

Murrumbidgee River Operations Plan

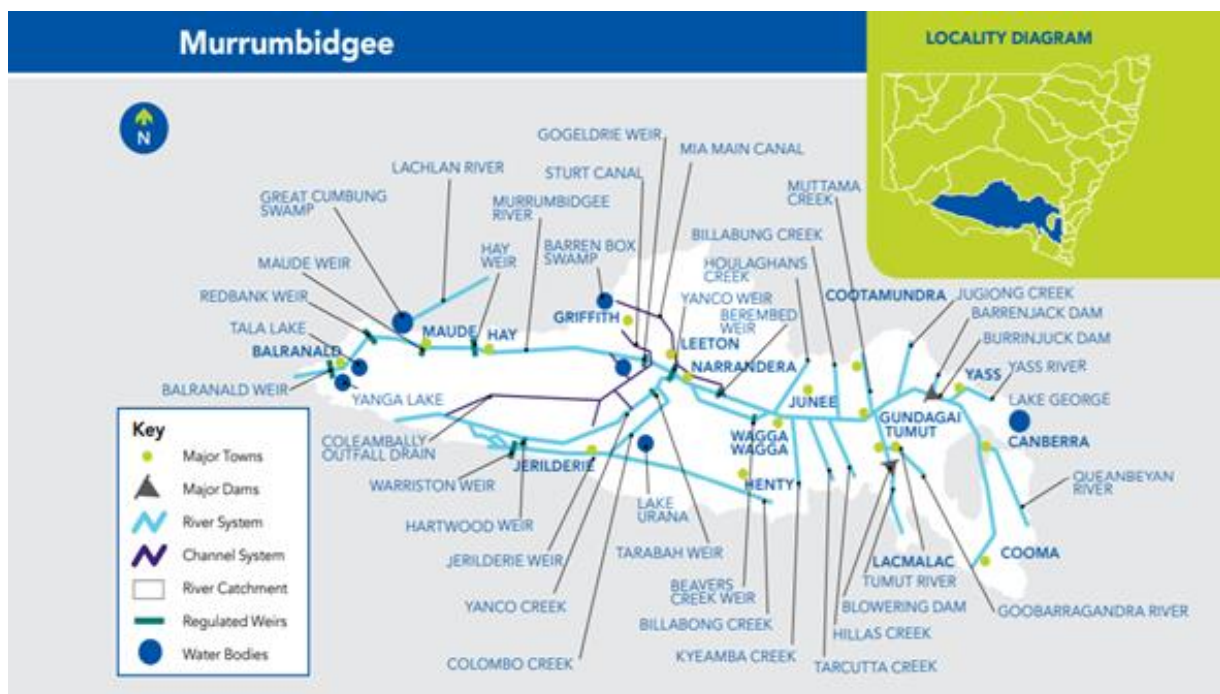
November 2018

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1. Highlights

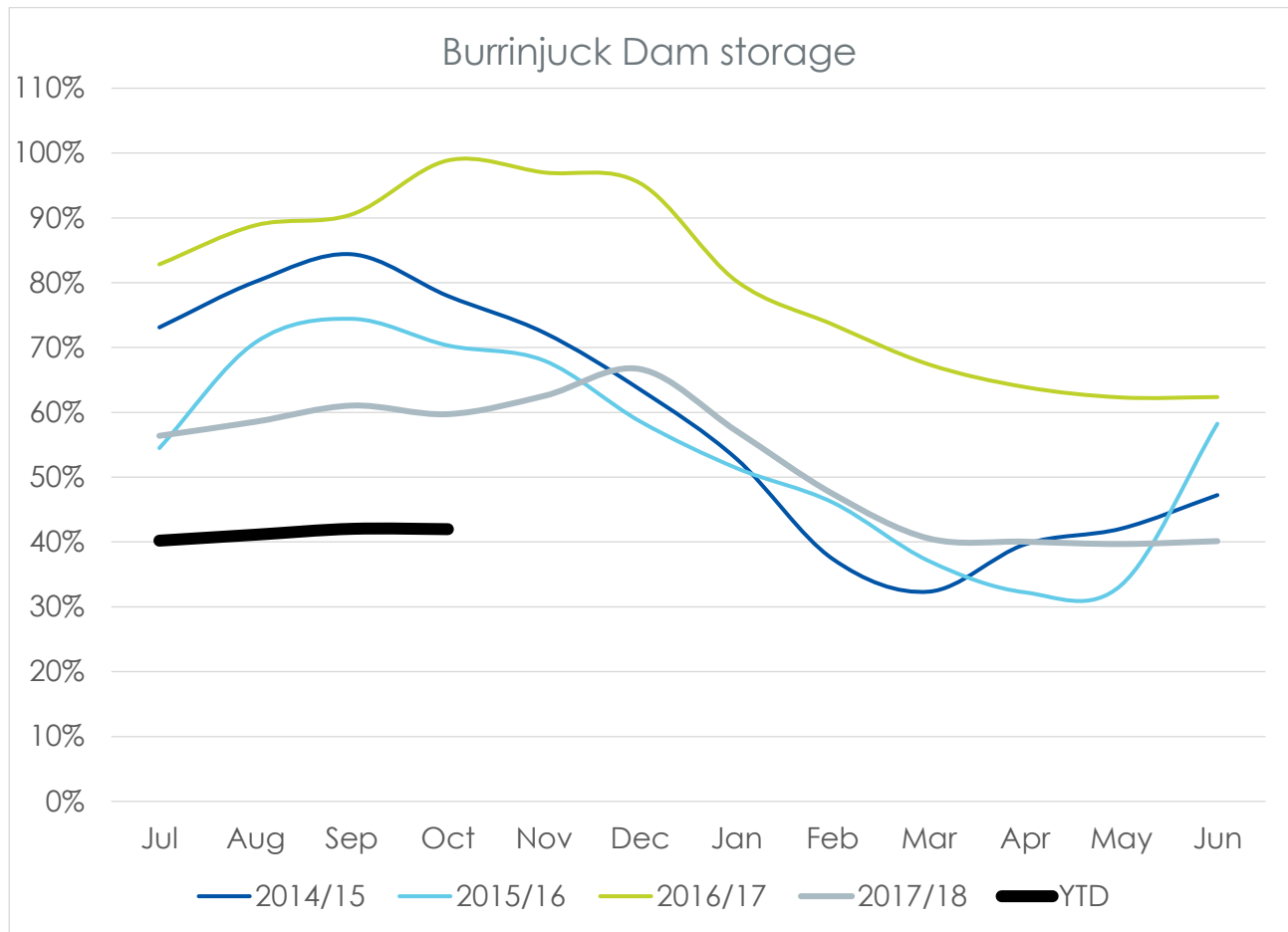
- The initial Available Water Determinations (AWD) are 100% for towns and 95% for high security, while general security has increased from an initial announcement of zero to 7%. Carryover into 2018-19 is 22% of general security share components.
- BOM Climate outlook indicates that parts of eastern Australia in the November to January period is likely to be wetter than average conditions. Current observations and model outlooks indicate the likelihood of El Niño conditions through the summer months.
- Water made available on 15th November consist of the following components:
 - Total Licensed water is about 866GL (allocation plus carryover minus usage to date).
 - Planned Environmental water - Discretionary component of about 49GL.
 - Planned Environmental water - End of system flows of about 74GL.
 - Essential requirements including transmission and evaporation losses of about 392GL.
 - IVT balance is remaining marginally positive at present.



2. Dam storage

2.1 Burrinjuck Dam storage

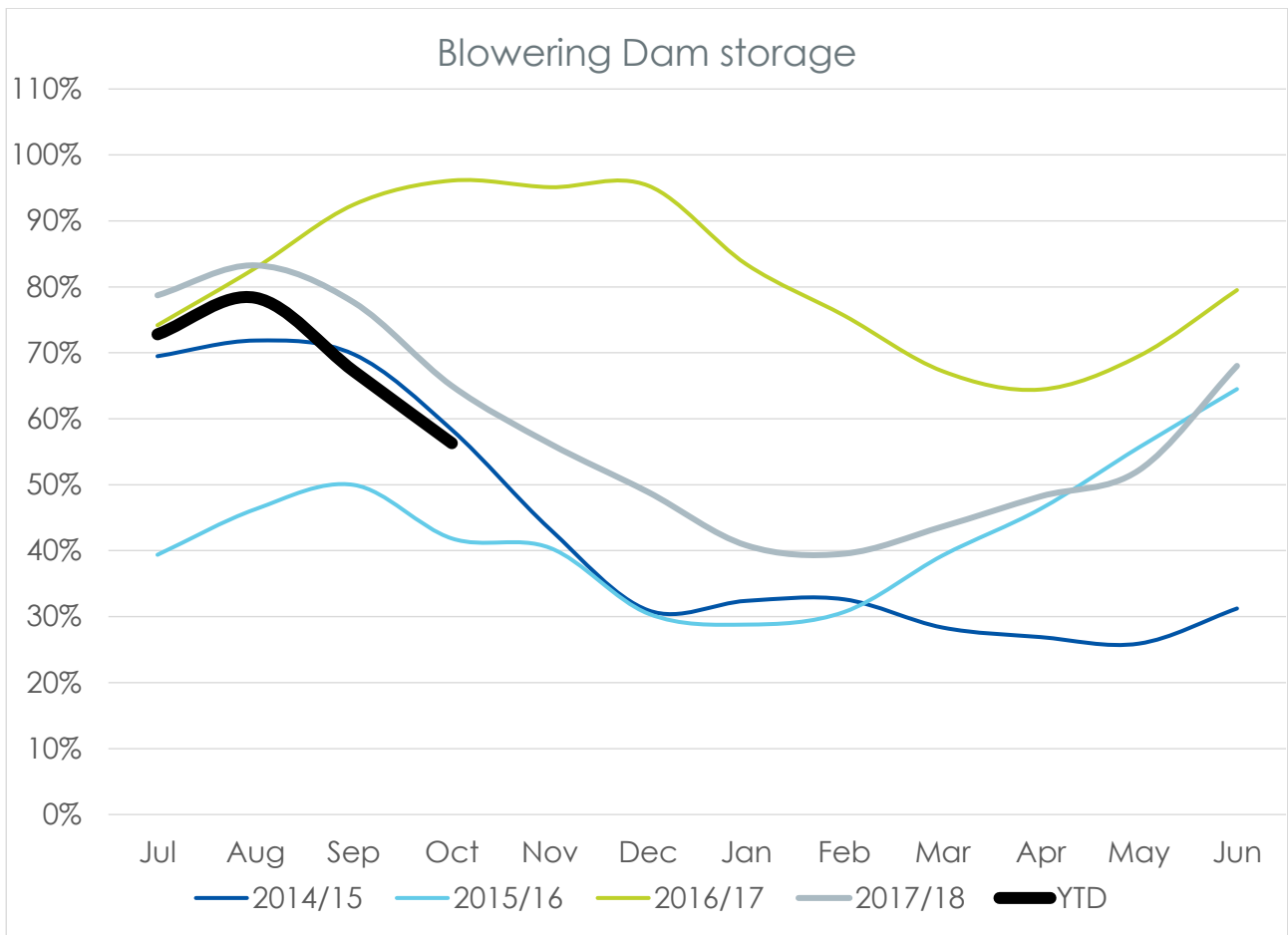
The figure below shows the Burrinjuck Dam storage behaviour for the current water year (2018-19) and for the last four water years.



