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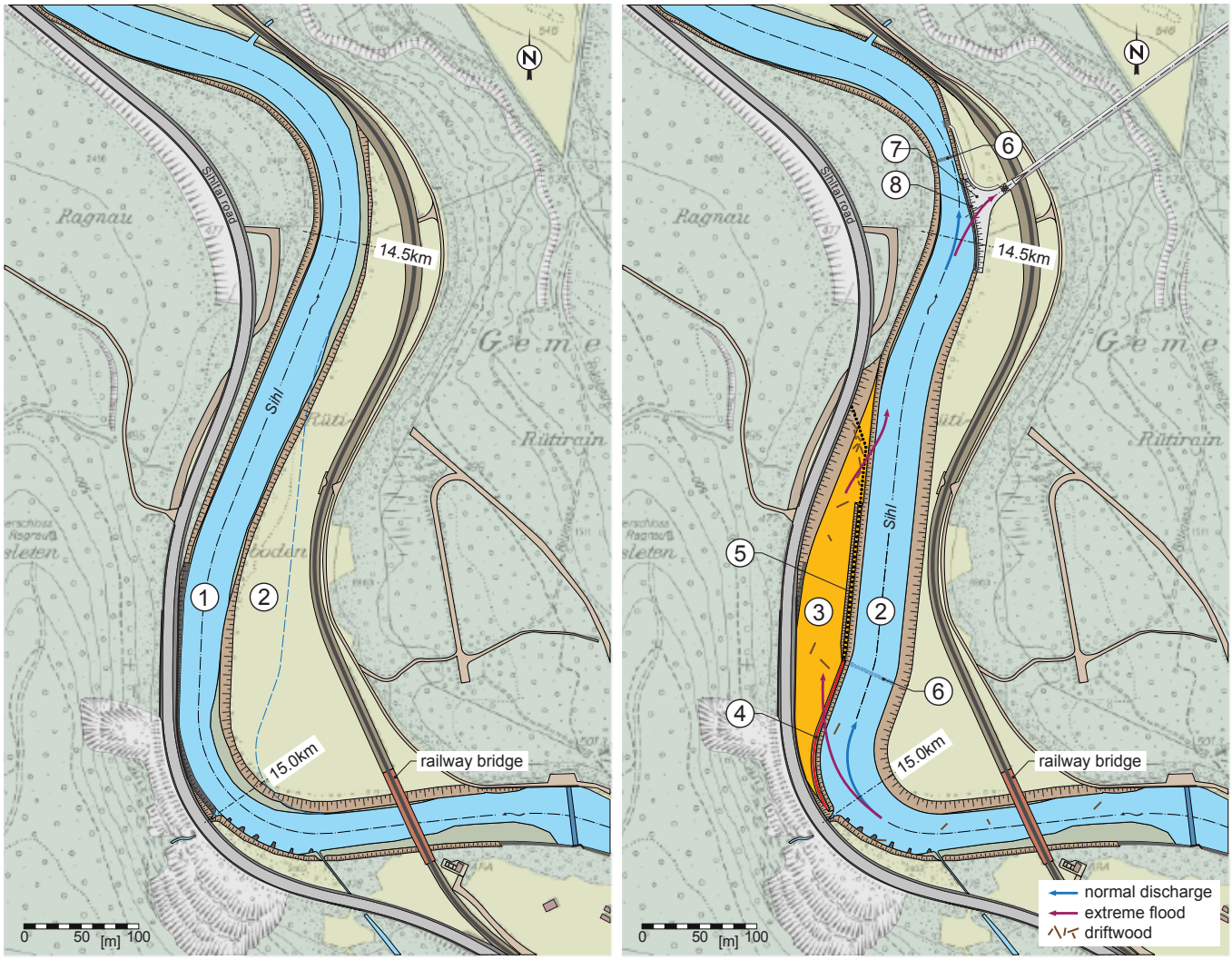
Physical experiments on driftwood retention and a diversion tunnel at the Sihl River, Zurich



① current river bed
② projected river bed
③ driftwood retention section
④ weir
⑤ pylon rack construction
⑥ bed protection structure
⑦ release tunnel intake
⑧ spillway construction

The driftwood retention at the location of the old main channel (left side), the new main channel (right side) and the spillway intake to the release tunnel.

The flood events 2005 and 2007 in the Sihl River showed that especially driftwood can lead to a strongly increased risk of inundation in Zurich city. Up to 6,000 m³ of driftwood are expected to be transported in the river during a 30 to 100year flood (290 – 360 m³/s) and a doubled amount during a 300year flood (450 m³/s). Driftwood accumulation at the culverts where the Sihl River flows underneath the central station would lead to large inundation areas in Zurich's city center. The estimated potential damage is about 3 to 5 billion CHF.

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The drift wood retention is part of an integral concept to save the city of Zurich from larger floods, where also the possibility of a diversion tunnel to Lake Zurich is considered. With the help of a physical scale model, the driftwood retention project and the spillway intake to the release tunnel are tested and optimized.

The driftwood retention construction is planned 15 km upstream of the central station in the river section Rütiboden where the Sihl River follows a distinct right hand bend. On a length of 400 m, the main channel is moved to a new position in the inner bend. Thus, the total river cross section gets much wider (fig. 1). The driftwood retention section is placed in the old channel. It is divided from the new main channel by a weir. During floods above 200 m^3/s, driftwood, which is expected to flow along the outer bend, should get carried over the weir into the driftwood retention section. Sediment transport should still take place through the main channel.

The spillway of the diversion tunnel is placed at an outer bend, 100 m downstream of the driftwood retention section (fig. 1). The tunnel discharges up to 300 m^3/s. It has dimensions of diameter = 5.6 m, length = 2.1 km and a mean slope of 2.7% .

The physical model is built at a 1:40 scale leading to model dimensions of 21 m x 11 m. It is equipped with a movable bed. Flow and sediment hydrographs of different flood scenarios can be represented. Flow discharge and sediment are supplied automatically via PC-controlled devices. The resulting bed levels are measured with laser distance meter mounted on a 3D traversing system. The driftwood is downscaled geometrically and prepared from smaller wood branches. It is added manually to the model tests. Driftwood and sediment balances are determined after each experiment.

Experiments are conducted since May 2011 up to summer 2012.

Keywords:	Driftwood retention, bypass tunnel, diversion tunnel, flood risk, flood protection, laboratory experiment, physical hydraulic model test
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