RMCG

Drought Resources Package

Greater Shepparton City Council
September 2021

1 Introduction

There will always be times of drought and so preparing for the inevitable is far better than a crisis response. Drought is all about managing variability and particularly managing with reduced rainfall and/or irrigation allocations. So, understanding irrigation supply and climate variability and its impact on the price of entitlements and allocations is critical to drought responses.

There are several agricultural industries within the Goulburn Valley, and each of these industries will respond in different ways to drought. The major agricultural industries can be grouped into:

i. Dryland crops
ii. Dryland livestock
iii. Irrigated crops
iv. Irrigated pastures for livestock
v. Dairy (irrigated)
vi. Horticulture (irrigated) including vegetables, canning fruit, vegetables and wine grapes
vii. Intensive industries (pigs and chickens)
viii. Horse industry including thoroughbreds, trotting and recreational
ix. Lifestyle properties (irrigated and dryland)

Irrigated agriculture provides approximately 60% of the Goulburn Valley agricultural output and so responding to drought with less irrigation water is critical to the long-term sustainability and health of the region.

Living through droughts is challenging and the emotions associated with it can mean that we can be slow to react. Being prepared doesn't avoid disappointments experienced during droughts but it may allow us to make sensible and more timely decisions.

Farmers who are armed with good information will be better able to respond effectively and adapt to drought conditions.

The Drought Resources Package has five sections:

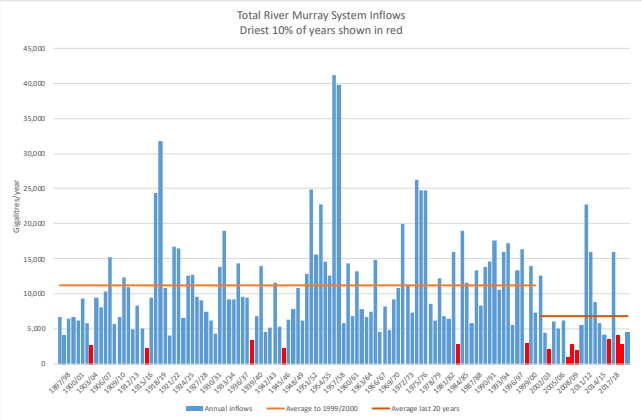
1. Water and climate
   - Variability of rainfall
   - Changes in irrigation water supply
   - Water price drivers: allocation/entitlement market
2. Agricultural industries and emerging trends
   - Number of farms, production trends
3. Drought preparedness
   - A resilient business
4. Industry specific management strategies
   - Drought actions and mitigation strategies by industry
5. Sources of information
   - Signposting to key information/assistance sites

2 Water and climate

2.1 RAINFALL AND IRRIGATION SUPPLIES ARE EXTREMELY VARIABLE

Understanding droughts is all about understanding the variability of rainfall and availability of irrigation water.

Murray system inflows



The last 20 years have seen inflows on average nearly 40% less than the long-term average. However, these inflows are only 7% less than the 20-year federation drought. While the last 20 years were bad it is not the first or the last time that inflows will be as low as this. On the other hand, inflows in the 1980's and 90's were 4% above the long-term average. The key point is we need to prepare for the variability that occurs.

Most businesses plan over a three to five year period and what we have recently seen in the Murray system is:

- the last five years were in the 10% lowest inflows
- the five years before were close to the long-term average (+3%)
- the five millennium drought years were the worst ever inflows

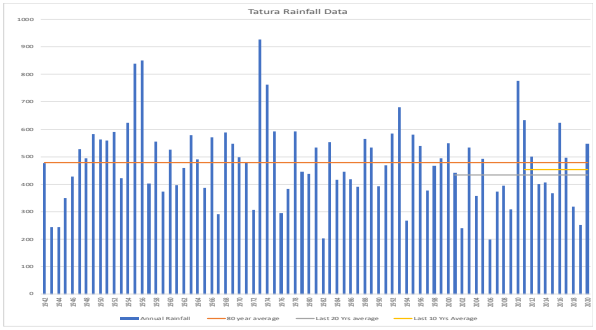
How did you go in the last 3 sequences of five years? What would you do different next time if it was a millennium drought, a wet period or a dry period? So what will the next five years bring? Are we prepared for the possibilities?

Managing with less irrigation water – about half what we used to have

Not only are inflows extremely variable from year to year but the available irrigation water has halved due to a combination of:

- Basin Plan (23% less water for consumptive use)
- Downstream trade in water entitlements
- Dry 20 year period

Tatura rainfall



The rainfall at Tatura varies incredibly. It was as low as 200mm in the worst year of the millennium drought (2006) increasing to 800mm four years later in 2010.

In terms of rainfall the last 20 years whilst lower than the long-term average by about 5%, this is not as bad as the reduction in available irrigation water.

For dryland farmers managing the extremes of rainfall from year to year is key to drought preparedness.

Climate change

The planet is warming, and we are seeing weather extremes more often. The incredible variability is what agricultural businesses need to manage. We can have wet, we can have dry and have everything in between.

2.2 THE GOULBURN SYSTEM IS PART OF THE SOUTHERN BASIN–IT CANNOT ACT INDEPENDENTLY!

Within the connected Southern Murray Darling Basin (sMDB) there are five main regions or communities that interact. The five main regions listed in the table below.

Table 2-1: Irrigation Regions in the sMDB

REGION	MAIN AGRICULTURAL ACTIVITIES	TYPICAL ANNUAL WATER USE (GL)
Riverland in SA	▪ Horticulture	▪ 400 GL
Sunraysia in Victoria and (to a much lesser extent) NSW	▪ Horticulture	▪ 700 GL
Victoria's Goulburn Murray Irrigation District	▪ Dairy ▪ Horticulture ▪ Cropping	▪ 900 – 1300 GL ▪ 100 GL outside the district
Murray Irrigation Area	▪ Rice ▪ Cropping ▪ Some Dairy	▪ 300 – 800 GL (gavity) ▪ 100 – 200 GL by river pumpers outside of gravity irrigation area
Murrumbidgee Irrigation Area.	▪ Rice ▪ Cotton ▪ Horticulture ▪ Cropping	▪ 700 to 1500 GL

