

## ANNUAL WATER OPERATING REPORT 2023/2024

**snowy**hydro

Safety is always our number one priority

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## **ABOUT THIS** REPORT

Since the Snowy Scheme's completion in 1974, Snowy Hydro Limited has carefully managed the water that flows through the Scheme's dams, tunnels, aqueducts and power stations in accordance with our water licence. This report outlines how we are managing the water that flows through the Scheme. Snowy Hydro operates a complex hydro-electric scheme utilising the water captured by the Scheme to generate energy to meet the market's needs, while also moving water from east to west to support irrigation districts.

Each year, we have to reach certain targets for downstream and environmental water releases. Snowy Hydro has operational flexibility day-to-day to strategically manage our generation and water releases, while at the same time providing long-term security to the downstream users around annual water releases. In the Snowy Scheme, water releases and electricity generation are inseparably linked.

Snowy Hydro operates under the Snowy Water Licence, issued by the NSW Government. The licence has many legally-binding and enforceable obligations on the company.

Snowy Hydro is obligated under the Snowy Water Licence to:

- Target water releases to the River Murray and Murrumbidgee River catchments, the annual volumes of which are determined according to highly-prescriptive formulae set out in the Snowy Water Licence:
- Target water releases from Jindabyne Dam into the Snowy River for environmental purposes (Snowy River Increased Flows): and
- Facilitate additional natural flows to nominated rivers for environmental purposes (Snowy Montane Rivers Increased Flows).

- This report is an important channel to educate and inform our stakeholders about the water operations of the Scheme. While we generate energy from the water that moves through the Scheme, we don't own a drop of it; nor do we sell the water, or charge people to access it.
- Snowy Hydro must operate the Snowy Scheme to first meet its water release obligations and then to maximise electricity market opportunities within the constraints imposed by the Snowy Water Licence.
- The Snowy Water Licence recognises the difficulties inherent in achieving precise release volumes at each release point, so any shortfall or excess is accounted for and generally dealt with by an 'unders' and 'overs' approach, whereby the shortfall or excess is added or subtracted to the following year's target – i.e. there is no way that Snowy Hydro can consistently 'under-deliver' water to any aspect of the release program.
- For more information about the Snowy Water Licence we encourage people to visit the NSW Department of Planning and Environment at industry. nsw.gov.au/water/basins-catchments/snowy-river



### 2022-2023 COMPLIANCE REPORT

## WHAT WATER WENT OUT

Snowy Hydro complied with all of the requirements imposed upon the company under the Snowy Water Licence during the 2022-2023 water year, including each water release target relating to:

- The Required Annual Release to the River Murray catchment.
- The Required Annual Release to the Murrumbidgee River catchment.
- Environmental releases into the Snowy River from Jindabyne Dam.
- Environmental releases into the Murrumbidgee River from Tantangara Dam.
- Environmental releases into the Goodradigbee River from Goodradigbee Aqueduct.
- Environmental releases into the Geehi River from Middle Creek and Strzelecki Creek Aqueducts.
- Environmental releases into the Snowy River from Bar Ridge, Diggers Ck and Falls Ck Aqueducts

## WESTERN RIVER RELEASES

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## RIVER MURRAY CATCHMENT

Snowy Hydro complied with its obligation to target the Required Annual Release (RAR) from the Snowy-Murray Development to the River Murray catchment during the 2022-2023 water year.

The total accounted release volume was 1,180 GL. This was made up of:

- 583 GL being the 2022-2023 RAR calculated under the Snowy Water Licence; plus
- 200 GL of pre-release of the 2022–23 RAR; plus
- 397 GL of Discretionary Above Target Water Releases (water not required for RAR releases that Snowy Hydro is able to release at its discretion)



This total accounted release volume includes 36 GL of montane environmental flow releases provided to the Geehi and Swampy Plains River which did not flow through the Scheme's power stations.

### MURRUMBIDGEE RIVER CATCHMENT

Snowy Hydro complied with its obligation to target the Required Annual Release (RAR) from the Snowy-Tumut Development to the Murrumbidgee River catchment during the 2022-2023 water year.

The total accounted release volume was 1,211 GL. This was made up of:

- 888 GL being the 2022-2023 RAR calculated under the Snowy Water Licence; plus
- 200 GL of pre-release of the 2022–23 RAR; plus
- 123 GL of Discretionary Above Target Water release (water not required for RAR releases that Snowy Hydro is able to release at its discretion).



