



**Project no. 4CE439P3**

**URBAN\_WFTP**

**Introduction of Water Footprint (WFTP) Approach in Urban Area  
to Monitor, Evaluate and Improve the Water Use**

**WP 5.5.2 Water Footprint Improvement assessment**

**Wrocław Urban Water Footprint Lab**

**Start date of project: 1 November 2012**

**Duration: 25 months**

**Submission date: 30 November 2014**

**CONTENTS**

1 Introduction .....3

2 Improvement Plan Structure.....3

3 Implemented measures .....3

4 Difficulties in achieving the objectives .....5

5 Achieving planned results .....6

6 Budget.....7

## **1 Introduction**

The aim of this document is to analyse the progress and continuation of the activities presented in the Improvement Plan (WP 5.4.2) a few months ago. The assessment of the structure and the concept of the plan will be made based on the implementation and experiences. It will be forecasted if the planned results will be achieved and justified if the chosen measures were appropriate.

## **2 Improvement Plan Structure**

The objectives of the Improvement Plan were determined based on the SWOT analysis and the needs of the city and region. They are a consequence of the possibilities and influences as well as limitations of the Municipal Water and Sewage Company in Wrocław. The objectives are focused on two groups of actions:

- The first group of actions is focused on involving different stakeholders from the water and sewage management sector. These are especially municipal and sewage companies representatives (from the whole Lower Silesia region) and municipality representatives responsible for storm water system management and spatial development of the city. The aim is to improve water and waste water management in the city and especially implement local rainwater management (Sustainable Drainage System) on a larger scale, by promoting sustainable solutions and possibly by implementing required modifications in legal regulations, in the future.
- The second group of actions is associated with reduction in Nitrogen concentration in the treated effluent. This is done by implementing various projects carried out in the Waste Water Treatment Plan, which were planned anyway, because reduction in Nitrogen concentration is an important objective for the Municipal Water and Sewage Company in Wrocław anyway.

## **3 Implemented Measures**

There were taken a few measures to fulfill these objectives. However, some of them could not have been implemented within the duration of the project due to the long scale of the Improvement Plan. There were also required some minor deadline adjustments.

The initial measures for implementation of Sustainable Drainage System required an

implementation of specific technological solutions such as permeable green areas, constructed wetlands and other solutions contributing to reduction in risk of urban floods (e.g. rainwater harvesting and reuse). These solutions contribute to a reduction of  $WFTP_{Blue}$  and  $WFTP_{Grey}$ , and a positive increase in  $WFTP_{Green}$ , which is a dominating  $WFTP$  in green areas. As these cannot be directly influenced by the Municipal Water and Sewage Company, it was decided to concentrate on their promotion among the stakeholders and municipality representatives responsible for storm water management and spatial development of Wrocław. The following actions were undertaken within 2014:

- Carrying out and analysing questionnaires on water and sewage management behaviours among citizens and students (future stakeholders).
- Media, conference and trade fair appearances as well as publications to promote the project methodology and sustainable water and waste water management solutions among scientists and stakeholders.
- Workshop addressed to students (future stakeholders), at which they have calculated their water footprints and monitored their water consumption for different household purposes and learned about the methods of water saving (reduction in  $WFTP_{Blue}$ ).
- Workshop dedicated to representatives of municipal water and sewage companies from Lower Silesia region, at which the water footprint of their cities was calculated using Model A and the solutions for water footprint reduction were discussed.
- One week training for municipality representatives responsible for storm water system management and spatial development of Wrocław, during which the technological solutions of sustainable city management, especially those related to local rainwater management, and the examples of the regulations and incentives favouring their implementation were presented.
- The Letter of Intent between Municipal Water and Sewage Company and Municipal office of Wrocław was signed to agree for future cooperation in terms of increasing the awareness and disseminating the knowledge about sustainable water management in urban areas.
- Open day addressed especially to architects and design engineers as well as workers of Municipal Water and Sewage Company responsible for investment permissions, on which the sustainable city management solutions were introduced and their implementation experience was discussed.

It is believed that the implementation of these measures was successful.

The measures for reduction in Nitrogen concentration in treated effluent applied in the Waste Water Treatment Plant were only partly implemented:

- The anaerobic reactors were transformed into denitrification reactors so the denitrification volume was increased.
- The internal recirculation was implemented in one of four sewage treatment lines in the old part of the Waste Water Treatment Plant. It will be implemented on a full scale within 2015.
- The optimization of the aeration conditions was conducted via computer modelling. The model was built on the basis of the data for one year of Waste Water Treatment Plant operation plus the results were confirmed by the extra measurements. The indicated most effective aeration algorithm will be implemented within 2015.
- The pilot scale plant for implementation of annamox or nitrification/denitrification process of sludge dewatering liquor was built and the test runs are carried out. The research will last for two years and if one of the methods proves to be effective and cost efficient, it might be implemented on a full scale until 2019.

