PINPOINT
Rivers Trusts and Farmers tackling water pollution

Best Practice Information Sheet

A clear solution for farmers
CATCHMENT SENSITIVE FARMING

A joint project between the Environment Agency and Natural England, funded by Defra and the Rural Development Programme for England, working in priority catchments within England.

Water Management

Sheet 46.0a

Introduction

Why change?

Whatever its source, water is a substantial cost to any farming business. It is essential for drinking, washing, cooling and crop irrigation. Wise water management can help you to sustain productivity, save money and protect the environment by:

- reducing the costs of supplies
- making effective use of water
- reducing wastage and leaks
- recycling water
- reducing dirty water disposal.

Steps to success

1. **Understand the water use on your farm** including the sources, quantities, seasonality, losses and charges. Aim to protect your future productivity by minimising water input and dirty water disposal costs by:

    - **Reviewing your existing and potential future use of water for irrigation** and checking that you are delivering the correct quantities where and when you want it without damage to the soil, crops or the environment

    - **Reducing water loss** from leaks, inefficient drinkers or delivery systems, and protecting pipes from frost damage by monitoring water use and checking water facilities as a routine part of farm operations

    - **Recycling water** by identifying what sources are available, such as irrigation runoff, cooling water, rainwater or washings, and the purpose for which it could be recycled, e.g. milk cooling water used for parlour washing and stock drinking in winter

    - **Reviewing clean water separation** procedures to ensure rainwater does not run to dirty water systems and add to disposal costs, as well as identifying potential recycling uses

    - **Considering alternative water supplies** including surface or groundwater, roof and yard runoff for some purposes - rather than mains supplies - to reduce costs and increase flexibility, security and future growth potential

2. **Map the existing water supplies on the farm** and identify potential opportunities to reduce costs, improve efficiency, and protect and enhance your supplies for the future.

3. **Develop a simple, practical long-term water management plan** to progressively implement the opportunities you have identified on a priority basis by taking account of:
    - cost savings against any outlay
    - the payback period
    - the importance to long term productivity
    - reduced risks to the environment, e.g. less water pollution risk from dirty water.

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Practical examples

Reducing mains water costs
Large areas of the country have high winter rainfall averaging 1000-1300 mm, much more in some areas, just when stock are indoors. Each square metre (m²) of roof will provide 1-1.3 cubic metres (220 galls) worth approximately £1.17/m³ (Defra, 2011) depending on where you live.

Based on experience from the Tamar catchment a 200 cow herd housed from November to Easter has average water requirements of some 70 litres/cow/day, a total of 98 m³ per week/5096 m³ per year. For mains water at £1.17 per m³ the annual cost would be £5962. If saving roof water, the cost of providing pumps and plumbing would be about £2000, with a further £3000 if a tank is needed, giving a total of £5000.

The saving will be much larger if all clean roof water is not already diverted from the dirty water systems where it will otherwise increase the cost of waste disposal. How much benefit you will gain by recycling roof water will depend on local circumstances and particularly whether there is existing storage, i.e. a tank, pond or reservoir, whether a pump is needed and the extent of plumbing, and treatment required.

Dairy farm
In this actual example, a dairy farm with 120 cows has 1500m² of open yard area and silos. The parlour is washed down with a pressure hose. Some roof water also mixes with the dirty water and drains into the collection system of a low rate travelling irrigator.

A review of the sources of dirty water found that repairing gutters and downspouts, diverting some clean yard water, and careful use of the pressure hose could reduce the quantity of dirty water by 1000m³ (37%).

Savings resulted from the reduced costs of water, electricity and labour, as well as wear and tear on the irrigation system.

The total saving was estimated at £700/year. In addition, the risk of water pollution was significantly reduced.

Remember

- Water use can often be reduced by simple and cost-effective changes.
- Changes to use of existing water sources or new supplies may need an abstraction licence, so consult the EA.
- Your local water company may advise on mains water use.
- Raise awareness with all concerned of the need to conserve water, and routinely check for leaks and losses.

