



HYDROUSA

**Regenerative & Nature-Based
Water Solutions**



LIFE PureAgroH2O



*Demonstration of water loops with innovative regenerative
business models for the Mediterranean region*

**Simos Malamis, HYDROUSA Coordinator
National Technical University of Athens**

LIFE PureAgro H2O Conference

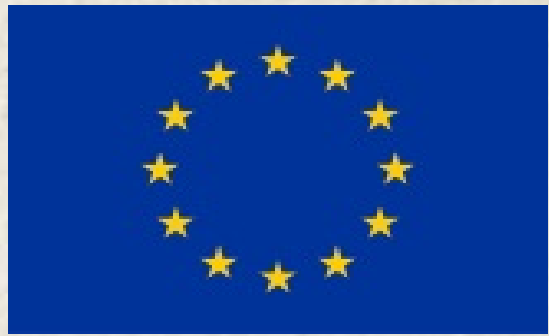
17th January 2020, Athens



This project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under Grant Agreement No 776643



BASIC HYDROUSA INFO



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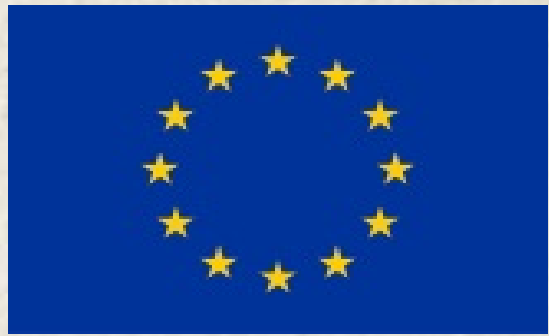
- **Title:** Demonstration of water loops with innovative regenerative business models for the Mediterranean region
- **Acronym:** HYDROUSA
- **CIRC-02-2016-2017:** Water in the context of the circular economy, Innovation Action
- **Total budget:** €12,015,448.75; EC contribution: €9,958,706.88
- **Duration:** 54 months
- **Start date:** 01/07/2018
- **Number of partners:** 28

HYDROUSA is materialised through:

- ✓ 13 innovations
- ✓ 6 demo sites (HYDRO 1-6)
- ✓ In 3 Greek islands



HYDROUSA TEAM



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HYDROUSA CONCEPT



This project has received



- Demonstrate the feasibility of **innovative, nature-based solutions** to **recover** and **preserve** valuable water, materials and energy from different types of water
- Demonstrate innovative supply chain within the concept of the circular economy
- **Decrease water acquisition cost**
- Applicability in **coastal areas** and in **islands**, particularly suitable for medium-small and decentralized regions
- Integrating within the supply chain **citizen and farmer** based **activities**
- Promote **novel agricultural practices and precision irrigation** within the water-food-energy nexus

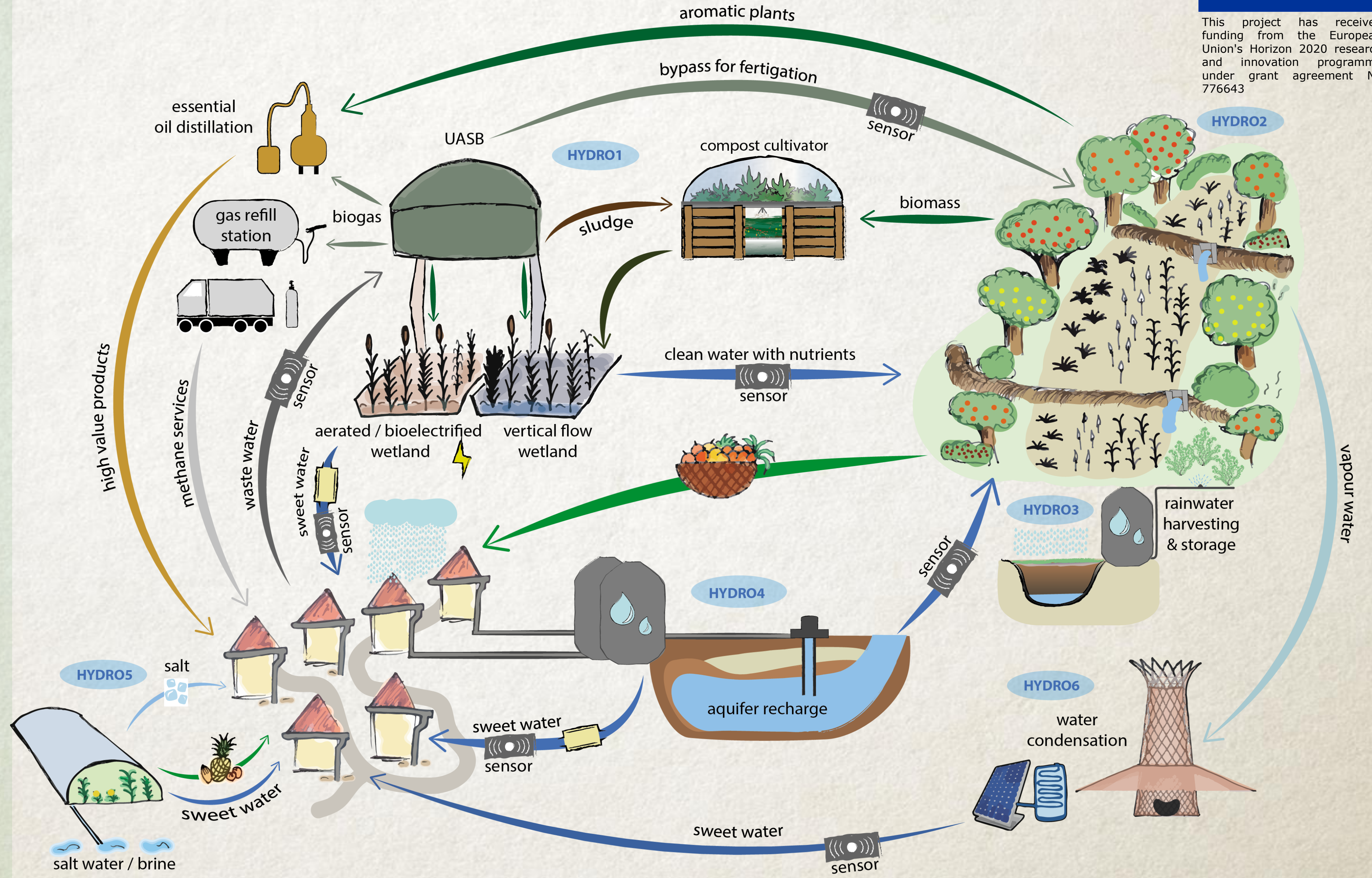




HYDROUSA IN ONE PICTURE



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IMPACT & EXPLOITATION



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HYDROUSA's Regenerative Model

