

IRRIGATION RISK MANAGEMENT PERMANENT HORTICULTURE KIT

Tailoring water entitlement to suit your business

Prepared by

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CONTENTS

CONTENTS	2
Introduction	3
six key questions	4
Definitions	5
1 How often will I be short of water?	7
2 Over the long term, how much will it cost me to use temporary water trade to avoid being short of water?	12
3 over the long term, am I better off trading permanent or temporary water?	14
4 How much can I afford to pay for temporary water over the long term?	19
5 How do the options compare in an extreme year?	23
6 How do the options compare in the event of rationing?	27
7 What are the main drivers for my water trading decisions?	32
8 Monitoring and reviewing your decisions	38

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INTRODUCTION

Every decision we make in life has a consequence, sometimes an upside and sometimes a downside. Risk management is about trying to foresee the risks associated with decision making to maximise the upside while minimising the potential downside.

A useful definition of risk management is: "The identification, assessment and control of those risks that threaten the assets or earning capacity of every organisation."

Businesses vary in their ability to take on risk. Tailoring your exposure to water shortage and your exposure to water price fluctuations is a relatively new challenge. This kit is designed to help you manage that challenge.

Permanent perennial plantings have their own unique stresses of high capital costs, long lead times before income is realized and critical (weather dependant) irrigation timings.

Your own attitude to risk is an important one and this will be affected by your current business risk profile (eg debt levels), and the industry you are in and its exposure to risk (eg amount of price fluctuation).

Each of the main water trading industries in your catchment can influence the market price to buy water and availability of water to you. Both of which are likely to be key drivers of your own risk position.

The higher the level of entitlement you decide to hold, the more you will be sheltered from these influences. However, there can be a cost in having more capital tied up in the entitlement value.

In order to establish an appropriate level of water entitlement you need to consider what is driving your decisions concerning water, both now and in the future.

The kit provides case studies and structured worksheets for you to record your own figures in the kit framework. This should provide a pathway through the many decisions you must make in settling on the 'right' level of entitlement for your irrigation business. You will need to keep reviewing your decisions at least once every season.

Caution. This kit includes numbers as examples to demonstrate how the risk management frameworks can be used. The results of these examples are not generic and do not apply to all situations. It is important that you use your own business figures in this kit for it to be of value to you.

SIX KEY QUESTIONS

At the end of the kit we aim for you to have thought through and have a framework for answering the following six questions.

- Q1. How often will I be short of water?**
- Q2. Over the long term, how much will it cost me to use temporary water trade to avoid being short of water?**
- Q3. Over the long-term, am I better off trading permanent or temporary water?**
- Q4. How much can I afford to pay for temporary water over the long term?**
- Q5. How do the options compare in an extreme year?**
- Q6. How do the options compare in the event of rationing?**

Each question is a chapter in this kit.

DEFINITIONS

The irrigation industry uses many different terms to describe the same things. More confusing still, one term can have several different meanings. This becomes especially important when comparing situations in different states. To help overcome the potential for confusion, we have adopted the following definitions for the terms used in this kit.

Water entitlement – The maximum volume of water the entitlement holder is entitled to use when the seasonal allocation is 100%. This is the long-term measure of the volume of water held. It is also variously called: permanent water; water right; licensed volume; high security water; or general security water.

Seasonal allocation – The proportion of water entitlement that is deemed available within a season. This may be adjusted up during the course of the season. It varies within the season, and between seasons, according to the amount of water available in the catchment.

Permanent trade - Trade in water entitlement. The rights for future use of that entitlement are transferred entirely to the buyer. It has seasonal variability. That is, one megalitre of entitlement will yield different allocations in different seasons.

Temporary trade – Trade in seasonal allocation. Because it involves only one season's allocation, it is not a variable volume. The buyer is able to use one full megalitre for each megalitre bought. However, at the end of the season, the rights for future use of the water entitlement revert to the seller.

Water price –The market price for water. This is the water-trading price paid by a water user to buy water on the open market. The price for permanently traded water is likely to be higher than the price for "temporary water."

Water charge – The annual service fee paid by irrigators to have water made available and delivered to them by water retailers or water authorities.

Water cost -The cost of water to the business. For temporary water, this is the same as the temporary water price. For permanent water, the water cost equals the interest on capital tied up in the business's water entitlement divided by the seasonal allocation.

Overdraw/Carryover - This refers to the ability of individual irrigators to draw against next year's water allocation or to carry-over unused water into next year. Currently this is only available in NSW.

LOCAL WATER TRADING RULES

This section includes the local water trading rules for the area where the kit is being delivered.

1 HOW OFTEN WILL I BE SHORT OF WATER?

Firstly, you need to work out how much water you need to irrigate fully. Multiply the area of irrigation for each crop by it's annual water requirement. This is shown in the example in Table 1.1 below.

Table 1.1 Estimating how much water you need to irrigate fully

Crop/Pasture	Ha	My Water requirement	My Total water needed
Citrus trees	15 ha X	8 ML/ha =	120 ML
Mature vines	5 ha X	6 ML/ha =	30 ML
Young vines	5 ha X	3 ML/ha =	15 ML
Total all ML			165 ML

Typical annual requirements for horticulture are shown below. But you would need to adjust these to suit your own irrigation system and crop types. Table grapes will tend to be higher and wine grapes (especially regulated deficit irrigation or partial root zone drying) will tend to be lower.

Cover crops, and canopy size and the efficiency /uniformity of your irrigation system will also affect the figure you should use. The bigger the canopy (as a proportion of ground cover) the higher the water demand will be. Young plantings with small canopies will require much less than fully mature large canopy crops.

Table 1.2 Estimating how much water your crops need (starting point)

Crop type	Furrow	Sprinkler	Drip
Mature vines	7-9 ML/ha	6-7.5 ML/ha	4-6 ML/ha
Mature citrus and other tree crops	9-12 ML/ha	8-11 ML/ha	7-10 ML/ha
Vegetables (will also vary with length of season, double cropping etc)	7-9 ML/ha	6-7.5 ML/ha	4-6 ML/ha

We recommend growers consider their historic water usage when estimating future needs

The Appendix has blank worksheets, which are designed for you to fill in with your own figures.

The second step is to compare what you need with what your entitlement can provide. Your entitlement will have a range of seasonal allocations attached to it, and these will vary with water availability in the catchment as well as the allocation method. Knowing

how often you will get full allocations and how often you will get less than 100% allocation is crucial to determining the value of the water.

To help you determine your long-term average seasonal allocation we have developed six scenarios. These are common to all systems/catchments, and they relate to your seasonal allocation at the close of the season. This is usually higher than the opening seasonal allocation. In all but the extreme droughts, you can expect that there will be storage inflows as the season progresses. Therefore, in most years, you will need to add an extra amount of allocation to the opening allocation to estimate your closing seasonal allocation. Water supply managers often give the probabilities for reaching different allocation levels at the time of their allocation announcements.

Table 1.3 Six scenarios for closing seasonal allocations

1	Very high	very high total seasonal allocation
2	Av to high	Average to high total seasonal allocation
3	Av to low	Average to low total seasonal allocation
4	Low	Low total seasonal allocation
5	Very low	very low total seasonal allocation
6	1:100 year lowest	Extremely low
7	Long term average	Long term average allocation

The six tables in Appendix 1 show the probabilities of getting different levels of seasonal allocation for each water supply system. For example, Victorian Murray irrigators in Goulburn Murray Water Districts will get 200% of their entitlement 60 years out of 100 and very low allocations for only 3 years in 100¹.

In Victorian Sunraysia the odds for the years of low allocation are the same, but no allocations over 100% are available.

Because each State has very different allocation policies, the story is different for those irrigators on the NSW Murray, for example in the Murray Irrigation Limited Irrigation District the very high allocation is only 84% of entitlement and the probability of getting that is only 1 year in 100.

Be aware that these allocations are based on recent figures and may be high for long term planning. There are many unused allocations at present and it is expected that these will either be sold or developed over time. As this happens,

¹ It is important to note that in Victoria the allocation systems are changing due to Retail Entitlement Reform. This will provide two different entitlements; a high security entitlement and a medium security entitlement. While this will alter the calculations you are about to do for closing seasonal allocations, it will also enable you to tailor water entitlement more closely to your needs.

seasonal allocations will gradually decrease. The possible impact of “The Living Murray” Murray Darling Basin environmental flows project is also not included.

Understanding the differences between catchments will help you to understand the market more fully, but the first step is understanding your own system. To start working through this kit, you will need to bring forward from Appendix 1 the table that best describes your system. An example is shown below.

