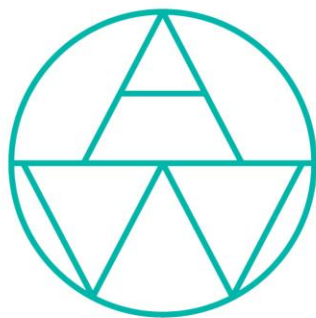


Rainwater aquifer storage and recovery for high-tech horticulture Glasparel Waddinxveen (NL)

RAINWATER HARVESTING & AQUIFER STORAGE AND RECOVERY (ASR)
SALUTIONS COLLAB



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Duurzaam Glas Waddinxveen BV

CHALLENGE: AVAILABILITY OF HIGH-QUALITY FRESHWATER

In Waddinxveen (Province of South-Holland, The Netherlands), a 90 ha high-tech greenhouse area is currently under development. Continuous availability of high-quality freshwater is a boundary condition for this development from a user's perspective. Rainwater stored in aboveground reservoirs are a primary water source. However, **water demands are too high** compared to the average gross precipitation in this area and serious **seasonal shortages** would arise during periods of drought.

It was decided to install a **rainwater harvesting system** in greenhouse area and the neighbouring industrial zone to create an **additional freshwater source**, delivering more than sufficient freshwater to the greenhouse area. One problem remained: where can the water be stored during periods of surplus for later use in periods of drought? Storage in aboveground reservoirs would require a vast and valuable part of the surface area, and results in high costs and possible deterioration of the water quality (warming, algal growth, atmospheric deposition, or even sabotage).

SOLUTION: SUBSURFACE STORAGE AS ESSENTIAL LINK

Allied Waters SALutions designed the **aquifer storage and recovery (ASR)** suitable for application in the local brackish groundwater aquifer, which was coupled with the rainwater harvesting system. Three decentral ASR-systems were proposed for storing rainwater surpluses in the subsurface on a timescale of weeks to months before later recovery. The rainwater is treated before infiltration by slow sand filtrations. **Multiple partially penetrating wells (MPPW)** are used to adjust ASR to the brackish character of the ambient groundwater and to optimize the recovery of high-quality freshwater. The deepest well screens act as **Freshkeepers** and recover brackish water beneath the stored freshwater for **desalination** by reverse osmosis (RO) as an additional source of freshwater and protection of the injected rainwater. The combined application of ASR, rainwater harvesting, and the Freshkeeper in Waddinxveen results in a robust and constant freshwater supply for the greenhouse area, and in a negligible spatial footprint.

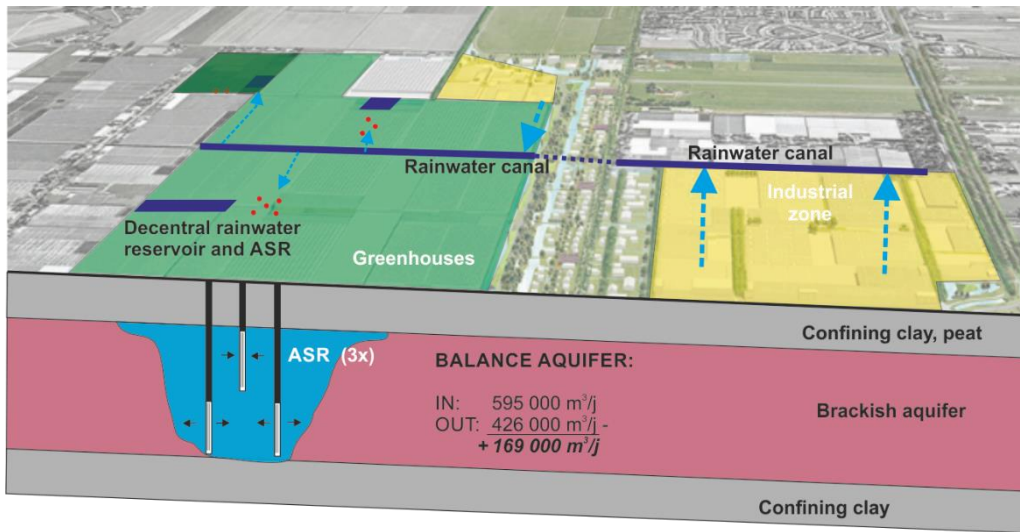


FIGURE 1: OUTLINE OF THE GLASPAREL+WADDINXVEEN WATER SYSTEM



FIGURE 2: IMPRESSION OF THE GLASPAREL WADDINXVEEN WATER SYSTEM

CHARACTERISTICS

Operator:	Duurzaam Glas BV	Target storage volume:	>426 000 m ³
10 ASR wells	in three well fields to store and recover filtrated rainwater surpluses.	Max. infiltration rate:	5 000 m ³ /d
Freshkeeper wells	to intercept brackish groundwater and provide source water for desalination	Recovery rate:	5 000 m ³ /d
		ASR recovery efficiency:	72% (projected)
		Total investment:	€ 2 000 000
		Year of realization:	2018

SERVICES PROVIDED BY ALLIED WATERS

- Pilot drilling and soil and water analyses to assess soil lithology and native groundwater compositions.
- Identification of suitable locations for the ASR well fields, taking into account the soil structure, groundwater quality, and surrounding infrastructure.
- Set up of a detailed water balance of the Glaspapel+ Waddinxveen greenhouse area to assess the robustness of the water system and to quantify operational extremes. Assessment of the required target storage volume of the ASR scheme and its operational constraints to effectively supplement the horticulturists' rainwater basins.
- Set up of the preliminary design of the ASR scheme in consultation with the end users.
- Analysis of the hydrological impacts on the surroundings and of environmental risks; Permitting.
- Supervision during realization. Site Acceptance Testing.
- Evaluation of the ASR cycles (hydrological effects, water quality developments, compliance)
- Daily liaison with constructor and developing company.

CONTACT

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