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Bureau of Meteorology

Australian Water Markets Report 2021–22

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Cover image: Aerial View of Hume Weir on Lake Hume at the Start of the Murray River, Albury, Australia, image by Hypervision Creative, 09 November 2017.

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Executive Summary

Australian water markets involve the buying and selling of water entitlements[1] and allocations[2]. They facilitate the movement of scarce water resources between agricultural, urban and environmental uses. Factors that influence water market activities are based on water availability (supply) and demand. On the water supply side, water availability is influenced by factors such as rainfall, water in storages and how much water is allocated to water users. On the demand side, the relative profitability of irrigated agricultural activities is the primary driver for demand and competition for irrigation water. Environmental water managers also use water markets to facilitate delivery of water to support healthy wetlands and riparian areas.

Water markets in 2021–22

In 2021–22, water markets in Australia had an estimated turnover (monetary value of water traded) of over $4 billion, down from around $6 billion in 2020–21. The decline in turnover was largely due to decreased volumes of entitlements traded and lower allocation prices.

Allocation trade

With a second consecutive year of widespread above-average rainfall leading to high water availability in 2021–22, there were record high volumes of water allocations traded (8111 GL); however prices paid remained low and generally declined further over the course of the water year (refer to Table E1).

Strong demand for water for high value horticultural crops continued in the southern Murray–Darling Basin (MDB), Australia's largest water trading area, as well as demand for seasonal crops such as rice and cotton, with irrigators taking advantage of continued wet conditions and lower allocation prices. Allocation prices in the southern MDB started the year at $115 per ML in July 2021, before steadily declining to finish 2021–22 at less than $20 per ML. This was in stark contrast to prices in the lower Murray during the first half of 2019–20, where prices peaked at over $900 per ML following two years of low water availability.

The record volume of allocation trades was due to increased trade in the southern MDB (up 3% from 2020–21). This increase can mostly be attributed to environmental trades or transfers to facilitate environmental watering, which accounted for about one third of the traded allocation volume in the southern MDB in 2021–22.

[1] A perpetual or ongoing entitlement, by or under a law of a State, to exclusive access to a share of the water resources of a water resource plan area or other water management area. An entitlement trade is a transfer of an entitlement from one legal entity to another, with or without change of location. It includes a transfer of a water licence.

[2] The specific volume of water allocated to water access entitlements in a given water year or allocated as specified within a water resource plan. An allocation trade is an assignment of an allocation from one authorised water user to another, or between water accounts held by the same water user, with or without a change in location.

Allocation trade intensity, which is the volume traded compared to the total volume of allocated water (including water carried over from the previous year) was 84% and 5% in the southern MDB and northern MDB, respectively. Despite record high trade volumes in the southern MDB and only a small decline in trade volumes in the northern MDB, the trading intensity for both the southern and northern MDB decreased significantly compared to 2020–21, reflecting the very high levels of water availability during 2021–22.

High traded volumes in 2021–22 shows water trading is an important business tool for irrigators and environmental water managers who capitalise on wetter conditions to expand production or maximise the benefits from environmental watering such as supporting native fish and bird breeding and to support the recovery and improvement of internationally significant wetlands.

In contrast to the MDB, surface water allocations traded outside the MDB decreased by 16% compared to 2020–21 due to the variability of water availability in other areas of Australia. Parts of Tasmania experienced dry conditions during 2021–22, whereas coastal NSW and Queensland experienced flooding which lessened demand for allocation trading. The volume of groundwater allocations traded nationally in 2021–22 was 125 GL, a 31% decrease from 2020–21, showing there was a continued shift away from groundwater in areas receiving significant rainfall and high surface water availability.

Table E1 Allocation trade summary, 2021–22

Region	Resource type	Transactions	Trades with market rate price reported (%)	Volume[1] (GL)	Estimated Turnover[2] ($m)
Southern MDB	Surface water	23,089	56	7,510	332
Northern MDB	Surface water	623	47	319	16
Groundwater MDB	Groundwater	412	54	116	8
Rest of Australia	Surface water	1,209	26	156	34
	Groundwater	179	30	9	2
All Australia	**Surface and Groundwater**	**25,512**	**54**	**8,111**	**392**

[1] The summation of region figures may vary from the total due to rounding.

[2] For the market turnover estimate, identified environmental transfers have been excluded. See Section 5 for how market turnover estimate was calculated.

Entitlement trade

There was a mixed result for entitlement trading in 2021–22 with high prices but low volumes being traded (Table E2). Most entitlement prices reached or remained at record highs in the southern MDB. These high prices were driven by:

- continued demand from irrigators looking to underpin water requirements for high value horticultural crops in the lower Murray
- increased allocations against general reliability and some low reliability entitlements, and the value of being able to use these entitlements to carryover allocations between water years, and
- decreased volumes being traded, with water holders potentially less willing to sell.

In terms of volumes of entitlement trade, there were 1,323 GL traded nationally in 2021–22, a 48% decrease compared to the previous year. This decline however followed a spike in trade in 2020–21 which can be attributed to a few large transactions in the Murrumbidgee system associated with property sales.

Volumes of surface water entitlement trades in the northern MDB increased in 2021–22 with a second year of high water availability, following a period of several years with limited water availability and low or zero water allocations. In regions outside the MDB, surface water and groundwater entitlement trading both declined compared to the previous year, reflecting the variability in water availability.

Table E2 Entitlement trade summary, 2021–22

Region	Resource type	Transactions	Trades with market rate price reported (%)	Volume (GL)	Estimated Turnover ($m)[1]
Southern MDB	Surface water	4,703	55	477	1,580
Northern MDB	Surface water	414	39	305	1,350
Groundwater MDB	Groundwater	714	34	153	430
Rest of Australia	Surface water	2,039	14	198	410
	Groundwater	1,383	14	190	180
All Australia	**Surface and Groundwater**	**9,253**	**38**	**1,323**	**3,950**

[1] For the market turnover estimate, see Section 5 for how market turnover estimate was calculated.

Water market participants, including irrigators and other water managers, rely on good quality information on water availability, water demand and water trading volumes and prices to make well informed decisions to manage climate variability and optimise the use of water as a valuable asset. Although water market information is improving in the areas of timeliness and reporting of trades for environmental purposes, improvements can still be made in areas such as price discovery to further support confidence and transparency in water markets in the MDB and the rest of Australia.

Hunter Valley vineyards, New South Wales. Image credit Mark Wong.

1. Introduction

Australian water markets involve the buying and selling of water entitlements and allocations. They facilitate the movement of scarce water resources between agricultural, urban and environmental uses. In 2021–22, the turnover value of Australia's water markets, or monetary value of market trade, was estimated at over $4 billion; down from around $6 billion in the previous year. The decline in turnover was largely due to decrease volumes of entitlements traded and lower allocation prices (see Section 5).

Whist water trading occurs mainly between agricultural users at various locations and water systems across Australia, more recently water market participants have also included environmental water managers, water utilities and investors, particularly in the Murray–Darling Basin (MDB).

What is water trading?

Australia's water markets allow the trading of a variety of water rights - termed water products - within and between water systems.

Water products generally fall into the broad categories of:

- **Water access entitlement:** a perpetual or ongoing entitlement to exclusive access to a share of water from a specified consumptive pool as defined in the relevant water resource plan
- **Water licences:** an ongoing right to take or hold water from a water resource
- **Water allocation:** the specific volume of water allocated to water access entitlements in a given water year or allocated as specified within a water resource plan.

An entitlement trade is defined as a transfer of an entitlement from one legal entity to another, with or without change of location. It includes a transfer of a water licence.

An allocation trade is an assignment of an allocation from one authorised water user to another, or between water accounts held by the same water user, with or without a change in location.

Entitlement and allocation trades include:

- commercial trades between unrelated parties such as an arm's length transaction where a market price is paid
- trades between related parties for example, between family members or between different properties with the same owner(s) - the trade price reported may not reflect the actual market rate
- environmental trades or transfers to facilitate environmental water deliveries for example, trade from the Commonwealth Environmental Water Office to a delivery partner – these trades have $0 reported.

This report provides an overview and characteristics of water trading activities in Australia based on supply and demand factors for the 2021–22 year. Chapter 2 describes the scale of major water markets in Australia, followed by an outline of water made available for use or trade through entitlements on issue (Chapter 3). Factors that influenced water markets activities based on water supply and demand are covered in Chapter 4. Water trade activities are detailed further for allocation markets or temporary trades (Chapter 5) and entitlement markets or permanent trade (Chapter 6) covering the southern-connected MDB, northern MDB, groundwater component in the MDB and areas outside the MDB (referred to in this report collectively as the rest of Australia).

How to harmonise different terminologies in Australia's water markets

Each state and territory use different terminology to describe statutory water rights. To avoid confusion, this report uses the generic terms of 'entitlement' and 'allocation' which are equivalent to the National Water Initiative (NWI) terms 'water access entitlement' and 'water allocation' respectively. Terminology used to describe the spatial areas where water trading occurs also differs across state and territories. The Bureau of Meteorology (the Bureau) has adopted the national equivalent term of 'water system' in this report.

Table of NWI or national reporting equivalent terminology:

Jurisdiction	Entitlement	Allocation	Water system
Queensland	Water allocation	Seasonal water assignment	Catchment/ basin
Victoria	Water share	Water allocation	Water system/ basin
South Australia	Water licence/ water access entitlement	Water allocation	Region
New South Wales	Water access licence	Water allocation	Catchment/ valley
Western Australia	Water licence	Water allocation – applicable to Harvey Water	Water management area
Northern Territory	Water licence	Water licence	Water control district
Australian Capital Territory	Water access entitlement	Water allocation	Catchment
Tasmania	Water licence	Water allocation	region

NB: this is not a complete list of entitlement and allocation types on issue in each jurisdiction.

Who provides water market data to the Bureau?

Data and associated information about water rights, allocations and trades was provided by 44 organisations from across Australia. This is required under the Water Regulations 2008. The Bureau converts the data received into a standardised form for easy comparison across different regions and this is presented as the Bureau's Water Market Dashboard (http://www.bom.gov.au/water/market/) for free public access. All the water market data presented in this report can be found here.

2. Water markets in Australia

To facilitate water markets, water systems need to be hydrologically connected. The Australian water market comprises many separate markets each defined by water systems or administrative boundaries. The scale of Australia's water markets varies greatly, from small unconnected water systems to extensive connected systems such as the southern MDB which is the largest water trading area in Australia (Figure 2.1).

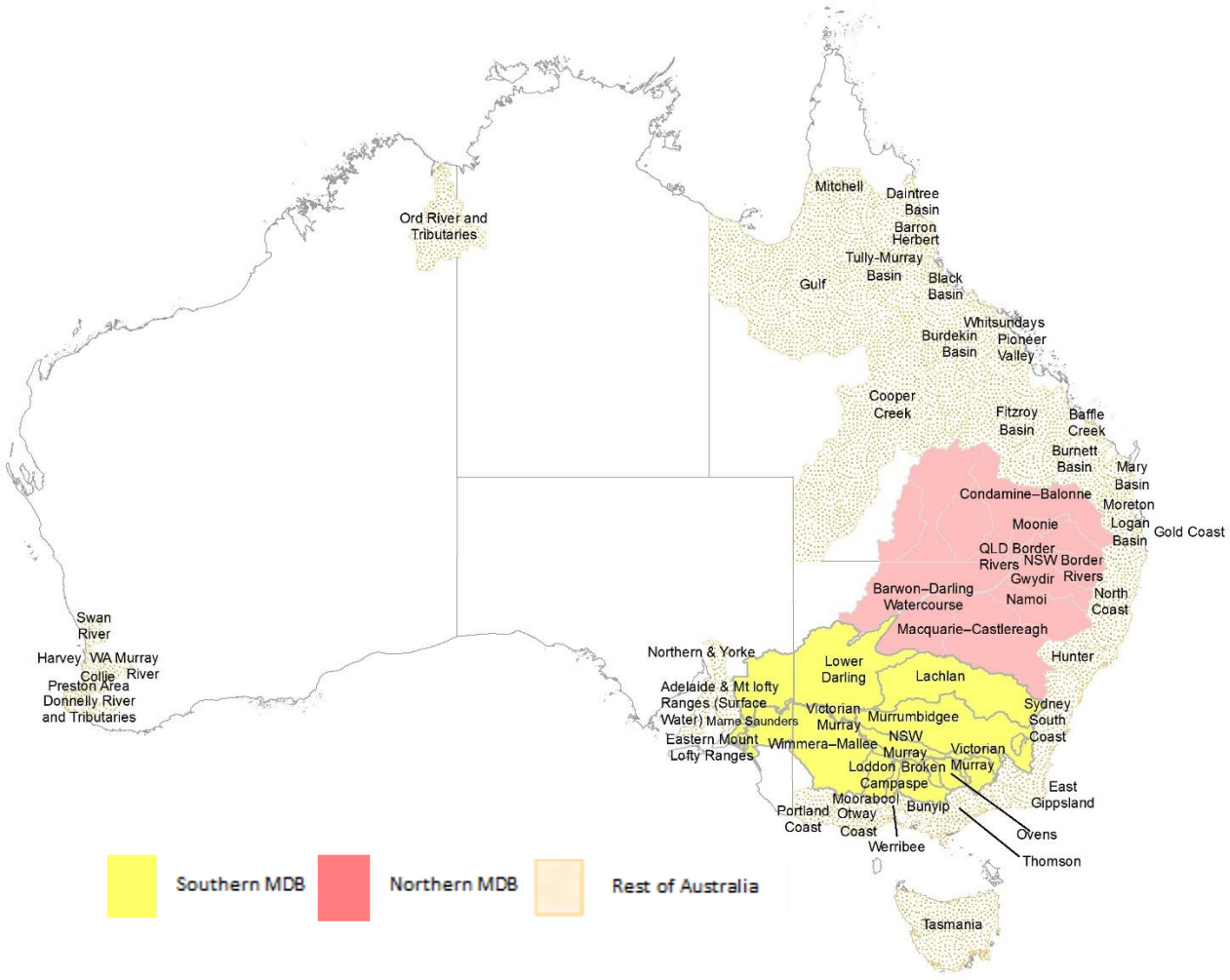


Figure 2.1 Surface water systems in Australia where trading occurred in 2021–22.

Although most water market activity in Australia occurs as surface water trading in the southern MDB, there are some sizable water markets that exist in other regions. They typically operate as independent water systems confined to smaller geographical areas due to a lack of hydrological connectivity.

The information in this report is given based on hydrologically connected water markets as follows:

- surface water in the southern connected Murray–Darling Basin (southern MDB)
- individual surface water systems in the northern Murray–Darling Basin (northern MDB)

- individual groundwater management areas in the Murray–Darling Basin
- individual water systems in other parts or the rest of Australia such as in Queensland, Tasmania, New South Wales Hunter region, southern Victoria, parts of South Australia and the south west and north east corners of Western Australia.

2.1. Surface water systems in the southern MDB

The southern MDB is Australia's most significant water market and is seen as a world leader in the market-based allocation and management of scarce water resources (ABARES 2016). It is unique because of a high degree of hydrological connectivity allowing for relatively unconstrained water trading between systems and across state boundaries. The southern MDB region generated $4.03 billion in gross value of irrigated production in 2019–20 (Westwood et al. 2020). Turnover of surface water traded in the southern MDB in 2021–22 was estimated to be worth around $0.3 billion for allocation trade and $1.6 billion for entitlement trade, totalling $1.9 billion.

Table 2.1 provides an overview of surface water markets in Australia with an emphasis on the southern MDB. The southern MDB accounts for 94% of allocation trades and 36% of entitlement trades in terms of volume of surface water traded.

Category	Variable	Australia	Southern MDB	
			Value	Relative to national scale
Allocation trade	Surface water trade volume	7,985 GL	7,510 GL	94%
	No. of surface water trades	25,512	23,089	91%
Entitlement trade	Surface water trade volume	1,323 GL	477 GL	36%
	No. of surface water trades	9,253	4,703	51%

Table 2.1 Overview of surface water markets with emphasis on the southern MDB, 2021–22.

For this report, the southern MDB includes the Murray, Murrumbidgee, Lachlan and Lower Darling systems in southern New South Wales; the Murray, Goulburn, Broken, Loddon, Campaspe, Ovens and Wimmera–Mallee systems in northern Victoria; and the Murray and Eastern Mount Lofty Ranges systems in South Australia (Figure 2.2). Horticulture such as nut and fruit trees, viticulture and broadacre cropping such as rice and cotton are the major irrigated activities in the southern MDB, followed by dairy farming.

Major dams that supply regulated sections of the southern MDB include Dartmouth, Hume, Blowering, Burrinjuck and Eildon.

Figure 2.2 Surface water systems in the southern MDB.

2.2. Surface water systems in the northern MDB

The northern MDB primarily comprises a range of inland systems along tributaries of the Darling River. However, in contrast to the southern MDB, hydrological connectivity between individual water systems in the northern MDB is limited. This results in variations in market prices and trading activity between systems. A relatively low number of regulated rivers with large variations in water supply between and during years has limited the development of water markets in the northern MDB (MDBA 2015).

Markets are active for several water systems in the northern MDB such as the Barwon–Darling, Macquarie–Castlereagh, Gwydir, Namoi, Border Rivers (New South Wales and Queensland), Moonie, Condamine–Balonne, Nebine, Warrego and Paroo (Figure 2.3). Cotton is the major irrigated activity in the northern MDB, particularly in the Condamine–Balonne, New South Wales and Queensland Border Rivers and Namoi systems (see Figure 4.9), followed by pasture and cereals production.

Major dams that supply regulated sections of the northern MDB include Burrendong, Copeton, Keepit and Split Rock.

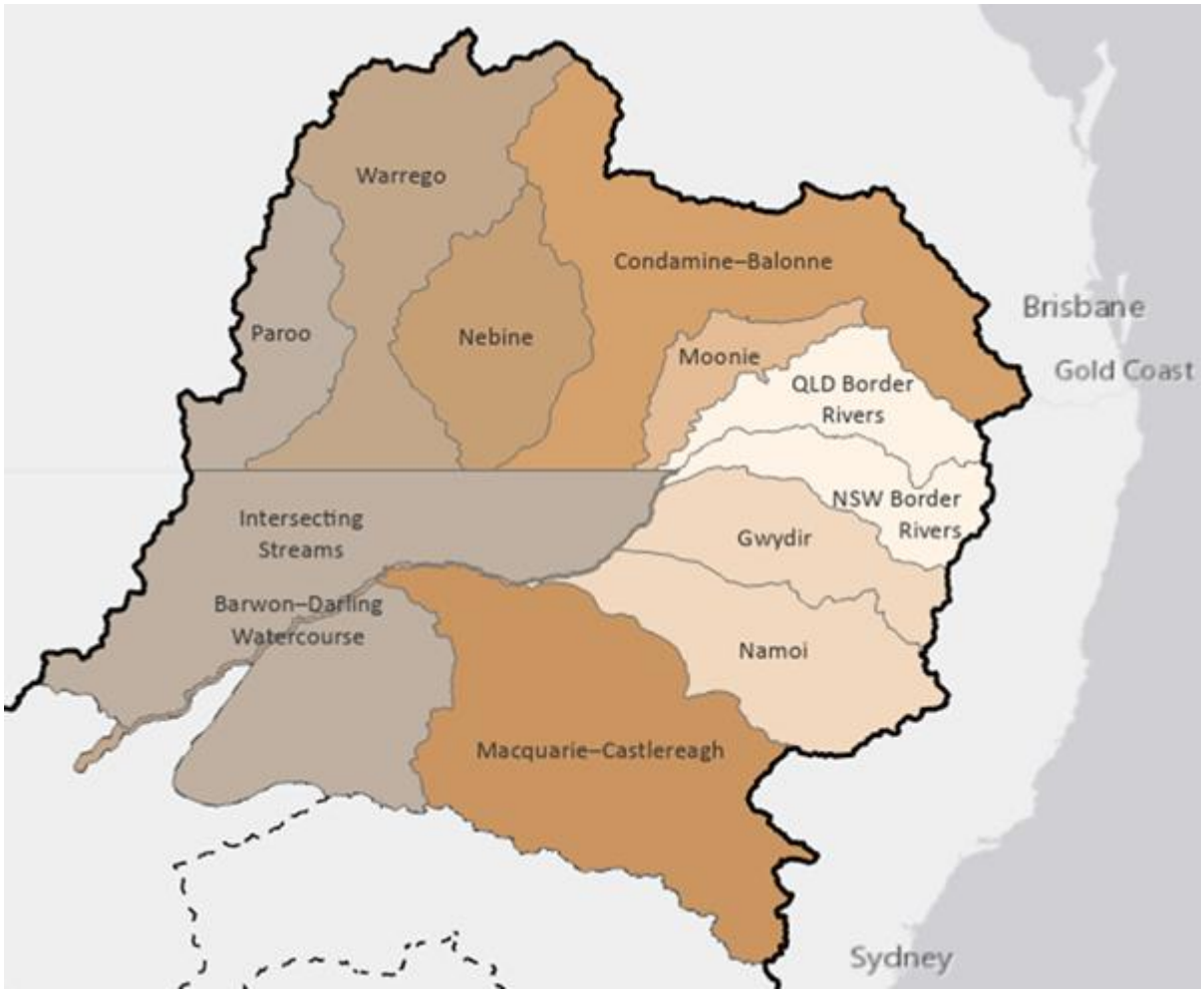


Figure 2.3 Surface water systems in the northern MDB.

2.3. Groundwater management areas in the MDB

Since some groundwater systems can extend across the southern and northern parts of the MDB, groundwater trading is considered as one resource for the whole MDB and treated separately to surface water trading in this report. Groundwater trading is typically limited to groundwater management areas defined by aquifer and administrative boundaries. Because of greater hydrological limitations, groundwater trading has been substantially less than surface water trading and often associated with the sale of land.

Figure 2.4 shows the geographical spread of groundwater resource plan areas (groundwater systems) in the MDB. Each groundwater system contains several groundwater management areas which in turn can consist of smaller trading zones often delineating the extent to which trading of groundwater entitlements and allocations can occur. Groundwater systems and management areas can vary significantly in geographical area and have overlapping layers at different depths. In some cases, groundwater systems closely match surface water system areas. In other cases, for example the Murray–Darling Basin Fractured Rock groundwater system, they extend across the southern and northern parts of the MDB.

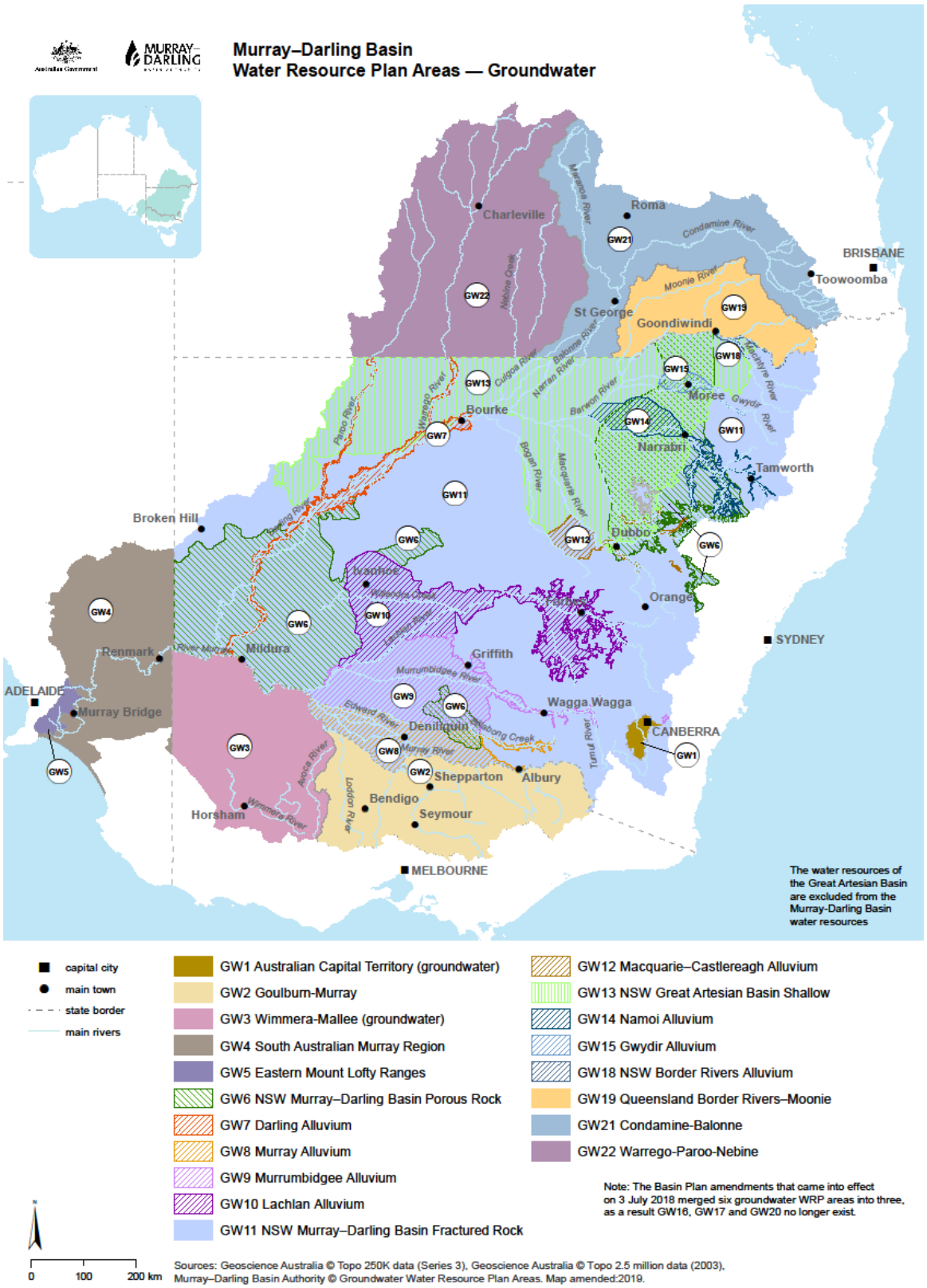


Figure 2.4 Major groundwater water resource plan areas (groundwater systems) in the MDB (source: MDBA 2019).

Limiting potential negative impacts of groundwater trading

Under the Murray-Darling Basing Plan, to limit the potential negative impacts to groundwater resources, groundwater trading (for a change of location) is not permitted unless the following conditions are met:

- There is sufficient hydraulic connectivity between the two locations
- Any resource condition limits in the Sustainable Diversion Limit resource unit specified in a water resource plan will not be exceeded as a result of the trade
- Water access rights in the two locations have substantially similar characteristic of timing, reliability and volume, or measures are in place to ensure the water access right will maintain its characteristics of timings, reliability and volume
- There are measures in place to address third party impacts as a result of trade (MDBA 2016).

Nevertheless, a groundwater licence sold as part of a property sale fits the definition of a water trade, with the licence being transferred from on legal entity to another without a change in location.

