Watercourse Guidance

Cambridgeshire County Council

THE WATERCOURSE REINSTATEMENT GUIDE

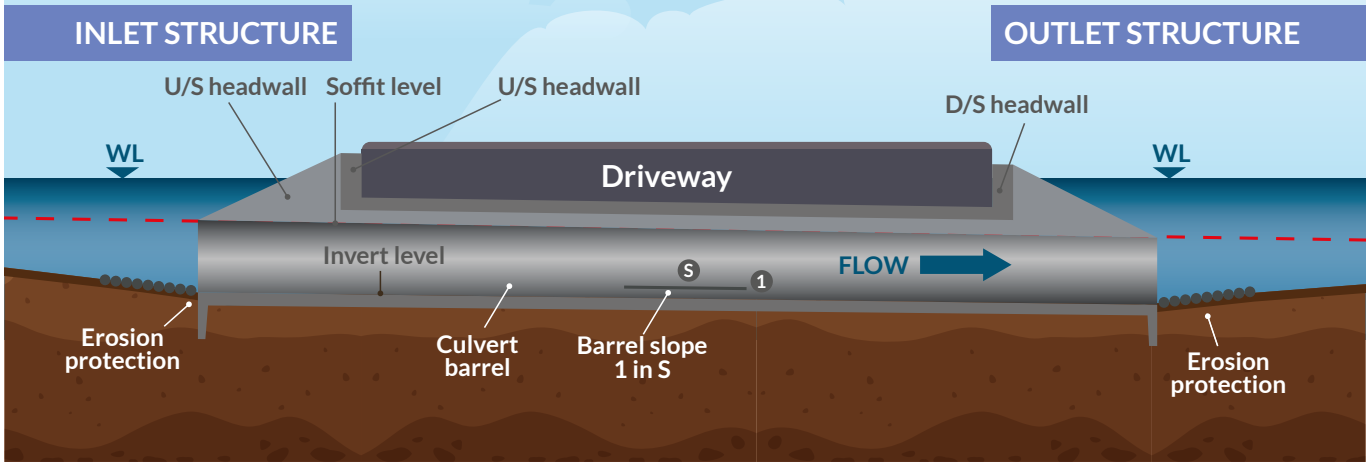
The Riparian Guide for reinstating a watercourse

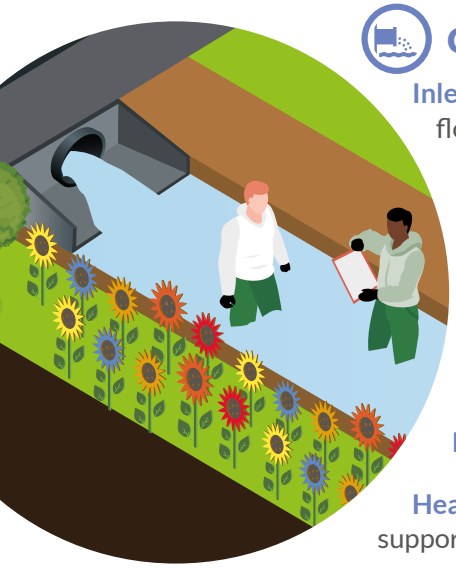
This guide covers the removal of culverts and a re-naturalising a watercourse back to its original state. This can provide improvements to reduce flood risk, and increase biodiversity, water quality and amenity.

Removing culverts

The diagram below shows a long section of the culvert in the diagram on the right. There are various engineering terms used to describe the different parts of a culvert. It may be useful to know these terms for discussions with contractors.

Long section of a culvert





Culvert Engineering Terms

Inlet The entrance to the culvert at the upstream end, where water flows in (or would flow in if the watercourse only carries water in flood).

Outlet The place where water exits the culvert at the downstream end, where water flows out (or would flow out if the watercourse only carries water in flood).

Barrel The culvert pipe which carries flow from the inlet to the outlet (or would carry flow if the watercourse only carries water in flood).

U/S Shorthand for upstream.

D/S Shorthand for downstream.

Headwall The wall around the inlet or outlet which guides flow into/out of the culvert supports the banks and bed of the watercourse, preventing erosion.

