

# Notes

## Data sources

Aither relies on data obtained from multiple third-party sources. Consequently, any information presented in this report shall be subject to the accuracy and limitations of data obtained from third-party sources on the date of extraction.

## State water register trade data and volume weighted average prices

Water trade data were sourced from:

- New South Wales Register (2021). Available at <<https://waterregister.watarnsw.com.au/water-register-frame>> [Accessed 12/07/2021].
- South Australian Water Register (2021). Available at <<https://www.waterconnect.sa.gov.au/Water-Management/Trading-and-Markets/SitePages/Home.aspx>> [Accessed 12-15/07/2021].
- Victorian Water Register (2021). Available at <<https://waterregister.vic.gov.au/>> [Accessed 12/07/2021].

Volume weighted average prices generated from state water register data may not reflect market prices for several reasons. In the case of entitlement prices, this may be due to wet prices being reported for some trades. A wet price includes the price paid for the entitlement and any allocation that may have been included in the transaction. If wet prices are reported, this will inflate volume weighted average prices in dry years when allocation prices are high.

## Data cleaning method

There are limitations associated with water trade information reported in the state-based registers, specifically the timeliness and accuracy of reported prices. To filter out outlier prices and generate robust statistics about market activity, Aither uses a proprietary and tested data cleaning method. Aither uses its data cleaning programs to analyse Aither's southern Murray-Darling Basin water trade database that includes over 300,000 individual allocation and entitlement trade records.

There continues to be potential for further improvements in water markets data and in the efficient operation of water markets. In the past, it has been impossible to separately report transfers between environmental holdings or related parties from commercial water market transactions, which complicates analysis of allocation and entitlement trade volumes and prices. In 2020-21, the NSW and Victorian governments have started to introduce improvements that may address this issue.

## Irrigation corporation trade data

A significant volume of water trade occurs within irrigation corporations, for which detailed data – especially in relation to prices of trades – is generally not publicly available in a timely manner. Due to these data availability and transparency issues, Aither has excluded trades within irrigation corporations from all analysis within this report unless specifically noted.

# Notes

## Carryover estimates

The volume of water carried over from one water year to the next is not published in a centralised manner across state governments. Aither's estimates of 2-19-20 and 2020-21 consumptive carryover in Victoria and NSW are based on the following data sources.

- Resource distribution information available in the NSW Department of Planning, Industry and Environment's water allocation statements (2 August 2021) for the NSW Murray and NSW Murrumbidgee. Carryover held by the environment is excluded in both cases, but carryover held on NSW Murrumbidgee conveyance licences is included because this is the way it is presented in the relevant water allocation statements.
  - Net carryover on 1 July 2021 in Victoria (Vic 1A Greater Goulburn, Vic 6 Murray and Vic 7 Murray), was sourced from the 'Water available by owner type' dashboard on the Victorian Water Register. Carryover held by the environment and Victorian water corporations is excluded.
- No private carryover is available in South Australia during 2021-22 after the projected minimum opening allocation announced in April 202 was greater than 50 per cent.

## Entitlement on issue data

There is no centralised data source for entitlement on issue. For water markets analysis, it is necessary to estimate the total and environmental entitlement on issue by entitlement, not water system. Aither has used the following data sources for entitlement on issue in the analysis presented in this report.

State	Total EOI	Environmental EOI
New South Wales entitlements	NSW Water Register 2020-21 Separation of zones 10 and 11 provided by NSW Government as reported in Aither, 2020.	NSW Environmental Water Register 2020-21 Separation of zones 10 and 11 provided by NSW Government.
Victorian entitlements	Victorian Water Register 2020-21.	Provided by Victorian Government as reported in Aither, 2020.  Adjustment made for Vic 1A to account for water savings from Mitiamo pipeline.
South Australian entitlements	Provided by the South Australian Government.	Provided by the South Australian Government.

Further information about environmental water holdings by system:

- Commonwealth environmental water holdings: <https://www.environment.gov.au/water/cewo/about/water-holdings>
- Victorian environmental water holdings: <https://www.vewh.vic.gov.au/watering-program/how-much-water-is-available>

## Rounding errors

Rounding errors may result in slightly different numbers being presented in this report as can be calculated from raw data and calculations.

# Notes

## Aither Entitlement Index

Like indices used in commodity and equity markets, the Aither Entitlement Index (AEI) provides a simple snapshot of how the major water entitlements in the southern Murray-Darling Basin are performing. Updated monthly, water market participants can use the AEI to benchmark the capital value performance of water portfolios and investments over time.

The AEI's scope and method is outlined below.

