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Waterwise on the farm

A simple guide to implementing a water management plan

LEAF
LINKING ENVIRONMENT AND FARMING
Integrated Farm Management

NFU

ENVIRONMENT AGENCY

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Why save water on the farm?

We tend to think of Britain as wet and rarely short of water. However, our variable climate, high population density and wide range of water-uses mean that at certain times and places water resources are scarce. This affects the quality of our numerous water-dependent habitats. Climate change is likely to result in wetter winters and drier summers.

Increasing the efficiency with which we use water not only makes good business sense, it will also help to protect a vital natural resource.

This document, which has been tried and tested by farmers, will help you to assess whether you are making the best use of your water resources, and may generate ideas for improvements.

The three organisations involved (Environment Agency, LEAF and NFU) have been pleased to work together on a project that delivers opportunities for farmers to make practical and cost-effective adjustments to their management practices in order to avoid future problems. We hope you find this document useful and we look forward to working with you on improving the quality of our environment.

Robert Campbell
Chairman, Linking Environment and Farming

Ben Gill
President, National Farmers' Union

Sir John Harman
Chairman, Environment Agency

Contents

Introduction

Being "waterwise" is good for farming and good for the environment.

The first two chapters of this booklet explain how to undertake a water audit and develop a Waterwise Action Plan on your farm. They will help you to:

- reduce water and energy use;
- reduce the quantity of dirty water requiring treatment and disposal;
- save money and increase profit;
- improve your environmental performance.

Real-life examples of water efficiency on the farm are provided in the form of case studies and practical advice that has been tried and tested by LEAF and NFU members.

Further information on issues such as Catchment Abstraction Management Strategies (CAMS), potential grants, and where to obtain advice on issues such as irrigation are given in Chapter 3, and Chapter 4 provides details of organisations that can provide further information and advice. Tables and forms are grouped together at the end of the booklet.

This guide has been produced by the Environment Agency, LEAF and the NFU. All three organisations are committed to working with farmers to improve the environment in a practical and realistic way.

1 Getting started: being waterwise on your farm

In order to carry out a water audit and develop a water management plan you need to follow five simple steps:

- Step 1: Identify how much water you are using and its cost
- Step 2: Carry out a water-use inventory
- Step 3: Calculate how much water you should be using
- Step 4: Identify and compare water efficiency activities to reduce water-use
- Step 5: Create, implement and review your Waterwise Action Plan

The following information will help you during these steps:

- your water bills from the last two years (a longer record will make your assessment more accurate);
- details of any abstraction licence(s) you hold;
- the number and type (species and age) of livestock on your farm;
- your crop protection and irrigation records;
- a map of the water network on your farm showing water pipes and uses.

In order to get the best out of this booklet it is recommended that you read through it all before developing your Waterwise Action Plan.

Step 1 Identify how much water you are using and its cost

Identify all your sources of water on the farm

Possible water sources include:

- mains water supplied by your water supply company;
- water abstracted from rivers, streams, canals, springs or boreholes;
- on-farm ponds or other winter-stored water;
- water drunk by animals from non-metered sources (e.g. from puddles or by eating wet grass);
- re-used water, such as plate cooling water or harvested rainwater.

Use Form 1 (page 20) to record the amount and cost of the water that you use each year.

If you expect consumption from unrecorded sources such as eating wet grass to be significant, then you can use a percentage of the theoretical daily consumption data in Table 1 (page 23) to calculate this.

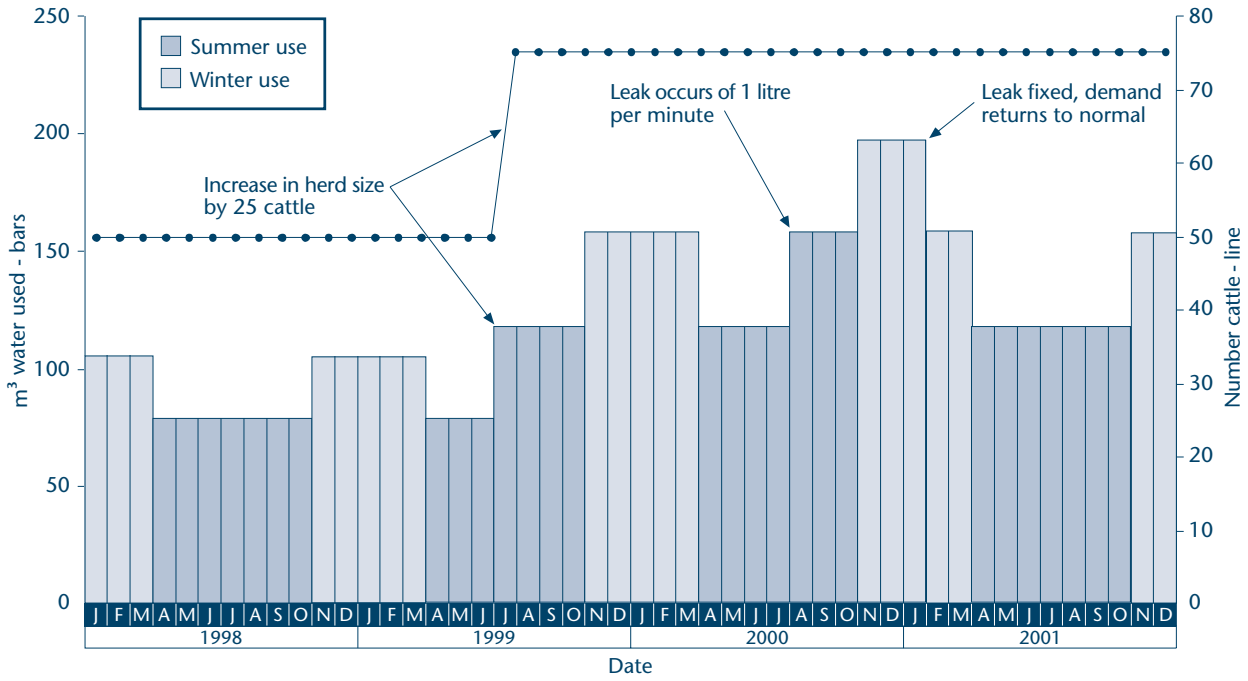
If you collect or recycle any water, such as rainwater or plate cooling water, then this will need to be included. The section on alternative sources of water in Chapter 2 (page 12) will help you calculate how much rainwater you collect.

