

# Lower Darling River – water quality and flow release update

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Following the mass fish deaths in the Darling River at Menindee in March 2023 multiple agencies are continuing to monitor water quality conditions in this area to identify potential risks to ecological communities, implement mitigating measures and minimise the risk of further fish death events. This update provides a summary of information and operational measures up to 15 December 2023.

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Operational releases from Menindee Lakes by the Murray Darling Basin Authority had been temporarily paused due to earlier heavy rainfall and tributary inflows to the Murray River from the upper catchment. These operational releases from Menindee Lakes were resumed on 23 November.

Since the pulsed release of 1,000 megalitres (ML)/day from Lake Pamamaroo last week, the return to lower flows and high air temperatures at Menindee have seen the redevelopment of thermal stratification in the Darling River. Dissolved oxygen near the riverbed was declining to levels that posed an increased risk to fish health. In response to the low dissolved oxygen levels, another pulse of water was released from Lake Pamamaroo to assist with managing downstream water quality.

Discharge from Lake Pamamaroo was increased from 100 ML/day up to 1,000 ML/day on Wednesday 13 December. At the same time, discharge from Lake Menindee was reduced from 1,000 ML/day down to 100 ML/day. Monitoring of water temperature and dissolved oxygen shows that the release of the pulsed flow resulted in the breakdown of thermal stratification and mixing of dissolved oxygen through the water column on the morning of 14 December. Dissolved oxygen levels are currently above the critical threshold of 2 mg/L.

Discharge from Lake Pamamaroo will drop back to 750 ML/day on Friday 15 December and then back to 100 ML/day on Sunday 18 December. At the same time releases from Lake Menindee will increase up to 350 ML/day and then 1,000 ML/day to maintain the Murray Darling Basin Authority operational requirement of 1,100 ML/day at Weir 32.

There have been no fish deaths reported in the Darling River this week. To report any incidents of dead fish, fish struggling or starting to gasp at the water surface, or crayfish exiting the water,

please call the NSW Department of Primary Industries Fisheries' Fishers Watch Phonenumber 1800 043 536 or fill in a fish kill protocol and report form (including a photo) at:

[www.dpi.nsw.gov.au/fishing/habitat/threats/fish-kills-2019-2020/info-sheet](http://www.dpi.nsw.gov.au/fishing/habitat/threats/fish-kills-2019-2020/info-sheet) or

[www.dpi.nsw.gov.au/fishing/compliance/report-illegal-activity](http://www.dpi.nsw.gov.au/fishing/compliance/report-illegal-activity) using the 'dead or dying fish' check box.

## Dissolved oxygen levels – Darling River at Menindee

As the surface water of the river is heated by the sun, the water at the bottom of the deeper pools is often not warmed to the same temperature. During the summer months this can result in a difference in temperature between surface and bottom waters which is known as thermal stratification. This can lead to other issues such as increased algal blooms on the surface, and nearer the riverbed, low dissolved oxygen and higher nutrient concentrations. In addition, the amount of dissolved oxygen water can hold decreases with increasing water temperature.

WaterNSW undertook dissolved oxygen and water temperature profile monitoring on 12 December in the Darling River near Menindee. At all five sites, dissolved oxygen was at safe levels near the water surface, but quickly dropped below 2 mg/L at between 2 and 3.5 metres (Figure 1). As a general guide, native fish and other large aquatic organisms require at least 2 mg/L of dissolved oxygen to survive but may begin to suffer if levels are below 4 to 5 mg/L for prolonged periods.

The water temperature results were stable in the first 2 metres and then decreased from there to the riverbed. This indicates that there was no mixing throughout the water column and the water near the surface and near the bottom were behaving as two separate layers (Figure 2).

In response to the low dissolved oxygen levels, persistent high air temperatures and the increasing risks to fish health, a pulse of water was again released from Lake Pamamaroo. The aim of the pulsed flow is to disrupt the thermal stratification which will encourage oxygen to mix through the whole water column once again.

During the pulsed release, WaterNSW undertook additional dissolved oxygen and water temperature profiles on the morning of 15 December. The dissolved oxygen (Figure 3) and water temperature (Figure 4) results from all five monitoring sites were consistent from the water surface down to the bottom indicating complete mixing through the profile. The highest dissolved oxygen results were at the two upper most sites (downstream Pamamaroo and upstream old weir) due to the arrival of the oxygenated water being releases from Lake Pamamaroo.

The location of the five sites assessed are shown in Figure 5.

