Engineering: Building with Nature 101x MOOC

Hints and Information for Building with Nature Design

Case 2: City with Nature

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As part of the Room for the River programme, several alterative interventions were considered for the City with Nature Case. These alternatives were screened using the Dutch planning kit “Blokkendoos” to simulate the effects of different potential interventions on high water level during floods in the Waal River in Nijmegen.

In Figure 1 below, a screen shot of the Dutch planning kit “Blokkendoos” is depicted. The red line represents the predicted high water level which has to be lowered by an average of 30 cm over the whole branch of the river Waal near Nijmegen (to reach the orange line – the desired high water level). The planning kit allows the user to test different interventions and to learn about their effects on the predicted high water levels. The blue line represents one of these tests. The planning kit also allows the user to detail each intervention by including annotated aerial photographs, the cost of the intervention, and the properties that would be affected by the intervention.

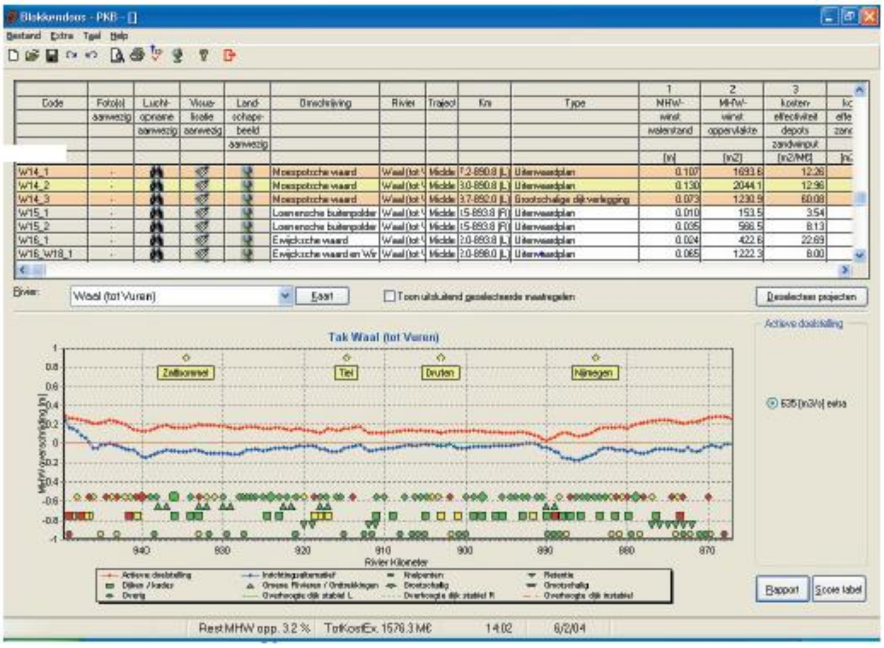

Figure 1. Planning kit output for the River Waal

When this planning kit was used for the River Waal, it became clear that certain interventions were more successful than others in achieving the reduction in high water levels during floods. This planning kit was used to convince both Houses of Parliament in the Netherlands of the necessity to approve a key planning decision and law that brought the *Room for the River* programme into being. In particular, the planning tool helped with the difficult decision of how to address the bottleneck at Nijmegen. A number of options were investigated, including deepening of the river bed, raising the dikes along the Waal, and the construction of a secondary channel to increase the discharge capacity of this reach of the Waal river.

Figure 2 represents the water levels on the river Waal between Millingen (at the left margin of the Rhine, kilometer 867) and Beuningen (kilometer 890). The horizontal axis of the graph depicts the kilometer of the Rhine where the water level is predicted. The vertical axis decpicts the predicted water level. The blue line represents the water levels under a design discharge of 16,000 m^3 / s at the Dutch-German border. The sharp change in the gradient of the blue line, at kilometer 884 is the bottleneck effect of Nijmegen, due to the narrowing of the river channel. The green line represents the effect on water levels of the relocation of the dike at Lent (on the North side). The red line represents the effect on water levels of both, the relocation of the dike at Lent and the construction of a secondary channel for the river.

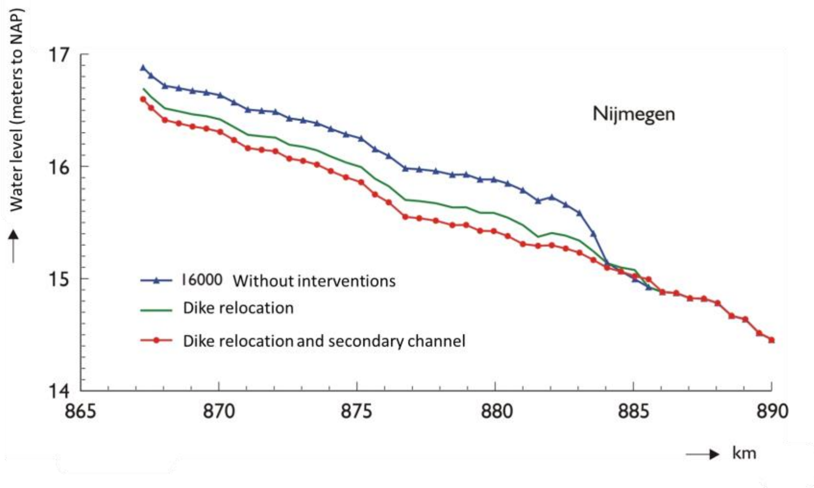

Figure 2. Effect on water levels of different interventions on the River Waal (Klijn, 2016)

The cross section of the river Waal needs to increase by 30% in order to decrease the water level during high discharges by 30cm. In this assignment, you are required to design a nature friendly solution that delivers this target.

You may assume that the geometry of the channel in this particular reach of the Waal is uniform in shape and depth, and has the measurements specified in Figure 3. Note that this figure is a schematic representation and is not necessarily accurate. However, you may use it to make your Building with Nature design calculations, if necessary.

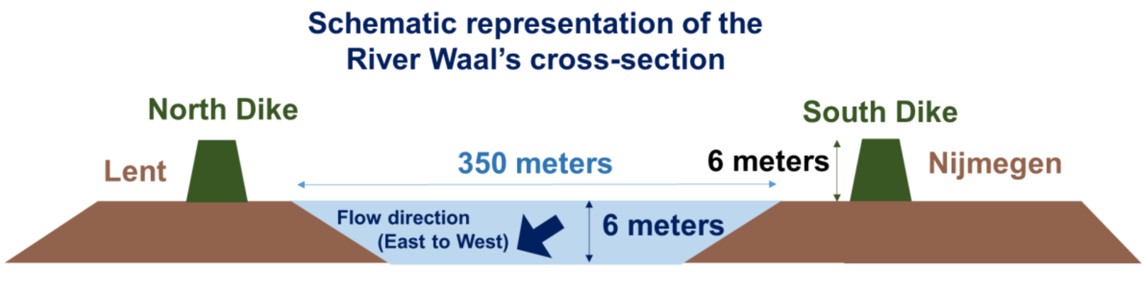

Figure 3. Schematic representation of the River Waal's cross-section. Prepared by the authors based on Eleftherakis (2012).

References

Eleftherakis, D., Amiri-Simkooei, A., Snellen, M., & Simons, D. G. (2012). Improving riverbed sediment classification using backscatter and depth residual features of multi-beam echo-sounder systems. The Journal of the Acoustical Society of America, 131(5), 3710-3725.

Klijn, F. (2016). Personal communication.