2.4. Water systems in the rest of Australia

Water systems in other parts of Australia include regions outside the MDB that already engage in, or in the future may have the capacity to engage in, any form of water trade. These water systems include agricultural areas along the New South Wales east coast, irrigation districts in Tasmania, parts of the South Australian south coast, northern Queensland and several irrigation districts in Western Australia (see Figure 2.1). Most of these regions have limited trade in allocation and entitlement markets. Several new irrigation districts have been established, leading to public offer of unallocated entitlements; recent examples include the Duck, North Esk and Swan Valley irrigation schemes in Tasmania, bringing the total to 18 irrigation schemes operated by Tasmanian Irrigation (Tasmanian Irrigation 2021).

3. Water availability

The amount of water made available for water users in Australia is governed by entitlements on issue (or water licences). Entitlements or licences are perpetual or ongoing rights to exclusive access to a share of water.

In 2021–22, 39,914 GL of water entitlements were on issue in Australia (around 0.4% increase compared to the previous year). These entitlements were distributed between regulated and unregulated[3] surface water systems and groundwater systems (Figure 3.1). The MDB accounted for just under half of the total nominal volume of water entitlements on issue in Australia. Within the MDB, regulated surface water accounted for 77% of entitlements on issue by volume, followed by groundwater (12%) and unregulated surface water (11%).

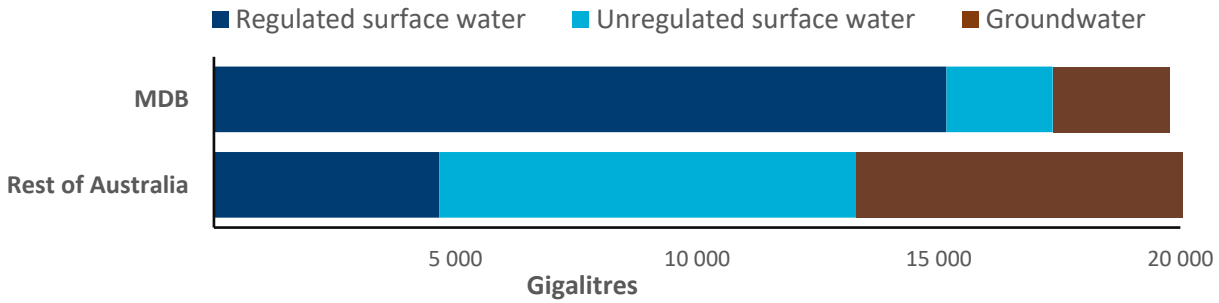


Figure 3.1 Nominal volume of water entitlements on issue for MDB and the rest of Australia, 2021–22.

In water systems outside the MDB, unregulated surface water reported 43% of entitlements on issue by volume, followed by groundwater (34%) and regulated surface water (23%). Water systems outside the MDB accounted for 80% of total unregulated surface water entitlements out of all entitlements on issue in 2021–22, which indicates that water systems outside the MDB are highly unregulated. For unregulated surface water and groundwater, where allocations are not often formally announced, available water is typically equal to the licensed entitlement volumes but is subject to specific rules around when water can be extracted.

3.1. Surface water

For entitlement on issue volumes at a surface water system scale, the largest systems are in the MDB (Figure 3.1). The MDB accounted for 76% of Australia's regulated surface water entitlements in 2021–22, out of which the southern MDB accounted for 84% (Figure 3.2), which indicates that the southern MDB is highly regulated. For regulated systems, available water each year consists of allocations made against each entitlement type, plus water carried over from the previous year. Around 5% of water systems in the southern MDB contain some unregulated surface water, mainly in the Lachlan, Australian Capital Territory, Loddon and Ovens water systems.

A substantial portion of water available in the Victorian Murray, South Australian Murray and Goulburn water systems are high reliability water. Water systems in New South Wales within the

[3] An unregulated system is where water is not stored for the purpose of supplying the orders of downstream users.

southern MDB such as the Murrumbidgee, New South Wales Murray and Lachlan have a high proportion of water holders with lower reliability surface water entitlements (such as general security entitlements) (Figure 3.3). These water holders are more exposed to volatility in water availability than are water holders with the more secure high reliability entitlements.

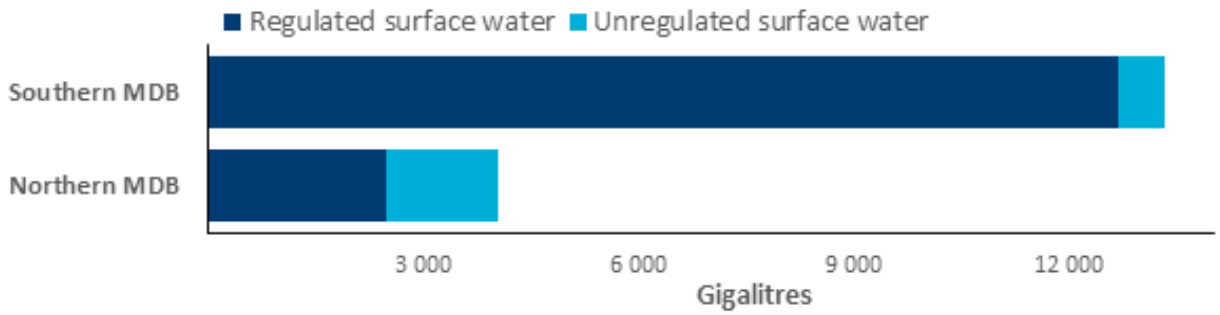


Figure 3.2 Nominal volume of water entitlements on issue for southern and northern MDB, 2021–22.

Most surface water entitlements in the northern MDB (62% of entitlements on issue) are for regulated systems such as the Macquarie–Castlereagh, Gwydir, Namoi and New South Wales Border Rivers. Of this 62%, the majority (42%) of northern MDB entitlements on issue are for New South Wales general security (Figure 3.3). High reliability entitlements, such as New South Wales high security and Queensland high priority, only account for 1.4% of entitlements in the northern MDB. Queensland medium priority accounts for 5% of entitlements of the northern MDB. Around 38% of water systems in the northern MDB contain unregulated surface water, mainly some areas in the Condamine–Balonne, Macquarie–Castlereagh, Namoi, Queensland Border Rivers and the Barwon–Darling Watercourse.

Large surface water systems outside the MDB include Tasmania, the Burdekin Basin, the Sydney South Coast and Hunter systems. Most entitlements on issue in these systems are unregulated surface water or groundwater, but a few regions contain regulated surface water including the Burdekin, Hunter, Fitzroy and Burnett Basins, which issue regulated surface water entitlements. In 2021–22, Tasmanian systems recorded over 2,517 GL of surface water entitlements on issue, followed by the Burdekin Basin (1,313 GL) and the Sydney South Coast region (1,294 GL) (Figure 3.3).

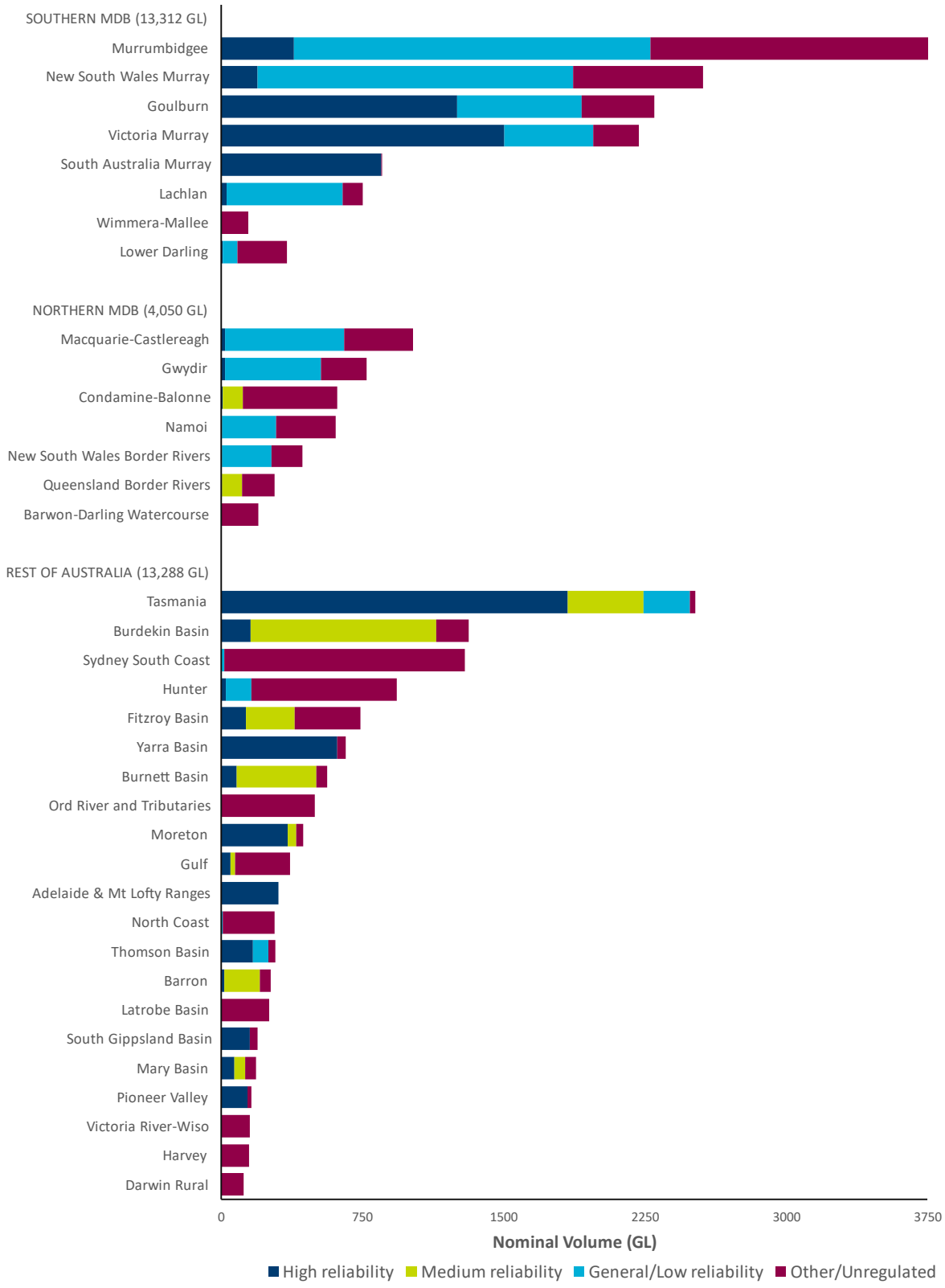


Figure 3.3 Volume of surface water entitlements on issue, by water system and reliability class, 2021–22 (only showing water systems with nominal surface water entitlement volumes greater than 100 GL).

3.2. Groundwater

For groundwater entitlements, where allocations are often not formally announced, available water is typically equal to the licensed entitlement volumes but is subject to specific rules around when water can be extracted. For example, some groundwater entitlements allow allocated water to be taken over multiple years, whereas most surface water entitlements allow allocated water to be taken annually. In some cases, groundwater systems may closely match surface water systems. However, other groundwater systems may cross surface water system boundaries. For example, the Great Artesian Basin traverses dozens of surface water systems across Queensland, New South Wales, the Northern Territory and South Australia. In some cases, layered groundwater zones may themselves traverse—for example, the Lachlan Fractured Rock groundwater source sits under parts of the Lachlan Alluvium, Lower Darling Alluvium and Murrumbidgee Alluvium. Given the hydro-geological challenges of sustainably managing groundwater systems, trade of groundwater, even within a system, is usually more limited than trade of surface water.

In 2021–22, 9,263 GL of groundwater entitlements were on issue in Australia. This is a 0.7% increase compared to the previous year. Most of these entitlements (74%) were for areas outside the MDB, particularly where surface water is less reliable (Figure 3.3). The Pilbara and south east groundwater systems contain more than 1,000 GL each of groundwater entitlements on issue (Figure 3.4).

In 2021–22, there were 12,849 groundwater entitlements on issue across the MDB with a total volume of 2,410 GL. The largest-by-volume systems were the Goulburn–Murray, Murrumbidgee Alluvium, Lachlan Alluvium and Condamine–Balonne groundwater systems (Figure 3.4).

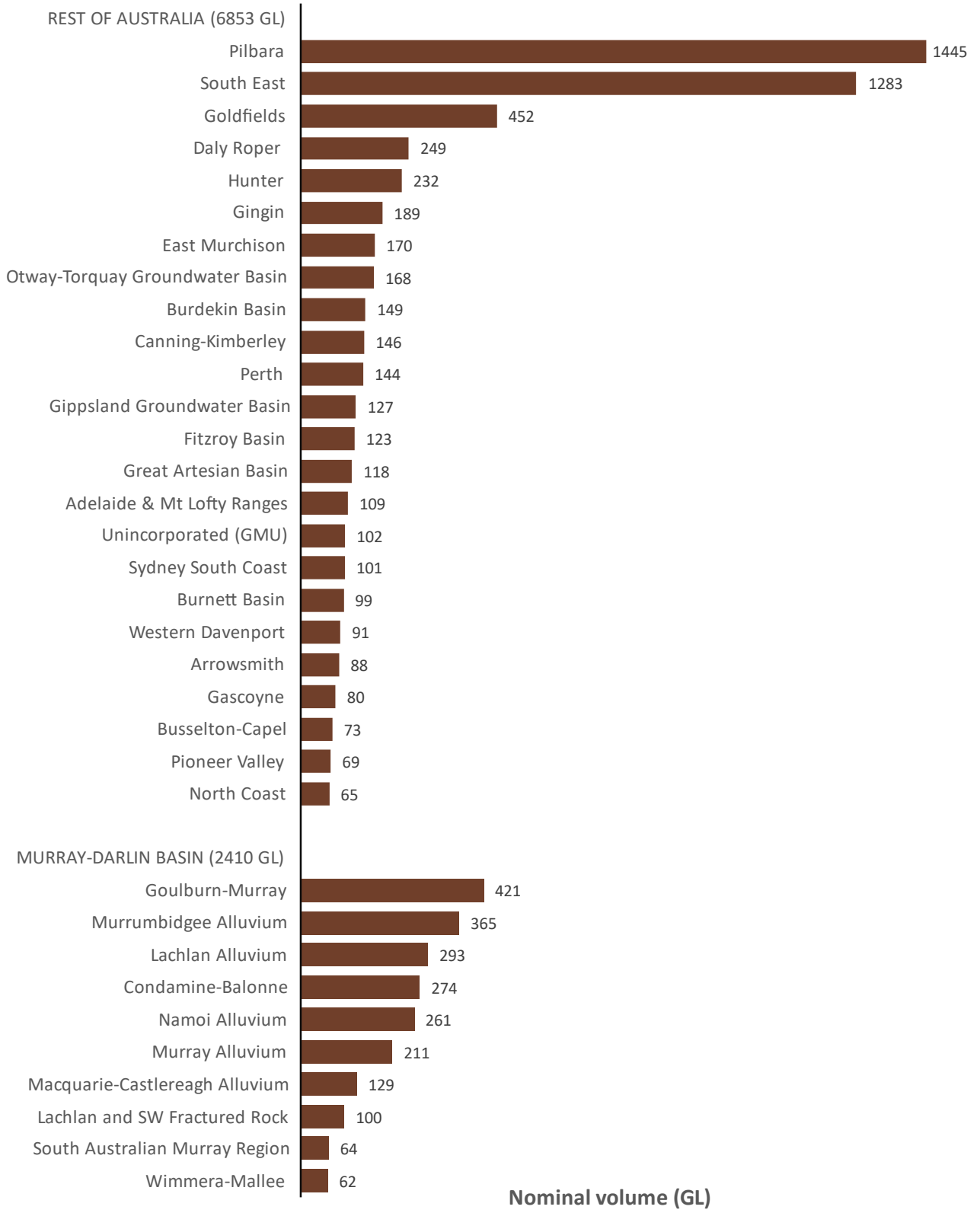


Figure 3.4 Groundwater entitlements on issue, 2021–22 (shows only groundwater areas with entitlements of greater than 50 GL).

4. Water markets–supply and demand

Water trade volumes and prices in water markets are driven by a variety of supply-side factors (discussed in section 4.1) and water demand-side factors (discussed in section 4.2) which are detailed in this chapter.

How do supply and demand forces work in water markets?

Like any market, water markets are influenced by supply (or availability) and demand factors for water. If water availability increases but the demand function stays the same (for example as shown in Part A in the diagram), it tends to lead to a lower water price and rise in volume of water traded. This was observed in 2021–22. The water supply curve shifts to the left (from S1 to S2) because of increase in supply-side factors such as:

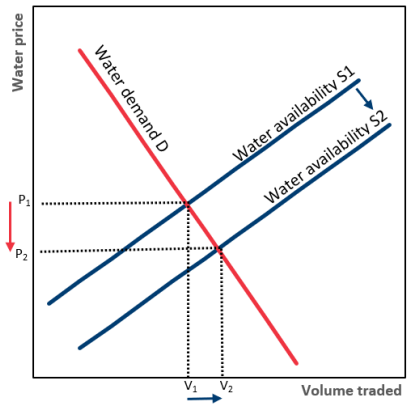
- rainfall, streamflow and storage volumes
- water allocation
- carryover from the previous water year.

If water demand increases but the water supply function stays the same (for example as shown in Part B in the diagram), it tends to lead to a higher water price and higher volume of water traded. The water demand curve shifts to the right (from D1 to D2) because of the increase in demand-side factors such as:

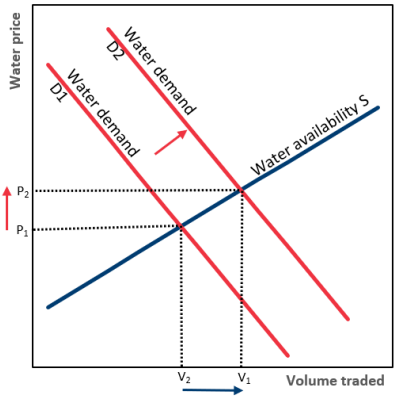
- changes in agricultural production toward higher value commodities,
- temperature, evaporation, and plant evapotranspiration
- investments in on-farm infrastructure.

During 2019–20, water availability decreased at the same time as demand for water increased, with the volume of water traded staying relatively unchanged but the price for water increasing dramatically (example shown in Part C of the diagram).

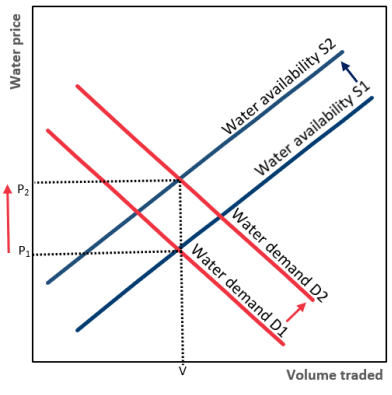
Part A. Increase in water supply typically leads to lower price and higher quantity traded.



Part B. Increase in water demand typically leads to higher price and higher quantity created.



Part C. Decrease in water supply and increase in water demand can lead to much higher prices but may not change quantity traded.



4.1. Water supply-side factors

While entitlements on issue govern long-term access to water, the amount of water that is available (or allocated) in a given year is determined by supply-side factors such as rainfall, storage volumes and carryover from the previous year which are detailed in this section. The Financial year climate and water statement 2021–22 (Bureau of Meteorology 2022) provides a summary of climatic conditions and drivers across Australia during 2021–22 together with the resultant annual and monthly streamflows. A more detailed assessment of climatic conditions is provided in the State of the Climate 2022 report (Bureau of Meteorology and CSIRO 2022). Changes in water supply-side factors for shorter timeframes are given in the Bureau's Murray–Darling Basin Water Information Portal (Bureau of Meteorology 2023).

4.1.1. Rainfall, streamflows and storage volumes

During 2021–22, the total rainfall for Australia was 9% above average, compared to all observations since national records began in 1900. La Niña became established in late November 2021, peaked in mid-summer, and weakened over autumn 2022. Rainfall was above average for much of the eastern mainland states, pastoral South Australia and Central Australia. Rainfall was highest on record for parts of south-eastern Queensland and north-east New South Wales, with significant flooding affecting these regions. Periods of flooding also occurred in the MDB during 2021–22. Rainfall was below average for the north of the Northern Territory, part of Queensland's Gulf Country, Western Australia's Goldfields and south-east coast region, far south-east South Australia and western Tasmania (Figure 4.1).

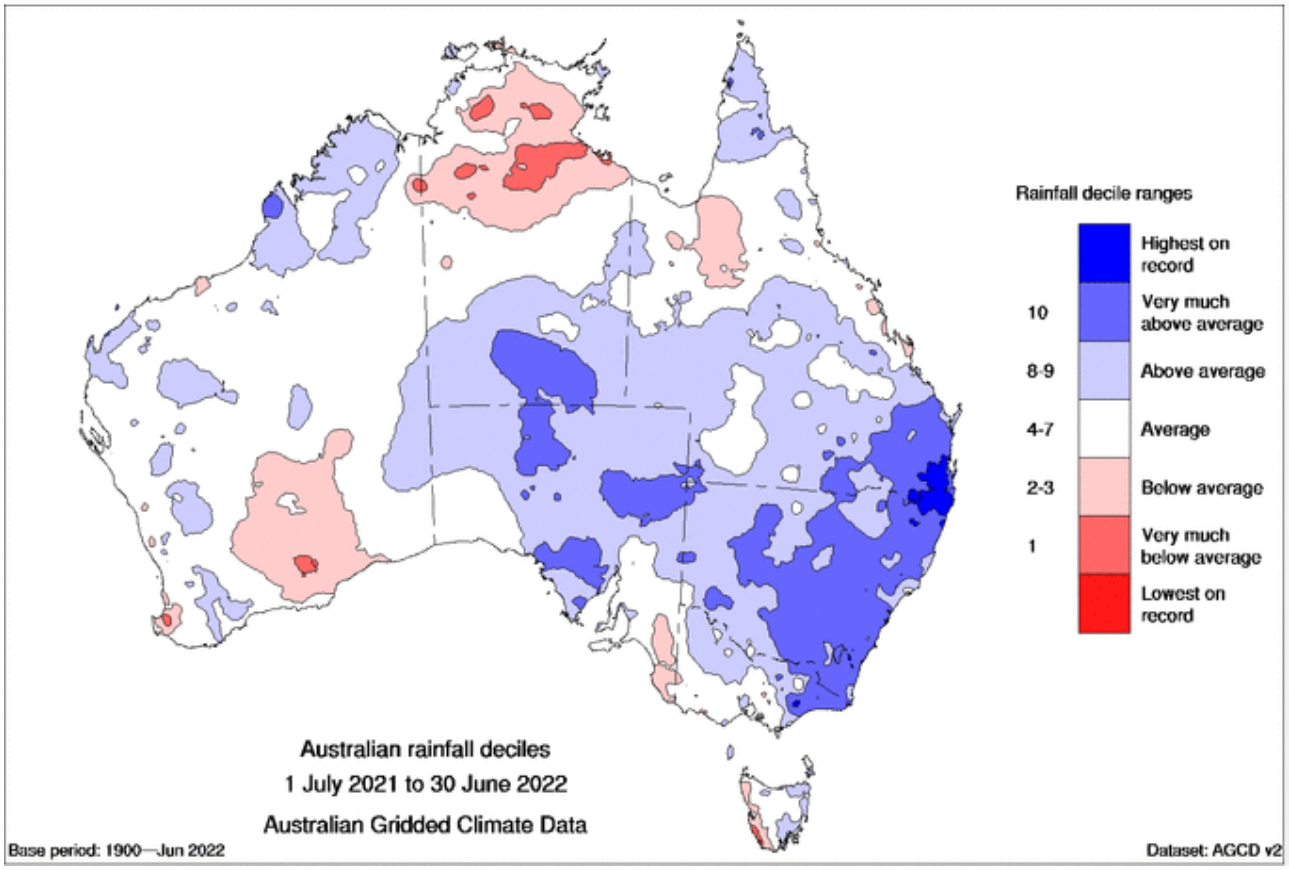
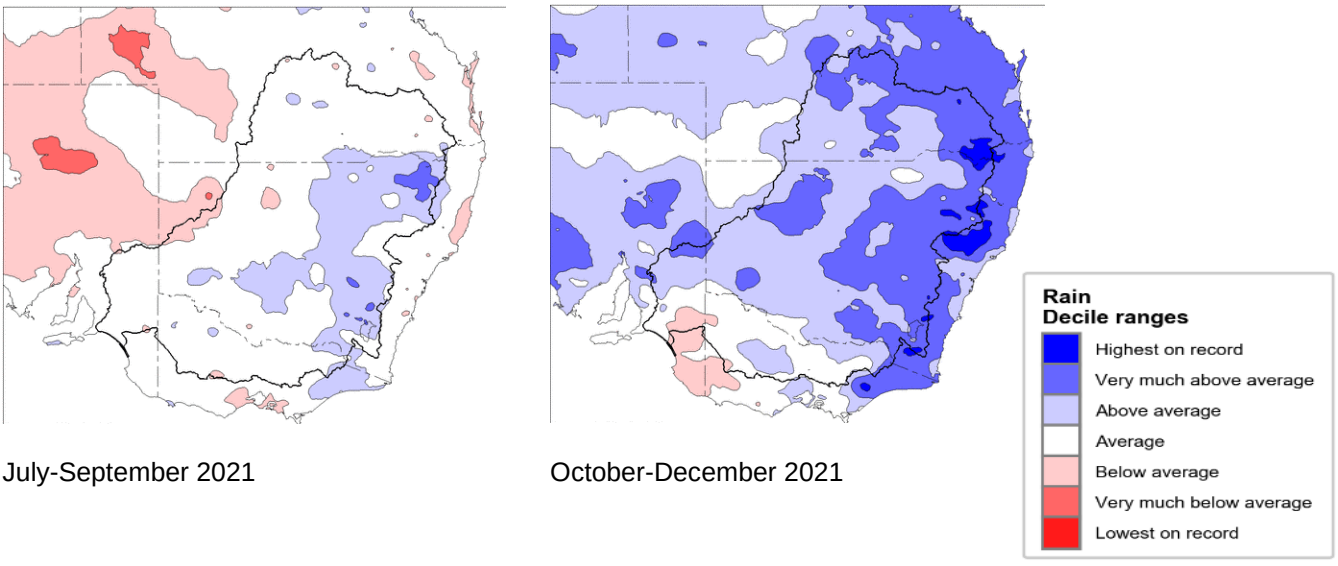


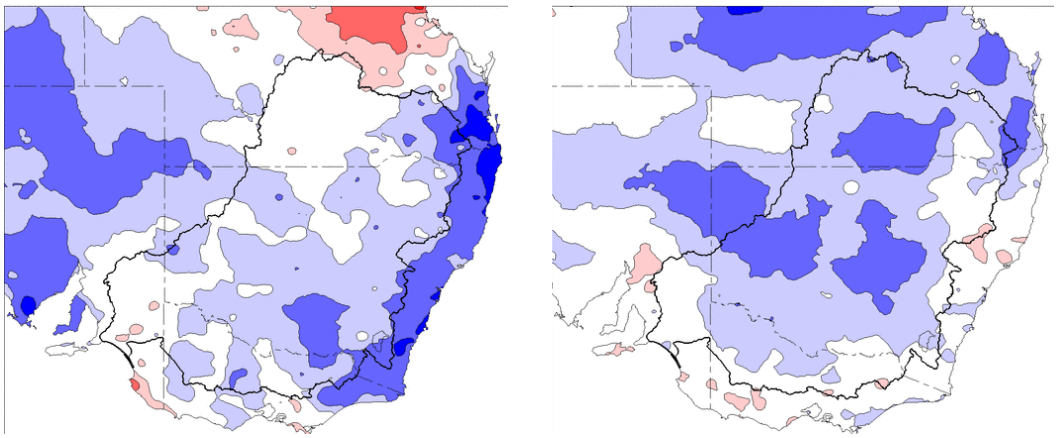
Figure 4.1 Rainfall deciles, Australia, 1 July 2021 to 30 June 2022.

