Farm Water Management Plan

Plan Workbook

Farm Water Management Planning

Know your numbers.
Know your needs.
Know the gap.
Have a plan.

This project received funding from the Australian Government's Future Drought Fund

Contents

This table of contents is an outline of some of the steps and details required to be able to come up with a realistic Farm Water Management Plan. It is not meant to be laid out exactly, however it is important to cover the 'topics' listed and document your own information in enough detail so you can come back to this plan in the future and know what you were thinking and planning. (Items with '*' are considered essential in a Farm Water Management Plan document.)

This template is produced as part of the Murray LLS 'Farm Water Management Planning' project, supported by the Southern NSW Innovation Hub through funding from the Australian Government's Future Drought Fund.

Contents

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Part I.
Weathering the dry

Introduction and Drought Strategy

Farm Water Management Planning

1. Introduction

1A. Example property details

Property name:	'Wandering Park'
Location:	Willafarm
Property size:	700 ha
Annual median rainfall:	650 mm
Enterprises:	Prime lambs, beef and some cropping
Household residents:	4
Garden area:	0.2 ha

Livestock:	1000 dry ewes
	100 dry cows (beef cattle)
	10 grey kangaroos

Crop:	31 ha sown to oats

House & shed tank:	3m dia. x 3.4m H x 2 tanks

1A. Your property details

Property name:	
Location:	
Property size:	
Annual median rainfall:	
Enterprises:	
Household residents:	
Garden area:	

Livestock:	

Crop:	

House & shed tank:	

1B. What is the purpose of this plan?
What do you want this plan to be able to do?

1C. Farm Map

Farm Water Management Project Webmap

24/01/2024

Property boundary ~ 700 Ha

Current medium dam

Small dam

Fence

1:26,181

0 0.17 0.35 0.7 mi

0 0.28 0.55 1.1 km

Maxar, Vicmap, Esri, TomTom, Garmin, Foursquare, METI/NASA, USGS

2. Drought Strategy

This will help dictate what actions you may need to take once you have done a Farm Water Budget/audit and determine the amount of water you will want to have on hand.

NOTE: (from 'Managing Drought' DPI publication) — p11. "Your drought strategy objectives should be clear and wherever possible be stated in numbers, dates or dollars." See also the '**Drought Plan – Template**' as a useful tool.

2A. Reflections on previous drought — learnings, lessons, what would you do differently?

2B. What is your overall strategy in the event of an oncoming drought/dry season 'Drought Strategy'?

1. **Do you intend to retain all stock?**

2. **If not, what classes and type of stock are you going to retain?**

3. **What numbers of each stock class would you like to retain?**

4. **How do you plan to manage those stock with regard to feeding/watering i.e. are you going to use a stock containment/management area or sacrifice paddock?**

2C. Trigger points for action prior to or during drought.

1. **At what point do you destock?** (Table with timelines)

2. **What are the ground cover trigger thresholds?**

3. **When are you doing your feed audit? — Feed On Offer (FOO) and stored**

Part II.
Water metrics

Understanding your water needs

Farm Water Management Planning

Farm water budget/audit

Example total supply and demand from Table 9 and Table 10.

'Annual' TOTAL Farm 'drought' Water Budget — Based on 181 days of 'summer period' calculations	
Drought stocking	1000 ewes with lambs and 100 beef cattle

Storage source	Available storage (ML)	Total demand from each source (ML)	Weeks of water available (at rates of consumption)	Years of storage at drought stocking rates
Dams	0.212 ML	3.6 ML		
Domestic & other tanks	0.046 ML	1.2 ML		
Totals:	0.26 ML	4.8 ML	1.4	0.0

It is highly desirable in planning your farm water needs to have 2 years supply on hand.

Whether you have 'adequate supply', or a 'deficit' is calculated by:

Adequate/deficit = Total available storage (ML) – (2 x total annual demand) (ML)

Total available storage (ML)	Total annual demand (ML)	Total demand for 2 years (ML)	Supply - demand	Adequate (+ve) or deficit (-ve) (ML)
0.26 ML	4.8 ML	2 x 4.8 = 9.6 ML	0.26 – 9.6	–9.34 ML

Your total supply and demand from Table 9.

