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).

MARSOL is an FP7 project which aims to demonstrate that Managed Aquifer Recharge (MAR) is a sound, safe and sustainable strategy that can be applied with great confidence. MARSOL aims to stimulate the use of reclaimed water and other alternative water sources in MAR and to optimize water resources management through storage of excess water to be recovered in times of shortage or by influencing gradients.

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

**PROJECT OBJECTIVES**

**WORK PACKAGE STRUCTURE**

[Diagram showing the work package structure with details on each activity line and its associated work packages.]
**MARSOL PARTNERS**

Technische Universität Darmstadt, Darmstadt (TUDa) - Germany
Institute of Communications and Computer Systems, Athens (ICCS) - Greece
Laboratório Nacional de Engenharia Civil, Lisbon (LNEC) - Portugal
Empresa de Transformação Agraria S.A., Madrid (Tragua) - Spain
Universitat Politècnica de Catalunya - BarcelonaTech, Barcelona (UPC) - Spain
Studio Galli Ingegneria Spa, Padua (SGI) - Italy
Scuola Superiore di Studi Universitari e di Perfezionamento Sant’Anna, Pisa (SSSA) - Italy
Mekorot Israel National Water Company, Tel-Aviv (MEK) - Israel
Malta Resources Authority, Marsa (MRA) - Malta
EPEM S.A.-Environmental Planning, Engineering & Management, Athens (EPEM) - Greece
Elaireia Ydreyseos kai Apocheftetikois Patraneios Anonimi Elaireia, Athens (EYDAP) - Greece

Rheinisches-Westfälisches Institut für Wasserforschung gGmbH, Mülheim an der Ruhr (IWW) - Germany
Helmholtz-Zentrum für Umweltforschung GmbH, Leipzig (UFZ) - Germany
Universidade do Algarve, Faro (UAlg) - Portugal
Terra, Ambiente e Recursos Hídricos, Lisbon (TARH) - Portugal
Autorità di Bacino dei Fiumi Isonzo, Tagliamento, Isonzo, Piave, Brenta-Bacchiglione, Venice (AAWA) - Italy
TEA-Sistemi S.p.A., Pisa (TEA) - Italy
Provincia di Lucca, Lucca (Lucca) - Italy
Agricultural Research Organization - Volcani Center, Bet Dagan (ARO) - Israel
Water Services Corporation, Luqa (WSC) - Malta
Paragon Europe, Mosta (PRN) - Malta

**DEMO SITES**

**Lavrion Technological & Cultural Park, Greece**
Development and implementation of advanced sensors

**Algarve and Alentejo, Portugal**
River water infiltration at three sites

**Arenales, Castilla & Leon, Spain**
River water infiltration, soil aquifer treatment (SAT)

**Llobregat River, Catalonia, Spain**
River water infiltration basin

**River Brenta Catchment, Vicenza, Italy**
Forest ed infiltration area for aquifer storage and recovery (ASR)

**Serchio River well field, Tuscany, Italy**
River bank infiltration with an advanced monitoring network

**Menashe Infiltration Basin, Hadera, Israel**
Aquifer storage of surplus water from the Hadera desalination plant

**South Malta Coastal Aquifer, Malta**
Create a seawater intrusion barrier at a coastal wastewater treatment plant

www.marsol.eu
MARSOL is a partner of the European EIP Water Action Group “MAR Solutions – Managed Aquifer Recharge Strategies and Actions (AG128)” – www.eip-water.eu

OBJECTIVES

Managed Aquifer Recharge technique, or simply MAR, has become, perhaps, the best technique within the Integrated Water Resources Management (IWRM) framework, to palliate Climate Change adverse effects. As some impacts are increasing rapidly in scale and intensity, permanent “technological solutions” are required as a “water innovation in action” line. It is worth mentioning that FP7 INNO-DEMO MARSOL project, that started Dec. 1st 2013, is supporting this AG making available 8 demo sites to show the suitability of MAR techniques.

Involving the principal stakeholders and SMEs in this action group and transferring the results of this action into guidelines/policy will ensure MAR transferability to other locations. This will allow a major social advance (in Europe and worldwide) and can clearly contribute to improving living standards and job creation, as it increases the water availability to important economic sectors, improves human health and well-being, and sustains ecosystem functions and biodiversity.

