Lower-Darling Operations Plan

July 2019

waternsw.com.au

Contents

1. Highlights

- Water remaining in storage as at 28 July 2019 Wetherell – 10.3 GL; Copi Hollow – 4.7 GL; All other storages are either dry or below the level where water is accessible.
- Pumping by Essential Water to Broken Hill is now met from the Wentworth to Broken Hill pipeline while pumping from Copi Hollow continues at lower rates for Menindee town and pipeline customers. Forecast is for resources in Copi Hollow to be exhausted by Sep 2019.
- Without further inflow, Wetherell resources is to be exhausted by January 2020, assuming releases are only made to maintain the Weir 32 weir pool.
- Inflows at Wilcannia over the past 12 months have totalled 6.3 GL, this is close to the lowest on record of 4 GL. The 24-month inflows totalled 59 GL which is lowest on record compared to previous record of 134 GL.
- Inflow from Warrego arrived Wilcannia on 14 June 2019 and around 3.3 GL observed up to 29 July. Flow will cease soon at Wilcannia and total volume is not expected to exceed 3.4 GL. Lake system did not receive any inflow from this event and no flow is expected to arrive as flow is about to cease at Wilcannia.
- As per the NSW Extreme Events Policy, the Lower Darling regulated river water source is assessed to be in Stage 4. A temporary water restriction came into effect on 4 December 2018 limiting the take of water to; town water, domestic and stock, permanent plantings, and, from Copi Hollow, high security licences. Gazette.
- Releases for flows at Weir 32 ceased on 12 February 2019, following the completion of native fish rescue downstream of Weir 32.
- Block bank regulators were closed during last week of January.
- According to Bureau of Meteorology's recent climate update, total rainfall during 2018-19 financial year was 24% below average and lowest since 1969-70. This was the second warmest financial year on record.

WaterNSW has developed the Lower-Darling Operations Plan to extend water supplies for surrounding communities and to the customers along the Lower-Darling. This plan is a living document and will be updated regularly based on changing conditions.

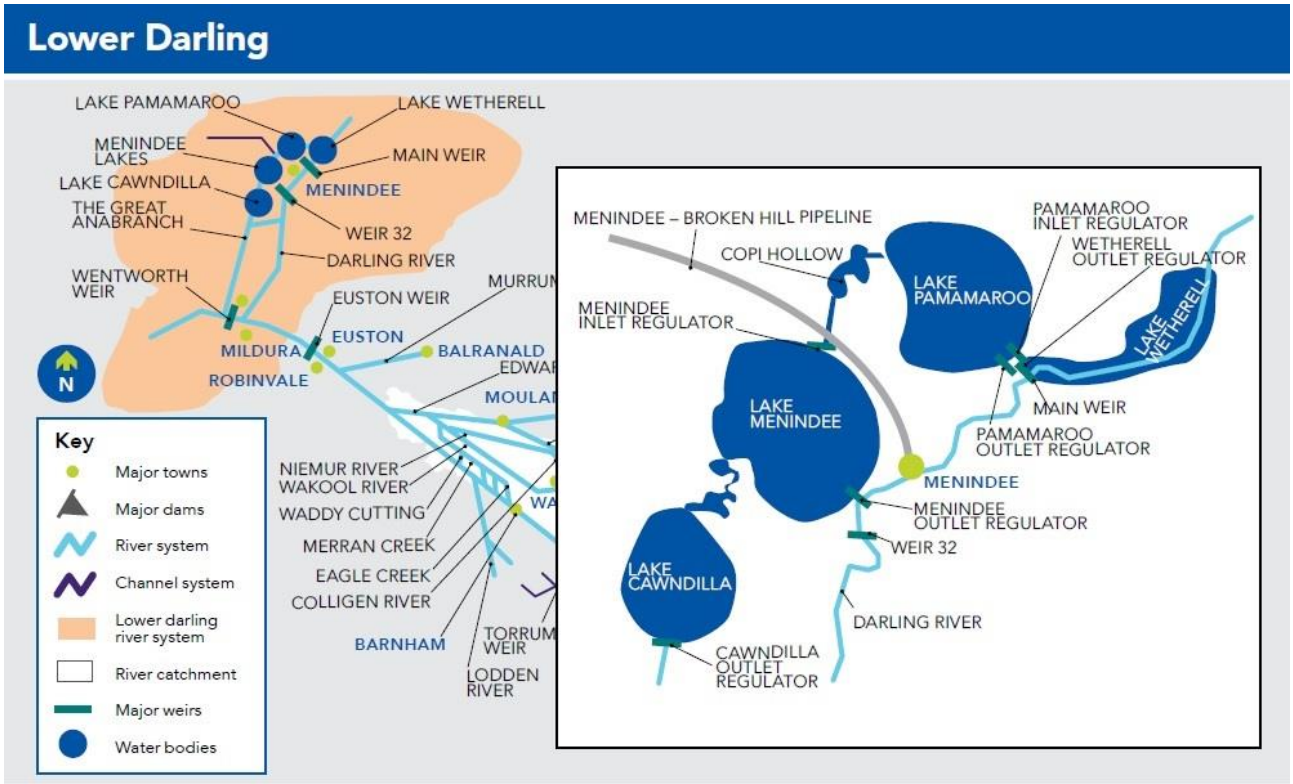
Water is stored in Menindee Lakes to meet water needs including provision for water losses (seepage and evaporation), maintaining the Lower-Darling environment supply for essential requirements (e.g.

town water supply, domestic and stock and basic land holder rights) and General Security Licenses in the Lower-Darling and Lower Murray systems.

While resources are currently at record low levels based on available data since 1979, the plan has provided a framework to optimise water delivery through maximising releases from the lower storages (Menindee and Cawndilla) and retaining water in the more efficient Upper Lakes (Wetherell and Pamamaroo) until demands and outlet capacity constraints of the lower storages necessitates releases from the upper lakes.

WaterNSW has planned for the lowest inflow sequences and maximum evaporation rates for the region with the aim of ensuring operation of the lakes are optimised for supply through a repeat of the drought of record.

With low storage volumes and possibility of no inflow in near future, WaterNSW is taking extreme care to manage the available resources for critical requirements.



2. Operational objectives

Lower Darling Valley is currently experiencing severe drought and water shortage and identified is at drought stage 4 by NSW DPI. Inflow for last 24 Months was worst on record and 12 months was 2nd worst on record. The aim of the plan is to ensure that critical water needs can be met, and the environmental needs of the Lower-Darling river are maintained for as long as possible using the current storage volume and identify key actions for different range of future inflow sequences

Key operational objectives

- Maintain supply for critical requirements.
- Maintain a continual flow of water along the Lower-Darling (maintain flow at Burtundy) through a repeat of the lowest inflows on record – achieving this objective has been compromised by the current inflows now falling below the previous worst on record for the Menindee Lakes system.

The operations plan usually considers three inflow scenarios that guide operational decisions. They provide assessment of a range of conditions that may occur in the coming 12-24 months.

- Scenario 1: Sahara – no inflow occurs at Wilcannia through to resource being exhausted;
- Scenario 2: Drought – minimum statistical inflow sequence on record - applied from July 2019 – with resources managed to the next significant inflow; and
- Scenario 3: Dry scenario - 80th percentile inflow sequences applied from July 2019 to represent the likely low inflow scenario. The dry scenario considers an inflow sequence that could be expected to be exceeded 8 years out of 10 based on historical records.

Considering the current drought conditions, three additional scenarios have been considered

- Scenario 4: Connectivity inflow – inflows required to establish connectivity up to Burtundy
- Scenario 5: Block banks removal inflows – inflows required to remove four block banks constructed as a part of drought management measures
- Scenario 6: WSP inflows – inflows required to run the minimum WSP flows (96.5GL) for 1 year.

We will continue to review the system operations forecast with the aim to implement drought measures as the volume of water in the lakes reduce or receive any inflows.

As there is no guarantee that the next drought will not be more severe than the last, the design scenario is considered to be scenario 1, it is the worst-case, no inflow scenario.

Scenario 2 provides for a repeat of the worst inflow sequence; this scenario considers the measures required to manage the system's water resources through a repeat of these conditions to provide the best outcome possible.

Scenario 3 provides scope of the potential system operations in the event of some inflows, but overall the system remains relatively dry, and what this would mean for river flows and town water supplies.

Overall it is unlikely that the conditions presented in these scenarios will be repeated. Rather they will be used to help inform customers and community about potential system operations over the next 12 months and guide operational decisions as time progresses. Ultimately the decisions made will be in response to the conditions that do occur.

3. Operational rules

3.1 Water Sharing Plan (WSP)

The WSP provides a framework for sharing of water resources within the Lower-Darling, aiming to provide a balance between environmental, economic and social objectives. The plan establishes a bulk access regime for the extraction of water under access licences providing for environmental water rules or planned environmental water, water for basic landholder rights and extraction under a number of access licence categories.

The WSP was originally gazetted in 2003 and as such the framework has been established based on inflow sequences prior to this time. Since gazette of the plan, the minimum inflow sequence prior to 2003 has been exceeded (by lower inflows) on at least 2 occasions and this current sequence marks a 3rd such occurrence.

The WSP provides for licenced entitlements of:

- Domestic & stock
- Local water utility
- Regulated river (high security)
- Regulated river (general security)
- Supplementary – although all supplementary entitlement is now held by government and has essentially be retired from extractive use

The WSP provides that minimum releases be delivered at Weir 32 for the suppression of algae, noting the seasonal variability, the minimum release requirements are as follows:

January-March	350 ML/d
April	300 ML/d
May-October	200 ML/d
November-December	300 ML/d

These releases total 95.6 GL/year.

3.2 Murray-Darling Basin agreement

The Commonwealth Water Act 2007 provides the Murray-Darling Basin Agreement within Schedule 1 of the Act. Clause 95 of Schedule 1 provides the New South Wales entitlement to water from Menindee Lakes.

Clause 95 provides that:

- Whenever water in the Menindee Lakes storage falls below 480 GL, New South Wales may use stored water as it requires until the volume next exceeds 640 GL.
- Whenever sub clause 1 does not apply, the resources within the storage are shared in accordance with Clause 94 (c), meaning that inflows to the storage are shared 50:50 between Victoria and New South Wales.

The agreement provides that the Murray-Darling Basin Authority, acting on behalf of the signatories to the agreement, shall manage the access and delivery of resources held within the Menindee Lakes storage in accordance with system operating requirements.

4. Customers

4.1 Domestic and stock

There are 115 Domestic & Stock licences with a total share component of 1,370 ML. Domestic & Stock use in the Lower-Darling generally exceeds 400 ML/year. Average annual use has been impacted by periods of no access in the Lower-Darling in recent years. Figure 1 shows the annual historical use for domestic and stock from 2012/13. Domestic & stock water is required all year round and requires a continual flow along the Lower-Darling between Weir 32 and Burtundy Weir.

