

# Flood mitigation and restoration of continuity in the Mérantaise River in Gif-sur-Yvette

## The operation

Category	Restoration
Type of operation	Partial or total weir/dam removal, meandering, bypassing/removal of a pond, return to the original bed
Issues at stake	River continuity
Start of operation	June 2013
End of operation	July 2015
Length of river affected by the works	1200 metres

## River in the restored sector

Name	Mérantaise River, tributary of Yvette river in Essone
Mean gradient	8,5‰
Mean discharge	0.09 <sup>3</sup> /s

## Aims of the project owner

- Flood mitigation;
- Protect and restore aquatic environments;
- Maintain existing activities;
- Enhance the area along the river (landscape and patrimony).

## Environment and pressures

The Mérantaise is a small river 13 kilometres long and a left-bank tributary to the Yvette River. It originates in the town of Voisins-le-Bretonneux and drains a catchment with a surface area of 33.5 square kilometres. The rather low mean discharge (9L/s) of the Mérantaise can surge very suddenly during strong hydrological events.

The river, from its upstream section located in the regional nature park of the upper Chevreuse valley to the section where the works took place, is included in the No. 2 list of rivers on the basis of article L214-17 in the Environmental code. It is also

a biological reserve within the Seine-Normandie RBMP. Brown trout have been detected in the river.

Over the past centuries, the river has undergone a series of development works that led to the physical configuration of the hydrosystem that may be observed today. To make use of the hydropower, several transverse obstacles, notably mill weirs, were built in the river. In conjunction with these structures, the river bed was significantly modified (channel rectification, resizing of the main bed, creation of leats).

The catchment area of the Mérantaise was also modified by major hydraulic works, notably the creation of a series of ditches to supply the fountains of the Château de Versailles and to drain the soil on the Saclay plateau.

In a more recent past, in the 1960s, a spot immediately next to the river was modified for the installation of a sewer system serving several towns. In the same period, flood-retention basin, like the one on the Mérantaise, were set up by the Yvette valley hydraulic-development board (SIAHVV).

On the downstream section of the river, the different gate systems slowed the flow of water and created more uniform river facies. In addition, some of the gate systems constituted total barriers, thus partitioning the aquatic environments and preventing the free movement of both fish species and sediment.

## Opportunities to act

Following the major floods in the town of Gif-sur-Yvette in 1995, 1999, 2001 and 2007 that caused major damage to private and public property, the SIAHVV decided to undertake work on the Mérantaise to protect life and property against the



Figure 1 : Four hydraulic structures concerned by the river continuity restoration

floods. In addition, in compliance with the applicable laws, an objective of this ambitious project was to combine flood mitigation with the restoration of river continuity in the lower section of the Mérintaise.

## ■ Works and developments

### • Upper section : the «Mérintaise flood-retention basin »

A new bed was created in the talweg of the river over a distance of 400 metres to replace the “raised leat” that had been created prior to 1900. In one part of this section, the river bed was slightly narrowed to increase the morphological adjustment of the river and the banks were stabilised with vegetation.

To stabilise the long profile of the river as it crosses through the Mérintaise basin, six weirs, made up of large rocks, were built in series. They were designed with “ramps”, i.e. slight upstream and downstream slopes to ensure river continuity. In addition, two to three vegetated groynes were adjoined to the weirs in order to diversify the flow dynamics and activate the erosive processes.

In preparing the new course for the river, the alluvial bed was reconstituted as a provisional measure until the natural transport of sediment took place, over the more or less short term, thanks to lateral erosion and natural inputs of gravel from upstream. To that end, some of the material from the short-circuited reach, the “raised leat”, was removed, stored and finally injected into the new bed in addition to material from other sources.

The installations at the output of the flood-control basin (spillway, discharge-regulation system) were renovated and modified to improve the hydraulic

functioning of the installations and to restore river and sediment continuity at that point in the river.



Figure 2: The spillway and discharge-regulation system and the concrete channel prior to the works



Figure 3: The spillway and discharge-regulation system and the new bed of the Mérintaise after the works

### • Mid section : the « Copropriété » gate system

After removing the gate system (moving and fixed parts, lateral protection devices of the reservoirs, concrete glacis), the river bed was stabilised (underwater rock weir) where the current gate system is located. Just downstream of the weir, a shallow dissipation pool was created. Upstream of the gate system, work was done on the river bed,

Mid section

Lower section

Upper section





the banks and the immediate vicinity, and the alluvial bed was reconstituted at certain selected points in the river, in anticipation of natural sediment loading.

The pond along the Mérantaise just upstream of the “Copropriété” gate system was filled in.

An outlet for the “Copropriété” pond on the right bank of the river was created and the water level was lowered.

- **Lower section : between the CNRS gate system and the Gibeciaux mill property**

The eastern CNRS pond on the left bank was filled in, the gate system of the western pond was removed and an outlet was created.

On the site of the former pond, inside the CNRS park and upstream of the wash house, work on an initial reach 175 metres long consisted of creating meanders and installing five rock weirs and equipped with ramps.

Downstream of the structure under the Avenue du Général Leclerc, where the Gibeciaux mill is located, meanders were created over a section 76 metres long and the banks were stabilised using bio-engineering techniques.



Figure 5: Gibeciaux mill prior to the works

In the park next to the Gibeciaux mill, downstream of the buildings, meanders were created and the reach was stabilised with two “rock ramps”. This formerly raised section is now aligned with the long profile of the river.

The structures for the wash house were “deconstructed” and rebuilt taking into account the new cross and vertical profiles of the Mérantaise.



Figure 4: Aerial view of the “Gibeciaux” mill after restoration works

#### ■ Regulatory approach

- Declaration of public interest (work authorisation)
- Authorisation in accordance with the Water law

#### ■ Monitoring

A report on the initial condition prior to the work was drafted for the various compartments of the river and its catchment. It included geological samples, a hydrological and hydraulic study, physical-chemical analysis of the water and sediment, and a study on the biological potential of the environment based on floristic and faunistic surveys (fish, macroinvertebrates, brown algae, reptiles, amphibians, insects, birds, mammals, molluscs, bats).

Hydromorphological (Carhyce), fish (electrofishing) and macroinvertebrate (standardised global

biological index) surveys were carried out in 2016 and 2017. Depending on the results, a final campaign may take place in two or three years.

■ **Cost of work and funding** : 4.5 million euros

Planned funding rates for costs before VAT:

- Seine-Normandie water agency, Essonne departmental council and the Île-de-France regional council: 80%
- SIAHVY: 20%

■ **Outcome of the project and outlook**

The work on the flood-control basin made possible an increase in the storage capacity of 8 100 cubic metres, i.e. 9% of its initial volume. Thanks to the work done and the increased capacity of the basin, 50-year floods in the Mérantaise can now be absorbed which has been observed during the June 2016 floods. Mérantaise contrary to the Yvette is not brought in in flood and seats create in plant techniques supported well the passage of this episode.

The new channel of the Mérantaise and its meanders were based, as much as possible, on the available historic data. A total of six hydraulic structures were removed and almost nine metres of head drop were eliminated. In the restored zones, flows are now more diverse and the impounded reaches have disappeared.

River continuity was restored over almost 1.5 kilometres in the lower section of the Mérantaise, however two total barriers for fish (including one at the Ors mill) remain upstream of the work area and block colonisation of the upper sections of the river basin, notably for brown trout.

To enhance the works done in the Mérantaise basin, landscaping in the form of walkways between the wet meadow, the river and the wooded areas was done. The former bed of the raised leat was filled in and turned into a walkway. In addition, informational signs were set up along the walking paths.

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