AGREEMed

Innovative Aquifers Governance for Resilient Water Management and Sustainable Ecosystems in Stressed Mediterranean Agricultural Areas

Demonstration site factsheeet

Valley demosite, Jordan

Description

The Jordan AGREEMed demo site is the Research Centre Al Karamah hosted in a private date farm in South Shouna in Jordan Valley, north of the Dead Sea. The farm is located at the geographic coordinates: 31°54'40" North, 35°34'49" East with an elevation of 315 m below the sea level as shown on the Jordan map. The climate of the Jordan valley is classified as semi-arid with an annual rainfall of about 150 mm and temperatures exceeding 40°C in the dry season. It is an import region for agriculture in Jordan and possesses substantial groundwater resources of brackish water with salinity of 2000 to 4000 ppm. In recent years, salinity levels have shown an increasing trend, further constraining water usability and agricultural productivity. Land utilization is limited due to the shortage of fresh water supply from the government's central distribution system.

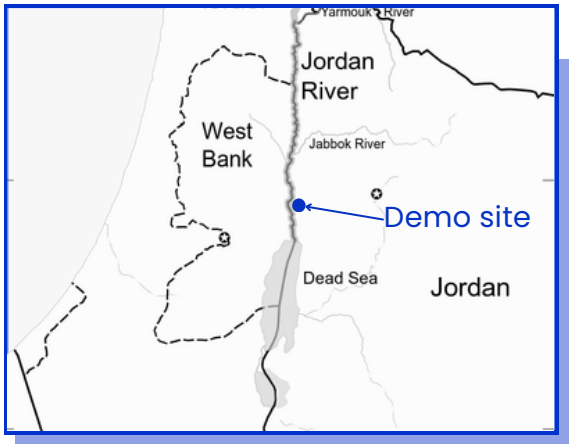

Figure 1. Valley demosite demo site

Specific problems

The major challenge in the Jordan Valley is the fresh water availability for irrigation considering the area as the Jordanian source for fruits and vegetables. The population explosion, rising living standards, and other factors that have accompanied economic and social development have all posed significant challenges to the water sector. These factors led to continued mining of renewable groundwater resources, with the current extraction rate (50%) exceeding the safe yields, increasing water salinity, declining water table levels, and rising pumping costs.

Stakeholder mapping

- Water users Associations
- Jordan Valley Authority
- Jordan water authority
- Ministry of water and irrigation
- The Jordanian Hashemite Fund for Human Development
- Irbid Chamber of industry
- Ministry of tourism
- Irbid and Southern Shouneh Chamber of Commerce
- Dead Sea tourism board
- Touristic facilities
- Fruits - and Vegetables Exporters association
- National Centre for Agricultural Research
- Agricultural Credit Corporation
- Ministry of agriculture
- Jordan Farmers Union
- Jordan Environmental Society
- Royal Society for the Conservation of Nature
- Ministry of environment
- EcoPeace Middle East

Stakeholder expectations

- **Environmental Conservation:** Prevent degradation and preserve biodiversity.
- **Water Management:** Improve water availability and quality
- **Renewable Energy:** Shift towards renewable sources, reducing reliance on non-renewables.
- **Community Engagement:** Involve local communities in decision-making processes.

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SOLUTION #1

ENHANCED RO PERFORMANCE THROUGH ADVANCED PRETREATMENT

Description

The solar-driven RO unit treats groundwater from a deep well and must reduce overall salinity to meet agricultural requirements.

To improve performance, the RO system uses a sand filter as pretreatment. This pretreatment was enhanced by adding an ultrafiltration (UF) unit, which can partially or fully replace the original sand filter.

Figure 2.

Methodology

A dedicated UF pretreatment station was installed upstream of the existing RO unit in collaboration with DELTA-GmbH (Germany). The UF unit acts as a physical barrier, effectively removing suspended solids, colloids, and microorganisms.

