

MARSOL



EUROPEAN COMMISSION

7th Framework Programme for
Research, technological
Development and Demonstration

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



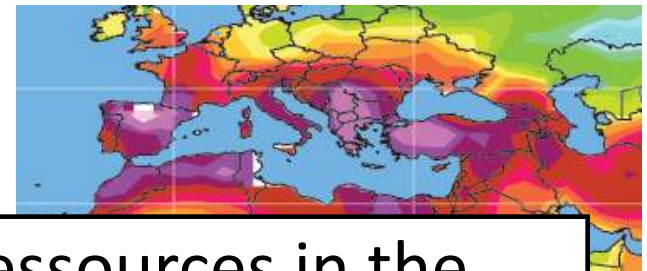
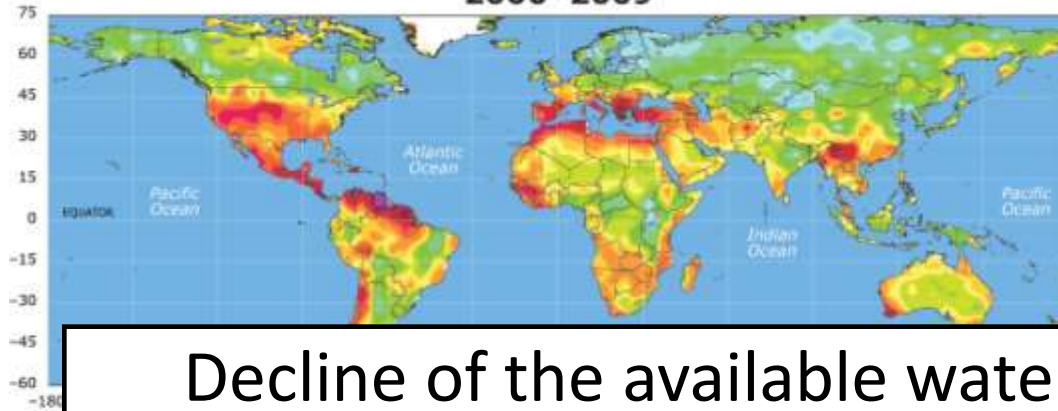
Monitoring and Investigation Technologies
Athens, March 16 - 18, 2016



Increasing number and intensity of dry periods

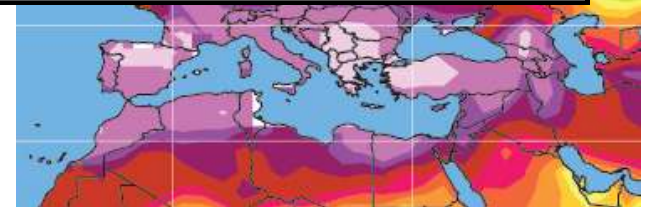
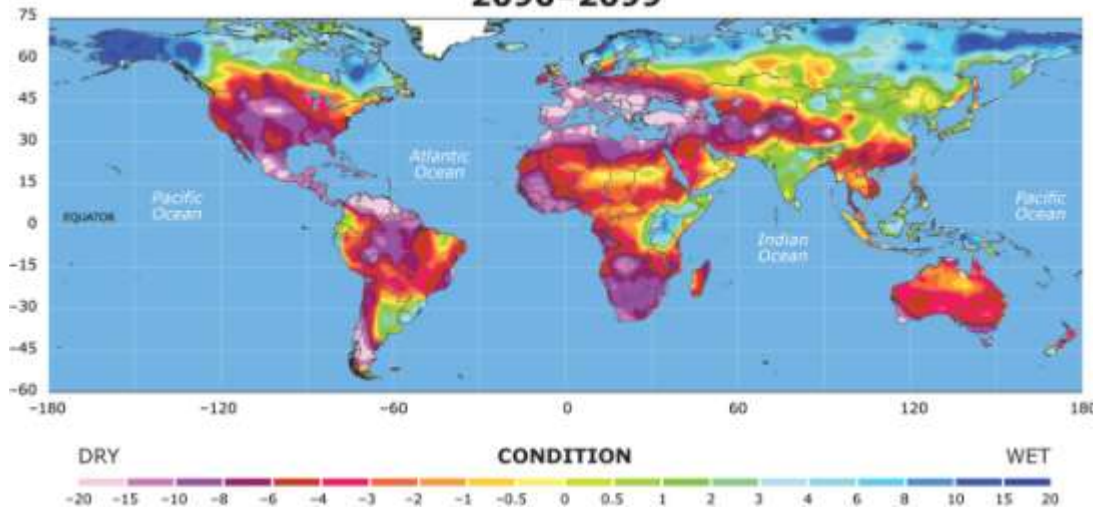
(Palmer Drought Severity Index*)

2000-2009



Decline of the available water resources in the mediterranean of up to 50% until 2100 !

