D.T2.5.3 JOINT PEER REVIEW

Municipality of Zugló 14th district of Budapest

Rainwater and Grewywater Utilisation Solution in the Hétszínvirág Kindergarten

Version 1
04.2022.

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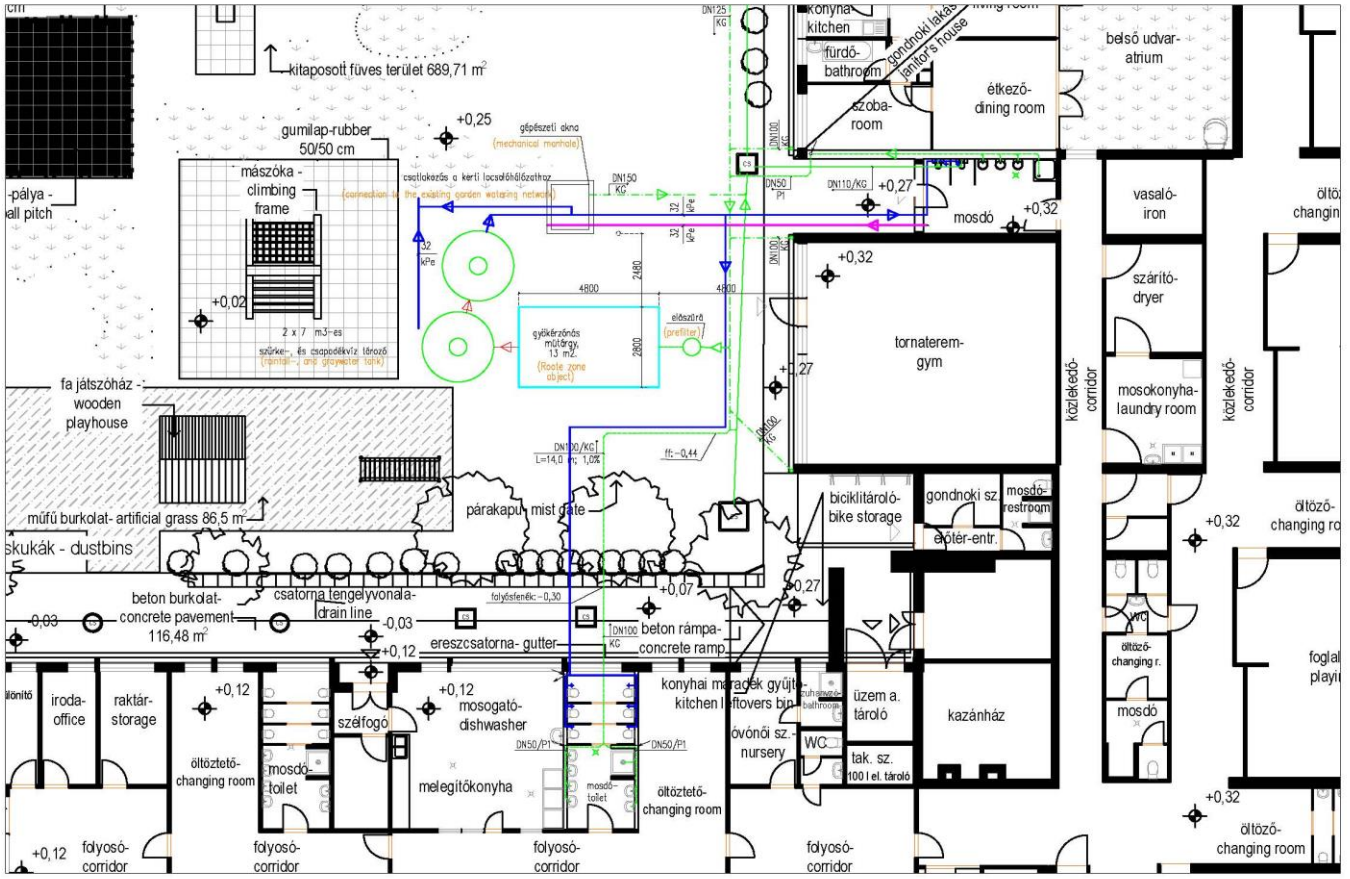
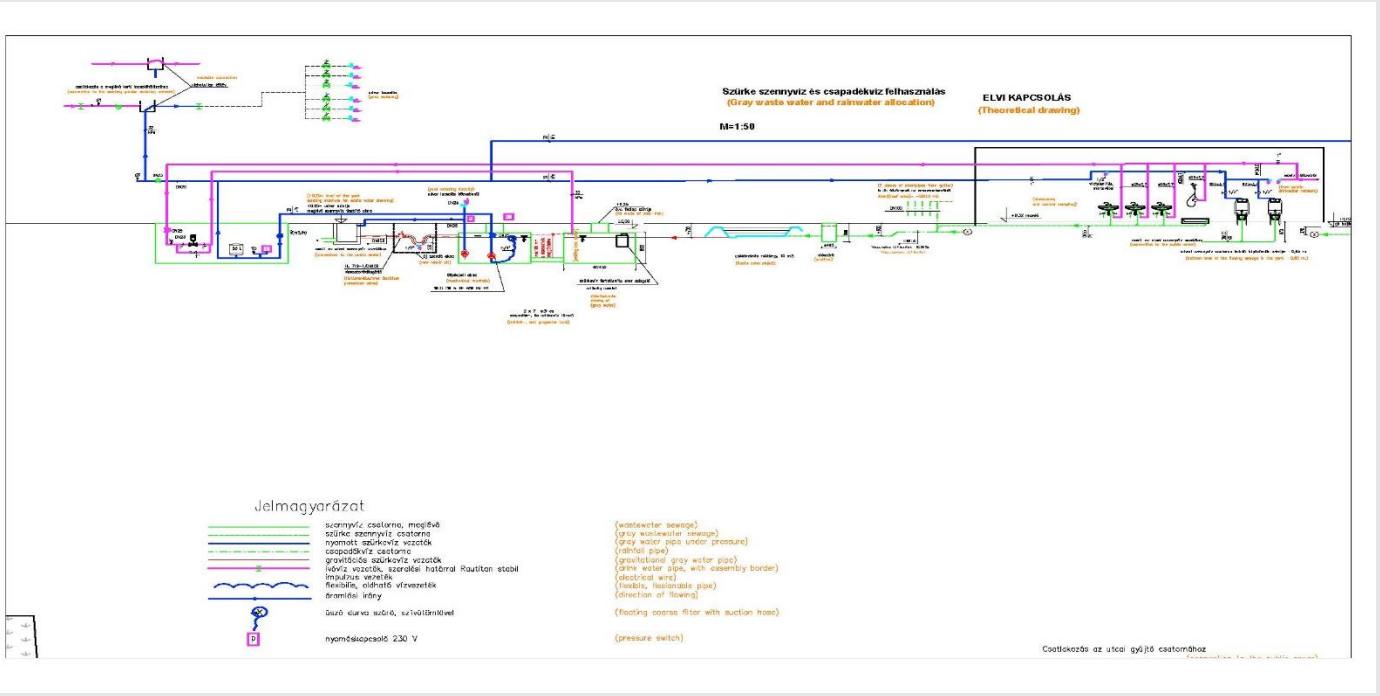
1. Pilot Action