Burrinjuck Dam was around 40% full at the start of water year and by the end of October has risen to 42%. The minimal increase is because of the combination of the; very small inflows, and the only releases from the dam have been for planned riverine environmental purposes.

2.2 Blowering Dam storage

The below figure shows the Blowering Dam behaviour for the 2018-19 water year compared to the last four water years.



From the above figure, Blowering Dam volume was around 73% at the start of the current water year and has fallen to about 56% at the end of October. This year's higher initial inflows from Snowy Hydro have been subsequently offset by significant releases made from Blowering Dam for irrigation and environmental watering.

3. Supplementary access

3.1 Commentary

No supplementary event has been triggered so far in 2018-19.

3.2 Explanation

Supplementary water, formerly known as off-allocation water, is surplus flow that cannot be captured or re-regulated in storages. When rain events result in flows that cannot be captured (regulated) in storage structures such as dams or weirs for future use, and the water is not needed to meet current demands or commitments, then supplementary access may be announced. Supplementary flow events can occur at any time and therefore access is purely opportunistic.

Supplementary access is made available when flows are in excess of those needed for; environmental water rules, domestic stock and native title rights, and water orders for other licence categories. Supplementary access announcements also consider the water required to fill Lake Victoria when Murrumbidgee general security Available Water Determinations (AWD) are above 70% and the NSW Murray valley's AWD plus carryover is less than 60%.

3.3 Uncontrolled flow access to general security licences

During announced supplementary events, those holding General Security Water Access Licenses may also pump water 'without debit' during these periods under the following circumstances.

Whenever the effective available water for general security is less than or equal to 0.7 ML/unit of share component, and until the total amount extracted without debit, plus the effective available water is less than 0.85 ML/unit of share component.

NOTE: The effective available water for the general security is defined as AWD plus "the maximum of zero or the average carryover from the previous water year less 0.15 ML per unit share".

$$\text{Average Carryover} = \frac{\text{Volume of water carried over by all general security licences as of 1 July}}{\text{Total share entitlements of general security category}}$$

4. Water availability

4.1 2018/19 water availability for Murrumbidgee

| Licence category | Share component | AWD Volume | Carryover In** | Allocation assignments in | Allocation assignments out | Usage | Account Balance* |
|---|------------------|------------------|----------------|---------------------------|----------------------------|----------------|------------------|
| Coleambally irrigation (conveyance) | 130,000 | 111,605 | 4,557 | 0 | 6,411 | 39,163 | 69,791 |
| Domestic and stock | 20,993 | 20,993 | -1 | 0 | 0 | 10,641 | 10,351 |
| Domestic and stock [domestic] | 271 | 271 | -20 | 0 | 0 | 4 | 247 |
| Domestic and stock [stock] | 12,883 | 12,883 | 0 | 0 | 0 | 7,224 | 5,659 |
| Local water utility | 23,816 | 23,816 | 0 | 0 | 500 | 2,775 | 20,541 |
| Murrumbidgee irrigation (conveyance) | 243,000 | 154,111 | 7,376 | 0 | 14,314 | 112,958 | 34,215 |
| Regulated river (conveyance) | 2,968 | 208 | 79 | 0 | 0 | 0 | 287 |
| Regulated river (general security) | 1,891,995 | 132,440 | 407,074 | 187,739 | 161,224 | 100,571 | 465,458 |
| Regulated river (high security) | 360,298 | 342,284 | -2 | 8,914 | 29,115 | 97,282 | 224,800 |
| Regulated river (high security) [Aboriginal cultural] | 2,150 | 2,150 | 0 | 0 | 0 | 0 | 2,150 |
| Regulated river (high security) [research] | 300 | 300 | 0 | 0 | 0 | 0 | 300 |
| Regulated river (high security) [town water supply] | 19,769 | 19,769 | 0 | 0 | 0 | 5,070 | 14,699 |
| Supplementary water | 198,780 | 198,610 | 0 | 25,436 | 25,436 | 0 | 198,780 |
| Supplementary water (Lowbidgee) | 747,000 | 747,000 | 0 | 393,117 | 393,117 | 0 | 747,000 |
| Grand total | 3,654,222 | 1,766,440 | 419,063 | 615,206 | 630,117 | 375,687 | 1,794,905 |

*As per water balance extraction on 15th November 2018

** Includes the carryover by the licences held by Ministerial Corporation for Snowy River Water Savings

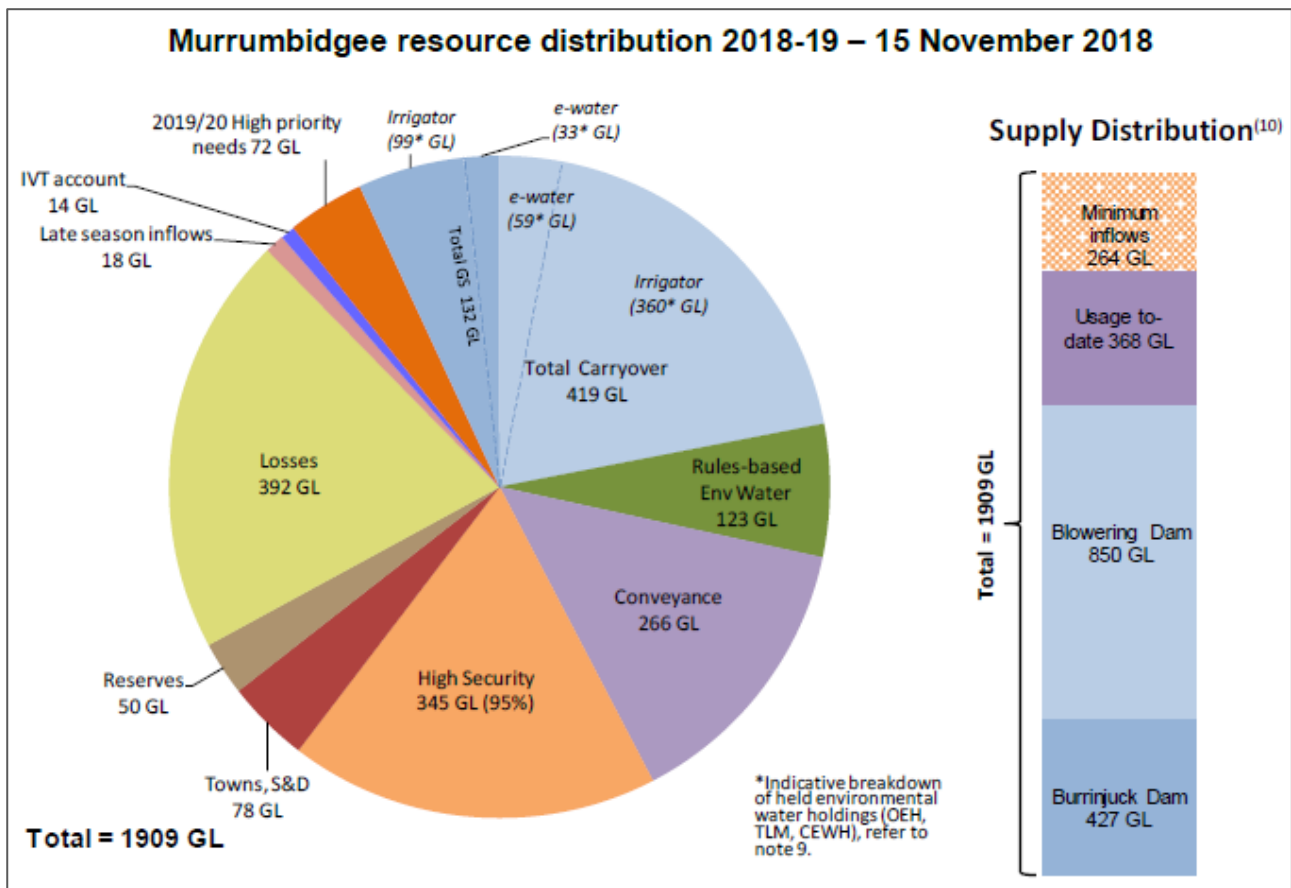
General security available water determination

| Date | AWD (ML/share) | Total % |
|-----------|----------------|---------|
| 1-Jul-18 | 0.03 | 3% |
| 16-Jul-18 | 0.02 | 5% |
| 1-Aug-18 | 0.01 | 6% |
| 17-Sep-18 | 0.01 | 7% |

In the current water year, 7% of general security Available Water Determinations (AWD) has been announced since 1st July 2018. For High Security licenses the AWD is 95%, and other higher categories such as Domestic and Stock, Local Water Utility etc. the AWD is 100%.

The total share component of regulated licenses is 2,708,749ML (excluding supplementary categories) and the sum of AWD volume is about 820,829ML. The sum of account balance refers to the amount of water available in the license accounts after adjusting for trade and usages. As of 15th November 2018, a total volume (excluding supplementary categories) of 849,294ML remained in account balances, including carryover from last water year.

4.2 Resource assessment



Note: Volumes in the pie chart are in Gigalitres. General Security volumes represent 100% carryover balance. Source: industry.nsw.gov.au/_data/assets/pdf_file/0011/197255/WAS-Murrumbidgee-181115.pdf

4.2.1 Significance of this resource assessment

The resource assessment undertaken on 15th November 2018 indicated that there was no increase in AWD. The future inflows of 264GL include estimated minimum natural inflows to dams and in downstream tributaries, as well as undelivered Required Annual Release (RAR) by Snowy Hydro. Burrinjuck and Blowering storages hold about 427 GL and 850 GL respectively.

4.2.2 Resource assessment process

Resource Assessment is the process of calculating how much water resource is available in the valley based on the rules of the Water Sharing Plan. The above resource assessment chart (Section 4.2) depicts the latest resource assessment done on 15th November 2018. The planning horizon for this resource assessment is from December 2018 to June 2019. There is sufficient volume of water from minimum inflows into this water source (including Snowy RAR) in 2019-20 to supply higher category requirements in that year.

The essential components of the assessment are:

- Calculation of the water currently available, including active water in storage, minimum inflows and the Snowy Hydro RAR into Blowering Dam and partly to Burrinjuck Dam as Montane flows.
- Volumes remaining in licence accounts, planned environmental water, undelivered inter-valley trades and allowances for transmission and storage evaporation losses.
- Typically, the resource assessment is undertaken twice every calendar month from late June until the start of the irrigation season (mid-November), there after once every month.

The main feature in the assessment process is that at no point of time in the forecast period do Burrinjuck or Blowering Dam fall below the dead storage level before the end of the assessment period (i.e. before the 2nd winter inflows).

The resource assessment data is communicated by WaterNSW to the Department to allow the Available Water Determination on the first business day on/after the 1st and 15th of each month. On receipt of the AWD Order WaterNSW makes the necessary changes to the license accounts in the Water Accounting System and disseminates the information to the customers through customer notices and weekly report.

