



IRRIGATION GLOVE BOX GUIDE

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ACRONYMS

DUL – Daily Upper Limit

DLL – Daily Lower Limit

RAW – Readily Available Water

CWU – Crop Water Use

PUR – Pump Utilisation Ratio

Ea- Application Efficiency

NIR – Net Irrigation Requirement

ETO – Reference Crop Evapotranspiration

KC- Crop Coefficient

ETC - Crop Evapotranspiration



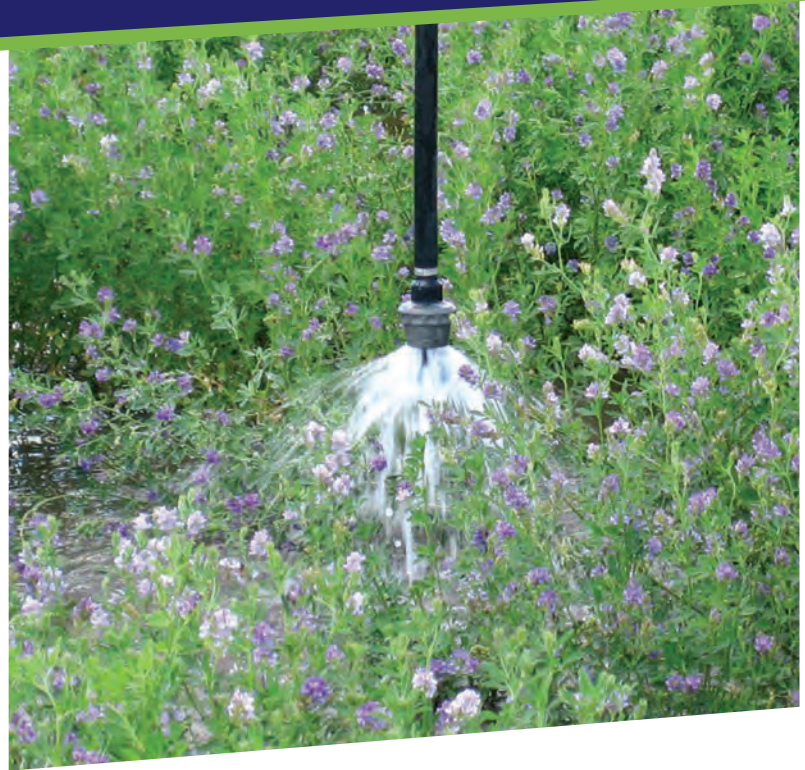
1. INTRODUCTION

This booklet has been developed as a quick reference guide for irrigators in the South East of SA. As such, a working knowledge of some of the equations and how to apply them is required.

The information provided is adapted from regional irrigation workshops that have been run in conjunction with Mackillop Farm Management Group, Natural Resources South East and Primary Industries and Regions South Australia.

More detailed information can be found on each of the topics through the

- Mackillop Farm Management Group website
www.mackillopgroup.com.au
- Natural Resources South East website
www.naturalresources.sa.gov.au/southeast
- Primary Industries and Regions South Australia website
www.pir.sa.gov.au



2. IRRIGATION BEST MANAGEMENT PRACTICE

To assist regional irrigators to improve the management of their irrigation enterprises, the South Australian Research and Development Institute has developed a number of non-prescriptive irrigation best management practices (BMP). They are general principles, rather than explanations on exactly how to manage your irrigation, or which tools to use.

BMP 1: Rate irrigation highly within your farm management system.

The best irrigators tend to rate irrigation management as a very high (if not No. 1) priority.

BMP 2: Get to know the soils on your property.

The variable ability of different soil types to hold plant-available moisture means irrigators should have a good understanding of soil types and distribution, and incorporate this understanding into their irrigation scheduling.

BMP 3: Design and maintain irrigation systems correctly.

Irrigation systems should be designed with several considerations in mind; including crop type, soil type, water quality and quantity. Once a correctly designed system is installed and set up, appropriate maintenance is required to ensure the system provides high standard, long term use.

BMP 4: Monitor all aspects of each irrigation event.

Having a thorough understanding of how much water was applied and where it went, should be the goal of every irrigator.

BMP 5: Use objective monitoring tools to schedule irrigation.

Using tools which actually measure things, such as soil moisture, can take a lot of guesswork out of the development of an irrigation schedule.

BMP 6: Use more than one tool for scheduling irrigation.

Use multiple tools to avoid the potential of getting the wrong information from just a single source.

BMP 7: Retain control of your irrigation scheduling.

Don't let your use of automation or external contractors result in a hands-off approach to irrigation.

BMP 8: Remain open to new information.

Continue to seek, and use, new information to help improve your irrigation practice.

3. SOIL TYPES AND CALCULATING RAW

Calculating Readily Available Water (RAW)

RAW = soil texture depth (metres) x soil texture
RAW value (millimetres/metre)

Table: Indicative soil-type RAW's

Soil Texture	RAW (mm/m)
Sand	25
Loamy sand	35
Sandy loam	35
Sandy clay loam	30
Clay loam	20
Clay	20

Example e.g. at -20 kPa

0	RAW 1	Clay sand
15		35mm/m available
40	RAW 2	Sandy clay loam
100		30mm/m available
	No Roots	Clay
		20mm/m available

How To Calculate Total RAW

RAW 1 = 0.15m of depth x 35mm/m
of water the clay sand can hold
= **5.25 mm**

RAW 2 = 0.25m of depth x 30mm/m
of water the clay sand loam can hold
= **7.5 mm**

Total RAW = RAW 1 + RAW 2
= 5.25mm + 7.5mm
= **12.75 mm**
(the total amount of water available to plants)

4. CROP WATER USE

The ability to assess the amount of water your crop requires is important for seasonal planning and periodic irrigation management (scheduling).