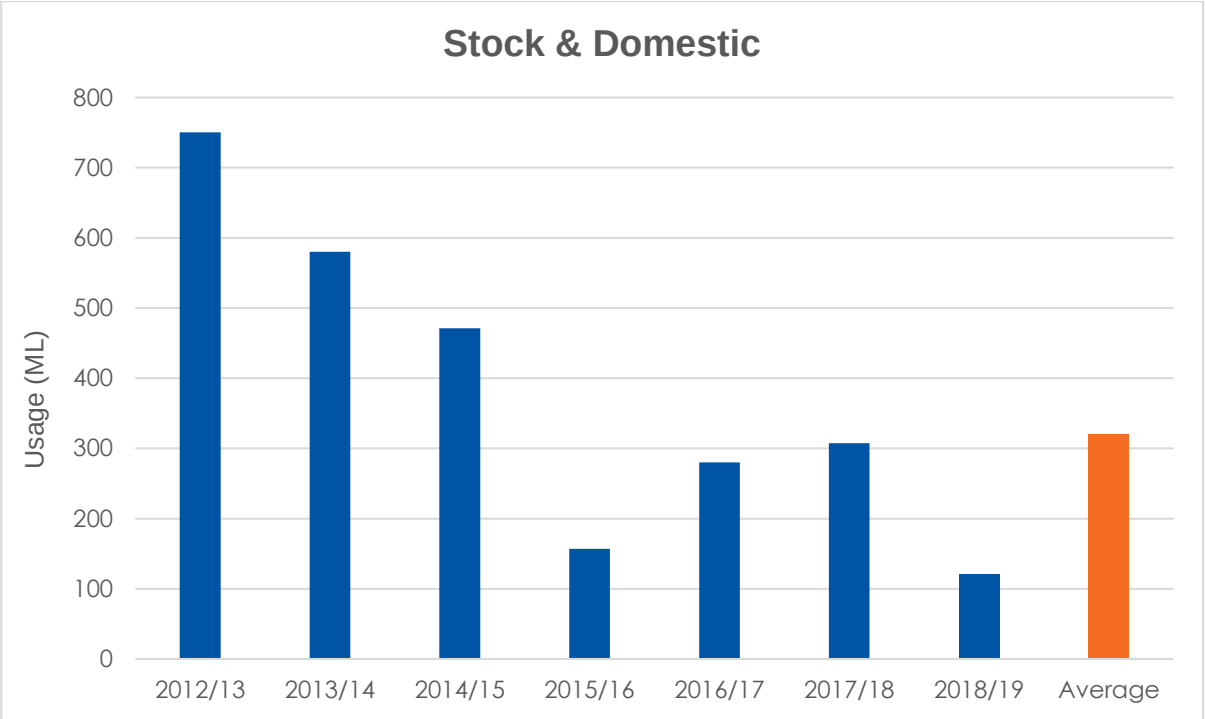


Figure 1: Historical Use - Domestic & Stock

4.2 Local water utility – Broken Hill, Pooncarrie

There are two Local Water Utility (LWU) with share component of 9,975 ML for Essential Water (Menindee and Sunset Strip) and 160 ML for Pooncarie.

Broken Hill's supply is now via the Wentworth to Broken Hill pipeline as the project completed in April 2019

Historical use shown in figure 2, including Broken Hill supply, indicates that use is usually over 3,500 ML/year, and regularly exceeds 5,000 ML/year.

Water quality can be a major issue for town water supplies with salinity content above 1,000 EC resulting in taste concerns and above 1,500 EC resulting in corrosive issues on residential, commercial and industrial equipment. Once water quality exceeds these levels additional levels of treatment is required to ensure the water can be used for town supply.

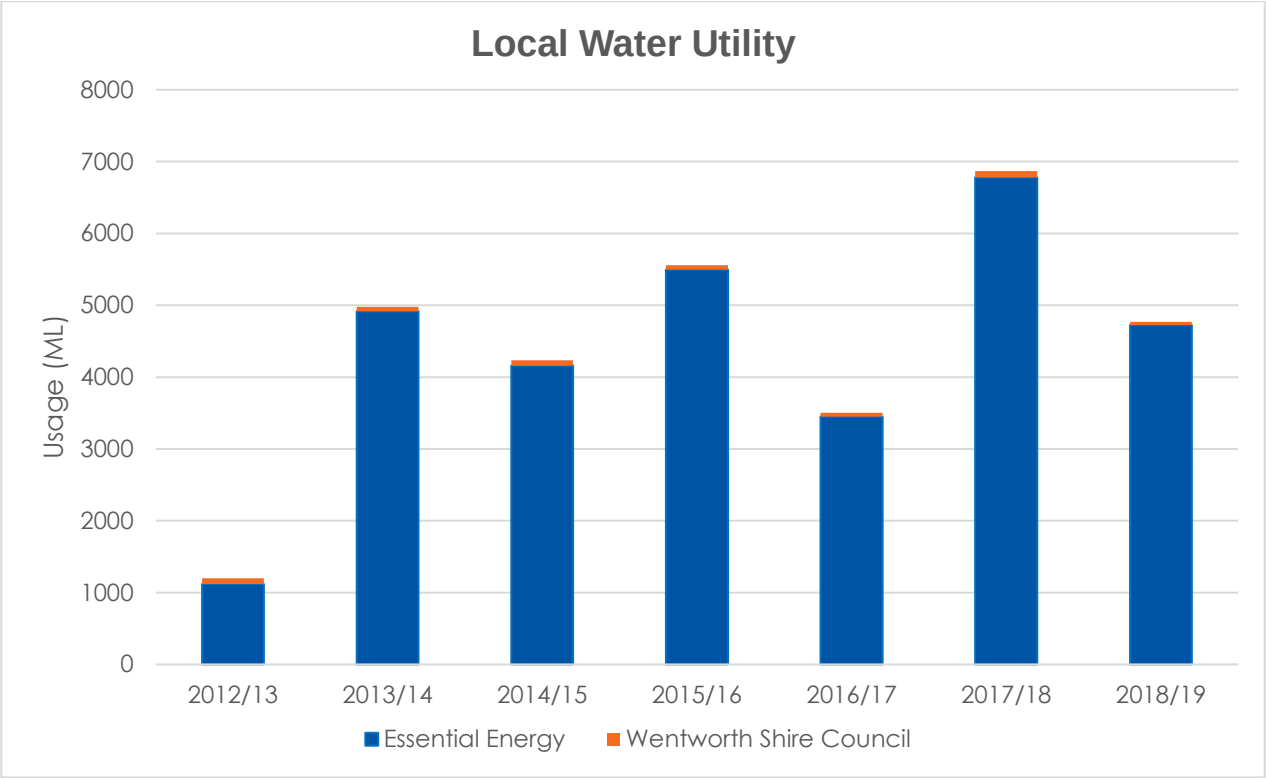


Figure 2: Historical use – Local water utility

4.3 Regulated river (high security)

There are 69 High security access licences with a total share component of 7,771 ML. Out of which, consumptive use account for 4,196 ML and environmental water account for 3,575 ML. Historical use in most years is over 3,000 ML, and regularly exceeds 3,500 ML/year (refer to figure 3). The exceptions being years in which use restrictions have been in place for drought management.

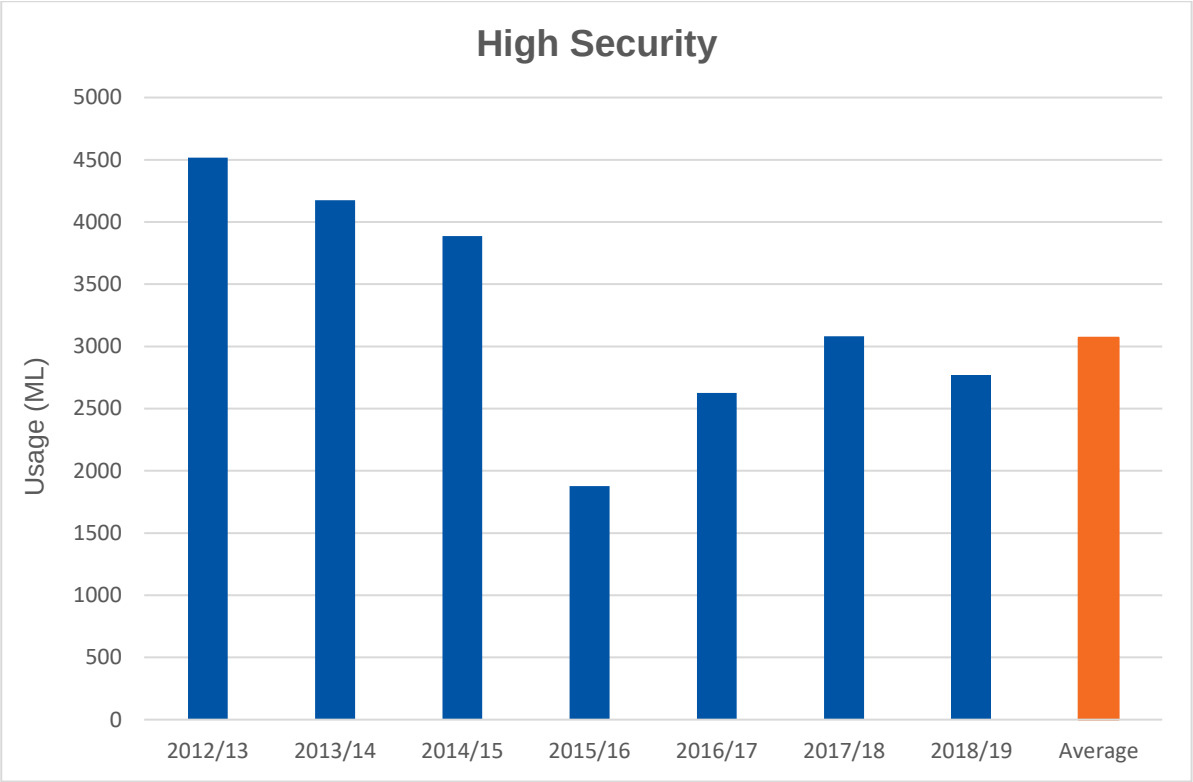


Figure 3: Historical use - high security

4.4 Regulated river (general security)

There are 92 General security access licences with a total share component of 79,507 shares. Out of which, consumptive use account for 10,143 shares and environmental water account for 69,364 shares. The history of general security use has been highly variable. Recent years has been boosted by significant allocation assignments into the Lower-Darling system by both consumptive users and the environmental water managers.

While the average use is calculated as 78,100 ML/year, that annual use ranges from 900 ML in 2015/16 to 185,000 ML in 2016-17, where e-water holders used 183,000 ML. Figure 4 shows the historical general security uses since 2012/13.