Top tip: meter reading

Set up a routine for monitoring water-use. Regularly read and record every water meter on the farm. If possible, this should be done at least once a month. This will alert you to any fluctuations in water-use and indicate a problem such as a leaking pipe or a faulty ballcock in a water trough. It may also alert you to problems with your pipes, such as blockages, that may be holding back your production.

Once you have a record of your water-use, this can be used to help you understand any seasonal changes in your water-use patterns, and will enable you to watch out for unexpected changes. Plotting your water-use on a graph may help you to do this.

Graphical example of water-use for a dairy farm



As the graph shows, a leak of 1 litre per minute raises water consumption by the same amount as increasing a dairy herd by 25 animals.

The table below indicates the cost of the leak at a price of 70p per m³ for mains water.

Time for which leak of 1 litre per minute occurs	Litres wasted	Cost at 70p per m³ (1,000 litres)
1 day	1,440	£1
1 week	10,080	£7
1 month	43,800	£31
6 months	262,800	£184
1 year	525,600	£368

It should be borne in mind that metered water-use for a dairy herd is lower in the summer as the cows will drink from puddles and eat wet grass.

Calculate the cost of your water-use

Your water costs you more than just the amount printed on the bill from your local water company or the Environment Agency, so do not forget the hidden costs.

Costs include:

- mains water and standing charge (from your water company);
- abstraction licence charge (from the Environment Agency);
- recycled water (pumping, storage and capital);
- dirty water (storage, treatment, disposal and capital);
- staff time (operational and maintenance).

Understanding the true cost of water is crucial in managing water-use. Often, costs are unknown and mistakenly perceived to be too low to be of concern. When you fill in Form 1 (page 20), you may be surprised by just how much you are spending on water each year.

Step 2 Carry out a water-use inventory

Once you have found out how much water you use and its cost, the next step is to identify where you use it.

Forms 2a and 2b (pages 21 and 22) will help you to review all uses of water by your equipment and animals. Examples are given of the kinds of calculations you may need to make.

Examine your water uses

When you have completed Forms 2a and 2b, you are in a position to examine your water uses. Do you need to:

- **Use water for that activity?** Could dry-clean methods, such as scraping, brushing or "squeegeeing", be used before (or instead of) washing down yards and pens?
- **Use as much as you do?** Are hoses or taps left running unattended? Are dripping taps fixed quickly?
- **Use high quality water for that activity?** Consider collecting rain and used water for washing down yards. Check whether any hygiene or farm assurance requirements need water of a certain quality to be used.