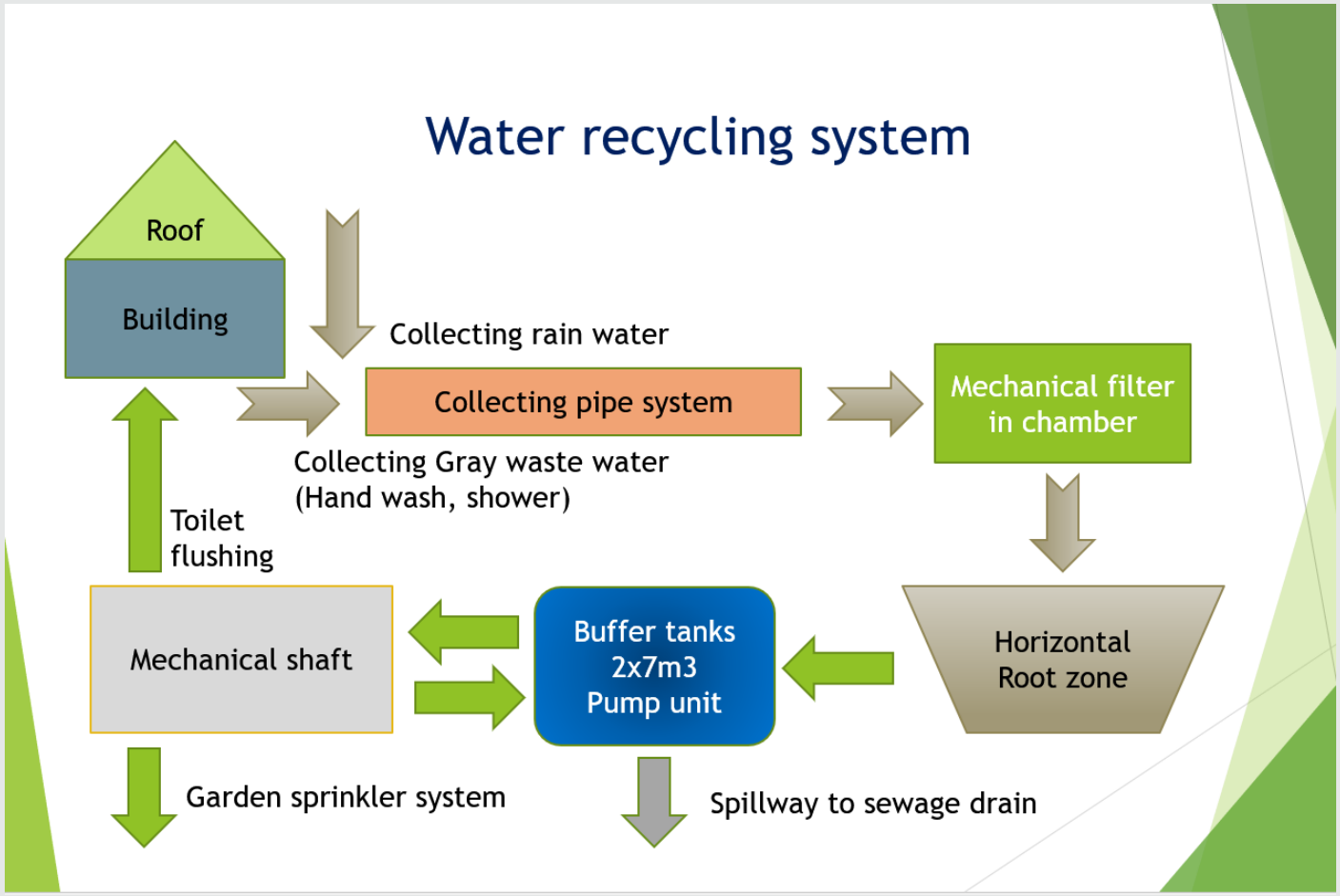
This section should include case study - description of pilot action (information prepared for study visit using the table below). All chapter is prepared by host partner.