The average rainfall in the MDB for 2021–22 was 637.7 mm (Bureau of Meteorology 2022). In the MDB, heavy rainfall and wet soil conditions were observed for most of the year, with widespread flooding across inland New South Wales and southern Queensland in November 2021 (Figure 4.2).



July-September 2021

October-December 2021



January-March 2022 April-June 2022

Figure 4.2 Rainfall deciles for the MDB for each quarter of 2021–22.

Streamflows in Australia are among the most variable in the world. To manage this variability, Australia has significant water storage capacity across the major water systems. The main factors for streamflow into water storages (inflows) are precipitation and soil moisture in catchments upstream of storages which influence levels of runoff into streams. Generally wetter conditions during 2021–22 resulted in improvements in storage levels throughout most of the MDB with the total accessible storage volume 84% full in June 2022 in the southern MDB, 23% higher than the same time in 2021 (Figure 4.3).

The volume of water in all storages across the northern MDB increased following heavy rainfall during 2021–22. The total storage in the northern MDB increased to 94% which was significantly higher than the same time last year when it was 59%.

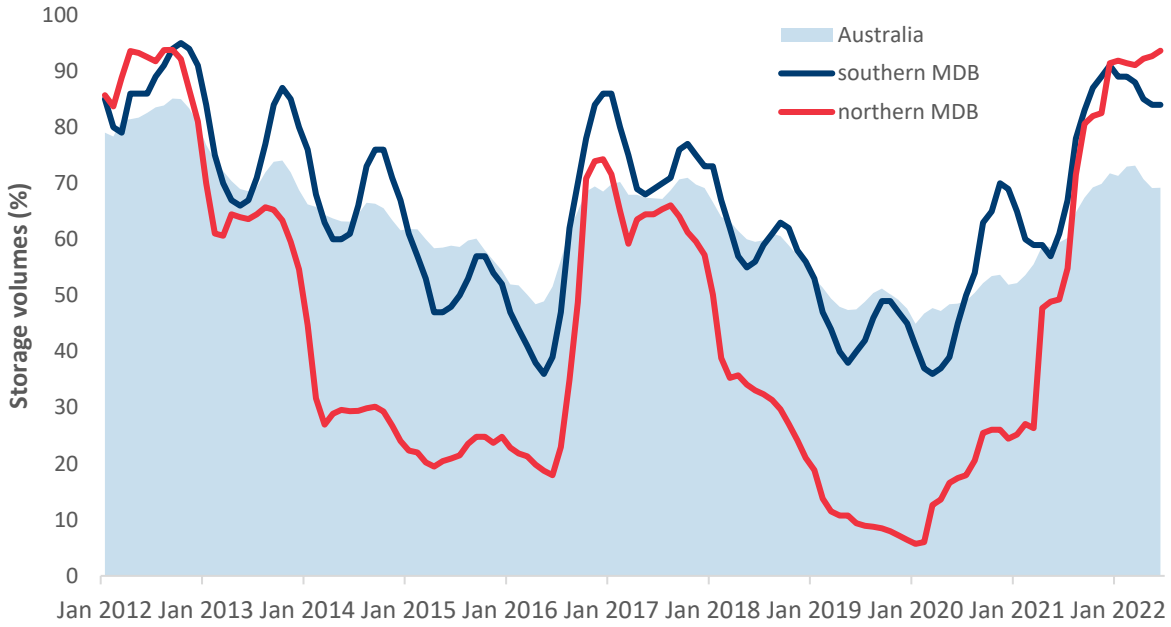


Figure 4.3 Average water storage volumes, January 2012 to June 2022.

4.1.2. Water allocation and carryover

Following increasing allocations in the southern MDB in 2020–21, total water allocations plus carryover in 2021–22 increased by another 18% from the previous year (Figure 4.4).

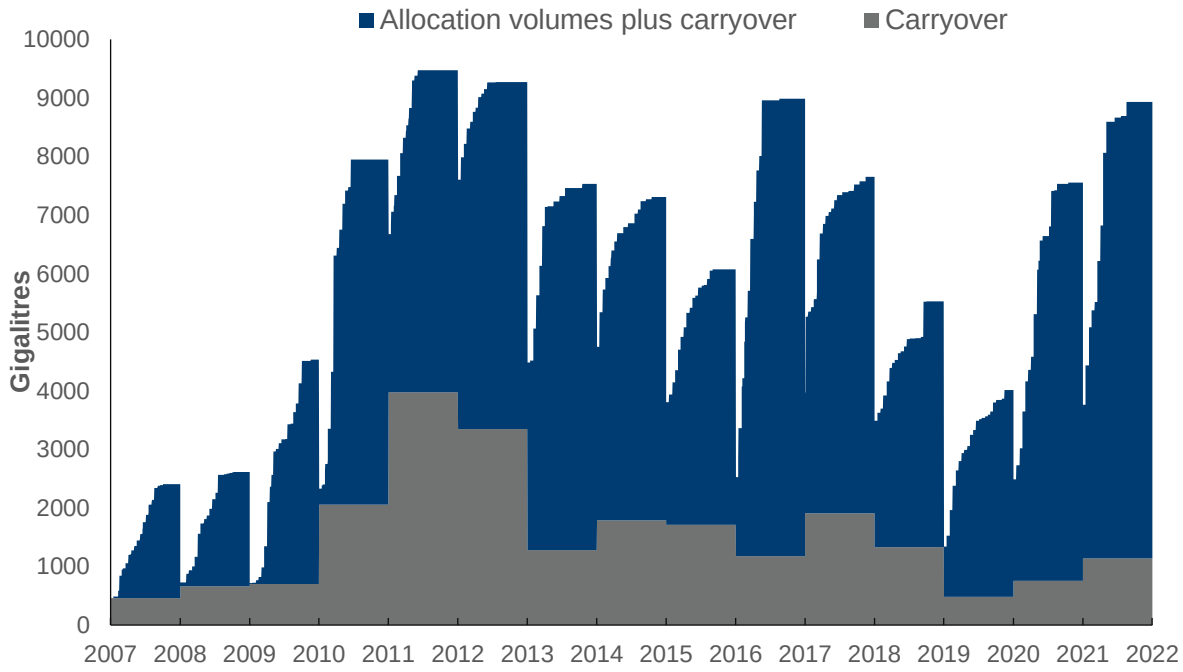


Figure 4.4 Water allocation volumes in the southern MDB, 2007–08 to 2021–22.

New South Wales, Victorian and South Australian high reliability surface water entitlements in the southern MDB received full allocations in 2021–22. It is worth noting that a substantial portion of water

available in the Victorian and South Australian systems are high reliability water (Figure 3.3). Reflecting high water availability in 2021–22, general security entitlements also received full allocations, the first time since 2016–17. High water availability allowed low reliability entitlement holders in Victorian Murray water systems to receive allocations for only the second time since 2007–08 (Figure 4.5).

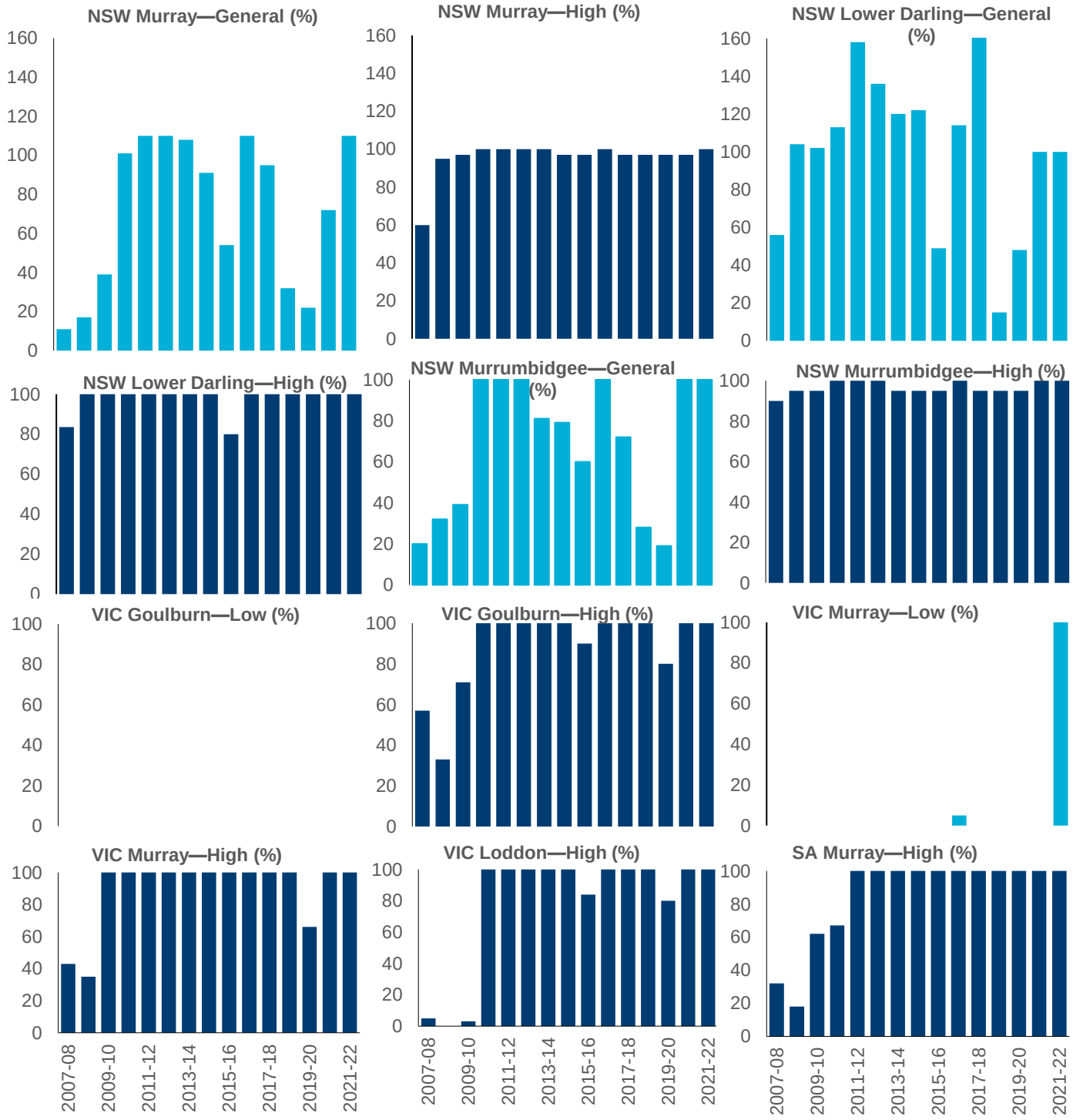


Figure 4.5 Allocations for major entitlement types (reliability), southern MDB, 2007–08 to 2021–22.

In 2021–22, water allocation volumes including carryover increased by over 230% in the northern MDB compared to the previous year. Figure 4.6 shows allocation volumes progressively increasing throughout 2021–22 to end the year at the highest level since 2007–08.

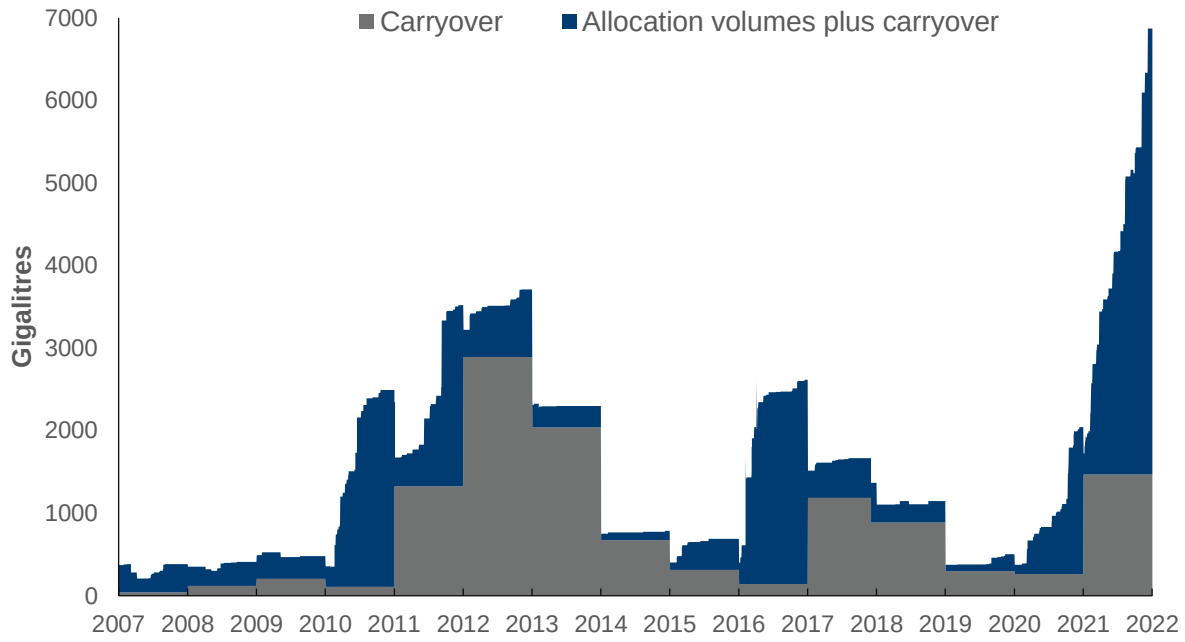


Figure 4.6 Water allocation volumes, northern MDB, 1 July 2007 to 1 July 2022.

4.2. Water demand-side factors

While the amount of water that is available (or allocated) in a given year is determined by supply-side factors, the amount of allocated water that is used in a given year is determined by demand-side factors such as water use by irrigated agriculture and for environmental watering events. In Australia, most water trade occurs between agricultural users (Grafton and Wheeler 2018).

4.2.1. Agricultural and irrigation water use

Agriculture is the primary user of water in Australia. Agricultural use accounts for around two-thirds of water extractions, followed by urban use and other industries (Bureau of Meteorology 2020). Most of the water extracted for agriculture is for irrigated agriculture. The most recent data available, which was for 2020–21, estimated a gross value of irrigated agricultural production of $18.9 billion. Fruits and nuts (excluding grapes) contributed $5.8 billion, followed by vegetables ($3.6 billion), dairy products ($2.1 billion), cotton ($1.3 billion) and rice ($0.2 billion) (ABS 2022a). Figure 4.7 shows the volumes of irrigation water use per crop type for 2020–21 in the MDB, with cotton being the highest water use, followed by fruit and nuts.

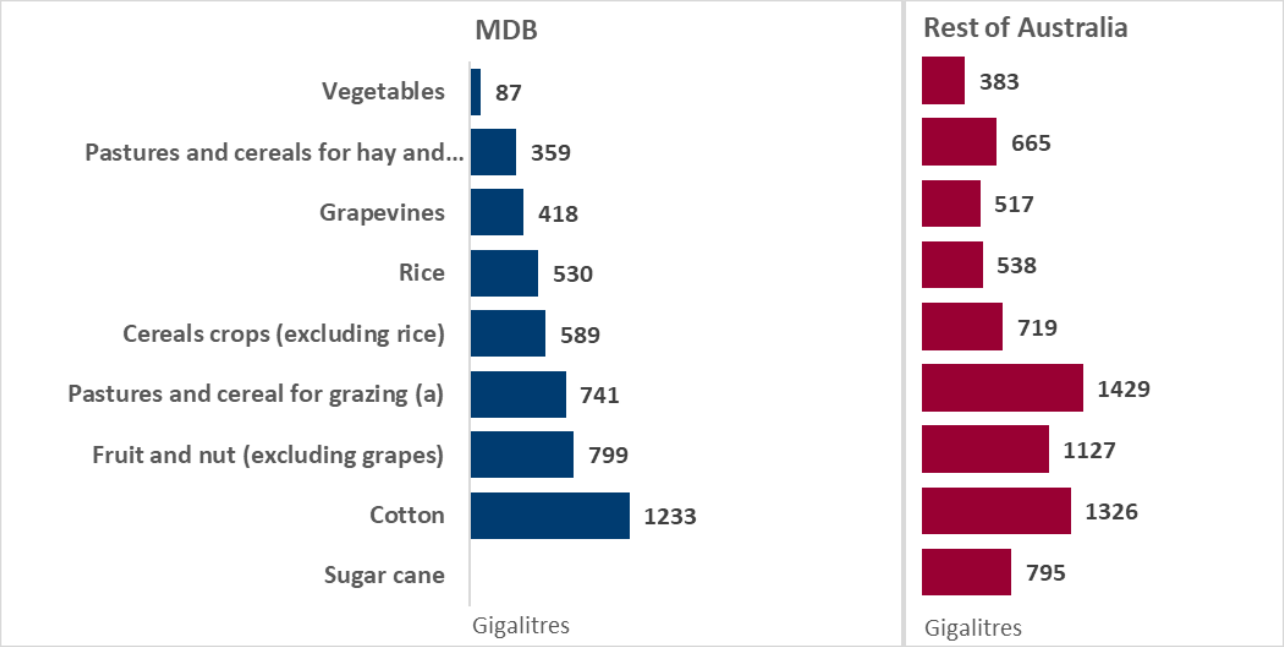


Figure 4.7 Irrigation water use in Australia for 2020–21 (source: ABS 2022b).

The most recent data available, which was for 2020–21 (ABS 2022b), shows the MDB accounted for 48% of irrigation water use and 60% of irrigated land use in Australia (Figure 4.8). The area of irrigated land in the MDB is volatile from year to year, changing in response to annual peaks and troughs in the supply of water. The area of irrigated agriculture in the rest of Australia appears to be more constant ranging between 700,000 ha to 900,000 ha each year.

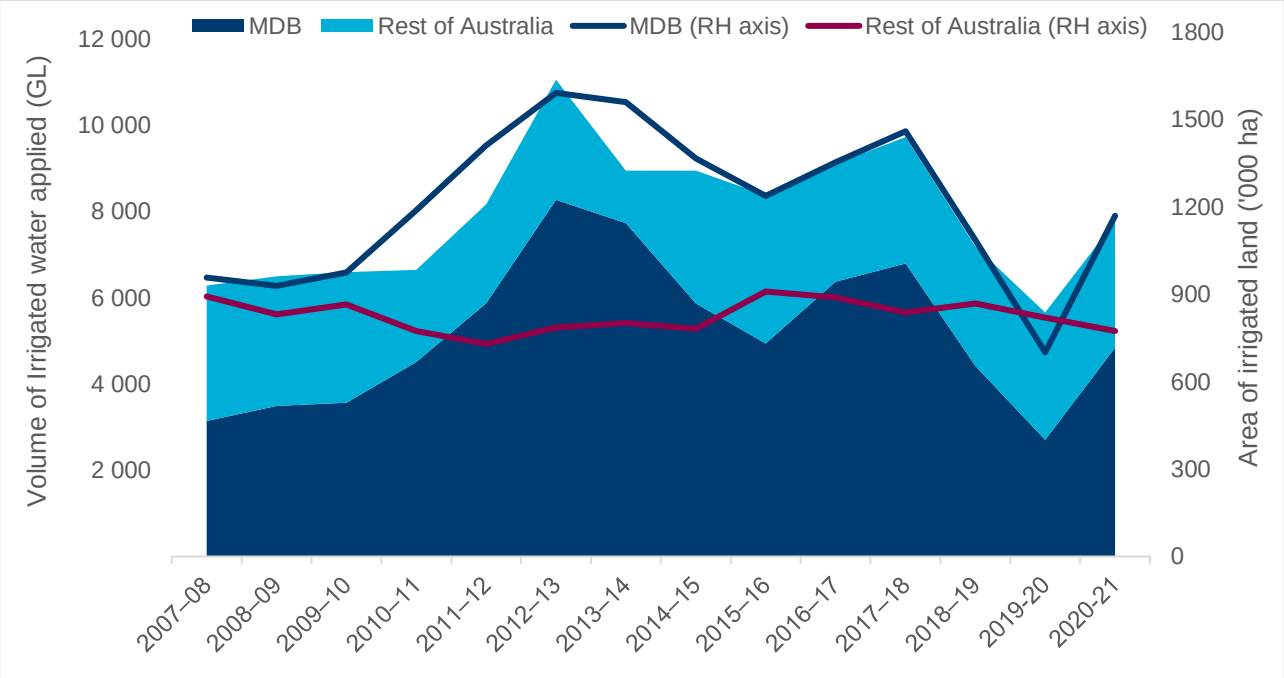


Figure 4.8 Farm irrigation water use with area of irrigated land, 2007–08 to 2020–21 (source: ABS 2022b).

4.2.2. Irrigation water demand

Demand and competition for irrigation water are primarily driven by the relative profitability of irrigation activities. Demand can also be influenced by the flexibility, or elasticity, of crop water requirements and where crops are grown.

For key irrigation regions such as the southern MDB, diverse climatic and soil conditions cater to a range of seasonal crops, permanent plantings and pasture for livestock. Seasonal crops such as rice have traditionally been grown in the Murrumbidgee and parts of the NSW Murray, while further downstream in the New South Wales and Victorian Murray, perennial tree nuts including almonds, hazelnuts and walnuts are key irrigated agricultural crops. Horticulture, such as grapes, is a key industry in the South Australian Murray and Murrumbidgee water systems and dairy maintains a strong presence in the Goulburn system. Cotton is grown in the Condamine–Balonne, Macquarie–Castlereagh, Namoi, Queensland and New South Wales Border Rivers in the northern MDB, and in upstream systems in the southern MDB such as the Lachlan and Murrumbidgee, where the areas planted to cotton are now rivalling that of areas more traditionally planted to rice crops (Figure 4.9).

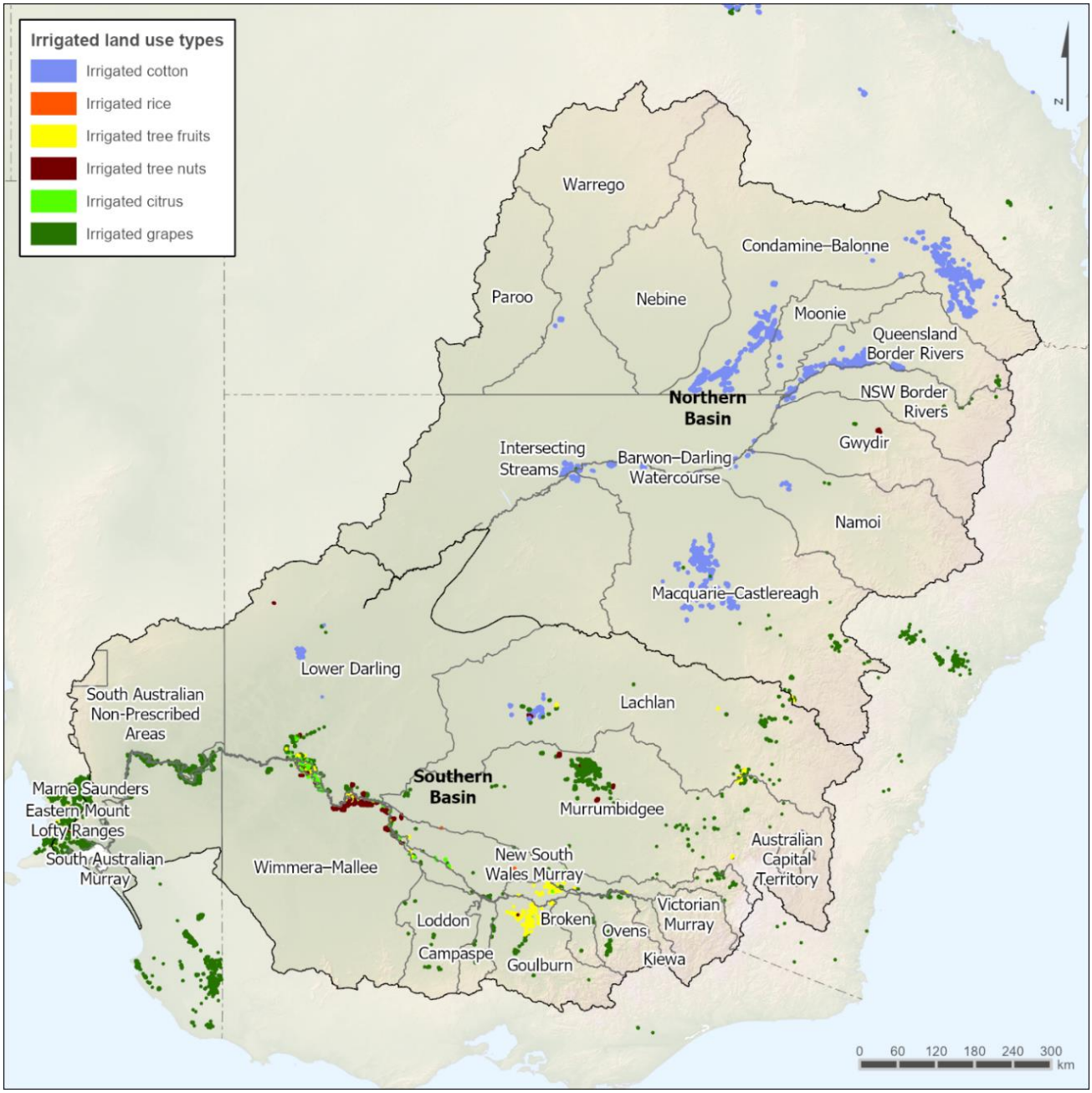


Figure 4.9 Major irrigated industries in the southern and northern MDB (derived from ABARES 2019).

Figure 4.10 shows water use by key irrigated industries from highest to lowest in terms of ML/ha for the MDB. It also shows irrigated land area in the MDB by industry. The highest water use in irrigated industries is rice, fruit and nut trees, cotton and vines in the MDB.

