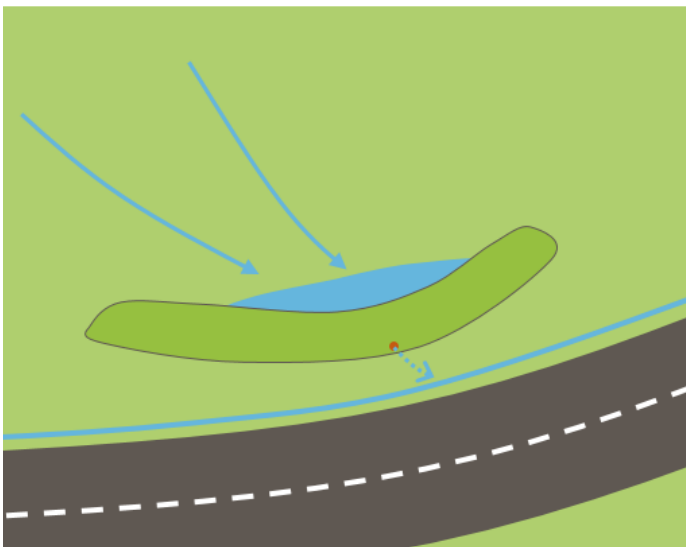


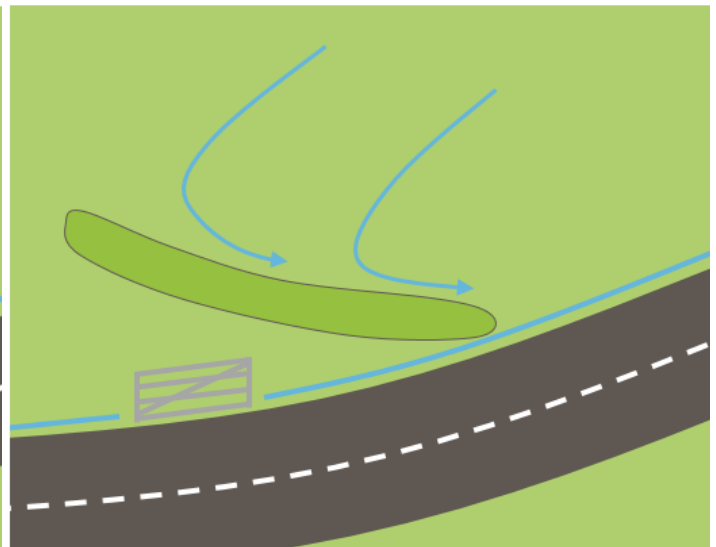
### What are bunds and how do they work?

A bund is a bank created from earth, generally used in one of two ways:

- 1) Run-off interception and storage: constructed along the contour to slow and hold back field run-off and sediment, as part of a leaky pond
- 2) Run-off diversion: constructed at an angle to the contour to slow and divert run-off away from high risk areas



*Run-off interception and storage. Run-off that over-topped the ditch and floods the road is held back and slowly released into the ditch.*



*Run-off diversion. Run-off that used to flow through the gate onto the road is now diverted into the ditch.*

### The best sites for bunds are:

- Where run-off can be intercepted and / or diverted (FWAG SW has maps for this)
- Close to tracks to divert run-off away from hard surfaces which act as preferential pathways
- If possible, in field corners and margins to minimise loss of productive land
- In combination with ponds or other water retention features

### Design and construction of bunds

- It is best to construct a bund when soil conditions are dry. This will a) reduce structural damage to the soil caused by heavy machinery, and b) allow the bund to stabilise
- The base of the bund should be at least three to four times its height
- Key in the base to the existing ground to prevent slumping or movement
- Build up the soil in 15 cm layers, compacting each layer as you go
- The shape is determined by where the water is coming from and whether it is to divert or hold water
- Consider installing a small pipe running through the bund to allow water to trickle out



- Create a low point (spillway) in the bund to allow water to overtop in a controlled manner
- Seed the bund with grass to improve stability and to limit erosion. Species should be tolerant of both wet and dry conditions (e.g. creeping red fescue with creeping bent and smooth meadow-grass)
- If erosion of the bund is a concern, consider protecting the vulnerable area with biodegradable geotextiles (e.g. coir matting).

*Bund sited in field corner, designed to intercept run-off, holding back water and letting sediment settle before reaching the watercourse*

- Regularly remove excess sediment from the base of the bund, spreading it on the field.

