

Protecting water from agricultural run-off: buffer strips

A buffer strip is an area of land maintained in permanent vegetation that may be used to protect existing features including hedgerows, trees and archaeology, as well as water bodies. Buffer strips contribute to the mosaic and connectivity of habitats in the wider landscape and can develop into valuable wildlife habitats in their own right. The aim of this note is to advise Environmental Stewardship (ES) applicants and agreement holders on how to create and manage buffer strips to protect water bodies. It also advises on the ES options that are available to help fund these. See also TIN098 *Protecting water from agricultural run-off: an introduction* and TIN099 *Protecting water from agricultural run-off: water retention measures*.

Why are buffer strips important?

Surface water run-off from fields is likely to contain pollutants such as sediment, nutrients, bacteria and pesticides. If these enter a water body they can reduce water quality and be harmful to aquatic life. Creating a network of grass strips next to watercourses and ditches, known as riparian buffer strips, can provide a physical barrier that helps restrict the flow of pollutants and prevent them from being washed from the field into the watercourse.

In the Entry Level Stewardship (ELS) handbook watercourses are defined as a lake, pond, river, stream, canal, leat or ditch, which regularly contains standing or running water. There are three ELS options for riparian buffer strips and two specifically for in-field ponds:

- O/EE9 - 6 m buffer strips on cultivated land next to a watercourse;
- O/EE10 - 6 m buffer strips on grassland land next to a watercourse;



Photo 1 Soil erosion running on to a buffer strip

- O/EJ9 - 12 m buffer strips for watercourses on cultivated land;
- O/EE7 - Buffering in-field ponds in improved grassland; and
- O/EE8 - Buffering in-field ponds in arable land.

These options all contribute towards the Campaign for the Farmed Environment.

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What is the best width for a buffer strip?

Generally speaking, the wider the buffer the better the protection for the water body. Current evidence shows that 6 m is the minimum effective width. Note this is in addition to the 1 m – 2 m cross compliance protection zone required under Good Agricultural and Environmental Condition 14, *The protection of hedgerows and watercourses*.

Therefore, in most cases a 6 m buffer plus the cross-compliance protection zone should give significant environmental benefits with the minimum amount of land taken out of agricultural production. However, in some circumstances wider strips will be necessary.

Where should I put buffer strips?

Considering the options

There are three main ways of preventing pollutants entering water courses. These are:

- **Preventing the source of pollution**
ie trying to prevent surface run-off in the first instance, for example by ensuring good soil management and using winter cover crops.
- **Slowing the pathway of contaminated water**
ie reducing the flow of water so that pollution does not reach watercourses. For example through the introduction of in-field grass areas.
- **Protect the watercourse**
This is the last line of defence and includes establishing buffer strips beside watercourses.

It is best to try to prevent erosion and run-off at source in the first instance before deciding where to establish your buffer strips.

Many of the steps to tackle the source of erosion and run-off will be part of good practice and if you are a Single Payment Scheme claimant they should be recorded in your *Soil Protection Review*. These steps can be as simple as preventing poaching and can include ELS options such as EJ13 *Winter cover crops*.

Where tackling the source of pollution is not enough, you should consider putting in place

options to slow the pathways of erosion and runoff. These include grassing valley bottoms or field corners where run-off collects. For further information see TIN099 on water retention measures.

On steeply sloping fields or vulnerable soils the source and pathway control options may not be enough and buffer strips should also be used.

The three different ways to prevent pollution should be designed to work in conjunction with one another and you should also consider other potential benefits they may provide, such as protecting and connecting existing habitats and providing new habitats for farmland birds and other wildlife.

Where does surface water runoff occur?

You should assess the risk of pollution from run-off across the farm, and record it in your *Soil Protection Review*. Your own knowledge of the land, especially knowing where the water flow is heaviest, is the best way of identifying where riparian buffer strips will be most useful.

It is important to know where water flows through fields and ponds before entering watercourses and which ditches silt up most frequently. This will be most obvious after periods of extreme rainfall.

What types of watercourses are best suited for buffer strips?

Buffer strips should be used to protect springs, headwater streams, ditches, streams, brooks, temporary watercourses as well as ponds and lakes.

