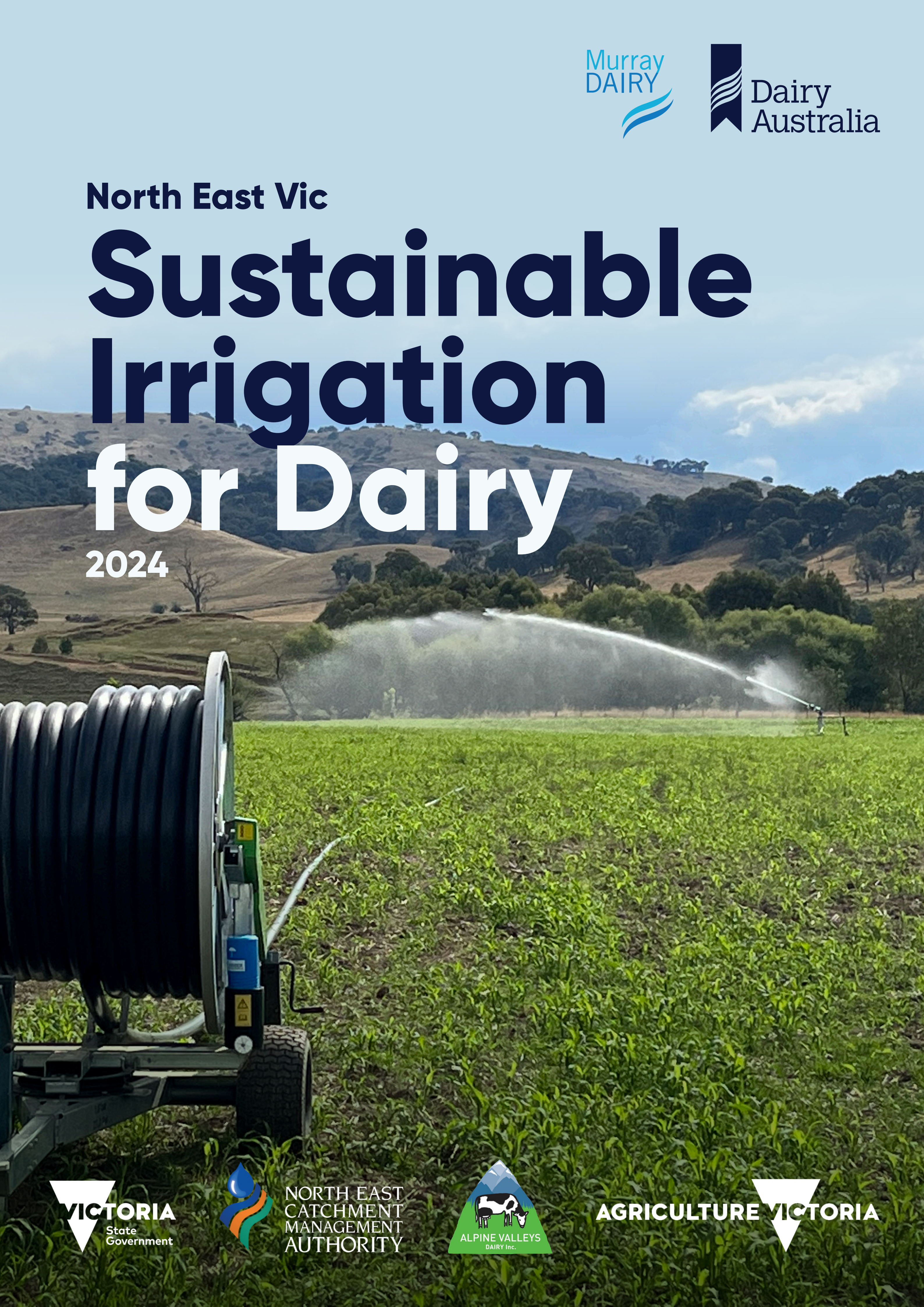


Murray DAIRY

Dairy Australia

North East Vic

Sustainable Irrigation for Dairy

2024

VICTORIA State Government

NORTH EAST CATCHMENT MANAGEMENT AUTHORITY

ALPINE VALLEYS DAIRY Inc.

AGRICULTURE VICTORIA

This project has been funded by the Victorian Government and was undertaken in partnership with the following agencies and organisations:

Contents

Project Overview

Proposal

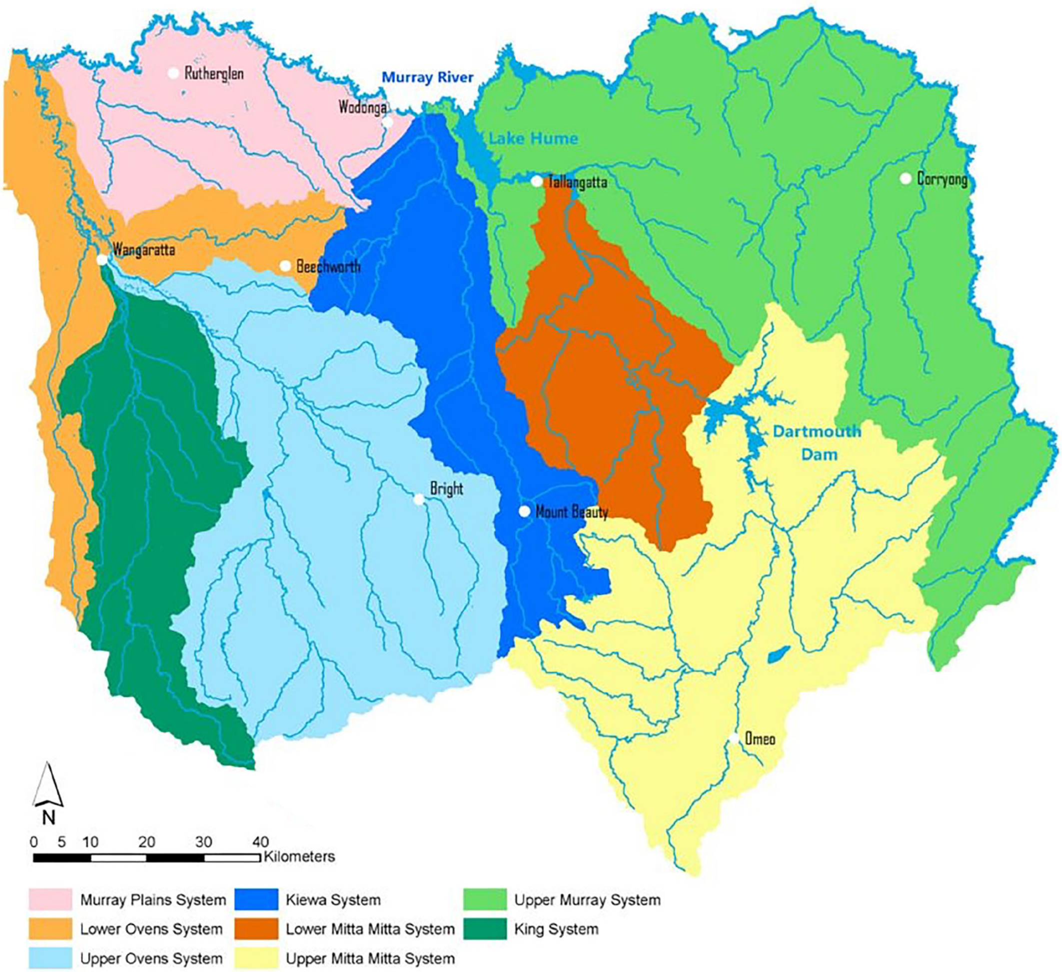
Alpine Valleys Dairy completed a significant study in 2021 called The Dairy Climate Futures report. This report outlined a climate strategy for the northern Victorian Alpine region. One of the areas for work identified was the development of irrigation strategies to ensure the effective, economic and environmentally sustainable use of irrigation water.

This project is following up on that report by looking into various factors impacting irrigation sustainability in the Alpine Valleys of Victoria. Some of the topics being investigated include irrigation system efficiency and applicability to crop type, irrigations role in broader farm system decisions, water use considerations, water source reliability and parameters that effect profitable and sustainable use of the irrigation resource.

For this project Alpine Valleys Dairy formed a working group to identify the irrigation and water utilisation challenges that have the biggest potential to help private landowners address the barriers to improving water use. Case studies were then identified as good representations of these challenges and have been investigated as real world examples. These case studies provide specific testing of the broader principles for good irrigation planning in the region. The material produced is specific to the situations being tested so for any individual looking to implement a new irrigation project they will need to context these case studies with their own unique situation and utilise specific professional support/advice services.

Regional Overview

Figure 1 NE region water management zones



Source: NE Regional Catchment Strategy

Irrigation water in the Alpine Valleys of northern Victoria is both a valuable resource for the region and also of critical importance to the health, productivity and environmental health of the broader Murray basin.

The North East catchment covers just 2% of the land mass but 38% of the water in the Murray Darling Basin (source: North East Regional Catchment Strategy). The huge contribution of water into the Murray Darling system coupled with being situated at the start of the largest river places the region under a lot of scrutiny to ensure good stewardship of this resource.

Annual average rainfall in the North East sits at 1060 mm over the last 30 years. With large seasonal and rain fall event variances across the different valleys, the whole area is classified as receiving reliable winter rain and highly variable summer rain particularly in the lower altitude zones. (source BOM). The temperature variance is large across the region with bitter frost and severe heat days both common (source North East Regional Catchment Strategy) with lasting spells of sub 10 degree and over 35 degree days common. This obviously plays a major role in the availability and use of water for irrigation explored in the case studies below.

Surface Water

In the Victorian Alpine region there is three major catchments Ovens/King, Kiewa and Upper Murray which are split into 8 management systems (see fi.1 above). The area also includes 7 million megalitres of storage capacity across the 5 water storages; Hume, Dartmouth, Rocky Valley, Buffalo and William Hovell. These storages service, industry, urban areas and irrigators right along the entire Murray system.

The area contains both regulated and unregulated streams with reliability, access, licensing varied between systems, which in turn effects the legality and suitability for different irrigation pursuits within the region. It is important to note that in this report we look at specific farms and where necessary outline the rules governing access and use of irrigation water on these farms **which may not be relevant to your specific circumstances.**

Unregulated streams will tend to be seasonal and/or low volume and trading of water restricted to a tight area (if allowable at all) so often only suitable for small scale, opportunistic use. The amount of water allowed to be taken in these systems is subject to restrictions and rosters based on the flow rate of those rivers (source Rosters and Restrictions GMW)

Regulated systems will tend to be more reliable, and water is generally tradable based on where water can be delivered to. The use and trade of this water is tightly monitored.

The water level in the regulated areas isn't only impacted by rainfall as is the case in most of the unregulated systems, but also by the volume of water being held in the 5 storages. In regulated systems seasonal determinations of allocation (how much water is made available to water entitlement holders) is made based on storage levels and projected inflows. Water levels of regulated streams and storages is then impacted by system management by the water authority, with water being released for consumptive or environmental use and in the case of Dartmouth for hydro-power generation and in line with system operating rules to manage inundation risks.

In northern Victoria no new surface licences are issued for surface water, access can only be gained by purchasing existing licences (source Polices for managing take and use licenses, water act 1989)

Groundwater

In the upper catchments and valley floors small localised systems can be found that are suitable for agriculture. With larger systems in the Ovens and King Valleys capable of supporting large scale irrigation districts.

The suitability of groundwater sources is influenced by the water quality, depth it's found and how easy it is to access (both physically and legally). In many cases it isn't until the time, money and expense to investigate a sources depth, quality and capacity is made can the feasibility of groundwater use be determined. In well mapped higher use areas predicting the potential yield and access requirements is more predictable however in many areas of the alpine valleys these predictors are not available. This report includes two case study's exploring new groundwater irrigation plans outlining the exploratory process and final outcomes.

New licences for groundwater access are only issued when it does not exceed the total permissible consumptive volume (TPCV) (source Polices for managing take and use licenses, water act 1989) determined for that system already under license (regardless of current use). Any new irrigation development requires, not just an understanding of the capacity, accessibility and quality of the water but also the size of the whole system and the associated calculated TPCV, how much of this capacity is already licensed and the suitability of your land for the planned irrigation use. This is further complicated where the aquifer is poorly mapped and or understood as the license is then likely to have clauses in place to review the conditions based on how the system is responding to use. Groundwater is also subject to seasonal allocation rules so access to the full licensed amount of water can be subject to restrictions in dry seasons or periods of low quality (as is surface water).

For this project Alpine Valleys Dairy formed a working group to identify the irrigation and water utilisation challenges that have the biggest potential to help private landowners address the barriers to improving water use. Case studies were then identified as good representations of these challenges and have been investigated as real world examples. These case studies provide specific testing of the broader principles for good irrigation planning in the region. The material produced is specific to the situations being tested so for any individual looking to implement a new irrigation project they will need to context these case studies with their own unique situation and utilise specific professional support/advice services.

Further details on surface and groundwater rules is available on the GMW website

https://www.g-mwater.com.au/water-operations/water-information/diversions/diverter-licencing-information

https://www.g-mwater.com.au/water-operations/water-information/diversions/rosters-and-restrictions

https://www.g-mwater.com.au/diversions-customers/diversions_surface-water

https://www.g-mwater.com.au/diversions-customers/diversions_groundwater

https://www.g-mwater.com.au/water-operations/water-information/ground-water/management/lowerovensgma

Irrigation potential for dairy farmers

With North East Victoria a generally reliable place to farm, with great natural water sources there remains plenty of opportunity (and some risk) in developing irrigation in the region. Many places in the North East are suitable for profitable dryland dairy farms and there is huge potential for long term sustainable use of irrigation water to enhance, intensify and/or expand the dairy footprint. There is also (quite rightly) scrutiny on irrigation practices in this region to preserve this area and avoid downstream impacts.

With all irrigation use there needs to be an irrigation and drainage plan in place, with the farming system, access to resources and general suitability of slopes/soils/climate of each farm determining how sustainable and efficient water use might be. This is further complicated in the North east compared to other districts as the reliability, availability, regulations, off farm impacts can be very localised and require case by case assessment.

Irrigation parameters across North East Catchment

Seven locations around the NECMA catchment area have had climate data examined for the.

- Irrigation demands for extending spring, autumn start and irrigating all season
- Weekly evapotranspiration rates
- Historic irrigation start up dates

These climate variables have been relied on heavily in the case studies to help model current practice versus the potential for improvement with irrigation investment. The tables in the appendix show figures for all modelled sites across the catchment allowing readers to re calculate the case study assumptions for figures more closely aligned to where they farm. The case studies also utilise assumptions of climate change outlined in the NECMA climate mapping work. Project Overview and Outcomes (necma.vic.gov.au)

If you require more information on irrigation in the Goulburn Murray Water system or planning your water portfolio there is a self paced, interactive water modules resource available, simply email elearning.support@dairyaustralia.com.au and request access to the GMID water modules course. Some screenshots of this resource are included in the appendices.

Case Studies

Overview

The case studies we have chosen are meant to cover a range of scenarios that you can pick, choose and alter to provide some starting thoughts for your own plans. We have taken a similar approach for all of them.

- Where is the water coming from?
- How certain is the quality, yield, access and cost of the water? (or do we need to find out)
- What is the current situation (production, waste, water use, operational cost, capital cost etc)?
- What is the feasibility, cost and potential benefits of making a change compared to current state?

Case Study: Improving irrigation system and changing use on small out-block

Small scale irrigation upgrade for small outblock	
Water source	Natural recharge dam 2.8 ML
Quality, Yield, Access, Cost	High quality water capacity recharge approx. .65 ML a day, surface water with only cost small dam license.
Current situation	Irrigation is by mobile spray system, with long set up time and effort, servicing aproximately ¾ of the available area of permanent pasture.
Potential change	Upgrade irrigation system to utilise more of the available water to grow maize crop.

The current situation

Farm Size **61ha**

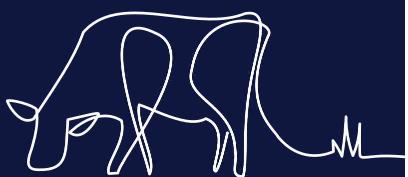
Cows **125**

Jerseys calving in May (looking to increase to 150)

Peak milk **21.5L/cow/day**

(target to 23-25)

The current feedbase is 61ha of dryland pasture. The case study area is 4.2 ha of irrigated land separate to the milking platform. The capacity of the water yield is undetermined as it is reliant on natural re-charge and the rate of recharge is untested. This study is investigating the potential for utilisation of this area for the dairy enterprise.



This document contains irrigation advice only and does not constitute approval or otherwise of any irrigation development. You should seek personal/business advice based on your own circumstances.

Figure 2 shows the annual feed demand against what is estimated to be grown in a year, modelled on an Autumn break in April and an 80% level of efficiency for pasture grown and grazed. The blue line represents the demand from the cows and the green line the supply from pasture. The short fall is currently made up from feeding hay/silage and concentrate.