- Apply the correct amount of water for optimum crop development
- Effective use of water within volumetric licence constraints

Things you should know:

1. Crop Water Use (CWU) is expressed in millimetres (mm).
2. How to calculate CWU from Evapotranspiration (ET_o) data:

$$\begin{array}{ccccc} \text{ET}_o & \times & K_c & = & \text{ET}_c \\ \text{Reference Crop} & & \text{Crop} & & \text{Crop} \\ \text{Evapotranspiration} & & \text{Coefficient} & & \text{Evapotranspiration} \end{array}$$

3. How to estimate

Net Irrigation Requirement (NIR) from weather data

Note: For crop NIR's refer to appendix 1

Monthly ETC and Net Irrigation Requirement
- Pasture example, Mount Gambier

	ET _o	K _c	ET _c	Rainfall (mm)	Net Irrigation Requirement NIR (mm)
July	42	0.4	17	107	
August	59	0.73	43	111	
September	81	1.05	85	86	
October	119	x 1.05 =	125	- 66 =	59
November	135	1.05	142	58	84
December	171	1.05	180	49	131
January	188	1.05	197	28	169
February	144	1.05	151	30	121
March	137	1.05	144	42	102
April	85	0.95	81	52	29
May	49		0	80	
June	37		0	104	
TOTALS	1247		1164	813	694

NOTE: 100mm = 1ML/Ha

5. IMPORTANT CONVERSIONS

Water depth & volume

Soil water content, crop water use, rainfall and irrigation all described in depth (mm)

Flow rate and volumes described in Litres (L), Kilolitres (KL), and Megalitres (ML).

1 KL = 1000 L (1m³)

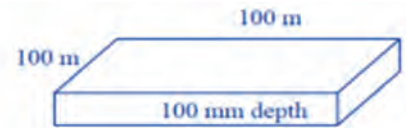
1 ML = 1000 KL

It is important to get conversions correct

Converting depth to Volume

1 ML/Ha = 100 mm

10 KL/Ha = 1 mm



How much water is required to apply 20mm over 37 Ha

$$\begin{aligned}\text{Volume (KL)} &= \text{Target Application (mm)} \times \text{Ha} \times 10 \\ &= 20 \times 37 \times 10 \\ &= 7400 \text{ KL or } 7.4 \text{ ML}\end{aligned}$$

6. VOLUMETRIC MEASUREMENT AND METERS

Unit	Litres	Kilolitres	Megalitre	Gigalitre
1 Litre (L)	1 L	0.001 KL		
1 Kilolitre (KL)	1 000 L	1 KL	0.001 ML	
1 Megalitre (ML)	1 000 000 L	1 000 KL	1 ML	0.001 GL
1 Gigalitre (GL)	1 000 000 000 L	1 000 000 KL	1 000 ML	1 GL

Depending on the unit of measure, it can be important to understand the value of each decimal place. The table below explains the value of each decimal place in relation to the unit of measure.

Water meters can measure and display volumes in many different ways.

This may depend on the manufacturer, the type of water meter or often the size of the meter. Some water meters may display the volume as factors of 10 or 100.

Unit of Measure	First decimal 1.0	Second decimal 0.01	Third decimal 0.001
Kilolitres (KL)	100's of litres	10's of litres	litres
Megalitres (ML)	100's of kilolitres	10's of kilolitres	kilolitres
Gigalitres (GL)	100's of megalitres	10's of megalitres	megalitres

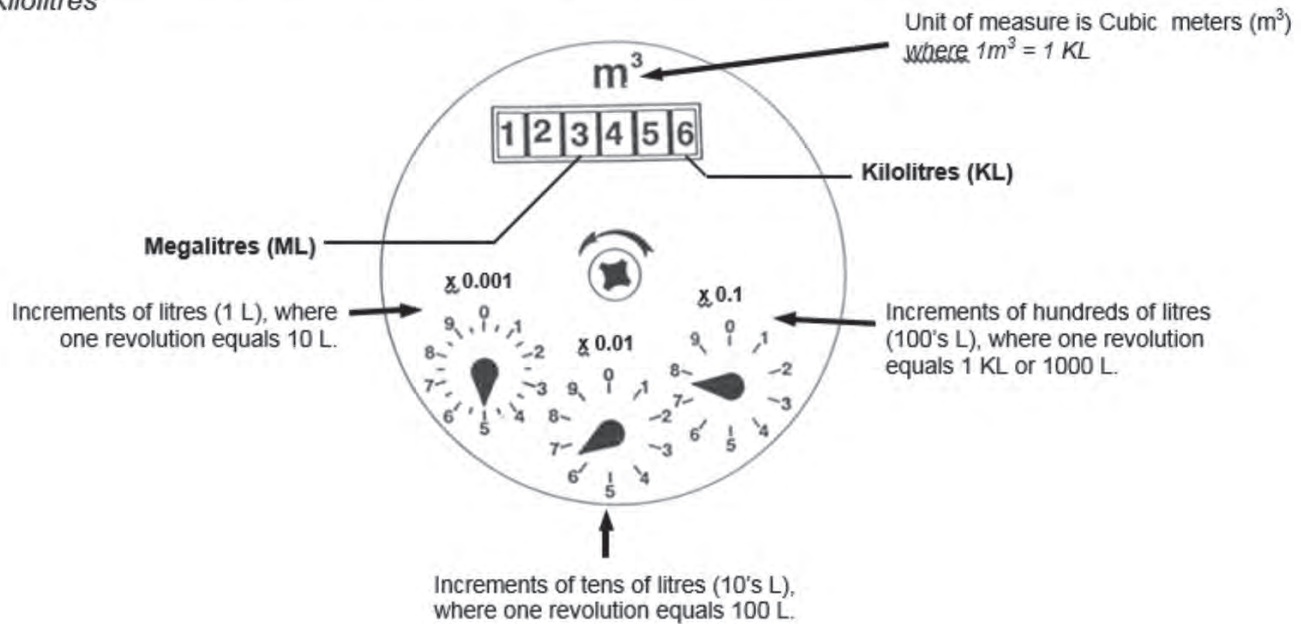
The following table provides a definition and details on the units of measure commonly used for irrigation water meters.

