Section 1: Water planning and dam decision-making

This section outlines the process of farm water planning and provides guidance for farmers who are thinking about whether to build new dams or how to use or manage existing dams. During wet times, take the opportunity to plan ahead and ensure that a farm water system is fit for purpose and ready for the next dry period.

Importance of farm water planning

The goal of farm water planning is to have the water you need, where you need it, when you need it.

Inadequate farm water planning can lead to a range of problems, including:

- Running out of water and having to sell stock at the lowest point in the market
- Water quality being compromised due to run-off from heavy rainfall events after drought or fire
- Poor water quality affecting stock health or productivity

Farming systems have changed considerably over the last twenty years. Changes to factors such as stocking rates, size of animals, changes in grazing management and use of stock containment areas have all contributed to farms using more water.

Quantifying water requirements and storage capabilities is now an essential part of farm planning. It should be undertaken well before water shortages become an issue – in other words, use the wet times to plan ahead for the dry times.

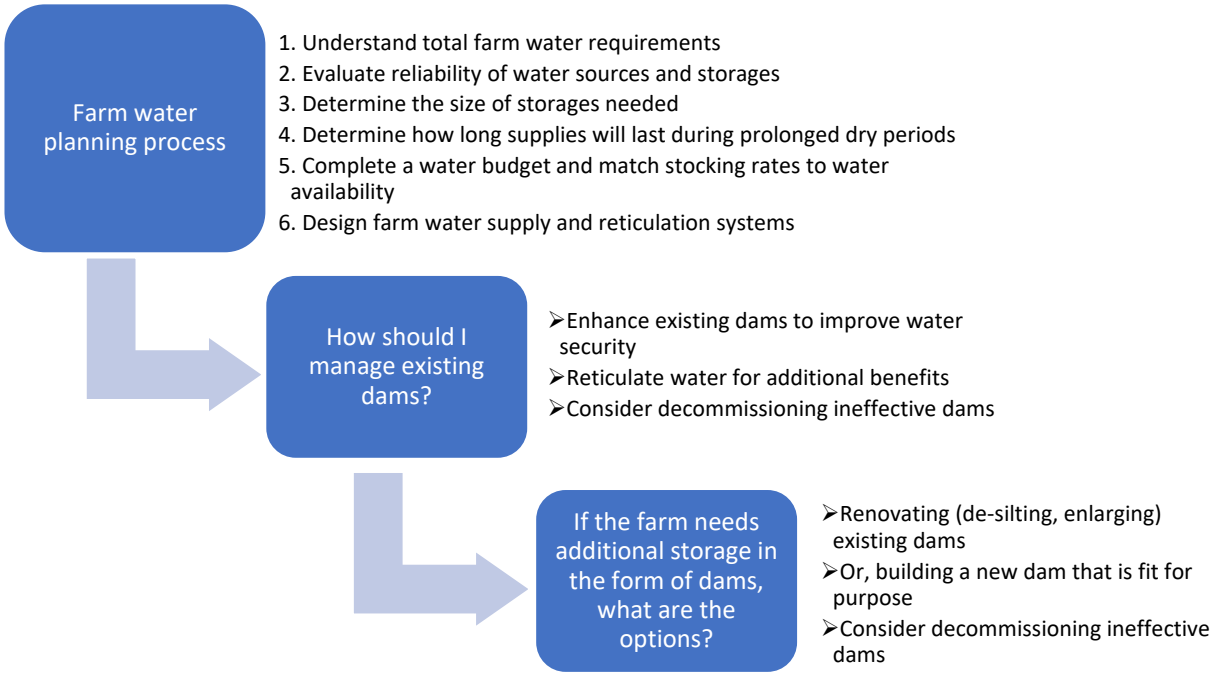

Figure 2: Farm water planning and dam decision making

Farm water planning steps

Step 1: Understand total farm water requirements

Consider all possible water uses on your farm, including:

- Household use
- Garden
- Stock
- Spraying
- Irrigation
- Dairy
- Processing
- Fire fighting

Determine how much water is needed for each proposed use, in which seasons it will be needed most and the quality required.