Figure 2 Pasture demand compared to pasture growth rate kg DM/ha/day

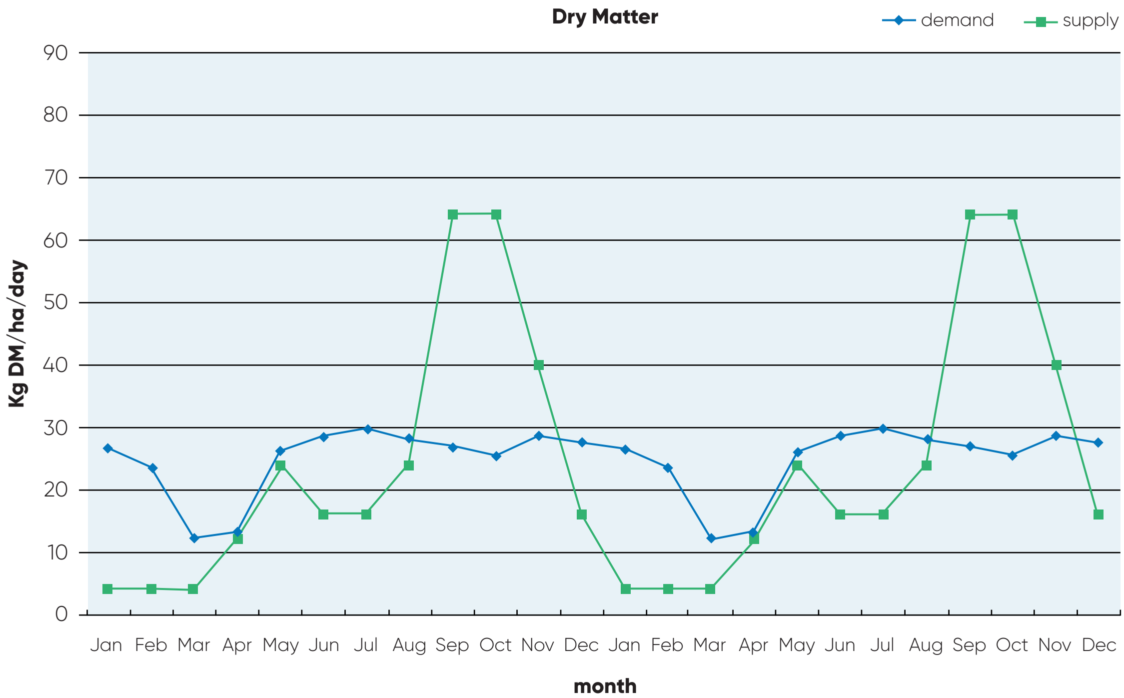
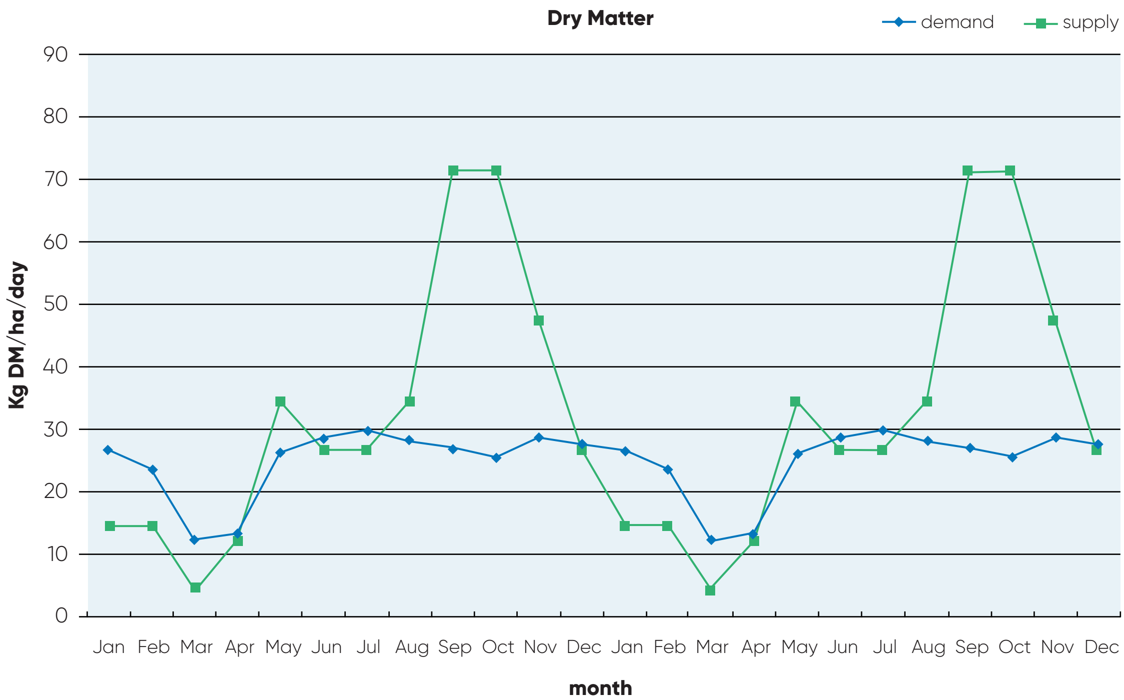


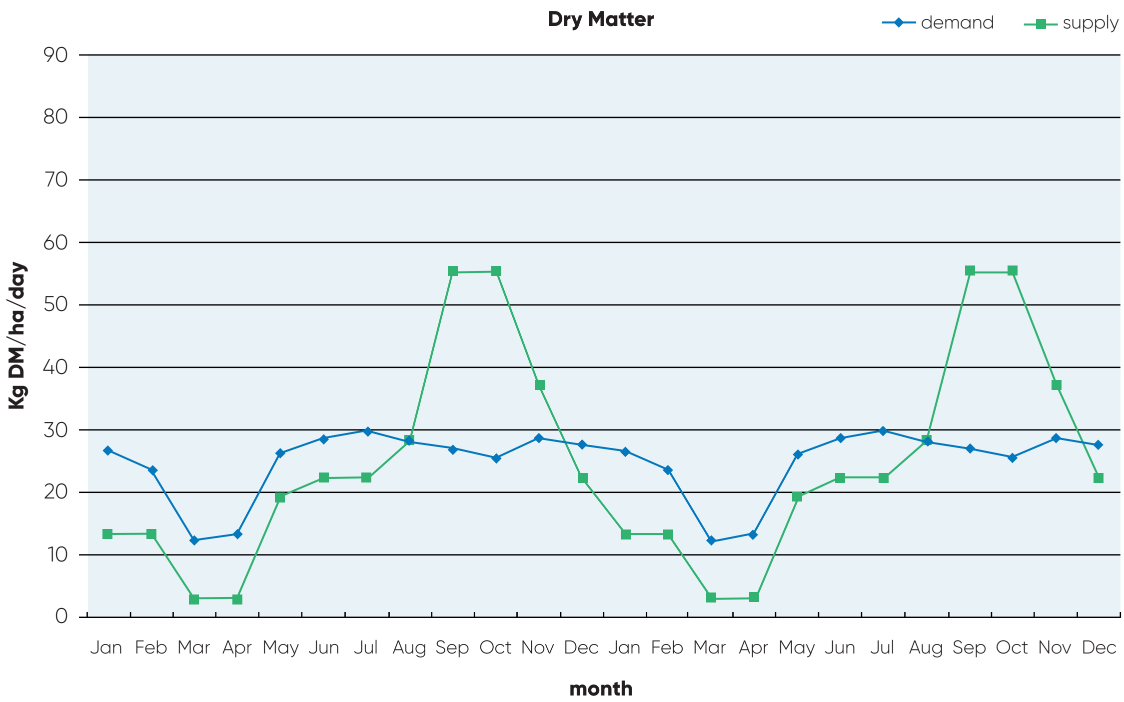
Figure 3 shows the addition of concentrate added to the diet at 5 kg/cow/day for most of the year dropping to 3.5 kg/cow/day in Spring.

Figure 3 pasture demand compared to pasture growth rate and feeding pellets kg DM/ha/day



To illustrate a poor year as is predicted to be more common under a climate change scenario figure 4 graphs out demand and production with an autumn break in May and the pasture efficiency dropping to 60% with the same amount of grain. By comparing Figure 4 (late break and poorer production/utilisation) and Figure 3 (current state) illustrates the predicted impact a step change caused by a change in climate for NE Victoria could have on this businesses ability to grow feed, based on the NECMA climate modelling work.

Figure 4 Pasture demand compared to pasture growth rate with a later autumn break and reduced pasture growth and feeding pellets kg DM/ha/day



The case study farm includes a block of approx. 4.2 usable hectares, not close enough to the main farm to be part of the milking platform. This area is currently utilised for ad-hoc irrigation of ryegrass that is cut for hay and silage, young stock and dry cow grazing. This area hasn't been a production focus, due to distance from the dairy, tricky access from the main farm for stock and being a smallish area.

How would a focus on this underutilised land/water asset to grow a high yielding crop like Maize for silage impact this business?

How much water is required each year?

Using historic climate conditions going back to 1970 summer rainfall and evapotranspiration was modelled for this farms location. On average irrigated Maize at this site in 5 out of 10 years would require 5.4 ML /ha (which is equivalent to 540mm of extra rainfall) (Figure 5).

Figure 5 outlines the modelled plants water requirement from wetter to drier (e.g 10% = wettest/lowest evapotranspiration year to 100% driest/highest evapotranspiration year). The figures are a calculation of the water demand from the plant so the inefficiency of the irrigation system needs to be factored in when estimating irrigation water required (e.g a fixed irrigation system we model as losing 20% of the water).

So by modelling on 50th percentile year and building in 80% efficiency of the irrigation system.

5.4 ML/ha ÷ 0.8 efficiency = 6.8 ML/ha would need to be applied to maximise Maize growth

Figure 5 Percentile water requirement

Percentile of water required	Irrigation of Maize or pasture over summer ML/ha	Autumn Start February	Spring start till November
10%	3.2	1.2	0.3
20%	4.3	1.6	0.5
30%	5.0	1.7	0.8
40%	5.3	1.9	1.0
50%	5.4	2.1	1.2
60%	5.8	2.2	1.4
70%	6.3	2.7	1.7
80%	7.2	2.9	2.1
90%	7.7	3.2	2.4
100%	9.3	3.8	3.4

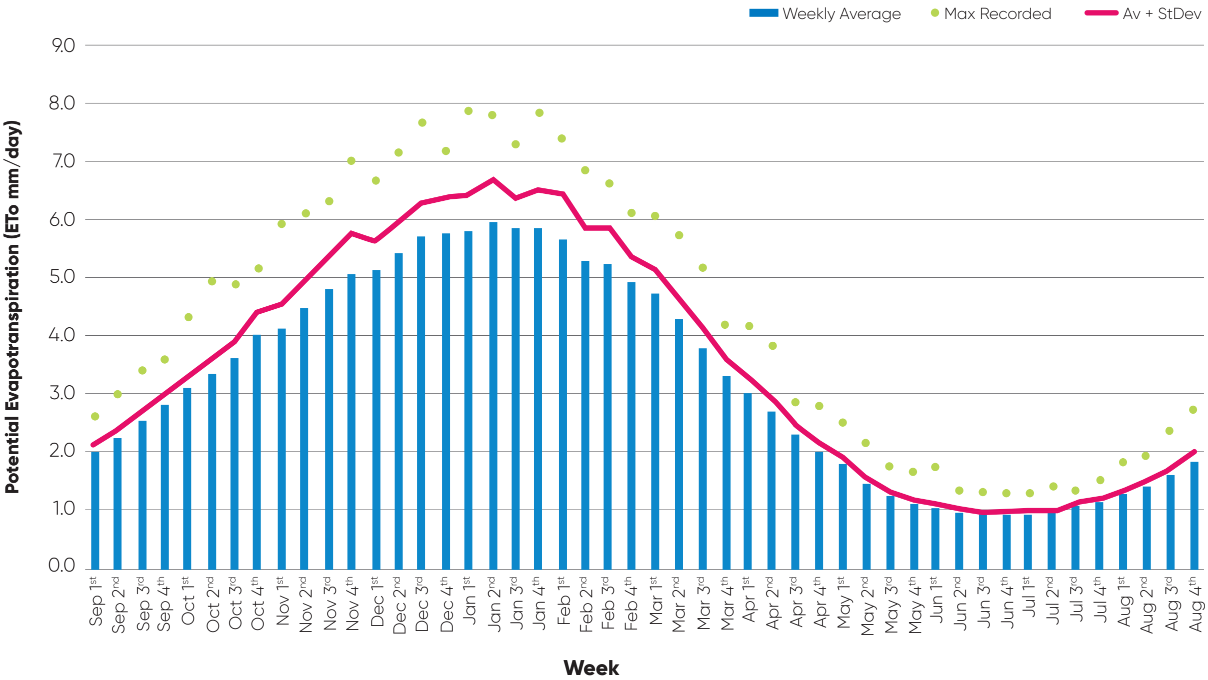
The dam capacity

On this property the irrigation requirement would be met by a licenced dam that naturally recharges. The dam can hold 2.8 ML which based on the predicted application rate is not large enough to warrant irrigation without significant recharge.

A test was conducted on the dam and the estimated recharge was .65 ML a day. It took 10 hours to lower the dam 813 mm, with a pump running at 65 litres per second so a total of 2.3 ML was pumped out (with an estimated .5ML of capacity still in the dam). It took 110 hours to fill with a bit of rainfall entering. This is a refill rate of 0.65ML/day during Autumn. Ie. it takes 4.6 days to fill. This is a single test so to be confident the refill rate needs to be retested at different times of the year across different seasons to determine reliability of the re-charge (the farmer believed there was a consistent recharge amount based on their experience).

Based on the data in figure 5 The crop is going to be using 6.7 mm x 1.2 = 8 mm/day at the peak. If the system is only 75% efficient the maize crop will be requiring 10.7 mm/day to account for evapotranspiration (figure 6) and system inefficiencies.

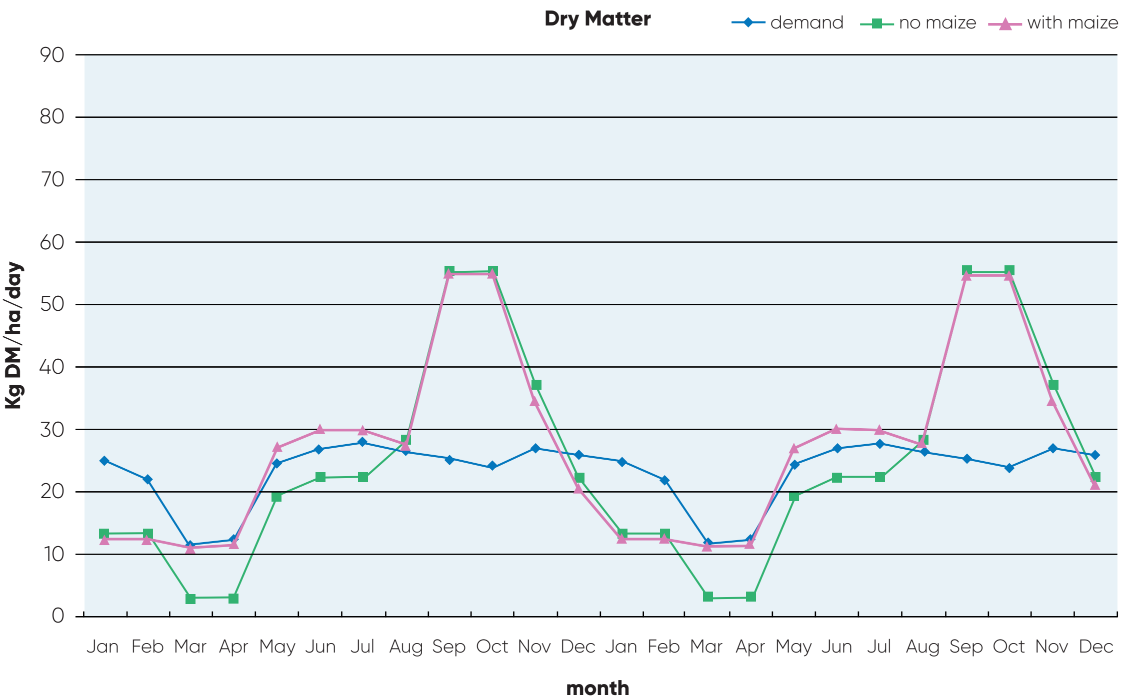
Figure 6 Daily Evapotranspiration rate for this location



With a fill rate of 0.56 ML/day and requiring a 10.7mm/day you should be able to irrigate 5 ha. The paddock is 4.2 ha available to irrigate so in theory there should be enough water.

This scenario included feeding the same amount of concentrate. If the 4.2 ha of maize is utilised this feed gap can theoretically be covered (figure 7).

Figure 7 Feed demand compared to growth rate with a later autumn break and reduced pasture growth with and without maize



Cost of setting up irrigation for Maize production

Figure 8 shows an estimate of the total irrigation cost and then the breakdown of this cost, diesel, labour, water, interest and depreciation. This has been done for three different irrigation systems.

Figure 8 Comparison of irrigation cost

	Fixed ($/ha)	Skippers ($/ha)	Travelling gun ($/ha)
Diesel	513	688	856
Labour	44	63	126
Water	318	360	360
Interest	200	125	100
Depreciation	400	250	200
Total	**1,475**	**1,486**	**1,642**
Growing cost	**2,000**	**2,000**	**2,000**
Cost if yield 16t	**$217/t**	**$218/t**	**$227/t**

When the cost of sowing fertilising, spraying, harvesting etc is calculated the growing cost calculates to an estimated $2,000/ha (see figure 9 for estimates used). This puts the cost of growing and irrigating the maize crop at between $3,475/ha and $3,642/ha. To grow 16 tonne/ha of silage (a conservative estimate) it is estimated to cost between $217/tonne to $227/tonne depending which irrigation system is in use.

Figure 9 Irrigation set up costs and estimates used

Expense	Cost/Estimate
Goulburn Murray Water fee	$50/ML
Diesel	$1.2 litre (by 70% efficiency of pump)
Labour	$35 per hr
Interest	5%
Depreciation of plant and equipment	20 years
Setting up fixed irrigation	$8,000 ha
Setting up skippers	$4,000 ha
Efficiency of skippers	75%
Pressure to run travelling gun	80m
Efficiency of travelling gun	75%

Case Study: Maintaining current homegrown feed security under climate change through irrigation

Irrigation for large grazing enterprise	
Water source	Regulated system, options to buy permanent water or use market to lease or purchase temporary water.
Quality, Yield, Access, Cost	High quality access and reliability; however in dry years allocation/ availability is low and cost is substantial. Permanent water.
Current situation	There is minimal irrigation in place and in essence farm is currently run as a dry land operation utilising opportunistic irrigation.
Potential change	Install irrigation system to increase quantity and reliability of feed produced on farm.

