Amendment date: 28 June 2017

1.	**Title of measure**	**2011 Snowy Water Licence Schedule 4** **Amendments to River Murray Increased Flows (RMIF) Call Out Provisions**
2.	**Proponent undertaking the measure**	**NSW and Victoria**
3.	**Type of measure**	**Supply**
4.	**Requirements for notification**	
a)	Date by which the measure entered into or will enter into operation *Must be before 30 June 2024*	The rule changes proposed for this measure will be operational by 30 June 2024.
b)	Confirmation that the measure is not an 'anticipated measure' *'Anticipated measure' is defined in section 7.02 of the Basin Plan to mean 'a measure that is part of the benchmark conditions of*	Yes It is a new measure (not already included in the benchmark conditions).
c)	NSW agrees with the notification	Yes
d)	Victoria agrees with the notification	Yes
5.	**Surface water SDL resource units affected by the measure**	
	This measure identifies all surface water resource units in the Southern Basin region as affected units for the purposes of notifying supply measures. The identification of affected units does not constitute an agreement between jurisdictions on apportioning the supply contribution, which will be required in coming months.	
6.	**Details of relevant constraint measures**	
	Not directly linked to constraint measures, implementing the Hume to Yarrawonga, Yarrawonga to Wakool and South Australian Murray Key Focus Area constraints proposals for the Murray River (see separate supply measure notifications) will provide outcomes that are complimentary to this supply measure.	
7.	**Date on which the measure will enter into operation**	
	The date by which the measure will enter into operation is 30 June 2024.	
8.	**Details of the measure**	
a)	Description of the works or measures that constitute this measure	The measure includes the 2011 variation to the Snowy Water Licence that allows NSW to "call out" RMIF from the Snowy Scheme (Section 10 in Attachment B), together with the revised strategy (Strategy) for management of RMIF that was endorsed by the Basin Officials Committee in May 2013 (**Attachment C)**.
b)	Capacity of the measure to operate as a supply measure *'Supply measure' is defined in section 7.03 of the Basin Plan to mean 'a measure that operates to increase the quantity of water available to be taken in a set of surface water SDL resource units compared with the quantity available under the benchmark conditions of*	Yes
c)	Geographical location of the measure	The Snowy Scheme is located in the NSW Snowy Mountains. Figure 1 in **Attachment A** shows the location and key elements of the scheme.
d)	Spatial data describing the inundation	*Not applicable*

	extent associated with the operation of the measure	
e)	Representation of the project in the MDBA assessment framework	***Current policies or operational rules relevant to proposal*** Section 3.1 of the business case (**Attachment A**) describes the current rules. In summary, Snowy Hydro Limited (SHL) use a monthly model based on its operations prior to corporatization in 2002. The SHL model calculates the total Murray 1 release. Based on the calculated Murray 1 release, MSM keeps track of the required annual releases (RAR) to account monthly releases as either below target water (BTW) or above target water (ATW). MSM also simulates environmental water recovery through the waters for rivers initiative. One third of the total water recovered (up to 70 GL) is available to Murray for environmental water needs, called River Murray Increased Flow (RMIF). The RMIF is released to Murray in excess of RAR as ATW release which represent management practices of ATW releases prior to the license amendments in 2011. ***Proposed policies or operational rules for proposal*** The Strategy proposes: a) a management framework for call out of RMIF from the Snowy Scheme; b) provisions for separating the crediting of State RMIF entitlements from the call of designated RMIF resources held within the Snowy Scheme to enable access to water resources already held in Hume Dam to be substituted for RMIF held in the Snowy Scheme, if sufficient reserves are available; and c) the crediting of RMIF to state-based entitlements in NSW and Victoria, allowing water to be used, traded, or to be carried over similarly to existing licensed entitlements. Victoria has created provision within its bulk entitlements to allow implementation of operating arrangements to give effect to the Strategy. A NSW callable entitlement for 35,000ML will be created under a new category of licence that will give effect to the Strategy as part of the implementation of this supply measure. The substitution approach in the Strategy provides potential benefits by allowing increased flexibility to RMIF managers (for example through delaying dates by which decisions must be made) and providing ancillary benefits to the States via the opportunity to build "callable" reserves in the Snowy Scheme. **Attachment C** describes the proposed rule changes to allow RMIF managers to call RMIF water from the Snowy Scheme.
g)	Representation of each operating strategy in the MDBA modelling framework.	Details of the hydrological assessment of the callable RMIF are set out in sections 3.1 to 3.3 (inclusive) in **Attachment A**. Modelling of the measure will be based on the simple storage model for the management of RMIF releases from Snowy to Hume Dam developed by the Snowy Hydro Ltd. This is described in Appendix A2 (Further description of the models) to **Attachment A**.

		There are five scenarios presented in Section 3.3 of the business case that determine the timing and volume of calling out RMIF water from the Snowy Scheme. In addition, **Attachment D** has further tested ways to call out RMIF water. The option adopted in the model is based on minimum of total RMIF callable and a threshold – (Murray account balance-environmental water need), where: • Threshold is 500 GL, • Murray account balance is environmental account balance at the beginning of October and • Environmental water need is forecast water required for environment based on a serial correlation built in MSM. The callout strategy may need to be revisited

Attachments:

A	NSW DPI Water, November 2015	Business Case: 2011 Snowy Water Licence Schedule 4 Amendments to River Murray Increased Flows Call Out Provisions
B	NSW Office of Water, October 2011	Variation of the Snowy Water Licence
C	MDBA	2013 Strategy for River Murray Increased Flow Rules Final Draft
D	MDBA (2016)	RMIF callout from Snowy

Department of Primary Industries
Water

BUSINESS CASE

2011 Snowy Water Licence Schedule 4 Amendments to River Murray Increased Flows Call Out Provisions

NSW Department of Primary Industries Water primary contact details

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Director, Surface Water Management

P: [redacted]

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Cover Image:

Snowy Hydro Murray 1 Power Station by [redacted]/Wikimedia Commons

Executive Summary

The 2011 Snowy Water Licence Schedule 4 Amendments to River Murray Increased Flows Call Out Provisions ("Callable RMIF") proposal for the Murray River is a supply measure that enhances the ability to use environmental flows when most needed to meet the environmental objectives of the Basin Plan.

This supply measure involves the amendments to the Snowy Water Licence in 2011 that provided NSW (on behalf of the MDBA) the ability to call on the environmental water stored in the Snowy Scheme that has been allocated to the Murray River. This environmental water, known as River Murray Increased Flows (RMIF), is a share of the water savings from the Snowy Initiative, and receives up to 70 gigalitres per year.

This business case assesses the increased level of control over the timing of release of RMIF water from the Snowy Scheme, and the flexibility specifically to target the environmental outcomes identified in the Murray River below Lake Hume.

River Murray Increased Flows

Following corporatisation of the Snowy Scheme in 2002, and it was recognised that flow regulation and consumption has contributed to environmental degradation in the Snowy River, the three Snowy Scheme shareholder governments (NSW, Victoria, and the Commonwealth) agreed to address environmental issues in the Snowy and Murray Rivers through the establishment and funding of the Joint Government Enterprise (trading as Water for Rivers) to recover water through water efficiency projects and water entitlement purchases, and through the commissioning of water savings projects in the Murrumbidgee River system, the Goulburn River system and diversions from the River Murray system. The water recovered would allow up to an additional 70 GL and 212 GL to be released to the Murray and Snowy Rivers respectively for environmental purposes.

Snowy Hydro Limited (SHL) was issued with the Snowy Water Licence (the Licence) on corporatisation of the Snowy Scheme that provided for RMIF to be released at the discretion of SHL. The release of RMIF was managed, together with the normal annual supply of water to the western rivers, for commercial reasons, or to manage the risk of an uncontrolled physical spill of water from the Scheme.

Snowy Water Licence Amendments

During 2010/11, variations to the Snowy Water Licence were negotiated with SHL by NSW, on behalf of the shareholder governments.

One of the amendments to the Snowy Water Licence was an option to call out a volume of RMIF each year for environmental purposes, subject to maintaining an appropriate reserve of water within the Snowy Scheme for commercial operations.

With the changes to accounting, the typical annual allocation to RMIF in the Snowy Scheme of 70GL can be called out or set aside for use at a time that provides maximum environmental benefit. Any RMIF in the Scheme can be accrued if not used within a water year. This business case proposes that the advantages of callable RMIF are considered through the environmental equivalence framework.

Following the amendments to the Snowy Water Licence, a revised RMIF Strategy has been developed by the MDBA on behalf of state governments to implement callout of RMIF from the Snowy Scheme into state RMIF entitlements. The revised RMIF Strategy has two key additional elements that complement the ability to call for a release of RMIF from the Snowy Scheme:

- storage and use of RMIF on the Murray to be conducted through State entitlements under the control of TLM managers, and
- States have the option to credit those entitlements through substitution of existing resources on the Murray.

The 2013 Strategy separates the crediting of State RMIF entitlements from the call of designated RMIF resources held within the Snowy Scheme. This enables the RMIF water to be used, traded, or to be carried over similarly to existing licensed entitlements.

Outcomes

An initial assessment of the flexibility to call RMIF on the Murray system has been undertaken, togther with an initial investigation of potential improvements in achieving environmental outcomes under the Basin Plan Benchmark conditions established by the Murray-Darling Basin Authority (MDBA).

The initial assessments indicate that this new option under the Snowy Water Licence is likely to provide significant flexibility to call RMIF releases from the Snowy Scheme, and this is likely to improve environmental outcomes. However, the need for further development of the Murray Simulation Model is required to fully assess environmental benefits, and this is expected to be undertaken by the MDBA.

The assessments undertaken in this business case are based on the current likely operational approach by SHL to management of water within the Snowy Scheme. The potential for changes to management of future Scheme operation is likely to be dependent on developments within the National Electricity Market, and future climate conditions, which have not been considered directly.

Governance & delivery

Development of this measure has already been undertaken by the MDBA on behalf of the state and Commonwealth governments. A revised RMIF strategy for callable RMIF, together with the necessary changes to Schedule F of the Murray-Darling Basin Agreement, has already been endorsed.

Creation of additional entitlement associated with additional inflows to the Murray River from the RMIF account within the Snowy Scheme, and associated changes to statutory and regulatory arrangements, will be undertaken by the NSW Department of Primary Industries - Water.

The measure is expected to come into effect in 2016 after arrangements for the ongoing costs of supply measures have been determined.

Costs

All capital costs for the initial water recovery have already been covered by the Joint Government Enterprise (Water for Rivers) as part of the Snowy Initiative.

The ongoing costs water charges for the entitlement that will be established to receive RMIF in the NSW Murray Valley will be subject to the NSW Independent Pricing And Regulatory Tribunal (IPART) determinations. The current charges for general security entitlements are a combination of fixed charges (proportional to the entitlement), and variable charges (proportional to the volume of water used each year).

These charges will form part of the ongoing costs for environmental works and measures proposed through supply measures more broadly and there are likely to be benefits in considering governance and cost sharing across the SDL adjustment process on a collective basis.

The Victorian Environmental Water Holder (VEWH) already meets the costs associated with storing Victorian water recovered under the Snowy Initiative and no change is proposed.

Glossary of Terms

ATW Above Target Water

BDL Benchmark Diversion Limit

BOC Basin Officials Committee

BTW Below Target Water

DISV Dry Inflow Sequence Volume

ESLT Environmentally Sustainable Level of Take

IGA Intergovernmental Agreement on Implementing Water Reform in the Murray Darling Basin

MSM Murray Simulation Model

PAM Program Administration Management

RAR Required Annual Release

RMIF River Murray Increased Flow

SDL Sustainable Diversion Limits

SDLAAC SLD Adjustment Assessment Committee

SFI Site-specific flow indicator

SHL Snowy Hydro Limited

SWIOID Snowy Water Inquiry Outcomes Implementation Deed

TLM The Living Murray

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1. Project Details

1.1. Background to the Project

1.1.1. Snowy System operations

The Snowy Mountains Scheme (Figure 1) is a dual-purpose development that utilises the storage of water for both electricity generation and additionally provides water beneficial to the irrigation industry.

Inflow to the Schemes' storages are apportioned as inflow to either of two developments; water apportioned to the Snowy-Tumut section of the Scheme flows to the Murrumbidgee River, while Snowy-Murray water flows to the Murray River, via Hume Dam near Albury-Wodonga. In practice and for the purposes of this business case they are separately accounted in terms of inflows and releases.

In addition to electricity generation, the Snowy Scheme provides a secure supply of regulated water in the Murray and Murrumbidgee Valleys, through a minimum annual volume to be released to the Murray and Murrumbidgee Valleys each year. This volume is based on the historical flow and climate data available at the time the scheme was constructed, and is intended to be available each year, even through a repeat of the (then) worst recorded drought (the design drought). This annual volume is called the Required Annual Release (RAR) and the nominal volume for the Murray is 1,062 GL.

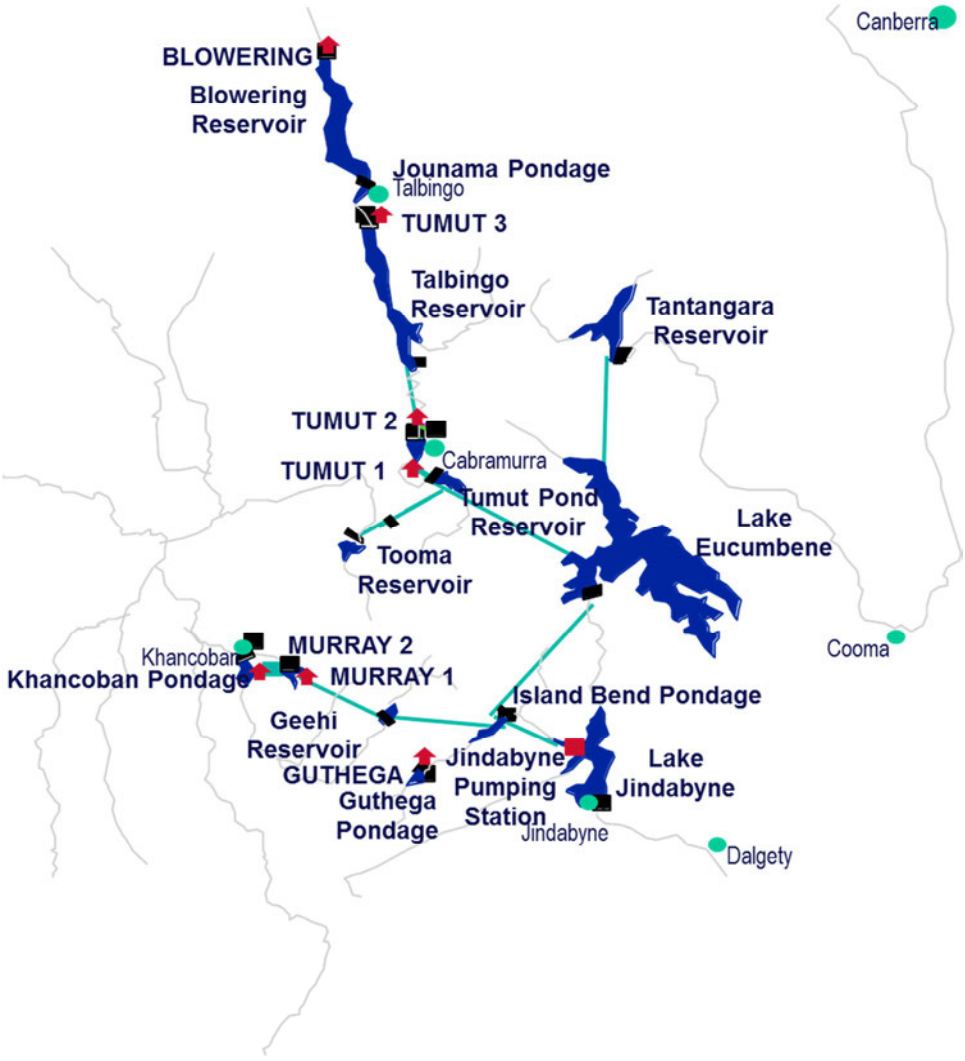

Figure 1: Map of the Snowy Mountains Scheme

Each "water year", commencing in May, the RAR is required to be released by Snowy Hydro into the Snowy-Murray system. These releases were determined as the amount of water required to meet a minimum release through a design drought sequence in order to provide environmental and agricultural benefits downstream.

The water stored within the Snowy Scheme is stored in two account category types (**Error! Reference source not found.**):

- Below Target Water (BTW) is the water required to deliver the RAR. Conceptually it is the volume that is required to be stored at any time to ensure that RAR can be delivered in the future through a repeat of the design drought. In practice, a target storage level has been calculated for each month of the year to represent the volume of water required to provide RAR through the design drought. All inflows to the scheme are credited to this account until the target for that time is met.
- Above Target Water (ATW) is credited as inflows occur after the total water stored in the Scheme has risen above the BTW 'target'.

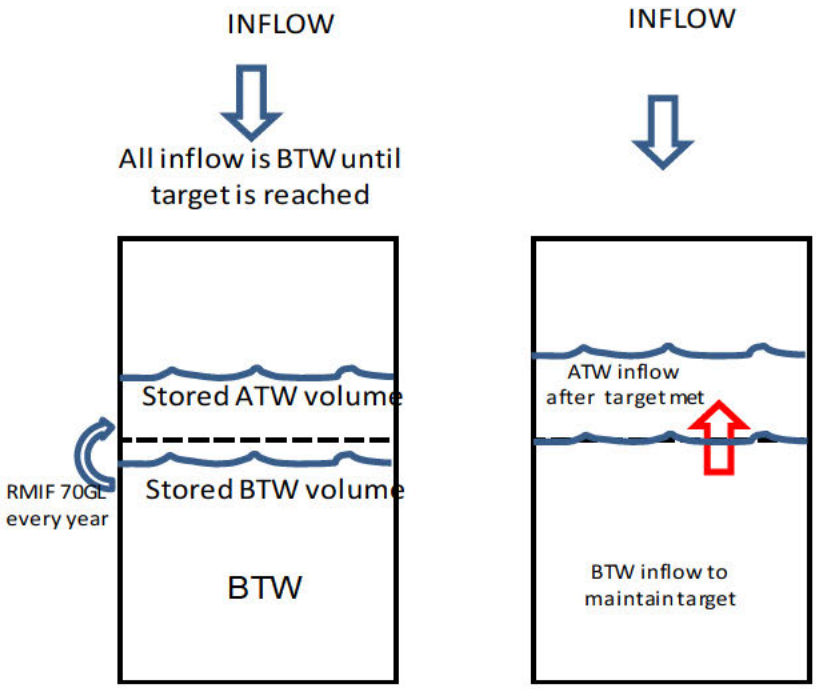

Figure 2 Below Target Water and Above Target Water

In this context, the BTW release is any amount *up to* the RAR (1062GL less adjustments) in a water year for the Snowy-Murray, and ATW release is any amount *above* 1062GL. The first water released from the Snowy during the water year is accounted as BTW until the RAR for that year has been achieved. Any subsequent ATW releases within that year are entirely at the discretion of SHL, unless as a forced release.

1.1.2. Corporatisation of the Snowy Scheme - The Snowy Initiative

The Snowy Scheme was corporatised in 2002, following a six year reform process. During this process a public inquiry (the Snowy Water Inquiry) was held, and it was recognised that flow regulation and consumption has contributed to environmental degradation in the Snowy River. This was acknowledged and the three shareholder governments (NSW, Victoria, and the Commonwealth) agreed to address

environmental issues through a series of commitments encapsulated in the Snowy Water Inquiry Outcomes Implementation Deed (SWIOID).

Key among the commitments in the SWIOID was the establishment and funding of the Joint Government Enterprise (JGE) (Australian, New South Wales and Victorian governments), trading as Water for Rivers, in 2002. The JGE was a commitment under the corporatisation of the previous Snowy Mountains Hydro-electric Authority, and reflects the agreement of all three governments to deliver water for environmental flows in the Snowy River and the River Murray, referred to as the Snowy Initiative.

The task of the 'Water for Rivers' initiative was to recover water through water efficiency projects and water entitlement purchases, and through the commissioning of water savings projects in the Murrumbidgee River system, the Goulburn River system and diversions from the River Murray system. The water recovered would allow up to an additional 70 GL and 212 GL to be released to the Murray and Snowy Rivers respectively for environmental purposes.

Snowy Hydro Limited (SHL) was issued with a Snowy Water Licence (the Licence) on 30 May 2002 under the Snowy Hydro Corporatisation Act 1997 (The Act). This Licence defined SHL's water rights and obligations.

The Licence requires the nominal or base RAR (1,062 GL/year) to be adjusted each year to account for water recovery in the western rivers, with approximately two thirds of the reduction amount to be released instead to the Snowy River for environmental purposes, known as Snowy River Increased Flows(SRIF). The remaining one third of water recovery (up to 70 GL each year) is to be provided to the Murray River for environmental purposes, known as River Murray Increased Flows (RMIF).

The Licence also includes requirements to adjust RAR to account for over/under release of RAR in the previous year(s) in certain circumstances.

RMIF is dedicated to environmental purposes by the SWIOID and, at corporatisation of the Scheme, the Licence provided for RMIF to be released at the discretion of SHL, as ATW. Only when discretionary releases of ATW were made by Snowy Hydro Ltd could states provide an opportunity to environmental water managers for the released ATW to then be accounted as RMIF.

1.2. Defining the proposal

1.2.1. The proposal in context

The extended drought period from around 2001 to 2010 saw record low inflows into most rivers in the southern Murray-Darling Basin and the Snowy Scheme.

Under the original Licence, when inflows to the Snowy Scheme fall below the lowest inflows observed prior to the issue of this Licence (the "design drought" upon which the Snowy Scheme was based) a "Dry Inflow Sequence Volume" (DISV) is calculated. The DISV represents the reduction in the Required Annual Release (RAR) to the Murrumbidgee and/or Murray Valleys as a result of a sequence of inflows being lower than the "design drought". In a succession of extremely dry years the DISV can accumulate. Due to the extent and severity of the recent drought, the cumulative DISV became a substantial volume. At the end of the 2009/10 water year, the cumulative DISV over the four year period since 2006/07 stood at 481 gigalitres for the Murrumbidgee Valley, and 784 gigalitres for the Murray Valley. Under the original provisions of the Licence, all accumulated DISV must be "repaid" as soon as inflows to the Snowy Scheme recover sufficiently to allow it. Releasing this volume in addition to the RAR in 2010-11 would have exceeded the capacity of the storages downstream of the Snowy Scheme, and resulted in extended periods of unseasonal high flows downstream of the dams.

During 2010/11, variations to the Snowy Water Licence were negotiated with SHL by NSW, on behalf of the shareholder governments.

The variations to the Licence that were formalised in October 2011 cover five key areas:

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" for each valley: 150 gigalitres for the Murrumbidgee Valley and 225 gigalitres 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 DISV is triggered (and at other times at the discretion of the NSW DPI Water).
3. An option each year to call out RMIF kept within the Snowy Scheme for environmental flows into the Murray Valley.
4. An option each year for SHL 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.
5. A requirement for SHL 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".

Prior to 2011, releases of ATW were either at the discretion of SHL for commercial or other reasons, or during a 'forced release' period. A forced release period is either when the scheme physically fills to capacity and spills or when SHL makes a controlled release to reduce the risk of a physical spill.

As these releases were largely at the discretion of SHL, ATW releases accounted as RMIF might only coincidentally provide environmental benefits downstream.

With the changes to accounting, the typical annual allocation to RMIF in the Snowy Scheme of 70GL can be called out or set aside for use at a time that provides maximum environmental benefit. Any RMIF in the Scheme can be accrued if not used within a water year. This business case proposes that the advantages of callable RMIF are considered through the environmental equivalence framework.

1.2.2. Description and Definition of the Measure

This measure is the framework for the managed callout of RMIF account water stored in the Snowy Scheme to be released into Hume Dam. This includes the 2011 variation to the Licence, together with the strategy for management of RMIF and changes to Schedule F of the Murray-Darling Basin Agreement that was endorsed by BOC in May 2013. The measure does not involve an increased volume of environmental water, but rather the release of this existing volume of water from the Snowy Scheme is optimised for environmental benefit. The framework will include guidelines/rules that specify the circumstances when the water is able to be called out and the volume that may be called upon.

This business case assesses the increased level of control over the timing of release of RMIF water from the Snowy Scheme, and the flexibility specifically to target the environmental outcomes identified in the Murray River below Lake Hume.

A Strategy for RMIF was originally agreed as part of The Living Murray Annual Watering Plan 2006/2007, through the Interim Rules for RMIF at Appendix D. Following the amendments to the Snowy Water Licence, the strategy has been revised to allow callout of RMIF from the Snowy Scheme into state RMIF entitlements. Whilst the 2013 revised Strategy for RMIF follows the principles of the previous Strategy, it has two key additional elements:

- storage and use of RMIF on the Murray to be conducted through State entitlements under the control of TLM managers, and

- States have the option to credit those entitlements through substitution of existing resources on the Murray.

All inflows to Hume Dam are shared equally between NSW and Victoria, including releases from the Snowy Scheme to the Murray Valley. The revised strategy is based on the establishment of entitlements within both NSW and Victoria in the Murray system, with each of the entitlements receiving 50% of the released RMIF.

The 2013 Strategy separates the crediting of State RMIF entitlements from the call of designated RMIF resources held within the Snowy Scheme. This enables the RMIF water to be used, traded, or to be carried over similarly to existing licensed entitlements.

The substitution approach provides potential benefits by allowing increased flexibility to RMIF Managers (for example through delaying dates by which decisions must be made) and providing the States with opportunity to build "callable" reserves in the Snowy Scheme.

