

Murray Operations Plan

November 2018

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1. Highlights

Storage status – end October:

- Dartmouth Dam is 78 per cent full – falling – holding 3,003 Gigalitres (GL). NSW share of this water is approximately 28%. Release through August averaged approximately 2,700 ML/day.
- Dartmouth to Hume transfers commenced mid-August.
- Hume Dam is 43 per cent full – falling – holding 1,303 GL. NSW share of this water is approximately 39%. Release through August averaged approximately 14,150 ML/d.
- Lake Victoria is currently holding about 551 GL or 78% of active capacity. The flow to South Australia is about 6,100ML/d.

Predicted release patterns:

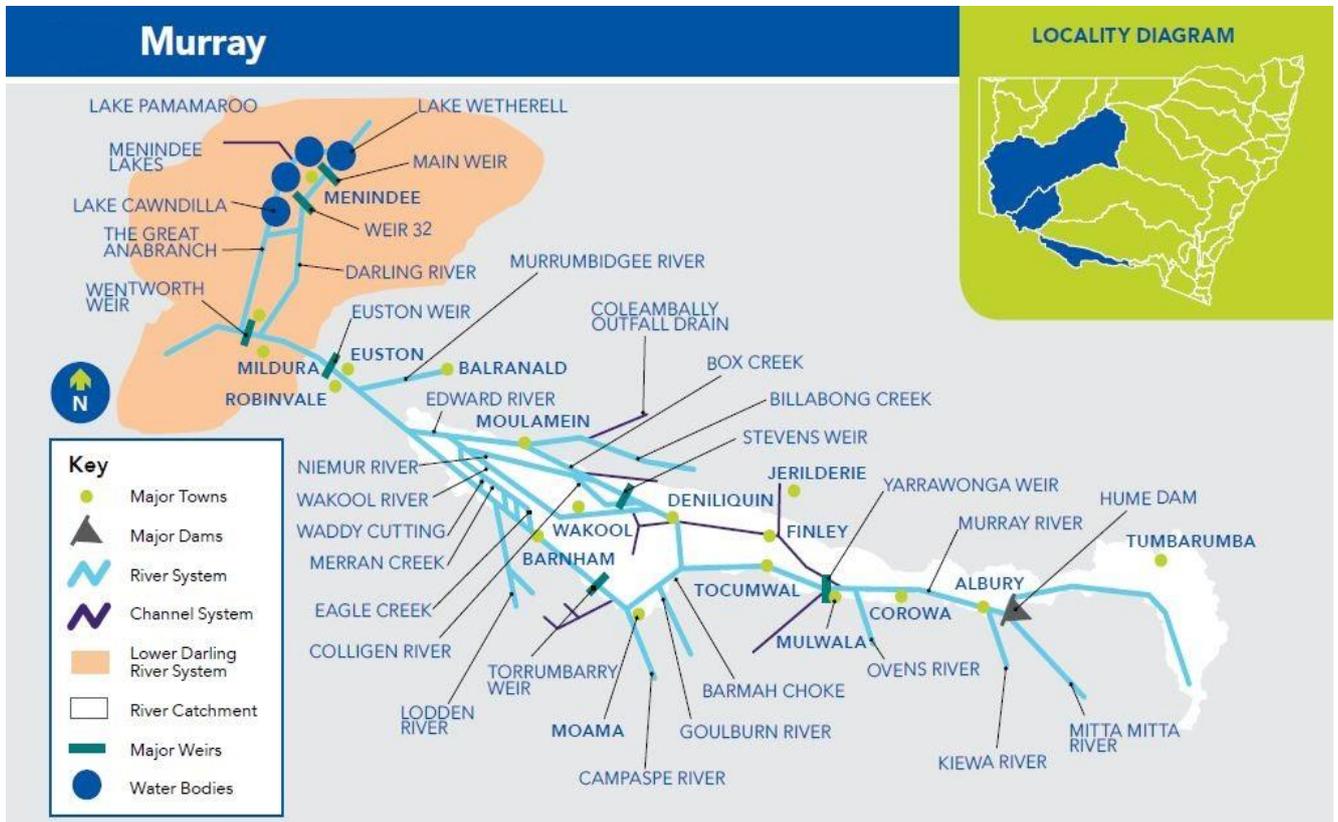
- Releases from Hume Dam are likely to continue but at a lower rate to meet irrigation and environmental demands and to transfer water to Lake Victoria for South Australia.
- Release downstream of Yarrawonga Weir is approximately 15,000ML/day. Currently the operational requirement is approximately 14,000 ML/day, with e-water now being delivered at 1,000 ML/day. It is expected that the operational demand will continue to reduce through December. Part of the flows will be passed through specific forest regulators to take advantage of prewetted anabranch channels that can transfer water efficiently around the Barmah Choke. The higher flows are required to ensure sufficient water is transferred to Lake Victoria in advance of expected summer demands and avoiding the need for higher flows and losses in summer.
- Forest regulators are being actively used to maintain the river level at Picnic Point below 2.6m. Currently the level at Picnic Point is about 2.55m.
- The Edward River Offtake is currently about 1,330ML/d and is likely to remain well below the channel capacity of 1,600ML/day. The objective is to manage the flows at Toonalook at about 3,300ML/day. The Edward offtake flow will increase as the flow from Gulpa Creek is reduced to regulated capacity by next week.
- The Gulpa Creek Offtake has increased to about 600ML/d and is likely to remain relatively steady until the start of next week.
- Stevens Weir level is currently about 4.53m and is likely to remain relatively steady to manage the level upstream of Wakool Canal offtake, which is about 1.80m. Flow downstream of Stevens Weir is currently about 3,000ML/day. These flows will be reduced to below channel capacity this week.

- Flows in the Colligen Creek (430ML/day), Yallakool Creek (450ML/day) and Wakool River (60ML/day) are likely to vary marginally in line with Stevens Weir pool height.
- The combined Wakool – Yallakool flows are augmented with supply from Mulwala Escape at Wakool so that the flows are maintained at about 600ML/day in the Wakool system.

Operating conditions:

- The latest Water Allocation Statement by DOI-Water confirmed that the general security allocation of zero, while Available Water Determinations (AWD) are 100% for towns and 97% for high security. Average carryover into 2018-19 is estimated to be about 31% of general security share components.
- Returns to Edward River upstream of Toonalook from the environmental water delivered into the Barmah – Millewa forest is currently averaging about 1,400ML/d.
- Supply to Gulpa Creek for environmental purposes have commenced above regulated channel capacity.
- Environmental water delivery to Wakool-Yallakool and Colligen-Neimur Creek systems as per the hydrograph provided by Fisheries have been suspended. The flows are now managed to maximise the delivery to Murray using the Edward Wakool system subject to channel capacity in the Wakool system.
- Supply through Perricoota Escape (90ML/day) and Wakool Escape (80ML/day) are expected to continue for the next few weeks.
- Supply to Edward River is also augmented with Billabong Escapes at Finley, (250ML/day), which is likely to continue for the next few weeks.
- Flow at Moulamein is currently at about 2,700ML/day is likely to remain steady.
- Flow in Niemur River at Mallan School is currently about 725ML/d and is likely to remain relatively steady.
- Merran Creek flows upstream of its confluence with Wakool is about 150ML/day and is likely to vary between 140 and 200 ML/day for the next few weeks.
- Flow in Wakool River at Stoney Crossing is currently at about 1,320ML/day and is likely to remain relatively steady.
- Flows at Balranald are currently about 540ML/day and are likely to remain steady until end of November. From early December the flow will reduce to about 280ML/day.
- Potential Blue Green Algae issues:
- Hume_Dam storage remains at green alert while

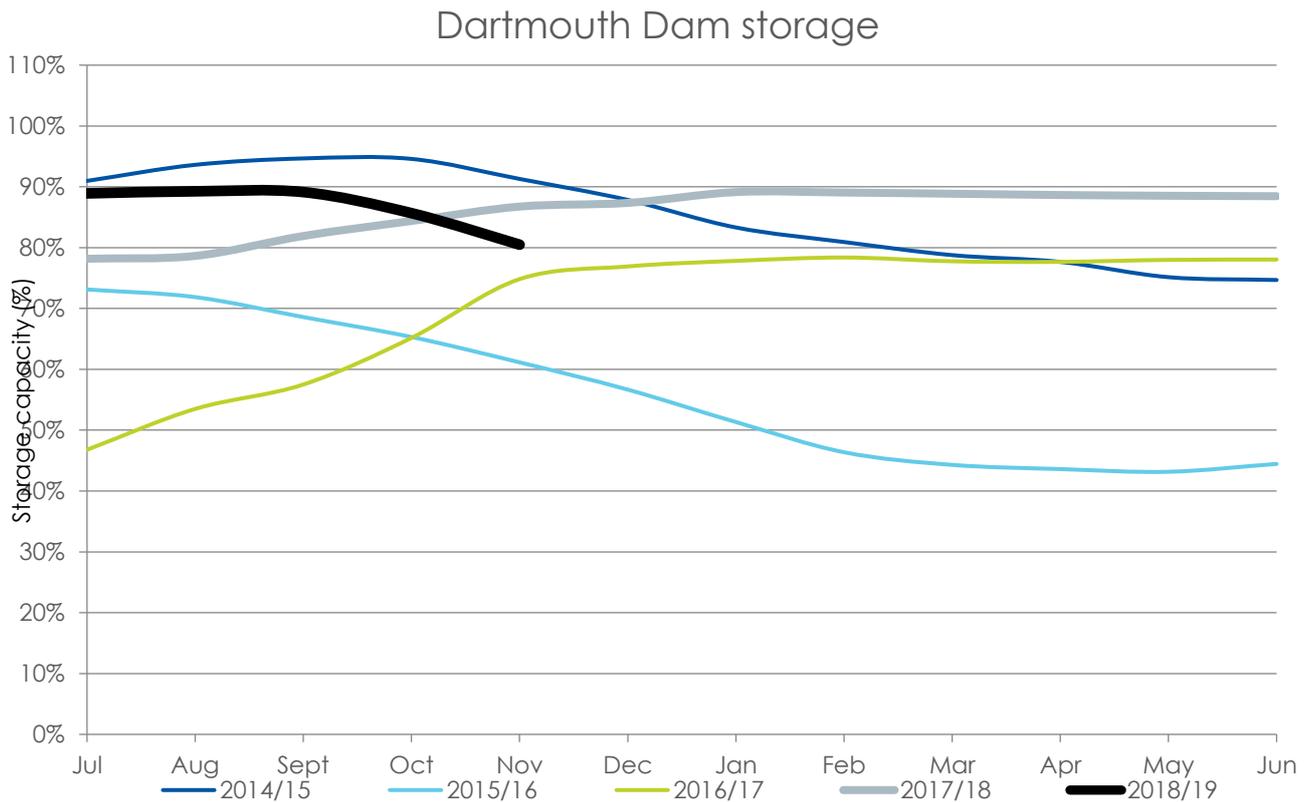
- Menindee Lakes remain at red alert.



