

MANAGED
AQUIFER
RECHARGE
SOLUTIONS

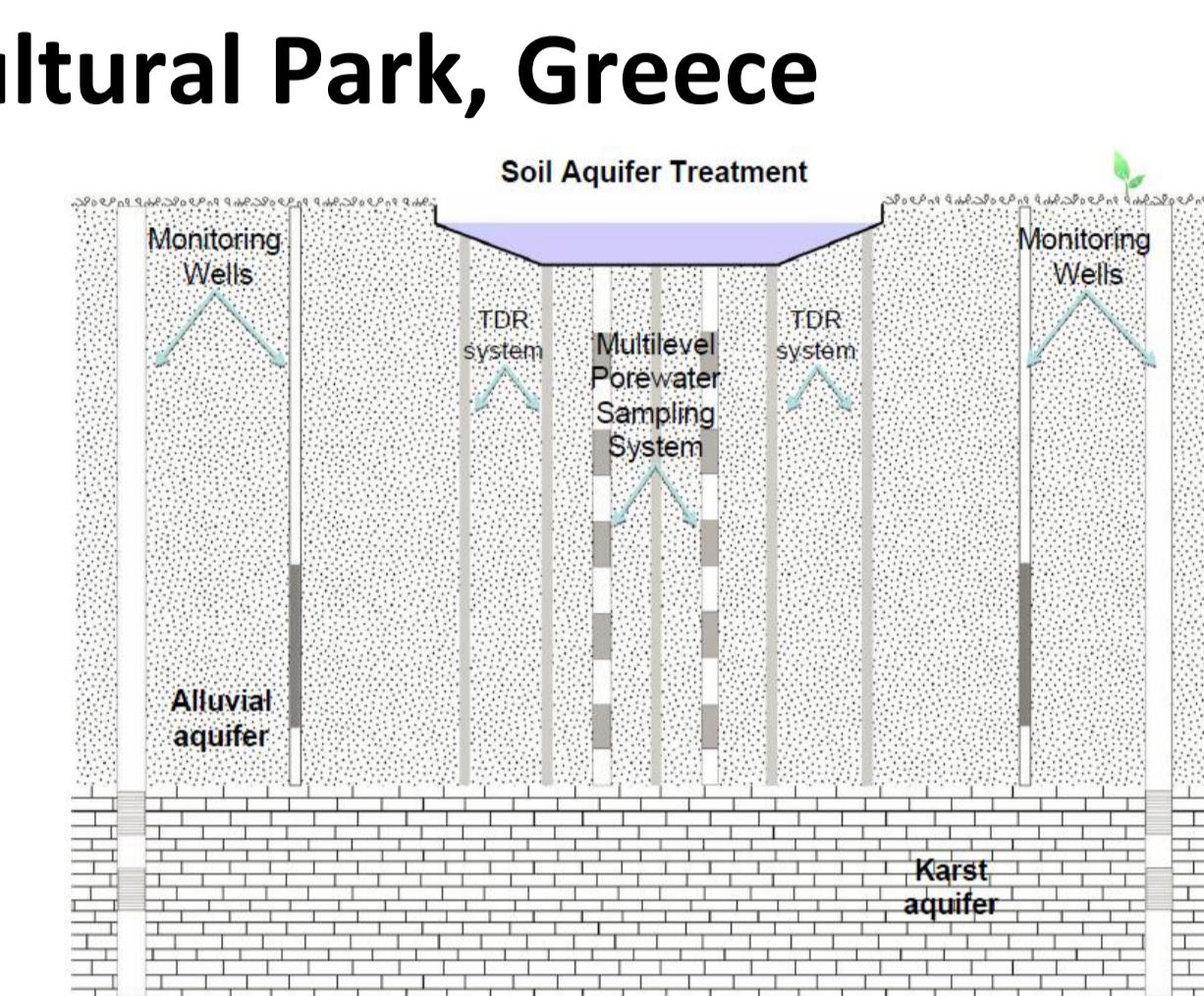
MARSOL: Demonstrating Managed Aquifer Recharge as a Solution to Water Scarcity and Drought

The Mediterranean region is suffering from increasing **water scarcity**, which is further exacerbated by climate change, high population density, and high water consumption by agricultural, industrial, and urban uses. Not only quantity but also **quality** is of increasing importance, e.g. due to intensive use of fertilizers and seawater intrusion. Meanwhile, **large water quantities are lost** to the Mediterranean Sea as surface runoff, river discharge, discharge of treated and untreated wastewater, and as discharge of excess water from various sources during periods of low demand. This water can be used in principle for the **controlled (re-)filling of exploited aquifers by artificial infiltration**, referred to as *Managed Aquifer Recharge (MAR)*.

1. Lavrion Technological & Cultural Park, Greece

⇒ Development and implementation of advanced sensors

- Treated wastewater effluents
- Infiltration basins
- Replenishment of exploited aquifer
- Combating seawater intrusion
- Soil Aquifer Treatment



2. Algarve and Alentejo, Portugal

⇒ River water infiltration at three sites

- Surface water
- Infiltration basins
- Wells
- Improving the ecological and chemical status of the aquifer



3. Arenales, Castile and Leon, Spain

⇒ River water infiltration in two catchments

- Surface water
- Treated wastewater effluents
- Infiltration ponds, artificial wetlands, drainage ditches
- Replenishment of exploited aquifer
- Soil Aquifer Treatment