The approach taken in this Strategy can be summarised as:

- RMIF is to be held in State accounts and entitlements on the Murray.
- RMIF has first refusal on releases of ATW made at the discretion of SHL. This does not include volumes (other than RMIF) called from SHL's ATW resources in accordance with the call out provisions of the SWL.
- The crediting of RMIF entitlements on the Murray is separated from the call of RMIF from the Snowy Scheme.
- States are obliged to credit RMIF entitlements in response to a request received between May and early September.
- Credit to State RMIF entitlements is accompanied by transfer of the ability to call water out of the Snowy Scheme from RMIF managers to state water resource managers.
- RMIF on the Murray will be part of the TLM portfolio of water entitlements;
- Where state water resource managers elect to call on resources held in the Snowy Scheme other States will be given the opportunity to provide that water from existing Murray resources.
- Transfers will be made between States' shares of the releases from the Snowy Scheme and Hume Dam holdings to achieve the required State sharing arrangements.

NSW is proposing to create an entitlement with similar characteristics to the existing general security entitlements in the valley. This entitlement will have a share component of 35,000 shares, equivalent to half of the typical annual volume of water accruing to RMIF within the Snowy Scheme from water savings.

In May 2014, the Victorian Minister for Water approved amendments to the VEWH's and Goulburn-Murray Water's River Murray bulk entitlements, formally establishing an entitlement to retain and release Victoria's share of RMIF and implementing arrangements to ensure it is managed in accordance with any agreed RMIF Strategy.

The Agreement, Snowy Water Inquiry Outcomes Implementation Deed (SWIOID), and Snowy corporatising documents do not specify rules to be included in State RMIF entitlements. However, they do describe the intent of the Commonwealth and the States for retaining and releasing RMIF, which the State RMIF entitlements should facilitate. This includes:

- Providing increased flows in the River Murray for environmental purposes only, not to be used for irrigated agriculture or any other consumptive purpose;
- Enabling use in the Lower Murray below the Barmah Choke to allow preference to be given to improving environmental outcomes in these areas;

- Providing an allocation of up to 70 Gigalitres per year;
- Providing that water need not be released during the water year in which it is credited; and
- Not adversely impacting on South Australian water security or water quality, the security of water entitlements of irrigators, and other water flows for environmental purposes.

There are now significant volumes of RMIF accrued within the Snowy Scheme. As at 1 May 2015, the total volume of RMIF within the Snowy Scheme is 440GL. The ability to accrue significant volumes of environmental water to callout in a particular year, or series of years, provides an opportunity to achieve better environmental outcomes that was not available under the 2009 baseline conditions from which the Basin Plan water recovery targets were set.

1.2.3. Measure Proponent and Implementing Entity

The proponent is the NSW Department of Primary Industries, DPI Water, on behalf of the NSW and Victorian Governments. The implementing entity for the state RMIF entitlements is the relevant water authority in each of NSW (DPI Water) and Victoria (DELWP), and the release strategy is coordinated by the Murray Darling Basin Authority under the revised RMIF strategy.

1.2.4. Interaction with other Measures

This measure is expected to complement and improve the delivery of existing and future sources of environmental water and consequently there is unlikely to be any risk of reducing the effectiveness of environmental flow management or damaging river ecology.

Environmental Assessment

2.1 Environmental objectives and targets

1.2.5. Objectives and Targets

The ability to call out water from the Snowy Scheme is expected to have positive effects on the ecological values and assets downstream of Hume Dam. This will be confirmedthrough modelling of the measure within the environmental equivalence framework; preliminary assessment by NSWDPI shows the possibility of improvements in the framework.

There are no specific environmental targets associated with this measure as it involves the enhancement of benefits in conjunction with existing environmental water accounts.

2.1.2 Relevance to Basin Plan Targets

It is anticipated that future modelling by the MDBA will demonstrate positive outcomes in the environmental equivalence framework, which should also allow an SDL adjustment to be made.

2.2 Anticipated Ecological Outcomes and Benefits

There are no detailed site specific or regional ecological outcomes from this measure as the environmental improvement comes from a change in the delivery of existing environmental water. The outcomes are measured as the relative improvement in the basin ecological outcomes that are assessed by the environmental equivalence framework. It is expected that the scoring method will show an improvement; however, this cannot be determined until modifications to MSM are undertaken.

In general, only positive impacts are anticipated with these changes. With the ability to call out water when it is most needed, the ecological outcomes should provide improvements.

2.3 Potential Adverse Ecological Impacts

It is not expected that adverse ecological outcomes will be experienced from this measure.

2.3.1 Salinity and water quality outcomes

As water from the Snowy Scheme has no appreciable salinity, inflow into Hume Dam will have no salinity change and it is highly unlikely that there will be a discernible change in salinity and water quality downstream

2.4 Anticipated Ecological Benefits

It is anticipated that callable RMIF will enable improved achievement of Specific Flow Indicators along the Murray River, and will be assessed through the environmental equivalence framework.

The ability to call on RMIF is generally complementary to the management of TLM water, therefore it should enhance the targeted inundation extents, and improve the ability to meet the frequency, duration and timing of relevant flow events. The potential to improve achievement of SFIs under the Benchmark conditions for the Basin Plan established by the MDBA is considered in more detail in Section 3.2.

2.5 Potential Adverse Ecological Impacts

it is not expected that adverse ecological outcomes will be experienced from this measure.

It is not envisaged that changes to RMIF callouts will have negative impacts on flora and fauna species or ecological function and connectivity.

There are no site-specific or regional cumulative negative impacts expected from this measure as this business case details a change in the delivery of existing environmental water only.

3 Hydrologic Assessment of Callable RMIF

3.1 Current Hydrology

SHL have a monthly-step hydrologic model of the Snowy Scheme that has been used to inform long-term decision making, including the corporatisation of the Scheme. This model assumes a mode of operation that is largely based on Scheme operations prior to corporatisation in 2002. For the bulk of releases from the Scheme for BTW, behaviour is assumed to be similar post corporatisation, but ATW is likely to be managed differently as a result of corporatisation and the Scheme's participation in the National Electricity Market. In particular, the Snowy model does not explicitly represent River Murray Increased Flows.

The Snowy Scheme model makes releases of ATW that are consistent with historical practice prior to corporatisation, reflecting the overall management of the Scheme to balance risk of spill or forced generation against the desire to have discretionary reserves that can be used to generate additional power.

A version of this model is used to generate releases from the Snowy Murray-Development each year, which are then used as an input to the Murray Simulation Model (MSM) held by the MDBA. This simulated release is the total release of BTW and ATW, based on a generalised operation of the Snowy Scheme up to corporatisation.

The simulated annual releases to the Murray River from the Snowy Scheme over the period 1895 to 2009 are presented in Figure 5. This dataset represents the combined total of BTW and ATW releases.

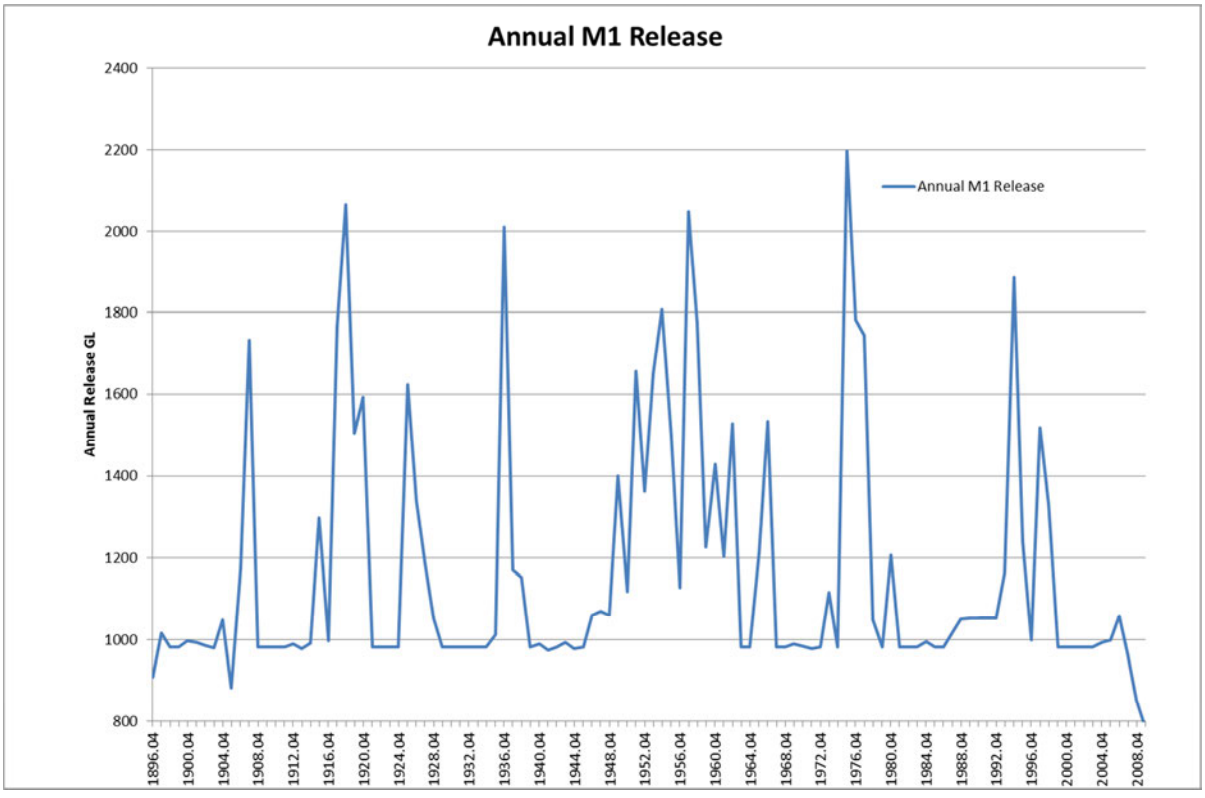

Figure 3: Existing annual Murray 1 releases

The Murray Simulation Model (MSM) uses the total modelled release through the Snowy-Murray development to calculate:

- delivery of RAR each month, and
- the accounting of Monthly releases as either BTW or ATW.

The ATW releases are simply calculated as releases in excess of RAR, and are simulated in 86 of the 114 years modelled. The current modelling of ATW within the existing MSM, represents previous management with ATW releases at the discretion of SHL.

MSM then simulates the volume of RMIF within the Snowy scheme (the Snowy (RMIF) account), based on:

- A RMIF (Snowy) account within the Snowy Scheme that accumulates the annual credit, and monthly debits with:
    - Credits to the RMIF (Snowy) account,assumed to be 70 GL per year (in May of each year).
    - Debits to the RMIF (Snowy) account whenever an ATW release occurs, until the RMIF sub-account is empty.
- A RMIF in authority storages account, with its particular carryover and spill rules described in the 2006 strategy.
    - Credits to the RMIF in authority storages account, for the releases of ATW from Snowy Scheme classified as the debits to RMIF above.
    - Releases of RMIF in authority storages to meet existing environmental demand in conjunction with other environmental water sourced by The Living Murray (TLM) program. These environmental water accounts are collectively referred to as environmental water in Hume Dam.

Whenever there is water in the RMIF sub-account within the Snowy ATW account, it is debited by the first release of ATW (at SHL discretion or as a forced release), i.e. there is no active or implied release management of the RMIF account.

The annual time series of simulated ATW release is shown in Figure 6. This figure shows the total simulated ATW released from the Snowy Scheme, with the portion of ATW attributed as RMIF shown separately.

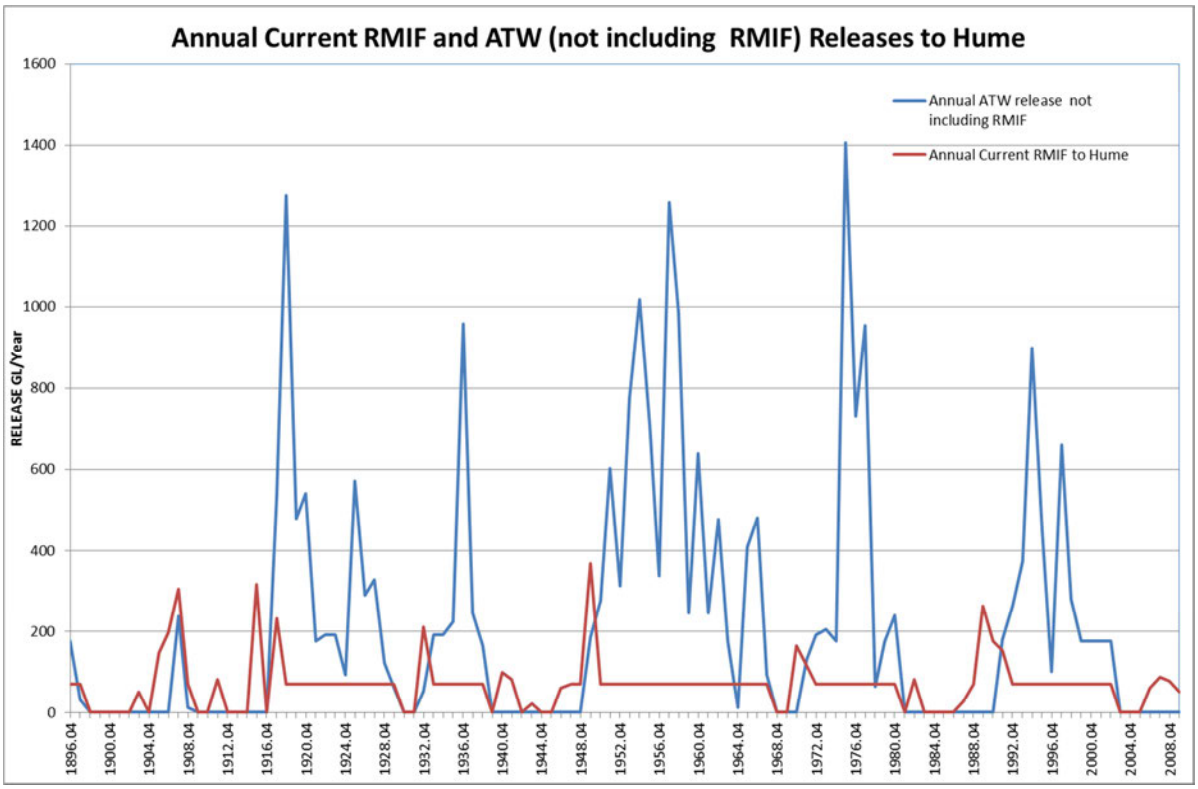

Figure 4: Annual RMIF and additional ATW releases to Hume Dam

The regular release of ATW confirms that its release is not simply a function of wet conditions and filling of Snowy Scheme storages. Figure 7 demonstrates a common scenario of water being released to meet generation requirements early in the year, satisfying RAR and then continuation of generation demand requiring the release of ATW.

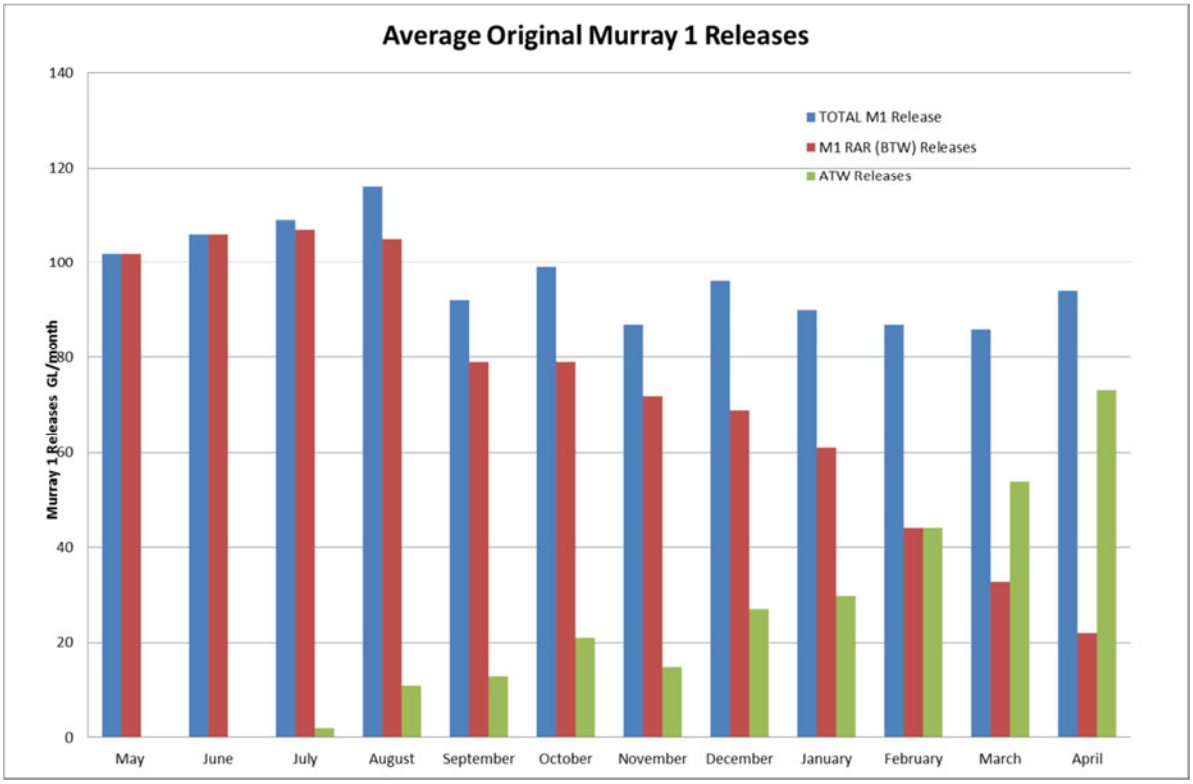

Figure 5: Monthly distribution of Above Target Water releases compared to RAR Below Target Water

3.2 Callable RMIF

To assess the benefits of callable RMIF, a necessary first step is to consider the bounds of flexibility that are available under the revised Licence. To do this, Snowy Hydro Ltd has provided a simplified model for the management of ATW (and hence RMIF) releases from Snowy to Hume Dam, which has been used by NSW DPI to allow the existing simulated pattern of RMIF releases (as a portion of ATW releases) to be varied within the constraints of the Licence and the operation of the Snowy Scheme. The simplified model of RMIF releases from the Snowy Scheme and RMIF (Snowy) accounting allows options for managing the release of RMIF water to different sets of rules to be considered. The results of this assessment can then be used to consider how the callout might affect ecological scoring under the environmental equivalence framework.

SHL's simplified model is a spreadsheet 'fill and spill' storage-type model that represents the ATW in the Snowy Scheme and the portion of ATW that is in the RMIF (Snowy) account, based on the key parameters listed below, together with historical inflows and a configurable demand. SHL have indicated appropriate values for these key parameters as sensible approximations of likely Scheme behaviour, in order to explore the benefits of the callable provisions of the RMIF account. Extended explanation of these changes can be found in Appendix A2.

1. **ATW Inflows.** ATW releases from the Snowy to Hume Dam are used as the "inflows" to the ATW storage model.
2. **An ATW account volume at which a forced release occurs**. The Snowy scheme will generally make increasing releases as it gets closer to physically spilling, in order to avoid an uncontrolled spill.
3. **draw down volume** that is released when the scheme reaches a forced spill.

4. **The maximum rate of release**. Assumed rate that forced releases are made (GL/month) until the draw down volume is reached.
5. **A minimum ATW account volume below which RMIF cannot be called out**. The Snowy Water Licence specifies the triggers here (800 GL total ATW – assumed to be 400 GL in each of the Snowy-Murray and Snowy-Tumut developments).
6. **The first water released from the ATW volume is accounted as a release from the RMIF account**. This is the assumption in the initial SHL model and the variation of this rule is the core of modelling the callable RMIF.

3.3 Calling RMIF Based on Environmental Water Requirements

This measure does not propose any new or varied environmental requirements, but instead seeks to better meet the environmental watering requirements of the Benchmark scenario. The changes to the RMIF callout will mean that water may be released to the environment at times considered to be more beneficial than those times where water is released in the current Benchmark simulation.

In order to make a preliminary assessment of the potential benefits of callable RMIF for environmental outcomes, NSW DPI developed another simple spreadsheet model to generate a demand sequence, drawing down the RMIF account within the account rules outlined above.

In the scenarios discussed below, a number of triggers for the release of RMIF from Hume Dam were tested:

- **Environmental water account in Hume Dam**. This account is calculated by MSM and includes all TLM and Commonwealth environmental water.
- Output from the **environmental elements scoring modelling**. The Basin Plan environmental scoring model uses MSM output or flow data to determine the annual success in satisfying the SFI (Site Flow Indicators) requirements. This analysis determined the “near miss” years, assuming that to target more water in the environmental water account in Hume Dam in those years would improve the chances of turning a “near miss” into a successful year.
- **Volume in Hume Dam**.

It should be noted that the environmental accounts and outcomes currently simulated by the Benchmark scenario in MSM utilise the existing pattern of RMIF releases as described above (Section 1.2.2). These accounts, and the time-series values of the triggers being tested, would change (from those currently produced by the Benchmark scenario) under a revised RMIF release scenario but, in the absence of further MSM model development, this interaction has not been assessed.

3.3.1 Demand Sequences for RMIF

Five scenarios for releases from the RMIF (Snowy) account have been trialled that increase the environmental water account in Hume Dam at different times to explore the potential for improving environmental benefits measured by the ecological elements scoring method, thus indicating that an SDL adjustment is possible.

Scenario 1

Base Case using the ATW inflows as currently calculated by MSM, with a modification to inflows to reflect the annual 70 GL RMIF sub-account inflow. RMIF is accounted as the first ATW inflows to Hume Dam.

Scenario 2

If the Hume environmental account holds less than 500 GL in October, then a callout of the maximum of

- The volume difference between 500 GL and the Hume environmental account volume, or
- The volume in the RMIF account above an ATW volume of 400 GL

is made in six equal monthly releases from October to March.

Scenario 3

If the Hume environmental account holds less than 500 GL in October, then a callout of the maximum of:

- The volume difference between 1000 GL and the Hume environmental account volume, or
- The volume in the RMIF account above an ATW volume of 400 GL

is made in six equal monthly releases from October to March.

Scenario 4

In the "near miss" years when the environmental water account in Hume Dam is less than 700 GL then a callout of the maximum of:

- 100 GL per month (600 GL total) is sought from October to March, or
- The volume in the RMIF account above an ATW volume of 400 GL

Scenario 5

Release 70 GL of RMIF every year. Under the current generalised ATW strategy, it can be expected to be available each year.

To illustrate the potential for positive impacts for this business case, it was possible to show that the change in RMIF inflows to Hume Dam could be targeted during periods when it is likely that additional environment water would be useful to achieve additional success in meeting the SFI targets.

The five scenarios described above were modelled to assess the potential for improvements in the delivery of environmental flows. Figure 8 shows the change in the pattern of RMIF releases under Scenario 2 when the environmental account in Hume Dam is less than 500 GL in October in any year. This demonstrate that the RMIF (Snowy) account can be called out in a significantly different manner to the Benchmark modelling to provide more water during periods when it is likely that it will have increased environmental value.

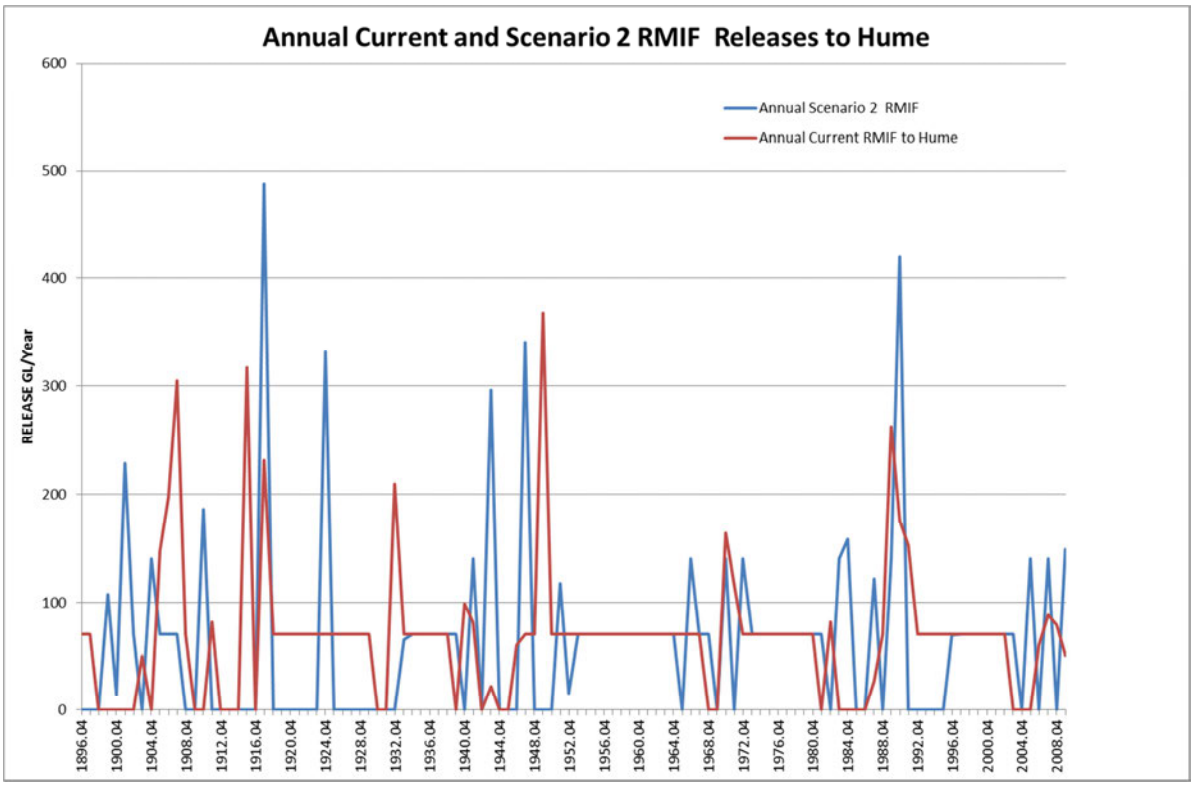

Figure 6: Current RMIF releases compared to releases under Scenario 2 conditions

This callout change is complementary to the management of TLM water, therefore it should enhance the targeted inundation extents, and improve the ability to meet the frequency, duration and timing of relevant flow events.

However, the spreadsheet assessment of improved environmental outcomes proved to be inconclusive.