Build a Water-Resilient Economy

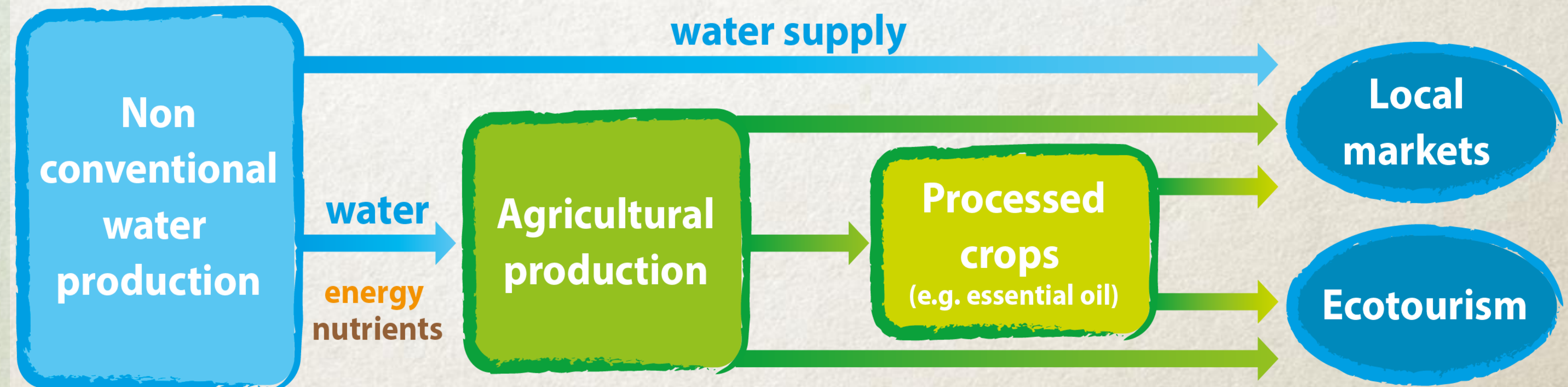
- Create Jobs
- Build Green Infrastructures
- Market Development

Mitigate Climate Change

- Sequester Carbon
- Rebuild Flourishing Ecosystems
- Turn a Problem into a Solution

Reimagine the Food System

- Rearrange Local Food Production
- Zero km Farming
- Establish Diversity as Commons



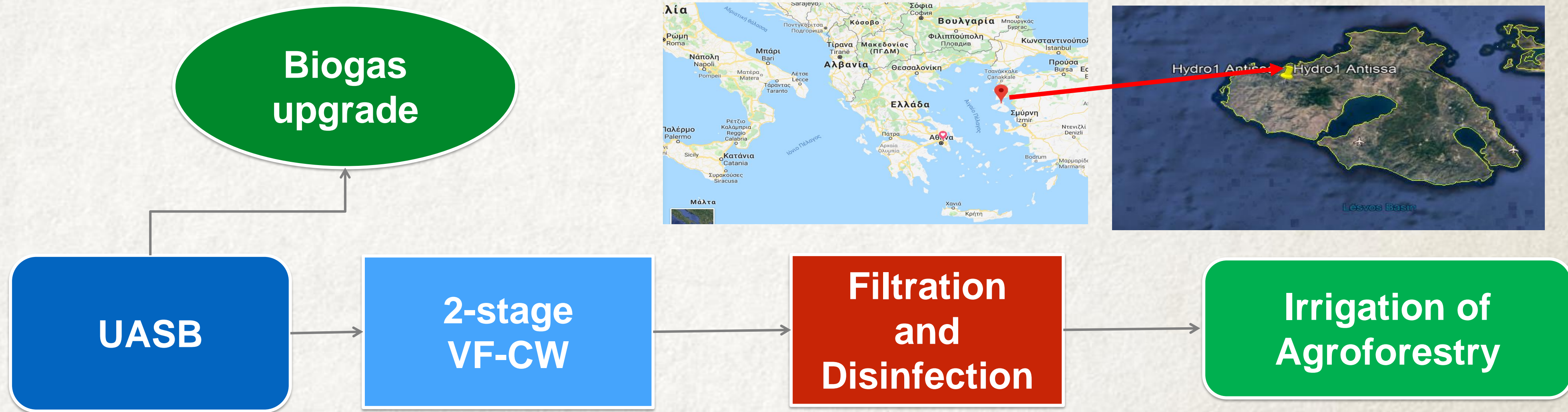


HYDRO1, Lesvos island

Integrated UASB-CW treatment at community level



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Advantages

- Low-cost treatment
- Nutrient recycling
- Versatility
- Composting of sludge and green biomass
- Diversified agricultural production (agroforestry)

Challenges

- Community engagement
- Conforming to water reuse limits
- Dealing with variable flow rates

