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Interreg Sudoe AQUIFER
European Regional Development Fund

Managed aquifer recharge as an innovative instrument for integrated groundwater management in a context of increasing water scarcity. The Catalan case in the interreg Sudoe zone.

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INTRODUCTION

The AQUIFER Project titled "Innovative instruments for the integrated management of groundwater in a context of increasing scarcity of water resources" was funded under the 4th INTERREG SUDOE call and is now ongoing. The main objective of this project is to capitalize, test, disseminate and transfer innovative practices for the preservation, monitoring and integrated management of aquifers to support decision making in groundwater management, improve technology transfer to local stakeholders, create new synergies and develop common tools in a context of water scarcity and environmental threats. Specifically, the main innovative element of the AQUIFER project is its holistic approach which lies in the contribution to SDGs and experimentation of management tools for both water quality and quantity. Examples are the management of aquifer recharge, network monitoring and hydrological modelling in demo sites that are declared being in bad status by hydraulic administrations according to Water Framework Directive criteria. One of the project's partners, the Groundwater Users Association of the Llobregat river, has historically carried out managed aquifer recharge practises in Catalonia [1]. In this project it has designed new artificial recharge ponds in a flood zone located in Molins de Rei (Barcelona) with the purpose of building a simple and economical infrastructure that allows to recharge in several hydrologic situations.

Another key element to the project is the way innovation is detected, tested and disseminated thanks to the participation of 3 water clusters, linked to a network of stakeholders in the water sector. At Catalan level, the Catalan Water Partnership is collecting innovative groundwater management practices that will be disseminated through an e-book and a website that will be made available for all water stakeholders.

CASE STUDY

The case study in Catalonia is located on the alluvial aquifer of the Vall Baixa and Delta del Llobregat, in the municipality of Molins de Rei (Barcelona). This aquifer has a strategic character as a guarantee of water supply in Barcelona and its metropolitan area in times of surface water low flows or high turbidity due to precipitation. For this reason, it is artificially recharged by means of different technologies in order to achieve a good condition of the water mass according to the Water Framework Directive and the SDG6.

Thus, an innovative recharging methodology was proposed by adapting the riverbed to favor aquifer recharge in a simple way.

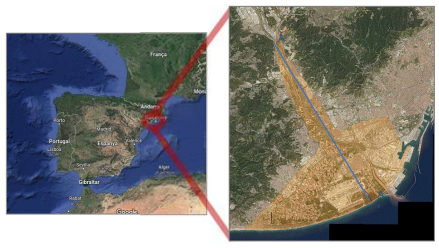

Fig. 1. Location of the case study's aquifer

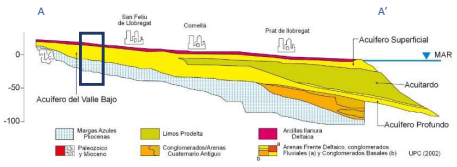

Fig. 2. Hydrogeological aquifer cross-section and recharge zone

GEOLOGICAL PREVIOUS TASKS

In the chosen area (Fig. 3), previous studies of geologic and geotechnical characterization were carried out to determine the areas suitable for greater recharge in the aquifer. Based on the information generated by electrical tomography and mechanical testing profiles, the artificial recharge system was designed on the Llobregat riverbed.

Fig. 3. Study zone location

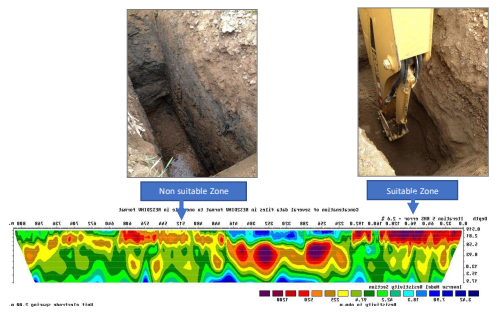

Fig. 4. Geophysical and mechanical tasting profiles results

ARTIFICIAL RECHARGE SYSTEM

The artificial recharge system consists of an inlet, a first decantation pond followed by two infiltration ponds, connected by means of a by-pass.
Water is deviated to the inlet by a transversal river motte, and it's accumulated in the first pond to get rid of suspended solids. From there, water flows by gravity to infiltration ponds, where aquifer takes place.