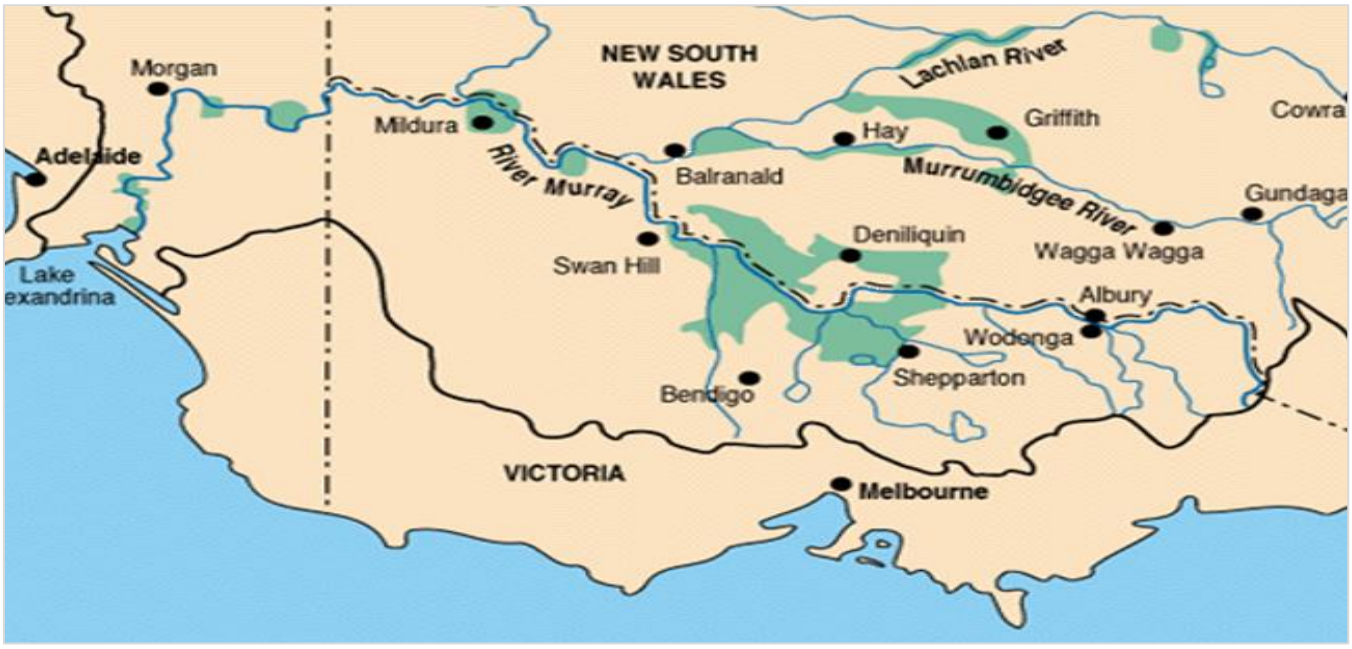


Figure 2-1 : Map showing the irrigation regions in the Southern Basin

There are some trade limitations:

Whilst it is true that the sMDB is acting as one general supply-system and water market, there are some trade limitations that can result in some differences (i.e. physical flow limits in the Barmah choke and lower Goulburn river, limitations on trade between the Murrumbidgee and Murray systems).

2.3 AGRICULTURAL INDUSTRIES HAVE CHANGED

Enormous changes over the last 40 years for a range of industries

Water has always been trading to the higher value use with:

- Rice and dairy replacing mixed grazing in the 80's and 90's
- Wine grapes in Sunraysia expanded in the 90s by buying water from mixed grazing in the Kerang/Pyramid region
- Cotton with new varieties moving south and replacing some of the rice since the Millennium Drought
- Maize for both grain and silage replacing summer pastures since the Basin Plan water recovery
- Almonds have expanded this century by buying water from dairy pasture irrigation since the Millennium Drought, largely from within the Victorian GMID
- Table grapes have expanded in Sunraysia over recent years, with retraction in areas of irrigated wine grapes and dried fruit
- Other horticulture has continued to slowly expand throughout the whole Southern Basin.

Three classes of water security

The trade to higher value water users has its limits which is based on the amount of the three types of water security (super secure, secure and variable).

The supply of up to 5,000GL of water (excluding e-water) in the sMDB can be thought of as a hierarchy of three broad climate scenarios, sectors of water users and classes of water security:

- **Super Secure water** (extreme drought): 1,500GL used by high value horticulture for permanent plantings
- **Very Secure water** (dry years):In addition to the 1500 GL above, 1,500GL used by medium value industries i.e. cotton, dairy and maize
- **Variable water** (average to wet years):in addition to the 3000 GL above 2,000GL used by rice, livestock, grazing and winter cereals
-

We are now in a new equilibrium within the sMDB with the 2018/19 drought year setting the limits to horticulture's expansion. As horticulture has no alternatives to water, its growth will be limited to the water available in droughts – the Super Secure water.

The three water-user groups have developed an equilibrium based upon water reliability and the relative commodity returns available from different irrigated sectors.

Three water user groups that compete for water

Table 2-2: Equilibrium of value and security - Southern Connected Basin

WATER SECURITY	SECTOR	GROSS INCOME $/ML
High value - limited to Super Secure water volume.	Stone fruit / table grapes	$5,000 - $10,000
	Canning fruit	$3,000
	Dried fruit / wine / almonds / citrus	$1,600 - $2,000
Medium value – uses the Secure Water above that used by high value	Dairy - Traditional grazing Feedpad/barn	$1,200 - $1,400 $1,800 - $2,400
	Maize	$800 - $1,000
	Cotton	$700 -$900
Low value – uses the Variable Water above the Secure Water	Rice	$300 -$600
	Winter Cereals	$200 -$400
	Livestock Grazing	$150 - $400

The three water-user groups have developed an equilibrium based upon perceptions of water reliability and the relative commodity returns available from different irrigated sectors

This results in the following annual water use by the different industries within the sMDB. It is expected that whilst there may be minor changes in relativity of water use between industries, there is no foreseeable major changes on the horizon.

Table 2-3 Annual water use by different industries across the sMDB

INDUSTRY	ANNUAL WATER USE RANGE (GL)
Horticulture (excluding almonds) slowly increased by 50% over 50 years.	800 - 900
Almonds have increased form almost zero demand in mid 1990's	500 - 600
Cotton has replaced rice in the Murrumbidgee since starting int 2010	450 - 700
Dairy peaked in the year 2000 but is now about half of that irrigation volume.	800 - 900
Irrigated crop (winter and summer).	200 - 600
Rice has drastically reduced and varies from year to year.	50 - 1,000
Mixed grazing declined drastically from peak in the 1980's of 2500 GL to now.	250 - 500
Carryover is used to store water in wet years for use in dry years.	+600 - 300
Total water available (includes 500GL of ground water).	Typical 3,000 - 5,600
	Averages around 4,500 but in a drought could be as low as 2,200 (incl 500GL GW)

Water availability and use within the GMID

Within the broad framework above, the GMID comprises a mix of dairy, horticulture (in fresh and canning-fruit) and mixed grazing/cropping. It typically uses ~1,100GL except in drought years, where only 300-500GL is typically available. Horticultural demand is fairly stable across the climate scenarios, while mixed grazing and cropping are opportunistic. The dairy sector has access to a relatively stable volume except in drought years where it bears much of the burden from variability in supply.