'Annual' TOTAL Farm 'drought' Water Budget — Based on 181 days of 'summer period' calculations	
Drought stocking	

Storage source	Available storage (ML)	Total demand from each source (ML)	Weeks of water available (at rates of consumption)	Years of storage at drought stocking rates
Dams				
Domestic & other tanks				
Totals:				

It is highly desirable in planning your farm water needs to have 2 years supply on hand.

Whether you have 'adequate supply', or a 'deficit' is calculated by:

Adequate/deficit = Total available storage (ML) – (2 x total annual demand) (ML)

Total available storage (ML)	Total annual demand (ML)	Total demand for 2 years (ML)	Supply - demand	Adequate (+ve) or deficit (-ve) (ML)

1. Quantifying Farm Water Requirements

1A. Livestock Requirements

How much water does the livestock use in summer (October to March – 181 days)?
(Refer to Farm Water AgGuide Appendix 3, Table 27, p.125)

Total daily water requirement (L) = daily requirement per head (L) x number of stock

Table 1 Example Livestock Water Requirements

Livestock type	Number	Daily water requirement (L)	No. days in summer	Total water required for summer (L)
Ewes dry	1000	10	181	1,810,000 (1.81 ML)
Beef cows dry	100	98	181	1,773,800 (1.77 ML)
Grey Kangaroo	10	1	181	1,810 (0.018 ML)
Total livestock requirement:				3,585,610 (3.6 ML)

Table 1 Your Livestock Water Requirements

Livestock type	Number	Daily water requirement (L)	No. days in summer	Total water required for summer (L)
Total livestock requirement:				

1B. Garden Water Requirements

How much water does the garden use in summer?
Range 10,000–30,000 L/ha/day (1-3 L/m², Farm Water AgGuide Table 11, p.16)

Total water required = area (Ha) x daily required (L) x No. summer days

Table 2 Example Garden Water Requirements

Example garden area (Ha)	Daily water requirement (L/Ha)	No. days in summer	Total water required for summer (L)
0.2	20,000	181	724,000 (0.724 ML)

Table 2 Your Garden Water Requirements

Example garden area (Ha)	Daily water requirement (L/Ha)	No. days in summer	Total water required for summer (L)

1C. Household Water Requirements

How much water does the household use in summer?
(Refer to Farm Water AgGuide Tables 11, 12, p.16)

Table 3 Example Household Water Requirements

Example household		Daily water requirement (L/person)	No. days	Total water required for summer (L)
No. residents:	4	180	365	262,800 (0.26 ML)
Evaporative air con		500	181	90,500 (0.09 ML)
Total:				353,300 (0.35 ML)

Table 3 Your Household Water Requirements

Example household		Daily water requirement (L/person)	No. days	Total water required for summer (L)
No. residents:				
Evaporative air con				
Other				
Total:				

1D. General Farm Needs

(Refer to Farm Water AgGuide Table 17, p.24)
Spraying – e.g. first application requires 100 L/ha, second application requires 70 L/Ha.

Table 4 Example Spraying Water Requirements

	Application rate (L/Ha)	Crop Area (Ha)	Total water required per application (L)
Spray 1	100	31	3,100
Spray 2	70	31	2,170
Total:			5,270 L (0.005 ML)

Table 4 Your Spraying Water Requirements

	Application rate (L/Ha)	Crop Area (Ha)	Total water required per application (L)
Spray 1			
Spray 2			
Total:			

Firefighting – 10 000 L/Ha home yard. See Farm Water AgGuide Table 17, p.24.

Table 5 Example Firefighting Water Requirements

Firefighting	Recommended storage rate or L/area	Home yard area (Ha)	Total water to store (L)
Buildings	10,000	x 2	20,000
House yard	72 L/m^2	0.2	144,000
Total:			164,000 L

Table 5 Your Firefighting Water Requirements

Firefighting	Recommended storage rate or L/area	Home yard area (Ha)	Total water to store (L)
Buildings			
House yard			
Total:			