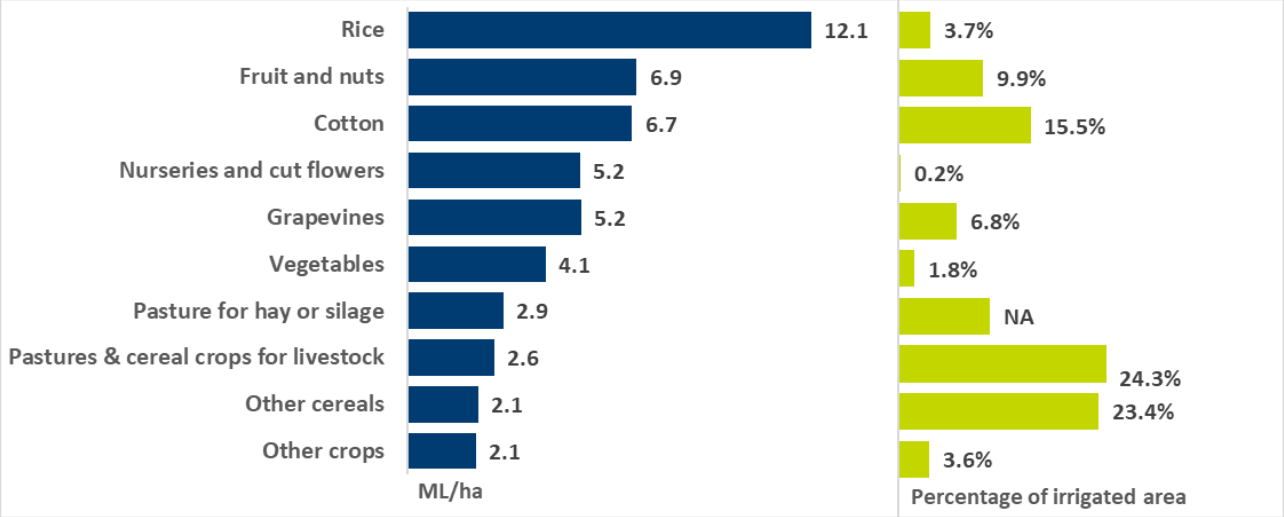


Figure 4.10 Water use and area by irrigated industry (2020–21), MDB (source: ABS 2022b).

Water users typically differ in their flexibility to change water use from year to year. At one end of the spectrum, irrigators with long-lived plantings such as trees and vines have inelastic water demand and higher willingness to pay for water. Irrigators with smaller margin annual crops such as rice have a lower willingness to pay and more elastic water demand. Areas planted to low margin annual crops with elastic water demand can vary dramatically from year to year depending on water availability and the price of water. For example, only a small crop of rice was planted in 2018–19 and 2019–20 due to very low water availability but there was a more than 900 per cent increase in area planted to rice in the MDB in 2020–21 following higher water allocations and low water prices (ABS 2022b).

4.2.3. Changes in irrigation demand

Profitability is a major driver for irrigated agriculture and depends on factors such as cost of production (including the price of water) and commodity prices. In 2021–22, the monetary value of agricultural production reached an all-time high of $81 billion, beating the previous year's record by over $12 billion. This was a result of record high crop production and high commodity price (ABARES 2022).

Figure 4.11 shows prices for a range of commodities from 2007–08 to 2021–22 in Australia, relative to 2007–08 prices. A notable trend is the decline in grapevines prices since the mid-2000s, which has driven a reduction in the area planted to grapevines (Figure 4.12). There has been a steady recovery of grapevine prices since 2013–14 but reduced export demand saw prices decline in 2021–22 compared to the previous year. The spike in rice prices in 2019–20 was caused by key exporting nations imposing export quotas and subsequent panic buying. However, due to low water availability in 2019–20, there was only a very small rice crop planted in Australia, so farmers were not able to benefit from the price spike. Prices in 2020–21 and 2021–22 returned to more normal levels. Strong demand for cotton and global supply chain disruptions caused an increase in the price for cotton in 2021–22 (ABARES 2022).

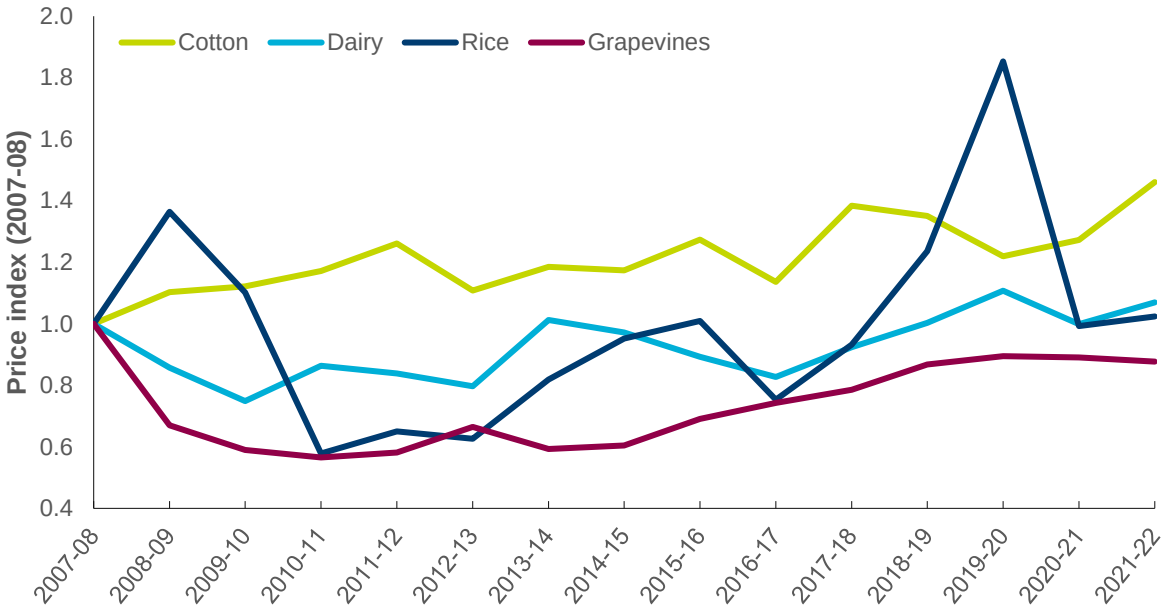


Figure 4.11 Selected commodity price indexes, 2007–08 to 2021–22 (indexed against 2007–08) (Source: ABARES 2021).

The trends in commodity prices and crop profitability have been marked by the geographic spread of higher value seasonal crops in the MDB. For example, between 2014–15 and 2017–18, higher cotton prices and the development of colder climate varieties of cotton, resulted in the area of irrigated cotton in the southern MDB increasing significantly replacing more traditional rice crops. Most of this expansion of cotton has occurred in the Murrumbidgee (Figure 4.12), where the area planted to cotton increased from 11,000 ha in 2010–11 to 54,000 ha in 2017–18. Between 2010–11 and 2018–19 water use for cotton in the Murrumbidgee increased from 76 GL to 356 GL (ABS 2022b). During 2018–20, the area planted for cotton has noticeably decreased due to a softening of cotton prices and the cost of water as an input increasing significantly. Increased water availability and lower water prices during 2020–21 and 2021–22 have seen a significant rebound in the area planted to cotton both in the Murrumbidgee and across the MDB.

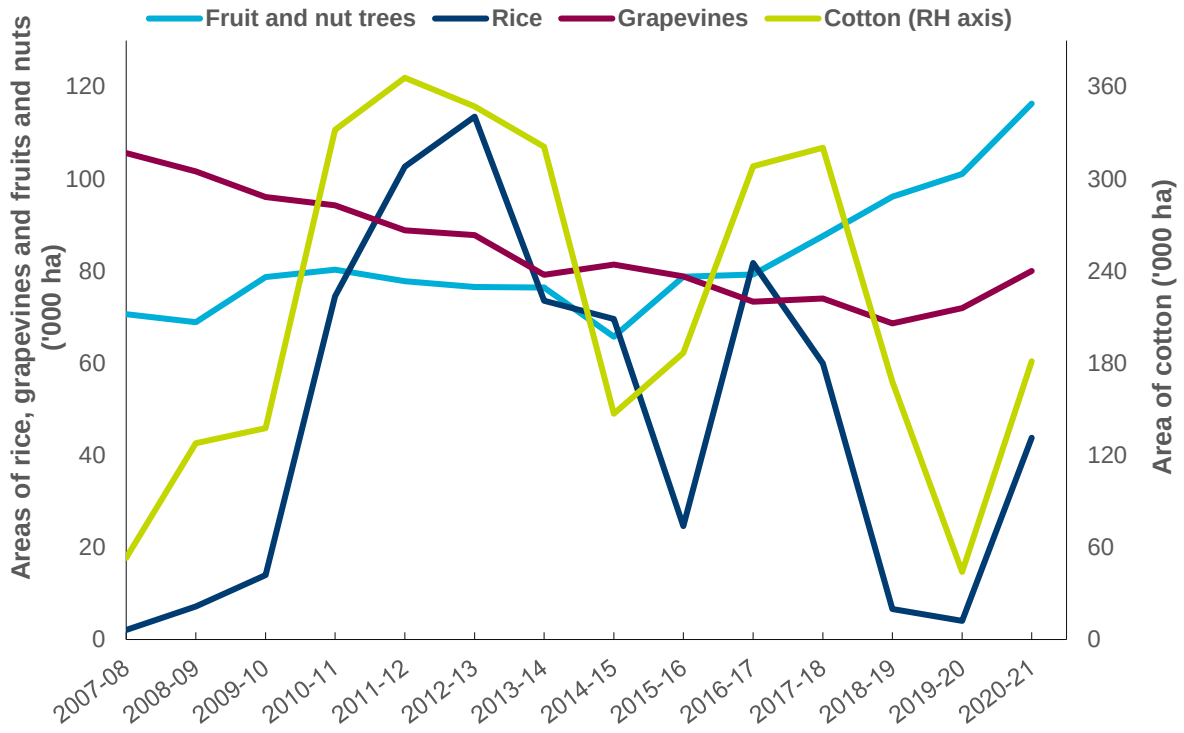


Figure 4.12 Area irrigated by major irrigated industry, **MDB, 2007–08 to 2020–21** (Source: ABS 2022b and ABARES 2021b).

Rice prices dropped considerably between 2010–11 and 2013–14, and afterwards stayed close to the range of 2007–08, apart from the price spike in 2019–20 caused by export quotas from key producing nations. Reflecting the change in commodity price for rice, lower margins in rice production, higher water prices as an input cost and competition from cotton cropping, areas planted to rice in the Murrumbidgee dropped from 56,000 ha in 2011–12 to 4,000 ha in 2019–20 (Figure 4.13). With higher returns and less water required to grow a hectare of crop, cotton was being grown in areas traditionally planted to rice from 2014–15 to 2017–18 (ABARES 2018; Figure 4.9). In 2018–19 and 2019–20, significantly higher water prices have encouraged some irrigators to sell their water, instead of growing a rice or a cotton crop. Increased water availability and lower water prices during 2020–21 and 2021–22 saw a significant rebound in the area planted to both rice and cotton.

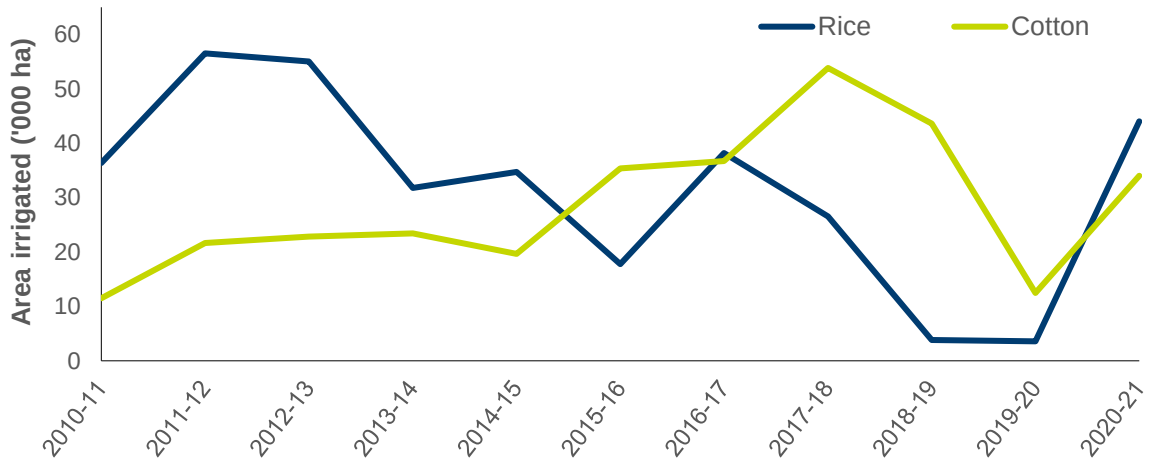


Figure 4.13 Changes of irrigated cotton and rice area in Murrumbidgee region, 2010–11 to 2020–21 (Source: ABS 2022b).

Increasing commodity prices for almonds since the mid-2000s have helped drive the expansion in perennial tree nut plantings (Figure 4.14), with almonds now Australia's most valuable horticultural export. Approximately 60% of almonds produced come from the lower Victorian Murray, 20% from the South Australian Murray and 13% from the Murrumbidgee, New South Wales Murray and Lachlan systems (Almond Board Australia 2021).

Australia is the world's second largest almond growing country, with over 17 million almond trees planted nationally (Hort Innovation 2022). Located mostly in the southern MDB, the land used for almonds has increased year on year, from 3546 ha in 2000 to 60 000 ha in 2021 (Figure 4.14). Increased water use by nut growers in the lower Victorian Murray is largely due to the expansion of area planted to almonds. It is predicted that the almond industry will continue to grow with production expected to increase from 82,000 tonnes in 2015 to 130,000 tonnes by 2025 (Australian Nut Industry Council 2020).

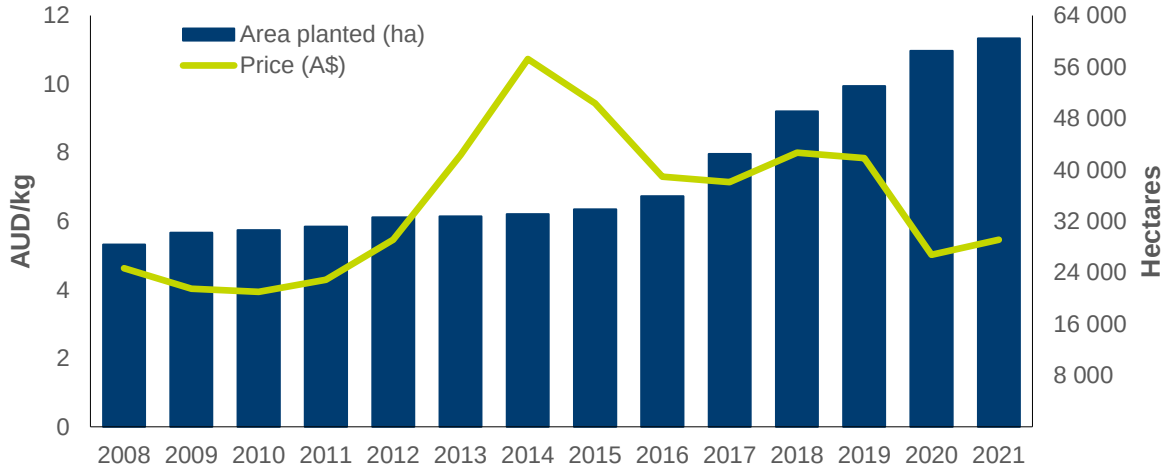


Figure 4.14 Almond prices ($AUD/kg) and area planted to almonds, 2008 to 2021 (Note: nominal prices are shown. Figure shows calendar years, Source: USDA 2023; Almond Board of Australia 2021; Hort Innovation 2022).

The increasing demand for water for the almond industry means that water demand in the Lower Murray is likely to stay strong. However, moving water from the upstream Murray to support this industry in the downstream Murray is constrained by the river capacity. This is largely caused by the Barmah Choke that restricts the flow of the River Murray to around 7,000 ML per day. A trade restriction is in place at the Choke, so that trade from upstream to downstream across the Choke may only occur if sufficient capacity has been created by trade in the opposite direction. This restriction is to manage system capacity constraints and to limit third party impacts (MDBA 2018). With increasing demand for delivery of water downstream, periods when the trade restriction is binding could become more common (see section 5.1.2 for discussion of trade restrictions).

The planting of higher value crops has placed a premium on high and general reliability water entitlement prices, as well as allocation prices, with irrigators willing to pay higher prices to protect their investments.

4.2.4. Temperature, evapotranspiration and soil moisture

Temperature is part of seasonal conditions which influence both the demand and supply for irrigation water. Temperature influences water application rates with increased temperature likely to increase the volume of irrigation water needed to sustain crops during dry periods. Higher temperatures can also lead to increased demand for water for urban consumption and watering for environmental purposes.

For 2021–22, Australia as a whole was warmer than average, with a mean temperature 0.96°C above the 1961–90 average, the 8th-warmest financial year on record since records commenced in 1910 (Bureau of Meteorology 2022). Heat was a feature in the northern Australia with severe to extreme heatwave conditions affecting the Kimberley and Top End during October and the north and west throughout summer and early autumn. Mean annual maximum temperatures were cooler than average for parts of eastern New South Wales and large parts of the MDB experienced average mean temperature during 2021–22 (Figure 4.15).

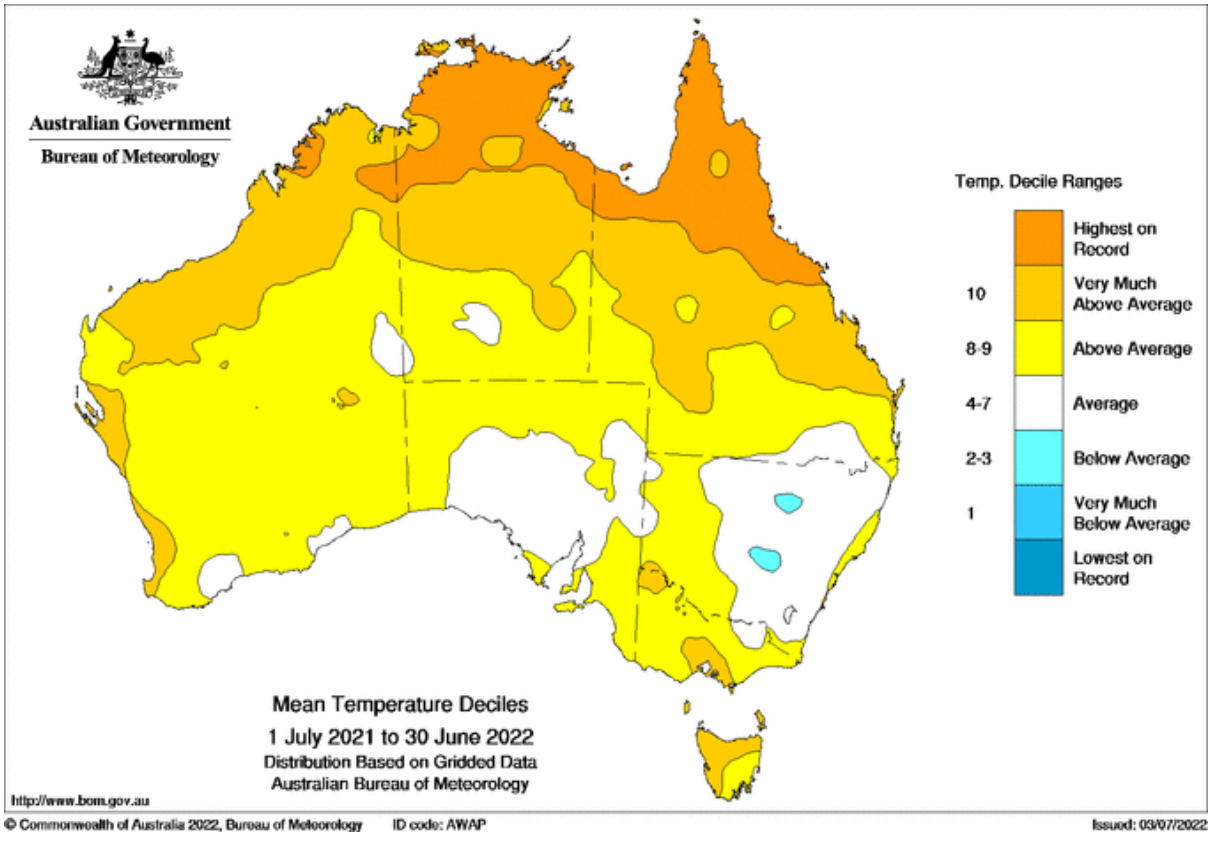


Figure 4.15 Mean daily maximum temperature deciles for Australia, 1 July 2021 to 30 June 2022.

For most of Australia, soil moisture in the root zone improved significantly by December 2021, largely in response to Australia's wettest November on record. Average to very much below average soil moisture in many parts of Australia during August was followed by very wet soils across most of the country during November. At the end of 2021, soil moisture in the east of the country, including the MDB, and much of South Australia outside the MDB was above average to highest on record (Figure 4.16).

Soil moisture decreased over summer but increased significantly again over autumn across the eastern mainland, with root zone soil moisture very much above average from eastern Victoria to south-eastern Queensland for March and April. In May and June 2022, there was a return to average soil moisture in Victoria and the east coast of New South Wales and a continuation of above average soil moisture for much of the remainder of the eastern mainland.

In western Tasmania, soil moisture persisted at very much below average to lowest on record from December to May following multiple months of below or very much below average rainfall for the west of the state. It was not until June that soil moisture in western Tasmania increased to above average (Bureau of Meteorology 2022).

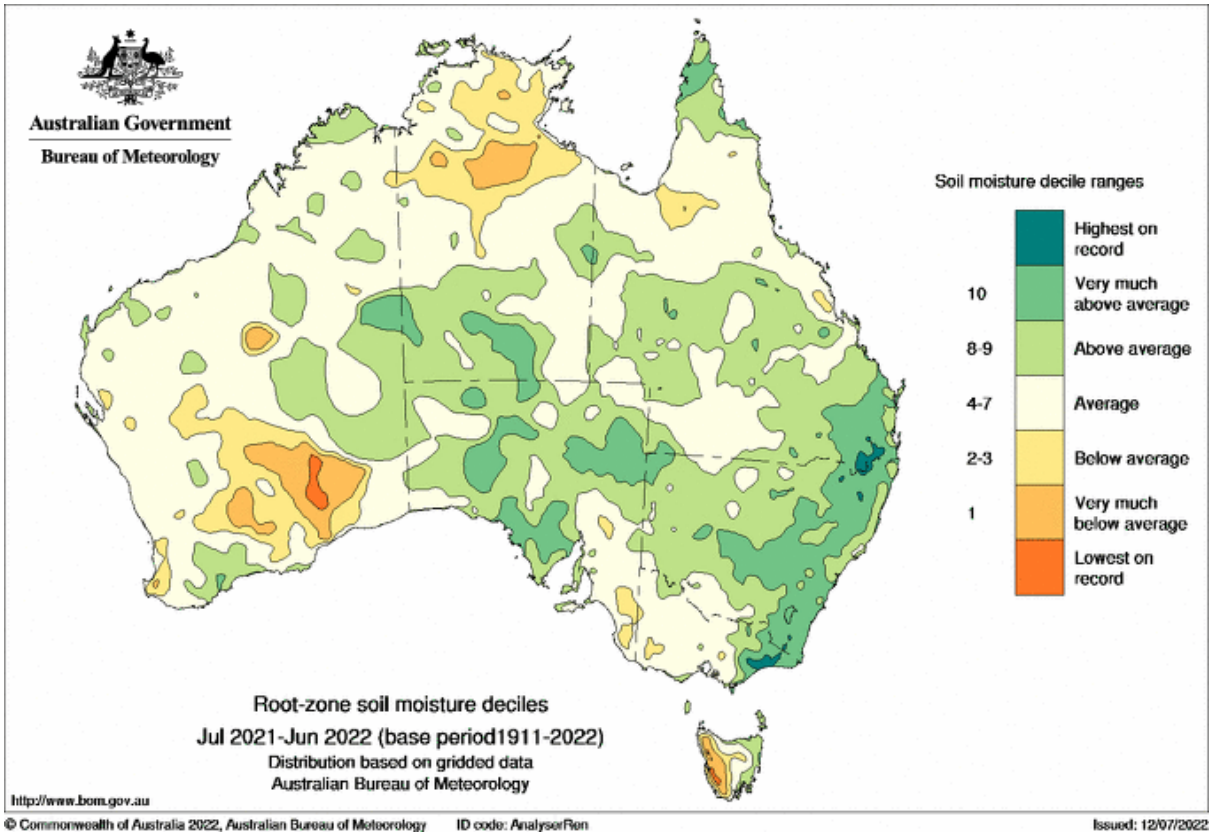


Figure 4.16 Root-zone soil moisture deciles for Australia, 1 July 2021 to 30 June 2022.

4.2.5. Environmental water use

The Commonwealth Government has acquired water entitlements for the environment to ensure the ongoing vitality and health of the river systems within the MDB. Under the *Murray–Darling Basin Plan,* the Commonwealth has committed to acquiring an equivalent to 2,750 GL of water for environmental purposes (subject to the Sustainable Diversion Limited Adjustment Mechanism). The Commonwealth has developed programs where the water entitlements can be acquired through either direct purchase or water efficiency measures, including on- and off-farm water infrastructure projects. Between 2007–08 and 2020–21, the Commonwealth acquired 2,107 GL of entitlements (long-term average annual yield) for the environment in the MDB through a mix of purchases and investments in infrastructure (DAWE 2021).

5. Water allocation markets in 2021–22

Water trade volumes and prices in allocation markets are driven by a variety of supply-side factors and water demand-side factors as detailed in Chapter 4. In 2021–22, 8,111 GL of allocation trades occurred across Australia (Table 5.1). The volume of allocation trades in Australia has grown substantially since 2008–09, with a record volume of allocations traded in 2021–22 (Figure 5.1). This represented a 1% rise in volumes trade compared to the previous year, although the number of transactions declined.

Table 5.1 Allocation trade summary, 2021–22

Region	Resource type	Transactions	Trades with market rate price reported (%)	Volume[1] (GL)	Estimated Turnover[2] ($m)
Southern MDB	Surface water	23,089	56	7,510	332
Northern MDB	Surface water	623	47	319	16
Groundwater MDB	Groundwater	412	54	116	8
Rest of Australia	Surface water	1,209	26	156	34
	Groundwater	179	30	9	2
All Australia	**Surface and Groundwater**	**25,512**	**54**	**8,111**	**392**

[1] Allocation trade market rate price involved transactions with a reported price above $5/ML and below $10,000/ML.
[2] The summation of region figures may vary from the total due to rounding
[3] For the market turnover estimate, identified environmental transfers have been excluded. See information box below for how market turnover estimate was calculated.