Table 1.4 Indicative water allocation probabilities (for Murray in Vic Sunraysia)

Scenario for seasonal allocation	Allocation in G-MW (%)	Allocation in SRWA (%)	Odds (%) or years in 100	Allocation ML per ML entitlement	Odds x allocation
		a	b	C	<u>b x c</u>
Very high	200%	100%	60%	1	0.6
Av to high	150-200 (176%)	100%	10%	1	0.1
Av to low	130-150 (140%)	100%	10%	1	0.1
Low	100-130 (116%)	100%	16%	1	0.16
Very low	60-100 (76%)	60-100%	3%	0.76	0.023
Extreme 1:100 years	60%	60%	1%	0.6	0.006
Long term average			100%		Sum above=0.99

After completing this section, you will have a guide as to how much water you need each year and be able to quantify how often, and by how much, your water needs will be different to seasonal allocations.

Using the allocations for your system from Appendix 1 you can work out how many megalitres you will have, and how many megalitres you will be short, for each of the six scenarios.

The example in Table 1.5 looks at 200 ML of entitlement in the Victorian Murray. Probability indicates that this irrigator will have 35 extra ML of water for 97 years in of each 100, or 97% of the time.

Table 1.5 Estimating how much water you will have

Scenario for seasonal allocation	Long term Odds (%) or years in 100	Allocation ML per ML entitlement	My Entitlement held	My Water allocation	Water needed to irrigate fully	Difference to ML needed
	From Table 1.4				From Table 1.1	
	a	c	b	d = b x c	e	f = d - e
Very high	60%	1	200 ML	200	165	35 extra
Av to high	10%	1	200 ML	200	165	35 extra
Av to low	10%	1	200 ML	200	165	35 extra
Low	16%	1	200 ML	200	165	35 extra
Very low	3%	0.76	200 ML	152	165	13 short
Extreme 1:100 years	1%	0.6	200 ML	120	165	45 short
Long term average		0.99	200 ML	198	165	33 extra

When opening seasonal allocations are low, most irrigation water suppliers now also announce the probabilities of the seasonal allocation being increased by the end of the season. In these circumstances, you can also use these short terms probabilities in Table 1.5 to estimate how many megalitres you will be extra or short in that particular season.

There is a blank worksheet at the end of this manual to assess your own allocation variability. You may like to try this now. This worksheet will help you answer the first question.

Q1. How often will I be short of Water?

2 OVER THE LONG TERM, HOW MUCH WILL IT COST ME TO USE TEMPORARY WATER TRADE TO AVOID BEING SHORT OF WATER?

In this chapter, you will quantify the cost of temporary water trading to fully meet the water requirements of your business. To do this you will need to estimate the market value of water for different allocation years. Historical figures can be a guide, but do not rely on them too much as the water market is rapidly changing and the patterns of the early trading years may not necessarily be repeated.

The following exercise helps you to estimate the cost to your business of annual water purchases. You have already worked out how many extra megalitres you need in Table 1.1. Using allocation factors and the odds of getting that allocation from Table 1.5 and combining this with your estimates for market values for temporary water for each of the 6 scenarios, you can find out the average annual cost of water purchases needed to meet your irrigation needs. An example of this is shown on Table 2.1 on the next page.

Table 2.1 assumes that the selling price for water is the same as the buying price to determine the long term average annual value of the entitlement.

The table shows that for this example the business makes an average of \$590/year through temporary water trade. This can vary between a cost of \$13,500 in the driest years to an income of \$2,100 from selling excess water in low allocation years.

Using this framework, you can test the change in your annual water purchase costs for different levels of entitlement.

There is a blank worksheet at the end of this manual to quantify your own cost of annual water purchases. You may like to try this now. If your answer is negative it shows that on average you will be selling more water than buying for the ML you need.

Once you have completed the worksheet you will be closer to answering the second question:

Q2. Over the long term, how much will it cost me to use temporary water trade to avoid being short of water?

Table 2.1 Assessing water trading costs for annual purchases

Scenario	Extra ML needed	Market Price of water ² \$/ML your estimate	Market value of water in that year	Odds %	Financial impact on business (after allowing for probability)	
	Table 1.5, column f			Table 1.5, column a		
	a	b	c = a x b	d	e = c x d	
					sell	buy
Very high	35 extra	10	350	60% or 0.6	350 x 0.6 = 210	2,600 x 0.03 = 78 13,500 x 0.01 = 135
Av to high	35 extra	20	700	10% or 0.1	700 x 0.1 = 70	
Av to low	35 extra	40	1,400	10% or 0.1	1,400 x 0.1 = 140	
Low	35 extra	60	2,100	16% or 0.16	2,100 x 0.16 = 336	
Very low	13 short	200	2,600	3% or 0.03		
Extreme 1:100 years	45 short	300	13,500	1% or 0.01		
Long term average	33 extra			100%	Average cost of temporary trade to business = sum above purchases 213 less 756 from sales = - \$543/year	

You need to be mindful of whether your market price estimate in b includes a variable delivery charge (based on usage) when completing this table. The market price needs to include any transfer costs, salinity levies etc associated with the trade

In Sunraysia the water purchase price generally does not include a delivery charge. In G-MW temporary trade generally does include it (because the seller pays the charge) except for trade in sales water

If your water purchase price includes the variable delivery charge in b (eg the seller pays for this) then the additional cost shown for water purchases in low allocation years is offset by water charges saved on the lower usage of your own permanent entitlement. If this is the case then you should deduct the delivery charge from column b.

² You need to include the water transfer costs and salinity levies in assessing this price.

3 OVER THE LONG TERM, AM I BETTER OFF TRADING PERMANENT OR TEMPORARY WATER?

This kit is all about helping you to decide at what point you are better off entering the market to either buy or sell water permanently relative to your other alternatives.

Buying permanent water is similar to buying land; you should do full farm budget and cash flow forecast first. You should also remember that different people can afford to pay different amounts. Because water entitlements are transportable, the water market is more like the share market than the land market. Water can be bought and sold by a range of different buyers; this influences both its price and its volatility.

Once you have taken account of the issues involved in owning water entitlements, it is relatively easy to work out how much a megalitre of water entitlement is worth to you. If this is different to the market price for permanent water, you may want to buy or sell permanent water.

3.1 TAKING ACCOUNT OF THE ISSUES INVOLVED IN OWNING WATER ENTITLEMENTS

Below are some of the aspects of a farm business that may influence your decision about buying or selling permanent water.

- **Interest costs.** When water is in excess you may be incurring an interest cost of owning water that is not being used. To date it has been cheaper to buy on the temporary market and use the capital to expand the rest of the business. You may not wish to tie up capital in water entitlement and would rather invest elsewhere and buy temporarily.
- **Skills.** Some people have good skills in getting water at the right price, but not all of us have that skill. If you do not have sufficient water trading skills to frequently enter the temporary market, then having more permanent water may be the better option for you.
- **Capital growth.** Whether you obtain your core water needs temporarily or permanently also depends on what you think permanent water prices will do in the future. In the Murray Basin, water prices have generally been tied to the performance of the rice and dairy industries as they use most of the water. Water prices are likely to fluctuate in line with the performance of these industries. If you believe these industries will improve in profitability then water values may increase to reflect this.
- **Flexibility.** You may be able to manage with a lower entitlement if you:
 - cannot readily use high seasonal allocations profitably because you have no extra land to irrigate.
 - have no way of storing water

- can easily reduce your irrigation area to cope with low allocations with no permanent damage to your income stream.
- **Farm development.** Do you want to establish more irrigation areas on your farm?
- **Security.** Do you want extra security of water resources?
- **Cash flow.** What value do you place on the income stream that comes from selling on the temporary market when you don't require your full seasonal allocation?
- **Impact on farm fixed costs.** Water and drainage charges can be higher if you own more permanent water (entitlement), compared to annual purchases of temporary water.

Do any of these apply to your business?

3.2 CALCULATING THE VALUE OF PERMANENT WATER FOR MY BUSINESS

We can build on the same framework used to establish the cost of temporary water trading to work out how permanent water costs compare with temporary. This is shown in Table 3.1.

Table 3.1 Calculating long term value of temporary water from estimated trading prices.