The current situation

Farm Size	240ha

140ha irrigation (when water price is low enough)
100ha dryland (40 ha unreliable stock water supply)

Cows	800

50:50 split calving

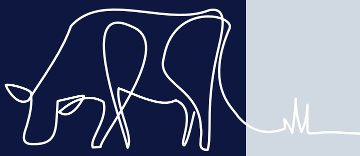


Figure 10 shows the current situation in a scenario where an Autumn break occurs in April with an 100% level of efficiency of pasture grown and grazed. The blue line represents the demand from the cows and the green line the supply from pasture. The short fall is currently made up from feeding concentrate, hay and silage.

Figure 10 Pasture demand compared to pasture growth rate kg DM/ha/day

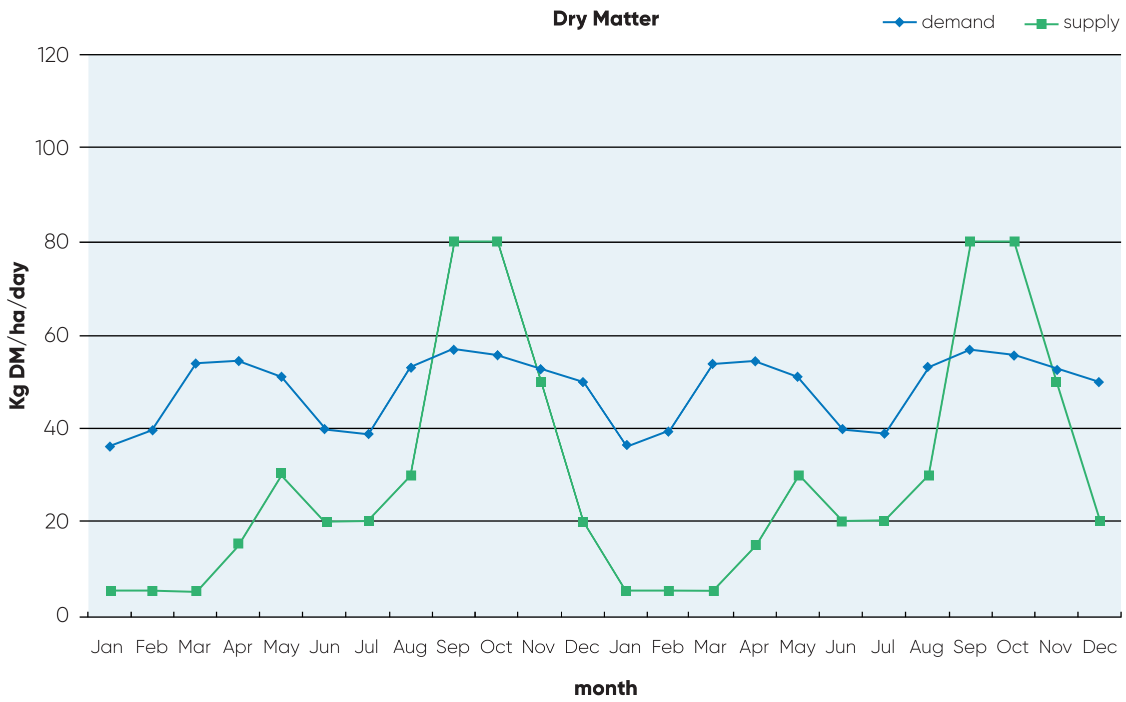
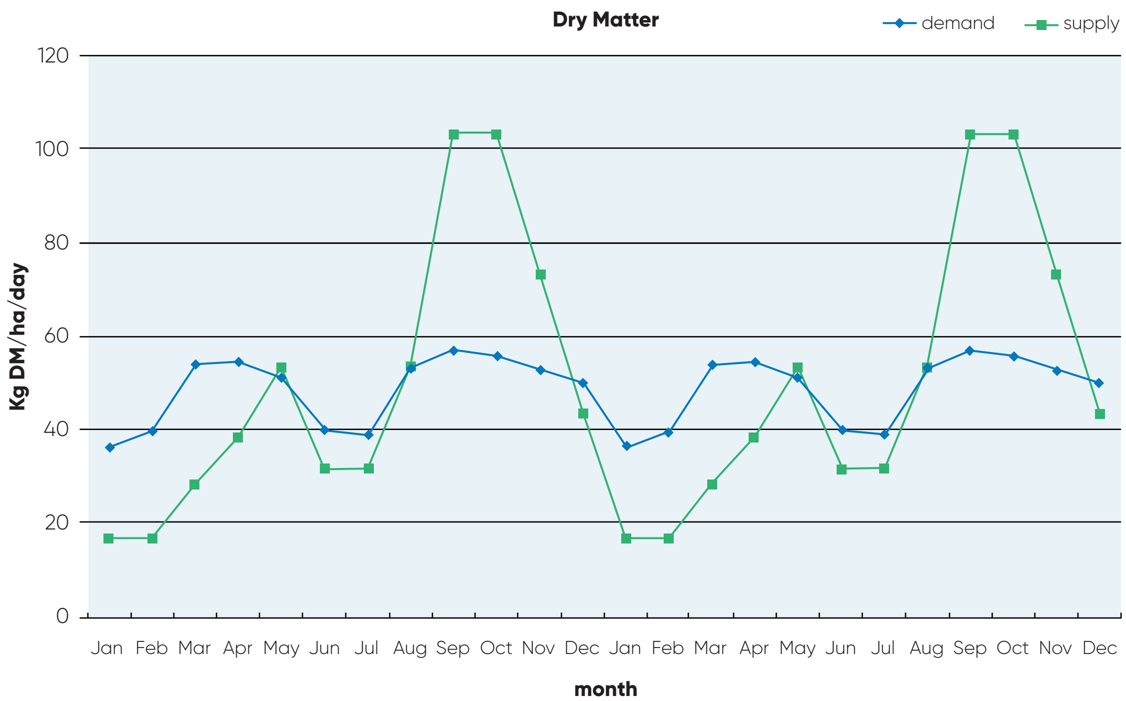


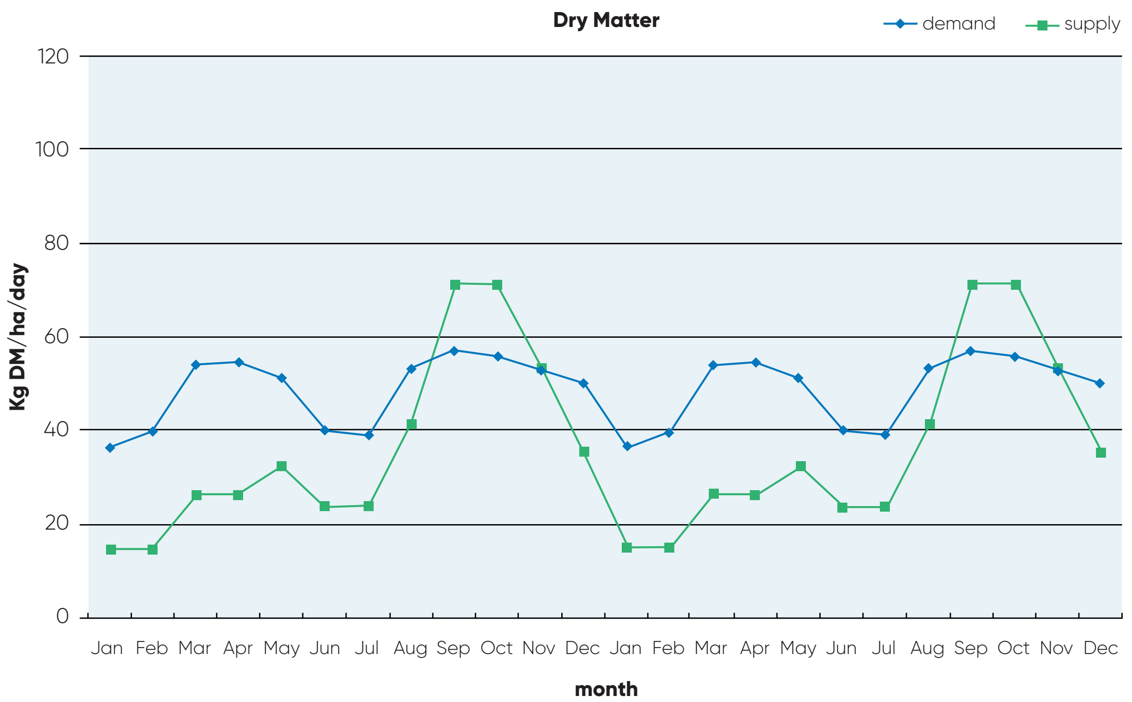
Figure 11 show the addition of grain added to the diet 7 kg/cow/day. There is also 3-4 kg of almond hulls. The short fall of feed from December to May currently is made up with silage.

Figure 11 Pasture demand compared to pasture growth rate and feeding 7 kg grain/cow.



The dilemma is how can the current milk production be maintained and even increased under the effects of climate change. To illustrate a predicted potential year in the future the autumn break has been changed to May and the pasture efficiency dropped to 80%. There is also the loss of 40ha of pasture simulating water being harder to access in dry years. This is shown in Figure 12 still including the same addition of grain. Comparing Figure 11 to Figure 12 the short fall of feed can be observed.

Figure 12 Pasture demand compared to pasture growth rate with a later autumn break and reduced pasture growth and feeding grain at a similar rate kg DM/ha/day



In the climate change scenario simulated comparing figure 11 and figure 12, an estimate of the shortfall has been calculated in figure 13, which shows an extra 563 tonnes of silage is required to make up for the feed short fall. At $200/t for silage this is an extra cost of $112,600 per year.

Figure 13 Amount of silage required to fill feed gap

	Control	**Dry year**	**Dry year 40ha with water reticulation**	**Irrigation of 40ha**
	Kg silage/ cow	**Kg silage/ cow**	**Kg silage/ cow**	**Kg silage/ cow**
January	11	12	12	9
February	13	14	14	11
March	8	8	8	6
April	5	8	8	6
May	0	5	5	4
June	4	8	7	8
July	4	8	7	8
August	0	3	2	2
September	0	0	0	0
October	0	0	0	0
November	0	0	0	0
December	2	4	3	2
Total	**1,127t silage/year**	**1,690t silage/year**	**1,591t silage/year**	**1,351t silage/year**
Difference from control	**N/A**	**563t silage/year**	**464t silage/year**	**224t silage/ year**

To reduce the need of the extra silage one option is to install a water reticulation system to ensure water is available for the 40ha when the existing dams are dry. This is likely to reduce the need by 99 tonnes of silage. A saving of $19,800. There would need to be a one off investment in developing the reticulation system.

The other option is to irrigate 40 ha and direct graze (not having access to the 40 ha due to insufficient stock water in the scenario above). In this case the need for the extra silage has been reduce by 339 t saving $67,800. However this has required 360ML of water based on a 70 percentile dry year (Figure 14) and assuming irrigation efficiency of 70% which if this cost $500/ML so $180,000 total...to save $67,800.

Figure 14 Shows the percentile water requirement from a low requirement through to a long hot dry summer

Percentile of water required	Irrigation of Maize or pasture over summer ML/ha	Autumn Start February
10%	3.0	1.1
20%	4.3	1.5
30%	4.8	1.6
40%	5.1	1.8
50%	5.4	2.0
60%	5.6	2.2
70%	6.3	2.6
80%	7.8	2.7
90%	7.3	3.0
100%	9.2	3.7

Case Study: Two cases exploring greenfield groundwater irrigation

Groundwater Pumping Case A	
Water source	Unknown underground system
Quality, Yield, Access, Cost	Unknown
Current situation	Dryland
Potential change	Irrigated greenfield site

Groundwater Pumping Case B	
Water source	Unknown underground system
Quality, Yield, Access, Cost	High quality, good pressure high yield
Current situation	Dryland
Potential change	Irrigated greenfield site

Ground water for Irrigation

In these two cases there was no information on the potential for these systems when they were first conceived. In both cases stepping through the logic of taking the next step in planning was required to determine whether or not to continue with the project.

Until a test bore(s) are dug it really is guesswork and speculation as to the exact nature of the underground water source trying to be utilised, of course the more mapping and local knowledge is available the less speculative the exploration into the feasibility of a system is. While the cost will vary (depth, difficulty of accessing site, ease of drilling etc) estimates we used were $25,0000 for a test bore and $50,000 to install a production bore.

The map below (figure 15) and table (figure 16) show the locations of known underground sources and estimated yields for those locations. Neither of the case study farms proposed irrigation plans was likely to be directly linked to any of the sites pinned in figure 15.

Figure 15

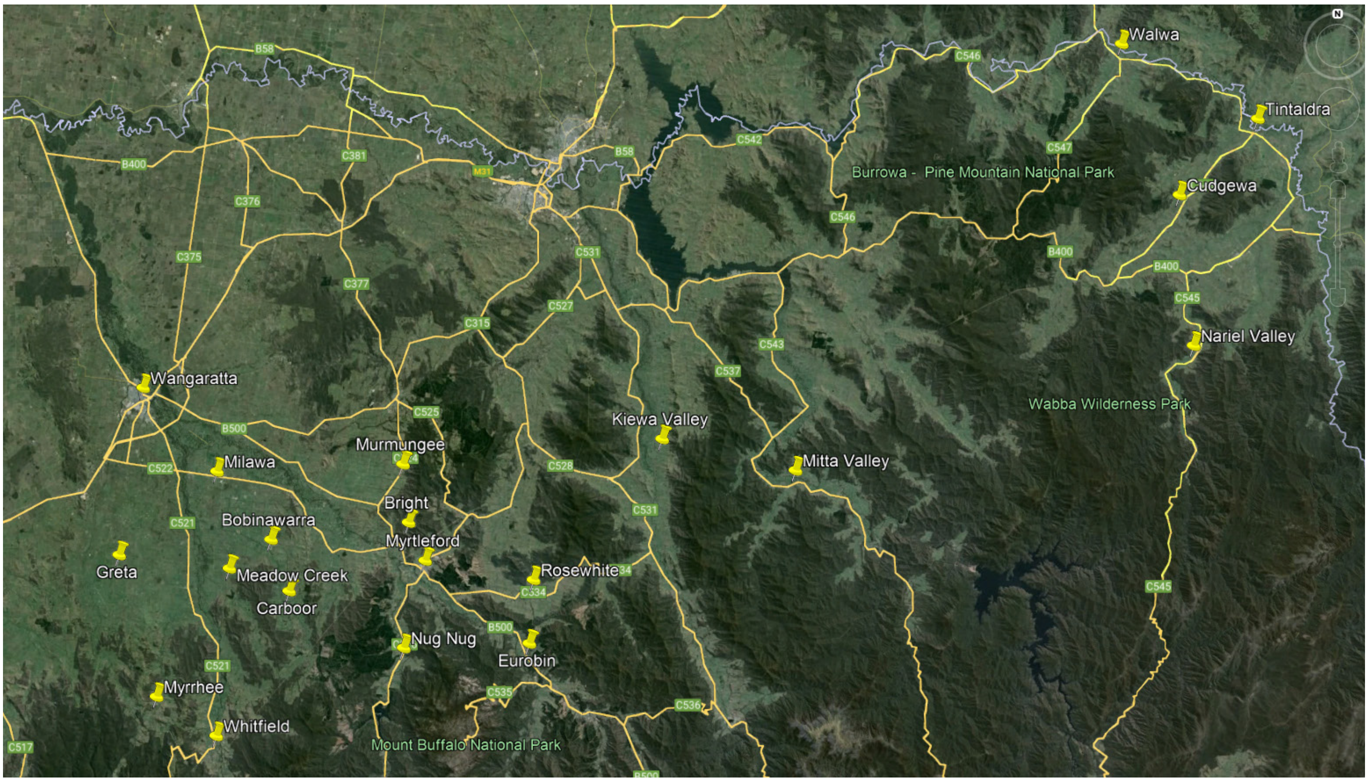


Figure 16 provides an estimate of flow rate in Megalitres per day, and an estimate of the likelihood of finding water. Also provided is the average maximum Evapotranspiration rate in mm per day for the middle of Summer. An allowance has been made for a higher than average Evapotranspiration rate. This rate has been used along with the estimate flow rate to determine the likely area that could be irrigated from these sources.

Figure 16 Different location, potential flow rates, and likelihood of finding water and evapotranspiration rates to determine a potential irrigatable area

Location	Source	Flow (ML/day)	Likelihood (%)	Average Maximum ETo (mm/day)	Allowing for higher than average ETo (mm/day)	Area irrigatable (ha)
Wangaratta	Deep lead	5	80	6.4	7.2	70
Milawa	Deep lead	5	80	6.2	7	71
Greta	Creek flats	1.5*	60	6.2	7	21
Myrrhee	Fractured Rock	1-2	70	5.7	6.5	15-31
Whitfield	Fractured Rock	2	80	5.9	6.6	30
Bobinawarra	Alluvial	1		6.2	7.1	14
Whorouly		2	80	6.1	6.8	29
Whorouly South		1.5		6.1	6.8	22
Meadow Creek	Fractured Rock	1.5	50	6.2	7.1	21
Carboor	Fractured Rock	1		6.1	6.8	15
Murmungee		0				
Bright	Fractured Rock	1-2		5.7	6.4	16-31
Myrtleford	Fractured Rock	1.5		6	6.7	22
Nug Nug	Fractured Rock	1		6	6.9	14
Rosewhite		Poor	10			
Eurobin	Fractured Rock	1.5		5.9	6.5	23
Kiewa Valley	Alluvial	0	0	5.8	6.5	0
Gundowring	Granite	0.5-1	50	5.8	6.5	8-15
Dederang	Granite	0.5-1	25	5.9	6.6	8 – 15
Coral Bank	Granite	0.5-1	20	5.7	6.4	8 -16
Tallangatta Valley	Granite	0.5-1	50	6	6.7	7 - 15
Mitta Mitta Valley	Granite	0.5-1	50	5.9	6.6	7 - 15
Walwa	River flat	1-2	50	6.2	7.1	14-28
Tintaldra	alluvial	1-2	60-70	6.2	7	14 - 29
Cudgewa		1-2	50	6.1	6.9	14 - 29
Nariel Valley	Flats	1-2	70	6	6.7	15 - 30
	Off flats	poor	20	6	6.7	

*poor water quality 2000 ppm

Using tables like figure 16 can help determine if a test bore is worth the gamble in a given location. It is worth noting even if the planned site is right on a known water source, that has the desired yield and quality there is still a requirement to ensure the land that will be irrigated is suitable for irrigation, the new licence is with in the TPCV and once operating the aquifer is not being depleted.