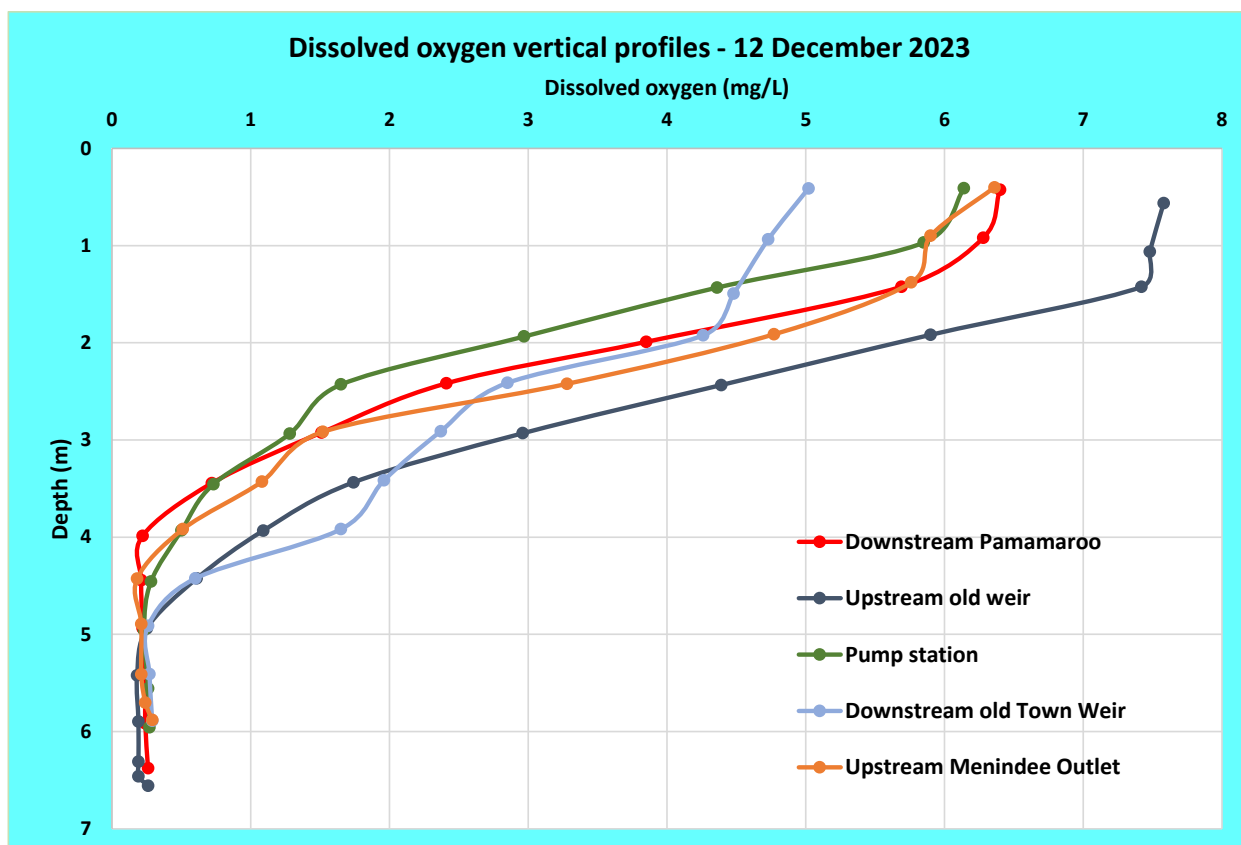


Figure 1: Dissolved oxygen (mg/L) profiles at five sites in the Darling River at Menindee: 12 December 2023

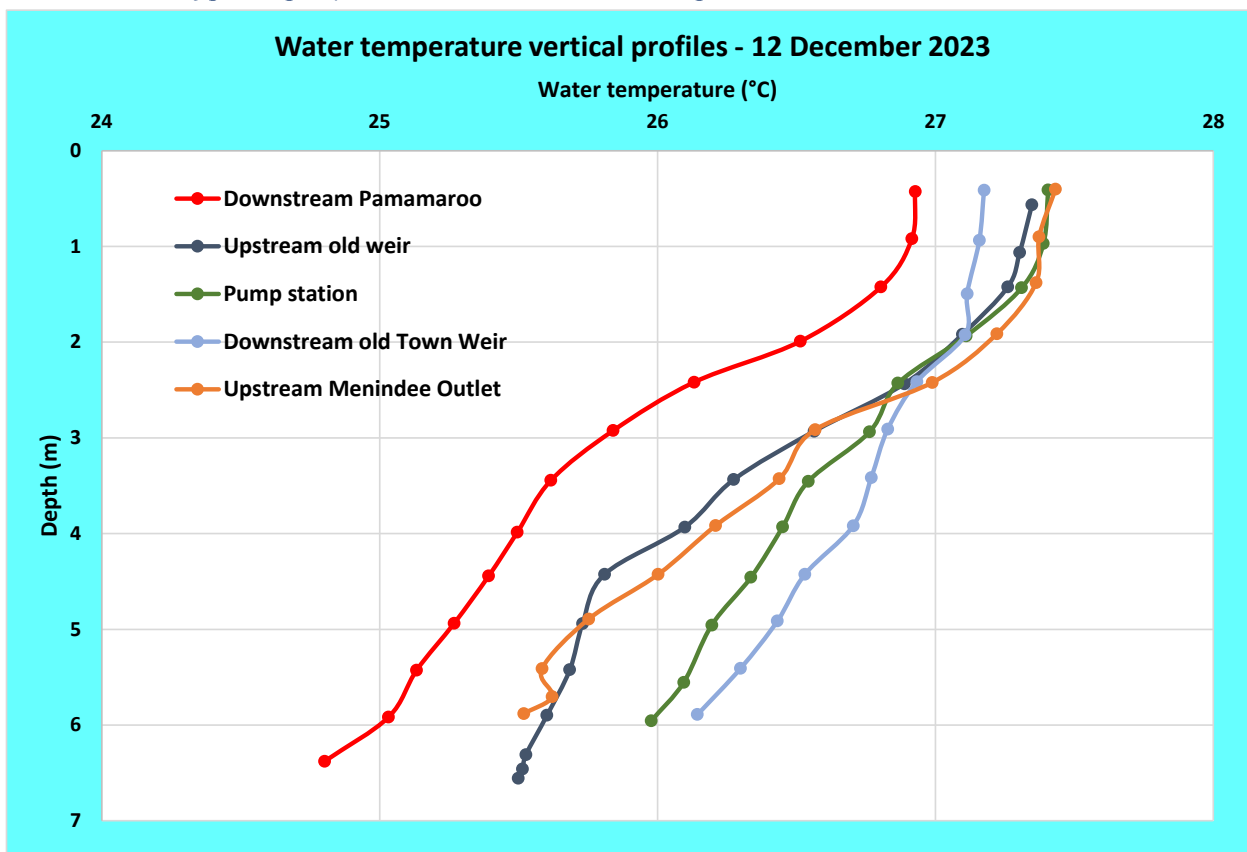


Figure 2: Water temperature (°C) profiles at five sites in the Darling River at Menindee: 12 December 2023

