

Watering point: Well-constructed and cleverly-designed troughs can ensure reliable service and simple maintenance. Photo: Ben White

Technology improves water storage options

AT A GLANCE

- ▶ Water storage options
- ▶ Lead Detection Unit sneak peak
- ▶ Tips on troughs and valves

Making sure your stock are adequately watered relies on infrastructure including pumps, pipes, troughs and tanks. **Jessica Strauss** checks in with our resident pump and pipe expert **Josh Giumelli** on what to consider, as well as getting an update on technology improving water storage and leak detection.

As important as selecting the right pump for the job is initially, maintaining pumps to ensure consistent and reliable operation is essential.

The delivery and storage of water ensures efficient use is made of the precious resource, but selecting the appropriate sizing of tanks and troughs makes sure adequate water is available for stock at peak demand times. Numerous trough material and design options, including poly and concrete, are now available while trough valve designs have improved considerably over the past two decades.

Table 1: Stock water requirements

Animal	Average consumption litres/day	Maximum consumption during summer litres/day
Cattle (lactating)	80	160
Cattle (adult, dry)	50	100
Cattle (weaners)	25	50
Sheep (lactating)	7	14
Sheep (adult, dry)	5	10
Sheep (weaners)	2.5	5

WATER KEY TO LIVESTOCK PRODUCTION

While there have been farmers who have experienced good seasons, many livestock producers remember only too well the previous years of drought, which showed their livestock watering systems to be unreliable, inadequate or outdated.

This article looks at some of the main considerations when designing a whole-farm livestock watering system to meet current and future requirements.

The first step when setting up a new livestock watering system, or revamping an existing one, is to decide what the maximum water requirements are likely to be.

This should be based on peak summer demand when the property is fully stocked.

Josh says a figure of 50,000 litres per day is often used as the summer requirement for watering 700 beef breeding cows (about 70l/hd/day), although this may alter slightly for different types of cattle, grazing conditions and distances from watering points.

A maximum distance of about 500-750 metres is often used for cattle in undulating country.

A 45kg Merino wether (or 1 Dry Sheep Equivalent) requires 4-6l/hd/day during summer, although this can increase to 12l/hd/day for sheep grazing saltbush.

They will also walk several kilometres between feed and water, although meat and

wool production will decline as the distance between the two increases.

HOW MANY HEAD?

It is also important to think of how this water may be required, in terms of the number of stock likely to be watering at one point at one time.

For example, a rotational grazing system using high stock densities may require all 700 cows to be watered from one trough if they are in a single mob.

If the desired flow rate at that single trough is, for example, two litres per second (to prevent thirsty stock damaging equipment) then the system must be designed to supply this as a possible peak demand.

Design all mains and branch lines for the worst-case scenario, such as watering at the furthest, and often the highest, point from the water source.

WATER QUALITY

Trials have regularly shown even slightly 'off' or contaminated water will depress feed intake and reduce animal production.

Cattle appreciate cool, clean water. Research in the dairy industry has shown the optimal water temperature for dairy cows to maximise water intake (and milk production) is between 15C and 17C.

If cattle are being watered directly

from dams, breed can affect their behaviour around the water source.

British Breed cattle will foul dams, while Bos Indicus tend not to. Water contaminated by urine and faeces will contain high nitrate levels, which can be detected by pH testing the water.

Generally speaking, if you would not drink the water yourself at a pinch, the water is probably not good enough for livestock.

THE BIG PICTURE

Farmers regularly invest big dollars in troughs, tanks, pipework and pumping infrastructure to provide a reliable water source for stock.

Generally speaking, the better the quality of the components, the less trouble they will give.

It makes little sense to skimp on the final piece of the puzzle, the trough valve, as it will ultimately decide how reliable the entire system is.

KEEP YOUR ANIMALS HAPPY

Much of the reliability of a trough valve will depend on the type used and how it is installed. A valve that cannot keep supply up to a large mob is vulnerable to damage as cattle and sheep play with it to get more water.

Stock damage is one of the leading causes of valve failure, and while a good supply of water goes a long way to improving the situation, valve design and location requires serious consideration.

Valves mounted on the surface of the water are most vulnerable to damage and lightweight units must be protected using a concrete or steel cover.

Alternatively, there are several heavy-

duty units which would stand up to severe punishment without requiring additional protection.

The other valve mounting option is below the water line, which leaves only the float for animals to tamper with.

DIRECT USE OF DAMS

Dams have traditionally been a common water source, being relatively easy to add as required as long as suitable sites can be found.

