THE NEW FLAZ RIVER – 8 YEARS LATER

AN EXCEPTIONAL PROJECT AND ITS MONITORING

Marietta von Pfuhlstein[1], Manuel Epprecht[2] and Volker Weitbrecht[3]

BACKGROUND

In order to protect the village of Samedan in the Canton of Grisons, Switzerland, against severe flooding, the Flaz River was permanently diverted over 4 km in 2004. This very unique flood protection measure was by far more expensive than another proposed alternative that intended to strengthen and heighten the dykes in Samedan. Nonetheless the river diversion was widely accepted by local politicians and citizens for two reasons: a) it fulfils the wish for durable flood protection, and b) it offered the chance for an ecological restoration of the fluvial system around Samedan. Not only was it possible to recreate the Flaz River so that it now corresponds to natural rivers in the region. An ecological revaluation of the Inn River in Samedan was also possible as its hydraulic capacity is no longer fully charged.

For the Swiss Federation the new Flaz River represents a very important model project that fulfils all the demands of an up-to-date flood protection policy: Samedan with its considerable damage potential is now protected against flooding by fluvial system that a) is ecologically restored and b) can cope with floods exceeding the design discharge without causing large damages. It also has to be mentioned that an extremely rapid execution of the measures on the Flaz and Inn rivers, costing 30 million CHF in total, was only possible because the municipality of Samedan adopted a very active and outspoken communication policy. From very early on various interested associations were integrated in the decision-making process, thus creating an atmosphere of trust and motivation.

What has become of the new river? Have the expectations been fulfilled?

Fig. 1 The new Flaz River: left: river widening and right: river bed reinforced with boulders

To find answers to these questions a multidisciplinary monitoring was set up in 2003, and data was collected until 2011. The monitoring program, commissioned by the Federal Office for the Environment (FOEN), covers the groundwater development, biological and river engineering aspects.

[1] Marietta von Pfuhlstein. ETH Zürich, Laboratory of Hydraulics, Hydrology and Glaciology (VAW), Switzerland (email: vonpfuhlstein@vaw.baug.ethz.ch)
[2] Manuel Epprecht, Federal Office for the Environment (FOEN), Hazard Prevention Division, Bern
[3] Dr. Volker Weitbrecht. ETH Zürich, Laboratory of Hydraulics, Hydrology and Glaciology (VAW), Switzerland

The latter is being studied by the Laboratory of Hydraulics, Hydrology and Glaciology (VAW) of ETH Zurich and presents the main focus of this paper.

OVERVIEW OF THE NEW RIVER

The new Flaz River consists of diverse subsections which vary in width, slope, bed material and morphology. For example, a river widening (Fig. 1a) enables the formation of gravel banks, further downstream, alternate bars have developed. There is also a section where the river is forced into a channel in order to assure sufficient bed load transport.
In July 2004, shortly after the termination of the works, a 10-year flood offered the first test to the new fluvial system. No major problems occurred, although locally significant redistribution of bed load material took place due to unfinished structures in the new river bed.

RIVER MONITORING: METHODS AND RESULTS

The Flaz River offers the unique possibility to monitor the development of a newly constructed river into a nature orientated river. Data on bed material und river geometry was collected before and after flooding the new river bed and successively during the last six years so that the evolution could be closely followed. In addition to regular surveys a webcam provides daily photos of the hydraulic and morphological changes in the river widening and three radar sensors measure the water level permanently.
The 10-year flood in 2004 provided data to assess the protection goal (100-year flood). Numerical 2D-simulations show that the goals have been attained (Vonwiller et al. 2010). It has also become evident that gravel extractions are only necessary after extreme floods, indicating that maintenance costs can be kept low.
Besides the hydraulic and morphological monitoring, the Flaz River offers the opportunity to collect data for various research activities such as, a) bed material sampling methods, b) unstructured block ramps and c) bed load transport rates:
a) Several **bed material sampling methods** were applied in order to identify and improve the most efficient methods. Focus is set on a digital sampling method that allows a rapid generation of grain-size distributions.
b) A point of interest is a river section where the bed is reinforced by large boulders (Fig. 1b) that cover up to 10% of the river bed. The field data collected at the Flaz River complements physical experiments at VAW that aim at establishing **unstructured block ramps** as a well-mastered measure in flood protection. The experiments belong to a research project (Tamagni, 2010) that intends to improve existing design guidelines with focus on both the hydraulic and the ecological requirements.
c) Furthermore, the detailed survey of morphological changes and the bed level make it possible to analyse **bed load transport** in the different river sections. Bed load rates estimated from physical experiments are compared to bed load rates extracted from the monitoring data. In particular, the development of the river widening seems to confirm bed load rates according to Zarn (1997).

REFERENCES

Tamagni, S. (2010). Design of unstructured block ramps: A state-of-art review, River Flow 2010, 729-736.

Vonwiller, L., Weitbrecht, V., von Pfuhlstein, M., Boes, R. (2010). Flussbauliches Monitoring am Flaz – Hydraulische 2D-Modellierung und ökologische Bewertung, Wasser Energie Luft, (2), 108-112.

Zarn, B. (1997). Einfluss der Flussbettbreite auf die Wechselwirkung zwischen Abfluss, Morphologie und Geschiebekapazität. Mitteilung 154, Herausgeber D. Vischer, Versuchsanstalt für Wasserbau, Hydrologie und Glaziologie (VAW), ETH Zürich, Zürich.

Keywords: monitoring, flood protection, numerical 2D-simulation, digital sampling method, ecological restoration, unstructured block ramps