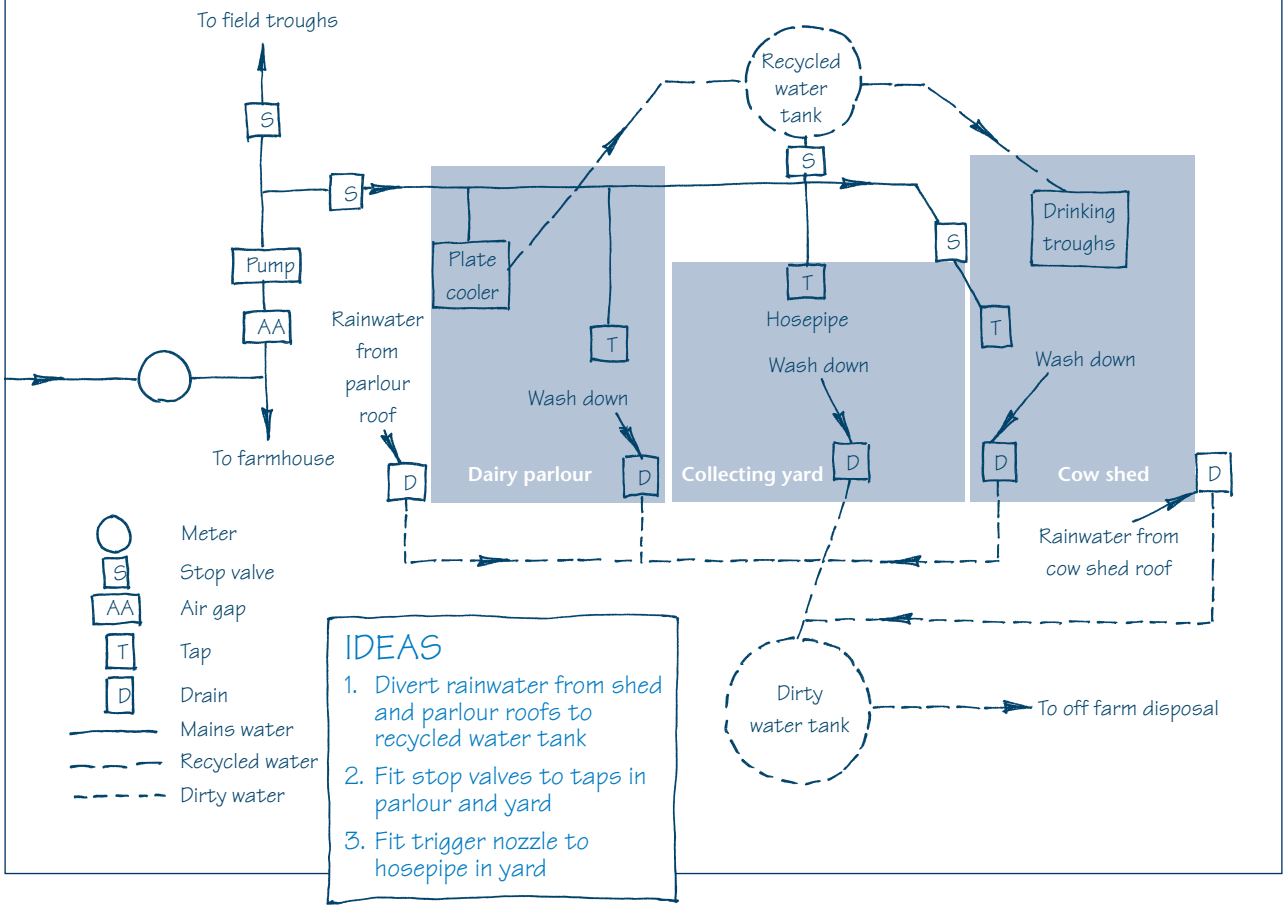
Top tip: measuring water-use

If you need to estimate the amount of water that a piece of equipment uses or a recycling system saves, all you need is a stopwatch and a container of a known volume. Carefully disconnect the outflow pipe and place the container to catch the outflow. You can then time how long it takes for the container to fill. This gives you the flow rate in litres per second (or other appropriate units) for that piece of equipment. You will then need to multiply this up to give you a use per year by working out how often the equipment is used.

Map your water uses

A map of the water network will help you pinpoint sources, uses, any potential areas of wastage and where rainwater could be collected.

Example of a 'Water-use' map



This map should indicate the location of all water uses, pipes, water troughs, taps, shut-off valves and stopcocks. You should also identify the sources of both clean and dirty water draining into the dirty-water system.

Clean water sources, such as roof water and runoff from clean yards, may be contributing to the amount of dirty water and increasing your costs. Consider whether this water could be diverted from the system and possibly collected and re-used. Page 13 gives details of how to calculate how much rainwater you could collect.

Remember that while you may save money by changing from mains to borehole, you are not saving water, merely using a different source.

Case study

Water Efficiency Awards 2001 Commendation: JR Weekes & Sons

Mr Weekes and his sons, who run a dairy farm in South Wales, have implemented several measures designed to improve overall water efficiency and reduce wastage. Each leg of the pipework supplying the animal drinking troughs has isolation valves installed. The legs are drained and inspected during the winter. All pipework above ground is lagged to protect against bursts and leakage in winter, and all visible pipes and troughs are inspected daily for leakage.

Step 3 Calculate how much water you should be using

When you know how much water you are using, the next step is to work out how efficiently you are using it.

Using Forms 1, 2a and 2b, compare your expected use to your actual use. If your actual use is more than 10 per cent greater than your expected use, this indicates that you are using water inefficiently. Even if the difference is less than 10 per cent, it is still worth checking your water-use regularly and following the generic water efficiency activities in the next chapter in order to maintain your efficiency.

If your expected water-use is less that your actual water-use, it may be that:

- your meter is over-recording your use;
- you have underestimated how much water your animals or crops require.

Comparing the difference

To compare the percentage difference between your expected and your actual water-use, you need to subtract the total theoretical water-use (from Forms 2a and 2b) from the actual water-use (Form 1) to get the difference between the two. Don't forget to convert the totals into the same units before you start (conversion factors are given in Table 2). Then divide the result by your total theoretical water-use (Forms 2a and 2b) and multiply by 100 to get the percentage difference between your actual and your theoretical water-use.

$$\text{Percentage difference} = \frac{\text{total form 1 - (sum of totals on forms 2a and 2b)}}{\text{sum of totals on forms 2a and 2b}} \times 100$$

$$\text{e.g. } \frac{10{,}000 - (5{,}000 + 3{,}000)}{8{,}000} \times 100 = 25\% \text{ more water being used than would be expected}$$

Step 4 Identify and compare water efficiency activities to reduce water-use

If your actual water-use is higher than your expected use, then the next step is to calculate which water efficiency activities are the most cost-effective for you.

A list of water efficiency measures for different activities is given in Chapter 2. Many of these options make good business sense and require little capital investment.

By combining your knowledge of your water-use with the suggestions in Chapter 2, you can calculate the payback period for each option and use the results to set priorities for your actions. As well as the savings on your water bill, do not forget to include savings from reduced dirty water, energy and treatment costs, but also include any increase in maintenance costs.

Case study

Water Efficiency Awards 2001 Finalist: Palmstead Nurseries

A recycling system was constructed to harvest all drainage water on the site of this Kent nursery which produces a million container shrubs each year. Rainwater from building roofs and runoff from container standing beds is now transferred by pipe to a holding lagoon, pumped into a 27,300 m^3 reservoir and then used for irrigation. This has resulted in:

- water consumption cut by 58 per cent;
- savings of £30,000 per year;
- payback periods of 4 to 5 years.

Calculating payback periods

To determine a payback period of a water-saving action (e.g. fitting trigger nozzles to two hosepipes) you will need to estimate the annual savings and potential maintenance cost.

$$\text{Payback period (in years)} = \frac{\text{capital cost (£)}}{\text{annual savings (£) - annual maintenance costs (£)}}$$

Example

Capital cost = 2 trigger nozzles at £10 each = £20.

Annual savings = 10 minutes less use of the hose per day at 30 litres a minute = 109,500 litres per year = 109.5 m^3 per year. At a price of 70p per m^3 = £76.65 per year.