Unit of Measure	Description	Conversion	Notes on Reading (counting from left to right)
KL	Kilolitre	1 KL = 1000 L	4th digit represents ML
ML	Megalitre	1 ML = 1000 KL	1st decimal place represent KL
m ³	Cubic metre	1 m ³ = 1 KL	Same as KL
m ³ x 10	Cubic metre times 10	1 m ³ x 10 = 10 KL	3rd digit represents ML
m ³ x 100	Cubic metre times 100	1 m ³ x 100 = 100 KL	2nd digit represents ML

6. VOLUMETRIC MEASUREMENT AND METERS

Mechanical meter recording in cubic meters (m^3)

Kilolitres

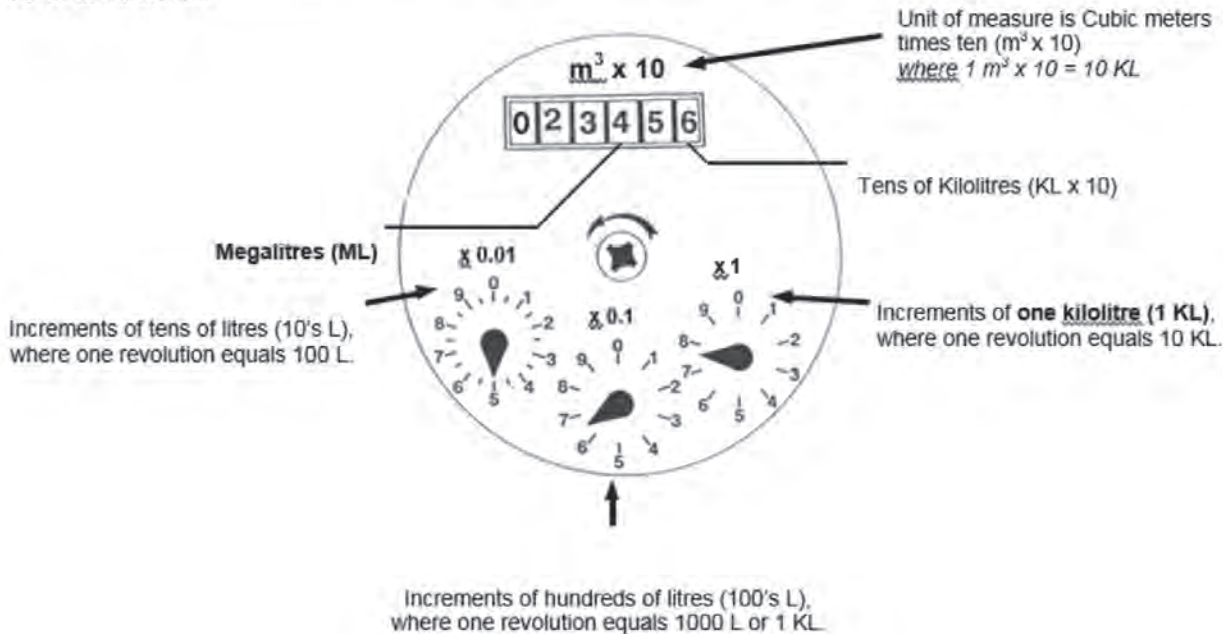


Meter Reading: 123.456 ML or 123 456.765 KL

6. VOLUMETRIC MEASUREMENT AND METERS

Mechanical meter recording in cubic meters times ten ($m^3 \times 10$)

Tens of Kilolitres



Meter Reading: 234.567 ML or 234 567.65 KL

7. UNDERSTANDING THE DEPTH OF IRRIGATION

The ability to measure and control the depth of irrigation is critical to properly meet the water requirement of your crop, incorporate fertilisers and manage salinity.

- Irrigation system design and specifications
- Estimating depth of irrigation from water meter readings

Things you should know:

1. For full cover irrigation, 1 ML/ha is equivalent to 100 mm irrigation depth (10 KL/ha = 1 mm)
2. Original Equipment (OE) installation and system performance specifications
3. How to estimate depth of irrigation from meter readings (assumes uniform distribution):

$$\text{Irrigation Rate (ML/ha)} = \frac{\text{Volume pumped (ML)}}{\text{Area Irrigated (ha)}}$$

$$\text{Irrigation depth (mm)} = \frac{\text{Volume pumped (ML)} \times 100}{\text{Area Irrigated (ha)}}$$

$$\text{Irrigation depth (mm)} = \frac{\text{Volume pumped (ML)}}{(\text{Area Irrigated (ha)}) \times 10}$$

Note: Method 2 is more suited to calculating irrigation depth for individual events or sites pumping small volumes .i.e. drip irrigation.

$$\text{Irrigation depth (mm)} = \frac{\text{End reading} - \text{Start reading}}{(\text{Area Irrigated (ha)}) \times 10}$$

Example:

Start meter reading – 554734, End meter reading – 556882, Irrigated Area – 28ha

$$\text{Irrigation depth (mm)} = \frac{556882 - 554734}{28 \times 10} = 7.7\text{mm}$$

7. UNDERSTANDING THE DEPTH OF IRRIGATION

Example 1:

Average depth per irrigation event.

