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International Water Resources Association
IWRA

XIX WORLD WATER CONGRESS
International Water Resources Association (IWRA)
Marrakech, Morocco | 1 - 5 December 2025

Kingdom of Morocco
Ministry of Equipment and Water

Governance of Managed Aquifer Recharge

Insights from the European Union's Regulatory Framework

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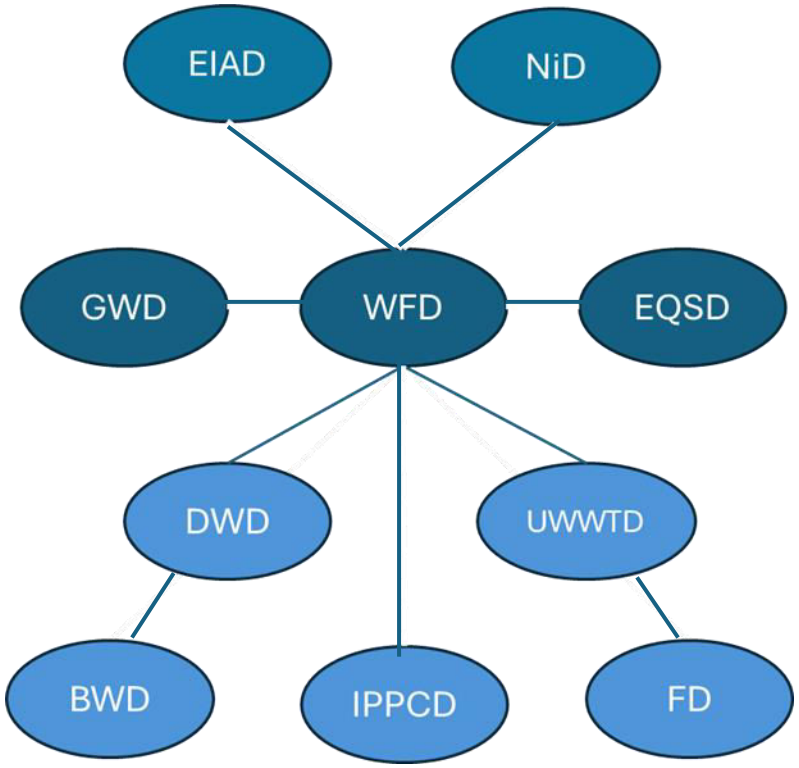
4th December 2025

Background

The EU Regulatory Framework on Water Resources Management is centred on the Water Framework Directive (Dir 2000/60/EC).

Groundwater quality issues are further expanded in the Groundwater Directive (Dir 2006/118/EC).

The WFD and GWD are complemented by other Directives – Nitrates Directive (Dir 91/676/EEC), Environmental Quality Standards Directive (Dir 2008/105/EC) and the Environmental Impact Assessment Directive (Dir 2001/92/EU).



Background

Common Understanding on the requirements of these Directives is achieved through the Common Implementation Strategy (CIS)

Consultation Framework between the EU Commission, Member State Representatives and Stakeholder Representatives.

WG Groundwater
Focuses on the Technical and Policy Levels
Discussions aim at informing EU policy development

Guidance Document No 39

Aim: To increase the understanding of the general principles of Managed Aquifer Recharge (MAR) and outline the requirements of EU legislation with respect to the application of MAR techniques.

Support from IAH MAR Commission in the drafting of the document.

Download Link: https://op.europa.eu/en/publication-detail/-/publication/e827bbe4-fe33-11ef-b7db-01aa75ed71a1/language-en

