Farm Water Quantity and Quality (5-15)

Providing enough water to stock is essential for high milk production. Clean water is also required in large quantities for cooling milk and washing the milking plant. Some key principles, measurements and water requirements are noted here. Accompanying Farmfact 5-18 provides tips for efficient water use in the farm dairy. Farmfact 5-19 addresses management of stock drinking water, while irrigation is covered in Farmfacts 5-20 to 5-23.

Principles of water flow

The rate at which water flows through a pipe depends on the following:

*Pressure - the amount of force which is pushing the water through the pipe.*
In a gravity-fed system, water flowing downhill from a tank to a trough becomes pressurised. The higher the tank above the trough, the more pressure is produced.

*In pumping systems, higher capacity pumps generate more pressure.*
For a given diameter pipe, more pressure will result in more water flow Pressure is measured as psi (imperial) or kPa (metric). Other metric units of pressure used are bars and metres of head, with psi and kPa equivalents as follows:

| 1 bar = 15 psi. | 1 bar = 100kPa = 10m head |

*Pipe friction - the friction between the water and the inside of the pipe.*
The inside walls of pipes are not completely smooth and the movement of water inside the pipe can create friction. This friction resists the water flow, and pressure is lost.

Smaller diameter pipes have more surface area in contact with the water (per unit of water in the pipe), causing more pressure to be lost. For example, more pressure will be lost in 100m of 20mm (3 /4”) pipe than 25mm (1”) pipe as noted in the table below.

<table>
<thead>
<tr>
<th>Pipe size</th>
<th>Head loss per 100m of pipe at 1 litre/sec flow rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Alkathene</td>
</tr>
<tr>
<td>20mm (¾”)</td>
<td>38.0m</td>
</tr>
<tr>
<td>25mm (1”)</td>
<td>9.3m</td>
</tr>
<tr>
<td>32mm (1¼”)</td>
<td>2.8m</td>
</tr>
</tbody>
</table>

Because of this friction loss, 20mm pipe should not be used in a farm water system except for the last few metres to the trough.

Pipe made out of rougher material creates more friction and pressure loss. Also, the further the water has to travel through a pipe, the more pressure that is lost due to friction.
Water requirements - quantity

A lack of trough water can cause milk production to be restricted in the summer. Thirsty cows will also lose condition, because they lose their appetite. Peak water flow rates needed on a dairy farm should be worked out on a per cow basis. The amounts typically used for planning are as follows:

<table>
<thead>
<tr>
<th>Dairy shed</th>
<th>70 litres/cow per day</th>
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</thead>
<tbody>
<tr>
<td><strong>Troughs</strong></td>
<td>70 litres/cow per day, available in a five-hour period</td>
</tr>
</tbody>
</table>

= 14 litres/cow/hour

Measuring the rate of water flow:

- Mark the water level on the side of a trough
- Bucket out a known amount of water (e.g. ten 20-litre buckets) while holding the ballcock up
- Push the ballcock right down and time the trough to refill back up to the mark
- Compare the measured flow rate with the desired flow rate, as in the following example:

For example:
200 cows drinking 14 litres/hr = 2800 litres/hr flow required
To get litres/minute, divide this by 60: 2800 / 60 = 47 litres/minute required
So it should take 4 min, 15 sec for 200 litres (ten 20-litre buckets) to refill.

Measure the flow at troughs around the farm to find out whether your water system is adequate.

Trough size

Trough size is important for access, rather than water storage. Troughs under fences allow only a third of the circumference on each side of the fence to be used. Boss cows can easily push heifers away in this situation. Herds in excess of 400 cows need two troughs in the paddock.

The trough size should be half the one-hour flow demand

For example:
200 cows need 2,800 litres/hr, so the trough size should be at least 1400 litres (370 gallons).

Water requirements - quality

The best test for this is the taste test: Would you drink the trough water yourself? Unpalatable water can leave cows thirsty, even if there is plenty of flow available. Water quality can be tested by sending a sample to a lab. A variety of filters and purifiers are on the market for inclusion in the water system if water quality is not adequate.

Consult a local agricultural engineer before designing or upgrading a water system. They can help work out the best pipe and pump sizes for your farm.