Widening and sediment reloading of the Drac riverbed in Saint-Bonnet-en-Champsaur

The operation

Catégorie	**Restoration**
Type of operation	**River gravel input**
Type of environment	**Intermediate river** (braided channel)
Issues at stake (water, biodiversity, climate)	**Hydromorphology**

Start of operation	**November 2013**
End of operation	**June 2014**
Length of river affected by the works	**3,600 m**

River in the restored sector

Name	**Drac River**
Distance to source	**36 km**
Mean width *(bankfull width)*	**30 to 40 m** before works **80 to 120 m** après travaux
Mean gradient	**10 ‰**
Mean discharge	Appr. **9 m³/s**

Aims of the project owner

- Restore the braided channel dynamics of the the Drac.
- Restore sediment continuity and halt river bed scouring.
- Restore lateral connections with tributaries, side channels and wetlands.
- Maintain tourism and economic activities at the lake and along the Drac.
- Make the area safer in terms of flooding and landslides.

Environment and pressures

The Drac Blanc and the Drac Noir torrents both originate at an altitude of over 2,500 metres in the Écrins mountains in the Alps and join to form the Drac River at the town of Orcières. The Drac transports considerable amounts of sediment and has a number of braided sections in its upper reaches. The river flows in a valley where rock bars and basins alternate in an Alpine and rural setting. The river basin is the site of major tourism activity, in both the summer and winter, with numerous aquatic activities (fishing, white-water sports, swimming) taking place in the Drac and in the lake.

The localisation

Country	**France**
River basin	**Rhône-Méditerranée-Corse**
Region(s)	**Provence-Alpes-Côte d'Azur**
Departement(s)	**Hautes-Alpes**
Commune(s)	**St-Bonnet-en-Champsaur, St-Julien-en-Champsaur, St-Laurent-du-Cros, Laye, La Fare-en-Champsaur,**

Regulatory context	**Peripheral zone of the Écrins national park**

European directive references

Water-body ref.:	**FRDR353b**
Natura 2000 site ref.:	*Not applicable*
ROE code of the obstacle	**49613** weir near the recycling center **49609** weir at the Baraques bridge

Bertrand Breil, CLEDA

Bed scouring of the Drac into the clay, loss of riparian vegetation and a landslide, in November 2011.

GéoPortail

A study carried out in 2000 signalled a problem of incision in the bed of the Drac (clay substratum) upstream of the town of Saint-Bonnet-en-Champsaur, caused by massive extractions of gravel since the 1960s and that ended only in 2012.

The major floods in 2006 and 2008 worsened the phenomenon. The results were perfectly clear, i.e. severe bed scouring over a distance of 3.5 km starting at the old weir at the Champsaur Lake and running downstream to the weir near the civic amenity site in the town of Saint-Bonnet. The bed and the alluvial groundwater level had dropped three metres. riverbed incision threatened the stability of nearby infrastructure, notably the dike for the Champsaur lake, affected economic activities (dewatering of abstractions) and nearby ecosystems (drying of parallel streams and disconnection of tributaries), and had clear consequences for recreational activities and for public safety.