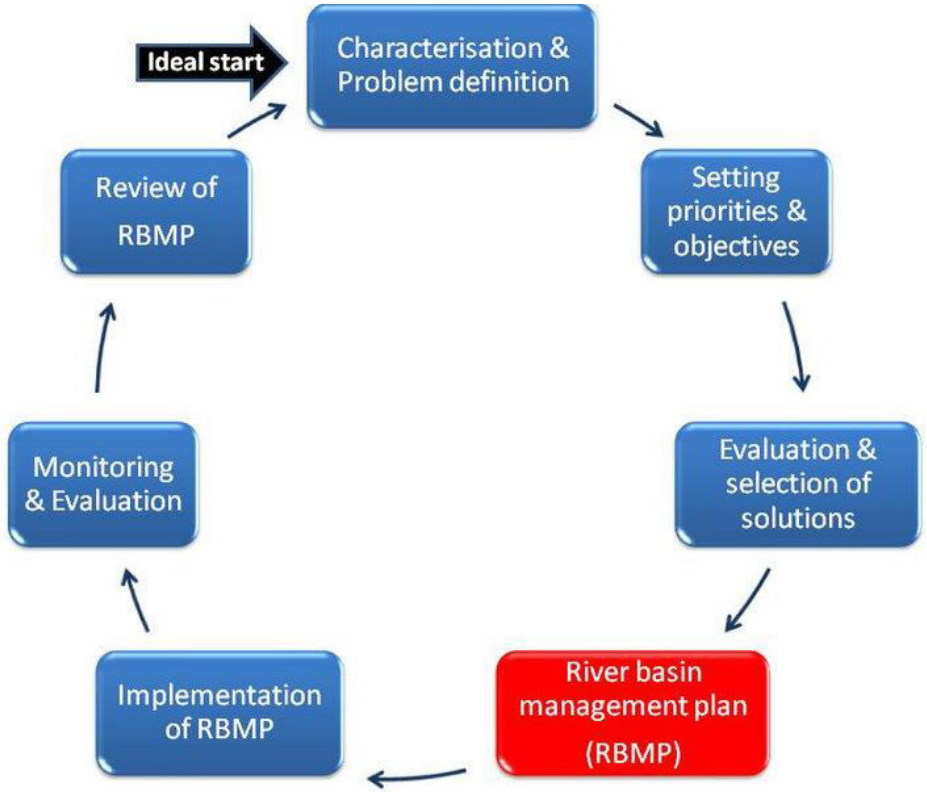
Context

The WFD's objectives are outlined under Article 4 – "Environmental Objectives".

The tool to achieve these objectives are the River Basin Management Plans (Article 13). The core of the RBMP is the Programme of Measures (Article 11) which identifies the actions necessary for the achievement of good status in the River Basin District.

Annex VI Part B - "Artificial Recharge" is one of the supplementary measures which Member States can apply to achieve good status.

WFD already provides consideration to Artificial or Augmented Recharge.



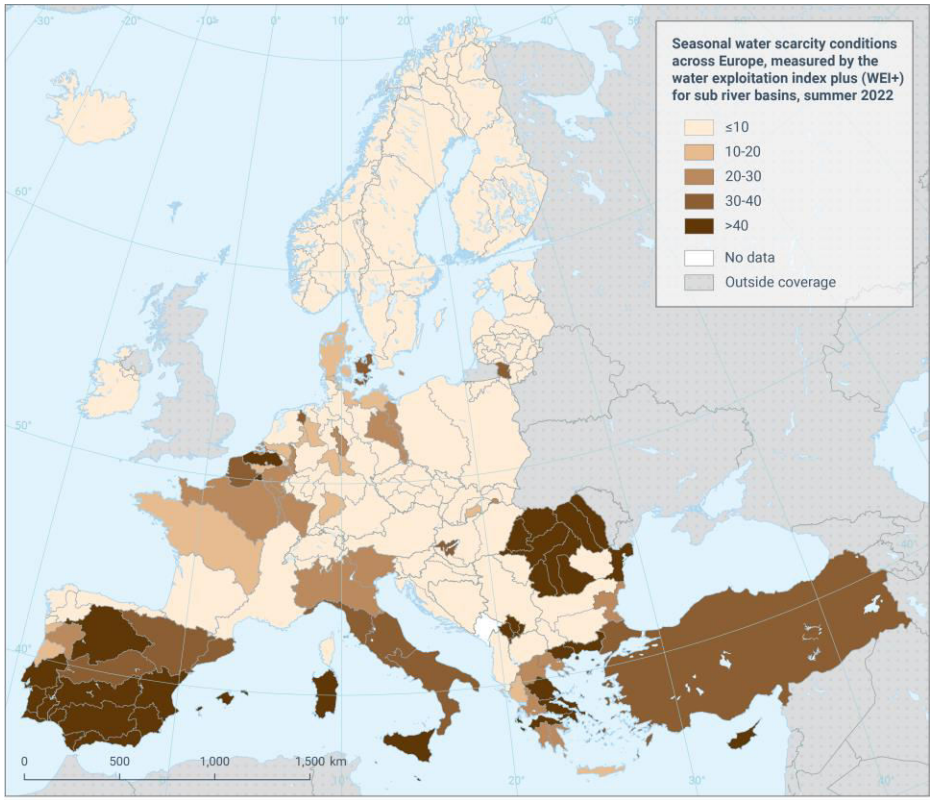
RBMP Planning Process

Context

The WFD (and GWD) provide an added emphasis on the protection of groundwater quality. This should be viewed within the perspective that in most European Member States, water resources are sufficiently available.

