Chapter 22

Commentary: Effectiveness and Integrated Multi-use of Retention Measures—A Hydraulic Engineering Perspective

Robert Jüpner

As a hydraulic engineer with a research focus on FRM, I read the chapter “Dilemmas of an Integrated Multi-use Climate Adaptation Project in the Netherlands: the Oekense Beek” with great interest. The described case in the Netherlands seems to me a typical river restoration project that aims to fulfill the requirements of the European Water Framework Directive. Since the implementation of this directive, a number of Europe’s rivers have been modified to improve their ecological status. Most of the projects focused on hydromorphological and biological quality elements. Updated case studies are published for a broader community, for example at <https://restorerivers.eu>.

The authors of the article provide few technical details about the size and the engineering part of the project. To fully understand the described “multi-use climate change adaptation project” from a hydraulic engineering perspective, the following information is essential:

- size of the project area, especially the relevant hydraulic and hydrological parameters,
- calculated retention volume for various flood scenarios,
- quantification of the described effects after successful implementation.

Even if there is no clear “threshold”, for a restoration project to be considered effective, the retention volume needs to be significant in proportion to the flood discharge. In engineering practice, hydraulic models will be used to calculate the reduction of the flood peak as the most important effect of increased retention capacity. The detailed figures thereby depend on a number of parameters, for example, the shape of the flood hydrograph and the filling procedure of the retention area itself (Patt and Jüpner 2013).

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Nevertheless, the core aim of the Oekense Beek project is clearly addressed: the restoration of a straightened and deepened stream and part of its floodplain. This will lead to an improvement of some parameters, for example, the quality of aquatic habitats, the variety of ecomorphologic parameters, more diverse flow conditions, and a rise in the ground water level. In addition, the retention capacity of the area will increase. However, due to the size of the project, these improvements will most likely be limited to the project region itself.

The effect of small- and medium-scale retention measures is subject of numerous research projects (Burek et al. 2012; Collentine and Futter 2016; Reinhardt et al. 2010; Rieger and Disse 2008). Even if there is no doubt about the general benefit of nature-based flood risk measures, the size of the flood peak reduction is usually very small. Meanwhile, multicriterial modelling of the effectiveness of decentralized flood protection measures are available (Neumeyer et al. 2018). The results are explicit: The more flood water needs to be considered the more limited the effect will be.

The illustrated Oekense Beek project is described as a “multifunctional-use-project”. While this constitutes progress, one must ask what are the main goals? A clear distinction between primary effects, such as the improvement of habitat for some species and positive “side effects”, will help to accurately measure the success of the project.

The effect of small- and medium-scale restoration projects toward reducing the negative effects of floods and droughts will diminish as the size of flood events increase. Various authors describe this phenomenon in detail (Burek et al. 2012; Patt and Jüpner 2013). Nevertheless, a positive result regarding FRM will certainly be achieved if the project is implemented successfully, because the overall “buffer capacity” will rise in the project area.

The statement that the “increase of precipitation [due to climate changes] can be compensated” is a very positive point of view. Most likely, a precise quantification of these effects will be very difficult (DWA 2015; Burek et al. 2012). Again, the more water needs to be retained during a rare flood event, the more limited the effects of (small-scale) nature-based flood retention measures are. In DWA (2015), quantitative results for the effectiveness of different nature-based flood retention measures are published. The results are related to the reduction of a flood event with a hundred-year recurrence interval. Based on 20 practical examples, the effectiveness of river restoration measures ranges from 0 to 30% with an average of 8.5% (DWA 2015, p. 79). Nevertheless, a very positive effect on the more frequent small flood events is verified.

In the case description, the cooperation between the relevant governmental and non-governmental actors is described in detail. This very interesting analysis is of great importance, because usually engineers are not specifically informed about this background of a project, whereas landscape and urban planners are more familiar with the project’s general background. Understanding the motivation and main ideas of all actors/stakeholders will facilitate developing a project that can be implemented successfully. Usually, a variety of engineering approaches are available to reach the main project goals. The more effort spent in the early stages, the smoother the realization of the project.

In the case of the Ookense Beek, conflicts emerged between various actors within the project. This seems typical and representative for river restoration projects. It is very interesting to read, which (legal) approaches are available in the Netherlands and how they are used. The explained effectiveness of the tools over time gives additional helpful information. This is especially significant, since the legal framework—the European Water Framework Directive—is the legal basis in all EU-member states, where “core values” are mostly identical. It is extremely beneficial for hydraulic engineers to learn from other European States how to efficiently use these instruments to reach project goals.

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