### Inflows and Releases to the River Murray Catchment during 2022-23

This total accounted release volume includes 47 GL of montane environmental flow releases provided to the Murrumbidgee and Goodradigbee Rivers which did not flow through the Scheme's power stations.

Inflows and Releases to the Murrumbidgee Catchment during 2022-23

## ENVIRONMENTAL RELEASES



### Snowy River Increased Flows (SRIF) and Jindabyne Base Passing Flow (BPF) releases including Mowamba riparian releases

## SNOWY RIVER **INCREASED FLOWS**

Snowy Hydro complied with its obligation to target releases from Jindabyne Dam for environmental purposes during the 2022-2023 water year.

The volume of Snowy River Increased Flows (SRIF) released from Jindabyne Dam during the 2022-2023 water year was 194.5 GL, which was 0.1 GL under the target volume of 194.6 GL. That deficit is well within the +/-10% annual tolerance around the target volumes allowed under the Snowy Water Licence. The 2023-2024 target has been adjusted down to account for this release deficit.

In addition to the environmental releases, 8.5 GL Base Passing Flow (BPF) was also released from Jindabyne Dam and 0.5 GL riparian flow was released from the Mowamba Weir.

Daily releases from Jindabyne Dam fell outside the permissible thresholds on two occasions during the 2022-23 water year. The first event occurred on 30 May 2022 and was related to the manual operation of the dam to deliver an 8-hour high flow release. The second event occurred on 18 April 2023 while necessary works were being carried out at the dam. Both events were reported to NSW Department of Planning and Environment – Water (DPE Water) and were not deemed to be a breach of the Snowy Water Licence. The volume of under release has been added as an adjustment to the 2023-2024 target volume.

All other daily and monthly releases were within the +/-20% tolerance allowed under the Snowy Water Licence. Even though allocations for the 2022–23 water year exceeded 100 GL, a flushing flow was not scheduled for the Snowy River.

The comparison of the annual, monthly and daily release targets for the Snowy River Increased Flow releases against the actual releases is shown in the following charts.





### Snowy River Increased Flows (SRIF) and Jindabyne Base Passing Flow (BPF) releases and Daily Limits



- SRIF Low Limit
- SRIF High Limit



- Actual progressive SRIF releases
- SRIF annual target + 10%
- SRIF annual target 10%

## JINDABYNE SPILL

Very wet inflow conditions from August 2022 through to February 2023 on top of the high storage levels led to 57 GL of physical spills from Jindabyne Dam between 28 October 2022 to 2 November 2022 and 5 November and 11 November 2022.

An additional 211 GL of airspace management pre-releases were made either side of the physical spill events-between 4 October 2022 and 1 December 2022 and 17 December 2022 to 8 January 2023-to avoid further spill and manage public safety, both around and downstream of Lake Jindabyne.

In total, 268 GL was released from Jindabyne Dam in addition to target flows in 2022/2023. These sequences of events were Prescribed Events, during which time Snowy Hydro's daily release obligations were suspended. The additional releases were discussed regularly with DPE Water. The volumes presented in this Annual Water Operating Plan are based on the releases in excess of the daily targets during these events. The spills were exacerbated by damage to the Burrungubugge intake described further down in this report. This infrastructure is upstream of Jindabyne Dam and the damage reduced the ability to divert water away from Jindabyne, leading to increased inflows to the storage during this wet period.

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## THE TEMPERATURE OF **RELEASES FROM LAKE** JINDABYNE

The Snowy Water Licence requires the outlet works at Jindabyne Dam to be capable of releasing water from above any thermocline in the reservoir. The thermocline is a thin, but distinct, layer in a large body of water in which water temperature changes more rapidly with depth than it does in the layers above or below. Typically, as the summer progresses, the surface waters warm and the deeper waters remain cold. This causes a lack of mixing between the upper and lower layers, which can result in the lower layer having reduced oxygen levels. For these reasons, the deeper waters within reservoirs are generally viewed as having undesirable water quality characteristics for releases, hence the requirement for the outlet works to be able to draw water from above the thermocline.

The intake works at Jindabyne are located at the end of a channel excavated into the bank of Lake Jindabyne. In addition to the variable level shutters in the intake tower, the level of the base of the channel means that the deeper waters of the reservoir are inaccessible. This means that the thermocline is only likely to be above the levels of the intake channel when the lake is at much higher levels.

Snowy Hydro undertakes temperature monitoring at the intake tower to detect the presence of a thermocline and adjusts shutter height as necessary. As can be seen in the chart below, all releases were made from above the thermocline.