2. Dam storage

2.1 Dartmouth Dam storage

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

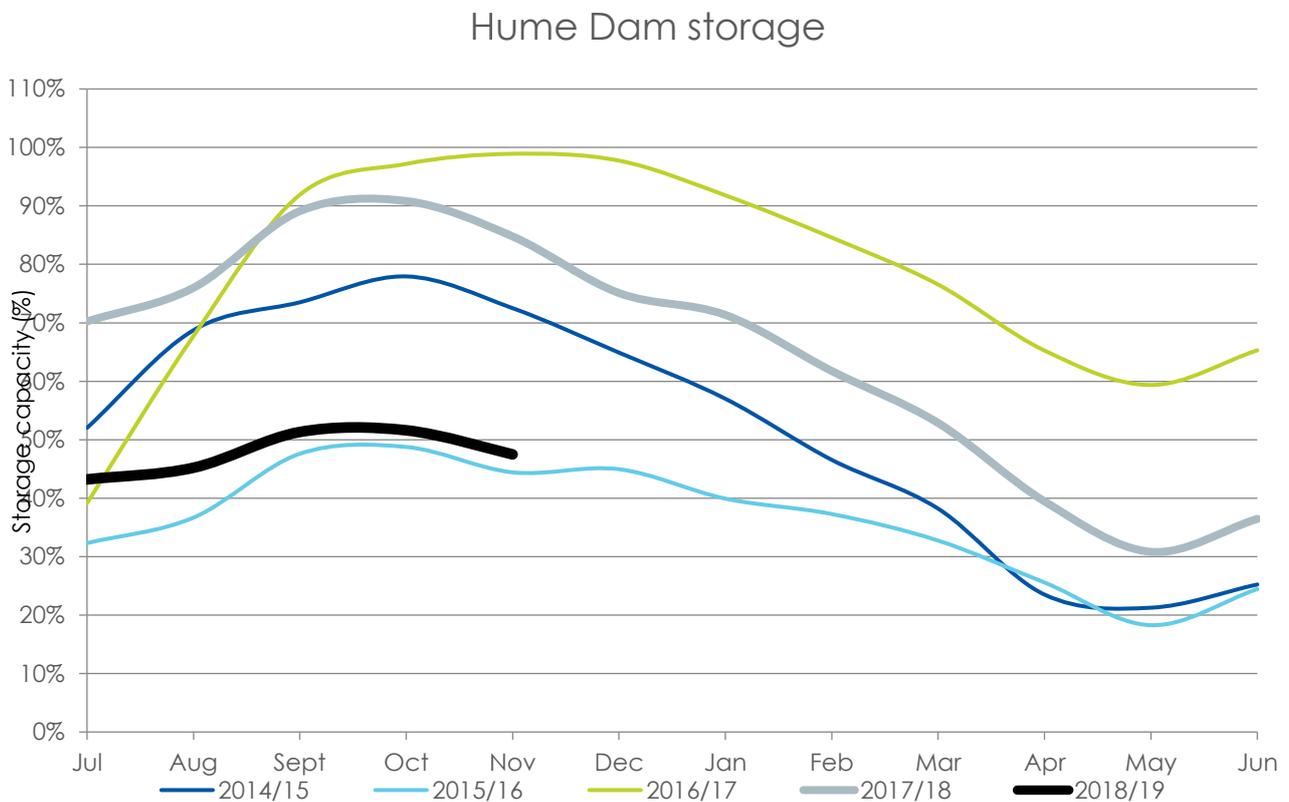


Dartmouth Dam is 78 per cent full – falling – holding 3,003 Gigalitres (GL). NSW share of this water is approximately 28%.

From the above figure it can be seen that Dartmouth Dam was under 90% at the start of this water year and it is now close to 80% of active capacity. Transfers from Dartmouth to Hume totaled almost 120 GL in the first 2 months of 2018/19. The storage has been steadily drawn down since September, as dry conditions persist.

2.2 Hume Dam storage

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

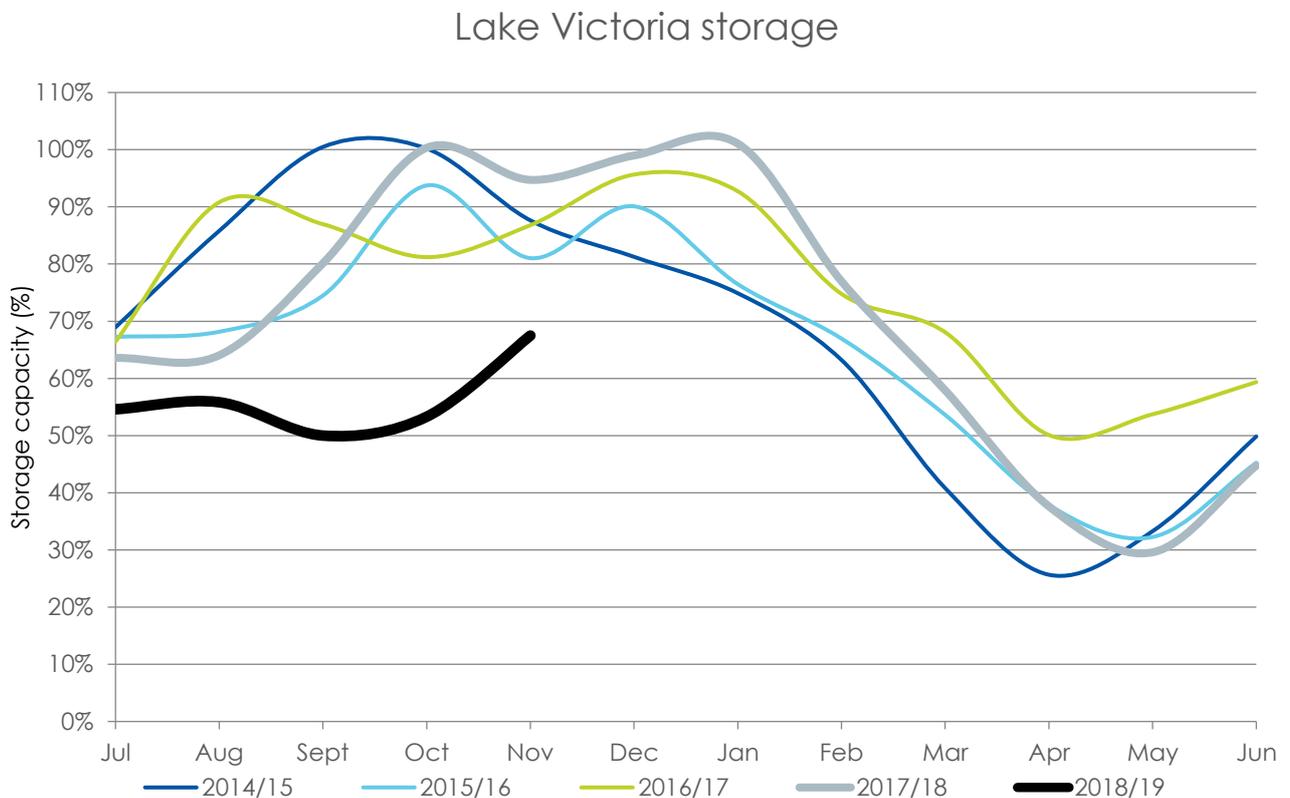


Hume Dam is 45 per cent full – falling – holding 1,354 GL. NSW share of this water is approximately 39%.

From the above figure it can be seen that Hume Dam was above 40% at the start of this water year and it is slightly under 50% of active capacity. The storage volume change was due to releases for deliveries and from approximately 120 GL of transfers from Dartmouth. Storage has not received any significant inflows. Transfers from Dartmouth to Hume are boosting the storage level, but not resulting in any new resource for NSW.

2.3 Lake Victoria storage

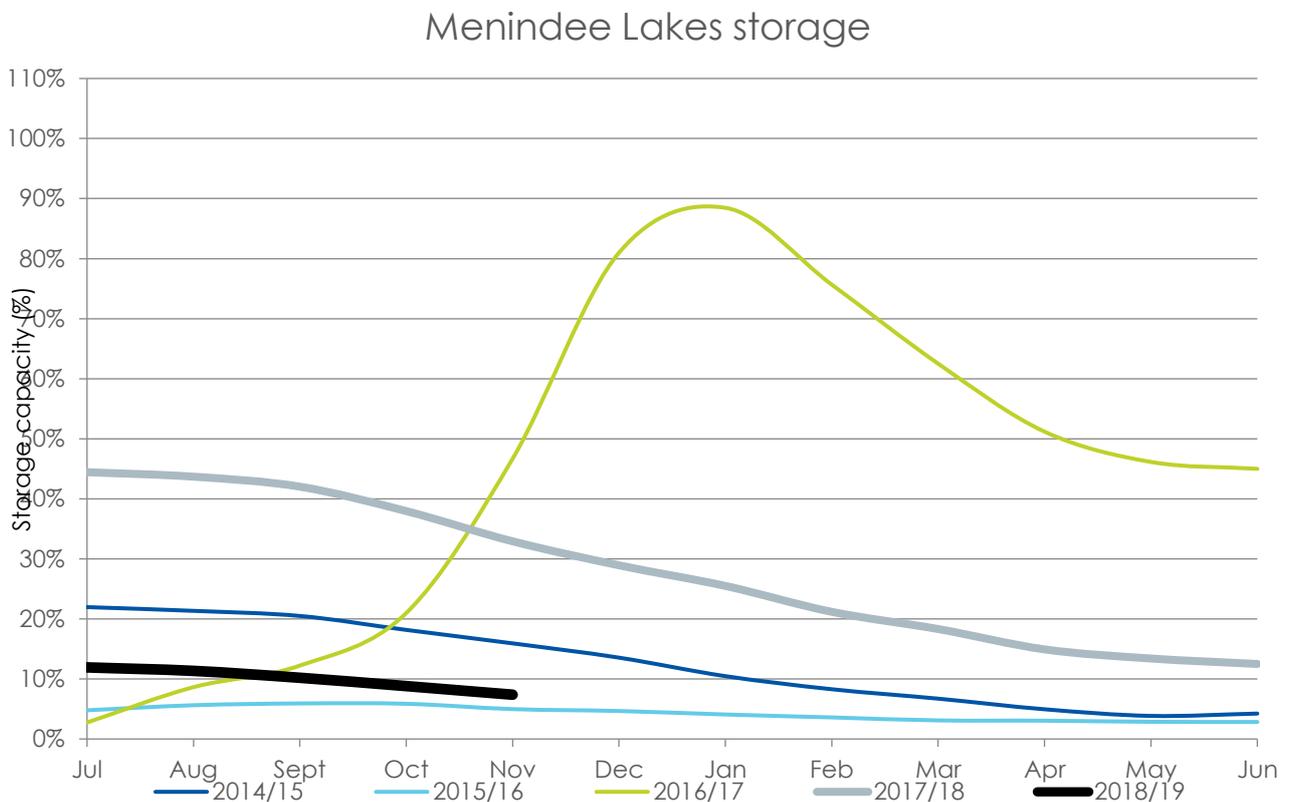
The below figure shows the Lake Victoria behaviour for the 2017-18 water year compared to the last four water years.