For case study B, the plan was to look at the feasibility of irrigation on a currently dryland site. The surface water options were limited to a small seasonal creek with little feasibility for worthwhile irrigation and exploring groundwater options. The information for groundwater nearest the site from the table above suggested there was only a 50% chance of a 1-2 mg flow. The map did indicate this site was not likely to be directly linked to the nearest location pinned so the real situation could be vastly different in the proposed location than the site of a known aquifer. A local bore contractor was then contacted to enquire about their knowledge on previous test sites in neighbouring areas. They indicated that a small number of related sites had not yielded any results; and no farms in that valley currently had bore water for irrigation, at this point the landowner did not believe further exploration for irrigation was warranted.

For case study A, the nearest site from the above table was even less promising, however that site was determined to be largely un-indicative for the proposed site. Based purely on local knowledge and some historical exploration the farmer decided to pursue further investigation into groundwater potential on the site. An ultimately high yielding test bore was commissioned, the estimated capacity of the aquifer was adequate to allow extraction for consumptive use and there was no other active licences linked to this water source and TPCV determined a licence could be issued on this aquifer. However before irrigation approval was granted the landowner was required to demonstrate no adverse impacts were likely to occur as a result of the new irrigation proposal on this greenfield site.

A report was commissioned to investigate the likely impacts from this development and some of the notes from the report are included below. This is indicative of the type of considerations that are made prior to the approval to irrigate a new site.

The report was compiled by a certified professional soil scientist and cost $1,500 (for a 22 page "Brief soil report"). The report concluded that: "...(this site) is suitable for sprinkler irrigation, should the recommendations and advice in this report be followed and risks of erosion be managed at all times". Had the report found greater potential issues a more extensive report including detailed mitigation and management practices might have been required at increased cost (and time to survey, map etc) or approval may not have been granted at this point.

The full report included:

- Referenced details on Site Location
- Qualifications and experience of person conducting the report
- Information on the site from soil records, geological and waterways studies on site, land zones and land systems, soils information, surveyed slope & landform records
- Rainfall and evaporation averages for the site
- A proposed irrigation water budget under different rainfall scenarios
- Observed soil conditions report from on site inspection
- Drainage and landform recommendations, based on professional site survey
- Soil amelieration and management recommendations, irrigation recommendations, soil and water monitoring requirements

As an example just some of these details are included below:

Figure 17 below shows a soil map for the pivot site

Figure 17 Soil map

Source: Geology map by Geovic (2023)

The surface geological units listed on the site include:

- *Qc1: Quaternary, colluvium. Unconsolidated deposits formed from hillwash. This covers almost all of the pivot site from the break of slope...*
- *Oap: Ordovician, Pinnack Sandstone. This zone covers the western part including steeper sloping land...*

Based on experience with soils of this type in this environment, soils are likely to be duplex, acidic throughout and may rest on sandstone bedrock.

*There are two marked waterways on the site. One of these runs the full width of the pivot from the west to east, in a north-easterly direction. The second is a drainage line which appears to be attached to the old farm dam which has since been backfilled. The presence of these waterways, particularly the longer northern waterway attached to the *name redacted* Creek raises interest with relation to drainage and water management on the site...*

...A summary of information from this component across these two land systems is listed below:

- *Annual rainfall Up to 40 inches (1016mm).*
- *Geology: Ordovician shales and mudstones*
- *Topography: Rolling to hilly.*
- *Vegetation structure: Mainly dry sclerophyll forest, tending to wet sclerophyll forest; savannah woodland tending to tall woodland in drier areas.*
- *Vegetation floristics: Eucalyptus macrorhyncha (Red Stringybark) alliance, Eucalyptus tereticornis (Forest Red Gum) to Eucalyptus albens (White Box), Eucalyptus goniocalyx (Long-Leaved Box) alliance.*
- *Present Land Use: Mostly cleared, grazing sheep for wool and/or meat, beef cattle, dairying. Pastures usually top-dressed with superphosphate, some sown to improved species.*
- *Potential Land Use: Grazing is the most suitable form of use. Higher productivity possible with improved pasture species, adequate fertiliser application and sound management.*
- *Hazards: Sheet and gully erosion, Slumps and earth flows from steeper slopes in wetter years.*
- *Problems: Pasture improvement and management, particularly on slopes where tractor working is not possible.*

Figure 18 Extract of the Land Zones map

Source: Land Zones map by Rowe (1967)

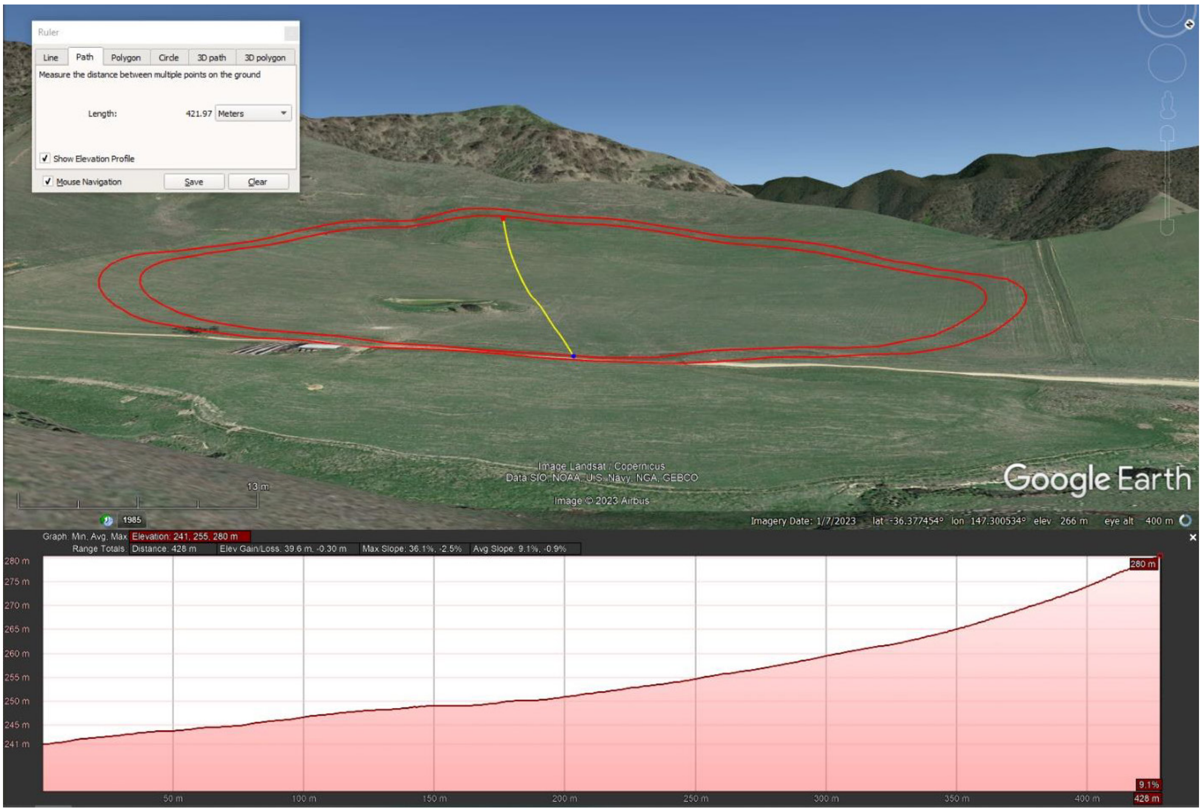
Almost all soils are listed as Podzols (Stace et al, 1964). Podzols are those which have B horizons dominated by the accumulation of compounds of organic matter, aluminium and/or iron compounds...often bleached above poorly drained clay subsoil...are inherently acidic and of low fertility.

...In accordance with land survey mapping by Mapcon (2023), land levels range from:

- *Highest areas on the western boundary: Approximately 293m AHD.*
- *Lowest areas on the eastern boundary: Approximately 240 metres AHD.*

Site elevation varies by approximately 53 metres over approximately 450 metres of run length from west to east, with an average slope of 11.7%. This is an equivalent to 11.7 metres per 100 metres, or a slope ratio of approximately 1:9 H:V. ...

Figure 19 Angled aerial view of site and relative elevation



...Soil profiles inspected are typical of this region covering land flanking older... Soils are duplex, acidic and increasing in acidity with depth and contain an accumulation of aluminium and iron with depth. Soils of this type under 1000mm average annual rainfall are subject to seasonal waterlogging, which can only be offset by perennial plant growth and installation of drainage systems.

Drainage & Landforming Recommendations

Surface drainage is the first step to successful irrigation on this site...., drainage recommendations are supported by water budgets which also show the amount of surplus water...which is considerable and averages 683mm or 6.83 ML/Ha on a summer cropping program with minimal growing throughout the winter. Under these conditions the risks of erosion remain high, particularly where land disturbances are regular supporting a summer cropping operation.

Although the site may appear manageable or trafficable in the current form, under irrigated cropping in a high rainfall zone the site will need to have surface drains installed to remove excess surface water or overland flow and direct this to lower areas of the site, safely without soil erosion.

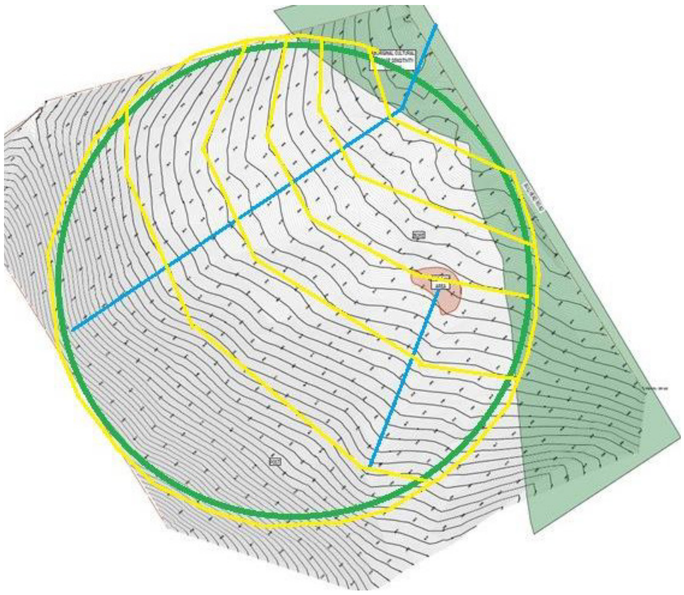
The site requires trafficable drains installed, incised into natural ground, without formation of banks... drains should not be banked or form contour banks, allowing water to pond, seep into the ground or breach. They should be below ground cuts, straight-lined where possible, but also following any major change in contour direction. They should discharge to a perimeter drain outside of the pivot and irrigation area, which then discharges to an on-farm recycle dam or detention dam...

Positioning of field drains and alignment:

The positioning of drains should follow a herringbone style of drain pattern...proposed an example of this (figure 4). Drains will need to be positioned on the break of slope, then closer together with distance downslope as land flattens out.

Perimeter drain: A perimeter drain should be installed to convey water from upper slope areas to the legal point of discharge, via a sump or small dam. In Victoria, it is illegal to change the discharge point in which water leaves a property, or the rate of flow, so the discharge point must stay the same and the rate of flow must be controlled. In this case it is wise to install recycle sumps or dams on the low end/s of the pivot site...This process will assist with controlling the rate of flow across the site boundary...Waterways need to be considered prior to any works given the presence of marked watercourses on the site...Avoid backfilling any low areas or eroded areas, particularly if these exist within these waterway/watercourse alignments.

Figure 20 General recommendation for surface drains (yellow, water ways in blue)



It is important to control drainage water where it lands... general rule of thumb, flow velocities must be:

- *Less than 1.0 m/s in non-dispersive soils, which are stable, well-vegetated and contain surface retained organic matter, and*
- *Less than 0.5 m/s in dispersive soils, which are stable, well-vegetated and contain surface retained organic matter.*

The main risk of exposing dispersive soil and inducing tunnel or gully erosion is by cutting in drains without adequate amelioration and protection. The recommendation to re-topsoil drains is provided for many reasons...

Soil dispersion tests should be carried out and the site checked. The Emerson aggregate test should be used... Slaking should be assessed, which will confirm whether the sample has enough organic matter to withstand the forces which may pull aggregates apart. Dispersion observations should be made regardless of the presence of slaking.

7 Soil Amelioration & Management Recommendations

Soil amelioration recommendations are summarised as follows:

1. *Groundcover should be achieved as a priority to improve soil stability.*
2. *All drainage works should occur at the outset. Subsoil should be removed from the site. Topsoil should be kept on site and used to stabilise all drains. Drains should be installed before any soil amelioration works. Gypsum treatment may be required during drain installation along drain alignments.*
3. *Soil chemical amelioration:* ***a.*** *Lime application. The site requires at least 5.0 t/Ha of high grade agricultural lime...*
4. *Soil physical amelioration:* ***a.*** *The site could benefit from ripping, for improvement of structure within the A2 horizon however ripping puts the site at risk of erosion and is not recommended in the outset. The purpose of ripping should be to improve the structure of the A2 horizon bleached layer, encouraging greater root density, plant vigour and water uptake...*
5. *Organic matter: The importance of organic matter has been covered in previous sections...will assist with preventing any soil crusting problems that may arise over time...*
6. *Plant nutrition:* ***a.*** *Minimal advice can be provided without soil test results. Initially, the site should be tested prior to lime application and then at least 12 months after lime application.* ***b.*** *A standard nutrient budget for maize should be selected in year 1, following lime application.* ***c.*** *Nitrogen: Irrigate to meet crop requirement, mainly to manage risks of nitrogen runoff from high intensity rainfall events. Avoid large applications of nitrogen in the form of Urea. Applying nitrogen as fertigation ensures that N will most likely end up in the soil and delivered efficiently to the plant, avoiding losses via volatilisation and surface runoff.* ***d.*** *Nutrient budgets should be adjusted after year 1, following time and pH adjustment.*
7. *Cultivation: Cultivation should be kept to a minimum and used only where absolutely necessary, or where the effects on soil structural improvement will outweigh any impact.*

With this report a licence to irrigate was granted, and a production bore and pivot commissioned.

Case Study: Is it better to grow your own Maize or buy it in

Growing feed or trucking it in	
Water source	Regulated surface water
Quality, Yield, Access, Cost	High quality, reliable yield, easy access, high cost
Current situation	Under utilised irrigation water due to current infrastructure
Potential change	Feasibility for irrigating current site or buying in fodder

There are lots of variables that need to be considered to answering the question of going to market or growing your own fodder.

Growing your own
- *Value of water*
- *Cost of inputs, sowing harvesting etc.*
- *Cost to pump water*
- *Set up costs of irrigation infrastructure if greenfield site*
- *Lost opportunity if irrigation infrastructure exist already*
- *Yield of your maize silage (based on agronomic, climatic and management factors)*
- *What is the risk of failure*

Purchasing
- *Cartage fee*
- *Distance of cartage*
- *Price of silage variability*
- *Reliability of supply*
- *Risk of failure*
- *Lack of control*
- *Ability to reliably source feed at reasonable cost*

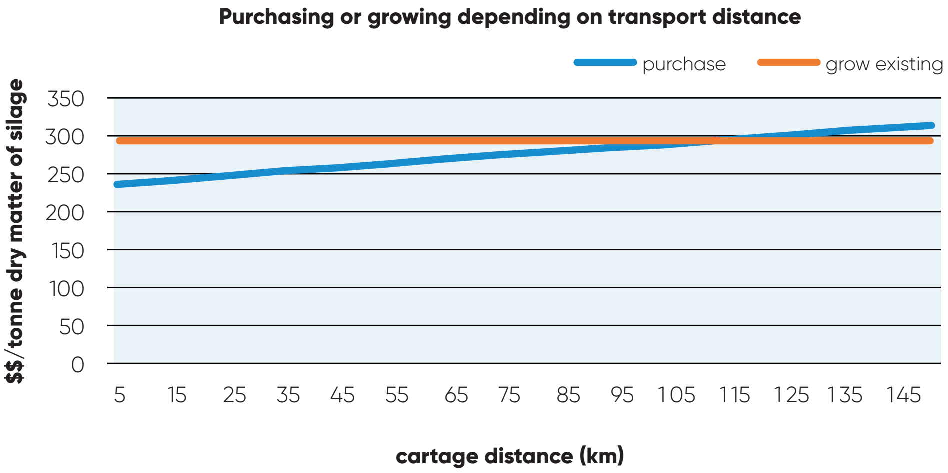
To explore this case study the following assumptions were made:

Figure 21 Buying vs purchasing case study assumptions

Expense	Cost/Estimate
Diesel for pump	$1.70 litre 35M head
Water demand	6.5ML/ha 90% efficiency @ $25ML
Sowing and harvesting	$2,200 ha
Opportunity cost forgoing pasture	6.5 t/ha @ 330/t
Cartage	$10t to load + $.16t/km to transport (70% Dry matter)
Maize cost	$200t DM

Based on the figure 21 assumptions figure 22 illustrates that it makes sense to grow your own maize when it can't be sourced with in 115 km of the farm on area that is a part of the milking platform.

Figure 22



Case Study: Upgrading inefficient existing system

Upgrading inefficient existing system	
Water source	Regulated surface water
Quality, Yield, Access, Cost	High
Current situation	Slow, labour intensive, inefficient system
Potential change	Labour, power and water saving upgrade

The current situation

Sometimes operating an irrigation system is time consuming and difficult. This often leads to poor irrigation scheduling hence loss of production over and above the inefficiencies inherent in the system itself. Investing in improvements in the irrigation system may be a way to address reduction in homegrown feed due to climate change and maximise water use.