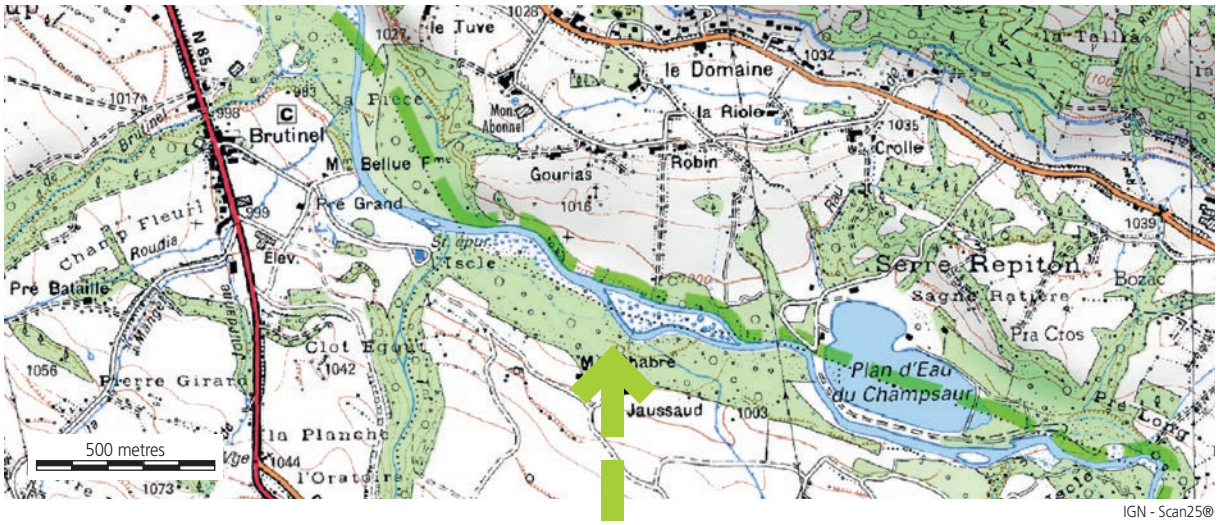
Opportunities to act

The Upper Drac management plan ("SAGE Drac amont") was established in 1999. The follow-on plan with a river contract and the corresponding action programme started in 2011-2012. Both the plan and the river contract are managed by CLEDA (managing entity for the upper Drac), which represents the intermunicipal associations in the river basin. The physical restoration of the riverbed upstream of Saint-Bonnet was a priority in the river contract for the upper Drac signed in 2011. The plan was for a major operation to physically restore the riverbed by widening the bed (lowering the banks) and reloading the river using the coarse sediment taken from the banks.

CLEDA succeeded in convincing the funding entities and in 2012 it was possible to launch the calls for tenders, the studies for the works and to prepare the authorisation requests.

Works and developments

The works were done over the winter of 2013-2014, during the low-flow period. It involved over 80 people and 60 earthmoving machines for a period of six months. During the first phase, 3.6 kilometres of alluvial terraces along the Drac were cleared of trees and trunks, representing a total surface area of 27 hectares. The active channel of the Drac was thus considerably widened and the alluvial bars were once again exposed to the river currents. Some small islands with vegetation were maintained to enable the formation of side channels, secondary channels and nesting sites.



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The second phase consisted of a vast operation to reload the bed with 450,000 m³ of alluvium removed from the former terraces of the Drac and from zones of sediment accumulation along other rivers in the river basin.

During the third phase, following the return of the water to the bed, the new banks were stabilised using geogrids and bundled wood (fascines), then seeded and planted with over 6,400 willow cuttings and 500 helophytes, notably along the track for maintenance access and walkers on the right bank. In addition, 13 hectares of wetlands and parallel streams were created, primarily in the lower section of the reach.

In order to make the transverse obstacles compatible with the river continuity requirements stipulated in article L. 214-17 of the Environmental code, works was done on the weirs at the Baraques bridge and the recycling center site, located downstream of the reloading zone, during the year prior to the reloading. It consisted amongst others of building a stud-type fish pass designed specifically for trout and a passageway for canoes.

Reloading required that the weir at the recycling center site, downstream of the reloading zone, be raised 1.65 metres in order to stabilise the new steady slope and the upstream reload level. Finally, the weir for the lake in Saint-Bonnet was maintained, but buried under the reloaded sediment in order to conserve a solid anchoring point, yet removing a difficult obstacle for fish.

Regulatory approach

• Declaration of works in the public interest, with purchase of land on the basis of mutual agreements with the land owners.

• Water-law formalities with an impact study and a public enquiry.

• CNPN authorisation to move a protected species (miniature cattail).

• Authorisation to clear 27 hectares (Forest code).

Post-restoration management

It was initially decided to let the dynamics of the river and the riparian vegetation proceed naturally. If clay formations are uncovered, CLEDA may, as necessary, reload specific spots.