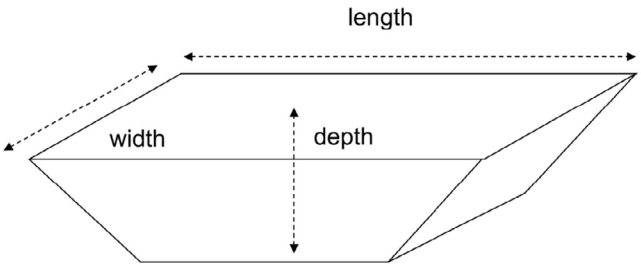
Part III.
From drop to data
Determining water storage capacity and losses — dams and tanks

Farm Water Management Planning

Rectangular Dam

Calculate the capacity of the rectangular dam:

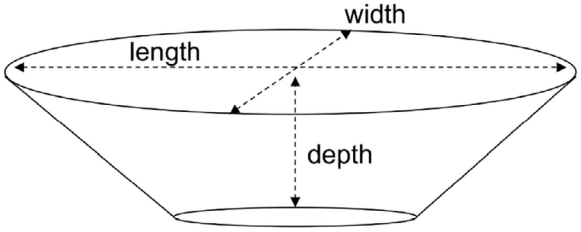
- ***Surface area (m²) = width × length***
- ***Volume (m³) = 0.4 × surface area × depth***



Circular Dam

Calculate the capacity of the round dam:

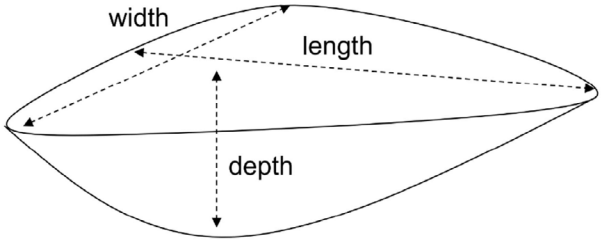
- ***Surface area (m²) = 0.8 × width × length***
- ***Volume (m³) = 0.4 × surface area × depth***



Triangular Dam (or gully dam)

Calculate the capacity of the triangular dam:

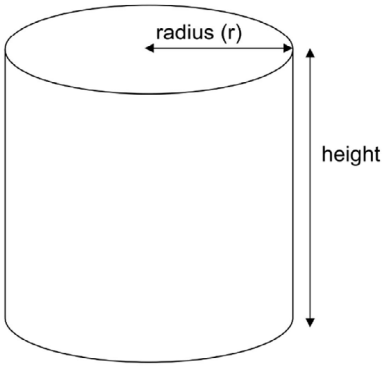
- ***Surface area (m²) = (width x length) ÷ 2***
- ***Volume (m³) = 0.4 × surface area × depth***



Estimating Tank Capacity

Calculate the capacity of the tanks:

- ***Surface area (m²) = π × r²***
  (π = 3.14, r² = r × r, where 'r' = radius)
- ***Volume (m³) = π r² × height***



1. Estimating Farm Water Storage Capacity

Table 6A Example farm dams

Water storage name	Width (m)	Length (m)	Depth (m)	Surface area (m²)	Approx volume (m³)	Water storage capacity (ML)
Dam 1 – square	30	30	4	900	1,440	1.44
Dam 2 – gully	35	45	4	788	1,260	1.26
Dam 3 – round	25	25	2	500	400	0.4
Other water storage:						
Total water storage:						3.1 ML

Table 6A Your farm dams

Water storage name	Width (m)	Length (m)	Depth (m)	Surface area (m²)	Approx volume (m³)	Water storage capacity (ML)
Other water storage:						
Total water storage:						

To record details of additional water storages, see Appendix 1, Page 31.

Table 6B Example farm tanks

Tank storage name	Radius (m)	Height (m)		Surface area (m²)	Approx volume (m³)	Water storage capacity (ML)
Tank 1	1.5	3.2		7.1	23	0.023
Tank 2	1.5	3.2		7.1	23	0.023
Other tank storage:						
Total tank storage:						0.046 ML
Total water and tank storage:						3.146 ML

Table 6B Your farm tanks

Tank storage name	Radius (m)	Height (m)		Surface area (m²)	Approx volume (m³)	Water storage capacity (ML)
Other tank storage:						
Total tank storage:						
Total water and tank storage:						

To record details of additional water storages, see Appendix 1, Page 31.