Lake Victoria is 67 per cent full – rising – holding 486 GL. NSW share of this water is approximately 37%. From the above figure it can be seen that Lake Victoria was under 55% at the start of the water year and it is now just under 70% of active capacity. The storage falling throughout August was an unusual occurrence and is due to the dry conditions and higher than expected demands. Operations are currently focusing on transfers to Lake Victoria from Hume Dam to ensure the storage holds sufficient volume to meet peak summer demands

2.4 Menindee Lakes storage

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



From the above figure it can be seen that Lake Menindee was around 12% at the start of the water year and it is now just 7% of active capacity. . Releases were reduced to the minimum required to maintain system connectivity, and filling of block banks in the Lower Darling constructed to provide drought supply. It is expected that without inflow, releases to the Lower Darling will cease in late December or early January.

3. Supplementary access

3.1 Commentary

There have not been any supplementary events in the NSW Murray or Lower Darling since the start of the 2018/19 water year.

3.2 Explanation

No supplementary access was available since the start of the 2018/19 water year due to lack of high flow runoff events entering the system.

4. Water availability

4.1 2018/2019 water availability for NSW Murray as of 31 October 2018

Licence category	Share component	Carryover in	AWD volume	Allocation assignments in	Allocation assignments out	Usage	Balance
Domestic and stock	13,748	-	13,748	-	-	4,918	8,830
Domestic and stock (domestic)	1,248	-3	1,247	-	-	422	823
Domestic and stock (stock)	2,063	-	2,063	-	-	300	1,763
Local water utility	33,497	-	33,497	-	-	4,437	29,060
Regulated river (Conveyance)	330,000	-1,683	119,988	39,966	13,047	90,959	54,266
Regulated river (general security)	1,674,096	543,175	-	187,981	101,320	149,722	480,115
Regulated river (high security)	190,571	-678	184,017	20,065	73,006	26,458	103,940
Regulated river (high security) [Community and Education]	47	-	47	-	-	-	47
Regulated river (high security) [Research]	801	-	801	-	-	-	801
Regulated river (high security) [Town Water Supply]	3,195	-	3,195	-	-	3,170	25
Supplementary water	252,579	-	252,579	-	-	-	252,579
Grand total	2,501,845	540,811	611,182	248,012	187,373	280,384	932,249

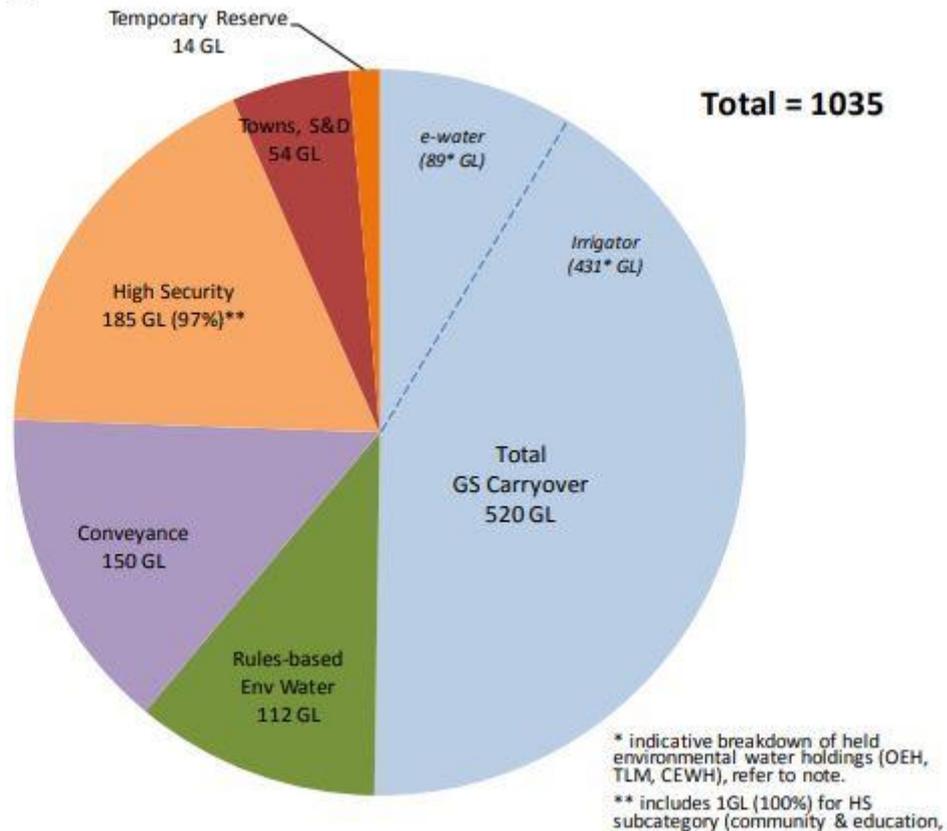
NSW Murray River Valley

Allocation (ML/Share, %)	Licence Category	Date of Allocation
0.0 / 0%	General security	1 July 2018
0.97 / 97%	High security	1 July 2018
1.00 / 100%	Domestic and stock	1 July 2018
1.00 / 100%	Local water utilities	1 July 2018
0.45 / 45%	Conveyance	15 November 2018

- No General Security AWD has been announced since 1 July 2018.
- In this current water year, 0% Available Water Determination (AWD) has been announced on 17 September 2018 for General Security (GS). For High Security water users the AWD is 97% while for Domestic and Stock as well as Local Water Utilities users the AWD is 100%. For conveyance the AWD is 45%.
- Average carryover into 2018-19 is 31% of general security share components.
- Further general security AWD's are possible throughout the year.
- The sum of account balance refers the amount of water available to the account of the users after trades and usage.

4.2 Resource assessment

NSW Murray resource distribution 2018-19 – 15 November 2018



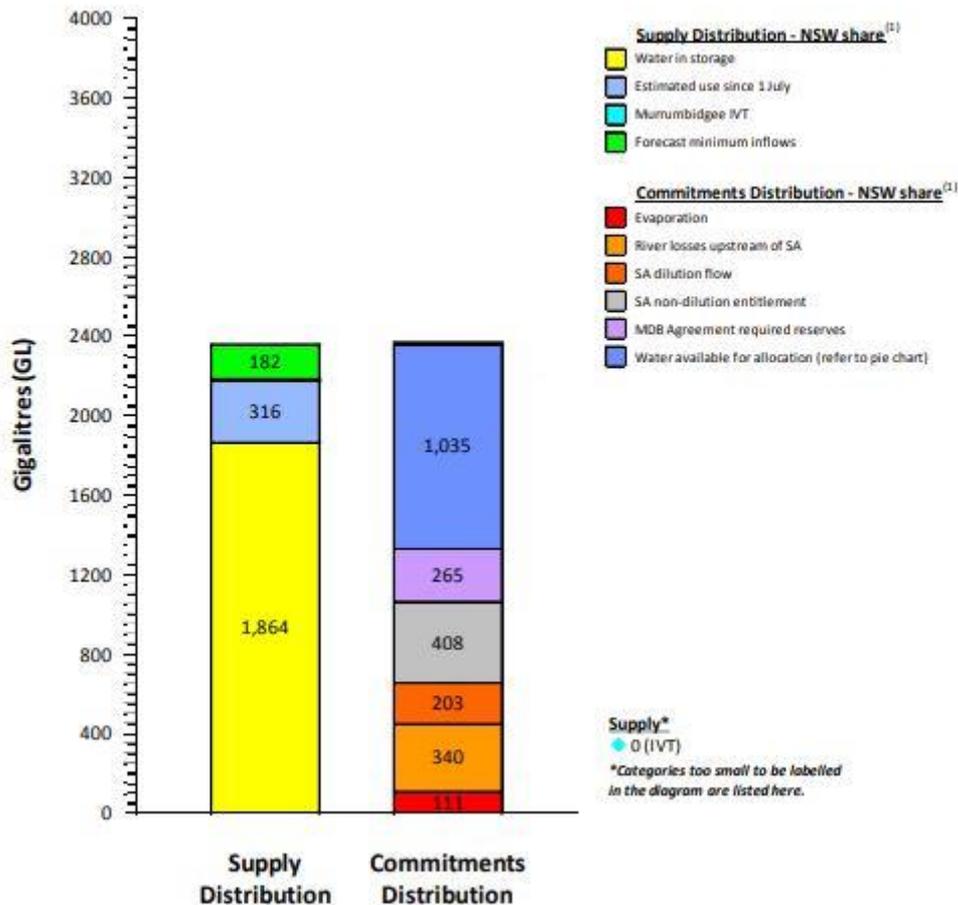
Source: https://www.industry.nsw.gov.au/_data/assets/pdf_file/0006/197277/WAS-NSW-Murray-and-Lower-Darling-181115.pdf

- Total available resource - NSW's state share of active storage volume (Hume, Dartmouth, Menindee and Lake Victoria) as assessed and accounted for under the Murray-Darling Basin Agreement at the time of the assessment, plus any usable flows in transit, plus assumed (99%ile) inflows for the rest of the year, plus Snowy Hydro's assured releases, as well as estimated usage to date. Snowy Hydro's net Murray 1 releases to date for this water year (2018- 19) is estimated to be 602 GL, and 200 GL of flex was pre-released in 2017-18. NSW remains in Special Accounting with South Australia (SA), details of which can be found in the MDB Agreement clauses 123- 129. Special accounting is triggered when NSW is forecast unable to meet the required reserve of 1,250 GL by the end of the water year to supply SA with its entitlement in the following year.
- NSW Murray general security water users can carryover a maximum account balance of 50 per cent of their share component into the following water year. The account limit is 110 per cent of

share component, meaning that account credits from allocation and/or carryover cannot exceed 110% of share component in any water year. The limit does not include allocation trade.