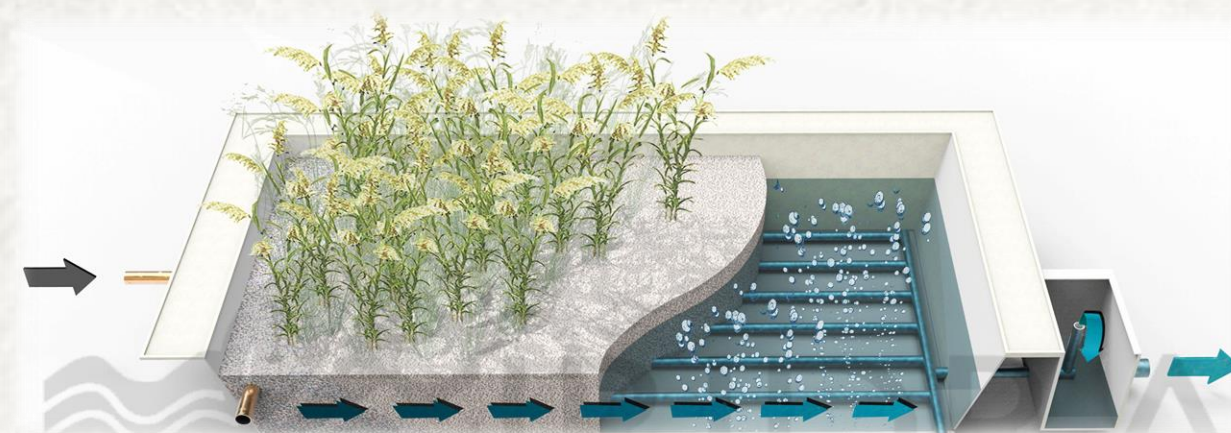


HYDRO1, Lesvos island

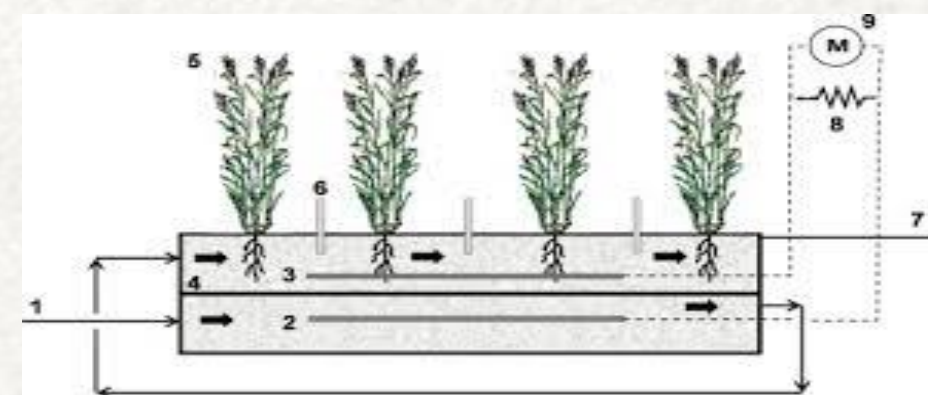


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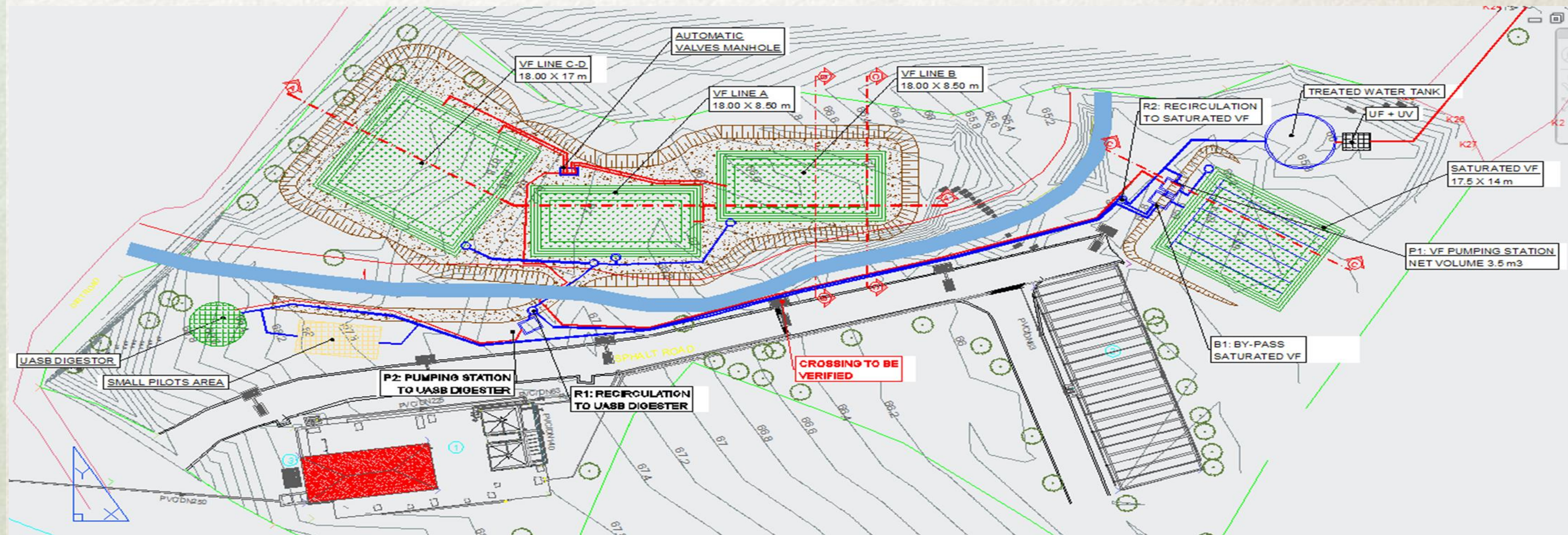
Full scale system (10-100 m³/d): 2-stage Vertical Flow CWs
Pilot systems (1 m³/d): Intensified CWs



Aerated CW



Electro-active CW





HYDRO 1, Lesvos island

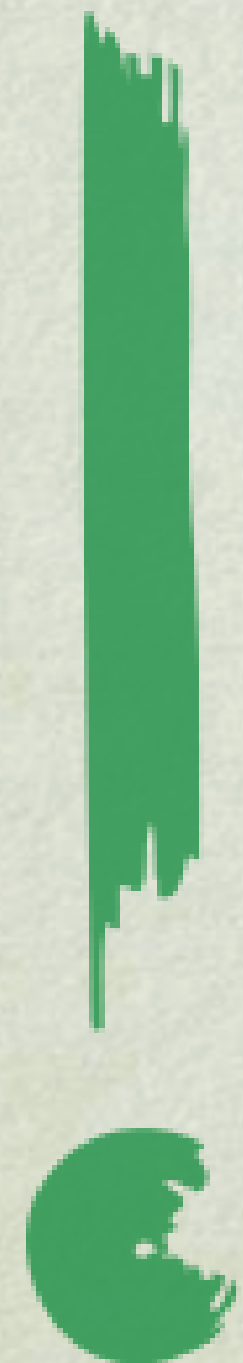
Treated effluent requirements



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- The UASB+CW+UF+UV full scale plant is designed to respect the Greek effluent water quality regulation for unrestricted agricultural reuse
- Versatile enough to meet other water reuse criteria including the Class A limits of the EU proposal for regulation