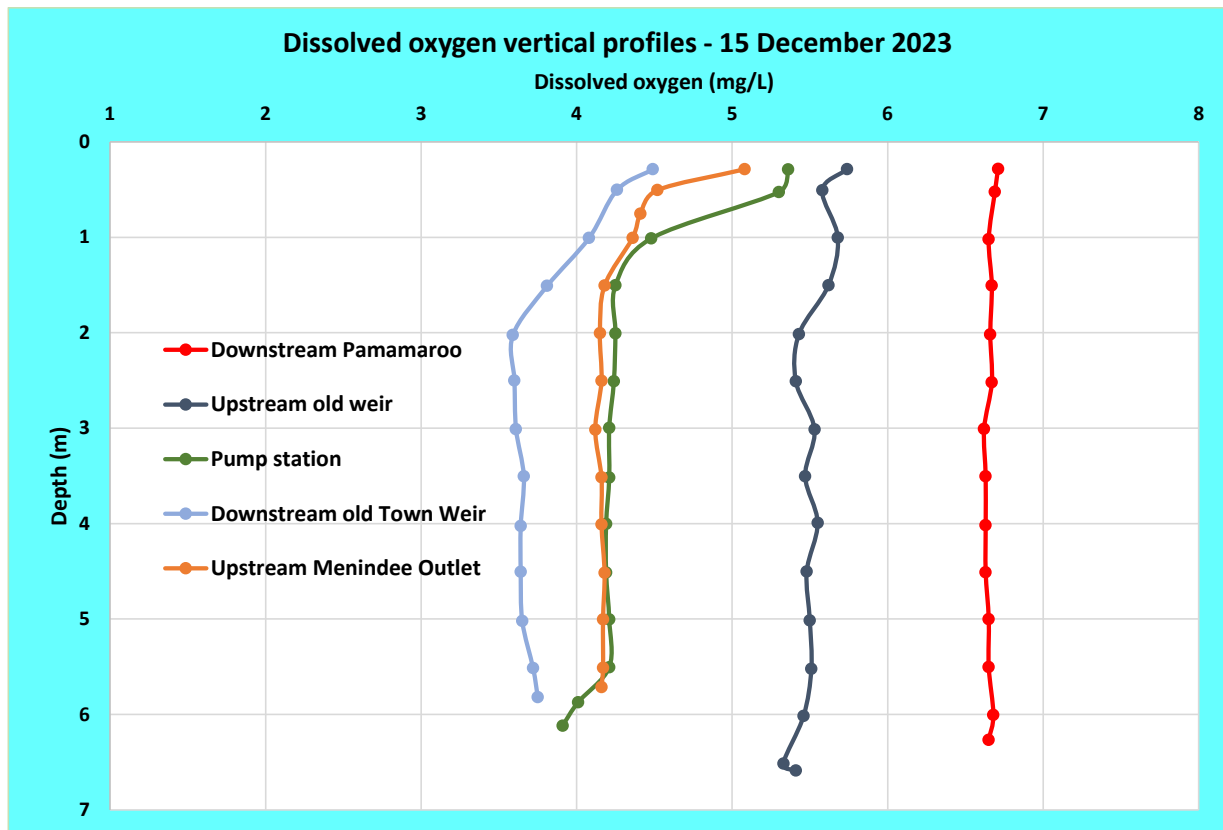


Figure 3: Dissolved oxygen (mg/L) profiles at five sites in the Darling River at Menindee: 15 December 2023