The core groundwater (quality) protection functions of the WFD are outlined under the "Prevent or Limit Objective" - Article 4(b)(i) ..... *Member States shall implement the measures necessary to* ***prevent or limit*** *the input of pollutants into groundwater and to prevent the deterioration of the status of all bodies of groundwater, ...*

However, groundwater protection needs to focus also on quantitative issues.



Reference data: © EuroGeographics, © FAO (UN), © TurkStat Source: European Commission – Eurostat/GISCO

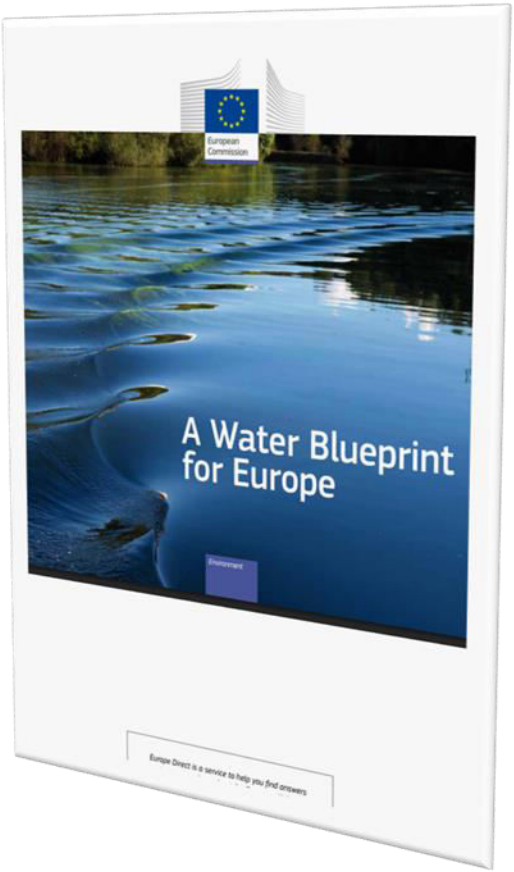
Why?

Discussions on the regulation of MAR started following the publication of the “Water Blueprint for Europe” (2013).

“By 2015, the Commission plans to propose EU-wide measures to encourage water reuse. It is considering all options including a regulation on common standards …….”

Managed Aquifer Recharge was associated with Water Reuse, to address primarily water scarcity in Southern Europe – and hence standards were required to ensure the protection of groundwater resources and its receptors.

Link: https://op.europa.eu/en/publication-detail/-/publication/4890db5a-ddc9-4181-9d39-8a277faef30b



But ……..

JRC(2018) – Minimum Quality Requirements for Water Reuse in Agricultural Irrigation and Aquifer Recharge.
Link: https://publications.jrc.ec.europa.eu/repository/handle/JRC109291

But related EU level discussions highlighted that Managed Aquifer Recharge is not only an issue for Southern Europe but actually is quite widespread in Europe, using different techniques and water resources.

Focus therefore shifted on the robustness of existing legislation to ensure “safe” MAR.

Water Framework Directive

Article 11(3) defines the "*Basic Measures*" which are the minimum requirements to be included in the Programme of Measures.

Paragraph (f) requires the establishment of "***controls, including a requirement for prior authorisation of artificial recharge or augmentation of groundwater bodies***. *The water used may be derived from any surface water or groundwater, provided that the use of the source does not compromise the achievement of the environmental objectives established for the source or the recharged or augmented body of groundwater. These controls shall be periodically reviewed and, where necessary, updated*;"

Groundwater Directive

The GWD was intended to introduce (set) the necessary provisions for making the WFD's prevent or limit objectives operational, emphasising on precautions to reduce anthropogenic pressures to groundwater chemical status.

CIS Guidance Document No 17 - Guidance on preventing or limiting direct and indirect inputs in the context of the Groundwater Directive
LINK: https://circabc.europa.eu/sd/a/3a87a7ad-858d-459e-9e45-bee034c013dd/Guidance%20Document%20No%2017%20-%20Direct%20and%20indirect%20inputs.pdf

Groundwater Directive

The prevent or limit concept is introduced under Article 6(1) of the GWD which outlines a series of requirements to be included under the WFD Programme of Measures.