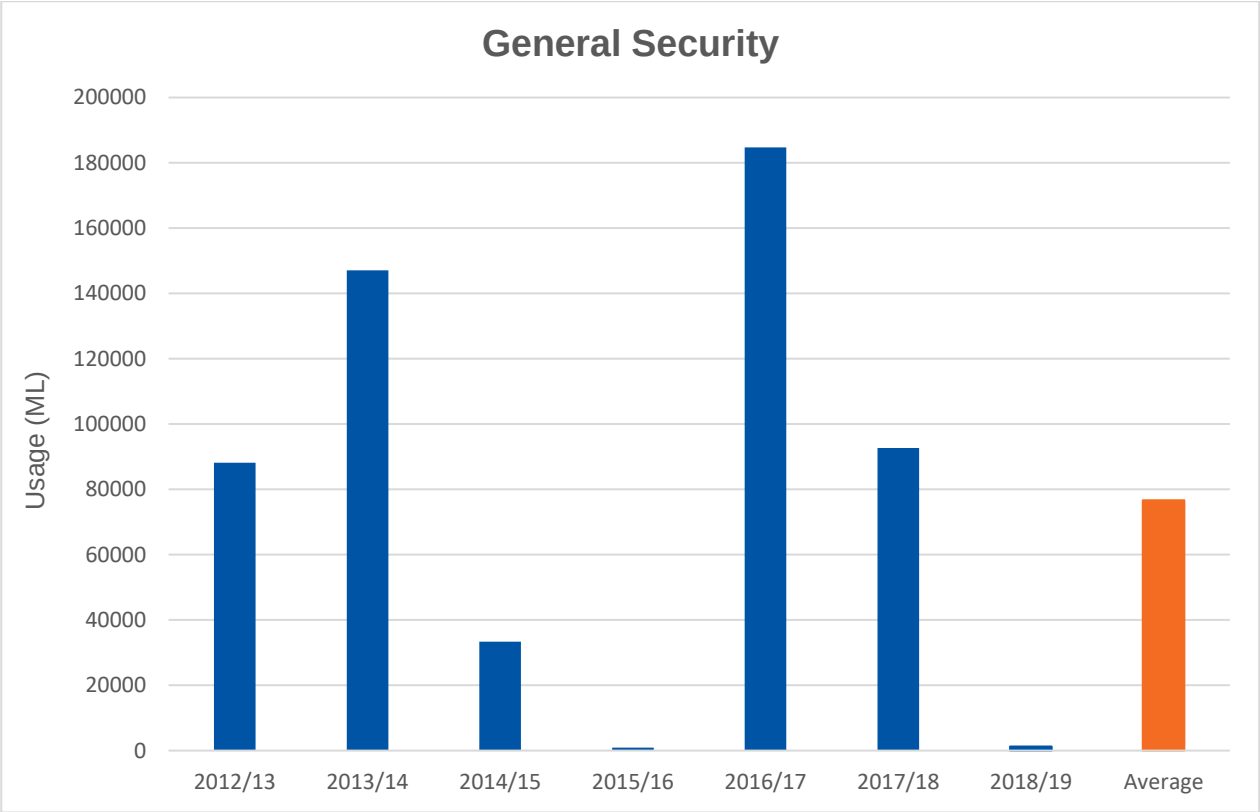


Figure 4: Historical use - general security

5. Drought management measures

5.1 Drought management measures taken since Dec 2017

Drought management measures started on 15th Dec 2017 when the system reached 480 GL and access to resources transfers solely to NSW. Following measures were taken to maximise the use of water.

5.1.1 Reduce water sharing plan minimum flow requirements

The WSP provides 95.6 GL (Section 3.1) of water for release over Weir 32, in a seasonal pattern for improved water quality in the Lower-Darling. Meeting the WSP requirement is a significant draw on the available resources, once the system reaches 480 GL and access to resources transfers solely to NSW.

WaterNSW has allocated a budget of 63 GL per year for releases downstream of Weir 32, once the 480 GL trigger is achieved – when no significant inflows are in transit upstream of the storage.

The WSP minimum flow requirements have been set based on what is assumed necessary to maintain ecological function and minimise risk of Blue Green Algal outbreaks. Reducing below the minimum required flows during Summer will create an increased risk of algal outbreak, that is unlikely to be mitigated through increased flow.

The option of maintaining minimum flow requirements at Weir 32 would reduce the duration of time that flow through the system could be maintained if no further inflows occur. That is, the resources would be depleted sooner, and as such, without inflow, cease to flow at weir 32 would occur sooner.

In this plan greater value has been placed on maintaining a reliable supply to the Lower-Darling water users, extending the duration of stock, domestic and town water supplies. However, if higher rates of release are supported by community and customers for management of water quality, these would be considered.

5.1.2 Pumping to Copi Hollow (maximum storage volume 12GL)

Additional storage in Copi Hollow requires the installation of a block bank across the interconnecting channel between Copi Hollow and Lake Pamamaroo. Pumping from Lake Pamamaroo to Copi Hollow needs to commence before the water level and water quality in Pamamaroo drops too low, commencing when Pamamaroo reaches 108GL, and can only be achieved to a volume of 72 GL. Pumping to Copi Hollow extends the period of time that supply can be made to Broken Hill without the need for reverse osmosis.

5.1.3 Pumping Lake Tandure to Lake Wetherell

Lake Tandure is a small flat storage lake that is usually connected to Lake Wetherell. Naturally the two lake bodies separate when the storage reaches 57.8 m or approximately 9.4 GL.
However, efficiency in system storage can be achieved by installing a bank and isolating Lake Tandure when the Lake Wetherell total storage reaches around 53 GL, and pumping the volume held in Lake Tandure to Lake Wetherell. This reduces the surface area of the stored volume and provides efficiency through reduced evaporation.

Pumping from Lake Tandure can extend the period that supply can be made to Broken Hill and the Lower Darling River.

5.1.4 Lower-Darling River block banks

When the water supply is insufficient to secure both Broken Hill and maintain continuous flows in the Lower-Darling, block banks are constructed as temporary weirs in the Lower-Darling. Releasing the remaining water in Lake Pamamaroo to these block banks extends the supply of water for stock and domestic and permanent plantings in these locations. However, they supply only a limited number of customers and do not address the need of all customers along the Lower-Darling.

5.1.5 Temporary bore field for Broken Hill and Menindee

Bores have been installed in the Menindee Lake and Tallyawalka aquifers. The water quality in these aquifers is suitable for supply to Broken Hill and Menindee township, although the Menindee bore-field would still require reverse osmosis treatment due to salinity marginally above the 1,500 EC threshold. Commissioning of these bore-fields would require; power, pumps and substantial pipelines that would take about six months to construct.

This action has been strongly opposed by many in the Broken Hill community in past years.

6. Resources analysis

6.1 Current situation

As of 28 July 2019, the total storages were at 15.1 GL and about 14.6 GL of that is active volume.

Table 1: Storage breakdown as of 28 July 2019

Lake	Current storage volume (ML)	Dead storage (ML)	Active storage (ML)
Wetherell	10,285	490	9,795
Pamamaroo	17	5,723	0
Copi Hollow	4,792	0	5,017
Total	15,094	6,213	14,587

6.2 Recent Inflows

Inflows to Menindee Lakes System have been very low since 2017. Storage volume peaked at 1,585 GL on 17 December 2016 and since then has decreased due to releases to meet downstream demands and system losses to evaporation and seepage.

As shown in figure 5, the storage volume was 209 GL at the start of 2018/19 water year which has depleted to 15 GL at the end of 30 June 2019.

Around 2 GL inflow was recorded during the start of 2018/19 water year and that was mostly from the Northern Connectivity Event. Inflow from Warrego arrived at Wilcannia on 14 June 2019 after around 8 months of dry spell and 3.3 GL observed till 29 July. Flow will cease soon at Wilcannia and total volume is not expected to exceed 3.4 GL. No inflow is expected at the lake system from this event.

The last 12 and 24- months inflows ending at June were 6.3 GL and 59 GL respectively. The 12-month inflow sequence is the 2nd lowest on record and the 24-month sequence is lowest on record. Figure 6 and 7 show the recent 12 and 24-months inflows at Wilcannia compared to previous four lowest inflows.

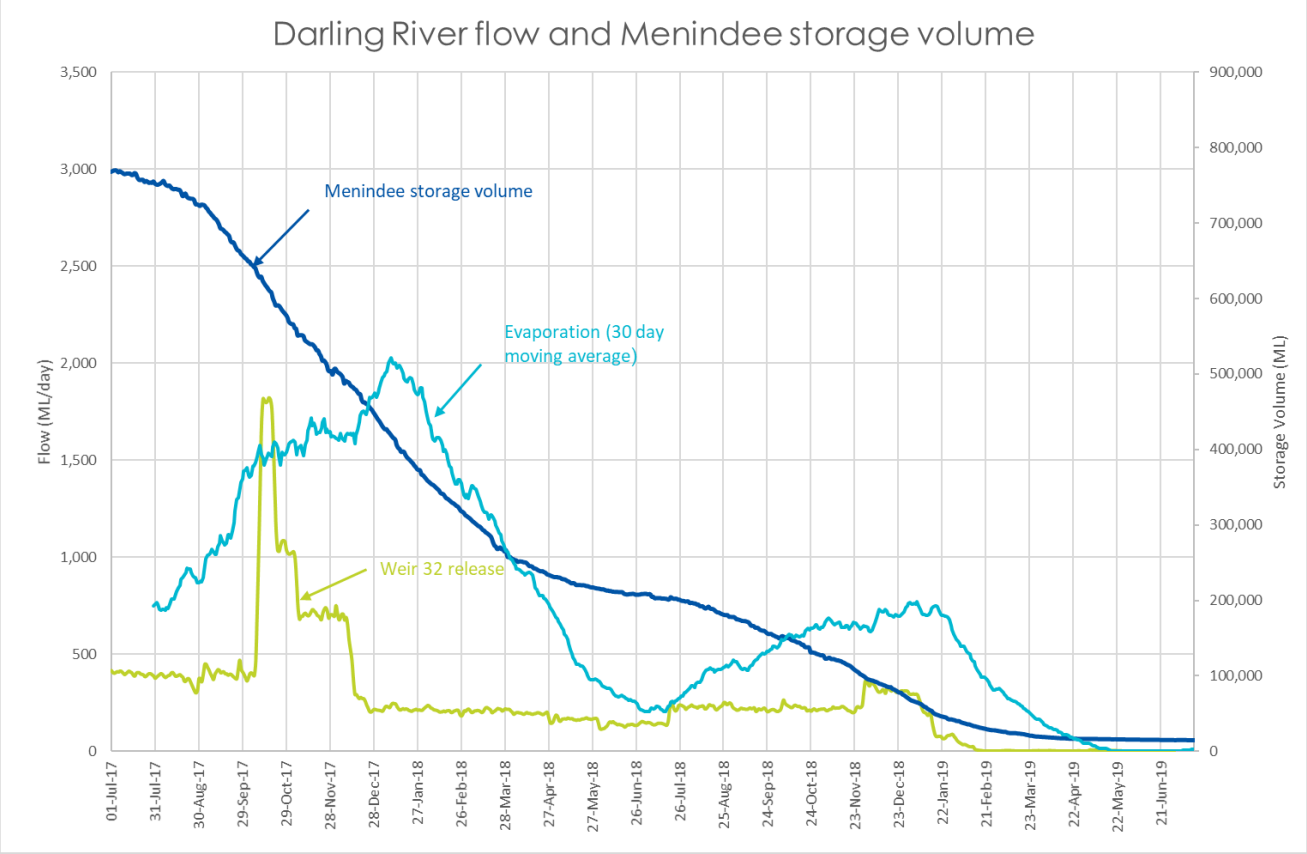


Figure 5: Menindee Lakes Total Volume, Storage release and Evaporation since July 2017

