Geophysical Research Abstracts
Vol. 14, EGU2012-9472, 2012
EGU General Assembly 2012

Sound management of sediment yields at the catchment scale by small detention ponds

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Keywords: small detention pond, sediment deposits, reservoir silting, urban catchment

Globally observed land use and climate changes have a clear impact on the sediment yields deriving from the catchment. Released sediments may originate from different point and non-point sources. Thereby it is difficult to manage and reduce sediment loads directly at the source without undertaking detailed and expensive monitoring programs. Small detention ponds are therefore frequently used water management systems in urban settlements to improve water quality at the catchment scale. Such ponds located at the outlet of small basins allow reducing sediment loads downstream. Additionally, they capture sediment-associated contaminants as heavy metals, nutrients and micropollutants. On the other hand, a sedimentation within the pond may be a severe problem because it decreases over the time its retention capacity. This is especially significant for small detention ponds, where the siltation rate is high. These ponds can loose their total capacity already after few years of their exploitation when no dredging operations are considered. Unfortunately, maintenance costs of small ponds are expensive and usually not taken into account when planning and constructing such ponds. Consequently, many small detention ponds become inefficient after an entire use of their capacity. Therefore careful planning of maintenance options is essential to keep an effectiveness of such ponds on the expected level.

Within presented here study we addressed the problem of silting small detention ponds and we assessed an applicability of such ponds to manage sediment yields discharged from small urban catchments. To this end, a periodic measurement of deposited sediments within a small detention pond (1.35 ha, 5 years old, Warsaw, Poland) has been undertaken. This pond receives a polluted runoff from a small urbanized basin (30 km2), for which no routine sediment measurement exists. The spatial sediment thickness within the pond was measured twice (in 2009 and 2011) by the echo sounding technique. A resulting sediment deposit volume was computed by constructing a Digital Elevation Model (DEM) of the pond. An alternating reservoir volume was estimated for both measurements and confronted with the initial characteristics (2007). Our first results demonstrate that the pond will loose its sufficient capacity after about ten years if no regular sediment dredging is undertaken. Moreover, the useful time of the pond will decrease by two years when the catchment area increases by 10% due to expected urbanization. Furthermore, different scenarios of maintenance options were analyzed and recommendations for sound sediment management of similar small ponds in urban catchments were given.