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title: **Ecohydrology as a key for application of systems solution for stormwater management and city strategic planning**

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Water in the urban space has been considered up to now mostly from the perspective of water supply, sewage purification and storm water management, with increasing awareness of the necessity of freshwater ecosystems conservation. The environmental cost of this rapid urbanization includes degradation of natural resources and compacted, highly impermeable development in the city.

Most of the urban streams were channelized, converted into a combined sewerage and stormwater system in the early years of the Twentieth Century, contributing to accelerated water outflow. Such investments permanently changed the environmental conditions, reduced catchment capacity for water retention and deteriorated water resources, living environment and quality of life.

According to the Ecohydrology concept, sustainable development of water resources is dependent on the ability to control processes of water and nutrient circulation, and the energy flow at the basin scale (Zalewski et al., 2002).

Ecohydrology principles provide a new framework for urban water management where the use of ecosystem properties as an integrating management tool should serve to reduce hydro peaking, improve storm water quality and retention, and convert excess nutrients, pollutants and even sludge in to biomass/bioenergy.

New environmentally friendly approaches in the Urban Water Management include a complementary component to the success strategy – the amplification of opportunities for enhancement of the absorbing capacity of ecosystems against intensified impact.

High quality of environment and ecosystem services are important for assuring high quality of life and human health as one of the top priorities for the sustainable city development. Therefore, there is a need for a new paradigm of holistic city management. Cities needs to be considered as ecological systems, where fundamental processes such as water circulation, matter and energy flow are extremely condense (Zalewski and Wagner 2005).

Understanding flow paths of these components can help to regulate them and enhance the effectiveness of the Integrated Urban Water Management (IUWM).

The city location, catchments morphology, compacted, highly impermeable historical development and streams chanalization reduces water retentiveness in the landscape and hydrological capacity of streams. This particularly evidences during storm events, through increased peak flows in the streams and sewage treatment systems.

The efficiency of the environmental resources use in highly impacted urban systems can be increased by understanding interrelations between hydrological and biological processes subjected directly to laws of thermodynamics.

The paper presents results of research related to demonstration activities in Lodz [SWITCH Project GOCE 018530]., focused on the application of ecohydrological approach to restoration of the municipal river for stormwater management by:

- harmonization of the existing hydro-technical infrastructure with ecosystems in urban catchments;
- enhancement of the absorbing capacity of the reservoir in the Sokolowka River cascade to reduce pollution and eutrophication by adaptation of the bottom structure by using phy-

totechnology to re-allocate nutrients into the unavailable pool for water quality improvement;

- increase of water retentiveness and improvement of quality of life by adaptation Blue-Green Network concept a framework for the sustainable development of the city based on its specific hydrological situation and character of water resources.

Storm-water related issues are being tested on the Sokolowka river(average flow: 0,17 m^3/s, catchment area on the City: 39,1 km, crossing the northern part of the city and representing a typical urban storm water receiver. The main channel was regulated by concrete slabs, to straighten the course and deepen the bed for purpose of runoff detention. The river's natural flow gradually disappeared, being nowadays supplied mostly by around 50 storm water outlets. Nevertheless, the middle section of the river valley located in the outskirts of the city, has maintained semi natural character with patches of meadows, wetlands and forests made this section appropriate as a pilot area for analyses best ecohydrological river rehabilitation options.

Hydrological, physical, chemical and biological parameters monitoring of the Sokolowka river, including installation of the online flow monitoring stations, which allows for analysis of the water budget and development of mathematical model for the stormwater management especially around residential area. These results, together with the results of large-scale field experiments, allowed for designing a Sedimentary Biofiltration System for efficient stormwater purification at stormwater outflows. Its constructions enhances allocation of nutrients into un unavailable pool and prevents flushing of pollutants into the river during high flows. Appropriate shaping of its hydrodynamic and plant structure shall positively influence the growth of sedimentation and reduction of biogenes in the outflow water.

The overarching goal of all the research activities is to develop a system solution which addresses the complexity of water and water-related issues in Lodz, and help to accomplish sustainable development of the city, based on water resources and Ecohydrology as a its fundamental component.

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