Supporting guidance for Rural Sustainable Drainage Systems – Swales

This is an old version of the page

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For recent changes to this guidance, please see the bottom of the page .

Swales are shallow grass-lined channels designed to collect water and move it gradually away downslope. Infiltration can take place along their route and the grass helps to filter out suspended sediments as well as taking up nutrients. The storage capacity can be increased and the rate of flow slowed by the construction of check dams.

Unlike ditches, they are normally dry outwith wet weather and their sides and base are grassed.

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What are the benefits of using swales?

Swales effective at improving water quality and are:

- cheaper to construct than piped systems
- able to be incorporated into the landscape
- a low-maintenance option
- visible in operation

What makes a good swale?

- a longer swale gives more time for the entrapment or settlement of suspended solids
- there should be no sharp bends – they should curve gently
- gradients should be shallow, ideally no more than five degrees (1 in 20). Swales can be built on steeper ground if they are constructed so that they curve to and fro across the slope with a shallow gradient
- an established grass sward is beneficial so the swale should be designed to prevent standing water

Where should the swale be located?

The location of the swale will depend on the layout of the site and the available space. Ideally the swale should run either parallel with or at right angles to the areas from where water is being collected, with hard-standing areas draining towards the swale.

On large sites, subsidiary swales may link with a main swale off to one side. Roof water may be led to swales via clean surface drains or smaller swales.

In regards to steadings, swales are useful for accepting and treating run-off from clean yard areas, as part of a treatment train approach where the swale accepts run-off and then discharges to another feature such as a pond or wetland for further treatment. They are not appropriate for accepting more contaminated types of run-off such as slurry. They can however be used to convey lightly contaminated run-off to a constructed farm wetland.

When treating steading run-off it is a requirement that the swale forms part of a treatment train including other Rural SuDS feature such as a pond or wetland. However where the run-off only receives roof run-off or run-off from a pig or poultry unit then the swale can be stand alone.

Generally swales will be located at the start of the treatment, although they can also be used to convey run-off between features and to the final discharge point.

Swales can also be used infield as part of soil erosion risk management. For example along a natural wet weather drainage line in arable fields to help stabilise soils and provide a flow pathway. They could also be used to capture down slope run-off along field boundaries or used alongside farm tracks / roads or hard standings.

> ***Using a combination of rural sustainable drainage systems will be more effective than individual measures – the treatment train approach.***

What needs to be done?

Drainage from a steading

Where it is proposed that the swale will take drainage from a steading the first step should be to carry out a diffuse pollution steading assessment.

The principle aim of this is to illustrate which parts of the yard areas will be suitable to be discharged to the swale and to assess the current diffuse pollution risk.

See the annex below for information on identifying different drainage types.It is important that the assessment clearly identifies where the run-off originates from, where it currently discharges to and how it currently gets there.

Where a new swale or surface water drainage system is to be created it is important to ensure that these are not located within 10 meters of any slurry store, effluent tank, silage clamp or silage bale storage area.

For concrete yards/ tracks and farms buildings constructed after 1 April 2007 there is a statutory requirement (Controlled Activities Regulations GBR10) that any water runoff should be discharged via a Sustainable Urban Drainage System (SUD).

This excludes areas draining to a silage tank or slurry store.

Therefore applications for any RSuDS options may be considered as ineligible for cases where the entire farm steading or new buildings adjacent to the original steading have been built since 1 April 2007 without the benefit of any associated SUD.

Similarly, where a large proportion of the original steading has been redeveloped since 1 April 2007 it may be considered ineligible. If the redevelopment does not involve significant changes to the surface water drainage system and/ or increasing the amount of runoff discharging to a water course then the case may well be eligible.

Cases involving substantial changes to surface water drainage etc. with no associated RSuDS are likely to be ineligible.

Field run-off

For arable situations, the principle aim of the swale will be to collect overland run-off to allow sediment to drop out and prevent further erosion.

In grassland situations the purpose may be to capture run-off from a track or road used by livestock or machinery and to discharge it to grassland away from watercourses.

For in-field swales it will be necessary to carry out a simple diffuse pollution risk assessment to determine where the swale should be created to be most effective.

Using a map, such as a copy of the IACS map, identify all watercourses on the farm or area of land in question.

The next step is to consider where the potential for soil erosion is greatest and where this can pose a risk to the water environment.