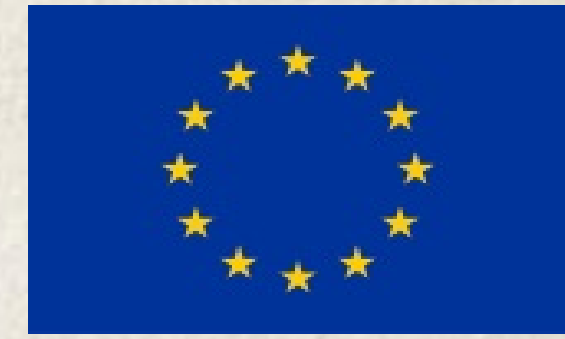
Parameter	Limit
BOD ₅ (mg/L)	10 for 80% of the samples
TSS (mg/L)	10 for 80% of the samples
Turbidity (NTU)	2 (median)
E. Coli (EC/100 mL)	5 for 80% of the samples 50 for 95% of the samples



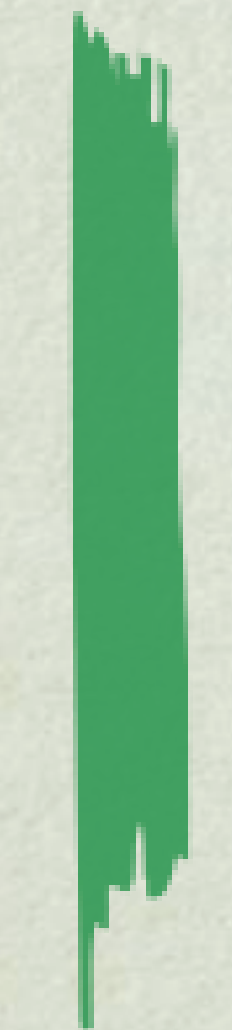
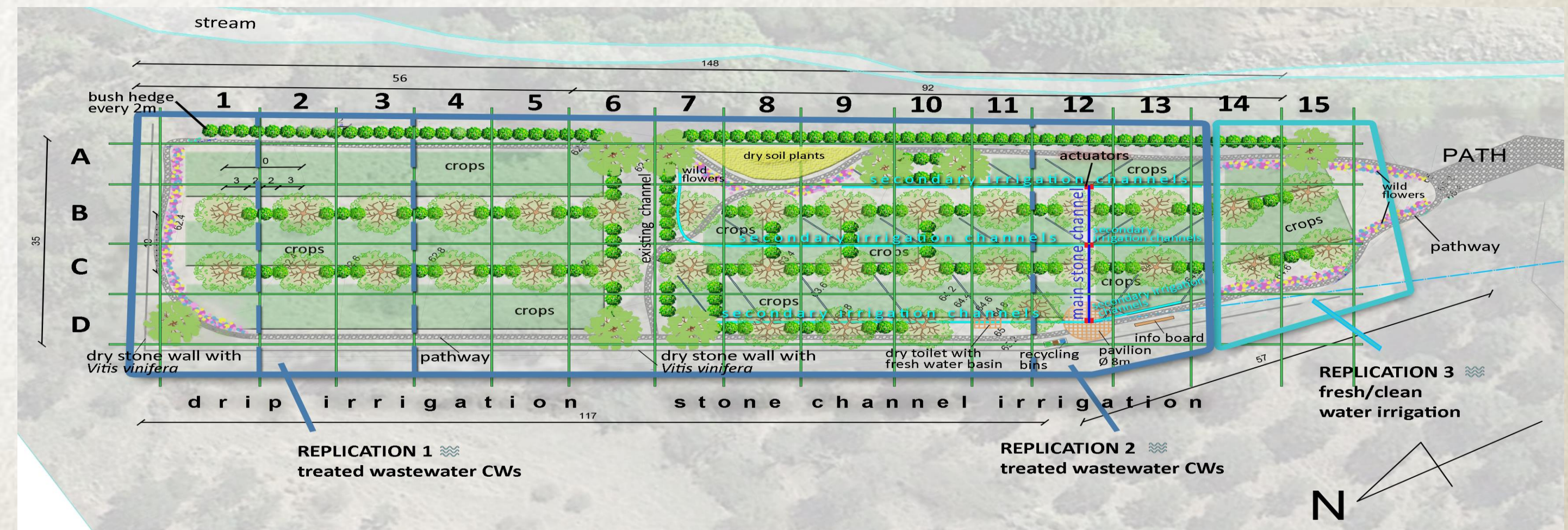
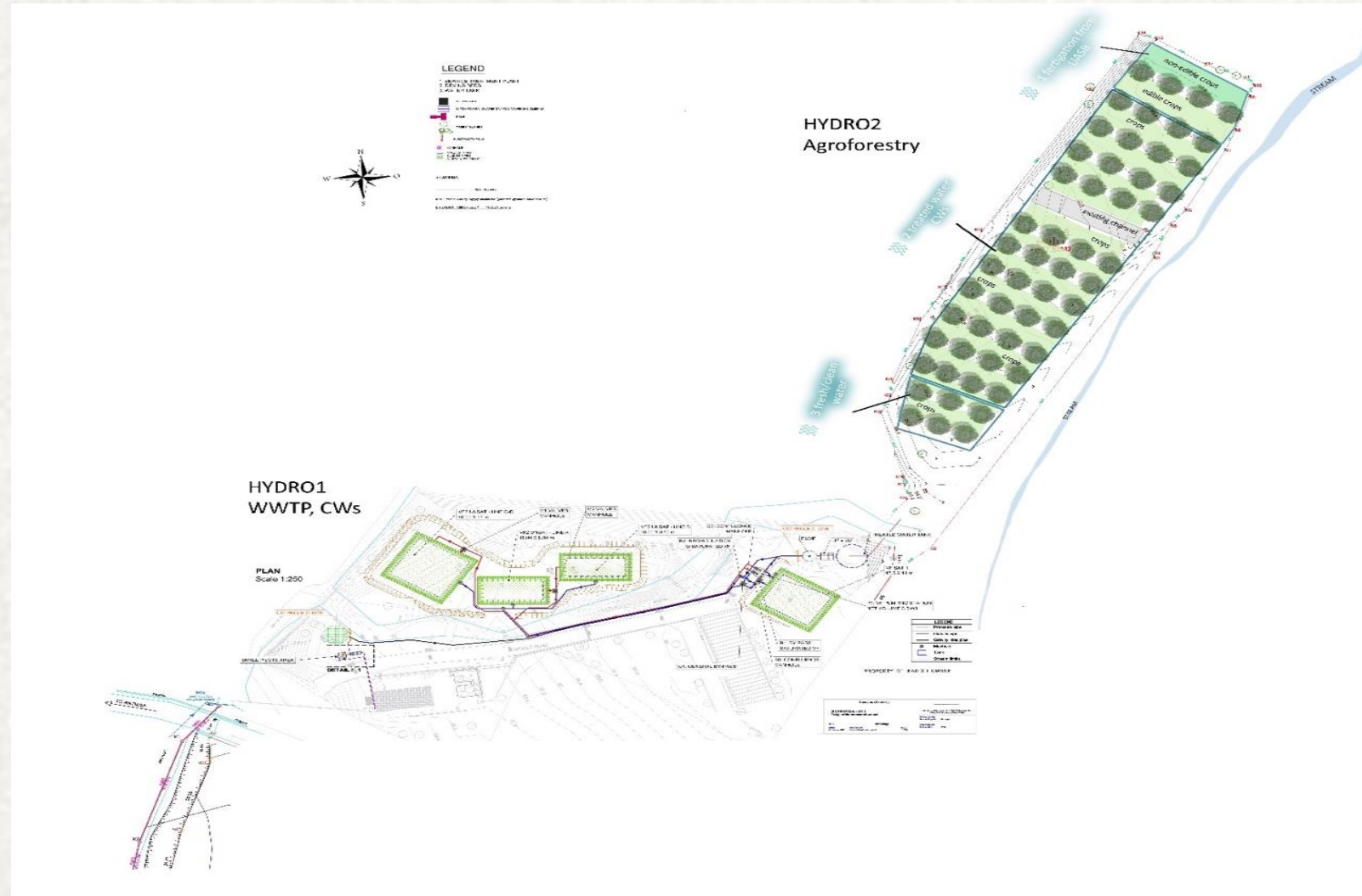