#### **4 Difficulties encountered in achieving the objectives**

The major difficulty is associated with the lack of time for implementing some measures within the time frame of the project. The Improvement Plan was written in June 2014, while the project ends in November 2014, which gives only 5 months for the activities.

Regarding the implementation of the Sustainable Drainage System the emphasis was shifted from implementation of particular solutions (on which the Municipal Water and Sewage company does not have an impact) to awareness building and their promotion among the stakeholders and decision makers, which might have a direct and/or an indirect impact on their implementation. It is believed this modified objective was achieved. The municipality representatives and stakeholders are willing to cooperate in this field, however more actions are required in the future to achieve any significant changes and progress.

If more time is available, the wider scale questionnaires could be carried out among larger number of citizens. In addition, the informative and promotional campaign could be carried out. More workshops could be organized for more students and stakeholders. The

completion of all planned activities has generally required a lot of organizational effort for the Wrocław Lab.

Regarding the reduction in Nitrogen concentration projects, some stages have been carried out within the time frame of the project, while some might last even until 2019.

## **5 Achieving planned results**

The Wrocław Lab has carried out all planned actions. However, the promotional and awareness building activities did not have any direct impact on the improvement in water footprint. It is believed that the involvement of different stakeholders and future cooperation will lead to some changes in investment practices and associated law.

The involved parties have shown high interest in improvement of water and waste water management in the city and slight modification in the city policies, which would favour implementation of related technological solutions. The municipality representatives and stakeholders are willing to cooperate in this field. If the relevant actions will be undertaken as a results of this cooperation, the measures mentioned in the Improvement Plan, i.e. technological solutions for rainwater management will be implemented on a larger scale and in consequence  $WFTP_{Blue}$  and  $WFTP_{Grey}$  will reduce, while  $WFTP_{Green}$  will increase.

For now, only some of the actions associated with reduction in Nitrogen concentration in the treated effluent lead to the water footprint changes, which can be already measured. The transformation of the anaerobic reactors into the denitrification reactors was carried out within the duration of the project, however it is difficult to measure to which extent within such short period of time (the results for the year before and after implementation should be compared). In addition, different Nitrogen reduction projects are carried out simultaneously.

The improvement of internal recirculation on a pilot scale was finished in October. This was implemented in one sewage treatment line of the old part of the Waste Water Treatment Plant, and resulted in the reduction in Nitrogen concentration by 0.3 mg/l (when compared with the unmodified lines). When applied to all four lines (2015), the reduction in Nitrogen concentration by 1.2 mg/l in the treated effluent is expected, so the total value will decrease from 10 to 8.8 mg/l, while  $WFTP_{Grey}$  will reduce from 51 135 000 to 44 998 800 m<sup>3</sup>/year.

The optimization of the aeration conditions conducted via computer modelling was also completed. The results are currently analysed. The tests indicated in which parts of the

biological chambers the aeration is most effective and what is the minimum aeration efficiency giving the optimum process conditions. The aeration algorithm will be implemented in the control system soon. It will be only possible to compare the improved results with those from the past after the operation of the biological chambers in the modified conditions for a longer period of time (optimally – a full year).

The implementation of anammox or nitrification/denitrification process of sludge dewatering liquor is currently implemented on a pilot scale. The construction was finished and the test runs are currently carried out. The research on a pilot scale should finish in 2016 and should indicate, which solution gives which Nitrogen value in the sludge dewatering liquor and thus – in the treated effluent. If any of the tested solutions proves to be effective and cost efficient, it might be implemented on a full scale until 2019.

Regarding the second part of the improvement plan – awareness building, promotion of sustainable solutions and involvement of different stakeholders and citizens, the outputs cannot be measured. It is hoped that as a result of these actions some modifications in the legal regulations especially regarding local rainwater management will be made and the investors and design engineers will implement sustainable solutions into their investments. In consequence,  $WFTP_{Grey}$  and  $WFTP_{Blue}$  will reduce, while  $WFTP_{Green}$  will increase.

It might be worthy to define the WFTP indicators for the new investments with regards to their location, in the future. This would enable control of WFTP within the city. Possibly, some of the approaches tested in Wroclaw, will be implemented in smaller municipalities from Lower Silesia region, as Wroclaw often serves often as an example to them.

## **6 The budget**

The budget planned for Wroclaw Lab activities was enough to cover their costs. However, this applies only to the activities associated with promotion, awareness building and involvement of stakeholders. All future activities carried out after the end of the project will require extra funds.

The projects associated with reduction in Nitrogen concentration in treated effluent were not funded by the project money.