Examination of the existing outputs from MSM showed that during “near miss” years, there were numerous instances where there were significant volumes of water in the environmental water accounts in Hume Dam, but small or no releases from that account.

Whilst new sequences of M1 releases were constructed using the output of the scenarios described above, using targeted RMIF releases, MSM continues to impose the Benchmark accounting treatment on the M1 releases that does not recognise the intended changes to the RMIF release. It recalculates the RMIF release based on the concept that the first ATW releases are accounted in Hume Dam as inflows to the RMIF account; frustrating the intention of recalculating the M1 releases.

Valuing the effect of changes to RMIF callouts within the ecological equivalence scoring framework will require the functionality of MSM to be modified to allow patterns of RMIF to be varied for simulation (code changes to MSM are required).

To develop the operational rules required to assess and implement the changed management regime, a number of modelling developments are required to modify MSM to enable it to:

- Separately account for SHL ATW and the RMIF sub-account, within the water accounting of the Snowy Scheme.
- Trigger releases from the RMIF sub-account and account for them within the ATW releases and existing RMIF accounts within Hume Dam.

It is understood preliminary work on these activities has already been undertaken, but full development and testing is required to incorporate it into the standard MSM operating platform.

3.3.2 - Callout Timing

A callout can only be made once per year and the latest it can be made is 5 October. The modelled callout assumes that any water requested is released equally over six months from October to March. Once the callout is made, that volume can be considered to be guaranteed inflow in that year.

In practice, SHL has a significant amount of discretion over the monthly pattern of releases, and will continue to have in the future. The impact of the assumption of the October to March releases is irrelevant as any additional release rates and timing are at SHL's discretion; water can be released from Hume in anticipation of the total volume being available within the year – provided there are sufficient other resources in Hume Dam to buffer the release of environmental water – before SHL accounts for the release of RMIF.

The substitution process proposed by the MDBA will further increase flexibility and reduce the relevance of the callout date constraint, if adopted. Just as legitimately, an instantaneous account transfer could be made to enable Hume demand triggers to be met, on the guarantee of the inflow, neglecting the possibility of Hume spilling. In practice the October callout is appropriate as there is good probability of inflows in the spring period, so that the later callout reduces the risk of callout being made redundant by seasonal flows. The flexibility generated either by the substitution process or the ability to release in expectation of "guaranteed" inflows reduces the impact of the October callout.

The "fill and spill" storage model with a simple RMIF demand trigger can only produce an approximate indication of ecological benefit. It demonstrates that the simple rules and RMIF management can deliver more RMIF water to the environmental account in Hume Dam when that account is low. This potentially allows more environmental water to be delivered to meet identified environmental demand.

3.4 Other Changes to the Snowy Water Licence

There were four key changes to the Snowy Water Licence in 2011 in addition to the ability to call out RMIF from the Snowy Scheme. In general, these other changes do not affect the ability to call out RMIF, and are not considered to have any material deleterious effect on Basin Plan outcomes.

In particular, the new provision in the Licence for flexibility around meeting of RAR targets ("flex" releases) and the protection against impacts in any subsequent period ("wet sequence protection") are unlikely to reduce the callability of RMIF from the scheme in any significant manner.

4 Operating Regime of the Measure

4.1 Ecological justification for the operating regime;

Prior to the Licence amendments, RMIF volumes were released from the scheme at the discretion of SHL, whenever releases in excess of the Required Annual Release (RAR) occurred. The lack of control with regard to timing meant that RMIF was typically provided during wet sequences and sometimes spilled from the RMIF account in Lake Hume, before an appropriately directed environmental release could be made to the Murray River. With the changes to accounting, RMIF may now be used, or set aside for use, at time that provides greater environmental benefit.

4.2 Operating scenarios

A strategy has been developed to allow callout of RMIF from the Snowy Scheme into state RMIF entitlements. This enables the RMIF water to be used, traded, or to be carried over similarly to existing licensed entitlements.

The strategy also includes the opportunity for state resource managers to “substitute” water already in Murray resources instead of any actual callout of RMIF from the Snowy Scheme. In exchange, a portion of RMIF within the Snowy Scheme would be reserved for consumptive use. This has the potential to provide further opportunities for access to RMIF for environmental requirements.

5 Risks and Impacts of Operation of the Measure

The table below sets out a generic risk management framework that has been applied across all identified impacts.

Table 1: ISO Risk prioritisation matrix

		Consequence			
Likelihood	Negligible	Minor	Moderate	Major	Extreme
Rare	Low	Low	Low	Moderate	High
Unlikely	Low	Low	Moderate	High	High
Possible	Low	Moderate	Moderate	High	Very High
Likely	Low	Moderate	High	Very High	Very High
Almost Certain	Moderate	Moderate	High	Very High	Very High

5.1 Identified project delivery and operating risks;

No potential for ecological risks associated with this project has been identified, in the context of the project having the effect of increasing the availability and flexibility of existing environmental water volumes.

The only risk assessed for delivery of improved outcomes under this measure is the potential for future changes to operational behaviour of the Snowy Scheme that may affect the volume of ATW maintained within the Scheme, and hence the degree to which the 800 GL ATW threshold restricts desired call out of RMIF.

The assessments undertaken in this business case are based on the current likely operational approach by SHL to management of water within the Snowy Scheme. The potential for changes to management of future Scheme operation is likely to be dependent on developments within the National Electricity Market, and future climate conditions, which have not been considered directly.

Future changes to Snowy Scheme operational behaviour with respect to ATW may have either a beneficial or detrimental impact on the callability of RMIF, and there is no clear way to assess the likelihood of any future changes to SHL's management of ATW.

The Snowy Water Licence requires that it is reviewed every 10 years, with the next review scheduled for 2017. Should future changes significantly affect the callability of RMIF, this review process would provide a recurring opportunity to address such changes.

5.2 Operational Risk Assessment

It is not envisaged that there will be any risks associated with ongoing operation of this measure.

The revised RMIF strategy endorsed by the Basin Officials Committee in 2013 has been developed to ensure that existing entitlement holders within NSW and Victoria are not impacted.

5.3 Mitigation strategies and residual risks after mitigation strategies are applied

There are no significant risks assessed.

6 Technical Feasibility and Fitness for Purpose

This measure has already been implemented, and RMIF is now callable from the Snowy Scheme.

6.1 Ongoing operational monitoring and record keeping arrangements

Monitoring and record keeping will be undertaken by the relevant agencies, being NSW DPI, Victorian Department of Environment, Land, Water and Planning, and MDBA.

7 Complementary Actions and Interdependencies

7.1 SDL resource units that are affected by the measure

NSW, Victorian, and South Australian Murray SDL Resource units (SS14, SS2, and SS11) are likely to be benefitted by this measure.

7.2 Complementary actions and Interdependencies.

Reducing or removing flow constraints is likely to provide synergies with this callable RMIF measure. The removal of flow constraints permitting higher releases from Hume Dam – coupled with the delivery of RMIF water during periods of low environmental water availability in Hume Dam – may provide an enhanced benefit from callable RMIF.

8 Costs, Benefits and Funding Arrangements

There are no implementation or infrastructure costs for this project.

The on-going operational rules and processes produced by this project will be incorporated into the standard operational activities of the MDBA and will not incur any additional costs.

The ongoing costs of the proposed NSW RMIF entitlement from water charges will be subject to NSW Independent Pricing And Regulatory Tribunal (IPART) determinations. The current charges for general security entitlements are a combination of fixed charges (proportional to the entitlement), and variable charges (proportional to the volume of water used each year).

These charges will form part of the ongoing costs for environmental works and measures proposed through supply measures more broadly and there are likely to be benefits in considering governance and cost sharing across the SDL adjustment process on a collective basis.

The Victorian Environmental Water Holder (VEWH) already meets the costs associated with storing Victorian water recovered under the Snowy Initiative and no change is proposed.

8.1 Stakeholder consultation

The key elements of this proposal are already in place, or developed and agreed through the existing Murray River governance arrangements. This includes the Snowy Water Licence, which has already been varied following a comprehensive public submissions process. The appropriate variations to the strategy for managing RMIF, and Schedule F of the Murray-Darling Basin Agreement have been developed and endorsed by the Basin Officials Committee.

Operational delivery of this measure will require further consultation with the stakeholders identified in section 9.1. However, it is expected that this will occur through existing River Murray system governance processes, and no new governance arrangements will need to be developed.

8.2 Ongoing operation and maintenance costs

The only operational costs for this measure is the water charges for the state RMIF entitlement proposed to be created in NSW.

The Victorian Environmental Water Holder (VEWH) already meets the costs associated with storing Victorian water recovered under the Snowy Initiative and no change is proposed.

8.3 Expected environmental, social and economic costs and benefits

It is not anticipated that there will be any on-going costs but that the opportunity to improve environmental callouts of water will offer benefits to the environment downstream, which may in turn flow on to provide economic and social benefit.

9 Project Governance and Project Management Arrangements

9.1 Stakeholder Management

9.1.1 Snowy Hydro Ltd

SHL have provided information regarding management of ATW that is commercially sensitive, and cannot be publicly released. A version of this document will be developed that does not allow commercially sensitive information to be identified.

At this stage it is not anticipated that this proposal will impact private stakeholders, either positively or negatively. State agencies will consult with local landholders as part of formal engagement on supply measures generally. The rules associated with the proposal will not change the volume or timing of water available for private consumptive or urban users and hence consultation is not anticipated. Information on the final outcomes will be made available via media and existing state agency processes.

Table 2: Map of agencies with an interest in the RMIF callout proposal, including their interface with proposal and potential areas of concern

Stakeholder	Role / responsibility	Interface with the proposal	Areas of interest
Murray-Darling Basin Authority	Operations planning Hydrological modelling Water policy	River operator The Living Murray coordinator / Basin Plan environmental water planning	**Impacts to state water shares** **Operational planning and operational management of Hume** **Achievement of ecological outcomes**
Department of Environment (Commonwealth)	Support management of Commonwealth environmental water portfolio	Environmental water planning	**Achievement of ecological outcomes** **Interface with other environmental water use**
Commonwealth Environmental Water Holder	Management of Commonwealth environmental water portfolio	Environmental water planning	**Achievement of ecological outcomes** **Interface with other environmental water use**
Department of Environment, Land, Water and Planning (Victoria)	Water policy and planning	Water resource manager	**Impacts on state water shares**
Victorian Environmental Water Holder	Management of environmental water entitlements (Vic)	Environmental water planning	**Achievement of ecological outcomes** **Interface with other environmental water use**
Goulburn-Murray Water	Water planning and resource operation.	Victorian resource manager	**Management of Victoria's share of River Murray water resources and user allocations.**
Department of Environment, Water and Natural Resources (South	Management of water and environment (South	Water planning Downstream water user	**Implications of proposal on downstream assets and water supply (quantity and**

Stakeholder	Role / responsibility	Interface with the proposal	Areas of interest
Australia)	Australia)		**quality)**
Snowy Hydro Ltd	Storage operator	Primary system operator Water availability and water system planning	**Impacts to Snowy water availability and release timing**
Office of Environment and Heritage	Environmental policy and planning (NSW) Management of environmental water entitlements.	Environmental water planning	**Achievement of ecological outcomes** **Interface with other environmental water use**
NSW DPI Water	Water policy and planning and water resource allocation	Water resource manager	**Impacts on state water shares and user allocations** **Impacts on NSW water users and riparian communities**
Water New South Wales	Storage Operator	Licence management	**Impacts on NSW water allocations and revenue**

9.2 Legal and Regulatory Requirements

Proposed amendments Schedule F to reflect a callable RMIF have already been endorsed by the Basin Officials Committee, and drafting instructions have been prepared are in readiness to implement the changes.

NSW will amend the water sharing plan for the NSW Murray and Lower Darling water source to reflect the proposed state RMIF entitlement.

These final steps will be undertaken when the responsibility for ongoing charges for state RMIF entitlements have been resolved.

Victoria formally established its state RMIF entitlement within the VEWH's and Goulburn-Murray Water's River Murray bulk entitlements in May 2014.

9.3 Governance and Project Management

Actions, including management of changes to the MSM, are required to be undertaken by the MDBA for this operational rule change, so it is appropriate that the MDBA should assume project management responsibilities for implementing the change. The allocation of specific project management roles and responsibilities is a matter for the MDBA.

9.3.1 Design and implementation plan and timelines

This measure will be in place before 30 June 2024.

9.4 Risk Assessment of Project Development and Delivery

It is expected that all outcomes of the project risk assessment will be listed as 'low'.

Table 3: ISO Risk prioritisation matrix

		Consequence			
Likelihood	Negligible	Minor	Moderate	Major	Extreme
Rare	Low	Low	Low	Moderate	High
Unlikely	Low	Low	Moderate	High	High
Possible	Low	Moderate	Moderate	High	Very High
Likely	Low	Moderate	High	Very High	Very High
Almost Certain	Moderate	Moderate	High	Very High	Very High

9.4.1 Design risks

Not applicable.

9.4.2 Risks to project completion on time

Low.

9.4.3 Risk of project failure

Low.

9.4.4 Delivery of the project within budget.

There are no costs associated with delivering this project.

References

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Appendices

A1. Summary of response to the Phase 2 Assessment Guidelines

This section confirms how this business case delivers against each of the relevant requirements of the SDLAAC Stage 2 Guidelines. The following table lists the requirements and then records where the issue is dealt with in this business case.

Table 4: Concordance - Stage 2 Guidelines and Business Case

Guidelines Section	Heading	Requirement	Business Case Section
3.1	Supply measure definition	Defines the requirements for supply measures to: operate to increase the quantity of water achieve equivalent environmental outcomes with a lower volume of water have no detrimental impacts	1.2
3.3	Operational by June 2024	The measure must be capable of entering into operation by 30 June 2024	9.3
4.1	Project details	Key project details and overview	1
4.2	Ecological values of the site	Description of the ecological values of the site	2.1
4.3	Ecological objectives and targets	Confirm objectives and targets	2.2
4.4.1	Anticipated ecological benefits	proposed outcomes from the investment	2.4
4.4.2	Potential adverse ecological impacts	Assessment of potential adverse impacts	2.5
4.5.1	Current hydrology and proposed changes	Clear articulation of current and proposed hydrology	3.1
4.5.2	Environmental water requirements	Water requirements of new inundated areas	3.2
4.6	Operating regime	Explanation of the role of each operating scenario	4
4.7	Risks and impacts from operation	Assessment of risks and mitigation options	5
4.8	Technical feasibility	Evidence that the project infrastructure is technically feasible	6
4.9	Interdependencies	Confirm interaction with other initiatives	7
4.10.1	Costs and benefits	detailed costing and listing of benefits	8
4.11.1	Stakeholder management	Stakeholder management strategy	9.1

	strategy		
4.11.2	Legal and regulatory requirements	Legal and regulatory requirements	9.2
4.11.3	Governance and project management	Governance and project management	9.3
4.11.4	Risks from project development and delivery	Risks from project development and delivery	9.4

A2. Further description of the models

Simple RMIF Management Model

Snowy Hydro Ltd has developed a simple storage model for the management of RMIF releases from Snowy to Hume dam.

SHL's simple spreadsheet storage type model was based on:

1. **ATW Inflows.** ATW releases from the Snowy to Hume Dam are used as the inflows to the model. These occur frequently (86 years in 114). This was the basis for the model provided by SHL and reflects the current behaviour of the Murray 1 releases and RMIF accounting. However, under the revised Snowy Water Licence 70 GL (or allocation volume) is credited to the ATW account via the RMIF sub-account every May. The Snowy Hydro Ltd discretionary ATW account is credited with the remainder of the total ATW inflow at the time they occur. Consequently, the inflow sequence for this model was modified by NSW DPI Water to reflect this change, i.e. there is at least 70 GL of inflow into the ATW RMIF sub account.
2. **An ATW account volume at which a forced spill occurs**. The Snowy scheme will physically spill when the total volume of ATW and BTW occupies the capacity of the Snowy storages. In practice, the Scheme rarely if ever "spills". Pre-releases are made to minimise the risk of a physical spill. For the purposes of this simple model it is assumed that the Snowy Scheme will release ATW whenever the total volume in the ATW account reaches 1700 GL. This is assumed to be 850 GL for the Snowy-Murray development within the scheme, thus the volume adopted by NSW DPI Water for modelling is 850 GL.
3. **An ATW account volume to which the storage is drawn down during/following a spill** event. Following a spill event the ATW account is drawn below the spill volume (850 GL) to an account volume of 750 GL (half of the 1500 GL scheme total).
4. **The maximum rate of spill**. It is assumed the spill is released at a rate of up to 400 GL/month until the draw down volume (750 GL) is reached.
5. **A minimum ATW account volume below which RMIF cannot be called out**. The Snowy Water Licence specifies (Schedule 4 Clause 10.4) :

   "If, during a Water Year:

   (a) The volume of Net Above Target Water in Snowy Scheme storages exceeds 800 GL; and

   (b) The Initial River Murray Increased Flows Account is in credit, the Ministerial Corporation may by notice in writing to the Licensee given not later than 5 October in that Water Year, require the Licensee to release from the Snowy-Murray Development in that Water Year a volume of Above Target Water that, as at the time the notice is issued, is equal to the lesser of:

   (c) The balance of the Initial River Murray Increased Flows Account; and

   *(d) The volume that, if released under this **clause 10.4**, would reduce the volume of Net Above Target Water in Snowy Scheme storages to 800 GL."*

   Note: The SHL model does not use this limit, as there is no demand driver to reduce the volume below the spill limits. (The volume adopted for later modelling is 400 GL, assumed to be the Murray half share of the Snowy Licence specified 800 GL. Snowy Hydro Ltd can release below this volume at its discretion, but there is no way to model this behaviour due to its discretionary real-time nature and decisions which would be commercially confidential.

6. **The first water released from the ATW volume is accounted as a release from the RMIF account**. This is the assumption in the initial SHL model and the variation of this rule is the core of modelling the callable RMIF.
7. **There are no "discretionary" releases** in the SHL model, i.e. the releases are 'reactionary', in that there are no external demand drivers.

The model described above is a simple 'fill and spill' storage type, with a specified inflow and a configurable demand. The variables above are total Snowy Scheme variables, and they have been divided equally between the Snowy-Murray and Snowy-Tumut developments within the Scheme.

Analysing Change

Changes to Hume Dam Environmental Accounts

The five modelling scenarios assessed the potential for improvements in the delivery of environmental flows. Table 6 shows the change in the pattern of ATW releases when the environmental account in Hume Dam is less than 1000 GL in October in any year, Table 7 show the releases *when the account is less than 500 GL* (ie does not include releases of RMIF at other times). These simple scenarios demonstrate the potential to provide more water during periods when it is likely that it will have increased environmental value.

Table 5: Summary Analysis of Scenarios when the Environmental water account in Hume is less than 1000 GL

Scenario	Number of months with RMIF releases	Number of years with RMIF releases	Total Volume of RMIF released (GL)
1	43	21	2502
2	89	22	3954
3	52	21	4976
4	51	14	4862
5	35	35	2442

Table 6: Summary Analysis of Scenarios when the Environmental water account in Hume is less than 500 GL

Scenario	Number of months with RMIF releases	Number of years with RMIF releases	Total Volume of RMIF released (GL)
1	23	11	1459
2	76	17	2799
3	46	17	4338
4	34	10	3142
5	18	18	1254

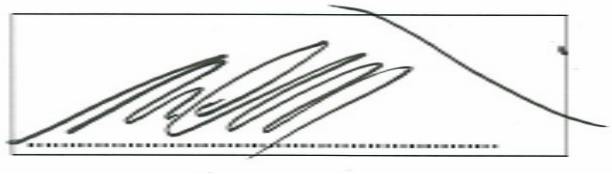
Note: That Scenario 1 is the default accounting for RMIF, i.e. the first ATW water is accounted as RMIF and hence is not targeted.

Variation of the Snowy Water Licence

In accordance with section 26(1)(d) and 26(1)(e) of the Snowy Hydro Corporatisation Act 1997 (NSW)

Commencement Date: 4 October 2011

Date of issue of Notice of Variation: 4 Oct 2011



Katrina Hodgkinson MP

Minister for Primary Industries

for the Water Administration Ministerial Corporation.

Agreement to and acceptance of the Variations by Snowy Hydro Limited is acknowledged

Date 4 October 2011

David Harris

Executive Officer, Snowy Hydro Limited

Licence administration contact:

The Manager, Corporate Licensing Unit
NSW Office of Water
Level 4, 2-6 Station Street, Penrith NSW 2750
Tel: (02) 4729 8128

Table 1: Variations proposed by the NSW Office of Water, June 2011

Section	Page Number	Proposed variation
1. DEFINITIONS AND INTERPRETATION		
1.1 Definitions		
(1) "Above Target Water"	1	After "…..in subsequent year" ***insert***: and: (a) includes in the case of the Snowy-Murray Development water in the River Murray Drought Account and in the case of the Snowy-Tumut Development water in the Murrumbidgee River Drought Account; but (b) excludes water in the Snowy-Murray Development DISV Reserve Account and water in the Snowy-Tumut Development DISV Reserve Account.
(6) "Assign"	1	***Renumber*** (6) "**Assign**"…….. to (10) "**Assign**"…….
(7) "Authorised Officer"	1	***Renumber*** (7) "**Authorised Officer**"… to (11) "**Authorised Officer**"……
New Sections	1	After (5) "Annual Water Operation Plan" ***insert new sections***: (6) **"Applied Snowy-Murray Development DISV Reserve Account Volume"** means, with respect to each Month, the lesser of: (a) the volume by which (if any) the Dry Inflow Sequence Volume for the Snowy-Murray Development calculated under **clause 8** of **Schedule Four** exceeds the volume of the Dry Inflow Sequence Volume for the Snowy-Murray Development calculated as at the commencement of March in the previous Water Year under **clause 8** of **Schedule Four**; and (b) the balance of the Snowy-Murray Development DISV Reserve Account. (7) **"Applied Snowy-Murray Development Forced Release Volume"** has the meaning given to that term in subclause -16.9(1) of Schedule Four. (8) "**Applied Snowy-Tumut Development DISV Reserve Account Volume**" means, with respect to each Month, the lesser of: (a) the volume by which (if any) the Dry Inflow Sequence Volume for the Snowy-Tumut Development calculated under clause 8 of Schedule Four exceeds the volume of the Dry Inflow Sequence Volume for the Snowy-Tumut Development calculated as at the commencement of March in the previous Water Year under clause 8 of Schedule Four; and

Section	Page Number	Proposed variation
		(b) the balance of the Snowy-Tumut Development DISV Reserve Account; (9) "**Applied Snowy-Tumut Development Forced Release Volume**" has the meaning given to that term in **subclause 16.9(2)** of **Schedule Four**.
New Section	1	After renumber section (11) "**Authorised Officer**"…… ***insert new section***: (12) "**Authority**" means the Murray-Darling Basin Authority as defined in the *Water Act 2007* (Cth).
(8) "**Base Passing Flow**"	1	***Renumber*** (8) "**Base Passing Flow**"…….. to (13) "**Base Passing Flow**"…….
(9) "**Baseline Conditions**"	1	***Renumber*** (9) "**Baseline Conditions**"…….. to (14) "**Baseline Conditions**"…….
(10) "**Blowering Air Space Deed**"	2	***Renumber*** (10) "**Blowering Air Space Deed**"…….. to (15) "**Blowering Air Space Deed**"…….
(11) "**Blowering Dam**"	2	***Renumber*** (11) "**Blowering Dam**"…….. to (16) "**Blowering Dam**"…….
(12) "**Business Day**"	2	***Renumber*** (12) "**Business Day**"…….. to (17) "**Business Day**"…….
(13) "**Claim**"	2	***Renumber*** (13) "**CLaim**"…….. to (18) "**Claim**"…….
(14) ""**Commissioner"**	2	***Delete whole section*** (14) "**Commissioner**" means the Murray-Darling Basin Commissioner as defined in the Murray-Darling Basin Act 1993 (Cth);
(15) "**Commonwealth**"	2	***Renumber*** (15) "**Commonwealth**"…….. to (19) "**Commonwealth**"…….
(16) "**Compensation Releases**"	2	***Renumber*** (16) "**Compensation Releases**"…….. to (20) "**Compensation Releases**"…….
(17) "**Compliance Report**"	2	***Renumber*** (17) "**Compliance Report**"…….. to (21) "**Compliance Report**"…….
(18) "**Corporation Date**"	2	***Renumber*** (18) "**Corporation Date**"…….. to (22) "**Corporation Date**"…….
(19) "**Cost**"	2	***Renumber*** (19) "**Cost**"…….. to (23) "**Cost**"…….
(20) "**Default Rate**"	2	***Renumber*** (20) "**Default Rate**"…….. to (24) "**Default Rate**"…….
(21) "**Development**"	2	***Renumber*** (21) "**Development**"…….. to (25) "**Development**"…….
(22) "**Dry Flow Sequence Volume**"	2	***Renumber*** (22) "**Dry Flow Sequence Volume**"…….. to (26) "**Dry Flow Sequence Volume**"…….
(23) "**Environmental Entitlements**"	3	***Renumber*** (23) "**Environmental Entitlements**"…….. to (27) "**Environmental Entitlements**"…….
(24) "**Eucumbene River**"	3	***Renumber*** (24) "**Eucumbene River**"…….. to (28) "**Eucumbene River**"…….
(25) "**First Draft Annual Water Operating Plan**"	3	***Renumber*** (25) "**First Draft Annual Water Operating Plan**"…….. to (29) "**First Draft Annual Water Operating Plan**"…….

