

## D.T2.5.3 JOINT PEER REVIEW

*BYDGOSZCZ & PILOT ACTION*

**2022**

**Rainwater utilisation via rooftop  
rainwater harvesting serving rain  
gardens in Bydgoszcz**

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**Version 1**

**05.2022**

**Version 2**

**06.2022**





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## 1. Pilot Action

*This section should include case study - description of pilot action (information prepared for study visit using the table below). All chapter is prepared by host partner.*

<p>ORIGIN AND EXPECTED RESULTS OF PILOT ACTION</p>	<p><i>The purpose of the pilot action is to implement the management of rainwater or snowmelt, assuming the implementation of rain gardens for the public utility. Decentralised rainwater retention is to be demonstrated via nature-based solutions.</i></p> <p><i>Demonstration will provide knowledge and foster the adaptation of innovative rainwater management methods via demonstration NBS in public buildings</i></p> <p><i>The City of Bydgoszcz carried out investment in two locations:</i></p> <p><b><i>Location 1 - Museum of Waterworks (Palace building) - MWiK</i></b></p> <p><b><i>Location 2 - Building A of the City Hall at Grudziądzka Street</i></b></p> <p><b><i>Location 1</i></b></p> <p><i>Rainwater management includes three types of rain garden and barrels:</i></p> <ol style="list-style-type: none"> <li><i>1) rain garden in sealed container,</i></li> <li><i>2) sealed rain garden in the ground,</i></li> <li><i>3) infiltration rain garden in natural permeable soil.</i></li> </ol> <p><i>All three types of rain gardens are connected to each other by a system of surface dry streams/gutters, and the rainwater reserve accumulated in barrels can be used for additional irrigation of local vegetation or rain gardens in the event of a longer rainless period.</i></p> <p><i>The purpose of the pilot action is:</i></p>
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	<ul style="list-style-type: none"> <li>- transfer of knowledge about the possibilities of managing rainwater from the roof</li> <li>- proper drainage of the historic building</li> <li>- relieving the municipal rainwater sewage system during heavy rains</li> <li>- reduction of the urban heat island</li> <li>- improving biodiversity</li> </ul> <p><b>Location 2</b></p> <p>The solution redirects the rainwater of the building's A roof to the containers with hydrophytic vegetation.</p> <p>In this building there is a main entrance to the City Hall Offices located in this Municipal complex. The building A is a site of few municipal departments: Property and Geodesy Department, the Department of Transport Authorities, the Department of Building Administration and the Municipal Urban Planning Office. For demonstration purposes downpipes located on both sides of the northern facade of the building are replaced with new gutters and partly exposed on the façade of building. Between containers of the rain garden there is integrated seat (bench) for the customers of the City Hall.</p> <p>The purpose of this pilot action is:</p> <ul style="list-style-type: none"> <li>- transfer of knowledge about the possibilities of managing rainwater from the roof</li> <li>- reduction of the urban heat island</li> <li>- improving biodiversity</li> </ul>
CWC GOALS	<p><b>Location 1</b></p> <p>We have already achieved our goals:</p> <ul style="list-style-type: none"> <li>- educational - school trips and guided tours of visitors take place at the Waterworks Museum, where participants are familiarized with CWC pilot action.</li> </ul>



	<p><i>Used solutions - rain gardens and barrels generate great interest</i></p> <ul style="list-style-type: none"> <li>- <i>building drainage - rainwater from drain pipes is moved away from the building foundations</i></li> <li>- <i>relieving the municipal rainwater drainage system during heavy rains - rainwater flows into the barrels</i></li> <li>- <i>improvement of biodiversity - 30 new plant species in the area instead of the lawn</i></li> </ul> <p><b>Location 2</b></p> <ul style="list-style-type: none"> <li>- <i>increasing awareness of the society on the managing of rainwater</i></li> <li>- <i>promotion of NBS</i></li> <li>- <i>enhanced biodiversity</i></li> </ul>
<p>TECHNICAL DESCRIPTION</p>	<p><b>Location 1</b></p> <p><i>Materials and technologies of good quality and local origin were used, matching the historic character of the building and the area:</i></p> <ul style="list-style-type: none"> <li>- <i>solid wood barrels</i></li> <li>- <i>copper drain pipe extensions</i></li> <li>- <i>rain garden in a container - reinforced concrete tank finished with brick in the color of the building</i></li> <li>- <i>dry streams and rain gardens lined with local river stone</i></li> <li>- <i>wetlands plants characteristic for Polish water areas and wetlands</i></li> </ul> <p><u>Basic data</u></p> <ul style="list-style-type: none"> <li>- <i>surface area of roof to be drained: 265 m<sup>2</sup></i></li> <li>- <i>average annual rainfall: 554 mm</i></li> <li>- <i>estimated annual water yield: 99-117 m<sup>3</sup></i></li> </ul> <p><u>Applied solutions</u></p>



- rain gardens: in the ground and infiltration, total capacity 6,2 m<sup>3</sup> and in a container, total capacity 1 m<sup>3</sup>
- rainwater barrels - 3 pcs, total capacity 1 m<sup>3</sup>

### **Location 2**

Rainwater from a section of the roof of building A, which was previously sent directly to the stormwater drainage system in the street, is now redirected to containers with hydrophytic vegetation. This solution provides slowdown of rainwater outflow, reducing the volume of surface runoff to the overloaded, during heavy rains, storm sewer in the street.