One megalitre (1 ML) pumped to irrigate 10 ha of crop.

$$\text{Depth (mm)} = \frac{1}{10} \times 100 = 10 \text{ mm.}$$

Example 2:

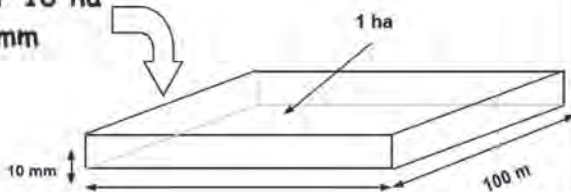
Average depth for irrigation season.

220 ML pumped to irrigate 40 ha of crop over the season.

$$\text{Depth (mm)} = \frac{220}{40} \times 100 = 550 \text{ mm}$$

or 5.5 ML / ha

1 ML over 10 ha
= 10 mm



Calculating the volume required to apply a given depth of water

If you know what depth of irrigation water you want to apply per event, you can calculate how much water you need to pump to apply that target depth. The calculation is shown below, along with an example:

$$\text{Volume (KL)} = \frac{(\text{Depth (mm)} \times \text{Area (ha)} \times 10)}{\text{System Efficiency (as a decimal)}}$$

Example:

You want to apply 12 mm of irrigation water to a 30 ha crop, using a centre pivot with an efficiency of 85% (expressed in the equation as 0.85)

$$\text{Volume (KL)} = \frac{12 \times 30 \times 10}{0.85} = 4235 \text{ KL}$$

8. IRRIGATION APPLICATION EFFICIENCY

All systems have losses due to friction, pipe size, maintenance and distance over which the water has to travel. These are usually available from the system designer and are expressed as efficiency curves.

Given the Application Efficiency of your system, how much additional water is required to meet NIR?

Guideline Application Efficiencies of major irrigation systems:

- Surface Irrigation 65%
- Centre Pivot 85%
- Drip 95%

$$\text{Total Flow Required (ML)} = \frac{(\text{Depth (mm)} \times \text{Area (ha)} \times 10)}{\text{System Efficiency (as a decimal)}}$$

Example: A 24 hectare stand of pasture requires 15mm irrigation. What total volume needs to be applied under different system efficiencies to provide the required depth of irrigation?

	Irrigation Efficiency			
	15mm	85%	75%	65%
Total Flow Required (ML)	3.6	4.24	480	5.54

Example: Determine the volume of water required to meet the Net Irrigation Requirements (NIR) of 6.94 ML/Ha using nominal irrigation system efficiency.

Irrigation Type	Application Efficiency (Ea)	Calculation	Total Volume Required (ML/Ha)
		NIR (ML/Ha) ÷ Ea	
Centre Pivot	0.85	6.94 ÷ 0.85	8.16
Surface Irrigation	0.65	6.94 ÷ 0.65	10.68

As application efficiency declines, the volume of water that must be pumped to meet crop requirement increases.

8. IRRIGATION APPLICATION EFFICIENCY

Factors that affect irrigation efficiency

- **System design** - along with maintenance requirements and site conditions are fundamental factors that influence the overall efficiency of irrigation systems.
- **Soils** - High irrigation efficiencies are generally easier to achieve on heavier and deeper soils, while low efficiencies are more common for sites located on shallow and free draining soils.
- **Sprinkler packages** - the right sprinkler package that is well maintained can reduce losses to evaporation and improve the distribution uniformity and application efficiency.
- **Pump flow rate** - high flow rates for flood irrigation systems can reduce the time required to water each bay and hence use less water per irrigation event.
- **Irrigation scheduling** - applying the right amount at the right time to match crop water requirements and soil moisture holding capacity can result in less deep drainage and improved efficiency.
- **Application depth** - if the average application depth is greater than the soil moisture holding capacity it will result in excessive deep drainage per irrigation event and therefore contribute to low overall system efficiency.

Factors to improve irrigation efficiency

Irrigation efficiency can be improved by reducing water losses. There are three major areas where improvements can be made:

- **Transmission system:** channel treatment or lining options can reduce losses in channel systems. Piped systems should be well maintained to avoid significant losses.
- **Application system:** Good irrigation system design and maintenance is a key ingredient to achieving high irrigation efficiency. Depending on the system type, the options will vary.
- **Irrigation management:** Applying the right amount of water at the right time minimises deep drainage losses.

9. IRRIGATION SYSTEM CAPACITY

Accurate knowledge of available water supply and flow rate information is essential **BEFORE** the design of your system. Total quantity of water available for the planned irrigation area must be known (Need to consider licensed entitlements, rainfall and temporary transfers). This is a major determinant of irrigable area.

The system capacity is the maximum possible rate at which the machine can apply water to the irrigated field area.

Note: System capacity is expressed in millimetres per day (mm/day), **NOT** the depth applied per pass (mm). This also assumes the machine is operating 24 hours per day and at 100% efficiency.

When planning a new irrigation system or designing a cropping program for an existing system ensure that the system can be managed to meet average and/or peak CWU.