ORIGIN AND EXPECTED RESULTS OF PILOT ACTION	*The pilot is an experiment implemented at a local kindergarten, testing the technological and socio-economic viability of rainwater and greywater utilisation in for non-consumption purposes in such an environment. The concept states that through the collection and use of both rain- and greywater for garden maintenance and hygiene (ie flushing toilets) the system would result in* - *significant reduction on tapwater and wastewater, contributing to the ROI and the sustainability of the institution* - *with rainwater retention/storage, alleviation of sewage network from heavy rain stress* - *serving as a live example of green/sustainable behaviour for both children and parents, contributing to the mindset shift in the area.* *Hétszínvirág Kindergarten is located in a suburban, green region of Zugló. With a relatively large green yard, watering and lawn maintenance has always been a significant cost component. At the same time the rainwater from the whole roof area and the greywater from the sanitary blocks has all gone unused, as per the old standard design.* *This pilot solution, which includes a collection and biological filtration system for all key rain- and greywater sources and a pumping/redistribution system for lawn sprinkling and toilet flushing aims to ease both cost components while consciously providing an easy-to implement live example of circular thinking for the community.*

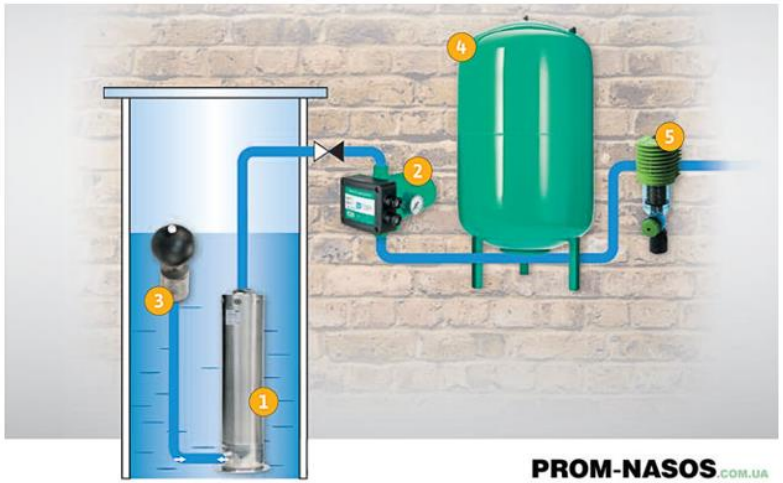
CWC GOALS	*The pilot focuses primarily on rainwater harvest and greywater reuse, and secondly on alleviation of water stress on sewage network*
TECHNICAL DESCRIPTION	*As seen in Fig 3 among the figures below, the solution cycle contains* - *a pipe system to collect recyclable rainwater from a 200 m2 section of the roof and grey water from the handwashing units of the building* - *a mechanical filtration station (including among others a leaf-catching chamber (fig 4b) to prepare the water for the biological cleaning* - *a rootzone biological filtering system (figs 5a and 6) consisting of a HDPE-bowl to separate the greywater from the ground, two layers of gravel (4-8mm and 16-32mm granule size respectively) to provide the root zone volume, and of course flowering plants and shrubs growing the roots themselves and offering an aesthetically pleasing view aboveground.* - *14m3 of plastic buffer tanks/cisterns for the collection and storage of the cleaned water (fig 5b and 5c) Overflow water is drained into the public sewage system.* - *an electric pump unit (fig 4a) linked to a mechanical distribution shaft towards both the automatic garden watering system (1000m2 sprinkler solution) and the 8 toilets inside the kindergarten building.* *Due to early testing experiences and feedback the system is to be further developed with an automatic tapwater refill mechanism, controlled by the built in and already existing water level sensor, for extended arid periods.*

GRAPHIC DETAIL	


Szürke szennyvíz és csapadékvíz felhasználás
(Gray waste water and rainwater allocation)
ELVI KAPCSOLÁS
(Theoretical drawing)
M=1:50
Jelmagyarázat
szennyvíz csatorna, megjelölő
szürke szennyvíz csatorna
nyomott szürkevíz vezeték
csapadékvíz csatorna
gravitációs szürkevíz vezeték
ivóvíz vezeték, szerelési határral Rautitan stabil
Imolitus vezeték
flexibilis, oldható vízvezeték
áramlási irány
(wastewater sewage)
(gray wastewater sewage)
(gray water pipe under pressure)
(rainfall pipe)
(gravitational gray water pipe)
(drink water pipe, with assembly border)
(electrical wire)
(flexible, flexionable pipe)
(direction of flowing)
(floating coarse filter with suction hose)
nyomáskapcsoló 230 V
(pressure switch)
Csatlakozás az utcai gyűjtő csatornához