In this case study a flood irrigation system using a rudimentary channel diversion system of "flags" or tarps placed in the channel and as water builds up the water runs on to the bay through a dug out section of channel. This dug out section is refilled after the bay has been watered.

Looking at IrriSat the for this site Average Kc (crop factor) value indicates 0.6 (Figure 23) which is low for an irrigated pasture it should be closer to 1.0; or in other words it is estimated that 40% of the potential pasture growth is not currently being realised. It is worth acknowledging that the farmer expressed that they would be unlikely to use the rudimentary system at all given the effort currently required and other demands on their time which would further reduce the potential summer feed growth. In an average year at this site 5.5 ML/ha (Figure 24) is demanded by a healthy pasture and using a one tonne dry matter per 1 ML ratio it can be estimated that 2.2 tonnes/ha of production potential is lost as a result of not irrigating. In a climate change scenario the average irrigation demand is expected to increase to may be the 70percentile which is 6.1ML/ha and a subsequent 40% loss of production amount or a potential loss of 2.44 t DM/ha.

Figure 23 IrriSatt image at the end of January

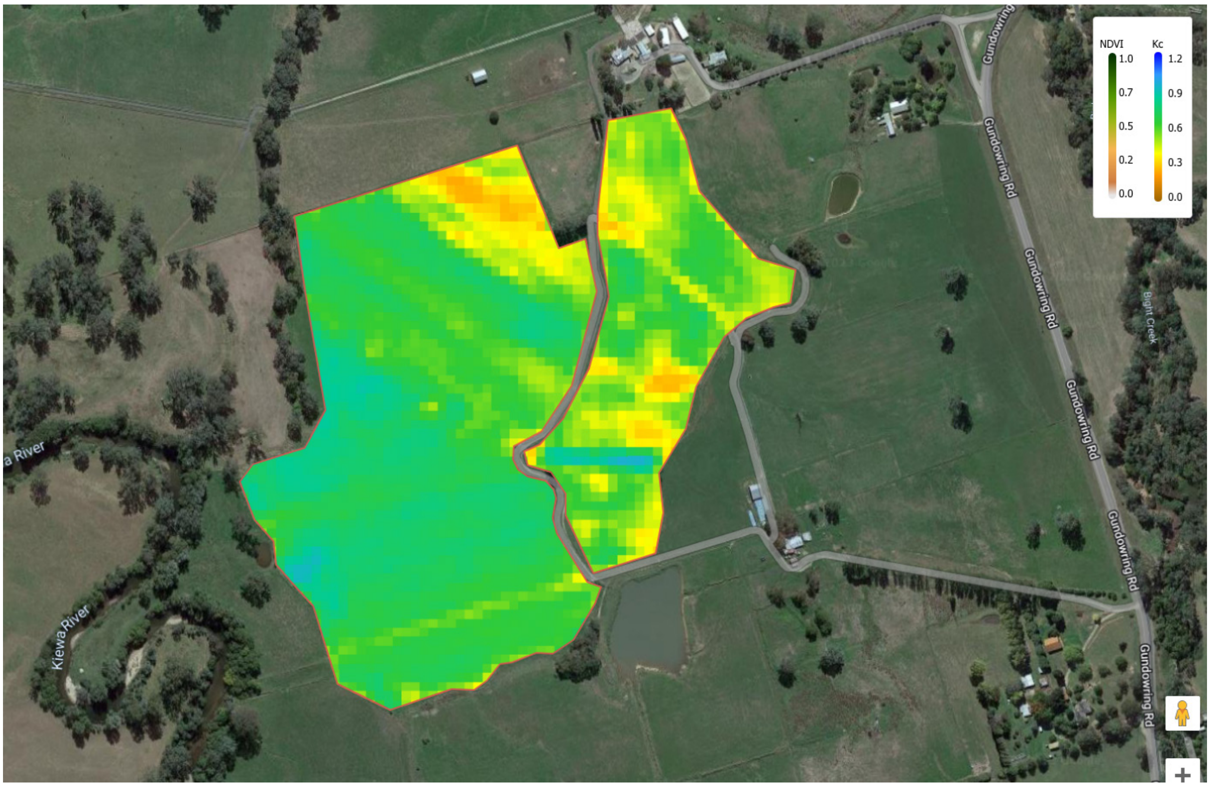


Figure 24

Percentile of water required	All summer crops/ pasture ML/ha
10%	3.7
20%	4.6
30%	5.0
40%	5.4
50%	5.5
60%	5.8
70%	6.1
80%	6.6
90%	7.4
100%	9.0

Figure 24 shows the percentile water requirement from a low requirement through to a long hot dry summer.

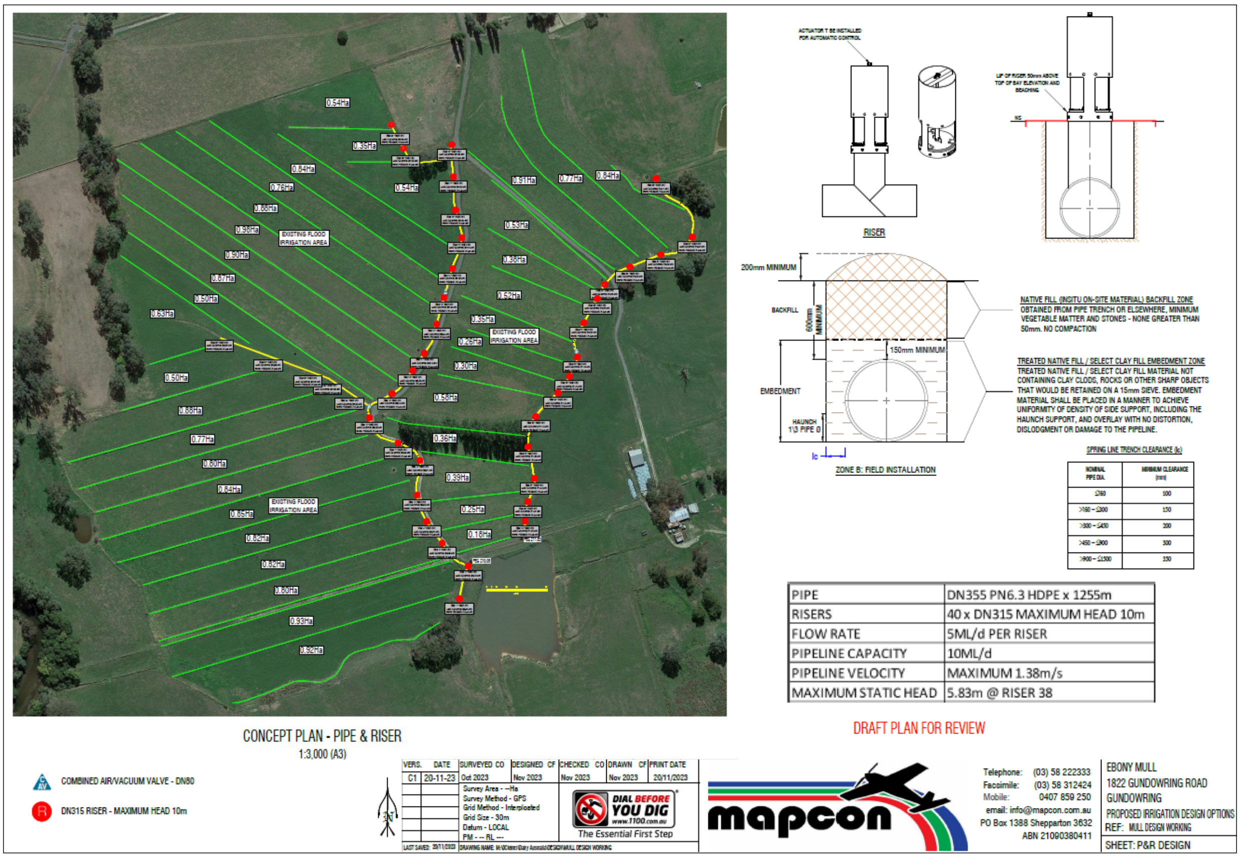
In this scenario an irrigation plan (Figure 25) has been undertaken to simplify and improve the water and labour efficiency of the old irrigation system by improving the channel and installing bay outlets or replacing the channel with a pipe and riser system. This should help to increase the Kc of the pasture closer to 1.0. If the potential pasture not realised is valued at $330/tonne (lucerne hay) in a climate change scenario this could be $805/ha. If the pipe and riser system cost $5,000/ha this is a return on investment of 6.2 years.

Looking at the climatic data for this location dating back to 1970 on average irrigating all summer requires 5.5 ML/ha, (Figure 24)

Note 5.5ML/ha is equivalent to 550 mm of rainfall.

These figures are the requirement in excess of natural rainfall.

Figure 25 Irrigation plan to improve current irrigation system



Case Study: Adding new land to existing irrigation dairy farm

Adding new land to existing irrigation dairy farm	
Water source	Regulated surface water
Quality, Yield, Access, Cost	High
Current situation	Irrigation on part of existing farm, new land purchased including additional water
Potential change	Deciding how to best use water resources for this property

How much water is required?

Looking at the climatic data for this location on average irrigating all summer requires 5.5 ML/ha, plus an autumn start in February 2.1 ML/ha (Figure 26)

Note 5.5ML/ha is equivalent to 550 mm of rainfall

These figures are the requirement in excess of natural rainfall.

Figure 26 shows the percentile water requirement from a low requirement through to a long hot dry summer.

Figure 26

Percentile of water required	All summer crops/pasture ML/ha	Autumn start in February ML/ha
10%	3.7	1.2
20%	4.6	1.6
30%	5.0	1.8
40%	5.4	1.9
50%	5.5	2.1
60%	5.8	2.3
70%	6.1	2.5
80%	6.6	2.7
90%	7.4	2.9
100%	9.0	3.6

The average daily water demand over the year shown in Figure 27 in the middle of January on average the **"Potential Evapotranspiration"** rate is 5.9 mm/day. This needs to be added to the water demand along with water losses due to the inefficiency of the irrigation system. This is important when designing the flow rate and system capacity in this case the highest demand estimated was 7.9 mm/day.

Figure 27 Average daily evapotranspiration rates for this location over the year

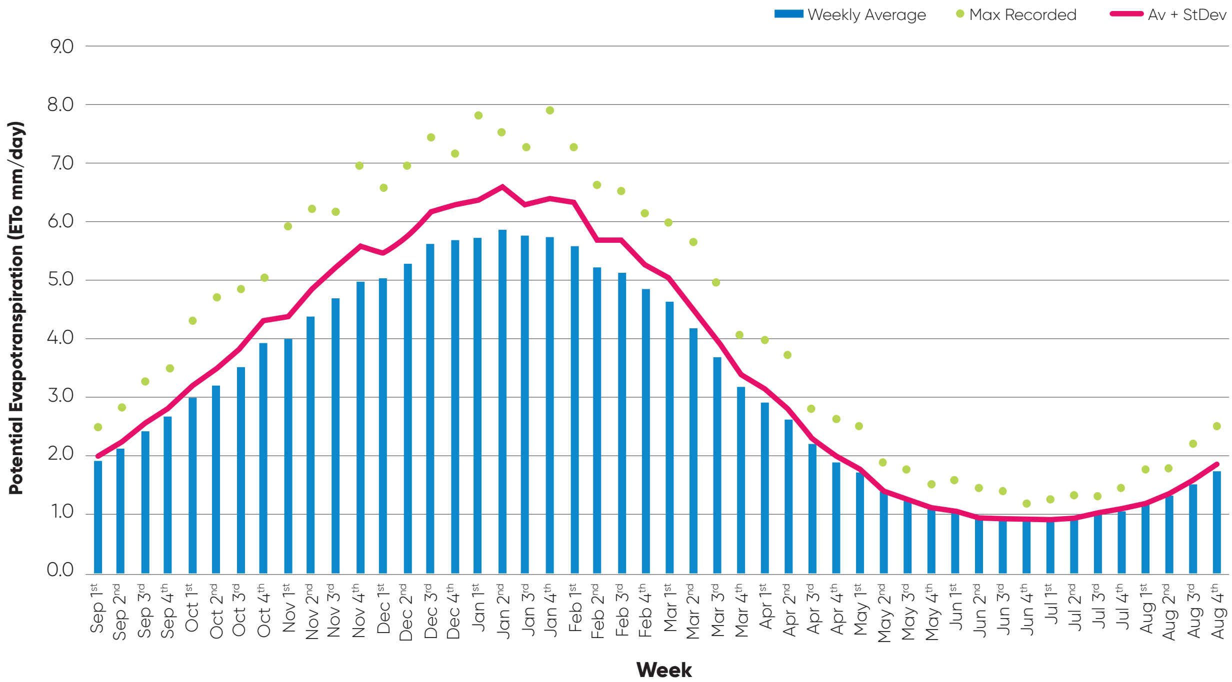
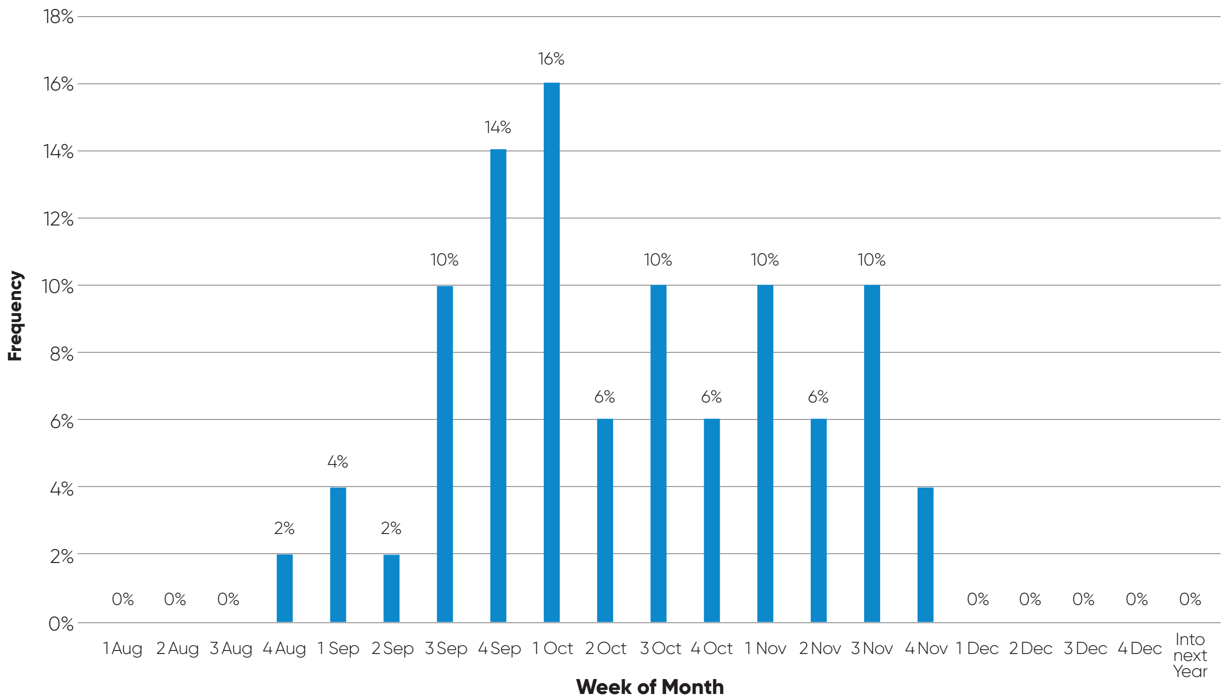


Figure 28 illustrates the probable irrigation commencement based on historical data for this location (e.g 16% of the time irrigation has commenced on the first week of October). By adding the percentages together, you can get a probability of when irrigation has commenced in previous years or a very rough estimate of likely starting dates for irrigating in this locality. i.e. 2% of years has it been necessary to irrigate on or before the last week in August, and 54% of years irrigation has commenced by mid October.

Figure 28 The likelihood when irrigation should commence for summer pasture in this location



Economics of different systems

Three different irrigation systems have been examined for this case study.

1. Travelling gun
2. Fixed cannons (Skippers)
3. Centre Pivot

For two scenarios,

1. Irrigating all summer,
2. Autumn start irrigation in February

The centre pivot was modelled on a higher part of the farm and the skippers and travelling gun on the lower parts (based on suitability of these sites on the case study farm). For this reason the estimates for the centre pivot include adding another 30 m height of pumping than the other systems.

The results below show the cost of the centre pivot is the cheapest per ha when irrigating all summer even when on top of the hill. The skippers on the flats are the cheaper option if just doing an autumn start (Figure 29)

Figure 29 The cost ($/ha) of irrigating all summer or autumn start with either a centre pivot skippers or travelling gun

	All Summer			February Autumn start		
	Travelling gun	Centre pivot	Skippers	Travelling gun	Centre pivot	Skippers
Water	367	306	367	140	117	140
Diesel	862	584	700	329	223	267
Labour	128	45	65	49	18	25
Depreciation	200	350	250	200	350	250
Interest	100	175	125	100	175	125
Total	**1,657**	**1,460**	**1,507**	**818**	**883**	**807**

Assumption made shown at end of document

Figure 30 is looking at the feed value multiplied by the yield and subtracting irrigation costs plus the extra cost to grow the feed (ie fertiliser, sowing, spraying etc). These values have been made based on several predictions that are explained in the assumptions. On paper with these calculations all options have a positive margin. The highest margin is to grow maize under the centre pivot up on the hill with a margin of $1,491/ha. (Figure 29). This would fit the best in terms of carting feed back to the home block. Autumn start pasture under a centre pivot provides the lowest margin.