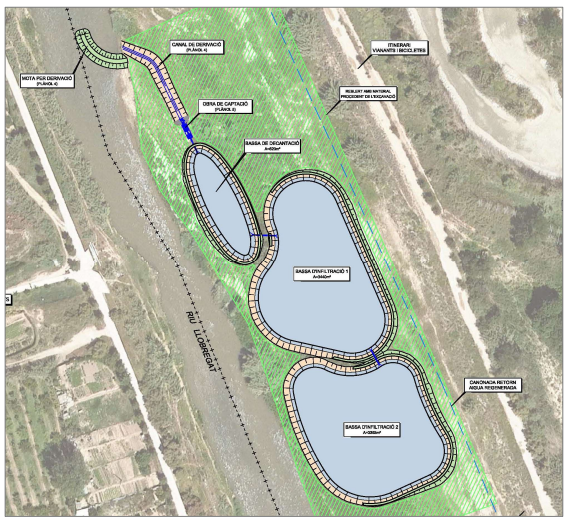

Fig. 5. Structural scheme of the recharge system by ponds

Fig. 6. Inlet

Fig. 7. Recharge system view

The ponds have been designed under the assumption that they can be flooded and after a simple clean the system will return to the ordinary operativity.

Operability data	
Infiltration useful surface	6800 m^2
Mid-flow design	40 L/s
Annual operability	70 %
Infiltrated volume	1 hm^3/year
River flow ranges	5 to 40 m^3/s
Stop recharge	• < 5 m^3/s: maintenance flow • > 40 m^3/s: river floods the ponds • River quality conditioned: episodes of high turbidity, ammonium, and chloride, mostly
Temporary derivation authorization of ACA	200 L/s
Aquifer monitoring	• Automatic sensors that measure temperature and water pressure in continuous • Water samplings

Table 1. Operability data

The possibility of expanding the recharge area by building two more infiltration ponds as compensatory measures for the water footprint of two companies in the area is being assessed.

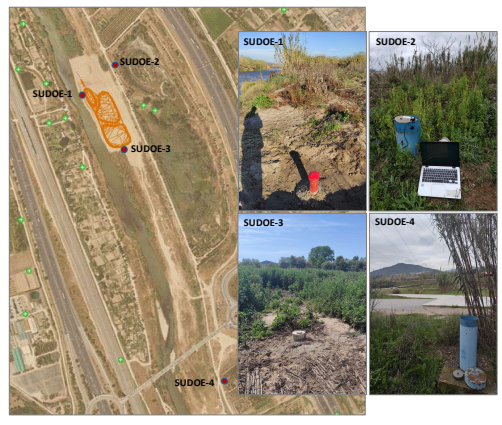

Fig. 8. Aquifer monitoring

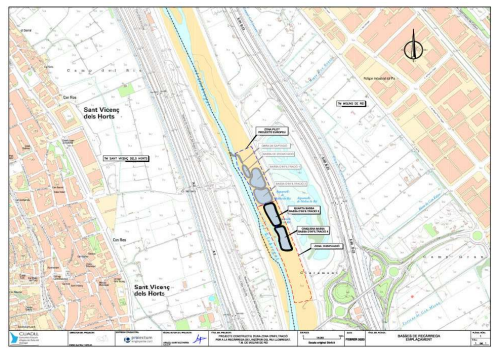

Fig. 9. Proposal of expansion of the recharge system

CONCLUSIONS

- Environmental adaptation of a section of a Llobregat riverbed as a innovative recharge technology, which will improve quantitative and chemical aquifer status.
- The low construction cost and subsequent maintenance makes the infrastructure sustainable, and its efficiency will only depend on the floods that occur throughout the year.
- The results of this experiment can be extrapolated to the SUDOE territory, with the aim of being a tool to help improve groundwater bodies in a territory with severe water scarcity, increasingly aggravated by the climate emergency we are suffering. This innovative recharge system is a good tool to reduce the water footprint and contribute to the Sustainable Development Goals.

[1] Queralt, E., Bernat X., Custodio E. 2020. Improving Water Quantity and Quality Supply Security by Managed Artificial Recharge Technologies in the Lower Llobregat Aquifers Integrated into a Conjunctive Surface and Groundwater Management Scheme for Barcelona, Spain. Journal of Environmental Science and Engineering A9 (2020) 119-139 Doi: 10.17265/2162-5298/2020.04.001