Scenario	Allocation ML per ML entitlement	Market Price of water ³ \$/ML Less any delivery charge your estimate	Odds %	Weighted value per ML of entitlement ⁴	Sum
	Table 1.5, column c		Table 1.5, column a		
	A	b	c	$a \times b \times c = d$	
Very high	1	10	60% or 0.6	$1 \times 10 \times 0.6 = 6$	6
Av to high	1	20	10% or 0.1	$1 \times 20 \times 0.1 = 2$	2
Av to low	1	40	10% or 0.1	$1 \times 40 \times 0.1 = 4$	4
Low	1	60	16% or 0.16	$1 \times 60 \times 0.16 = 9.6$	9.6
Very low	0.76	200	3% or 0.03	$0.76 \times 200 \times 0.03 = 4.6$	4.6
Extreme 1:100 years	0.6	300	1% or 0.01	$0.6 \times 300 \times 0.01 = 1.8$	1.8
Long term average	0.99		100%		Average annual value of entitlement = sum above = \$28/ML

To compare the average annual value of entitlement with permanent water prices you will have to nominate an interest rate and a capital gain factor for your water entitlement.

In the example below an interest rate of 10% is the interest cost paid on debt to buy the water. Or if you are debt-free then it is the return on capital you might expect from the investment in water entitlement. However, in reality, the interest cost is the interest or opportunity cost of the money you have invested in water entitlements less any capital growth you expect in the value of your water entitlement.

³. For G-MW you need to subtract the delivery charge to purchases of temporary water right unless it is sales. (This is paid for by the seller of water).

⁴ Weighted by probability and market value. This calculation determines the average annual value per ML of entitlement. It multiplies the allocation by its market price by its probability for different scenarios.

For example, interest of 10% less capital gain in water value of 3% per year gives a net interest rate of 7%. If the business believes the capital gain in water value is 4% per year and is borrowing at 10% then the net interest cost expected is 6%. Some people may believe that water entitlement could fall in value in which case a negative capital gain may be used. Even if debt free you need to think about the alternative returns that other investments might pay (and their risk) as the opportunity cost for investing in water.

The worked example below illustrates that the interest rate you pay, (or nominate as a target if not borrowed) and the capital gain can have a strong influence on a decision.

Table 3.2 Estimating the value of permanent water entitlement against market price

Market value of permanent water <i>a</i>	Interest rate <i>you nominate</i> <i>b</i>	Capital gain or loss <i>You expect</i> <i>c</i>	Net interest rate $d = b - c$	Annualised cost of market value for permanent water $e = a \times d$	Add any fixed costs (eg. access charge, drainage charges, environmental fees charged) if different to annual purchase of water		Decision influence if average annual value of entitlement is \$28
					<i>f</i>	<i>Total</i> $= e + f$	This figure is from Table 3.1
\$800	10%	3%	7%	$800 \times 7\% = \$56$	\$0	\$56	Cheaper to buy temporary
\$800	6%	3%	3%	$800 \times 3\% = \$24$	\$0	\$24	Cheaper to buy permanent
\$1,000	10%	3%	7%	$1,000 \times 7\% = \$70$	\$0	\$70	Cheaper to buy temporary
\$1,000	6%	3%	3%	$1,000 \times 3\% = \$30$	\$0	\$30	Little difference between temp. or permanent
\$1,100	10%	3%	7%	$1,100 \times 7\% = \$77$	\$0	\$77	Cheaper to buy temporary
\$1,100	6%	3%	3%	$1,100 \times 3\% = \$33$	\$0	\$33	Cheaper to buy temporary

You also need to consider that for some districts your access charges and other fixed charges can be higher for owning permanent water. Fixed charges are quite different for private diverters when compared to district growers. You will need to add these fixed charges to your annualized cost of market value for permanent water as in column e above.

There is a blank worksheet at the end of this manual to compare permanent water prices with temporary water prices. You may like to try this now.

Once you have completed the worksheet you will be closer to answering the third question: *Q3. Over the long-term, am I better off trading permanent or temporary water?*

4 HOW MUCH CAN I AFFORD TO PAY FOR TEMPORARY WATER OVER THE LONG TERM?

Over the long term, buying more water only makes sense if you are making money from the water. This section shows you how to work out much money you are likely to make from buying water. Knowing this can help you decide whether you should be buying or selling temporary water. It will also help you judge the appropriate price to pay over the long term.

You will make better water trading decisions if you know when you are trading above or below your optimum long-term average affordable price. The aim of this section is for you to be able to know what this price is, using estimates of operating surplus per ML.

The operating surplus per ML can be defined as the income less operating costs divided by the ML used to earn that income. Operating costs include both variable and overhead costs. (Therefore, it will be slightly lower than a gross margin per ML, which is income less variable costs).

Operating surplus/ML = Income – operating costs (both variable and overhead)

ML used to earn the above income

The operating surplus per ML indicates the dollars available to cover the annual cost of buying water. This cost can be an interest cost in the case of permanent water, or the purchase price in the case of temporary water.

There is a worksheet provided at the back of this book for you to calculate your operating surplus. You may like to follow this example through before doing your own.

**STATEMENT OF PROFIT & LOSS
FOR THE YEAR ENDED 30th June 1997**

INCOME	1995/96	
Primary Production Income		
Wine grapes	256,510	← Sales of all grapes
Fresh Fruit & Vegetables		
Total	256,510	← Total farm income
Add other income		
Dividends		
Interest	9,357	← Non farm income
Total Income	\$265,867	
LESS EXPENDITURE		
Accountancy fees	2,637	← Interest & Bank charges
Bank charges	852	
Depreciation	12,428	← Depreciation
Donations	30	
Fencing Repairs	0	
Fertiliser	14,214	
Fuel & Oil	13,310	
Insurance	4,880	
Interest - Lands Department	1,809	
Irrigation repairs & rental	1,996	
Leasing & Hire Charges	501	← Leasing expenses
Licenses, Registrations & Membership	1,347	
Light & Power	12,361	
Market Reports & Rural Newspapers	727	
Motor Car Expenses	5,295	
Packing Costs	3,600	
Pest Control	1,642	
Plant, Truck & Utility Repairs	16,572	
Printing, Postage & Stationery	96	
Protective Clothing & Footwear	1,009	
Rates - Shire	4,808	
Rates - Water	1,584	
Rent - Lands Department	686	← Land rent
Repairs - Employees Quarters	534	
Repairs - Implement Shed	509	
Replacement vines and posts	2,000	← Development expenditure
Spray Materials	9,685	
Staff & Picker Amenities	180	
Superannuation	2,862	
Telephone	2,350	
Travelling costs	0	
Wages	85,618	
Weedicides	9,603	
Workers Compensation	2,184	
	0	
Total Expenditure	\$217,909	← Total expenditure
Surplus/Deficit	\$47,958	

Income

Step 1. Calculate income per ML

From your profit and loss statement, write down gross income for year

\$ 256,510

Subtract income (\$) from dryland enterprises and any off farm income from total farm income (\$) to give the proportion of income produced from irrigation

\$ 256,510 - \$ 9,357 = \$ 247,153

Calculate ML of irrigation water used in the year 200 ML. Divide income from irrigation by number of ML irrigation used to give income for each ML

\$ 256,510 ÷ 200 ML = 1,236 \$/ML

Operating costs

Step 2. Calculate operating costs from irrigation

From profit and loss, look up the total farm expenditure for year. Subtract costs that are not operating costs such as interest, lease costs, temporary water purchases, rent, payment to partners, superannuation, depreciation and any capital expenditure (eg replanting/vine training) that have been included in the total expenditure.

You will be left with your farm operating costs; it should include variable costs such as labour, fertiliser, contractors, fuel, repairs and maintenance, water charges, rates, electricity, chemicals, consultants, and overheads such as office, accountant, legal.

\$ 217,909 - \$ 16,467 = \$ 201,442

Deduct any dryland farming operating costs (estimate costs for dryland part of farm if significant).

\$ 201,442 - \$ 0 = \$ 201,442 operating costs for irrigation

Step 3. Calculate operating surplus from irrigation

Subtract operating costs from irrigation (Step 2) from income from irrigation (Step 1)

\$ 247,153 - \$ 201,442 = \$ 45,711

Step 4. Calculate operating surplus from irrigation/ML

Divide operating surplus from irrigation (Step 3) by number of ML of irrigation water used in the year (Step 1)

$$\text{\$ } \underline{45,711} \div \underline{200} \text{ ML} = \underline{229} \text{ \$/ML}$$

Step 5. Calculate the long term average price you are prepared to pay for water after considering capital and owners labour costs

In the long term, it is important to cover capital costs (such as interest/return on capital, machinery depreciation and orchard or vineyard depreciation i.e. need to replant) and owners' labour costs. You need to do a full farm budget to calculate your own figures for this, particularly for farm expansion. But the following figures may be useful as a guide:

Use the figure of 25% of the operating surplus if the capital costs associated with using the water purchased will be high, for example when new equipment or a new layout is needed.