2090-2099



* Determines aridity from precipitation and temperature information, especially for long-term prediction

< -4 = extreme drought

source: NCAR images, 2010

MARSOL



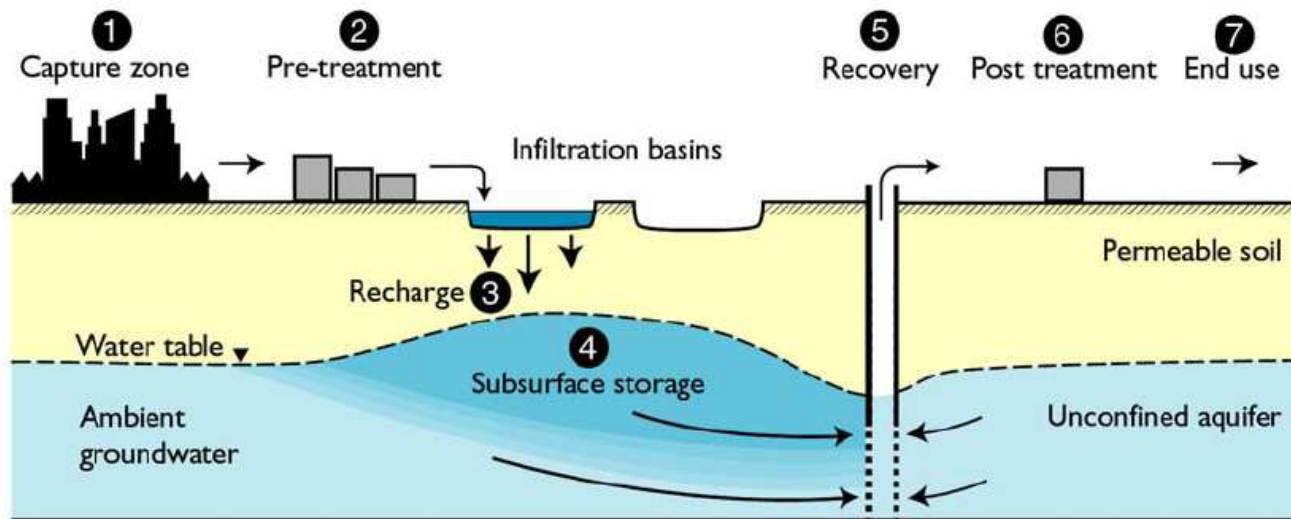
Demonstrating Managed Aquifer Recharge as a Solution to Water Scarcity and Drought (FP7-Env-2013-Water-Inno-Demo)

Start: 12.2013

Duration: 3 years

EU Contribution: 5.2 Mio €

The main objective of MARSOL is to demonstrate that MAR is a sound, safe and sustainable strategy that can be applied with great confidence. With this, MARSOL aims to stimulate the use of reclaimed water and other alternative water sources in MAR and to optimize WRM through storage of excess water to be recovered in times of shortage or by influencing gradients.