Erosion The gradual wearing down of the banks and bed of the watercourse by any of the following methods:

- the sheer force of the water flow as it moves over the banks and bed of the watercourse (this would usually have a bigger impact in a flood)
- material carried in flow such as boulders, pebbles, gravel, sand, litter and fly tipping hitting the bank and bed of the watercourse
- material dissolved into the water such as pollutants and minerals from rocks having chemical reactions with material on the bank and bed of the watercourse

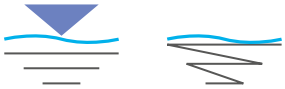
Invert Level Height of the base of the culvert pipe above mean sea level.

Soffit Level Height of the top of the culvert pipe above mean sea level.

Slope Also known as gradient, this is a measure of steepness, which may be applied to a variety of scenarios including watercourses and culverts but also hills, roads etc.

Level Height above mean sea level, commonly represented by this symbol:

Both these symbols mean water level:



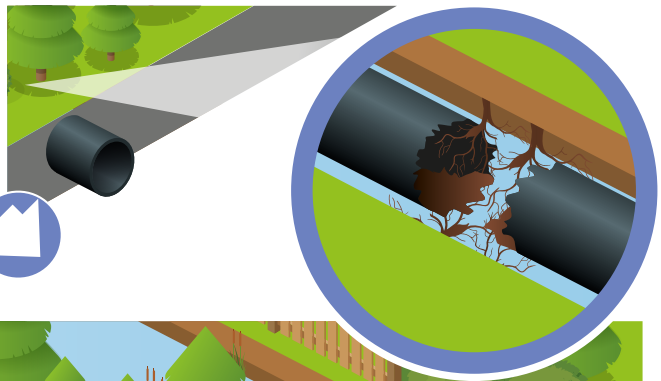
Culvert vs Clear Span Bridge

If a **culvert** has collapsed, both repairing the **culvert** and reinstating the **watercourse** will require excavation. Unless the **culvert** is needed for a specific purpose such as at a road crossing, we recommend reinstating the **culvert** back to being a **watercourse.**

If you require access over the **watercourse,** a clear span bridge may be suitable instead of a **culvert,** which would leave more space for flood flows in the watercourse.

Watercourse reinstatement simplifies maintenance and inspection, with no need for a CCTV survey to tell when there is a blockage. As a result of this, and the likely increase in capacity, flood risk will be reduced for the land upstream.

Tree roots damaging the culvert



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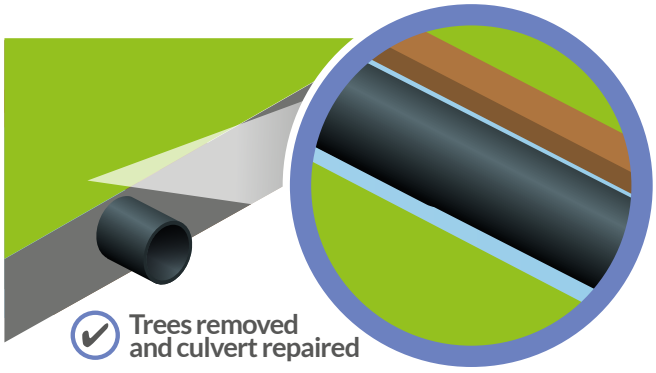


Trees removed and culvert repaired

Preferred outcome

Culvert removed and watercourse reinstated to open watercourse

Who can get involved in removing a culvert?

We don't recommend undertaking works to reinstate a culvert on your own. Specialist machinery and equipment is required and therefore we recommend employing a contractor.

However, there are other tasks around reinstatement that can be community led, such as culvert inspections prior to removal, riparian planting once the watercourse has been reinstated, and in some situations, communities can even get involved with wildlife surveys.

For more information on conservation and habitat improvement, please see the Resources document.

Re-naturalising a watercourse

Particularly for watercourses in steeper "high-land" areas, you may wish to re-naturalise the watercourse, introducing meanders and berms, and riffles and pools. You may also wish to move the banks of the watercourse back and decrease the bank gradient in places.

Moving the banks back, and creating meanders and berms makes more storage for the water in times of flood. An excellent example of this, although on a much larger scale, is the "Room for the River" project by Rijkswaterstaat[1] in the Netherlands, see linked below. **https://www.rijkswaterstaat.nl/en/water/water-safety/room-for-the-rivers**

Moreover, in times of low flow a variety of water depths with riffles and pools keeps water moving and creates a variety of environments for aquatic and marginal plants and wildlife. This is good for water quality as it is maximising the amount of dissolved oxygen.