- **System Capacity** is the maximum rate of irrigation that can be applied
- Changing the conditions in which the system is operated is the **Managed System Capacity**
- Understanding this concept is very useful for planning

Calculating system capacity:

$$\text{System capacity (mm/day)} = \frac{\text{Daily Pump Flow (L/day)}}{\text{Irrigated Area (m}^2\text{)}}$$

Example

Pump flow rate @ 55L/Sec, Irrigated Area = 35ha

$$\text{System capacity (mm/day)} = \frac{55 \times 86400 \text{ (secs in 1day)}}{35 \times 10000 \text{ (m}^2 \text{ in 1Ha)}} = 13.6 \text{ mm/day}$$

9. IRRIGATION SYSTEM CAPACITY

How to apply different management conditions

- Pump Utilisation Ratio, PUR
- Application Efficiency, E_a

$$\text{Managed System Capacity (mm/day)} = \text{System capacity} \times \text{PUR} \times E_a$$

Example

$$\text{PUR} = 0.71, \text{ Application Efficiency, } E_a = 0.9$$

$$\text{Managed System Capacity (mm/day)} = 13.6 \times 0.71 \times 0.9 = 8.7 \text{ mm/day}$$

Note: Stored soil moisture may be used as a short-term buffer in situations where Managed System Capacity is less than the target CWU. To create this short term buffer, strategies such as watering well ahead of potential dry hot weather may need to be employed.



10. CALCULATING IRRIGABLE AREA

To calculate irrigable area, you need to know the required **system capacity** and **water supply rate**

$$\text{Field irrigated area (m}^2\text{)} = \frac{\text{Daily Pump Flow (L/day)}}{\text{System Capacity}}$$

Example (using figures from previous calculations):

For a flow rate of 55 Litres/second, this equates to $55 \times (60 \times 60 \times 24) = 4\,752\,000$ Litres/day, System capacity of 8.7mm/day

$$\begin{aligned} \text{Field irrigated area (m}^2\text{)} &= \frac{4,752,000}{8.7} = 546,206\text{m}^2 \\ &= 54.6\text{Ha} \end{aligned}$$

Calculating the area that can be irrigated with a given volume

- Step 1.** Determine the volume of allocation you plan on using.
- Step 2.** Multiply this volume by the overall system efficiency to account for irrigation system losses. This provides an indication of the volume that would be available to the crop to use.

$$\text{Volume available to Crop (ML) (less system losses)} = \text{Total allocation available} \times E_a$$

- Step 3.** Lookup the theoretical crop irrigation requirement table to find the average NIR_c value for your crop type in your climatic band.
- Step 4.** Divide the volume available to the crop (from step 2) by the NIR_c value to determine the area that can be irrigated

$$\text{Area that can be irrigated (Ha)} = \frac{\text{Volume available to Crop (ML) (less system losses)}}{\text{NIR}_c}$$

10. CALCULATING IRRIGABLE AREA

Worksheet for calculating the area

Important Notice: The calculation of irrigated area from volumetric allocations (as shown) is based on maximum production of irrigated crops (for an average water requirement season) along with a given overall efficiency. Licensees have the choice to spread their water over larger areas (i.e. at a lower level of production) or irrigate less area to remain on the safe side, especially in the event of dry seasons with above average crop water requirements.

1. Volume available to be used (ML)	=		ML
2. Volume available to the crop (less system losses)	=		ML
		<i>from step 1</i>	<i>overall efficiency</i>
	=		x
			(in decimal form)
	=		ML
3. NIRc value for crop / climatic band	=		ML / ha
		<i>See appendix 1</i>	
		<i>from Step 2</i>	
			ML
4. Area to irrigate (ha)	=		ML / ha
		<i>divided by</i>	
			ML / ha
		<i>from Step 3</i>	
	=		ha

11. SYSTEMS EVALUATION

Comparing soil moisture monitoring probes

Points to consider:

- What are the range of measurements associated with the probe, and how do these compare to the crop water use and potential irrigation requirements?
- What number of monitoring sites are required at each irrigation site? This could be dependent on the irrigation system being monitored, on any soil variation across the site, or crop variation across the site.
- What level of output detail is required? What are the frequency of readings (daily readings vs continuous logging)?
- What is the level of input required to get the readings? Does it have to be downloaded and processed to be useful, or is it automatically processed and telemetered back to the office or smart phone?
- What level of backup is available post purchase (rectification of hardware/software issues, assistance with installation and calibration, interpretation of the probe outputs)?
- In what form are the system outputs? How easy are they to interpret?
- What is the purchase price? Consider initial cost and any ongoing/future costs.

Siting of soil moisture monitoring probes

Points to consider:

- Place site a few rows into the crop
- Place site on the north-west side of the plant

Places to avoid when siting probes.

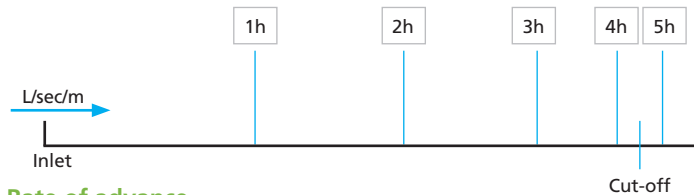
Outside rows	Outside rows are exposed to wind, especially on the edges of roads or adjoining broadacre properties
Wheel tracks / gateways / stock traffic areas	Soil is compacted and may lead to inaccurate readings
Disturbed soil	Sites where the soil has been disturbed can lead to inaccurate readings
Stunted or sick plants	Sick plants usually use less water
Areas with poor sprinkler distribution uniformity	These areas can give readings not representative of the whole shift
Areas with shallow water tables	Rising water tables may be detected, giving a false impression of water needs across the crop
Pasture or broadacre areas sheltered by trees or shelterbelts	Shading and shelter effect transpiration, and tree roots may rob soil moisture

12. SYSTEM EVALUATION – SURFACE IRRIGATION

Irrigation system assessments should be performed at regular intervals to ensure consistent performance through and between seasons.

