MAR2PROTECT

Innovation Factsheet

AI-based Decision Support System for managed aquifer recharge in a Climate Change perspective

Problem Solved

MAR operators and water utilities currently lack a single integrated platform covering the full MAR lifecycle, from site selection and design to operation and performance evaluation. Data is fragmented across disconnected geographic information system (GIS), sensor, climate and hydrogeological systems. Modelling is expensive, slow and requires specialist expertise. Operational risks (clogging, salinity intrusion, water quality deterioration) are often identified too late. Under growing climate uncertainty, these challenges threaten the viability and efficiency of MAR investments across Europe and globally.

How It Works

M-AI-R DSS is an AI-enhanced integrated platform that supports decision-making across the full MAR lifecycle:

- **Site suitability assessment:** GIS- and Earth Observation (EO)-based mapping to identify optimal MAR locations considering hydrogeological, climate and land-use data.
- **Design and planning:** Integration of REACH Tool (groundwater quality prediction), DRONE (data driven modelling for climate impacts in GW) and RAINREC (recharge dynamics) modelling tools to support MAR scheme design under CC scenarios.
- **Operational management:** Real-time sensor data integration for monitoring water quality, clogging risk and aquifer performance.
- **Risk assessment:** Proactive quantification of clogging, salinity and scarcity risks before they occur, enabling preventive action.
- **Visualization and reporting:** Decision-ready dashboards for MAR operators, regulators and civil society.

Unique Value Proposition

A comprehensive visualisation and decision-support tool for MAR operators. Addresses MAR performance through: risks mitigated by MAR, innovative pre-treatment technologies and operational risk identification.

As a consequence of Climate and Global Change effects, groundwater resources experience serious problems in relation to their quality and quantity. In this context, the M-AI-R DSS solves these problems by consolidating advanced AI forecasts, real-time sensor monitoring, and policy guidelines into a single, intuitive online platform. This comprehensive tool provides policymakers with a long-term foresight to plan sustainable water security, while delivering real-time alerts that allow operators to safely manage day-to-day managed aquifer recharge.

Result Identification

Technology Short Name

M-AI-R DSS.

Full Name

AI-based decision support system (DSS) for managed aquifer recharge in a climate change (CC) perspective.

Lead Partner

CETAQUA Andalucía, Spain.

Work Package / Task Related Deliverables

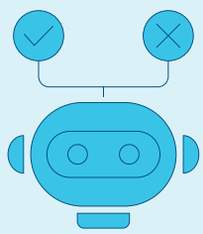
WP4. Linked to Task 4.6 and D4.6 contributing to SO5 to develop GW management strategies through the development of a DSS, based on AI techniques, enabling decision makers to (i) identify suitable areas for MAR projects, (ii) perform a cost-effective design of MAR projects, (iii) develop MAR-based risk assessment and mitigation measures, considering GC/CC scenarios, (iv) visualize in a user-friendly interface the outputs of all the MAR-related activities.

Current TRL

TRL 5. The demo version with key functionalities was delivered on november 2025. The final improvements are ongoing.

KER Type

Tool → Software Platform, Decision Support System.



- **Efficiency:** through real-time monitoring MAR operations and quality improvement with water treatment technologies that prove to reduce 60-99% micropollutants.
- **Cost:** cost reduction by preventing contamination and infrastructure damage.
- **Safety:** safety enhancement through health and environmental risk monitoring.
- **Sustainability:** enabling climate-resilient groundwater management with predictive modeling under different climate scenarios
- **Competitive advantage:** integration of real-time monitoring systems for MAR operations.

Target Markets & Users

Segment	Description	Role
Water utilities, drinking water/ water suppliers	Public and private water utilities and MAR operators managing recharge schemes, particularly in water-stressed regions	Primary user; buyer
Government and international organisations	Local, regional and national water authorities responsible for groundwater management, MAR planning and climate-adaptation strategies	Institutional buyer; policy maker
Industrials (SMEs and large companies)	Environmental and hydrogeological consultancies integrating the DSS into assessment, planning and advisory services	Integrator; service provider
Government and international organisations	International and multilateral organisations supporting water-security and climate-adaptation programmes	Funder; enabler
Foundations, NGOs and environmental organisations	Organisations supporting groundwater protection and water-security initiatives	Funder; enabler
Academia and research community	Research institutions using the platform for model development, validation and advanced groundwater studies	Research and validation partner

Exploitation Route & Business Model Outline

Exploitation route	SaaS (Software as a Service): annual licence per utility / MAR site; academic fee for research use
Revenue model	SaaS licence fees; consultancy and site-specific model customisation; training workshops; maintenance contracts
IP strategy	Software copyright protection and trademark under assessment
Next steps	Finalize platform for November 2026; develop commercial SaaS offering

Contact **Isabel Gamallo** (isabel.gamallo@cetaqua.com) and **Sara Espinosa Martinez** (sara.espinosa@cetaqua.com) from **CETAQUA** for pilot testing and guides/technical discussions. For project coordination matters, please reach out to **NOVA**, coordinator of the MAR2PROTECT project. Collaboration, exploitation, and technology transfer opportunities are supported by **FEUGA**, project's Technology Transfer Entity.

Discover all the technologies!

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No GA 101082048. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union. Neither the European Union nor the granting authority can be held responsible for them.

Funded by the European Union