



ground water

Project AQUOR

Implementation of a water saving and artificial recharging participated strategy for the quantitative groundwater layer rebalance of the upper Vicenza's plain

PROJECT DESCRIPTION

The AQUOR project was conceived as demonstrative action aimed at facilitating the inversion of the current trend of overexploitation of **groundwater resources** and increasing aquifer recharging rates in order to rebalance the **upper Vicenza plain's** aquifers and foster their sustainable use. The project area has an important underground water heritage, which represents the water supply for a total of **400.000 inhabitants** of the provincial territory. Moreover this great availability of water has allowed the development of different agricultural and industrial activities. As consequence of a series of interconnected phenomena - such as changes in rainfall patterns caused by **climate change**, increase of artificial water extraction, soil sealing caused mainly by population growth and human activities – the traditional balance between resurgent and underground water has been altered leading to the **disappearance of 30% of the resurgent water** in the territory of Vicenza and to the **lowering of the groundwater layer by several meters**. So the hydrogeological reserves of the floodplain are decreasing in average by 3.8 cm/ year.



OBJECTIVES

Specific objectives of the project were to:

- **understand**: create and share an integrated knowledge system on the hydro-geological structure and its fragilities;
- **save**: raise awareness and increase active participation of the water resources' users concerning water saving and rebalancing of the groundwater layer;
- **recharge**: demonstrate the technical feasibility, the economic benefit and the environmental sustainability of technical solutions for recharging groundwater layers;
- **manage**: develop an integrated and participated groundwater resource policy at local level.

PROJECT PHASES

The project was articulated in 6 areas of activities:

- **Preparation** concerning, in particular: collection of all the information necessary for carrying out specific studies aimed at analyzing the territory of the upper Vicenza's plain (pedological map, census and characteristics of the state-owned lands, hydromorphological characteristics of the Astico river); development of a Geographic Information System to support the governance of groundwater; creation of a final overview of the recharge operations together with an economic, legal and management analysis.
- **Outreach** related to environmental education activities and awareness raising on topics of water saving concerning different contexts (rural, urban), levels (public, private) and sectors of users (civil, productive, tertiary), so to favor the correct use of water resources, through: lessons in schools and in productive and agricultural activities, training of public employees, activation of an information desk, videos, gadgets, etc.;



- **Interventions:** several demonstrative solutions for groundwater recharge (infiltration wells, infiltration fields, infiltration forest areas and interventions on dispersion pits and ditches) were put in place in order to demonstrate the technical, economic and environmental feasibility of the artificial and natural groundwater recharging actions for the quantitative rebalancing of groundwater resources;
- **Preventive and in-progress monitoring:** the implemented measures were aimed at optimizing the project actions, evaluating the expected results and planning future measures through: experimental monitoring, by bioindicators (moss), of the quality of water intended for infiltration; physical and chemical monitoring (ex-ante and in-progress) of the water quality before and after infiltration; (in-progress) monitoring of the infiltration rate at the intervention sites and of the hydrogeological response of the underground basins;
- **Water governance:** development of a participatory decision-making process based on the application of a strategy shared by all project partners and stakeholders interested in the integrated water resource management, and of the [Action plan for groundwater governance \(Groundwater Contract\)](#);
- **Communication:** aimed at giving the biggest possible dissemination of the project results, in particular of the adopted approach and of the comparison of the achievements at local, national and international levels.

PROJECT RESULTS

The AQUOR project has developed a **governance model for the sustainable management of groundwater resources** that can be replicated as a whole (following the entire project strategy) or in part (by putting into operation some already implemented actions). Moreover the project has contributed to the implementation of the **EU Water Framework Directive (2000/60/EC)**, as well as to the development of other three national and European policy documents on integrated water management; such as “**The Blueprint to Safeguard Europe's Water resources**”, the 7th “General Union Environment Action Programme to 2020”; and the **Italian National Adaptation Plan to Climate Change** of the Ministry of the Environment, Land and Sea.

Some significant achievements of global significance in numbers:

- approx. **100.000 people reached by water-saving awareness** activities.
- approx. **5.000.000 cubic meters of water infiltrated artificially** in the groundwater layer in conditions controlled through the realized demonstrative facilities.
- **7 institutional players who joined the Groundwater Contract** (meaning all the stakeholders having responsibility for water resource management in the frame of this work).