Table 2-4 Annual water use in the GMID by sector (GL) (incl. 70–120GL of groundwater)

SECTOR	HISTORICAL (GL PRE 2000)		CURRENT (GL)	
	2000	**Drought**	**Average**	**Drought**
Mixed grazing	283	75	120	40
Crops	160	42	108	33
Dairy	1,468	615	838	327
Horticulture	90	100	110	119
Total	**2,000**	**832**	**1,175**	**510**

[Source: RMCG analysis 2020 – Water Update – Southern Connected Basin]

2.4 UNDERSTANDING THE WATER MARKET – MORE CONFIDENT DECISIONS

In droughts it is too expensive to buy water – why is it so expensive? Understanding the water market helps in decision making

Price of water – depends upon allocations

The following graph shows that the price in real terms has maintained the same relationship to the volume allocated in the sMDB for the last 25 years. This means that once the allocations are known then the price can be easily predicted. Goulburn system water prices are heavily influenced by the NSW General Security allocations. This is not always well recognised in the Goulburn Valley.

Even with all of the changes in the past 25 years the supply price relationship has remained remarkably consistent.

It is the volume of water available through allocations in the whole of the southern connected basin that drives price.

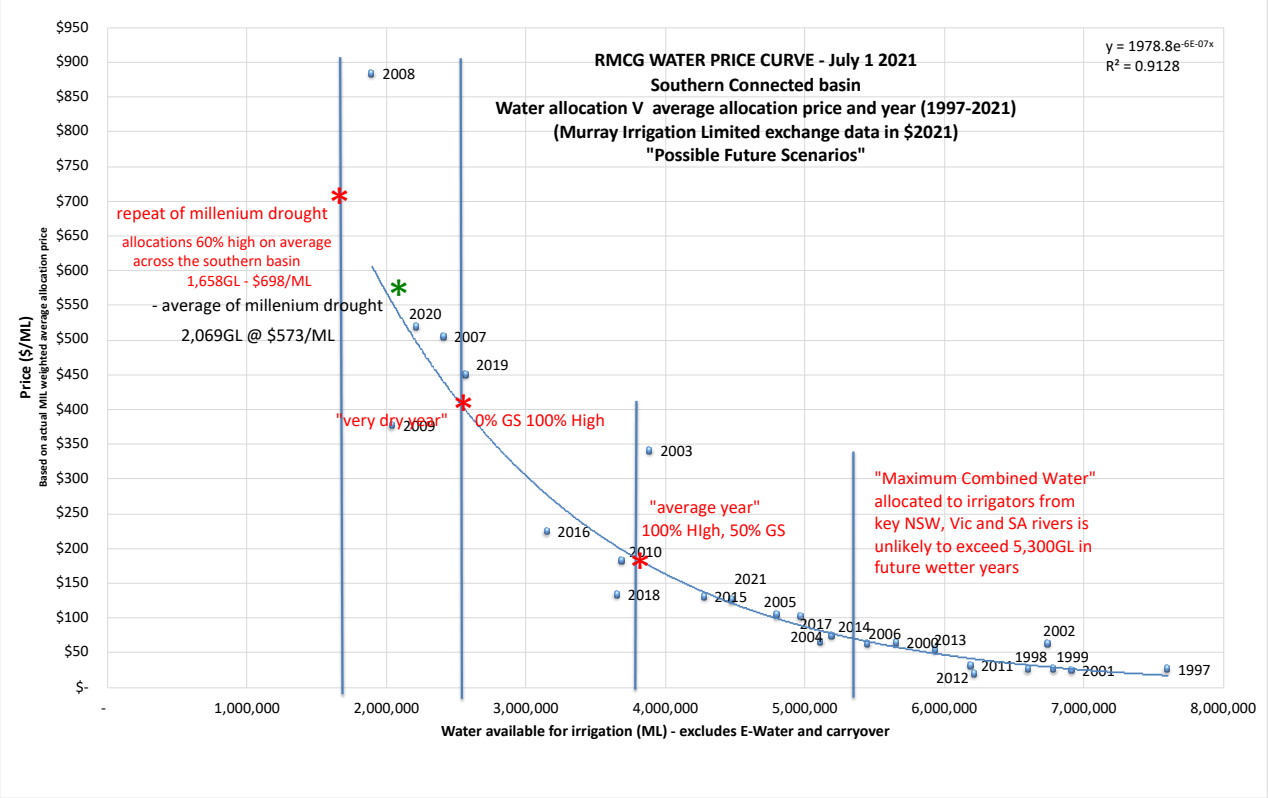


Figure 2-2 RMCG Water Price Curve

Prices vary between regions and during the seasons

The following graph show the variation over the last five years and the difference between seasons. The Goulburn system has traded at a slightly lower price that the other regions due to better allocations and downstream trade limits due to the Goulburn River flow restrictions in summer. However, the allocations in the Goulburn will not always be better than the Murray.

