

Checklist for Good Waterways

- Bridge preferable to culvert if the road embankment is long or high, if the watercourse has a steep gradient or if there is an important fauna crossing.
- An arched culvert preferable to a standard pipe culvert if the watercourse has a steep gradient or a high velocity flow. This preserves the natural streambed.
- Adjust the placement so as to minimise the slope of the culvert. If a pipe culvert that is used in an existing stream alignment has a steep slope, try to adjust its placement so as to reduce the angle of this slope, even if this entails a partially new diversion of the stream.
- Oversize the culvert a little wider than the width of the stream. If the culvert is to be combined with a land passage, the culvert shall be twice the width of the stream.
- The bottom of the culvert shall lie below the streambed.
- Natural gravel and stone in the culvert is desirable. Place the bottom of the culvert below the streambed, normally about 2 decimetres down. This demands oversizing, otherwise the waterflow velocity will increase.
- The normal waterflow velocity shall remain unchanged when passing through the culvert.
- Land passages shall be dry when the waterflow is normal and be at least 0.4 decimetres high.
- At a bridge there is to be a strip of land along at least one bank of the stream.
- Connect the wildlife fence to guide animals into the land passage.
- Construct when the waterflow is low.
- Ensure that there is no turbidity during or after construction.
- Cover blasted rock with natural materials (stone and gravel).
- Restore the natural vegetation along the stream alignment.
- There are to be no bushes on the road embankment between the culvert and the road so that flying insects can see the continuation of the stream on the other side of the road.



Photo: Ove Eriksson

A dry strip of land along the bank of the stream under the bridge enables both people and animals to pass by.



Photo: Sven Waldemarsson

Foxes prefer to use a culvert or the dry strips of land along the streambank under a bridge instead of risk crossing the road.

Provisions in the Swedish Environmental Code

Culvert works can mean that the provisions in Chapter 11 of the Swedish Environmental Code concerning both water engineering works and ground drainage will be applicable. A permit for water engineering works is required unless it is obvious that such activities will not damage either public or private interests. It is incumbent on the body executing the works to prove that the requirements have been fulfilled. Water engineering works are reviewed for approval in the environmental court. A permit is always required for ground drainage due to the special protection of wetlands. An application to carry out ground drainage works shall be submitted to the county administrative board, which in turn refers the case to the environmental court if any issues should arise concerning compensation, cost distribution, etc.

An application to carry out water engineering works shall always include an Environmental Impact Assessment (EIA) as well as details concerning consultation with the parties concerned in accordance with Chapter 6 of the Environmental Code. An application to perform ground drainage works shall also include an EIA according to the Environmental Code unless the environmental impact is insignificant. The environmental court and the county administrative board shall decide whether the EIA submitted by the applicant meets the requirements in Chapter 6 of the Environmental Code.

The environmental court and the county administrative board will specify the terms for executing the works, primarily in accordance with the provisions in Chapter 2 of the Environmental Code concerning due consideration. Even if the measures do not require a formal assessment, the body executing the works shall always apply the provisions concerning due consideration.

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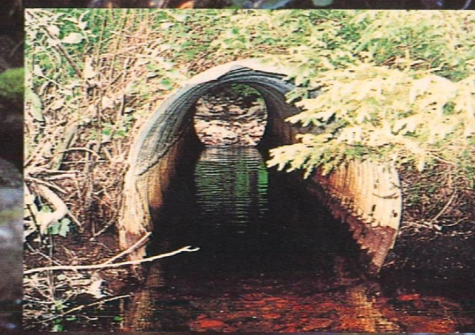
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Road Culverts

Nature's path under the road



FREE PASSAGE for fish and other marine life.



IMPASSABLE for anything wanting to continue on.



Road Culverts Vital to Life in Water

In Sweden there are about 520 000 kilometres of road, and there are watercourses covering a distance of about 300 000 kilometres. Roads cross these watercourses at innumerable places. Today, every second to third culvert is incorrectly placed, posing an obstruction to the marine life found in these waters.

In difficult periods, such as during spring floods or in times of drought, fish and insects often escape downstream. An incorrectly placed culvert can become an effective barrier during the migration back up-stream. Over time, this can result in a marked depletion of the marine life upstream.

This depletion not only affects the watercourse itself, but has an impact on the surrounding natural environment, since the living organisms in the water are an important component in the ecocycle. It can be said that the watercourse is nature's own bloodstream.

Life in a watercourse constitutes a complicated interplay between an enormous number of living organisms. Normally 4 000 – 5 000 individual specimens can be found per square metre, representing 50 – 100 different species.