Annual maintenance costs = 5 minutes check and clean (for both nozzles) per month = 5 x 12 months = 1 hour per year. At a staff cost of £15 per hour = £15 per year.

$$\text{Payback period} = \frac{£20}{£76.65 - £15} = \frac{£20}{£61.65} = 0.3 \text{ of a year} = 4 \text{ months}$$

Note

This does not include any savings in dirty water disposal costs or improved efficiency in cleaning due to having a better water jet.

Step 5 Create, implement and review your Waterwise Action Plan

Creating your plan

Once you have identified which measures you intend to carry out, you should draw up a basic Waterwise Action Plan. This should include:

- how you plan to save water;
- targets for water savings;
- targets for financial savings;
- who is responsible for each action.

An example of a simple Waterwise Action Plan is given in Table 3 (page 25).

Actions should be detailed in full and placed in order of priority for implementation, starting with the most cost-effective measures.

Implementing your plan

Make sure that your Waterwise Action Plan addresses the following issues:

- staff, family and contractor awareness of the need to save water;
- timing of improvements;
- routine maintenance checks;
- monitoring and reviewing progress.

Gaining support from others and promoting successes are just as important as data gathering and setting targets. By involving everyone in the Waterwise Action Plan you can achieve continuous improvements.

Starting with simple and low cost actions will help to build enthusiasm and demonstrate the benefits of being "waterwise".

Reviewing your plan

A Waterwise Action Plan should be reviewed and updated at least once a year. Compare your actual savings with expected savings. Actions that have not achieved anticipated savings should be reviewed to establish any problems.

Top tip: drain check

After a period without rain, check your drains to see if they are still wet. If they are, then it may be that a leak is flowing into them or that they are blocked.

2 Water efficiency actions

Some actions that you can take to make your water-use more efficient are listed below.

Water efficiency actions for all farms

These water efficiency measures could be applied on most farms and many of them are low or no cost options.

Leaks

There are two main ways to check for leaks.

Visual checks

Using your water network map (see Chapter 1), check the ground above your pipes to look for visible signs of a leak. Such signs can include:

- unusually damp ground;
- lusher than expected vegetation (for a recent leak);
- reduced vegetation (for a long-term leak, because of reduced soil quality).

Flow monitoring

There are two main techniques that you can use for detection of leaks that cannot be seen:

- **Record your meter readings.** See "night flow" top tip below.
- **Specialist leak detection.** If you suspect that the leak is deeply buried or under concrete, then there is various equipment that can be used for detection. This includes listening sticks, remote listening devices, pressure fluctuation sensors and "intelligent" meters that "know" your expected water-use patterns and then alert you to any unexpected flows. To find such services, either consult your local Yellow Pages or contact your local water company to see whether they run a leak detection programme.

Top tip: "night flow" check

A "night flow" test involves checking your water meter over a period of time when you would expect water-use to be minimal (e.g. overnight). Record your meter reading at the start and the end of the period. Has more water passed through the meter than would be expected for this period? If so, this indicates that you have a leak in your network that will need to be located.

Sections of pipework or troughs that are not in use over the winter should be isolated and drained to prevent frost damage that could result in a leak when they are refilled. If an above-ground pipe is in constant use, it should be lagged for the same reason.

Pressure management

Water supplied by your local water company is usually at a pressure (head) of 40 metres (56.8 psi). This may be higher than is necessary for day-to-day use around the farm. The higher the water pressure, the greater the quantity of water wasted when a leak develops.

To reduce pressure, control valves can be fitted at strategic points across your water network. These allow a steady, lower-pressure flow to be delivered.

Top tip: "leak location"

If you have shut-off valves on your water network, shut off different sections in turn and then re-perform the night flow test. When the reading stops increasing, the section that you have isolated will be the one with the leak in it.

Taps and hosepipes

Fix dripping taps promptly and, where taps are used regularly, consider fitting automatic shut-off valves to ensure that they are not left running when unattended.

Fitting self-closing trigger nozzles to hosepipes will help you to:

- control the flow of water;
- direct the water more accurately to where it is needed;
- eliminate wastage when the hose is unattended.

Check the nozzles on a regular basis to ensure that they are free from blockages and damage.

Fact: how much does a drip cost?

One drip per second wastes **4** litres per day (£1.02 per year)[1]

Drips breaking into stream waste **90** litres per day (£23.00 per year)[1]

1.5mm ($1/16$″) stream wastes **320** litres per day (£81.76 per year)[1]

3mm ($1/8$″) stream wastes **985** litres per day (£251.67 per year)[1]

6mm ($1/4$″) stream wastes **3,500** litres per day (£894.25 per year)[1]

[1] At a price of 70p per m^3 (does not include disposal costs)

Washing and cleaning

Dry-cleaning techniques, such as scrapers, squeegees and brushes, can be used to remove solid waste from yards and pens before they are cleaned with water. This will reduce the amount of water used, as well as the quantity of dirty water requiring treatment, storage and disposal.

Top tip: pre-soak

If it takes a lot of water and effort to clean your parlour after milking, you could use a small amount of water (a bucket or so) to lightly wet the parlour first. This will make the muck stick less, reducing the amount of water that you will need to use to clean after milking.

Alternative sources of water: rainwater

Rain collected from the roofs of farm buildings can be re-used for a variety of activities, including washing down yards and stock watering. How much rainwater you can use depends on:

- **How much rain you receive.** If you do not know your annual rainfall, your local Environment Agency office may be able to tell you the figure for your nearest rain gauge. See Chapter 4 for contact details. Please have your grid reference handy as this will speed up your enquiry.
- **How much you can collect.** This will vary depending upon the size, slope and material that your roof is made from. Do not collect the water if your roof is made from, or coated with, bitumen, metals other than stainless steel, or concrete containing asbestos.