This assessment should consider the following:

- proximity to nearby watercourses – the closer the area is to a watercourse, the greater will be the risk
- slope of the land will be one of the most significant factors – the steeper the downward slope towards the watercourse the greater will be the risk. Slopes of over three degrees (1 in 14) should be considered moderate risk and those above eight degrees (1 in 7) considered high risk. Fields with slopes which tend to converge or fall to a specific low point or corner of the field near to a watercourse will have a particular high risk of causing pollution. Long, uninterrupted slopes are also of greater risk of erosion
- past experience – consider where it has previously been noted that surface run-off has entered a watercourse or where soil erosion has occurred.
- soil texture – light soils with a high sand content are at greater risk of erosion

Once the assessment has been completed, identify on the map those areas which are at risk of soil erosion and which may potentially pollute a watercourse. Mark on the map where the swale would be best located to intercept the run-off and where it should discharge to.

Design guidelines

Anyone considering creating a swale or other Rural SuDS on their farm should refer to the recently published (December 2016) guidance document - Rural Sustainable Drainage Systems - A Practical Design and Build Guide for Scotland's Farmers and Landowners .

This guide was written with the Scottish Rural Development Programme in mind and will help you to select, size, design, and build the most suitable Rural SuDS for your farm.

Maintenance

Importantly the above guidance document also explains how to look after the systems and maintain them which is essential in order to optimise their effectiveness. It also promotes the wider benefits such as coping with extreme weather related to climate change, localised flood prevention and enhancing biodiversity.

Further information

- Rural Sustainable Drainage Systems - A Practical Design and Build Guide for Scotland's Farmers and Landowners , CREW (2016)
- The SuDS Manual CIRIA Report C697, CIRIA (2007)
- Guidance for Treating Lightly Contaminated Surface Run-off from Pig and Poultry Units, Northern Ireland Environment Agency (2006)
- Diffuse Pollution, Campbell et al (2004), IWA Publishing, ISBN: 1 900222 53 1
- Sedimentation in Small Constructed Wetlands. Retention of Particles, Phosphorus and Nitrogen in Streams from Arable Watersheds, Braskerud BC (2001), Doctor Scientiarum Theses 2001:10, Agricultural University of Norway, As, Norway, ISSN: 0802-3220

Annex – Identifying run-off types

In general, farm steadings, particularly livestock farms, produce a wide range of run-off ranging from relatively clean roof water to highly contaminated run-off and slurry.

Roof run-off can be considered relatively clean and may already directly discharge to a watercourse. Exceptions may include poultry or pig house roofs with roof vents. Also, any buildings or areas constructed after 1 April, 2007 must be drained by a sustainable drainage system, and roof water can discharge to a closed soakaway or to a watercourse via an infiltration trench or swale.

Yard run-off tends to vary to a greater degree in its polluting load. Therefore, for the purpose of producing the plan for this option, run-off should be classified as:

Slurry and silage effluent

The Control of Pollution (Silage, Slurry and Agricultural Fuel Oil) (Scotland) Regulations 2003 as amended (SSAFO) defines slurry as excreta produced by livestock while in a yard or building and includes a mixture of run-off containing excreta, bedding etc, from yards and buildings used by livestock and middens, weeping wall structures etc.

Silage effluent is defined by SSAFO to include effluent produced from any forage crop which is being made or has been made into silage. This will also include any mixture consisting wholly of or containing such effluent or run-off emanating from a silo or silage effluent collection system.

Run-off from such areas requires to be collected in a suitable storage system. However there is a provision to allow certain types of slurry and silage effluent to be conveyed to a constructed farm wetland that has been designed in accordance with the Constructed Farm Wetland Design Manual. The types of slurry that can be conveyed to such constructed farm wetlands for treatment includes run-off from:

- areas used by livestock occasionally, but excluding areas where livestock regularly move on and off to be milked, housed, fed or gathered
- silos within the period 1 November to 30 April, unless a crop has been added to the silo within this period. This excludes run-off from silos where livestock have access, such as self-feed silos
- an outdoor midden containing farmyard manure

Lightly contaminated run-off

This could include drainage from yards and areas where livestock do not frequently have access, which are not contaminated with oils and pesticides. It is accepted that such areas will build up a degree of contamination from passing machinery and other activities carried on nearby. In the majority of cases this run-off would be suitable for treatment via a rural sustainable drainage system or alternatively could discharge to local grassed areas.

Dairy washings

This includes washings from the milking parlour and rinsings from the milk storage tank(s), milking machine and ancillary equipment. These types of effluent can be highly polluting and should be collected in a slurry storage facility or a dedicated storage tank.

Pesticide contaminated run-off

Drainage from pesticide handling and loading areas must not be allowed to discharge into a surface water drainage system or a rural sustainable drainage system. There is a capital item available for upgrading pesticide handling facilities.

Recent changes

Section	Change
Where should a swale be located	Addition of advice
Drainage from steading	Addition of advice
Annex A - slurry and silage effluent	Change of section title Addition of advice

Previous versions

Previous versions of this page