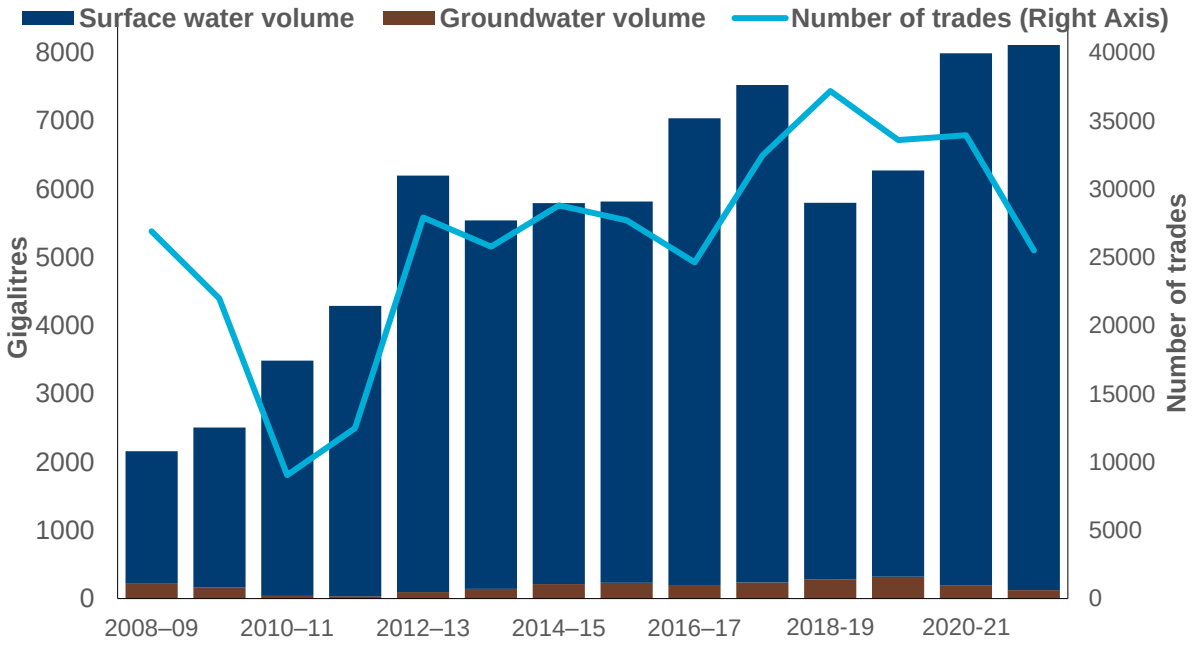


Figure 5.1 Volume and number of water allocation trades, Australia, 2008–09 to 2021–22.

Nationally, the volume of surface water trade continued to dominate over groundwater, accounting for 98% of allocation trades during 2021–22. Similarly, most of the allocation trades within the MDB are attributed to surface water, with only 2% of the basin's allocation trades in 2021–22 related to groundwater. Surface water allocation trade in the southern MDB dominated, accounting for 93% of total national allocation trade volumes.

Nationally, the total number of surface water allocation transactions was 24,921 transactions in 2021–22 (a 24% fall compared to the previous year) out of which 93% of these trades came from the southern MDB. In 2021–22, there were 623 surface water allocation transactions in the northern MDB; which was a 40% decrease compared to the previous year.

What is the median price?

The median price is the midpoint of the water price distribution. It is the midpoint $/ML transaction price when all transaction price values ($/ML) are sorted from least to greatest. Median price is considered to be a more robust measure than mean price as it is less affected by "outliers" (very small or high price transactions) which can skew an average price calculation (Sanders et al 2019).

How is median price and estimated market turnover calculated for this report?

For this report, the price data have been cleansed to remove zero prices and outliers that are unlikely to be valid. The price data are cleansed by:

- Removing transactions involving water entitlements in which the price was reported to be below $50/ML or above $20,000/ML.
- Removing transactions involving water allocations in which the price was reported to be below $5/ML or above $10,000/ML.
- After outlier removal, the median price per ML is presented for the time period, water system and reliability type selected.

To estimate the value of market turnover for allocation trade, the annual median price for each water system is multiplied by the volume of allocation trades, excluding the volume of identified environmental transfers. The turnover values are then aggregated.

To estimate the value of market turnover for entitlement trade, the annual median price for each water system and reliability type is multiplied by the volume of entitlement trades. The turnover values are then aggregated.

As a comparison, an estimate for market turnover was calculated using Steps 1 and 2 and substituting the volume weighted average price (VWAP)[4] for median price in Steps 3 to 5. This was to allay concerns that using a median price (which represents the midpoint transaction

[4] VWAP is the mean value for a price data set where the individual contribution to the average price made by each sale is weighted proportionally by the volume of water involved in the transfer.

price) would not be representative when the volume of each transaction is taken into consideration. The estimate of market turnover using VWAP gave a similar result to using median prices.

Other published estimates of market turnover exclude all $0 transactions as non-commercial trades. Given there are gaps in the reporting of trade prices to the Bureau, this approach is likely to provide an underestimate of the value of market turnover. Further effort is required to improve trade price reporting to allow the differentiation of commercial arm's length trades from related party trades, environmental transfers and property sales that include water licences.

The volume of groundwater allocations traded in 2021–22 was 125 GL (Table 5.1). This was 31% lower compared to 2020–21, showing a shift away from groundwater when there is significant rainfall and high surface water availability. Of these groundwater trades, the Murrumbidgee Alluvium groundwater system accounts for about 44% of all groundwater allocation trades in the MDB.

The increase in the volume of surface water allocations traded for the MDB in 2021–22 was largely due to the increase in the southern MDB (up 3% compared to the previous year and driven by allocation trades for the environment). Surface water allocation trade in the northern MDB decreased by 31 GL or 9%. Similarly, surface water allocations traded outside the MDB also decreased by 16% compared to 2020–21 (Table 5.1 and Figure 5.2).

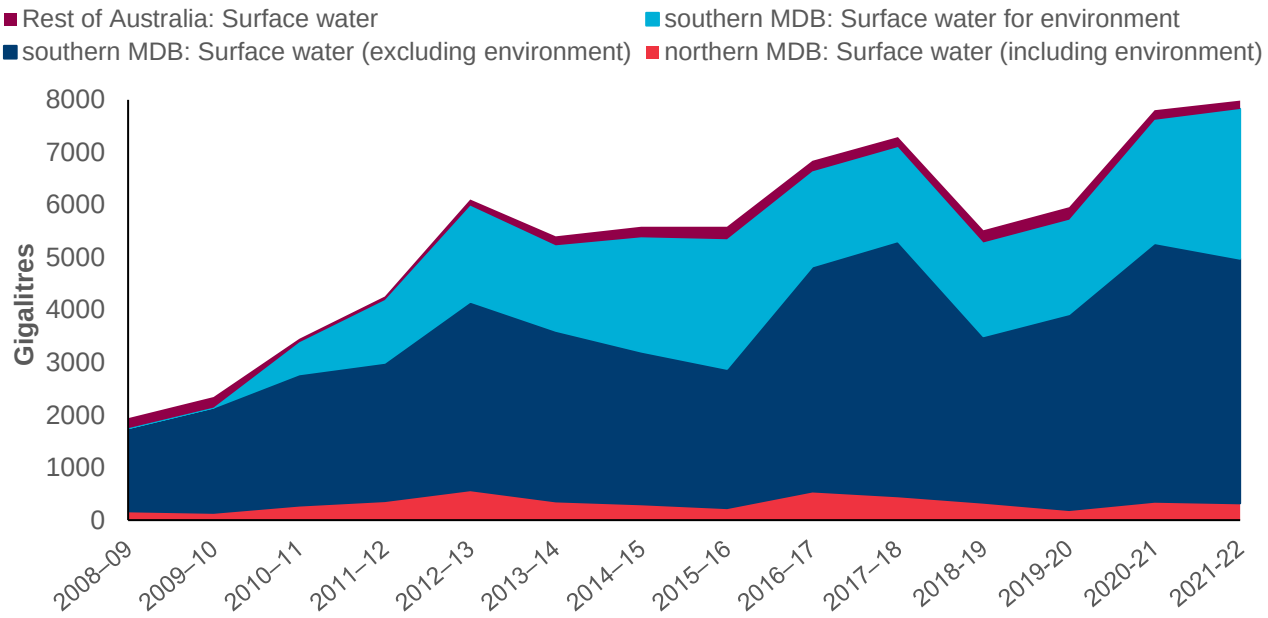


Figure 5.2 Volume of surface water allocation trade, by region, 2008–09 to 2021–22.

Allocation trades for the environment in the southern MDB were up by 22% in 2021–22 compared to 2020–21. These transfers within and between water systems were to achieve environmental watering objectives. These transfers have nil consideration paid, but they are still included on trade registers along with market activity.

There is a significant proportion of allocation trades with 'non-market rate' prices reported (i.e. no price reported or price unlikely to be from an arm's length transaction, defined in this report as a price <$5/ML or >$10,000/ML). Allocation trades without a 'market rate' reported made up 46% of all allocation trade transactions in 2021–22. Most of these trade transactions either had no price or $0 price reported, due to several reasons:

- Outside of the MDB, there is limited price data available for allocation trades.
    - Trades with market rate price reported outside the MDB were around 26% (up from 10% in 2020–21).
- Around 8% of $0 or no price transactions are between water accounts of related entities, such as different accounts of the same business or between families, or for managing carryover. For these transactions, nil consideration is often reported.
- The trades related to non-financial transfers for the purpose of environmental watering.
    - Within the southern MDB, 54% by volume of $0 transactions related to environmental water transfers but they accounted for only 3% of the total $0 transactions. Improved water quality to support native fish survival, migration and spawning was a focus of environmental watering in the southern MDB, as well as delivering water to support the recovery of floodplain wetlands (such as the New South Wales Murray forests, Hattah/Kulkyne Lakes and the Chowilla, Pike and Katarapko floodplains) (CEWO 2022).
    - Within the northern MDB, 61% by volume of $0 transactions related to environmental water transfers but they accounted for only 7% of the total $0 transactions. With higher water allocations for entitlement holders, including environmental water holders, the focus of environmental watering in the northern MDB in 2021–22 was supporting native fish populations and internationally significant wetlands (including Narran Lakes, Macquarie Marshes and the Gwydir wetlands (CEWO 2022).

Environmental water holders are an important part of water markets with allocation trading a key mechanism to allow delivery of water to environmental assets. However when calculating the median price data shown in this report, $0 trades such as environmental transfers and other 'non-market rate' price trades have been excluded to provide a good representation of market prices being paid for water allocations.

In 2021–22, 27 per cent of traded allocation volumes were reported with a market rate price nationally, which was the same per centage as the previous year. Excluding transfers for the purpose of environmental trades (37% of total allocation trade by volume in 2021–22), the total percentage of allocation trades by volume with 'market rate' prices reported was 43% . This shows there is still a need to improve price reporting to allow price discovery for all market participants.

To provide better insight into trades that are arm's length transactions versus non-commercial trades, such as related parties or environmental transfers, 'Reasons for trade' is now being recorded and collected by several Basin State water agencies. The requirement to report prices is

also being strengthened. Improved price and reasons for trade reporting will allow for greater transparency of commercial and non-commercial drivers of water market activities for the MDB.

A measure of how prevalent allocation trading has become is called allocation trading intensity. This shows the proportion of water that was available through allocations and carryover that was then traded one or more times. Trading intensity in the southern MDB was 84% in 2021–22, of which 32% were environmental trades or transfers to facilitate environmental watering. This shows that even during periods of high water availability, such as 2021–22, significant proportions of water is traded. Water trading is an important business tool for irrigators and environmental water managers who capitalise on wetter conditions to expand production or maximise benefits from environmental watering. For the northern MDB, the trade intensity was 5% in 2021–22 (a drop from 17% in the previous year), of which 2% were identified as environmental trades (Figure 5.3).

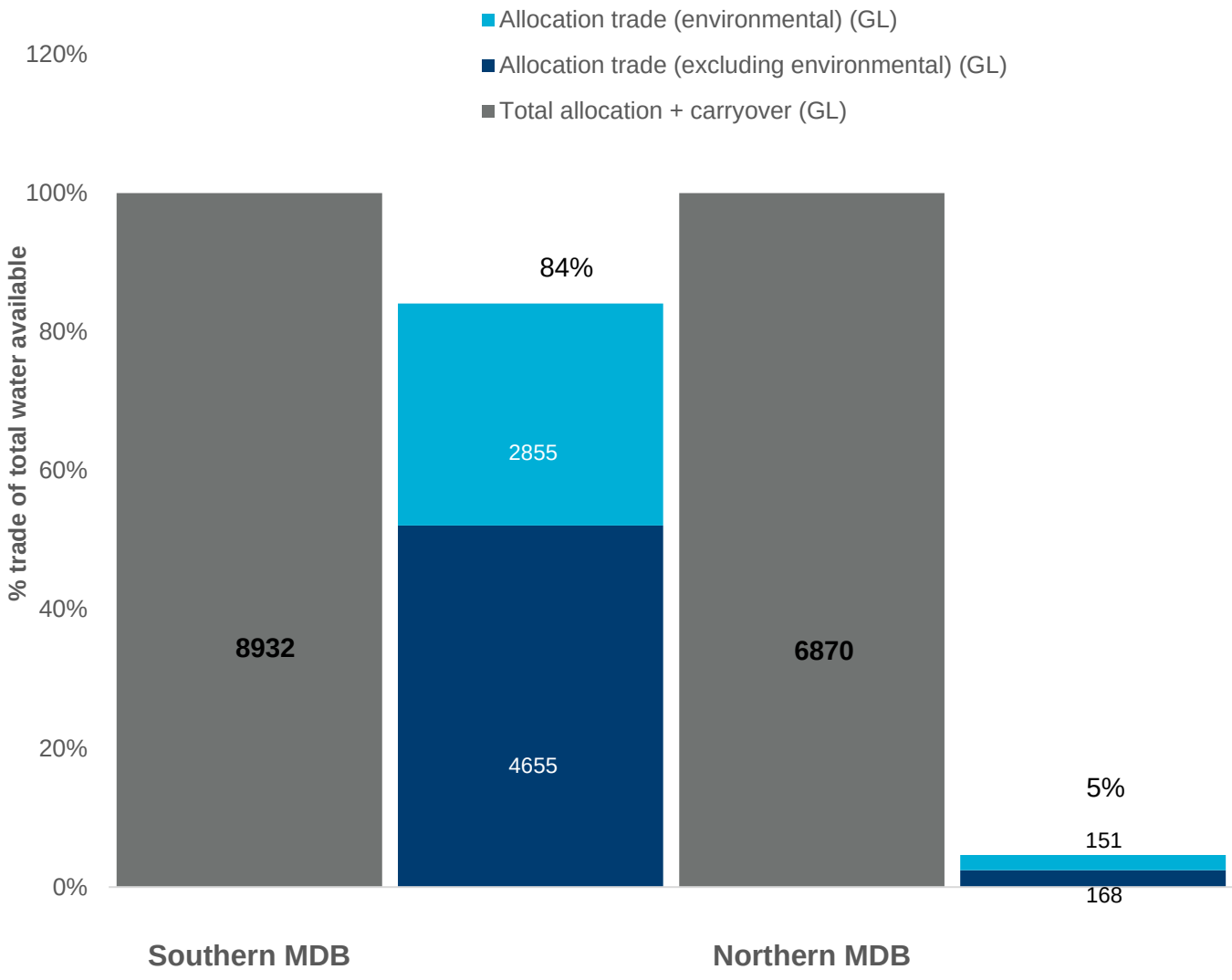


Figure 5.3 Trade intensity of surface water allocation trade, southern and northern MDB, 2021–22 (per cent allocation trade of total volume of water allocated). NB: Bold figures are total water available including carryover (GL); figures in columns are volumes of allocation trade (GL).

5.1. Surface water allocation market southern MDB

The allocation trade volume of surface water in the southern MDB was 3% higher than the previous year. Most allocation trades occurred in the Murray, Murrumbidgee and Goulburn water systems in the southern MDB (Figure 5.4).

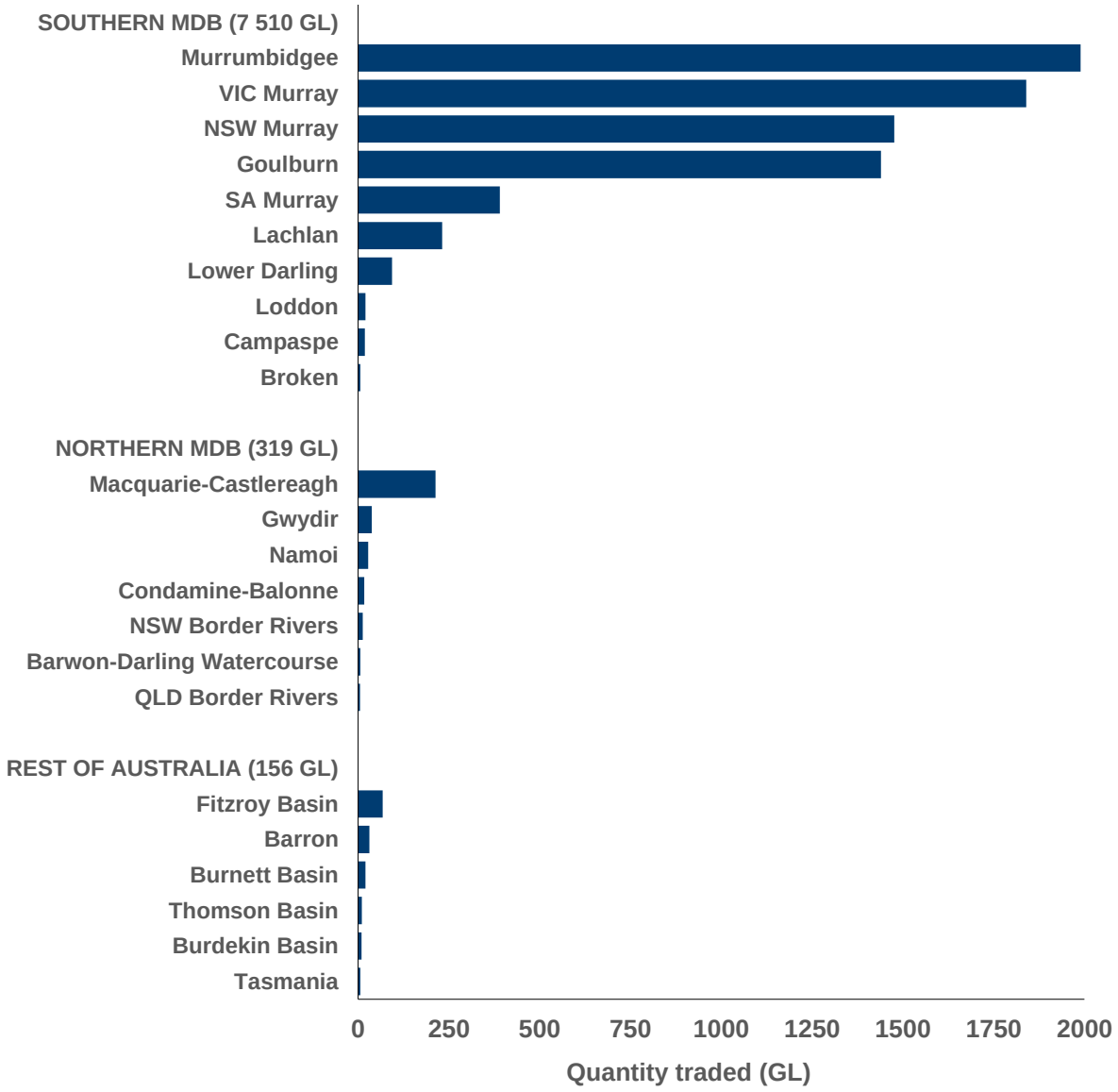


Figure 5.4 Surface water allocation trade, by region and water system, 2021–22 (includes only areas with more than 5 GL of surface water trade. Total allocation trade for each region is shown in brackets).

Across the different water systems in the southern MDB, median prices decreased by an average of 25% compared to 2020–21, driven largely by continued wet conditions and high water availability experienced throughout the MDB.

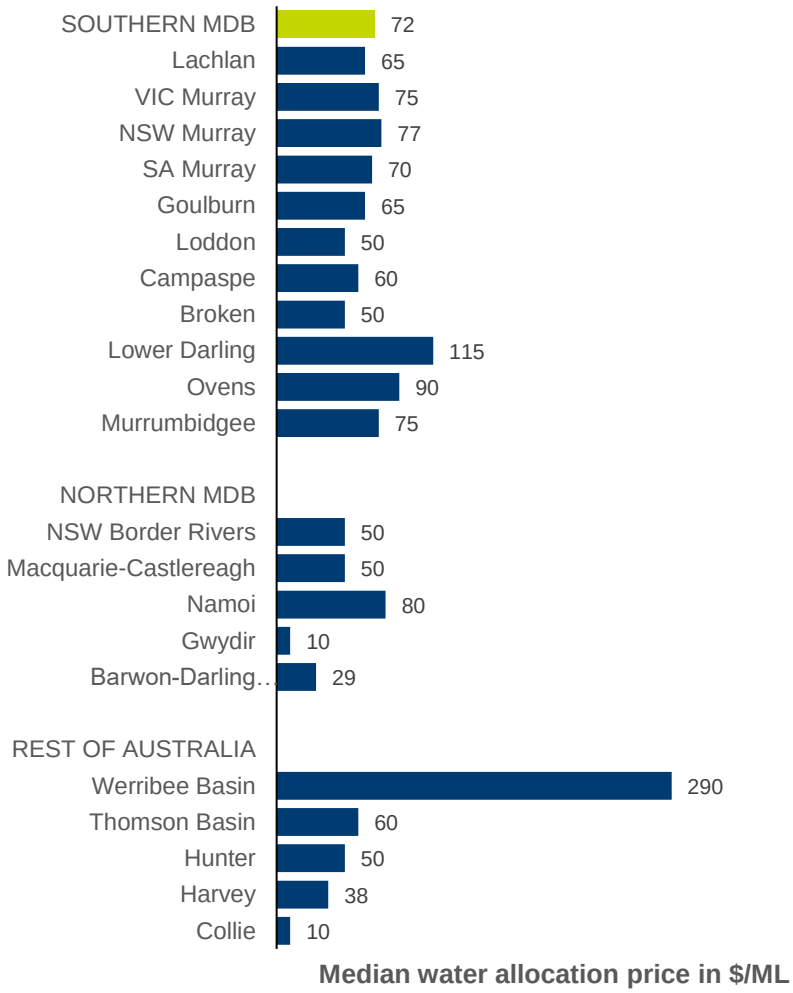


Figure 5.5 Median allocation price for surface water by region and water system, 2021–22.

The main driver of allocation prices in the southern MDB is its inverse relationship with available water for allocation, which is highly dependent on the volume of water held in storage (Figure 5.6). The average monthly allocation price in the southern MDB was very high during the Millennium drought with average prices above $500/ML in 2008–09. Prices dropped significantly to as low as $10/ML with the wet conditions between 2010 and 2012. With water availability progressively declining between 2013 and 2016, surface water prices steadily increased peaking at $270/ML in late 2015. With higher water availability during 2016–17, prices fell again to $25/ML in May 2017. Decreasing water availability and increasing demand for water have seen prices continuously increase to around $690/ML in January 2020. Widespread rainfall received across the southern MDB in the second half of 2019–20 and during 2020–21 caused a sharp drop of prices after February 2020. Prices remained low during 2021–22 with continued high water availability.

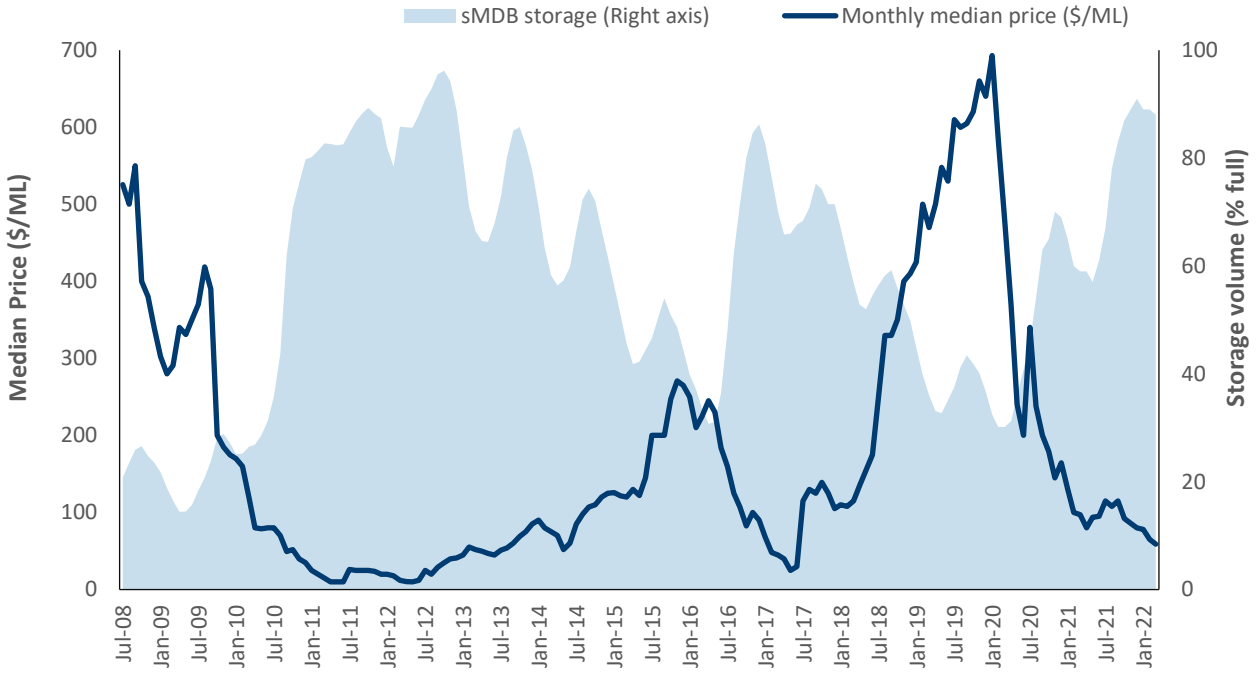


Figure 5.6 Median allocation price against storage volume (% full) volume, southern MDB, 2008–09 to 2021–22 (only showing storages that facilitate water trades).

5.1.1. Inter-regional allocation trade

In the southern MDB, water can be traded between the Murrumbidgee, New South Wales Murray, New South Wales Lower Darling, Victorian Murray, Goulburn and other Victorian and South Australian regulated river water sources. In 2021–22, the total amount of water moving between these systems decreased by 13%.

The total movement of water between water systems (1,550 GL) in 2021–22 decreased due to less commercial inter-regional trade in the southern MDB. In total, the South Australian Murray, Lower Darling and Campaspe were net importers of water during 2021–22, while all other systems in the southern MDB were net exporters except Lachlan with zero inter-regional trades.

5.1.1.1. Commercial inter-regional trade in the southern MDB

In 2021–22, continuing the previous 3-years' trend, the Murrumbidgee water system was the largest net exporter of commercial water (that is, allocation trade excluding environmental trades or transfers) with net outward trades of 75 GL (Figure 5.7). In addition to the Murrumbidgee, New South Wales Murray, Loddon, Broken, Lower Darling, Goulburn and Campaspe were commercial water exporters (59, 8, 5, 5, 4 and 2 GL respectively). With relatively higher prices being paid by lower Murray buyers, this was a driver for water to be traded out of the Murrumbidgee system and the upper Murray when inter-regional trade restrictions were not binding.

