Summary of doctoral thesis

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"The influence of human activities on the fluvial processes of lower part of the Brda River."

Doctoral thesis concerns the issues of the dynamics of sediment transport in the Brda River, which is strongly influenced by anthropopression. Its impact is reflected primarily by the construction of the cascade of reservoirs (Koronowski, Tryszczyn and Smukała) and in the functioning of a series of hydrotechnical structures in the estuary (urban) part of the Brda River - hydroloops Bydgoszcz and Czersko Polskie.

The main objectives of the research work is to make the characteristics of the suspended sediments transport, to identify the sources of its supply from the catchment area and to determine the effect of functioning of the cascade of lower part of the Brda. The linking of basin's parameters with sources of supply of the sediments and the course of transport and deposition allowed to specify the degree of anthropopression in lower part of the Brda River.

The results come from the research conducted in years 2012-2016, also covering analytical data for the period since the creation of the Koronowski Reservoir (1961) till the present time. The study was divided into two main stages: field work and data processing. Basic field work included monthly measurements of turbidity of water from the Brda and its tributaries in the lower part of the river and depth soundings. In addition field measurements were carried out as part of two field experiments: (1) for possible usage of bottom deposits in the process of resuspension, caused by the undulation of water and further including it as a part of suspension transported downwards, (2) relating the measurement of the suspension transport and bottom deposits in the part of the old river channel of the Brda River in Koronowo, in conditions of extreme water flows, caused artificially by discharging water from the dams - so-called cleaning of the river channel. The phase of data processing enabled, a part from the preparation of the collected field data, determination of the balance of suspended sediments in the longitudinal profile of the Brda, calculating the degree and rate of siltation of reservoirs and identify other sources of supply of suspended sediments.

The environmental characteristic of the Brda valley was made, indicating the attributes of the catchment area, which distinctly determine the supply and the possibility of transport of the suspended sediments. The most important features include: lithology (sandur of the Brda), soil cover, high value of lakes index in the upper part of the catchment area and hydrological

conditions of the Brda River and its tributaries. The impact of anthropopression also pointed out in the use of land.

The characteristic of the existing hydrotechnical structures was made - reservoirs: Koronowski, Tryszczyn and Smukała and facilities of hydroloops Bydgoszcz and Czersko Polskie. The emphasis was put on specifying the connection between the regime of waters and the dynamics of transport of the suspension. Furthermore, the characteristic of morphometric conditions of reservoirs was done by a series of indicators. The two zones of a fluvial and limnetic nature were separated, because of a different conditions for the transport and accumulation of sediments.

In the next part of the thesis the characteristic of the transport of major components of the sediments was performed, with particular emphasis on the suspension. The zones of increased accumulation and erosion of suspension were defined in the longitudinal profile, as well as the seasonal course of the turbidity of waters was designated. The balance of suspended sediments with its mechanical composition was determined. Other components of the sediment transport were subjected to a short characteristics, enabling determination of dominance.

The next chapter describes the nature of sources of suspended sediments supply in the catchment area of the Brda River. It consists of the analysis of surface water erosion in the basin, calculated by the USLE model, and balance of the sediment loads supplied from municipal wastewater treatment plants. Delivery of the other sources, determined by the above mentioned field experiments, referred to the possibility of delivery of suspended sediments as a result of resuspension and abrasion within the reservoirs and the balance of suspension and bottom deposits in the part of the old river channel of the Brda, initiated as aresult of the emergency cleaning by waters tapped from Koronowski Reservoir.

The last chapter includes the determination of the role of reservoirs in the lower part of the Brda in the continuity of sediments movement. The ability of retention of the reservoirs was calculated by using nomograms and the actual retention capacity, based on data from turbidity of waters. This enabled the precise determination of the annual volume of deliveries and lift of the sediments for the analyzed reservoirs, both during the years of their operation and in terms of seasonality. The aboved mentioned calculations were verified by calculation of silting of the Koronowski Reservoir using a comparative analysis of the depth’s bathymetry from the three periods (1961, 1988 and 2013 - the author's own measurements).