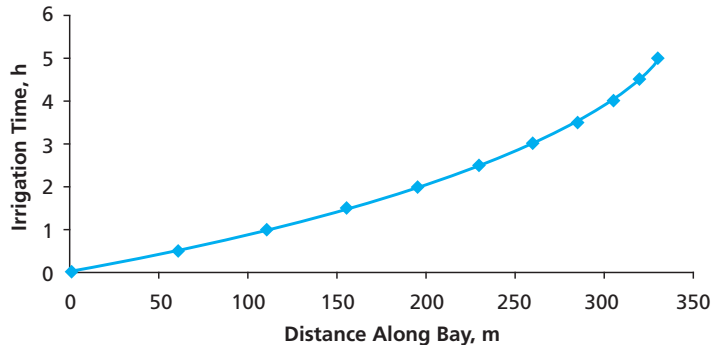
Inflow

Surface Irrigation Measurements



Rate of advance

Surface Irrigation Advance Curve



Things you should know:

1. If the Advance Curve approaches vertical **when the inlet is open**, irrigation has stalled and you should consider:
 - a. Reducing field length (readily achievable)
 - b. Increasing inflow and improving distribution infrastructure (moderately achievable)
 - c. Increasing surface slope (may not be achievable)
2. In reality, system performance often varies between irrigation applications. So assessments should be performed at various stages of crop or pasture development to gauge the degree of variation and establish benchmarks.
3. Assess distribution losses (channel seepage test) for greater accuracy.

12. SYSTEM EVALUATION – SURFACE IRRIGATION

Application Rate

$$\text{Application rate (mm/hr)} = \frac{\text{Sprinkler flow rate (L/hr)}}{\text{Sprinkler spacing (m)} \times \text{row spacing (m)}}$$

Example

For a sprinkler system, where sprinklers are 5.5m apart within rows, and rows of sprinklers are 7.3m apart, with a discharge of 185 L/hr:

$$\text{Application rate (mm/hr)} = \frac{185}{5.5 \times 7.3} = 4.6 \text{ mm/hr}$$

Hours of Irrigation

$$\text{Hours of Irrigation (hr)} = \frac{\text{Depth required (mm)}}{\text{Application rate (mm/hr)}}$$

Example

The hours required to apply a 33 mm irrigation (including leaching) with an application rate of 4.6 mm/h is:

$$\text{Hours of Irrigation (hr)} = \frac{33}{4.6} = 7.2 \text{ hr}$$



13. SYSTEM EVALUATION – CENTRE PIVOT

Application Per Pass

For centre pivot irrigators, the amount of water you are applying can be calculated as follows:

$$\text{Irrigation depth (mm)} = \frac{\text{Volume (KL)}}{\text{Area (Ha)} \times 10}$$

Example

2 000 kL has passed through an irrigation meter for one complete pass of a 40 ha pivot.

$$\text{Irrigation depth (mm)} = \frac{2000}{40 \times 10} = 5\text{mm}$$

Passes to Irrigate

$$\text{Passes to Irrigate} = \frac{\text{Depth required (mm)}}{\text{Depth per pass (mm)}}$$

Example

The number of passes required to apply 10mm of irrigation with an application rate of 5mm per pass.

$$\text{Passes to Irrigate} = \frac{10}{5} = 2 \text{ passes}$$

Note: To evaluate the calculated output vs the actual output a method known as “Catch Can testing” may need to be employed. This is the process by which cans of known volume are placed in the field at various points (both radially along the boom and also randomly across the field) and the collected water from one pass of the pivot system is captured and measured.

14. SYSTEM EVALUATION – DRIP IRRIGATION

Flow Rate

$$\text{Flow Rate (L/hr)} = \frac{\text{Water collected in mL} \times 3.6}{\text{Time of collection (seconds)}}$$

Application Rate

$$\text{Application rate (mm/hr)} = \frac{\text{L/hr per dripper}}{\text{Dripper spacing (m)} \times \text{row width (m)}}$$

Or

$$\text{Application rate (mm/hr)} = \frac{\text{Number of drippers/ha} \times \text{L/hr per dripper}}{10\,000}$$

Example

Dripper rate 4L/hr, dripper spacing @ 1m, row width @ 3.3m

$$\text{Application rate (mm/hr)} = \frac{4}{1 \times 3.3} = 1 \times 3.3$$

Hours of Irrigation

To calculate the number of hours required, the wetted volume of soil should be considered. For the above examples we will assume one-third wetted area (0.33)

$$\text{Hours of Irrigation (hr)} = \frac{\text{X mm RAW} \times 0.33}{\text{Application rate (mm/hr)}}$$

Example

The hours required to refill a soil with 33 mm RAW (including leaching) with an application rate of 1.2 mm/hr and a wetted area of one third is:

$$\text{Hours of Irrigation (hr)} = \frac{33\text{mm RAW} \times .033}{1.2} = 9.2\text{hr}$$

Note: Catch can testing should be used along the lateral lines away from the sub mains and this will give you an indication of the efficiency and effectiveness of the system.