For further information: Defra (www.defra.gov.uk), CSF (www.gov.uk/catchment-sensitive-farming), Natural England (www.naturalengland.org.uk/csf), Environment Agency (www.environment-agency.gov.uk), Cross Compliance Helpline 0845 345 1302 (www.crosscompliance.org.uk) and The Rivers Trust (www.theriverstrust.org)

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Water Management

Sheet 47.0a

Irrigating crops

Why change?

In some parts of the country there are already restrictions on the availability of surface and groundwater. Reviewing water use can help ensure supplies in the longer term. Using irrigation water wisely:

- reduces costs
- improves crop production
- protects soils
- protects the environment
- helps to safeguard future supplies.

Water is an extremely valuable asset

Steps to success

1. **Review the current situation** by undertaking an irrigation water use audit - preferably with an agronomist - to check your whole system for waste and to decide if there is sufficient water to meet crop requirements. Use water consumption levels in recent years as a guideline.

2. **Identify potential opportunities** by:

- Checking the availability of alternative surface and groundwater supplies to meet existing needs
- Considering use of roof and recycled water, e.g., vegetable wash after treatment and settlement
- Deciding on potential improvements, e.g., to the delivery system and pump/pipe size, in order to reduce losses by leakage or evaporation from storage
- Reviewing future needs to ensure water supply is not a limiting factor for your business.

3. **Calculate the cost-benefit of these opportunities** by determining the most cost-effective water sources available for different purposes. Determine the costs of irrigation and compare with crop margins. Consider the cost-benefit of identified improvements, e.g., trickle irrigation or booms, by comparing with the savings from reduced water use. Identify payback periods.

4. **Prioritise** the opportunities by deciding which of the most cost-effective actions also help to protect soils and the environment. Some options may require permission to change abstraction conditions so remember to consult the EA. If mains water is involved your local water provider may also provide help.

5. **Implement the action plan** introducing first the most cost-effective of the identified improvements. Raise awareness of water costs with staff and ensure regular checks for leakage in the delivery system. Programme applications using irrigation scheduling to assess the soil water deficit and hence crop needs.

   Use the optimum time to apply water, e.g., night time applications reduce evaporation. Ensure rates or droplets do not seal the soil surface and result in accelerated runoff and erosion. This can damage crops (greening of potatoes), cause loss of valuable soils and nutrients and result in water pollution. Use techniques such as tied ridges, e.g., in potato crops to retain water and reduce soil erosion.

6. **Monitor progress** by checking applications to ensure accuracy and uniformity of delivery.

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Water Management

Sheet 47.0b

Irrigating crops
Practical examples

Potato crop

In a potato crop, which traditionally shows the best economic response to irrigation, an old style hosereel irrigator was identified as wasting water at the headland. Water losses also occurred from runoff and erosion resulting from poor uniformity of application and large rain gun droplet size.

A turbine irrigator with speed regulation avoids water loss and improves uniformity of application. Before crop canopy cover, a boom with sprinklers was used to improve distribution and reduce erosion. Costs were reduced by saving water and decreasing greening, which improved the potato crop quality.

Improving irrigation management and equipment can reduce water consumption by 10% for overhead irrigators, and 20-30% for trickle systems. The savings and potential benefits to crops and soils can be used to further reduce the payback period for changes.

Nursery irrigation losses

Nursery growing one million container plants a year initially missed the opportunity to reduce costs and increase business growth, due to the limited availability of water supplies. At the time, all irrigation runoff from container standing beds (15 acres) and building roofs (5 acres) ran to waste.

After a careful review, a water harvesting system was developed which transferred the drainage water by pipe to a six million gallon reservoir. It is then reused for irrigation. A system for measuring water needs now automatically irrigates the plants.

The two systems have allowed expansion from 5 to 20 acres whilst maintaining the level of water usage; 84% now comes from harvested sources. This has saved the equivalent of £34,740/year in mains water costs (Defra, 2011 prices approximately £1.17/m³ depending on your location). Payback on the recycling system is expected to be 4 -5 years.