HYDRO 2, Lesvos island

Agroforestry



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HYDRO 2, Lesvos island

Agroforestry



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Pomegranate



Laurel



Olive Tree



Chestnut



Sea-buckthorn



Sage



Rosemary



Goji berries



Corn



Wheat



Barley





HYDRO 3, Mykonos island



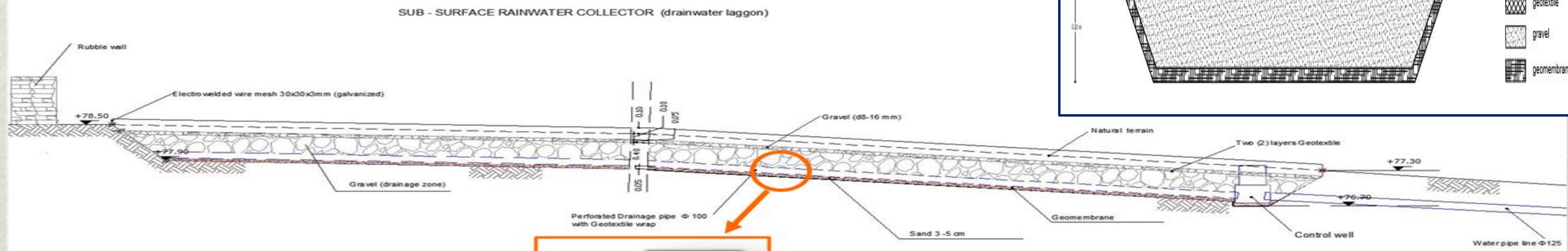
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Innovative rainwater harvesting system

Shallow sub-surface rainwater collection system in remote agricultural areas:

- **Geo-membrane** to seal the water from penetrating into the soil
- **Gravel**
- **Geotextile** at the top to allow the passage of water but not of soil
- **Soil** (top) to avoid visual intrusion

The rainwater collection system covers an area of **280 m²**.
Rainwater use for the irrigation of oregano.