Calculating collectable rainwater

Collectable rainwater (litres) = roof area (m^2) x drainage factor x filter efficiency x annual rainfall (mm)

Drainage factor. This allows for evaporation that occurs when water is retained in irregularities in the roofing material. The factor can be viewed as the percentage of the rainwater that will flow off the roof. Examples of factors for different roof types are given in the table below.

Roof Type	Drainage Factor
Pitched roof - tiles	0.75 - 0.9
Flat roof - smooth tiles	0.5
Flat roof - with gravel layer	0.4 - 0.5

Filter efficiency. Filters designed specifically for rainwater collection will reject the first flush of rainwater which carries any contaminants (such as leaves or bird droppings) off the roof. High quality filters typically have an efficiency of 90 per cent and thus a factor of 0.9. The manufacturer will be able to supply the model-specific efficiency rating.

Example

A farm building with a pitched roof area of 300 m^2, using a downpipe filter unit with an efficiency of 90 per cent, in an area with 1,200 mm annual rainfall would yield:

300 x 0.9 x 0.9 x 1,200 = 291,600 litres of rainwater annually.

- **How much you can store.** This depends upon the space that you have for storage and the demand that you have for the water. For regular demand such as stock watering, you will only need to store a few days' requirement. Irregular but water-demanding uses such as irrigation will probably require a larger tank.

We have created a spreadsheet that considers the relationship between your demand and the amount of water you can collect, and allows you to work out the best tank size for you needs. This can be downloaded from the Environment Agency's website at http://www.environment-agency.gov.uk/savewater

Rainwater harvesting is particularly suited to dairy farms, as they tend to be located in the wetter areas of the country and have a regular demand for water. A study by the Environment Agency has found that a typical dairy farm could meet 20 per cent of its water-use with rainwater.[1]

Before using rainwater, you should check that this does not breach the requirements of any farm assurance schemes that you are part of.

Water efficiency actions for dairy farms

Re-use of plate cooling water

It is possible to re-use plate cooling water for watering stock or washing down the collecting yards. Cows may even prefer warm drinking water, especially in the winter! Re-using plate cooling water will not only reduce the quantity of water taken from the mains supply, but will also reduce the quantity of water requiring treatment, storage and disposal.

Fact

Plate coolers use between 2 and 3 litres of water for each litre of milk cooled. For a 150 cow herd, yielding 22 litres of milk per cow, a plate cooler will use up to 9,900 litres of water each day. Compare this to the drinking requirements of the same herd - they drink approximately 10,500 litres of water each day.

Case study

LEAF member: Tony Bradley

At his 520 hectare mixed estate in Hampshire, the dairy uses a total of 11,000 m^3 of water a year, of which 2,000 m^3 is used in cooling the milk. With limited investment, Mr Bradley installed additional pipework from the plate cooler to a nearby header tank and water trough. This allows the re-use of the plate cooling water for animal drinking and washing down. This measure also reduced the quantity of dirty water requiring treatment and disposal, thus producing an additional cost saving. At a water price of 70p per m^3 this would save £1,400 per year in water costs alone. If dirty water disposal costs were twice the supply costs, then these measures would save £4,200 per year.

Water troughs

Overflowing water troughs and incorrectly set or damaged ball-valves can waste significant amounts of water. Ball-valves can be adjusted to lower the float so that there is less risk of spillage and overflowing. Troughs should be drained when not in use during the winter to reduce frost damage.

Fact

A leaking ball-valve in a water trough can waste up to 150 m^3 of water per year - this is nearly the same annual water consumption as a family of four. A fractured ball-valve can waste up to 2,000 m^3, which is enough water to meet the drinking requirements of 80 cows in milk for a whole year. Replacement valve seats cost less than 10p.

Water efficiency actions for pig and poultry farms

Animal drinkers

Regularly check the water drinkers to make sure they are securely fastened and there are no blockages. When replacing drinkers, consider investing in an alternative design, such as nipple and cup drinkers in poultry units or bite-type drinkers in bowls within a pig unit, as these reduce the amount of water wasted by the animals "playing" with the drinkers.

[1] *Dairy Farm Audits South West Wales,* Environment Agency, May 2000.

Water efficiency actions for irrigators

By making effective and efficient use of your irrigation water you will be able to make your resources go further and potentially add more value to your crops. Some suggestions are listed below.

- **Pump and pipe size.** Make sure that you are using the correct pump and pipe size - trying to pump too much water through a small pipe will increase friction (reducing pressure at the end) and increase the chance of a leak occurring.
- **Boom irrigation instead of gun irrigation** for fields will apply water more accurately, improving efficiency and resulting in a better quality crop.
- **Trickle irrigation** for certain crop types such as ornamental trees can greatly reduce water consumption.
- **Don't irrigate when it is windy** as this will result in uneven application and, if you are using a spray gun, may result in drift of the water onto areas that do not need watering.
- **Irrigate at night** as this will reduce the amount of water that evaporates and is lost to your crops.
- **Schedule your irrigation** according to a accepted methods which take account of evapotranspiration or soil moisture deficits as this will result in more effective use of limited supplies. Commercial advisers can assist with prioritising crops and fields in terms of water need.
- **Equipment.** Regularly check the condition of your pumps, mains and hydrants and repair worn items such as seals. Also ensure that seals are tight to prevent water wastage.

Case study

Water Efficiency Awards 2001 Winner: CA Strawson Farming Ltd

Through the installation of a number of weather stations, the farm now receives more accurate information on irrigation requirements and has cut down on watering. The change from a gun to a boom irrigation system has saved both water and electricity, as water is applied with greater accuracy to the base of the crop, reducing wastage.

Previously the farm used mains water for vegetable washing and then let it go to waste. Now the water for washing is recycled in a number of different ways:

- For potatoes, the water is cleaned through a cyclone filtration system and then re-used in the wash process.
- For other vegetables, water is re-used for brush and barrel washing before being recycled.
- When the water is periodically changed it is carried by piping and used to irrigate a willow coppice.