The Murrumbidgee water system exported around 75% less commercial water in 2021–22 compared to 2020–21. Exports may have been higher if the Murrumbidgee's export trade limit was not binding for most of 2021–22. This limited the amount of water exports to buyers in the lower

Murray. The Victorian Murray and South Australian Murray were net importers, excluding environmental transfers (both with 79 GL), reflecting the strong demand for water to support horticultural industries like fruits and nut trees. For the Goulburn, there was very little inter-regional trade, mainly due to continuing intervalley trade restricting exports during most of 2021–22.

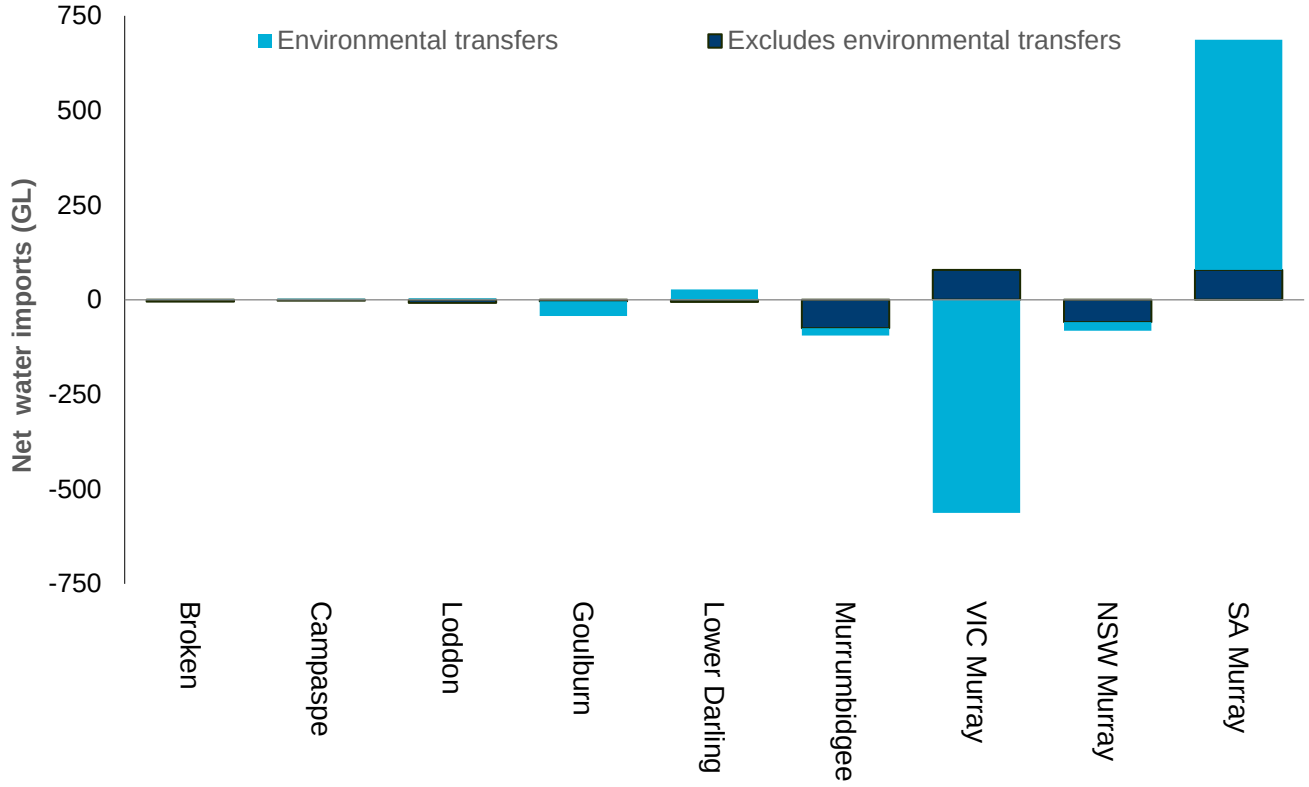


Figure 5.7 Surface water allocation net inter-regional trade flows, southern MDB, 2021–22.

5.1.1.2. Environmental inter-regional trades in the southern MDB

Identified environmental trades (or transfers) accounted for 54% of total inter-regional water trade in 2021–22, up by 17% compared to the previous year. Environmental transfers move in a downstream direction, with large volumes flowing out of the Victorian Murray system into the South Australian Murray (Figure 5.7). Environmental trades within the southern MDB facilitate the use of water to improve the health of rivers, floodplains and wetlands with decisions guided by the *Murray–Darling Basin Plan environmental watering strategy* (CEWO 2020). The Commonwealth Environmental Water Office (CEWO) is one of several environmental water holders that regularly transfer allocations between southern MDB regions. Other major environmental water holders include the Victorian Environmental Water Holder, the Living Murray and the NSW Environment, Energy and Science.

5.1.2. Trade restrictions

A trade restriction is a limit in the volume of water that can be traded from one water system to another. This can be imposed to guard against third party impacts such as environmental harm or can occur when physical or hydrological limitations within the interconnected river system are reached and become binding. This is also to ensure current and future security of supply to

existing entitlement holders. Water systems become separated from the remainder of the interconnected southern MDB while trade is restricted. Separated water systems can experience price differentials reflecting underlying supply and demand factors driving prices to a higher or lower level than the remainder of the southern MDB. Many trade restrictions in the southern MDB, in terms of inter-valley transfers (IVT), were binding for most of 2021–22.

How does the Barmah Choke affect water trades?

The Barmah Choke is a naturally occurring narrow stretch of the River Murray, which restricts flow to around 7 GL per day at Picnic Point. This is the lowest flow in any stretch of the Murray (MBDA 2021). Due to the flow restrictions, water trade from upstream to downstream of the Choke is limited to protect water delivery to existing entitlement holders and for environmental reasons as demand for water from the Murray downstream of the Barmah Choke is concentrated in the summer months (MDBA 2018).

Trade restrictions through the Barmah Choke limited the volumes of water that could be traded from the upper Murray to meet the demands for water in the lower Murray. Apart from a very brief period in early July 2021 and in June 2022, trade from above to below the Barmah Choke was restricted (MDBA 2022). Higher demand from buyers in the lower Murray below the Barmah Choke resulted in higher prices generally being paid in the lower Victorian, New South Wales and South Australian Murray regions, compared to the Upper Murray regions (Figure 5.8). The price differential or premium paid in the lower Murray was over $60 per ML or 60% higher during July 2021. With increased water demand in the downstream Murray regions likely to continue into the future, this will exacerbate the impact these trade restrictions have on water prices.

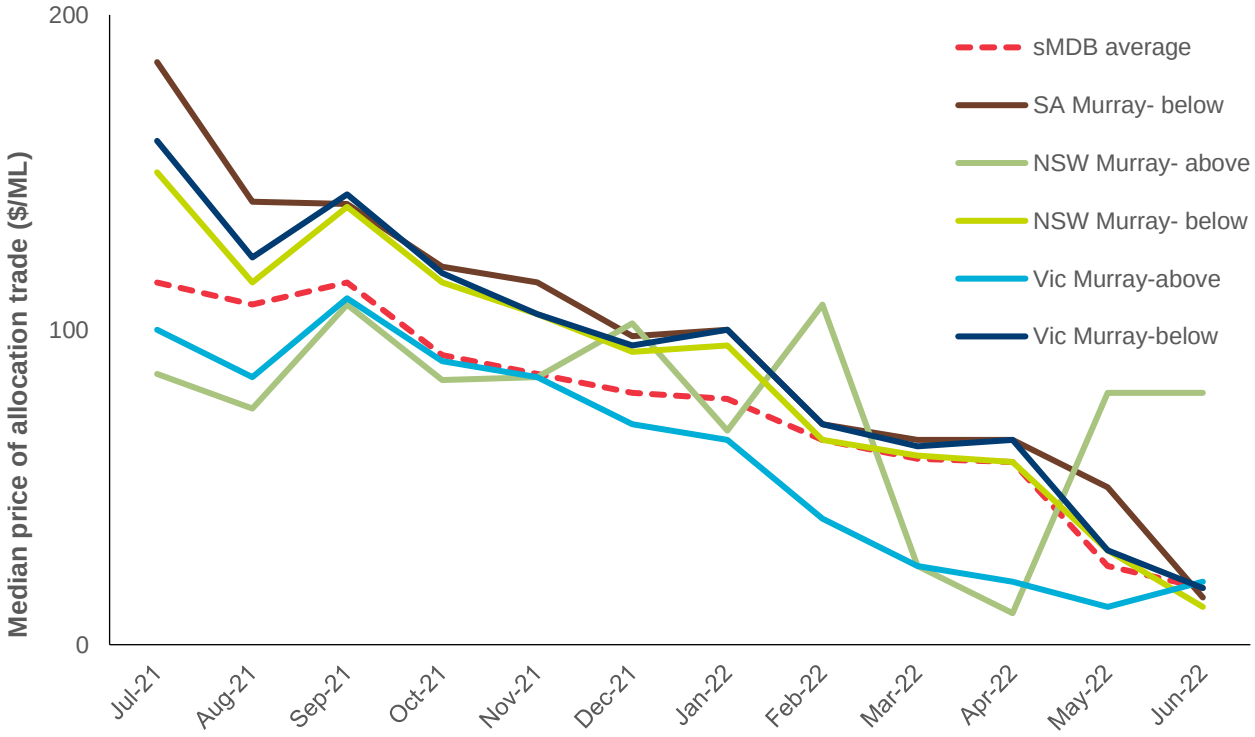


Figure 5.8 Allocation prices upstream to downstream of the Barmah Choke, the southern MDB, 2021–22.

How does the Murrumbidgee Intervalley Trade (IVT) limit affect water trades?

The Murrumbidgee IVT is the net balance of water that can be traded between the Murrumbidgee and the New South Wales Murray, New South Wales Lower Darling, Victorian and South Australian Murray water systems. The Murrumbidgee IVT limits trade from the Murrumbidgee water system to a balance between 0 and 100 GL. A maximum volume of 100 GL is applied due to the volume of water that can be physically transferred out of the Murrumbidgee via Balranald in one year without incurring excessive transmission losses. When the Murrumbidgee IVT balance reaches 100 GL, trade out of the Murrumbidgee is closed and reopens when the IVT balance reduces to 85 GL (WaterNSW 2019).

Trade out of the Murrumbidgee water system was closed during 2021–22, apart from a brief period in November 2021 (NSW DPIE 2022). With the Murrumbidgee system separated from the southern MDB water market, the combination of high water availability and the prevalence of lower margin seasonal crops grown in the Murrumbidgee saw water prices track below average prices for the southern MDB for most of 2021–22. Murrumbidgee prices were nearly $50 per ML less, or 80% below the Southern MDB average in March 2022 (Figure 5.9).

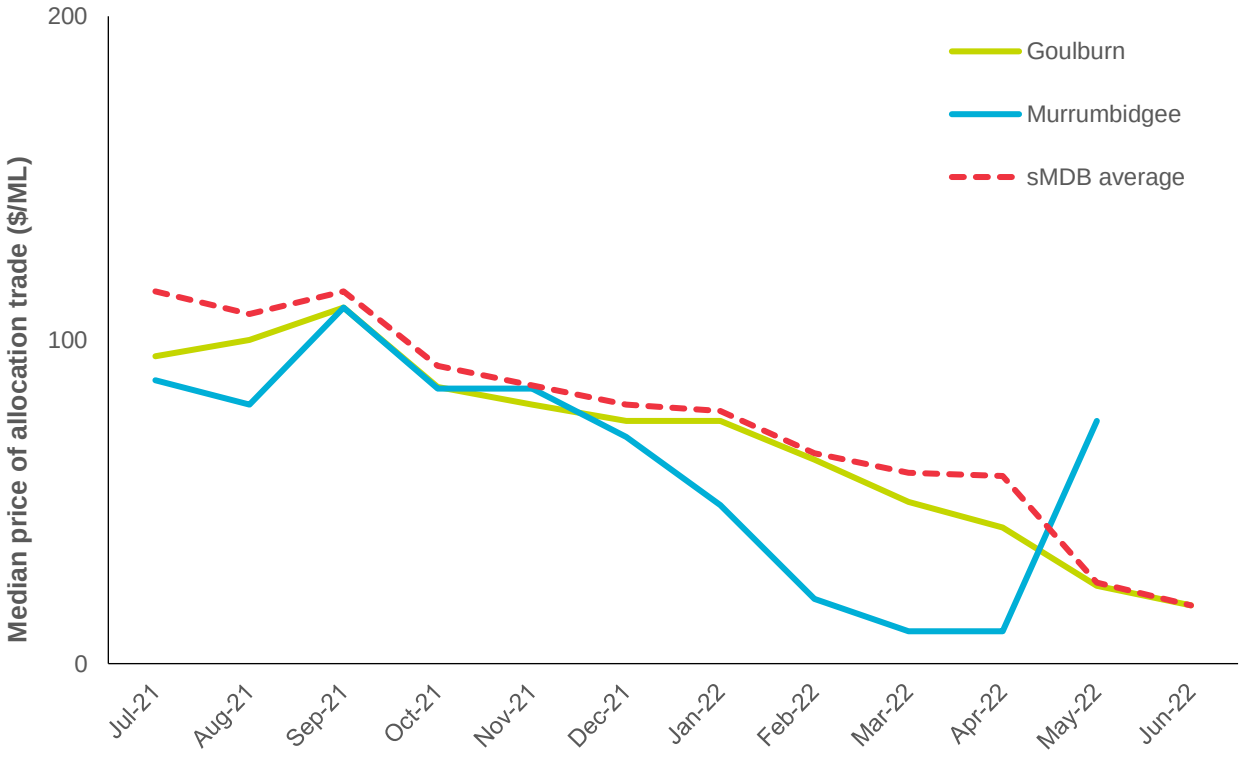


Figure 5.9 Impact of IVT Murrumbidgee and Goulburn limits on allocation prices (monthly median), 2021–22.

How does the Goulburn IVT limit affect water trades?

The Goulburn IVT is the net water balance of water that can be traded between the Goulburn, Loddon, Broken and Campaspe systems and the Murray system. The Goulburn IVT balance is limited to between 0 and 200 GL, with the upper limit introduced so that the volume stored in dams could supply Victorian Murray and Goulburn entitlements and the increasing commitment to meet large volumes of trade between Victorian water systems and the Murray did not adversely impact on storage levels (DELWP 2021).

Trade from the Goulburn, Campaspe, Broken and Loddon systems to other water systems is limited when the IVT Goulburn balance exceeds 200 GL. The upper limit of the Goulburn IVT was reached in July 2021, with trade out of the Goulburn restricted until May 2022, apart from a very limited period in November and December 2021. With high water availability across the southern MDB and lower demand in the Goulburn compared to the Victorian Murray and New South Wales Murray, trade restrictions contributed to allocation prices in the Goulburn tracking lower than the southern MDB average for most of 2021–22 (Figure 5.9).

How does the New South Wales to Victoria trade limit affect water trades?

The New South Wales to Victoria trade limit is designed to protect allocations to Victorian Murray entitlement holders. Victoria has limited storage space in the Victorian share of Dartmouth and Hume dams to store water traded in from New South Wales. If Victoria cannot store that water, it may 'internally spill' to the New South Wales share of the storage or down the river. This would mean less water available for Victorian Murray entitlement holders. The New South Wales to Victoria trade limit restricts allocation trade from New South Wales to Victoria to the lesser of 200 GL net annual volume or a volume that keeps the risk of spill in Victoria's share of the Murray system to below 50% (DELWP 2019). From July 2021 to March 2022, there were trading opportunities available from New South Wales to Victoria, mainly due to a lower risk of spill for Darthmouth Dam. From April to June 2022, the risk of spill in the Murray system was greater than 50%, resulting in trade from New South Wales to Victoria being restricted (NVRM 2022).

5.2. Surface water allocation markets – northern MDB

In 2021–22, the northern MDB recorded 623 surface water allocation trades (transactions) totalling 319 GL, including environmental allocation trades. The northern MDB surface water trades accounted for 4% of the total volume of national allocation trades (similar to the previous year) and 2% of the total number of trades. In 2021–22, trade volumes decreased by 9% compared to 2020–21.

Allocation prices can differ significantly across the northern MDB as hydrological connection between water systems is limited and the headwaters are geographically dispersed, resulting in larger differences in allocations.

Price data from the northern MDB are not as comprehensively available as for the southern MDB, however lower prices compared to 2020–21 were reported in most catchments were indicative of

the continued high availability of water in many parts of the northern MDB during 2021–22 (Figure 5.10).

Figure 5.10 Allocation trade volumes and average price (commercial trades), northern MDB, 2021–22.

5.3. Groundwater allocation markets – MDB

In 2021–22, there was 116 GL of groundwater allocation trade across the MDB (Figure 5.11); 32% lower compared to the previous year. Murrumbidgee Alluvium accounted for the largest volume of groundwater allocation trade in Australia and 44% of allocation groundwater trading in the MDB. Groundwater trading only made up 1% of the total volume of allocation trades for the MDB in 2021–22, 1% less than the previous year (Table 5.1). The decline in volumes of groundwater allocations traded is likely to reflect the increased availability of surface water in 2021–22.

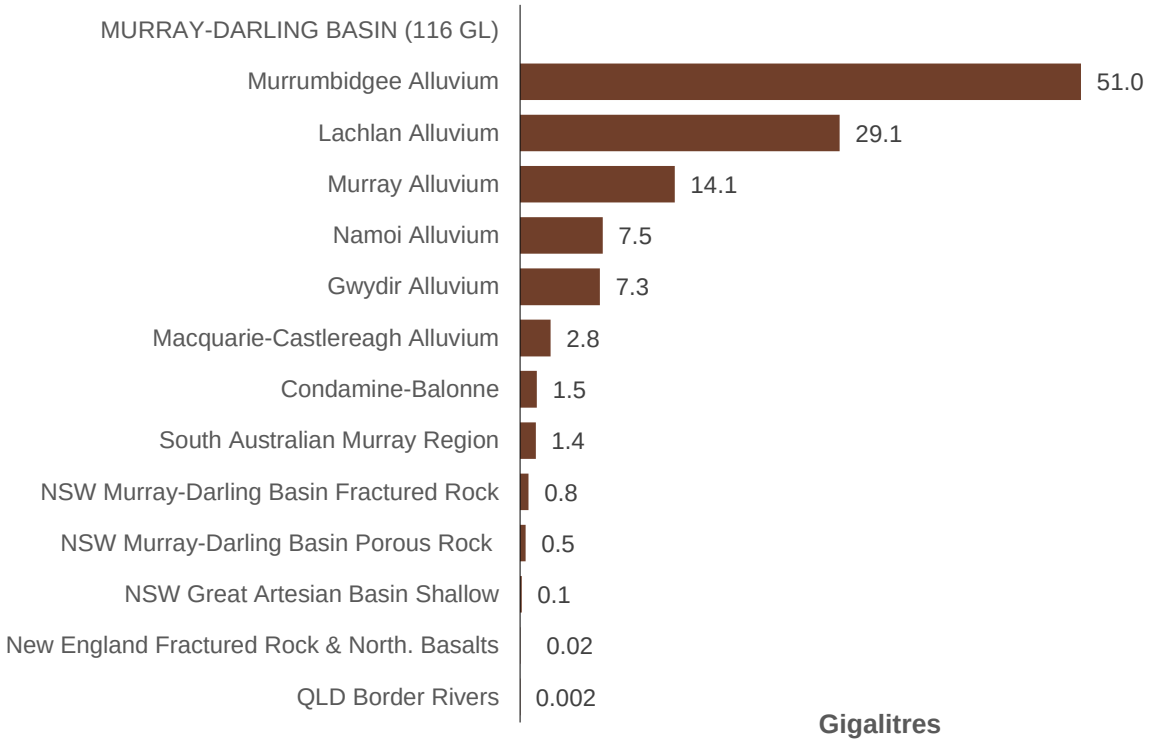


Figure 5.11 Allocation trade volume by groundwater system, MDB, 2021–22.

Similar to previous years, there is only a limited amount of allocation price data available for groundwater in 2021–22, notwithstanding the low number of trades undertaken, and there were gaps in trade prices reported (Table 5.1). Allocation prices varied significantly between groundwater systems, from $160 per ML paid in the Gwydir Alluvium to $14 per ML in the Condamine–Balonne (Figure 5.12). This variation is expected given the isolated nature of each groundwater system with different market demand and supply factors, and individual trades being able to influence average prices where few trades occur.

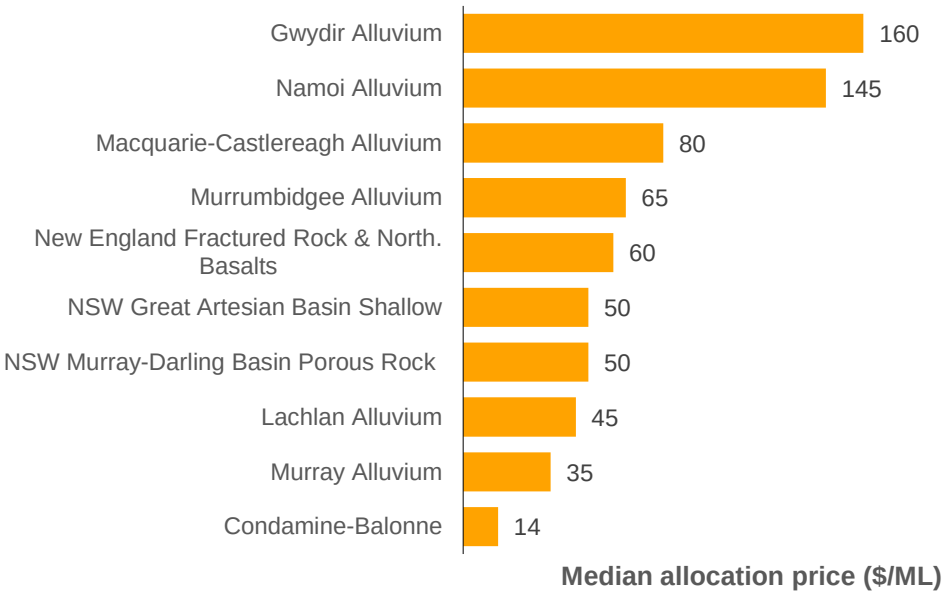


Figure 5.12 Median allocation price for groundwater systems, MDB, 2021–22.

The variation of price and traded volumes in the largest groundwater allocation market in Australia—Murrumbidgee Alluvium—is shown in Figure 5.13. The decline in allocation prices of groundwater after January 2020 is likely due to higher availability of surface water which is often cheaper to access compared to pumping groundwater and can be more freely traded. Groundwater allocations can only be traded within connected aquifers, so prices depend on demand for water within an individual groundwater management area.

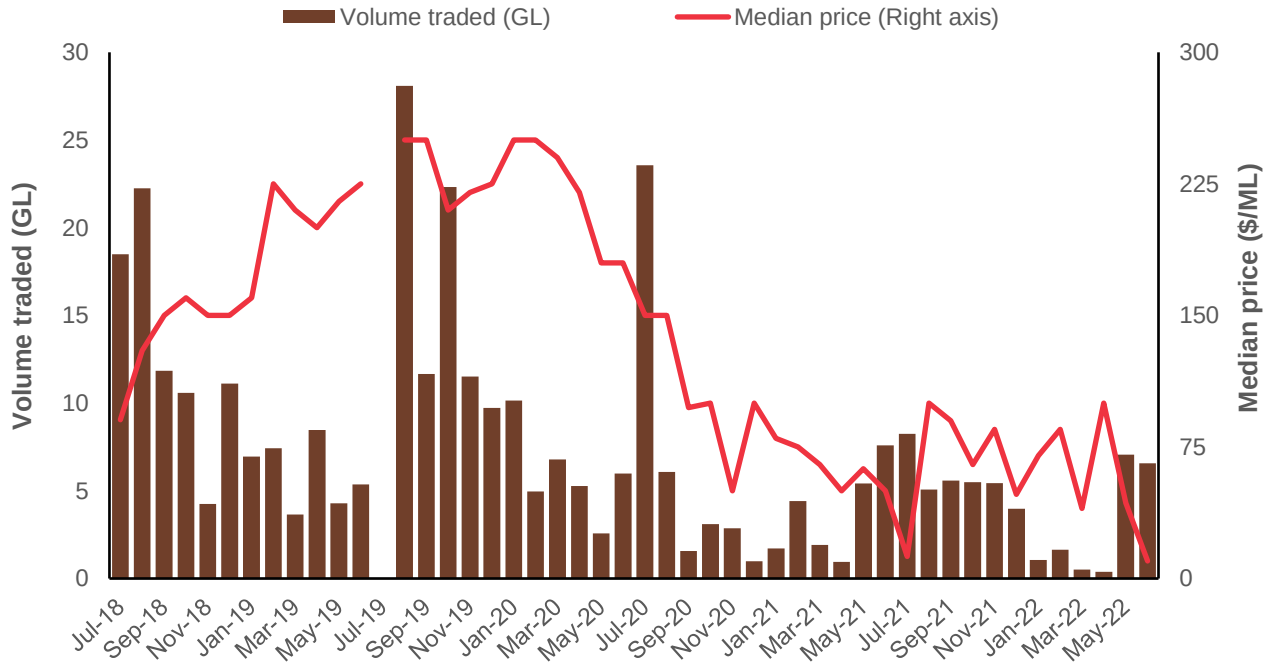


Figure 5.13 Median allocation price and traded volume for the largest groundwater allocation market—Murrumbidgee Alluvium—for the last 4 water years, 2018–22 (no trade was recorded in July 2019).

5.4. Allocation markets – rest of Australia

Despite some regions throughout the rest of Australia having substantial volumes of entitlements on issue (Figure 3.1), high volumes of water trade and the number of trade transactions are limited to a few water systems. Water systems that did engage in allocation water trade in 2021–22 tended to have a greater volume of regulated surface water. Outside of the MDB, the region with the largest volume of allocation trade in 2021–22 was the Fitzroy Basin in Queensland (68GL) followed by the Barron Basin (32 GL) (Figure 5.14).