Water recycling system
Roof
Building
Collecting rain water
Collecting pipe system
Mechanical filter in chamber
Collecting Gray waste water (Hand wash, shower)
Toilet flushing
Mechanical shaft
Buffer tanks 2x7m3 Pump unit
Horizontal Root zone
Garden sprinkler system
Spillway to sewage drain

Pump system



1. Wilo-Sub TWI 5
2. Pump control and protection device.
3. Floating suction filter.
4. Hydroaccumulator.
5. Backwash filter.

Leaf catcher chamber

PILOT PERFORMANCE	*Implementation is still ongoing at the time of the peer review workshop, therefore monitoring data is not yet available. Performance categories to be monitored later include:* - *quality of recycled water* - *rainwater and greywater collected* - *tapwater and drainage saved*
OPERATION AND MAINTENANCE	*General maintenance is to be provided by the janitor of the kindergarten, who is fully qualified to carry out minor repairs. Semi-annual checkup are scheduled for 2 years after the installation is ready by Hidroconsulting Ltd., afterwards this will transit into an on-need basis access. Parts exchanges are covered within the warranty period.*
CHALLENGES / REQUIREMENTS FOR IMPLEMENTATION	*There are no national standards and official permit procedure on the use of greywater and rainwater in buildings. On one hand it made the technical engineering design easy, on other hand, the missing standards result a lot of uncertainty in the project.* *Due to difficulties in the cash-flow of the municipality, the project procurements were banned for several months in 2020, that hindered the technical planning and the implementation of the pilot.* *The quite long information and decision-making chain of stakeholders (from the transnational project team to the subcontracted construction companies) results challenges in the information flow.* *The limitations of the Hungarian market made the procurement challenging. There is a limited number of companies with proper experiences, competence, and references for the specific investment of rainwater harvest, gravel bed filtration and greywater reuse.*

	Due to difficulties in the global supply chains, the procurement of the water tanks needed more time than planned. *The pilot needs extra space for the pipes, underground tanks, engineering equipment etc, it occupies the space during the constructions from playing, green area, trees, bushes etc.* *In winter and early spring of 2021-2022 there was a long arid period in Hungary without significant precipitation to fill in the water tanks. The system was operated with the mix of greywater and tap water. Due to this, the water quality analysis is in delay.* *Unexpected objects under the ground: During the excavation works, an unexpected metal object was detected, which was blocking the works for one day.*
BENEFITS	- *Direct savings in water use through recycling, in the water bill, and indirectly freeing up drinking water treatment plant capacity* - *Decreasing natural water resource usage* - *Changes in local attitudes though the pilot serving as an active and tangible good practice example for both the children of the kindergarten and the wider community*
CLIMATE CHANGE IMPACTS ON CITY / FUA	*The pilot is not large enough to cause a significant change in the water footprint of the district, but both the local positive impact on water use and the mindset shift caused by promoting both the direct savings (vs costs and complexity) and the "green pride" of the district are expected to propagate.*
IMPLEMENTATION SCHEDULE	*Due to the financial restrictions of the municipality and the amendments in the architectural and mechanical plans, the planning and procurement phase took 19 months, the implementation phase of main works took*

	1.5 months. At the time of the visit the pilot was still in implementation, waiting for the rootzone to be populated by plants and the automatic refill system to be added to the system.
COSTS	*Information about costs of:* *planning, - 19 000 EUR* *Implementation: construction, equipments, installation: 52 000 EUR* *operation and maintenance: no data available*
FINANCING SOURCES	*European Regional Development Fund / Interreg Central Europe; (95%)* *Government of Hungary (5%)*
OBSTACLES	- *Financial restrictions (due to Covid-19) and difficulties in the cash flow of the municipality hindered the pilot implementation* - *Multi-level procurement process slowed implementation, future projects need to streamline this, especially due to the seasonality of construction, which added to the delay.* - *A large tree had to be cut down in the yard during the implementation, the required number of new saplings have been planted to compensate.* - *Plans underestimated the length of arid periods, there is a need to add an automatic level sensor and tank refill system for extended droughts.*
SUCCESS FACTORS / CRITERIA	*The key element of success was the tight cooperation and flexibility of stakeholders, including the kindergarten, the planning company and the construction company as well.*

