Best Practice Examples of Water Retention in Urban Areas of the Danube Region

Source: https://www.asb-portal.cz/aktualne/udrzitelnost-zmena-klimatu-zelena-architektura-hlavni-temata-noveho-vydani-asb

EUROPEAN STRATEGY FOR THE DANUBE REGION

Priority Area 4: To restore and maintain the quality of waters

DANUBE REGION strategy

Interreg Danube Transnational Programme

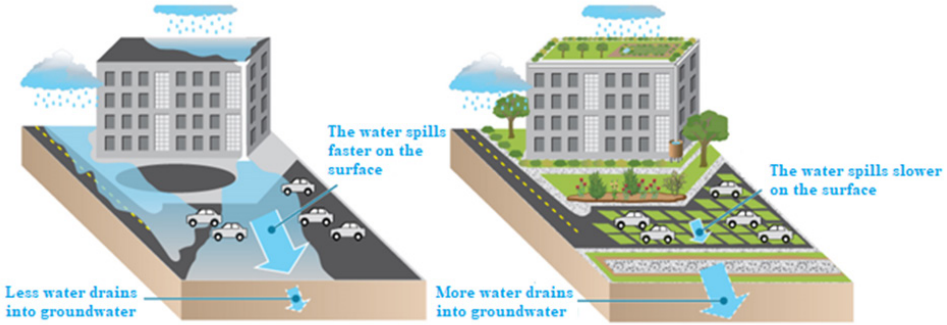
https://waterquality.danube-region.eu

Introduction

In the 21st century, much of human population lives in the cities. Special microclimate in urban areas enhances importance of water retention to make the cities more comfortable for life. “Sponge cities” and cities storing rainwater locally, are safer of torrential rainfalls and floods, and more resistant to water stress caused by droughts and heat waves. Water retention in urban areas is a comprehensive benefit, and necessity in the modern world to cope with climate change impacts.

So, what are the solutions?

Vegetation in urban areas has multiple benefits related to aesthetics, microclimate regulation and urban hydrology. Green places as important biodiversity refuges, contribute to reducing particulate air pollution and regulate temperature of microclimate. Moreover, they intercept precipitation and balance rainfalls. The water retention measures increase infiltration capacity of the urbanised surface (compared to impermeable surfaces) and replenish groundwater supplies. Vegetation enhance the capacity for rainfall storage and regulates microclimate.



https://waterquality.danube-region.eu
https://liberecky.pirati.cz/aktuality/civilizace-vs-priroda-modro-zelena-infrastruktura-setri-krajinu-i-rozpocet.html

Apparently, the best solution from the main points of view – social, economic and environmental are **natural water retention measures (NWRM)**. The diversity of such measures are implemented by various sectors or considered in different planning processes dealing with water management, food risk management, biodiversity protection, climate change adaptation, urban planning, etc. Some of these measures aim to modify the ecosystem directly, while others focus on changes of common practice and habits of economic players.

The method of water retention itself should be linked to its use. The retained water with an open surface is subsequently affected by sunlight, which leads to its warming and especially to the growth of algae and other organisms, which deteriorate the quality of water. Retaining water in underground rocks is more demanding to meet the quality limits. Therefore, based on water quality, the rainwater can be infiltrated through an unsaturated area

without pre-treatment or with applying a suitable method of physical pre-treatment. When planning water retention measures, it must be taken into account climatic and meteorological conditions; hydrogeological conditions and technical conditions (soil/rock permeability has a significant influence on the choice of infiltration method).

Facilities in rainwater management:

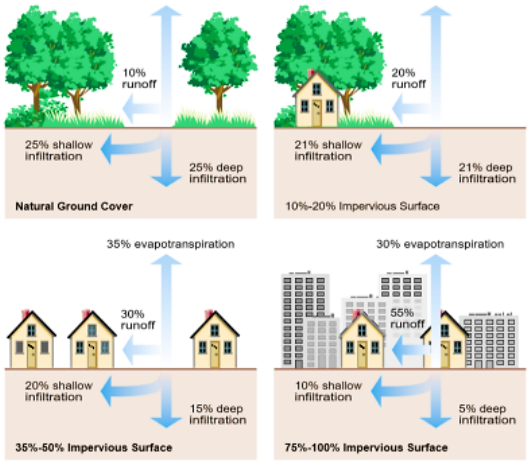
1. Measures to improve the microclimate (e.g. lawns, trees, semi-permeable surfaces, vegetation roofs, vegetation facades, shallow infiltration areas, etc.)
2. Infiltration measures without regulated drain (e.g. surface infiltration without retention, infiltration inserts, infiltration retention tanks, furrows, infiltration shafts, etc.)
3. Infiltration measures with regulated runoff (e.g. infiltration field with retention furrows or tanks with regulated drainage or runoff)
4. Retention objects with regulated runoff (e.g. dry retention rain tank (water playground, park), retention rain tank with storage space, underground retention rainwater reservoir, artificial wetland).
5. Accumulation and subsequent use of rainwater (e.g. watering, flushing, etc.)