Water efficiency actions for vegetable washing

Many farms are now required to wash vegetables before sale to customers and this offers great potential for water efficiency:

- **Recycling and re-use.** Instead of letting wash water go to waste, it can be recycled for use in wash cycles that do not need such a high quality of water, or even cleaned and recycled for high quality use.
- **Irrigation.** If it is of a sufficient quality, wash water can be stored and used for irrigation purposes rather than letting it go to waste.

Mains contamination issues

In order to comply with the Water Supply (Water Fittings) Regulations 1999, you must ensure that any water from sources other than the mains is not connected to any pipes, fittings or equipment which has a mains connection or which supplies water for food production purposes. To make this easier, pipes that carry non-mains water should be clearly labelled.

For example, if you intend to use plate cooling water as drinking water, but wish to have a mains back-up for the header tank, then you need to ensure that there is an air-gap in between the mains supply and the tank.

Further details on the regulations and issues such as air-gaps are given in Chapter 3.

Water efficiency actions in the farmhouse

Water-use minimisation should not be seen just as a business issue, as experience has shown that the most successful waste minimisation schemes are those where staff are encouraged to be "waterwise" at home as well as at work.

There are many ways of cutting down on water-use in the home without compromising on either comfort or hygiene.

In the kitchen

Wash fruit and vegetables in a bowl rather than under a running tap and use the waste water for watering houseplants. By using only the minimum amount of water required when you boil water in saucepans and kettles, you will save both water and energy. Make sure that you have a full load before switching on the dishwasher or washing machine, because half-load programmes use more than half the water and energy of a full load.

In the bathroom

Turn the tap off while you brush your teeth or shave and try taking a quick shower instead of a bath. Old toilet cisterns can use as much as 9 litres of clean water every flush. You can reduce this by placing a device in the cistern that displaces some of the volume (e.g. a "sava-flush" or "hippo"). Your local water company may provide you with one for free.

Fact

A five-minute shower uses about a third of the water of a bath, but remember that power showers can use more water than a bath in less than 5 minutes.

3 Other issues

Grants

Under the English Rural Development Programme's Rural Enterprise Scheme, projects that fall under the scope of "agricultural water resources management" are eligible for grant funding. In order to find out whether any activities that you are considering are eligible, please contact you local Rural Development Service office via the DEFRA helpline on 0845 9335577 or consult http://www.defra.gov.uk/erdp/default.htm for further details.

Obtaining an abstraction licence in England and Wales

Anyone intending to abstract water from inland and tidal waters in England and Wales must obtain a licence from the Environment Agency. For agricultural purposes, a licence is needed if abstracting from groundwater, regardless of the volume. With the exception of irrigation uses, if you intend to abstract less than 20 m^3 per day from surface water for domestic and agricultural use, then you do not need an abstraction licence.

Catchment Abstraction Management Strategies

In April 2001 the Environment Agency embarked on the production of Catchment Abstraction Management Strategies (CAMS). The CAMS process has been developed following a proposal set out by the Government in *Taking Water Responsibly*.[1] CAMS will make information on the amount of water and licensing within a catchment publicly available and will also provide a greater opportunity for public involvement. Where abstraction within a catchment is thought to be unsustainable, the options for restoring a sustainable balance will be considered and these will include ensuring that the water abstracted is used efficiently.

The principal objectives of CAMS are:

- to make information on water resources availability and licensing within a catchment publicly available;
- to provide a consistent and structured approach to local water resources management, recognising both environmental needs and abstractors' reasonable needs for water;
- to provide the opportunity for greater public involvement in the process of managing abstraction at a catchment level;
- to provide a framework for managing time-limited licences;
- to make possible licence trading.

CAMS could potentially affect farm abstraction licences. Further details are available in a booklet entitled *Catchment Abstraction Management Strategy Process: Managing Water Abstraction*, which is available from the Environment Agency.

Water Regulations

The Water Supply (Water Fittings) Regulations 1999 make it a legal duty for installers and users of water fittings not to cause or permit waste, misuse, undue consumption or contamination of the supply of wholesome water. Prevention of contamination of mains water supplies by back-syphonage or backflow is of particular relevance to farmers, and inspections are carried out by your local water company. Where sources of water other than the mains supply are used (e.g. abstracted water or harvested rainwater) there must be adequate backflow prevention, typically a Type AA air-gap to prevent contamination of the mains supply. Specific guidance entitled *Water Supply Systems, Prevention of Contamination and Waste of Drinking Water Supplies - Agricultural Premises* is available free of charge from the Water Regulations Advisory Scheme (WRAS) on 01495 248454 or consult http://www.wras.co.uk

[1] *Taking Water Responsibly: Government Decisions Following Consultation on Changes to the Water Abstraction Licensing Systems in England and Wales,* DETR and Welsh Office, 1999.

4 Useful organisations

Environment Agency

The Environment Agency is a statutory body with the duty to secure the proper use of water resources in England and Wales. The Agency's vision for the next 25 years is: "abstraction of water that is environmentally and economically sustainable, providing the right amount of water for people, agriculture, commerce and industry, and an improved water-related environment".

For further information on water efficiency, contact the National Water Demand Management Centre via email helen.parrish@environment-agency.gov.uk or telephone 01903 832275, or consult http://www.environment-agency.gov.uk/savewater

For further information on Catchment Abstraction Management Strategies (CAMS), abstraction licences or any other aspect of the Environment Agency's work, contact the Environment Agency general enquiry line by telephone 0845 9333111 or consult http://www.environment-agency.gov.uk

Linking Environment and Farming (LEAF)

LEAF is a membership charity helping farmers improve their environment and business performance and focusing on creating a better public understanding of farming through a nationwide network of demonstration farms. LEAF is committed to a viable agriculture which is environmentally and socially acceptable and ensures the continuity of supply of wholesome, affordable food while conserving and enhancing the fabric and wildlife of the British countryside for future generations.