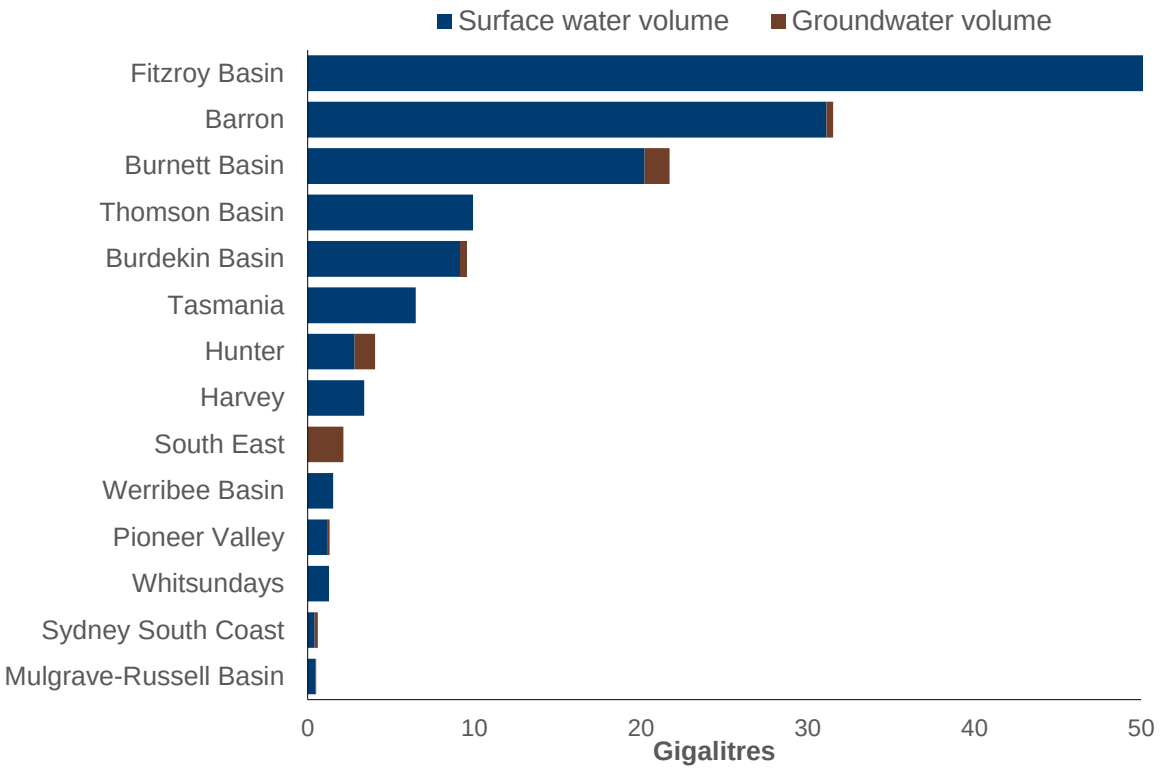


Figure 5.14 Allocation trade volume, rest of Australia, by resource type and water system, 2021–22 (shows only management areas with a quantity traded more than 0.5 GL).

Price data are not available for most regions outside of the MDB. Therefore, results for all the water systems shown in Figure 5.15 are based on limited price data. In 2021–22, reported median allocation prices were highest in Tasmania with $1,200 per ML (with 6,476 ML traded), followed by Adelaide and the Mount Lofty Ranges (Groundwater) averaging $984 per ML (with 453 ML traded).

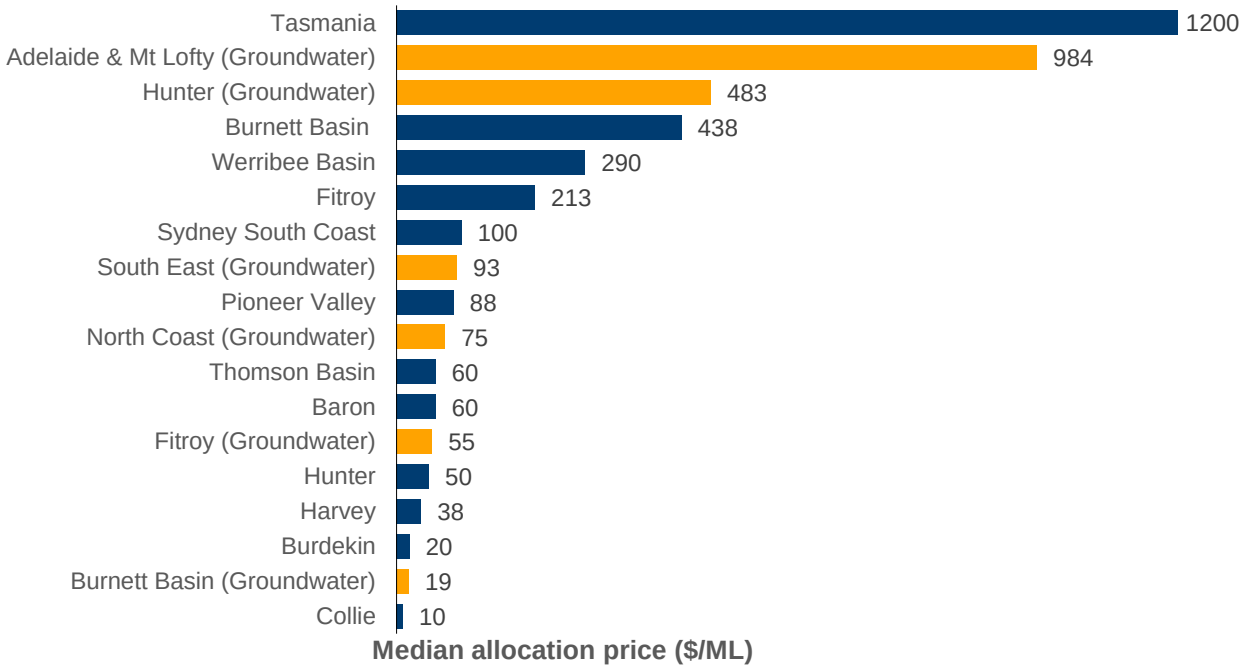


Figure 5.15 Median water allocation price by water system, rest of Australia, 2021–22.

6. Entitlement markets in 2021–22

Water trade volume and prices in entitlement markets are driven by several longer-term supply-side factors and water demand-side factors as detailed in Chapter 4. There was 1,323 GL of entitlement trade that occurred across Australia in 2021–22, a 48% decrease compared to the previous year (Table 6.1).

Table 6.1 Entitlement trade summary, 2021–22

Region	Resource type	Transactions	Trades with market rate price reported (%)[1]	Volume (GL)	Estimated Turnover ($m)[2]
Southern MDB	Surface water	4,703	55	477	1,580
Northern MDB	Surface water	414	39	305	1,350
Groundwater MDB	Groundwater	714	34	153	430
Rest of Australia	Surface water	2,039	14	198	410
	Groundwater	1,383	14	190	180
All Australia	**Surface and Groundwater**	**9,253**	**38**	**1,323**	**3,950**

[1] Entitlement trade market rate price involved transactions with a reported price above $50/ML and below $20 000/ML
[2] For the turnover estimate calculations, refer to section 5.

The volume of entitlement trade in Australia has grown since 2008–09 (Figure 6.1). Surface water trade continued to dominate, accounting for 74% (980 GL) of entitlement trade in 2021–22. In 2021–22, the total volume of entitlement trade was down 48% on the previous year, which was largely a result of a decrease in the surface water entitlement trades in the southern MDB. However, this decrease followed a spike in 2020–21.

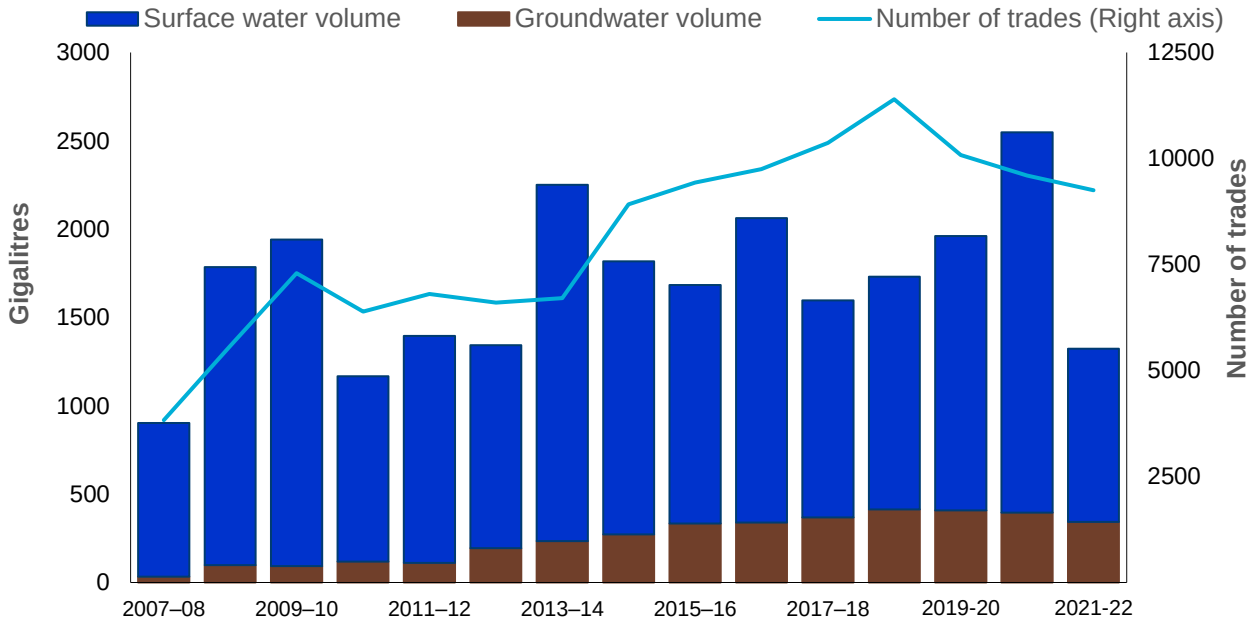


Figure 6.1 Volume and number of entitlement trades, Australia, by source, 2007–08 to 2021–22.

Between 2007–08 and 2021–22, there have been 3 notable spikes in the volume of surface water traded in the southern MDB (Figure 6.2). During 2008–10 and 2013–14 there was a significant increase in the volume of water traded to the Commonwealth as part of the *Murray–Darling Basin Plan* water recovery. The 2008–10 water recovery was predominantly achieved through direct purchase, however, in 2013–14 recovery was associated with infrastructure upgrades. In 2020–21, the volume of surface water entitlement trades in the southern MDB increased by over 100% compared to 2019–20 mostly attributed to a few large transactions in the Murrumbidgee system associated with property sales.

Most of the entitlement trades within the MDB are attributed to surface water, with only 16% of the basin's entitlement trades in 2021–22 related to groundwater. The volume of entitlement trades for surface water outside the MDB decreased by 28% compared to the previous year. There has been an upward trend in the volume of entitlement trades outside of the MDB as new water markets have expanded.

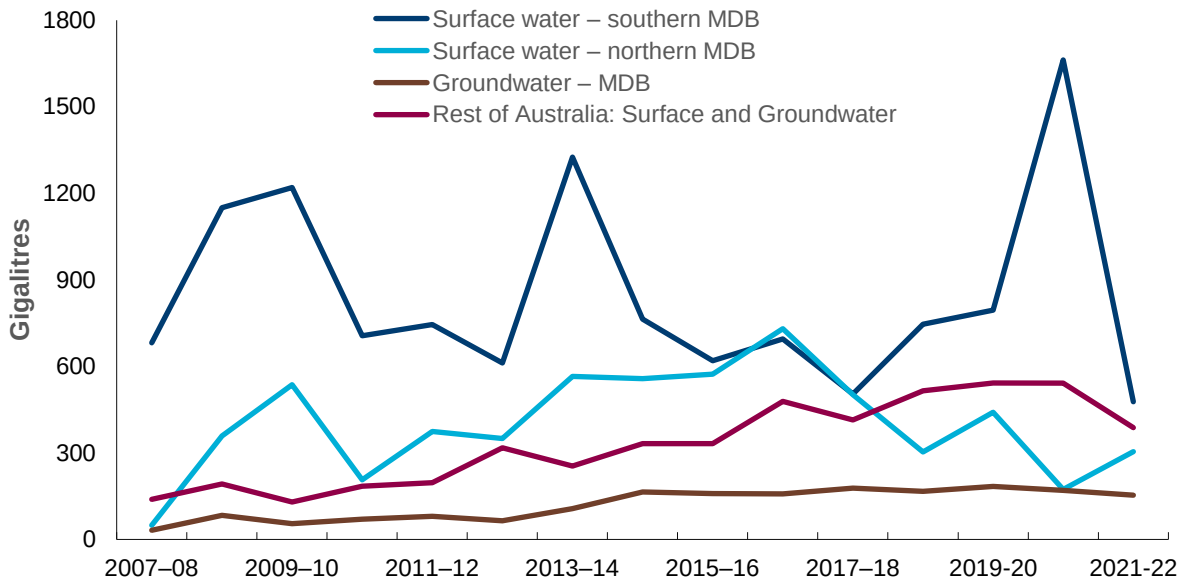


Figure 6.2 Volume of water entitlement trade, Australia, 2007–08 to 2021–22.

A measure of how prevalent entitlement trading has become is called entitlement trading intensity. This shows what proportion of entitlements on issue were traded one or more times during 2021–22 (Figure 6.3). Trading intensity of entitlement trade was 3% nationally in 2021–22, down by 3% compared to the previous year, which was largely attributed to the southern MDB with 4% trade intensity compared to 12% in 2020–21.

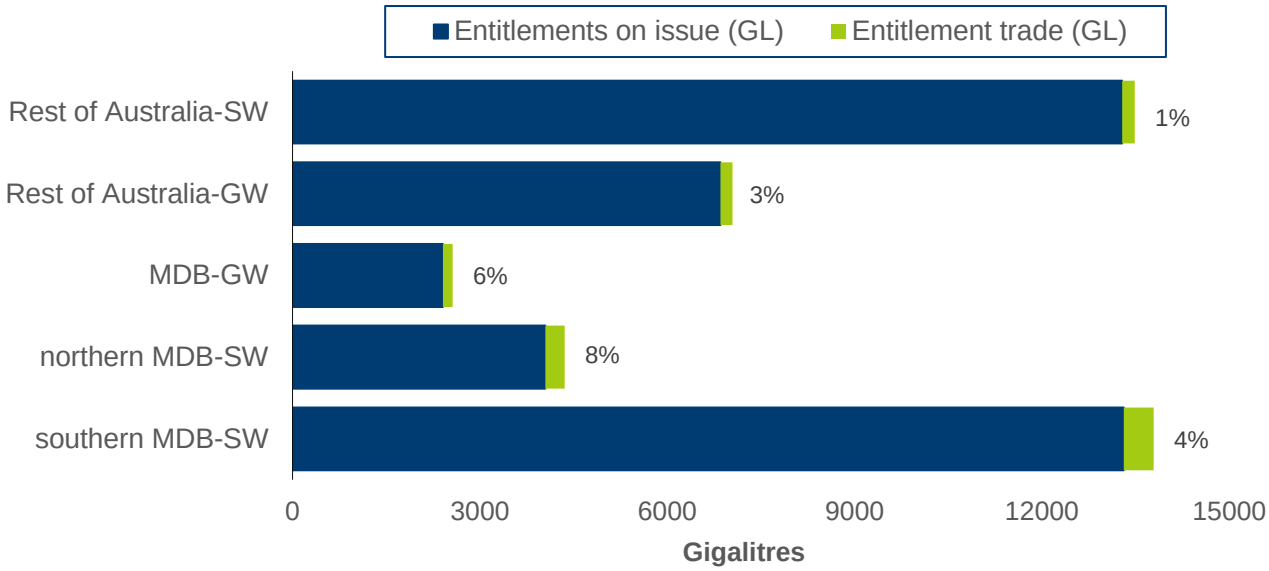


Figure 6.3 Entitlement trading intensity, Australia, 2021–22 (per cent of entitlements issue volumes that were traded).

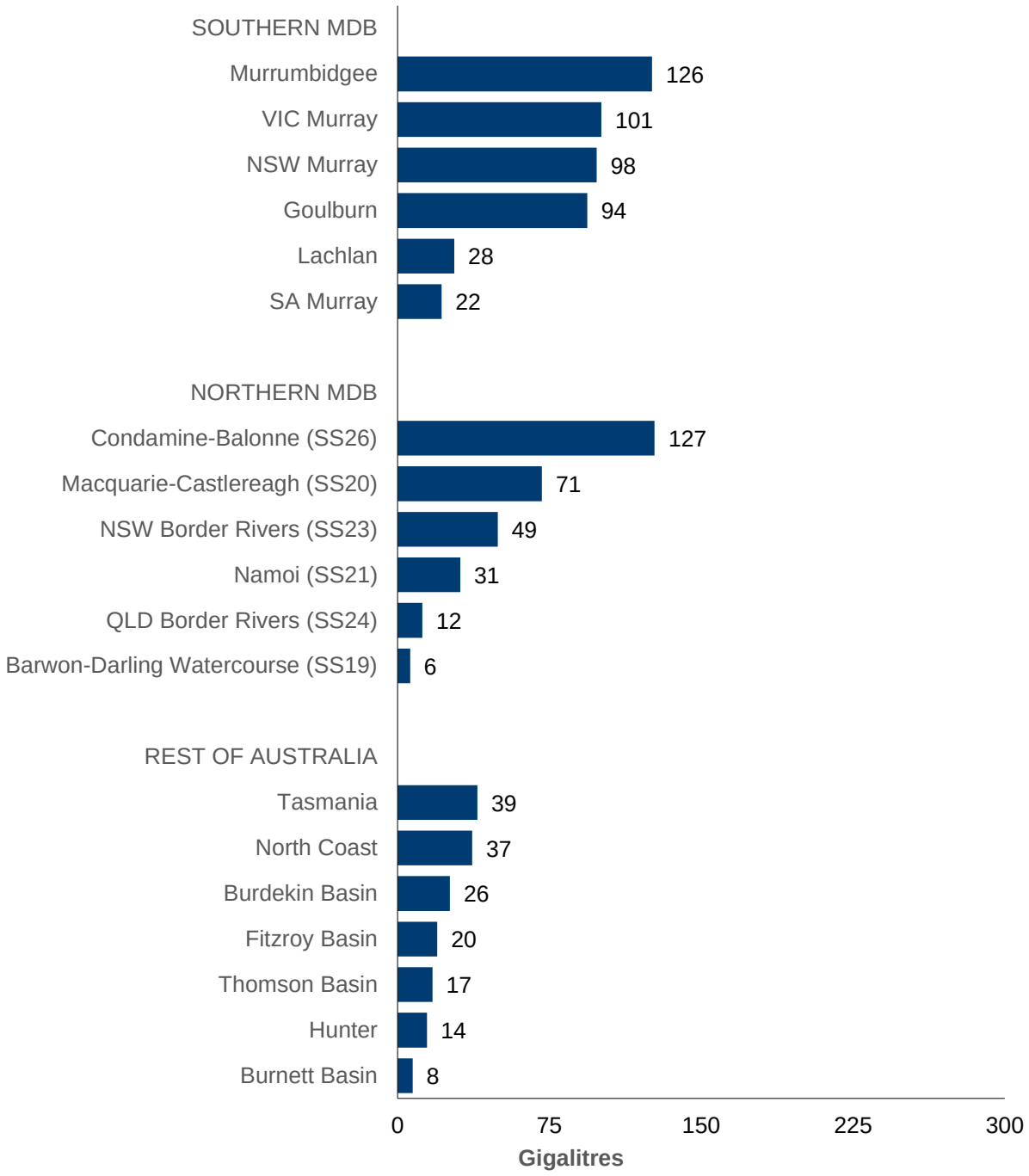


Figure 6.4 Volume of surface water entitlement trade, by water system, Australia, 2021–22 (shows only water systems with entitlement trade volumes greater than 5 GL).

Figure 6.4 shows the volume of entitlement trade for the MDB and the rest of Australia. The largest entitlement market was the Condamine–Balonne followed by Murrumbidgee, the Victorian Murray and New South Wales Murray in the southern MDB. Among water systems outside of the MDB, Tasmania, North Coast (New South Wales) and Burdekin Basin were the largest. It is evident that there is an increasing participation in water trading in systems outside of the MDB.

Figure 6.5 shows median surface water entitlement prices have generally increased in both the southern and northern MDB since 2007–08. Consecutive years of limited water availability between 2015–16 and 2019–20 put upward pressure on entitlement prices. Increasing water availability in 2020–22, particularly in the southern MDB, has slowed the upward trend in prices.

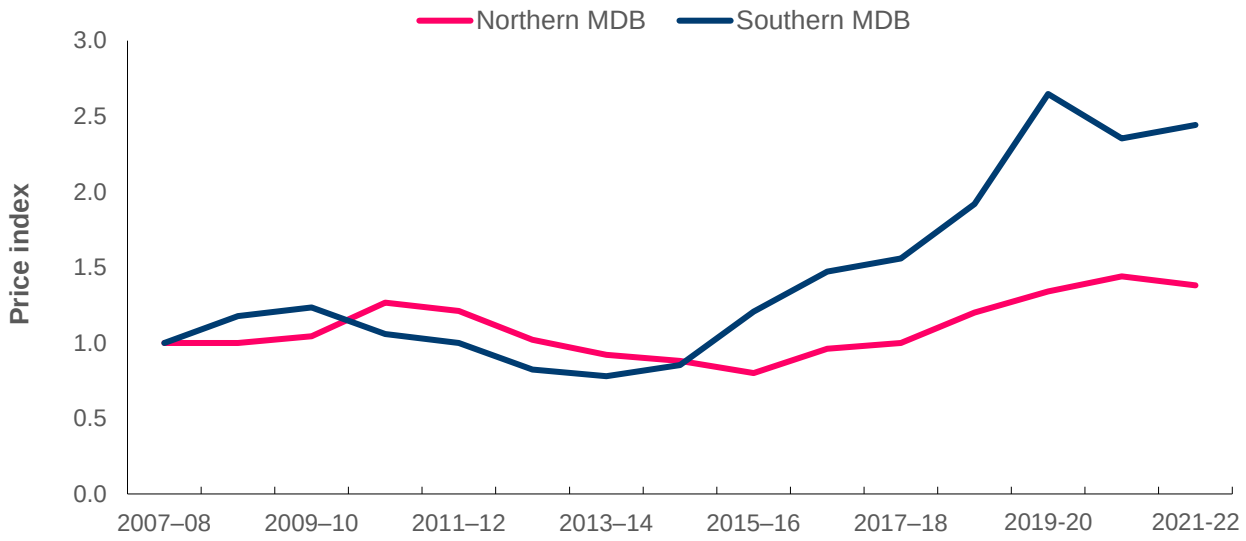


Figure 6.5 Median price indexes for surface water entitlement trade in the MDB, 2007–08 to 2021–22 (indexed against 2007–08).

6.1. Surface water entitlement markets – southern MDB

Surface water trade in the southern MDB is the largest component of entitlement trade in Australia in terms of both volume and number of trades. As shown in Figure 6.6, spikes in volume in 2008–09, 2009–10 and 2013–14 reflected years where there were significant volumes of water traded to the Commonwealth as part of *the Murray–Darling Basin Plan* water recovery. The spike in 2020–21 was due to a few large transactions associated with property sales in the Murrumbidgee system. If these spikes are removed from historical surface water entitlement trend data, the volume of surface water entitlement trade in the southern MDB has continued to be in the same range since 2007–08. There was 477 GL of surface water entitlement trade in the southern MDB in 2021–22, which was 36% of the total entitlement market in Australia for the year (Table 6.1). The southern MDB recorded significant surface water entitlement trade in the Murrumbidgee, followed by the Victorian Murray, New South Wales Murray and Goulburn systems.

In 2021–22, the price index of surface water entitlements in the southern MDB was over 140 per cent higher compared to 2007–08 (Figure 6.6). As discussed in Section 4.2, several factors could have contributed to this price increase, most notably the increased value of irrigated crops, which drives demand for irrigation water in the southern MDB. The area planted to cotton and nut trees has expanded in the Murrumbidgee and the Lower Murray, respectively, in recent years further driving competition for water. As discussed in Section 4.1, a growing recognition of long-term climate trends including decreasing rainfalls may also be driving entitlement price increases.

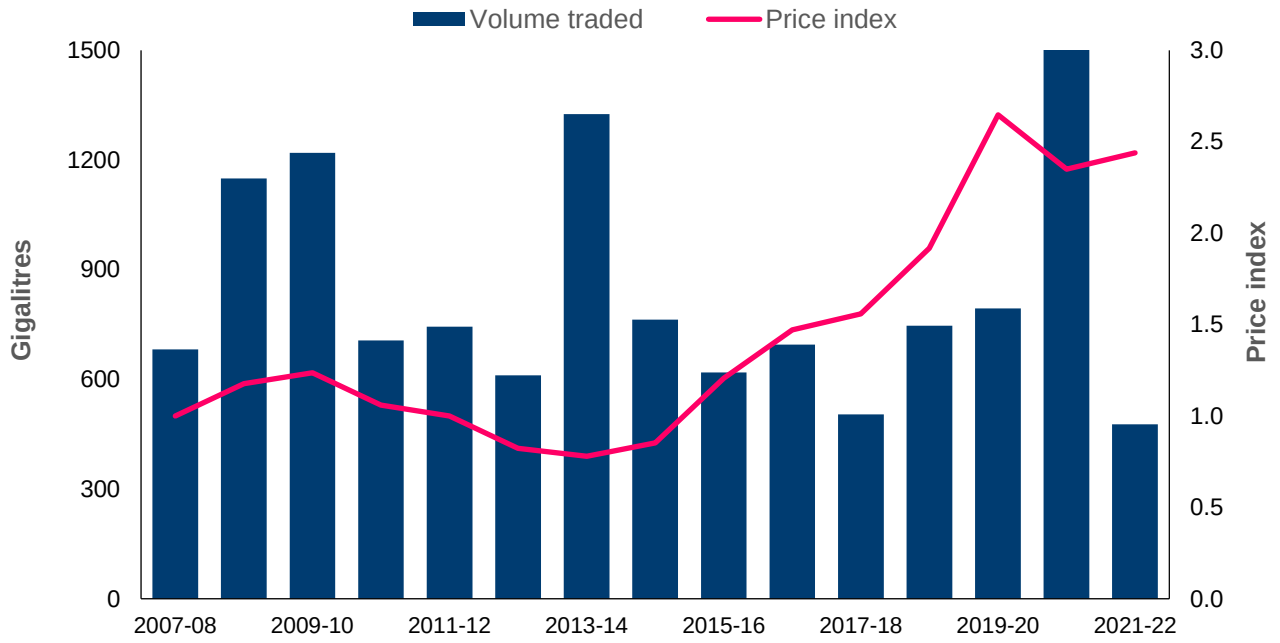


Figure 6.6 Entitlement trade volume and price index for southern MDB, 2007–08 to 2021–22.

Water entitlement prices are specific to water systems, resource types and reliability classes. Figure 6.7 shows that better water reliability leads to higher prices. As a result, high reliability prices are higher than general reliability prices and general reliability prices are higher than low reliability prices. Prices of individual entitlement types are also affected by the location of the entitlement, catchment-specific rules, carryover rights that the entitlement affords, trade restrictions, and the value of crops grown in specific regions. In 2021–22, median entitlement prices reached record highs in all major water systems and reliability classes in the southern MDB, except for Goulburn high security which was just below its 2019–20 record. Overall demand for securing water for high value crops such as horticulture remained strong in 2021–22 putting upward pressure particularly on high reliability entitlement prices. For general security and low reliability entitlements, high prices reflect increased allocations against these entitlements and/or the value of being able to carryover water between water years.