However, the GWD aims to facilitate the adoption of artificial recharge schemes by introducing a specific exemption. In fact, Article 6(3)(d) notes that “Without prejudice to any more stringent requirements in other Community legislation, Member States may exempt from the measures required by paragraph 1 inputs of pollutants that are:
(d) The result of artificial recharge or augmentation of bodies of groundwater authorized in accordance with Article 11(3)(f) of Directive 2000/60/EC.”

GWD Article 6(3) however also clarifies that these “exemptions … may be used only where the Member States’ competent authorities have established the efficient monitoring of the bodies of groundwater concerned, …, or other appropriate monitoring, is being carried out”.

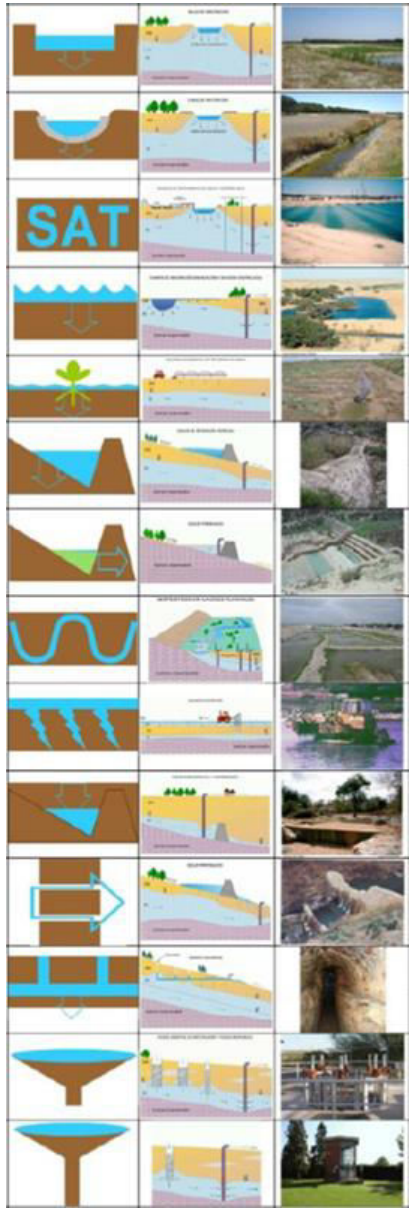
Gaps

(i) Defining Managed Aquifer Recharge

WFD/GWD use the term “artificial recharge” which is broad. But by requiring prior authorisation – the WFD recognizes the intentionality to undertake MAR.

(ii) Nature of MAR Authorisations

The WFD does not provide an outline of the minimum requirements which a “MAR authorisation” should include – although it is sufficiently clear that such requirements should contribute to the achievement of the Article 4 Environmental Objectives

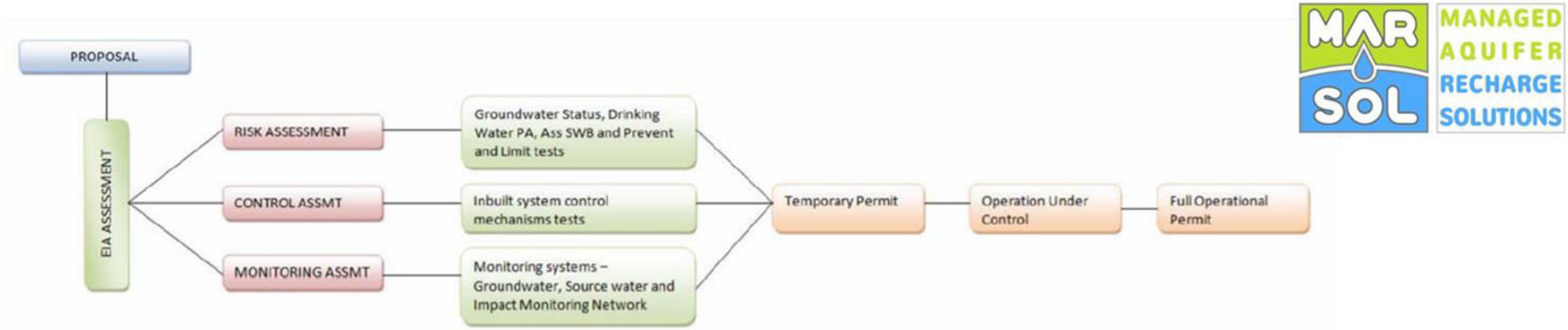


Source:
MARSOLUT (2022)

Authorisation Process

Guidance document provides three possible frameworks on which MAR authorisation processes can be based. Not exclusive – other approaches can be adopted.