For demonstration purposes, the downpipes located on both sides of the north elevation of building were partially relocated to the front of the building.

The polystyrene frame of containers is reinforced with a plastic finishing mass. This makes the pots light yet strong, resistant to damage, fungi, mould, UV rays and frost. The walls of the pots were protected with PVC foil and bucket foil to increase the frost resistance of the pots and to limit the freezing of the plants.

The containers were filled with a layers of expanded clay aggregates and coarse sand with supplements that will help to keep the container moist and purify rainwater. The pots were replenished with garden soil, gravel and humus. Flat stones were placed on top. The pots were planted with hydrophytic plants.



#### Basic data

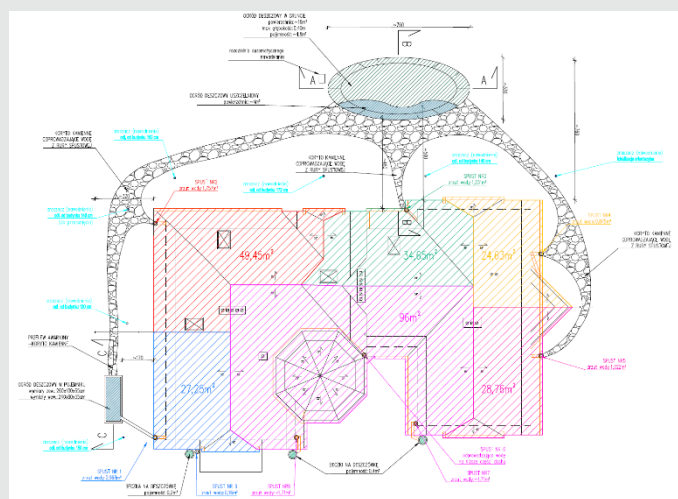
- surface area of the roof to be drained: 275 m<sup>2</sup>
- rain garden area: 12 m<sup>2</sup>
- total retention capacity of rain garden: 3,37 m<sup>3</sup>

#### Applied solutions

- containers with plants (10 pcs), bench

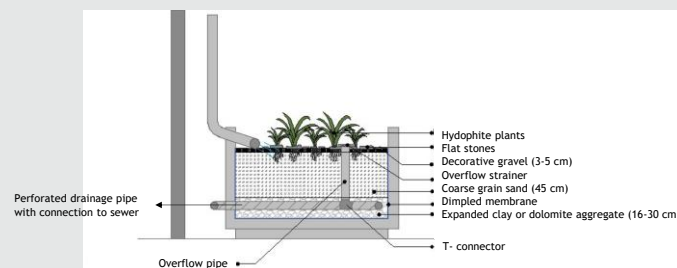


	<ul style="list-style-type: none"><li>- downpipes: 2+1</li><li>- weather station, hygrometer, rain gauge</li></ul>
GRAPHIC DETAIL	<p><i>Location 1</i></p>  



**Location 2**





PILOT PERFORMANCE

*Monitoring activities include assessment of quality of rainwater from selected locations and monitoring of rain*



*garden at Location 2 in terms of precipitation and soil moisture.*

***Assessment of quality of rainwater***

*Monitoring activities were undertaken at 3 locations: Locations 1 (Museum of Waterworks (Palace building) and 2 (Building A of the City Hall at Grudziądzka Street) and the Municipal Waterworks Headquarters at Torunska Street. Rainwater samples were collected from the roof surfaces of the buildings at the outlet of the downpipes and analysed for their physico-chemical and microbiological quality. Generally parameters tested showed good results.*

*The conclusion common to all locations shows that despite the parameter exceedances (in 2 locations - Enterococci) indicated in the report, they do not disqualify the locations presented as potential sources of plant irrigation with such installations as drainage in vessels or rain gardens. When analyzing the remaining parameters, it can be assumed that the tested rainwater collected from the roofs in each of the presented locations can be used for watering plants which are not intended for consumption.*

***Monitoring of the rain garden (Location 2. Building A of the City Hall at Grudziądzka Street)***

*The rain garden is monitored using:*

- a compact weather station with a built-in solar panel for long-term monitoring of environmental measurements via GSM network,*
- two sensors measuring soil moisture, designed to work with a wireless network,*
- a rain gauge - a smart, hourglass rainfall level sensor.*

*The monitoring station described above was launched on April 25, 2022, at 08:05 a.m. and is operating continuously, taking measurements of precipitation [mm] and soil moisture [m3/m3] in two of the ten pots of the rain garden. Measurements are recorded at 5-minute intervals.*