15. DEVELOPING AN IRRIGATION SCHEDULE

The aim of irrigation scheduling is to keep soil water within an acceptable range, avoiding plant stress by not allowing your soils to remain too dry or too wet. Scheduling makes the best use of your irrigation water. Plants that are not water stressed have the potential to produce optimum yields and remain healthy and vigorous. Scheduling involves deciding when to irrigate and how much water to apply

Information required to develop an irrigation schedule:

- Soil properties – particularly RAW
- Irrigation system specifications
- Monitoring crop water use (CWU) utilising ETo and/or Soil Moisture Monitoring

$$\text{Irrigation Interval (days)} = \frac{\text{Rootzone RAW}}{\text{Daily CWU}}$$

Note: Crop water use (CWU) will vary throughout the year based on several factors of weather, stage of plant growth, and evaporation. Estimate of average daily CWU can be calculate from the Tables in appendix 1 & 2 for varying crops.



16. WEATHER AND REGIONAL DATA SOURCES

DEWNR/NRM

NatureMaps

NatureMaps, www.naturemaps.sa.gov.au is an initiative of the Department of Environment, Water and Natural Resources that provides a common access point to maps and geographic information about South Australia's natural resources in an interactive online mapping format.

- Administrative Boundaries
- Cadastral Information
- Coast and Marine
- Fauna and Flora
- Fire
- Heritage and Tourism
- Landscapes
- Protected Areas
- Tenure and Landuse
- Vegetation Mapping
- *NEW* Water (Ground and Surface)
- Wetlands
- Graticules, Grids and Map Tiles
- Photo Centres and Flight Line

nrmWEATHER

To access detailed weather data from the Natural Resources South East automatic weather station (AWS) website, click on se-aws.nrmspace.com.au.

This link takes you to the nrmWEATHER homepage and a map of the South East (with site locations of the 19 regional AWS's) and a menu with dedicated links to each site.

For detailed site information, click on the menu link for the relevant site of interest. This will take you to a summary page for that station, with a range of archived data links above a table comprising the most recent site information.

The 'Download' link allows you to view or save data from within any data range you enter (Note the format required for entering dates in the adjacent brackets). This facility gives you the option of retrieving either daily or 15 minute data.

Saved data can be exported into Excel spreadsheets; allowing you to produce tables and graphs from the information of interest.

16. WEATHER AND REGIONAL DATA SOURCES

Bureau of Meteorology

AWS

The Bureau of Meteorology has several Automated Weather Station's AWS (and one manned site) in the South East. View data from these sites by scrolling down to the 'Upper South East and Lower South East' table at

www.bom.gov.au/sa/observations/saall.shtml.

Click on the site link (in the first column) for more detailed information.

Met Eye

MetEye™ — our new interactive weather resource, helps you view real-time weather observations and seven day forecast information. Using your mouse or tapping on your tablet you can now view different weather elements such as real-time temperature, rainfall, radar images, cloud cover and wind speed for one location. It's a new way to view local weather. When the roll out of the Next Generation Forecast and Warning System is complete, MetEye™ will display forecasts, satellite and radar imagery, as well as the Bureau's weather

www.bom.gov.au/australia/meteye

PIRSA

AGINSIGHT

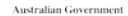
The new AgInsight South Australia site is part of the 4 year Agribusiness Accelerator Program and a key part of the *Premium food and wine produced in our clean environment and exported to the world* economic priority.

AgInsight South Australia has more than 150 geospatial layers that can show you:

- land type
- land zoning
- transport infrastructure
- energy infrastructure
- commodities produced
- climate information
- water availability
- and much more.

www.aginsight.sa.gov.au

Appendix 1



17. APPENDICES

Appendix 2: Average Net Irrigation Requirements (NIRc)
of crops grown in the South East of South Australia (ML/Ha of crop)

Crop Type	CLIMATIC BAND									
	1A	2A	3A	4A	5A	6A/1	6A/2	7A	8A	9A
BEANS - BROAD/FABA	0.97	1.02	1.09	1.20	1.31	1.33	1.42	1.51	1.61	1.80
CANOLA	0.43	0.49	0.61	0.23	0.34	0.40	0.49	0.62	0.75	0.92
CARROT SEED	2.00	2.09	2.25	2.41	2.56	2.63	2.81	3.06	3.25	3.53
CEREALS	0.57	0.62	0.71	0.84	0.97	0.99	1.09	1.18	1.30	1.52
CHINESE CABBAGE SEED	1.13	1.18	1.25	1.36	1.48	1.50	1.60	1.69	1.78	1.98
CLOVER SEED - ANNUAL	1.62	1.68	1.79	1.93	2.07	2.09	2.23	2.37	2.50	2.77
CLOVER SEED - PERENNIAL	3.20	3.34	3.63	3.90	4.21	4.37	4.65	5.08	5.41	5.83
CLOVER SEED - SUB	1.77	1.83	1.94	2.08	2.23	2.25	2.40	2.60	2.76	3.04
CORIANDER	1.71	1.77	1.89	2.03	2.17	2.21	2.36	2.56	2.71	3.01
FRUIT TREES	3.96	4.13	4.50	4.76	4.96	5.14	5.37	5.73	5.95	6.29
GRASS SEED	3.09	3.16	3.34	3.52	3.68	3.73	3.94	4.20	4.41	4.77
LUCERNE HAY/GRAZE	3.40	3.52	3.84	4.08	4.28	4.43	4.63	4.94	5.15	5.50
LUCERNE SEED	2.48	2.59	2.86	3.09	3.29	3.38	3.57	3.81	4.02	4.38
LUPINS	0.98	1.03	1.10	1.21	1.32	1.34	1.43	1.52	1.61	1.81
MAIZE	4.80	4.87	5.16	5.33	5.44	5.61	5.76	6.04	6.19	6.47
MUSTARD	1.15	1.19	1.26	1.33	1.42	1.41	1.51	1.61	1.69	1.89
NATIVE FLOWERS	2.02	2.10	2.35	2.52	2.65	2.75	2.88	3.06	3.18	3.41
NATIVE FOLIAGE	0.84	0.90	1.08	1.23	1.35	1.45	1.55	1.72	1.83	1.99

