Online monitoring for evaluation of CSO impact on surface water

Hauke Sonnenberg, Pascale Rouault, Bernd Heinzmann
The Berlin drainage system

- 3.4 Mill. inhabitants
- Total Area: 900 km²
- Length of sewerage: 9000 km
- 63 main pump stations
- 6 wwtps
- DWF: 635,000 m³/d
CSO discharge points in Berlin

In the whole combined system:
- 700 CSO structures
- 150 outlets to rivers
Problem

CSO have impact on surface waters
- long-term effects: eutrophication
- mid-term effects: O₂ deficits due to BOD degradation
- acute effects: hydraulic stress, toxicity (NH₃)
Measures of reducing CSO in Berlin

In Berlin, 90 million EUR will be invested until 2020 for CSO reducing measures:

- building new storage
  (stormwater tanks, storage sewers)
- activation of existing storage capacities
  (increasing weir heights, additional automatic weirs)
Are these measures sufficient to protect the river?

Objective:
- **impact-based** assessment of measures in the combined sewer system

Duration: Feb. 2009 – Apr 2012 (3 years)

Volume: 1.3 million EUR

Consideration of climate change scenarios
Planning instrument

MIA-CSO planning instrument

Input/boundary data

- InfoWorks CS™
  - Sewer model

- Hydrax/ Qsim
  - River water quality model

Modelling framework

- Statistical module
  - CSO impact assessment method*

* Impact assessment method based on:
  - Target parameter definition
  - Threshold values for concentrations, event durations and frequencies
  - Statistical approach for data analysis
Need for integrated monitoring

Water quantity and quality measurements needed for
- understanding interaction CSO → river quality
- model adaptation, calibration, validation
- methodology to identify critical WQ situations in river

Therefore integrated monitoring
- continuous monitoring of Q and WQ of CSO in one CSO discharge pipe
- continuous monitoring of water quality at selected sites within receiving waters
## Sewer monitoring: site selection

Table: Criteria for site selection for sewer monitoring.

<table>
<thead>
<tr>
<th>CSO</th>
<th>CSO-vol. in % of total annual vol. of study catchment</th>
<th>Restructuring Measures planned</th>
<th>Access infrastructures</th>
<th>Protection vandalismus</th>
<th>Authorization</th>
<th>Distance from KWB</th>
</tr>
</thead>
<tbody>
<tr>
<td>outlet 1</td>
<td>25%</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>12 km (30 min)</td>
</tr>
<tr>
<td>outlet 2</td>
<td>15%</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
<td>yes</td>
<td>6 km (6 min.)</td>
</tr>
<tr>
<td>outlet 3</td>
<td>13%</td>
<td>no</td>
<td>no</td>
<td>yes</td>
<td>yes</td>
<td>9 km (20 min.)</td>
</tr>
</tbody>
</table>
Sewer monitoring: site selection

outlet 2: Ca. 15% of annual polluting load
Sewer monitoring: design

OCM Pro

Condu::lyser
Conductivity, T

Con::stat

Spectro::lyser
SSeq, NO3-N, CODeq, CODfeq

Ammo::lyser
NH4-N, pH
Impressions
Impressions II
River monitoring

existing monitoring stations
DO, pH, Conductivity, T

CSO outlet of monitored sewer

need for further monitoring.
River monitoring: site selection

Criteria for choice of additional monitoring sites

- River topology, location of CSO outlets
- On-site inspection (access to river bank?, vandalism prone?)
- Measurement of DO along and across the river (optical DO sensor ProODO, YSI)

- During dry weather conditions (normal situation) and
- after CSO discharges
River monitoring

- existing monitoring stations
  DO, pH, Conductivity, T

- Further water quality parameters
  TSS, COD, NH3, (NH4)

need for further parameters...

CSO outlet of monitored sewer
Example Monitoring point

- Multiparameter probe: MS 5, OTT
  - DO (optical sensor), pH, Conductivity, T

- Further parameters with s::can probes
  - ISE probe for NH4-N
  - Spectrometer for COD, TSS, NO3-N
What happens with all the data?

Data generation and validation

- **raw database**
  - measured data
  - meta data

- **validated database**
  - validated data
  - calculation of variables

- **treated database**

Data exploitation

- diagrams and advanced statistical analysis

External data

- Rain data, CSO volumes
First measurements
Acknowledgements

Hauke.sonnenberg@kompetenz-wasser.de