- Rules-based planned environmental water is required to be set aside to provide for riverine environments, as per water sharing plan and other interjurisdictional agreements. In the NSW Murray this includes the Murray Additional Allowance (MAA) (about 6 GL), Wakool system requirements (up to 70 GL, currently 40 GL available), and the Barmah-Millewa Allowance (B-MA) (about 258 GL – currently 100% borrowed). It also includes River Murray Increased Flows (RMIF) in Hume, accrued as part of the Snowy Water Initiative (currently 66 GL available out of a total commitment of about 96 GL, continuing a 30 GL shortfall). The total commitments to B-MA and RMIF will decrease over the water year as they are released from Hume for use. Excludes 'licence-based' environmental water also known as held environmental water (HEW).
- The Water Sharing Plan for the New South Wales Murray and Lower Darling Regulated Rivers Water Sources 2016 has subcategories of high security licenses in the Murray Water Source. High security subcategory licences under Part 7 Division 2 Clause 46(2) that are present in the Murray include community and education, research, and town water supply. At the commencement of each water year, these licences are to receive 100% allocation, while remaining high security licences are to receive 97% allocation. For the purposes of this water allocation statement, the high security town water supply allocation volume has been grouped as "Towns, S&D".
- Conveyance entitlement – a category of access licence originally issued to Irrigation Corporations to facilitate delivery of water through their channel systems. Allocation to this category is prescribed in the water sharing plan and is a function of current high and general security allocation.
- Reserves – required primarily under statutory plans, up to 61 GL; set aside for critical human needs in accordance with Clause 11.03 of the Basin Plan.
- Held environmental water (HEW) – water administered by environmental water holders is reported here, with the associated portions of general security allocation and carryover also identified in the above pie chart. This reporting of held environmental water is limited to only NSW entitlements, reporting of credits to accounts (not usage or trade), and estimated to be 0 GL of GS, 24 GL of HS, 23 GL of conveyance allocation and 89 GL of GS carryover. These entitlements are held and/or managed either singly or jointly by various environmental holders, including the NSW Office of Environment and Heritage (OEH), The Living Murray (TLM) and the Commonwealth Environmental Water Holder (CEWH). Details on environmental holdings can be found on individual agency websites.
- Temporary reserve – small reserve introduced to buffer against elevated risk of higher than budgeted losses.

NSW Murray water balance – 15 November 2018



Source: https://www.industry.nsw.gov.au/_data/assets/pdf_file/0006/197277/WAS-NSW-Murray-and-Lower-Darling-181115.pdf

4.3 Water Balance Notes

- Supply Distribution and Remaining Commitments – the distribution of supply and commitments is being provided on a monthly basis. The volumes in the categories shown are only those relating to NSW's share of the resource, at the end of the preceding month. The categories include the following:
- Water in storage: Volumes in the dams at the end of the previous month. (Excludes water in storage unavailable to NSW under the water sharing arrangements of the Murray Darling Basin Agreement).

- Estimated use since 1 July: Estimated NSW usage to-date, reconciled periodically with hydrographic updates (meter readings).
- Forecast inflows: NSW's share of forecast inflows into the River Murray System based on assumed extremely dry future conditions (includes Snowy Hydro's guaranteed inflows for the water year).
- Murrumbidgee IVT: Total Murrumbidgee system water bought by Murray system users that is yet to be delivered, as reported in the Murrumbidgee IVT account balance. A negative IVT balance will appear as a commitment of NSW Murray water to the Murrumbidgee, until trades between the two valleys brings the IVT balance up to nil.
- Evaporation: Water set aside for evaporation for the remainder of the year. This reduces as the year progresses.
- River losses upstream of SA: Water budgeted for transmission losses from the River Murray system upstream of the South Australian border for the remainder of the year. Generally, reduces as the water year progresses.
- SA non-dilution entitlement: Water to supply South Australia's entitlement flow, as required under the Murray-Darling Basin (MDB) Agreement. Reduces as water year progresses.
- SA dilution flow: Water to provide South Australia's dilution and conveyance component of flow, as required under the MDB Agreement. Reduces as the year progresses unless Additional Dilution Flow (ADF) is triggered.
- MDB Agreement required reserves: Includes conveyance reserve and minimum reserve to be set aside for use in the next water year, as required by the MDB Agreement in clause 102D and 103, respectively.
- Water available for allocation: NSW's bulk share of the resource that can be assigned to NSW Murray entitlement holders based on the water sharing plan. This volume includes entitlement holder carryover. The allocation of this volume is provided in the above table and pie chart.

Source: https://www.industry.nsw.gov.au/_data/assets/pdf_file/0006/197277/WAS-NSW-Murray-and-Lower-Darling-181115.pdf

4.4 Chances of improvement

Forecast general security allocation (per cent) – using Dry Tercile#. Any carryover water can be added to these indicative allocations.

Murray River Valley		
Potential inflow conditions	1 Dec 2018 general security allocation	1 Feb 2019 general security allocation
99 chances in 100 (extreme) (99%)	0	0
9 chances in 10 (very dry) (90%) [^] 0 ^{^^}		1
3 chances in 4 (dry) (75%)	1	4
1 chance in 2 (mean) (50%)	2	7
1 chance in 4 (wet) (25%)	3	12

Outlook modelling using inflow data for the driest one-third of years only and GS carryover of 31%.

[^] July to October 2018 conditions for the system as a whole have been tracking at 91% AEP

^{^^} Conveyance estimated to be around 165 GL at 1 December 2018.

B-M Allowance remains borrowed for all scenarios

4.4.1 Significance of this resource assessment

The current resource assessment at 15 November 2018 indicates that there is no general security AWD announcement in this month.

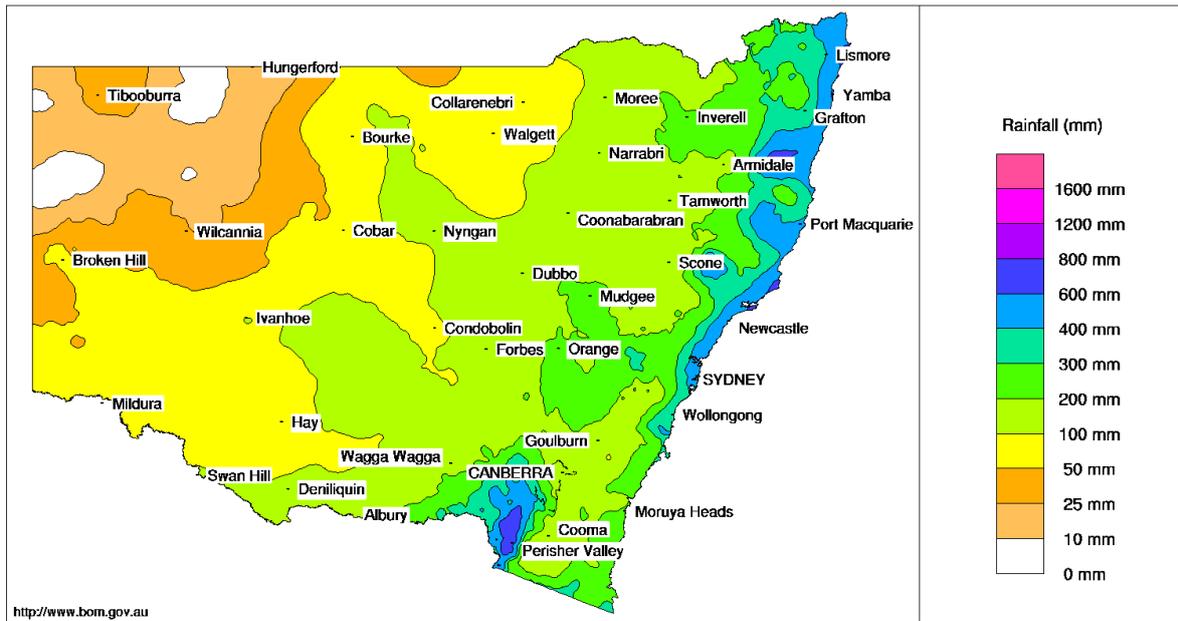
4.4.2 Resource assessment process

The resource assessment is the process of calculating how much water is available based on the rules of the Water Sharing Plan (WSP). This is done at the end of the month and when any significant inflow event happens. The above resource assessment table is for the planning horizon from 15 November 2018 to 30 June 2019.