Use 50% if there is existing spare capacity within your farm to expand irrigation and production with little extra capital and if the owner has the time to manage the expansion and the need for extra profit is high.

$$\underline{229} \text{ \$/ML} \times \frac{\underline{25}}{100} \% = \underline{57} \text{ \$/ML}$$

Put simply, if your final figure is significantly higher than the annual cost of buying water then it may be worth buying water and expanding. If it is much lower then it may be worth selling some water.

Once you have worked out your own operating surplus you would be able to answer the fourth question:

Q4. How much can I afford to pay for temporary water over the long term?

5 HOW DO THE OPTIONS COMPARE IN AN EXTREME YEAR?

Each time you buy temporary water, the maximum price you should pay for that water will depend on the value of the next best alternative to purchasing water. Therefore, you need to consider what these options are and how much they will cost.

For example, an option might be to not buy water and to dry an area off and reduce production instead. When this option is studied in more detail, you may find that while variable costs are reduced by cutting back on area, fixed costs remain the same and this will dramatically reduce profitability. At the same time, you also need to be careful that you do not pay more for water than you can afford.

On the other hand if you intended pulling out this area for redevelopment anyway this may be a good strategy.

Therefore, you need to be able to compare the costs and benefits of those options, over more than one season and to understand how those costs might vary throughout the season. At the same time, you also need to be aware of the potential dangers involved in making decisions in isolation.

Partial budgets can be used to compare all these options with each other. Market prices for water vary through the year so you will need to update your partial budget as things change.

Identifying your options

Except for the very driest of years, seasonal allocations are likely to rise during the year. The closing allocation is therefore usually higher than opening seasonal allocation. It is difficult to predict what the final allocation will be, but water authorities have started to give probabilities for different levels of allocation. You should consider these probabilities when calculating your likely total seasonal allocation.

When you believe that water will be scarce you have several options. For example (tick the ones that apply to you):

- ☐ Buy more water
- ☐ Increase your irrigation efficiency
- ☐ Use drainage water as a substitute
- ☐ Irrigate a smaller area
- ☐ Spread the lower allocation over all the property
- ☐ Sell water, if market prices are high enough to justify irrigating even less area
- ☐ Do nothing and hope for an allocation increase later in the season

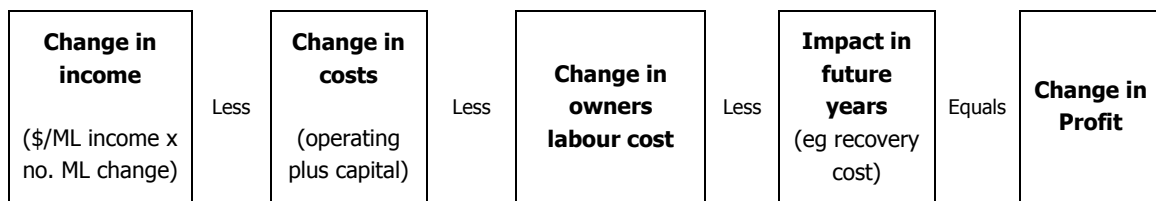
On the other hand, when water is plentiful and the seasonal allocation is in excess of your requirements, you can:

- ☐ sell water
- ☐ do nothing
- ☐ irrigate a larger area
- ☐ store water

To help you choose your best option we have included a partial budget table so that the impacts of each option can be compared. A partial budget helps you to compare the cost of the options with the cost of buying extra water.

Using a partial budget to help choose your best option

In a partial budget, you estimate the impact on your business of implementing each option. The impact is measured by calculating the extra costs for this option, the extra income generated, and the change in profit. This is illustrated in the diagram below.



For any one year, you can use a partial budgeting worksheet to work out the marginal profit per ML for the action that you wish to carry out. If this is lower than the water price then it pays to do this option rather than buy, but remember to consider any flow-on impacts into future years.

Your partial budget will also need to be updated as the season progresses. As well as the market price for water changing, the value of water to you may change.

For a once-off purchase, the maximum you should pay for water is the value of the next best alternative to purchasing water.

A sample partial budget is included in Table 5.1 comparing some options when a property is 80ML short of water (or 60% of a 200ML allocation) – with an average or ‘normal’ year.

The options for action are described in the second column.

When short of water, the suggested options are to buy more water, irrigate the whole block at a lower rate, or to dry off a designated area of the block.

Note – these figures are an example only to demonstrate the framework. You need to use your figures and assumptions.

Column a. Change in no. of ML used compared to normal year

If the action you are testing involves more or less water than your 'normal' long-term seasonal average this is the difference between the ML you expect to be used versus the 'normal' year.

In Table 5.1, this ranges from –80ML to full allocation.

Column b. Change in income

If the action you are testing involves lower production than your 'normal' long term average this is the difference between the \$ expected versus that 'normal' year. It refers to gross income before any expenses. Think about your income per ML as discussed in chapter 4. and multiply this with the no. of ML from above to work this out. = \$/ML X ML change. In the worked example this is done in income/ha.

For example, when the option involves drying off an area there is a loss in income from loss of production ranging from \$100,000 to \$120,000. When the option involves watering to at a lower rate there is a loss in income from loss of production of \$75,000.

Change in operating cost

If the action you are testing involves lower or higher operating costs than your 'normal' long term average, this is the difference between the \$ cost expected versus that 'normal' year.

Operating costs are both variable and overhead costs. Overhead costs are unlikely to change but variable costs almost certainly will. It includes items such as paid labour, water charges, power, fertiliser, but not capital costs such as water purchase, land rent, leases, interest, depreciation or capital repayments.

Drying off an area results in less operating costs through a reduction in the area that is producing for that season.

Change in capital cost

If the action you are testing involves lower or higher capital cost than your 'normal' long term average this is the difference between the \$ cost expected versus that 'normal' year.

It includes items such as temporary water purchase or sale, land rent, leases, interest, depreciation. It does not include capital repayments or income from sale of permanent water as this should be shown in saved or earned interest.

In the example, the option of buying more water when short results in increased capital costs of water purchase and interest payments on overdraft of \$26,400.

Column c. Change in total cost

The total of the changes in operating and capital costs above.

Column d. Change in \$ owners labour

You will want to make sure that you do not end up selecting an option that means more work for the owners for little benefit. Therefore, you should include an amount for the extra work the owners would have to do or extra time that is saved compared with a 'normal' year.

In this example, there are no increased labour costs.

Column e. Impact next year and future years

Make an estimate of the recovery cost for next year and any future recovery costs that may be associated with the action you are considering. This does not allow for a discounted cash flow (i.e. time value of money).

If an option is to dry off an area, there will be a future cost to rehabilitate this area and this must be included in the budget. In this case it amounts to \$24,000/ha to be rehabilitated.

Other future costs are the foregone profit if the vines dried off are to be replaced in 2 years and are not rehabilitated. This foregone margin is \$90,000/year.

Column f. Change in profit \$

This is the likely impact on your bottom line for each option.

For the options when 80ML short of water, buying water has the least negative impact on the business, followed by irrigating the whole vineyard at a lower rate. There is a \$280,000 difference between drying off vines not due for replacement and those due for replacement.

Revised annual profit

This is the effect on the change in profit on a 'normal' year' profit. This will test whether your business could survive a given loss.

In this example the 'normal profit' was \$28,000.

Revised annual profit varies between -\$277,000 to \$1,600, depending on the option chosen for the 80 ML short fall.

In this example buying water is clearly the best solution.

There is a blank worksheet at the end of this manual to do your own partial budget. You may like to try this now.

Once you have identified you own options run your own partial budget you can answer the fifth question:

Q5. How do the alternatives to water trade compare?