2. Quantifying Losses from Dams

2A. Example Evaporation Loss

Your location: Holbrook	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Mean daily evaporation (mm)	8.0	6.8	5.0	2.9	1.5	1.03	1.06	1.6	2.7	4.2	5.8	7.3
Decile 1 monthly drought rainfall (mm)	7.7	3.3	0.9	6.9	15.7	24.8	30.3	24.4	15.4	10.4	22.6	10.2
Note: Data can be sourced from: Average evaporation 2000–2023 from Queensland Government SILO (Australian Climate Data from 1889 to 2023), average Decile 1 rainfall 1994–2024 from BOM Albury airport												

From the table above, determine the average (mean) daily summer evaporation (mm) in your location

Average daily summer evaporation = (sum daily mm for October to March) ÷ 6

Average daily summer evaporation =	37.1	mm ÷ 6 =	6.2	mm/day	
Average summer drought rainfall =	55	mm for months October to March			
Average daily drought rainfall =	55	mm ÷ 181 =	0.3	mm/day	
Net daily drought evaporation =	6.2	- 0.3 =	5.9	mm/day	

2A. Your evaporation and drought rainfall data

Your location:	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Mean daily evaporation (mm)												
Decile 1 monthly drought rainfall (mm)												
Note: Data can be sourced from:												

Average daily summer evaporation =		mm ÷ 6 =		mm/day	
Average summer drought rainfall =		mm for months October to March			
Average daily drought rainfall =		mm ÷ 181 =		mm/day	
Net daily drought evaporation =		-	=	mm/day	

In Table 7A below, calculate the summer evaporation loss using this formula:

Evaporation loss (L) = surface area (m²) × (average daily evaporation (mm) - average daily drought rain) × no. days

Table 7A Example farm dam evaporation

Dam	Surface area (m²) (from Table 6)	No. days	Daily evaporation – daily rain (mm)	Total evaporation loss (L)
Dam 1 – square	900	181	5.9	961,110
Dam 2 – rectangle	788	181	5.9	841,505
Dam 3 – round	500	181	5.9	533,950
Total:				2,336,565 L

Table 7A Your farm dam evaporation

Dam	Surface area (m²) (from Table 6)	No. days	Daily evaporation – daily rain (mm)	Total evaporation loss (L)
Total:				

2B. Seepage Loss

Estimate the seepage loss from the dams over summer.

Note: Seepage loss will depend on the material on which a dam is located and built and the quality of construction. Maximum acceptable loss is 5 mm/day — if your losses are above this, the dam needs attention.

In Table 7B below, calculate the summer seepage loss in L using this formula:

Seepage loss (L) = surface area (m²) × seepage (mm) × no. days

Table 7B Example farm dam seepage
Assumed seepage rate for this activity: 1 mm per day

Dam	Surface area (m²) (from Table 6)	No. days	Summer seepage (mm)	Summer seepage loss (L)
Dam 1 – square	900	181	181	162,900
Dam 2 – rectangle	788	181	181	142,628
Dam 3 – round	500	181	181	90,500
Total:				396,028 L

Table 7B Your farm dam seepage

Dam	Surface area (m²) (from Table 6)	No. days	Summer seepage (mm)	Summer seepage loss (L)
Total:				

2C. Residual or 'dead' water

Sometimes a portion of water in a dam cannot be retrieved. This is referred to as residual or 'dead' water.

In Table 8, estimate the residual water in the dams.

Table 8 Example Residual water

Dam	Total volume (m³) (from Table 6)	Residual water (%)	Residual water (m³)	Residual water (L)
Dam 1 – square	1,440	5%	72	72,000
Dam 2 – rectangle	1,260	5%	63	63,000
Dam 3 – round	400	5%	20	20,000
Total:				155,000 L

Table 8 Your Residual water

Dam	Total volume (m³) (from Table 6)	Residual water (%)	Residual water (m³)	Residual water (L)
Total:				

Part IV.
Know your flow

Getting the water to where and when you need it

What are your options? (Based on Parts I, II and III above.)