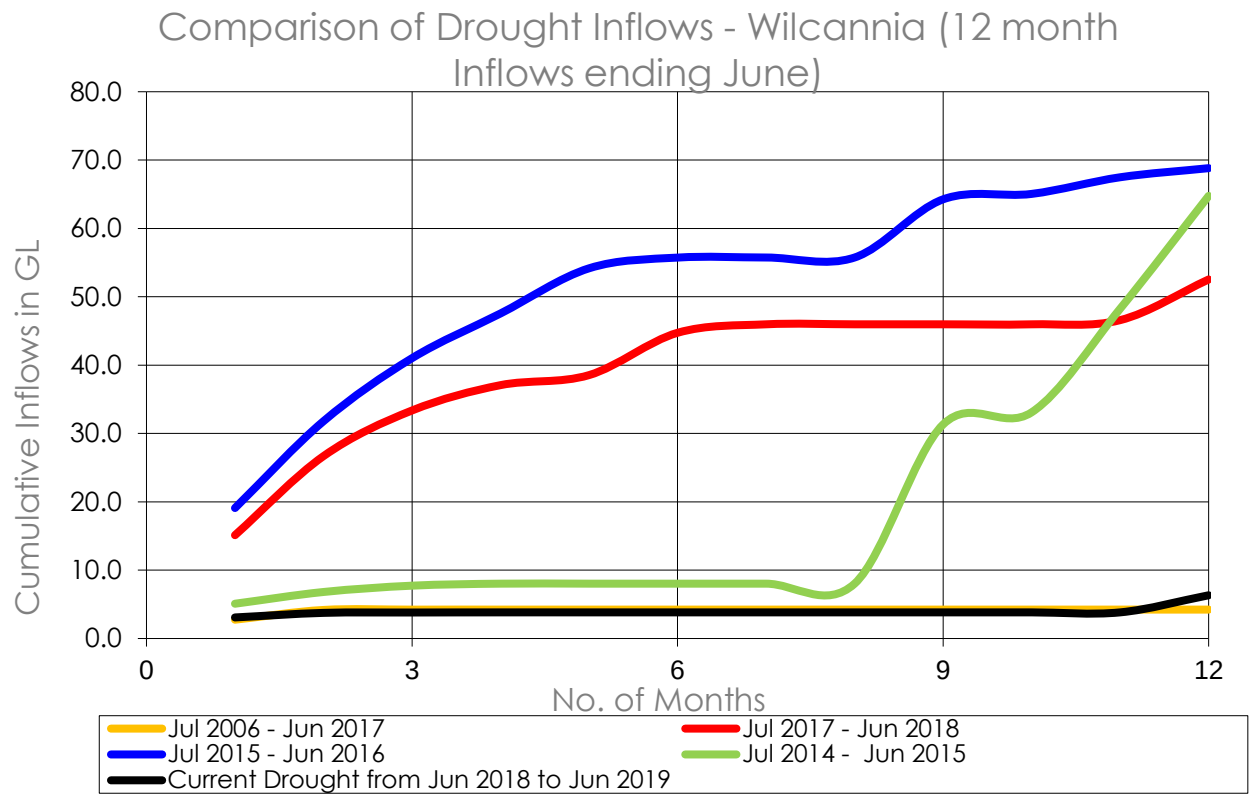


Figure 6: Comparison of 12 Months drought inflows at Wilcannia

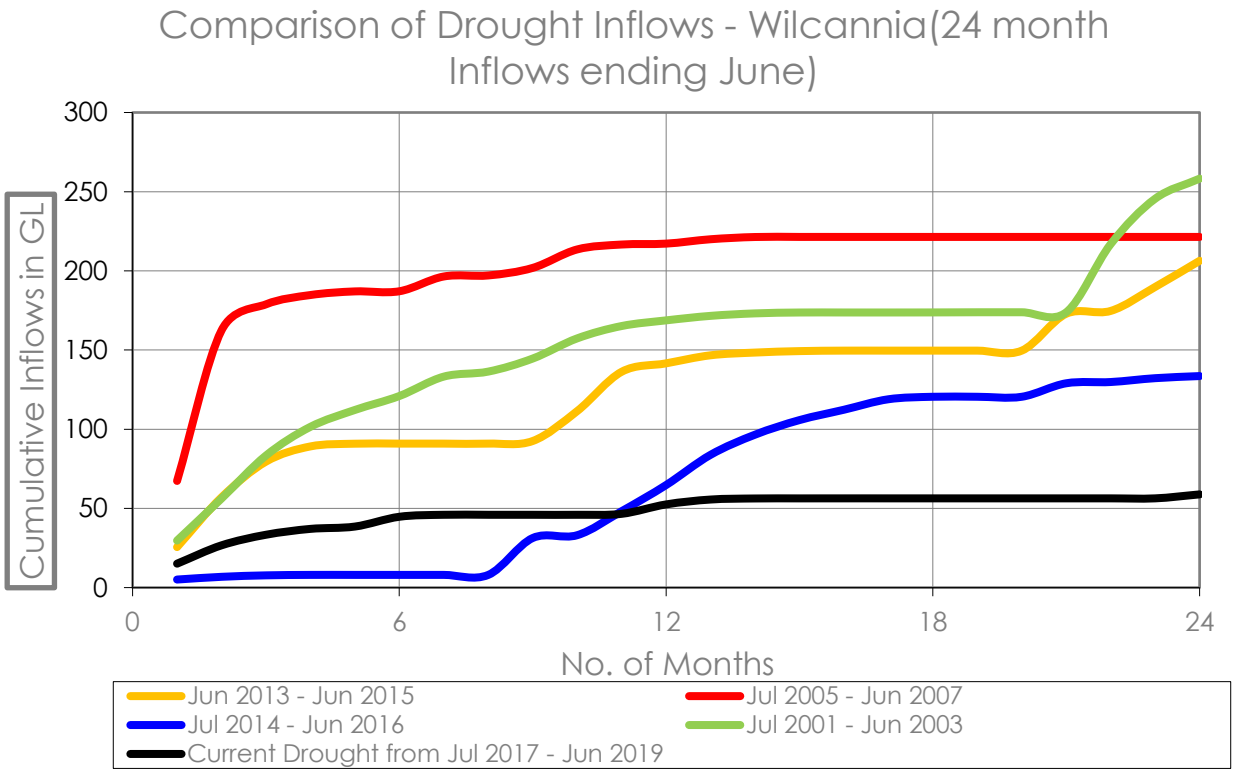
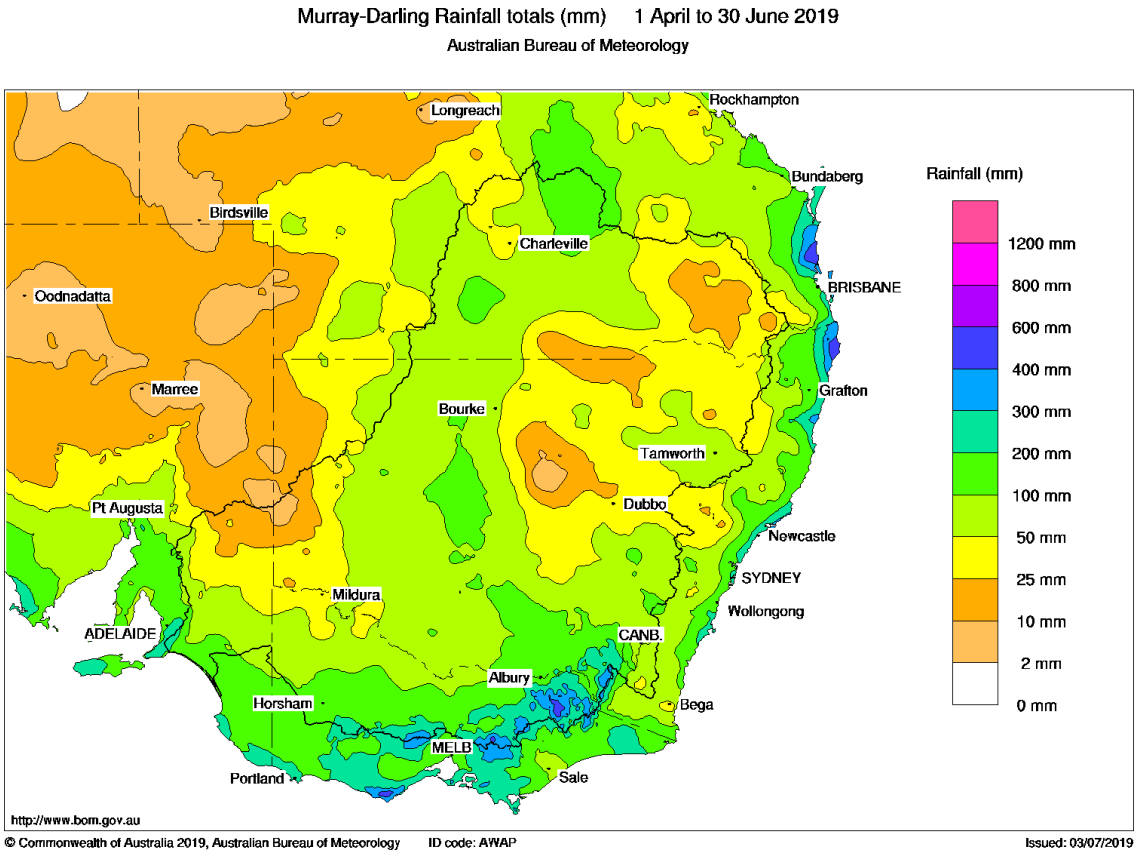


Figure 7: Comparison of 24 months drought inflows at Wilcannia

Flows in the Darling had recommenced between Bourke and Louth because of local rainfall over the Easter weekend and further inflow arrived from Warrego catchment upstream of Louth during 1st week of May 2019. Observed volume at Wilcannia till 29 July June is around 3.3GL and total volume is not expected to exceed 3.4GL. This is the first flow at Wilcannia since Northern connectivity flow ceased on Aug 2018. Section 324 Temporary Water Restriction order is currently in place. No inflow is expected to reach lake system from this event.

6.2.1 3-months rainfall

Rainfall over last three months varies across NSW, with large areas especially eastern half and western part receiving below to very much below average rainfall. Rainfall for last three months was lowest of record for some areas. Rest of the central strip received average to above average rainfall. Areas west of the Great Dividing Range have received less than 200mm of rain during last three months. South east Queensland has experienced below average to lowest on record rainfalls with the Lower Darling basin catchment receiving only 10-100mm of rain.