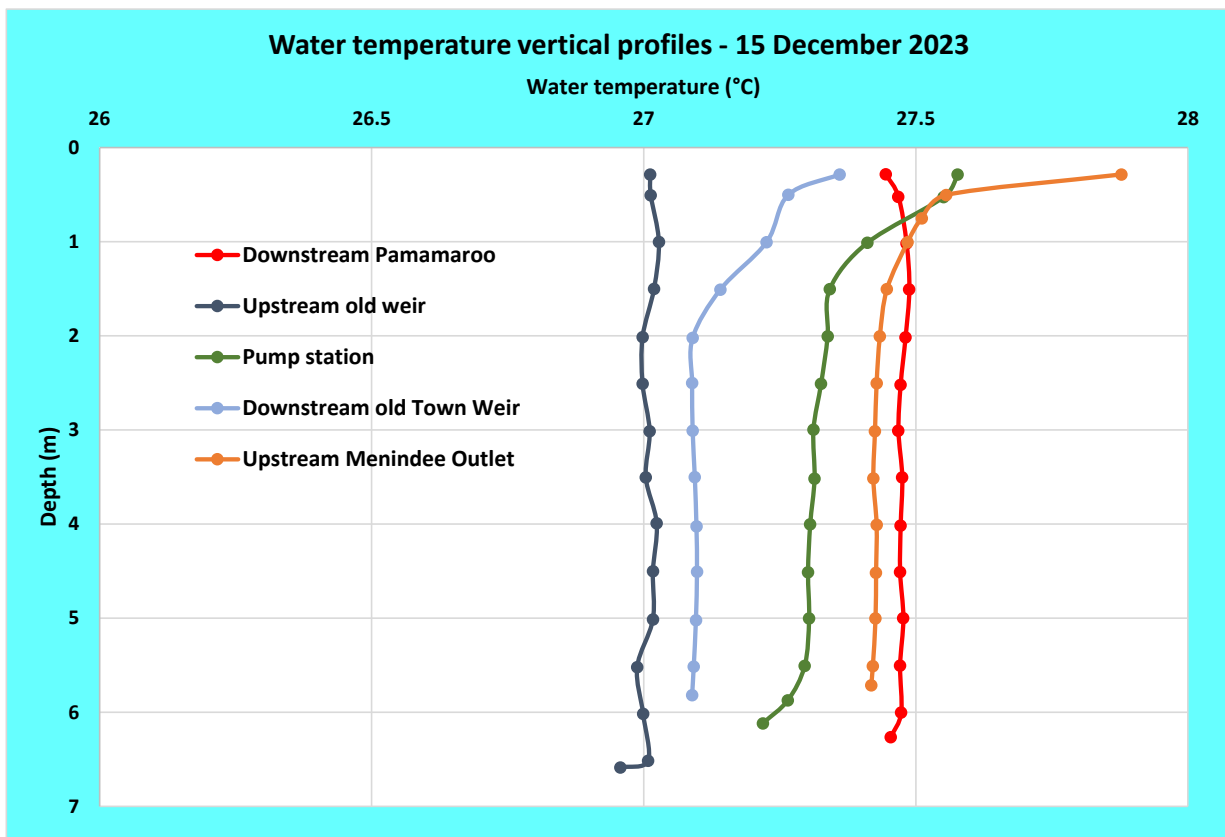


Figure 4: Water temperature (°C) profiles at five sites in the Darling River at Menindee: 15 December 2023

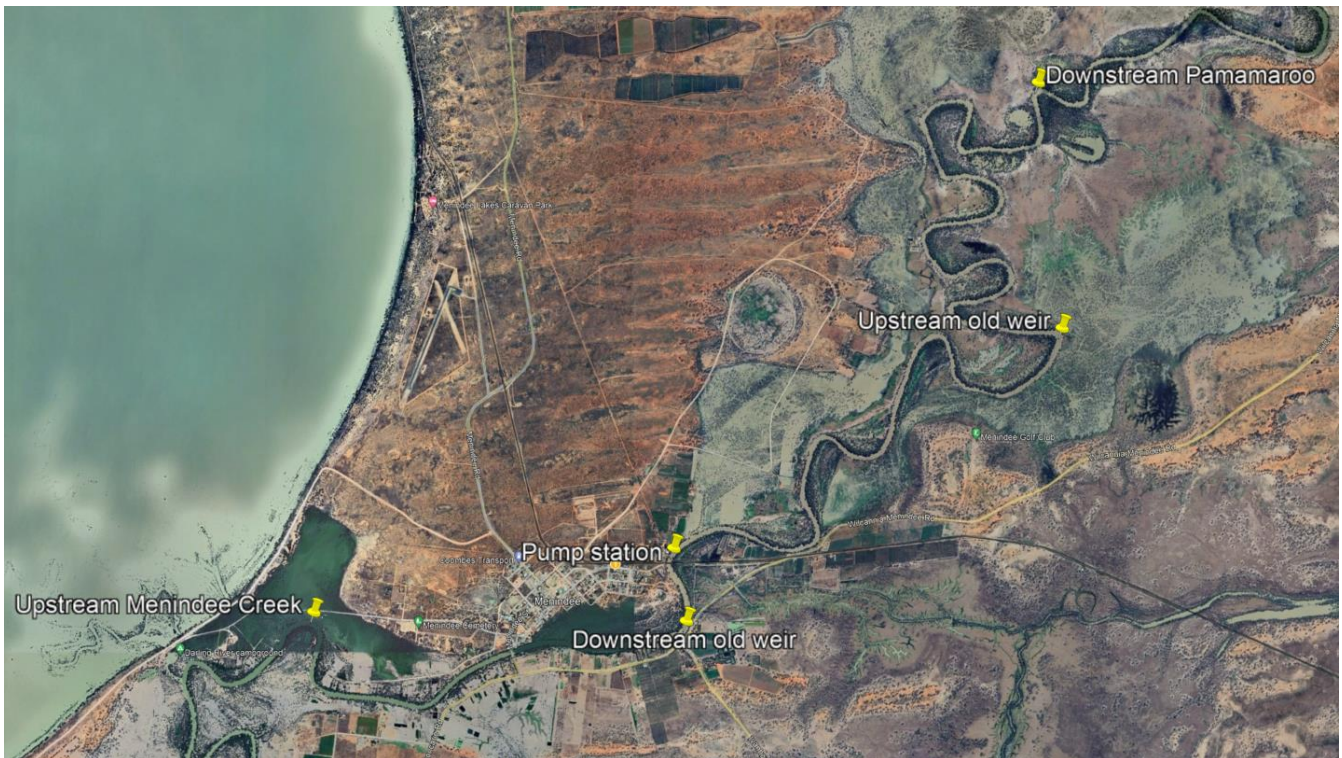


Figure 5: Location of vertical profile monitoring sites in the Darling River near Menindee.

## Vertical profile water quality monitoring buoys

Five multi depth monitoring buoys have recently been installed in the Menindee area. These buoys monitor water quality at specific depths down through the water column. This data can be used to indicate when stratification starts, how long it has been present and if it has broken down, allowing the mixing of dissolved oxygen. The locations of the buoys are shown in Figure 6. The sites are:

- Lake Wetherell. Installed by Department of Planning and Environment – Environment and Heritage Group
- Darling River at Menindee weir pool – upper. Installed by Department of Planning and Environment – Environment and Heritage Group
- Darling River upstream Menindee. Installed by WaterNSW
- Darling River at Menindee weir pool – town. Installed by Department of Planning and Environment – Environment and Heritage Group
- Darling River downstream Menindee. Installed by WaterNSW.