Remember

- Water is a valuable commodity and is likely to become increasingly scarce and costly – the less that is wasted the more you will benefit.
- Changes in water management such as abstractions may require licence variations so consult the EA.
- Some water companies provide free advice to business customers.

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Water Management

Sheet 48.0a

Reducing Water Loss

Why change?

Since water is an expensive input to your business, it is advisable to monitor your use periodically and check for waste and leaks. Taking action could make worthwhile savings by:

- Reducing mains water costs
- Reducing the quantity of dirty water produced and hence disposal costs
- Helping to protect vulnerable and precious water resources
- Reducing the risk of pollution.

Steps to success

1. **Review the current situation** by continually monitoring your overall use. Do this by checking the water meter and your bills for any trends and then compare with national or other average water use patterns. Also check for wastage by inspecting all water systems for leaks. Periodically check meters for leaks in the system when no water is being used in the early morning or late at night, or install electronic leak monitors.

2. **Identify potential opportunities** arising from:
   - inefficient stock drinkers
   - leaks from water troughs
   - leaks from pipelines
   - potential leaks, e.g. pipes which could freeze and should be lagged or drained over winter.

3. **Calculate the cost-benefit of these opportunities** by estimating the cost of the necessary work, e.g. replacing washers, provision and fitting of new drinkers, provision of leak monitoring equipment, lagging and isolation valves. Consider the cost-benefit of identified improvements by comparing with the savings from reduced water use (mains approximately £1.17/m^3 Defra, 2011, depending on where you live). Identify payback periods.

4. **Implement the action plan** taking care to raise the awareness of all concerned of the need to check for leaks and:
   - check all equipment including taps, troughs, hoses and pipelines for leaks, e.g. wet areas or water issuing from leaks in pipes, as part of routine farm work
   - repair or replace damaged or inefficient equipment, e.g. consider a five year washer replacement policy - a dripping tap or overflow can waste as much as 4 to 90 litres a day costing £1.70 - £38.43 a year (£1.17/m^3 Defra, 2011).
   - minimise costs by reducing waste and improving the effectiveness of equipment, e.g. drinkers
   - check above ground pipes and equipment to ensure they are frost proof
   - consider isolation valves on the distribution system and drain when not in use during the winter months.

5. **Monitor** progress by reviewing water use and the savings in water costs to ensure payback is achieved. Ensure a careful watch is kept on your mains water pipeline because you will be responsible (in most cases) for any leaks onto public highways.

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Water Management

Sheet 48.0b

Reducing Water Loss
Practical examples

Livestock farm leaks
By tackling a surface water pipe leak of 50 litres/hour that drained to a slurry storage system, as well as a mains leak of 1m^3/hour (for 3 months) that soaked away, a farmer significantly reduced costs. Leak detection and repairs by the farmer totalled £7/hour.

The average contractor costs £100/leak, in addition to commercial leak detection at approximately £130/day. The surface water leak of 50 litres/hour is 438m³/year = £512 per year at £1.17/m³. Spreading this volume with slurry @ £1.80/m³ = £775, giving a sum of £1287/year for the surface water leak.
Over 3 months the mains water leak cost £2562. Sorting both out saved £3850, and resulted in a payback in under a year.

It is worth ensuring the farmhouse water supply system is secure on the same basis.

Reducing use for dairy cows
Overuse can be controlled to ensure that it is at or less than the typical rate of use of 35 -70 litres/cow/day. Using a 100 cow herd as an example the reduction of only 1 litre/cow/day of wash water would reduce the volume by:

$$\frac{1 \times 100 \times 365}{1000} = 36.5 \text{ m}^3\text{/year}$$

This could reduce the cost of the mains water (£1.17/m^3) by £34, with the cost of storage of dirty water and spreading to land of over £100/year.

Leaking drinkers for pigs
In a pig unit, an increase in water wastage by as little as 10% could cost £1.50/pig place annually. Some drinkers generate wastage of up to 50% so the potential savings can be substantial.