PUBLIC INVOLVEMENT / OUTREACH	*The kindergarten was never left to be a passive beneficiary/victim, their needs and comments are constantly funnelled into the process. Budapest Sewage Works have been involved from the very start as a monitoring and consulting organisation.* *A press event is scheduled for the end of the implementation phase, and the the Municipality and the kindergarten are cooperating on the best ways of showcasing the good practice in the longer term too. Social media has been updated with the unfolding of the process and will continue to be so at every milestone.* *To inform the wider public and professional stakeholders a short film was published about the investment:* *A short version for wider public: https://youtu.be/DlR3ZQNc25U* *A longer one for professional stakeholders https://youtu.be/mBlaM4vL-0c*
POSSIBLE APPLICATION AREAS / TRANSFERABILITY	*The project is set up to be easily replicable, so in case of solid numbers, it is possible to be introduced in other public institutions around the district even in the medium term. Through the dissemination efforts after the start of the operation period a scaled-down version of the solution is to be promoted for residential areas. The plans are robust, so the solution is easily adaptable for other regional environments as well.*

2. Evaluation of pilot action

EVENT DESCRIPTION: Multilateral online peer review showcasing the Hétszínvirág (Seven-coloured Flower) Kindergarten, and the rainwater and greywater-utilisation solution developed and implemented there in the framework of the pilot investment within the framework of the CWC project.

TIME: Wednesday, 30 March 2022, 09:30-12:30 CET

LOCATION: online zoom.us platform

IMPLEMENTING CWC PARTNER: Municipality of Zugló (HU)

EVALUATING PARTNERS: City of Bydgoszcz (PL), Regional Development Agency for Podravje Maribor (SI)

The peer review visit event was structured along the template guidelines with some local twists. After a quick introduction of the topic by project management, the specifics of the technical solution were showcased by the developing engineer and the representative of the implementing company. As an extra point of view, the representatives of the kindergarten itself were invited to present the aspect of the users/beneficiaries and provide feedback to consider in interventions to come. Lively discussion followed each one.

Breakout discussions were carried out in 4 rooms, Hungarian-, Polish-, and Slovenian-speaking for the larger national delegations and an English-speaking one for all other international partners. All rooms received an online editable sheet with guiding questions, the links to which can all be found among the attachments.

An online quiz gauging interest and attention paid, plus serving as quality assurance in a gamified way was conducted before event closure. The event finished on time, providing all feedback hoped-for by the hosts.

- Breakout room guidance sheets: English, Hungarian, Polish, Slovenian

2.1. Summary

The participants provided unanimous positive feedback about the organisation of the study visit and the content provided. The average score is 4.73/5

In the quiz a question referred to the evaluation of the solution presented and the quality of the implementation, which also received an average score of 4.54/5.

Key comments and learnings referred mostly to the applicability of the solution, its development opportunities and possible local responses to global trends.

3. Recommendations

Key takeways for Zugló included (1) the need for a more robust monitoring system across the board to channel the benefits of the project to other stakeholders more easily and have a more solid grasp on the climate impact of the interventions, and (2) the need to consider climate change and the resulting more extreme weather patterns in all future projects. Both recommendations are taken to heart, and steps will be taken to escalate them.

4. Attachments

4.1. Evaluation of pilot action by PP from Poland: City of Bydgoszcz and ISD

ORIGIN AND EXPECTED RESULTS OF PILOT ACTION	*Most important information about the idea and the expected results of the pilot action from your point of view* reuse of grey water, especially in facilities such as kindergartens, where hygiene considerations are particularly important
CWC GOALS	*Which of the achieved project objectives are important to you?* Saving water Using of treated gray- and rainwater. As the upcoming EU regulations of water reuse must be implemented in all EU countries, the Zuglo's pilot action is an example to follow for other CE cities. Demonstrating that re-use of gray water is possible and safe for health.