Figure 6: Locations of vertical profile water quality monitoring buoys at Menindee

Monitoring by the Department of Planning and Environment – Environment and Heritage Group in the upper weir pool shows that stratification had been breaking down each night between 7 and 10 December. With consistent high air temperatures and low discharge from Lake Pamamaroo (100 ML/day) thermal stratification established again on 11 December (Figure 7). Downstream near Menindee town the last complete mixing through the water column occurred on the morning of 8 December (Figure 8). Since then, thermal stratification has developed with no mixing during the cooler air temperatures overnight. At both sites, the difference in water temperature between the surface and the bottom was increasing.

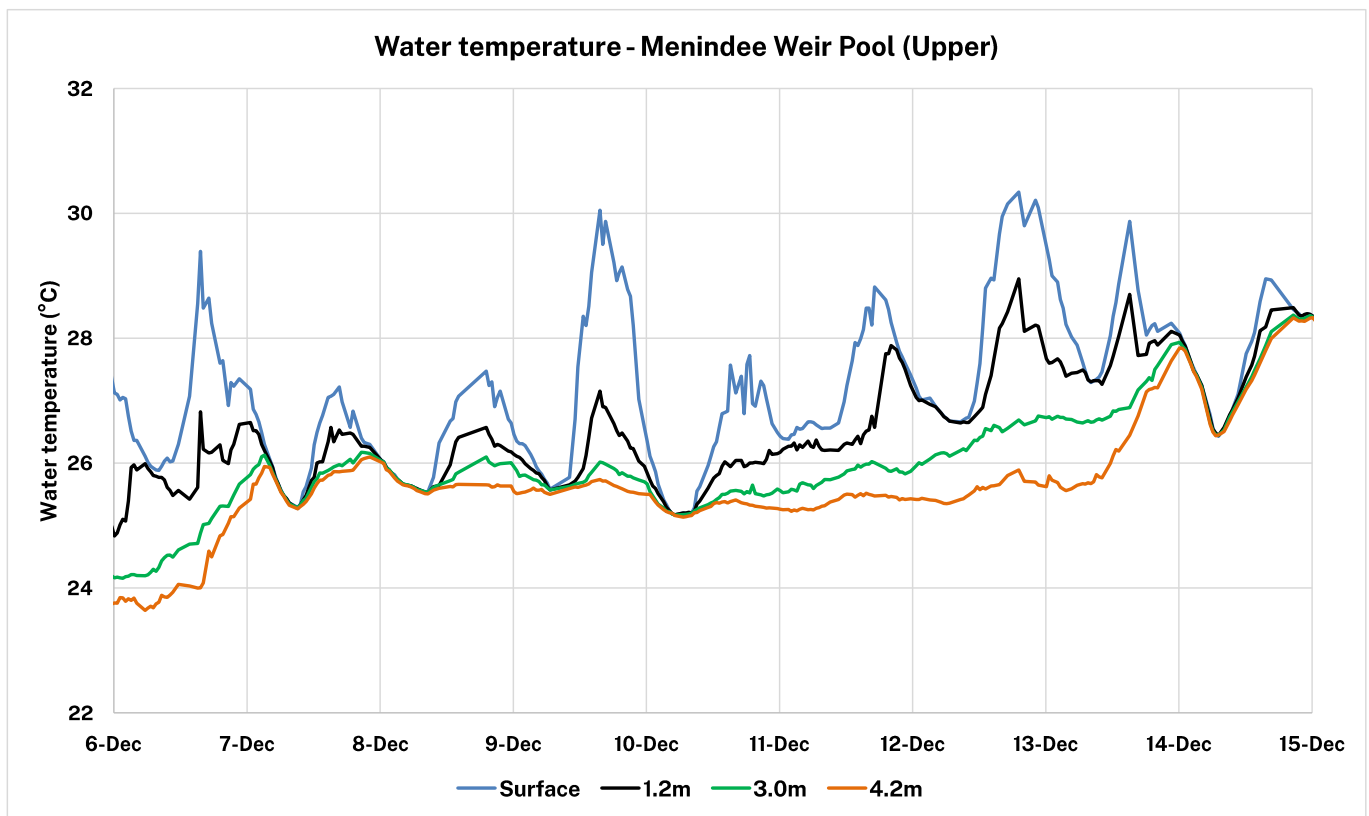


Figure 7: Water temperature (°C) continuous monitoring in the Darling River at Menindee weir pool (Upper)