Tool: Farm Water Calculator

Agriculture Victoria has created a farm water calculator to assist with planning water supplies on your farm. If you are located outside Victoria, the tool can still be useful to get an indication of the types of information you need to consider.

See https://agriculture.vic.gov.au/support-and-resources/tools-and-calculators/farm-water-calculator and check your state's agricultural department website for state-based information.

Step 2: Evaluate the reliability of water sources and storages

Water for agricultural use can originate from a variety of sources including:

- public pipelines
- groundwater (usually via bores)
- rivers
- streams
- farm dams
- roof runoff

Public pipelines tend to have the highest level of reliability closely followed by groundwater. Rivers, streams and farm dams tend to dry up during periods of drought. Water collected from the roof of dwellings and sheds and stored in tanks can provide a reliable and valuable source of high-quality water.

Other risks to consider include:

- Reduced right to access streamflow allocations during dry times.
- Reduced runoff and increased evaporation affecting dam storage as the climate becomes increasingly dry.
- Mechanical failure or loss of power affecting pumps, which is a particular risk to water reliability during bushfire.

- Failure of structures such as dam walls, or of fittings and pipes if not properly maintained.

Step 3: Determine the size of storages needed

Now that water usage is understood, consider when and where that water is needed, and the size of storages (dams and tanks) required.

Section 3 demonstrates how to calculate the size of a storage required to meet particular needs, based on usage, critical storage periods (the length of time a water storage may need to last before replenishment) and evaporation rates (in the case of dams).

Also consider how much water needs to be kept in reserve and accessible in the case of a water source or storage failure. For example, this may mean having a header tank large enough to meet stock or household requirements for three days while a power outage is addressed.

How much water storage capacity do I have already?

Calculating the volume of tank storages is straightforward, but dams can be trickier due to varied shape and depth. Additionally, a dam that was built decades ago is probably not as deep as it was initially due to accumulation of silt.

Tool: Measuring the depth of your dam
This video demonstrates how to make a DAMDEEP measuring tool[1] that enables accurate measurements of dam depth. The video also demonstrates how to use the summer water calculator (see below) to determine how much water you have in your dam. See https://youtu.be/Kp21tB5hPj8

Step 4: Determine how long water supplies will last during times of prolonged dry conditions

As well as understanding how much water will be used by stock, garden, household, firefighting and other uses on a farm, evaporation rates from uncovered storages are an important consideration.

If relying on dams as a primary water source, the size of dam required for it to remain in use during dry spells has increased significantly. For example, in Victoria during the last two droughts, experience, rainfall data and catchment yield indicate that dams need to be at least 4 to 5 ML in size for water to persist through two years without replenishing from runoff. A dam of this size furthermore needs to be connected to a water reticulation system to get the water to where it is needed on the farm. Upgrading a subset of dams to this size can provide greater water security, rather than relying on a greater number of smaller dams that may all be at risk of going dry. Note that regulations must be consulted before upgrading the size of any dams.

Section 3 provides average annual evaporation rates for different regions of NSW, while Agriculture Victoria's Farm Water Calculator (see above) provides guidance on determining evaporation from

[1] Developed by Greg Bekker, Agriculture Victoria

farm dams. A rough rule of farm is that most dams lose around one metre per year (from the total dam surface area) in evaporation.

Remember that the final half a metre of water in a dam is probably unusable, and certainly should not be relied upon for stock water.

Tool: Summer Water Calculator

Agriculture Victoria's Summer Water Calculator enables farmers to enter a number of water storages, stock type and numbers, and to calculate how long water will last during summer. It takes into account evaporation and batter slope.

See https://agriculture.vic.gov.au/support-and-resources/tools-and-calculators/summer-water-calculator

Step 5: Match stocking rates to water availability (water budget)

This element of farm water planning is the inverse to the step above. Given the water available on a farm and its likelihood of persistence, a realistic water budget (knowing where water is available on a farm and how much is available) is an essential component of preparing for drought.

A water budget considers evaporation from storages, seepage, native and feral animal usage, water taken for fire-fighting, and fouling. Consider not only past experience, but the likelihood of more extreme weather events under climate change.