5. Rainfall

5.1 6-month rainfall

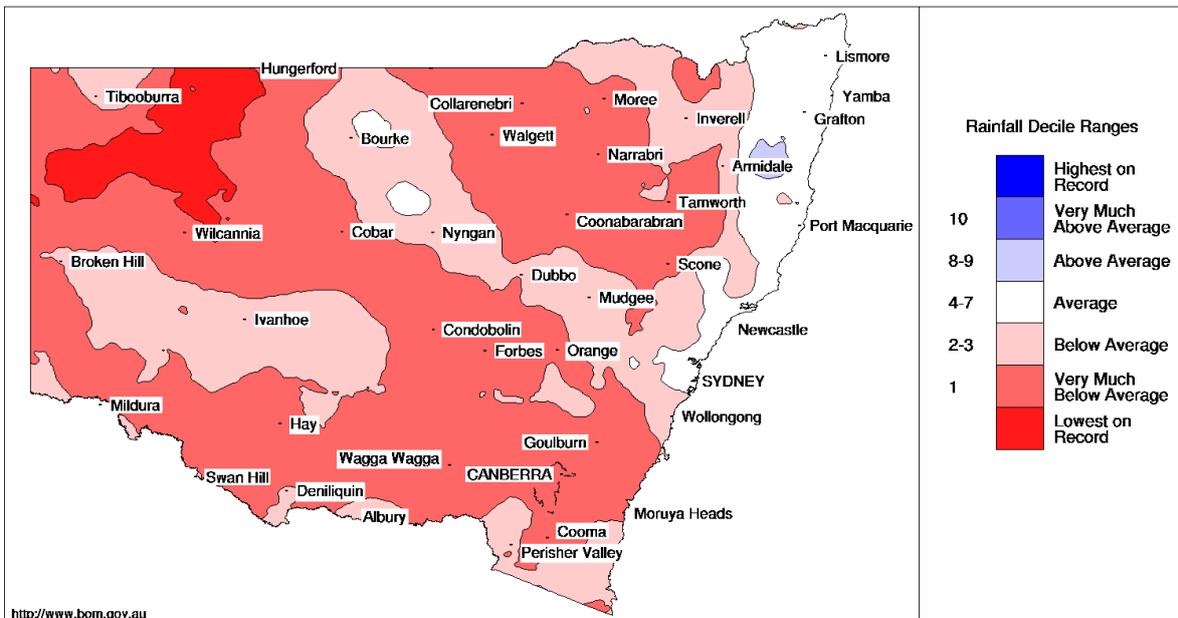
New South Wales Rainfall totals (mm) 1 May to 31 October 2018
Australian Bureau of Meteorology



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Issued: 03/11/2018

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



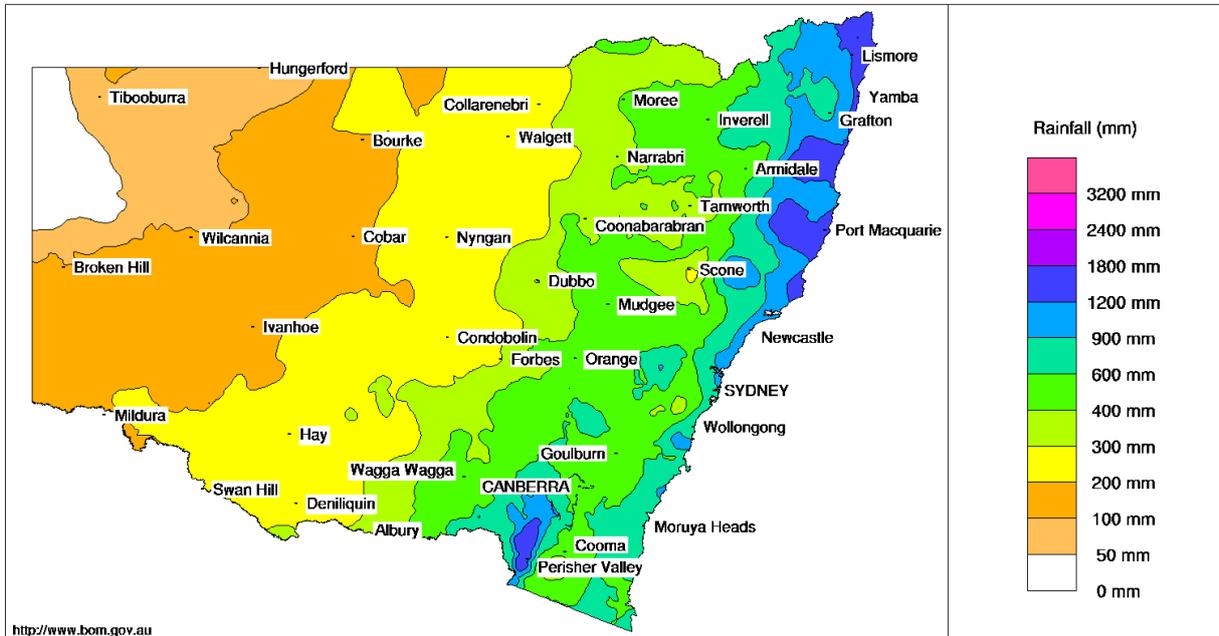
© Commonwealth of Australia 2018, Australian Bureau of Meteorology ID code: AWAP

Issued: 03/11/2018

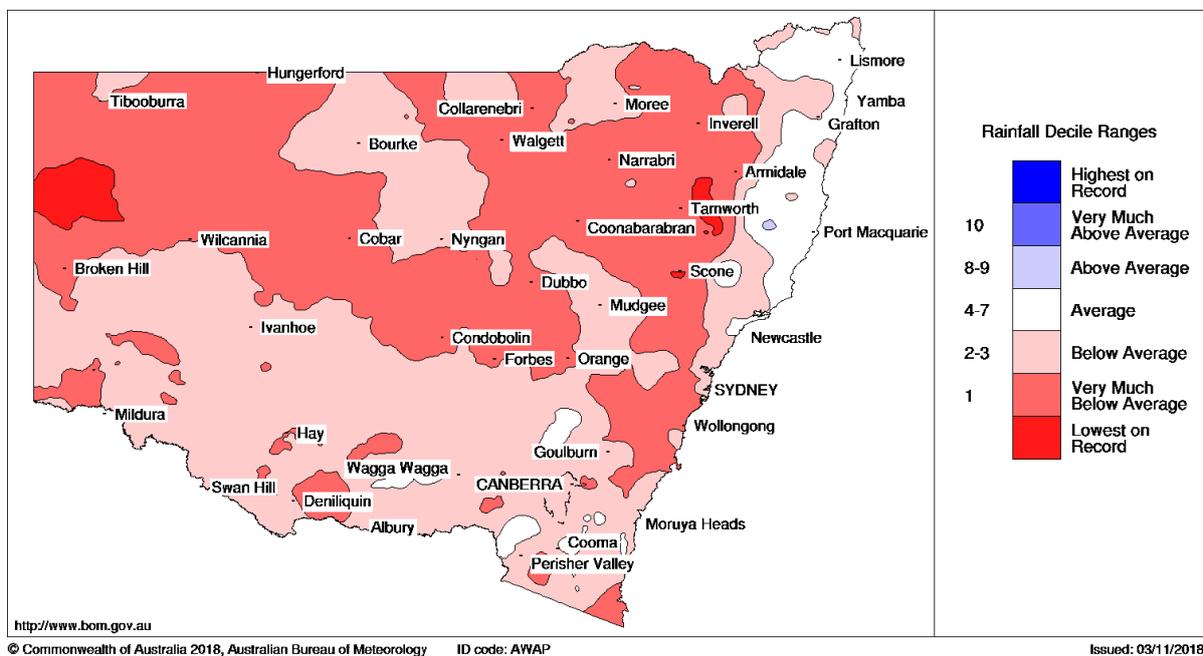
The above figures show that the last 6-month total rainfall is within the below average to very much below average for the most of the NSW Murray catchment.

5.2 12-month rainfall

New South Wales Rainfall totals (mm) 1 November 2017 to 31 October 2018
Australian Bureau of Meteorology



New South Wales Rainfall Deciles 1 November 2017 to 31 October 2018
Distribution Based on Gridded Data
Australian Bureau of Meteorology



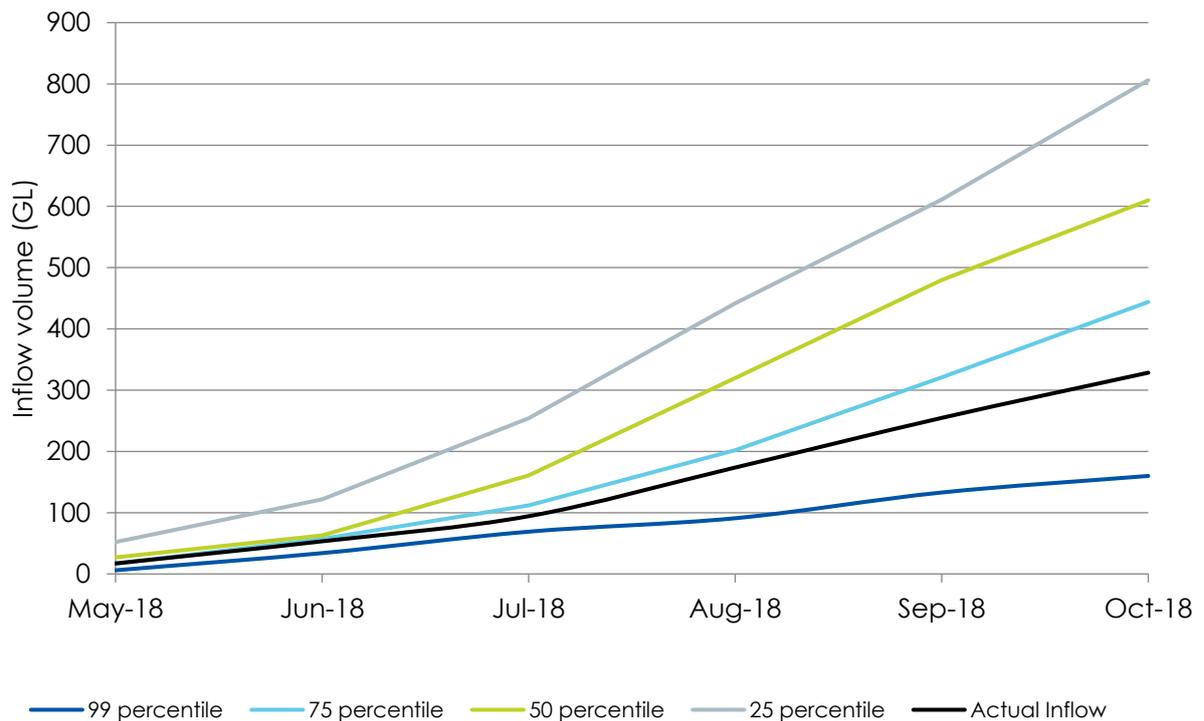
The above figures show that the last 12-month total rainfall is within the below average range for most of the NSW Murray catchment.