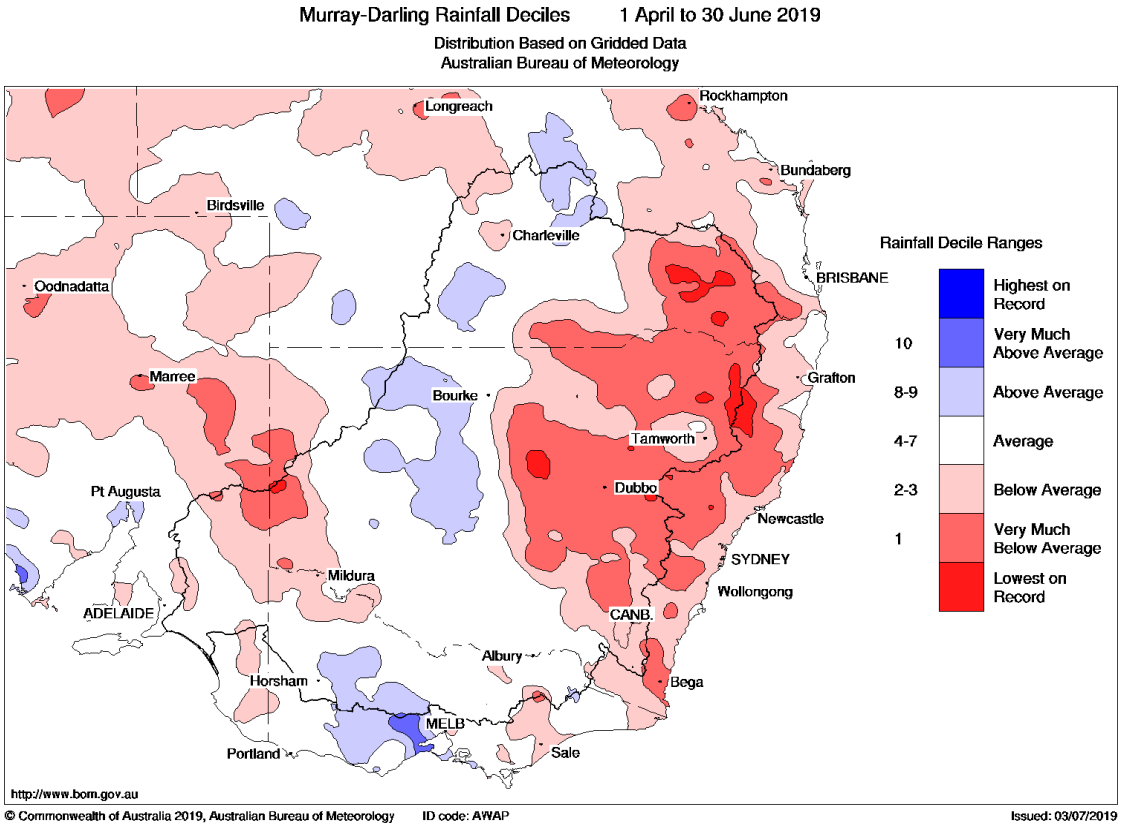
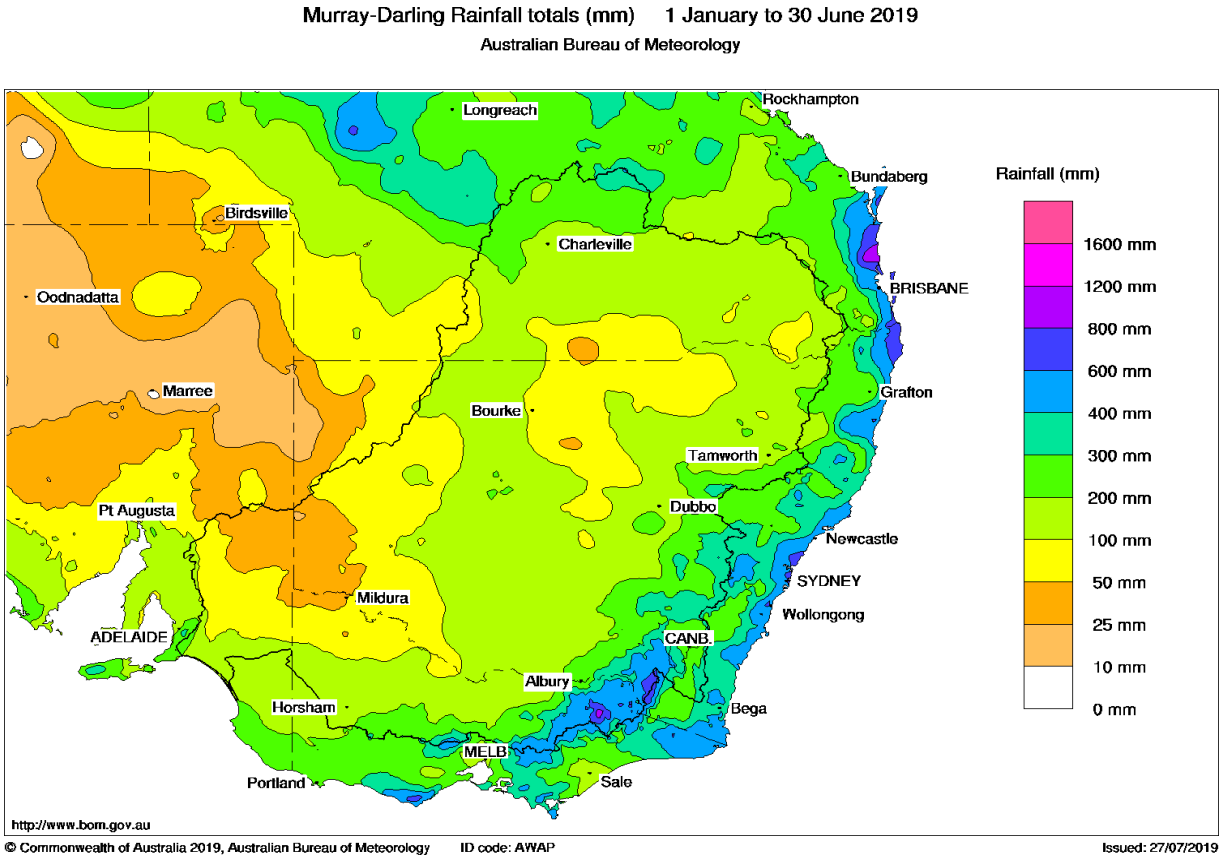


Figure 8: Last 3 months rainfall in the Murray Darling Basin

6.2.2 6-months rainfall

Rainfall over last six months varies across NSW. Some areas of central and north west NSW received average rainfall, but rest of areas received below to very much below average rainfall over last six months. Total rainfall varies from 25 to 600mm across NSW during last six months. South east Queensland has experienced below average to lowest on record rainfalls with the Lower Darling basin catchment receiving only 25-200mm of rain.



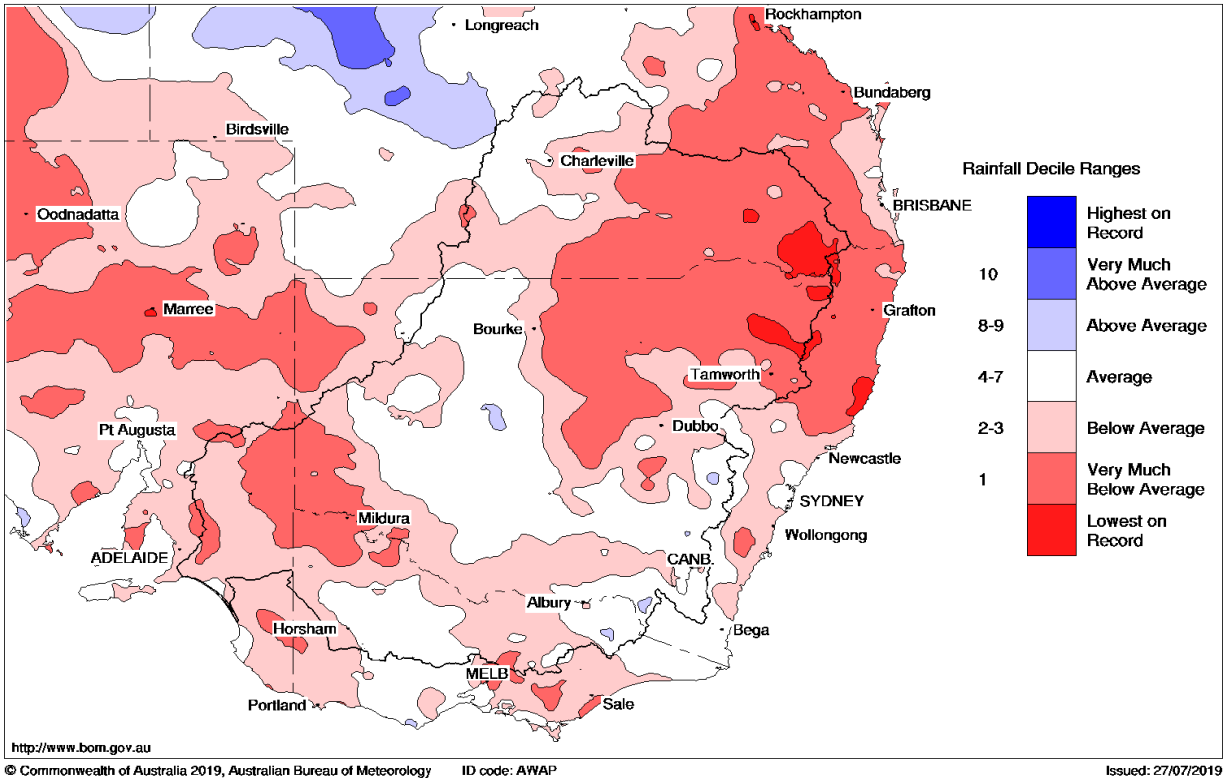
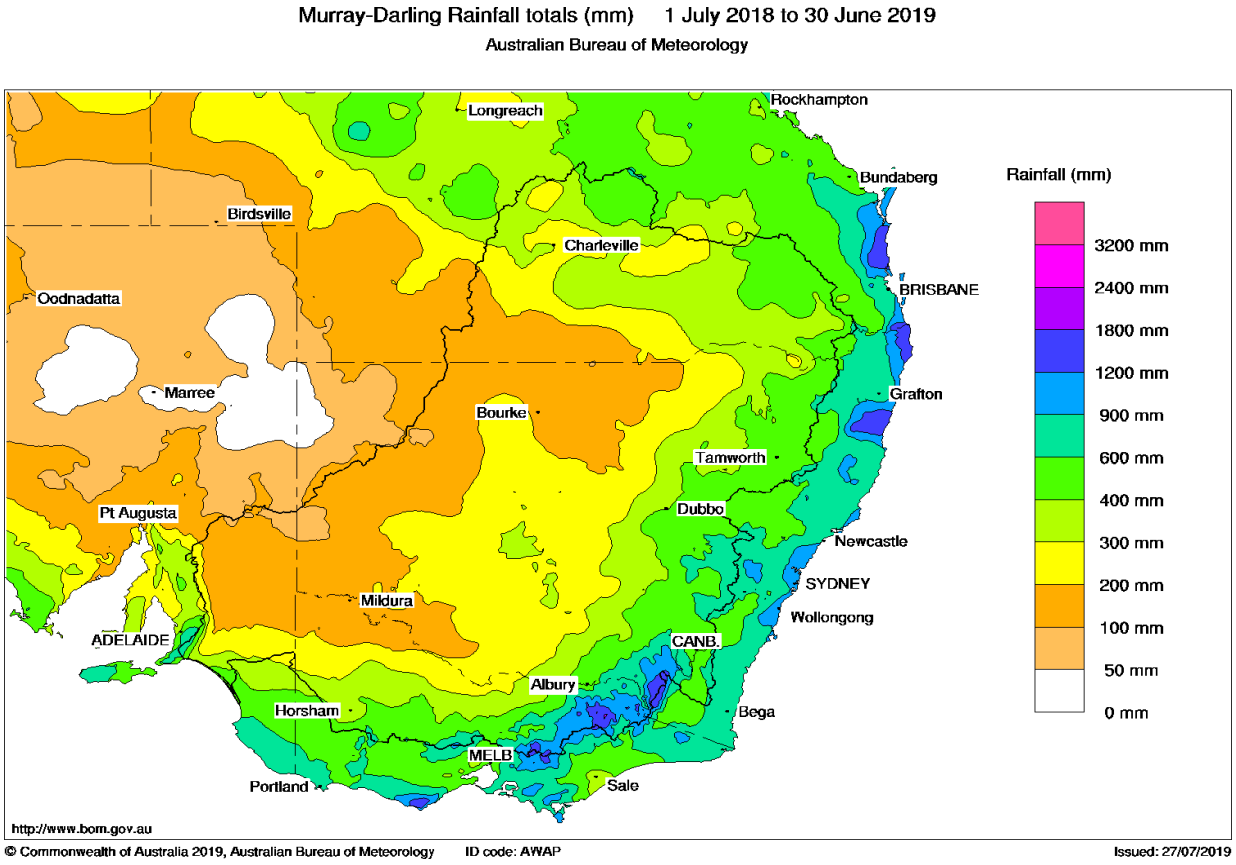