Figure 30 The margin made ($/ha) when looking at, irrigation cost and growing feed cost, feed grown compared to purchasing equivalent feed**

	Centre pivot	Skippers	Travelling gun
Pasture	441	394	243
Autumn start pasture	228	303	292
Brassica	1341	1294	1,143
Sorghum	1241	1194	1043
Maize	1491	1444	1293

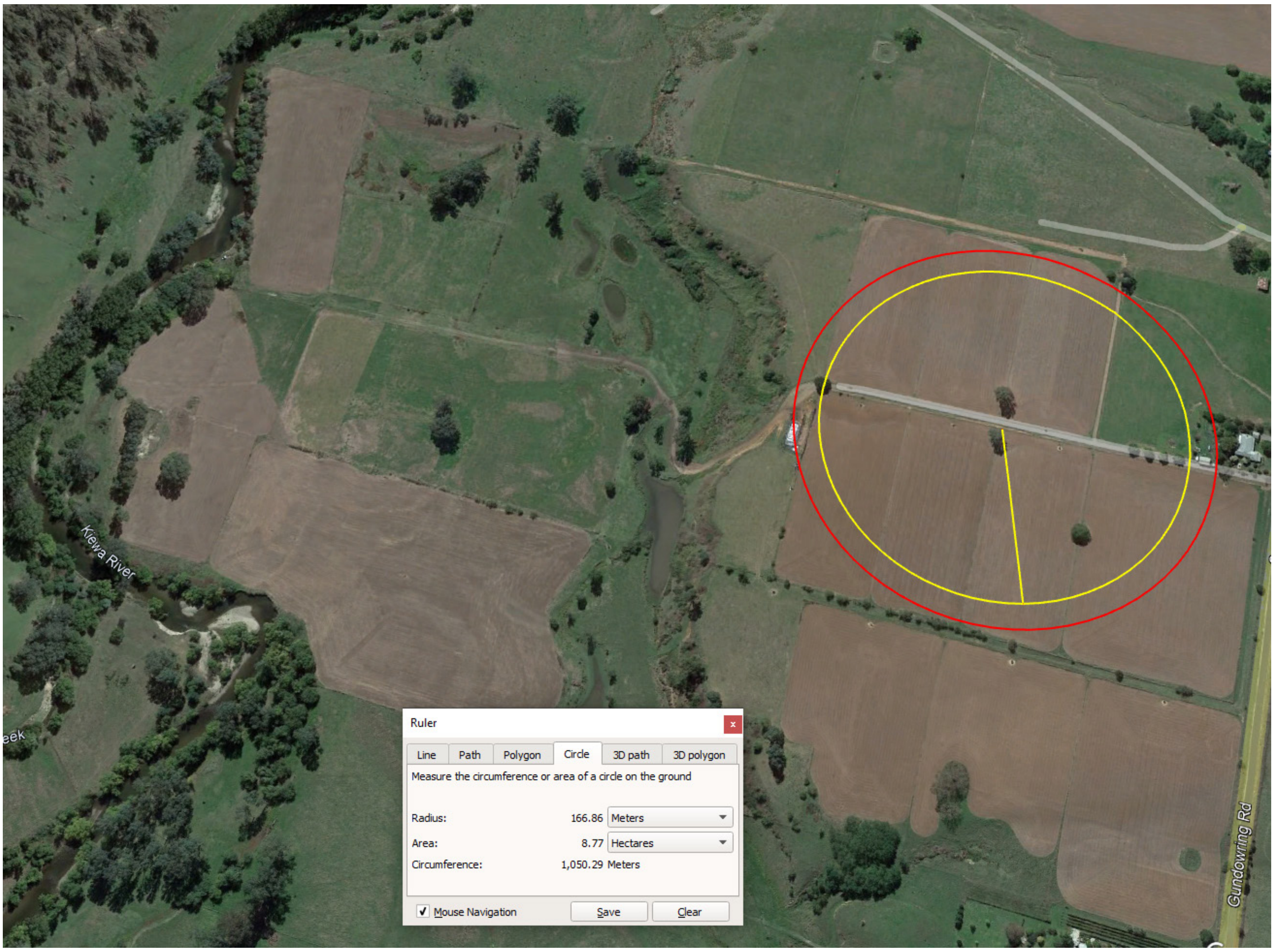
**assumption made shown at end of document

There are also opportunities to irrigate the flats as well as the centre pivot on the hill. Maize may not be as easy to grow on the flats but you might get away with sorghum under Skippers which would allow you to make hay or just grow feed for dry stock.

Location of a centre pivot

Assessing the farm the preferred location for a centre pivot was made (figure 31). For the case study calculations on the centre pivot margins were made based on this location. Figure 31 illustrates an area under direct irrigation of 8.8 ha based on 166m radius and with the inclusion of an end gun this could be expanded to about 11ha. There will be some tree removal required and refencing. While the road down the middle is not ideal it does provide easy access the centre tower. **Note:** The photo indicates a number of trees if they are native to the area approvals would be needed to remove them.

Figure 31 Location of a centre pivot watering 11 ha pivot including the end gun



Conclusion

Based on these calculation and assumptions the investment in the centre pivot is worthwhile examining in more detail. It is also worth while considering skippers on the flats.

Figure 32 Case study assumptions

Expense	Cost/Estimate
Labour	$35 hr
Interest	5%
System depreciation	20 years
Set up cost Centre pivot	$7,000
Centre pivot efficiency	90%
Centre pivot pressure at pump	65m (incl. 30m lift)
Centre pivot Diesel	$1.5 litre at 80% efficiency
Travelling gun set up	$4,000
Travelling gun efficiency	75%
Pressure at pump	80m
Travelling gun diesel	$1.5 litre @ 80% efficiency
Skippers set up	$5000
Skipper Efficiency	75%
Pressure at pump	65m
Skipper Diesel	$1.5 @ 80% efficiency

Summer pasture should grow 1 t DM per ML when irrigating all summer (5.5 tonnes/ha on average)

Autumn start pasture should grow 1.5 t DM per ML when irrigating as an autumn start (3.2 tonnes/ha on average)

Brassicas will grow 8.3 t/ha

Sorghum will grow 11 t/ha

Maize will grow 17t /ha (silage)

Each tonne of pasture and brassica is worth $400/tonne (compared to buying pellets)

Each tonne of sorghum and Maize is worth $300/tonne (compared to buying hay)

The cost of putting in and fertilising, pasture is $300/ha

The cost of putting in and fertilising, autumn start pasture is $150/ha

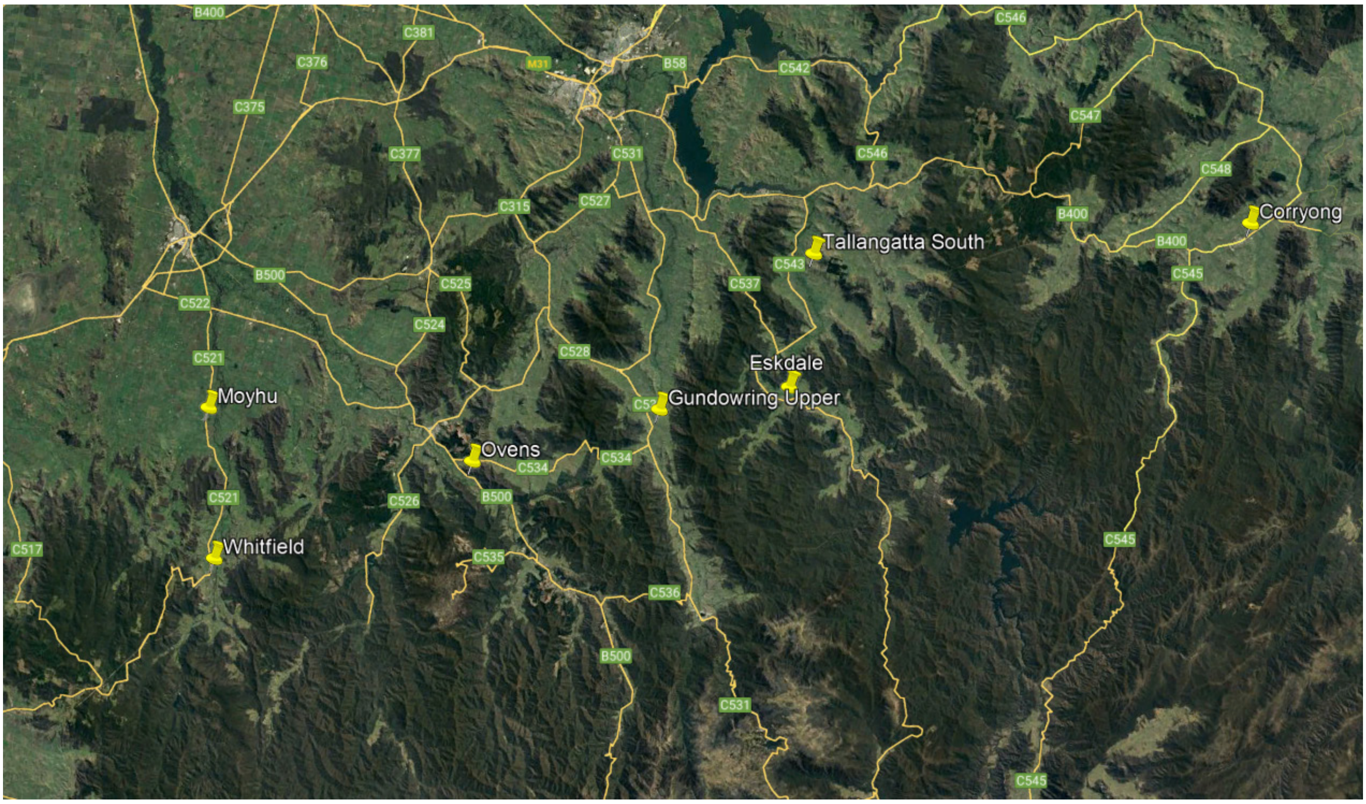
The cost of putting in and fertilising etc Brassica is $500/ha

The cost of putting in and fertilising etc Sorghum is $600/ha

The cost of putting in and fertilising etc Maize is $2000/ha

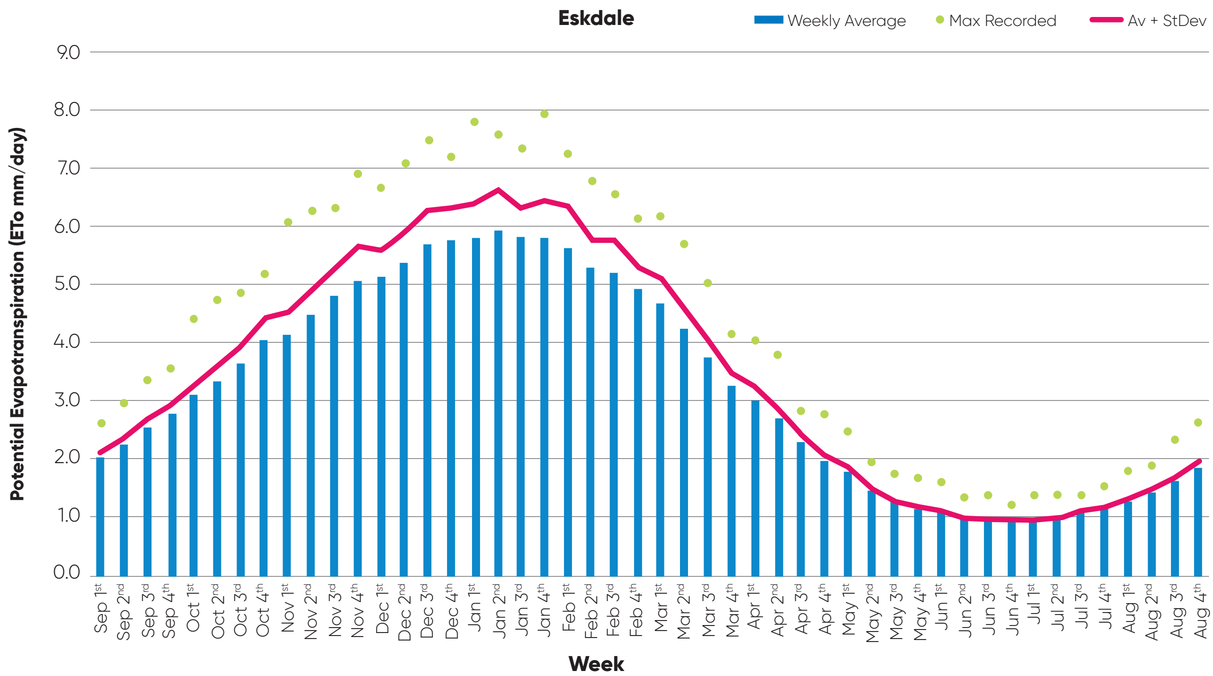
Appendix

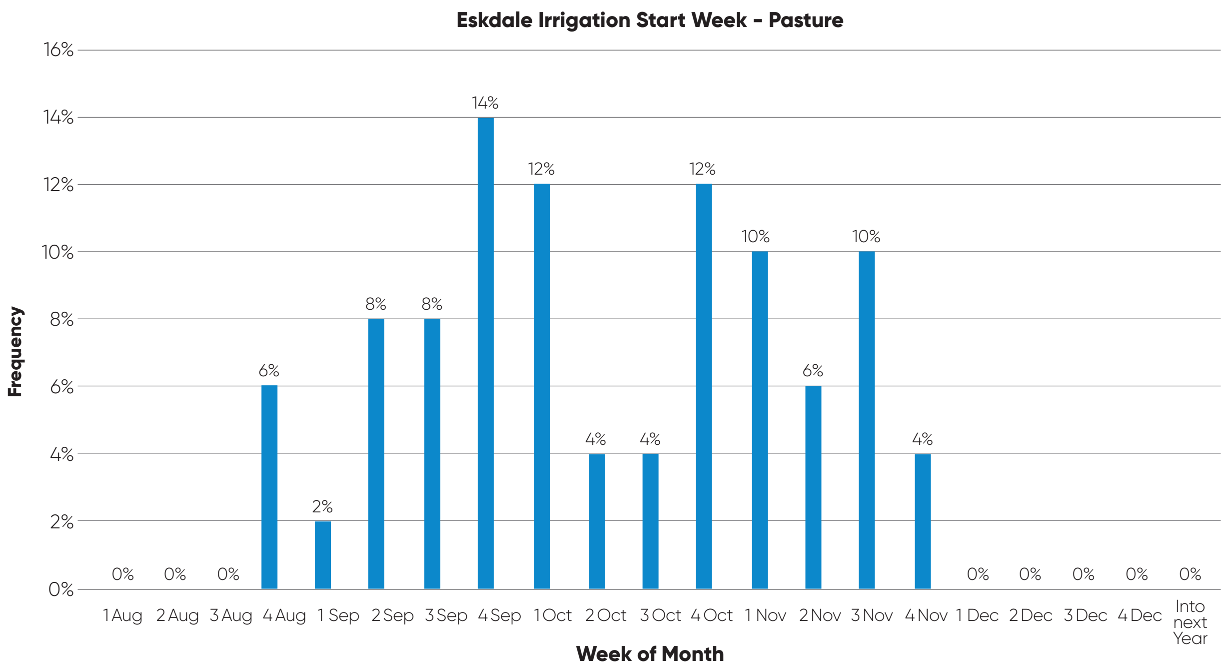
Locations of climate data



Eskdale irrigation demand under differing rainfall scenarios. Spring-Autumn or all season

Percentile	Spring November ML/ha	Autumn February ML/ha	All season ML/ha
10	0.2	1.0	3.4
20	0.5	1.5	4.1
30	0.6	1.7	4.6
40	0.8	1.9	5.1
50	1.0	2.0	5.4
60	1.4	2.3	5.7
70	1.6	2.5	6.2
80	2.1	2.7	6.6
90	2.3	3.0	7.2
100	3.4	3.6	9.0

