RESTORING A WATERCOURSE

HAZARD

RAINFALL AND FLOODS

HEAT

IMPLEMENTATION STEP

TERRITORY

AREA OF ACTION

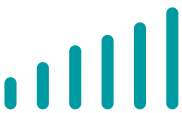
OUTDOORS

COST

€ € €

low medium **high**

LEVEL OF SKILL



high

Watercourses are heterogeneous environments that are dynamic in time and space. However, a large proportion of watercourses have been channelled or even culverted (buried), reducing their hydromorphological variations (variations in the shape and dynamics). Restoring watercourses therefore involves returning the river banks and bed closer to their original natural state, in order to recover the ecosystem services associated with the proper functioning of these ecosystems.

IMPACTS

Under the pressure of climate change, rivers may be fed by sudden, more intense rainfall. The risk is that these volumes will be greater than the capacity of the channel, which is undersized in relation to climate change. **Restoration of the minor river bed and major river bed** (only under water for part of the year) enables rivers to **function naturally** again, allowing high water to spread across the alluvial plain during normal flood periods **without causing overflow flooding** in urban areas.

Opening up watercourses laterally and vertically reduces **erosion** and helps to **fertilise alluvial plains**. Renaturing riverbanks helps **to provide shelter for local biodiversity**, while opening up watercourses helps to diversify fluvial facies, recreating **diverse habitats** for aquatic fauna.

Renaturing watercourses and wetlands in urban environments helps **to cool urban areas** during heat waves. Restored riverbanks also offer other **social and recreational amenities** to users (reception areas, walking areas, etc.).

INSTALLATION GUIDE

Before restoration, a diagnostic study should be carried out to determine the physical, chemical, biological and morphological characteristics of the watercourse.

Several actions can be taken to restore the hydromorphology of the watercourse:

- **Re-meandering** restores a winding watercourse with diverse flows and bed morphologies (facies and cross-sections).

- **Removing cross-cutting structures** (weirs, dykes, etc.) and **lateral constraints** (artificial banks, riprap, etc.) helps to recreate natural river dynamics and increase lateral connectivity with surrounding wetlands. **Hydraulic annexes** (submersible zones) can thus be created, reducing the risk of flooding in downstream urban areas. It is only possible to leave a natural expansion zone on **unconstrained land**.

- In urban areas, it is advisable to ensure that **land ownership** and nearby **uses** do not conflict with the restoration of the watercourse. It is also important to ensure that stormwater and wastewater networks are disconnected from the watercourse.

- When an operation is carried out to reconnect the watercourse to the valley floor, it may be necessary to **reconstitute an alluvial mattress** if the sediment supply process doesn't take place naturally. This involves bringing materials on site to recreate a layer of substrate and thus limit **erosion** downstream.

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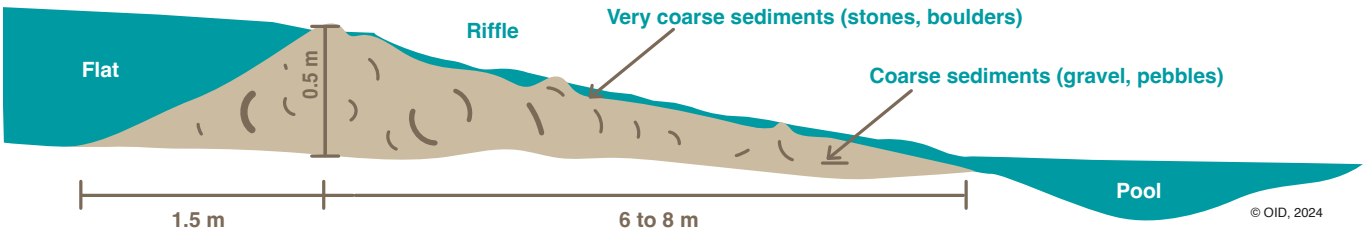
MORPHOLOGICAL RESTORATION OF THE MINOR BED BY DIVERSIFICATION OF FLOW FACIES

Source: Sage-Authion



Following these restoration operations, **hydromorphological, biological and physico-chemical monitoring** must be put in place to follow the evolution of the watercourse.