Section	Page Number	Proposed variation
(26) "**GL**"	3	***Renumber*** (26) "**GL**"…….. to (30) "**GL**"…….
(27) "**Government Agency**"	3	***Renumber*** (27) "**Government Agency**"…….. to (31) "**Government Agency**"…….
(28) "**Governments**"	3	***Renumber*** (28) "**Governments**"…….. to (32) "**Governments**"…….
(29) "**GWH**"	3	***Renumber*** (29) "**GWH**"…….. to (33) "**GWH**"…….
(30) "**Increased Flow Requirements**"	3	***Renumber*** (30) "**Increased Flow Requirements**"…….. to (34) "**Increased Flow Requirements**"…….
(31) "**Increased Flows**"	3	***Renumber*** (31) "**Increased Flows**"…….. to (35) "**Increased Flows**"…….
New Section	3	After renumber section (35) "**Increased Flows**"…… ***insert new section***: (36) "**Initial River Murray Increased Flows Account**" has the meaning given to that term in Schedule F to the Murray-Darling Basin Agreement.
(32) "**Law**"	3	***Renumber*** (32) "**Law**"…….. to (37) "**Law**"…….
(33) "**Licensee**"	3	***Renumber*** (33) "**Licensee**"…….. to (38) "**Licensee**"…….
(34) "**Licensee's Obligations**"	3	***Renumber*** (34) "**Licensee's Obligations**"…….. to (39) "**Licensee's Obligations**"…….
(35) "**Lower Darling River System**"	3	***Renumber*** (35) "**Lower Darling River System**"…….. to (40) "**Lower Darling River System**"…….
(36) "**Ministerial Corporation**"	3	***Renumber*** (36) "**Ministerial Corporation**"…….. to (41) "**Ministerial Corporation**"…….
(37) "**Month**"	3	***Renumber*** (37) "**Month**"…….. to (42) "**Month**"…….
(38) "**Mowamba Borrowings Account**"	4	***Renumber*** (38) "**Mowamba Borrowings Account**"…….. to (43) "**Mowamba Borrowings Account**"…….
New Sections	4	After renumber section (43) "**Mowamba Borrowings Account**"…… ***insert new sections***: (44) "**Murray-Darling Basin Agreement**" means the Murray-Darling Basin Agreement in Schedule 1 to the Water Act 2007 (Cth); (45) "**Murrumbidgee River Drought Account**" means the water account to be maintained by the Licensee under subclause 16.1(2) of Schedule Four; (46) "**Murrumbidgee River Drought Account Agreed Transfer Volume**" has the meaning given to that term in subclause 16.7(1) of Schedule Four; (47) "**Murrumbidgee River Drought Account Nominated Transfer Volume**" has the meaning given to that term

Section	Page Number	Proposed variation
		in subclause 16.6(1) of Schedule Four;
(39) "**Murrumbidgee River System**"	4	***Renumber*** (39) "**Murrumbidgee River System**"…….. to (48) "**Murrumbidgee River System**"…….
New Sections	4	After renumber section (48) "**Murrumbidgee River System**"…… ***insert new sections***: (49) "**Murrumbidgee Water Sharing Plan**" means the Water Sharing Plan for the Murrumbidgee Regulated River Water Source as in force under section 50 of the Water Management Act 2000 (NSW); (50) "**Net Above Target Water**" means Above Target Water in each Development less: (a) in the case of the Snowy- Murray Development, the volume of water in the River Murray Drought Account; and (b) in the case of the Snowy- Tumut Development, the volume of water in the Murrumbidgee River Drought Account;
(40) "**Net Jounama Releases**"	4	***Renumber*** (40) "**Net Jounama Releases**"…….. to (51) "**Net Jounama Releases**"…….
(41) "**New South Wales**"	4	***Renumber*** (41) "**New South Wales**"…….. to (52) "**New South Wales**"…….
(42) "**Notice of Intention**"	4	***Renumber*** (42) "**Notice of Intention**"…….. to (53) "**Notice of Intention**"…….
(43) "**Pre-Release Compensation Account**"	4	***Renumber*** (43) "**Pre-Release Compensation Account**"…….. to (54) "**Pre-Release Compensation Account**"…….
(44) "**Prescribed Event**"	4	***Renumber*** (44) "**Prescribed Event**"…….. to (55) "**Prescribed Event**"…….
New Section	5	After renumber section (55) "**Prescribed Event**"…… ***insert new section***: (56) "**Recovery Amount**" means, for each Development with respect to each Month, the volume (if any) by which the Dry Inflow Sequence Volume for that Development calculated as at the commencement of that Month under **clause 8** of **Schedule Four** is less than the volume of the Dry Inflow Sequence Volume for that Development calculated as at the commencement of the Month immediately preceeding that Month under **clause 8** of **Schedule Four**;
(45) "**Relaxation Volume**"	5	***Renumber*** (45) "**Relaxation Volume**"…….. to (57) "**Relaxation Volume**"…….
(46) "**Required Annual Release**"	5	***Renumber*** (46) "**Required Annual Release**"…….. to (58) "**Required Annual Release**"…….
New Section	5	After renumber section (58) "**Required Annual Release**"…… ***insert new section***: (59) "**Required Annual Release Pre-Release Volume**" for each Development has the meaning given to that term in **subclause 13.4(1)** of **Schedule Four**;

Section	Page Number	Proposed variation
(47) "**River**"	5	***Renumber*** (47) "**River**"…….. to (60) "**River**"…….
(48) "**River Murray Annual Allocation**"	5	***Renumber*** (48) "**River Murray Annual Allocation**"…….. to (61) "**River Murray Annual Allocation**"…….
New Sections	5	After renumber section (61) "**River Murray Annual Allocation**"…… ***insert new sections***: (62) "**River Murray Drought Account**" means the water account to be maintained by the Licensee under **subclause 16.1(1)** of **Schedule Four**; (63) "**River Murray Drought Account Agreed Transfer Volume**" has the meaning given to that term in **subclause 16.4(1)** of **Schedule Four**; (64) "**River Murray Drought Account Nominated Transfer Volume**" has the meaning given to that term in **subclause 16.3(1)** of **Schedule Four**;
(49) "**River Murray System**"	5	***Renumber*** (49) "**River Murray System**"…….. to (65) "**River Murray System**"…….
(50) "**Second Draft Annual Water Operating Plan**"	5	***Renumber*** (50) "**Second Draft Annual Water Operating Plan**"…….. to (66) "**Second Draft Annual Water Operating Plan**"…….
(51) "**Security Interest**"	5	***Renumber*** (51) "**Security Interest**"…….. to (67) "**Security Interest**"…….
(52) "**Security Interest Holder**"	5	***Renumber*** (52) "**Security Interest Holder**"…….. to (68) "**Security Interest Holder**"…….
(53) "**Snowy Compensation Deed**"	5	***Renumber*** (53) "**Snowy Compensation Deed**"…….. to (69) "**Snowy Compensation Deed**"…….
(54) "**Snowy Montane Rivers**"	5	***Renumber*** (54) "**Snowy Montane Rivers**"…….. to (70) "**Snowy Montane Rivers**"…….
(55) "**Snowy Montane Rivers External Increased Flows**"	6	***Renumber*** (55) "**Snowy Montane Rivers External Increased Flows**"…….. to (71) "**Snowy Montane Rivers External Increased Flows**"…….
(56) "**Snowy Montane Rivers Increased Flows**"	6	***Renumber*** (56) "**Snowy Montane Rivers Increased Flows**"…….. to (72) "**Snowy Montane Rivers Increased Flows**"…….
(57) "**Snowy-Murray Development**"	6	***Renumber*** (57) "**Snowy-Murray Development**"…….. to (73) "**Snowy-Murray Development**"…….
(58) "**Snowy-Murray Development Annual Allocation**"	6	***Renumber*** (58) "**Snowy-Murray Development Annual Allocation**"…….. to (74) "**Snowy-Murray Development Annual Allocation**"…….
(59) "**Snowy-Murray Development Designated Entitlement**"	6	***Renumber*** (59) "**Snowy-Murray Development Designated Entitlement**"…….. to (75) "**Snowy-Murray Development Designated Entitlement**"…….
New Sections	6	After renumber section (75) "**Snowy-Murray Development Designated Entitlement**"…… ***insert new sections***:

Section	Page Number	Proposed variation
		(76) "**Snowy-Murray Development DISV Reserve Account**" means the water account to be maintained by the Licensee under **subclause 16.1(3)** of **Schedule Four**; (77) "**Snowy-Murray Development Downstream Wet Sequence Protection Volume**" has the meaning given to that term in **subclause 13.5(1)** of **Schedule Four**; (78) "**Snowy-Murray Development Forced Release**" has the meaning given to that term in **subclause 16.9(1)(b)(i)** of **Schedule Four**; (79) "**Snowy-Murray Development Net DISV Increase**" means, at the commencement of each Month, the volume equal to the greater of zero and: the volume of the Dry Inflow Sequence Volume for the Snowy-Murray Development calculated under **clause 8** of **Schedule Four** **MINUS:** the volume of the Dry Inflow Sequence Volume for the Snowy-Murray Development calculated as at the commencement of March in the previous Water Year under **clause 8** of **Schedule Four** **MINUS:** the Applied Snowy-Murray Development DISV Reserve Account Volume (80) "**Snowy-Murray Development Target Annual Release**" has the meaning given to that term in **subclause** 10.2(2) of **Schedule Four**;
(60) "**Snowy Notional Spill**"	6	***Renumber*** (60) "**Snowy Notional Spill**"…….. to (81) "**Snowy Notional Spill**"…….
(61) "**Snowy River**"	6	***Renumber*** (61) "**Snowy River**"…….. to (82) "**Snowy River**"…….
(62) "**Snowy River Annual Allocation**"	6	***Renumber*** (62) "**Snowy River Annual Allocation**"…….. to (83) "**Snowy River Annual Allocation**"…….
(63) "**Snowy River Apportioned Entitlement**"	6	***Renumber*** (63) "**Snowy River Apportioned Entitlement**"…….. to (84) "**Snowy River Apportioned Entitlement**"…….
(64) "**Snowy River Increased Flows**"	7	***Renumber*** (64) "**Snowy River Increased Flows**"…….. to (85) "**Snowy River Increased Flows**"…….
(65) "**Snowy Scheme**"	7	***Renumber*** (65) "**Snowy Scheme**"…….. to (86) "**Snowy Scheme**"…….
(66) "**Snowy-Tumut Development**"	7	***Renumber*** (66) "**Snowy-Tumut Development**"…….. to (87) "**Snowy-Tumut Development**"…….

Section	Page Number	Proposed variation
(67) "**Snowy-Tumut Development Annual Allocation**"	7	***Renumber*** (67) "**Snowy-Tumut Development Annual Allocation**"…….. to (88) "**Snowy-Tumut Development Annual Allocation**"…….
New Sections	7	After renumber section (88) "**Snowy-Tumut Development Annual Allocation**"…… ***insert new sections***: (89) "**Snowy-Tumut Development DISV Reserve Account**" means the water account to be maintained by the Licensee under **subclause 16.1(4)** of **Schedule Four**; (90) "**Snowy-Tumut Development Downstream Wet Sequence Protection Volume**" has the meaning given to that term in **subclause 13.6(1)** of **Schedule Four**;
(68) "**Snowy-Tumut Development Designated Entitlement**"	7	***Renumber*** (68) "**Snowy-Tumut Development Designated Entitlement**"…….. to (91) "**Snowy-Tumut Development Designated Entitlement**"…….
New Sections	7	After renumber section (91) "**Snowy-Tumut Development Designated Entitlement**"…… ***insert new sections***: (92) "**Snowy-Tumut Development Forced Release**" has the meaning given to that term in **subclause** 16.9(2)(b)(i) of **Schedule Four**; (93) "**Snowy-Tumut Development Net DISV Increase**" means, at the commencement of each Month, the volume equal to the greater of zero and: the volume of the Dry Inflow Sequence Volume for the Snowy-Tumut Development calculated under **clause 8** of **Schedule Four** **MINUS:** the volume of the Dry Inflow Sequence Volume for the Snowy-Tumut Development calculated as at the commencement of March in the previous Water Year under **clause 8** of **Schedule Four** **MINUS:** the Applied Snowy-Tumut Development DISV Reserve Account Volume (94) "**Snowy- Tumut Development Target Annual Release**" has the meaning given to that term in subclause 10.3(2) of Schedule Four;
(69) "**Snowy Water Catchment**"	7	***Renumber*** (69) "**Snowy Water Catchment**"…….. to (95) "**Snowy Water Catchment**"…….
(70) "**Snowy Water Inquiry Outcomes Implementation Deed**"	7	***Renumber*** (70) "**Snowy Water Inquiry Outcomes Implementation Deed**"…….. to (96) "**Snowy Water Inquiry Outcomes Implementation Deed**"…….

Section	Page Number	Proposed variation
(71) "**Table One**"	7	***Renumber*** (71) "**Table One**"…….. to (97) "**Table One**"…….
(72) "**Tooma River**"	7	***Renumber*** (72) "**Tooma River**"…….. to (98) "**Tooma River**"…….
(73) "**Unused Spill**"	7	***Renumber*** (73) "**Unused Spill**"…….. to (99) "**Unused Spill**"……. **AND** ***Delete all after*** "**Unused Spill**" means; and ***insert instead*** to following wording so renumbered (99) "**Unused Spill**" reads: (99) "**Unused Spill**" means: (a) **in the case of the Snowy-Murray Development**: either or both of: (i) a physical spill from Hume Dam; and (ii) a release made from Hume Dam to prevent it from exceeding full storage level under a return to expected minimum inflow conditions prior to an onset of water supply demands (consumptive or environmental) which would result in a storage drawdown; and (b) **in the case of the Snowy-Tumut Development**: either or both of: (i) a physical spill from Blowering Dam; and (ii) a release made from Blowering Dam to prevent it from exceeding full storage level under a return to expected minimum inflow conditions prior to an onset of water supply demands (consumptive or environmental) which would result in a storage drawdown, but does not include "pre-releases" as that term is defined in the Blowering Air Space Deed;
(74) "**Upper Murrumbidgee River**"	7	***Renumber*** (74) "**Upper Murrumbidgee River**"…….. to (100) "**Upper Murrumbidgee River**"…….
(75) "**Upper Snowy River**"	8	***Renumber*** (75) "**Upper Snowy River**"…….. to (101) "**Upper Snowy River**"…….
(76) "**Victoria**"	8	***Renumber*** (76) "**Victoria**"…….. to (102) "**Victoria**"…….
(77) "**Water Consultation and Liaison Committee**"	8	***Renumber*** (77) "**Water Consultation and Liaison Committee**"…….. to (103) "**Water Consultation and Liaison Committee**"…….
(78) "**Water Release Requirements**"	8	***Renumber*** (78) "**Water Release Requirements**"…….. to (104) "**Water Release Requirements**"…….
(79) "**Water Year**"	8	***Renumber*** (79) "**Water Year**"…….. to (105) "**Water Year**"…….
(80) "**Works**"	8	***Renumber*** (80) "**Works**"…….. to (106) "**Works**"…….

Section	Page Number	Proposed variation
8. ANNUAL WATER OPERATION PLANS		
8.7 Licensee to Submit Second Draft Annual Water Operating Plan to Ministerial Corporation	16	***Delete all after*** "……3 April each year" ***to read***: **8.7 Licensee to Submit Second Draft Annual Water Operating Plan to Ministerial Corporation** The Licensee must submit the Second Draft Annual Water Operating Plan to the Ministerial Corporation not later than 3 April each year.
10. REVIEWS OF LICENSEE'S OBLIGATIONS		
10.7 Variation of Schedule Two	23	In suclause 10.7(1)(b) ***delete*** "Murray Darling Basin Commission" and ***insert instead*** "Authority" to read: (b) where the Ministerial Corporation determines, in consultation with the Authority, that the proposed decommissioning or removal of the relevant dam by the Licensee could affect the Licensee's ability to comply with the Water Release Requirements, the Increased Flow Requirements or any other obligations under the Licence over the remaining term of this Licence then the Ministerial Corporation must notify the Licensee of that determination, and the Licensee must not decommission or remove the relevant dam without the prior written consent of the Ministerial Corporation; and
Schedule 4: WATER RELEASE REQUIREMENTS		
6. RELAXATION VOLUME: SNOWY-MURRAY DEVELOPMENT		
6.1 Relaxation Volume: Snowy-Murray Development	70	Within the definition for "**SR =**" ***insert after*** "……previous Month" the words "plus any Required Annual Release Pre-Release Volume released from the Snowy-Tumut Development under **clause 13.4** of this **Schedule Four** in the previous Water Year" to read: **SR =** Water Available to the Snowy-Murray Development released by the Snowy Scheme to the catchment of the River Murray upstream of Hume Dam from the commencement of the relevant Water Year until the end of the previous Month plus any Required Annual Release Pre-Release Volume released from the Snowy-Murray Development under **clause 13.4** of this **Schedule Four** in the previous Water Year
7. RELAXATION VOLUME: SNOWY-TUMUT DEVELOPMENT		
7.1 Relaxation Volume: Snowy-Tumut Development	71	Within the definition for "**SR =**" ***insert after*** "……previous Month" the words "plus any Required Annual Release Pre-Release Volume released from the Snowy-Murray Development under **clause 13.4** of this **Schedule Four** in the previous Water Year" to read:

Section	Page Number	Proposed variation
		SR = Water Available to the Snowy-Tumut Development released by the Snowy Scheme to either or both of the catchment of the Tumut River and Murrumbidgee River from the commencement of the relevant Water Year until the end of the previous Month plus any Required Annual Release Pre-Release Volume released from the Snowy-Tumut Development under **clause 13.4** of this **Schedule Four** in the previous Water Year
8. DRY INFLOW SEQUENCE VOUME		
8.1 Dry Inflow Sequence Volume	73	Within the definition for "**PEATmax =**" ***insert before all occurences of*** "….Above Target Water" the word "net" to read: **PEATmax =** The component of PEmax attributable to the Net Above Target Water stored in the relevant Development from the current month to the end of the Water Year. Losses attributed to PEATmax are to be calculated by reference to the ratio of Net Above Target Water in the relevant Development to the total gross storage in the relevant Development.
10. RELEASES THAT MAY BE CALLED OUT IN THE SUBSEQUENT WATER YEAR		
10. RELEASES THAT MAY BE CALLED OUT IN THE SUBSEQUENT WATER YEAR	75	***Delete*** "IN THE SUBSEQUENT WATER YEAR" and ***insert instead*** "BY THE MINISTERIAL CORPORATION" to read: **10. RELEASES THAT MAY BE CALLED OUT BY THE MINISTERIAL CORPORATION**
New Section	76	After clause "**10.1 Ministerial Corporation May Call Out in Subsequent Water Year" *insert*** **10.2 Ministerial Corporation May Call Out River Murray Drought Release** (1) This **clause 10.2** of **Schedule Four** applies despite any other provision in or under this Licence. (2) If, as at 1 October in a Water Year: (a) the Authority determines (acting reasonably) that River Murray system inflows are insufficient to enable the delivery of critical human water needs; and (b) the River Murray Drought Account is in credit, the Ministerial Corporation may by notice in writing to the Licensee given not later than 5 October in that Water Year, specify a release volume for the Snowy-Murray Development for that Water

Section	Page Number	Proposed variation
		Year ("**Snowy-Murray Development Target Annual Release**"). (3) The Snowy-Murray Development Target Annual Release must be greater than the Required Annual Release for the Snowy-Murray Development calculated as at the date of the giving of notice by the Ministerial Corporation. (4) If a notice is given by the Ministerial Corporation under **subclause 10.2(2)** of this **Schedule Four**, the Licensee must release from the Snowy-Murray Development in that Water Year: (a) if the Required Annual Release for the Snowy-Murray Development calculated as at the end of that Water Year exceeds the Snowy-Murray Development Target Annual Release: the Required Annual Release; or (b) if the Required Annual Release for the Snowy-Murray Development calculated as at the end of that Water Year is less than the Snowy-Murray Development Target Annual Release: the lesser of: (i) the Required Annual Release for the Snowy-Murray Development calculated as at the end of that Water Year plus the balance of the River Murray Drought Account; and (ii) the Snowy-Murray Development Target Annual Release. (5) The difference (if any) between the volume released under **subclause 10.2(4)(b)** and the Required Annual Release for the Snowy-Murray Development (a "**River Murray Drought Release**") must be debited from the River Murray Drought Account. (6) For the avoidance of doubt, the Ministerial Corporation may only issue one notice under **subclause 10.2(1)** in each Water Year. **10.3 Ministerial Corporation May Call Out Murrumbidgee River Drought Release** (1) This **clause 10.3** of **Schedule Four** applies despite any other provision in or under this Licence. (2) If, as at 1 October in a Water Year: (a) annual allocations attaching to regulated river (high security) access licences under the Murrumbidgee Water Sharing Plan are less than 50%; and (b) the Murrumbidgee River Drought Account is in credit, the Ministerial Corporation may by notice in writing to the Licensee given not later than 5 October in that Water Year, specify a release volume for the Snowy-Tumut Development for that Water Year ("**Snowy-Tumut Development Target Annual Release**"). (3) The Snowy-Tumut Development Target Annual Release must be greater than the Required

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		Annual Release for the Snowy-Tumut Development calculated as at the date of the giving of notice by the Ministerial Corporation. (4) If a notice is given by the Ministerial Corporation under **subclause 10.3(2)** of this **Schedule Four**, the Licensee must release from the Snowy-Tumut Development in that Water Year: (a) if the Required Annual Release for the Snowy-Tumut Development calculated as at the end of that Water Year exceeds the Snowy-Tumut Development Target Annual Release: the Required Annual Release; or (b) if the Required Annual Release for the Snowy-Tumut Development calculated as at the end of that Water Year is less than the Snowy-Tumut Development Target Annual Release: the lesser of: (i) the Required Annual Release for the Snowy-Tumut Development calculated as at the end of that Water Year plus the balance of the Murrumbidgee River Drought Account; and (ii) the Snowy-Tumut Development Target Annual Release. (5) The difference (if any) between the volume released under **subclause 10.3(4)(b)** and the Required Annual Release for the Snowy-Tumut Development (a "**Murrumbidgee River Drought Release**") must be debited from the Murrumbidgee River Drought Account. (6) For the avoidance of doubt, the Ministerial Corporation may only issue one notice under **subclause 10.3(1)** in each Water Year. **10.4 Ministerial Corporation May Call Out River Murray Increased Flows** (1) If, during a Water Year: (a) the volume of Net Above Target Water in Snowy Scheme storages exceeds 800 GL; and (b) the Initial River Murray Increased Flows Account is in credit, the Ministerial Corporation may by notice in writing to the Licensee given not later than 5 October in that Water Year, require the Licensee to release from the Snowy-Murray Development in that Water Year a volume of Above Target Water that, as at the time the notice is issued, is equal to the lesser of: (c) the balance of the Initial River Murray Increased Flows Account; and (d) the volume that, if released under this **clause 10.4**, would reduce the volume of Net Above Target Water in Snowy Scheme storages to 800 GL. (2) For the avoidance of doubt, the Ministerial Corporation may only issue one notice under

Section	Page Number	Proposed variation
		subclause 10.4(1) in each Water Year.
12. REQUIRED ANNUAL RELEASES FROM EACH DEVELOPMENT		
12.1 Required Annual Release for the Snowy-Murray Development	76	***Delete***: **PLUS:** **Carry Overs**: the volume of the Dry Inflow Sequence Volume for the Snowy-Murray Development as at the commencement of March in the previous Water Year under **clause 8** of this **Schedule Four** ***Insert***: **PLUS:** The volume (if any) of the Snowy-Murray Development Downstream Wet Sequence Protection Volume for that Water Year **MINUS:** The River Murray Drought Account Agreed Transfer Volume **MINUS:** The River Murray Drought Account Nominated Transfer Volume ***Reword***: **MINUS:** The Dry Inflow Sequence Volume calculated as at the commencement of March in that Water Year under **clause 8** of this **Schedule Four** ***To Read*** **MINUS:** The Snowy-Murray Development Net DISV Increase calculated as at the commencement of March in that Water Year ***Reword***: MINUS: Any excess of the volume of water actually released in the previous Water Year and the Required Annual Release from the Snowy-Murray Development as at the end of the previous Water Year, up to a volume equal to the Dry Inflow Sequence Volume for the Snowy-Murray Development as at the commencement of March in the previous Water Year ***To Read*** **MINUS:** The volume of any Required Annual Release Pre-Release Volume released

Section	Page Number	Proposed variation
		from the Snowy-Murray Development in the previous Water Year. Such that after "….water calculated as follows:" reads: 1,062 GL **PLUS:** **Inter-Valley Transfers**: the volume (if any) of transfers from the Snowy-Tumut Development during that Water Year under **clause 9** of this **Schedule Four** **PLUS:** **Within-Year Releases**: the volume (if any) of releases, in addition to any other releases referred to in this **clause 12.1**, that are required to ensure that the Licensee complies with the within-year release requirements set out in **clause 11** of this **Schedule Four** **PLUS:** **Call Outs**: the volume (if any) calculated under **subclause 10.1(1)** of this **Schedule Four** **PLUS:** Any shortfall between the volume of water actually released in the previous Water Year and the Required Annual Release from the Snowy-Murray Development as at the end of the previous Water Year **PLUS:** The volume (if any) of the Snowy-Murray Development Downstream Wet Sequence Protection Volume for that Water Year **MINUS:** **Inter-Valley Transfers**: the volume (if any) of transfers to the Snowy-Tumut Development during that Water Year under **clause 9** of this **Schedule Four** **MINUS**: The Snowy-Murray Development Annual Allocation **MINUS:** The River Murray Drought Account Agreed Transfer Volume **MINUS:** The River Murray Drought Account Nominated Transfer Volume **MINUS:** The maximum Relaxation Volume calculated during that Water Year under **clause 6** of this **Schedule Four** **MINUS:** The Snowy-Murray Development Net DISV Increase calculated as at the commencement of March in that Water Year **MINUS**: The volume of any Required Annual Release Pre-Release Volume released from the Snowy-