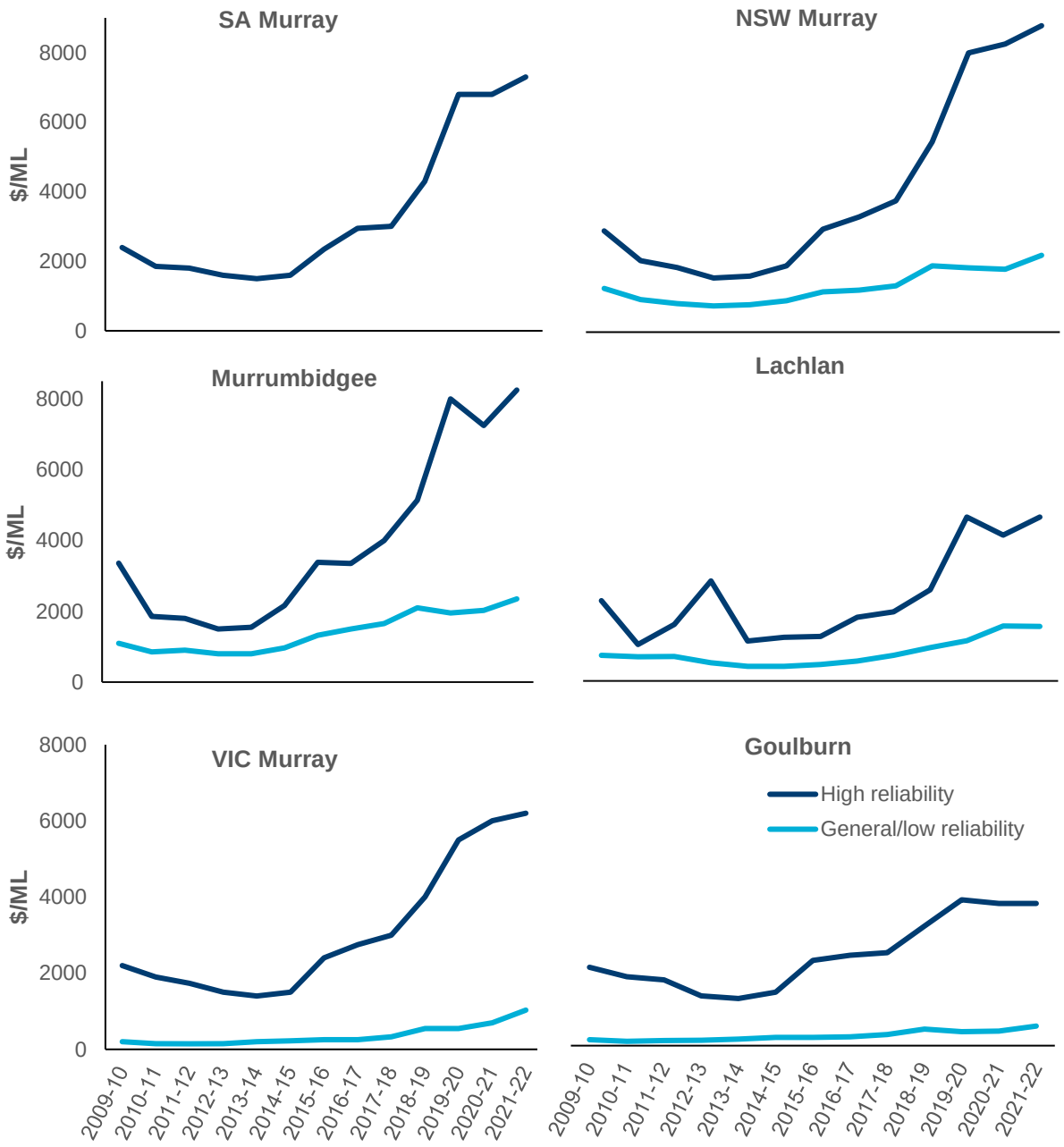


Figure 6.7 Median entitlement prices for high and general/low reliability classes for selected water systems, 2009–10 to 2021–22.

6.2. Surface water entitlement markets – northern MDB

The volume of water in surface water entitlement trade in the northern MDB has grown since 2007–08, however volumes traded have dropped off since a peak in 2016–17 (731 GL). Trade in 2021–22 increased from 174 GL in the prior year to 305 GL. Despite increased water availability in 2020–21 and 2021–22, buyer confidence in entitlement trading is still recovering following several years of limited water availability and low or zero water allocations (Figure 6.8). Condamine–

Balonne overtook Macquarie–Castlereagh as the largest surface water entitlement market in the northern MDB in 2021–22 (Figure 6.4).

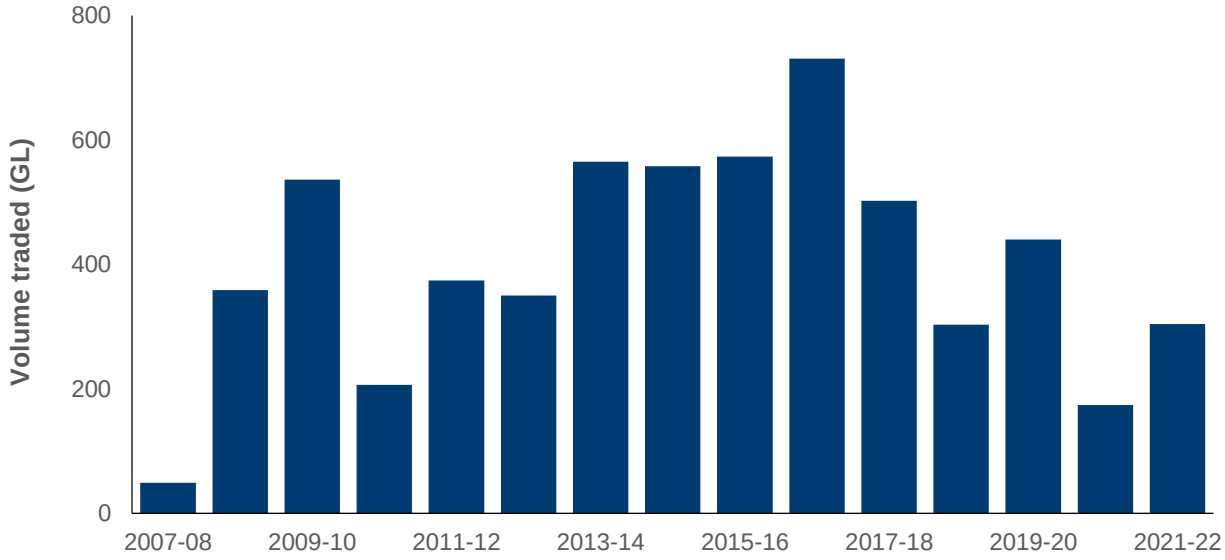


Figure 6.8 Entitlement trade volume for surface water, northern MDB, 2007–08 to 2021–22.

Median prices for surface water entitlements were similar between water systems in the northern MDB for 2021–22. High security entitlements prices ranged from $5,000 per ML in New South Wales Border Rivers to $5,625 per ML in Macquarie–Castlereagh. Medium security entitlements ranged from $2,680 to $2,800 per ML across the northern MDB, with prices for general security entitlements varying from $2,000 to $4,680 per ML (Figure 6.9).

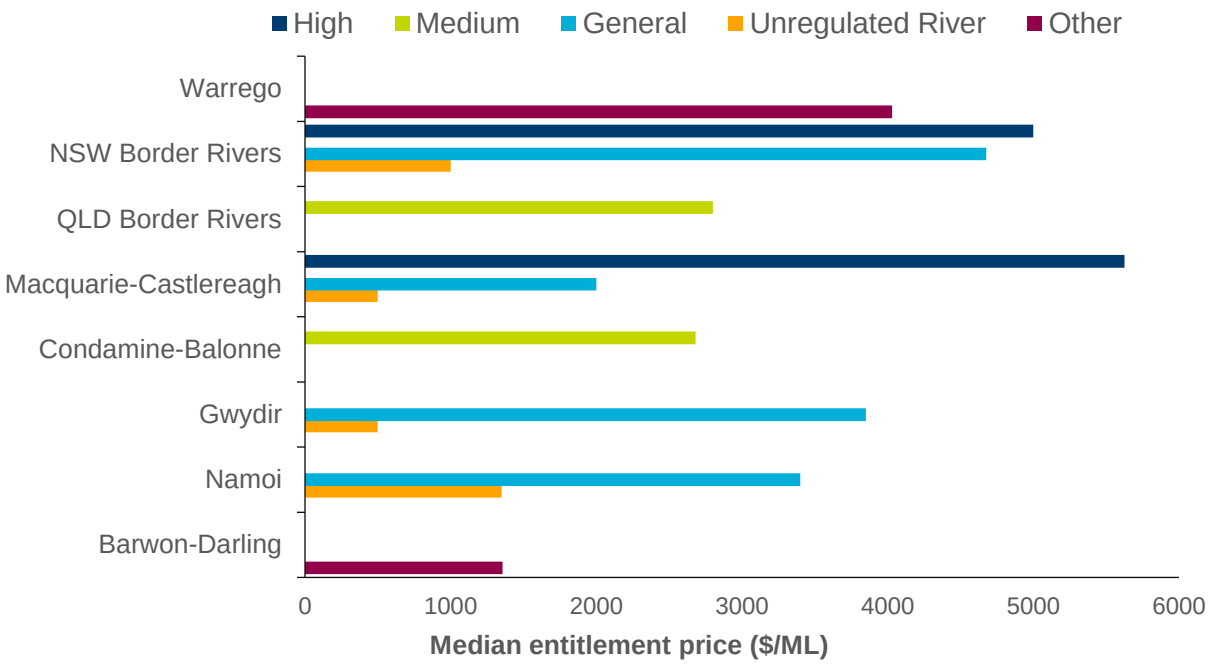


Figure 6.9 Median water entitlement price, northern MDB, by water system, water resource and reliability class, 2021–22.

6.3. Groundwater entitlement markets – MDB

Despite trading limitations associated with groundwater resources (see the information box on limiting potential negative impacts of trading in Section 2.3), the trading of groundwater entitlements has steadily expanded since 2007–08 in the MDB both in terms of volume and number of trades (Figure 6.10). This upward trend is likely to be in part due to structural changes in agricultural businesses associated with buying and selling of land and water entitlements. In 2021–22, 153 GL of groundwater entitlement trade occurred in the MDB, representing 16% of total entitlement trade in the MDB; a small overall volume decline compared to the previous year.

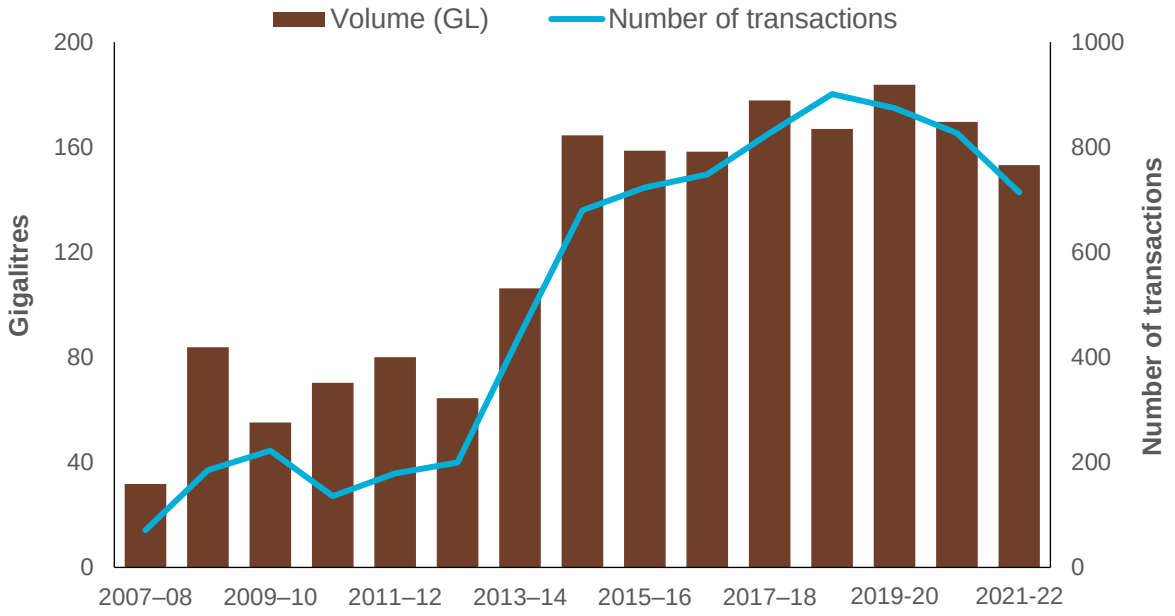


Figure 6.10 Groundwater entitlement trades, volume and number, MDB, 2007–08 to 2021–22.

Most entitlements in terms of water volume were traded in the Goulburn–Murray, Murrumbidgee Alluvium and Lachlan Alluvium groundwater systems (Figure 6.11), reflecting where most groundwater entitlements are issued (Figure 3.4).

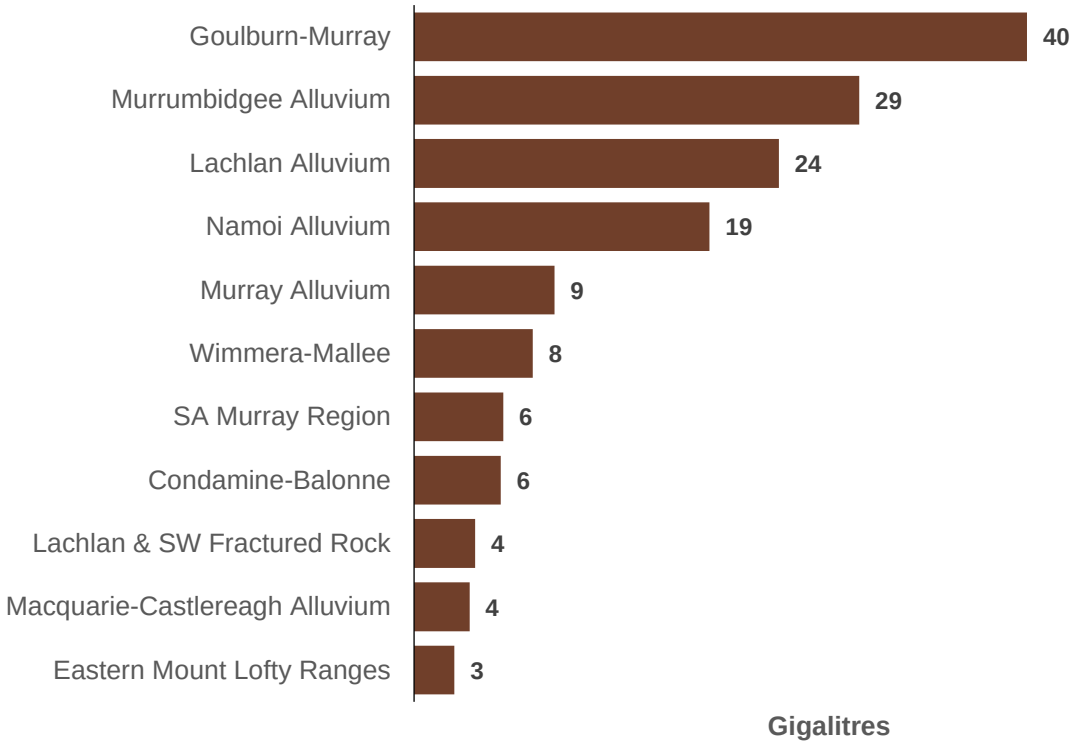


Figure 6.11 Entitlement trade volume, by groundwater system, MDB, 2021–22.

Like groundwater allocation trades, there is significant variation in the median price of groundwater entitlement trades in each groundwater management area (Figure 6.12). Entitlements were traded for an average price of around $13,300 per ML in the Condamine–Balonne compared to $1,000 per ML in the Goulburn–Murray groundwater system in 2021–22.

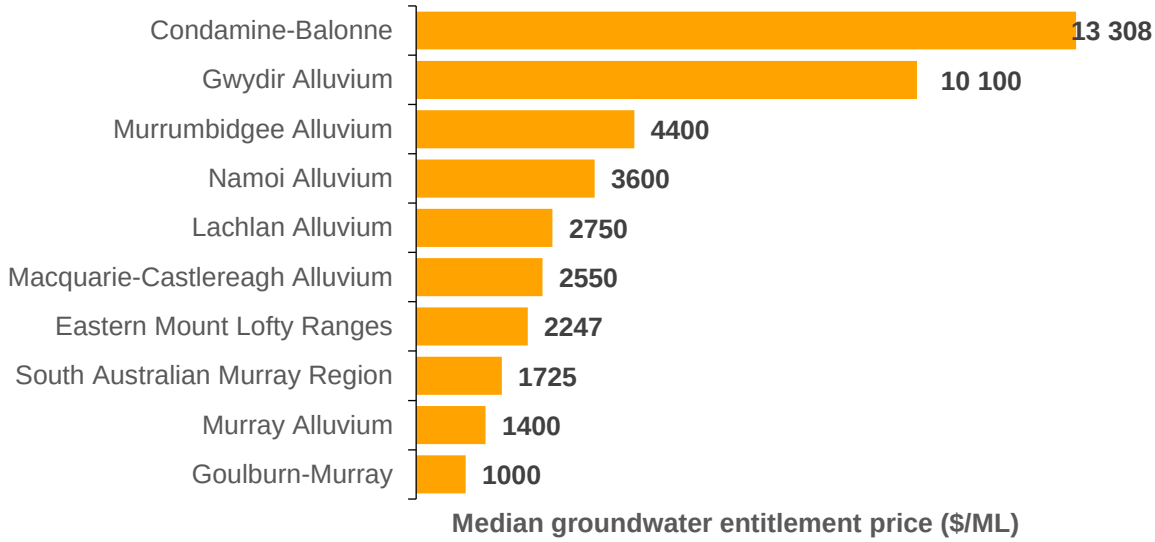


Figure 6.12 Entitlement trade price for major groundwater systems, MDB, 2021–22.

6.4. Entitlement markets – rest of Australia

In regions outside the MDB, surface water and groundwater entitlement trading is slowly expanding (Figure 6.13). In 2021–22, total surface water and groundwater entitlement trade outside of the MDB accounted for 388 GL or 29% of entitlements traded nationally (Table 6.1). For surface water, the most significant activity outside the MDB was in Tasmania, North Coast (New South Wales) and the Burdekin systems in 2021–22 (Figure 6.4).

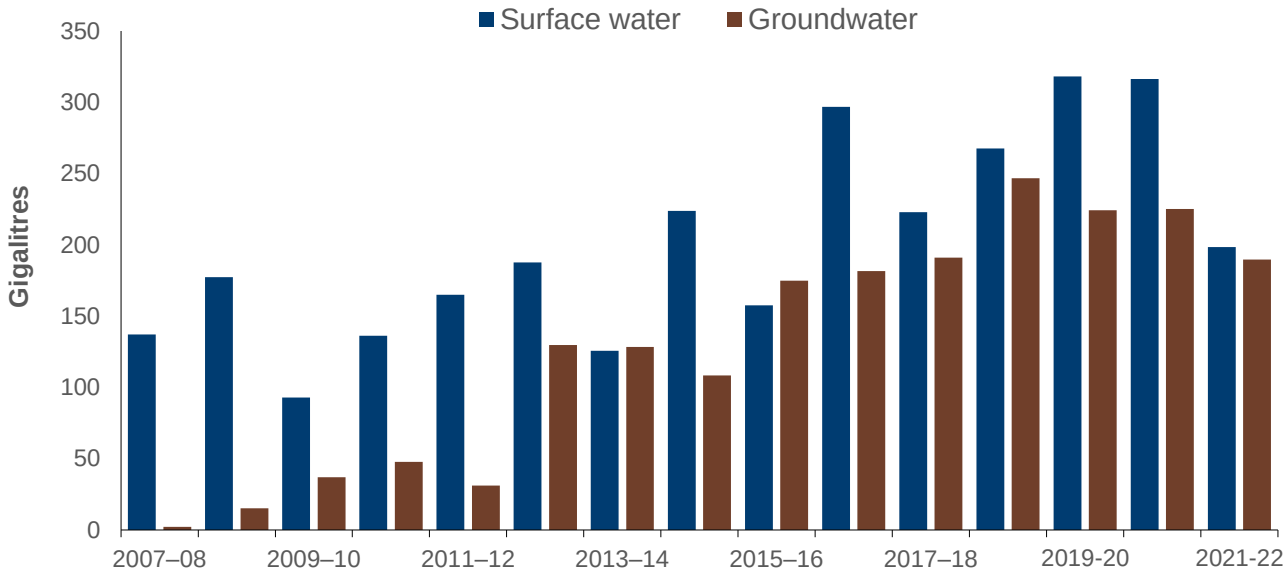


Figure 6.13 Entitlement trades, rest of Australia, by resource type, 2007–08 to 2021–22.

One region that continues to have significant groundwater entitlement trade is the south east region of South Australia (Figure 6.14). This expansion coincides with the release of the *Lower Limestone Coast Allocation Plan* in 2016 which allows trades between some management areas (Waterfind 2018).

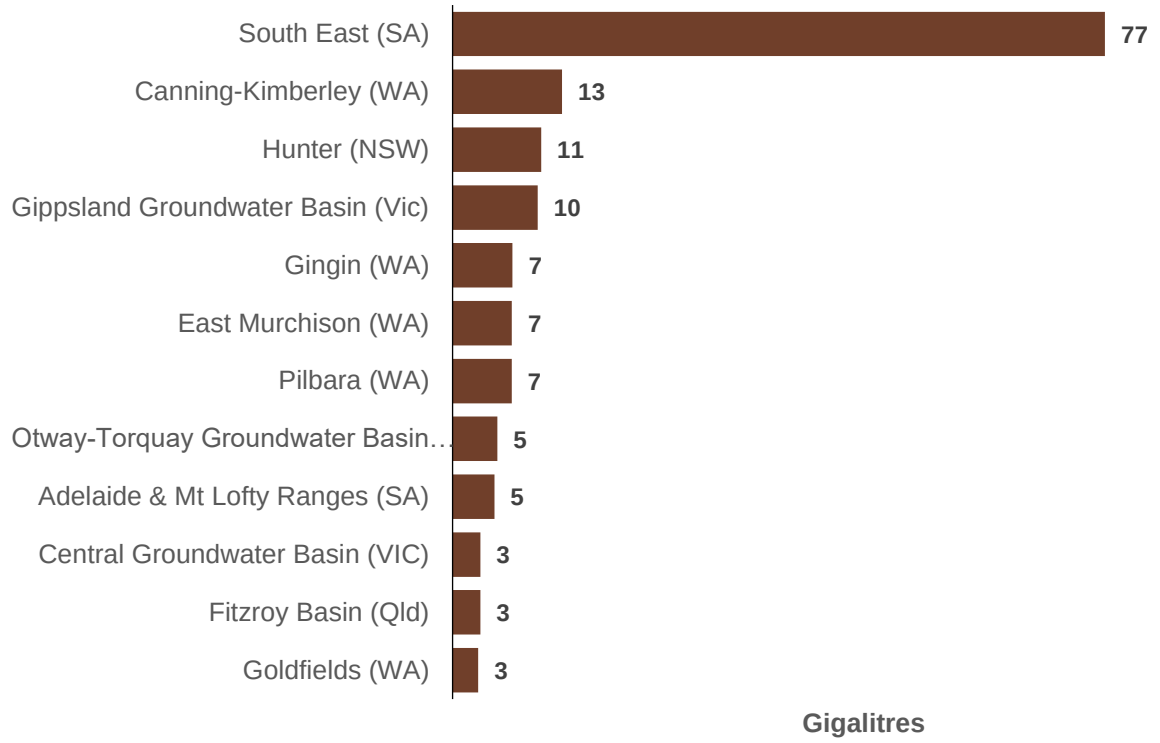


Figure 6.14 Entitlement trade volume, by groundwater system, rest of Australia, 2021–22.

In 2021–22, Queensland recorded the highest volume of total surface and groundwater entitlement trade outside the MDB of 85 GL (including water licence trades), followed by South Australia. South Australia and Western Australia recorded a high proportion of groundwater entitlement trades in 2021–22, reflecting the reliance on groundwater in these areas (Figure 6.15).

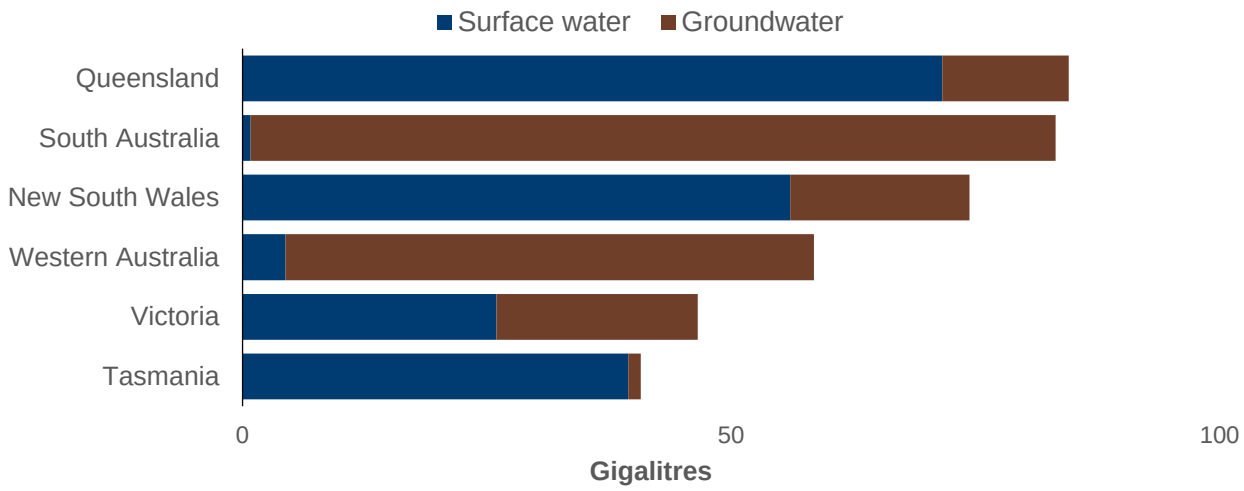


Figure 6.15 Entitlement trade volumes, rest of Australia, by resource type and state, 2021–22.

Reliable entitlement price data were not available for many water systems outside of the MDB. Only 14% of surface water and groundwater trades were reported with a market rate price in 2021–22. Most trades either had $0 or no price reported, or a price of >$20,000 per ML, which is likely to

include the price of the land and water in a property sale transaction. Entitlement trade price reporting decreased compared with the previous year in terms of the percentage of transactions reported with a market rate price. This shows there is still a need to more readily differentiate arm's length market transactions from related party transfers, gifts and trades involving water and land. This differentiation will support water trade price discovery for market participants.

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