In general surface water collects in the smaller watercourses and then flows into larger rivers. Therefore the buffers alongside these smaller waterways will also improve the water quality of larger rivers and channels. Headwater streams are also important wildlife habitats and provide nurseries for the majority of our juvenile fish. The quality of these habitats is therefore fundamental to the fisheries of our larger streams and rivers.

Temporary watercourses (for example, ditches and streams that are not permanently wet, but regularly contain standing or flowing water) will also benefit from the use of buffer strips.

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Photo 2 A buffer strip beside a winter-flowing ditch

Roads and tracks that act as temporary watercourses during high rainfall may also require a buffer strip. Track placement, surface management and drainage should also be considered when trying to reduce run-off.

Land with outdoor pigs has the potential to become poached and damaged and this can lead to increased run-off and soil erosion problems. Buffer strips should be used to protect a watercourse near outdoor pigs and to help prevent soil and nutrient loss into the water.

For buffer strips beside temporary watercourses and other non permanent watercourses you should use ELS options EE3 and EE6 which relate to general buffer strips, not EE9 and EE10, which specifically relate to buffer strips beside permanent watercourses.

Buffer strips are not restricted to headwaters, they can also help to protect and maintain good water quality in larger rivers.

How does my soil type affect the location of buffer strips?

Riparian buffers are best suited to assisting the control of run-off on sandy and light silty soils, medium and chalk and limestone soils.

What if I have heavy or peaty soil?

Buffer strips are often less effective for these soil types. The small soil particles tend to flow with the water over the surface of the buffer strips into watercourses, or under the buffer strip through drains. If you have heavy soils you should consider, in addition to buffer strips, alternative management options from your *Soil Protection Review*.

Do I still need buffer strips if the land is already well drained?

If run-off occurs when soils are saturated on under-drained land, even where the majority of the water will by-pass the buffer strip, installing buffer strips should still be considered as it will still reduce the amount of sediment entering water courses.

On what gradient of slope are buffer strips most effective?

Buffer strips beside watercourses should be established where field slopes next to the watercourse range from:

- 2° – 11° on sandy and light silty soils; and
- 2° – 7° on medium and chalk and limestone soils.

What if I have a steep sloping field?

If slopes next to the watercourse are steep (more than 7° on medium, chalk and limestone soils and more than 11° on sandy and light silty soils) water runs more quickly over the surface of the land, bringing with it soil, nutrients and pesticides. A 6 metre vegetated buffer strip is unlikely to have the capacity to slow down or filter pollutants or catch the sediment. The wider *EJ9 12 m buffer strips for watercourses on cultivated land* should be used in conjunction with alternative management options as identified in your *Soil Protection Review*.

Higher Level Stewardship (HLS) also has the potential to pay you to take these high risk fields

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out of intensive productivity through arable reversion options.

How do I measure slopes?

To measure the slope of your land you can:

- View slope information about your holding online using the Whole Farm Approach.
- Seek advice from your local Catchment Sensitive Farming (CSF) Officer (if you are in a CSF Priority Catchment) or farm adviser. You can find out if you are in a CSF Priority catchment by using the website in the *Further Information* section.
- Use a clinometer or other technique to estimate the slope of your land yourself.

What if the landscape of my fields is complex?

Smaller “dry valley” depressions that feed into a watercourse can generate considerable water flow at times of high rainfall and these can overwhelm riparian buffers. In these situations, it’s worth considering one of the following:

- A buffer strip in the base of the dry valley (which is often saturated land and may be difficult to farm).
- Widening the buffer strip where the dry valley meets the water course.
- Strategic placement of ELS option EJ5 *In-field grass areas to prevent soil erosion and run-off*, particularly where water flow intensity has traditionally concentrated in the field.

Deciding what to do in these complex situations will often be quite difficult and it’s worth talking this through with your local farm adviser or if you are in a CSF area, your local CSF officer.

How do I establish buffer strips?

Establish a dense grassy buffer strip either by natural regeneration or sowing. Sowing is generally best for quicker establishment. The vegetation on a dense grassy buffer strips will provide help intercept surface run-off all year round. There is an increased risk of erosion risk during establishment, when the soil is bare, where the risk is high it can be reduced by using

a temporary protection for example by mulching or by laying a geotextile.



Photo 3 Establishing a new buffer strip

Over time sediment will accumulate within the buffer strip, but if the grass is not smothered the vegetation growth will root into this silt and incorporate it into the soil.

