Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

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Master's or Project Thesis
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Design of countermeasures for macroplastics in rivers

Recent studies indicated that a substantial fraction of marine plastic originates from land-based sources such as rivers. Specifically, the ten top-ranked rivers may transport 88 to 95% of the global plastic load into the ocean. Macroplastics can be defined as plastic items with a diameter ≥ 5 mm. They are the primary contributor to riverine plastic pollution by mass and can pose a significant flood risk. Similar to increased wood transport during floods, macroplastics may block at river infrastructures (Fig. 1), resulting in an increase in flow depth (i.e., backwater rise) and potential flooding of the surrounding area. The design of retention racks may be a promising countermeasure for macroplastics in rivers.

Fig. 1: Accumulation of macroplastics and wood after a flood at the upper Tisza River in Hungary (photo: https://petkupa.hu)

Numerous studies on the rack design exist for wood accumulations with the governing parameter being the resulting backwater rise. It can be hypothesized that such rack structures may also be a robust countermeasure for macroplastics in rivers. Therefore, a series of flume experiments are to be conducted to study the resulting backwater rise due to macroplastics. The objectives are to (1) study the effect of different flow conditions and macroplastics characteristics on backwater rise at a rack, (2) optimize the rack structure to decrease backwater rise, and (3) compare the findings with studies on backwater rise due to wood in rivers. The results of this thesis will contribute to an improved process understanding of macroplastics in rivers and may aid ongoing flood risk mitigation efforts. This topic can be conducted as a project-based research work.

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Remarks:

Hydraulic laboratory experiments;
Project language: English or German
1 student for Master's or up to 2 students for project thesis