

GARDENS OF THE FUTURE IN NICOSIA CITY



The DEMO9

In Nicosia, Cyprus, stands as a prime example of a holistic approach to enhancing the city's water supply infrastructure, water quality, and environmental sustainability.

This group of three distinct Nature-based Solutions (NbS) is implemented across separate urban sites—Makrigianni Park (2,400 m²), Anthis Christophidou Park (860 m²), and the Gardens of the Future (1,000 m²). Each location showcases a unique method:

sub-DEMO9.1

A **photobioreactor system** to improve groundwater quality.

Introduces advanced microalgae techniques to further refine groundwater quality.

sub-DEMO9.2

A **subsurface rainwater harvesting system** for sustainable irrigation.

Implements an innovative subsurface rainwater harvesting system to optimize irrigation.

sub-DEMO9.3

Green facades with vertical gardening and hydroponics to bolster food security.

Adds to the city's green infrastructure with wall-based green facades, supporting food security through vertical gardening and hydroponic methods.

Collectively, these Nature-based Solutions create a decentralised yet integrated framework that enhances the city's resilience to climate and water-related challenges.

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Improvement of groundwater quality using photobioreactor



sub-DEMO9.1

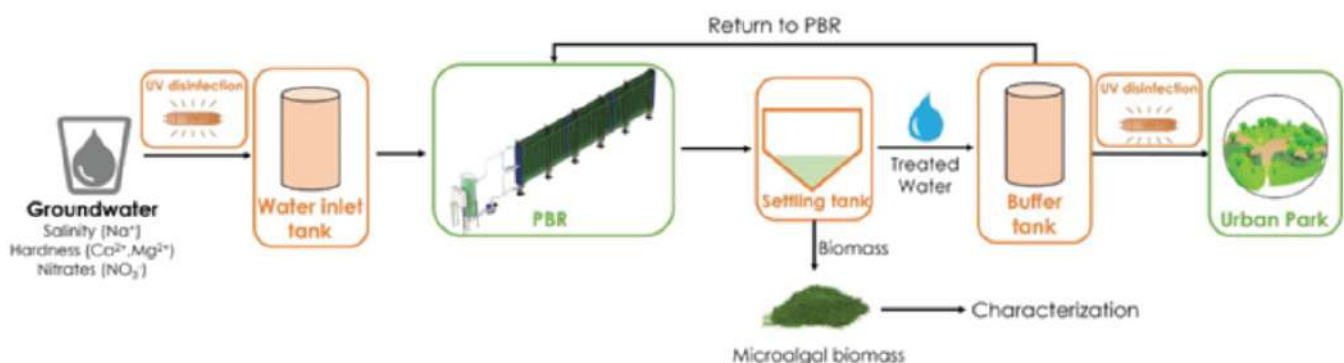
Nicosia, Cyprus

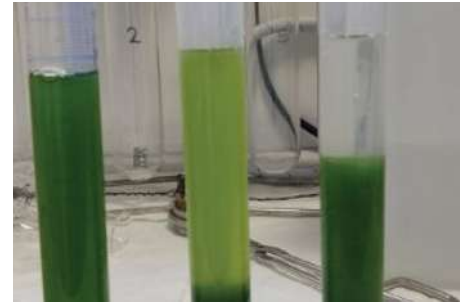
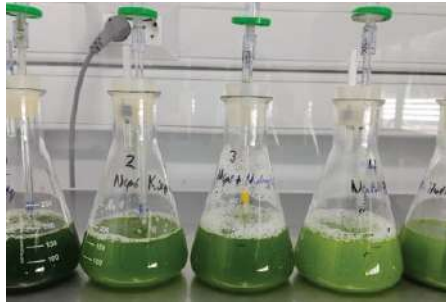
What has been done in sub-DEMO9.1?

At the core of sub-DEMO9.1 lies a large-scale, closed tubular photobioreactor (PBR) installed in Makrygiannis Park, harmoniously integrated into the urban landscape. This innovative system treats groundwater by removing salinity, nitrates, and hardness, producing water suitable for irrigating the park's green spaces.

The treatment process begins with UV disinfection, followed by groundwater entering the system through an inlet tank. It then flows into the photobioreactor, where selected strains of microalgae—carefully chosen by the National Technical University of Athens (NTUA) for their efficiency—carry out the purification process. After treatment, the water moves to a settling tank, where microalgal biomass is harvested using flocculation and sedimentation. The resulting clean water is collected in a buffer tank, where it is either sent for laboratory analysis, delivered to the park's irrigation system, or recirculated for additional treatment if necessary. The entire system is enhanced with smart technologies, including advanced irrigation controls, real-time water quality sensors (monitoring temperature, pH, conductivity, chlorophyll, and dissolved oxygen), flow meters, and water level sensors.