They can also require less monitoring and maintenance than troughs.

When building dams, ensure they are made deeper, rather than wider to minimise surface area and evaporation.

Ideally dams need sides (or batters) with a minimum gradient of 3:1 or even 2.5:1 if possible and a minimum depth of three metres and preferably closer to six.

To maintain water quality as much as possible when watering a mob directly from a dam, electric fencing tape can be used to restrict livestock to one area on the dam bank.

If feasible, gravel on the dam bank where livestock are drinking may help reduce bogging and encourage animals to come in, drink and go again.

Be wary of bogging if watering sheep on a dam where cattle are, or have been recently.

DAMS AS STORAGE

To keep water clean and cool, it may be preferable to have a system of large dams fenced off from livestock and reticulating into troughs.

Piping from the dam may be done through the bank during construction. The pipe must be on a steady, downhill angle to ensure there

are no potential air traps, and large enough to provide the flow rate required.

Care must also be taken when gravity supplies are drawn from a pipe through, or around, a dam bank to ensure the pipe through the bank is effectively sealed.

Conduct regular checks of all valves and fittings to ensure they are not leaking and to minimise the risk of a pipe burst or valve jam which could potentially empty the dam if it goes unnoticed.

Only consider using a dam to store ground water pumped up from a bore if it has very low levels of salts and minerals, as these will accumulate in the bottom of the dam over time and eventually make the water unusable for stock.

Also be wary when inflow from the bore into a dam with a large surface area is low (less than 1 litre per second) because all the water pumped in could be lost through evaporation loss on one hot summer day.

Trough size and flow to a degree, the inflow rate of water into a trough is the most important consideration when setting up a livestock watering system.

An inflow rate of 2l/second is generally regarded as a minimum if relatively large mobs of cattle are being watered on a single trough.

If inflow rates of this magnitude can be achieved, smaller troughs can be used but there still must be enough headspace to ensure shy animals drink.

Smaller troughs with a fast infill will also keep water cooler and more aerated than a large trough, shallow trough with a slow turnover.

Water drawn from a dam to a trough should be taken from a medium depth if possible, where it is cooler than the surface water but more aerated than water at the bottom.

SINKING A BORE

Following ongoing problems with surface water quality and reliability, many livestock producers are sinking bores to establish a ground-water supply alternative.

All bores must be licensed, even if they are deemed to be a failure as no, or insufficient, water is found.

Licences for bores to be used for stock and domestic watering purposes must be applied for before drilling starts and are usually free, but check with the relevant state department of water or equivalent.

It is the landholder's responsibility, not the drillers, to ensure the licence application is lodged and all the driller's construction details are submitted to the appropriate authority.

CONFIRMING THE SUPPLY

The bore driller must give a measured flow rate for each aquifer of a bore as part of the report sent to the licensing board.



Floats are a pretty important, but often overlooked, part of the system. Make sure the threads are in good condition, and any locknuts on the float arm are tightened against the valve. Floats pictured (clockwise from left) are the Philmac 150mm, Cocky valve, Philmac Stockproof, Raindrop, Jobe, Hansen Max-flo and Apex Xtraflo.

But it is advisable to test the reliability of the bore flow rate (using the bore driller's suggested yield) during a 12 or 24-hour period.

Bore tests are usually carried out by an independent contractor using an electro-submersible pump and generator.

The contractor should also supply an appropriate instrument to measure the water level in the bore during the test.

Ensure the test pump to be used can maintain the set flow rate at the depth suggested by the bore driller.

During flow testing, collect at least two litres of bore water for independent quality testing. Get the samples tested for all intended livestock and domestic requirements.

STEPPING IT OUT

The next step for a bore and pipeline watering system will be to step out the planned pipelines and then possible tank sites.

At this point physical factors such as rock outcrops, ridgelines and gullies come into play and alternative pipe routes may be needed, or become more practical.

Even the smallest rise and fall in a

pipeline accumulates air, which reduces the water flow rate within the pipe, so try to go around, rather than over, ridgelines.

If a 'hump' in the line is unavoidable, an air valve must be placed in the pipeline to release accumulated air.

Although small, these valves are still exposed and require protection from livestock so, if possible, are best suited on fence lines or buried and covered.

If a trough or hydrant site is on the crest of a highpoint, a permanent air release valve still needs to be included.

It can also be useful to think of future maintenance requirements when installing air valves by placing a ball or gate valve under the air valve.

This means should an air valve start leaking; the water can be turned off in the pipeline before the air valve is removed for repair.