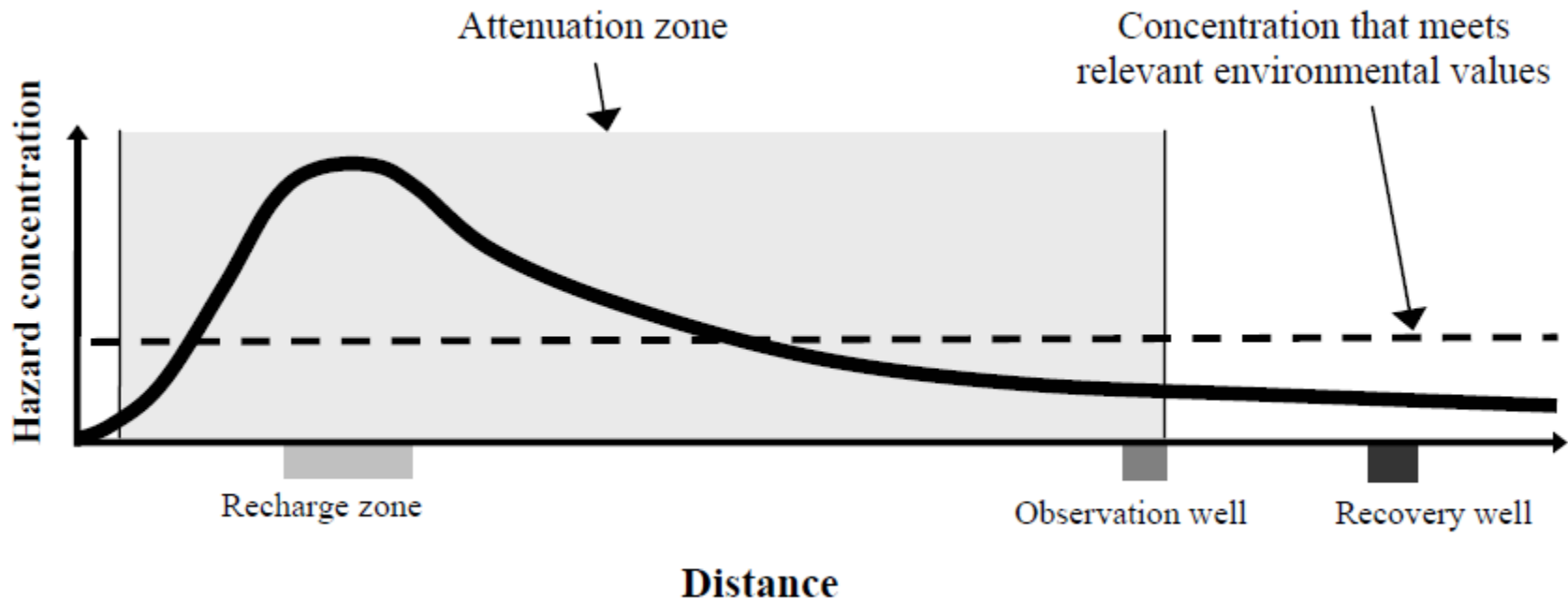


Australian guidelines for Water recycling, 24: Managed Aquifer Recharge (2009)

Managed Aquifer Recharge (MAR)



Plot of hazard concentration on a transect through the aquifer from recharge zone to recovery well. It shows that an observation well on the perimeter of the predetermined attenuation zone would verify that the required attenuation is achieved within the zone.



MARSOL Consortium



21 partners

7 countries

8 field sites

Public (Research)
Institutions (5)

Universities (6)

Industry (4)

SMEs (6)



Scientific Advisory Board

MARSOL Field sites

Various water sources and qualities - various technologies - various objectives



MARSOL

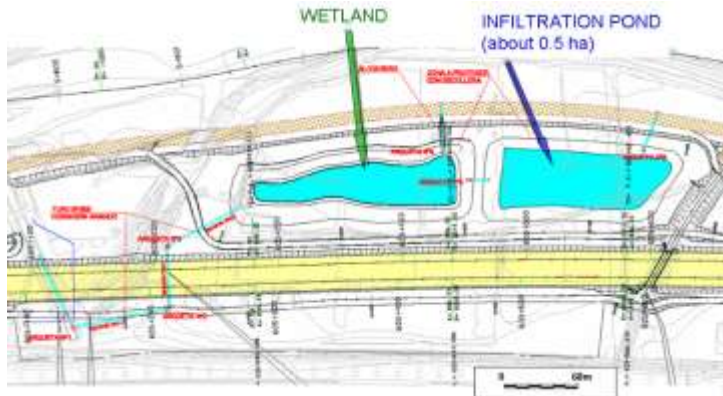


Diverted river water - Spain

Artificial aquifer recharge through infiltration ponds. The site includes a sedimentation and an infiltration pond. Water for recharge is diverted from the Llobregat River. Recovery is done by extraction wells downgradient.