Section	Page Number	Proposed variation
		Murray Development in the previous Water Year.
12.2 Required Annual Release for the Snowy-Tumut Development	78	***Delete***: **PLUS:** **Carry Overs**: the volume of the Dry Inflow Sequence Volume for the Snowy-Tumut Development as at the commencement of March in the previous Water Year under **clause 8** of this **Schedule Four** ***Insert***: **PLUS:** The volume (if any) of the Snowy-Tumut Development Downstream Wet Sequence Protection Volume for that Water Year **MINUS:** The Murrumbidgee River Drought Account Agreed Transfer Volume **MINUS:** The Murrumbidgee River Drought Account Nominated Transfer Volume ***Reword***: **MINUS:** The Dry Inflow Sequence Volume calculated as at the commencement of March in that Water Year under **clause 8** of this **Schedule Four** ***To Read*** **MINUS:** The Snowy-Tumut Development Net DISV Increase calculated as at the commencement of March in that Water Year ***Reword***: MINUS: Any excess of the the volume of water actually released in the previous Water Year and the Required Annual Release from the Snowy-Tumut Development as at the end of the previous Water Year, up to a volume equal to the Dry Inflow Sequence Volume for the Snowy-Tumut Development as at the commencement of March in the previous Water Year ***To Read*** **MINUS:** the volume of any Required Annual Release Pre-Release Volume released from the Snowy-Tumut Development in the previous Water Year

Section	Page Number	Proposed variation
		Such that after "….water calculated as follows:" reads: 1,026 GL **PLUS:** **Inter-Valley Transfers**: the volume (if any) of transfers from the Snowy-Murray Development during that Water Year under **clause 9** of this **Schedule Four** **PLUS:** **Within-Year Releases**: the volume (if any) of releases, in addition to any other releases referred to in this **clause 12.2**, that are required to ensure that the Licensee complies with the within-year release requirements set out in **clause 11** of this **Schedule Four** **PLUS:** **Call Outs**: the volume (if any) calculated under **subclause 10.1(2)** of this **Schedule Four** **PLUS**: any shortfall between the volume of water actually released in the previous Water Year and the Required Annual Release from the Snowy-Tumut Development as at the end of the previous Water Year **PLUS:** Any Compensation Releases called out during that Water Year **PLUS:** The volume (if any) of the Snowy-Tumut Development Downstream Wet Sequence Protection Volume for that Water Year **MINUS:** **Inter-Valley** Transfers: the volume (if any) of transfers to the Snowy-Murray Development during that Water Year under **clause 9** of this **Schedule Four** **MINUS:** The Snowy-Tumut Development Annual Allocation **MINUS:** The Murrumbidgee River Drought Account Agreed Transfer Volume **MINUS:** The Murrumbidgee River Drought Account Nominated Transfer Volume **MINUS:** The maximum Relaxation Volume calculated during that Water Year under **clause 7** of this **Schedule Four** **MINUS:** The Snowy-Tumut Development Net DISV Increase calculated as at the commencement of March in that Water Year **MINUS:** the volume of any Required Annual Release Pre-Release Volume released from the Snowy-

Section	Page Number	Proposed variation
		Tumut Development in the previous Water Year
12.3 No Obligation to Release More than Required Annual Release for Each Development	79	In suclause 12.3(2) ***delete*** "12.1" and ***insert instead*** "12.2" to read: (2) to release from the Snowy-Tumut Development each Water Year a volume of water that is more than the volume calculated under **clause 12.2** of this **Schedule Four**,
13. FLEXIBILITY PROVISIONS		
13. FLEXIBILITY PROVISIONS	79	***Insert*** "**AND PRE-RELEASE**" after "FLEXIBILITY" to read: **13 FLEXIBILITY AND PRE-RELEASE PROVISIONS**
13.1 Reduction of Required Annual Release	79	***Renumber*** **13.1 Reduction of Required Annual Release**…….. to **13.2 Reduction of Required Annual Release** **AND** ***Delete*** "Despite any other provision in or under this Licence" to read: **13.2 Reduction of Required Annual Release** (1) In any Water Year the Ministerial Corporation and the Licensee may agree on any terms to an agreed release that is less than the Required Annual Release for either or both of the Developments. (2) Where a reduction in the Required Annual Release is agreed between the Ministerial Corporation and the Licensee, the Licensee is required under this Licence to release from the relevant Development in that Water Year only the Agreed Annual Release.
New Section	79	Before renumbered clause "**13.2 Reduction of Required Annual Release" *insert*** **13.1 This Clause to Apply Despite Any Other Provision of this Licence** This **clause 13** of **Schedule Four** applies despite any other provision in or under this Licence.
13.2 Consideration of Proposals by Water Consultation and Liaison Committee	80	***Renumber*** **13.2 Consideration of Proposals by Water Consultation and Liaison Committee** .. to **13.3 Consideration of Proposals by Water Consultation and Liaison Committee** **AND** ***Delete*** reference to "clause 13.1" and ***insert instead*** "clause 13.2" to read: **13.3 Consideration of Proposals by Water Consultation and Liaison Committee** The Ministerial Corporation must give the Water Consultation and Liaison Committee a reasonable opportunity to consider each proposal to reduce the Required Annual Release for a Development under **clause 13.2** of this **Schedule Four**.

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New Sections	80	After renumbered clause "**13.3 Consideration of Proposals by Water Consultation and Liaison Committee" *insert***

13.4 Required Annual Release Pre-Release Volumes

(1) During each Water Year the Licensee may release from each Development a volume of water in excess of the Required Annual Release for the relevant Development (as at the end of that Water Year) that is accounted as a pre-release of the Required Annual Release for the relevant Development for the subsequent Water Year and not as a release of Above Target Water ("**Required Annual Release Pre-Release Volume**").

(2) The maximum volume of the Required Annual Release Pre-Release Volume that may be released by the Licensee with respect to a Development for a Water Year ("Water Year X") is calculated as the sum of:

(a) DISV March(x); plus

(b) the Recovery Amount; plus

(c) if the sum of (a) and (b) is less than 200 GL, the difference between the sum of (a) and (b) and 200 GL, otherwise nil,

Where $DISV_{March(x)}$ = the Dry Inflow Sequence Volume as at 1 March for **Water Year X** for that Development.

13.5 Downstream Wet Sequence Protection Volume: Snowy-Murray Development

(1) If:

(a) during a Water Year ("**Water Year 1**") a Required Annual Release Pre-Release Volume is released from the Snowy-Murray Development that includes a volume under **subclause 13.4(2)(c)** ("**Snowy-Murray Development Relevant Volume**"); and

(b) during the subsequent Water Year ("**Water Year 2**") an Unused Spill occurs from Hume Dam,

the Licensee must calculate and record the "**Snowy-Murray Development Downstream Wet Sequence Protection Volume**", being the lesser of:

(c) the Snowy-Murray Development Relevant Volume;

(d) the volume of the Unused Spill; and

(e) the volume (if any) by which, at the time of the Unused Spill, the sum of the Required Annual Release Pre- Release Volume in Water Year 1 and the actual progressive releases from the Snowy-Murray Development since the commencement of Water Year

Section	Page Number	Proposed variation
		2 exceed pro-rated progressive releases from the Snowy-Murray Development since the commencement of Water Year 2 calculated as if no Required Annual Release Pre-Release Volume was released from the Snowy-Murray Development in Water Year 1. **13.6 Downstream Wet Sequence Protection Volume: Snowy-Tumut Development** (1) If: (a) during a Water Year ("**Water Year 1**") a Required Annual Release Pre-Release Volume is released from the Snowy-Tumut Development that includes a volume under **subclause 13.4(2)(c)** ("**Snowy-Tumut Development Relevant Volume**"); and (b) during the subsequent Water Year ("**Water Year 2**") an Unused Spill occurs from Blowering Dam, the Licensee must calculate and record the "**Snowy-Tumut Development Downstream Wet Sequence Protection Volume**", being the lesser of: (c) the Snowy-Tumut Development Relevant Volume; (d) the volume of the Unused Spill and (e) the volume (if any) by which, at the time of the Unused Spill, the sum of the Required Annual Release Pre- Release Volume in Water Year 1 and the actual progressive releases from the Snowy-Tumut Development since the commencement of Water Year 2 exceed pro-rated progressive releases from the Snowy-Tumut Development since the commencement of Water Year 2 calculated as if no Required Annual Release Pre-Release Volume was released from the Snowy-Tumut Development in Water Year 1.
15. DEVELOPING ANALYTICAL MODELS		
15.2 Ministerial Corporation to Procure Commission to Develop Analytical Model	83	***Delete*** "**Commission**" and ***insert instead*** "**Authority**" to read: **15.2 Ministerial Corporation to Procure Authority to Develop Analytical Model** The Ministerial Corporation must procure that the Authority develops an analytical model for determining, in the case of the River Murray System: (1) storage volumes; and (2) total diversions, that would have occurred under Baseline Conditions.
15.3 Requirements for Analytical Models	83	***Delete*** "**Commission**" and ***insert instead*** "**Authority**" to read:

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		15.3 Requirements for Analytical Models An analytical model developed by the Ministerial Corporation or the Authority under this **clause 15** of **Schedule Four**: (1) must be the best model available to the Ministerial Corporation or the Authority from time to time, for the purpose of calculating the timing and quantity of the Relaxation Volume under Baseline Conditions; and (2) must be tested against relevant historical data to determine the accuracy of the model.
15.5 Ministerial Corporation to Procure Evaluation of Commission Model	83	***Delete*** "**Commission**" and ***insert instead*** "**Authority**" to read: **15.5 Ministerial Corporation to Procure Evaluation of Authority Model** The Ministerial Corporation must, at the request and at the Cost of the Licensee, procure the engagement of independent auditors to evaluate the accuracy and appropriateness of the model developed under this **clause 15** of this **Schedule Four** by the Authority for the purpose referred to in **clause 15.3** of this **Schedule Four**.
New Section	83	After clause "**15.5 Ministerial Corporation to Procure Evaluation of Authority Model**" ***insert*** **16. LICENSEE TO MAINTAIN WATER ACCOUNTS** **16.1 Water Accounts** The Licensee must maintain the following continuous and audited water accounts: (1) **River Murray Drought**. This account must specify: (a) as a credit: (i) the volume of any water calculated as a Recovery Amount for the Snowy-Murray Development, provided that the credit balance of the River Murray Drought Account cannot at any time exceed 225 GL; (ii) the volume of water, if any, transferred from the Snowy- Murray Development DISV Reserve Account under **clause 16.2** of this **Schedule Four**; (iii) the volume of water, if any, transferred from the Snowy-Murray Development Required Annual Release under either or both of **clauses 16.3** and **16.4** of this **Schedule Four**; and (b) as a debit:

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		(i) the volume of any River Murray Drought Releases; and (ii) the volume of any Applied Snowy-Murray Development Forced Release Volumes. (2) **Murrumbidgee River Drought**. This account must specify: (a) as a credit: (i) the volume of any water calculated as a Recovery Amount for the Snowy-Tumut Development, provided that the credit balance of the Murrumbidgee River Drought Account cannot at any time exceed 150 GL; (ii) the volume of any water transferred from the Snowy- Tumut Development DISV Reserve Account under **clause** 16.5 of this **Schedule Four**; (iii) the volume of water, if any, transferred from the Snowy-Tumut Development Required Annual Release under either or both of **clauses 16.6** and **16.7** of this Schedule Four; and (b) as a debit: (i) the volume of any Murrumbidgee River Drought Releases; and (ii) the volume of any Applied Snowy-Tumut Development Forced Release Volumes. (3) **Snowy-Murray Development DISV Reserve**. Subject to **clause 16.8** of this **Schedule Four**, this account must specify: (a) as a credit, the volume of any water calculated as a Recovery Amount for the Snowy-Murray Development that is not credited to the River Murray Drought Account; and (b) as a debit: (i) the volume, if any, of the Applied Snowy-Murray Development DISV Reserve Account Volume for any Month; and (ii) the volume of water, if any, transferred to the River Murray Drought Account under **clause 16.2** of this **Schedule Four**. (4) **Snowy-Tumut Development DISV Reserve**. Subject to **clause 16.8** of this **Schedule Four**, this account must specify: (a) as a credit, the volume of any water calculated as a Recovery Amount for the Snowy-Tumut Development that is not credited to the Murrumbidgee River Drought Account; and (b) as a debit:

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		(i) the volume, if any, of the Applied Snowy-Tumut Development DISV Reserve Account Volume for any Month; and (ii) the volume of water, if any, transferred to the Murrumbidgee River Drought Account under **clause** 16.5 of this **Schedule Four**. **16.2 Transfers From The Snowy-Murray Development DISV Reserve Account to the River Murray Drought Account** If at any time: (1) the balance of the River Murray Drought Account is less than 225 GL; and, (2) the Snowy-Murray Development DISV Reserve Account is in credit, the Licensee must both debit the Snowy-Murray Development DISV Reserve Account and credit the River Murray Drought Account by the volume equal to the lesser of: (3) the balance of the Snowy-Murray Development DISV Reserve Account; and (4) the volume by which the balance of the River Murray Drought Account is less than 225 GL, provided that no such transfer from the Snowy-Murray Development DISV Reserve Account to the River Murray Drought Account is to be made in circumstances where the water transferred would then be immediately debited from the River Murray Drought Account as a result of a Snowy-Murray Development Forced Release. **16.3 Transfers From The Snowy-Murray Development Required Annual Release to the River Murray Drought Account Following One or More Snowy-Murray Development Forced Releases** (1) If at any time the balance of the River Murray Drought Account is less than 225GL as a result of one or more Snowy-Murray Development Forced Releases the Ministerial Corporation may, by giving notice to the Licensee not later than 13th February in any Water Year, specify a volume to be transferred to the River Murray Drought Account ("**River Murray Drought Account Nominated Transfer Volume**"). (2) Each River Murray Drought Account Nominated Transfer Volume must not be greater than: (a) 100GL; and (b) the applicable Snowy-Murray Development Forced Releases, whichever is the lesser volume. (3) At the beginning of the Water Year following a River Murray Drought Account Nominated Transfer Volume being notified by the Ministerial Corporation under **subclause 16.3(1)**, the Licensee must transfer the River Murray Drought Account Nominated Transfer Volume to Above Target Water in

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		Snowy Scheme storages by: (a) crediting the River Murray Drought Account by the River Murray Drought Account Nominated Transfer Volume; and (b) reducing the Required Annual Release for the Snowy-Murray Development for that Water Year by the River Murray Drought Account Nominated Transfer Volume. **16.4 Transfers From The Snowy-Murray Development Required Annual Release to the River Murray Drought Account Generally** (1) If at any time: (a) there is a nil balance in the Snowy-Murray Development DISV Reserve Account; and (b) the balance of River Murray Drought Account is less than 225 GL, the parties may agree to transfer a further volume into the River Murray Drought Account ("**River Murray Drought Account Agreed Transfer Volume**"). (2) Each River Murray Drought Account Agreed Transfer Volume must not be greater than the volume by which the balance of the River Murray Drought Account is less than 225 GL. (3) A River Murray Drought Account Agreed Transfer Volume is to be achieved by the Licensee transferring the River Murray Drought Account Agreed Transfer Volume to Above Target Water in Snowy Scheme storages by: (a) crediting the River Murray Drought Account by the River Murray Drought Account Agreed Transfer Volume; and (b) reducing the Required Annual Release for the Snowy-Murray Development for that Water Year by the River Murray Drought Account Agreed Transfer Volume. (4) For the avoidance of doubt this **clause 16.4** of **Schedule Four**: (a) operates in addition to; and (b) does not depend on, preclude, or act as a pre-condition to any transfer under, **clause 16.3** of **Schedule Four**. **16.5 Transfers From the Snowy-Tumut Development DISV Reserve Account to the Murrumbidgee River Drought Account** If at any time: (1) the balance of the Murrumbidgee River Drought Account is less than 150 GL; and

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		(2) the Snowy-Tumut Development DISV Reserve Account is in credit, the Licensee must both debit the Snowy-Tumut Development DISV Reserve Account and credit the Murrumbidgee River Drought Account by the volume equal to the lesser of: (3) the balance of the Snowy-Tumut Development DISV Reserve Account; and (4) the volume by which the balance of the Murrumbidgee River Drought Account is less than 150 GL, provided that no such transfer from the Snowy-Tumut Development DISV Reserve Account to the Murrumbidgee River Drought Account is to be made in circumstances where the water transferred would then be immediately debited from the Murrumbidgee River Drought Account as a result of a Snowy-Tumut Development Forced Release. **16.6 Transfers From The Snowy-Tumut Development Required Annual Release to the Murrumbidgee River Drought Account Following One or More Snowy-Tumut Development Forced Releases** (1) If at any time the balance of the Murrumbidgee River Drought Account is less than 150GL as a result of one or more Snowy-Tumut Development Forced Releases the Ministerial Corporation may, by giving notice to the Licensee not later than 13th February in any Water Year, specify a volume to be transferred to the Murrumbidgee River Drought Account ("**Murrumbidgee River Drought Account Nominated Transfer Volume**"). (2) Each Murrumbidgee River Drought Account Nominated Transfer Volume must not be greater than: (a) 100GL; and (b) the applicable Snowy-Tumut Development Forced Releases, whichever is the lesser volume. (3) At the beginning of the Water Year following a Murrumbidgee River Drought Account Nominated Transfer Volume being notified by the Ministerial Corporation under **subclause 16.6(1)**, the Licensee must transfer the Murrumbidgee River Drought Account Nominated Transfer Volume to Above Target Water in Snowy Scheme storages by: (a) crediting the Murrumbidgee River Drought Account by the Murrumbidgee River Drought Account Nominated Transfer Volume; and (b) reducing the Required Annual Release for the Snowy-Tumut Development for that Water Year by the Murrumbidgee River Drought Account Nominated Transfer Volume. **16.7 Transfers From The Snowy-Tumut Development Required Annual Release to the Murrumbidgee River Drought Account Generally**

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		(1) If at any time: (a) there is a nil balance in the Snowy-Tumut Development DISV Reserve Account; and (b) the balance of Murrumbidgee River Drought Account is less than 150GL, the parties may agree to transfer a further volume into the Murrumbidgee River Drought Account ("**Murrumbidgee River Drought Account Agreed Transfer Volume**"). (2) Each Murrumbidgee River Drought Account Agreed Transfer Volume must not be greater than the volume by which the balance of the Murrumbidgee River Drought Account is less than 150GL. (3) A Murrumbidgee River Drought Account Agreed Transfer Volume is to be achieved by the Licensee transferring the Murrumbidgee River Drought Account Agreed Transfer Volume to Above Target Water in Snowy Scheme storages by: (a) crediting the Murrumbidgee River Drought Account by the Murrumbidgee River Drought Account Agreed Transfer Volume; and (b) reducing the Required Annual Release for the Snowy-Tumut Development for that Water Year by the Murrumbidgee River Drought Account Agreed Transfer Volume. (4) For the avoidance of doubt this **clause 16.7** of **Schedule Four**: (a) operates in addition to; and (b) does not depend on, preclude, or act as a pre-condition to any transfer under, clause **16.6** of **Schedule Four**. **16.8 Accounting Transactions When Storages Fall Below Target Storage: Snowy-Murray Development DISV Reserve Account and Snowy-Tumut Development DISV Reserve Account** (1) Despite any other clause in this **clause 16** of **Schedule Four**: (a) each time that the storage in the Snowy-Murray Development less the Above Target Water in the Snowy-Murray Development increases from being below the relevant target storage set out in **clause 8.1** of this **Schedule Four** to being at or above that target storage, the balance of the Snowy-Murray Development DISV Reserve Account is deemed to be zero; and (b) each time that the storage in the Snowy-Tumut Development less the Above Target Water in the Snowy-Tumut Development increases from being below the relevant target storage set out in **clause 8.1** of this **Schedule Four** to being at or above that target storage, the balance of the Snowy-Tumut Development DISV Reserve Account is

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		deemed to be zero. (2) For the avoidance of doubt, nothing in this **clause** 16.8 of **Schedule Four** has the effect of transferring water that was in the Snowy-Murray Development DISV Reserve Account or in the Snowy-Tumut DISV Reserve Account into Above Target Water. **16.9 River Murray Drought Account and Murrumbidgee River Drought Account: Forced Releases From the Snowy Scheme** (1) If, during a Water Year: (a) There is a balance in the River Murray Drought Account; and (b) both: (i) the Licensee deems it necessary (acting reasonably) to make a release from the Snowy-Murray Development to avoid a physical spill from either or both of Eucumbene Dam and Jindabyne Dam ("**Snowy-Murray Development Forced Release**"); and (ii) as at the end of that Water Year, the Licensee is accounted as having released Above Target Water from the Snowy-Murray Development, the River Murray Drought Account must be debited by the lesser of: (c) The balance in the River Murray Drought Account; and (d) the volume of the Snowy-Murray Development Forced Release, (each volume so debited an "**Applied Snowy-Murray Development Forced Release Volume**"). (2) If, during a Water Year: (a) There is a balance in the Murrumbidgee River Drought Account; and (b) both: (i) the Licensee deems it necessary (acting reasonably) to make a release from the Snowy-Tumut Development to avoid a physical spill from either or both of Eucumbene Dam and Tantangara Dam ("**Snowy-Tumut Development Forced Release**"); and (ii) as at the end of that Water Year, the Licensee is accounted as having released Above Target Water from the Snowy-Tumut Development, the Murrumbidgee River Drought Account must be debited by the lesser of: (c) The balance in the Murrumbidgee River Drought Account; and

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		(d) the volume of the Snowy-Tumut Development Forced Release, (each volume so debited an "**Applied Snowy-Tumut Development Forced Release Volume**").

Australian Government

MURRAY–DARLING BASIN AUTHORITY

2013 Strategy for River Murray Increased Flow Rules

Final Draft

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1. Purpose

This document forms the 2013 Strategy for River Murray Increased Flows (2013 Strategy).

The Water Act (2007) requires the Murray-Darling Basin Authority's Ministerial Council to make River Murray Increased Flows in accordance with the Strategy for River Murray Increased Flow.

Clause 20 (3) of Schedule F to the Murray-Darling Basin Agreement (Agreement) provides for the Ministerial Council to amend the Strategy for River Murray Increased Flows (RMIF) by resolution provided that the amended strategy meets the listed conditions and environmental objectives.

2 Overview

RMIF is water recovered under investment in the Snowy Joint Government Enterprise (Water for Rivers) and is managed under The Living Murray (TLM) framework once released from the Snowy Scheme.

Under the Snowy Water Inquiry Outcomes Implementation Deed (SWIOID), New South Wales, Victoria and the Commonwealth Governments committed to providing up to 70 GL each year for environmental purposes for the River Murray. This water has been realised through the funding of efficiency measures and water purchases.

The water savings generated in one year are transferred to the Snowy Scheme by reducing the volume of water that Snowy Hydro Limited (SHL) is required to release in the subsequent year. The Murray component of accrued RMIF is initially held in SHL's above target water (ATW) resources with an account of the volume held maintained by the Authority.

As of May 2013 the Strategy for RMIF is The Living Murray Annual Watering Plan 2006/2007, particularly the Interim Rules for RMIF (at Appendix D). As of May 2013 a total of 368 GL has been sourced for RMIF, 38 GL of RMIF has been released from the Snowy Scheme to the Murray and 330 GL is held in SHL storages.

The October 2011 amendments to the Snowy Water Licence (SWL) allow RMIF to be called from the Snowy Scheme to the extent that SHL maintains at least 800 GL of net ATW in the Scheme. Allowing RMIF to be called from the Scheme changes what was a very low value water product to a more secure, reliable source of water for the environment, to the extent that net ATW exceeds 800 GL..

The 2011 changes to the SWL fundamentally changed the nature of RMIF and requires the Strategy for RMIF to be amended, as provided for in Schedule F of the Agreement. Amendments to the Strategy are also necessary to implement current practices in the management of environmental water and to allow for the efficient use of the RMIF allowance.

The 2013 Strategy for RMIF follows the principles of the previous Strategy. Additional elements include the requirement that storage and use of RMIF on the Murray be conducted through State entitlements under the control of TLM managers and that States have the option to credit those entitlements through substitution of existing resources on the Murray.

The substitution approach is particularly significant. A Strategy amended only for consistency with the SWL would allow RMIF Managers to direct that a release be made from the Snowy to give access

to RMIF on the Murray. A direct credit approach does not recognise inter-dependencies of water users and could introduce undesirable third party impacts.

The 2013 Strategy separates the crediting of State RMIF entitlements from the call of designated RMIF resources held within the Snowy Scheme. When RMIF is credited to State entitlements the option to call water from Snowy is transferred from RMIF (environmental) interests to the Water Resource managers of the State that credited the RMIF account.

The substitution approach provides potential benefits to all parties by allowing increased flexibility to RMIF Managers (for example through delaying dates by which decisions must be made) and providing the States with opportunity to build "callable" reserves in the Snowy Scheme.

The approach taken in this Strategy can be summarised as:

- RMIF is to be held in State accounts and entitlements on the Murray.
- RMIF has first refusal on releases of ATW made at the discretion of SHL. This does not include volumes (other than RMIF) called from SHL's ATW resources in accordance with the call out provisions of the SWL.
- The crediting of RMIF entitlements on the Murray is separated from the call of RMIF from the Snowy Scheme.
- States are obliged to credit RMIF entitlements in response to a request received between May and early September.
- Credit to State RMIF entitlements is accompanied by transfer of the ability to call water out of the Snowy Scheme from RMIF managers to state water resource managers.
- RMIF on the Murray will be part of the TLM portfolio of water entitlements;
- Where state water resource managers elect to call on resources held in the Snowy Scheme other States will be given the opportunity to provide that water from existing Murray resources.
- Transfers will be made between States' shares of Murray 1 releases and Hume Dam holdings to achieve the required State sharing arrangements.

3 RMIF in Authority Storages

3.1 Assignment to RMIF in Authority storages accounts

RMIF will be assigned to the RMIF in Authority Storages Account and consequently to State RMIF Entitlements, at the request of TLM Managers.

The assignment to RMIF will require either for ATW released from the Snowy Scheme to be deemed RMIF or for RMIF held in the Snowy Scheme to be transferred to State RMIF Entitlements on the Murray by substitution.

Clause 20 (3) of Schedule F requires that any amended RMIF strategy *must include a provision to the effect that River Murray Increased Flows have first priority from River Murray Above Target Releases.* The 2013 Strategy continues the provisions for RMIF to have a first refusal right on water released from the Snowy Scheme in excess of mandated requirements. It should be noted that call outs of ATW allowed under Clause 10 of Schedule 4 of the 2011 SWL are excluded from the *River Murray Above Target Releases* available for assignment to RMIF.