ACCURATE LEVELS

When the watering system plan has reached the stage where pipeline layout routes to preferred watering points seem achievable, seek the services of an independent professional with the experience to measure accurate and appropriate levels.

Get these measured at the pump site, along all proposed pipeline routes, at storage and balance tank sites, trough sites and at any other points important to the final design plan.

This independent person should also be able to provide independent advice about the watering system as a whole and help design the final layout.

POTENTIAL COLLAPSE

In steeply undulating country, one of the biggest problems for reticulation systems is controlling water flow down hills and avoiding collapsed pipes.

This can be particularly apparent when, for example, there is not much fall along a flat or low slope gradient section of a gravity line which allows a flow of about 1.5l/sec, but the pipeline then continues down a dramatically steep decline where the potential flow rate could double.

In this situation a potential suction effect can take place and collapse sections of polythene.

To avoid or prevent this problem, try to select an alternative profile route for the pipeline with a more constant gradient. For pumping lines, careful selection of pipe

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Tanked: Using a tank to store water between a pump and the trough ensures peak demands can be met.

lengths and diameters will help, as will the critical location of air inlet valves.

For gravity lines only, also use balance tanks, break pressure tanks, or a combination if re-routing the proposed line is not feasible.

Be aware some of the above methods could restrict or prevent water flows to more distant service points or higher elevations.

When planning the proposed pipeline routes, seek professional on-site advice to address concerns or identifying potential problems.

TANK TECHNOLOGY OPTIONS AND INNOVATIONS

Water tanks are the equivalent of a battery in an electrical system.

Storing water as it is pumped in from a water source and making it ready for delivery on demand, often delivering at rates exceeding that of the pump.

But tanks can come in multitudes of shapes and sizes and more importantly, are made from different materials.

Fabrication from different materials also allows some innovations in design including

roof catchment of rainwater.

Pricing will ultimately depend on location and proximity to the place of manufacture.

CONCRETE

Concrete tanks can be pre-spun and transported or formed and poured on-site in the case of larger tanks.

Reinforcing is embedded in the concrete giving it increased strength.

They are heavy and solid but require a firmly compacted and stable foundation to prevent cracking.

POLY

Poly tanks are today possibly the most popular tank used on-farm.

This is mainly because they are easily transported and represent good value for money when it comes to a cost per litre of capacity.

Poly tanks are available in a multitude of colours, capacities and designs.

Corrosion is not an issue, and with a degree of flexibility making them resilient can accommodate minor irregularities on their foundations.

FIBREGLASS

Fibreglass tanks have been around a lot longer than poly tanks and as such are reasonably proven.

Look for designs incorporating a single-piece construction and solidly mounted spigots.

Innovative designs include rain catching roof sections such as the Freedom Tanks Raincatcher design.

The Raincatcher lid is designed in a convex curve to catch rainfall.

At the same time while a central channel collects and directs water into the tank through a mesh grate and drop into the tank, it provides clearance for leaves and debris to be washed over the side.

STEEL FABRICATED AND CORRUGATED IRON

Steel fabricated and corrugated iron tanks have been around for a long time and are a well-established water-storage option.

They are typically heavily galvanised to provide corrosion resistance, but may not be the best choice for coastal or high salinity areas.

Steel fabricated and corrugated tanks are relatively light and easily transported but are mostly made to order.

Lifespan can be improved with the addition of a liner, which will further reduce the rate of corrosion or leakage in older tanks.

TUNING YOUR PUMP FOR OPTIMAL PERFORMANCE

There is more to installing a pump than just connecting the pipes, plugging it in and turning it on.

In fact, a poorly tuned pumping system can use excessive electricity, reduce pump life, or deliver poor pressure to the trough, tap or shower head.

Pressure pumps equipped with automatic pressure switches need to be carefully adjusted to optimise their performance.

While switches are pre-set at the factory, pumps are used in so many different situations they need tuning to their working environment to get the best results.

And it doesn't hurt to go back and check pumps installed some time ago to see they are still working at their best.

Constant cycling of the pump, where it cuts in and out continuously, does no one any favours.

For a start, it delivers an uneven, pulsating flow at the tap, which can be annoying for a household supply.

But a pump which cuts in and out too frequently will consume far-too-much electricity.

The capacitor is continuously charged ►

SOME GOLDEN RULES FOR WATERING SYSTEMS

When selecting pipe diameters for gravity flows from a storage tank to a watering point, remember the potential flow rate will reduce by about one half each time the pipe is reduced to the next smaller diameter.