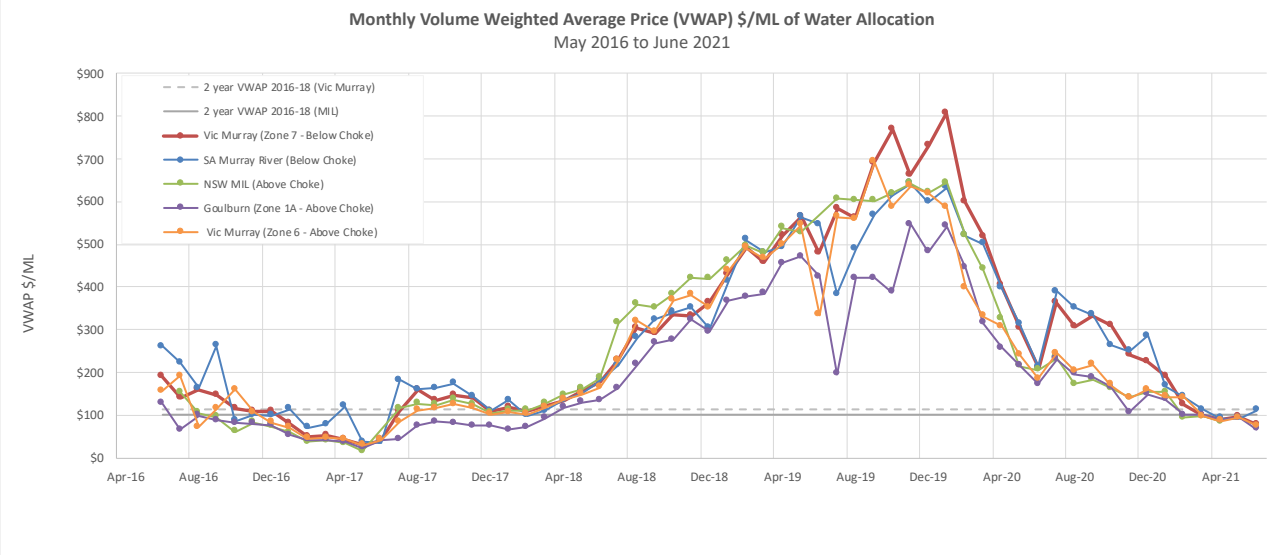


Figure 2-3 Monthly Volume Weighted Average price $/ML of water allocation.

Using informed predictions for allocations is key to decision making

Each year from mid-May to November Victoria (DELWP) and NSW (State Water) provide monthly updates on the projections for this coming season's allocations. The following is an example (May 15 2021) for the Goulburn system and the NSW Murray system. Preparing for drought means keeping an eye on the predictions – particularly following the 90% (very dry) predictions for NSW GS.

Goulburn HRWS allocation outlook (May 2021) : https://nvrm.net.au/outlooks/current-outlook

Goulburn and Loddon System Outlook for Seasonal Determination of High-Reliability Water Shares

Inflow Conditions	1 July 2021	16 August 2021	15 October 2021	15 February 2022
Wet	46%	89%	100%	100%
Average	31%	50%	100%	100%
Dry	22%	33%	46%	60%
Extreme Dry	19%	23%	29%	33%

Wet – Inflows volumes to major storages are greater in 10 years in 100

Average – Inflow volumes to major storages are greater in 50 years out of 100

Dry – Inflow volumes to major storages are greater in 90 years out of 100

Extreme Dry – Inflow volumes to major storages are greater in 99 years in 100.

NSW General Security allocation outlook (May 2021):
https://www.industry.nsw.gov.au/water/allocations-availability/allocations/statements

Forecast general security allocations (%)

(Any carryover water can be added to these indicative allocations)

Repeat of historical inflow conditions	1 Sep 2021	1 Nov 2021
99 chances in 100 (extreme) (99%)	0	0
9 chances in 10 (very dry) (90%)	1	6
3 chances in 4 (dry) (75%)	5	15
1 chance in 2 (mean) (50%)	9	28

What we have learnt from the outlooks is that they are very good in predicting the allocations based on the inflow conditions experienced. The question we have to answer to determine our likely allocation levels and price ranges is what are the actual inflow conditions? The different water authorities provide information on current inflows and by taking into consideration seasonal weather forecasts individuals can start to develop a reasonable picture of what might the likely outcome in terms of allocation levels and water prices.

Two useful sites that provide current inflow conditions:

https://nvrm.net.au/resources-and-data/storage-inflow-data

https://www.mdba.gov.au/water-management/regular-reports-murray-data-storages/weekly-reports

Improved confidence of the likely seasonal water price helps farmers to make good tactical seasonal watering decisions.

The last five years demonstrate what can happen in practice

For an irrigator planning future water use, the last five years (2015/16-2019/21) have provided examples of the possible different scenarios that could apply in the future. There are five future scenarios in which, the data and behaviours around water use/trade/prices and production provide a reasonable basis for irrigators engaged in planning. At the more extreme ends of seasonal variation, RMCG has also considered the likely impacts of a repeat of the millennium drought (2007-09), based on current demand and current water-ownership. At the other end of the spectrum, a possible variation on the wet-year scenario is a wet summer, with widespread flooding, where irrigation demand is supressed, as occurred in the 2010/11 season.

Table 2-5 Water availability in the Southern Basin

SEASON & CLIMATE SCENARIO		ALLOCATIONS %			AVAILABLE WATER IN SOUTHERN BASIN (GL)[1]	PRICE OF WATER ($/ML)[2]
		NSW GS (MURRAY)	VIC HS MURRAY (GOULBURN)	MURRUMBIDGEE		
2015/16	Dry	23	100 (100)	34	3,232	$208
2016/17	Wet	100	100 (100)	100	5,204	$63
2017/18	Average	51	100 (100)	41	3,738	$129
2018/19	Very Dry	0	100 (100)	7	2,644	$438
2019/20	Drought	0 (late 3%)	66 (80)	6 (extra 5% late)	2,187 (late + 108GL)	$515
Repeat of millennium drought – worst on record		0	50 (50)	10	1724	$800 - 900
Repeat of a wet summer e.g. 10/11		100 plus supplementary Water	100	100 plus supplementary Water	5,600	$55

[1] Entitlements held by irrigators times the allocations for that season for the major valleys ie Murrumbidgee, Murray and Goulburn

[2] This is the average weighted by volume price paid on the Murray Irrigation Limited water exchange

Entitlement prices

There are many different entitlements across the sMDB and they all have different levels of reliability. Over the long time the high security products are similar and the NSW GS entitlements are also generally similar. Each year the dividend or income generated from an entitlement (assuming that all of the allocation was sold on the market and received the average price for the year) can be calculated. By averaging the dividend for the last 5 years an average return can be calculated. The following graph shows this calculation for Goulburn system entitlements. It can be seen that entitlement prices reflect the dividends over the last five years. It is important to note that the increase in dividend returns over time reflect a combination of CPI, reduced water due to the Basin Plan water recovery and the changing from very dry to wet and back to dry conditions over the last 20 years.