Figure 9: Last 6 months rainfall in the Murray Darling Basin

6.2.3 12-months rainfall

Rainfall over last twelve months was mostly below average to very much below average across whole Murray Darling Basin. Few areas received record lowest rainfall over last 2018-19 water year. Total rainfall varies from 50 to 1200mm across NSW whereas the rainfall over Lower Darling varies from 50-300mm.



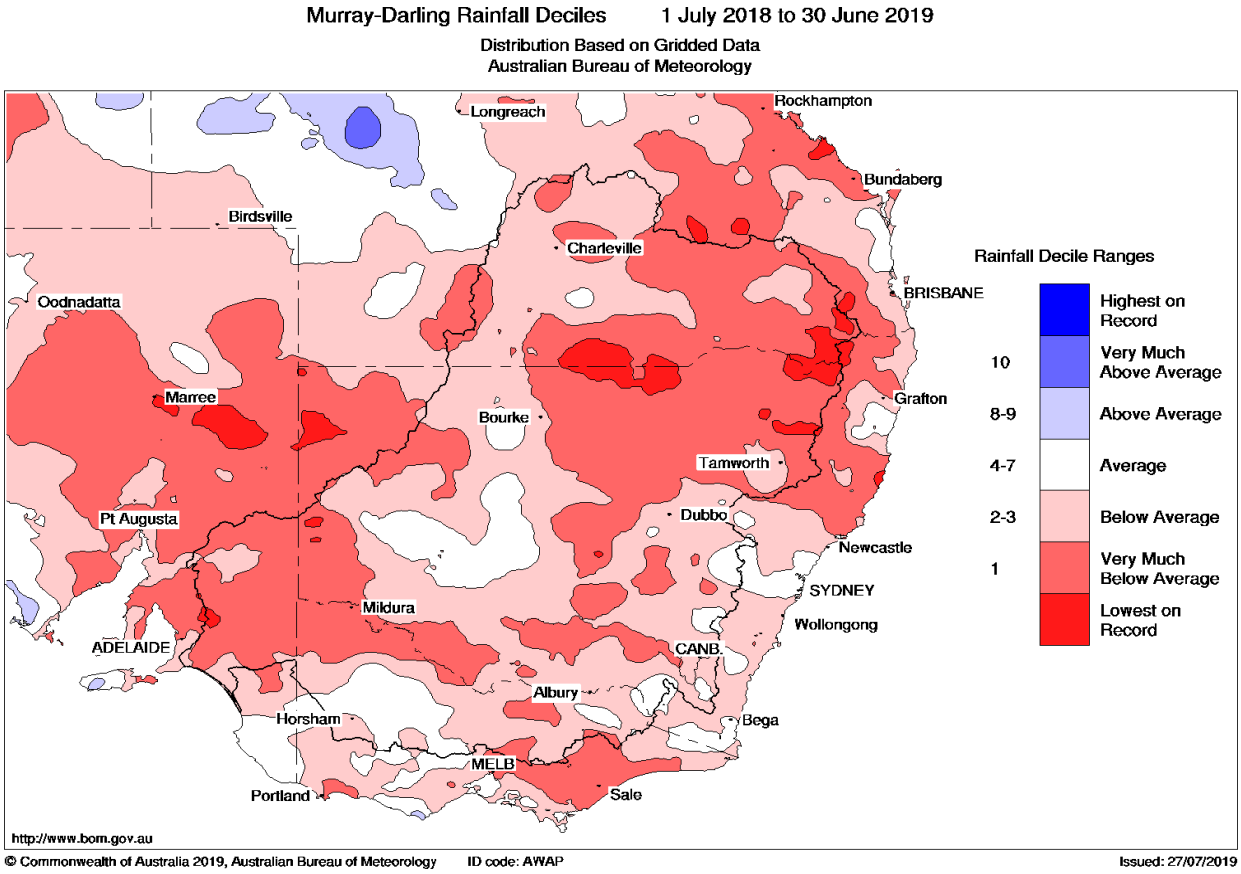
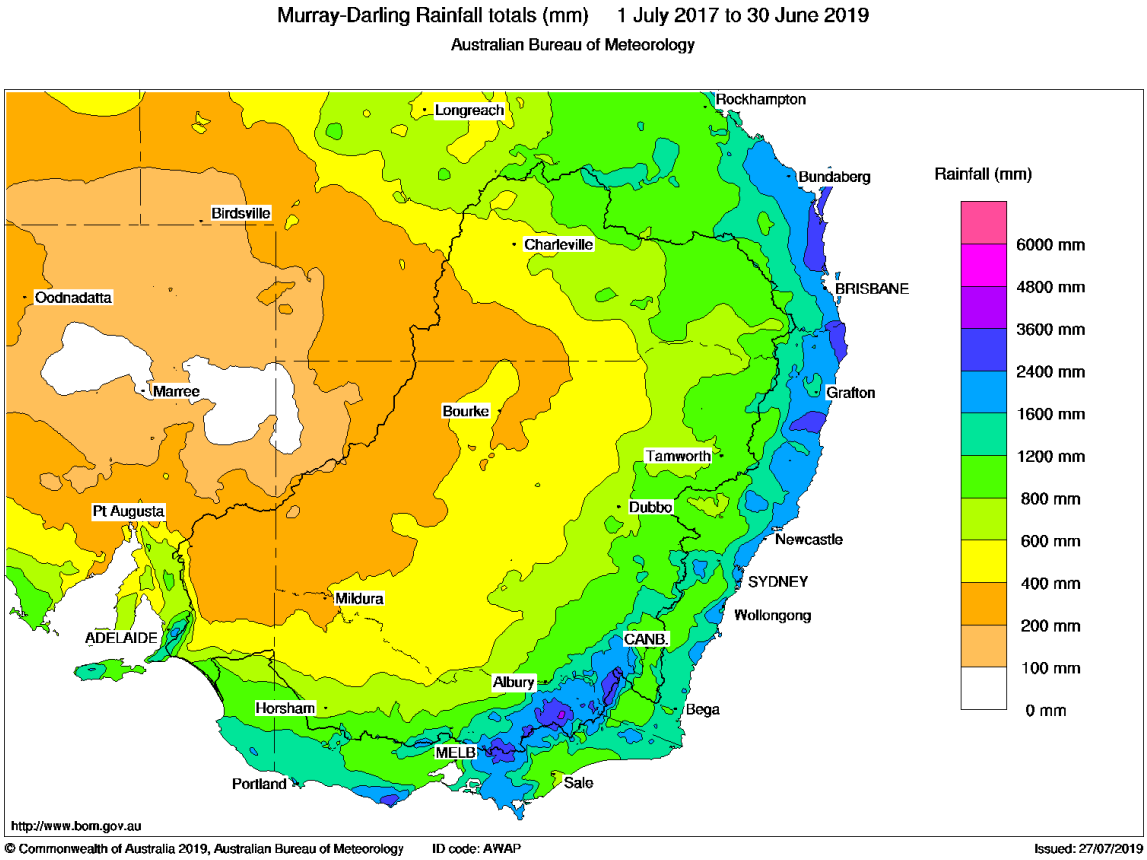


Figure 10: Last 12 months rainfall in the Murray Darling Basin

6.2.4 24-months rainfall

Rainfall over last twenty-four months was mostly below average to very much below average across whole Murray Darling Basin. A significant area received record lowest rainfall during this period. Total rainfall varies from 50 to 2400mm across NSW whereas the rainfall over Lower Darling varies from 5200-3600mm.



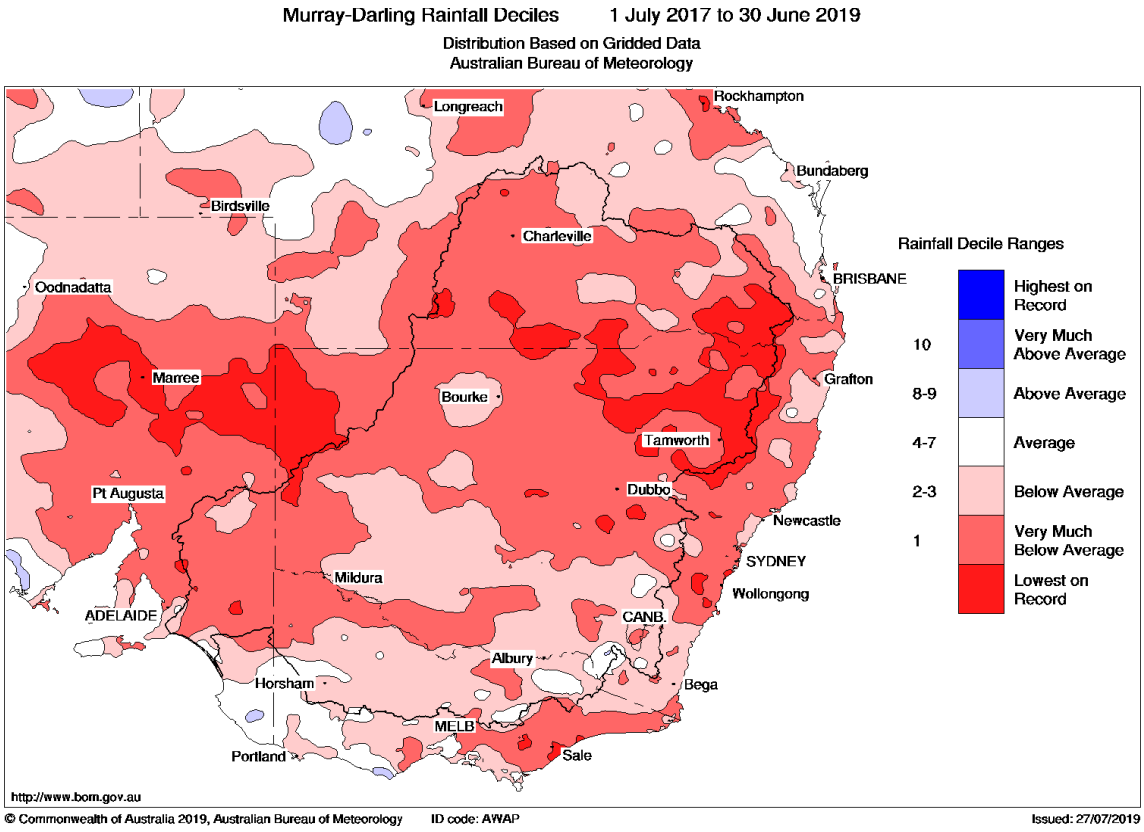


Figure 11: Last 24 months rainfall in the Murray Darling Basin

6.3 Allocations and uses during 2018/19 water year

6.3.1 Water allocations

Water allocation for the Lower-Darling were announced on 1 July 2018 with 100% allocation provided to High Security customers and no allocations for General Security customers. Average carryover was about 15%.