The total volume available to be credited to State RMIF entitlements is given by reference to the SWL. It is currently the lesser of the balance of the Environmental RMIF (Snowy) Account and SHL's net ATW holdings in excess of 800 GL.

Where total RMIF held in Snowy exceeds the volume available to be supplied from the Snowy Scheme a call on State (General) RMIF resources will be given preference to a call on environmental RMIF holdings. This is to minimise potential third party impacts from the substitution approach because the State resources in the General RMIF Account have previously been allocated to RMIF entitlements on the Murray

3.2 State RMIF Entitlements

The detail of the State entitlements holding the RMIF will be determined by New South Wales (NSW) and Victoria.

The Agreement, SWIOID and Snowy Corporatising documents do not specify rules to be included in State RMIF entitlements. However, they do describe the intent of the Commonwealth and the States for retaining and releasing RMIF, which the State RMIF entitlements should facilitate. This includes:

- providing increased flows in the River Murray for environmental purposes only, not to be used for irrigated agriculture or any other consumptive purpose;
- enabling use in the Lower Murray below the Barmah Choke to allow preference to be given to improving environmental outcomes in these areas;
- providing an allocation of up to 70 gigalitres per year;
- providing that water need not be released during the water year in which it is credited; and
- not adversely impacting on South Australian water security or water quality, the security of water entitlements of irrigators, and other water flows for environmental purposes.

The State Entitlements housing RMIF in Authority Storages will also allow for the operation and use of RMIF as specified in the 2013 Strategy.

3.3 Objectives for Use of RMIF

The use of RMIF will be in accordance with the strategy for use of The Living Murray (TLM) water specified in the TLM Business Plan (2007): "*To apply the recovered water in a way that maximises ecological outcomes across the six Icon Sites and achieves other environmental Objectives as agreed by all parties to the Intergovernmental Agreement 2004 taking into account the agreed specific outcomes...*".

The agreed specific outcomes are focussed on maintaining and enhancing native flora and fauna and elements of the natural flow regime and are without exception consistent with the environmental objectives required for the RMIF Strategy, detailed at Clause 20 (4) of Schedule F of the Agreement.

The 2013 Strategy ensures that use of RMIF *gives preference to improving environmental outcomes in the Murray system below the Barmah Choke* (expressed in the Intergovernmental Agreement) through adopting the TLM focus on the six Icon Sites:

- Barmah Millewa forest;
- Gunbower and Koondrook-Perricoota Forests;
- Hattah Lakes;
- Chowilla Floodplain (including the Lindsay-Wallpolla System);

- Murray Mouth, Coorong and Lower Lakes; and
- River Murray Channel.

The objectives of TLM and the location of the Icon Sites offer sufficient safeguards that RMIF will be used in accordance with Governments' intentions for the Strategy for RMIF. Any requirement to specify particular uses for RMIF has the potential to reduce efficiencies in water management provided by combining the RMIF with TLM water.

3.4 Specific Use

The TLM Annual Environmental Watering Plan outlines the priority watering actions for the TLM icon sites and presents the decision-making process for determining those priorities.

Assigning RMIF State Entitlements to the TLM water rights portfolio provides for the entitlements to be used in accordance with the objectives for TLM water. The operation of the Water Act (2007) at Clause 18H (1) will ensure the Murray-Darling Basin Authority (the Authority) manages the RMIF State Entitlements "*in accordance with and in a way that gives effect to the Living Murray Initiative"*.

Through the **Instrument of Delegation – Water Act** the Authority has delegated its obligation to manage the TLM portfolio to the Executive Director Environmental Management (see section5).

The accounting of specific use of RMIF will be addressed through the normal State management of entitlements. The Authority will address bulk accounting of RMIF by revising the RMIF in Authority Storages Account periodically to reflect use of the entitlements and any other agreed debits to the RMIF State Entitlements.

3.5 Reporting

Schedule F (Clause 20 (5)) of the Agreement requires the Authority to report to the States annually on the environmental outcomes of the RMIF in that water year in light of the objectives for the RMIF determined by the Ministerial Council.

The TLM reporting structures meet the requirements for reporting on the use of RMIF. For example, the reporting requirements of the TLM Business Plan (2007) include annual reporting of performance against the TLM Environmental Watering Plan and achievement of the environmental objectives for the Icon Sites by 30 August each year. The TLM Annual Environmental Watering Plan routinely expands on the requirements of the TLM Business Plan and specifies additional reporting and monitoring requirements in respect of the TLM portfolio.

To aid the integrated management of the TLM portfolio, there will be no additional requirements placed on the TLM Initiative in respect of the use of RMIF State Entitlements.

Any changes to TLM reporting processes would need to, at a minimum, meet the requirements of Schedule F (Clause 20 (5)) of the Agreement in regard to the reporting of the use of RMIF.

4 RMIF in Snowy Hydro Limited Storages

4.1 The Substitution Approach

The 2013 Strategy de-couples the supply of RMIF from SHL storages from the assignment of RMIF to State Entitlements and in doing so provides for the crediting of RMIF to State entitlements to be a transaction between RMIF managers and the State issuing the entitlements to hold the RMIF.

Where a volume of RMIF is credited to a State Entitlement by **substitution** of existing resources in Murray storages, the right to that volume in the Snowy Scheme is transferred from RMIF interests to State Resource Managers.

RMIF held by the States in the Snowy Scheme will add to their general Murray resources and be managed to meet their demands in the River Murray system. This will enable the States to build reserves in the Snowy Scheme, available for use when needed.

4.2 Calls on General RMIF from the Snowy Scheme

The SWL gives NSW alone the right to make one call on the RMIF (Snowy) Account by 5 October each year. Schedule F of the Agreement safeguards the rights of Victoria and South Australia against unilateral decisions made by NSW to reduce the Required Annual Release from the Snowy Scheme.

The 2013 Strategy places an obligation on NSW to provide any volume called out in accordance with the Strategy to the appropriate party if a request is made to access RMIF from the Snowy Scheme. NSW can provide the volume either by exercising a call on the RMIF (Snowy) Account from SHL or by substitution through giving up access to releases from the Snowy Scheme.

Where NSW, Victoria or South Australia opts to make a call on RMIF, the other State(s) will be given an option to provide the water in Hume Dam in return for a credit of that volume in SHL storages. If two States want to increase their RMIF holdings in SHL storages and can provide the necessary volume from Hume Dam, then each State will be entitled to provide half of the volume available.

In accordance with subclause 11(2) of Schedule F to the Agreement, any RMIF water released by SHL into the Murray is accounted as a State Tributary inflow which means that, during periods of Special Accounting, it will not contribute to the water available to be shared by South Australia.

Excepting water coming out of South Australia's Hume storage right, all calls on the General RMIF (Snowy) Account supplied from Snowy storages will be deemed to be delivered in equal monthly quantities across the months October to April inclusive unless otherwise agreed by the relevant States. For transfers involving South Australia State shares will be adjusted retrospectively, applied in the month preceding the month in which the supplying State advises the MDBA of its intention to provide the volume called.

ATW released from the Snowy Scheme will be deemed delivered from RMIF when required to ensure that the ATW held in the Scheme available to RMIF remains greater or equal to the available RMIF in Snowy. Where necessary, State resources will be deemed delivered from RMIF in Snowy before Environmental water (Snowy) Account as the State holdings have previously been allocated on the Murray.

5 Governance

Use of RMIF will be managed under TLM Governenace structures. Current TLM arrangements include the Environmental Watering Group considering proposals and making recommendations to the Authority which may be acted upon by the Executive Director Natural Resource Management Division.

Any change to TLM Governance structures or processes will need to consider the requirements of the 2013 Strategy.

RMIF held by the States in the Snowy Scheme will be managed by State Resource Managers. Call outs and dealings will be processed by the Water Liaison Working Group and Basin Officials Committee.

The Authority's obligations under Schedule F are assigned to individual Authority staff through its Instrument of Delegation.

6 Accounts to be Kept

As of April 2013, Schedule F specifies the requirement for the Authority to maintain:

- the Initial River Murray Increased Flows Account to record the volume of RMIF held in the Snowy Scheme; and
- the River Murray Increased Flows in Authority Storages Account.

For the purposes of clarity, the 2013 Strategy refers to these accounts as RMIF (Snowy) and RMIF (Murray) respectively.

The 2013 Strategy follows the direction of Schedule F. However, the decision to hold RMIF (Murray) in State entitlements has left the requirement to record the transfer of RMIF between Authority storages redundant. Water held in State entitlements is not generally associated with a particular location and the holdings of a particular user are not transferred between storages.

The 2013 Strategy introduces sub-accounts to the RMIF (Snowy) Account and the RMIF (Murray) Account.

The RMIF (Snowy) Account will incorporate two sub-accounts:

- the Environmental RMIF (Snowy) Account, giving the volume of RMIF held in Snowy Scheme that has not been assigned to State entitlements and is available for use as RMIF on the Murray; and
- the General RMIF (Snowy) Account, giving the volume of RMIF that has previously been assigned to State RMIF entitlements and is no longer available for use as RMIF.

The Environmental RMIF (Snowy) Account will in turn have two State sub-accounts, one for each of NSW and Victoria.

The General RMIF (Snowy) Account will have sub-accounts for each of the three States. .

The volume of the RMIF (Snowy) Account will be the aggregate of the two RMIF (Snowy) Sub Accounts.

The Environmental RMIF (Snowy) Account is equivalent to the RMIF (Snowy) Account required under Schedule F discussed and specified in the Interim Rules. It will be allowed to hold a negative value.

The volume held by each State in the General RMIF (Snowy) Account will be under the independent control of that State's Resource Managers and available for use for any purpose.

RMIF held in the Environmental RMIF (Snowy) Account can be credited to State Entitlements (and the RMIF in Authority Storages Account) either through TLM managers calling on resources held in Snowy or through classification of discretionary ATW releases from SHL as RMIF.

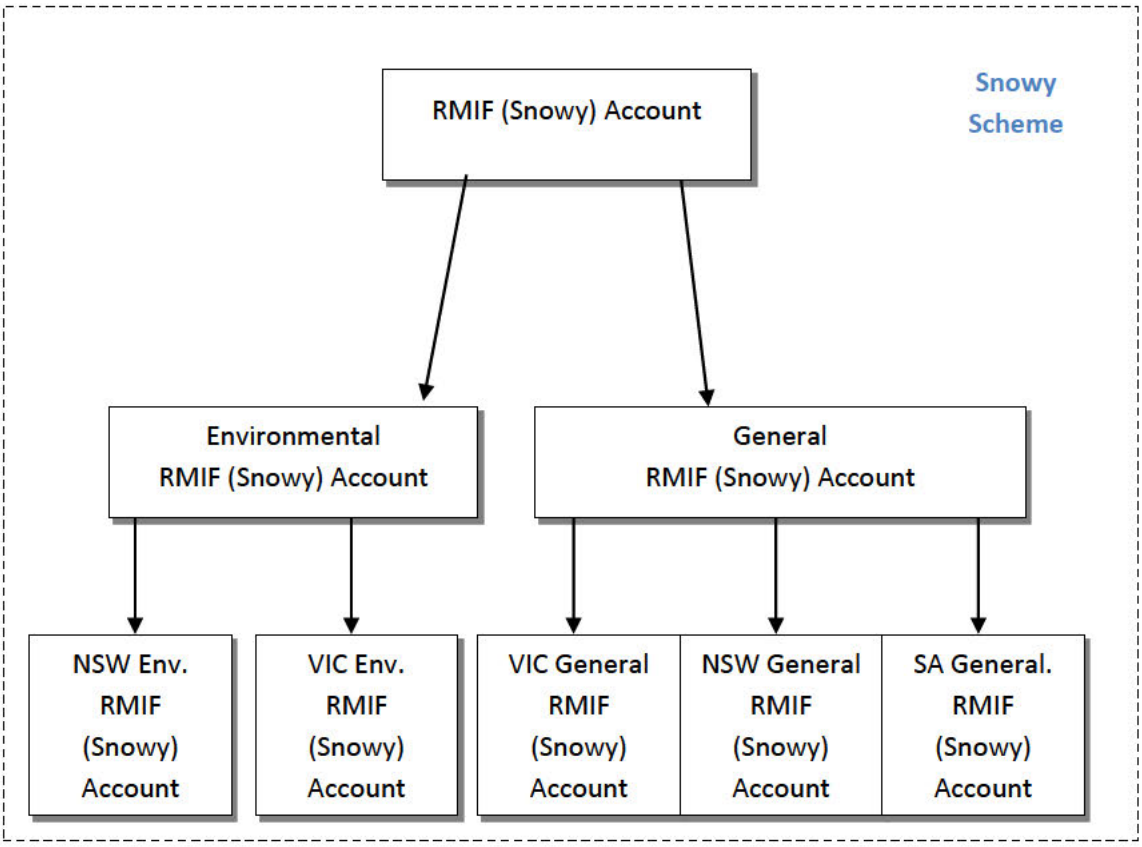
The RMIF in Authority Storages Account will have State based sub Accounts credited through accessing holdings in the Snowy Scheme and debited by use and other agreed debits on RMIF State entitlements.

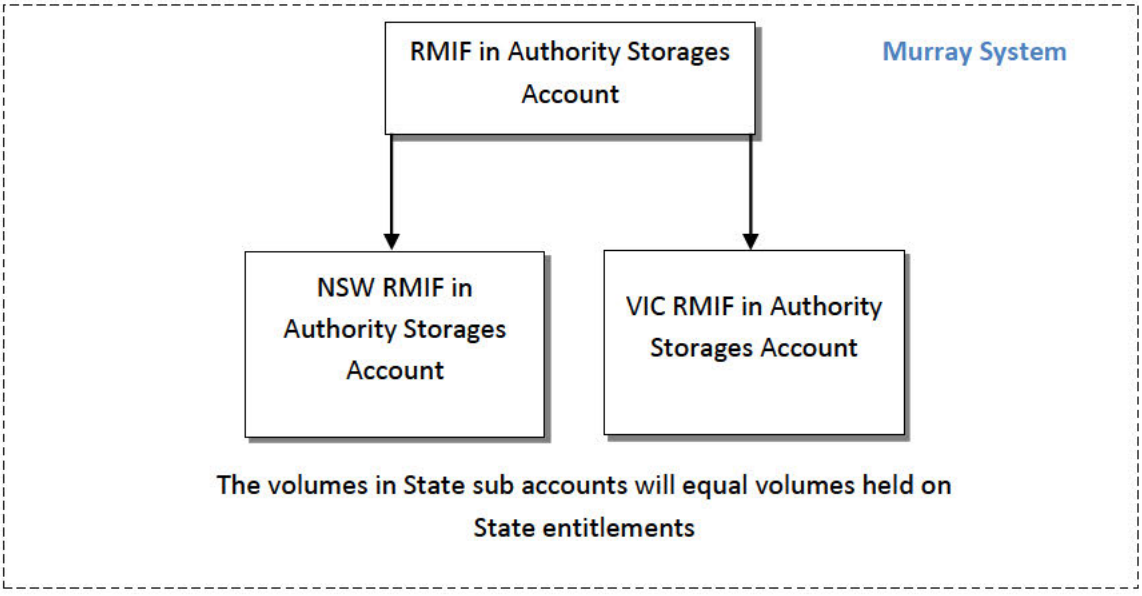
The RMIF in Authority Storages Account will not be required to record releases from the General RMIF (Snowy) Account as this water will form part of the general State Resource and does not require further specification.

Any debit made on any sub account will result in a debit to any associated higher level account.

The hierarchy of RMIF (Snowy) and RMIF (Murray) accounts is illustrated below at section 6.1.

6.1 Hierarchy of Related Accounts





7 RMIF Rules

7.1 General Rules for RMIF

Rule 1 Objectives for RMIF

TLM managers will use RMIF in accordance with TLM objectives.

Rule 2 Reporting Use of RMIF

Reporting on the use of RMIF will be undertaken in accordance with the reporting requirements for TLM. TLM managers will not be required to report or justify the use of RMIF State Entitlements distinct from the use of the TLM portfolio.

Rule 3 Credit to RMIF (Snowy)

The Authority will credit the Environmental RMIF (Snowy) Account on 1 May each year with the River Murray Annual Allocation as notified by NSW.

Note:
The Joint Communiqué (issued in February 2002) specifies that *up to 70 gigalitres per annum* will be allocated to RMIF. The Communiqué explicitly states that the 70 GL limit currently applied in relation to RMIF is an annual maximum not a long term average figure.

Rule 4 Distribution of RMIF (Murray)

An account of total RMIF in Authority storages is to be held. RMIF managed under State entitlements will not be identified for transfer between Authority storages.

Note:

Water will be held in State entitlements on the Murray. Storage location is not a consideration in water allocated to State entitlements. The distribution of RMIF between Authority storages will not be recorded.

Rule 5 Debits to RMIF (Murray)

The RMIF in Authority Storages Account will be reduced by any usage or other agreed debits to the State entitlements holding the RMIF allocation.

Rule 6 Nature of State RMIF Entitlements

State RMIF Entitlements are to give effect to the intent of Governments in regard to retaining and releasing RMIF as per the Agreement, SWIOID and Snowy Corporatising documents, as described in Section 3.4.

7.2 Rules for Assigning ATW Released to State RMIF Entitlements

Rule 7 Nominating Discretionary ATW Released as RMIF

Following notification of a discretionary release of ATW from the Snowy Scheme, TLM Managers can advise the Authority, no later than 31 May in any water year, of any volume of that release that should be assigned to State RMIF entitlements held in the Murray.

Note:

A discretionary release of ATW is a release in excess of the Required Annual Release and any call-outs exercised under the Snowy Water Licence 2011.

Rule 8 Crediting of Discretionary ATW Release

Following a direction under Rule 7 the Authority will:

- *notify NSW and Victoria of the requirement to each credit half of the volume assigned to RMIF (Murray) to their respective State RMIF entitlements;*
- *debit the balance of the Environmental RMIF (Snowy) State sub Accounts.*

Note:
ATW released at SHL's discretion will have been credited equally to the shares of NSW and Victoria in the River Murray Water Accounts so will in turn be credited equally to NSW and Victorian State RMIF Entitlements.

The crediting of the RMIF in Authority Storages account will occur as a result of the credits made to State entitlements.

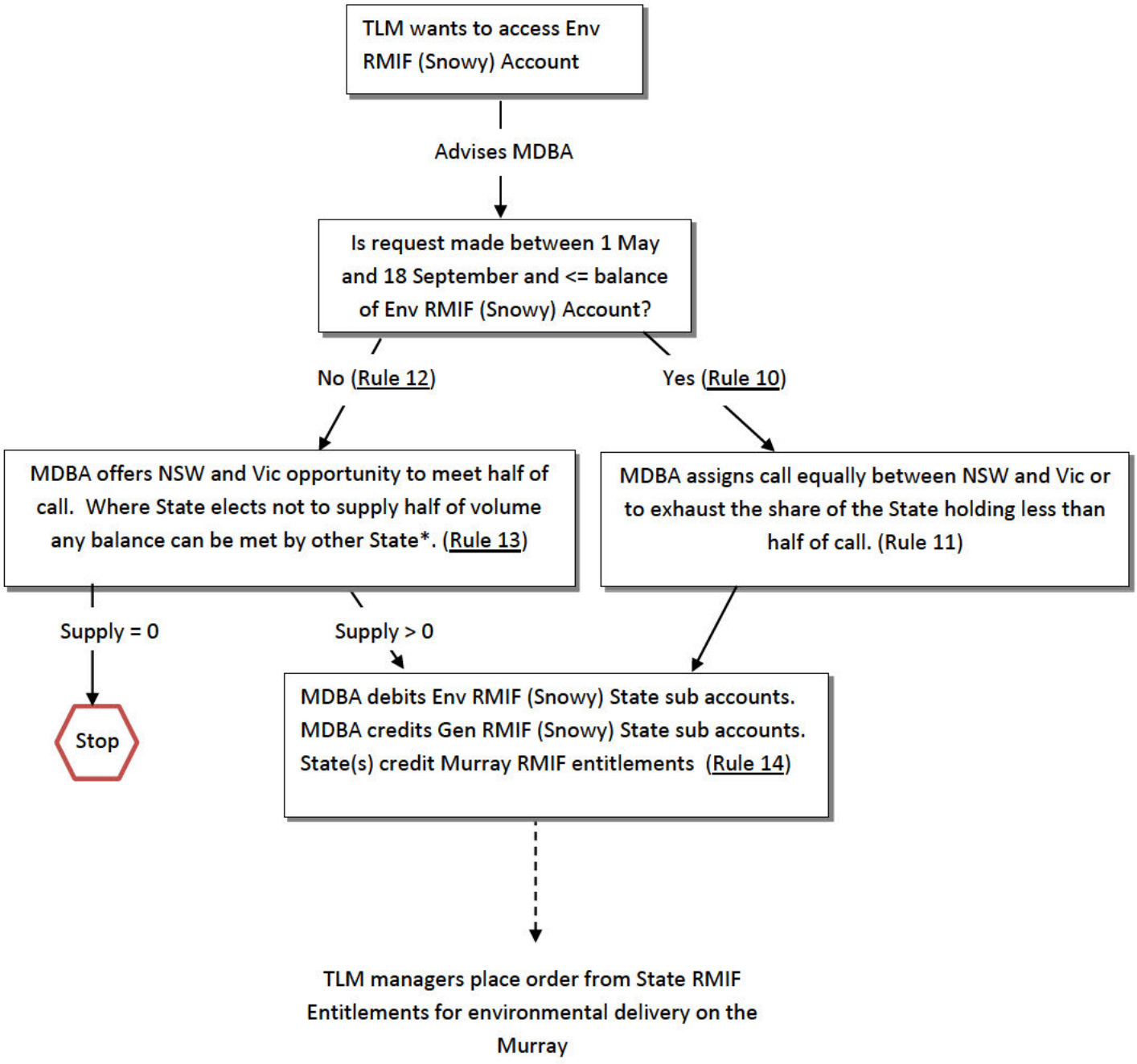
Rule 9 Maximum Volume for Credit of Discretionary Release of ATW

The maximum volume that may be assigned to RMIF (Murray) in response to a release of ATW is the lesser of the volume of discretionary ATW released, as determined by the Authority's Water Liaison Working Group, and the balance of the Environmental RMIF (Snowy) Account.

7.3 Rules for Assigning RMIF held in SHL Storages to RMIF Entitlements

The Flow Chart Following illustrates the process for call on the Environmental RMIF (Snowy) Account.

7.4 Calls on the Environmental RMIF (Snowy) Account



*Offering process likely to only be significant when one State has opted to supply the initial call.

Rule 10 TLM Instruct Credit to State RMIF Entitlements

Between 1 May and 11 September in any year TLM managers can advise the MDBA that they require a credit be made to State RMIF entitlements held in the Murray of a volume less than or equal to the volume in the Environmental RMIF (Snowy) Account and available for delivery

Note:

The State's do not have a right of refusal over providing a credit requested in accordance with this rule.

The volume available for delivery will include consideration of the SWL and competing calls for delivery of .RMIF from SHL storages *(see* Rule 26*).*

As of May 2013 the SWL allows for the lesser of the balance of the RMIF (Snowy) Account and Snowy net ATW holdings in excess of 800 GL to be called from the scheme.

The 11 September deadline allows for seven days for operation of rules relating to supply from the State Interim RMIF Account, under Rule 17, if required.

There is no limit on the number of requests for credit that may be made by TLM managers.

The SWL effectively restricts NSW to one call per year on the RMIF (Snowy) Account made between 1 May and 5 October. The window for non-refusable calls to be made by TLM managers allows time for NSW to make a call on Snowy if required.

The operation of the Strategy will discourage NSW from making a call on Snowy prior to 18 September in any year as it is limited to one call per year.

Rule 11 State Shares of Credits to RMIF (Murray)

Following a request under Rule 10 the Authority will direct NSW and Victoria to credit their respective State RMIF entitlements with half the volume required.

Where the balance of one of the State's Environmental RMIF (Snowy) Account is less than half the requested volume, the Authority will direct that State to credit its State RMIF entitlement with a volume equal to the balance of its sub-account, and direct the other State to credit its State RMIF entitlement with the shortfall in the requested volume.

Note:

The TLM managers do not request delivery of water held in the Snowy Scheme from a particular State and any call on the Environmental RMIF (Snowy) Account is initially assigned equally between NSW and Victoria *(see Rule 13).*

The balances of the two Environmental RMIF (Snowy) State sub accounts can vary where States permit different volumes of water to be credited to their respective RMIF entitlements through the discretion allowed under Rule 12.

Rule 12 TLM Request Discretionary Credit

TLM Managers may request via the Authority a credit to RMIF State Entitlements at any time and for any volume. A request or portion of a request that that does not meet the requirements of Rule 10 *can be met at the discretion of NSW or Victoria.*

Note:

This allows TLM managers to request an advance of water when allocation is certain to be available in the future, providing additional flexibility to meet any circumstances that may arise. TLM managers and State Resource Managers can be certain this water will be available because both NSW and Victoria build allocation in State accounts before transferring it to RMIF in the Snowy Scheme.

Rule 13 State Shares of Discretionary Request

Following a request made under Rule 12 the Authority will initially assign the relevant volume equally between NSW and Victoria and offer each State the opportunity to make the appropriate credit to State RMIF entitlements.

Where only one State elects to meet the requested credit in full the Authority will give that State the option to provide the shortfall in the requested volume.