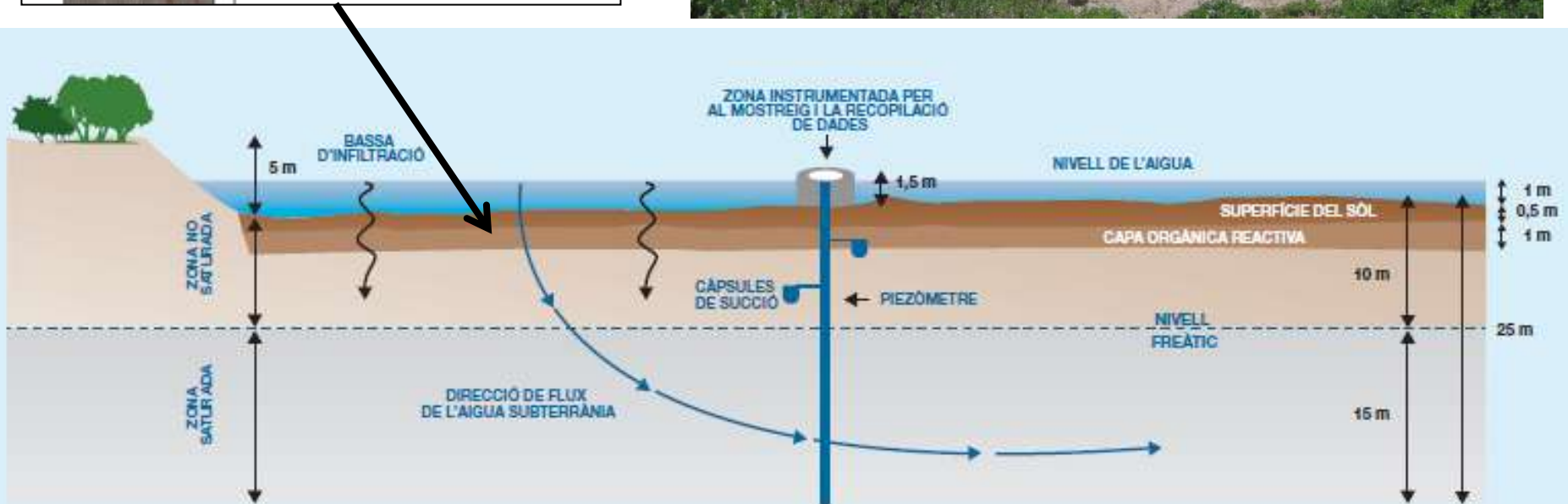
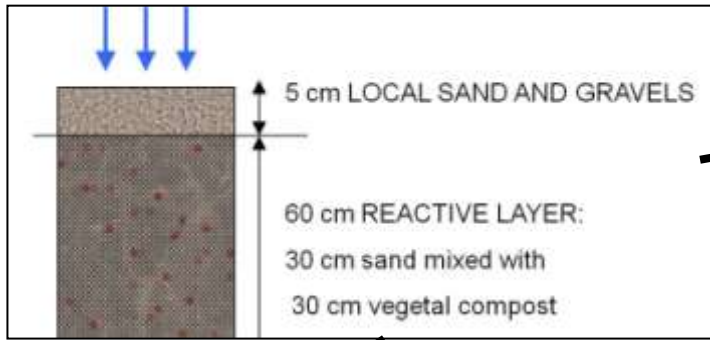
Major goals

- (i) increase the strategic groundwater reserves in the Llobregat aquifer in order to supply water to Barcelona
- (ii) improve the groundwater quality



MARSOL – Llobregat river

An active layer located at the bottom of an infiltration pond to enhance the degradation of certain contaminants.



Treated waste water - Malta

A floating lens of freshwater in direct contact to seawater. Due to agricultural water abstraction increasing problems with seawater intrusion.

Availability of large quantities of waste water effluent available from a nearby treatment plant. Water used for irrigation, but a surplus is available

Major goals

- (i) combat seawater intrusion by creating a hydraulic barrier
- (ii) increase availability of freshwater in the coastal aquifer



Desalinated sea water - Israel

3 desalination plants currently operating, by 2014 two more will start operation

- Desalination plants built under build-operate-transfer (BOT) contracts
- Less dry periods during the last years

→ Production of an increasing amount of excess water.

Water authorities aim at seasonal storage as well as aquifer storage recovery (ASR) of large volumes of these surpluses in the adjacent coastal aquifer via artificial recharge.

Techniques include infiltration ponds and injection wells



Synergies with other EU Projects

Joint Workshop with DEMEAU

Tel Aviv, December 03 – 04, 2014



Discussion on the formation of a MAR/SAT expert forum The Action Group on water (EIP – European Innovation Partnership) will be used as a platform.



Joint Workshop with FREEWAT

Pisa, March 21, 2015



Discussion on the formation of a MAR/SAT expert forum The Action Group on water (EIP – European Innovation Partnership) will be used as a platform.