	Social acceptance (in this case of parents) of such a solution.
TECHNICAL DESCRIPTION	*Which of this information can you use? Who could carry out such investments?* we have not completed this type of investment neither in the city of Bydgoszcz nor in MWiK. The investment would have to be a pilot (demonstrator) of the use of various water resources, especially gray water, implemented by the city in cooperation with MWiK (in a public utility building).
GRAPHIC DETAIL	*Which of this information can you use?* The graphic information provided by the pilot owner shows a clear overview of the system and the operation. The technical drawing is useful for technical experts but wider public, even decision makers and potential investors could receive proper information from the visual support of the videos photos and presentations.
PILOT PERFORMANCE	*How can you use this information?* The information materials of the pilot can be used in purpose of raising new attitudes, engage decision makers and further stakeholders, promote and develop similar projects.
OPERATION AND MAINTENANCE	*Who could manage such an investment?* the owner of a building with this type of installation should have a person / employee to operate it; the system should be serviced by the installation company; use of digital tools for monitoring
CHALLENGES / REQUIREMENTS FOR IMPLEMENTATION	*Can you meet similar requirements in your FUA?*

	the challenge would be to gain acceptance for reusing graywater
BENEFITS	*Whether and which benefits (environmental, social, economic) may be relevant in your FUA?* environmental - rainwater retention, water protection, reducing the need for water economical - savings in environmental charges (fees of deposing wastewater), reduction of drinking water consumption, Social – educational, change of behavior and opinions about the use of graywater (and rainwater).
CLIMATE CHANGE IMPACTS ON CITY / FUA	*What impacts of climate change could be mitigated as a result of a pilot operation in your FUA?* *What climate and water challenges in cities / FUA could similar actions solve?* counteracting water shortages and flooding
IMPLEMENTATION SCHEDULE	*Was the implementation time too long in your opinion? Where do you see the possibilities to shorten the time?* the decision-making process in public institutions is long and rather difficult to shorten
COSTS	*Will the cost level be acceptable in your FUA?* As we have no information about similar investment in Bydgoszcz we cannot assess the costs.
FINANCING SOURCES	*What financing sources could be obtained for a similar investment in your FUA?* European and Norwegian funds

	international projects such as CWC pilot solutions are sporadically co-funded by the National Fund for Environmental Protection and Water Management
OBSTACLES	*Can you meet similar requirements in your FUA?* *How could you avoid them?* Requirement for us: quality of water. We have doubts whether the hydrophyte / root treatment plants are sufficient without additional disinfection (hygiene reasons) MWiK is implementing a project in which rainwater (from roofs and streets) will be used for watering after disinfection
SUCCESS FACTORS / CRITERIA	*Would such incentives work in your FUA / country? Would you have to consider other conditions?* Commercial point of view: Economic profitability of the investment / implementation of the solution; financial support / subsidies for investment; high prices (taxes) of wastewater and potable water.
PUBLIC INVOLVEMENT / OUTREACH	*Would you have to involve stakeholders to implement a similar investment?* Definitely yes. Accepting the reuse of graywater requires a change of mentality
POSSIBLE APPLICATION AREAS / TRANSFERABILITY	*Other areas where the described solutions can be used (different application area);* *Portability / system adaptation to local conditions / replication options in other FUAs;*

	the use / harvesting of rainwater is possible in any building, however, the reuse of graywater seems to be economically profitable in multi-family buildings, collective residence facilities (hotels, dormitories) where graywater is produced continuously and in large quantities
OTHER	As part of the competition organized by the National Center for Research and Development - Home Retention Technologies, an innovative system for rainwater storage and treatment and the reuse of gray water will be developed, which will minimize water intake from the water supply and minimize the amount of wastewater discharged into the sewage system. The pilot projects (demonstrator) will be carried out in a single-family home and at school. The project is financed by the European Regional Development Fund