Rule 14 Accounting for TLM Calls on RMIF (Snowy)

Following assignments of State shares under Rule 8 *or* Rule 11 *or Rule 13:*

- *the State will credit the relevant State RMIF Entitlement with the appropriate volume; and*
- *The Authority will:*
    - *debit the Environmental RMIF (Snowy) State sub Account(s);*
    - *Credit the General RMIF (Snowy) State sub Account(s); and*
    - *Credit the RMIF in Authority Storages Account and State sub Account(s).*

Note:

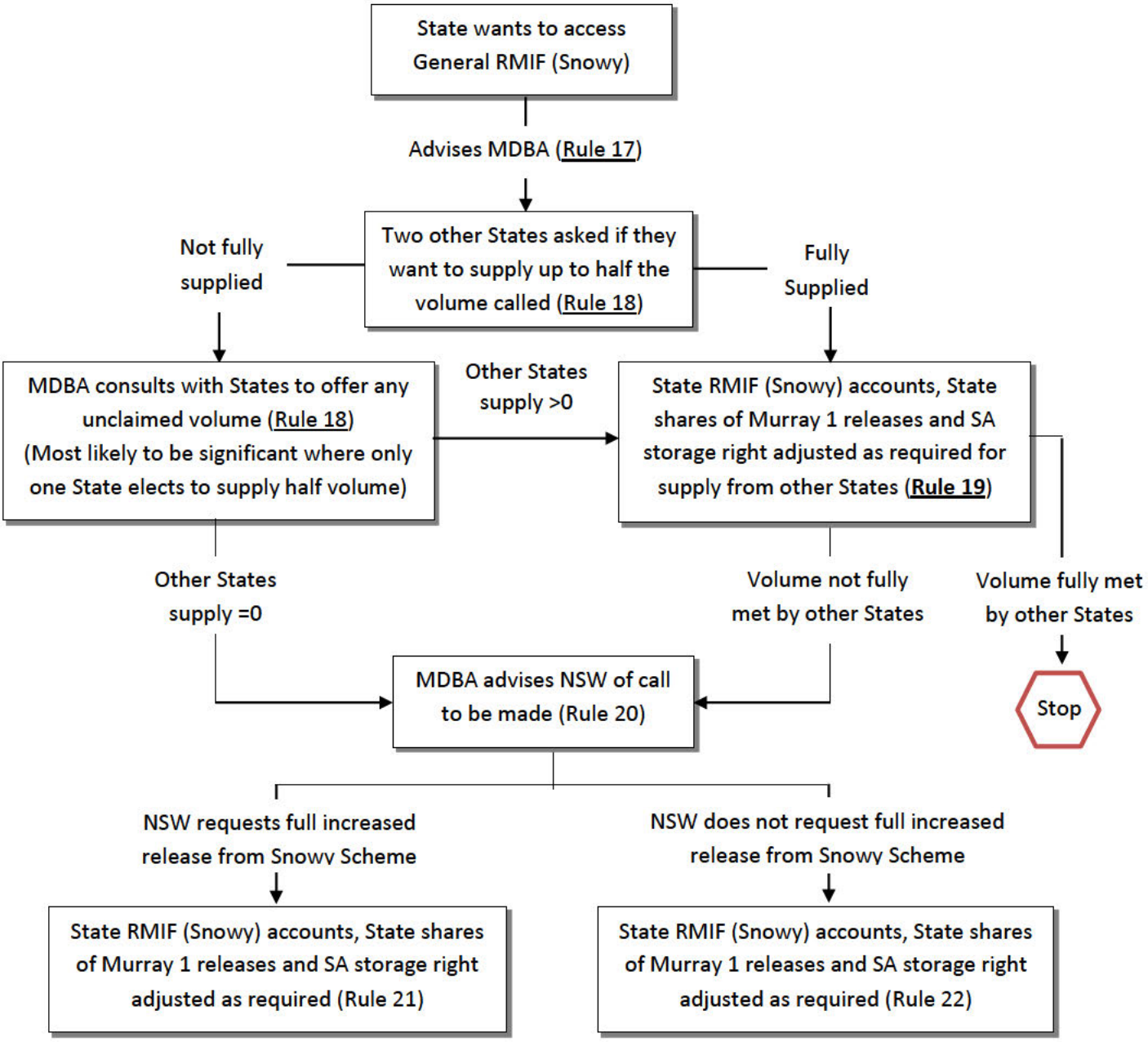
Consistent with the treatment of other inflows in the River Murray Water Resources Assessment the RMIF will be credited when the delivery is guaranteed, not when it is delivered. The use of RMIF may be restricted due to operational considerations.

A State's Environmental RMIF (Snowy) sub-account is allowed to be negative. The Environmental RMIF (Snowy) Account is allowed to be negative. The RMIF (Snowy) Account cannot be negative.

The Operation of the General RMIF (Snowy) Account

A flow chart describing the operation of the General RMIF (Snowy) Account is at 7.5

7.5 Calls on the General RMIF (Snowy) Account



Where NSW or Victoria is the other State meeting the call:

Transfer between General RMIF (Snowy) Accounts and State shares of Murray 1 Releases adjusted equally over the months October to April.

Where SA is meeting a call:

Transfer between General RMIF (Snowy) Accounts and transfer of full volume from SA's Hume storage right to receiving State made in accounts at the end of the month preceding the month in which transfer is agreed.

Where call is being supplied through physical delivery from the Snowy Scheme:

Debit of General RMIF (Snowy) Account;

Murray 1 releases adjusted equally over the months October to April;

Credit to SA Hume storage right made equally over the months October to April

Rule 15 General RMIF (Snowy) State Sub Accounts

The General RMIF (Snowy) Account will have three State sub Accounts, being accounts for NSW, Victoria and South Australia.

Rule 16 State Access to Delivery Capacity from Snowy

Each State holding water in the General RMIF (Snowy) Account will initially be entitled to an equal share of the total available delivery capacity. Where a State does not use the full capacity available to it the excess capacity of that State will be shared equally between any other States holding water in the General RMIF (Snowy) Account.

Note:
This is intended to provide States access to water that has been previously allocated. It is not intended to otherwise restrict access to capacity. A State does not own "airspace" in the call and cannot prevent any unused right being available to other parties.

Rule 17 States to Notify Authority of Call on General RMIF (Snowy)

Where a State elects to access the General RMIF (Snowy) State sub Account, it must notify the Authority by 8 September.

Note:

This date is chosen to allow NSW to meet the 5 October deadline for calling on SHL to release water from the RMIF (Snowy) Account as provided under the SWL.

Rule 18 Authority to Offer States Option to Supply Call on General RMIF (Snowy)

Following a request made under Rule 16 the Authority will offer any other State(s) not accessing its General RMIF Snowy State sub Account the opportunity to each supply half the volume called.

Unless otherwise agreed between the providing and receiving State, the supply must be made in Hume Dam.

Where only one State elects or is able to meet the requested volume in full the Authority will give that State the option to provide the shortfall in the requested volume.

Note:

The Authority is only required to approach a State once under the assumption that a State will not alter a decision to supply less than the volume requested as a result of the action of another State.

Rule 19 Call on General RMIF (Murray) met by other State

Where a State elects to supply resources to another under Rule 18, unless otherwise agreed by both States, the Authority will, in accordance with Rule 25*,:*

- *Transfer the volume from the receiving State's General RMIF (Snowy) sub-Account to the providing State's General RMIF (Snowy) sub-Account; and*

For transfers between NSW and Victoria:

- *Adjust State shares of the Murray 1 release equally across the months October to April to realise the transfer of resources between the States in the Murray System.*

For transfers involving South Australia

- *Make a retrospective adjustment to the water accounts to transfer the volume supplied between South Australia's Hume storage right and the relevant State share in Hume in the month preceding the advice received under Rule 18.*

The total of General RMIF (Snowy) Account will be unchanged.

Note:

Depending on the approach taken, it will be necessary to adjust the Murray 1 releases by twice the volume supplied to achieve the appropriate transfer of resources between States. Where transfers from the Snowy Scheme are accompanied by increased releases it is only necessary to adjust the Murray 1 releases for the transfer volume.

The timing of the adjustment to South Australia's storage right is necessary to guarantee supply against spill from Hume Dam.

Rule 20 Notify NSW of General RMIF (Snowy) to be Supplied from Snowy Storage

If a call under Rule 16 *is not fully met by other States (under* Rule 18*), the Authority will, by 18 September, notify NSW of the volume required from the General RMIF (Snowy) to fully supply the call.*

Rule 21 Accounting for Supply from Snowy Storage with Increased Delivery from Snowy

Where NSW has fully called a notification under Rule 20 the Authority will:

- *debit the General RMIF (Snowy) sub account of the State calling water under Rule 17;*
- *alter State shares of Murray 1 release in equal monthly quantities over the period 1 October to 30 April to properly deliver the additional supply from the Snowy Scheme; and*
- *credit any volume called to the SA storage right in Hume equally from the shares of NSW and Victoria in equal monthly quantities over the period 1 October to 30 April.*

Where NSW has called the water from Snowy the portion destined for SA will be assumed delivered equally to NSW and Victoria (requiring no adjustment to the sharing of Murray 1 releases) and supplied to SA equally from the (increased) resources of those States.

Rule 22 Accounting for Supply from Snowy Storage without Increased Delivery from Snowy

Where NSW has not fully called a notification under Rule 20 any shortfall in supply from Snowy will be deemed to be made from existing Murray resources and will be accounted under Rule 19 as NSW electing to supply the requesting State.

Note:

This approach is consistent with Schedule G of the Agreement with NSW bearing responsibility for not implementing with Snowy actions agreed by the States.

7.6 RMIF and the State Water Accounts

Rule 23 RMIF Delivery Under Special Accounting.

RMIF released from the Snowy Scheme, including water called by South Australia, is treated as a State tributary inflow for the purposes of Special Accounting.

Note:

This applies at the time of physical release it is not at the time when a State entitlement is credited through substitution.

Rule 24 *Calls on General RMIF (Snowy) Account Delivered from Snowy*

Where a call on RMIF (Snowy) results in increased deliveries from the Snowy Scheme the delivery will be assumed to occur in equal monthly quantities over the period October to April; and:

- *a call delivered to NSW or Victoria will be assigned exclusively to the calling State through adjusting State shares of the Murray 1 release by the total volume delivered;*
- *a call delivered to South Australia will not require adjustment to State shares of the Murray 1 release but half the additional volume delivered from the Snowy Scheme will be credited to South Australia's Storage Right in Hume by both NSW and Victoria.*

Note:

For deliveries to South Australia the increased release will be allocated equally to NSW and Victoria, a credit in Hume is made from the additional resources received.

Rule 25 *Calls on General RMIF (Snowy) met by Other State*

Where a call on the General Account is met by either NSW or Victoria, State shares of the Murray 1 releases will be adjusted by twice the volume called, distributed in equal monthly quantities over the period October to April.

Subsequent supply to South Australia or any supply from South Australia will be made between State shares of Hume Dam and South Australia's Hume storage right under Rule 19. No adjustment is required to the State share of the Murray 1 release.

Example:

Assume 100 GL released from Snowy and NSW supplying Victoria with 16 GL. Default sharing would give each State 50 GL. Under this rule sharing would be:

- NSW share of Murray 1 release will be (100-32)/2 = 34 GL
- Victorian share of Murray 1 release will be (100+32)/2 = 66 GL

NSW has transferred 16 GL to Victoria.

7.7 Forced Calls and Interaction between the RMIF (Snowy) Accounts

Rule 26 Calls on General RMIF (Snowy) have Priority

Where requests to credit State RMIF entitlements from the RMIF (Snowy) Account and calls on the General RMIF (Snowy) Account exceed the capacity to deliver from the RMIF (Snowy) Account, as described in the SWL, or for any reason, a call from the General RMIF (Snowy) Account (under Rule 19) will be given priority.

Note:

This water has been assigned and possibly delivered on the Murray. The precedence is given to avoid possible third party impacts.

As of April 2013 the SWL allows for the lesser of the balance of the RMIF (Snowy) Account and Snowy net ATW holdings in excess of 800 GL to be called from the scheme.

Rule 27 Timing of Access to Limited Delivery Capacity

Where there is limited capacity to deliver from the Snowy Scheme, States may opt to access the General RMIF account subsequent to receiving a request from TLM providing that notification to the Authority is made within 7 working days of the request being received and meets the timing requirements of Rule 17 .

Note:

This is to avoid a first come first serve scenario where TLM and State Resource Managers can access limited capacity solely based on the timing of request.

Rule 28 RMIF Forced Call on RMIF (Snowy)

Where the balance of the RMIF (Snowy) Account would otherwise exceed the net ATW held in SHL storages the RMIF Snowy Account will be accounted as having been called to the extent that RMIF (Snowy) is made to equal the net ATW held in the scheme.

The General RMIF (Snowy) account will be deemed called prior to any call assigned to the Environmental RMIF (Snowy) account.

State sub-accounts will be deemed called in proportion to the volume held in those accounts unless otherwise agreed by all States holding non-zero balances in the relevant RMIF (Snowy) sub-account).

Note:

RMIF could otherwise exceed ATW where ATW released from or spilled by the Snowy Scheme is not assigned to RMIF.

The General RMIF (Snowy) water has been assigned and possibly delivered on the Murray. The approach is consistent with the priority given to the General RMIF (Snowy) Account for delivery from the Snowy.

Where volume of forced call exceeds the volume of General RMIF (Snowy) the State shares of General RMIF will be fully drawn down in proportion to the share of total General RMIF. Then State shares of Environmental RMIF (Snowy) will be drawn down in proportion to the share of total Environmental RMIF (Snowy).

Rule 29 Flexibility of General RMIF (Snowy)

Two States may agree to transfer water between General RMIF Account State sub accounts. Such a transfer cannot alter the balance of the General RMIF Account.

Note:

This is to increase flexibility and to allow for unforeseen circumstances.

Australian Government

MURRAY–DARLING BASIN AUTHORITY

RMIF callout from Snowy

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1 Introduction

The Snowy Water Licence (SWL) has been amended in 2012 to allow RMIF called out from the Scheme. Clause 10.4 of Schedule 4 of the SWL allows the Ministerial Corporation to notify the Licensee no later than 5 October to call RMIF water when the Net Above Target Water (NATW) in the Scheme exceeds 800 GL. Before the amendment, it was under the Snowy Hydro Limited (SHL)'s discretion to decide timing and volume of RMIF release from the Scheme.

In 2015, NSW submitted a business case as a SDL supply measure on the flexibility to the environmental water managers to call RMIF out from the Scheme when needed. The Murray model has been modified recently (MDBA, 2016) so that this supply measure can be assessed. Given that the Snowy storages provide high security, in general it would be beneficial to delay a RMIF callout as long as possible and try to access it when environment needs. However, there will be certain cases that all ATW storage in the scheme is occupied by RMIF and further inflow to ATW leads to forced release of RMIF water and leaves no choice to environmental water managers to accept the release as RMIF. Figure 1 presents RMIF water available in Snowy when no callout is made. It shows an annual credit of around 70 GL to the account which builds up continuously until ATW storage is occupied by RMIF fully and further ATW inflow causes forced releases of RMIF water shown as several sudden drops in the account. This figure indicates that the time and volume of calling RMIF out from Snowy may be crucial to optimise its use.

In the Business Case of a SDL adjustment measure for calling out RMIF from the Scheme, NSW has proposed 5 strategies to determine timing and volume of the callout. They are:

1. Strategy 1: Base case, accounting first ATW releases from Snowy as RMIF,
2. Strategy 2: If Hume environmental account is less than 500 GL in October, then callout RMIF water to maintain the account at 500 GL as long as NATW is more than 400 GL,
3. Strategy 3: If Hume environmental account is less than 500 GL in October, then callout RMIF water to maintain the account at 1000 GL as long as NATW is more than 400 GL,
4. Strategy 4: In the "near miss" years when the environmental account in Hume is less than 700 GL then call out maximum of 100 GL per month from October to March and callable RMIF volume above NATW of 400 GL where the "near miss" years are defined as targeted environmental events are not achieved with small margin and
5. Strategy 5: Release 70 GL every year.

Strategy 1 is what is assumed under the Benchmark and Strategy 5 is not a useful strategy to optimise the callable nature of RMIF water. Strategy 4 can potentially provide good environmental outcomes if the "near miss" years are defined well before making a callout.

Therefore, this report assesses Strategy 2 and Strategy 3 based on MDBA's interim advice from the package of 19 measures.

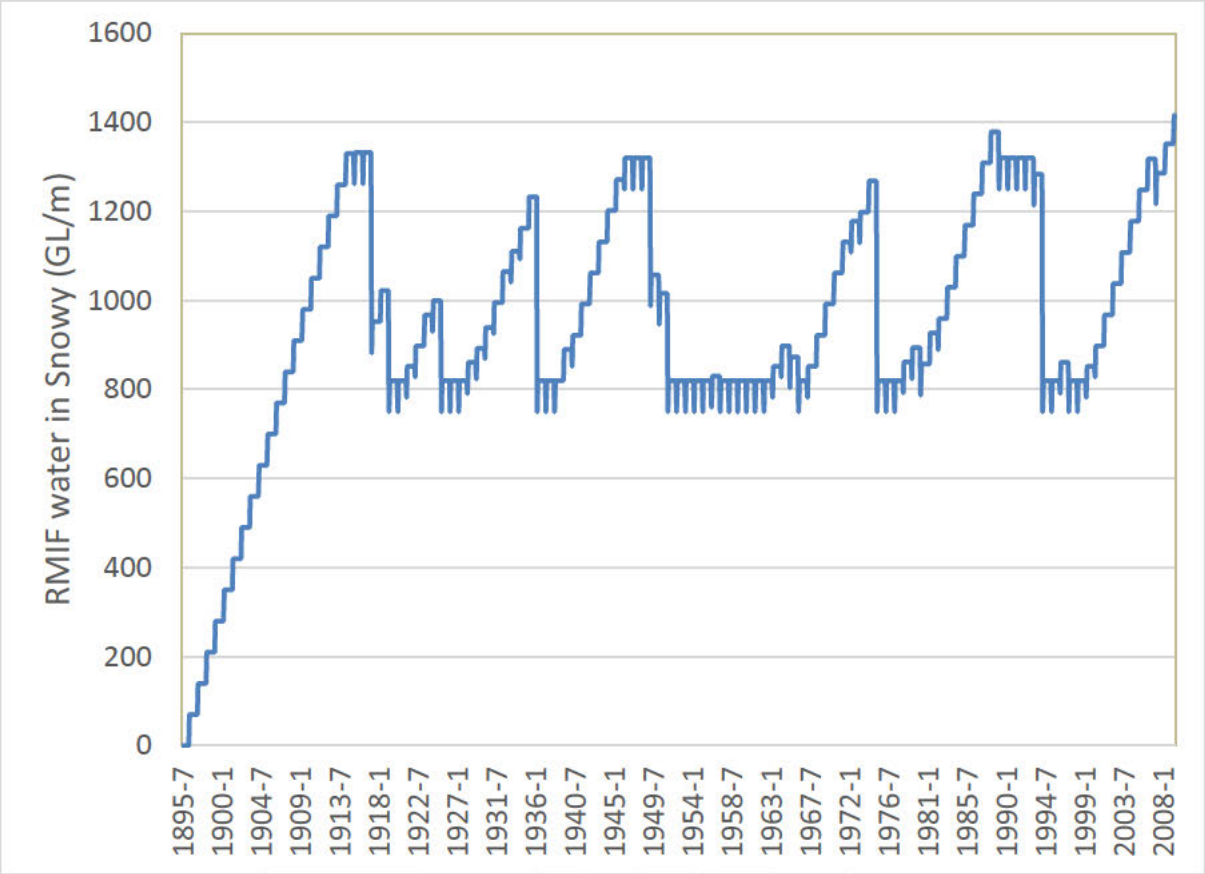

Figure 1: RMIF account in the Snowy Scheme without callout

2 Implication of different thresholds for calling RMIF out

According to the variations to the licence, a callout can only be made once per year and the latest it can be made is 5 October. The model assumes that the requested water is released equally over six months from October to March once a call is made. For the Basin Plan, most environmental water events are delivered between June and December. There may be sometimes when environmental water delivery is required during late spring and summer to maintain ecological outcomes at Lower Lakes and Coorong. Therefore making a decision on a RMIF callout requires a judgement call based on future environmental water need for the season. If it is called out too much and not fully used, the unused account can be socialised being subject to the states' carry-over provisions. On the other side, if it is not called enough, RMIF water gets accumulated in the Snowy storages more than the SHL can comfortable manage or physically store. As shown at Figure 1, the SHL has to release RMIF (i.e. forced release) when ATW storage is occupied by RMIF fully.

For testing timing and volume of potential callout, Strategy 2 in the business case is examined by varying thresholds to make RMIF transferred from Snowy to Murray. Similar to Strategy 2, environmental account balance in Murray is used and the volume of RMIF callout is limited to maintain the total account up to the thresholds. The thresholds are varied from 0 GL to 1500 GL with a 500 GL interval.

Figure 2 shows that RMIF accumulated in Snowy gets reduced when the threshold is increased as RMIF is called out more frequently. When the threshold is at 1500 GL, it is called out too frequently so that the RMIF account in Snowy is emptied almost every year. In the meanwhile, if the threshold is at 0 GL, the RMIF account in Snowy gets up to about 1400 GL and the only way of transferring RMIF from Snowy is by forced releases. These behaviours are presented further in Figure 3 and Figure 4.

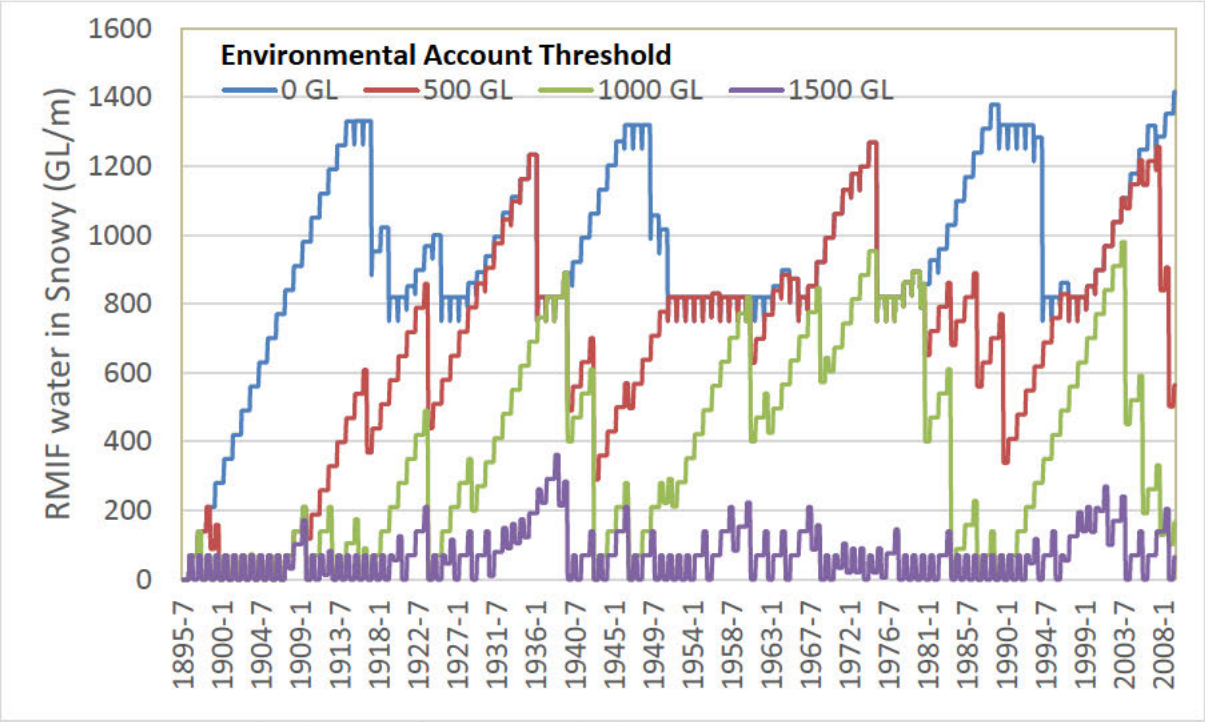

Figure 2: RMIF accounts in the Snowy Scheme depending on different environmental account thresholds

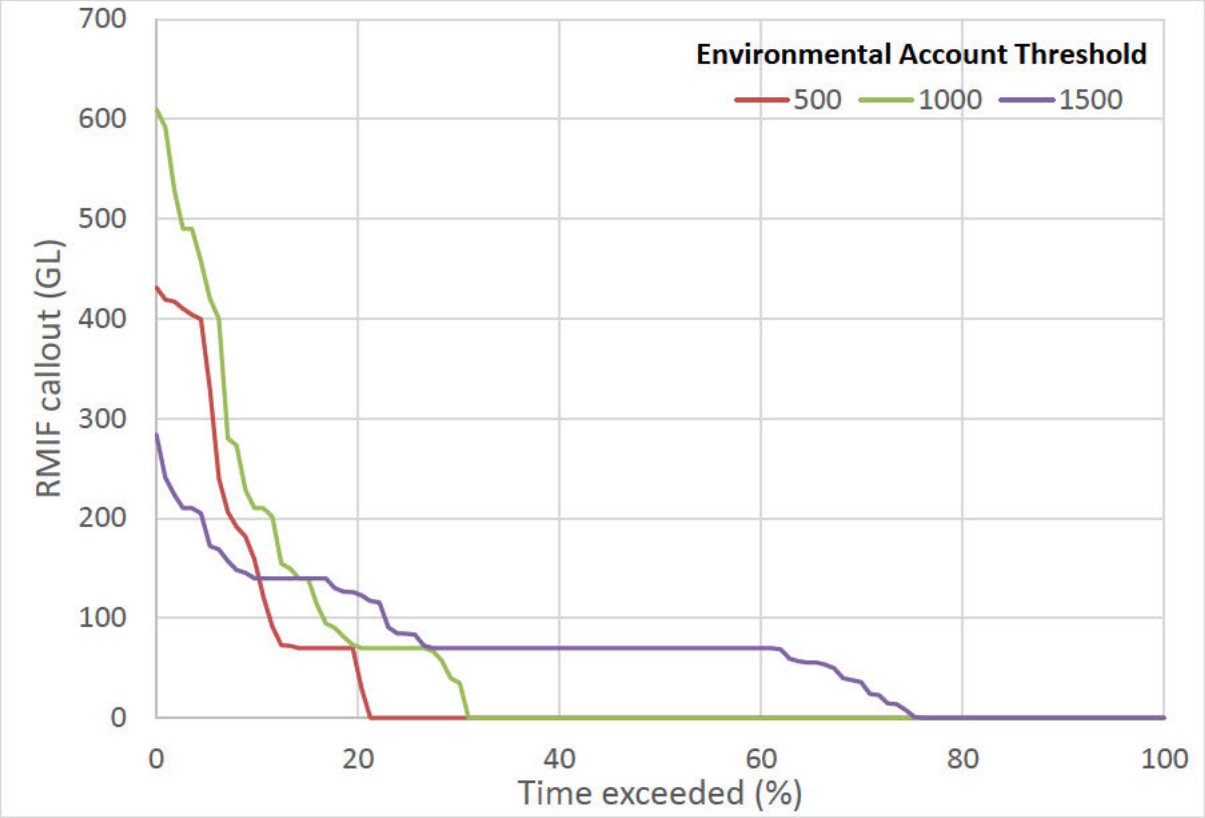

Figure 3: RMIF callouts (GL) depending on different environmental account thresholds used