<p>OPERATION AND MAINTENANCE</p>	<p><b>Location 1</b></p> <p><i>The exploitation of rain gardens is not difficult or costly - in the first year, you have to control the irrigation of the garden and water it during too long drought. In the following years, rainwater from the roof of the building should be enough to irrigate the gardens. In the event of a long period of drought, water accumulated in barrels can be used for additional irrigation. Plants should be cut once a year (in spring) and any weeds should be removed. In the first year, the Contractor takes care of the plants and trains the staff of the Waterworks Museum, to take over responsibilities. The barrels should be impregnated once a year. You do not need a specialized service, the work can be done by employees of Waterworks Museum.</i></p> <p><b>Location 2</b></p> <p><i>The Contractor is bounded for 1 year guarantee service in case of operation and vegetation.</i></p> <p><i>After that the Department of Greenery will take care of containers with plants and Department of Organisation and Administration will be responsible for technical issues related to building.</i></p>
<p>CHALLENGES / REQUIREMENTS FOR IMPLEMENTATION</p>	<p><b>Location 1</b></p> <p><i>For the purpose of constructing an infiltration garden in the ground, it was necessary to examine the soil - infiltration coefficient and groundwater level.</i></p> <p><i>Due to the climatic zone with negative temperatures in winter, it was important to select frost-resistant plants.</i></p> <p><i>The construction of rain gardens and barrels did not require a building permit, but due to the works on the historic building - it was required to get permission of the Municipal Conservator of Monuments.</i></p> <p><b>Location 2</b></p> <p><i>A building permit is not required for small architecture. We only applied to the Building Administration Department with a notification of</i></p>



	<p><i>intent to begin construction work on the rain garden. Moreover we had to obtain:</i></p> <ul style="list-style-type: none"> <li>- <i>approval from Municipal Conservator of Monuments due to location of pilot site in the city center,</i></li> <li>- <i>approval of city visual designer due to needed consistency in terms of aesthetics of CWC pilot with newly-designated Park&amp;Ride facility nearby,</i></li> <li>- <i>agreements from facility managers</i></li> </ul>
<p><b>BENEFITS</b></p>	<p><i>For the first time City of Bydgoszcz run international pilot project to reuse rainwater and close the water circle. The rainwater reuse solutions used by the City, Municipal Waterworks as well as other project partners can provide inspiration for the implementation of similar approaches by ordinary residents, private and public institutions. In order to take advantage of the potential of the Waterworks Museum and familiarize the youngest residents with the available opportunities for rainwater management, we are currently preparing, in cooperation with the Education Department, an educational campaign aimed at school, kindergarten institutions.</i></p> <p><b>Location 1</b></p> <p><i>Environmental benefits:</i></p> <ul style="list-style-type: none"> <li>- <i>groundwater restoration</i></li> <li>- <i>rainwater treatment</i></li> <li>- <i>reducing urban heat islands</i></li> <li>- <i>improvement of biodiversity</i></li> </ul> <p><i>Social benefits:</i></p> <ul style="list-style-type: none"> <li>- <i>relieving the rainwater drainage system during heavy rains</i></li> <li>- <i>interesting and aesthetic space arrangement</i></li> <li>- <i>educational and demonstration function</i></li> </ul> <p><i>Economic benefits:</i></p> <ul style="list-style-type: none"> <li>- <i>lower cost of watering lawns</i></li> </ul>



	<ul style="list-style-type: none"> <li>- lower fees for rainwater</li> </ul> <p><b>Location 2</b></p> <p><i>Environmental benefits:</i></p> <ul style="list-style-type: none"> <li>- increase in water retention</li> <li>- increase humidity</li> <li>- reduction of urban heat island effect</li> <li>- increase of biodiversity</li> </ul> <p><i>Social benefits:</i></p> <ul style="list-style-type: none"> <li>- support in education and dissemination of common values</li> <li>- promotion of NBS</li> <li>- improving the aesthetics of the area</li> <li>- creating a recreational area next to the building</li> <li>- relieving the rainwater drainage system during heavy rains</li> <li>- interesting space arrangement</li> <li>- educational and demonstration function</li> </ul> <p><i>Economic benefits:</i></p> <ul style="list-style-type: none"> <li>- reduction of tap water consumption for watering</li> <li>- reducing overloading the stormwater drainage network</li> </ul>
<p>CLIMATE CHANGE IMPACTS ON CITY / FUA</p>	<p><i>As a result of climate change, long periods of drought and sudden heavy rainfall are a problem in our region.</i></p> <p><i>Cutting off the water runoff from the rainwater sewage system and development in rain gardens relieves the sewage system and improves soil and water conditions as well as the microclimate of the place.</i></p> <p><i>Reduction of urban heat island effect</i></p>
<p>IMPLEMENTATION SCHEDULE</p>	<p><b>Location 1</b></p> <p><i>Pilot was implemented in 1 year and 10 months, including:</i></p>