- Select pipe carefully for both pumping and gravity flows. In some instances the highest-pressure pipe may not actually be required for the length of a section. Money saved by using lower-pressure pipe can be spent elsewhere in the system.
- Remember to be practical. A pipeline generally should not change from large diameter to small diameter and back to larger diameter to maintain a desired flow rate.

- The bigger the pipe diameter, the less friction and the lower the pumping head, reducing the pump power requirements.
- All types of pipe, regardless of manufacturing composition, have different friction loss coefficients due to differing internal diameters (pipe wall thickness) and roughness. Use friction charts available from pipe retailers to check this closely.
- When laying any pipeline, especially in rugged, rocky, gullied or heavily timbered country, consider ease of installation and access before taking the shortest or cheapest route as the extra pipe costs usually outweigh high labour and machinery costs through difficult terrain.
- When planning any scheme, use accurate plans. Topographical maps show

- approximate heights but are not accurate enough to determine all design requirements. Similarly aerial photos can show inaccurate distances, especially at the edges where photos have been joined. Accurate measurements for the final design are best determined with a theodolite or a quality global positioning satellite (GPS) unit.
- Never underestimate the effect of friction when purchasing pipes — while the initial outlay may be larger, you will have lower operating costs if you buy bigger diameter pipe and a smaller pump.
- If you are burying pipelines, don't skimp on infrastructure. A few dollars saved here and there on pipe and fittings can come back to haunt you if you need to dig it up for repairs later on.

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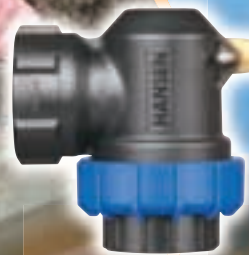


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TROUGH PURCHASE AND INSTALLATION GUIDE

Buying and installing a trough? Checking off the following features will help you select the best model for your needs.

- Look for a solid trough which will withstand animal pressure. Wall rigidity is important to minimise damage and water loss.
- Trough valves and trough inlets should be protected from damage. An integrated shroud design is recommended. Cockatoos have been known to destroy polystyrene floats.
- Cleaning should be simple with an easy to access bung at the lowest point of the trough for washing out.
- Valve access should be simple for maintenance and seal refurbishment.
- If fitted, valves should be of solid construction and of suitable flow capacity to meet peak demand requirements. Larger troughs should be fitted with larger valves.
- Consider transport costs and installation processes. Concrete troughs can be more expensive and difficult to shift and install.
- A well-prepared compacted and raised pad will minimise hoof traffic compaction around the trough.
- The trough length should accommodate at least 10% of the stock drinking at any one time.
- A longer trough will prevent jostling, stock injuries and damage to the trough, piping and valves.
- To determine trough length, if livestock have access to both sides of the trough allow about 0.3m per sheep (for example three metres of trough edge per 100 sheep) or about 0.5m per cow, or steer (four metres of trough edge per 40 cattle).
- Where the animals only have access to one side of the trough, its length will need to double.
- The depth of the trough will affect the amount of evaporation and the water temperature. Choose troughs which have sufficient depth and volume to keep the water reasonably cool.
- Evaporation from troughs can increase the concentration of salts in the water. Fallen material dropped into the water by livestock while they are drinking can also cause fouling, making the water unpleasant.
- Providing shade over troughs is an extra expense, but will help keep water cooler and evaporation rates down. But it may not be a cost-efficient option.
- An incorporated concrete apron is much better for stability.

up to start the pump, and drawing anything from three to five times the running current the power bills will quickly add up.

It can also lead to power fluctuations on the farm supply; and flickering lights at night time.

LEAK DETECTION UNIT

Alpha Group Consulting's Leak Detection Unit was first released in 2011. It has recently been revamped with a new model released in August 2014.

The new model is lower in cost, but still offers the same alert features with daily text message reporting of total daily water use and minimum flow per hour plus online access to view usage graphs.

The Leak Detection Unit provides the advantages of a solar panel, high gain aerial and regular upload intervals. This tool has proven itself invaluable at detecting minor water system leaks as well as providing rapid detection of major leaks.

The unit fits onto all standard Mains Water meters or aftermarket flow meters with pulse output capacity and requires no annual maintenance. Full installation and ongoing servicing is provided.

The units are made in South Australia and have low annual operating costs.

The system operates with a long lasting re-chargeable lithium ion battery, are moisture and pest protected and are fitted with an external high gain aerial to overcome poor Next G reception.