The choice of grass species should be tailored to the soil type and cutting regime. If wild flowers are to be included in the sward the grass mixture should not be too vigorous. As a guide the following species will grow in most conditions and can form part of a basic grass seed mixture although cocksfoot and timothy should be used with care as they are tussocky and vigorous and can become dominant:

- timothy *Phleum pratensis*;
- cocksfoot *Dactylis glomerata*;
- crested dogstail *Cynosurus cristatus*;
- red fescue *Festuca rubra rubra*; and
- smooth stalked meadow grass *Poa pratensis*.

The environmental benefit of these buffer strips can be increased by adding wild flowers, but these need to be fairly robust species, for example:

- ox-eye daisy *Leucanthemum vulgare*;
- black knapweed *Centaurea nigra*;
- bird’s-foot-trefoil *Lotus corniculatus*; and
- common sorrel *Rumex acetosa*.

For the flowers to survive in the long term the sward will have to be managed appropriately and this may not be compatible with managing the sward to capture soil run-off. Also on fertile sites the grass growth may out-compete even robust wild flower species.

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When preparing the seedbed for the buffer strip remove any compaction from the topsoil and remove any rills or gullies. Sub-soiling to a depth of 30 cm will help improve percolation, but this should not be done where archaeological features are present as these can be damaged by sub-soiling and soil moving.

If you have an ELS agreement the archaeological features should be marked on your Farm Environment Record/Environmental Information Map.

Avoid using heavy equipment during seeding, especially near the top of the stream bank as this could collapse the bank. Heavy equipment can also cause soil compaction under the buffer strip and this will reduce its ability to absorb water. To reduce the risk of soil compaction avoid sowing when conditions are too wet.

How do I manage buffer strips?



Photo 4 Ideal sward structure for water percolation

Regular cutting 2-3 times in the first 12-24 months is likely to be needed to control annual weeds and encourage grasses to tiller. This is permitted under GAEC 12 if you are establishing a buffer strip. To avoid soil compaction do not mow when the conditions are wet.

After the grass has become established cut the 3 m beside to the crop edge annually after mid-July. Only cut the remaining 3 m and the 1-2 m cross compliance protection zone to control woody growth, and no more than once every 2 years.

Apply herbicides by spot-treating or weed-wiping to control injurious weeds ie:

- creeping and spear thistles;
- curled and broadleaved docks;
- common ragwort; and invasive alien species, for example:
- Himalayan balsam;
- rhododendron; and
- Japanese knotweed.

Things to avoid

- Try not to compact or poach the buffer strip as this will affect its capacity to absorb water.
- Do not cut when soils are wet.
- Do not use buffer strips for regular vehicle access, turning, livestock movement/grazing or storage.
- Avoid excessive grazing pressure including by rabbits, deer or invertebrate infestation.
- After the first year of establishment do not cut before August to avoid disturbing ground nesting birds.
- Do not apply fertilisers or manures or broad spray pesticides (including slug pellets) at any time.

How do I ensure my buffer strips are working?

Maintaining good soil structure on the agricultural land next to the buffer is important to prevent sediment deposits.



Photo 5 Sediment deposit on buffer strip

Once you have established your buffer strips they will need careful management to maximise performance. You should inspect them regularly and take corrective action when you spot any

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problems. Ideally, inspections are best done during or immediately after heavy rain so you can see where surface run-off is occurring.

Look out for areas that have been inundated with sediment, also monitor animal burrows as these can cause the buffer to be bypassed.

Problems

Breaching

Breaching is where the flow of water has overwhelmed the buffer strip and begun to form channels. This reduces or stops the effectiveness of the buffer. Look for evidence of breaching where rills or gullies have formed across the strip.



Photo 6 Breaching of buffer strip

Where breaching occurs on a regular basis due for example when micro-topography in association with the orientation of tillage combine to concentrate and channelise flow. Examine what has caused the breach and either:

- Undertake field management measures that will remove compaction and increase infiltration. For example sub-soiling after harvest, adding a headland tramline, leaving rough seedbeds and taking steps to increase soil organic matter. For more information see TIN098.
- If the breach is minor, fill in the gully and consider widening the buffer strip to 12 m.
- If the breach is more serious consider planting trees to help prevent further erosion or creating grassed waterways. For further information on grassed waterways see TIN099.

