Managing Farm Water Supplies

Economic Development, Jobs, Transport and Resources

AGRICULTURE VICTORIA

MANAGING FARM WATER SUPPLIES

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Further information regarding this publication, contact the Customer Service Centre on 136 186 For more information about DEDJTR visit the website **www.agriculture.vic.gov.au**

OVERVIEW OF FARM WATER PLANNING

Water is an essential requirement for running a livestock business and has a significant impact upon stock welfare, farm productivity and business profitability.

Knowledge of stock drinking water requirements and potential sources of water are important for planning on both an annual and daily basis.

The goal of farm water planning is to have the water you need, where you need it, when you need it. Farm water planning also takes into account the levels of risk associated with water supply reliability.

Essential elements of farm water planning include:

- understanding total farm water requirements
- evaluating the reliability of water sources
- determining the sizes of storages (dams or tanks) needed
- matching stocking rates to water availability
- designing farm water supply and reticulation systems
- determining how long water supplies will last during times of prolonged dry conditions.

Stock water shortages can be a significant limitation to productivity. A lack of water can mean destocking the property or carting water in, while poor water quality can restrict the type of stock run or inhibit their productivity.

This booklet is designed to provide information on range of water requirement and quality topics along with a series of tips on water management.

CONTENTS

FARM WATER BALANCE

A key component of farm water planning involves undertaking an annual farm water balance.

A water balance considers:

- Water requirements (uses of water)
- Water supplies on-farm (water available)
- The balance between water supply and use
- Storages (actual and potential).

The information provided by the water budget along with an understanding of water distribution, quality and seasonal weather patterns can help guide decision making on-farm.

For information on how to carry out a water budget, please refer to the farm water calculator at: **www.agriculture.vic.gov.au/farmwater** and click on the *Online Farm Water Calculator* button.

STOCK WATER REQUIREMENTS

DAILY INTAKE

Daily water intake varies widely among different types of livestock and according to the activity level of the animal. It is also influenced by factors such as climate, environmental conditions and the type of feed and water being consumed. It is important to remember that the peak consumption for your local area could be significantly higher than the figures given.

Table 1 Daily average and yearly as well as winter and summer stock drinking requirements.

	DAILY			
Livestock unit	**Daily average litres/day**	**Winter litres/day**	**Summer litres/day**	**Annual litres/ year/head**
Sheep				
Nursing ewes on dry feed	10	6	14	3,650
Prime lambs on dry pasture	4	2.4	6	1,460
Mature sheep on dry pasture	6	4.2	10	2,190
Prime lambs on irrigated pasture	1.1	0.7	1.5	400
Mature sheep on irrigated pasture	3.5	2.1	4.9	1,280
Cattle				
Dairy cow, dry	80	48	112	29,200
Dairy cow, milking	150	90	210	54,750
Beef cattle	80	42	100	29,200
Weaners (250-300kg)	55	30	70	20,075
Horses				
Working	55	33	77	20,075
Grazing	35	21	49	12,775

Livestock unit	DAILY			Annual litres/ year/head
	Daily average litres/day	Winter litres/day	Summer litres/day	
Pigs				
Brood sow	45	27	63	16,424
Mature pig	20	12	28	7,300
Grower (25-90kg)	12	7.2	16.8	4,380
Poultry				
Laying hen	0.33	0.2	0.46	120
Pullet	0.18	0.1	0.25	65
Turkey	0.55	0.3	0.77	200
Alpaca				
Dry	6	3.6	8.4	2,190
Deer				
Dry	6	3.6	8.4	2,190
Goat				
Dry	4.5	2.7	6.3	1,645
Milking	6	3.6	8.4	2,190

Note: To convert L/year to ML/year, divide L/year by 1,000,000.

Daily water intake varies widely among different types of livestock and according to the activity level of the animal.

WATER QUALITY

Having water of a quality that is fit for purpose is important. Water quality can affect plant growth, livestock health, soil quality, farm equipment and domestic use. The quality of a water source is also variable depending upon weather and external inputs.

Evaporation increases the concentrations of salts while a flush of water dilutes salts but may increase sediment and fertilisers, and manure or nutrient runoff. Monitoring should be done regularly and more frequently in summer or in periods of prolonged moisture stress.