The system can be hooked up to an existing water meter (for \$1450 +GST) or can be purchased with a flow meter (extra \$200-

\$300). A subscription to the Next G phone connection is also needed to run the system. The data hosting costs around \$200-\$250, plus GST a year.

Alpha Group Consulting director Shane Oster said the unit was born out of a need for people operating in South Australia on water supplied from the Murray River.

For a lot of farmers in this area their only form of water supply is mains water from the Murray River.

"Over the past 10 years the price of mains water has jumped dramatically. It used to be about 90c a kilolitre, now it's around \$3.45 and it peaked at \$3.75," Shane said.

"A lot of my clients are in the situation where they're getting crippled by mains water bills. The bills for their stock water range from \$20,000-\$100,000. If they have a leak or a burst pipe, the bills from the leak are anywhere from \$1000-\$15,000.

"As you can imagine, a lot of people have reasonably large sized holdings and it's just not possible to monitor every pipeline all of the time."

Based on the needs of his clients, Shane developed the Leak Detection Unit system.

Essentially what it does is monitor the flow coming out of the water meters.

"I don't think it matters what state you're in, most water meters have got the capacity to produce a 'pulse output' – that's a little electrical signal. Every time the meter clicks over a litre of water, there's a little electrical pulse and the electrical pulses can be counted by the device," Shane said.

"All we need to do is put a pulse output unit onto the existing mains water meter. The



Alpha Group's Leak Detection Unit



device has a sim card in it and then every couple of hours it sends that data via the internet and it's available on the web.

"From the grower's point of view, what they receive is a text message each morning and that will tell them exactly how much water they've used over the previous 24 hours and what their minimum flow per hour was."

Shane said usually there would be a period between about 2am and 6am when stock generally would not drink.

"If your system has no issues, you're usage should get down to zero litres per hour at some stage through the night. What the system does is it monitors the total usage and also on the minimum litres per hour," he said.

From that information you can figure out whether or not you've got a leak and the severity of it.

Shane said all of the information was also emailed to the user and they could also nominate a number of other email addresses to receive the information, such as other workers on the farm or family members.

Everyone who has a unit has a unique password and username which they can input on the Alpha Group website to obtain their data. This can be viewed 24/7 and is updated every two hours.

"What people can do as a means of trying to isolate a leak is just go and turn off a section of their pipeline and come back a few hours later and they can see if it's made an impact on water usage or not," Shane said.

"The text message gives the user a daily snapshot and if it is normal, they can go along with their day, but if there is an unusual reading, they can act on it.

"There's been a lot of uptake of the unit with young farmers, but it's amazing how a lot

of the older generation are really getting into it too."

While uptake of new technology with older generations has typically lagged a bit, Shane said his product was breaking through.

As it is easy to use, Shane said what has been common would be a son would buy a unit and the dad would initially be hesitant, but once they have had an introduction to it, they end up really liking it.

He said the unit was really useful, in particular if you had a slow leak because this

"If your system has got no issues, you're usage should get down to zero litres per hour at some stage through the night."

— Shane Oster

would be hard to pick up from day-to-day without the unit as it could just blend into the readings and appear normal.

"A lot of the people using the unit pick up a leak within 12 hours or less, whereas without a detection unit you might take weeks to realise you've got one."

While South Australia is the current focus of the company as demand has been so high, interest from other states is growing and that is on the company's radar.

"You can upscale and accessorise the unit as well. You can run two water metres for example. There are a lot of situations where there'll be two flow monitors alongside each other — one might be yours and the other your neighbours," Shane said.

"I can hook up to both of them and split the data at the backend, so that Client 1 sees

his data and Client 2 sees his. They never see each other's data and only have to pay half the hardware cost as they're sharing the unit.

"The other thing which can be done is to link in rain gauges, pressure gauges, tank level sensors, salinity metres, weather stations and soil moisture probes. There is a huge opportunity to put other devices on there if people want to."

Shane said on the Eyre Peninsula, there were quite a few people who experience some really fierce pressure spikes from their

pumping stations, so people heavily relied on pressure reducing valves.

"Their water is also quite corrosive so the pressure reducing valves might only last 6-12 months and they start either corroding out or failing or they'll get jammed up with silt and debris from the pipelines.

"What people have been able to do is fit an electronic pressure gauge so each day the system reports what their maximum pressure was for the previous 24 hours.

"If it's not 60 PSI like they'll set their pressure regulator to and if it starts slowly creeping up, they'll know that their pressure regulating valve is failing.

"In response they can either service or replace it before they start to get blow-outs with 120 PSI on their line instead of 60 like it should be."

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