Look for evidence of prolonged pooling of water within the buffer strip, which can damage soil and vegetation. To correct this you may need to widen and re-establish the buffer.

Silting up of buffers

It is not practical and would be costly to remove sediment from buffers if excessive sediment deposits smother and reduce the growth of the grass. In addition, it is a clear indication that in field erosion control measures, for example soil management, tillage and crop management options are not working.

Reseeding the buffer strip will be costly if the problem is just likely to re-occur. In the first instance you should review your field practices to reduce erosion and to avoid build up of sediment in future. For further information see TIN098.

Silting up of watercourses

If the watercourse becomes silted despite the establishment of the buffer strip, consult your Natural England adviser, Catchment Sensitive Farming Officer or farm adviser for further guidance on which measures to take.

If you remove the silt, do not place spoil/risings on the buffer strip. If removing silt from a ditch, and you have an ELS agreement, check to see whether the ditch management is part of your agreement as specific rules may apply to the type and frequency of management.

Compaction and poaching

ELS buffer strips should not be used for regular vehicular access, turning or storage, but if compaction occurs, the best way to put this right is by appropriate sub-soiling (if it is an ELS buffer please speak to your Natural England adviser before doing so).

You will also need to think about any buried archaeology protected under GAEC 7 (if you are in ELS these should be marked on your Farm Environment Record/Environmental Information map).

Vegetation problems

Excessive grazing (rabbits/deer/invertebrate infestation) will require management and

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corrective action. Wider 12 m buffers strips can be helpful in some situations where the grazing pressure is high, as the negative impact of over grazing will be offset by the wider strip.

Culverts

A culvert is a sub-surface drain that channels a watercourse under a road or other feature.

In storms culverts often do not cope with all the storm water and temporary channels form on the soil surface over the culvert. This temporary channel is likely to require a buffer strip. Current legislation does not permit the culverting of watercourses without the consent of the Environment Agency.

Further information

How to apply for an ELS agreement

Natural England offers training and information to farmers and land managers on ELS and Organic ELS. Farm-based group events and farm-specific one-to-one visits are available free of charge.

This training gives information on applying for ELS, how to choose and locate the right options on your farm and how to effectively manage the options over the agreement period. Call our events team to find out what advice is available in your area on 0300 060 1695 or visit: www.naturalengland.org.uk/ourwork/farming/landmanagementadvice/events/default.aspx

Further guidance

Further guidance on buffer strips is available in *The Single Farm Payment Cross Compliance Guidance for Soil Management*. www.crosscompliance.org.uk/cms/assets/Uploads/CrossComplianceGuidetoSoilManagement2010edition.pdf

Detailed information on the creation and establishment of buffer strips is in the ELS handbooks: www.naturalengland.gov.uk/ourwork/farming/funding/es/default.aspx

To understand the threats to the aquatic environment on and around your farm, including the main threats to water quality in your area, you can check available information on the

Environment Agency Website. The *What's in your backyard* pages detail local information based on your postcode. www.environment-agency.gov.uk/research/library/data/34383.aspx

Further information on soil management and assessment in relation to diffuse pollution can be found in the *Think Soils* handbook which you can order from the Environment Agency website: www.environment-agency.gov.uk/business/sectors/soils.aspx

If your farm is in a Catchment Sensitive Farming priority area, further advice on using riparian buffers can be sought from your local Catchment Sensitive Farming Officer: www.naturalengland.org.uk/ourwork/farming/csf/default.aspx

Information on the Campaign for the Farmed Environment (CFE) is available online at www.cfeonline.org.uk/ or by contacting the CFE on: cfeonline@nfu.org.uk or 024 7685 8536.

Information on *Local Environment Risk Assessment for Pesticides* (LERAP) requirements is available from: www.pesticides.gov.uk/safe_use.asp?id=207

Natural England Technical Information Notes and other publications are available to download from the Natural England website: www.naturalengland.org.uk. In particular see:

- NE230 *Farming for cleaner water and healthier soil*
- TIN098 *Protecting water from agricultural run-off: an introduction*
- TIN099 *Protecting water from agricultural run-off: water retention measures*
- TIN081 *Illustrated guide to watercourses beside grassland*
- TIN093 *Shelter woods to prevent wind erosion*

For further information contact the Natural England Enquiry Service on 0300 060 0863 or e-mail enquiries@naturalengland.org.uk.

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