More space between the water's edge and the top of the bank also creates more room for pollutants such as pesticides used on crops, to filter out before reaching the water. Furthermore, reducing the bank gradients and introducing berms facilitates easier access to the water's edge for people living nearby, for example for nature walks or for activities such as pond dipping.

1 Ministry of Infrastructure and Water Management in the Netherlands

Historic Environment

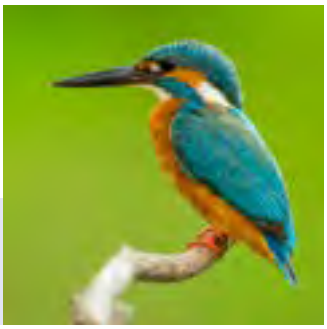
Some watercourses, including ditches, dykes, moats, and culverts, may be registered as scheduled ancient monuments.

For watercourses within a scheduled ancient monument, it might be difficult to make certain changes. At Worts Meadow Local Nature Reserve, in the moat pictured left, silt protects underlying archaeology, so there are restrictions around its removal. Scheduled ancient monuments are registered on the National Heritage List for England. Please see the Resources document for information on searching this list.

Biodiversity

Bird nesting season is between April and October. Between these times you must survey any trees, hedgerows, and vegetation for active bird nesting. Works cannot go ahead if bird nesting is taking place, until the end of bird nesting season.

It is an offence under Section 1 of the Wildlife and Countryside Act of 1981 to intentionally take, damage or destroy the nest of any wild bird while it is in use or being built.



Kingfisher from Wildlife Trust BCN competition in 2017 © Robert Grice

Culverts can also provide roosting features for bats, particularly those made of brick or stone and over 1m in height.

Bats can roost in very small gaps between brickwork (missing mortar) or other holes within the structure and therefore, are more likely to be found within culverts that have been poorly maintained.

Bats and their roosts are protected under the Conservation of Habitats and Species Regulations 2017 (as amended), making it illegal to damage, destroy or obstruct the entrance to their roosts. Prior to any maintenance works, these structures should be assessed for the presence of roosting bats by a suitably qualified bat ecologist. Further information about bats and waterways, including culverts, is available from The Bat Conservation Trust: www.bats.org.uk

Pipistrelle Bat resting on some brickwork

Of course, these types of watercourse management won't be possible everywhere in Cambridgeshire. For example in urban areas, there may be developments right up to the existing watercourse bank, but through parks and green spaces in urban environments, this might still be achievable to an extent.

Many fenland watercourses are manmade, having been dug when the fens were drained, so it might not be as appropriate to introduce meanders in these watercourses, as the "naturalised" environment would often be completely flooded for at least part of the year.

Additionally, the sheer number of watercourses in the fens means that meanders would take up a lot of space, which might be needed for other land uses such as agriculture.

Consents and permits

A consent or permit may be required for construction or alterations that affect the flow of water in a watercourse or water body. Please see the resources section for more information. Consent is not required to remove a culvert, although it is required to put one in.

Case Study: Werrington Brook Improvement Project

The Werrington Brook Watercourse Improvement Project is led by the Environment Agency, Peterborough City Council and Peterborough Environment City Trust (PECT). A series of urban watercourses in the North of Peterborough are being transformed over a 5+ year programme. This includes physical works to the watercourses, along with community and business engagement, with the aim of tackling water pollution at the source, improving habitat potential and increasing flood resilience.

Most notably in terms of watercourse re-naturalisation, a straight cut channel was excavated, with the banks made less steep, and meanders introduced, along with gravel riffles, pools, and a small wetland pond. A low-level berm was also for maintenance access and for amenity access to the water's edge. The watercourse was planted with reeds and other marginal aquatic plants.

Surveys before and after the works have found twice as many aquatic plants (macrophytes), this indicates improved water clarity. An increased complexity of riverbed morphology has resulted in a more diverse habitat. The project has received a number of local and National awards for its success, and the water framework directive has confirmed the re-naturalised watercourses have improved from fluctuating between moderate and poor ecological status to good ecological status. For more information on this project please visit: **https://www.pect.org.uk/projects/werrington-brook-improvements/**

Case Study: Histon and Impington Culvert replacement

The Histon and Impington Surface Water Management Plan (Hyder, 2014), commissioned by Cambridgeshire County Council, identified a number of options to reduce flood risk in the area. One of these was to replace a culvert in the park lane area, which had structural issues and was too small. Further investigations identified several constraints:

- Bird nesting surveys were required as a couple of trees close to the culvert had potential for roots ingress and needed to be removed
- Bat surveys were undertaken as the historic brick culvert had potential for bats to roost in cavities between the bricks

In January 2020, works were completed to replace the culvert. A crossing was still required for access and a clear span bridge was considered and costed but for engineering and financial reasons it was decided that a like for like new culvert, with betterment was the preferred option. A new 900mm diameter PVC pipe was installed, with a brick facing.

