

## Flood Protection at River Würzenbach, Luzern: Physical experiments to optimize bed load and large wood retention at a spillway tunnel intake



Accumulation of bed load and driftwood after the flood in June 2015  
(Photo: Stadt Luzern)

Heavy rainfall events in summer 2015 caused spacious inundations in the quarters of Würzenbach in Luzern. An operating spillway tunnel upstream of a dam in the Würzenbach is prone to lose its discharge capacity during flood events due to clogging with large wood. Furthermore, the sediment retention basin is not working properly which results in large sediment inputs into the tunnel.

The lower reach of the Würzenbach downstream of the dam has a discharge capacity of 3 m<sup>3</sup>/s, whereas the estimated discharge of a 300-year flood amounts to 30.5 m<sup>3</sup>/s. In case of bigger flood events the spillway tunnel needs to be fully operational.



Accumulation in the intake area of the spillway tunnel  
(Photo: David Cathomas)

Short-term safety measures were implemented after the flooding in 2015 including two large drift wood racks upstream of the intake. Further improvements are necessary to ensure permanent effectiveness including a fully operational intake during floods. Because of the hazard and damage potential, canton Luzern commissioned Hunziker, Zarn & Partner AG to find the best solution for this flood protection project.

The VAW was initially involved in the planning stage due to the comprehensive experiences with impacts of driftwood, clogging of hydraulic structures and driftwood retention. However, small system changes in cases of combined retention of sediment and driftwood can entail major and unexpected impacts on the total system. Since the relief capacity must be preserved for a multitude of load cases, physical experiments are inevitable.

The physical model is built at a scale of 1:15 with dimensions of 14.5 m x 3 m, reproducing around 170 m of the River Würzenbach. The aims of the model are surveying the functionality of suggested reconstructions (a lateral weir and an upstream located rack) in the spillway tunnel's intake area to achieve a sufficient retention of bed load and driftwood. To guarantee the connection of longitudinal river passability for fish, a lateral fish ladder will be implemented.

Keywords: bed load retention, driftwood retention, spillway tunnel, flood risk, flood protection

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