### Jindabyne Dam Intake Water Temperatures and Level (May 2022 to April 2023)

15		
ure	(Deg	C)

- May-22 Dam Level
- Jun-22 Dam Level
- Jul-22 Dam Level
- Aug-22 Dam Level
- Sep-22 Dam Level
- Oct-22 Dam Level
- Nov-22 Dam Level
- Dec-22 Dam Level
- Jan-23 Dam Level
- Feb-23 Dam Level
- Mar-23 Dam Level
- Apr-23 Dam Level
- Shutter Position

### SNOWY MONTANE RIVERS **INCREASED FLOWS**

Snowy Hydro complied with its obligation to target Snowy Montane Rivers releases for environmental purposes during the 2022-2023 water year.

During the 2022-2023 water year, Snowy Hydro was directed to make Snowy Montane Rivers Increased Flows (SMRIF) from the following locations:

- Tantangara Dam to the Murrumbidgee River, Goodradigbee Aqueduct to the Goodradigbee River (a tributary of the Murrumbidgee River),
- Middle Creek Aqueduct to Middle Creek and Strzelecki Creek Intake (on the Geehi River Aqueduct) to Strzelecki Creek (tributaries of the Geehi River),
- Diggers Creek Aqueduct to Diggers Creek and Bar Ridge Aqueduct to Tolbar Creek (tributaries of the Snowy River below Island Bend Dam), and
- Falls Creek to the Snowy River below Guthega Dam.

The target volume for SMRIF totalled 92.7 GL, with 35.7 GL from Tantangara Dam, 12.0 GL from Goodradigbee Aqueduct, 22.7 GL from Middle Creek and Strzelecki Ck, 9.4 GL from Diggers Creek and 9.5 GL from Bar Ridge Aqueduct and 3.4 GL from Falls Creek, all to be targeted over the whole water vear.

The total actual montane release volume was 115.1 GL. This was made up of 35.2 GL from Tantangara Dam, 11.7 GL from Goodradigbee Aqueduct, 35.9 GL from Middle Creek Aqueduct and Strzelecki Ck combined, 14.7 GL from Diggers Creek Aqueduct and 14.1 GL from Bar Ridge Aqueduct and 3.4 GL from Falls Creek, released over the whole water vear

The comparison of the annual, monthly and daily release targets for the SMRIF against the actual release from Tantangara Dam is set out in the graphs opposite. All daily, monthly and annual release targets were within the compliance limits.

Monthly releases from Goodradigbee, Middle Creek, Strzelecki Creek, Diggers Creek and falls Creek are also provided on the following pages. As these releases are made from small catchments and the inflows (and therefore releases) cannot be predicted or controlled, there are no annual compliance targets for these releases. The above/below target delivery of water in these catchments in 2022-2023 reflects the inflows received in these locations. In years when inflows are above average, above average volumes of water will be delivered to these catchments, and vice versa.

From September 2022 on, due to damage to the Burrungubugge intake, Bar Ridge Aqueduct was returned to service to reduce inflows to Jindabyne Dam and allow monitoring of flows in this area. The temporary arrangement was conditionally agreed by DPE Water to be reviewed annually and on the basis that it would cause no material adverse localised environmental impacts. From September to April, 124 GL flowed into the Snowy River from Burrungbugge and Gungarlin Rivers. The volume diverted from Tolbar Creek into Island Bend Dam via Bar Ridge Aqueduct was 10 GL. This volume was accounted as a montane release. As a result of this change, the 1km long section of the Snowy River from Diggers Ck to Tolbar Ck saw no change in flows. The 3km long section between Tolbar Ck and Gungarlin River saw releases into the Snowy River approximately halved. Releases to the 8km section of river between Gungarlin River and Jindabyne Dam increase sevenfold.

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### 2022-2023 Water Year Period under review: 1 May 2022 to 30 Apr 2023 15 40 14 13 35 12 30 1 11 10 9 8 8 25 20 æ 15 5 4 10 3 2 5 1 --0 May-22 Jun-22 Jul-22 Aug-22 Sep-22 Oct-22 Nov-22 Dec-22 Jan-23 Feb-23 Mar-23 Apr-23 Number of months when Tant montane releases were outside monthly limits = 0 Actual Riparian Releases Actual Progressive SMRIF Release Actual SMRIF Release Target Progressive SMRIF Release SMRIF monthly target - 20% SMRIF annual target - 10% -

### Snowy Montane Rivers Increased Flows (SMRIF) and Riparian Releases from Tantangara Dam

SMRIF monthly target + 20% SMRIF annual target + 10%

### Snowy Montane Rivers Increased Flows from Tantangara Dam and daily limits



Number of days when montane releases were outside daily limits = 0

- Actual SMRIF Releases

- SMRIF Low Limit

— SMRIF High Limit

-





× Water Year Target (GL)



Note: There are no monthly or annual compliance targets for Falls Creek.

