

The impact of the modernization of the drainage system on the water retention in ditches:

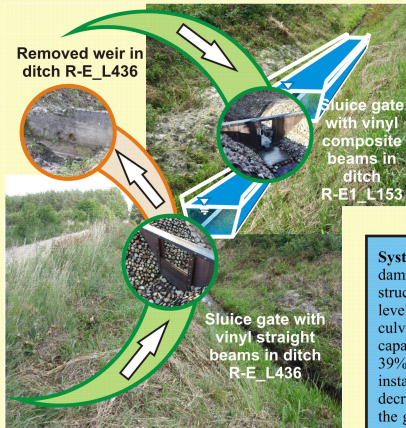
The case study of Grabow ditches net

Aims

The aim of the presented research was the estimation of water resources control possibilities of a selected open ditch network. The application objective of the fieldwork and resultant calculations was the estimation of retention capabilities increase after the system refinement.

Materials

Parameters of the system. The R-E ditch is characterized by a small average slope of the bottom $J_{R-E} = 0.752\text{‰}$. The maximum potential damming depth in the mouth of the ditch R-E resulting from the minimum elevation of the bank at the damming length is $H_{p_{R-E}} = 1.26$ m, gives the value of the potential volume index $kp_{R-E} = 60\%$. The R-E1 trench is characterized by a large average bottom slope $J_{R-E1} = 2.934\text{‰}$ and $H_{p_{R-E1}} = 1.32$ m. This ditch becomes shallower towards the sources and its depths decrease, which causes a decline in the potential volume index to the value of $kp_{R-E1} = 49\%$. The R-E4 trench also has a large average bottom slope $J_{R-E4} = 3.099\text{‰}$ and $H_{p_{R-E4}} = 1.25$ m, hence the retention volumes of its bed are much smaller and the potential volume index $kp_{R-E4} = 28\%$.



Results

Retention properties of the system. The total geometric capacity of the system, considering the whole length of the ditches, equals $V_g = 5\,020$ m³, while more than 50% of it is covered by the ditch R-E, for which $V_{g_{R-E}} = 2\,792$ m³.

System parameters before modernization (BM). The existing weir height provided a dead retention capacity of 2.0% of the geometric capacity of all ditches of the system, and a usable capacity of 23%. It made feasible to use only 25% of the full geometric capacity, without the possibility to regulate the water levels.

System parameters after modernization (AM). The 7 new damming structures were made. These were 4 weirs of a plastic structure, with movable closures that allow regulating the water level, two permanent crest weirs and a disc regulator built into the culvert pipe. In the R-E ditch the geometric capacity by useful capacity utilization indicator becomes 52%, in the R-E1 ditch it is 39%, and in the R-E4 ditch it is only 16%. As a result of those installation works on the object, the dead storage volume decreased to 1.0%, and the increase of the useful storage to 41% of the geometric storage of all ditches of the system. This ensures 42% utilization of the geometric capacity of the ditches.

Conclusions

As a result of the construction of control structures, the location of damming has changed and the use of the geometric volume of the system has increased. The development of devices resulted in an increase in the usable volume from 22% to 41% of the geometric volume of the system.