

## Wloclawek Reservoir – is it lake or river?

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### ABSTRACT

In Polish gazetteer (list of geographical names) artificial water bodies are named "lake" while in hydro-technical literature these objects are named "reservoirs". There is a discussion about difference between natural lake and artificial reservoir on the river not only in respect of geographical names, but that concerns also other natural science studies. The aim of this study is to show on the example of Wloclawek Reservoir that artificial water body created by the damming of large lowland river shows the hydraulic and sedimentation properties of riverine, transitional and lacustrine environments.

Wloclawek Reservoir was created in 1970 at lower Vistula river when Wloclawek barrage was completed and put in to operation. The aim of building the dam was to start cascade of reservoirs in so called Vistula Program. The barrage consists of following elements: earth dam of 626 m length, 10 weirs of total opening length 200 m, fish passage, hydro-electric plant with 6 Kaplan turbines with installed power of 162 MW, ship sluice with dimensions 115x12 m. Characteristic discharges at the Wloclawek dam profile are  $LQ = 312 \text{ m}^3 \text{ s}^{-1}$ ,  $MQ = 903 \text{ m}^3 \text{ s}^{-1}$ ,  $Q1\% = 8970 \text{ m}^3 \text{ s}^{-1}$ . The normal head at weirs was designed as 11.3 m.

Created above the barrage an reservoir has an area of approximately  $70.4 \text{ km}^2$ , with a total storage capacity of 408 million  $\text{m}^3$ . At a normal damming level, the reservoir covers the river section from 618 to

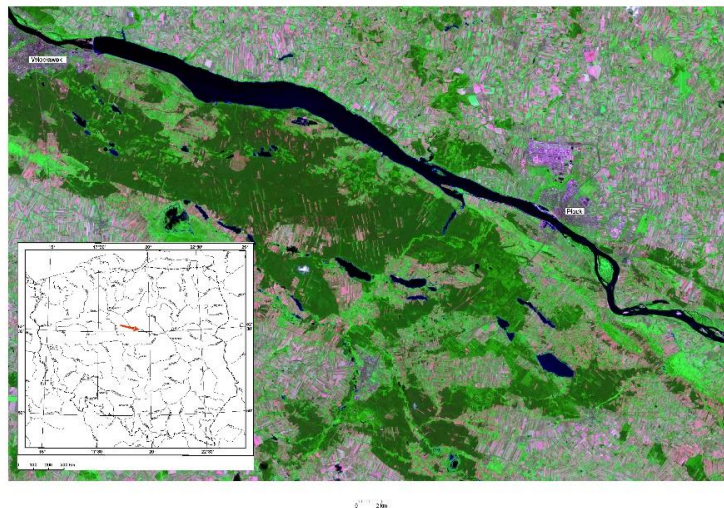
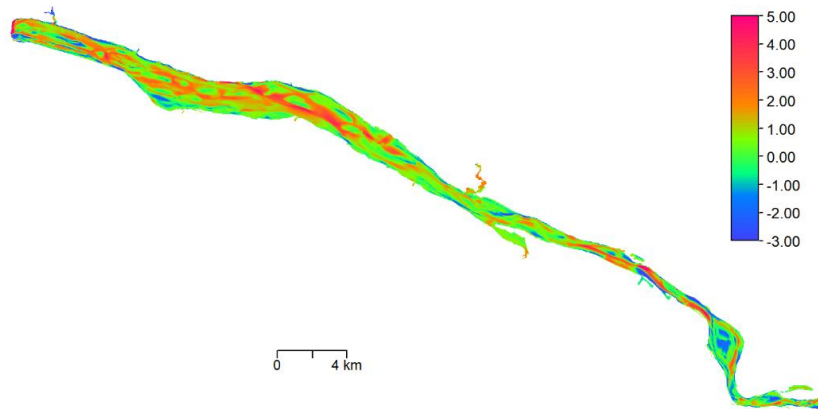


Fig. 1. Wloclawek Reservoir location and details shown at Landsat satellite image

674.8 km. It is a typical valley reservoir (Fig. 1), long and narrow, with a relatively straightforward coastline, and a backwater of over 58 km, reaching beyond the city of Plock. Right bank of the reservoir below city of Plock is limited by the high slope of glacial plateau, while left bank is protected by the side dams.

Three hydraulically different zones may be identified for a Wloclawek Reservoir from the results of the numerical study using the two-dimensional model CCHE2D, these are: lacustrine (km 649.8-674.8, profiles 1-27), transitional (km 632-649.8, profiles 27-56), and riverine (km 617.9-632, profiles 56-81).

Lacustrine zone and transitional zone are found to provide good sedimentation conditions on former floodplains and in the channel macro-forms (Fig. 2). In winter low velocity of water (below  $0.2 \text{ ms}^{-1}$ ) in the lacustrine and transitional zone promote the fast formation of ice cover with a structure typical for lakes. Edge of the new ice on the reservoir create the barrier which stops floating slush and fragile ice. Hydraulic conditions of Wloclawek Reservoir shows that lower part of this object acts as a trans-fluent lake, while upper part has a properties of free flowing lowland river.



**Fig. 2.** Bed change of the Wloclawek Reservoir bottom in the period 1992 – 2012