Photographs show a clear improvement in the capacity of the culvert. Flows will be significantly less restricted going forward, which reduces flood risk to property upstream of the culvert.

Explanation of terms

In addition to the culvert engineering terms discussed on pages 1 and 2, several further technical terms used in the document are defined below

Bird Nesting Season
April to October in the UK.

Riverbed morphology
Physical features and forms of the riverbed.

Meander
Sinuosity or bends in a watercourse which occur naturally when a watercourse moves over gently sloping ground, with erosion (sediment picked up and carried by the flow) on the outside of a bend and deposition (sediment drop out) on the inside bend.

Berm
A flat or slightly sloped shelf or step in the riverbank, which allows for increased filtration of surface water running off land into the river, and provides access to the water's edge for amenity activities like pond dipping and nature walks.

Riffles
A shallow, faster flowing section of a watercourse which may have cobbles, pebbles, or gravel to reduce the depth and break up the water surface, adding oxygen to the water. Riffles are a key habitat for fish spawning.

Pools
A deeper, slower flowing section of a watercourse, usually at the corners of a meander, in between riffles. These deeper areas of water are key refuges for fish in times of low flow and during winter.

Pollution
Introduction of harmful materials into the environment (National Geographic).

Pollutants
The harmful materials which pollute the environment. Pollutants to water can be categorised into Suspended solids, metals, and hydrocarbons (CIRIA, 2015, pp. 564-589) Pollutants can cause environmental damage in the water in both the short and long term. The Yellow Fish Project, a community awareness campaign about water pollution in Werrington, Peterborough, has more information about water pollution. (Peterborough City Council).

Suspended solids
Suspended material or particulates in effluent from industry, and runoff from construction sites. These particles make the water cloudy, which hinders growth of aquatic vegetation as it stops the sunlight from reaching them. Particulates also damage fish gills causing respiratory distress and can interfere with fish spawning and other wildlife on the riverbed, when particulates settle out. (Open University)

Pesticides
These include herbicides, fungicides, insecticides, which are used on crops, and additionally cleaning materials such as disinfectants. (United States Environment Protection Agency)

Hydrocarbons
These include fossil fuels which may reach the water environment from runoff from roads and other means like oil spills, microplastics and plastics which may enter the water system via fly tipping and illegal waste dumping and air pollution in water vapour which arrives from vehicles, industries, and wildfires, and ends up in watercourses via the natural processes in the water cycle.

Watercourse
Over the years many different words have been used to describe the natural and urban systems that store and move water: river, stream, ditch, dyke, swale, lode, culvert, piped watercourse. We use the term "watercourse" as an umbrella term to describe any channel, above or below ground, that may to move water from one place to another.

Watercourses and waterbodies do not need to have a formal inlet or outlet to move or store water. Water can enter from rainfall, overland or groundwater inflow, and exit either by soakage into the ground beneath, or by evaporation. Usually, smaller watercourses discharge into larger watercourses, in a network that moves surface water runoff from rural and urban areas into rivers, and then out to the sea.

Groundwater
Water stored underground in porous rocks such as limestone and chalk and in soil.

Porous
A material which has small holes or gaps which can hold water, air or other liquids and gases.

Biodiversity
The variety of plant and animal life within a given area.

Water quality
Water quality standards are set out by the European Commission Water framework directive. Each watercourse or water body may be assessed and assigned an ecological status based on biological elements (phytoplankton, macrophytes, aquatic invertebrates and fish) and physio-chemical elements (nutrients, amount of dissolved oxygen, temperature, transparency and salinity of water, and other physical characteristics of the watercourse/water bodies (e.g., features like meanders, berms, riffles, and pools) (European Environment Agency, 2018).

Amenity
A place, which is desirable, pleasant, attractive, and accessible to people in the local area.

Culvert
A watercourse which has been piped.

References

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Contact us

If you require assistance accessing any data or information discussed above, have a query, or would like more information about a topic or relating to your site, please do not hesitate to contact us at:

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