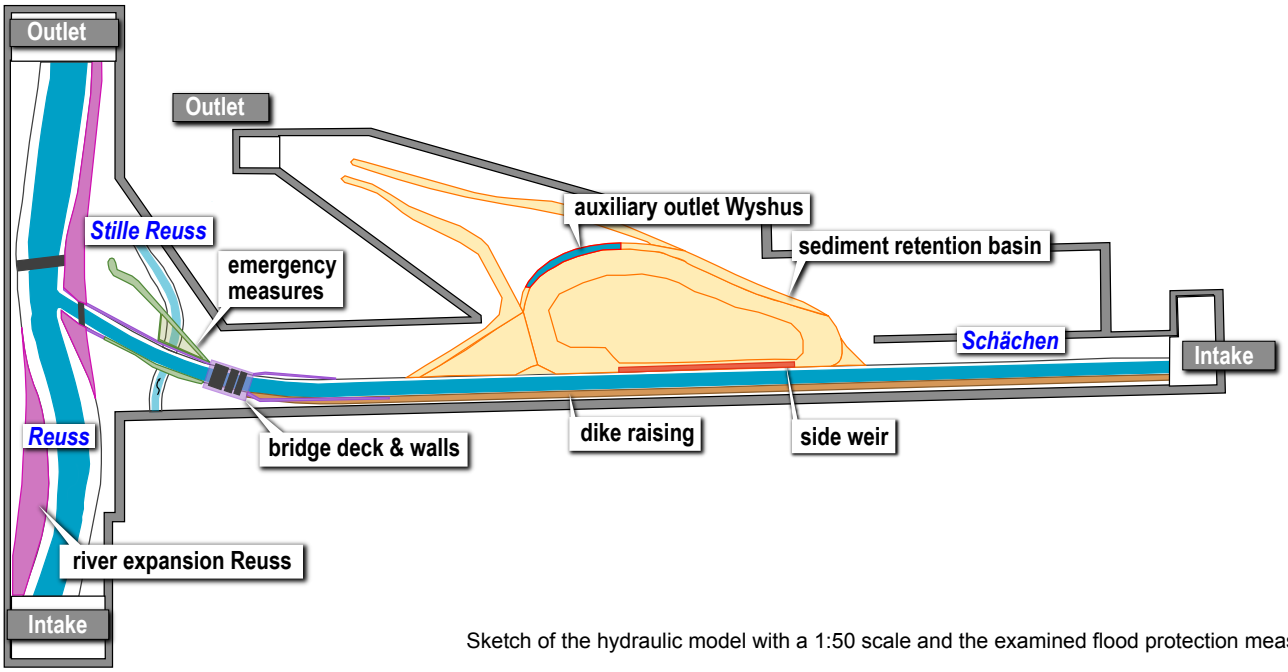
ETH zürich

Flood protection “Urner Talboden”: Hydraulic scale model tests

Photo taken after the flood event in August 2005, the village of Altdorf flooded by water and sediment caused by two blocked bridges in the river Schächen

During the flood event in August 2005 the valley of canton Uri was strongly affected by flooding. In the night of the 22nd August the river Schächen overtopped his banks and devastated the nearby industrial zone, the biggest of the canton. The total economic loss caused by the flood event amounted up to 300 million CHF. The river Schächen originates close to the Klausenpass and flows through the Schächen valley and meets the river Reuss at the valley bottom of Uri. The catchment area has a size of about 110 km^2. In the alluvial fan the Schächen is routed in a prismatic, straight lined, fixed torrent channel to its confluence where it flows in a slight right hand bend into the Reuss. Several transportation routes of international importance cross the Schächen about 200 m upstream of the confluence.

The 2005 flood can be characterized with a very long period of high discharges. The discharge exceeded 100m^3/s (50-70-year flood) during 12 hours, causing an enormous bed load displacement due to distinct bank erosion and channel degradation. Because of the slope reduction, the sediment has initially been deposited in the confluence region propagating backwards into the Schächen. The progressing sediment deposition filled the upstream channel and finally the flow cross section under the bridges upstream of the confluence was blocked. This culvert blockage caused an enormous overbank flooding of water and bed load material.



Sketch of the hydraulic model with a 1:50 scale and the examined flood protection measures.

Laboratory of Hydraulics, Hydrology and Glaziology
Versuchsanstalt für Wasserbau, Hydrologie und Glaziologie

After the devastating flood the canton of Uri commissioned a consortium of engineering companies to elaborate a flood protection project. The most significant measures, which are examined in the hydraulic model, are (1) the redesign of the bridges as a 45m long bridge deck inducing pressurised flow conditions, (2) the construction of a lateral sediment retention basin, which is linked with the fixed torrent channel via a 240m long side weir in the right channel bank and (3) to increase the bank height with hydraulic capacity of the channel. To analyze the impact of the different measures separately and in combination, hydraulic model tests have been conducted parallel to the project planning phase. The hydraulic model has been built on a 1:50 scale, representing 1100m of the Schächen and 600m of the Reuss to investigate possible backwater effects.

First technical expertises show that the planned bridge deck is able to induce pressurized-flow under the bridge during high load leading to a decreased blocking and flooding risk. The planned lateral sediment retention basin has a potential of retaining about 100’000m^3 of sediment during a design load (300-year flood), corresponding to 75% of the overall bedload.

Photo of the bridge deck to improve pressurised flow conditions; view in flow direction.

Photo of the planned lateral sediment retention basin during the design load experiment (300-year flood); view in flow direction.

Keywords:	backward deposition, lateral sediment retention basin, bridge deck inducing pressurised flow conditions
Commissioned by:	Tiefbauamt Kanton Uri