4.3 Prognosis

The chances of improved General Security Allocation, based on various possible inflow scenarios:

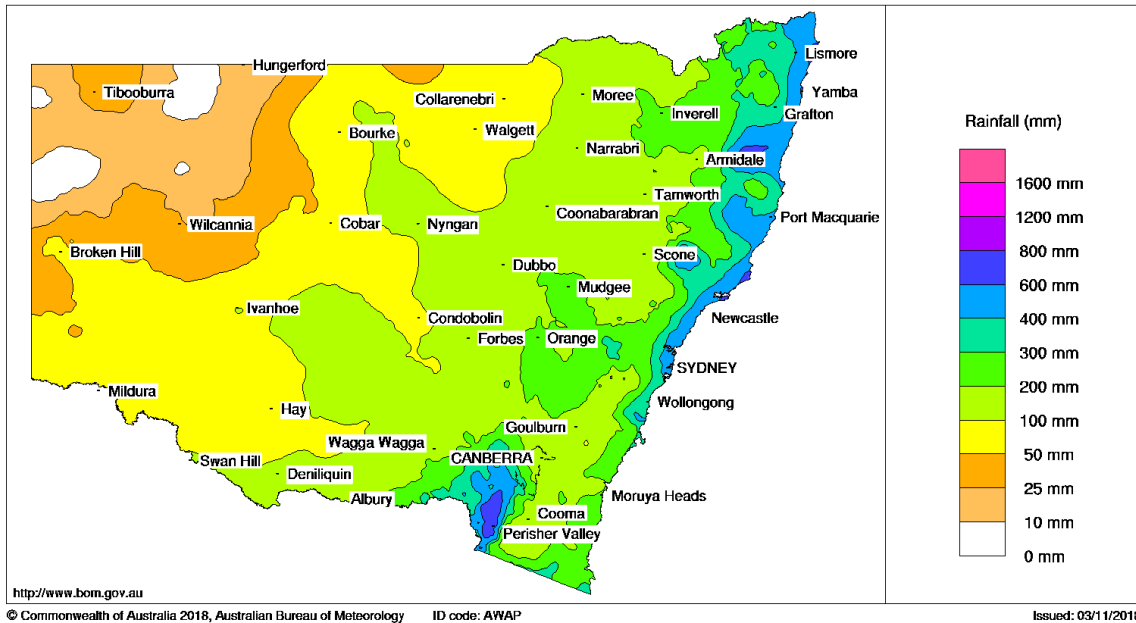
| Potential inflows conditions | Probability | 2018/19 Allocation by start of December 2018 for assessment carried out Mid November 2018 | 2018/19 Allocation by start of February 2019 for assessment carried out Mid November 2018 |
|------------------------------|--|---|---|
| Droughts (99) | 99th percentile inflows 99 chances in 100 | 7% | 7% |
| Very dry (90) | 90th percentile inflows 9 chances in 10 | 7% | 7% |
| Dry (75) | 75th percentile inflows 3 chances in 4 | 7% | 7% |
| Median (50) | 50th percentile inflows 1 chance in 2 | 7% | 7% |
| Wet (25) | 25th percentile inflows 1 chance in 4 | 7% | 10% |

The probability quoted for each allocation is the likelihood of that allocation being reached or exceeded by the start of months indicated. These allocations are in addition to remaining carryover from previous seasons. The estimated average carryover from this water year into 2018-19 is about 22%.

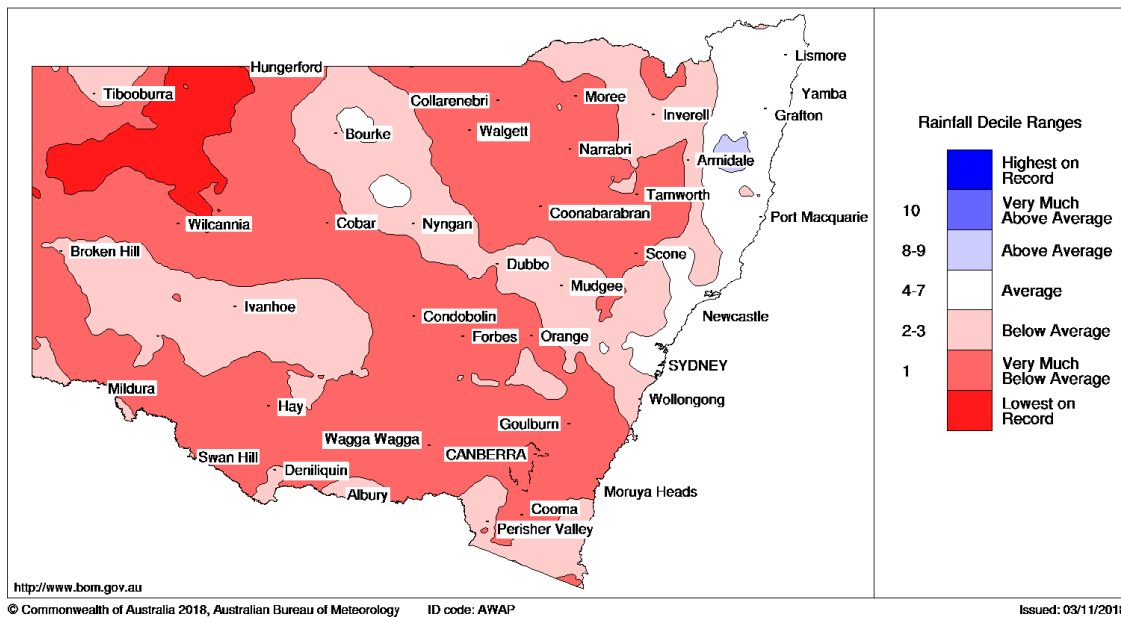
5. Rainfall

5.1 6-month rainfall

New South Wales Rainfall totals (mm) 1 May to 31 October 2018
Australian Bureau of Meteorology



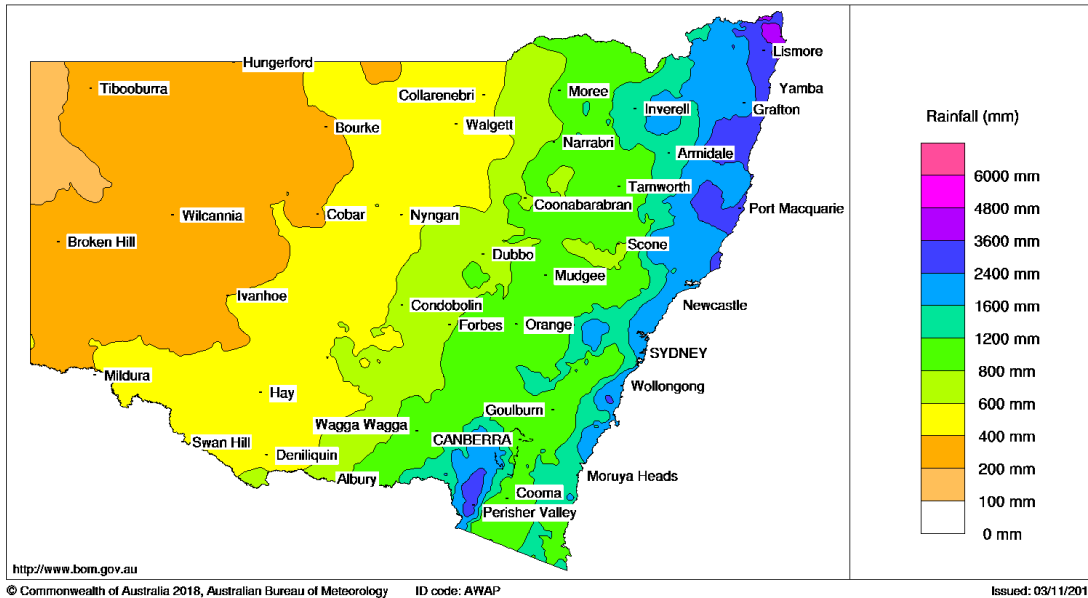
New South Wales Rainfall Deciles 1 May to 31 October 2018
Distribution Based on Gridded Data
Australian Bureau of Meteorology



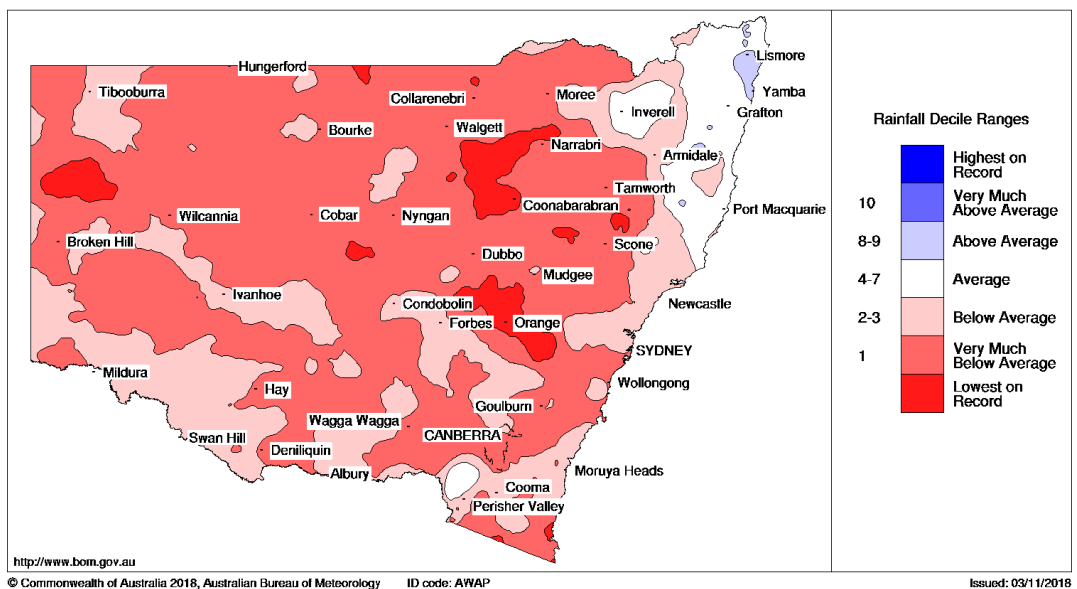
Above figures indicate that rainfall varies across the catchment. During last 6-months, total rainfall lies in the range of 50 to 300mm and is below to very much below average. The catchment has remained dry to very much below average.

5.2 24-month rainfall

New South Wales Rainfall totals (mm) 1 November 2016 to 31 October 2018
Australian Bureau of Meteorology

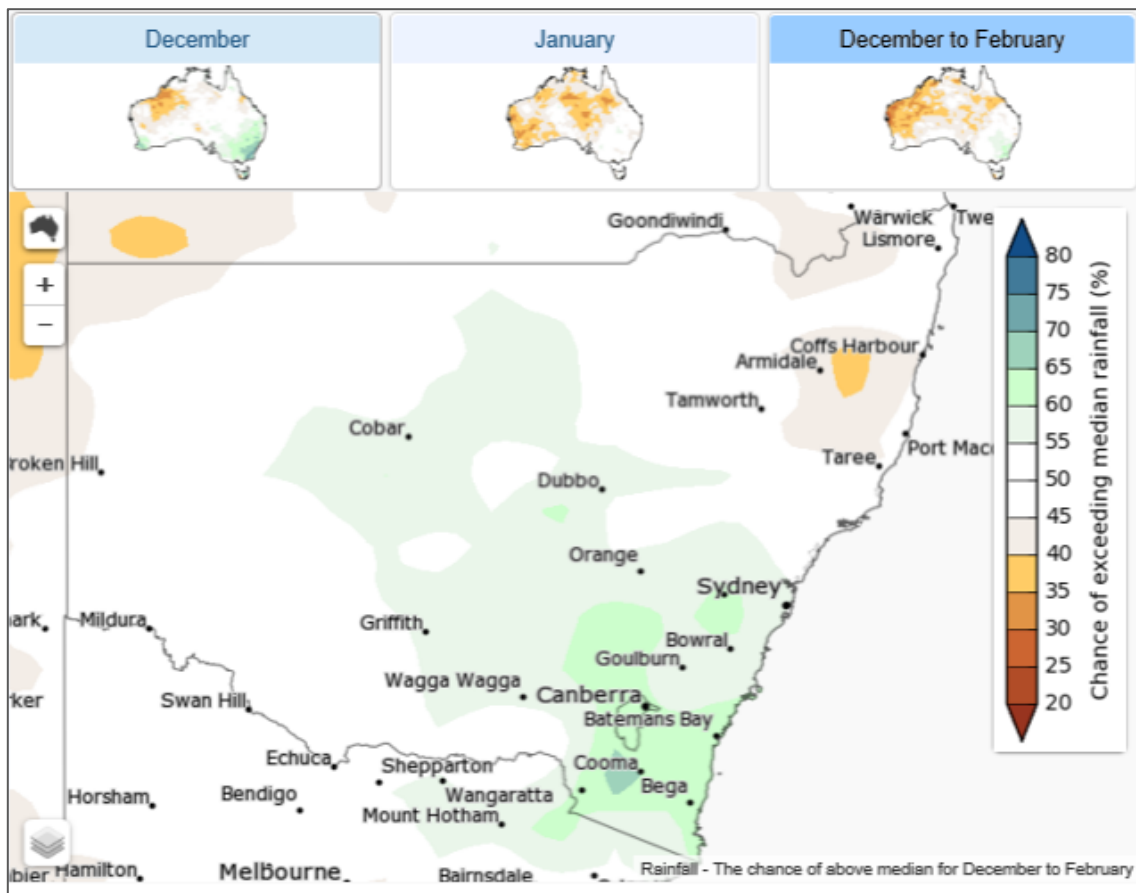


New South Wales Rainfall Deciles 1 November 2016 to 31 October 2018
Distribution Based on Gridded Data
Australian Bureau of Meteorology