Estimated Release (GL)

Estimated Progressive Release (GL)

× Water Year Target (GL)



### Snowy Montane Rivers Increased Flows from Diggers Creek Aqueduct

### Snowy Montane Rivers Increased Flows from Falls Creek Aqueduct

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### Snowy Montane Rivers Increased Flows from Goodradigbee Weir



Actual Progressive Releases (GL)

× Water Year Target (GL)

### Snowy Montane Rivers Increased Flows (SMRIF) from Bar Ridge Aqueduct



Note: There are no monthly or annual compliance targets for Bar Ridge.

Estimated Release (ML)

---- Estimated Progressive Release (GL)

× Water Year Target (GL)





---- Actual Progressive Releases (GL)

× Water Year Target (GL)

### Snowy Montane Rivers Increased Flows from Strzelecki Creek Aqueduct



Note: There are no monthly or annual compliance targets for Strzelecki Creek.

- Estimated Releases (GL)
- ----- Estimated Progressive Releases (GL)
- × Water Year Target (GL)



### Snowy Montane Rivers Increased Flows (SMRIF) from Middle Creek Aqueduct

### Tantangara Dam Intake Water Temperatures and Level

### THE TEMPERATURE OF RELEASES FROM TANTANGARA RESERVOIR

The Snowy Water Licence requires the outlet works at Tantangara Dam to be capable of releasing water from above any thermocline in the reservoir.

The thermocline is a thin, but distinct, layer in a large body of water in which temperature changes more rapidly with depth than it does in the layers above or below. Typically, as the summer progresses, the surface waters warm and the deeper waters remain cold. This causes a lack of mixing between the upper and lower layers, which often results in the lower layer having reduced oxygen levels. For these reasons, the deeper waters within reservoirs are generally viewed as having undesirable water quality characteristics for releases, hence the requirement for the outlet works to be able to draw water from above the thermocline. The new intake works at Tantangara Dam are located on the upstream face of the dam wall. They comprise a series of 'telescoping' shutters to create a variable level off-take.

Snowy Hydro undertakes temperature monitoring at the intake tower to detect the presence of a thermocline and adjusts the shutter height as necessary. As can be seen in the chart below, all releases were made from above the thermocline.





— Apr 23 Temp

- May 22 Dam level
- Jun-22 Dam Level
- Jul-22 Dam Level
- Aug-22 Dam Level
- Sep-22 Dam Level
- Oct-22 Dam Level
- Nov-22 Dam Level
- Dec-22 Dam Level
- \_ Jan-23 Dam Level
- Feb-23 Dam Level
- Mar-23 Dam Level
- Apr-23 Dam Level
- Shutter Position



### 2023-2024 OPERATING PLAN



Snowy Hydro will operate the Snowy Scheme to target the requirements imposed upon the company under the Snowy Water Licence during the 2023-2024 water year, including each water release target relating to:

- The Guaranteed Minimum Water Release to the River Murray and Murrumbidgee River catchments
- Environmental releases into the Snowy River from Jindabyne Dam.
- Environmental releases into the Murrumbidgee River from Tantangara Dam.
- Environmental releases into the Goodradigbee River from Goodradigbee Aqueduct.
- Environmental releases into the Geehi River from Middle Creek and Strzelecki Creek Aqueducts.
- Environmental releases into the Snowy River from Bar Ridge, Diggers Ck and Falls Ck Aqueducts

### This report will also contain:

- Any agreements by the Water Consultation and Liaison Committee regarding matters relevant to the Annual Water Operating Plan; and
- Other information with respect to water releases and diversions Snowy Hydro and/or the Ministerial Corporation see fit.

- The expected Required Annual Release to the River Murray and Murrumbidgee River catchments

## WESTERN RIVER RELEASES



## RIVER MURRAY CATCHMENT

Snowy Hydro will guarantee a minimum water release from the Snowy-Murray Development to the River Murray of 663 GL, on the basis of pre-release volumes, water available in storage at the start of the water year and the maximum relaxation volume occurring throughout the year.

The expected Required Annual Release is 725 GL. This volume can increase or decrease through the year based on numerous factors set out in the Snowy Water Licence, particularly the Dry Inflow Sequence Volume under dry conditions and Relaxation Volumes under wet conditions.