Table 2: Available water as at 1 July 2018

Customer group	Account volume (ML)
Local water utility	10,135
Domestic and stock	1,370
High security, irrigation	4,196
High security, environment	3,575
General security (AWD)	0
General security, irrigation (carryover)	2,152
General security, environmental (carryover)	10,061

6.3.2 Water availability in 2018/19

This information was current as 30 June 2019 based on provisionally closed accounts for 2018-19 water year.

Table 3: Account balance

Licence category	Share component	Carryover in	AWD volume	Allocation assignments in	Allocation assignments out	Usage	Balance
Domestic and stock	334.5	0	334.5	0	0	101	233.5
Domestic and stock (domestic)	421	0	421	0	0	86.4	334.6
Domestic and stock (stock)	612	0	612	0	0	24	588
Local water utility	10135	0	10135	0	0	4813.2	5321.8

Regulated river (general security)	79507	12212.8	0	4136.9	271.4	1374.8	14703.5
Regulated river (high security)	7771.1	-0.6	7771.1	1020	4885.5	2908.1	996.9
Supplementary water	250000	0	250000	0	0	0	250000
Grand total	348780.6	12212.2	269273.6	5156.9	5156.9	9307.5	272178.3

6.4 Allocation and forecast for 2019/20 water year

The Available Water Determinations (AWD) for 2019-20 water year has been announced by Department of Primary Industries on 1 July 2019. Water Allocation Statement is available in this link. Following is the summary of the allocations.

- AWD is 50% for stock and domestic licence holders and local water utility licence holders,
- AWD is 30% for high security licence holders and
- AWD is 0% for general security licence holders. Average carryover is19%.
- Lower Darling water users are restricted to use water for critical human needs and permanent plantings only. The restriction will be eased or removed if flow situation improves in the future.

Table 4: Account balance as of 31 July 2019

Licence category	Share component	Carryover in	AWD volume	Allocation assignments in	Allocation assignments out	Usage	Balance
Domestic and stock	334.5	-5.8	167.3	0	0	0	161.5
Domestic and stock (domestic)	421	0	210.5	0	0	0	210.5
Domestic and stock (stock)	612	0	306	0	0	0	306

Local water utility	10135	0	5067.5	0	0	27.1	5040.4
Regulated river (general security)	79507	14703.5	0	0	56.4	8	14639.1
Regulated river (high security)	7771.1	-21.2	2331.4	56.4	0	3.3	2363.3
Supplementary water	250000	0	250000	0	0	0	250000
Grand total	348780.6	14676.5	258082.7	56.4	56.4	38.4	272720.8

With only 15 GL available in lakes, it is unlikely to deliver any water for the users unless inflow arrives from upstream catchments. Four block banks were constructed in the Lower Darling River to provide an extended supply to water users in the Lower-Darling River. Those banks were filled by releases made during 1st half of 2018-19 water year. Followings are the current status of those block banks.

- Jamesville Bank: Located near Pooncarrie, the bank was constructed on July 2018. The bank level was 3.73m during November 2018. The bank was about 1.15m on 30 July 2019.
- Ashvale Bank: Located near Burtundy, the bank was constructed on 3 August 2018. The bank level was 2.29m during September 2018. The bank is currently empty.
- Karoola: The Bank was constructed 15 November 2018. The bank level was 2.89m during January 2019. The bank is currently empty.
- Another block bank was constructed at Court Nareen. No height data is available for that black bank but is expected that a similar rate of drawdown has occurred at this site as the Karoola site.

With low storage volume, any further supply will be dependent upon future inflows.

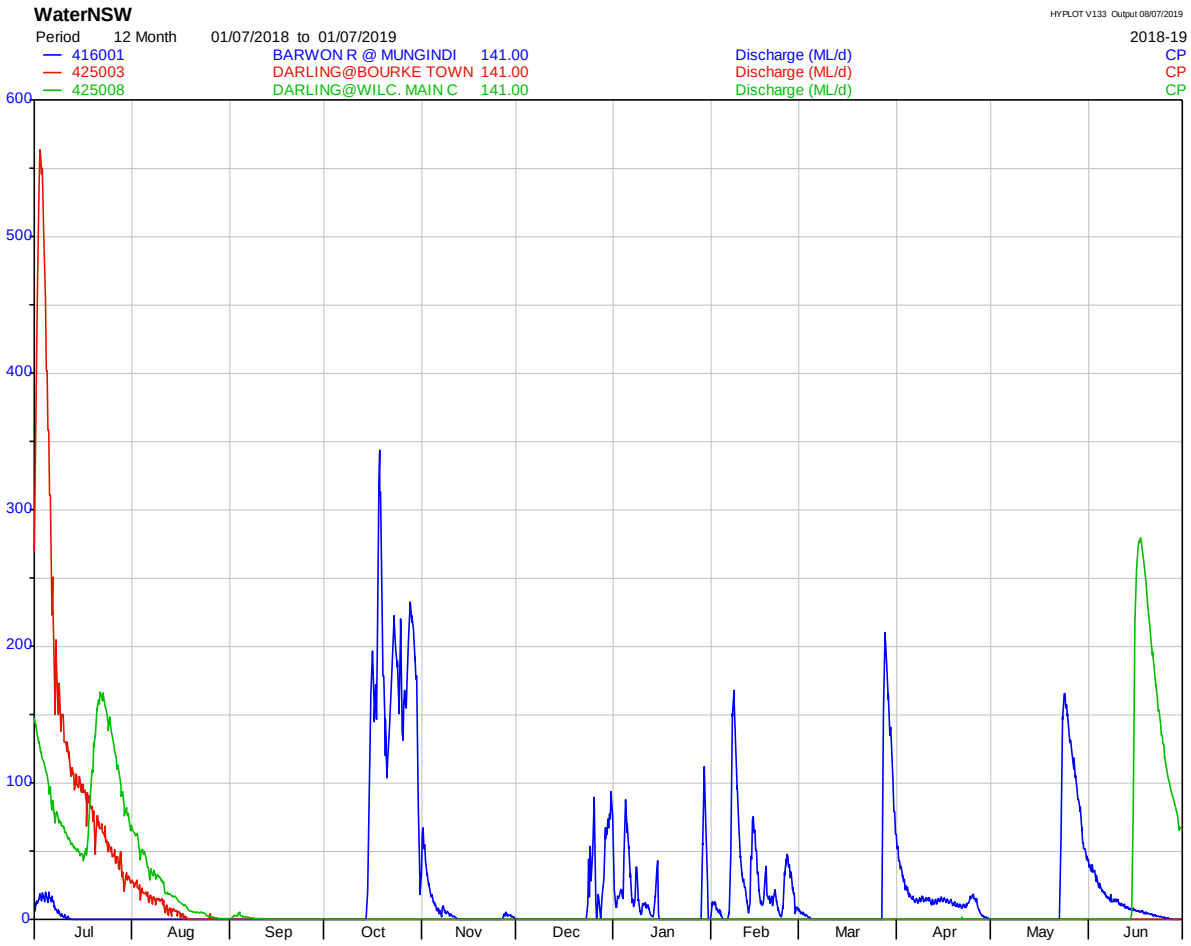


Figure 12: Flows in the Barwon Darling since 1 July 2018.

7. Operational strategy

WaterNSW will operate the storages based on critical requirements in 2019/20 – without inflows, operational options are very limited.

WaterNSW has engaged with customers to understand demands for the current year and shall continue to consult to ensure available resources and any inflows are managed to provide critical outcomes for the system.

The lake system storages are almost exhausted so the main drivers for customer demands for the rest of the water year will be:

- Maintain a pool upstream of weir 32 for longest duration possible;
- Supply downstream of Weir 32 is dependent on access to the remaining water in block banks and minor weirs. Further inflows are required before a replenishment of these banks can be provided.

As outlined in the Operational Objective (Section 2) WaterNSW has consider several scenarios within the operational strategy. Figure 10 shows the Menindee lakes storage volume forecasts for three different scenarios.