Monitoring

In the framework of the network of demonstration sites, the Water agency established a monitoring programme before and for five years (n+5) after the works, addressing biological aspects (fish, macroinvertebrates, diatoms) and the hydromorphology. This programme was filled out with a complete survey of active and potential redds for trout, in the main channel and in the reconnected secondary channels. This survey was carried out by the Onema local office*.

DR

The Drac with the scoured bed next to the Champsaur Lake in August 2009.

DR

The restored Drac next to the Champsaur Lake in June 2014.

A multi-partner monitoring plan (CLEDA, Water agency, Onema, Hautes-Alpes department, IRSTEA, Écrins national park, consulting firms) has been set up to complement the EU ALPeril programme that made possible Lidar topographical surveys in 2009 and 2015.

In addition, a thesis organised by Onema/CNRS/University of Paris 7 is now under way to assess the effectiveness of restoration works on rivers characterised by high levels of sediment transport and to study the dynamics of sediment transport.

Outcome of the project and outlook

Even in the absence of a significant flood, the entire widened section of the active channel has since become a braided riverbed. The current monitoring programme will provide information on the subsequent changes in the reloaded zone.

** For more information, see the "Monitoring" section in the fact sheet on the Wetlands portal.*

Costs

In euros ex. VAT

Preliminary study	**174,850 €**
Purchase of land	**210,000 €** *(59 ha)*
General-contractor fees	**224,240 €**
Works and developments	**4,142,920 €** *including 420,000 € to raise and equip the weir near the civic amenity site*
Monitoring	*Not calculated*
Promotion	**50,000 €** *(share paid by CLEDA, not including funds from IFORE and the Water agency)*
Total cost of project	**4,802,010 €**

Financial partners and funding: *Rhône-Méditerranée-Corse water agency: 47.25%; Champsaur intermunicipal association: 20%; Provence-Alpes-Côte d'Azur region: 14.25%; Hautes-Alpes departmental council: 10%; EU (ERDF): 8.5%*

Technical partners:
Onema; assistant to project owner: ETRM; general contractor: Burgeap and Geolithe

The works produced a long-lasting solution for the problems arising from riverbed scouring and resolved the difficulties threatening the attractiveness of the valley for tourists (safeguarding the Champsaur Lake, creation of a walking trail along the Drac, passage for white-water craft, enhanced fishing conditions, etc.).

From the ecological standpoint, sediment reloading of the Drac and the rise in groundwater reconnected six tributaries and resupplied with water side channels of high biological value. The return to the Drac of emblematic species, such as the common kingfisher, was observed shortly after the works. The living and reproductive zones of aquatic species that had abandoned the most heavily down-cut areas were recreated and clogging of the riverbed was reduced. During the 2015-2016 winter, Onema noted approximately 30 salmonid redds over the four-kilometre work area where only five had been observed prior to the works.

The physical restoration of the Drac required enormous resources and means at a very high cost. The project would have been much smaller and less expensive if measures had been taken when riverbed incision was first observed.

Promotion of the project

CLEDA launched a major communication effort before and after the works. Several films were produced, before the works in 2013 by CLEDA and in September 2015 by IFORE, with 3D animation showing the risks of erosion if the Drac continued to drop.

Signs explaining the project were set up prior to the works at each end of the restored sector. In addition, the walking trail created along the right bank of the Drac offers local residents and tourists a close view of the riverbed and its ecological environment.

This project was a candidate for the National ecological-engineering grand prize in the category "Ecological engineering for the preservation of continental aquatic ecosystems".

- *La restauration écologique du Drac : un projet de territoire,* Films IFORE, septembre 2015, *14'37*. *https://www.youtube.com/watch?v=HHLnsfWbF5Q*
- *Les travaux de restauration du lit du Drac pour éviter une catastrophe écologique et humaine,* Film CLEDA, oct 2013, 4'38. *https://www.youtube.com/watch?v=VsanyriLOC4*

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