ACTIVITIES

Activity 1 KNOWLEDGE BASE FOR EXISTING MAR FIELD APPLICATIONS: Development of MAR knowledge-base of existing field applications for addressing different societal challenges related to water availability.

Activity 2 MAR to MAR-ket: Permanent demonstration activity to show industry that they can rely on hydrogeology techniques by involving nine different industrial branches as demo cases. Industry will realise the benefits and will feel more identified with the activities developed in MARSOL project and the expertise from other previous EU founded projects. Provide technical solution for their water supply guarantee and the feasibility to maintain their livelihood.

Activity 3 BLUE PRINT IMPACT, INDICATORS, RISK ASSESSMENT TECHNICAL SOLUTIONS FOR INDUSTRY: Development of a methodology for probabilistic risk evaluation linked to MAR activities.

Activity 4 TECHNICAL SOLUTIONS FOR INDUSTRY: Development of design and construction criteria, and testing protocols for different exemplary MAR schemes and their benchmarking. Developing and testing appropriate engineering solutions, e.g. underground dams and wastewater hydraulic barriers, to convert karst aquifers into large groundwater storage reservoirs. The pros and cons of each technology will be assessed systematically, and compared to alternative solutions. Economic costs and benefits of MAR options for the various.

Activity 5 MODELLING (incl. water balance, water availability, climate change): Mathematical models to simulate the impact of MAR on aquifer hydrology and hydro geochemistry.

Activity 6 TRANSFERRING KNOWLEDGE INTO PRACTICE: A complex and Specific Dissemination & Technology Transfer (D&TT) Plan will be designed based in the product previous analysis, business and development plans as well as target users. The Plan will contain several programs specially dedicated to the industrial branches, beneficiaries of the technology improvements. Different activities & materials will be developed to achieve an impact on the entire industrial driven sector.
ACHIEVEMENTS

Site
AG 128 MARtoMARket EIP site available (http://www.eip-water.eu/working-groups/marsolutions-managed-aquifer-recharge-strategies-and-actions-ag128)

Conferences, workshops, summer school
• MAR at the Water R&D workshop; MAR Action Group was represented by TRAGSA, April 2014.
• MAR Modeling Workshop in Lisbon, July 2014
• MAR component of IWA 2014 Inspiring Change, session on “Adaptation to climate change impacts: urban resiliency”, September 2014
• WARBO summer school, Lisbon, October 2014
• GeofluidMAR Workshops in Piacenza, Italy, October 2014
• MAR4FARM Workshop in Arenales and Santiuste, Spain, November 2014

DEMO Sites
• Infiltration (Set 2014), tracer (Out 2014) and clogging (July 2014) experiments in Campina de Faro aquifer, Algarve, Portugal aiming data gathering for groundwater rehabilitation through artificial recharge using rain/river water surpluses
• Large well infiltration tests in Campina de Faro and Querença-Silves aquifers (April 2014), Algarve, Portugal, aiming extra groundwater storage in wet years to be usable later during drought years
• Laboratory soil-column infiltration tests with Campina de Faro, Querença-Silves and Melides soils for further use in SAT basins to be constructed in 2015

Books
• Managed Aquifer Recharge Sites - Knowledge Basis I, under the related DEMEAU FP7 project: M11_1 catalogue of European MAR applications_plus_appendix.pdf
• Managed Aquifer Recharge - Knowledge basis II - two GABARDINE (Groundwater artificial recharge based on alternative sources of water) project reports are available on Portuguese and Spanish (Catalonia) Case studies
• Managed Aquifer Recharge - Knowledge basis III - TRAGSA contributes a new publication on one decade of managed aquifer recharge in the Santiuste aquifer, Spain

Papers:

PARTNERS, SCIENTIFIC SUPPORT & NETWORKING

Laboratório Nacional de Engenharia Civil (AG lead organization) Águas do Algarve, S.A.
Grupo Tragsa (Tragsa and Tragsatec) Santiuiste Basin Irrigation community
Technische Universität Darmstadt, Dept. of Applied Geosciences Autorità di Bacino dei Fiumi Ionzo Tagliamento Livenza Piave
IWW Rheinisch-Westfälisches Institut für Wasserforschung Brenta Bacchiglione (AAWA)
gemeinnützige GmbH Agência Portuguesa do Ambiente
National Technical University of Athens Athens Water Supply and Sewerage Company
Lavrion Technological & Cultural Park Agricultural Research Organization - the Volcani Center
Universitat Politècnica de Catalunya-BarcelonaTech Water Services Corporation
Helmholtz-Zentrum für Umweltforschung GmbH Spanish Water Technology Platform
Universidade do Algarve Institute of Communications and Computer Systems
Malta Resources Authority International Groundwater Resources Assessment Centre (IGRAC)
Paragon Europe Aquifer Storage And Recovery Systems
Scuola Superiore Sant’Anna, SSSA Korean Institute of Geoscience and Mineral Resources (KIGAM)
Amphos 21 Regional governing body of Regione Toscana
Mekorot Water Company Israel Local authority of Provincia di Lucca
SGI Studio Galli Ingegneria TEA Sistemi SPA
Carracillo Region Irrigation community Ingegnerie Toscane
Comunidad de Usuarios de Aguas del Valle Bajo Kompetenz Zentrum Wasser Berlin (KWB)
y Delta del río Llobregat Universidade Federal de Pernambuco (UFPE), Brazil
Terra, Ambiente e Recursos Hídricos

www.marsol.eu
The kick-off meeting for MARSOL took place in Darmstadt, Germany on the 16-17 January 2014. The meeting served as an opportunity for 48 members from the 21 partner organisations to meet in person for the first time, for the demo sites to be presented and for the next steps to be established.
The coming months are going to be even busier for the MARSOL Project as we continue to work towards achieving the goals set in our agenda for this year through the following events.

**Demo Site Workshops**

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Topic</th>
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<tbody>
<tr>
<td>March 09-11, 2015</td>
<td>Arenales, Spain.</td>
<td>Technical Solutions for MAR</td>
</tr>
<tr>
<td>April 21-23, 2015</td>
<td>Pisa, Italy.</td>
<td>Modelling</td>
</tr>
<tr>
<td>June 24-26, 2015</td>
<td>Faro, Portugal</td>
<td>Water Quality</td>
</tr>
<tr>
<td>October 2015</td>
<td>Malta</td>
<td>Legal Issues &amp; Governance</td>
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*Join Us: These workshops are open to external experts in the field. If you would like to join us for any of the above mentioned activities please do not hesitate to contact us through our website www.marsol.eu or on the email address provided here.*

**Consortium Meeting**

Mid-term Consortium Meeting, Lisbon, Portugal, June 2015

The mid-term meeting for MARSOL will take place in Lisbon, Portugal on the 22-23 June 2015. Its objectives is to report on the status of the project and to get an overview from all 21 partners on the results achieved so far and on the ongoing work. The mid-term meeting will be followed by a two-days workshop on water quality issues related to MAR activities on 25-26 June 2015 in Faro, Portugal. Between the two meetings there will be a one-day field-trip on 24 June to visit the different MARSOL demonstration sites in the Algarve region.

**European Events**

**Malta Water Week, Malta, 25-27 March 2015**

The Malta Water Week 2015, which is being organised by Paragon Europe as part of the WE@EU, FP7 project (www.weateu.eu), will include a number of activities including a Water Research Conference, Training Workshops, an Exhibition Space, a B2B Brokerage Event, EU Funding Brokerage Event and an Investment Brokerage Event. The topics to be addressed include Smart Infrastructure, Water Education, Innovative Water Technologies and Innovative Financial Solutions Promoting Public-Private Partnerships (PPPs) on water innovation.

For more information contact us on sara.meli@paragoneurope.eu

**EGU Vienna, Austria, 12-17 April 2015**

The EGU General Assembly 2015 will bring together geoscientists from all over the world to one meeting covering all disciplines of the Earth, planetary and space sciences. The EGU aims to provide a forum where scientists, especially early career researchers, can present their work and discuss their ideas with experts in all fields of geoscience.

For more information visit the event website on http://www.egu2015.eu/

**IAH Rome, Italy, 13-18 Sept 2015**

The themes of the Congress will address the main issues facing hydrogeology in this millennium, including new perspectives related to groundwater and food.

For more information visit the event website on: http://www.iah2015.org/rome/
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