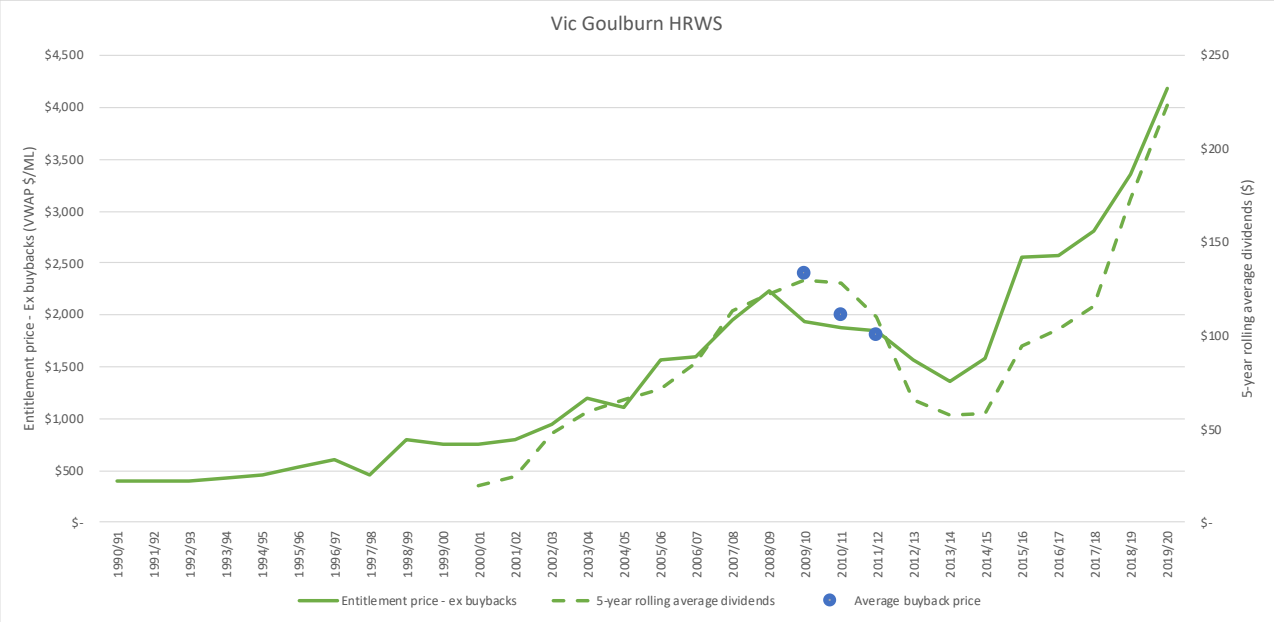


Figure 2-4 Relationship between entitlement price and five year rolling average dividend (allocation price)

It is expected that entitlement prices will continue to reflect the climatic conditions and it can be seen that the recent return to average allocations has seen a drop in entitlement prices.

Entitlements typically comprise between 25% and 50% of the total asset value in an irrigation business in the Goulburn Valley. So understanding the relationship between entitlement prices and the allocation market is critical to managing droughts.

The relationship between entitlement prices and dividend can be expressed as a return on capital. The following table shows the current return on capital for the HRWS in Victoria. Basically all entitlements across the sMDB are priced similarly, and based on the dividend returns for the last five years sit at around 3 to 5%.

Table 2-6 Entitlement price (VWAP $/ML 2019/20) and dividend income (% return) for Victorian HRWS

	VIC MURRAY (ABOVE CHOKE)	VIC MURRAY (BELOW CHOKE)	VIC GOULBURN
Entitlement Price (VWAP $/ML)	$4,829	$5,611	$4,180
Dividend Income (% Return – 5-year average)	4.6%	4.5%	5.4%

2.5 GROUNDWATER

Groundwater is a source of water that can be used very successfully as a drought mitigation strategy. But is location specific and not available to all.

In recent years there has been approx. 500GL of deep lead aquifer groundwater used annually in sMDB with 350GL in the Murrumbidgee, 80GL within Murray Irrigation Ltd's area of operations and 70GL in the Victorian GMID. There is another 50GL scattered throughout the upper reaches of the Murray Goulburn catchments.

The very high reliability of groundwater in the deep lead of Katunga system and the Goulburn give individual farmers options to manage drought that is not open to most farmers in the region.

In addition to the deep lead aquifers are shallow Shepparton formation aquifers which have been extensively developed throughout the Shepparton region. The shallow system extraction is currently estimated at around 70 -100GL in the GMID but is considered to be reducing significantly as the groundwater levels decline.

Farmers with access to the shallow systems can obtain additional water in droughts although falling groundwater levels during extended drought conditions makes this water source less reliable.

Some of the groundwater systems are relatively saline and need to be shandied with surface water to prevent production losses. However, one off applications in drought years of higher salinity water can be tolerated and quite productive as a drought mitigation strategy.

2.6 WATER ACCESS DECISIONS

Owning water or relying on the allocation market

This question about owning entitlements comes heavily into focus during droughts.

Many people have ***sold entitlements in drought*** as a way of surviving droughts. Whilst this may have been an expedient option for some and enabled survival, in the longer term there are fundamental issues that need to be recognised in making this decision. For example:

- Over the long term there has been enormous capital gain from owning water and this increase in asset values has underpinned many farmers ability to survive droughts or downturns. This option no longer exists once entitlements are sold
- Water prices are extremely high in droughts and those without entitlements pay a premium during this period. If there had not been provision for this, surviving the drought would have been even harder for many farm businesses.
- The average cost of buying on the temporary market is very similar over the long term to borrowing from a bank (provided there is sufficient borrowing capacity). Even if the entitlement is sold there will be consequential increase costs to buy the water back on the allocation market.
- If selling entitlement is the only option to survive then larger questions about the profitability of the business should be considered.
- It is possible that the business has just expanded and taken a calculated risk which a drought has undermined leaving limited options of which selling maybe one remaining
- For some farmers (croppers and non-dairy livestock) selling water in a drought at high prices is an excellent way of managing a drought and even dairy farmers will do this in the extreme seasons and use the money to purchase alternative feed. This option does not exist for those who don't own entitlements.

Others have ***chosen to not own water*** or at least only own a portion of their water use, but to use the funds to purchase other assets like land and undertake irrigation efficiency works and thus rely heavily on the allocation market. However, in a drought the very high prices can make this strategy extremely vulnerable and create additional pressure.

Every business has to decide which is a better use of funds. Provided the business understands the relationships between entitlement values and allocation prices and how entitlement prices are influenced by wet and dry periods then this maybe a good option.

Further some farmers particularly dairy farmers which have some flexibility in feed source (purchase feed, and /or store feed) decide to have a mix of owning and operating in the allocation market when prices are low. Getting the balance right depends on individuals' attitude to risk and ability to manage risk.

Horticulture needs the water regardless, so if they choose to operate on the allocation market then they need to have the ability to manage the high prices during droughts.

Croppers and general livestock farmers and hobby farmers can choose to simply not irrigate in a drought when prices are high, but expand their operation when prices are lower. In this case not owning all their water in entitlements can be a very effective strategy.