Occupying 2,400 m² of public urban land, this Nature-based Solution (NbS) combines ecological innovation with digital monitoring to support sustainable groundwater management. It ensures reliable irrigation for urban green areas while demonstrating the synergy between natural processes and cutting-edge technology for environmental benefit.





Identified Nature-based Solutions



The identified Nature-based Solutions are those mentioned above, specifically:

- Photobioreactor
- Urban Park

Co-benefits

Implementing sustainable water management systems offers multiple advantages for urban environments, addressing both environmental and social needs. By providing a reliable, non-potable source of water for irrigation, these systems significantly reduce reliance on costly drinking water supplies. This ensures that urban green spaces remain healthy and vibrant—even during periods of drought or water restrictions.

Critically, the treatment of groundwater through systems like photobioreactors also reduces the risk of nitrate contamination in aquifers. By removing excess nitrates before water is reused, these systems help protect vital underground water reserves from long-term degradation. Additionally, by lowering water hardness and salinity, they contribute to preventing soil salinization—preserving soil health and promoting the long-term vitality of urban vegetation.

Enhanced urban greenery, supported by sustainable irrigation, further contributes to public health and well-being. Greener cities benefit from improved air quality, reduced urban heat island effects, and increased access to spaces for recreation and relaxation. Collectively, these outcomes foster a more resilient, livable, and environmentally responsible urban landscape.

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The Rainwater Harvesting when Nature Inspires: An innovative filter drain for rainwater harvesting in the urban environment



What has been done in sub-DEMO9.2?

In sub-DEMO9.2 an innovative approach to urban water management through an NBS enhances climate resilience and sustainability in urban environments, harmony in the urban landscape as it is situated in a hydro-pocket urban park in the heart of Nicosia city, Cyprus. A comprehensive transformation of Anthi Christofidou Park is being implemented. The main objective is to achieve full water self-sufficiency for the park.

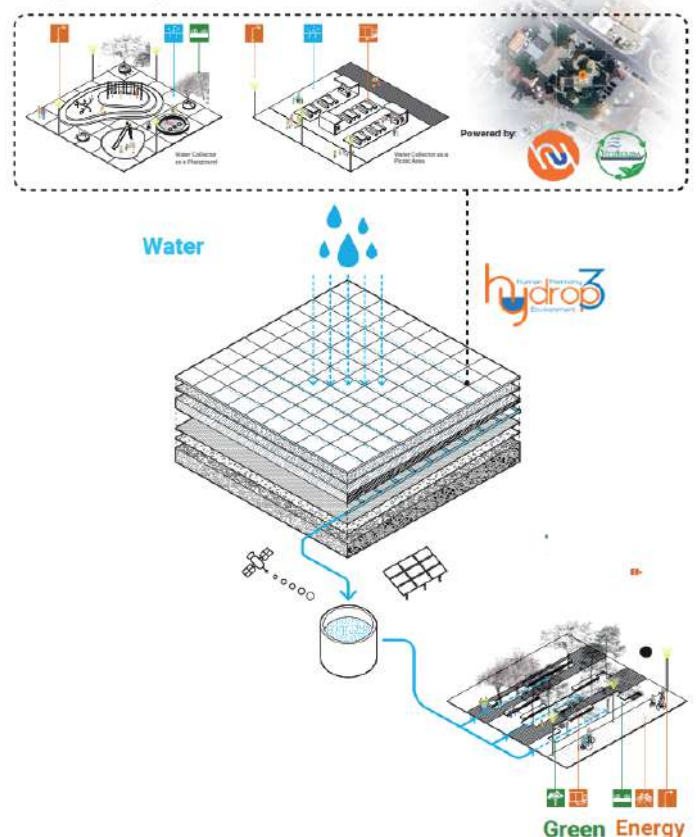
Until recently, the park depended on municipal water trucks to maintain its greenery – a labor- and resource-intensive practice that was neither sustainable nor efficient. The intervention introduces a range of innovative technologies designed to ensure long-term real-world outcomes, environmental functionality and water autonomy.

At the core of the solution is an advanced water management system, which includes a shallow subsurface rainwater collector, smart storage tanks, and a sensor-controlled irrigation network with remote monitoring capabilities. This system captures and stores high-quality rainwater, which is then used for the park's irrigation needs in a targeted and efficient manner.

To support these functions, new permeable paving materials are being installed to allow for natural water infiltration, reducing surface runoff and enhancing groundwater recharge. At the same time, the park is undergoing an architectural and aesthetic upgrade that blends modern, functional design with environmental performance, enhancing its appeal and usability for local residents.