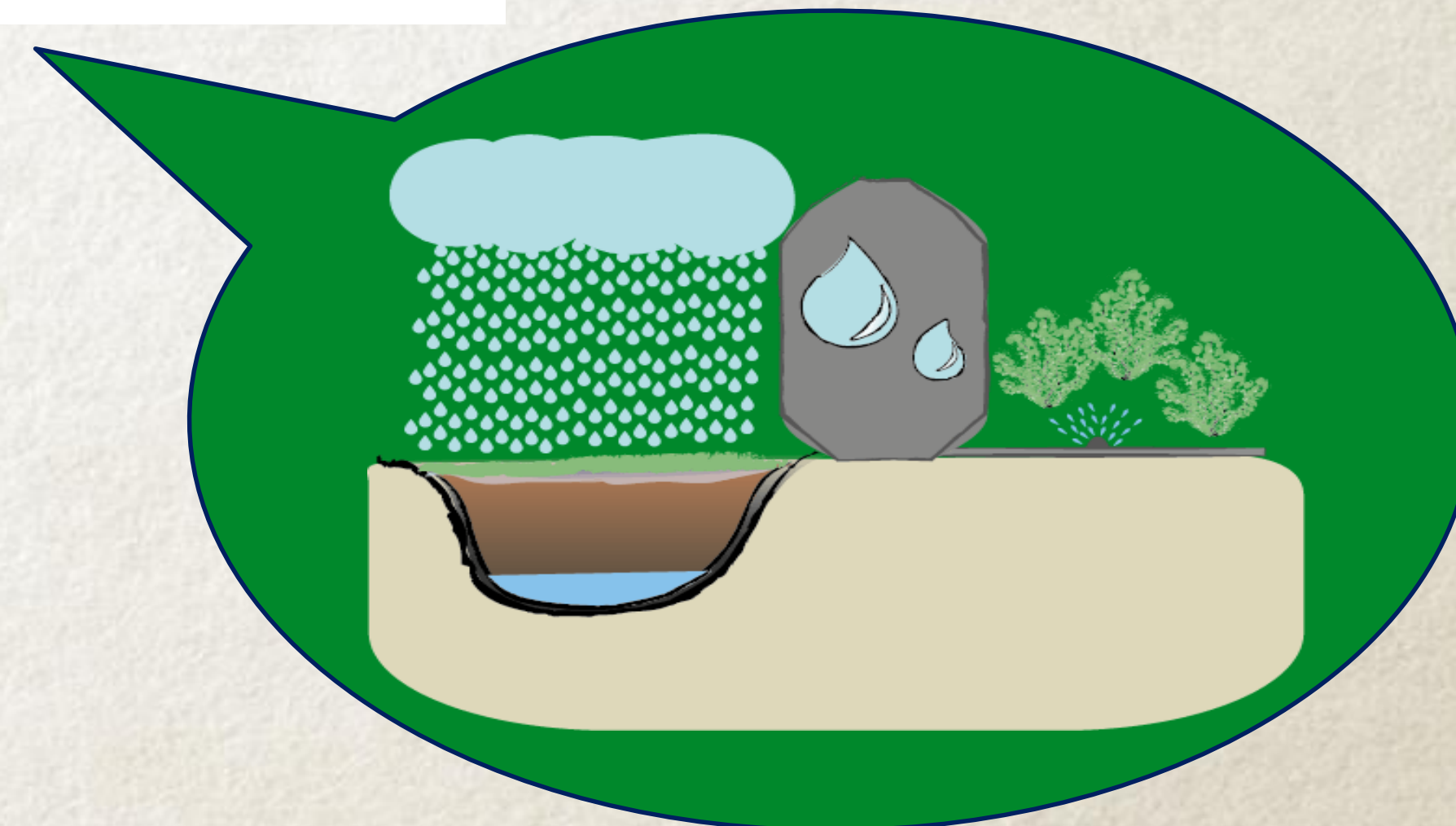
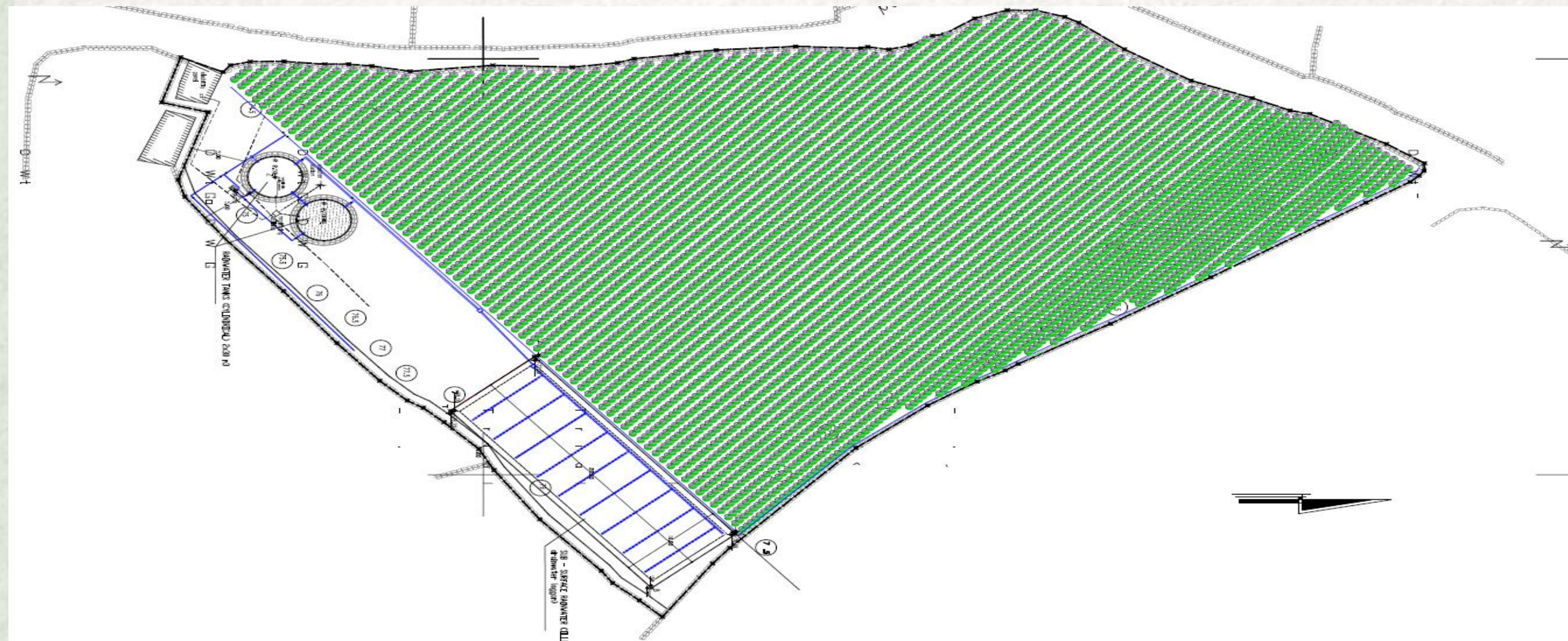