Water Quality has to be regulated

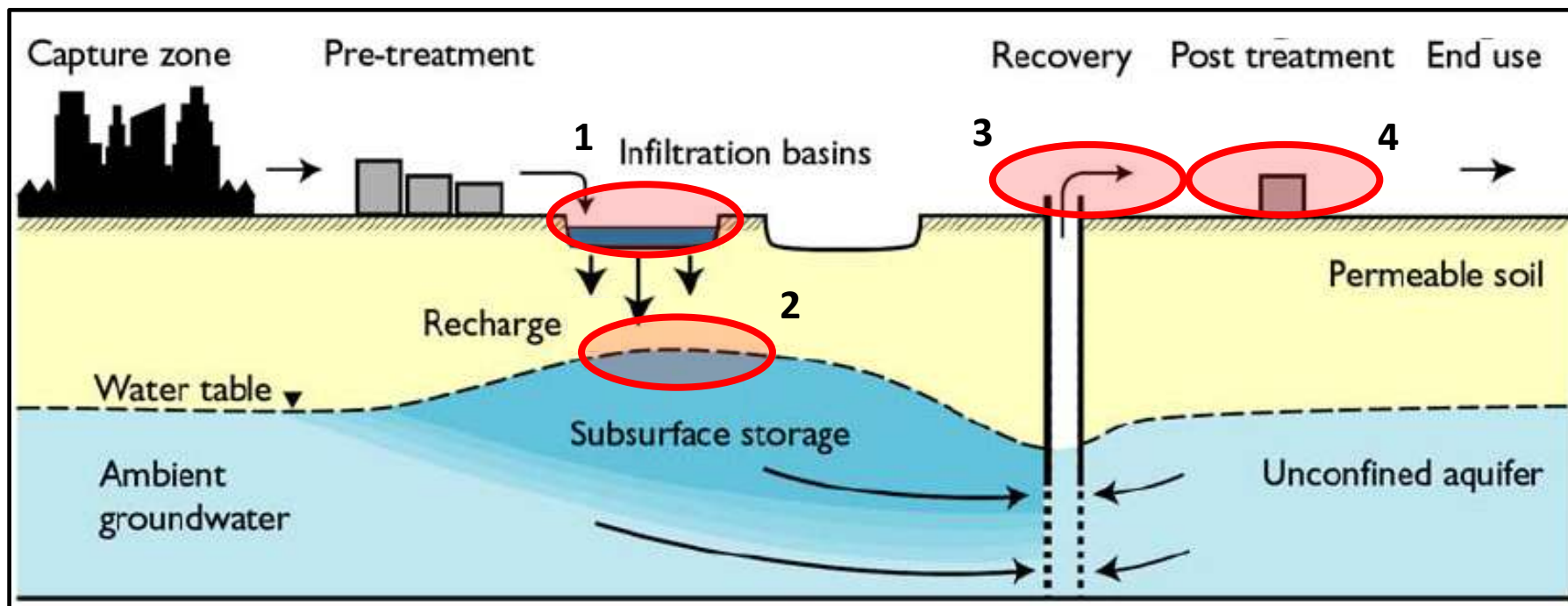
Category	Number of Sub Categories	Number of Substances	Source/Indicator for	Number of data
Pharmaceutics	58	292	Domestic, Hospital	9,379
Industrial Chemicals	11	87	Industry	1,020
Personal Care Products	9	32	Domestic	348
Pesticides	5	39	Agriculture	565
Food Additives	1	6	Domestic	84
Others	1	2	Domestic	6
Total	85	458		11,402

	Treated waste water (municipal) [µg/L]		Comparison Max	Surface water [µg/L]	
	Min	Max		Min	Max
Pharmaceuticals					
Carbamazepine	0.0020	67.7150	>	0.0001	11.5612
Ciprofloxacin	0.0030	5.6920	<	0.0010	13.5670
Clarithromycin	0.0040	1.7270	<	0.0008	2.3300
Clofibric acid	0.0020	1.8000	<	0.0002	7.9100
Diclofenac	0.0017	97.0000	>	0.0002	18.7400
Erythromycin	0.0009	3.8470	>	0.0007	0.3625

Point of Compliance

Where do we regulate the water quality ?

- 1 In the Infiltrated Water ?
- 2 At the Groundwater Table ?
- 3 At the Extraction Point ?
- 4 After Post Treatment ?