Above figures indicate that rainfall varies across the catchment with total rainfall lies in the range of 400mm to 800mm in western part which is below average and 600mm to 1600mm in the eastern part of the catchment which is below average. 12-month statistics indicate that Murrumbidgee catchment remained below average dry conditions.

5.3 Next 3 months scenario based on BOM forecast

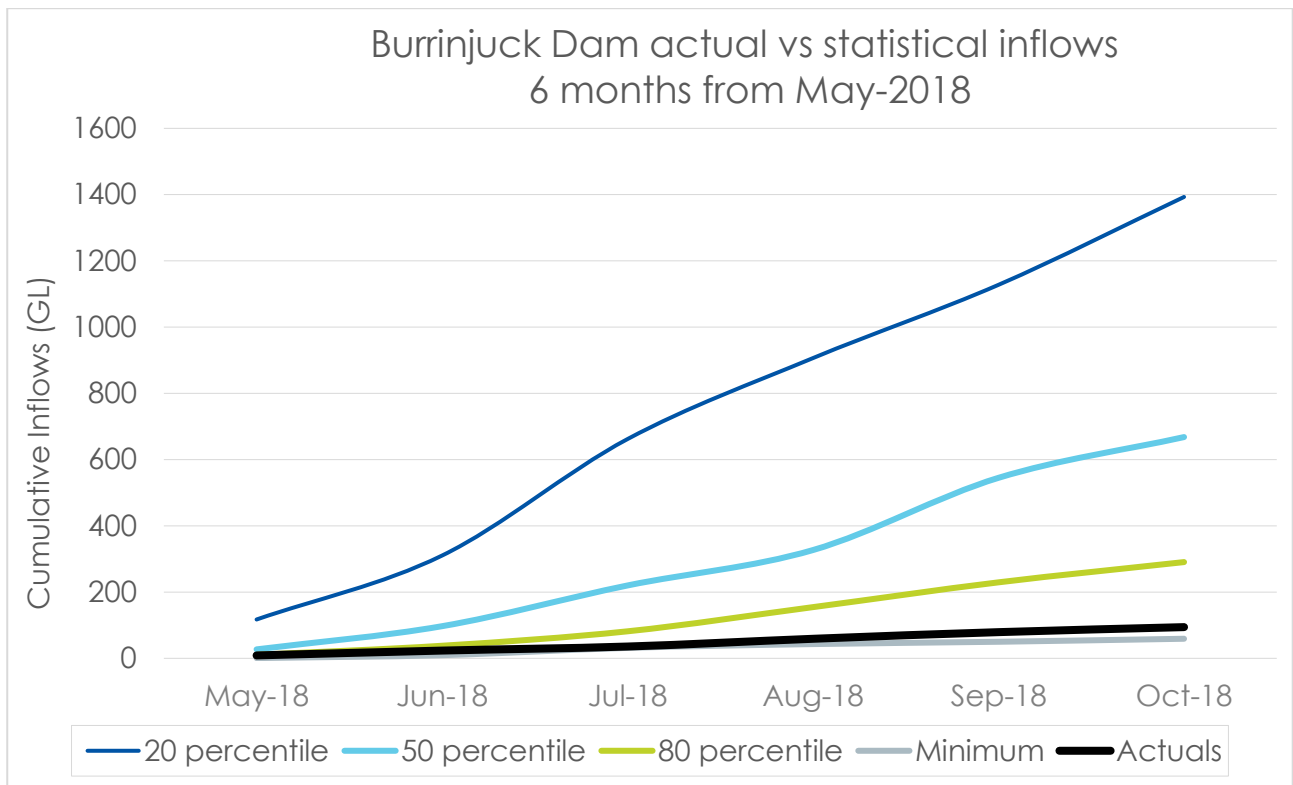


The above figure shows seasonal rainfall forecast over the next three months (December to February). The forecast rainfall is likely to be wetter than median in the catchment.

6. Inflows

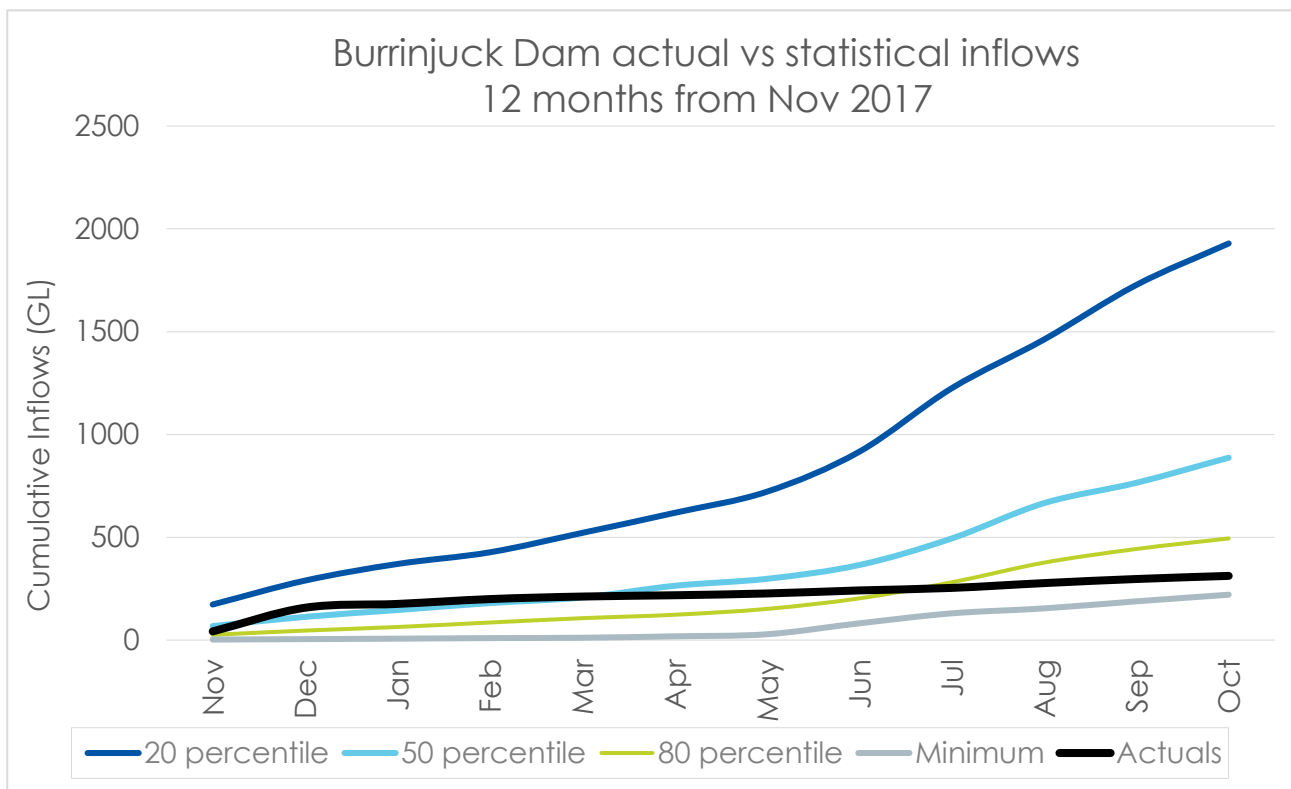
6.1 Burrinjuck Dam inflows

6.1.1 Burrinjuck past 6-month inflows - actual vs statistical



Inflows are drier than the rainfall over the past 6-month period. Actual inflow for the 6 months is 94 GL in line with about 96 percentile inflows; while the minimum is 59 GL.

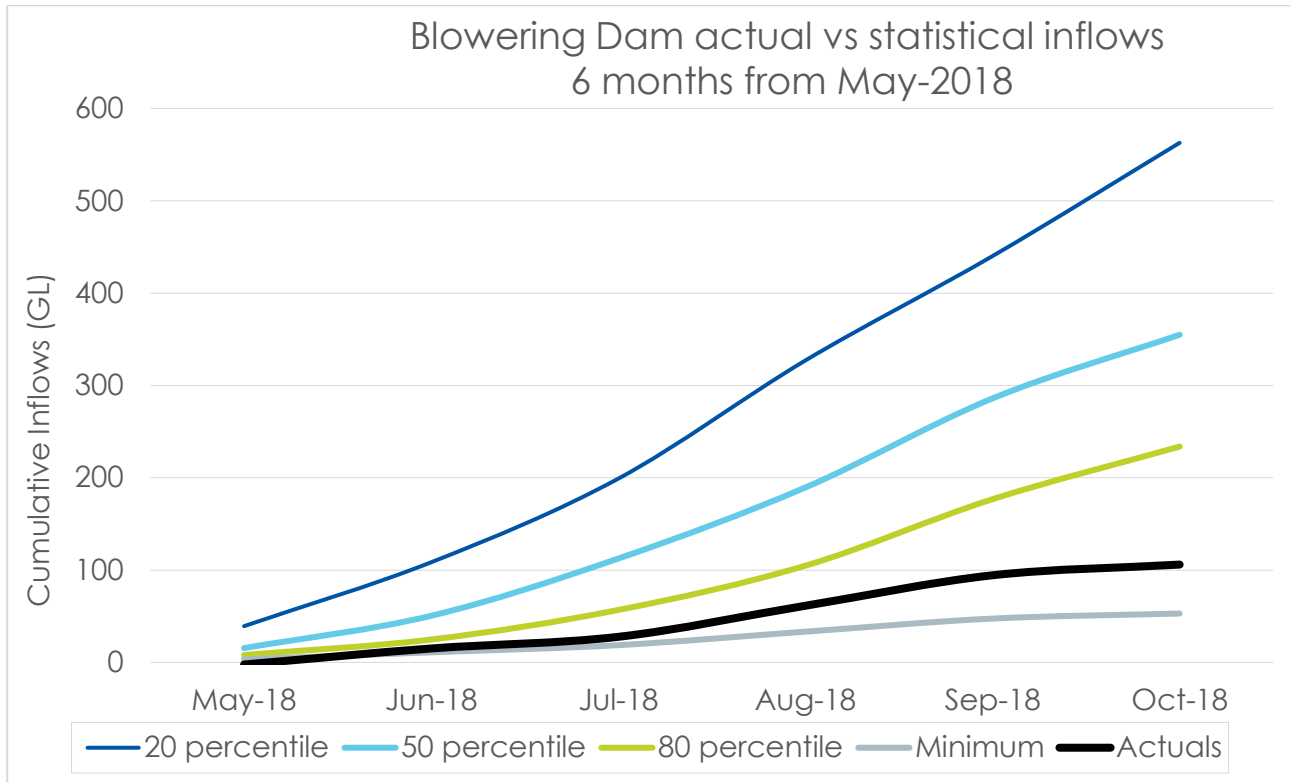
6.2.2 Burrinjuck past 12-month inflows – actual vs statistical



Inflows are marginally wetter than the rainfall over the past 12-month period. Actual inflow for the 12 months is 312 GL in line with about 94 percentiles; while the minimum is 221 GL.