Water leaks cost money, damage soils and can affect stock health. A leak of 1 litre a minute costs over £600 a year and in terms of water consumption can be equivalent to increasing the dairy herd by 25

Remember

- To monitor the use and losses from the water system on a regular basis since responsibility and financial liability for pipeline leaks on the farm are likely to be yours.
- Water is a valuable commodity - the less that is wasted the more you will benefit.
- A drip a second can cost over £10 a year.

For further information: Defra (www.defra.gov.uk), CSF (www.gov.uk/catchment-sensitive-farming), Natural England (www.naturalengland.org.uk/csf), Environment Agency (www.environment-agency.gov.uk), Cross Compliance Helpline 0845 345 1302 (www.crosscompliance.org.uk) and The Rivers Trust (www.theriverstrust.org)

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Water Management

Sheet 49.0a

Recycling Water

Why change?

Many farmers have made large reductions in the cost of their water supply and disposal of wastewater by recycling some of the water that occurs on the farm. These benefits result from identifying the water quality needed for all operations and recycling water to meet the needs of different uses which:

- Reduces costs
- Protects supplies from overuse
- May allow for expansion of operations.

Steps to success

1. **Review the current situation** by identifying all the uses of water on the farm such as stock drinking, washing, and irrigation, and then estimate the quality, e.g. mains, and quantities needed for each purpose.

2. **Identify potential opportunities** by ascertaining if there is water of a quality that could be recycled for other purposes, for example:

- Irrigation runoff
- Cooling water
- Rainwater
- Vegetable washings
- Clean yard runoff

Avoid unnecessary contamination of water supplies in supply, storage or after initial use by avoiding back siphoning, and protecting ground and surface water sources during farm operations.
Consider if the development of your business is restricted by the lack or cost of water, and decide if recycled water would make expansion possible. Identify if any treatment such as settlement or slow sand filtration is necessary before reuse becomes feasible.

- **Calculate the cost-benefit of these opportunities** by establishing the costs of recycling water such as collection, transfer and treatment. Compare costs with the potential savings such as reduced use of mains quality water (approximately £1.17/m³ Defra, 2011 depending on where you live), a reduction in waste water disposal costs (low rate irrigation £1.50/m³), and reduced energy and labour costs. Identify the payback period.

- **Implement the action plan** taking care to raise awareness of water costs with staff and ensure regular checks for any leakage in the delivery system. Introduce the improvements that are most cost-effective and help protect water resources and the wider environment.

- **Monitor progress** with the recycling of water supplies to ensure that benefits associated with costs, crop yields and quality are realised.

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Water Management

Sheet 49.0b

Recycling Water
Practical examples

Using your roof water
Are there uses such as yard/equipment washing or stock drinking for which roof water could replace mains water? If so, what volume of water storage, e.g. tank/reservoir, exists in m^3 (220 galls)? What area (m^2) of roof could be diverted to storage? What is the average rainfall for the area (m)?

Roof area (m^2)	x	Average rainfall	x	Savings in mains water (£1.17/m^3)	=	Potential savings (£ per annum)
	x		x	£1.17	=	

Dairy farm cooling water
A farm recycles the water used for cooling 225,000 litres of milk (typically 3 x milk yield = 675 m³) produced each year. Instead of discarding the warm water from the plate cooler as it leaves the heat exchanger, it is collected and reused to clean the milking parlour. In winter this warm water is given to the cows to drink instead, thereby saving on additional storage, handling and mains costs.

This is your potential gross annual saving. This does not take account of evaporation from the roof, which may be 10% - 25%, the capacity of your filter or the cost of storage. Since the cost and solutions are site-specific, it is essential when calculating cost-effectiveness to use your actual estimates.

Remember

- Water is a valuable commodity and is likely to become increasingly scarce and costly - the less that is wasted the more you will benefit.
- Changes in management such as abstractions may require licence variations so consult the EA.
- Some water companies provide free advice to business customers.