Farm Water Management Planning

1. How long will the water last over the 'summer period'?

Table 9 Example farm data

Water usage over summer		Example farm	
No. of days in summer		181	**A**
Livestock	(Table 1)	3,585,610	
Garden	(Table 2)	724,000	
Household	(Table 3)	353,300	
General farm needs	(Table 4)	5,270	
Firefighting	(Table 5)	164,000	
Total summer usage:		4,832,180 L	**B**
Daily summer water consumption:	(B ÷ A)	26,697 L	**C**

Table 10 Example farm data

Total storage capacity (Litres)	(Table 6)	3,146,000 L	**D**
Less evaporation losses	(Table 7A)	2,336,565	**E**
Less estimated seepage losses	(Table 7B)	396,028	**F**
Less residual water	(Table 8)	155,000	**G**
Available water:	(D - E - F - G)	258,407 L	**H**
Days water will last:	(H ÷ C)	9.7 days	

Table 9 Your farm data

Water usage over summer		Your farm	
No. of days in summer			**A**
Livestock	(Table 1)		
Garden	(Table 2)		
Household	(Table 3)		
General farm needs	(Table 4)		
Firefighting	(Table 5)		
Total summer usage:			**B**
Daily summer water consumption:	(B ÷ A)		**C**

Table 10 Your farm data

Total storage capacity (Litres)	(Table 6)		**D**
Less evaporation losses	(Table 7A)		**E**
Less estimated seepage losses	(Table 7B)		**F**
Less residual water	(Table 8)		**G**
Available water:	(D - E - F - G)		**H**
Days water will last:	(H ÷ C)		

2. Checking supply flow rate and trough capacity

Water must be supplied at least at the rate of stock and domestic usage. This sets the minimum flow rate that the pump and the pipework have to deliver. For our calculations, it is considered advisable to ensure all stock can be watered in a 4 hr (240 min) period. This allows for a fast steady stream of water for stock, and reduces the chances of fighting and dominance around troughs that can cause damage — i.e. broken valves, pipes kicked etc. The system needs to be able to meet this peak flow.

(Refer to Farm Water AgGuide Table 21, p.96)

Table 11 Example farm data

Peak flow rate for 4 hr watering (L/ min)					Trough capacity (L)	
Stock type	**Number of stock**	**Daily intake (L/head)**	**Total daily requirement (L)**	**Flow rate required (L/min)**	**Volume (L/head)**	**Trough capacity required (L)**
	A	B	A × B = C	C ÷ 240 min	D	A × D
Dry Ewes	1000	10	10,000	42	1	1,000
Dry cows (beef)	100	98	9,800	41	5	500
Total:			19,800 L	83 L/min		1,500 L

Table 11 Your farm data

Peak flow rate for 4 hr watering (L/ min)					Trough capacity (L)	
Stock type	**Number of stock**	**Daily intake (L/head)**	**Total daily requirement (L)**	**Flow rate required (L/min)**	**Volume (L/head)**	**Trough capacity required (L)**
	A	B	A × B = C	C ÷ 240 min	D	A × D
Total:						

3. Example options and actions

Planning: Take a 'big' picture approach to plan a whole system — it can be modular and rolled out sequentially.

We have a big deficit to reach 2 years of storage capacity. For us this is a reasonable period to aim for initially. This deficit is 9.34 ML i.e. 9,340,000 litres.

At this point in time, we are focussed on setting up a 'drought' management system. As we have several key dams across the property, we will be able to set up a few systems. However, working on the eastern part of the property nearer to the house will be the first system set up. In this area there are well vegetated creek lines, and good catchment.

The calculations for harvestable rights (from the Water NSW site calculator) on our 700-ha property in our location (eastern zone) indicates we have up to 77 ML dam storage capacity. As such we have ample room for new storages or enlarging old ones.

Options:

1. a. Increase size of two current dams (in 'Tree' paddock) as location is good and it seems the location would work for efficient management of stock in drought times. These dams currently hold around 3 ML, and we would anticipate enlarging to hold around 5-6ML each depending on assessment. (= increase of ~5ML?)

b. Fence out the dams (use 'Enhanced Dams' guides from ANU) to protect water quality and prevent stock entering. Potentially 1 x hardened access for 'holiday' back up in case of pump and tank failure.

c. Install pump to move water to productive paddocks ('Top Feed' – already in 3 sections) over a small ridge approx. 55 m head). This would involve the install of a pump and big tank (50-150,000 L?) and troughs. This system would service both 'Top Feed' and 'Tree' paddocks.