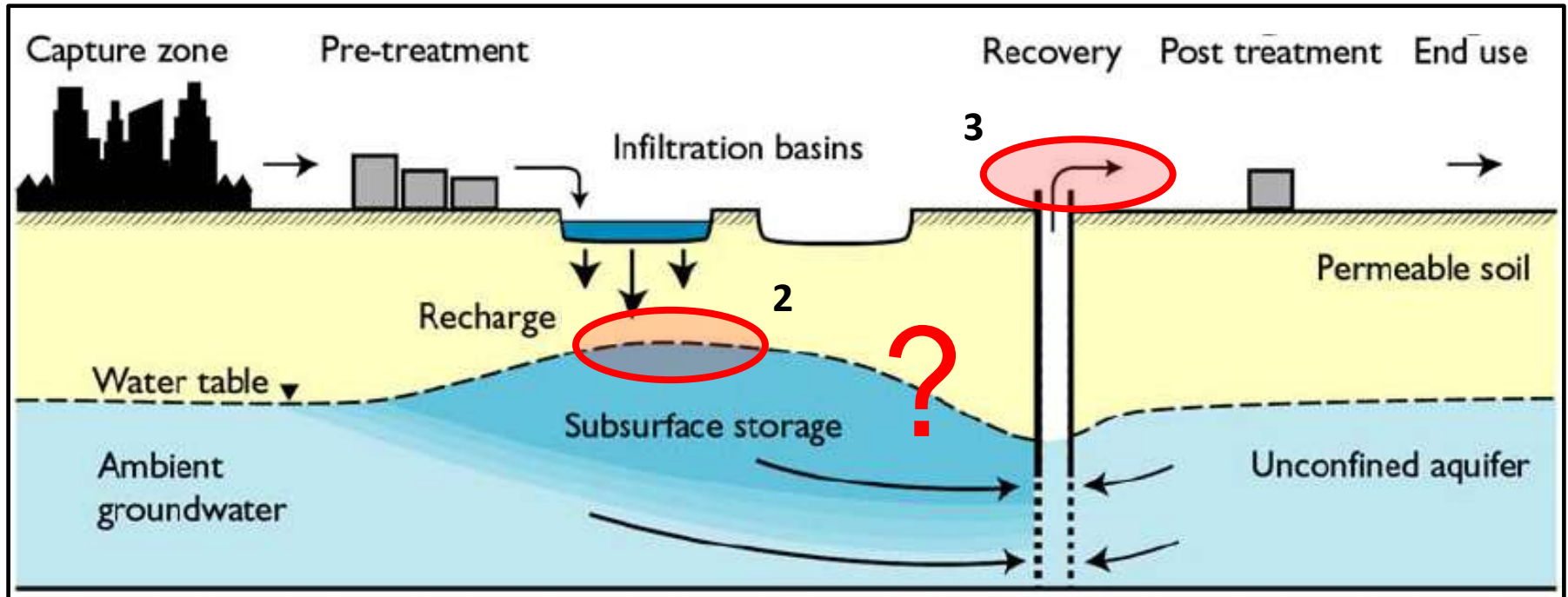


Point of Compliance What is reasonable ?

2 At Groundwater Table and 3 At Extraction Point

Will we be able to predict concentrations at the groundwater table and at the recovery point for none of the compounds / selected compounds / all compounds based on infiltrated concentrations and hydrochemical conditions ?

What are the error ranges ?



MARSOL – from lab to field

Water quality – Lavrion, Campina de Faro, Menashe etc.

Fate of water constituents during infiltration, optimization of wetting/drying cycles, database for reactive transport modelling



LNEC



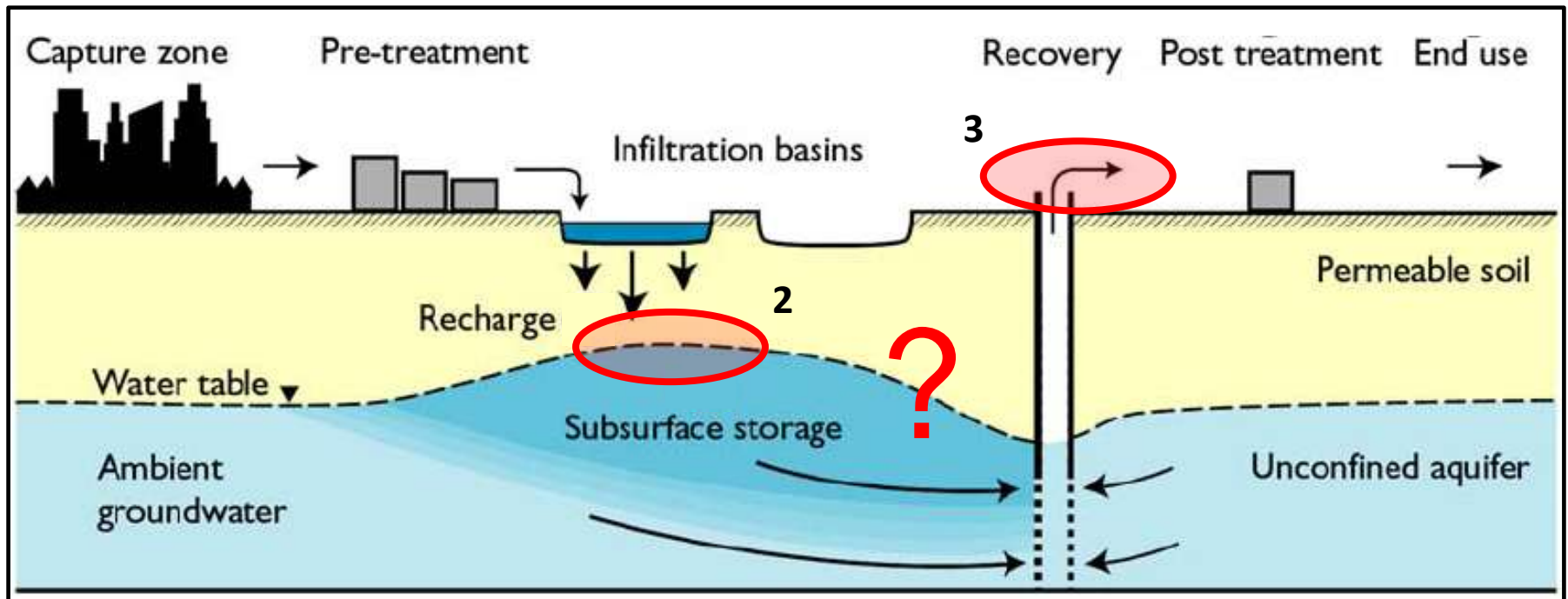
IWW/TUDa/NTUA/Eydap

Point of Compliance What is reasonable ?