6. Inflows

6.1 Dartmouth Dam inflows

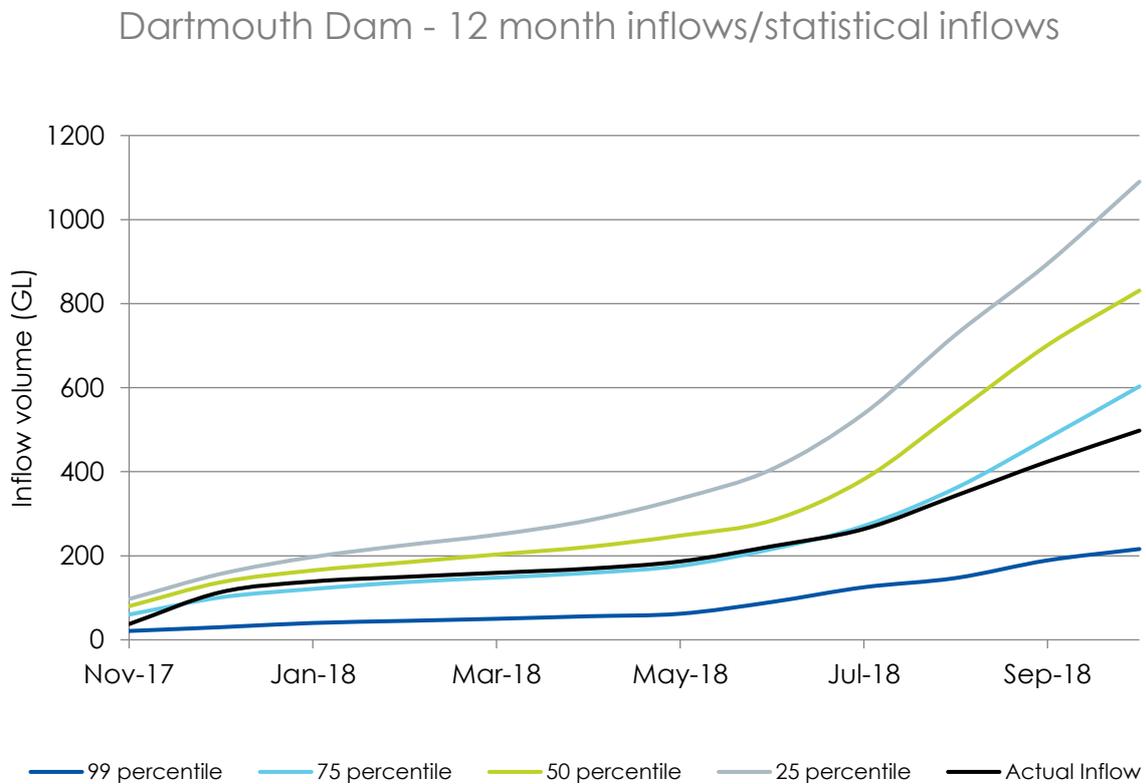
6.1.1 Dartmouth Dam - past 6-month inflows/statistical inflows

Dartmouth Dam - 6 month inflows/statistical inflows



Inflows are consistent with rainfall trends over the past 6-month period. Actual inflow for the 6 months is 329 GL which is consistent with 90th percentile inflows (340 GL); the minimum inflow is 166 GL.

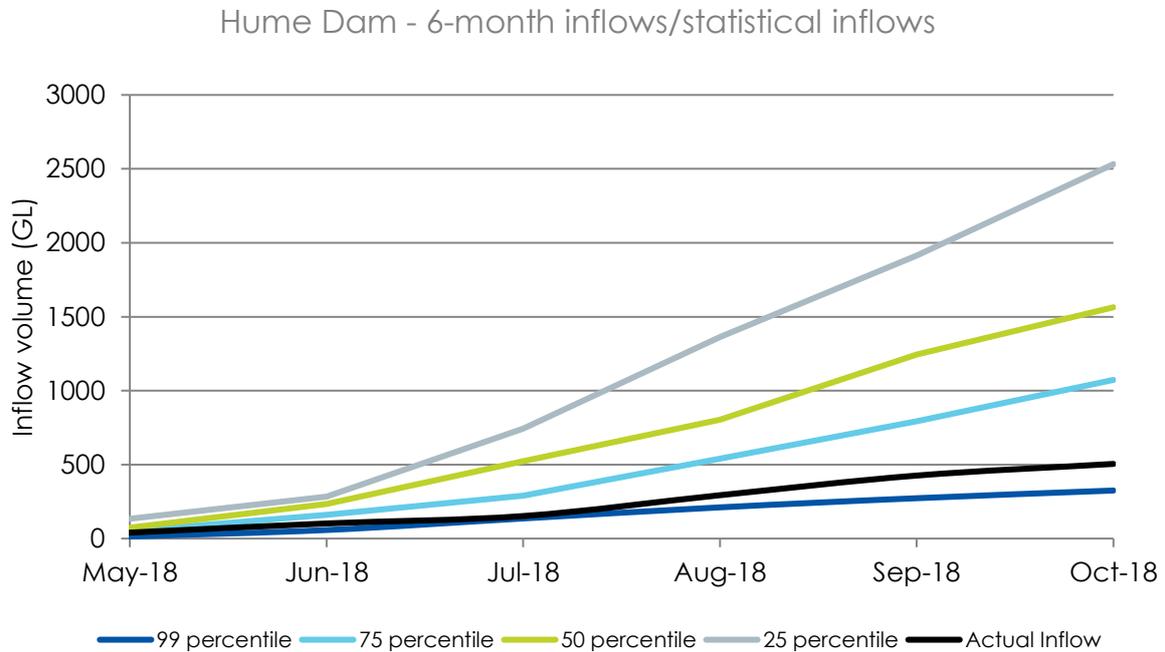
6.2.2 Dartmouth Dam - past 12-month inflows/statistical inflows



Inflows are below rainfall trends over the past 12-month period. Actual inflow for the 12 months is 500 GL which is slightly greater than 95th percentile inflows (450 GL); the minimum inflow is 119 GL.

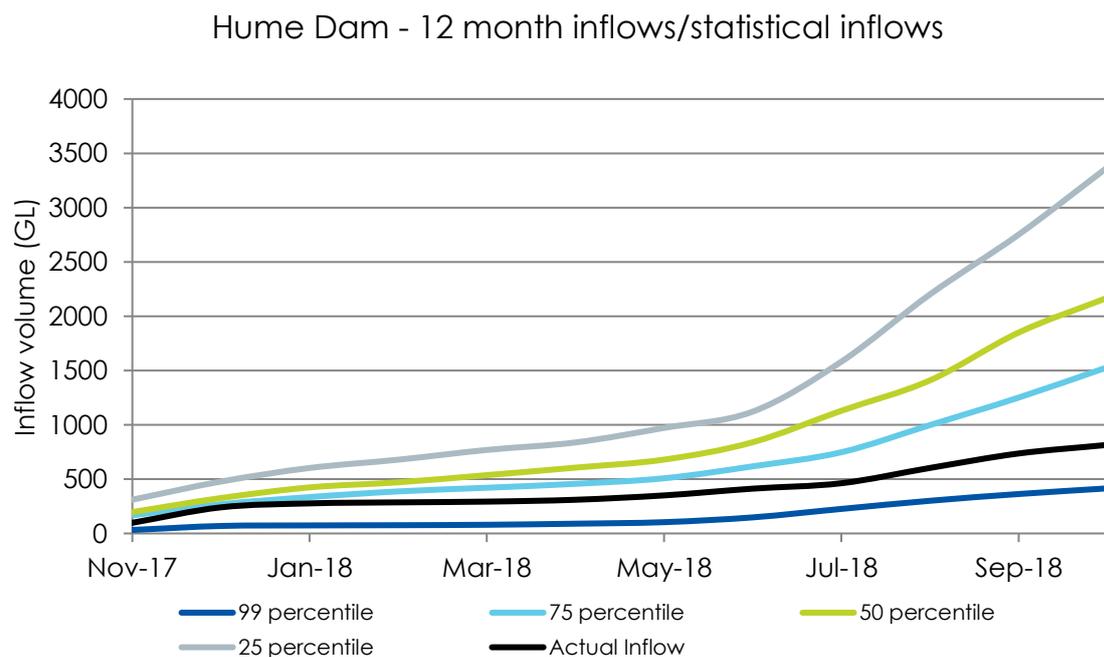
6.2 Hume Dam inflows

6.2.1 Hume Dam - past 6-month inflows/statistical inflows



Inflows are consistent with rainfall trends over the past 6 months period. Actual inflow for the 6 months is 505 GL - slightly better than 95th percentile inflows (403 GL); the minimum inflow is 105 GL.

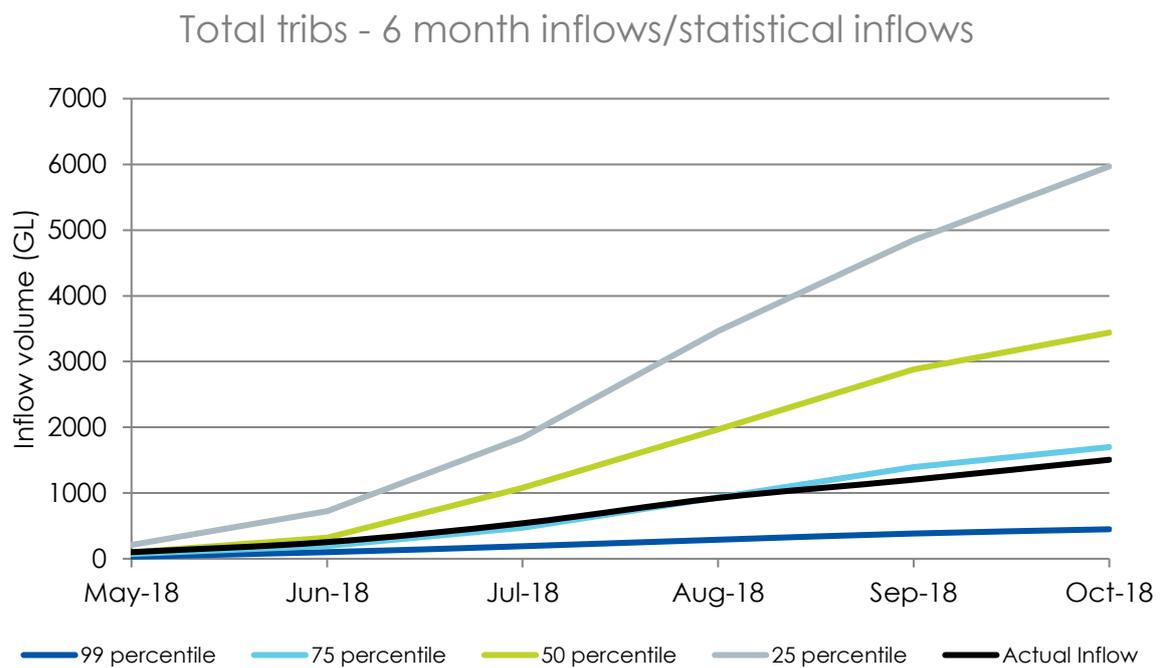
6.2.3 Hume Dam - past 12-month inflows/statistical inflows



Inflows are below rainfall trends over the past 12 month period. Actual inflow for the 12 months is 815 GL which is between the 95th and 90th percentile inflows (602 to 1050 GL); the minimum inflow is 124 GL.