Table 5.1 - Reduction in Annual Allocation

Example scenario	Options different to base case	Change in ML used (ML)	Change in Income (\$)	Change in total costs (capital + operating)(\$)	Change in value of owners' labour (\$)	Impact next year & future (\$)	Change in profit(\$)	Revised annual profit(\$)
	Describe the Action	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f = b - c - d - e</i>	<i>28,000 + f</i>
Typical normal year	Average seasonal allocation used and usual trading and ML 'sales' usage	0	0	0	0	Nil	0	\$28,000
80 ML short of water	Buy 80 ML at \$300/ML	0	0	\$24,000 water cost plus \$2,400 extra interest = \$26,400	0	Nil	-\$26,400	\$1,600
	Irrigate whole vineyard @ 4.8ML/ha/yr	-80	25% yield &/or price loss loss on \$12,000/ha x 25ha = -\$75,000	0	0	Nil	-\$75,000	-\$47,000
	Dry off 10 ha of vines due for replacement	-80	10ha x \$8,000/ha = -\$80,000	\$15,000 saved operating costs = \$15,000	0	Nil	-\$65,000	-\$37,000
	Dry off 10 ha of vines not due for replacement	-80	10ha x \$12,000/ha = -\$120,000	\$15,000 saved operating costs = \$15,000	0	10ha vines rehab. = \$240,000	-\$345,000	-\$317,000
	Dry off 10 ha of vines due for replacement in 2 years	-80	10ha x \$11,000/ha = -\$110,000	\$15,000 saved operating costs = \$15,000	0	Loss of 2 years margin = \$180,000	-\$275,000	-\$247,000

6 HOW DO THE OPTIONS COMPARE IN THE EVENT OF RATIONING?

Like a reduction in allocation the partial budget can be used to work out the best option when rationing is enforced.

The four options compared are:

- Spread the restrictions over the whole area
- Dry off or restrict a designated area due for replacement
- Dry off or restrict a designated area not due for replacement
- Dry off or restrict a designated area due for replacement in 2 years

The right answer for you will depend on the characteristics of your block and may be different to the answer for your neighbours.

A sample partial budget is included over the page comparing some options in the event of rationing – Table 6.1 – with an average or 'normal' year.

The options for action are described in the second column.

When rationing is enforced, possible options are to spread the restrictions over the whole area, or to dry off a designated area of the block.

Note – these figures are an example only to demonstrate the framework. You need to use your figures and assumptions.

Managing restrictions

Restrictions are likely to be imposed as capacity shares, measured as a % of your water entitlement available on a 14 day cycle. You can choose the number of irrigations this is spread upon.

Water supply organizations are also exploring the possibility of trading capacity shares so that one option may be to buy other growers capacity shares in order to avoid rationing. For this to be worthwhile for you the price to purchase capacity shares must be less than the loss avoided.

Some water supply organizations also allow the temporary or permanent transfer of water to provide an increase in capacity share during rationing; others do not.

Discussions with workshop participants have provided a range of possible management strategies to consider when having to restrict water. These are worth considering and may be applicable strategies for your situation:-

1. Make sure system is working efficiently – distribution uniformity (Du) is critical at low applications. Get a system check done.
 - improve the system eg for young planting go to drip
2. Know your soil readily available water holding capacity (RAW) & soil types.
 - keep frequency of irrigation high (increase if possible), especially on soils with low RAW
 - general rule is little & often (reduce the amount, not the frequency)
 - Give high attention to soil moisture monitoring to determine irrigation frequency and amount
3. Furrow
 - start off alternate row
 - if enough water then may finish off conventional
 - quick irrigations – consider surge – but don't reduce uniformity down row(2/3 problem)
4. Identify your most dry tolerant patches
 - eg vigorous root stocks, low value patches etc. – stress these more
 - areas of low income and older plantings requiring replanting
5. Start/strop times regulating irrigation are likely to be suspended by the water supply authority. This should enable you to finish irrigating earlier and spread your ration more effectively.
6. Reduce water demand by reducing size of crop canopy by Regulated Deficit Irrigation (RDI)/Partial Rootzone Drying (PRD)/or Mechanical methods
 - Minimum internode
 - bring trellis drying forward for dried fruit
8. Spray off cover crop – knockdown to reduce competition for water

Column b. Change in income

All options involve a loss in income ranging from \$12,500 to \$15,000.

Change in operating cost

Drying off an area is assumed to have no effect on operating costs as the area is only dry for a short period.

Change in capital cost

There are no changes in capital costs associated with the options for managing rationing. Except for interest on overdraft due to lower income.

Column c. Change in total cost

The total of the changes in operating and capital costs above.

Column d. Change in \$ owners labour

In this example, there are no increased labour costs.

Column e. Impact next year and future years

Rehabilitation costs were assumed to be negligible in the case of rationing as it resulted in restricted water for a short period.

If a longer period of rationing occurs then reduced yield in future years should be included.

Column f. Change in profit \$

In this example, the change in profit was marginally lower from drying off vines due for replacement.

Revised annual profit

In this example the 'normal profit' was \$28,000.

The best scenario in this example was to dry off vines due for replacement.

Another approach to consider is to dry off areas that have the least efficient irrigation systems.

Table 6.1 - Reduction due to rationing

Example scenario	Options different to base case	Change in Income (\$)	Change in total costs (capital + operating)(\$)	Change in value of owners' labour(\$)	Impact next year & future(\$)	Change in profit(\$)	Revised annual profit(\$)
	Describe the Action	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f = b - c - d - e</i>	<i>28,000 + f</i>
Typical normal year	Average seasonal allocation used and usual trading and ML 'sales' usage	0	0	0	Nil	0	\$28,000
Rationing to 75% of usual peak demand for 2 weeks	Spread restrictions evenly over all 25ha	5% yield &/or price loss on \$12,000/ha x 25ha = \$15,000	0	0	Nil	-\$15,000	\$13,000
	Dry off 6.25ha of vines due for replacement for 2 weeks	20% yield &/or price loss x \$8,000/ha x 6.25ha = \$10,000	0	0	Nil	-\$10,000	\$18,000
	Dry off 6.25ha of vines not due for replacement for 2 weeks	20% yield &/or price loss x \$12,000/ha x 6.25ha = \$15,000	0	0	Nil	-\$15,000	\$13,000
	Dry off 6.25ha of vines due for replacement in 2 years for 2 weeks	20% yield &/or price loss x \$11,000/ha x 6.25ha = \$13,750	0	0	Nil	-\$13,750	\$14,250

7 WHAT ARE THE MAIN DRIVERS FOR MY WATER TRADING DECISIONS?

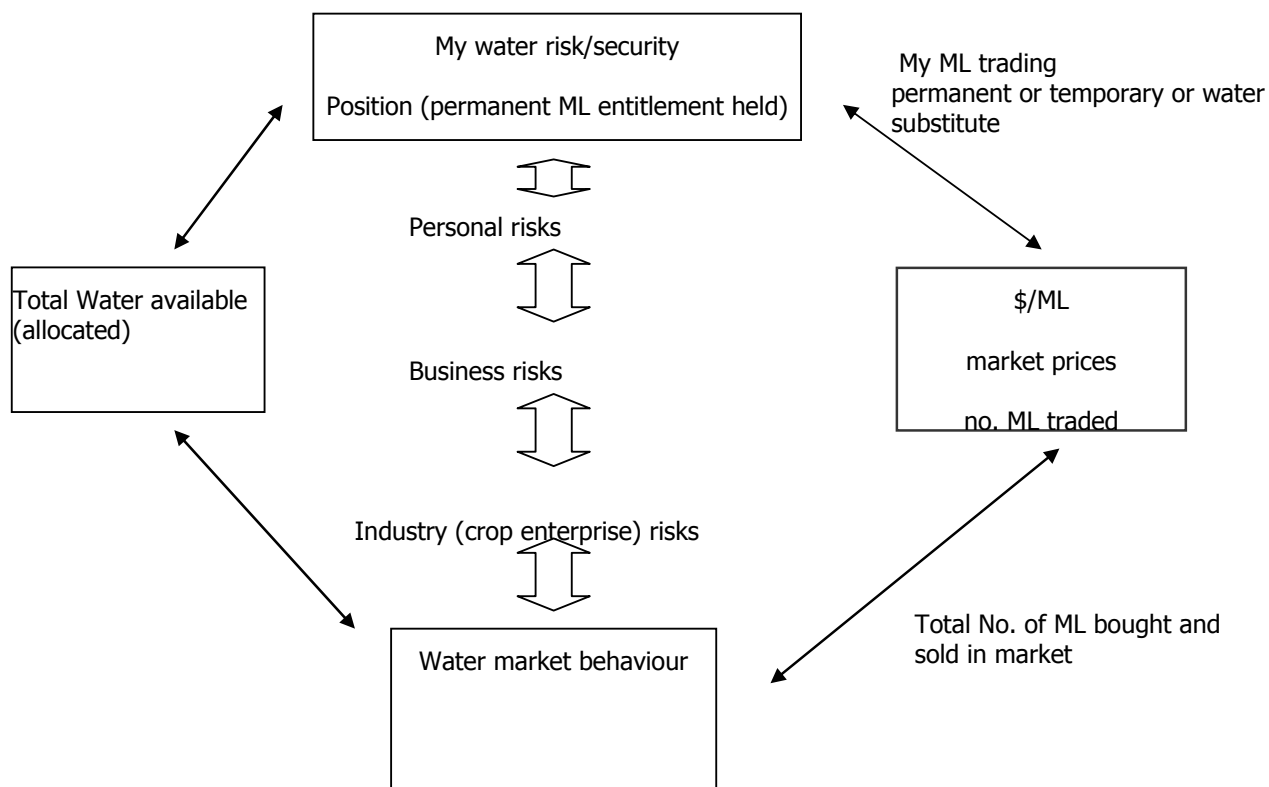
Whenever you think about buying or selling water, you are thinking about the security of your business enterprise. You are also thinking about your water security.