The three-point approach to respond to climate change:

A – daily rain (i.e. 80% of total precipitation) is aimed at improving the annual water balance (retention, evaporation) and using rainwater as a source to increase the sustainability or attractiveness of cities.

B – proposed rain (with a repetition period of 10 years, i.e. 19% of total precipitation) where traditional technical solutions lead to the reduction of sewer network overload and flooding of the terrain.

C – extreme torrential rains (with a repetition period of about 100 years, i.e. 1% of total precipitation), when traditional sewer networks fail and flooding impact must be reduced in cooperation with urban planners.



Changes in hydrological conditions with increasing impermeable surface (Hack, J., 2020)
https://www.tu-darmstadt.de/see-urban-water/teaching/lectures_suw/index.en.jsp

Germany

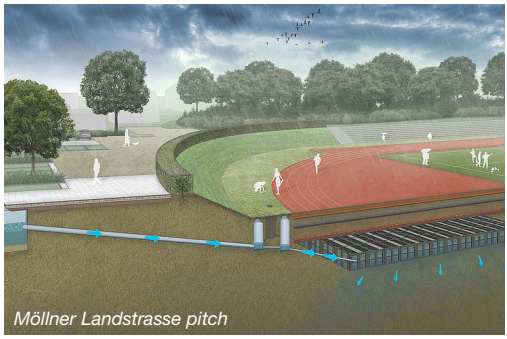
The rainwater retention in Hamburg and Stuttgart

Source:https://doi.org/10.1007/3-7643-7668-6_14. 2005

The first German rain playground was opened in the Neugraben-Fischbek district of **Hamburg**. The starting point for the construction was the multiple flooding of neighbouring schools. The existing rain-catchment basin was extended to the maximum possible volume. As floods continued to occur in the event of heavy rain and the adjacent playground was to be renovated at the same time, it was decided to redesign it for temporary rainwater storage.

Scharnhauser Park in **Stuttgart** is an area of ecological residential buildings. The ecological approach is applied to drainage of the water by open ditches and grassy outcrops where the water is retained, partially evaporated and cleaned by infiltration through the humus layer and through the gravel body. These ditches are located in the vast green areas of the city district. Finally, the water is brought into a natural water recipient, i.e. into both streams to the west and east of the Scharnhauser Park.

Source:https://www.risa-hamburg.de/projekte/freiraeume/



Möllner Landstrasse pitch

Source:https://www.risa-hamburg.de/projekte/sportstaetten/

Unique project in **Hamburg**-Mitte district, an underground storage and infiltration system was built under the Hein-Klink stadium that relieved rainwater runoff.

In the event of heavy rain, excess water is drained from the road to the sports field. Underground storage elements absorb excess water and gradually drain it into the ground. The pilot system can hold more than 500 000 litres of water.

Czech Republic

Rainwater Management in Bratice, Hloubětín and Brno

Rainwater from family houses and public areas around the **Bratice** village no longer flows into the sewerage. It is stored in the lake, which used to be an unutilised fire tank in emergency conditions filled by muddy impermeable sediment. Thanks to the conversion of the tank into a natural lake, the ability to retain water has significantly increased. Besides environmental advantages, the water playground equipment together with lit benches make the village square a pleasant place to stay not only during the day, but also at night.

Source:https://www.adapterraawards.cz/Databaze/2020/Hospodareni-se-srazkami-Na-Bahne

Source:https://www.adapterraawards.cz/Databaze/2020/Hospodareni-s-destovkou-SUOMI-Hloubetin

Not a drop of rainwater flows from the **Hloubětín** residential area into the classic sewerage, but it infiltrates directly into the ground. The outflow of rainwater from the area is slowed down in retention tanks, infiltration rigs along the roads, flooding infiltration meadows and a nature-like central lake. Moreover, a green courtyard and newly planted trees are irrigated using rainwater underground drainage system and a runoff water from the slope.