Among the main results and products the following are to be mentioned:

- **5 facilities implemented in 7 sites** (applying different techniques, based in part on naturalistic engineering, in part on agricultural hydraulics principles, or in other cases on the underground hydrology standards): 1) **infiltration wells: 2 in Montecchio Precalcino (VI)** and **4 in Breganze (VI)**: wells are a good solution in limited spaces, as far as they take up few space and allow to recharge groundwater in depth; 2) **a dispersion pit** in Sarcedo (VI): this technique consists in artificial excavations filled with highly waterproof inert material; 3) **forest infiltration areas** in Schiavon (VI) and Carmignano di Brenta (PD): recharge system that supplies water during the non-irrigation months in areas provided with a drainage network and planted with various tree and shrub species according to the type of forest to be grown. So as result they combine recharging with depuration ensured by the filtration effect of the plants' root structure and the microorganisms living in symbiosis with them; 4) **a dispersion ditch** in Sandrigo (VI): creation of an ecological corridor carrying out different functions (groundwater recharge, enhancement of the phytodepuration capacity, flood scaling, etc.); 5) **sub-surface irrigation** in Rosà (VI): this technique involves the use of farmlands in suitable position for the recharge, but normally not made available by the owners because of the agronomic value of the surface cultivations. If the farmer wants to keep this cultivation, it's necessary only that he respects the correct fertilization and weeding practices.
- Development of a **Geographic Information System** to collect hydrogeological and territorial information. The GIS has contributed to the creation also of the [Chart of infiltration capacities](#) characterizing the project area and differentiating between sites suitable for superficial or in-depth recharge.
- Preparation of the **guidelines “Groundwater recharge in controlled conditions” (first part - second part)**? aimed at providing a technical-operational reference to managers, experts, and land-owners to support them in the localization, identification and implementation of solutions for groundwater recharge.
- Activation of the **Aquor Support Office** to provide advice to operators interested in designing and implementing solutions for groundwater recharge. **This service is available until 2019.**
- **More attention, responsibility and education for the environment, in particular for the groundwater resources:** 1.482 students involved in environmental education in the schools, 35 participants at the conference “Water saving in agriculture. There is no water when you need it ...” (environmental education in productive and agricultural activities),



participation of 70 experts to the training “Water saving in municipal planning – solutions for a sustainable water management through urban planning instruments and building regulations” (training for public employees). Approx. 10%-30% reduction of water consumption in the drinking water sector for the 50% of the families reached in the frame of the awareness campaign on water saving, with an estimated groundwater saving of 0,5% - 2% compared to the current general consumption.

- Thanks to the installation of 196 flow reducers purchased by the farms, their water consumption has been reduced by approx. 30% with an estimated groundwater saving of 1% - 3% compared to the current general consumption.
- Conclusion of the **Groundwater contract**, a strategic and negotiated planning tool, which - through a participated process – leads the territory to have shared sustainable water management standards in line with the provisions of the existing Water Protection Plans and Management Plan of the Eastern Alps’ Hydrographic District.
- Elaboration of the **Final report and action plan for the governance of groundwater and the Groundwater Contract**.
- Publication of “**Demonstrative techniques of artificial recharge for the quantitative rebalancing of the upper Vicenza’s plain**” which describes the characteristics of the 5 most significant AQUOR project sites and the techniques applied by them: forest infiltration areas (Carmignano di Brenta), dispersion pit (Sarcedo); sub-surface irrigation (Rosà); dispersion ditch (Ancignano di Sandrigo); and infiltration wells (Breganze).
- Elaboration of a **Disclosure report: Artificial groundwater recharge by means of integrated water resource management – INVENTORY OF RESURGENCE SPRINGS**. The work on the resurgences carried out in the frame of the project was requested by the Basin Authority to update the Water Management Plan. Moreover it is envisaged that the monitoring system developed in the frame of the ACQUOR project will become a permanent system for the protection of the resurgence springs’ ecosystems.
- The quantitative results obtained from the two seasons of groundwater recharge resulted to be in line with what was expected, both from the qualitative and quantitative point of view. The experience has shown the efficiency and effectiveness of the implemented actions, confirming that an extensive implementation can be a valid solution for the quantitative rebalancing of the groundwater of the upper Vicenza’s plain.
- Realization of an **infomercial** on water saving “**We are the Water. Let’s defend ourselves from waste**”.
- Elaboration of the technical report “**Artificial groundwater recharge through integrated water resource management; Update report - March 2015 – FINAL RESULTS**”
- Elaboration of the **Reports: Economic-financial analysis of technical solutions for groundwater balancing within the AQUOR project** and: **Analysis of legal solutions to directly and/ or indirectly compensate for the interventions aimed at infiltrating and recharging aquifers.**

All documents produced within the frame of the LIFE+ AQUOR project are available at www.lifeaquor.org/it/download.





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Acronym

AQUOR

Number of reference

LIFE10 ENV/IT/380

Reference Programme

[LIFE](#)

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EU contribution

693.348,00

Call Year

2010

Start Year

2013

End Year

2015

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Region

Veneto

Description

Province of Vicenza