	<p>- development of project - 1 year (the hired designer planned too large rain garden, the design had to be improved)</p> <p>- selection of a contractor in an open tender - 6 months</p> <p>- implementation - 2 months</p> <p><b>Location 2</b></p> <p>Pilot implemented in 1 year and 9 months, including:</p> <p>- preliminary concept, design and cost estimate documentation (contractor selection and design development) - 7 months</p> <p>- selection of the contractor for the works (tender proceedings) - 2 months</p> <p>- execution of the pilot by the selected company - 2 months</p> <p>During peer review visits construction in 2 locations was completed, however at location no. 2 monitoring of precipitation and soil humidity was not conducted yet (we were still waiting for equipment).</p>
COSTS	<p>EUR conversion rate as of 30.06.2022 is 4,6806 PLN</p> <p><b>Location 1</b></p> <p><u>Project design:</u> 0</p> <p><u>Cost of construction:</u> 147 600 PLN (31 534,42 EUR), in this 47 600 PLN (10 170 EUR) was paid from the City of Bydgoszcz budget as an ineligible cost.</p> <p><u>Examples of costs:</u></p> <p>- rain garden in a container with an overflow: 15 708,33 PLN (3 356 EUR)</p> <p>- rain garden in the ground sealed and unsealed, filling a rain garden in a container: 22 790,67 PLN (4 869,18 EUR)</p> <p>- dry streams: 48 363,60 PLN (10 332,78 EUR)</p> <p>- supply, installation of rainwater barrels: 21 031,77 PLN (4 493,39 EUR)</p> <p>- planting the gardens and dry streams with hydrophytic plants: 35 607,27 PLN (7 607,42 EUR)</p>



	<p>- cutting down trees and shrubs with disposal, supplementing the soil, sowing grass: 4 098,36 PLN (875,61 EUR)</p> <p><b>Location 2</b>  <u>Project design:</u> 17.220 PLN (3 679,02 EUR)  <u>Cost of construction:</u> 123 000 PLN = 26 278,68 EUR  <u>Examples of costs:</u>          - delivery and installation of fiberglass pots along with wooden lamellas - 67 650 PLN (14 453 EUR)          - delivery and assembly of a bench - 8 000 PLN (1 709 EUR)          - irrigation system with drainage - 16 750 PLN (3 579 EUR)          - filling the pots with filter material and soil - 7 380 PLN (1 570 EUR)          - delivery and planting of hydrophytic plants in pots - 8 120 PLN (1 735 EUR)          - purchase and installation of a monitoring system - 5 600 PLN (1 196 EUR)</p>
FINANCING SOURCES	<p><b>Location 1</b></p> <p>Cost of investment: 147 600 PLN (31 534 EUR), in this:          1000 000 PLN (21 365 EUUR) from CWC project budget          47 600 PLN (10 170 EUR) from City of Bydgoszcz budget (ineligible costs)</p> <p>85% EFRR of eligible costs - 104 550 PLN (22 337 EUR)          15% City of Bydgoszcz budget (eligible - 18 450 PLN (3 942 EUR)</p> <p><b>Location 2</b></p> <p>Cost of investment: 123 000 PLN (26 278,68 EUR)          85% EFRR - 104 550 PLN (22 337 EUR)          15% City of Bydgoszcz budget - 18 450 PLN (3 942 EUR)</p>
OBSTACLES	<p><b>Location 1</b></p> <p><i>In Poland, there are no official guidelines for calculating the capacity of rain gardens. There are many</i></p>



	<p><i>publications that give very different indicators and calculation methods. For this reason, the designer adopted very high indicators and proposed a rain garden that was too large, the design had to be corrected.</i></p> <p><i>The second problem was the long process of selecting a contractor in a public tender. This resulted in little time for the implementation of the pilot project and little interest of contractors in the tender. Only 1 contractor applied, the offer price was much higher than that provided for in the cost estimate.</i></p> <p><b>Location 2</b></p> <p><i>The main problems:</i></p> <ul style="list-style-type: none"> <li>- <i>costs for realisation of rain gardens exceeded estimated value and available budget (we had to give 1 location)</i></li> <li>- <i>low interest of potential contractors of rain gardens</i></li> <li>- <i>limited accessibility of the site (e.g. the need to maintain a fire road), high degree of sealing of the site, extensive, partly uninventoried underground infrastructure, collision of the investment with the existing technical infrastructure</i></li> <li>- <i>limited choice of ready-made products for the construction of the garden (the necessity to make containers to size)</i></li> <li>- <i>lack of availability of products on the local market</i></li> <li>- <i>several changes of people involved in the implementation process from Municipality site (lack of knowledge and appropriate preparation of persons involved at various stages resulted in delays in the whole process)</i></li> </ul>
<p>SUCCESS FACTORS / CRITERIA</p>	<p><i>The growing awareness of the society and city authorities about measures to mitigate the effects of climate change, encourages such implementations.</i></p> <p><i>An additional incentive is the saving of drinking water and the costs of its collection as well as the exemption from the fee for draining rainwater into the sewage system.</i></p>





<p>PUBLIC INVOLVEMENT / OUTREACH</p>	<p><i>Stakeholders had the opportunity to present their opinion during selection phase of pilots' sites.</i></p> <p><i>The CWC project and pilots are presented to the general public at rainwater management conferences and on City's project website, social media (City and Waterworks), local radio and television. Municipal Waterworks is implementing an information campaign titled Rain is Profit, which includes the educational program Bydgoszcz Water on rainwater management, broadcast periodically on regional TV.</i></p> <p><i>The Museum of Waterworks has an educational path which is visited by both residents and tourists. School trips take place at the Museum, children and youth receive ecological education about water circulation in the city.</i></p>
<p>POSSIBLE APPLICATION AREAS / TRANSFERABILITY</p>	<p><i>The pilots were prepared in such a way as to show the residents typical and easy ways to manage rainwater. The solution applied can be used for both single-family and multi-family buildings as well as public utility buildings. In case of rain gardens in the ground it is required each time to check the possibility of infiltration of the soil and to calculate the amount of rainwater obtained from the sealed area.</i></p>

## 2. Evaluation of pilot action

*Pilot peer review meeting in Bydgoszcz took place on 11 April 2022 from 11 am to 2 pm online. All project partners were invited, however partners from Hungary and Slovenia were Nations that had to participate. We also invited relevant FUA stakeholders.*



The aim of peer review visit was presentation of solutions for rainwater reuse (rain gardens) implemented at 2 locations in Bydgoszcz and pilots' evaluation.