Pond in park was built as part of the cultivation of a public area between panel buildings on a housing estate in the town district of Nový Lískovec in **Brno**. The retention pond is situated in the centre of the park and is fed by rainwater drained from the roofs of three panel buildings in the vicinity, which have an area of approximately 1,600 m^2.

Source:https://www.adapterraawards.cz/Databaze/2019/Park-pod-Plachtami

Originally, water was supposed to be drained from four roofs. The volume of water in the pond at the operating level (max 1,2 m) is 630 m^3. In addition to its retention capacity, the lake has a positive effect on the local microclimate. Thanks to the introduction and breeding of fish and various species of animals, it functions as a natural habitat with educational aspects.

Austria

Solar city Linz – ecology in the urban concept

Innovative approaches have been implemented in many areas when planning Solar City in **Linz**. In addition to quality architecture and citizen-friendly infrastructure, particular importance has been attached to energy efficiency and sustainability issues. Particular attention was also paid to integrating sustainable rainwater management into the overall concept.

Source:https://www.latzundpartner.de/en/projekte/freianlagen/solar-city-linz-pichling/

In line with this ambitious philosophy, a so-called modified rainwater management concept has been developed for Solar City based on the following principles:

- Rainwater is handled in a predominantly surface, decentralized system that makes the natural rainwater cycle visible and understandable.
- Drainage, capture and disposal of rainwater is carried out primarily through troughs, retention ditches and vegetation-overgrown areas.
- These elements are included in a comprehensive, interconnected system that uses the Aumühle stream in the southern part and the alluvial meadows in the northern part of the district as recipients.
- The above elements of the rainwater management system are an integral part of open space planning. Ecological settlement bordering the Traun River was built in 2006

Slovak Republic

Water retention measures in Handlová and Bratislava

Restoration on Handlovka River tributaries and on Handlovka River in **Handlová** town enabled newly built water retention measures within town residential area. Water storage has the aesthetic and flood protection effects. Measures are based on building barrages for partial water accumulation to slow down the runoff and to serve the purpose of erosion protection.

Barrages are designed in the following tributaries: Račí, Jalovec and Horeňovo brooks. Accumulation volume is planned to be 30 m^3. Water will be used in dry seasons to cope with microclimate change. Projects on Račí and Jalovec brooks are under implementation. Project on Horeňovo brook was completed. Innovative technology "TUBOSIDER" was used there for the first time in Slovakia – water course was covered by steel construction. It is on Handlovka River flowing through Handlová town.

Source: Monika Supeková

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Karlova Ves is a part in **Bratislava** city where the Town Council prepared the water retention project. The project will bring the following benefits: good rainwater management, successful deal with flash floods and improving the microclimate during drought in urban area.

Green infrastructure involves green roofs and walls, e.g. vegetation roof is at the building of Local Authority, and green walls and green grass areas in the pedestrian zones are located in the Veternicova and Pribišova Streets.

Rainwater retention and consequent utilization is installed in the area of Kolískova kindergarten, A. Dubček primary school and Kaskády public place. Moreover, rainwater barrels are placed in public spaces.

Source: Zuzana Hudeková

Source: Zuzana Hudeková

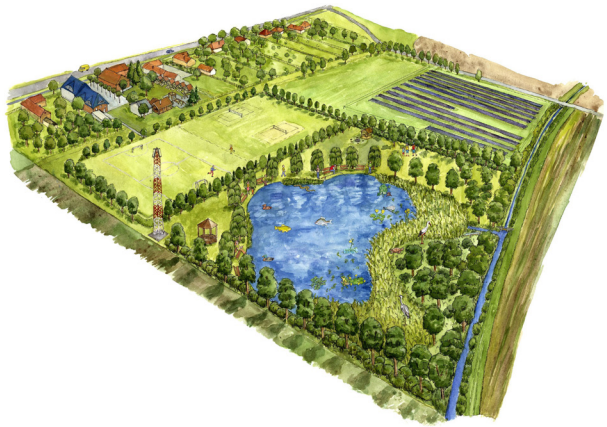
Hungary

Improving climate resilience of vulnerable municipalities in Hungary

Hungarian experts addressed a key cross-sectoral issue – use of natural water retention measures and sustainable water management. Local communities affected by climate change impacts combat different forms of extreme events, namely the lack or excess of water. To mitigate detrimental effects, and to provide effective adaptation measures, the effective settlement management should handle, relieve and retain water, as well as cooperate with stakeholders from the water and agriculture sectors.

