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More room for flood waves in the Tisza basin

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Hydrological consequences of the existing system of flood retention basins in the the Hungarian part of the Tisza Basin are investigated together with the planned ones envisaged int he frame of the recent framework plan for the enhancement of flood safety, rural and regional development. The Tisza Basin ranks high on the world list of catchments exposed to flooding, substantial part of the 123 000 km2 large basin are flood plains, out of those 16 000 km2 in Hungary, levees protecting 97% thereof against inundation. Namely less than 500 km2 remained for the streams and their active floodplain. This change of landuse is irreversible: the one and a half century since the intensive development of the flood protection system resulted in quadrapling of the population on the protected floodplain. 400 villages and towns, over 300 000 buildings, 6400 km of national and international roads and railways and 30 000 km of drainage and irrigation canals add to the infrastructure. The importance of floods depends on the impacts on a particular economy. The magnitude of impacts is influenced by the behaviour of the flood wave and the conditions of the river valley, whilst the hazard: benefit ratio is controlled by the pattern and time schedule of flood plain use. Technology based evolution of economy has made floods a dangerous natural phenomenon to modern industrialised societies. The extreme floods of the past years have revealed how dangerous the flood control situation actually is along the Lower Tisza. Accordingly, the Hungarian government have decided to improve fundamentally the flood safety of the river. As a result a conceptual plan has emerged, the name of which is Improvement of the Vasarhelyi Plan (IVP). As the naming indicates the new plan is essentially based on the original regulation concept of the river, even though it proposes significant improvements and new ideas. The primary objective of IVP is to reduce flood water levels along the lower reach of the Tisza. There are basically two ways on which this goal can be achieved: increasing the discharge capacity of the flood bed on the one hand, and storing excess waters in reservoirs on the other hand. Further reduction of flood levels needs the construction of flood retention reservoirs. Two types of

such reservoirs may be taken into consideration: 1. Flood detention reservoirs along the lowland reaches of the river outside the floodplain 2. High dammed reservoirs in the valleys of the mountainous headwaters. Construction of mountain reservoirs is not planned by the IVP, since the headwaters of the Tisza and of its tributaries are outside the borders of Hungary. Nevertheless, the neighboring countries have already put a great emphasize on constructing and operating such reservoirs. Romania has already installed several reservoirs in the headwaters of the Körös and Szamos river systems, and Ukraine is also planning a large system of retention reservoirs on the Upper Tisza basin. Obviously these reservoirs influence the flow regime of the entire river, thus it is the elementary interest of the downstream country (Hungary) to avoid any negative influences and to get as much positive influence as possible. These all emphasize the importance of coordinating the development of the flood control systems between the countries sharing the Tisza basin. As far the flood detention basins are concerned, the IVP gives a significant role to them in the future flood defense system of the Hungarian Tisza reach. These reservoirs are in fact existing lowland basins bordered by flood control dikes from the riverside, and by older dikes or roads on the inland sides. This means that only limited amount of dike enlargement works are needed to build these reservoirs up to their planned capacities. Filling and releasing the reservoirs have to be controlled by means of gates or gated culverts built into the flood control dike. Operation of these structures has to be carried out according to elaborated policies, which takes into consideration forecasted flood waves coming from upstream as well as flow conditions on the downstream reaches. The later implies that Hungary should take into the consideration the flood safety interest of Yugoslavia, just like the upstream countries that of Hungary when operating the different flood retention reservoirs. The total storage capacity of the proposed detention basins is 1526 million m3. According to preliminary calculations, this capacity is enough for decreasing the peak levels of extreme floods with 1 m all along the Hungarian reach of the Tisza . The structural and non-structural (e.g. operation policies for flow control structures) measures proposed by the IVP form the building blocks for a new master plan for improving flood safety along the River Tisza. As it has been pointed out above, the cause-effect mechanism of the measures is so complex that inadequate designing and sizing may even worsen the state of flood safety. This complexity is just enhanced further when the different measures are combined into one master plan. These all emphasize the importance of a model package, which enables the planners to check the effect of potential plans on the water regime of the river system. This package comprises hydrological models simulating rainfall-runoff processes on the mountainous sub-catchments, as well as hydrodynamic models simulating runoff processes in the river channels of the Tisza system. Outputs of the former are boundary conditions for the later. When not playing their flood control role, detention basins can be utilized for agricultural and/or

nature protection purposes. Obviously, agricultural activities should be carried on by accounting for the chance of inundation; always, flood protection leads the list of priorities. The conflicts coming from this situation may be resolved by providing financial compensation to the interested farmers in case of flood damages. Carrying on less inundation sensitive agricultural activities, such as cattle grazing or forestry, is also a good solution. As far as nature protection is concerned, detention basins offer excellent habitats for the typical, rich floodplain flora and fauna, given that hydrological conditions are adequate. Adequate hydrological conditions mean a dynamic regime of inundation and stranding with appropriate timing and durations. This can be achieved by generating artificial floods in the reservoir with the help of the sluices built into the flood control dike. However, the ecological function of the reservoirs cannot endanger their primary, flood control role, which means that ecological inundations should always be kept under a well-defined water level.