Selling allocation in droughts – when to buy and when to sell allocations

For businesses that have retained a level of water ownership then the tactical seasonal decisions around when to buy, when to sell and when to build up reserves (carryover) will have a big impact on the overall performance of the operation. There is no one set price that triggers a buy or sell decision as it will be influenced by a range of factors including ;

- Commodity type –has a big influence on the capacity to pay for water i.e., high value vs low value
- Efficiency of water use – the price triggers will be different within the same commodity type as there is a wide range of water use efficiency that is achieved between farms. Dairy Farmer A might have a much higher capacity to pay for water than Dairy Farmer B because they are growing a different crop, or they have more efficient irrigation infrastructure, or they have a better soil type or a combination of all of these factors.

- Attitude to risk – some farmers are risk adverse and will be prepared to pay more for water security than others
- Timing of use – the price trigger for a cropper who is purchasing some water to "finish off a crop" where the marginal return for that extra ML of water can be quite high.

It is therefore important that farmers understand their own earning capacity per ML of water and develop their own trigger points for when they might buy, sell or look to build up reserves. Trigger points can take some of the emotion and speculation out of the decision-making process and result in more profitable decisions being made.

Carryover – a drought management strategy

Carryover is a very important strategy for managing droughts and variable water supplies. The way carryover is permitted varies between the three states but generally it has a similar effect in all jurisdictions. There are limits to the volume able to be carried over and the water can be forfeited if there are wet periods with high allocations and/or dam spills. In Victoria carryover water can be held against both low security entitlements and high security entitlements. Water held against low security entitlements is extremely unlikely to be spilt and is very secure. However, there are limited volumes of low security entitlements, 400GL and 300 GL in the Goulburn and Murray systems respectively which represents approximately 30% of the total high security entitlements.

Table 2-7: Spills and forfeits (GL) trends[3]

SEASON START	GOULBURN		VIC MURRAY		NSW MURRAY		MURRUMBIDGEE		TOTAL	
	CARRYOVER	SPILLS	CARRYOVER	SPILLS	CARRYOVER	FORFEIT	CARRYOVER	FORFEIT	CARRYOVER	SPILLS/ FORFEIT
2021/22	490		436		500		389		1815	
2020/21	306	0	305	0	315	0	268	na	1188	na
2019/20	173	0	190	0	262	0	111	0	734	0
2018/19	285	0	172	0	449	6	359	2	1265	8
2017/18	538	29	318	58	654	12	484	7	1994	106
2016/17	220	0	286	163	301	54	281	181	1088	398
2015/16	204	0	196	0	342	9	355	7	1097	16
2014/15	357	0	267	22	352	18	470	23	1446	63
2013/14	298	0	663	472	170	33	309	30	1440	na
2012/13	867	288	1,240	33	668	37	544	77	3319	na
2011/12	930	113	1,228	0		151	564	335	na	na

[3] RMCG analysis of reports from various publications and the yellow indicates the time before Vic Murray spill rule change occurred

2010/11	325	0	446	0			493	678	na	na

How carryover is used

The volume of water carried over can be considered as five different volumes that are used very differently.

i. *Insurance volume (400GL)* used by Horticulture for use in extreme droughts and also for ensuring sufficient water in dry seasons at the start of the season. In practice this volume has never been used as there is always water put aside for next year even during the millennium drought period

ii. *Averaging volume(100-300GL)* Dairy industry buys in average and low prices periods to use in dry in order to average out allocation purchase prices

iii. *Two year operations volume (0-800GL)* Cropping industry use as much water as they can afford and only carry water over for the next year when it is wet and cannot be used in the current season – two year operation.

iv. *Unused water (0-400GL)* In some years there is an extra allocation at the end of the season or there is a very wet autumn which limits need for irrigation and results in used water being carried over by all industries.

v. *Conveyance carryover volume (150-300GL)* In NSW the water corporations have a secure annual conveyance allowance which through operational efficiencies is surplus to their requirements. They carryover the surplus to the next season and provide the water as a very secure (but small 5-15%) dividend allocation to their farmers

A key drought strategy is to participate in the carryover provisions. It is a way farmers can buy in low-price year as form of insurance against the potential higher price in the following season.

3 Industry Characteristics

3.1 NUMBERS OF FARMS IS CHANGING

A key feature of Australia (and the developed world) is the ongoing decrease in commercially focussed farm business numbers and increase in farm business size. Since the second world war the number of farmers in Australia has been halving every 20 years or so as productivity gains have been made.

The Goulburn Valley was initially immune to this decline as increased water availability and irrigation development from 1950 to 2000 provided the business growth. However since 2000 the halving of available water combined with the inevitable increase in business size has seen the dairy industry in northern Victoria decline from just over 3000 businesses to approximately 1200[4] in 2020. In the fruit industry rather than a change in numbers it has been more about the canning fruit industry declining with some replaced by larger fresh fruit businesses. The processing tomato industry has seen the greatest decline where there were 1400 growers in 1970 producing similar tonnes of tomatoes as the current remaining 12 growers do!

There are always a small number of new “niche” agricultural businesses being established but overall it is expected that the number of commercially focussed farm businesses will continue to decline. Often the decline is most severe in the years following either droughts or low commodity prices or both.

The key to managing drought is to recognise that not all farm business survive and that a deliberate decision to exit is “normal” for many farms each generation. However ,being forced into exiting following a drought is not a good outcome.

The other factor with businesses as they look to expand is the timing of those decisions. The timing and the level of risk taken during this ongoing expansion can be problematic if a drought occurs soon after the investment has been made. Timing of droughts can be critical and being aware of the risk when expanding is important.

3.2 NUMBER OF FARMERS IN THE REGION

Land use across the water service areas in the GMID - In 2017 the Victorian Government published a report: Regional Irrigated Land and Water Use Mapping in the Goulburn Murray Irrigation District, Technical Report

[4] Dairy In focus (2006) and In Focus 2020 Australian Dairy Industry (2020)