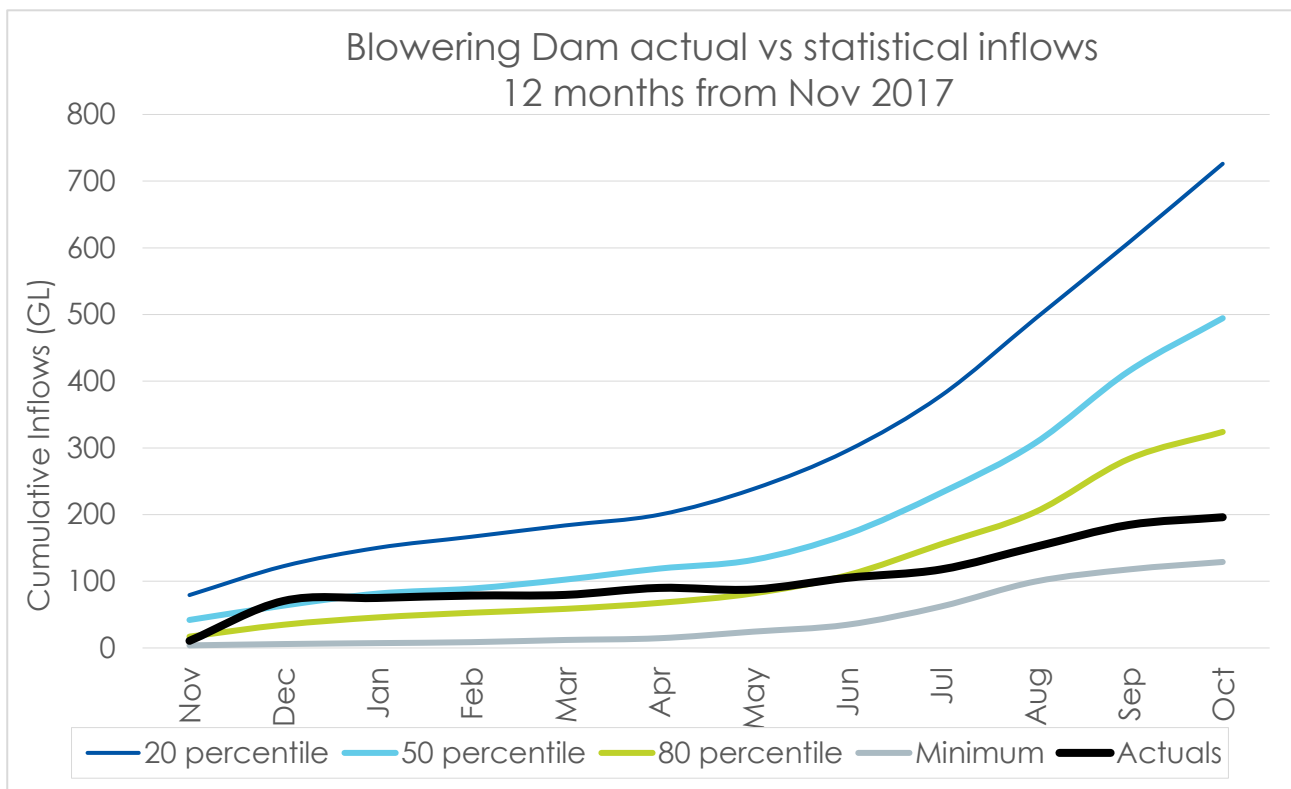
6.2 Blowering Dam inflows

6.2.1 Blowering past 6-month inflows – actual vs statistical



Inflows are drier than rainfall over the past 6-month period. Actual inflow for the 6 months is 106 GL in line with about 94 percentile inflows; while the minimum is 53 GL.

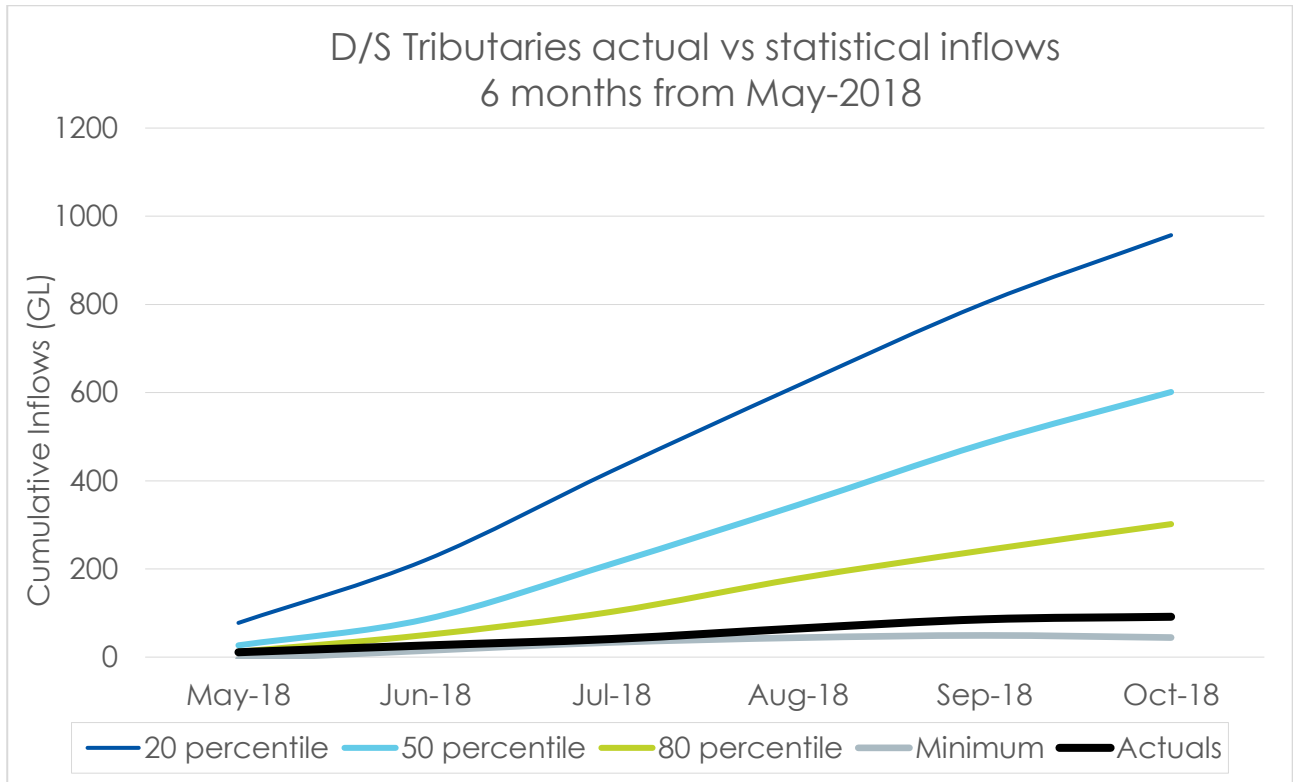
6.2.2 Blowering past 12-month inflows – actual vs statistical



Inflows are marginally drier than rainfall over the past 12-month period. Actual inflow for the 12 months is 196 GL in line with about 96 percentile inflows; while the minimum is 129 GL.

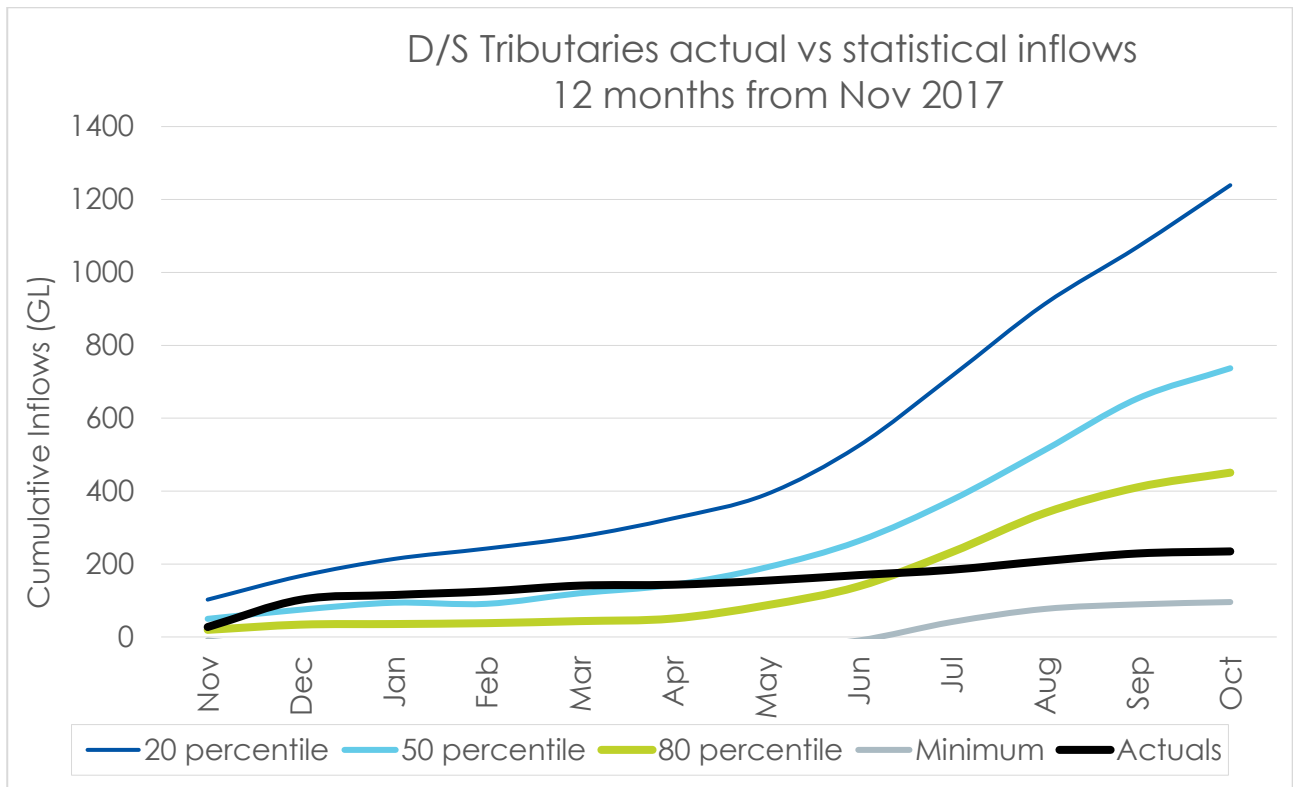
6.3 Downstream tributary inflows

6.3.1 Downstream tributary past 6-month inflows – actual vs statistical



Inflows are drier than rainfall over the past 6-month period. Actual inflow for the 6 months is 92 GL in line with about 95 percentile inflows; while the minimum is 44 GL.