By delivering significantly cleaner feed water to the RO unit, the UF pretreatment directly addresses membrane fouling, which previously limited system recovery. In this configuration, the UF unit replaces the sand filter by removing undissolved particles more efficiently.

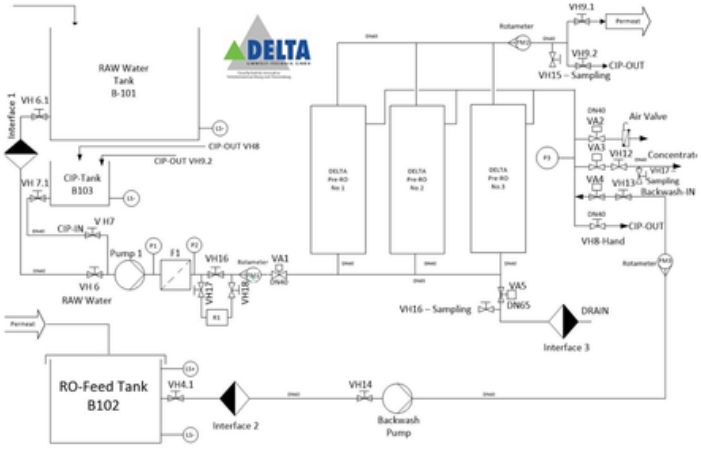

Figure 3.

Latest outcomes

The implementation of the optimized ultrafiltration pretreatment has significantly reduced the consumption of chemicals and antiscalant by improving the quality of the feed water to the RO system. With fewer suspended solids and contaminants reaching the membranes, the RO unit can operate at higher efficiency and with greater stability. This reduction in fouling helps extend membrane lifespan, lowers maintenance needs, and improves the overall performance and reliability of the RO system.

S O L U T I O N # 2

IMPROVING WATER YIELD AND REDUCING BRINE DISCHARGE THROUGH SECOND-STAGE RO TREATMENT

Description

Different scenarios were evaluated, one of them is Incorporating extra membranes into a reverse osmosis (RO) system which can significantly enhance its overall efficiency. This enhancement frequently leads to increased filtration capacity, resulting in higher rates of purified water production within the same operational period.
Combined with the UF unit, the overall water recovery rate reach the targeted 80%.

Figure 4.

Methodology

The increase of the recovery ratio is achieved by the installation of a second-stage unit with two additional membranes, where the brine from the first-stage desalination is processed at higher pressures. This operation is associated with a higher risk of scaling and requires a proper pretreatment to prevent membrane fouling.
The second stage benefits from the residual pressure of the first stage, which can be slightly increased using a booster pump. This modification is based on collaboration with partners DELTA and TU-Berlin

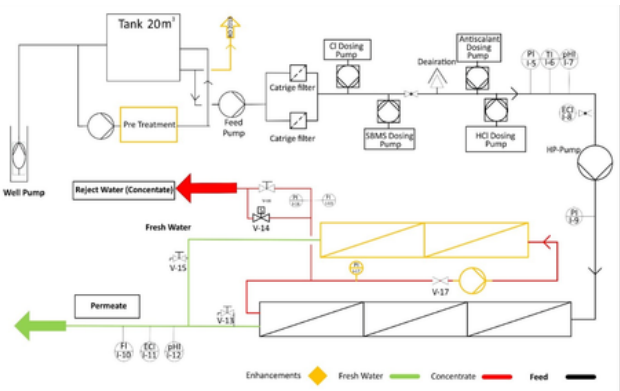

Figure 5.

Latest outcomes

Increasing the recovery ratio leads to a lower brine volume and a higher amount of product water. In the optimal configuration, a recovery of more than 80% is achieved. With the implemented modifications at the Jordan Valley site:

- Freshwater production increased from ≈ 2 m³/h to ≈ 3.4 m³/h.
- Overall efficiency improved by around 25% from the membranes addition.
- Specific energy consumption decreased from 2.2 kWh/m³ to 1.8 kWh/m³.
- Product water quality improved, with salinity reduced to below 90 µS/cm..