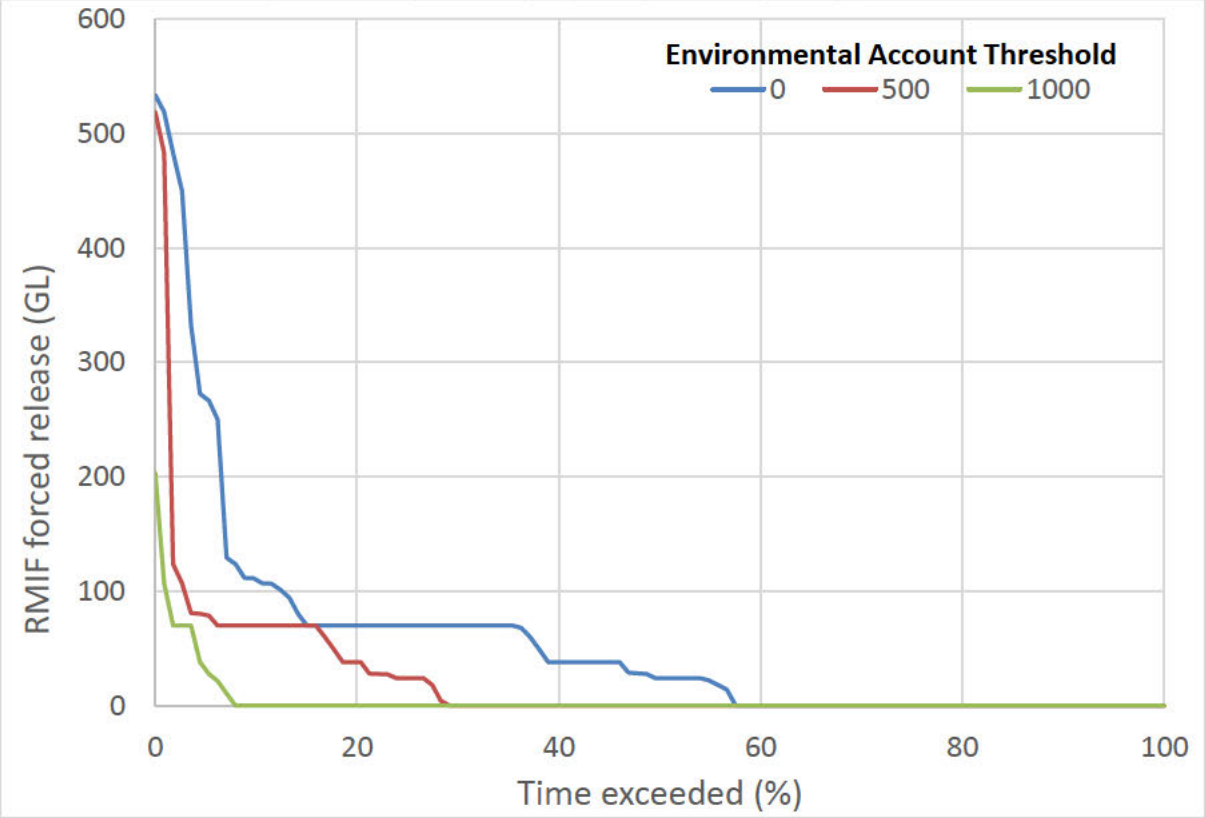

Figure 4: RMIF forced release (GL) depending on different environmental account thresholds used

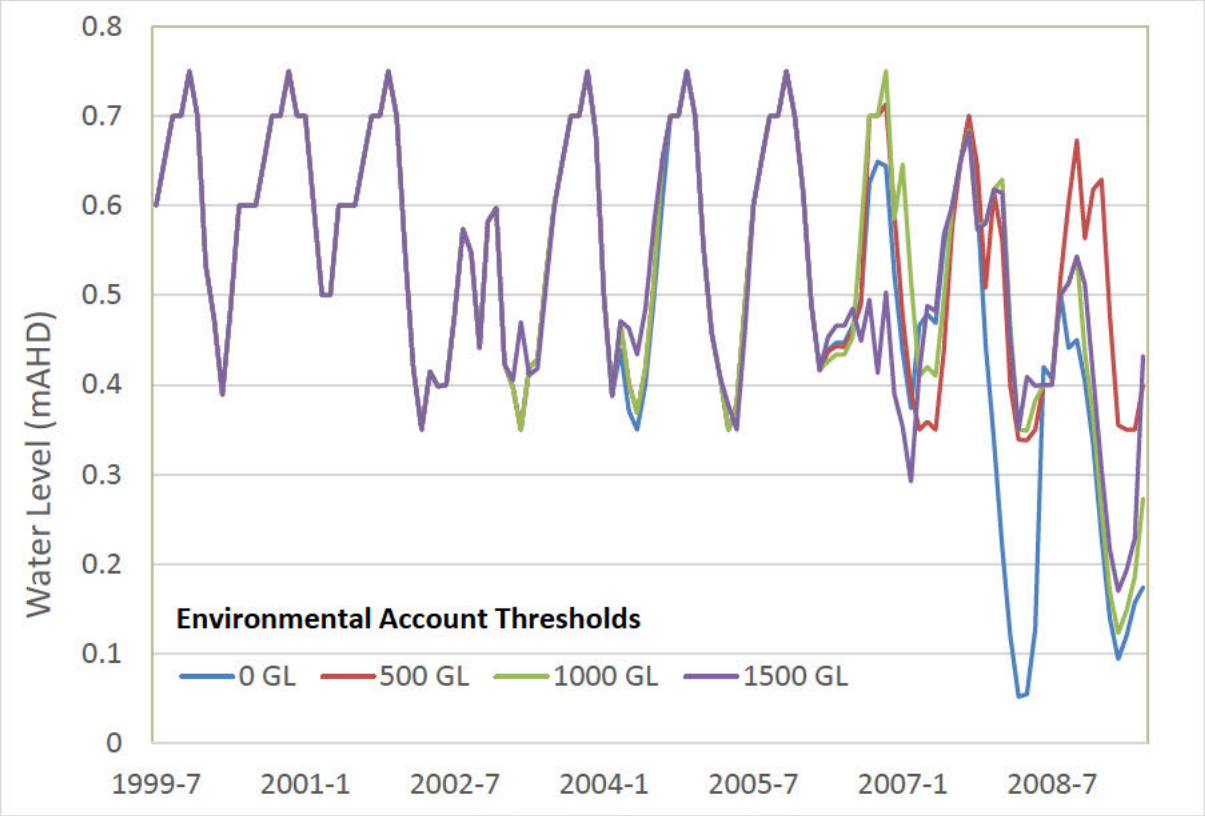

Figure 5: Water level (mAHD) at Lake Alexandrina for different environmental account thresholds

Overall environmental outcomes depending on different environmental account thresholds used are summarised in Appendix A and Appendix B. Even though difference in environmental outcomes are marginal, Appendix A shows that overbank flow outcomes are achieved best when the threshold is 1000 GL or 1500 GL. This is mostly because of its nature of one off usage. That is, once RMIF water is called out, remaining balance in the Snowy scheme is reduced and future usage of the water is limited until the account builds up as illustrated in early 1900's from Figure 2. Figure 5 also demonstrates its nature well. It shows when RMIF water is called out (i.e. when environmental account thresholds are bigger than 0 GL) water levels at Lower Lakes are sustained at reasonably heights for longer time. However, if a RMIF callout is made too early (i.e. a higher threshold), then there may be not enough water available later when environmental water is required for Lower Lakes to maintain Lower Lakes' level and minimum required Barrage flows. In these scenarios, it is found a threshold of 500 GL to be most effective.

In general, Appendix A and Appendix B indicate that the environmental account balance is a good surrogate for making a RMIF callout.

3 Further investigation on volume of RMIF callouts

As discussed above, Strategy 2 and its subsequent MDBA's variations are likely able to locate good timing of calling RMIF water. In this section, the volume of RMIF callouts is reviewed more closely. Rather than trying to maintain the environmental account balance at

a threshold level, a forecast of further environmental need is added to determine the volume of RMIF callouts.

There may be a number of ways to estimate further environmental need. However, in this report, a method developed for managing Hume air space targets (MDBA, 2014) is used. More detailed descriptions are available in MDBA (2014). Therefore it is briefly discussed below.

When the SDL benchmark developed, it was assumed that environmental water holders would like to try to re-instate some events that have been disappeared and captured by river regulation. Therefore most of environmental watering occurs during winter-spring seasons where inflows to the system get increased. It is thought that it is reasonable to equate likelihood of environmental watering events to unregulated flows to the Upper Murray. This calculation is based on serial correlation where the current month inflow to Upper Murray is strongly related to the inflows in the subsequent months. It involves multiple steps as below:

1. Plot the last month's natural inflow to Upper Murray against the cumulative natural inflows over a forecast period using 114 years modelled data.
2. Find a lower bound of the scatter points which defines the minimum natural flows expected over a forecast period.
3. From the cumulative natural inflow curve, find % of time exceeded corresponding to the minimum natural flows. Use the % of time exceeded to find unregulated flows expected from the cumulative unregulated flow curve.
4. Use a relationship developed between unregulated flows and environmental water requirements from the expected unregulated flows, and find environmental water requirements for a season.

For developing a relationship between unregulated flows and environmental water needs, the environmental demand sequence that are used for developing the SDL Benchmark is used. Without knowing future behaviours of environmental water holders, it is thought to be best iolinformation becomes available in future and when the assumptions used for environmental water holders' behaviours under the Benchmark are changed significantly.

Using a similar option to Strategy 2, a maximum volume of RMIF callouts is adjusted to include the estimated further environmental need. In this test, the threshold of 500 GL is used as below

$$\text{RMIF callout} = \max[\text{RMIF callable}, \text{Threshold} - (\text{Murray account balance} - \text{environmnetal water need})].$$

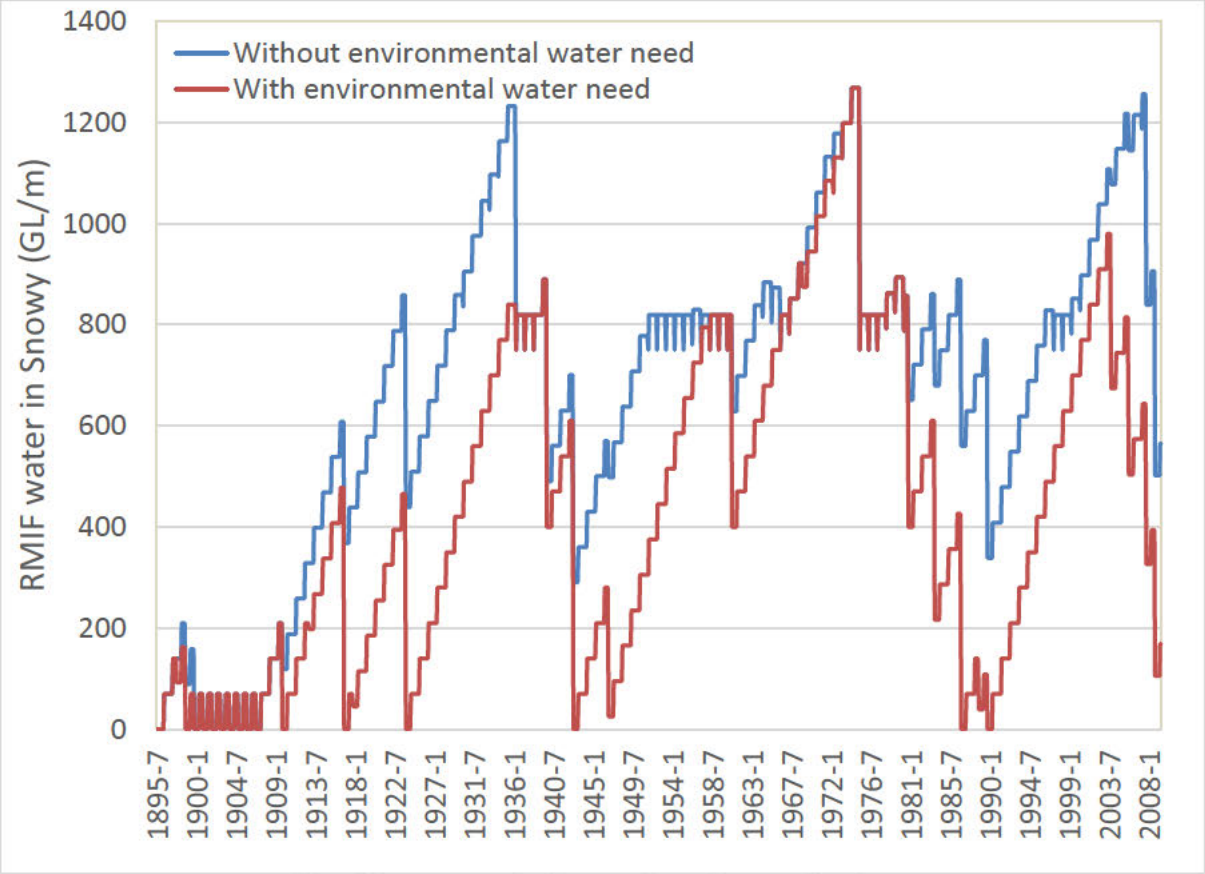

Figure 6: RMIF account in the Snowy Scheme when the account threshold is at 500 GL with and without estimated future environmental water need

Comparing Figure 2 and Figure 6, RMIF account accumulation in the Snowy Scheme for this scenario would expect to be somewhere in-between the threshold driven scenarios of 500 GL and 1000 GL. Appendix A and Appendix B also show a similar story on environmental outcomes.

4 Conclusion

In this report, the callable nature of RMIF account in the Snowy Scheme has been reviewed. Recently MSM has been updated so that RMIF water can be called out when environment needs to access the account (MDBA, 2016). To determine time of a RMIF callout, it uses the environmental account balance in Murray at the beginning of October every year. When the balance falls below a threshold, a callout is made to increase the balance up to the threshold. This is a similar to Strategy 2 proposed in the business case submitted by NSW.

In this report, the threshold is varied from 0 GL to 1500 GL with a 500 GL interval. This modelling suggests that calling out RMIF water too frequently gives less opportunity to meet environmental water requirements especially during droughts. On the other hand, if the threshold is too low, then RMIF water is called out less frequently and the account is accumulated in the Snowy Scheme more than the scheme can physically accommodate or

the Snowy Hydro Limited (SHL) can comfortable operation its storages without affecting its main business.

Based on the modelling assessment, it provides best environmental outcomes when the environmental account threshold is between 1000 GL and 1500 GL (Appendix A). When the threshold is at 500 GL, water level at Lower Lakes is sustained well during the millennium drought leading to best CLLMM environmental outcomes (Appendix B).

A scenario is further developed from the environmental account driven strategy. For the scenario, a threshold of 500 GL is used to determine timing of a callout but volume is varied depending on estimated future water need for environment. Compared to the scenario with the 500 GL threshold, it calls out more RMIF water leading to:

- Less RMIF account accumulated in the Snowy Scheme (Figure 6),
- Floodplain environmental outcomes are improved slightly (Appendix A) and
- CLLMM environmental outcomes are slightly worsen (Appendix B).

This modelling study suggests that environmental account balance in Murray can be a useful surrogate to determine timing of a RMIF callout. Out of the modelled scenarios, a threshold of 500 GL with the volume of callout adjusted by estimated future environmental need seems to be the best operating strategy. Therefore this option is recommended to be adopted for assessing SDL adjustment for the project subject to its operability by SHL. Even though future Snowy and environmental water holders' behaviours are unknown, its on-ground operational practices and decisions are likely to be improved using different and more sophisticated triggers based on experiences over the time to achieve better environmental outcomes. Once more data is available after the callout provision is fully operationalised, the modelled operating strategy should be reviewed and revisited.

Reference

MDBA (2016), Modelling changes to Snowy Water Licence in the Monthly Simulation Model, MDBA Technical Report No 2016/04.

MDBA (2014), Changes for the current Hume Air Space Management due to future demand condition, MDBA Technical Report No 2014/23.

■

RMIF callout from Snowy

Appendix A Environmental Outcomes

Barmha-Millewa		Target	Without Development	Baseline	Environmental Account Thresholds				
Flow Event - threshold, duration, season (as gauged on the River Murray at Yarrawonga Weir)					0 GL	500 GL	1000 GL	1500 GL	500 GL with Env need
1	12,500 ML/d for a total duration of 70 days (with min duration of 7 consecutive days) between Jun & Nov	70 - 80 %	87%	50%	75%	73%	75%	73%	75%
2	16,000 ML/d for a total duration of 98 days (with min duration of 7 consecutive days) between Jun & Nov	40 - 50 %	66%	30%	49%	49%	50%	51%	49%
3	25,000 ML/d for a total duration of 42 days (with min duration of 7 consecutive days) between Jun & Nov	40 - 50 %	66%	30%	43%	43%	43%	43%	43%
4	35,000 ML/d for a total duration of 30 days (with min duration of 7 consecutive days) between Jun & May	33 - 40 %	53%	24%	36%	36%	36%	36%	36%
5	50,000 ML/d for a total duration of 21 days (with min duration of 7 consecutive days) between Jun & May	25 - 30 %	39%	18%	19%	19%	19%	19%	19%
6	60,000 ML/d for a total duration of 14 days (with min duration of 7 consecutive days) between Jun & May	20 - 25 %	33%	14%	16%	16%	16%	17%	16%
7	15,000 ML/d for a total duration of 150 days (with min duration of 7 consecutive days) between Jun & Dec	30%	44%	11%	34%	32%	35%	34%	34%
Koondrook-Perricoota and Gunbower									
1	16,000 ML/d for a total duration of 90 days (with min duration of 7 consecutive days) between Jun & Nov	70 - 80 %	86%	31%	62%	61%	61%	62%	61%
2	20,000 ML/d for a total duration of 60 days (with min duration of 7 consecutive days) between Jun & Nov	60 - 70 %	87%	34%	59%	59%	60%	60%	60%

RMIF callout from Snowy

3	30,000 ML/d for a total duration of 60 days (with min duration of 7 consecutive days) between Jun & May	33 - 50 %	60%	25%	38%	38%	38%	38%	38%
4	40,000 ML/d for a total duration of 60 days (with min duration of 7 consecutive days) between Jun & May	25 - 33 %	39%	11%	25%	24%	24%	23%	24%
5	20,000 ML/d for a total duration of 150 days (with min duration of 7 consecutive days) between Jun & Dec	30%	43%	7%	24%	25%	25%	25%	25%
Hattah									
1	40,000 ML/d for a total duration of 60 days (with min duration of 7 consecutive days) between Jun & Dec	40 - 50 %	67%	30%	42%	42%	42%	42%	42%
2	50,000 ML/d for a total duration of 60 days (with min duration of 7 consecutive days) between Jun & Dec	30 - 40 %	47%	19%	32%	31%	32%	31%	32%
3	70,000 ML/d for a total duration of 42 days (with min duration of 7 consecutive days) between Jun & Dec	20 - 33 %	38%	11%	18%	18%	18%	18%	18%
4	85,000 ML/d for a total duration of 30 days (with min duration of 7 consecutive days) between Jun & May	20 - 30 %	33%	10%	14%	14%	14%	13%	13%
5	120,000 ML/d for a total duration of 14 days (with min duration of 7 consecutive days) between Jun & May	14 - 20 %	23%	8%	10%	10%	10%	9%	10%
6	150,000 ML/d for a total duration of 7 days (with min duration of 7 consecutive days) between Jun & May	10 - 13 %	17%	5%	7%	7%	7%	7%	7%
Chowilla									
1	20,000 ML/d for 60 consecutive days between Aug & Dec	71 - 80 %	89%	43%	68%	68%	68%	69%	68%
2	40,000 ML/d for a total duration of 30 days (with min duration of 7 consecutive days) between Jun & Dec	50 - 70 %	80%	37%	53%	54%	54%	54%	54%

RMIF callout from Snowy

3	40,000 ML/d for a total duration of 90 days (with min duration of 7 consecutive days) between Jun & Dec	33 - 50 %	58%	22%	36%	36%	37%	36%	36%
4	60,000 ML/d for a total duration of 60 days (with min duration of 7 consecutive days) between Jun & Dec	25 - 33 %	41%	12%	27%	25%	26%	25%	28%
5	80,000 ML/d for a total duration of 30 days (with min duration of 7 consecutive days) between Jun & May	17 - 25 %	34%	10%	13%	13%	13%	13%	13%
6	100,000 ML/d for a total duration of 21 days (with min duration of 1 day) between Jun & May	13 - 17 %	19%	6%	8%	8%	8%	8%	8%
7	125,000 ML/d for a total duration of 7 days (with min duration of 1 day) between Jun & May	10 - 13 %	17%	4%	6%	6%	6%	6%	6%
Edward-Wakool									
1	1,500 ML/d for a total duration of 180 days (with min duration of 1 day) between Jun & Mar	99 - 100 %	75%	96%	94%	94%	96%	95%	96%
2	5,000 ML/d for a total duration of 60 days (with min duration of 7 consecutive days) between Jun & Dec	60 - 70 %	82%	39%	61%	61%	62%	61%	61%
3	5,000 ML/d for a total duration of 120 days (with min duration of 7 consecutive days) between Jun & Dec	35 - 40 %	52%	22%	37%	36%	36%	36%	36%
4	18,000 ML/d for a total duration of 28 days (with min duration of 5 consecutive days) between Jun & Dec	25 - 30 %	39%	15%	19%	19%	19%	19%	19%
5	30,000 ML/d for a total duration of 21 days (with min duration of 6 consecutive days) between Jun & Dec	17 - 20 %	28%	12%	16%	16%	16%	16%	16%
Lower Darling									
1	7,000 ML/d for 10 consecutive days between Jun & May	70 - 90 %	95%	57%	66%	67%	66%	65%	66%
2	17,000 ML/d for 18 consecutive days between Jun & May	20 - 40 %	47%	18%	19%	19%	18%	19%	19%
3	20,000 ML/d for 30 consecutive days between Jun & May	14 - 20 %	27%	10%	15%	15%	15%	15%	15%
4	25,000 ML/d for 45 consecutive days between Jun & May	8 - 10 %	14%	8%	9%	9%	9%	9%	9%

RMIF callout from Snowy

5	45,000 ML/d for 2 consecutive days between Jun & May	7 - 10 %	10%	7%	8%	8%	8%	8%	8%
Coorong, Lower Lakes and Murray Mouth									
1.1	Lake Alexandrina salinity: Percentage of days that Lake Alexandrina salinity is less than 1,500 EC	100%	87%	96%	100%	100%	100%	100%	100%
1.2	Lake Alexandrina salinity: Percentage of days that Lake Alexandrina salinity is less than 1,000 EC	95%	85%	89%	95%	98%	98%	98%	98%
2.1	Barrage flows: Percentage of years that barrage flows are greater than 2,000 GL/yr (measured on a three year rolling average) with a minimum of 650 GL/yr	95%	97%	77%	93%	94%	94%	95%	94%
3.1	Barrage flows: Percentage of years that barrage flows are greater than 600 GL for any two year period	100%	100%	97%	100%	100%	100%	100%	100%
4.1	Coorong Salinity: Percentage of days South Lagoon average daily salinity is less than 100 grams per litre.	96%	100%	93%	100%	100%	100%	100%	100%
5.1	Mouth Openness: Percentage of years mouth open to an average annual depth of 1.0 meters (-1.0 m AHD) or more	90%	100%	76%	90%	91%	91%	91%	91%
5.2	Mouth Openness: Percentage of years mouth open to an average annual depth of 0.7 metres (-0.7 m AHD) or more	95%	100%	84%	94%	95%	96%	95%	95%

Appendix B Additional statistics for CLLMM environmental outcomes

CLLAMM: Lower Lakes	0 GL	500 GL	1000 GL	1500 GL	500 GL with env need
% of days when Salinity in Lake Albert > 2000 EC	2	1	1	1	1
% of days when Salinity in Lake Alexandrina > 1000 EC	5	2	2	2	2
% of time when Lake Alexandrina level < 0.4 m	8	7	7	6	7
CLLAMM: Coorong Salinity					
Maximum salinity in south Coorong (g/L)	135	90	103	113	103
Maximum Salinity in south Coorong: % of years < 100 g/L	98	100	99	98	99
Maximum period south Coorong salinity: > 130 g/L (days)	24	-	-	-	-
Average salinity in south Coorong (g/L)	42	42	42	42	42
Maximum salinity in north Coorong (g/L)	87	55	73	71	63
Maximum period north Coorong salinity: > 50 g/L (days)	201	53	166	161	142
Average salinity in North Coorong (g/L)	23	22	22	22	22
CLLAMM: Barrage Flows					
3yr rolling ave Flow: % of years > 1,000 GL/yr	99	99	99	99	99
3yr rolling ave Flow: % of years > 2,000 GL/yr	94	95	95	95	95
10yr rolling ave flow: % of years > 3,200 GL/yr	94	94	94	94	94
Annual flow: % of years > 2,000 GL/yr	82	81	81	82	81
Average flow (GL/yr)	6792	6,808	6,807	6,806	6,808