6.3 Downstream tributary inflows

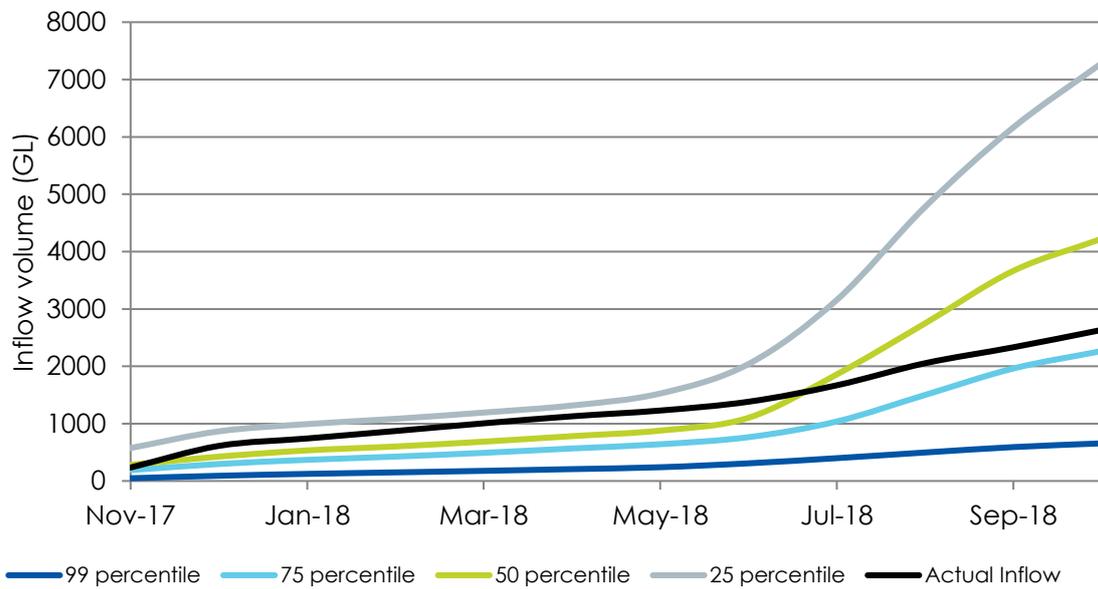
6.3.2 Total tributary - past 6-month inflows/statistical inflows



Inflows are consistent with rainfall trends over the past 6 month period. Actual inflow for the 6 months is 1500 GL which is between the 90th and 75th percentile inflows (1112 to 1699 GL); the minimum inflow is 398 GL.

6.3.3 Total tributary - past 12-month inflows/statistical inflows

Total Tribs - 12 month inflows/statistical inflows



Inflows are consistent with rainfall trends over the past 12-month period. Actual inflow for the 12 months is 2635 GL which is slightly greater than 75th percentile inflows (2266 GL); the minimum inflow is 575 GL.

7. Operational loss

6.4 Operational losses for 2018-19

Operational loss is water above that which could reasonably be expected to pass end-of-the-system gauge as the last point on Murray River being supplied with regulated flow (dam releases and controlled tributary inflows – not supplementary flows).

Murray River - water delivery operational surplus vs sales
- 2018-19 cumulative %
(regulated licensed is included in sales)



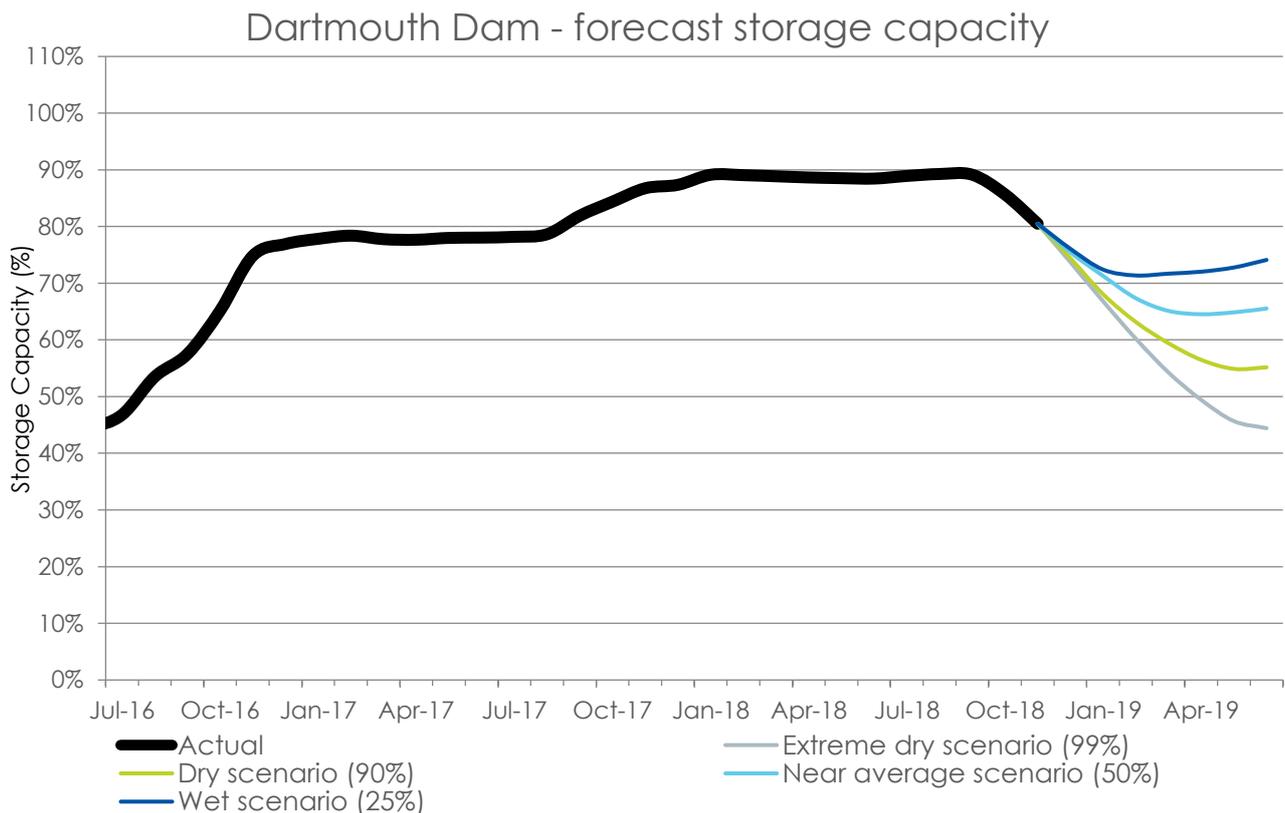
The table below shows that year to date sales and environmental delivery, including end of system flow requirement (493 GL) and operational loss (2 GL).

NSW Murray cumulative totals for 2018-2019

Dates	Sales + environmental delivery + EOS	Operational surplus	Actual	Target
July	57	1	1%	5%
July-Aug	208	2	1%	5%
July-Sep	354	2	1%	5%
July-Oct	493	2	0%	5%

8. Storage forecast

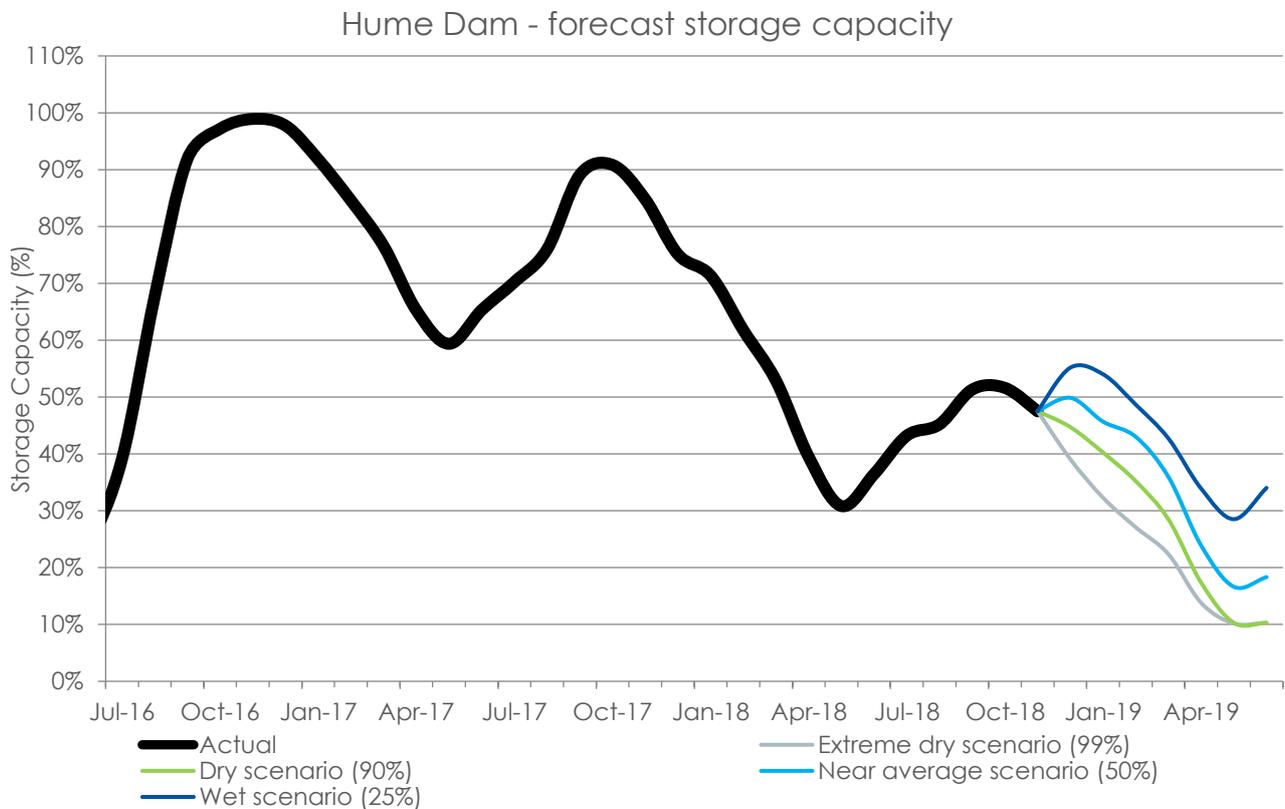
8.1 Dartmouth Dam storage forecast



Forecast was completed at end October, 2018.