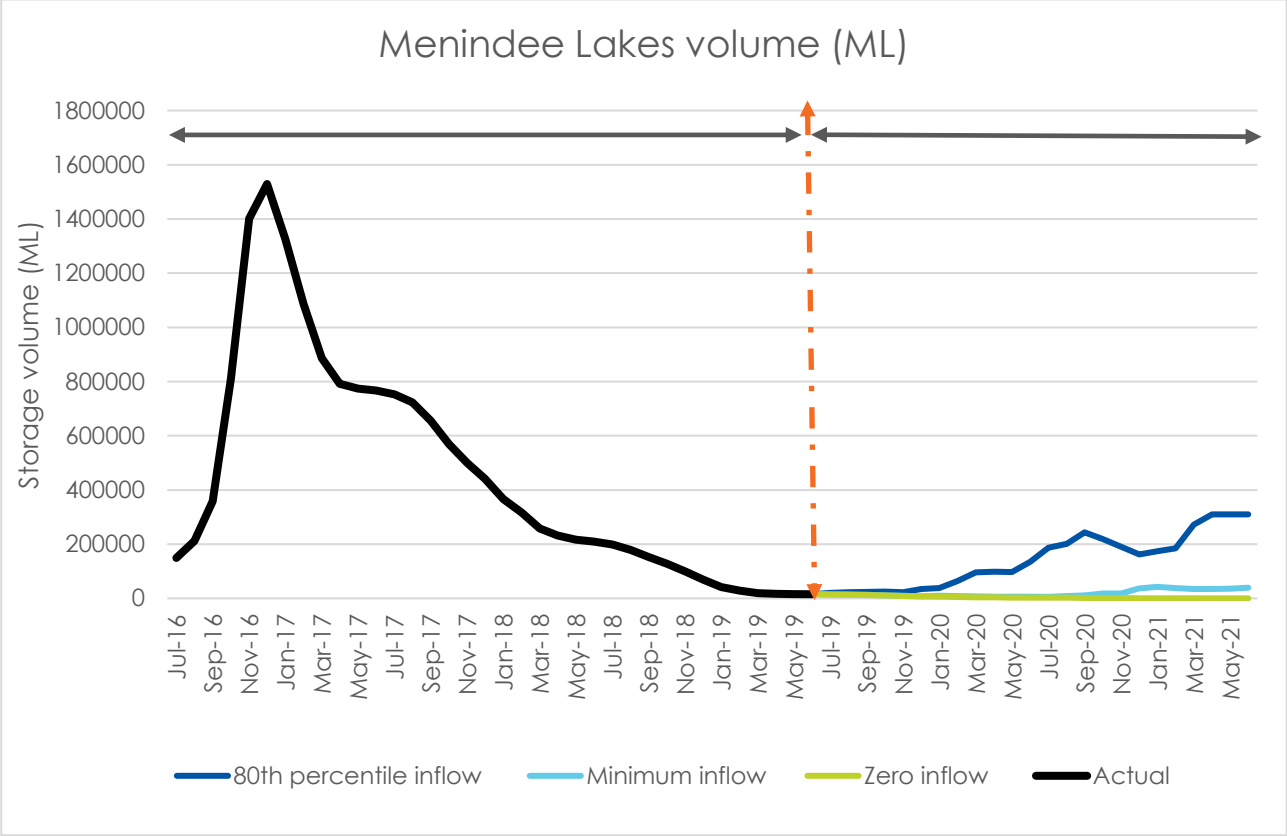


Figure 10. Menindee Lakes volume based on the three inflow scenarios

7.1 Drought strategy

Drought management measures in place since Dec 2017. These drought management measures include reducing the minimum environmental releases along the Lower-Darling and implementing drought storages (Copi Hollow) and Lower Darling block banks. Total storage volume is only 15 GL now and aim is to use this small volume as effectively as possible. The main focus is now to prepare strategy to use the future inflows efficiently. As a part of this Operations Plan, WaterNSW developed different inflow scenarios and modelled those scenarios to ensure that future inflows are used effectively.

7.2 Dry scenario (80th percentile inflows)

The dry scenario considers the 80th percentile inflow sequence to the lakes, inflows that would be exceed 8 years in 10.

Under this scenario the volume of water held within the lakes would start to increase from Jan 2020. No major drought management measures will be required.

Under this scenario supply to customers would continue. However, depending upon timing of the inflows it is high likelihood the total volume in the Lakes will remain below the 480GL and not increase above the 640GL over the two-year period. This means no water will be available for the MDBA to meet demands in the Murray over that period.

7.3 Connectivity Inflow

This scenario considers the releases required to create a connectivity up to Burtundy considering all block banks are in place. Preliminary consultation with stakeholders provided strong support for the passing of inflows, regardless of size through the storage to establish connectivity through the Lower Darling.

This would provide significant improvements to fish habitat and provide for stock and domestic supplies. Consultation indicated the connectivity flows do not need to be perfect, that is the volume does not need to be sufficient to provide connectivity for the full length of river, while this is preferred, it is not seen as necessary in the assessment for release.

A risk assessment would be required before release, as timing in the year will be a key issue. Depending on timing it is expected that a volume of 10 - 20 GL would be required to achieve full connectivity, although the total volume may not be a critical trigger for release in this scenario.

7.3.1 Block Bank Filling

From July 2018 to Dec 2018, around 48 GL was released, and total usage was around 5 GL. As such it is estimated that 45 GL was used to fill up the block banks. All block banks were not constructed at the same time but currently all banks are in place and releases will fill up the banks sequentially from upstream to downstream. So, the pattern of filling will be different than last year's event. It is reasonable to assume that around 50GL of releases is required to create a connectivity up to Burtundy including partially fling up the block banks. The inflow required to release that volume will depend on the duration of inflow arrival and rate of release. For simplicity, it is assumed that, all inflows will be made available for release and rate of release is similar to last year's release. Modelling results indicate that around 57 GL of inflow will be required to release 50 GL from Lake Wetherell and 7 GL will be lost through evaporation. This inflow is between 70th and 75th percentile inflow over 6 months staring from July.

7.4 WSP inflow

The WSP provides that minimum releases be delivered at Weir 32 for the suppression of algae, noting the seasonal variability the total volume is 96.5GL/year. To maintain that flow at weir 32 for over the year a release of around 103GL is required from lake Wetherell. Total inflow requires is around 240 GL as rest will be lost from the lakes due to evaporation. Considering July starting sequence, it is close to 80th percentile inflow for 12 months duration and 50th percentile inflow for 6 months duration.
Implementation of WSP flows may not be possible with block banks in place, so the removal of banks scenario will need to be assessed at the time this scenario is being assessed.

7.5 Block banks removal inflows

Block banks are installed as a drought management measures and they are extending the supply of water to the downstream customers. The decision to remove banks would be taken only when the system has received enough inflows and it would not be required to install the banks again soon after making the removal decision.

It is assumed that block banks can be removed when the system has enough inflows to run the water sharing plan flows for at least about two consecutive years. Modelling results indicate that around 880GL inflow would be required to operate the Lower Darling river as per the water sharing plan for two years. Around 415GL will be lost from the lakes over two years. For a sequence starting in August, 880GL is close to 80th percentile inflow for 23 months. similar to the system inflows that occurred in 1985-87.

7.6 Water quality

The last available salinity data indicate that Lake Wetherell is around 830 µS/cm. Based on zero inflow sequence forecasts, the salinity levels is expected to increase gradually, and the electrical conductivity may reach 1,500 µS/cm by late December 2019. Figure 11 shows the lake Wetherell salinity levels for the zero-inflow sequence.
If raw water salinity levels increase above 1,000 µS/cm, it would begin to have an impact on the taste of the potable water supply and once salinity levels reach about 1,500 µS/cm the water quality will have a corrosive impact on water using appliance and equipment.

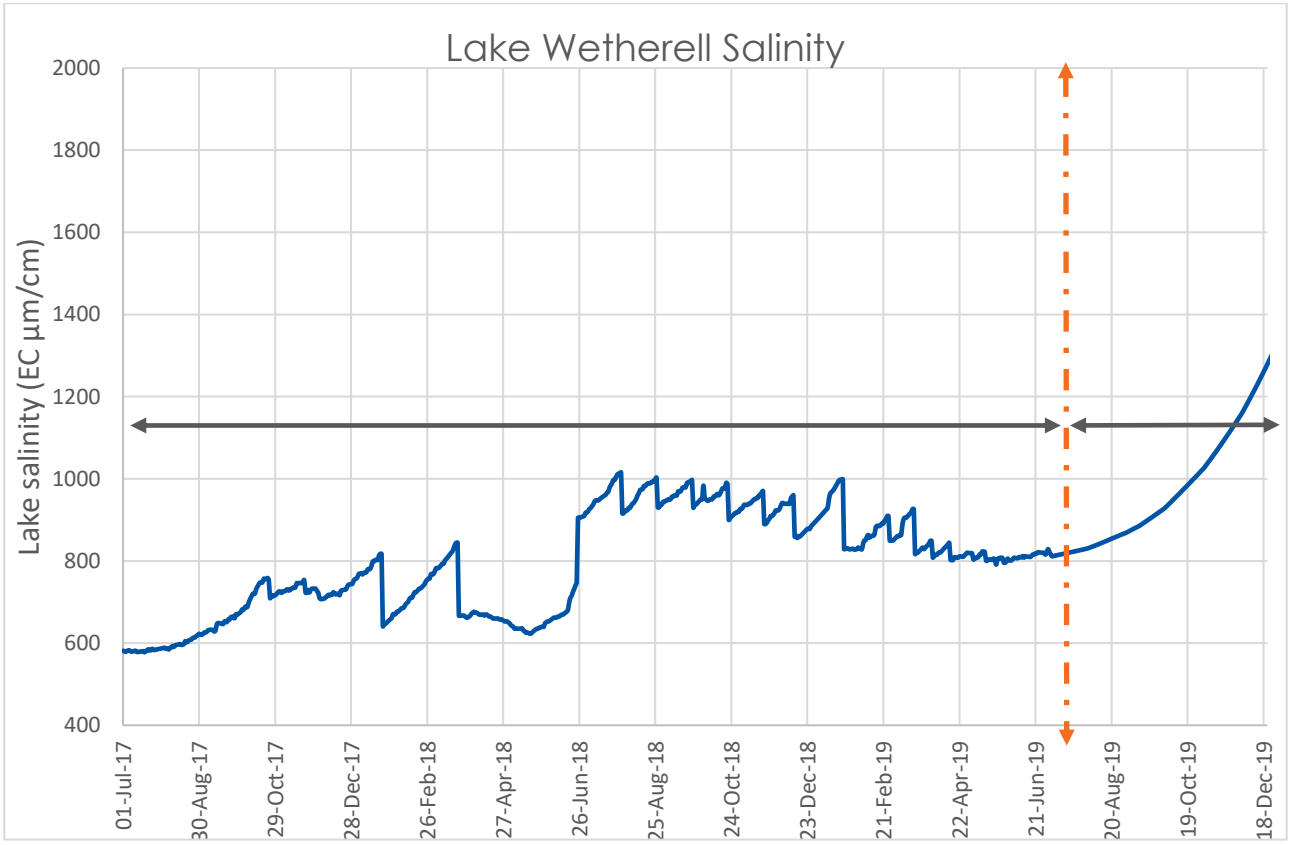


Figure 11: Salinity levels in lake Wetherell (zero inflow sequence)

7.7 Key operational decisions and dates since drought Operation commenced

The below table outlines dates for key operational decisions since commencement of drought operation to ensure operational objectives are met.

Table 5: Key operational decisions and dates

Date	Operational decision	Comments
15-Dec-17	MDBA delivery cease - 480 trigger	Lakes under NSW control. Drought operation commenced.
25 Mar to 17 May 2018.	Tandure pumping	Around 7.2 GL was pumped

25 Sep to 5 Nov 2018 and 2 Dec to10 Dec 2018	Pumping to Copi Hollow	Around 12 GL was pumped
18 Dec 2018	Broken Hill supply Switched to Copi Hollow	Copi Hollow at full supply level
Mid Feb 2019	Lower-Darling Cease to Flow	Release ceased from Lake Pamamaroo
April 2019	Broken Hill Supply from W2BH pipeline	W2BH pipe line project completed

7.8 Key messages regarding drought measures

Drought measures have been progressively implemented since Dec 2017. WaterNSW is continuously monitoring the situations and has implemented various measures to manage the resources during drought. Following are the highlights regarding key drought management measures

- Broken Hill water supply is currently from Murray through W2BH pipeline. WaterNSW ensured that supply was available from Copi Hollow till the pipeline wasavailable.
- Block Bank in place between Wetherell and Tandure isolating lake Tandure providing efficiency through reduced evaporation.
- Block Bank between Copi Hollow and Lake Pamamaroo is in place to continue supply to Broken Hill without the need for reverse osmosis.
- Four temporary block banks (Karoola, Court Nareen, Ashville and Jamesville) were installed to extend supply to customers and to secure S&D supply.
- Increased frequency of lake water quality monitoring of all water supplies.

More information

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