Two pilot locations:

- 1) rain garden at the Waterworks Museum (MWiK), Las Gdański, and
- 2) rain garden at the Bydgoszcz City Hall, 9-15 Grudziądzka Street, next to building A.

Meeting was conducted by external facilitator.

### Meeting agenda

<b>10:50-11:00</b>	<b>Registration</b>
<b>11:00-11:05</b>	Welcome and introduction Ms Aleksandra Kowalska, Project Coordinator, City of Bydgoszcz
<b>11:05-11:15</b>	Presentation of videos on pilot projects - amateur video - technical video
<b>11:15-11:35</b>	Presentation of pilot investment at City Hall, Grudziądzka Street Ms B. Katarzyna Napierała, Project Manager, City of Bydgoszcz
<b>11:35-11:55</b>	Presentation of pilot investment at Waterworks Museum Mr Marcin Zarzycki, Waterworks Company in Bydgoszcz
<b>11:55-12:10</b>	Questions and answers
<b>12:10-12:30</b>	Coffee break
<b>12:30-13:20</b>	Breakout room discussions
<b>13:20-13:40</b>	Plenary evaluation of discussion results
<b>13:40-13:50</b>	Questions and answers, discussion
<b>13:50-13:55</b>	Film about Bydgoszcz
<b>13:55-14:00</b>	Closing thoughts, event closure

Meeting was divided into 2 parts. In the first one we focused on presentation of Bydgoszcz pilots. In the second part of meeting the participants were divided into 3 groups: Hungarian partners, Slovenian partners and an international group (with a representative of the Italian partner and Polish team). Each group evaluated the Bydgoszcz pilot actions from the point of view of their own experience and local conditions (FUA).

Discussions in these groups addressed 6 questions:

Do you think solutions implemented in Bydgoszcz could also be implemented in your FUA? What Bydgoszcz solutions might be useful for your FUA?

Do you have similar solutions implemented in your FUA? Give some examples of such implementations. Are these solutions popular or not?



*Do you have similar projects planned in your CWC Water Management Strategy?  
What kind of problems/obstacles might you come across when implementing such projects in your FUA?  
What benefits (environmental, social, economic, etc.) can you foresee in your FUA from the implementation of projects similar to the Bydgoszcz pilot?  
Who could implement such projects in your FUA (institutions, etc.)?  
The group discussions were summarised and followed by a presentation in the forum, with a representative from each group presenting the results of the discussions.*

*Examples of the main results of discussion:*

*Implementation of solutions*

- Slovenian Partners indicated that rainwater retention solutions are implemented, particularly individual parts of these solutions, mainly by private investors, especially in single family houses, but they are missing in collective living places: housing estates or housing communities, in blocks of flats. Large-scale implementations in public and industrial areas are rare. They have problem with standing water in summer periods, which gathers mosquitoes. The development of rain gardens may escalate this problem and therefore may not be socially accepted. They indicated that education of citizens, who could implement similar solutions, although on a smaller scale is crucial.*
- in Zuglo and the 18th District there is a lack of rainwater retention solutions in public institutions and public spaces, however green roofs are developing. Several rain gardens are located in Budapest and the agglomeration but these are not customary solutions, rather they are still models. Hungarian cities are planning further water management and rain water management as climate change adaptation activities.*
- Italian partner stated that a rain garden is implemented within one of the projects, in addition other solutions like green roofs are emerging.*

*Who could implement similar projects*

- public institutions with implementation in their buildings (offices, government buildings, kindergartens, schools, state-owned enterprises) and public spaces in cities,*
- educational institutions, where implementations would have an additional educational function,*
- households with small scale implementations,*
- solutions should be popularized by the private sector of building investment entrepreneurs (developers),*
- private associations consuming larger amounts of water (e.g. tennis, football, skating, swimming, etc.)*

*Water management strategies*

- in Budapest, rain gardens are planned under the climate strategy and the green space management strategy. There are municipal projects aimed at citizens, e.g. providing free barrels for rainwater collecting. A pilot project on circular rainwater management is also being carried out.*
- Slovenian partners proposes rainwater retention solutions for three large buildings where water can be retained on a larger scale, while also considering how the collected rainwater can be used (in the immediate area).*

*Problems and obstacles related to the implementation of rain gardens*

- range of possibilities to use the collected water. In Hungary there is no guidance on the possibilities of using the collected water in rain gardens (for example which plants can be watered with it).*
- maintaining a rain garden during dry periods and choosing the right plants to survive in changing conditions (excess water and dry periods)*



- the general lack of water and the predictions related to the increase of this problem in cities.
- accumulation of mosquitoes and other insects
- lack of acceptance by residents when aesthetics of the solutions used to build rain gardens is not good
- low social awareness and low interest in the problem of water deficit and water saving among residents and private investors, which results in lack of understanding for the introduction of new solutions (rain gardens)
- application of rainwater retention solutions by designers is still rare. There is a lack of top-down regulations which would force the use of rainwater retention solutions. The Slovenian partners stressed that the local authorities do not approve of these solutions, which means that there is neither encouragement nor pressure from above to implement solutions in this field.
- financing implementation investment is problematic.

