Lower Darling (SS18)** | **Victorian Murray (SS2)** | **Kiewa (SS3)** | **Ovens (SS4)** | **SA River Murray (SS11)** |
| s.10.12(1)(a) | All forms of take from the SDL resource unit and all classes of water access right | Section 3.1.1 | Section 3.1.1 | Section 3.2.1 | Section 3.2.1 | Section 3.2.1 | Section 3.3.1 |
| s.10.12(1)(b) | Water allocations that are determined in one water accounting period and used in another, including water allocations that are carried over from one water accounting period to the next | Section 3.1.2 | Section 3.1.2 | Section 3.2.2 | Section 3.2.2 | Section 3.2.2 | - |
| s.10.12(1)(c) | For a surface water SDL resource unit—return flows, in a way that is consistent with arrangements under the Agreement immediately before the commencement of the Basin Plan | MDBA (2018a) | - | MDBA (2018a) | - | - | - |
| s.10.12(1)(d) | Subject to subSection (3)—trade of water access rights | Sections 3.5 , 3.6 and 3.7 | | | | | |
| s.10.12(1)(e) | Water resources which have a significant hydrological connection to the water resources of the SDL resource unit | Sections 1.1 and 2.1 | | | | | |
| s.10.12(1)(f) | Circumstances in which there is a change in the way water is taken or held under a water access right | See respective Water Resource Plans | | | | | |
| s.10.12(1)(g) | Changes over time in the extent to which water allocations in the unit are utilised | See respective Water Resource Plans | | | | | |
| s.10.12(1)(h) | Water sourced from the Great Artesian Basin and released into a Basin water resource, by excluding that water | See respective Water Resource Plans | | | | | |
| s.10.12(1)(i) | Water resources which are used for the purpose of managed aquifer recharge | See respective Water Resource Plans | | | | | |
| s.10.12(2) | Subject to this Section, the method may account for other matters | See respective Water Resource Plans | | | | | |
| s.10.12(3) | For paragraph (1)(d), the water resource plan must account for the disposal and acquisition of held environmental water separately and in a way that does not affect the method under Section 10.10 | See respective Water Resource Plans | | | | | |

Office locations
Adelaide
Albury-Wodonga
Canberra
Goondiwindi
Toowoomba

mdba.gov.au 1800 230 067 engagement@mdba.gov.au