5 pilot sites (see map) represent the typical climate related water risks, which settlements in Hungary do face. A very important element of the project is to demonstrate which and how ecological-based local 'assets' are accessible for municipalities to adapt without substantial investments. As an example is the area of **Rákócziújfalu**. Inland excess water inundation, a special Hungarian phenomenon, causes significant damages to agriculture, infrastructure and settlements.

The municipality identified its accessible natural assets (channels and natural depressions) to capture excess water in inundation periods and rainwater in heavy rain periods to retain this water to reduce the risk of droughts.



Source: https://vizmegtartomegoldasok.bm.hu/en

Slovenia

Water Retention Reservoir Podutik (Ljubljana)

The flood reservoir **Podutik** (Ljubljana) has been redesigned into a multifunctional flood reservoir that provides a broad range of ecosystem services through the integration of nature-based technologies (Eco Technologies).

Source:http://www.space.net/pdf/2015/presentations/Istenic_Spacenet2015.pdf?fbclid=IwAR17vK4wQfN0P1AtmQ80WJuB1EwQb-nEuano8vihRJ-08wyjpkuUGFu0O4dI

Some of the benefits are flood prevention, water retention for irrigation purposes of nearby green areas, water pollution mitigation from urban gardens and sewage overflows, increased self-cleaning capacity of the ecosystem, enhanced biodiversity, and the provision of a recreational and educational path.

Source: https://oppla.eu/casestudy/17577

Croatia

Green Campus at the Zagreb University

The project involved the redevelopment of old military infrastructure at the periphery of the **Zagreb** city (Boronaj) into a green and carbon-negative university campus.

The Boronaj campus, planned as the green campus, uses renewable energy (biomass, geothermal and solar), treatment cell for wastewater and a huge green area (with trees and shrubs).

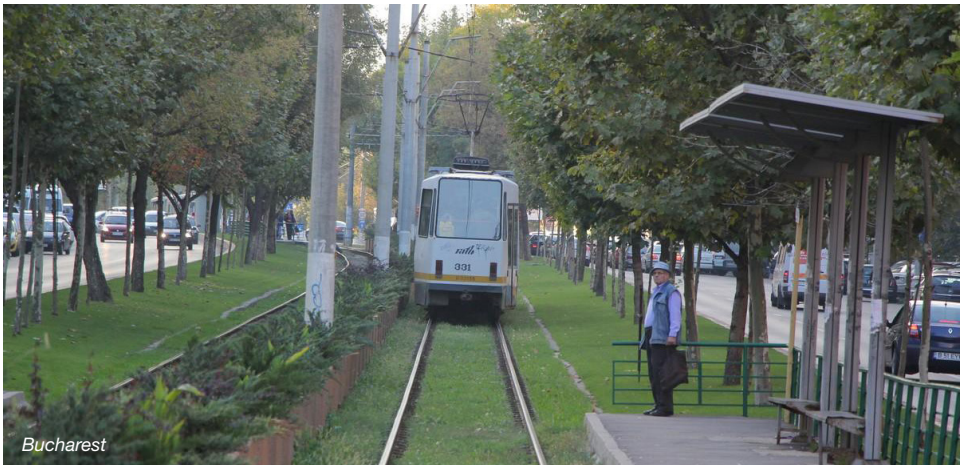
Source:https://una.city/nbs/zagreb/green-campus-zagreb-university

The buildings (constructed and to be constructed) are planned to be carbon negative. A significant portion of the campus is the green areas (with trees and shrubs). This was created with the aim to contribute and maintain the native species diversity.

Romania

Turf on tram lines in Bucharest

Tram lines that are trespassing a neighbourhood in **Bucharest** were covered with turf, creating green spaces alongside the lines, improving air quality and enabling infiltration of the rainwater to the ground. The neighbourhood is dubbed “the greenest neighbourhood” of Bucharest.



Bucharest

Source: https://una.city/nbs/bucuresti/turf-tram-lines

Very similar solution was applied in **Bratislava** (Slovakia) after reconstruction of tram rails. The municipality placed a green areas beneath tram railways, which contributes to fresher microclimate.

Bratislava

Source: dpb

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