***Bunds can be used as standalone NFM features or as part of leaky ponds, which aim to store water temporarily.***

### What are leaky ponds and how do they work?

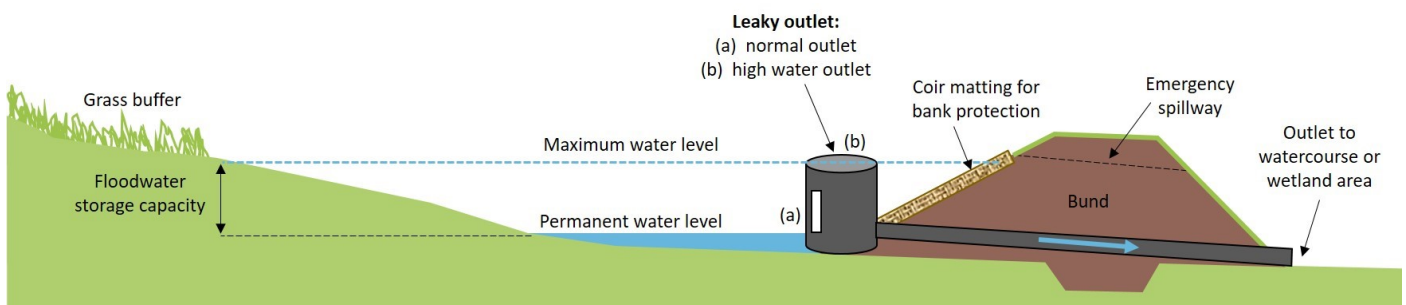
- The aim of a leaky pond is to store run-off during periods of heavy rainfall; it has a moderate inflow and a slow outflow. It is important that a leaky pond can be emptied before the winter to provide maximum water storage capacity during high rainfall.
- Leaky ponds collect run-off from upslope fields or agricultural ditches without fish populations.
- Benefits:
  - Collect run-off and trap sediment
  - Can double up as irrigation ponds or a water source for livestock
  - Create wetland habitats

### Site selection for leaky ponds

The best sites for leaky ponds are:

- Where run-off pathways can be intercepted
- Areas of regularly wet ground and low productivity (not replacing valuable habitat)
- Areas with easy access for maintenance, where compaction can be avoided
- Adjacent to watercourses where the water can be discharged responsibly

Principle of leaky pond designs:



*Leaky pond collecting run-off. Pond design using a passive leaky outlet*

## Design and construction of leaky ponds

- Size and shape:
  - Determined by a) soil type, b) available land and c) volumes of run-off and directions of flow pathways to be intercepted (FWAG SW has maps for this)
- Side slopes should be no steeper than 1:4
- Establish grass around the pond edges (choose mixes suitable for wet and dry conditions)
- Consider using biodegradable geotextiles (e.g. coir matting) to protect the banks and / or channels against erosion and scour especially in the first few years after construction.
- Consider combining the run-off pond with a silt trap to trap silt before it enters the leaky pond.

There are a number of different options for the inflow and outflow methods for leaky ponds:

Leaky run-off pond design options		
Source of water	Inlet method	Outlet method
Collected by a swale (dry, vegetated ditch)	Spillway from ditch / stream / swale	Sluice
Field run-off	Bund(s) to direct run-off	Pipe (non-return valve if discharging to a watercourse)
Agricultural ditch with no fish populations		Spillway

## Management of ponds

- Check water level and depth of silt regularly (especially after heavy rain and before the winter)
- Empty prior to heavy rainfall and before the winter if outflow mechanism allows
- Remove silt and spread back onto the field (if combined with a silt trap, the pond should not need de-silting but the silt trap will)

## Leaky run-off ponds and your farm business

Leaky ponds have a basic set of requirements to provide flood risk management but can also be designed with other factors in mind. For example, it may have features to encourage wildlife or could be used for irrigation.

## Consents and Licences

Planning Permission or Prior Notification (Agricultural Exemption) may be needed depending on the size and agricultural use. Land Drainage Consent or EA Flood Risk Activities Permit may also be needed if the pond is connected to a watercourse. A waste exemption (U10) from the Environment Agency may be required when spreading silt. An EA Discharge Licence may be needed when discharging straight into a watercourse. An RLE1 form should also be completed as the pond may count as a Permanently Ineligible Feature for Basic Payments. FWAG SW can give site specific advice on these. If the pond is used for irrigation, an Abstraction Licence may be needed. You may need consent from Natural England if the land is designated as a SSSI or in an agri-environment agreement.