## 2.1 Summary

Participants of the meeting agreed that the solutions implemented in Bydgoszcz can be used with minor changes in partner FUAs.

They indicated that education of citizens, who could implement similar solutions, is crucial.

Rain gardens are foreseen in the measures included in the **water management strategies** developed by partners under the CWC project.

Partners perceive a great potential of entities and institutions that could implement similar solutions in their countries. However the implementation of rain gardens raises problems and obstacles in several areas that may complicate the deployment of such investments in partner countries.

## 3. Recommendations

All partners agreed that in the face of existing and incoming water problems, we should take extensive measures to reduce drinking water consumption and increase the use of rainwater. We should focus on activities to increase awareness of different stakeholders. We should consider and implement solutions in small and large scale.

## Attachments

1. Evaluation of pilot action by PP 1 Zuglo, Hungary (full text of PP's assessment)



<p>ORIGIN AND EXPECTED RESULTS OF PILOT ACTION</p>	<p><i>Most important information about the idea and the expected results of the pilot action from your point of view</i></p> <p><i>For Zugló and Budapest city the raingardens in Bydgoszcz provide relevant examples, how to build small scale CUMW solutions in city conditions: densely built-in areas and in historic buildings.</i></p> <p><i>The two cities have similar climate conditions in the average volume and distribution of yearly precipitation, that makes the Bydgoszcz pilots particularly useful for Budapest.</i></p>
<p>CWC GOALS</p>	<p><i>Which of the achieved project objectives are important to you?</i></p> <p><i>The mitigation of heavy rains and the advantages of water retention, like positive effect on microclimatic conditions of the city, improvement of water storage capacity of soils, and alleviation of the pressure on the sewage system are relevant objectives in Budapest too. As the pilot sites are located in frequented areas of the city, the awareness raising, and education factors are important as well.</i></p>
<p>TECHNICAL DESCRIPTION</p>	<p><i>Which of this information can you use? Who could carry out such investments?</i></p> <p><i>concept designs drawings - designers, investors, implementing companies</i></p> <p><i>involvement of the local stakeholders (community planting action, site visit with pupils) - project managers</i></p> <p><i>list of plants used in the raingardens - designers, investors, implementing companies</i></p> <p><i>aspects of operation and maintenance - maintenance department and subcontracted partners of the municipality</i></p>
<p>GRAPHIC DETAIL</p>	<p><i>Which of this information can you use?</i></p> <p><i>The graphic information provided by Bydgoszcz shows a clear overview of the system and the operation. The concept drawings are useful for technical experts, designers and for wider public, even decision makers and potential investors could receive proper information from the visual support of the videos, photos, and presentations.</i></p>
<p>PILOT PERFORMANCE</p>	<p><i>How can you use this information?</i></p> <p><i>The information materials of the pilot can be used in purpose of raising new attitudes, engage decision</i></p>



	<p><i>makers and further stakeholders and develop similar projects.</i>  <i>Information of the Bydgoszcz pilot were shared with the local stakeholders in Hungary. Feedbacks are quite positive.</i></p>
OPERATION AND MAINTENANCE	<p><i>Who could manage such an investment?</i>  <i>- municipalities in public spaces and institutes</i>  <i>- educational institutions at their own properties</i>  <i>- households in private properties</i>  <i>- private building investment sector (e.g. offices, cultural or sport buildings)</i></p>
CHALLENGES / REQUIREMENTS FOR IMPLEMENTATION	<p><i>Can you meet similar requirements in your FUA?</i>  <i>Trends of precipitation and the legal requirements are similar in the CE region.</i></p>
BENEFITS	<p><i>Whether and which benefits (environmental, social, economic) may be relevant in your FUA?</i>  <i>Relevant environmental benefits:</i></p> <ul style="list-style-type: none"> <li><i>• better microclimate in the city</i></li> <li><i>• improved air quality</i></li> <li><i>• improved biodiversity in the city</i></li> <li><i>• bee-friendly areas</i></li> <li><i>• alleviation of pressure on the sewage system</i></li> <li><i>• refill of the soil and natural water bodies</i></li> <li><i>• preventing natural water sources from overuse by less need of watering the green areas</i></li> <li><i>• Retrieved run-off of rain reduces soil erosion</i></li> </ul> <p><i>Relevant social benefits:</i></p> <ul style="list-style-type: none"> <li><i>• awareness and attitude raising</i></li> <li><i>• local citizens can be involved in the implementation, financing, and maintenance</i></li> <li><i>• technical innovation, knowledge transfer</i></li> <li><i>• potential cooperation of public, scientific, NGOs, business sector and local citizens</i></li> <li><i>• educational potential of raingardens in public spaces</i></li> <li><i>• improved appearance of city buildings</i></li> </ul> <p><i>Relevant economic benefits:</i></p> <ul style="list-style-type: none"> <li><i>• less cooling needs in Summer</i></li> <li><i>• savings of watering fees</i></li> </ul>
CLIMATE CHANGE IMPACTS ON CITY / FUA	<p><i>What impacts of climate change could be mitigated as a result of a pilot operation in your FUA?</i>  <i>What climate and water challenges in cities / FUA could similar actions solve?</i>  <i>Future climate scenarios are projected less consistent precipitation in Budapest: long water scarcity periods</i></p>