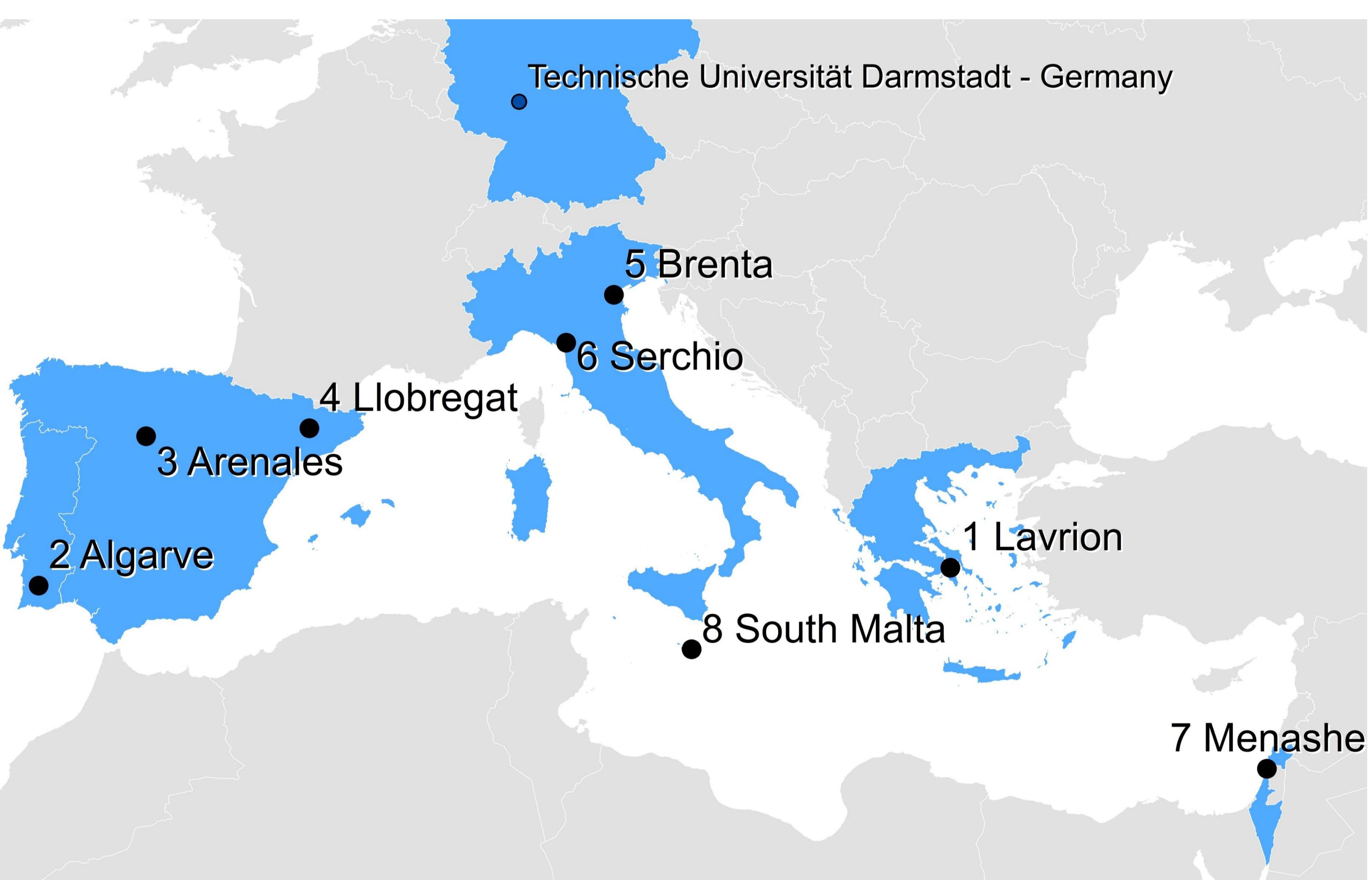


Demonstration Sites

For the project eight demonstration sites have been selected to represent different MAR purposes and hydrological settings.

MARSOL follows an holistic approach, which considers different:

- **Recharge water sources**
- **Recharge techniques**
- **MAR objectives**



8. South Malta Coastal Aquifer, Malta

⇒ Create a seawater intrusion barrier at a coastal wastewater treatment plant

- Treated municipal sewage effluent
- Injection boreholes
- Combating seawater intrusion



7. Menashe Infiltration Basin, Hadera, Israel

⇒ Aquifer storage of surplus water from the Hadera desalination plant

- Desalinated water
- Infiltration basin
- Seasonal storage and aquifer storage recovery of surplus desalinated water



6. Serchio River Well Field, Tuscany, Italy

⇒ River bank infiltration with an advanced monitoring network

- Surface water
- Induced river bank filtration
- Improving groundwater quantity and quality
- Continuous monitoring and automated operations



The Project

- 21 Partners
- 36 months, starting 12/2013
- Total budget ~ 8.0 million EUR
- EU contribution ~ 5.2 million EUR



MARSOL Project—Main Objectives

- Demonstrate at 8 field sites that MAR is a sound, safe, and sustainable strategy to increase the availability of freshwater under conditions of water scarcity.
- Improve the state of MAR applications to enable low-cost, high-efficiency MAR solutions that will create market opportunities for European Industry and SMEs (**MAR to Market**).
- Promote the advantages of MAR by tailored training and dissemination programs to enable and accelerate market penetration.
- Deliver a key technology to face the challenge of increasing water scarcity in the Mediterranean region of southern Europe and other regions of the world.

Tools to Reach the Objectives

- Data collection
- Monitoring (improvement of sensors, new sensors)
- Improvement of MAR devices (planning, design, and maintenance)
- Modelling (to simulate the impact of MAR on aquifer hydrology and hydrogeochemistry)
- Scenario analysis
- Development of a Decision Support System
- Definition of guidelines and policies
- Increase of public participation within Public Private Partnership (PPP) schemes
- Market analysis on the potential market exploitation solutions



Participants of the MARSOL kick-off meeting in Darmstadt, Germany; January 2014