Table 2 Water quality stock tolerance levels.

Element	Rainwater	Upper limit	Effect
Calcium	40 mg/L	>1000 mg/L	Phosphorous deficiency
Magnesium	0-19 mg/L	> 1000 mg/L	Scouring and diarrhoea
Nitrate	10 mg/L 1mg/L	>1500 mg/L nitrate, > 30 mg/L nitrite	Vomiting, convulsions, death
Sulfate	250 mg/L	>1000-2000 mg/L	Diarrhoea
Aluminium	0.05-0.2 mg/L	5 mg/L	Phosphorous deficiency
Arsenic		0.5 mg/L	Diarrhoea, anaemia, poor coordination
Copper	1mg/L	0.5 mg/L	Liver damage and jaundice, Copper accumulation in the liver
Fluoride	1 mg/L	>2 mg/L	Tooth damage and bone lesions
Iron	0.3 mg/L	Low toxicity	
Lead (notifiable disease)*	0.015 mg/L	0.1mg/L	Reduced coordination, blindness, going off feed
Molybdenum (related to copper)		0.15 mg/L	Scouring and loss of condition. Infertility, skeletal disorders, testicular damage
pH	6.5-8.5	>9 <5	Other minerals become available such as Copper and Aluminium
Total Dissolved Solids	500 mg/L	Variable generally > 5000 mg/L	Poor production, diarrhoea, higher mortality rates

* Notifiable disease – seek advice from DEDJTR Animal Health

The upper limits of mineral and metal levels described on the previous page will vary due to specific geology weathering and acid conditions, in conjunction with high salinity levels or specific management.

If feed contains the particular minerals then the limits are lower (Guidelines from the ANZECC 2000).

Please refer to **page 12** of this booklet for information on water testing.

Water quality can affect plant growth, livestock health, soil quality, farm equipment and domestic use.

WATER SALINITY

Salinity is a major water quality issue in areas where accumulated salts are mobilised in the landscape and make their way into waterways and dams.

Evaporation of these water sources increases the concentration of the salts and the problems associated with them.

Salinity refers to all the mineral salts present in the water including sodium, calcium, magnesium, chloride, sulphate and carbonate. High salinity levels can make water unsuitable for drinking or irrigation. Electrical conductivity (EC) of water can be used as a measure of salinity. The higher the value the higher the salt content. Units are micro siemens/centimetre (µs/cm).

Table 3 Salinity tolerance levels for stock water.

Type		EC (µS/cm)	mg/L* (ppm)
Poultry	production decline begins	3,100	2,000
	maximum	6,250	4,000
Pigs	production decline begins	3,100	2,000
	maximum	6,250	4,000
Horses	health / growth affected	6,250	4,000
	maximum	10,900	7,000
Dairy Cattle	production decline begins	4,700	3,000
	maximum	9,300	6,000
Beef Cattle	production decline begins	6,250	4,000
	maximum	15,600	10,000
Lactating Ewes, Weaners	production decline begins	6,000	3,800
	maximum	10,000	6,400
Sheep, dry feed	production decline begins	9,300	6,000
	maximum	21,800	14,000

*Source: Victorian Department of Economic Development, Jobs, Transport and Resources

Production decline begins = upper limit salt concentration for healthy growth.
Maximum = maximum salt concentration that may be safe for limited periods.
Seawater = 55,000 µs/cm
Rainwater = 100-300 µs/cm

WATER TESTING

The best way to be certain about the quality of your water is to have it tested. When testing water:

- Rinse meters and container in water to be tested. Read off numbers taking note of units.
- Stock bores can be tested on freshly pumped water at the trough.
- Bores should be monitored at regular intervals (monthly or quarterly), for example March, June, September and December.
- EC meters are relatively inexpensive and available at various water equipment dealers.
- EC measurements can be done free of charge at some Department of Economic Development, Jobs, Transport and Resources (DEDJTR) locations. Contact the Customer Service Centre 136 186.
- For more indepth water tests including mineral analysis contact testing labs listed in the contacts section of this booklet.