	<p><i>heavy rain events, frequent and long heat waves, and boosting heat island effect</i></p> <p><i>Restrictions of watering the green areas in long dry periods are even more likely in the future.</i></p> <p><i>Raingardens can provide flexible solution for the challenges above: size, plants, design, technology, operation can vary on a wide scale</i></p>
IMPLEMENTATION SCHEDULE	<p><i>Was the implementation time too long in your opinion? Where do you see the possibilities to shorten the time? Preparation (design, procurement, subcontracting) was a long and challenging period, but as soon as the city found the proper partners, implementation was a smooth and well managed process.</i></p>
<b>COSTS</b>	<p><i>Will the cost level be acceptable in your FUA? The market prices varies and raising fast in Hungary, so we can hardly assess the market situation.</i></p>
FINANCING SOURCES	<p><i>What financing sources could be obtained for a similar investment in your FUA?</i></p> <ul style="list-style-type: none"> <li>• <i>Crowd funding</i></li> <li>• <i>Municipality budget</i></li> <li>• <i>Investor companies</i></li> <li>• <i>EU funds dedicated NBS and green city solutions</i></li> <li>• <i>Contribution of business sector, sponsorship</i></li> <li>• <i>Contribution of NGO sector</i></li> </ul>
OBSTACLES	<p><i>Can you meet similar requirements in your FUA? How could you avoid them?</i></p> <ul style="list-style-type: none"> <li>• <i>insects, mosquitos: free water/wet surfaces support the reproduction of mosquitos, investments like rain gardens bring up questions/debates from local citizens,</i></li> <li><i>solution: covering wet surfaces, with proper design the wet full period of the raingarden can be minimize</i></li> <li>• <i>water supply of the raingardens in dry periods</i></li> <li><i>solution: resisting plants with wide water optimum, awareness raising (its important, to inform people that the less attractive appearance of the plans in dry periods is a temporary phenomenon, they will turn green again when the rain comes)</i></li> <li>• <i>historic buildings have specific design requirements</i></li> <li><i>solution: early involvement of the responsible authority, applied design</i></li> <li>• <i>An obstacle in Hungary: there are no official standards for collected water and for the purpose of the use</i></li> </ul>
SUCCESS FACTORS / CRITERIA	<p><i>Would such incentives work in your FUA / country? Would you have to consider other conditions?</i></p>



	<i>Considering all the benefits of the pilot, we see the potential to adapt it to Budapest as a new pilot.</i>
PUBLIC INVOLVEMENT / OUTREACH	<i>Would you have to involve stakeholders to implement a similar investment? The project is a potential field of cooperation of the public (municipality/municipal supply company), scientific (universities, research centres), NGO (awareness raising) and business sectors and has high education and awareness raising potential.</i>
POSSIBLE APPLICATION AREAS / TRANSFERABILITY	<i>Other areas where the described solutions can be used (different application area); All Hungarian cities and settlements can benefit from the lessons and provided information The technologies are applicable in Budapest (and in Hungary)</i>
OTHER	-

2. Evaluation of pilot action by PP 5 Mariborski vodovod, Slovenia (full text of PP's assessment)

ORIGIN AND EXPECTED RESULTS OF PILOT ACTION	<i>Most important information about the idea and the expected results of the pilot action from your point of view Under the Köppen Climate Classification Maribor's climate subtype is "Cfb". (Marine West Coast Climate) and Bydgoszcz's climate type is also defined as Cfb, thus similar problems and consequentially solutions are appropriate and interchangeable for both cities. The city of Maribor and Bydgoszcz have similar precipitation, whereas in the last few years prolonged droughts have been more present in Maribor meaning that water retention measures as demonstrated in Bydgoszcz will be more and more necessary to be implemented also in Maribor.</i>
CWC GOALS	<i>Which of the achieved project objectives are important to you?</i> <ul style="list-style-type: none"> <li>• <i>Maximum water retention</i></li> <li>• <i>Alleviation of pressure on the sewage system</i></li> <li>• <i>Increasing awareness on using alternative water sources</i></li> <li>• <i>Positive effect on microclimatic conditions</i></li> </ul>
TECHNICAL DESCRIPTION	<i>Which of this information can you use? Who could carry out such investments?</i>