So far in this kit, we have looked at water trading decisions from the context of how your business operates. In this section, you will take a broader look at your place in the water market. You will start by picturing all of the things that influence your water security position, and then you will explore each of them in more detail.

7.1 IDENTIFYING THE OVERALL INFLUENCES ON YOUR WATER SECURITY

Your own water security position is influenced by a combination of personal, business and industry influences. The diagram below illustrates these influences and the relationship between them:-

Figure 1 Influences on water security



The diagram shows that your water security/risk position as measured by the amount of permanent entitlement you hold is influenced by a number of factors.

Your own attitude to risk is an important one and this will be affected by your current business risk profile (eg debt levels), and the industry you are in and its exposure to risk (eg amount of price fluctuation).

In turn, the industry risk profile in combination with other irrigation users in your catchment can influence the water market price and availability of water. Both of which are likely to be key drivers of your own risk position.

The higher the level of entitlement you decide to hold, the more you will be sheltered from these influences. However, there can be a cost in having more capital tied up.

In order to establish an appropriate level of water entitlement you need to consider what is driving your decisions concerning water, both now and in the future.

7.2 RECOGNISING YOUR OWN PERSONAL RISK PREFERENCES

A key part of risk management is understanding your own preference for risk.

Choice and the management of risk is a very personal process. Some people live their lives avoiding risk (risk averters) while others revel in calculating the odds and taking chances (risk preferrers). Trying to impose the decisions or the risk management regime of a risk preferrer on a risk averter, and vice versa, will not work and could jeopardise their entire business.

In the horticultural industry, a high risk-preferrer may be a high input producer with a high debt load and less permanent water per ha.

If you are risk averse, you will tend to have more permanent water for a given area. You may be driven by a desire for lower debt.

Almost any business choice has an upside and a downside and your view on the size of the risks you take is a very personal one.

At the end of the day, our decisions are made on a mix of "the numbers" and what our "gut" tells us. Both are important. We ignore our intuition at our peril; we can all think of examples where our intuition proved correct and the logical explanation only became apparent later.

Are you a risk averter or a risk preferrer?

Would you enjoy more risk or less risk than your business currently presents?

Does this make you want to increase or decrease your permanent water entitlement?

7.3 ASSESSING YOUR BUSINESS'S RISK PROFILE

Each business is unique. Table 7.1 looks at the physical, financial and personal aspects that may be influencing your attitude to water security risk. Tick the boxes for each of the influences on your business then total each of the three columns.

Table 7.1 Assessment of influences on business risk

Type of Influence	Potential influence on you water risk position	YES (& easily) Comfortable with temporary trading to meet shortfalls	Maybe	NO (or difficult) Prefer more permanent water to increase security
Physical	I can dry off large areas of lower value crops to cope with a low allocation and use this as an opportunity to redevelop			
	I can dry off irrigation with little extra recovery costs in future years			
	I can easily access water market to buy extra water when needed			
	I can sell entitlement without losing services from irrigation provider such as affecting water rationing			
Financial	I believe temporary water is cheap compared to permanent water averaged over dry and wet years			
	I spend more than 10% of my total farm income on interest and leases (not including capital repayment)			
	I have above average operating surplus per ML for my industry			
	I believe that there will be little capital growth in the value of permanent water			
Personal	I have the skills to trade and enjoy regularly trading water			
	I am comfortable with the idea that in some years I will be looking to supplement my water allocation			
	Add up the number of ticks in each column			

If you have more ticks in the YES column, it suggests that you a risk preferer.

If you have more ticks in the NO column, it suggests you are more risk averse and you value a higher level of water security.

What other influences need thinking about?

Has working through this section made you want to increase or decrease your permanent water entitlement?

7.4 ASSESSING YOUR INDUSTRY'S APPROACH TO RISK

Apart from understanding your personal approach to risk, and your business's capacity to deal with risk, it is also important to understand how your industry in general responds to the risk of water shortage. Similarly it is important to understand how your industry compares with the other major water using industries. A range of irrigation industries influences the water market; the important characteristics of the main ones are shown in Table 7.2 following.

A key implication of the differences in industries is that in a year of very low seasonal allocations the cost of losses in subsequent years for dairy and horticulture will mean that they will pay more for water, while low value croppers and broad acre grazers may choose to sell. These sellers will lose crop income in that year, but not necessarily have carryover costs in subsequent years.

The performance of the rice and dairy industries has been the main driver of water prices in the southern part of the Murray Darling Basin. These industries are likely to continue to dominate water trading. Therefore, the profitability of rice and dairy will influence future water prices. Horticulture while having a higher profit per ML is still a very small player in terms of volumes used or traded.

The trend in permanent water trading so far has been that water is moving from industries that make a low profit per megalitre towards the buyers who make a higher profit per megalitre. The sellers are more likely to be willing to trade off some security for a lower cost in owning water entitlement.

Even within the horticultural industry, there is a wide range in performance of properties with both buyers and sellers participating in the water market.

Table 7.2 Risk drivers for different irrigation industries

Industry	Gross Income/ML	Dominant risk factor	Impact of lack of irrigation supply	Capacity to use surplus water
Broad acre grazing Beef and sheep	< \$100 /ML	Cost of water	Relatively low crop loss as each farm has annual pasture areas not irrigated	Some - by irrigating extra annual pasture Difficult to respond quickly to changes in water availability due to inability to change stock levels
Lower Value Annual Croppers Rice	\$100 - \$300/ML	Potential to vary the planted area	Relatively low crop loss as crops are not planted if water is not available	Some - by planting extra crops and low labour requirement per ML
Medium Value Croppers Grains and oilseeds	\$400 - \$600/ML	Potential to vary the planted area	Relatively low crop loss as crops are not planted when there is no water available	Large – by using on-farm storages and then sowing more crop
Higher Value Annual Croppers Cotton	\$800- \$2000/ML	Need for consistent output	Relatively high crop loss Hold contracts to supply consistent quantities of produce	Limited - by increasing the planted area
Permanent agriculture Dairy	\$200 - \$600/ML	High fixed costs Water price compared against hay price and grain price	Relatively high crop loss as plants are already in the ground and drought damage cannot be avoided Impact of drought can reduce production in subsequent seasons	Limited - by increasing the planted area (the enterprise capacity is usually constrained by a limiting resource other than water eg land area or herd size)
Permanent horticulture Orchards and vineyards	\$1,000 to \$5,000/ML	High fixed costs	Very high crop loss in current and subsequent years	None

7.5 UNDERSTANDING YOUR PLACE IN THE TRADING MARKET

The chart on the next page illustrates the schedule of operations for the major traders of water (rice and dairy). It may be useful to know when buyers and sellers may be 'locked' in or might be considering selling or buying. On the other hand, it is important to note that Appendix 2 suggests that there is not a strong relationship between these critical decision making points and market activity.

At this stage, the biggest drivers of temporary trade seem to be price, seasonal conditions and seasonal allocation announcements. Time of purchase doesn't necessarily match time of use.

Risk preferrers who do not have sufficient water for their total seasonal requirements can delay their purchase in the hope that seasonal allocations will rise and prices will drop or that early Autumn rains may arrive. This paid off in the early years of water trade on the Goulburn system, but in 2001/2 it did not and temporary water prices went very high.

How does will this section influence the timing of your water trading decisions?

You should now be able to answer the sixth question:

Q6. What are the main drivers in my water trading decisions?