SOURCES OF WATER

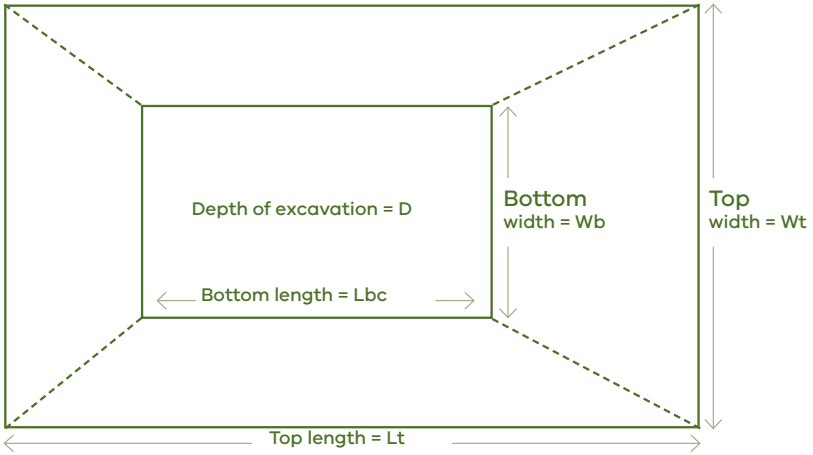
Water supply can be extremely variable both seasonally and annually. In farm water planning it is important to consider all available sources of water and how much of this can be stored.

It is also important to note that the amount of run off might not match amount that can be stored. For example once a water tank or dam fills, the water overflows and goes back into the environment.

CALCULATING DAM VOLUME

Knowing the volume of a farm dam is useful for estimating how long the dam will last during prolonged dry periods. Below is a simple calculation used to calculate the volume of a dam.

Plan of a linear sided dam. Dimensions in metres.



$$\text{Volume (ML)} = \frac{\left[\text{LtWt} + \text{LbWb} + \left[(\text{Lt}+\text{Lb})\,(\text{Wt}+\text{Wb})\right]\right] \times \text{D}}{6000}$$

If you don't know the bottom width or bottom length the following formula can be used.

- **Lb = Lt – 2 (Depth x Batter Slope)**
- **Wb = Wt – 2 (Depth x Batter Slope)**

Or alternatively, you can use the table below.

An online farm water calculator can be used for circular and gully dams and dam sizes outside the dimensions in Table 4. Refer to **agriculture.vic.gov.au/watercalculator**

Table 4 Volume of a square/rectangle with a batter slope of (1 : 2.5 batter) and depth is in brackets.

	LENGTH (m)				
WIDTH (m)	**15m**	**20m**	**30m**	**40m**	**60m**
15m (3m)	0.23ML	0.34ML	0.56ML	0.79ML	1.24ML
20m (3m)	0.34ML	0.53ML	0.9ML	1.28ML	2.02ML
30m (4m)		0.93ML	1.73ML	2.53ML	4.13ML
40m (4m)		1.3ML	2.53ML	3.73ML	6.13ML
60m (4m)		2.13ML	4.13ML	6.13ML	10.13ML

*ML = Mega litre = 1,000,000 litres

CAPTURING RUNOFF FROM ROOF AREAS

Rainfall runoff from shed and house roofs can be a reliable, efficient water source that is easily overlooked.

Roofs are high yielding and can turn even minor rainfall events into a useful supply of good quality water. Such supplies are ideal for stock and domestic consumption or for use in spraying equipment.

The yield from a roof is dependant upon the area of the roof and the rainfall received, however not all of this is always captured as at times the tank may overflow.

To calculate the volume of rainfall that can be collected from roof area the following formula is used:

Volume of water (litres) **= Annual average rainfall** (mm) **x Roof area** (m^2) **x 0.95**

***Note: for a rectangular roof the area is the length (m) x width (m).**

For example: A shed with the dimensions 15m x 9m has a roof area of 135m^2 and an annual rainfall of 1000mm will yield 128,250 litres/year (1000mm x 135m^2 x 0.95).