LEAF's vision for the future is of a sustainable system of agriculture which meets the economic needs of farmers, addresses the concerns of consumers and minimises any impact on the environment. This could be achieved through the adoption of Integrated Farm Management (IFM), which provides a common-sense and realistic way forward for farmers and land managers.

LEAF offers a new way of working by creating strategic alliances throughout the food industry. One of LEAF's guiding principles is that by forging strong and long-lasting partnerships, we can speak with one voice and work towards a common agenda for farming. The governing body is an Advisory Board made up of some 30 members representing national government departments, farmers, supermarkets, conservation, environmental and consumer groups, educational establishments and industry bodies.

Contact LEAF by telephone 02476 413911 or email enquiries@leafuk.org or consult http://www.leafuk.org

National Farmers' Union (NFU)

The National Farmers' Union is the democratic organisation representing farmers and growers in England and Wales. Its central objective is to promote the interests of those farming businesses producing high quality food and drink products for customers and markets both at home and abroad.

Central to this objective is its encouragement of environmentally friendly and welfare-conscious farming practices and a desire to ensure the long-term survival of viable rural communities.

The NFU takes a close interest in the whole range of rural affairs and works with politicians and officials - both in the UK and internationally - and other groups and organisations to advance rural interests. It has particularly close links with consumer groups, countryside and wildlife bodies, animal welfare organisations and academics.

Contact the NFU by telephone 0207 3317200 or consult http://www.nfu.org.uk

Other sources of information

Action Energy

Action Energy provides advice to all businesses and public sector organisations, to help them save money by improving their energy efficiency.
More information is available from http://www.actionenergy.org.uk

Country Landowners and Business Association (CLA)

The CLA represents and supports business in rural communities. Its members represent the breadth of the rural economy of England and Wales. The CLA can provide information and advice on all areas of water use, including water abstraction and irrigation, general on-farm water use, reservoirs, ponds and lakes. For more information consult http://www.cla.org.uk or telephone 020 7235 0511

Farming and Wildlife Advisory Group (FWAG)

FWAG provides farmers and landowners with practical advice to support wildlife, landscape, archaeology, access and other conservation issues. For more information consult http://www.fwag.org.uk

Farming Connect

Farming Connect was set up by the National Assembly for Wales to provide farming businesses with the opportunity, information and expertise to help them make informed decisions about the future of their business. For more information telephone 0845 6000813.

Farm Energy Centre (FEC)

The FEC provides advice to farmers on all issues concerning energy conservation. For more information consult http://www.farmenergy.com or telephone 02476 696512.

Local water company

Your local water company may be able to help you with water efficiency issues. See your water bill or Yellow Pages for contact details.

National Farmers' Union of Scotland (NFUS)

The NFUS promotes and protects the interests of the Scottish farming industry. It influences Government in Scotland, Whitehall and Brussels, and it assists its members to meet the needs of their customers, consumers and the environment.

For more information consult http://www.nfus.org.uk or telephone 0131 4724000

Scottish Environment Protection Agency (SEPA)

For water resources issues in Scotland, please contact SEPA, which is responsible for the protection of the environment in Scotland. For more information consult http://www.sepa.org.uk or telephone 01786 457700

Ulster Farmers' Union (UFU)

The UFU is the democratic voluntary organisation representing farmers and growers in Northern Ireland. It's central objective is to promote their interests both at home and abroad through professional lobbying. For more information consult http://www.ufuni.org or telephone 028 90 370222.

UK Irrigation Association (UKIA)

UKIA provides up-to-date information on irrigation to its members and has been a voice supporting irrigation since its inauguration following the droughts in the mid 1970s. UKIA is not a trade association; it runs for the benefit of its individual members and promotes all aspects of irrigation by providing information and helping to raise standards of knowledge and competence in irrigation design, installation and management. For more information consult http://www.ukia.org or email Melvyn Kay, the Executive Secretary, at m.kay@ukia.org

Water Regulations Advisory Scheme (WRAS)

The WRAS provides information on the Water Supply (Water Fittings) Regulations 1999 which regulates how to alter or fit water related equipment. They have produced guidance specifically for farmers consult http://www.wras.co.uk or telephone 01495 248454.

Water Service Northern Ireland

For water resources issues in Northern Ireland, please contact Water Service Northern Ireland who are responsible for delivering water and sewerage services. For more information consult http://www.waterni.gov.uk

Form 1 | Water supply and cost

		Annual quantity (m^3)					
		Quarter 1	Quarter 2	Quarter 3	Quarter 4	Total	Annual cost
Metered	Mains supply water						
	Abstraction - surface water						
	Abstraction - groundwater						
Total metered							
Unmetered	Stored rainwater (e.g. storage tank) - see page 13						
	Other sources (e.g. water drunk by animals directly from farm ditches						
	Recycled water (e.g. vegetable wash water for irrigation) - see page 15						
Total unmetered							
Other	Dirty water disposal						
	Staff costs (operation and maintenance)						
	Other (e.g. capital costs)						
Total other							
	Total annual quantity						

Item	Number (A)	Location	Flow rate (litres/minute) (B)	Operating time (minutes/day) (C)	Water used (litres/day) = A x B x C	Source	Comments
Taps	4	Yard	4 litres/minute	30 minutes	480 litres/day	Mains	Left running during machinery washing - fit cut-off valves
Spray irrigation guns	2	In fields as required	50 litres/minute	4 hours a day = 240 minutes	24,000 litres/day	Mains	Used for about 20 days a year = 480m³ per year
				Total			