WEAK POINTS AND STRONG POINTS

- Clearing a watercourse or renaturing riverbanks with a view to improving stormwater management requires rethinking the **stormwater and** wastewater **networks.**
- Restoration operations may be hampered **by planning constraints**, which can lead to land conflicts.
- The renaturation of watercourses, particularly in urban areas, raises issues of **social acceptability**.
- A **communication** and **awareness-raising campaign** on the benefits of restoring watercourses and the amenities they offer can help to win the support of the various stakeholders.
- In addition, including stakeholders via **public consultation** will facilitate acceptance of the project.

MALADAPTATION

Maladaptation can result from the following:

Unsuitable vegetation

Vegetation plays an important role in the restoration of watercourses by contributing to the proper functioning of the ecosystem. Spontaneous vegetation will be better adapted to local conditions, fit in better with the existing ecosystem and increase interactions with local fauna.

Proliferation of invasive alien species

The lack of monitoring of biological evolution to detect the **potential proliferation of invasive exotic species**. Their presence modifies biodiversity by contributing to the decline of native species and disrupting local ecosystems. They can also have an impact on human health (CBD). It is then necessary to intervene in order to protect the restored ecosystem.

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MONITORING INDICATORS

ESSENTIAL RECOMMENDATIONS WORTH THINKING ABOUT

- GIVE PRIORITY TO ECOLOGICAL ENGINEERING PRACTICES
- LEAVE WATER-DEPENDENT AREAS TO CONTAIN FLOODING AND PROVIDE HABITATS FOR SOME SPECIES
- LEAVE SPACES TO ALLOW THE MORPHOLOGICAL READJUSTMENT OF WATERCOURSES
- ENCOURAGE THE DEVELOPMENT OF RIPARIAN VEGETATION

MONITOR MY ACTIONS FOR CLIMATE CHANGE ADAPTATION

+/− : Quantitative indicator ★ : Qualitative indicator

INDICATORS OF MEANS	INTERPRETATION
+/− Number of different fluvial facies (riffles, pools, flats, rapids, waterfalls, etc.)	To be maximised
+/− Number of obstacles to flow upstream from the study area	To be minimised
+/− Percentage of essential recommendations followed (%)	To be maximised

INDICATORS OF RESULTS	INTERPRETATION
★ Morphological heterogeneity (high or low)	Encourage heterogeneity
+/− Low flow rate (m/s)	Ensure minimum flow
+/− Comparison between the Biological Diatom Index (BDI) (algae) after operation and a control situation*	BDI after operation > BDI before operation
+/− Comparison between the Standardised Global Biological Index (SGBI) (invertebrates: insects, molluscs, etc.) after the operation and a control situation*	SGBI after operation > SGBI before operation
+/− Comparison between the River Fish Index (RFI) after operation and a control situation*	RFI after operation > RFI before operation
+/− Flood discharge with a return period of 1 to 3 years (m^3/s)	The full flow rate must be close to the flow rate for floods with a return period of 1 to 3 years.
+/− Solid flow (m^3/s)	Dynamic balance between erosion and deposition

**The control situation is defined by the parameters set to isolate the influence of the adaptive action (similar conditions: weather, time of measurement, space, etc.).*

REGULATION

- The European Water Framework Directive (EWFD) sets the target of achieving good ecological status for EU waters by 2027. The "good ecological status" of watercourses depends on water quality and the functioning of aquatic environments. To assess the condition of watercourses, the EWFD provides biological, psycho-chemical and hydromorphological indicators.

DEFINITIONS

- The Biological Diatom Index (BDI) is based on the study of algae sampled from riffles (the bottom of a shallow, fast-flowing, heterogeneous watercourse with a gravel substrate). Laboratories identify the species, making it possible to assess the abundance of each taxon and the distribution of the different species.
- Standardised Global Biological Index (SGBI): eight samples of macro-invertebrates are taken during low-water periods using a Surber net (a net with a 1/20m^2 frame), on different substrates and in different habitats.
- River Fish Index (RFI): this involves carrying out an inventory of fish fauna using electric fishing at a defined station. The fish are identified and counted and the biological parameters (size, weight) are measured.

FIND OUT MORE

CEPRI (2022), *Guide SafN - ARTISAN : les SAfN pour prévenir les risques d'inondation*

OFB (2018), *La remise à ciel ouvert de cours d'eau*

Eau & Biodiversité (2019), *Guide pour l'élaboration de suivis d'opérations de restauration hygromorphologique encours d'eau*

OFB, Why restore river continuity ?

Grow Green (2022), Brest city

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