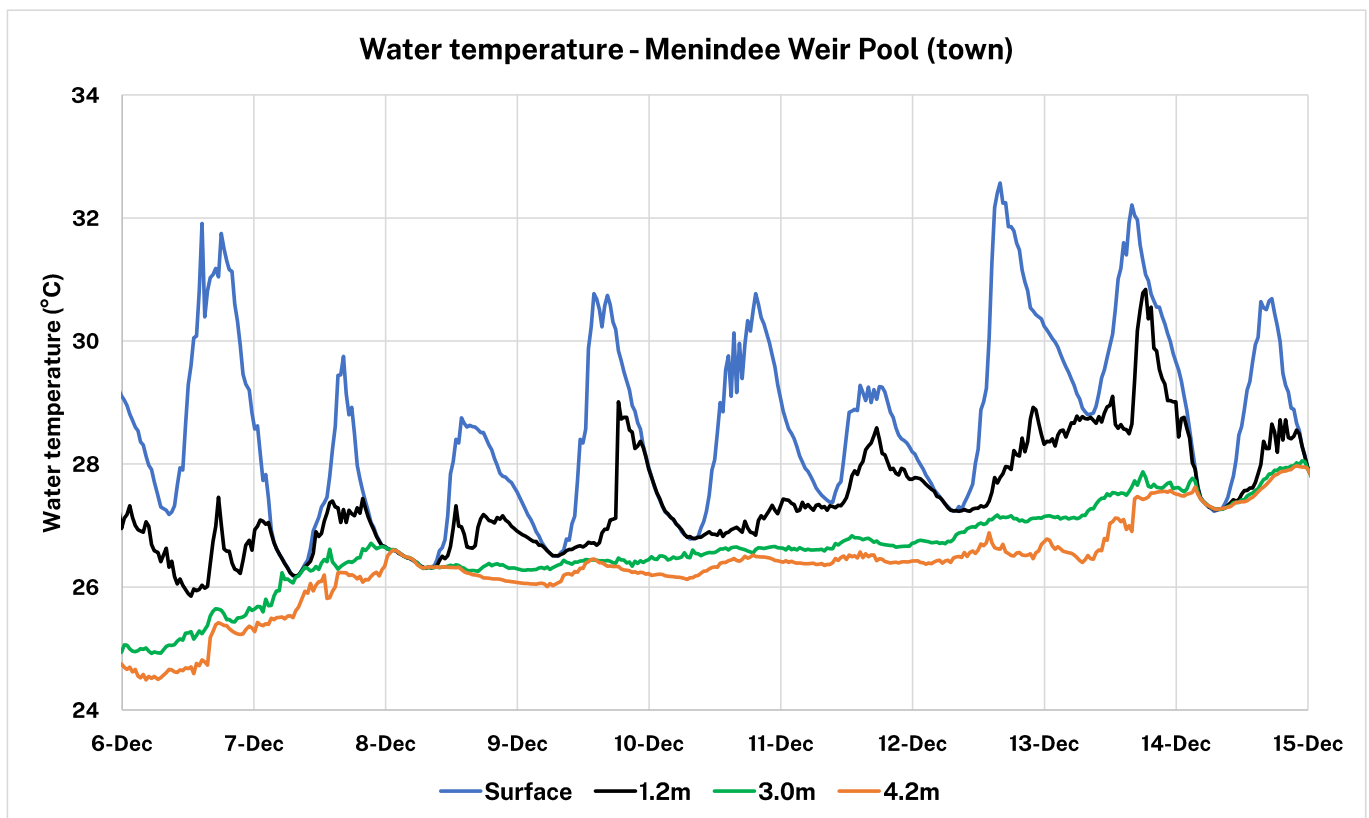


Figure 8: Water temperature (°C) continuous monitoring in the Darling River at Menindee weir pool (Town)

Similar to water temperature, the dissolved oxygen results also show stratification between 1.2 and 3.0 metres. The lack of mixing overnight at both monitoring sites resulted in very low dissolved oxygen near the riverbed (Figure 9 and Figure 10). At the monitoring buoy near Menindee town, dissolved oxygen has been dropping below the 2 mg/L critical threshold for fish health at 3 metres.

Persistent thermal stratification and dissolved oxygen dropping to critical levels for fish health prompted the releases of another pulsed flow of 1,000 ML/day from Lake Pamamaroo commencing Wednesday 13 December. Monitoring during the previous two pulsed flows from Lake Pamamaroo has shown that this volume successfully breaks down stratification and promotes the mixing of oxygen through the water column. As a further measure, discharge from Lake Menindee was reduced from 1,000 ML/day down to 100 ML/day at the same time to encourage the flushing of the weir pool through Menindee township.

Monitoring of water temperature and dissolved oxygen shows that the release of the pulsed flow from Lake Pamamaroo on 13 December resulted in the breakdown of thermal stratification and mixing of dissolved oxygen through the water column on the morning of 14 December. Dissolved oxygen levels are now back above the critical threshold of 2 mg/L.

