



# THE DINA-MAR PROJECT. AQUIFER RECHARGE MANAGEMENT WITHIN THE FRAMEWORK OF SUSTAINABLE DEVELOPMENT

This is a I+R&D project that is financed by the Grupo Tragsa, the aim of which is to establish which zones in Spain are liable to be used for artificial recharge operations (AR) and Artificial Aquifer Recharge or Managed Aquifer Recharge (MAR), within the framework of sustainable development and following standards involving minimum negative environmental impact.

- The area of land likely to store volumes in addition to the yields from natural recharge with forestry use, generally lying in the upper reaches of basins, is slightly lower than 9,000 km<sup>2</sup>.
- The land that is associated with river beds or wetlands with the same conditions as in the preceding case amount to 10,500 km<sup>2</sup>.



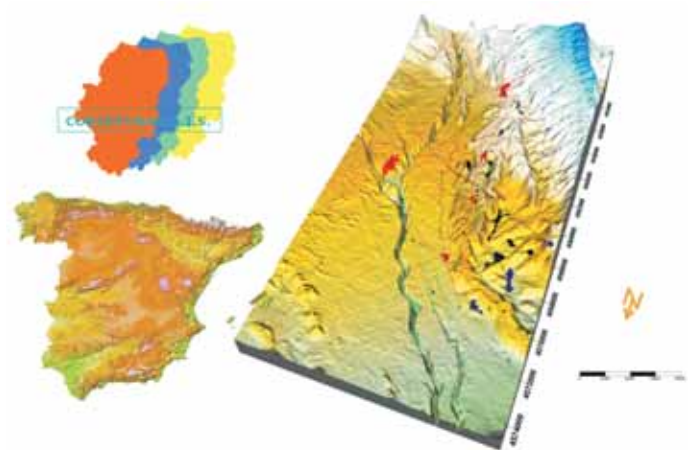
The project, which consists of five phases, began with an extensive study of the state of the art, especially on a national scale. Until the present time, the technique has hardly ever been put into practice. Mention must be made of the activities that have been promoted by the MAPA in the Arenales Aquifer (Segovia), the research into the subject undertaken by the Instituto Geológico y Minero de España and the experiences that have been obtained in Catalonia.

## PHASE 1: Establishing the geological formations suitable for artificial recharge

The calculation process is based upon the GIS analysis used for this with more than 80 thematic covers tested using different deductive methods.

### GIS Analysis. First results

- The total area calculated (Mainland Spain and the Balearic Isles) ranges from 43,000 to 66,000 km<sup>2</sup> in aquifer zones close to river beds of a reasonable size, most of which lie in irrigation zones where groundwater is used.



ID	CUENCA	Total cuenca (km <sup>2</sup> )	Sup.cuenca (km <sup>2</sup> )	% cuenca	% total
1	NORTE	1952.98	5378.90	3.63	2.92
2	DUERO	21565.45	78955.69	27.31	32.26
3	TAJO	10186.19	55814.90	18.25	15.24
4	GUADIANA	5183.57	60125.19	8.62	7.75
5	GUADALQUIVIR	4878.02	63298.10	7.71	7.3
6	SUR	1457.55	18408.22	7.92	2.18
7	SEGURA	2282.97	18833.04	12.12	3.41
8	JUCAR	7891.79	42682.26	18.49	11.8
9	EBRO	8686.32	85936.39	10.11	12.99
10	PIRINEO	1746	16555.28	10.55	2.61
11	BALEARES	1023.07	5038.33	20.31	1.53
	TOTAL	66853.9	499428.31	13.39	100

GIS analysis. Results.

## PHASE 2: Establishing and controlling in “Pilot zones”

Work has begun on taking ongoing data in the pilot zones, and it is planned to add to more in the near future. Studies are conducted in these to establish the way the infiltration rates evolve and to test the effectiveness of the prototypes of artificial aquifer recharge devices (AR).

### PHASE 3: Studying and designing specific devices to achieve a high infiltration rate

This is based upon the analogical scenario technique. At present, tests are being carried out on different devices for the artificial recharging of aquifers in the pilot zones, with a view to establishing the most suitable technique to use in each one of the potential application zones.



### PHASE 4: Environmental aspects

#### a) CONSERVING THE ECOLOGICAL FLOWS

A methodology is being developed for establishing what environmental flows must be conserved in the river beds concerned, on the basis of a variety of different hydrological and environmental criteria.

#### b) WATER REGENERATION. KEY ELEMENTS

Water regeneration of wetlands by means of AR is one of these key elements. This is the case with the experience



carried out by the JCL and the Grupo Tragsa in the Iglesia de Coca Lagoon (Segovia). Other further aspects are the recovery of springs, restoring dune systems, etc.

#### c) SUDS

The Sustainable Urban Drainage Systems (SUDS) are conducive to the infiltration of surface water in urban

areas, and are likely to be used as a tool in a suitable and sustainable environmental management model.



### D) ENVIRONMENTAL INDICATORS

At the same time as research is being conducted into the technique, a series of new environmental indicators are being prepared that will enable the users to obtain an approximation of the actual effect of the potential, implementation of the infrastructures for artificially recharging aquifers and environmental impact assessment criteria.

### PHASE 5. Environmental Education and Dissemination

The project intends to disseminate the information generated in different fields, distinguished by action groups, as well as to disseminate environmental education premises. With a view to this, specific educational material is being prepared and communicated with respect to aquifer recharge management, and action strategies are being drawn up.



### CONTACT

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