17. APPENDICES

Appendix 2: Continued

Crop Type	CLIMATIC BAND									
	1A	2A	3A	4A	5A	6A/1	6A/2	7A	8A	9A
OLIVE - FRESH	2.61	2.77	3.09	3.33	3.55	3.70	3.89	4.20	4.42	4.77
OLIVE - OIL	2.26	2.41	2.71	2.93	3.12	3.25	3.43	3.69	3.90	4.22
ONION	4.82	4.92	5.24	5.47	5.64	5.82	5.99	6.30	6.49	6.83
ONION SEED	3.09	3.16	3.38	3.55	3.71	3.78	3.96	4.20	4.38	4.71
PASTURE - FULL	4.53	4.68	5.01	5.28	5.50	5.66	5.88	6.20	6.44	6.79
PASTURE - HALF	1.74	1.80	1.93	2.07	2.20	2.22	2.37	2.52	2.68	2.94
PASTURE - STARTER/FINISHER	0.25	0.29	0.36	0.45	0.54	0.55	0.63	0.74	0.86	1.03
PASTURE - MAX PRODUCTION	6.03	6.19	6.57	6.86	7.11	7.31	7.56	8.00	8.27	8.69
PEAS - FIELD	0.77	0.81	0.88	0.98	1.09	1.10	1.19	1.27	1.34	1.52
POTATOES	4.16	4.23	4.49	4.68	4.83	4.94	5.12	5.38	5.54	5.89
POTATOES - SEED	2.83	2.87	3.06	3.16	3.23	3.33	3.41	3.60	3.68	3.86
RADISH SEED	1.10	1.15	1.26	1.39	1.52	1.53	1.65	1.80	1.94	2.17
SUMMER FODDER	2.44	2.54	2.79	2.95	3.07	3.19	3.31	3.51	3.65	3.83
SUNFLOWER	3.01	3.08	3.31	3.43	3.51	3.65	3.73	3.94	4.04	4.22
SWEETCORN	3.21	3.25	3.46	3.57	3.63	3.76	3.83	4.03	4.12	4.30
WINEGRAPE	1.56	1.65	1.89	2.05	2.18	2.26	2.42	2.61	2.74	2.96

Note:

1. NIRc values represent the volume of irrigation water required (in addition to rainfall) to achieve the maximum production for an average water requirement season.
2. See Appendix 1 on page 27 to identify the location of each climatic band.

17. APPENDICES

Appendix 3: Percentage of Annual Water Use (% Use)

CROP	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
BEANS - BROAD FABA			0.05	0.46	0.49							
CANOLA			0.03	0.56	0.40	0.01						
CARROT SEED (YR1)									0.70	0.25	0.04	0.01
CARROT SEED (YR2)			0.03	0.18	0.37	0.43						
CEREALS				0.30	0.70							
CHINESE CABBAGE SEED			0.03	0.39	0.58							
CLOVER SEED - ANNUAL			0.04	0.31	0.51	0.15						
CLOVER SEED - PERENNIAL			0.03	0.14	0.27	0.31	0.09		0.05	0.08	0.02	0.01
CLOVER SEED - SUB			0.08	0.27	0.48	0.17					0.00	
CORIANDER			0.05	0.25	0.46	0.23						
FRUIT TREES					0.06	0.21	0.25	0.23	0.18	0.06	0.01	
GRASS SEED			0.03	0.17	0.30	0.38	0.12					
LUCERNE HAY/GRAZE				0.01	0.15	0.22	0.26	0.23	0.12	0.01		
LUCERNE SEED				0.04	0.25	0.29	0.18	0.16	0.09			
LUPINS			0.03	0.38	0.59							
MAIZE					0.04	0.21	0.30	0.27	0.18			
MUSTARD				0.24	0.76							
NATIVE FLOWERS					0.03	0.23	0.30	0.27	0.17			

17. APPENDICES

Appendix 3: Continued

CROP	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
NATIVE FOLIAGE							0.18	0.42	0.33	0.07		
OLIVE - FRESH					0.09	0.21	0.25	0.23	0.17	0.05		
OLIVE - OIL					0.07	0.21	0.26	0.24	0.17	0.04		
ONION				0.04	0.13	0.20	0.25	0.23	0.15			
ONION SEED			0.01	0.07	0.24	0.34	0.33					
PASTURE - FULL			0.01	0.07	0.14	0.18	0.21	0.19	0.15	0.05		
PASTURE - FINISHER			0.06	0.50	0.44							
PASTURE - STARTER								0.15	0.49	0.28	0.07	0.02
PASTURE - MAX PRODUCTION			0.02	0.08	0.14	0.18	0.20	0.18	0.15	0.05		
PEAS - FIELD			0.03	0.54	0.43							
POTATOES				0.04	0.19	0.28	0.33	0.16				
POTATOES - SEED					0.05	0.24	0.37	0.34				
RADISH SEED			0.02	0.23	0.51	0.23						
SUMMER FODDER					0.00	0.14	0.30	0.27	0.21	0.08		
SUNFLOWER					0.01	0.15	0.40	0.37	0.08			
SWEETCORN					0.00	0.22	0.43	0.35				
WINEGRAPE					0.05	0.33	0.27	0.21	0.13	0.01		

Note: The NIRC values used to calculate the percentage of annual water use are based on the irrigated crop achieving maximum production for an average water requirement season and are to be used as a guide only.