- **Scope:** The AEI tracks the performance (capital value) of a group of major water entitlements across the southern Murray-Darling Basin. The AEI includes the following entitlements: NSW Murray HS; NSW Murray GS; NSW Murrumbidgee HS; NSW Murrumbidgee GS; VIC 1A Greater Goulburn HRWS; VIC 1A Greater Goulburn LRWS; VIC 6 Murray (Dart to Barmah) HRWS; VIC 6 Murray (Dart to Barmah) LRWS; VIC 7 Murray (Barmah to SA) HRWS; VIC 7 Murray (Barmah to SA) LRWS; SA Murray (Class 3) HS.
- **Timing:** The AEI is calculated monthly and is indexed to 100 in July 2008. The index commenced from this date as this is when sufficiently reliable data became available.
- **Prices:** Historical monthly entitlement prices are calculated as volume weighted average prices (VWAPs) from state water register data. Since June 2015, Aither has generated the AEI using monthly entitlement valuations that we undertake in-house.
- **Index method:** The computation of the AEI uses a Tornqvist-Theil Price Index method. The AEI is not an accumulation index.



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# Notes

## Table notes

**Table 1:** Aither has applied a cleaning methodology to remove outlier and \$0 trades before calculating volume weighted average prices. The estimated value of commercial allocation trade excludes allocation transfers reported at \$0 per ML which are used as a proxy for non-commercial transfers. This approach may underestimate the total value of commercial trade because known trade disclosure issues result in the reporting of some commercial allocation trades at \$0.

**Table 2:** All reported trades are included in all calculations. Total net trade calculations will not necessarily equal zero because some connected systems are not included in this analysis. Victorian data includes an adjustment for pooled accounts and reflects information available on the public Victorian Water Register.

**Table 3:** Separating commercial transfers from non-commercial transfers is important to achieve an accurate picture of the market. Based on current public reporting practices of most state governments, it remains difficult to identify or categorise types of transfers. In Table 3, trades with a reported price greater than \$0 per ML are included in all calculations. Transfers reported at \$0 per ML are removed (a proxy for non-commercial transfers). Total net trade calculations will not necessarily equal zero because some connected systems are not included in this analysis. Victorian data includes an adjustment for pooled accounts and reflects information available on the public Victorian

Water Register. Aither notes that the NSW and Victorian governments are now reporting 'purpose of trade' data for allocation trades on their water registers. However, data for 2020-21 are incomplete. See Section 3.6.

**Table 4:** Outlier entitlement trades have been excluded from price calculations. All reported trades are included in calculations of number and volumes of trade regardless of reported price. Trade within irrigation corporations is not included in calculations in this table because they are not reported on the New South Wales Water Register.

**Table 5:** In previous reports, Aither has reported the estimated value of environmental holdings based on Commonwealth environmental purchases only. In this report, estimates of the total entitlement on issue and total environmental holdings were compiled from a range of sources, including the NSW and Victorian water registers, and the respective state governments. The estimated value of entitlements is based on the volume of entitlement on issue (total or environment) multiplied by the annual volume weighted average price for a given entitlement. Annual volume weighted average prices were generated using data reported on the state water registers. The exceptions are NSW Murray 10 and NSW Murray 11 (general security and high security) entitlements. Trades in zones 10 and 11 are not separated on the New South Wales Water Register. In these cases, Aither

used its in-house monthly fair market unit values averaged across 2020-21 to estimate the value of these markets.

**Table 6:** All reported trades are included in calculations of number and volumes of trade. Estimated turnover value calculations are based on total volumes transferred or traded multiplied by the annual volume weighted average price for a given entitlements. Annual volume weighted average prices were generated using data reported on the state water registers. Liquidity calculations exclude water allocated to entitlements held by environmental water holders (see note to Table 5). Returns are presented in gross terms; they do not account for any fees or charges associated with holding entitlements or trading allocations. In zones which received 0 per cent water allocation for the 2020-21 water year, no returns are recorded because it was not possible to trade water allocations not received (carryover water would be an exception, but this has been excluded for simplicity). Return calculations do not include capital appreciation. Trade within irrigation corporations is not included in calculations in Table 6.

**Table 7:** Peak irrigation season outlooks have been compiled from the state government water allocation outlooks available as of 15 July 2021. State governments report outlooks for different periods. Outlook months used to estimate the volume of water allocated by peak irrigation season are November for NSW

entitlements and December for Victorian entitlements. The estimate of consumptive water allocated to major entitlements in the southern MDB is based on forecast allocations under average inflows reported by each state government (50 per cent chance of exceeding).

# Notes

## Figure notes

**Figure 1:** For the purposes of this report, Aither has defined the southern Murray-Darling Basin as comprising of the Vic Goulburn, Vic Murray, NSW Murray, NSW Murrumbidgee, and SA Murray.