2 At Groundwater Table and 3 At Extraction Point

Will we be able to **measure** concentrations at the groundwater table and at the recovery point for none of the compounds / selected compounds / all compounds based on infiltrated concentrations and hydrochemical conditions ?



MARSOL – from lab to field

Geo Probe Campaigns – Greece and Italy



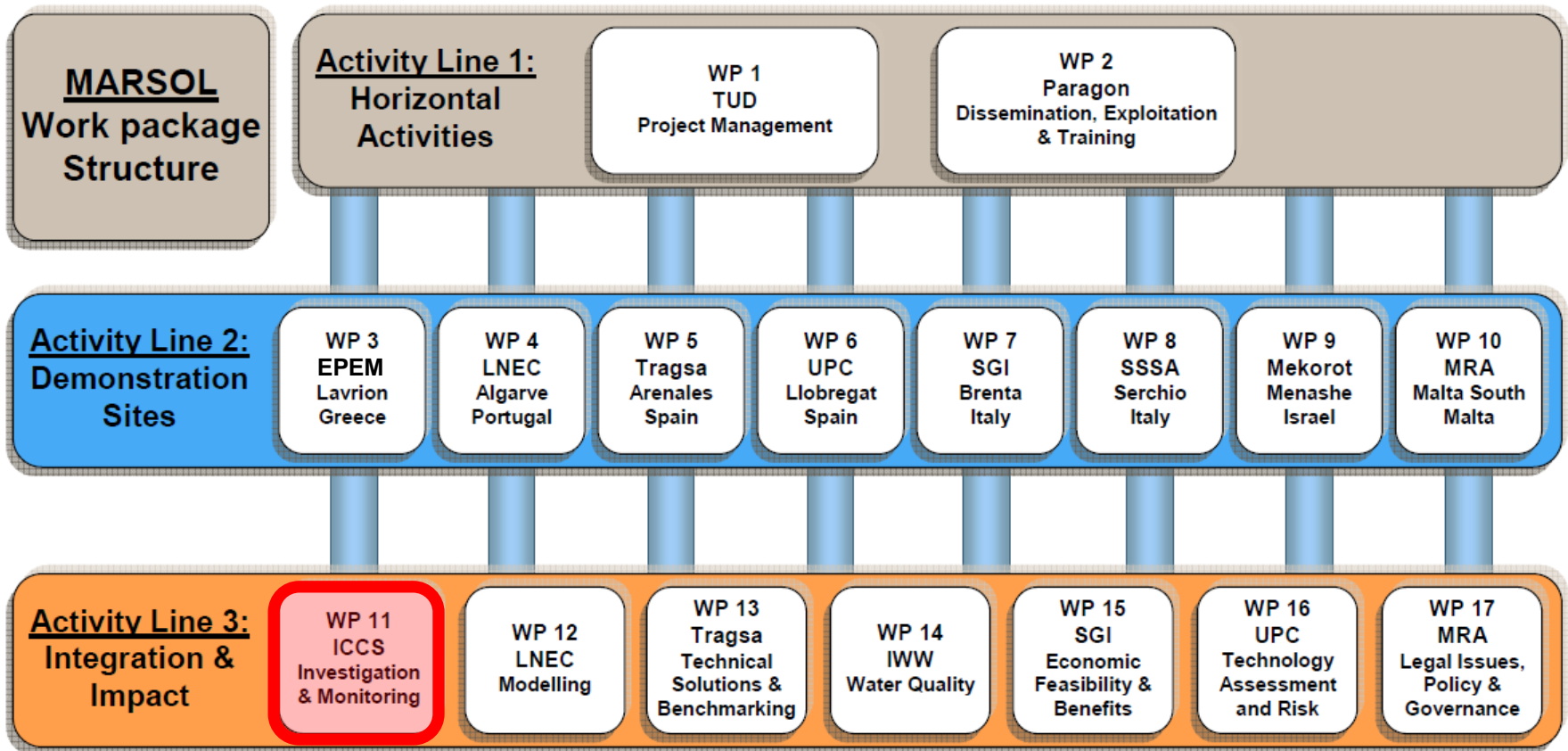
UFZ/SSSA/NTUA/ICCS

Monitoring an operational MAR event



Israel, Menashe site

Workpackage structure



MAR to MARKET

Action Group, European Innovation Partnership (EIP)

The aim is to speed up innovations that contribute to solving societal challenges, enhance Europe's competitiveness and contribute to job creation and economic growth. EIPs help to pool expertise and resources by bringing together public and private actors at EU, national and regional level, combining supply- and demand-side measures.