HYDRO 3, Mykonos island

Innovative rainwater harvesting system



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HYDRO 4, Mykonos island

Rainwater harvesting and aquifer storage system

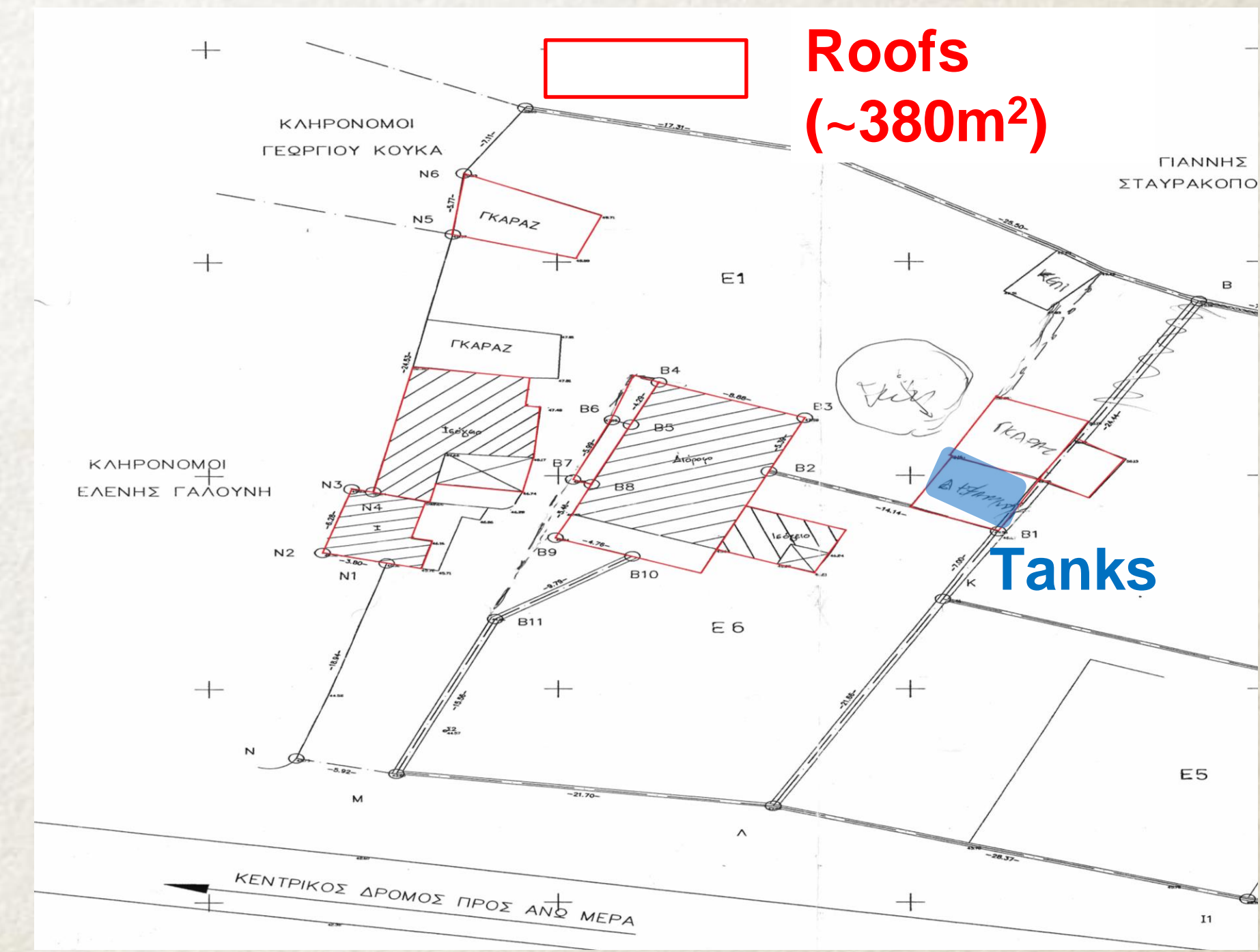


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Rainwater harvesting and aquifer storage system

- Harvested rainwater from residential roofs are reserved in tanks for domestic use
- Surface runoff from road is collected, filtered and stored into tanks and into the aquifer to be used for irrigation purposes

Decentralized, flexible, transferable and scalable solution for recovering rainwater





HYDRO 3&4, Mykonos

Rainwater harvesting



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HYDRO 5, Tinos island

Mangrove Solar Still

- ✓ Modular desalination system based on **solar still technology** (evaporation/condensation)
- ✓ Production of **distilled water for land regeneration practices** and **food production in arid, semi-arid areas.**
- ✓ Production of **salt for commercial use**
- ✓ Inspired by the way Mangrove trees function

Activities Within HYDROUSA

- Design and system up-scaled
- Feed saline water from local Desalination Plant (seawater and brine)
- Embed "Salt factory"
- Optimize Integration with Greenhouse to produce tropical fruits and other fruits/vegetables



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HYDRO 6, Tinos island

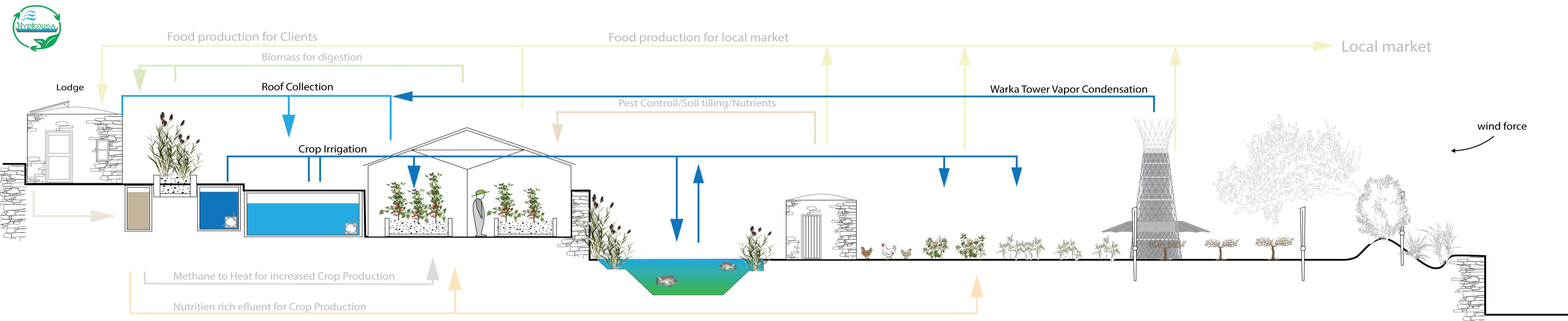
Water loops in eco-tourist facility



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- Rainwater and vapour water collection
- Onsite reed bed for wastewater treatment and reuse
- 100% reuse of all non-conventional water streams
- Energy, water and food self-sufficiency

Hydrusa: Rainwater catchment and storage



Sewage Water	Biodigester	Water Treatment	Treated Water Cistern	Rain Water Cistern	Greenhouse	Open Cistern/Pond	Chicken Coop	Artichoke P. & Caper plantation	Grape P.	Wind brake hedge Fog Catcher
	Produced Methane could be used for direct burning for heat or stored and transformed into electricity	natural system with excess production of biomass, could be used for biodigestion	water quality control by sensors, if quality low, repass by reed bed or increase oxygen level in cistern. UV disinfection Unit	collection of rainwater from roof areas during winter months and storage of excess natural stream water in order irrigate in summer	increase productivity and variety of crop production. Excess biomass could be digested	increased water retention from cistern overflow, rainwater and stream water. Possibility of Aquaculture for increased food production and enriched irrigation water	food production and pest control for cultivation. Good source of natural fertilizer and soil tilling	high value crop if organic, low maintenance and very adapted to local climate conditions	high value crop if organic, low maintenance and very adapted to local climate conditions	Wind brake hedges can protect areas that couldn't be cultivated otherwise. In combination with fog catcher nets sufficient water and wind shielding could be provided for fast growth.