For further information: Defra (www.defra.gov.uk), CSF (www.gov.uk/catchment-sensitive-farming), Natural England (www.naturalengland.org.uk/csf), Environment Agency (www.environment-agency.gov.uk), Cross Compliance Helpline 0845 345 1302 (www.crosscompliance.org.uk) and The Rivers Trust (www.theriverstrust.org)

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Water Management

Sheet 50.0a

Clean Water Separation

Why change?

Farmers have found that diverting clean water and recycling it for specific purposes can provide significant benefits by:

- Lowering costs
- Reducing the volume of dirty water which otherwise arises in the farm yard
- Allowing reuse of clean water for other purposes
- Reducing the risk of water pollution of which dirty water is a common source.

Steps to success

1. **Review the current situation** by identifying all the sources and pathways of clean water on the farm arising from roofs, clean yards, land adjacent to the yards, tracks and access roads. It is best to do this during a period of wet weather.

2. **Identify potential opportunities** such as guttering and downspouts, which need fitting or repairs, and drains or ditches. Consider whether keeping additional working areas clean or roofing them to exclude rain would reduce dirty water production. Take into account whether roofing any manure storage would be possible.

3. **Calculate the cost-benefit of these opportunities** by:

- Identifying the cost-benefit of redirecting clean water from the sources you have identified
- Establishing if the clean water is of a quality that could be employed directly for other purposes including irrigation and washing yards
- Comparing costs with the potential savings such as reduced costs of disposal of waste water (low rate irrigation approximately £1.50/m^3), reduced energy and labour costs, and take account of any reduction in mains water costs that recycling water provides
- Identifying the payback period and developing an action plan, based on those opportunities that is cost-effective and helps to protect water resources and the environment.

4. **Implement the action plan** taking care to ensure that:

- Guttering and downspouts are repaired or fitted, and clean water yard drains are enclosed
- Fields, tracks and access roads drain separately to a ditch, stream or storage
- All clean water is drained away from dirty yards, manure storage and stock gathering areas
- Avoid unnecessary contamination of water supplies in supply, storage or after initial use by avoiding back siphoning and protecting ground and surface water sources during farm operations.

5. **Monitor** progress by raising awareness of all those concerned of the benefits of keeping clean water separate, and ensure checks are made as part of routine work.

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Water Management

Sheet 50.0b

Clean Water Separation
Practical examples

Dairy farm
A dairy farm with 120 cows has 1500m² of open yard area and silos. The parlour is washed down with a pressure hose. Some roof water also mixes with the dirty water and drains into the collection system of a low rate travelling irrigator.

A review of dirty water sources found that repairing gutters and downspouts, diverting some clean yard water, and careful use of the pressure hose could reduce the quantity of dirty water by 1000m³ (37%).

Savings resulted from reduced costs of water, electricity, labour, as well as the wear and tear on the irrigation system. The total saving was estimated as £700/year and the risk of water pollution was significantly reduced.

Consider reducing stock gathering areas or roofing them

Hill farm
A hill farm with an annual rainfall of 1200mm on a roof of 600m² produced 720m³ (160,000 galls) of clean water that drained into dirty water and slurry systems.

The cost of diverting this water included renewing 30m of guttering and two downspouts @ £7.17/m = £215, 30m of clean water drainage @ £5/m = £150; a total of £565 using farm labour.

Half the total (360m³) had been mixed with dirty water and was irrigated to land @ £0.5/m³. Diverting the water saved £180/year. A similar quantity had been collected in the slurry system and spread to land @ £1.80/m³. Diverting this water saved £648/year.

The total saving was £828/year with a payback of less than one year. Since the cost and solutions are site-specific, it is essential when calculating cost-effectiveness to use your actual costs and not to rely on the examples illustrated above.

Remember

- In many cases dealing with causes such as roof water is relatively inexpensive and can provide a rapid payback period for the costs incurred.
- Keeping clean water out of dirty water storage helps reduce storage pressure and the risk of causing water pollution. You may be able to make further savings by using the clean water from roofs for purposes such as washing yards.

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