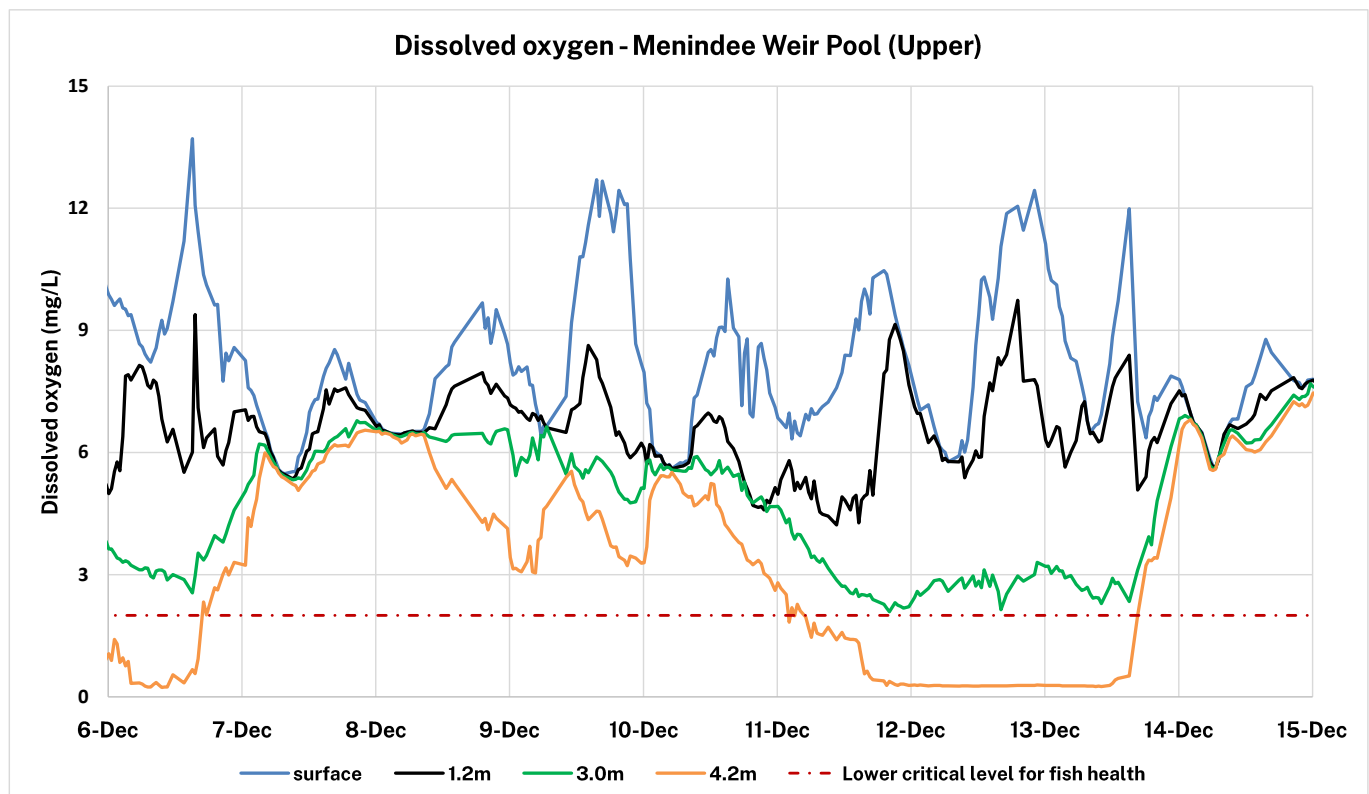


Figure 9: Dissolved oxygen (mg/L) continuous monitoring in the Darling River at Menindee weir pool (Upper)



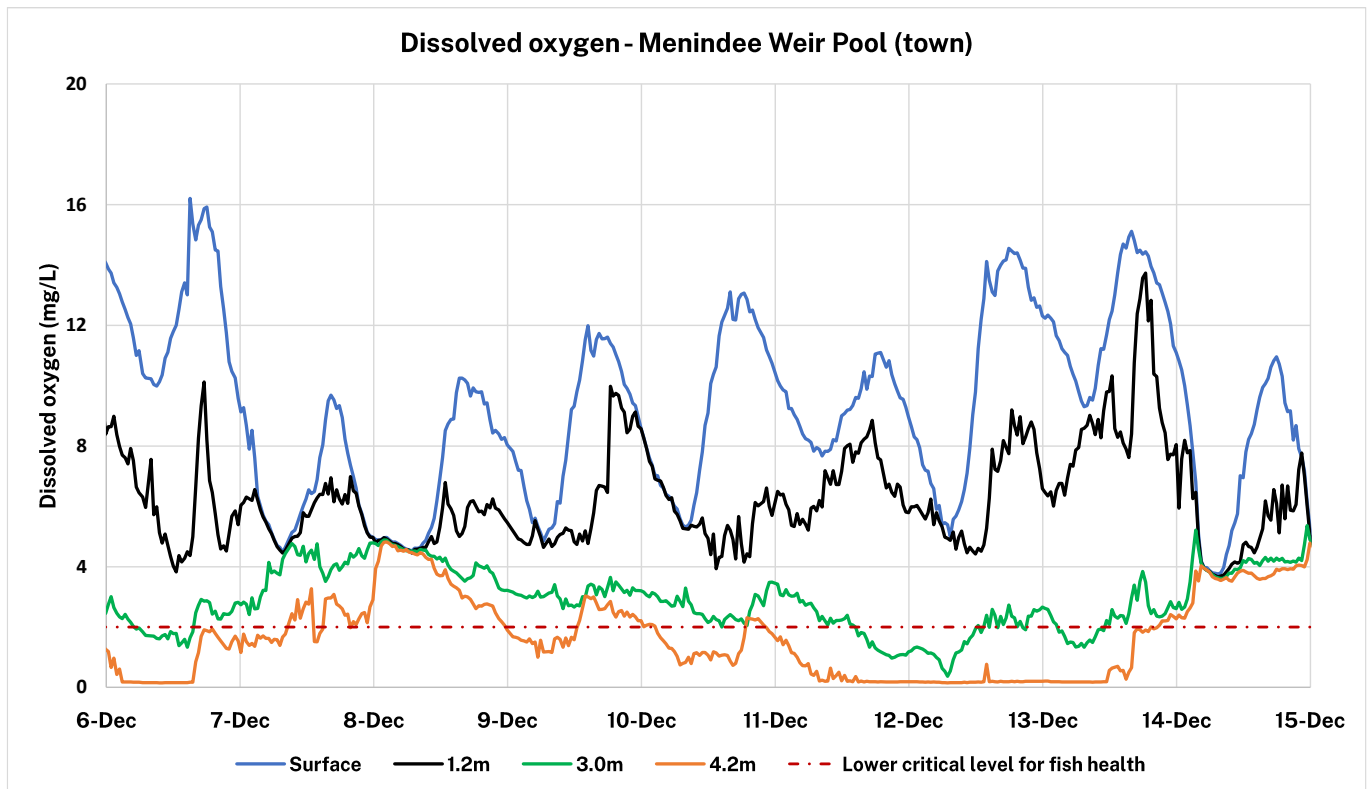


Figure 10: Dissolved oxygen (mg/L) continuous monitoring in the Darling River at Menindee weir pool (Town)

NSW and Commonwealth agencies will continue to work together and monitor dissolved oxygen levels in this area and advise the best operational measures to mitigate risks to aquatic life as much as possible. This can involve adjusting the timing, size and location of releases from the lakes into the lower Darling-Baaka River to maintain the quality of the water in the river. Releases from both Lake Pamamaroo and Lake Menindee continue to be managed to minimise the risk of further hypoxia-related fish deaths in the Darling River at Menindee.

## Fish death summary

In the past week there have been no reports of native fish deaths.

Large numbers of Bony Herring and Carp remain in the reach of Darling River between Main Weir and Menindee Creek (Weir 32 weir pool). There remains a risk of further fish deaths in the Menindee area as fish (particularly Bony Herring) may be in poor condition from previous low oxygen conditions, limited food supply and may be more susceptible at reduced flow rates.