These are all dependent for their food on that which falls from above, mostly leaves. Roughly speaking, these species can be classified according to their way of life:

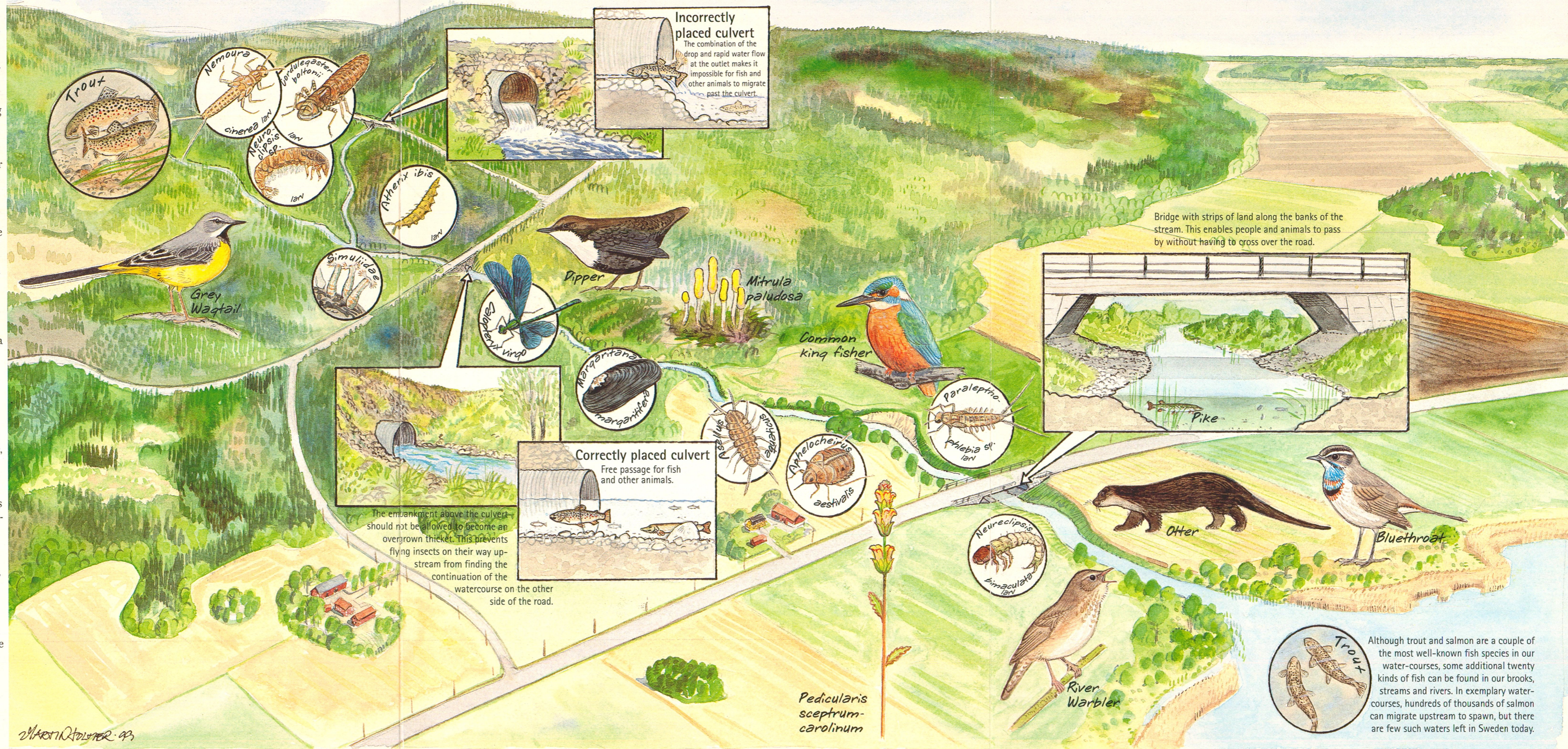
Shredders – break down the leaves

Suspension feeders – collect microscopic fragments in the water

Scrapers – eat that which fastens on rocks, etc

Predators – prey on other animals, but in turn are often prey themselves. Fish are often the final link in the characteristically short food chain existing in streams.

All of these are dependent on one other for their survival. The size of the species found in watercourses vary from those invisible to the naked eye, to fish, birds and mammals. The adjacent drawing illustrates some of the species that can be found.



Incorrectly placed culvert
The combination of the drop and rapid water flow at the outlet makes it impossible for fish and other animals to migrate past the culvert.

Correctly placed culvert
Free passage for fish and other animals.

Bridge with strips of land along the banks of the stream. This enables people and animals to pass by without having to cross over the road.

The embankment above the culvert should not be allowed to become an overgrown thicket. This prevents flying insects on their way up-stream from finding the continuation of the watercourse on the other side of the road.

Although trout and salmon are a couple of the most well-known fish species in our water-courses, some additional twenty kinds of fish can be found in our brooks, streams and rivers. In exemplary water-courses, hundreds of thousands of salmon can migrate upstream to spawn, but there are few such waters left in Sweden today.

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