Categories	Murray Valley		Shepparton		Central Goulburn		Rochester		Torrumbarry		Pyramid-Boort		Totals	
	Properties (Number)	Area (ha)	Properties (Number)	Area (ha)	Properties (Number)	Area (ha)	Properties (Number)	Area (ha)	Properties (Number)	Area (ha)	Properties (Number)	Area (ha)	Properties (Number)	Area (ha)
Properties with dairy	264	26,169	103	8,049	363	37,493	155	19,758	204	26,690	53	8,561	**1,142**	**126,720**
Associated with dairy	152	12,365	81	3,678	220	11,454	97	7,774	152	11,473	63	7,201	**765**	**53,945**
Dairy cattle agistment/fodder	153	11,137	44	3,250	238	14,243	199	13,637	115	11,448	10	1,138	**759**	**54,853**
Perennial horticulture	136	4,672	227	6,482	179	5,460	9	981	389	7,086	8	4,448	**948**	**29,129**
Annual horticulture	8	794	12	283	28	2,203	25	3,501	37	1,139	5	2,120	**115**	**10,040**
Cropping	198	21,607	271	19,792	508	45,845	397	38,118	412	39,154	540	97,258	**2,326**	**261,774**
Mixed	76	4,856	292	21,561	471	35,451	201	20,000	505	23,638	95	12,610	**1,640**	**118,116**
Grazing non-dairy	456	40,540	99	6,901	113	7,578	47	3,955	418	48,197	132	26,719	**1,265**	**133,890**
Intensive animal	2	52	1	74	21	978	6	160	17	2,110	9	1,936	**56**	**5,310**
Horses	14	761	31	1,855	42	1,821	8	245	1	8	6	647	**102**	**5,337**
Lifestyle	379	5,690	645	5,755	1,454	11,014	734	4,198	760	2,835	140	776	**4,112**	**30,268**
Totals	1,838	128,643	1,806	77,680	3,637	173,540	1,878	112,327	3,010	173,778	1,061	163,414	**13,230**	**829,382**

When published data on farm business numbers is adjusted for many businesses having several properties, the number of businesses that rely primarily on agriculture are estimated to be less than1,000 within the City of Greater Shepparton, with a further 800 associated with agriculture.

3.3 INDUSTRY TRENDS CANNOT BE IGNORED

Dairy production in GMID

Dairy production in the GMID is expected to continue at around 1.4billion litres (or half the peak from 20 years ago). The future level of production will depend upon the following factors:

- Whether the horticulture development in Sunraysia continues or has effectively reached its equilibrium due to the limitations of available water in drought and constraints in delivery capacity
- The price of milk continues to be sufficient to allow the continued conversion to fodder and the use of feedpads/barns
- Whether the recent drier climatic conditions continue, get worse or return to wetter periods
- Whether the 450GL Upwater is proceeded with using farm efficiency program which will reduce the water available to the GMID

A best case scenario is that the use of feedpads and barns enables the industry to increase by 25% to 1.7billion litres, while if the worst case occurs production will reduce by a further 25% to 1 billion litres. Whatever happens with production the long term trend is that dairy farm numbers will halve yet again within 20 years.

Horticulture in GMID

A key aspect of horticulture in the GMID is that fresh fruit production (apples, pears and stone-fruit) has been a success story for the region since the year 2000. A report in 2013[5] identified some key trends:

- The total volume of fruit production declined by 7% in the decade from 2001, but its value increased by almost120% to $440 million in 2011

[5] RMCG (2013), *Goulburn Valley Fruit Growing Industry Roadmap.*

- The number of independent fruit growers declined (by 28%) but the total area of orchards increased (by 26%)
- There was an increase in the rate of orchard plantings, especially for stone-fruit for the fresh fruit market
- Fruit production for processing/canning declined significantly, with peach production reducing by over 53% and pear production by 65%.

These trends and developments have continued since the publication of the report, and the canning industry is now only 25% of its peak 20 years ago. The expansion in orchards is producing fruit for the higher value fresh fruit markets.

Land Use in the GMID

The land use in the GMID has seen large reductions in "green" areas over summer. Only about 8% of the region is now irrigated summer pastures, with a further 22% being irrigated annual pastures and winter crops. The area of "summer pasture" which the dairy industry was built upon has declined from 200,000 ha twenty years ago to only 20,000ha in 16/17. There has been a maintenance of irrigated annual pasture, but it is no longer predominantly grazed but used primarily for fodder production in conjunction with increasing fodder production from the dryland area. This means that 70% of the region is now dryland compared to twenty years ago when only 40% was dryland with nearly 60% irrigated.

There have been many changes in the mix of horticulture over time i.e. decline in tomato planting areas, decline in canning fruits, introduction of olives and grapes and the expansion of the fresh fruit industry. However, despite this the area planted to horticulture (including vegetables) has remained steady at around 18,000ha since the 1990's.

3.4 RECOGNISE THE COMMODITY PRICE CYCLES

Commodity prices cycle over time invariably affect the ability to respond to droughts. Being continually aware of the relevant commodity price cycle and where today's price fits is key information affecting drought response options.

4 General Drought Preparedness

4.1 HAVING A PROFITABLE BUSINESS

The best drought preparedness is to run profitable businesses. The more profitable a business the more resilient it will be in managing climate variability.

Knowing whether you are profitable in good times or just making a wage.

Many farm businesses only produce enough income to maintain a wage with limited capacity to build reserves for the hard times.

What does a profitable business do?

4.2 BEING RESILIENT – IS BEING PREPARED

The characteristics of a resilient business:

- Strong balance sheet that provides the capacity to access funds for working capital in extreme periods
- Use of Farm Management Deposits to tax effectively draw upon when needed
- Livestock – forward planning and feed budgeting to allow for the build-up of feed reserves (carryover water and/or physical feed reserves) to mitigate impacts of drought
- Solid budgeting practices and ability to take opportunities when they arise – i.e. have the capacity to buy the feed or water when the opportunity presents.
- Access to off farm income – both exertion (working off farm) or non exertion (off farm investments)
- Has a clear vision and action plan to achieve that vision
- Keep informed and prepared to act when things change
- Seek off farm expertise to assist in decision making (agronomist, nutritionist, veterinarian, financier, accountant, farm business management consultant)
- Participate in farmer support groups – peer decision support
- Have a good knowledge of the farms financial and physical performance and how that compares to others
- Has strong business relationships with key suppliers and customers to the business
- Has good financial control and actively reviews actuals compared to budget
- Ensures the potential of good seasons are realised to build reserves for bad seasons
- Continually reinvests in the business to improve productivity

4.3 WHAT IS YOUR RISK PROFILE

Risk is tested during droughts and therefore knowing your key risks and ways to mitigate those risks is important.

Taking a proactive approach to your risk management will enable you to make decisions rather than having decisions made for you. Look at your whole business and identify the risks. Prioritise those risks by assessing likelihood of them happening and the impact they may have to the business. Those rated as high likelihood and high impact need to be prioritised and mitigation strategies identified and implemented.

There needs to be an honest appraisal of your position and what can realistically achieved. For some businesses there will be some hard decisions that need to be made to either to continue to trade or to exit. An early exit decision can prevent further erosion of equity and provide more choices for the next stage of life.

Leaving farming is not a failure as it can be a very considered and positive decision for a farming family.

Managing successfully through droughts can be very rewarding and reinforcement that your business has a strong future.

Off farm income can make a difference particularly during droughts. While this is not an option for all, a stable off farm income can help meet day to day living requirements and just help take some of the financial pressure during difficult times.