A calculation using numbers of livestock and their predicted water intake will determine a timeframe for which the water will last. Depending on the outcome of this calculation, stock numbers may need to be reduced, or a trigger point identified for when stock numbers will be reduced during dry times in preparation for water shortages.

An additional consideration when planning for prolonged dry conditions is the impact on wildlife. Farm dams play an important role in sustaining biodiversity (including native animals, vegetation, invertebrates and aquatic life). Consider the impact on native plants and animals if all water storages on a farm are depleted during drought.

Step 6: Design farm water supply and reticulation systems

What are my options for accessing, storing and moving water on a farm?

Once water requirements are known, step back and consider the ideal setup for water supply on a farm. If current water storage on a farm is insufficient, how can this be supplemented or enhanced? What other water sources could be accessed, or other types of storage utilised? A range of engineering and technological options are now available to assist farmers in water planning.

Cost may be a barrier to redesigning existing systems, but the long-term benefit of improving water supply and storage may enable these costs to be recouped through, for example, a reduced need to destock during drought.

Investing in a farm's water system during profitable times is a long-term investment that will pay dividends in future dry times.

Potential methods of supplementing storage include:

- enhancing existing dams (see Section 2)

- enlarging an existing dam or building a new dam (potentially alongside decommissioning smaller dams – check water regulations for your state)
- increasing roof collection and storage in tanks (not all properties need a dam – rooftops provide sufficient harvestable water for small properties).

Dam water quality can be greatly improved by fencing dams and using a large fenced dam as a water source for a reticulation system. Well-designed reticulation systems are reliable and electronic monitoring systems make them considerably safer than in past decades.

Further resources for farm water planning

NSW Local Land Services Farm Water video series: www.lls.nsw.gov.au/regions/south-east/key-projects/farm-water

Agriculture Victoria Farm Water Solutions information: www.agriculture.vic.gov.au/farm-management/water/farm-water-solutions/how-much-water-does-my-farm-need

Livestock water requirements and water budgeting for south-west Western Australia: www.agric.wa.gov.au/small-landholders-western-australia/livestock-water-requirements-and-water-budgeting-south-west

Dam decision-making options

Enhancing existing dams

Maybe you have enough storage, but want to increase water quality and retention, enhance biodiversity, or flexibility in cation of water points. In this case, choosing one or more dams to enhance is an excellent investment.

Alternatively, a need for additional storage may be met through renovation (de-silting and/or enlarging) of an existing dam. This would ideally be coupled with fencing and revegetation.

Considerations for the management of existing dams include:

- Is there a particular large dam that would be suitable as the farm's primary water source? If so, what enhancements can be made to improve the dam's water holding capacity and water quality?
- Are there particular dams that might be suitable for modifications to support biodiversity, for example located near a vegetation patch or that could be incorporated into a fenced revegetation area?
- Smaller dams that have silted up or dry out easily may be candidates for decommissioning, if the farm's water requirements are met with larger dams that retain water for longer. Alternatively, one or more of these dams might be suitable for modifications to support biodiversity.
- Can a change in dam management help address a problem such as erosion, or support landscape rehydration? For example, fencing and enhancing a dam to reduce bank erosion.

- Is the dam leaking? If so, can it be repaired and improved, or is it a dam that can't make a strong contribution to the farm's water supply and therefore could be a could candidate for decommissioning?

For more information on dam enhancement and improvement see Section 2

Do I need a new dam?

Having undertaken a process of farm water planning as outlined above, the conclusion may be that a new or significantly larger dam is required to meet a farm's water requirements.

Landholders will need to check regulations on dam construction and harvestable rights in their state or region as a permit may be required. Contact your regional water authority.

Note that the construction of new dams has implications at a landscape and hydrological level, as water captured by dams is water that is not sustaining downstream rivers and wetlands.

For more information on dam construction see Section 3

Decommissioning ineffective dams

Some dams are ineffective and are not required for a farm's water system, and also not providing significant habitat for biodiversity. Given that such dams may still be holding water that would otherwise be utilised downstream, and that they will also contribute to a farm's water-holding capacity under state regulations, there can be value in decommissioning these dams.