Coordinated by LNEC and TRAGSA (Joao-Paulo, Enrique), 36 Partners

The screenshot shows the website interface for the EIP Water Online Market Place. The header includes the EIP Water logo, navigation links for EU water policy, Contact, Register, and Login, and a red 'Subscribe for Newsletter' button. A search bar is located on the right. The main navigation bar includes links for ABOUT, EVENTS, SHOWCASE, RESOURCES, WORKING GROUPS (highlighted), GLOSSARY, and PRESS ROOM, along with social media icons for Twitter, YouTube, Facebook, and RSS. The breadcrumb trail reads: Home > Working Groups > MAR Solutions - Managed Aquifer Recharge Strategies and Actions (AG128). Below the navigation, there is a 'back' button and tabs for 'Profile' and 'Members'. The main content area features the title 'MAR Solutions - Managed Aquifer Recharge Strategies and Actions (AG128)' and a brief description of the Managed Aquifer Recharge technique. To the right, there is a 'NEWS OF THIS GROUP' section with a news item dated 17th November 2014 titled 'MAR4FARM. Workshops on MAR for the "general population" in rural areas. An experimental dissemination activity for the MtoM branch: "agroindustry"'. Below the text, there is a diagram showing a cross-section of the ground with a water table and a large blue arrow pointing downwards, indicating recharge. The diagram is labeled 'M.A.R. TO MAR-k€t' and includes the EIP Water logo.

EU water policy | Contact | Register | Login

Subscribe for Newsletter

Search

Home > Working Groups > MAR Solutions - Managed Aquifer Recharge Strategies and Actions (AG128)

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Profile | Members

MAR Solutions - Managed Aquifer Recharge Strategies and Actions (AG128)

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

M.A.R. TO MAR-k€t

EIP Water [Water Innovation](#)

NEWS OF THIS GROUP

17th November 2014

MAR4FARM. Workshops on MAR for the "general population" in rural areas. An experimental dissemination activity for the MtoM branch: "agroindustry"

Within the broad scope of industry branches that MAR to MARKET is

MARSOL Webpage

www.marsol.eu *Info:* marsol@tu-darmstadt.de

The screenshot shows a web browser displaying the MARSOL homepage. The browser's address bar shows 'http://www.marsol.eu/' and the page title is 'MARSOL | Home'. The search bar contains 'Google'. The website layout includes a navigation menu on the left with links for Home, News, The Project, Partners, Demo Sites, Publications, Links, Contact, Internal, and Imprint. The main content area features a large header image with the MARSOL logo and the text 'MANAGED AQUIFER RECHARGE SOLUTIONS'. Below this is the main heading 'Demonstrating Managed Aquifer Recharge as a Solution to Water Scarcity and Drought' and the sub-heading 'MARSOL An Environment 2013 Cooperation Project funded by the European Commission'. The text describes the project's goal: 'How can the increasingly scarce resource called water be exploited and used intelligently? The joint project MARSOL is aiming to demonstrate that Managed Aquifer Recharge techniques are able to secure 'excess' water and store it in the soil. The EU is funding the MARSOL project with 5.2 million Euros over 3 years under the WATER-INNO-DEMO scheme.' It also mentions that 'It is estimated that due to climatic changes only about 50 percent of today's amount of water will be available in the Mediterranean region by 2100 - while the population continues to grow. The lack of water will result in drought and crop losses.' and that 'The project consortium will demonstrate that Managed Aquifer Recharge is a viable approach to address the predicted water shortages over the long term. The basic idea is simple: Collect water when there is too much of it and store it for dry times in aquifers. This subsurface storage works even under deserts. Managed Aquifer Recharge can also be utilised to combat sea water intrusion in coastal areas and to give pre-treated waste water a final clean-up.' The footer includes the MARSOL logo, the text 'MARSOL deals with some of the overriding questions concerning the method such as risks.', and logos for the European Union, CORCOS, Facebook, LinkedIn, and EP Water.

MARSOL
MANAGED AQUIFER RECHARGE SOLUTIONS

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

MARSOL
An Environment 2013 Cooperation Project funded by the European Commission

How can the increasingly scarce resource called water be exploited and used intelligently? The joint project MARSOL is aiming to demonstrate that Managed Aquifer Recharge techniques are able to secure 'excess' water and store it in the soil. The EU is funding the MARSOL project with 5.2 million Euros over 3 years under the WATER-INNO-DEMO scheme.

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MARSOL
Demonstrating Managed Aquifer Recharge as a Solution to Water Scarcity and Drought
An EU FP7 Project

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EP Water
MULTIPLYING THE WATER INNOVATION