4.4 TALK ABOUT DROUGHTS AND WHAT IFS WITH OTHERS

The best drought planning does not happen during droughts is occurs pre the event. Early preparation is the key and sharing the problem with others helps explore the options that you can consider. Look at potential scenarios, and plan for both the ups and the downs.

5 Industry specific management strategies.

There will be a range of different strategies that an individual farmers will implement in response to drought. However different industries will have different drivers of their decisions

The following table summarises how different industries react to droughts.

INDUSTRY	CHARACTERISTICS	PRODUCTIVITY FOCUS – GETTING MORE FROM WATER (RAINFALL/IRRIGATION)
Dryland Crops	▪ Will nearly always plant a crop ▪ Crop selection will alter if soil moisture profiles are low and climate outlooks uncertain ▪ Matching inputs to climatic conditions ▪ Grain storage investment – proactive grain marketing ▪ Objectively assess crops on their grain potential and make decisions accordingly – i.e. cut for hay/silage, feed off with stock or take it to grain	▪ Soil moisture conservation ▪ Minimum tillage techniques ▪ Precision Ag – GPS sowing, yield mapping, controlled traffic, matching inputs to area capability ▪ Soil amelioration ▪ Moisture monitoring
Dryland Livestock	▪ Feed supply forecasts ▪ Stocking rate decisions	▪ Soil moisture conservation ▪ Minimum tillage techniques

	▪ Destock and/or supplementary feed at high cost ▪ Maintaining breeding stock ▪ Develop feed budgets and make destocking decisions early ▪ Implement stock containment areas	▪ Precision Ag – GPS sowing, yield mapping, controlled traffic, matching inputs to area capability ▪ Soil amelioration ▪ Moisture monitoring ▪ Stock containment areas
Horticulture – Irrigation	▪ Will generally have a high level of water ownership so water exposure limited ▪ Managing the higher water cost during drought ▪ Actively use carryover for drought mitigation ▪ Access to capital to support additional water purchases ▪ Opportunity to dry off low returning varieties or bring forward tree replacement plans	▪ Already implementing highly efficient irrigation technology ▪ Move to fresh markets away from lower value canning options ▪ Crop protection investments (shade cloth) ▪ Scale to allow for introduction of technology – i.e. robots
Dairy – Irrigation	▪ Will get water in most years ▪ Have alternatives to water for feed ▪ Feed reserves to manage exposure to feed market in dry years ▪ Feed reserves in the form of carryover water and physical feed reserves ▪ Focus on maintaining a core dairy herd for rebounding when conditions improve ▪ Implement a higher culling program to ensure retained stock are the most productive ▪ Sell all surplus stock ▪ Investigate failed crop options to bolster feed requirements ▪ Seek agistment options for young stock ▪ Have trigger points to sell water if proceeds can be used to purchase more feed than would be able to be grown with the water ▪ Dry off all but the best producing areas on the farm	▪ Introduction of more water efficient crops – Maize/Lucerne. ▪ Investing in feeding systems (feedpads and/or barns) ▪ Irrigation modernisation (high flows, pipe and riser, overhead sprays, sub surface drip, automation) ▪ Soil moisture monitoring ▪ Developing cropping expertise
Livestock – Irrigated pastures	▪ Can be highly variable ▪ Farm specific drivers – often will have a dryland component that can support the feed requirements of the livestock operation.	▪ Soil amelioration ▪ Moisture monitoring ▪ Stock containment areas

	▪ Marginal decisions on finishing stock ▪ Need to be strategic with sales for finishing stock and retaining breeding animals ▪ Develop feed budgets and make destocking decisions early ▪ Implement stock containment areas for stock retained	▪ Irrigation modernisation (high flows, pipe and riser, automation)
Crop – Irrigated	▪ Highly variable from year to year (maize and cereal) ▪ Sound understanding of crop gross margins that drive cropping decisions – Price trigger points ▪ Need to be flexible with approach year by year ▪ Assessment on cost/benefit on finishing crops ▪ Focus on soil moisture retention in preparation for following season	▪ Irrigation modernisation (high flows, pipe and riser, overhead sprays, sub surface drip, automation) ▪ Soil moisture monitoring ▪ On farm grain storage and drying investment – proactive marketing
Intensive Industries (animal)	▪ Reliant on bought in feed ▪ Will source the feed with reduced margins ▪ Contracted feed supply ▪ Feed risk management – contracts, reserves, relationships	▪ Standard water efficiencies
Horse Industry	▪ High proportion of feed requirements bought in ▪ Feed procurement plans ▪ Will generally pay the price to maintain animals ▪ Feed risk management – contracts, reserves, relationships	▪ Not wasting water
Lifestyle properties	▪ Not reliant on farm income therefore can forego production ▪ Could pay higher prices to maintain amenity of properties verses commercial agriculture	▪ Standard water efficiencies – focus more on convenience of operation rather than productivity improvements

6 Resources

WATER INFORMATION

Current Seasonal Allocations:

Northern Victoria - https://nvrm.net.au/seasonal-determinations/current

NSW - https://www.industry.nsw.gov.au/water/allocations-availability/allocations/statements

Seasonal Outlooks:

Victoria: https://nvrm.net.au/outlooks/current-outlook

NSW: https://www.industry.nsw.gov.au/water/allocations-availability/allocations/statements - information in the Water allocation statements usually towards the end of the document

Inflow Conditions

Victoria: https://nvrm.net.au/resources-and-data/storage-inflow-data

Murray: https://www.mdba.gov.au/water-management/regular-reports-murray-data-storages/weekly-reports - Inflow diagrams at the end of the report.

Climate outlooks

Climate Driver Update (BOM): http://www.bom.gov.au/climate/enso/?utm_medium=email&utm_source=enso-wrapup&utm_campaign=public-weather&utm_term=enso&utm_content=text-01012020--ENSO-wrap

Water Market

Victorian Water Exchange : https://www.waterregister.vic.gov.au/water-trading/allocation-trading

Murray Irrigation Limited: https://www.murrayirrigation.com.au/exchange-tables/

INDUSTRY ORGANISATIONS

Murray Dairy: https://www.dairyaustralia.com.au/murray-dairy

GRDC: https://grdc.com.au

Horticulture Australia : https://www.horticulture.com.au

MLA : https://www.mla.com.au

FARM INFORMATION

Farm Table: https://farmtable.com.au

SUPPORT NETWORKS

Rural Counsellors : https://www.rfcsvicne.org.au

WELLBEING SUPPORT

Beyond Blue: https://www.beyondblue.org.au/personal-best/pillar/wellbeing

Life Line: https://www.lifeline.org.au

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