2. a. Install new dam in 'Jones CK' paddock as this only has a small one on a minor gully. Previously this paddock was watered from a small creek that was reasonably reliable but dried up last drought. It seems there is good runoff area for flow to be collected in a big dam (don't know why this wasn't set up years ago?). New dam size ~5-8 ML (increase overall capacity of ~6-7ML?)

b. Fence out this new dam and get ground cover going to protect dam from silting and get good water quality.

c. Install pump and medium size tank (to allow for a few days' supply) and troughs.

d. This is a big paddock, so probably divide into 3 and install troughs (2-3 per paddock).

e. Retain small old dam as back up.

3. Part of the overall plan would be to establish a stock management area so that before conditions get tight, we can protect ground cover and prevent erosion and damage. The location of this area of XXX ha with water supplied to troughs. It would make sense to locate this near or in 'Tree' paddock and perhaps need to install additional tank on ridge for gravity feed from water pumped from enlarged dams (see 1 above).

Example options continued:

4. Note: One of the areas in 'Jones' could be classed as an 'erosion control dam' so it is possible this may not contribute to our harvestable rights allocation, however we need to check on any conditions around this. But given we have up to 77 ML, this issue may not be required at the moment.

5. In any of these above options we will investigate installing remote monitoring for the tanks and pump operation. This is particularly the case for the tank holding water from 'Tree' paddock and servicing the 'Top Feed' paddock. Also, this would be good to do for 'Jones' as it is further from the house and not as easily monitored.

6. **General:**

   a. With any of the pump, tank and trough set ups, we will need to ensure that correct pipe diameters are used to make sure 'peak flow' can be maintained, especially in scenarios where cattle will be in the paddocks.

   b. Where tanks are plumbed, we will use a 2-outlet system, where there will be one outlet halfway up the tanks and another at the base. The primary outlet will be the halfway outlet. This is a safeguard in case of leaks in the system and protects half the storage capacity of those tanks.

Example financial options:

The final costing for the proposed works is considerable. We are in a reasonably solid financial position; however, it makes sense to take advantage of the low interest loans outlined by the Rural Financial Counsellor.