## What is being done?

### Flow releases into the lower Darling-Baaka

Operational releases from Menindee Lakes were resumed by the Murray Darling Basin Authority on 23 November. A pulsed flow of 1,000 ML/day was released from Lake Pamamaroo over two days

commencing 6 December when monitoring showed there was a need to disrupt thermal stratification and reduce the risk to fish health from declining dissolved oxygen levels in the weir pool between the Main Weir and Menindee Creek. Due to the development of similar circumstances, discharge from Lake Pamamaroo was again increased from 100 ML/day up to 1,000 ML/day on Wednesday 13 December. At the same time, to further encourage the flushing of the weir pool through Menindee township, discharge from Lake Menindee was reduced from 1,000 ML/day down to 100 ML/day.

Increased discharge from Lake Menindee causes a backwater effect up the Darling River toward Menindee town. The still water makes this area prone to stratification. With the installation of the water quality monitoring buoys, there is an opportunity to assess if changing the release pattern from Lake Pamamaroo to 750 ML/day and releasing 350 ML/day from Lake Menindee on Friday 15 December will still maintain destratification in the weir pool, despite the backwater effects.

Discharge will be returned to 1,000 ML/day from Lake Menindee and 100 ML/day from Lake Pamamaroo on Sunday 17 December to maintain the Murray Darling Basin Authority operational requirement of 1,100 ML/day at Weir 32. Ongoing monitoring will continue to inform operations to mitigate potential fish deaths.

### **Flows from Lake Cawndilla into the Great Darling Anabranch**

River operators, Commonwealth and state agencies have been working together on options for releases to best meet the needs of all water users. Some of the Murray Darling Basin Authority's call on water is now being delivered from Lake Cawndilla via the Great Darling Anabranch rather than via the lower Darling River. With the support of landholders, agreement has been reached to trial a small volume of releases, targeting around 500 ML/day at Packers Crossing initially.

The trial commenced on 11 December, with operational releases replacing the previous environmental flows that were being delivered. Environmental Water Holders will cover any additional loss of the water resource from delivering this water via the Great Darling Anabranch rather than the Darling River.

Using water from Lake Cawndilla to help meet operational demands allows water managers to conserve more water in the 'upper lakes' of Pamamaroo and Wetherell for use as a drought reserve. At the same time, it delivers an environmental benefit by maintaining connectivity through the Great Darling Anabranch, which facilitates the dispersal of native fish predominantly golden perch into the Murray River. The flows are also benefitting vegetation, waterbirds, bush birds, aquatic bugs, frogs, yabbies and other animals that live on the floodplain. This is a 'win' for the environment and the community that relies upon the water supply of the upper lakes.

## Blue-green algae

WaterNSW undertake routine blue green algae monitoring in Menindee Lakes and in the Darling River. Alert warnings are declared where algal cell numbers exceed the triggers identified in the Guidelines for Managing Risk in Recreational Waters (NHMRC 2008).

The most recent results indicate a red alert warning for recreational use in the Great Darling Anabranch at Silver City Highway. Algal numbers at most sites in the Menindee Lakes area remaining in the amber alert range for recreational use ([Algae Alerts NSW map - WaterNSW](#)). When a red alert warning is in place, people should avoid recreational activities that brings them into contact with the water and drinking untreated water. At the amber alert warning level, blue-green algae may be multiplying in numbers but remains suitable for recreational use. The water may have a green tinge and musty or organic odour.

The water should be considered unsuitable for potable use and alternative supplies or prior treatment of raw water for domestic purposes should be considered. The water may also be unsuitable for stock watering. Water users should use caution and avoid water where signs of blue-green algae are present.

## Weather outlook

Refer to the [Bureau of Meteorology website](#) for the latest forecasts.

## Additional information

To notify the NSW Department of Planning and Environment – Water of potential blackwater events email: [waterqualitydata@dpie.nsw.gov.au](mailto:waterqualitydata@dpie.nsw.gov.au)

To report dead fish, fish struggling or gasping at the water surface, or crayfish leaving the water please call the NSW DPI Fisheries Phonenumber 1800 043 536 or fill in a fish kill protocol and report form at: [www.dpi.nsw.gov.au/fishing/habitat/threats/fish-kills-2019-2020/info-sheet](http://www.dpi.nsw.gov.au/fishing/habitat/threats/fish-kills-2019-2020/info-sheet)

Information on recent fish deaths is available at: [Fish kills in NSW](#). When reporting, please include the name of the river/waterbody, location and date of your observation and provide photographs. If possible, please also record what species are affected and an estimate of number of each species observed.

Further information on blackwater events can be found at the DPE Water website at: [water.dpie.nsw.gov.au/allocations-availability/drought-and-floods/hypoxic-blackwater](http://water.dpie.nsw.gov.au/allocations-availability/drought-and-floods/hypoxic-blackwater)

To view community updates issued, visit: [water.dpie.nsw.gov.au/menindee/community-updates-and-frequently-asked-questions](http://water.dpie.nsw.gov.au/menindee/community-updates-and-frequently-asked-questions)

Additional information is also available on the Murray-Darling Basin Authority website at:

[www.mdba.gov.au/publications/mdba-reports/water-management-101-factsheets](http://www.mdba.gov.au/publications/mdba-reports/water-management-101-factsheets)

Operational updates are available at: [WaterInsights - WaterNSW](#)

Water quality data collected after the fish deaths at Menindee is available on the Environment Protection Authority web page at: [www.epa.nsw.gov.au/working-together/community-engagement/updates-on-issues/menindee-fish-kill](http://www.epa.nsw.gov.au/working-together/community-engagement/updates-on-issues/menindee-fish-kill)

To report suspected algal blooms see the [WaterNSW website](#).