HYDRO 6, Tinos island

Water loops in eco-tourist facility



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Cistern construction



Finishing up a Lodge



Greenhouse building progress



Waterproof roof for rainwater harvesting





ICT implementation



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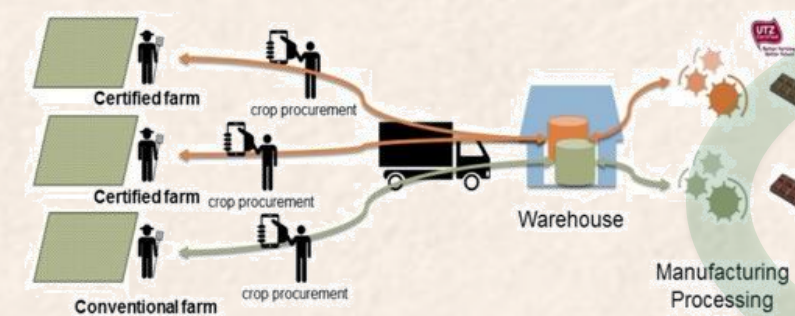
Circularity performance assessment

Water Loops

Circular Food, Nutrients
Valuable Material

Circular Energy
Environmentally Efficient Technologies

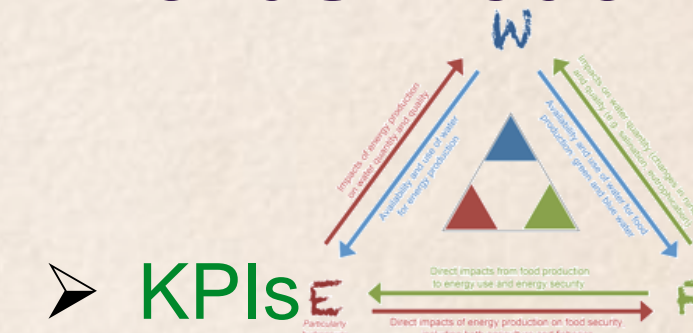
Tracking and tracing



Monitoring & Control



Nexus modelling



- KPIs
- Products
- Markets

Digital World

Physical World

Data acquisition system and data repository

Digitisation

ICT Tools

Digitisation

ICT Tools

Digitisation

ICT Tools

Digitisation

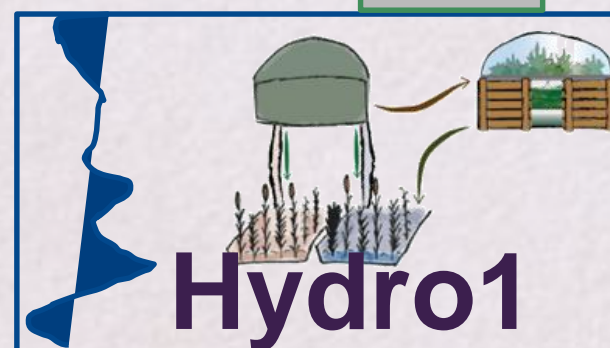
ICT Tools

Digitisation

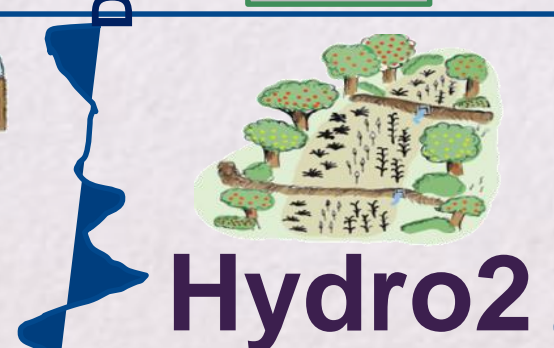
ICT Tools

Digitisation

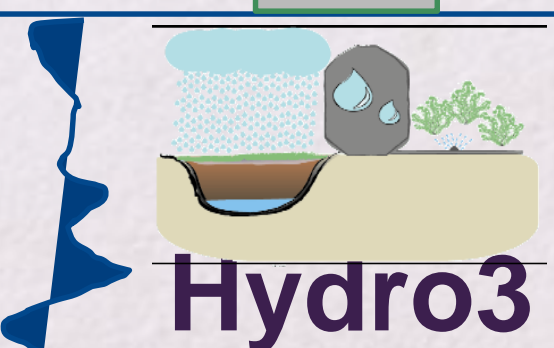
ICT Tools



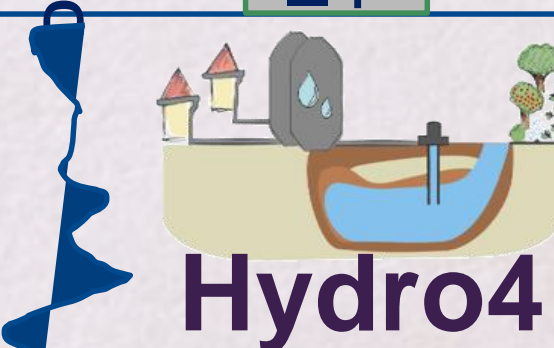
Hydro1



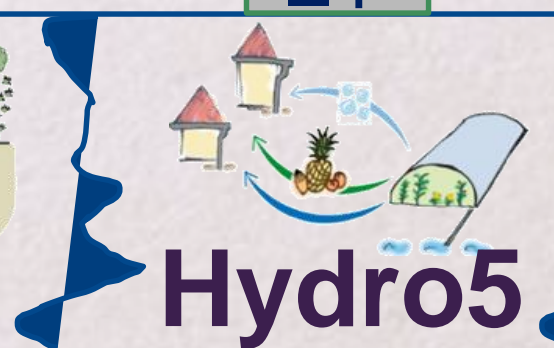
Hydro2



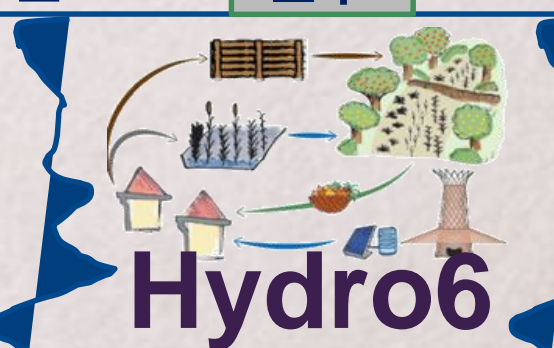
Hydro3



Hydro4



Hydro5



Hydro6

Technology-Innovations-Optimisation



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