The above figure demonstrates provides a range of scenarios that may occur at Dartmouth Dam under different inflow conditions through to June 2019. The chart demonstrates that only under wettest forecast conditions would the dam be likely to fill up to 70% of storage capacity. Under the dry scenarios, Dartmouth will be drawn on to transfer water to Hume Dam to ensure summer demands can be met.

8.2 Hume Dam storage forecast

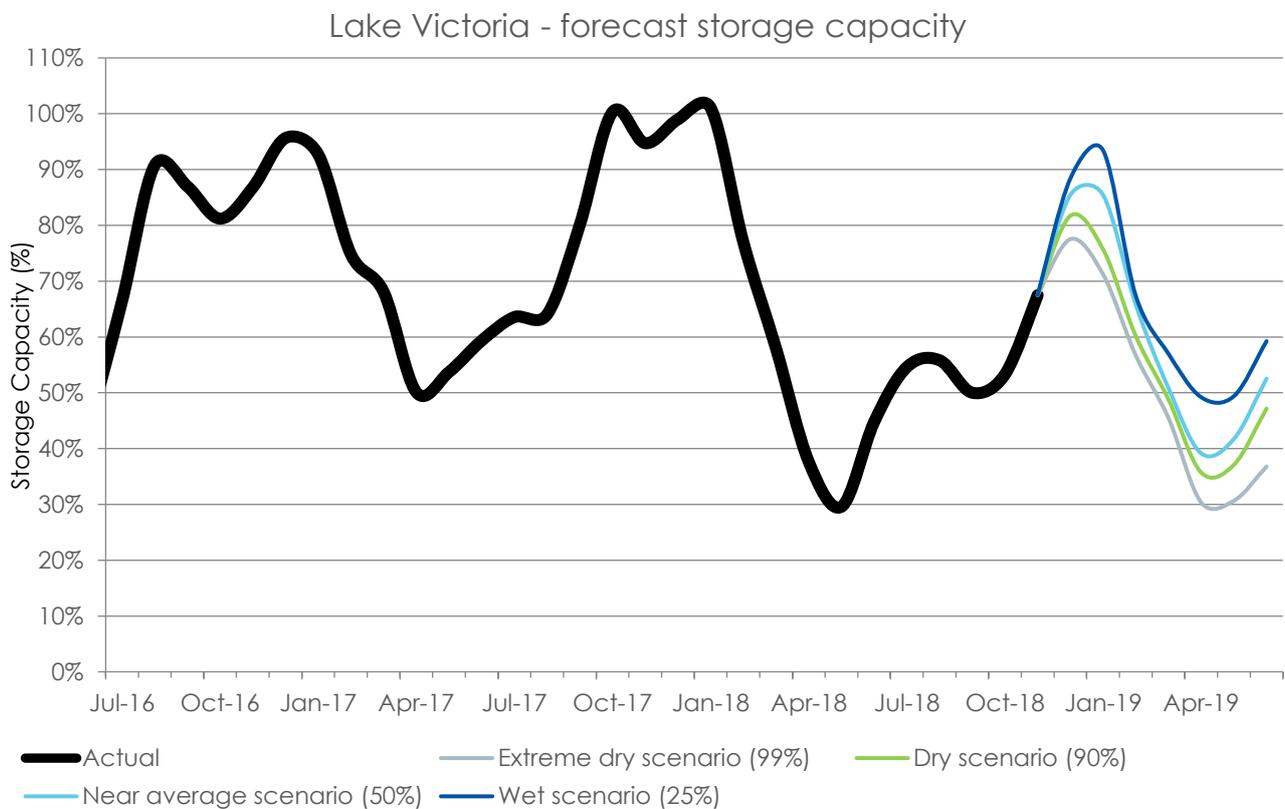


Forecast was completed at end October, 2018.

The above figure demonstrates provides a range of scenarios that may occur at Hume Dam under different inflow conditions through to June 2019. The chart demonstrates that under a wet inflow scenario would the dam would reach approximately 55%, essential there is only a 1 in 4 chance of this occurring. Under all scenarios, Hume Dam will be drawn on to meet system demands.

Under the driest scenarios the storage could fall to as low as 10%. In essence the chart shows that there is a 10 % chance of this occurring, and a 90% of the storage ending the season higher than this.

8.3 Lake Victoria storage forecast



Forecast was completed at end October, 2018.

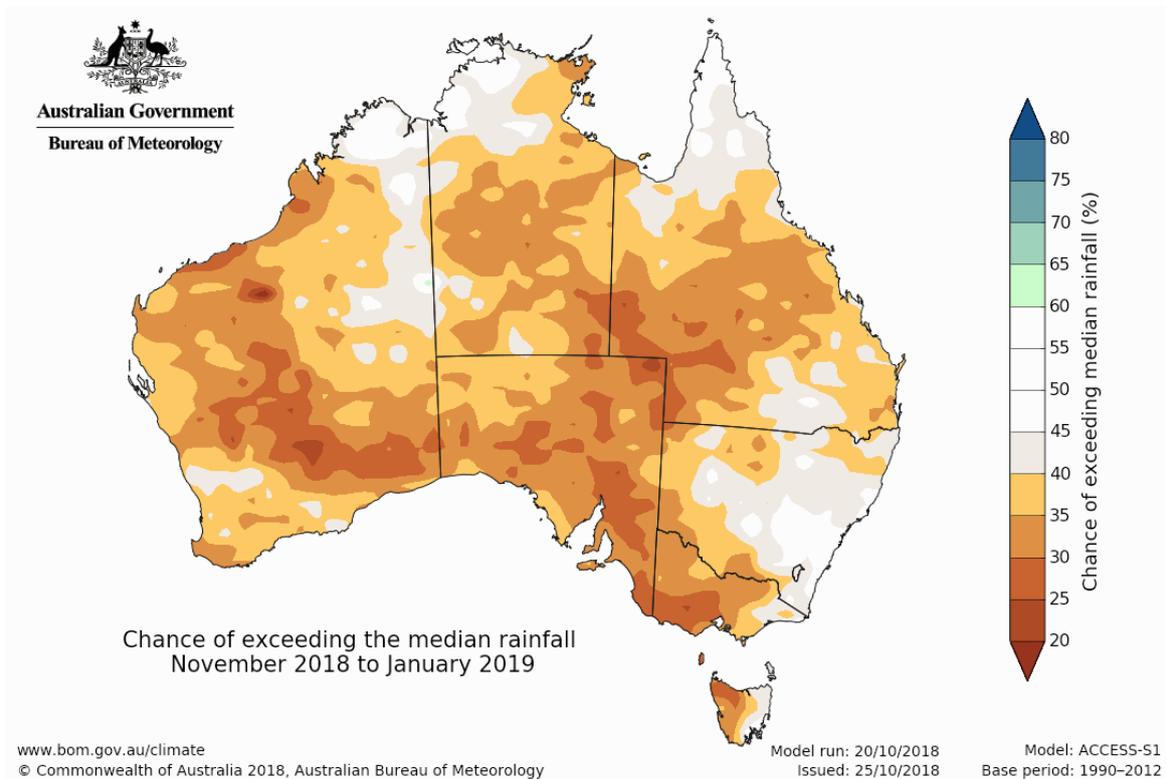
The above figure demonstrates provides a range of scenarios that may occur at Lake Victoria under different inflow conditions through to June 2019. The chart demonstrates that the storage is unlikely for Lake Victoria to fill this water year. Under all scenarios, Lake Victoria will be drawn on to meet system demands.

Under all scenarios, the storage is likely to meet the Lake Victoria operating strategy and of May storage target.

8.4 Menindee Lakes storage forecast

A storage forecast is provided in the [Lower-Darling Operations Plan](#).

8.5 Next 3 months scenario from the BOM forecast



The Bureau of Meteorology seasonal outlook for November to January, issued 25 October 2018, indicates that rainfall conditions are generally likely to be below average in the valley over this period. November has a high chance of being dry, while December shows no clear indications of drier or wetter than average conditions. Above average temperatures experienced so far in 2018 are likely to continue into early 2019. The Bureau's El Niño-Southern Oscillation (ENSO) Outlook remains at El Niño ALERT, with El Niño likely to develop before January 2019. A positive Indian Ocean Dipole (IOD) event is underway but may dissipate through November. When combined, an El Niño and positive IOD event increase the chances of dry and warm conditions, particularly during spring. (Source: https://www.industry.nsw.gov.au/_data/assets/pdf_file/0006/197277/WAS-NSW-Murray-and-Lower-Darling-181115.pdf)

9. Outage planning

Item	Time	Description
Hume Dam	N/A	None
Mulwala weir	N/A	None
Torrumbarry weir	N/A	None
Stevens weir	Winter	Painting of the super structure. Works planned to commence in the winter drawdown to minimize the risk of impact to consumptive demands. However, the duration may extend into late – Winter or Spring. This risk is being considered in the planning of the outage and will be managed through the design of the maintenance process.
Euston weir	N/A	None
Wentworth weir	N/A	None

More information

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