4.2. Evaluation of pilot action by PP from Slovenia: City of Maribor

ORIGIN AND EXPECTED RESULTS OF PILOT ACTION	*Most important information about the idea and the expected results of the pilot action from your point of view* Reusing the rainwater and greywater for garden maintenance and sanitation and using this as an example of green/sustainable behaviour for future generations.
CWC GOALS	*Which of the achieved project objectives are important to you?* • Using the stored rainwater to irrigate plants. • Retention of rainwater with green roof on the flat part of the roof. • Educating by playing – water and climate elements in the playgrounds.

TECHNICAL DESCRIPTION	*Which of this information can you use? Who could carry out such investments?* • Municipality of Maribor as funding party and in cooperation with engineering company • Aqua systems (wastewater treatment plant) • Public institutions in their own buildings
GRAPHIC DETAIL	*Which of this information can you use?* All of the graphic information is useful, as pilot action could be implemented almost anywhere in CE (depending on rainfall data and national legislation) with minor technical adaptations. Schematic and technical representation of the pilot action and pump system graphic could be particularly useful when planning a similar investment.
PILOT PERFORMANCE	*How can you use this information?* The monitoring was not finished yet at the time of the peer review visit, but we can conclude that the full results 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.
OPERATION AND MAINTENANCE	*Who could manage such an investment?* Municipality of Maribor, public institutions in their own buildings (agencies, governmental buildings, kindergartens, schools, publicly owned companies) as investors. Maintenance and operation should be done by experts, whether employees or outsourced.

CHALLENGES / REQUIREMENTS FOR IMPLEMENTATION	*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.
BENEFITS	*Whether and which benefits (environmental, social, economic) may be relevant in your FUA?* • Environmental: reduction of freshwater use, increase in use of alternative water sources, avoiding the over-abstraction of groundwater, reducing the environmental and energy footprint of extraction and distribution of freshwater • Social: increased awareness of citizens on using alternative water resources, increased water security, using best practices for educating next generations • Economic: less energy used for freshwater abstraction and distribution, reduced costs for water users, lessening the burden (and thus deterioration) of freshwater supply networking
CLIMATE CHANGE IMPACTS ON CITY / FUA	*What impacts of climate change could be mitigated as a result of a pilot operation in your FUA?* *What climate and water challenges in cities / FUA could similar actions solve?* 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.

IMPLEMENTATION SCHEDULE	*Was the implementation time too long in your opinion? Where do you see the possibilities to shorten the time?* Due to worldwide unstable conditions during implementation (pandemic conditions and later material shortage) the implementation took longer than expected, but in different circumstances over which we have no control, the implementation could be shorter. Overall, the implementation was well managed.
COSTS	*Will the cost level be acceptable in your FUA?* 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.
FINANCING SOURCES	*What financing sources could be obtained for a similar investment in your FUA?* • from Municipality budget, • national initiatives, • EU projects
OBSTACLES	*Can you meet similar requirements in your FUA?* *How could you avoid them?* • requirements: discussion with parents and children, monitoring water quality • obstacles: identification of fund resources, missing good practices
SUCCESS FACTORS / CRITERIA	*Would such incentives work in your FUA / country? Would you have to consider other conditions?*

	The success in our FUA would also be dependent on tight cooperation of all involved parties.
PUBLIC INVOLVEMENT / OUTREACH	*Would you have to involve stakeholders to implement a similar investment?* • Municipality, • Management of kindergarten • Kindergarten users
POSSIBLE APPLICATION AREAS / TRANSFERABILITY	*Other areas where the described solutions can be used (different application area);* *Portability / system adaptation to local conditions / replication options in other FUAs;* As the pilot action could be replicable it could be used in Maribor FUA with minor technical adaptations. The pilot action in Maribor similarly shows the reuse of rainwater, treated wastewater and industrial water, but for the purpose of production of construction materials.
OTHER	