A critical design principle throughout the implementation has been the full preservation of the park's existing trees and mature vegetation. All construction and installation works have been carefully planned to ensure that no existing greenery is harmed, reinforcing the project's commitment to sustainability.

Hydropark*



Identified Nature-based Solutions



The identified Nature-based Solutions are those mentioned above, specifically:

- Filter drain
- Urban Park

Co-benefits

The sub-DEMO9.2 intervention provides a wide range of co-benefits beyond water efficiency and climate adaptation. These include:

Environmental benefits such as improved stormwater management, enhanced biodiversity, and mitigation of the urban heat island effect.

Social benefits through the creation of a greener, cooler, and more inclusive public space that supports well-being, recreation, and community interaction.

Economic benefits, including reduced operational and maintenance costs for the municipality, long-term savings in water use, and increased property and land value in the surrounding area.

By integrating these multi-functional benefits, the project reinforces the role of nature-based solutions as cost-effective, scalable tools for building resilient and livable cities. The transformation of Anthi Christofidou Park under sub-DEMO9.2 stands as a replicable model for sustainable urban development across the Mediterranean region and beyond.

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Nurturing Urban Nature: Enhancing Food Security with Wall-Based Green Facades

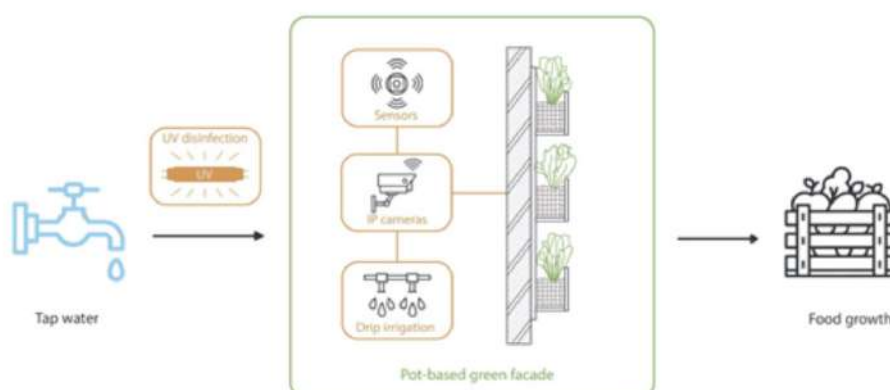


What has been done in sub-DEMO9.3?

sub-DEMO9.3 consists of a wall-based green façade, thoughtfully designed to advance urban greening and sustainability. This innovative system relies on a hybrid water circulation approach, functioning simultaneously as both a hydroponic and aquaponic system to purify water for planting.

The system uses a UV disinfection unit to purify water—primarily city water, though groundwater and greywater are also being considered for future integration. After disinfection, water from the aquaponic fish pond is efficiently distributed across the façade using a circular drip irrigation system. This ensures that plants receive the moisture and nutrients they need without unnecessary water waste. To maintain optimal conditions, the system is equipped with temperature sensors and internal data loggers that continuously monitor environmental factors influencing the façade's performance. Additional oversight is provided by operational sensors and IP cameras, supporting efficient maintenance and daily operations. A hydroponic fertilizing system delivers nutrients directly to the plants to support healthy growth. Storage and equipment facilities are available to house the necessary tools and materials, simplifying the care of both the green façade and the integrated hydroponic-aquaponic systems. A seed bank and plant incubator are included to preserve plant diversity and support the propagation of new seedlings. Social interaction units are integrated into the design, offering dedicated spaces for educational workshops, community gatherings, and farm-to-table experiences with the local community—fostering stronger engagement and collaboration with the sub-DEMOS.

This Nature-based Solution will be established within a publicly accessible internal urban garden at the **Gardens of the Future**, covering over 1,000 m² in the heart of the Historic Center. Surrounded by a vibrant flow of tourists, students, and civic groups, the project thrives in an atmosphere of active civic engagement. By utilizing vertical space for urban agriculture, the system promotes local food resilience and reduces transportation emissions. In doing so, it offers a practical and inspiring model for sustainable urban living—bringing together technology, community, and environmental stewardship in a single, accessible location.





Identified Nature-based Solutions



The identified Nature-based Solutions are those mentioned above, specifically:

- Wall-based green facade

Co-benefits

This innovative circular water system brings together multiple water sources-including tap water, groundwater, and lightly used greywater from a fishpond and transforms them into a valuable resource for growing fresh produce. By feeding a soil-less modular vertical farming system, it creates a sustainable cycle that maximizes water efficiency and minimizes waste. What makes this approach important is the active involvement of the local community, whose support and participation help ensure the system's success and foster a shared commitment to sustainable urban agriculture.

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