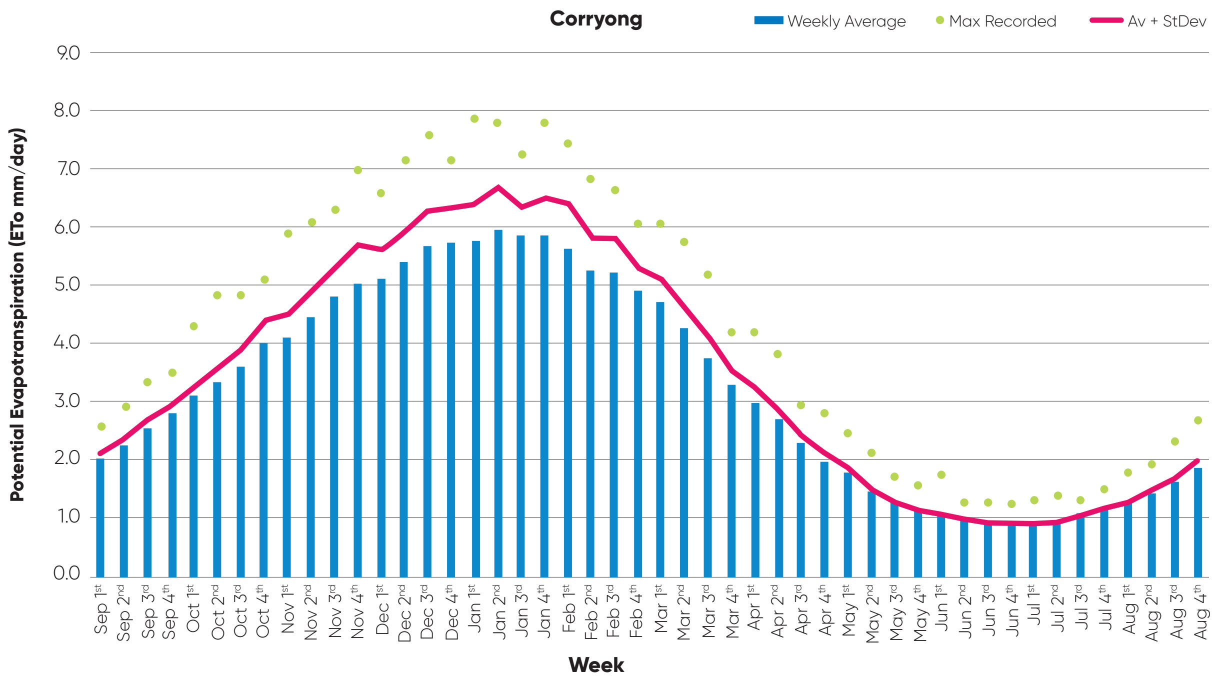


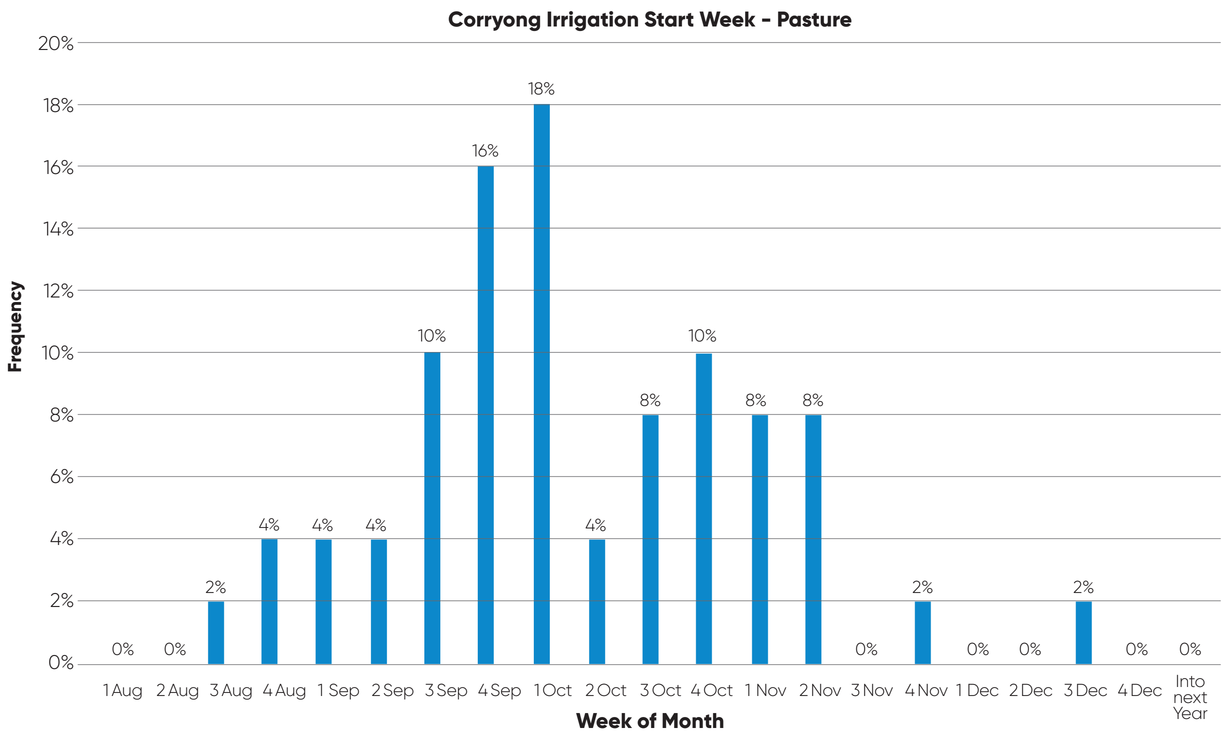


This document contains irrigation advice only and does not constitute approval or otherwise of any irrigation development. You should seek personal/business advice based on your own circumstances.

Corryong irrigation demand under differing rainfall scenarios. Spring-Autumn or all season

Percentile	Spring November ML/ha	Autumn February ML/ha	All season ML/ha
10	0.2	1.0	3.4
20	0.5	1.5	4.1
30	0.6	1.7	4.6
40	0.8	1.9	5.1
50	1.0	2.0	5.4
60	1.4	2.3	5.7
70	1.6	2.5	6.2
80	2.1	2.7	6.6
90	2.3	3.0	7.2
100	3.4	3.6	9.0

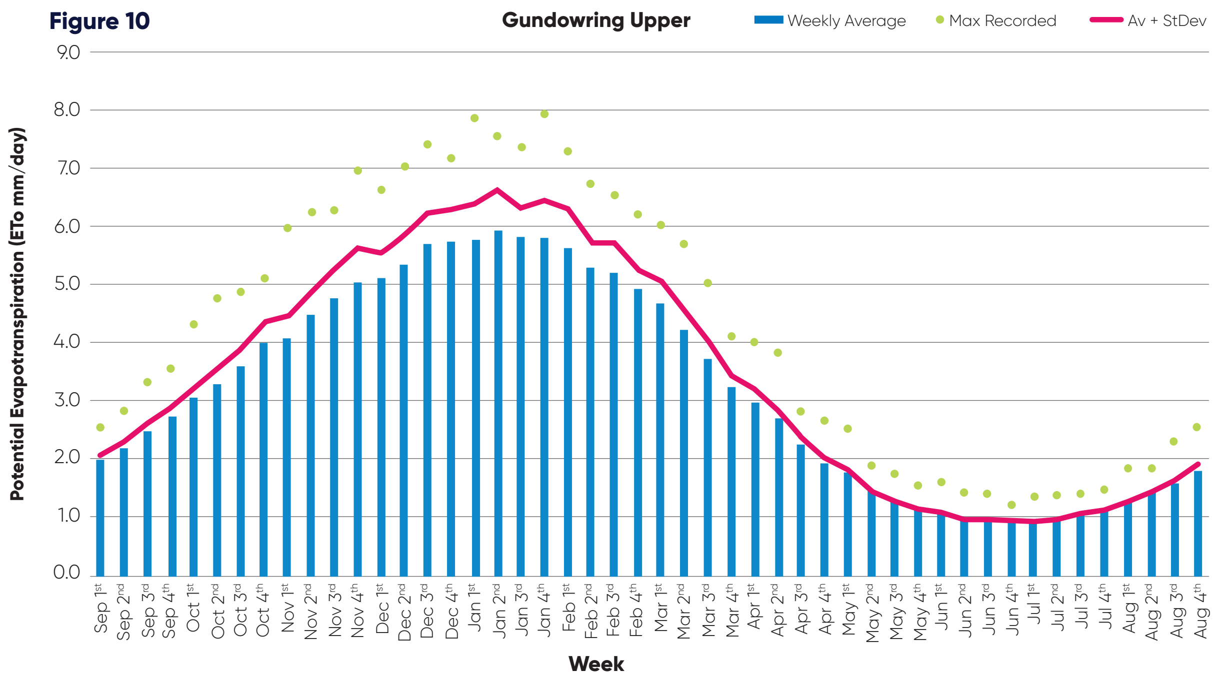


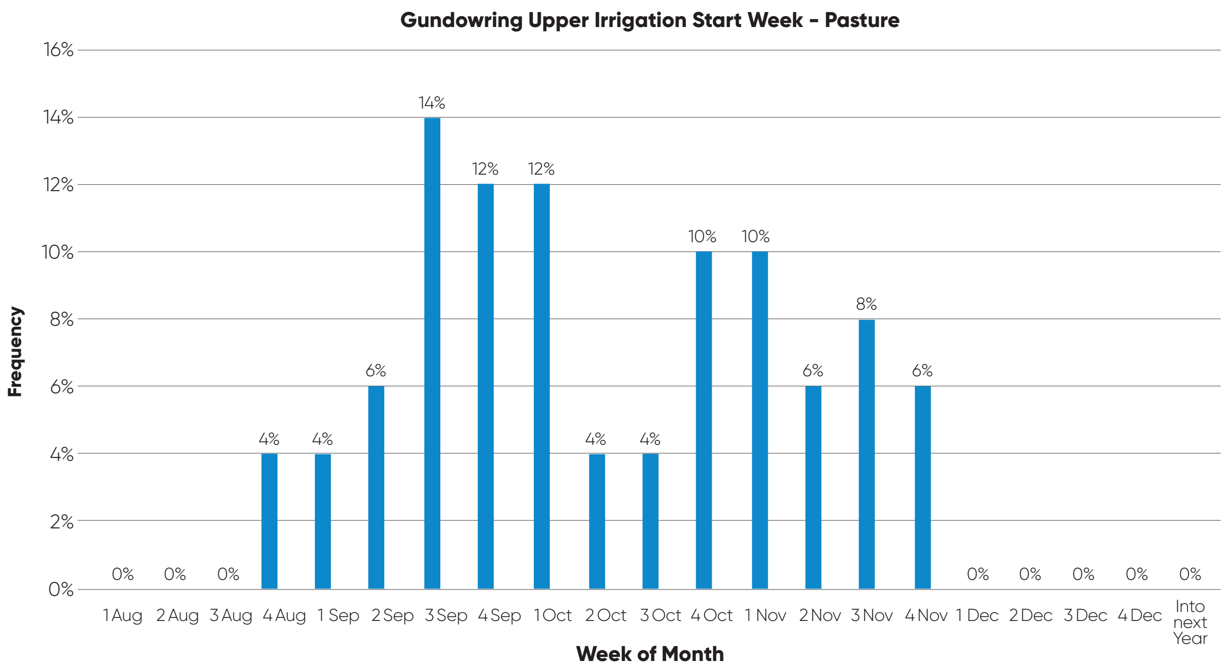


Gundowring irrigation demand under differing rainfall scenarios. Spring-Autumn or all season

Percentile	Spring November ML/ha	Autumn February ML/ha	All season ML/ha
10	0.2	0.8	3.1
20	0.4	1.5	4.0
30	0.7	1.8	4.9
40	0.8	1.8	5.2
50	1.1	2.0	5.4
60	1.4	2.3	5.9
70	1.6	2.6	6.2
80	2.1	2.8	6.7
90	2.3	3.0	7.3
100	3.3	3.6	9.0

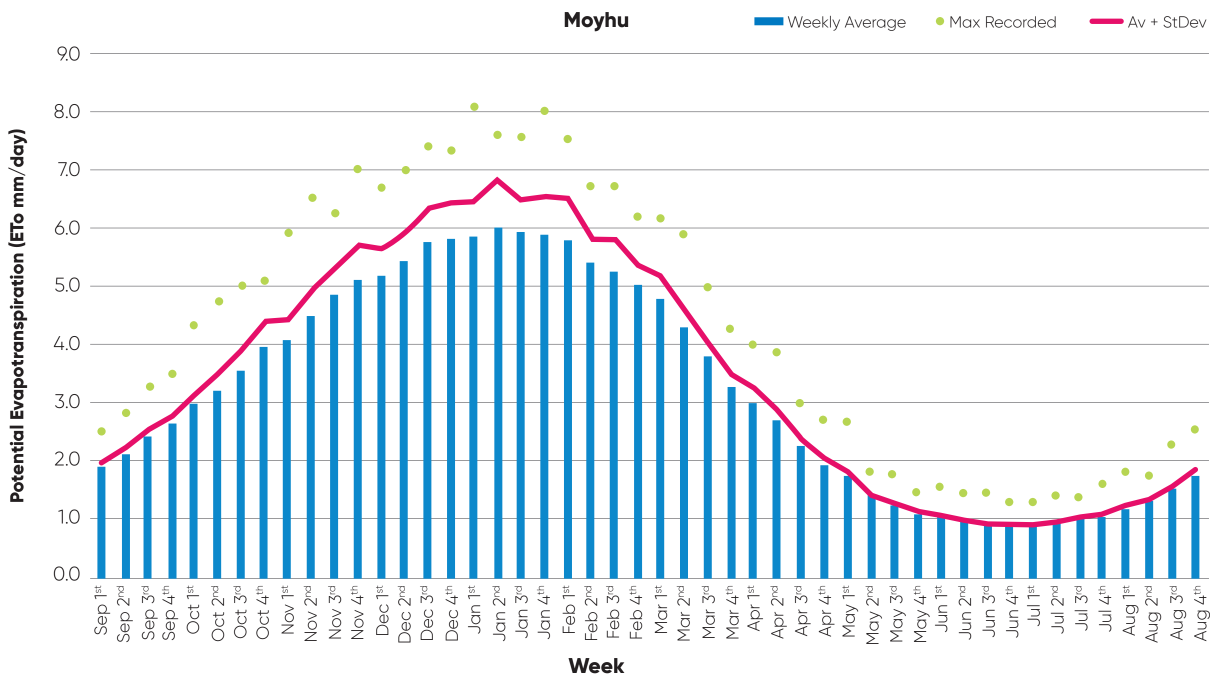
Figure 10

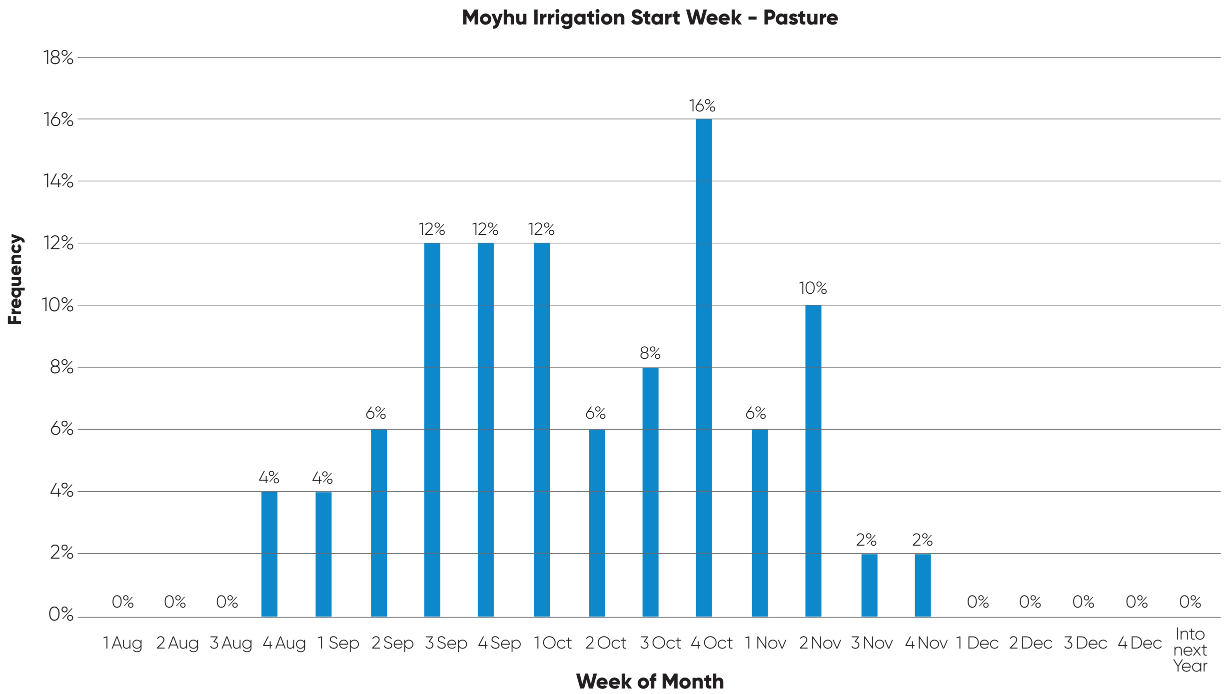




Moyhu irrigation demand under differing rainfall scenarios. Spring-Autumn or all season

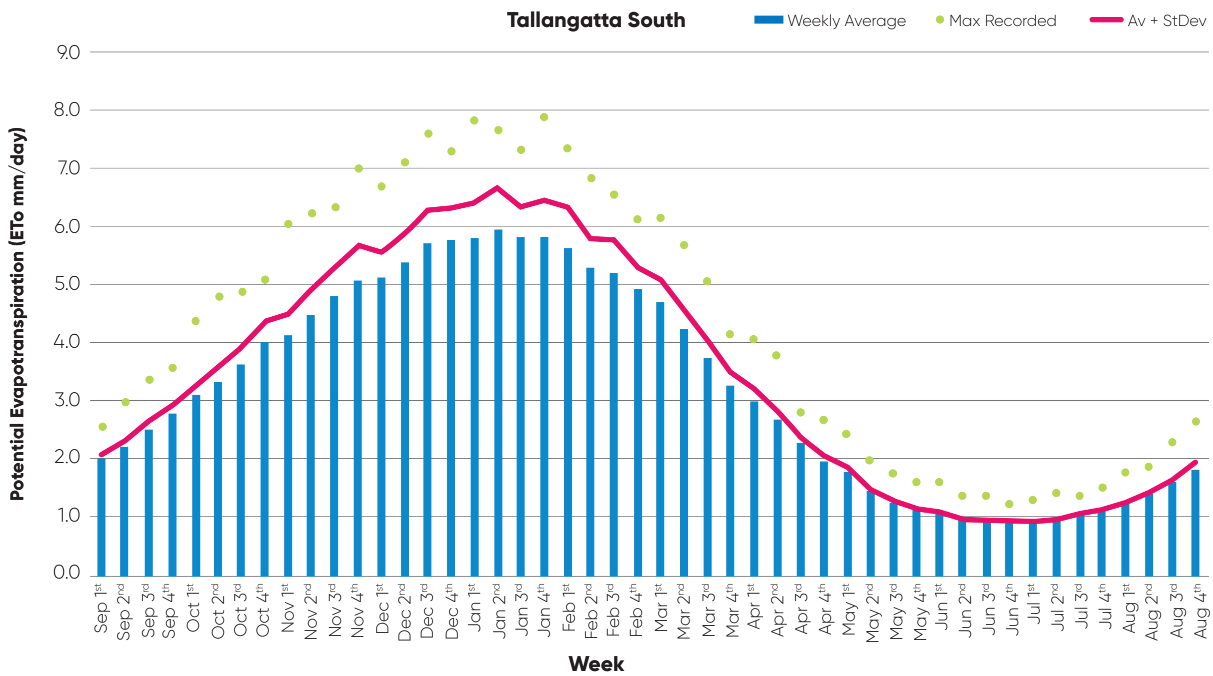
Percentile	Spring November ML/ha	Autumn February ML/ha	All season ML/ha
10	0.3	1.2	3.9
20	0.7	1.7	5.0
30	0.9	1.9	5.4
40	1.1	2.1	5.6
50	1.3	2.2	6.0
60	1.6	2.5	6.3
70	1.8	2.7	6.6
80	2.1	2.9	7.1
90	2.5	3.0	7.5
100	3.6	3.6	9.3

