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Morphodynamics of Channels with Groins and its Application in River Restoration

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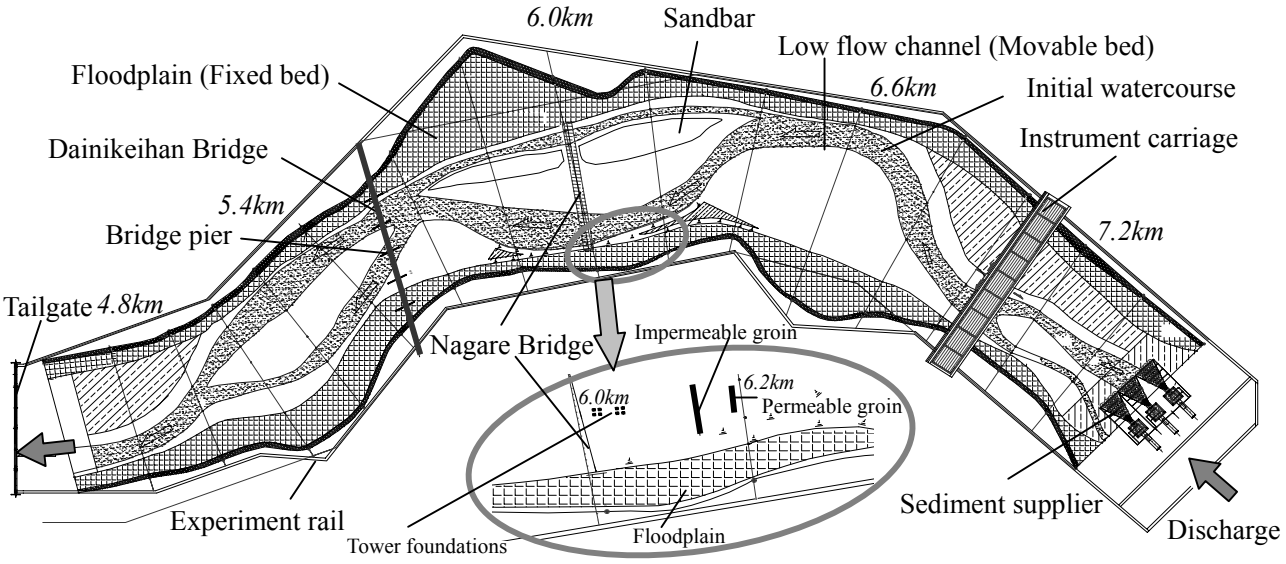
Groins have been widely used in river engineering practice to restore channel morphologies and improve aquatic habitats. In the state-of-the-art, approaches based on trial-and-error and limited experiences still play an important role for the restoration design and management. Without a full understanding of the channel hydraulics and morphodynamics caused by restoration measures, many projects have failed in the early stage of their design working life or have been found to be unsustainable. These usually implicate a loss of a huge amount of investments as well as potential disasters for the riverine eco-system and people living nearby. Therefore, it is necessary to develop more general restoration schemes based on an insight into the underlying physics of the problem. This research investigates the flow and bed deformation due to groin structures taking as a reference an existing restoration project along the Kizu River in west Japan.

Both physical model experiments and numerical simulations have been carried out. The experiments are conducted in a large-scale physical model (1:65) representing a 3km-long stretch of the Kizu River. The model is able to resolve the local flow and sediment transport phenomena with a relatively high accuracy. 2D morphological model is developed formulated with the finite volume method based on unstructured mesh. The model is advantageous to precisely represent the complex boundaries of actual rivers and restoration structures.

The numerical simulation results are compared with those of the experimental measurements. Generally good agreements have been found. It is hence expected that the numerical model may serve as a promising tool for the engineering designs and decision-makings in the river restoration.



Setup of the physical model experiment