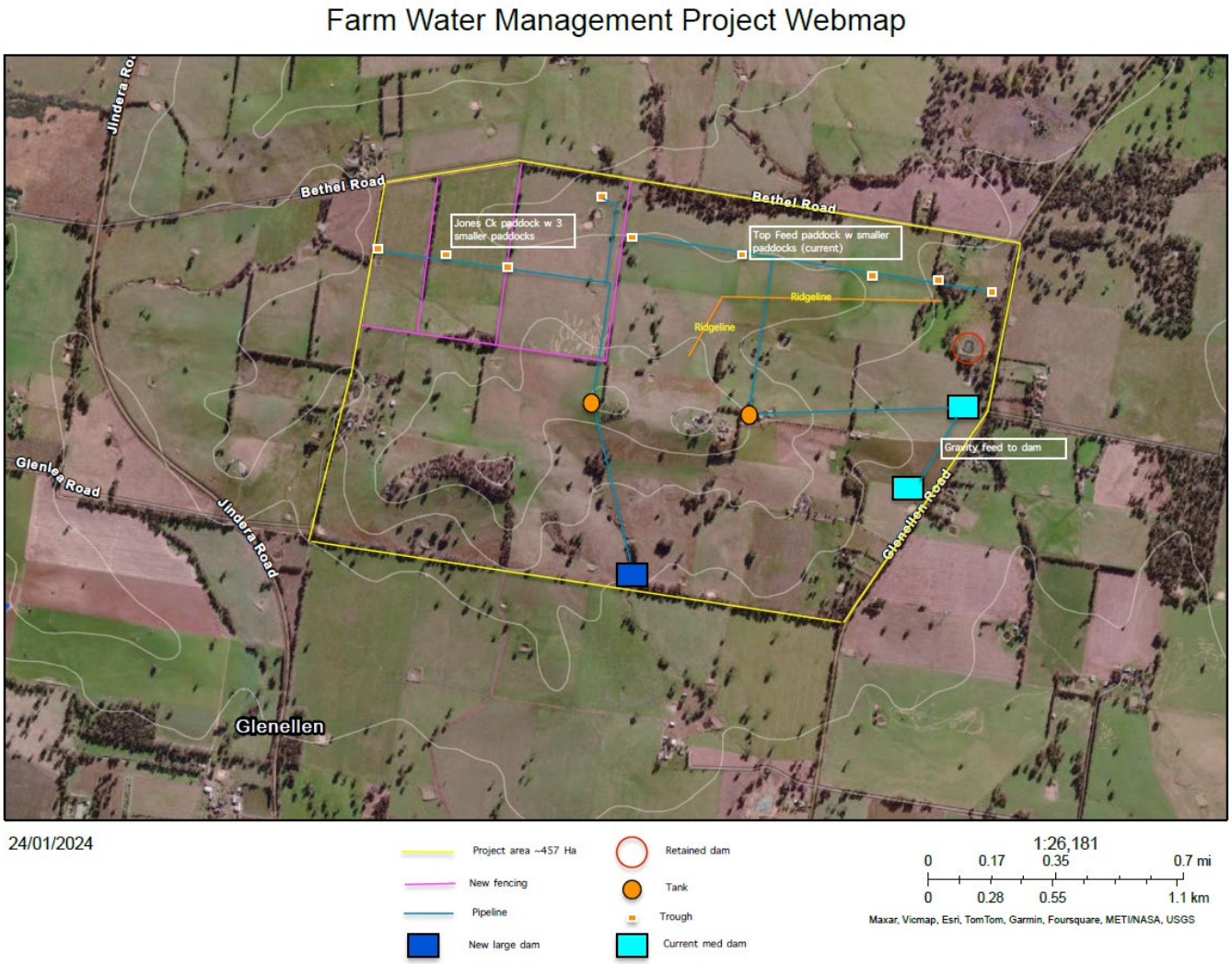
In particular, the 'Drought Infrastructure Fund' loan that is a 2.5% fixed interest and up to $1 million over 20 years. Our initial estimate would be our first section of the system could cost around $80,000–$110,000. The addition of extra 'modules' to secure water supply for additional areas of the farm could also be undertaken once we have completed and perhaps learnt from the first section. Costs estimates include:

Estimated costings example

Item	Per-item cost $	Total cost $
Dam construction	12,500	25,000
2x large (150-200,000L) tanks	20,000	40,000 (installed)
Fencing and gates	@ ~ $10/m + install	10,000
Blue Line 2"m polly	3000m =	10,000
15 concrete troughs	@ ~ 1000	15,000
Fittings and joiners		2,000
Pipe installation – DIY or contractor		$???
Remote monitoring for tanks x 2	3000	6,000
Solar pumps and panels		~ 12,000

Example farm map with options set out:

Insert map with layout of proposed options – new dams, enlarged/ renovated dams, note actions on existing redundant dams (left open for backup, 'wet-land etc), likely route of pipes, location of pumps, tanks and troughs. Indicate where any new fencing may go.



Example next steps:

a. Get final design specifications – get Willafarm 'Irrigation and Pump Supplies' Phillip to help finalise technical specs for pumps, pipes etc.

b. Get dam construction & renovation quote from Greg Jones Excavation and Earth Moving – local dam builder with good reputation.

c. Contact Rural Financial Counsellor to assist with loan application.

d. Discuss finances with the accountant to ensure serviceability and the best way to structure loans and decide how much – full or part funding.

3. Options and actions

Planning: Take a 'big' picture approach to plan a whole system — it can be modular and rolled out sequentially.

Options:

1.

2.

3.

Options continued:

4.

5.

6. General:

Financial options:

Your estimated costings:

Item	Per-item cost $	Total cost $

Farm map with options set out:

Insert map with layout of proposed options – new dams, enlarged/ renovated dams, note actions on existing redundant dams (left open for backup, 'wet-land etc), likely route of pipes, location of pumps, tanks and troughs. Indicate where any new fencing may go.

Next steps:

Appendix 1

Other Water Sources

Water storage name	Width (m)	Length (m)	Depth (m)	Surface area (m^2)	Approx volume (m^3)	Water storage capacity (ML)
Total other water storage:						

Farm Water
Management
Planning

Know your numbers.
Know your needs.
Know the gap.
Have a plan.