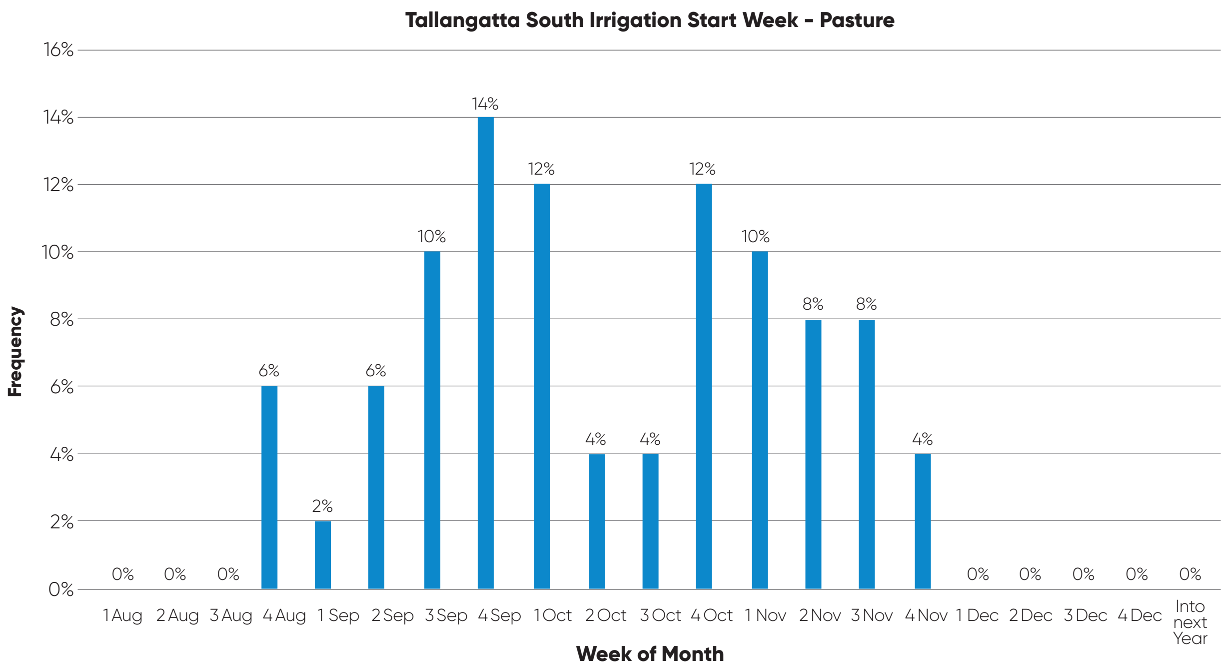




Tallangatta South irrigation demand under differing rainfall scenarios. Spring-Autumn or all season

Percentile	Spring November ML/ha	Autumn February ML/ha	All season ML/ha
10	0.3	1.1	3.0
20	0.5	1.5	4.3
30	0.7	1.6	4.8
40	0.8	1.8	5.1
50	1.0	2.0	5.4
60	1.2	2.2	5.6
70	1.7	2.6	6.3
80	2.1	2.7	6.8
90	2.3	3.0	7.3
100	3.4	3.7	9.2



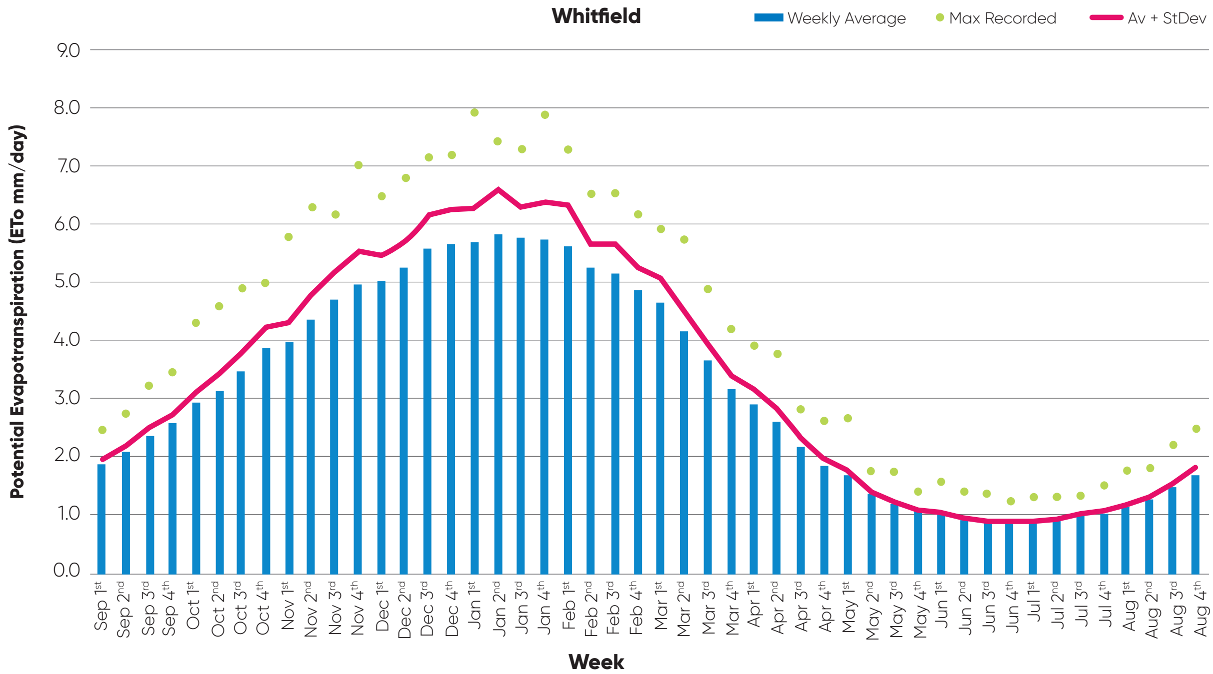


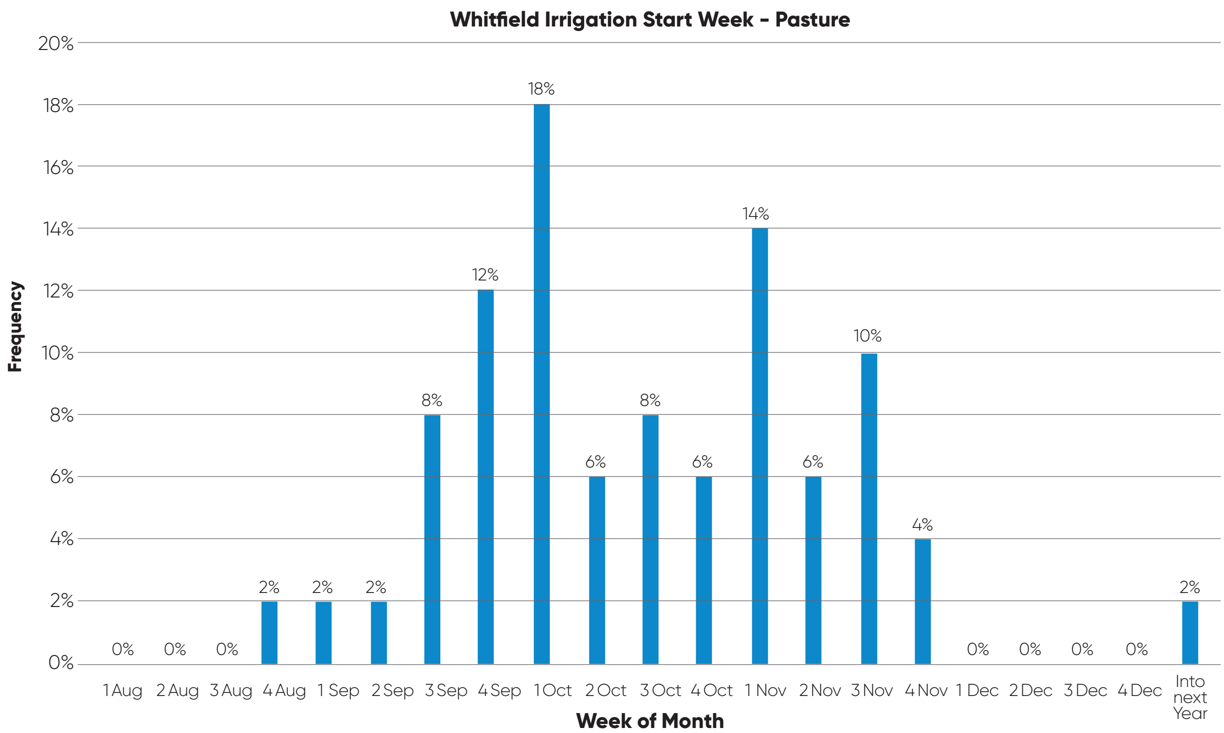
This document contains irrigation advice only and does not constitute approval or otherwise of any irrigation development. You should seek personal/business advice based on your own circumstances.

Whitfield irrigation demand under differing rainfall scenarios. Spring-Autumn or all season

Figure 18

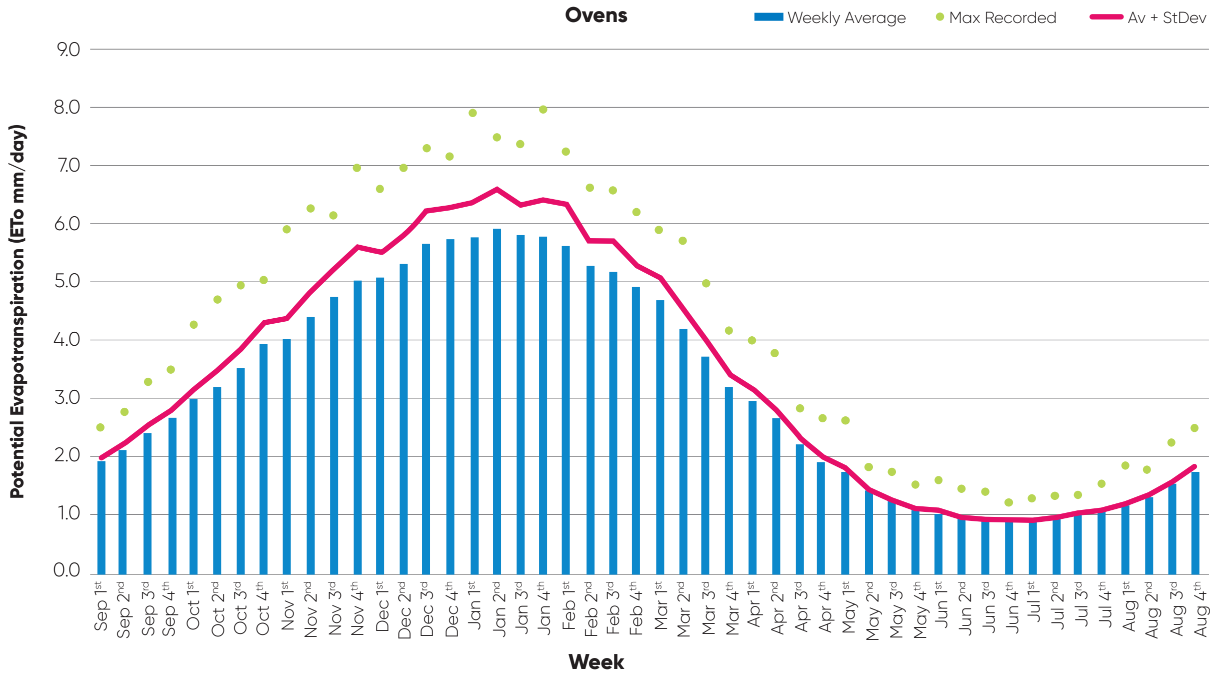
Percentile	Spring November ML/ha	Autumn February ML/ha	All season ML/ha
10	0.1	0.9	3.4
20	0.5	1.5	3.9
30	0.7	1.6	4.7
40	0.7	1.7	4.9
50	1.1	1.9	5.3
60	1.2	2.3	5.8
70	1.5	2.5	6.0
80	1.8	2.6	6.3
90	2.2	2.8	6.7
100	3.4	3.5	8.1

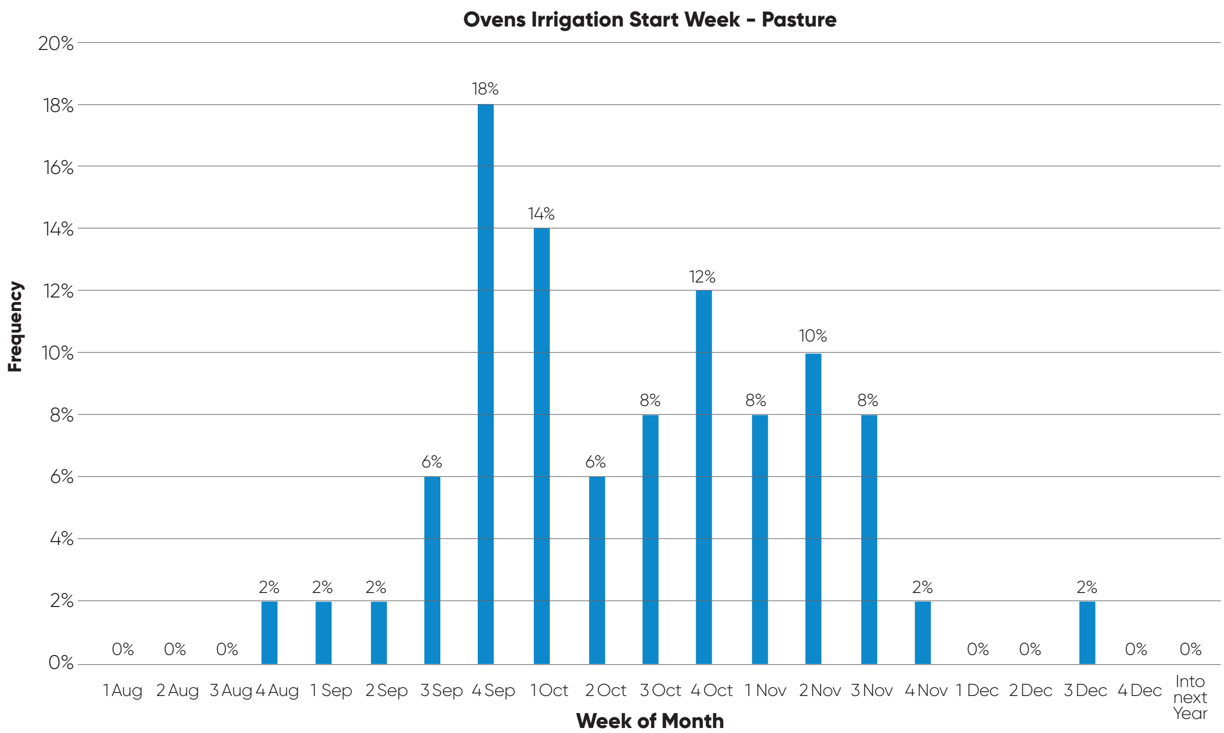




Ovens irrigation demand under differing rainfall scenarios. Spring-Autumn or all season

Percentile	Spring November ML/ha	Autumn February ML/ha	All season ML/ha
10	0.3	1.0	3.4
20	0.5	1.5	4.0
30	0.6	1.7	4.7
40	0.7	1.9	5.1
50	0.9	2.0	5.2
60	1.2	2.2	5.5
70	1.5	2.5	5.9
80	1.9	2.7	6.3
90	2.2	2.8	6.9
100	3.3	3.5	8.9





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Irrigation Module Screenshots

Welcome

Welcome

A very warm welcome to the GMID Water modules course. By getting this far we assume you're interested in finding out more about how the irrigation system work in the Goulburn Murray Irrigation District and/or your keen to set a plan for how you will position your business to take advantage of irrigation water.

Whether you are new to the district, new to farming, looking to take the next step in irrigated dairy or want to fine tune what you are already doing this program and its learning resources will provide you with a strong foundation for understanding this complicated topic. Most importantly, you will gain insights into what you can do to avoid the pitfalls and be inspired to take effective action.

What will you achieve?

By the end of the program, you'll be able to....

- Understand the basic terminology used in water markets in the region
- Understand the mechanics of buying, trading and carryover water
- Understand how the basic market mechanisms impact price and availability of irrigation water and identify opportunities to apply to own farm
- Evaluate and refine the plan on an annual basis
- Understand how your water portfolio and farm system function together and evaluate options to plan your water portfolio
- Evaluate seasonal, allocation and price signals and apply to your farm business
- Document a plan to position your farm for long term irrigation need

What topics will you cover

To get started on this site, look at the information listed in "Before you start' page. This will take you directly to more course information, from details regarding how to study in the course, to the interactive program forums, to the topics, resources and activities.

There are FOUR modules to cover

Start by learning more about the program by clicking on each of the links below.

Introduction to Water

Learn how water is allocated to your water shares for use on your farm and gain an understanding of terminology associated with using water in the Goulburn Murray Irrigation District.

Find out more

Trading in the GMID

Understand the complexities, opportunities and risks associated with water trading in the GMID through exploring new concepts; Water Outlook, Trading Water and Allocation Trade Prices.

Find out more

Tactical Use to Water

Find out what water means to farmers and to the agricultural and dairy sectors and how to conduct and alter a simple feed and water budget based on best use of water, land, herd and cash.

Find out more

Strategic Use to Water

Explore what options are available to position your business to make best use of irrigation in our region by selecting the most cost effective and reliable mix of water products for you over a long period.

Find out more

To access these modules simply email ***elearning.support@dairyaustralia.com.au***

Murray DAIRY

Dairy Australia

VICTORIA State Government

NORTH EAST CATCHMENT MANAGEMENT AUTHORITY

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