6.3.2 Downstream tributary past 12-month inflows – actual vs statistical



Inflows are drier than rainfall over the past 12-month period. Actual inflow for the 12 months is 235 GL marginally drier than 93 percentile inflows, while the minimum is 96 GL.

7. Inter valley transfer (IVT)

The trading of allocated water is allowed in accordance with the Water Sharing Plans between the regulated Murrumbidgee River and Murray River, Lower Darling River and Snowy River catchments.

The Murrumbidgee inter-valley transfer (IVT) account keeps track of net allocation trade to and from the Murrumbidgee valley, and the delivery of that water to the Murray. A positive IVT account balance means there is currently net trade out of the valley that has not been delivered to the Murray. Trade into the Murrumbidgee can only occur as a back-trade of water that has been traded out but not yet been delivered to the Murray. A negative value would mean net trade into the valley from downstream which cannot be physically delivered from the Murray to the Murrumbidgee valley. A negative balance means further trade into the valley is not allowed as this water cannot be physically delivered upstream.

7.1 Tagged licences

An entitlement can be 'tagged' on a register, allowing the water to be taken at the different location in another hydraulically connected valley. Like other water licenses, the tagged licenses are also subject to water ordering conditions. The license holder should place a valid water order with WaterNSW before water is extracted. The approval of such water orders is subject to prevailing IVT trade conditions.

7.2 Current status

The 2018-19 IVT opening balance was -13.5 GL. Negative balance is resulted due to tagged licence usage.

- Account Balance as at 15th November 2018 is about 1.9 GL.
- The IVT trade into Murrumbidgee is closed.
- The IVT trade out of Murrumbidgee is open.

For most recent update refer to [Murrumbidgee IVT Account](#). Customers can subscribe to IVT email at waternsw.com.au/customer-service/news/subscribe.

8 Operational loss

8.1 Operational loss to date

Operational loss is water released from storage above that which could reasonably be expected to pass the last extraction point on each given river/creek. Two main causes of operational loss are over ordering, and rain rejection during the irrigation season when the river flow is being controlled to meet consumptive demands and environmental flow requirements to minimise losses.

The operational loss is deemed as nil when the system spills due to tributary inflows under wet conditions, and when the dams are on minimum release.

Operational losses are a significant concern in the regulated system because lost water may not be providing significant environmental benefits and it compromises the long-term water security in the valley.

In the Murrumbidgee River system, the operational loss is measured at Balranald and Darlot. However, at times operational surplus is also noted at Bundidgerry Escape and Warriston Weir. The following chart provides the operational loss in the valley. The chart also shows the operational loss as a percentage of diversions in the valley (regulated sales, planned and discretionary environmental flows, and IVT delivery). WaterNSW targets the operational loss to be less than 5%. In the Murrumbidgee Valley, delivery of IVT assists in minimising the operational surplus as the IVT delivery rates and pattern is negotiated with MDBA so that during the period of IVT delivery the operational loss is minimal.

Operations loss for 2018/19 in the Murrumbidgee valley is forecast to be about 62GL (upper bound).

Murrumbidgee siver - water delivery operational surplus vs sales - 2018-19 cumulative %

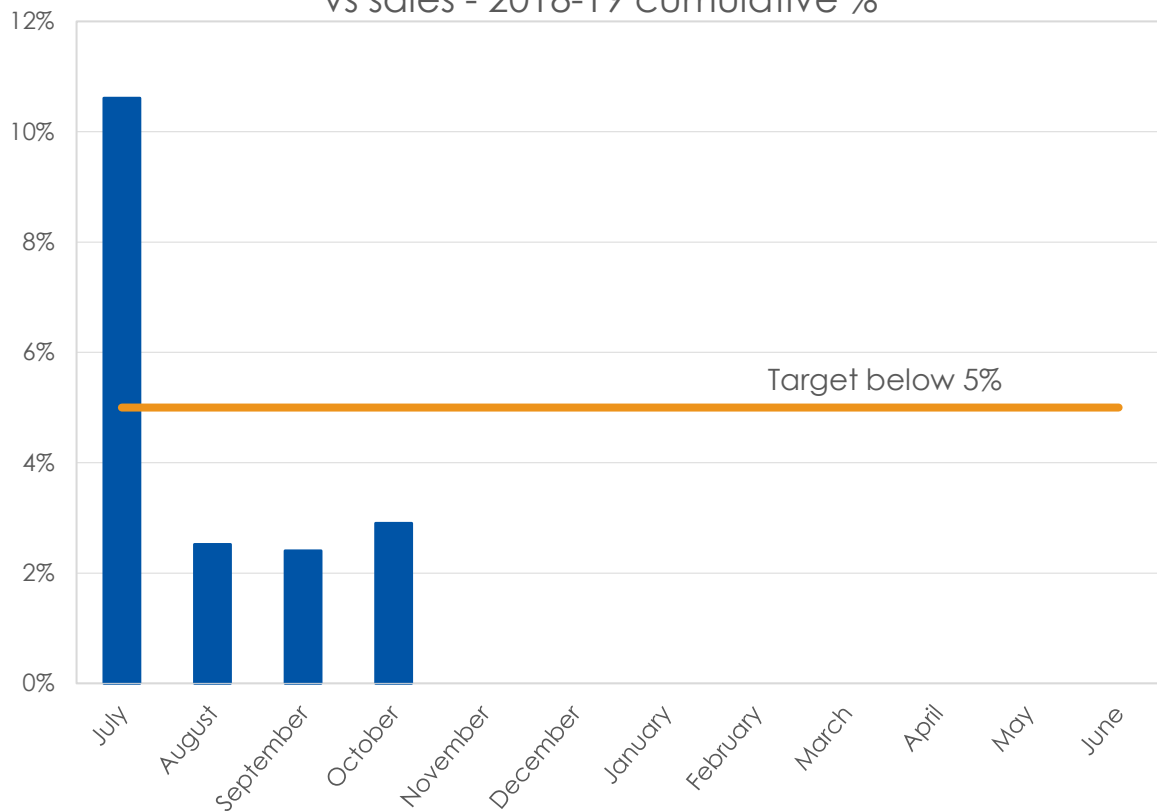


Table below shows the year to date sales & environmental delivery (523GL) and operational loss(15GL).

Murrumbidgee cumulative totals

| Dates | Sales + environmental delivery | Operational surplus | Actual | Target |
|----------|--------------------------------|---------------------|--------|--------|
| July | 36 | 4 | 11% | 5% |
| July-Aug | 162 | 4 | 3% | 5% |
| July-Sep | 327 | 8 | 2% | 5% |
| July-Oct | 523 | 15 | 3% | 5% |

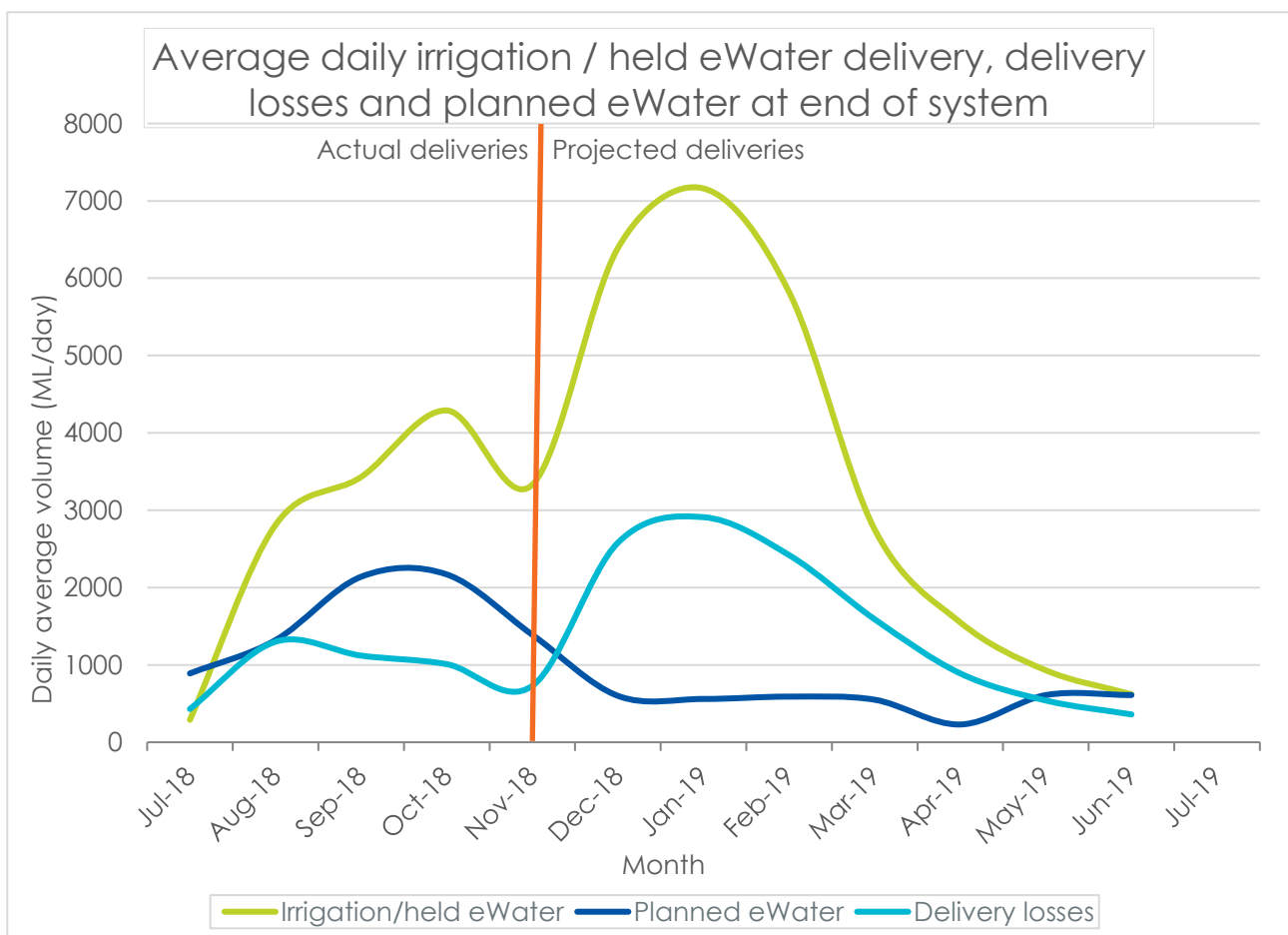
9 Storage forecast

The system demands are met from the following sources:

- Blowering Dam
- Burrinjuck Dam
- Downstream tributaries

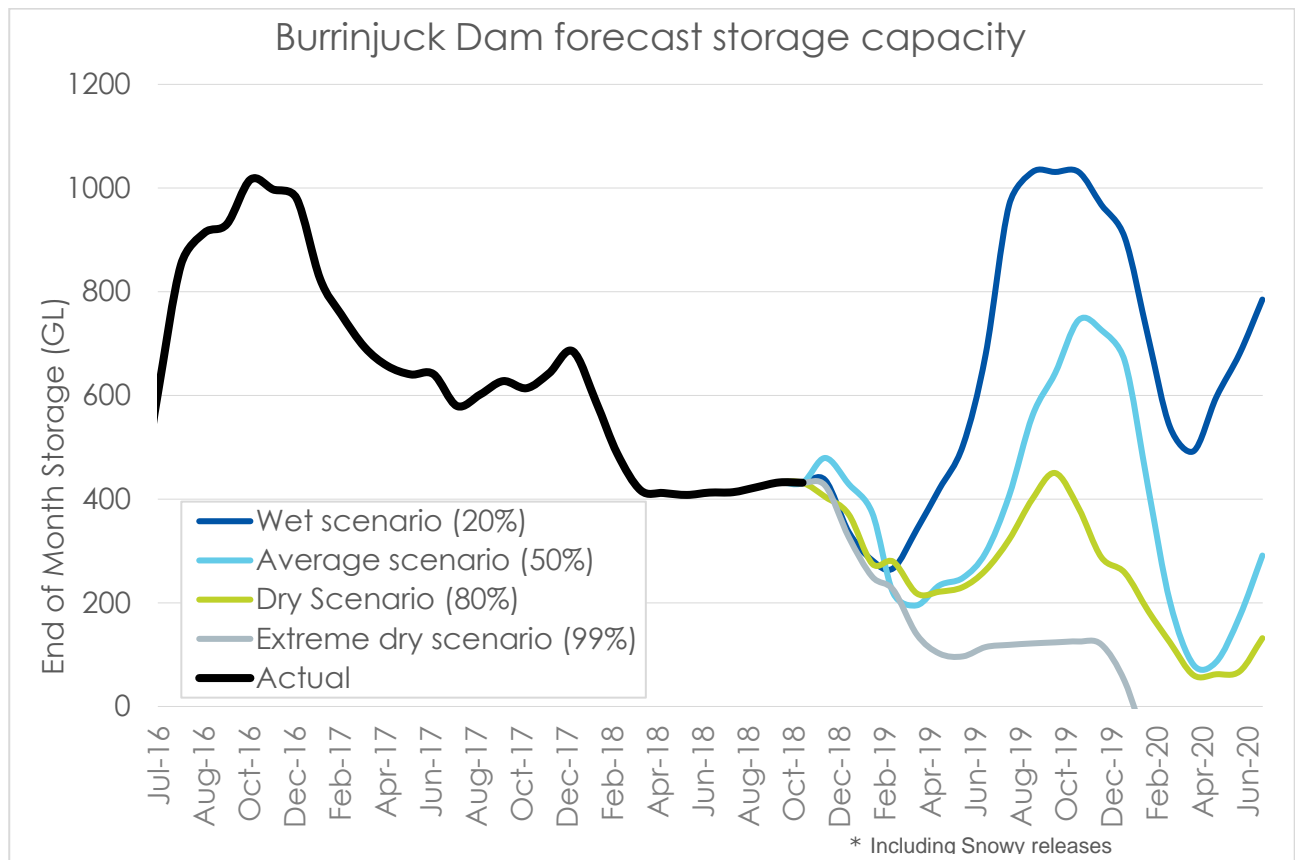
The operational procedures are intended to maximise the conservation of water resources so the demands downstream of Gundagai are firstly met from tributary flows and minimum planned environmental releases from Blowering and Burrinjuck Dams. Additional system demands are next met from Blowering Dam releases subject to the Tumut River channel constraints. Finally, any additional demand is met from release from Burrinjuck Dam.

The figure below indicates the likely daily average delivery to licensed customers, Planned Environmental Water (including end of system flows at Balranald and Darlot) and transmission losses expected over 2018-19.

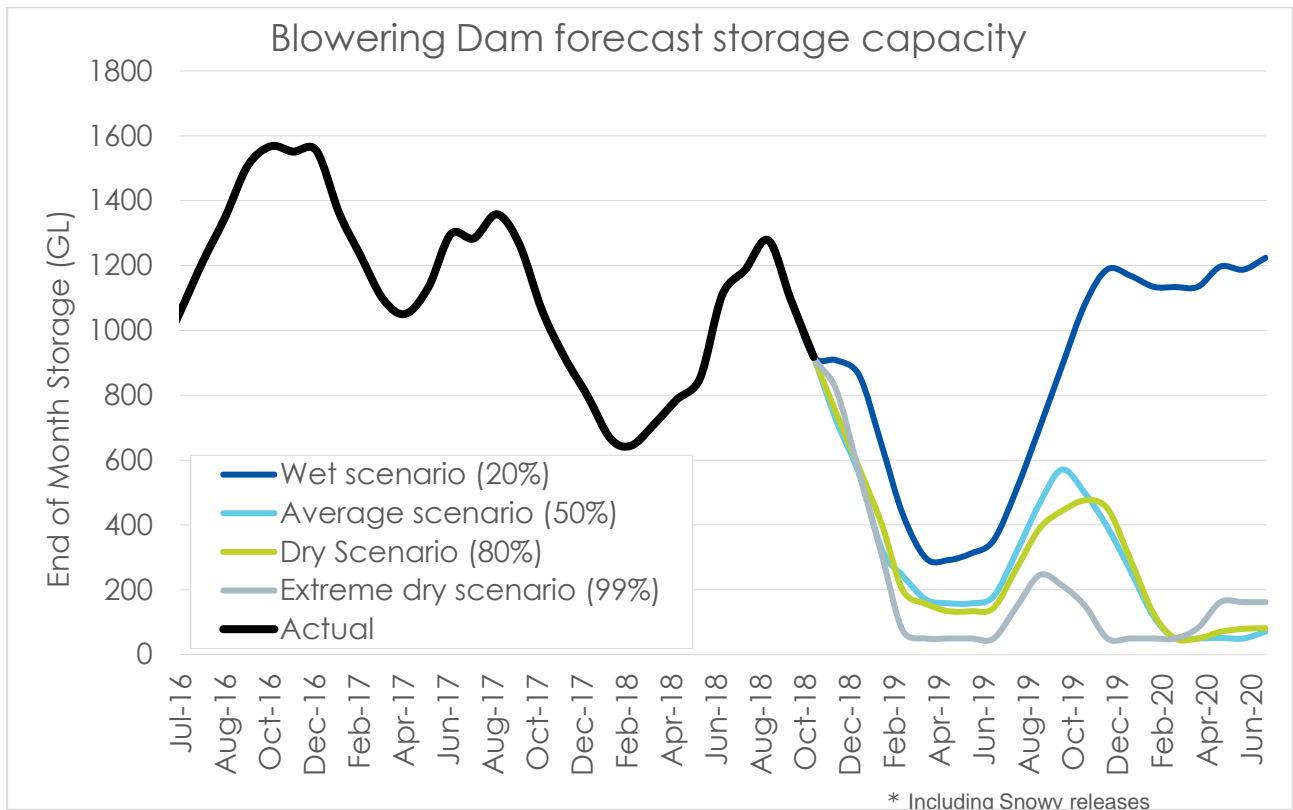


The following two figures demonstrate the behaviour of Burrinjuck and Blowering Dams under various inflow conditions until June 2020. For example, under wet inflow sequence (20th percentile) the dam may fill and spill (100%) at the end of June 2019. Chances of Exceedance (COE) in the figures indicates the possibility of that storage level being exceeded by these dates.

9.1 Burrinjuck storage forecast



9.2 Blowering storage forecast



9.3 Planned releases

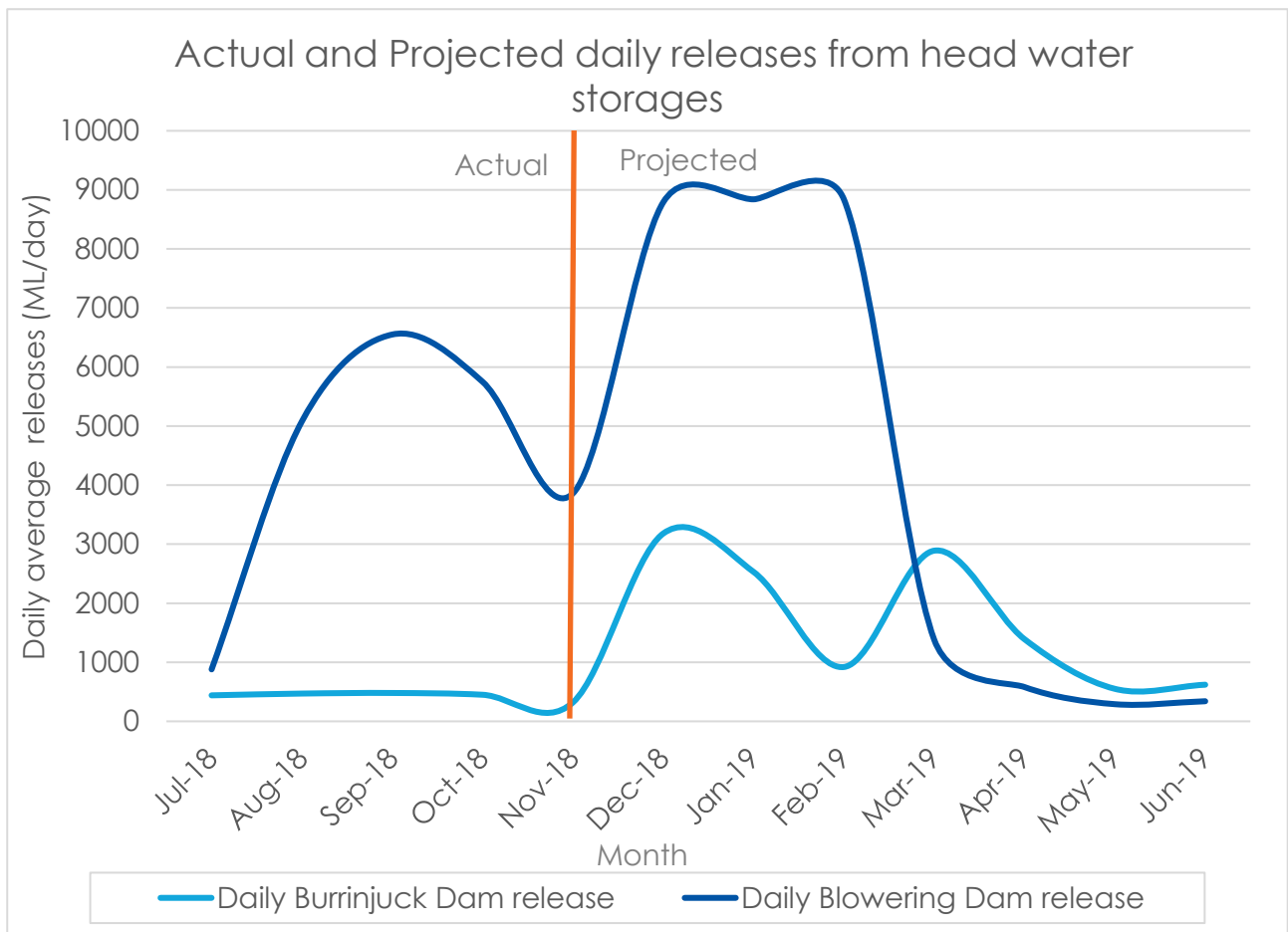


Figure above shows the expected daily average releases from Burrinjuck and Blowering dams over the next 8-month period.