Form 2b | Water-use inventory - stock

Animal	Number (A)	Location	Activity	Use per animal per day (see Table 1) (B)	Water used (litres/day) = A x B	Source	Comments
Cows (in milk)	150	Dairy	Drinking	70	10,500 litres/day	Mains	Store plate cooling water for drinking?
				Total			

Table 1 | Livestock watering requirements

Farm enterprise	Animal	Age/cycle per animal	Purpose	Litres/day/animal
Indoor housed pigs[1]	Weaners	5 - 20 kg	Drinking	0.9 - 3
	Growers	15 - 40 kg	Drinking	2.7 - 5
	Finishers	40 - 100 kg	Drinking	4 - 7
	Dry sows and boars		Drinking	6
	Farrowing sow and litter	Per farrowing place (all animals)	Drinking	9 - 35
	Spray cooling	Summer months only	Cooling	1 - 2.5
	All		Cleaning pens after each batch	16 - 24
Outdoor housed pigs[2]	All		Wallowing	Add 50% to the drinking figures for indoor housed pig unit
Indoor housed poultry[2]	Poultry (chickens and ducks)	Layers	Drinking	0.2 - 0.3
	Poultry (chickens and ducks)	Fattening	Drinking	0.13
	Turkeys	Fattening	Drinking	0.55 - 0.75
	All	Cleaning after each batch	Non-power hose Pressure washer	14 - 22 27 - 45
Dairy[2]	Cow	In milk (producing 22 litres milk/day)	Drinking	70
	Cow	Dry	Drinking	35
	Calf	Up to 6 months	Drinking	15 - 25
	All		Milk cooling	3 times milk yield
	All		Cleaning parlour	20 - 50
	All		Washing down - non-power hose	14 - 22
	All		Washing down - pressure washer	27 - 45
Beef[2]	Calf	Up to 6 months	Drinking	15 - 25
	Steer/bullock	Fattening	Drinking	25 - 45
Sheep[2]	All		Drinking	2.5 - 2.9
	All		Dipping	2.5
Humans[3]		All household uses	Average	149 litres/person/day

[1]Data from Farm Energy & Control Services Ltd 'diacam' system. Private communications August 2002.

[2]Data from *Optimum Use of Water for Industry and Agriculture Best Practice Manual*, R&D Technical Report W254, Environment Agency, 2000.

[3]Data from *Leakage and the Efficient Use of Water, 2000-2001 report,* Ofwat.

Table 2 | Conversion factors

Metric	Other units	Imperial
Length		
1 centimetre (cm)	10 millimetres (mm)	0.39 inch (in)
1 metre (m)	100 cm	1.09 yards
1 kilometre (km)	1,000 m	0.62 mile
0.03 m	2.54 cm	1 in
0.91 m	91.44 cm	1 yard
1.61 km	1,609 m	1 mile
Area		
1 square centimetre (cm^2)	100 square millimetres (mm^2)	0.16 square inch (in^2)
1 square metre (m^2)	10,000 cm^2	1,500 in^2
1 m^2	1.20 square yards ($yards^2$)	10.76 square feet ($feet^2$)
1 square kilometre (km^2)	100 hectares (ha)	247.11 acres
6.45 cm^2		1 in^2
0.84 m^2	9 $feet^2$	1 $yard^2$
0.004 km^2	4046.86 m^2	1 acre
Pressure		
1,000 millimetre water (mm H_2O)	1 metre H_2O	1.42 psi
Volume		
1 cubic centimetre (cm^3)	0.000001 cubic metres (m^3)	0.06 cubic inch (in^3)
1 cubic metre (m^3)	1,000 litres (l)	35.32 cubic feet ($feet^3$)
1 m^3		1.31 cubic yards ($yards^3$)
1 cubic decametre (dm^3)	1 l	0.22 gallon
1 millimetre per hectare (mm ha)	10 m^3	2,199.69 gallons
16.39 cm^3	0.02 l	1 in^3
0.03 m^3	0.04 $yards^3$	1 $foot^3$
0.77 m^3	168.18 gallons	1 $yard^3$
4.55 l	8 pints	1 gallon
0.57 l	20 fluid ounces (fl oz)	1 pint
Weight		
1 gram (g)	1,000 milligrams (mg)	0.04 ounce (oz)
1 kilogram (kg)	1,000 g	2.2 pounds (lb)
1 tonne (t)	1,000 kg	0.98 ton
1 cubic metre (m^3) water	1 t	
28.35 g		1 oz
0.45 kg	16 oz	1 lb
1.016 t	20 hundredweight (cwt)	1 ton

Table 3 | Example Waterwise Action Plan

Waterwise Action Plan
Raise awareness
– Involve everyone, including family and staff.
– Hold meetings at least once a year with all members of staff to discuss the use and management of water around the farm, and identify with them opportunities for improvement.
– Make sure staff are aware of the importance of using dry-cleaning techniques - such as brush, scraper and squeegee - before washing down solid waste, soil etc.
– Make sure that all new members of staff and contractors are aware of the approach to water-use on the farm.
Routine maintenance checks
– During field walking/stock checking, check all taps and water troughs in the farmyard and in outlying fields.
– Once a quarter, check all hoses and trigger nozzles to identify blockages and wear and tear.
– Once a quarter, check pressure washers against the manufacturer's recommended operating instructions.
– Before winter, check all pipes and troughs. Drain those not in use and lag pipes as appropriate.
Phased programme to implement improvements
– Fit trigger-operated nozzles to all hosepipes by the end of quarter two.
– Fit shut-off values to all taps in the farmyard by the end of quarter three.
– Get quotes for fitting pipework to divert rain from barn roof to storage tank.
Monitoring programme
– Carry out weekly water meter readings to identify fluctuations in water-use and identify leaks.
– Review progress against the benchmark each quarter.

Notes

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