8 MONITORING AND REVIEWING YOUR DECISIONS

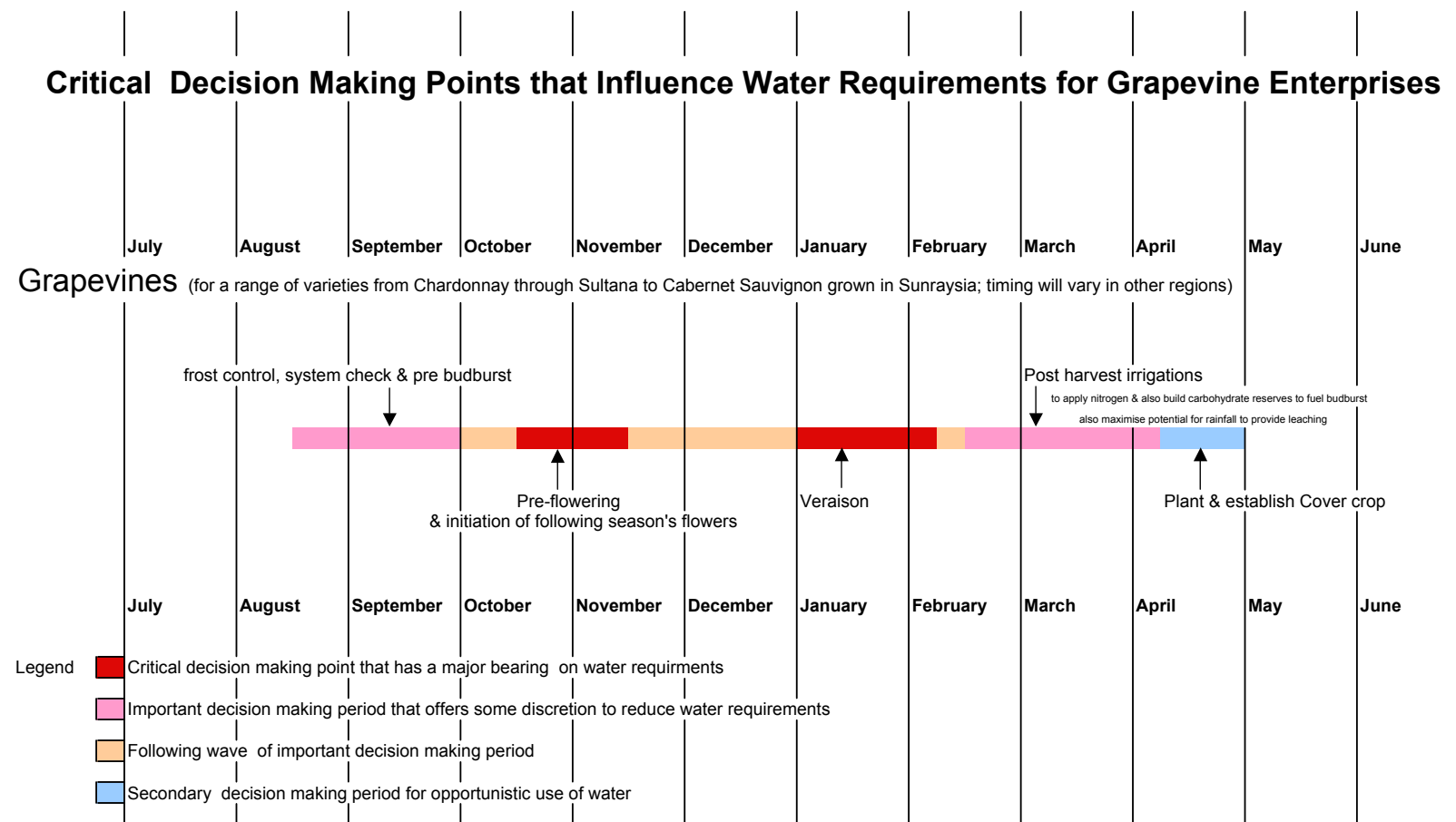
“What would have happened if...?” When you ask yourself this question, it is not “crying over spilt milk”, it is learning.

It is important to evaluate your risk management decisions. How do you know if you made the right decision? You need to be able to measure your progress so you do not make the same mistake twice and so you can build on the success of your risk management.

As you make predictions each year and record what actually happened you will be building up your understanding on the water market for your business. You can:

- Compare budget figures to actuals
- Update your budget figures
- Assess how you feel about your position regularly as the water environment and rules continue to evolve.

APPENDIX



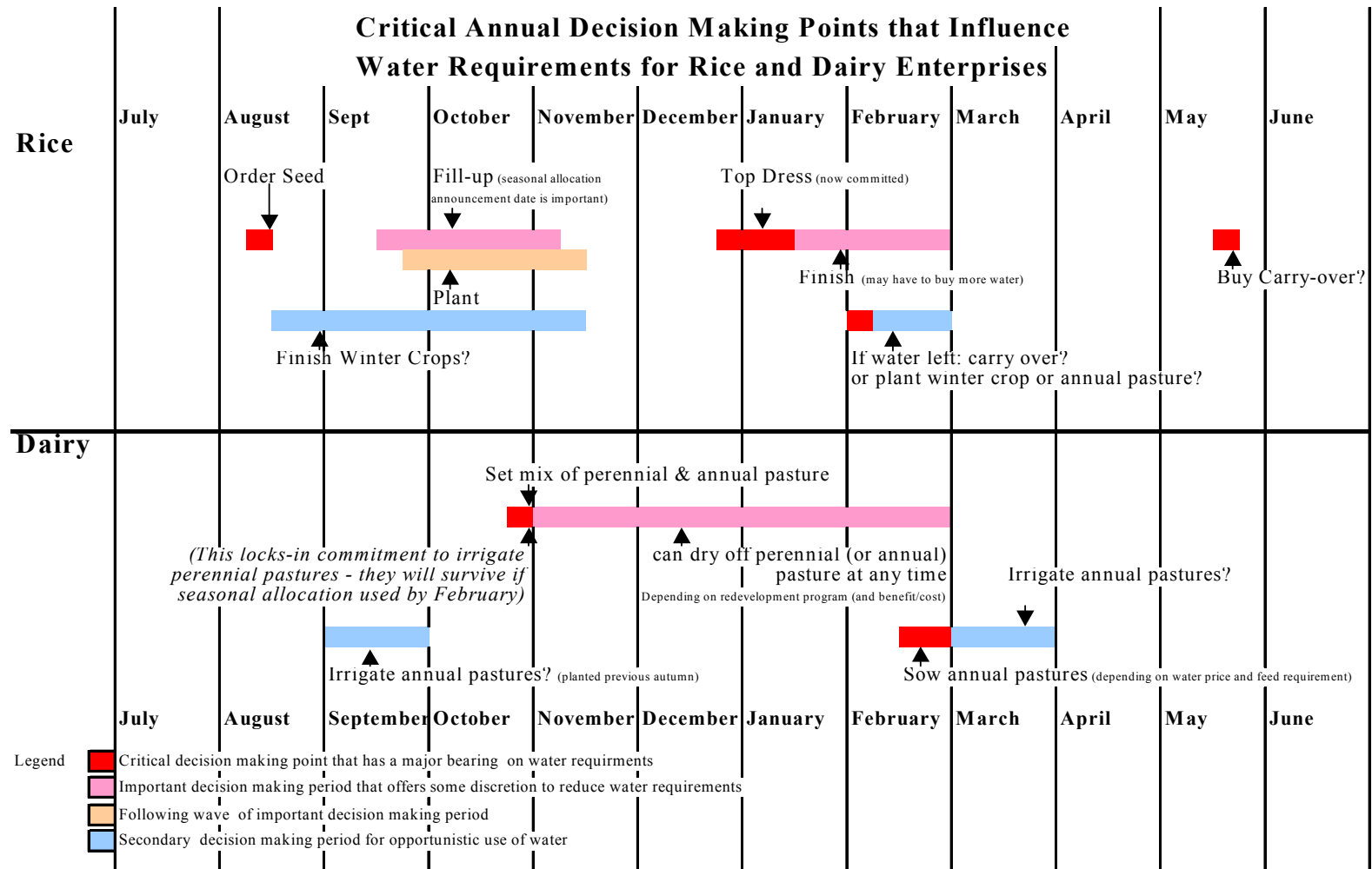


Table 1 Estimating how much water you need to irrigate fully

Crop/Pasture	ha	Water requirement ML/ha	Total water needed ML = ha x ML/ha
Orchard area - mature trees			
Orchard area - young trees			
Grape vines - mature			
Grape vines - young			
Other crops - mature			
Other crops - young			
Total all ML			

Table 2 Indicative water allocation probabilities (for my System)

Scenario for seasonal allocation	Allocation (%)	Odds (%) or years in 100	Allocation ML per ML entitlement (ML)	Odds x allocation
	a	b	c	b x c
Very high				
Av to high				
Av to low				
Low				
Very low				
Extreme 1:100 years				
Long term average		100%		sum above =

Q1. How often will I be short of Water?