10 Outage planning

Most of routine maintenance work on the water infrastructure in the Murrumbidgee valley were undertaken during winter period. Maintenance work on the following structures are withheld / in progress for want of suitable flow conditions. They will be completed at the earliest opportunities.

| Item | Time | Status | Description |
|---------------------|--------------|----------|---|
| Tarabah Weir | Nov/Dec 2018 | Withheld | Waiting for low flow conditions |
| Spiller's regulator | Nov/Dec 2018 | Withheld | Gates to be replaced, waiting for low flow conditions |

11 Recreational events

Several community recreational events are organised along the Murrumbidgee river system. For the safety, economic, social, and cultural benefit of the community additional service may be provided by WaterNSW by maintaining a suitable flow level, subject to prevailing irrigation / environmental demands. In other words, the supply of water for town water supply and to the environmental and irrigation entitlements, and conservation water resources take priority when operational decisions are made. Where possible WaterNSW will schedule operations to assist these events when this will not compromise efficient operations.

| Month | Location | Recreation event | Specific requirement |
|-------|------------------|------------------|---|
| Jan | General | Australia Day | High weir pool levels |
| Jan | Hay | Fishing Classic | High weir pool, say greater than 7.5m |
| Feb | Wagga | Gumi race | Lower river levels, say 8500ML/day at Wagga |
| Feb | Darlington Point | Fishing Classic | Steady, higher flow levels at Darlington Point |
| Mar | Leeton | Bidgee Classic | Steady, higher levels US Gogeldrie Weir |
| Mar | Balranald | Fishing classic | Higher flow levels at Balranald |
| Apr | General | Easter Weekend | High weir pool levels |
| May | Tumut | Fly fishing | Low river levels say 800ML release from Blowering |
| Oct | Tumut | Trout fishing | Moderate river levels say 4,000ML/day |

12 Flow targets

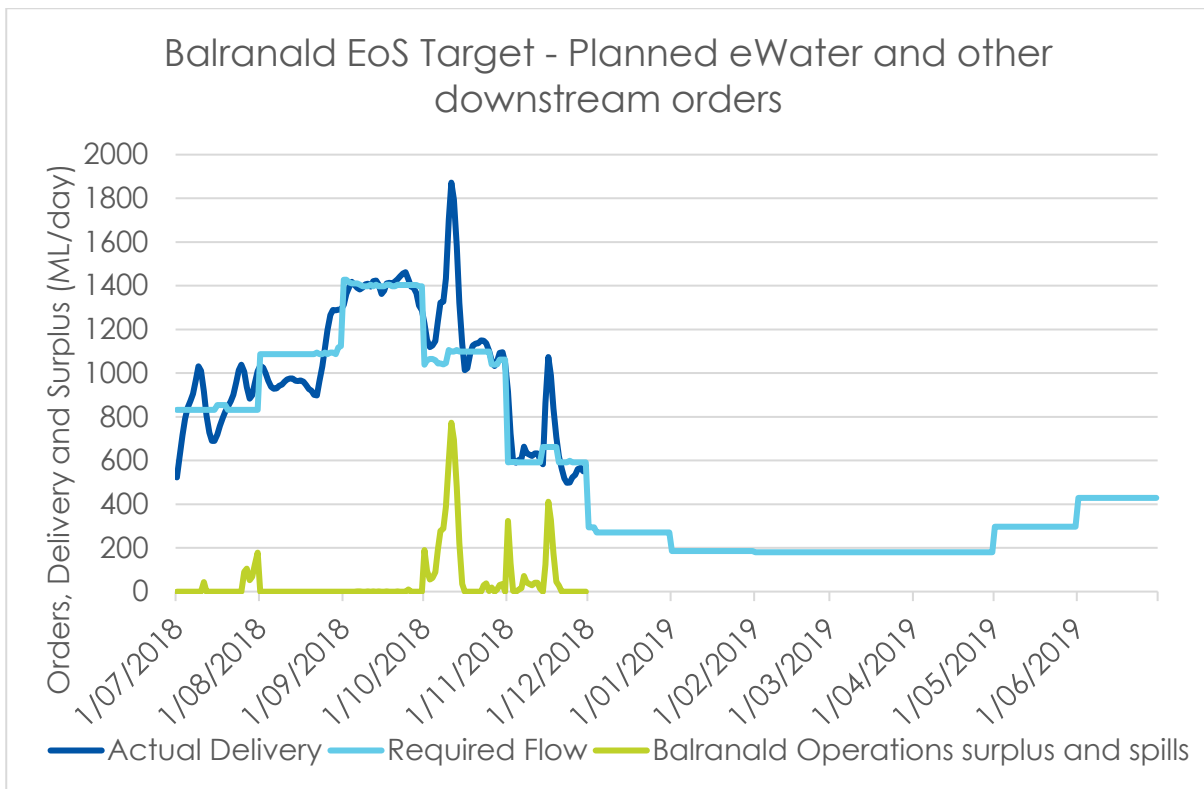
12.1 Minimum flow at Balranald

WaterNSW maintains minimum daily flows in the Murrumbidgee River at D/S Balranald Weir site throughout a water year. The minimum daily flow cannot be used to meet access licence water requirements or bulk water transfer requirements (Inter-valley Transfers to the Murray Regulated River system etc.) below Balranald.

| Month | Minimum daily flows at Balranald (ML/day) |
|-----------|---|
| January | 186 |
| February | 180 |
| March | 180 |
| April | 180 |
| May | 297 |
| June | 429 |
| July | 829 |
| August | 1,087 |
| September | 1,330 |
| October | 1,030 |
| November | 568 |
| December | 254 |

The supply of the above minimum flows is subject to the following conditions

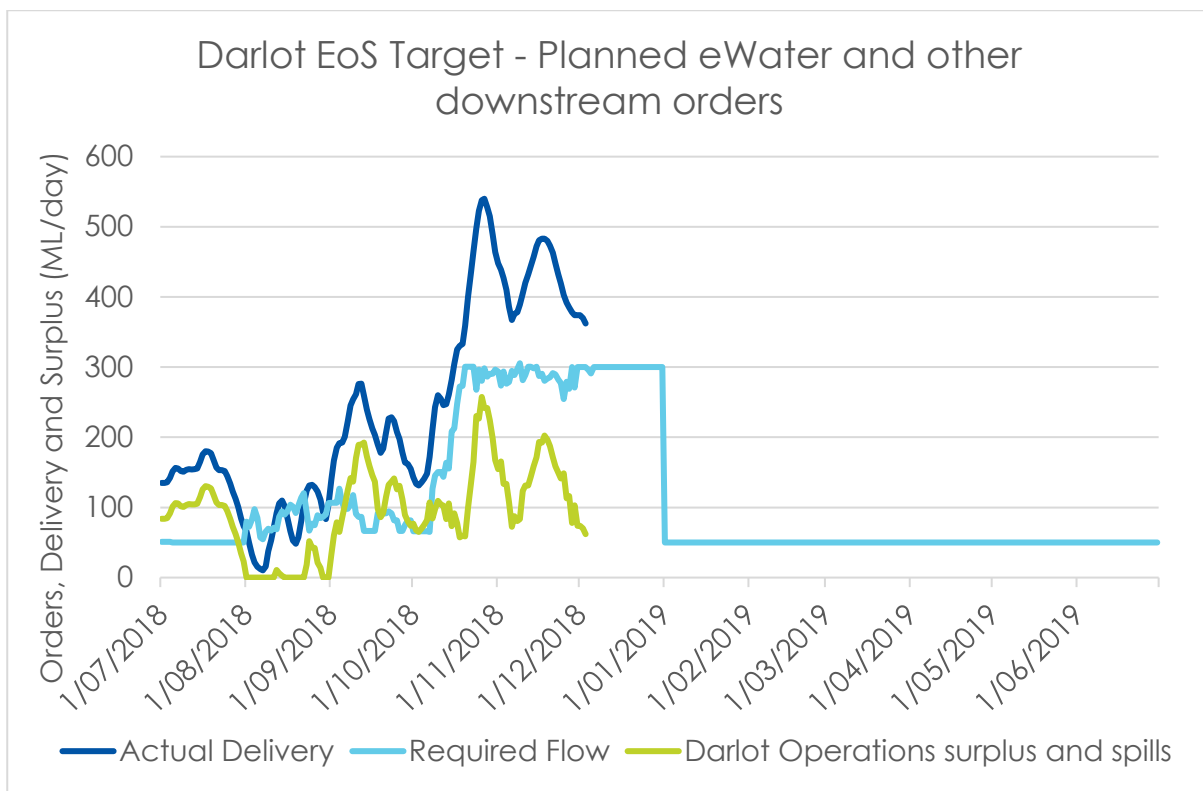
- a) The average daily flow for each month, measured at Balranald, is maintained at the target minimum environmental flow;
- b) A variability of 25% below the target is not exceeded for a period greater than seven (7) consecutive days and/or ten (10) days per month;
- c) Exceedance of the target by up to 25% is used to offset existing shortfalls; and
- d) The cumulative shortfall in daily target flows for any month is distributed evenly to the daily target for the next month's minimum flow.
- e) Exceedance of environmental water releases cannot be used as a credit against future shortfalls.



The above Figure shows the Balranald end of system (EoS) actual delivery, required flow and operational surplus. The end of system target includes planned environmental water, irrigation orders below Balranald and any IVT or other operational orders by MDBA. For details on total operational loss refer section 8.1.

12.2 Minimum flow at Darlot

WaterNSW has a minimum daily flow target of 50ML/day in the Billabong Creek at Darlot site throughout a water year. The minimum daily flow cannot be used to meet bulk water transfer requirements (Inter-valley Transfers to the Murray Regulated River system etc.) below Darlot. The supply of the above minimum flows at Darlot is subject to similar conditions as at Balranald (Section 12.1)



The above Figure shows the Darlot end of system (EoS) actual delivery, required flow and operational surplus. The end of system target includes planned environmental water, irrigation orders below Darlot and any IVT or other operational orders by MDBA. In the above chart, the required flows are higher from early October as MDBA is calling water through the Finley Escape to partly address the Barmah Choke constraint in the Murray River. The MDBA operational orders are expected to continue to end of December 2018. For details on total operational loss refer section 8.1.

12.3 Seasonally varied flow targets in the Old Man Creek

After meeting all consumptive demands during non-supplementary periods, the following end of system flow targets are maintained at Kywong (Old Man Creek):

- a) The average September flow – at least 600ML/day
- b) The average October flow – at least 400ML/day
- c) The average November flow – at least 100ML/day
- d) From December to April a minimum flow of 60ML/day
- e) Between May and August, the Beavers Creek Offtake regulator gates remain fully open.

The above flow conditions are to be met only when possible with existing river levels in the Murrumbidgee River, without additional releases from the head water storages.

12.4 In-stream operational targets

- Minimum instream flow targets at the following locations for operational purposes are maintained, when possible:
 - Yanco Creek @ Downstream Tarabah Weir – 25ML/day
 - Yanco Creek @ Morundah – 65ML/day
 - Yanco Creek @ Wiraki – Up to 70ML/day
 - Billabong Creek @ Downstream Hartwood Weir – 25ML/day
 - Tumut River @ Oddy's bridge 100ML/day
 - Tumut River @ Tumut 500ML/day
 - Murrumbidgee River @ D/S Gogeldrie Weir 200 ML/day
 - Murrumbidgee River @ D/S Maude Weir 100 ML/day
- An operational stream flow target of 800ML/day (=1.0m) at Murrumbidgee R @ Darlington Point to supply customers in the Uri Creek when there are no third-party impacts.
- Maximum flow targets at the following locations to minimise transmission losses:
 - Colombo Creek @ Morundah - 600ML/day

More information

Subscribe to our customer information (weekly water availability reports, e-newsletters, etc.) at waterNSW.com.au/subscribe.