ANNUAL RAINFALL (mm)	ROOF CATCHMENT AREA (m^2)							
	50m^2	100m^2	150m^2	200m^2	300m^2	500m^2	1000m^2	2000m^2
300mm	14,250L	28,500L	42,750L	57,000L	85,500L	142,500L	285,000L	570,000L
400mm	19,000L	38,000L	57,000L	76,000L	114,000L	190,000L	380,000L	760,000L
500mm	23,750L	47,500L	71,250L	95,000L	142,500L	237,500L	475,000L	950,000L
600mm	28,500L	57,000L	85,500L	114,000L	171,000L	285,000L	570,000L	1,140,000L
700mm	33,250L	66,500L	99,750L	133,000L	199,500L	332,500L	665,000L	1,330,000L
800mm	38,000L	76,000L	114,000L	152,000L	228,000L	380,000L	760,000L	1,520,000L
900mm	42,750L	85,500L	128,250L	171,000L	256,500L	427,500L	855,000L	1,710,000L
1000mm	47,500L	95,000L	142,500L	190,000L	285,000L	475,000L	950,000L	1,900,000L
1100mm	52,250L	104,500L	156,750L	209,000L	313,500L	522,500L	1,045,000L	2,090,000L

HELPFUL TIPS

- Water loss through evaporation is substantial. If you have a number of shallow dams, think about pumping water to a single dam to minimise evaporative losses.
- Water collected from farm sheds in excess of domestic requirements can contribute to overall stock supplies by reticulating to nearby paddock troughs from tanks.
- When piping around the farm remember doubling the pipe diameter will increase the flow rate four times.
- 50mm (2inch) pipe will deliver four times the supply compared to 25mm (1 inch) pipe.
- Large water troughs located centrally in paddocks can reduce the walking distances for stock and reduce erosion.
- Air pressure or solar pumps provide an alternative option where there is no power supply. These pumps can supply water around the farm from a reliable source, either dam or bore without any requirement for wind. They also have the capacity to pump water to considerable heights.
- Water troughs with low usage need to be flushed out periodically as evaporation will lead to a concentration of any salts present.
- Gully dams with bare paddock catchment areas need to be protected from manure 'runoff' into dams after heavy rainfall. This can be done by constructing silt traps with small hay bales or various types of mesh upstream of the dam, by fencing and revegetating around the dam and by restricting stock access.

CONVERSIONS

- µS/cm ÷ 1.56 = ppm
- µS/cm x 0.001 = mS/cm
- mS/m = dS/cm
- 1mg/L = 1ppm = 1g/m^3
- 1 ML = 1 000 000 L = 1000 m^3

Seawater = 55 000 µS/cm
= 55 mS/cm
= 55 dS/m

*** ppm stands for parts per million**

Note:

L = litre,
ML = megalitre
mg = milligram
m^3 = cubic metre
mm = millimetre
ha = hectare
µS/cm = microSieman/centimetre
mS/cm = milliSieman per centimetre
dS/m = deciSiemens per metre

CONTACTS AND REFERENCES

General farm water information
www.agriculture.vic.gov.au/farmwater

Rural water corporations & services

Southern Rural Water
Phone: 1300 139 510
or (03) 5564 1700
Website: www.srw.com.au

Goulburn-Murray Water
Phone: 1800 013 357
or (03) 5826 3500
Website: www.g-mwater.com.au

Grampians Wimmera Mallee Water
Phone: 1300 659 961
Website: www.gwmwater.org.au

Lower Murray Water
Phone: (03) 5051 3400
Website: www.lmw.vic.gov.au

Water quality testing services

SGS
20 Hotham Street, Traralgon
Phone: (03) 5172 1555
Irrigation and stock water analysis

NATA Facilities and Labs Deakin University, Warrnambool
Phone: (03) 5563 3481
Email: wql-info@deakin.edu.au
Water testing service – Blue green algae and chemistry

ALS Water Resources Group
22 Dalmore Drive, Caribbean Business Park, Scoresby
Phone: (03) 8756 8000
Email: melbournewrg@alsglobal.com
Domestic, stock and irrigation packages available

Constructing a domestic and stock bore

If you are planning to construct a domestic and stock bore, you will need a bore construction licence, apply for one online at www.mywater.waterregister.vic.gov.au or go to your relevant water authority website.

It is recommended that you utilise a licensed driller - you can find a list of licensed drillers at the Australian Drilling Industry Association website www.adia.com.au.

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