My answer = _____

Table 3 Estimating how much water you will have available

Scenario for seasonal allocation	Odds (%) or years in 100	Allocation ML per ML entitlement	My Entitlement held	My Water allocation	Water needed to irrigate fully (same each year)
	a	b	c	d = b x c	e
Very high					
Av to high					
Av to low					
Low					
Very low					
Extreme 1:100					
Long term average	100%				

Table 4 Assessing water trading costs for annual purchases

Scenario	Extra ML needed	Market Price of water \$ / ML your estimate plus transfer costs	Market value of water in that year	Odds %	Financial business
	a	b	c = a x b	d	e
					Sell water
Very high					
Av to high					
Av to low					
Low					
Very low					
Extreme 1:100 years					
Long term average				100%	sum of sales is \$ ____
					Aver. tempo business mil

* NOTE THAT THE ELECTRONIC SPREADSHEET AUTOMATICALLY TRANSFERS NUMBERS IN COLOURED BOXES FROM ONE TABLE TO ANOTHER - ON A HARD COPY THIS MUST BE DONE MANUALLY

Q2. Over the long term, how much will it cost me to use temporary water trade to avoid being short of water?

Answer = _____

What's the worst year and how often does it occur?

Answer = _____

Table 5 Assessing value of temporary water

Scenario	Allocation ML per ML entitlement	Market Price of water \$/ML less water charge your estimate	Odds %	Weighted value per ML of entitlement
	a	b	c	$d = a \times b \times c$
Very high				
Av to high				
Av to low				
Low				
Very low				
Extreme 1:100 years				
Long term average			100%	Average annual value of entitlement = sum above = \$ ____ /ML

↑ ↑ ↑
Transfer from previous tables of same colour

Table 6 Estimating the value of permanent water entitlement against market price

Market value of permanent water	Interest rate you nominate	Capital gain or loss You expect	Net interest rate	Annualised cost of market value for permanent water	Add any fixed costs (eg. access charges, drainage charges, environmental charges charged) if different annual purchase price water	Total
a	b	c	$d = b - c$	$e = a \times d$	f	
\$ ____						
\$ ____						
\$ ____						
\$ ____						
\$ ____						
\$ ____						

Once you have completed the worksheet you will be closer to answering the third

Q3. Over the long-term, am I better off trading permanent or temporary water?

Q4. How much can I afford to pay for temporary water over the long term?
Income
Step 1. Calculate income per ML

From your profit and loss statement, write down gross income for year (\$)

Subtract income (\$) from dryland enterprises or other off farm income from total farm income (\$) to give the proportion of income produced from irrigation:

$$\boxed{} - \boxed{} = \boxed{} \text{ income from irrigation}$$

(gross income) (off farm income)

Calculate ML of irrigation water used in the year. Divide income from irrigation by number of ML irrigation used to give income for each ML:

$$\boxed{} / \boxed{} \text{ ML} = \boxed{} \text{ \$/ML}$$

(irrigation income) (irrigation used)

Operating costs
Step 2. Calculate operating costs from irrigation

From profit and loss, look up the total farm expenditure for year. Subtract costs that are not operating costs such as interest, lease costs, temporary water purchases, rent, payment to partners, superannuation, depreciation and any capital expenditure (eg replanting/vine training) that have been included in the total expenditure.

You will be left with your farm operating costs; it should include variable costs such as labour, fertiliser, contractors, fuel, repairs and maintenance, water charges, rates, electricity, chemicals, consultants, and overheads such as office, accountant, legal.

$$\boxed{} - \boxed{} = \boxed{} \text{ farm operating costs}$$

(farm expenditure) (non operating costs)

Deduct any dryland farming operating costs (estimate costs for dryland part of farm if significant).

$$\boxed{} - \boxed{} = \boxed{} \text{ operating costs for irrigation}$$

(operating costs) (dryland costs)

Step 3. Calculate operating surplus from irrigation

Subtract operating costs from irrigation (Step 2) from income from irrigation (Step 1)

$$\boxed{} - \boxed{} = \boxed{} \text{ operating surplus from irrigation}$$

Step 4. Calculate operating surplus from irrigation/ML

Divide operating surplus from irrigation (Step 3) by number of ML of irrigation water used in the year

$$\boxed{} / \boxed{} \text{ ML} = \boxed{} \text{ \$/ML}$$

In high rainfall areas (>500mm/year) the operating surplus can be inflated because rain increases production. Therefore, the final figure needs to be adjusted down so that it only reflects the surplus due to irrigation. A simple way of approximating the value of irrigation is to estimate the percentage of production caused by irrigation and multiply the operating surplus per ML by this amount. For example, if total production would be 33% if there was no irrigation then 67% is due to irrigation and the operating surplus needs to be multiplied by 67%.

For areas of rainfall > 500 mm multiply by % productive capacity caused by irrigation =

$$\boxed{} \text{ \$/ML} \times \boxed{} = \boxed{} \text{ \$/ML}$$

Step 7. Calculate the long term average price you are prepared to pay for water after considering capital and owners labour costs

In the long term, it is important to cover capital costs (such as interest/return on capital, machinery depreciation and orchard or vineyard depreciation ie need to replant) and owners' labour costs. You need to do a full farm budget to calculate your own figures for this, particularly for farm expansion. But the following figures may be useful as a guide:

Use the figure of 25% of the operating surplus if the capital costs associated with using the water purchased will be high, for example when new equipment or a new layout is needed.

Use 50% if there is existing spare capacity within your farm to expand irrigation and production with little extra capital and if the owner has the time to manage the expansion and the need for extra profit is high.

$$\boxed{} \times \boxed{} = \boxed{} \text{ \$/ML}$$

Put simply, if your final figure is significantly higher than the annual cost of buying water then it may be worth buying water and expanding. If it is much lower then it may be worth selling some water.

Q4. How much can I afford to pay for temporary water over the long term?

My Answer: _____

Q5. How do the alternatives to water trade compare?

Example scenario	Options different to base case	Change in ML used (ML)	Change in Income (\$)	Change in total costs (capital + operating)(\$)	Change in value of owners' labour(\$)	Impact next year & future(\$)	Change in profit(\$)	Revised annual profit(\$)	Marginal profit/ML (\$/ML)
	Describe the Action	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f = b - c - d - e</i>	<i>normal budget profit + f</i>	<i>f/a</i>
Typical normal year	Average seasonal allocation used and usual trading and ML 'sales' usage	0	0	0	0	Nil	0		0
___ ML short of water									
___ ML extra water									

Example scenario	Options different to base case	Change in ML used (ML)	Change in Income (\$)	Change in total costs (capital + operating)(\$)	Change in value of owners' labour(\$)	Impact next year & future(\$)	Change in profit(\$)	Revised annual profit(\$)	Marginal profit/ML (\$/ML)
	Describe the Action	<i>a</i>	<i>b</i>	<i>c</i>	<i>d</i>	<i>e</i>	<i>f = b - c - d - e</i>	<i>normal budget profit + f</i>	<i>f/a</i>
Typical normal year	Average seasonal allocation used and usual trading and ML 'sales' usage	0	0	0	0	Nil	0		0
___ ML short of water									
___ ML extra water									

Q4. How do the alternatives to water trade compare?

Table 1 Assessment of influences on business risk

Type of Influence	Potential influence on you water risk position	YES (& easily) Comfortable with temporary trading to meet shortfalls	Maybe	NO (or difficult) Prefer more permanent water to increase security
Physical	I can dry off large areas of lower value annual pasture/crops to cope with a low allocation			
	I can dry off irrigation with little extra recovery costs in future years			
	I can easily handle large amounts of extra bought in feed if required			
	I can easily access water market to buy extra water when needed			
	I can sell entitlement without losing services from irrigation provider such as affecting water rationing			
Financial	I believe temporary water is cheap compared to permanent water averaged over dry and wet years			
	I spend more than 10% of my total farm income on interest and leases (not including capital repayment)			
	I have above average operating surplus per ML for my industry			
	I believe that there will be little capital growth in the value of permanent water			
Personal	I have the skills to trade and enjoy regularly trading water			
	I am comfortable with the idea that in some years I will be looking to supplement my water allocation			
	Add up the number of ticks in each column			

Has working through this section made you want to increase or decrease your permanent water entitlement?

Q6. What are the main drivers in my water trading decisions?

Personal

Business

Industry

Critical decision points through the season