The Required Annual Release is expected to include 23 GL of montane environmental flow releases provided to the Geehi and Swampy Plains River without flowing through the Scheme's power stations. For the 2023-2024 water year, the Water Consultation Liaison Committee have endorsed Snowy Hydro's proposal to enter into a one-off option agreement to progressively (by election at monthly interval) reduce the Snowy-Murray Required Annual Release by up to 100 GL if a Relaxation Volume is not triggered as expected. The final reduction volume, if Snowy Hydro takes the option up, will be calculated at 30 April 2024 and be added to the 2024-2025 Required Annual Release. It will also be the first water delivered in that water year. The operation of other licence provisions will be unaffected by the agreement. The agreement provides more flexibility for Snowy Hydro to operate in the National Electricity Market and will increase water security for Murray water users.

Snowy Hydro will closely monitor inflows and will provide monthly advice to water authorities regarding the Dry Inflow Sequence Volume and the extent of the possible reduction in the Required Annual Release.

### MURRUMBIDGEE RIVER CATCHMENT

Snowy Hydro will guarantee a minimum water release from the Snowy-Tumut Development to the Murrumbidgee River of 655 GL, on the basis of prerelease volumes, water available in storage at the start of the water year and the maximum relaxation volume occurring throughout the year.

The expected Required Annual Release is 681 GL. This volume can increase or decrease through the year based on numerous factors set out in the Snowy Water Licence. The Required Annual Release is expected to include 48 GL of montane environmental flow releases provided to the Murrumbidgee and Goodradigbee Rivers without flowing through the Scheme's power stations. Snowy Hydro will closely monitor inflows and will provide monthly advice to water authorities regarding the Dry Inflow Sequence Volume and the extent of the possible reduction in the Required Annual Release.

# RELEASES



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lindabyne Dam

### SNOWY RIVER INCREASED **FLOWS**

Snowy Hydro will target the daily, monthly and annual release targets from Jindabyne Dam, as developed and prescribed by NSW DPE Water. The volume of Snowy River Increased Flows (SRIF) apportioned to be released from Jindabyne Dam of 212.0 GL was increased by the under release from last Water Year of 0.1 GL to ensure the Snowy River does not receive more or less than allocated by NSW DPE Water in the long term. In addition to the environmental releases, 8.5 GL Base Passing Flow (BPF) will be released from Jindabyne Dam and 0.5 GL riparian flow from the Mowamba Weir. Total releases from Jindabyne Dam will therefore be 212.0+0.1+8.5 = 220.6 GL

Although allocations for the 2023-2024 water year are greater than 100 GL, NSW DPE Water has not directed Snowy Hydro to operate Jindabyne Dam to target a flushing flow delivery in 2023/2024.

However, it has notified that it wishes to hold discussions with Snowy Hydro in May 2023 and again around August 2023 to determine if conditions allow for an opportunistic release from the Jindabyne Dam spillway at these times. NSW DPE Water, working with representatives across local, state and Commonwealth Government agencies, will be responsible for the advice to downstream landholders and other stakeholders that would be impacted by the increased Snowy River levels if an opportunistic flushing flow is requested.

The annual, monthly and daily release targets for the Snowy River Increased Flow releases are shown in the following table and charts.





Jindabyne Dam Monthly Release Targets



---- Progressive Releases





## SNOWY MONTANE RIVERS **INCREASED FLOWS**

### Monthly Release Targets for Snowy Montane Rivers Increased Flows from Tantangara Dam

Snowy Hydro will target the daily, monthly and annual release targets from Tantangara Dam, and the annual targets for Goodragidgee, Middle Creek, Strzelecki Creek, Bar Ridge, Diggers Creek and Falls Creek Aqueducts, as developed and prescribed by NSW DPE Water for the 2023-2024 water year.

As directed by DPE Water, Snowy Hydro will take Bar Ridge Aqueduct out of service to return flows to Tolbar Creek.

The apportionment volume for SMRIF totalled 92.8 GL, with 40.8 GL from Tantangara Dam, 7.0 GL from Goodradigbee Aqueduct, 22.7 GL from Middle Creek and Strzelecki Ck, 18.9 GL from Bar Ridge and Diggers Creek Aqueducts and 3.4 GL from Falls Creek, all to be targeted over the whole water year. The adjusted annual target volume for releases from Tantangara Dam is 41.2 GL after being increased by 0.4 GL of under release from last Water Year.





Daily Release targets for Snowy Montane Rivers Increased Flows from Tantangara Dam