	<i>As the pilot action is replicable, all technical data provided by Bydgoszcz partners could be useful in preparing similar project in our FUA or other regions of CE.</i>
GRAPHIC DETAIL	<i>Which of this information can you use? The graphic information provided could be useful in preparing similar projects in other FUA's, videos could be useful for promotion of sustainable behaviour, to increase awareness of citizens on using alternative water resources and to convince potential investors and decision makers to invest in similar projects.</i>
PILOT PERFORMANCE	<i>How can you use this information? It could be used to promote sustainable behaviour, to promote reduction of freshwater use and to increase the awareness of citizens on using alternative water resources with similar projects.</i>
OPERATION AND MAINTENANCE	<i>Who could manage such an investment?</i> <i>Public:</i> <ul style="list-style-type: none"> <li>• <i>the municipality,</i></li> <li>• <i>public institutions in their own buildings (agencies, governmental buildings, kindergartens, schools, publicly owned companies)</i></li> </ul> <i>Private:</i> <ul style="list-style-type: none"> <li>• <i>citizens in their homes (single-, multiple-resident),</i></li> <li>• <i>private companies on their infrastructure,</i></li> <li>• <i>private associations that consume larger amounts of water (e.g. tennis, football, ice skating etc.)</i></li> </ul>
CHALLENGES / REQUIREMENTS FOR IMPLEMENTATION	<i>Can you meet similar requirements in your FUA? Yes, but the obstacles that could occur are similar to other areas in CE, i.e: acceptance by local authorities, acceptance and inclusion of such solutions by designers, architects, lack of interest by citizens and other stakeholders (companies), lack of investment funds to carry out said interventions, overall abundance of water.</i>
BENEFITS	<i>Whether and which benefits (environmental, social, economic) may be relevant in your FUA?</i> <i>Environmental benefits:</i> <ul style="list-style-type: none"> <li>• <i>reduction of freshwater use,</i></li> <li>• <i>increase in use of alternative water sources,</i></li> </ul>



	<ul style="list-style-type: none"> <li>• <i>avoiding the over-abstraction of groundwater,</i></li> <li>• <i>reducing the environmental and energy footprint of extraction and distribution of freshwater</i></li> </ul> <p><i>Social benefits:</i></p> <ul style="list-style-type: none"> <li>• <i>increased awareness of citizens on using alternative water resources,</i></li> <li>• <i>increased water security,</i></li> <li>• <i>using best practices for educating next generations</i></li> </ul> <p><i>Economic benefits:</i></p> <ul style="list-style-type: none"> <li>• <i>less energy used for freshwater abstraction and distribution,</i></li> <li>• <i>reduced costs for water users,</i></li> <li>• <i>lessening the burden (and thus deterioration) of freshwater supply network</i></li> </ul>
CLIMATE CHANGE IMPACTS ON CITY / FUA	<p><i>What impacts of climate change could be mitigated as a result of a pilot operation in your FUA?</i></p> <p><i>What climate and water challenges in cities / FUA could similar actions solve?</i></p> <p><i>Avoiding the over-abstraction of groundwater, reducing the environmental and energy footprint of extraction and distribution of freshwater, reducing water shortage, contribute less to flooding.</i></p>
IMPLEMENTATION SCHEDULE	<p><i>Was the implementation time too long in your opinion?</i></p> <p><i>Where do you see the possibilities to shorten the time?</i></p> <p><i>Implementation took longer than expected due to unstable conditions worldwide (pandemic conditions and later material shortage). Overall the implementation was well managed.</i></p>
COSTS	<p><i>Will the cost level be acceptable in your FUA?</i></p> <p><i>Due to recent trend of increasing material prices it is hard to determine cost acceptance. However, due to a lot of environmental and social benefits, it depends on the mindset of potential investors.</i></p>
FINANCING SOURCES	<p><i>What financing sources could be obtained for a similar investment in your FUA?</i></p> <ul style="list-style-type: none"> <li>• <i>Municipality budget,</i></li> <li>• <i>national initiatives,</i></li> <li>• <i>EU projects</i></li> </ul>
OBSTACLES	<p><i>Can you meet similar requirements in your FUA?</i></p> <p><i>How could you avoid them?</i></p> <ul style="list-style-type: none"> <li>• <i>Acceptance by local authorities,</i></li> </ul>



	<ul style="list-style-type: none"> <li>• <i>acceptance and inclusion of such solutions by designers, architects,</i></li> <li>• <i>lack of interest by citizens and other stakeholders (companies),</i></li> <li>• <i>lack of investment funds to carry out said interventions,</i></li> <li>• <i>overall abundance of water.</i></li> </ul>
SUCCESS FACTORS / CRITERIA	<p><i>Would such incentives work in your FUA / country? Would you have to consider other conditions?</i></p> <p><i>Yes, definitely so, particular parts of said solutions are already being implemented mostly by private investors. Various rainwater retention measures are implemented in the FUA. They are quite popular among single-family homes usually combined with urban gardens, whereas implementation on public, industrial and multi-home blocks of flats are scarce.</i></p>
PUBLIC INVOLVEMENT / OUTREACH	<p><i>Would you have to involve stakeholders to implement a similar investment?</i></p> <p><i>The success in FUA Maribor would also be dependent on tight cooperation of all involved parties.</i></p>
POSSIBLE APPLICATION AREAS / TRANSFERABILITY	<p><i>Other areas where the described solutions can be used (different application area);</i></p> <p><i>As the pilot action could be replicable it could be used in Maribor FUA with minor technical adaptations.</i></p>
OTHER	-