DESSIN
DEMONSTRATE ECOSYSTEM SERVICES ENABLING INNOVATION IN THE WATER SECTOR

Emscher, Germany: CSO cleaning and regulation techniques

Two innovative solutions for the improvement of water quality in urban areas

Nadine Gerner[1], Gebhard Weiß[2], Vasco de Freitas[3], Christian Niclas[3], Timo Wortberg[4], Thorsten Mietzel[4], Christian Flores[1], Issa Nafo[1]

[1] Emschergenossenschaft (EG), [2] UFT, [3] SEGNO, [4] University of Duisburg-Essen (UDE)

Site description

Over a century ago, the Emscher region was transformed into an industrial conurbation with coal and steel industry. The Emscher and its tributaries were turned into a man-made system of open wastewater channels (Fig. 1). With the decline of mining, the river and its tributaries are re-converted into near-natural waterways. As part of this re-conversion, a total length of about 400 km of sewers and 290 combined sewer overflow (CSO) structures with a total volume of 485.000 m³ have been and are still to be built until 2017 (Fig. 2 and Tab. 1).

Figure 1: The Emscher © Emschergenossenschaft, Nadine Gerner

Context

In DESSIN, the Emscher system serves as a demonstration area for innovations in the cleaning treatment of CSOs (see Cross-flow lamella settler) as well as regulation of large-scale sewer systems (see RTC of sewer system) to support the Emscher re-conversion process. By minimizing the entry of pollutants into water bodies during storm events, both will help to further improve water quality. As water quality is an important measure of a healthy aquatic environment, this will facilitate the WFD implementation for this heavily modified water body and will contribute to the increased value of ecosystem services (ESS).

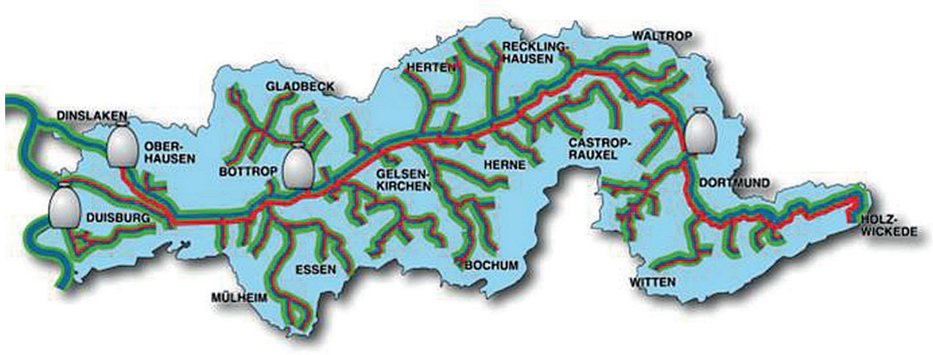

Figure 2: Emscher region with sewers to be built and streams to be ecologically restored

	No. of CSOs	Total volume
Realized	91	327.931 m³
To be built	290	485.000 m³

Table 1: CSO construction during Emscher re-conversion

Innovative solutions

Cross-flow lamella settler

As additional treatment of CSO, a cross-flow lamella settler will be experimentally implemented in the Emscher region. The cross-flow lamella settler (Fig. 3) enhances sedimentation inside a CSO facility during storm events. It helps to remove particles from overflowing combined sewage to reduce the pollution load into the receiving waters.

A prototype of a cross-flow lamella settler unit was developed by UFT as part of the DESSIN project. For the demo phase, it is located in a movable container and will be employed at a CSO facility operated by EG.

During each rain event, particle sedimentation in the container will be monitored by UDE, indicating the CSO load reduction potential. A comparison of the sedimentation efficiency in the container with and without lamella modules will allow assessing the real effect of the lamellae.

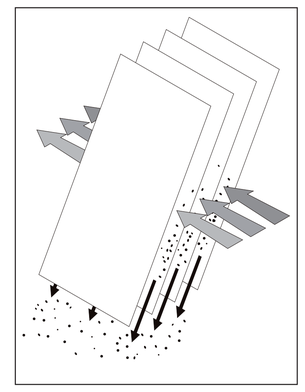

Figure 3: Experimental cross-flow lamella settler unit in cleaning position © UFT, Gebhard Weiß

Recent experiments with upflow lamella settlers have shown a fairly good sedimentation efficiency of up to 50 % of total suspended solids. Prior to building the test container, cross-flow lamella settler model tests in the laboratory were conducted within DESSIN. They also indicated a good particle separation efficiency while – other than with upflow settlers – the particles are less subject to re-entrainment into the inflow to the lamellae. The DESSIN container is fed by an electronically controlled pump so that tests with different yet constant inflows are possible. Within DESSIN, the container will be transferred to the Hoffselva demo site in Norway in 2016.

RTC of sewer system

The ADESBA real-time control (RTC) system enables communication between single CSO facilities with the aim of effectively utilizing the total existing storage capacity of the system. Thus, the RTC can facilitate a reduction in water pollution by decreasing the volume of overflow. The principle of operation is depicted in Fig. 4. Water levels is being measured at all CSO facilities. A request of a higher to a lower sewer storage will be sent if the water level is rising and the higher storage facility wants to drain water to the lower one. The lower one analyses the request and sends an answer of approval or denial.

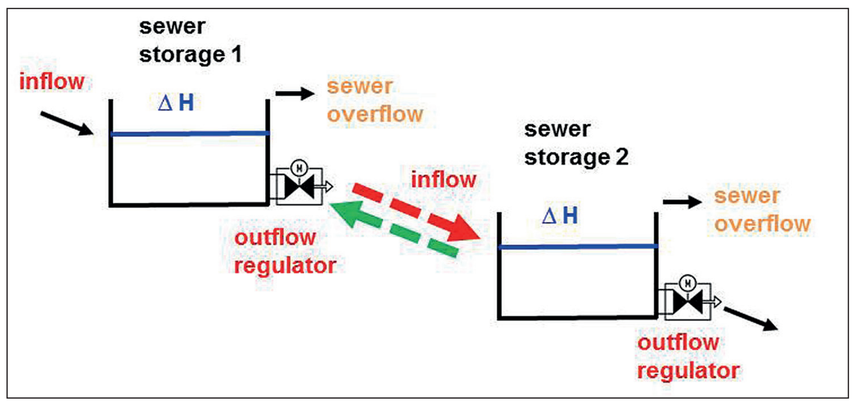

Figure 4: ADESBA RTC concept © SEGNO, Christian Niclas

Within DESSIN, the application of ADESBA has been further advanced by SEGNO. During the demo phase, ADESBA will be implemented in a number of CSOs of the combined sewer system in the Emscher area. A-priori planning can be realized based on historical data using the ADESBA planner tool.

The sewer overflow reduction potential is being assessed by UDE. For the Emscher region, first calculations of the regulation potential based on historical data of the CSO facilities under consideration show that one or more facilities already discharged wastewater into near-by streams while others still had storage capacity available. Thus, a potential for reducing wastewater overflow with the ADESBA system is present.

Outlook

The two technologies tested within DESSIN can facilitate a further improvement of the water quality in streams of the Emscher region after completion of the re-conversion. This creates potential for a healthy aquatic environment and can contribute to increased values of ESS. Regulation services such as biodiversity preservation and nutrient retention can be enhanced as well as cultural services like recreation and quality of life enhancement.

EMSCHER GENOSSENSCHAFT
UFT Umwelt- und Fluid-Technik Dr. H. Brombach GmbH
SEGNO
UNIVERSITÄT DUISBURG ESSEN Open-Minded

The research leading to these results has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement no. 619039