**Figure 4:** Major headwater storages include Burrinjuck (Murrumbidgee), Blowering (Murrumbidgee), Dartmouth (Murray), Hume (Murray) and Lake Eildon (Goulburn). Data were sourced from the Bureau of Meteorology. The Bureau of Meteorology sources its storage data from various third-party organisations (such as WaterNSW, Goulburn Murray Water). Data cleaning is undertaken by various organisations, and as such, the data are subject to the accuracy and limitations of the data obtained from these sources.

**Figure 5:** Allocations to all entitlement categories are shown, including allocations to environmental water holdings and Victorian water corporation holdings. Excludes carryover and distributions from irrigation corporations. Major entitlements included are: NSW Murray HS; NSW Murray GS; NSW Murrumbidgee HS; NSW Murrumbidgee GS; VIC 1A Greater Goulburn HRWS; VIC 1A Greater Goulburn LRWS; VIC 6 Murray (Dart to Barmah) HRWS; VIC 6 Murray (Dart to Barmah) LRWS; VIC 7 Murray (Barmah to SA) HRWS; VIC 7 Murray (Barmah to SA) LRWS; SA Murray (Class 3) HS.

**Figure 7:** Weather stations and time periods used are as follows: Griffith: Griffith Airport AWS, 75041 (Sep 1958 – present); Berri: Berri, 24025 (Oct 1960 – present); Deniliquin: Deniliquin Airport AWS, 74258 (June 1997 – present); Shepparton: Shepparton Airport, 81125 (June 1996 – present); Mildura: Mildura Airport, 76031 (Aug 1946 – present); Leeton: Yanco Agricultural Institute, 74037 (Jan 1957 – present).

**Figure 8:** Water usage in the NSW Murrumbidgee and Murray is based on usage against HS and GS entitlements only (consumptive and environment). Water usage in the Victorian Murray and Goulburn is based on all allocation accounts with regulated trading zone sources including water shares and bulk entitlements.

**Figure 9:** Allocations to all entitlement categories are shown, including allocations to environmental water holdings and Victorian water corporation holdings. Excludes carryover and distributions from irrigation corporations. Major entitlements included: NSW Murray HS; NSW Murray GS; NSW Murrumbidgee HS; NSW Murrumbidgee GS; VIC 1A Greater Goulburn HRWS; VIC 1A Greater Goulburn LRWS; VIC 6 Murray (Dart to Barmah) HRWS; VIC 6 Murray (Dart to Barmah) LRWS; VIC 7 Murray (Barmah to SA) HRWS; VIC 7 Murray (Barmah to SA) LRWS; SA Murray (Class 3) HS.

**Figures 10 & 11:** Murray above Choke includes zone 6 and 10. Murray below Choke includes zone 7, 11 and 12. Combined Goulburn includes zones 1A, 1B and 3. Aither has applied data cleaning methods to remove outlier and \$0 trades before calculating volume weighted average prices. For volume calculations, all trades and transfers are included, including trades reported at \$0. Only 'within' and 'into' allocation trades have been included in volume and price calculations. 'Out of' allocation trades have been excluded on the basis that it would double count trades between zones. Trade within irrigation corporations is not included in these charts.

**Figure 12:** Aither has applied data cleaning methods to remove outlier and \$0 trades before calculating volume weighted average prices. For volume calculations, all trades and transfers are included, including trades reported at \$0. Only 'within' and 'into' allocation trades have been included in volume and price calculations. 'Out of' allocation trades have been excluded on the basis that it would double count trades between zones. Trade within irrigation corporations is not included in these charts.

**Figure 13:** Aither has applied data cleaning methods to remove outlier and \$0 trades before calculating volume weighted average prices. The trade opportunity represents the volume of water that is permitted to be traded downstream at the end of the day.

**Figure 14:** No data cleaning methods were applied. All trades or transfers recorded on the NSW and Victorian water registers are included. Although NSW uses 12 purpose of trade categories, 8 of the categories align with the 8 categories used by Victoria.

**Figure 15:** Volumes from the NSW and Victorian water registers include all trades and transfers, including trades reported at \$0. Volumes transferred or traded within Murray Irrigation Limited were accessed 30 June 2021.

**Figure 16 & 17:** Aither has applied data cleaning methods to remove outlier and \$0 trades before calculating volume weighted average prices. For volume calculations, all trades and transfers are included, including trades reported at \$0. Trade within irrigation corporations is not included in these charts.

**Figure 18 & 19:** Aither has applied data cleaning methods to remove outlier and \$0 trades.

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