(i) Permitting Framework proposed under MARSOL Project



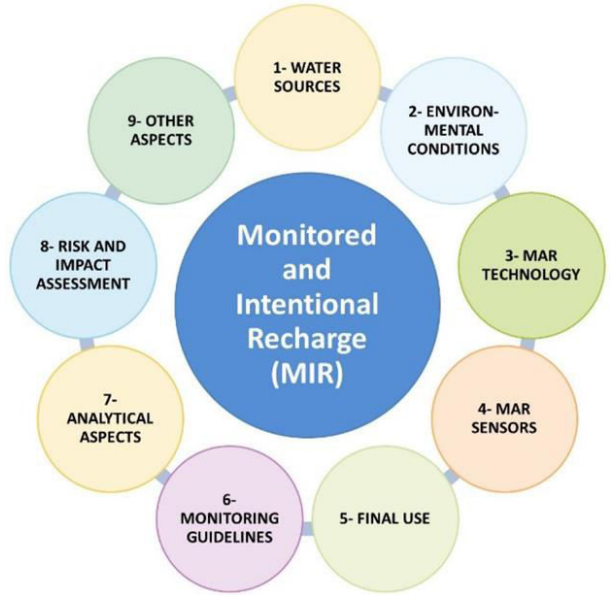
Authorisation Process

(ii) Risk Assessment Based Framework

Focuses on the development of a stepwise approach which considers: (i) the role of the MAR scheme operator, (ii) the role of the Competent Authority, (iii) the role of stakeholders / end-users, (iv) the prior authorisation process for MAR schemes and (v) the development of a MAR risk management plan

(iii) Monitored and Intentional Recharge (MIR) Framework

Based on: Fernández Escalante, E et al. Monitored and Intentional Recharge (MIR): A Model for Managed Aquifer Recharge (MAR) Guideline and Regulation Formulation. https://doi.org/10.3390/w14213405 Provides an added focus to the social acceptance of MAR, and therefore provides interesting opportunities for strengthening the above authorisation frameworks.



MIR Concept
Escalante et al (2022)

Conclusion

CIS Guidance Document 39

Addresses a number of issues related to the interpretation of MAR under the WFD, namely, it:

- defines MAR as a planned (intentional) activity;
- confirms flexibility in the sourcing of water inputs for MAR activities;
- provides guidance on the interpretation of WFD Article 11(3)(f) – 'prior authorization of artificial recharge';
- provides guidance on the application of GWD Article 6(3);
- develops an outline framework for the application of a risk management approach in MAR authorizations; and
- provides an alignment between the WFD and GWD requirements – **highlighting that the current legislative framework is 'fit for purpose'.**

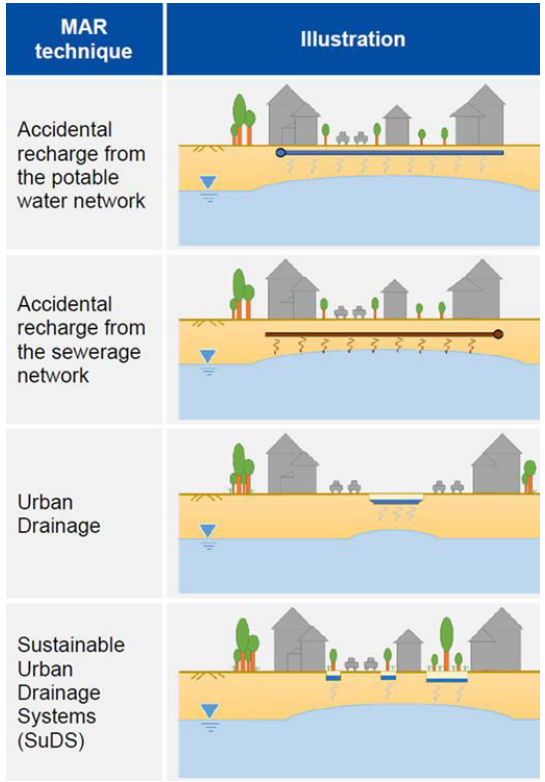
And hence promotes the application of "safe" MAR for enhanced resilience.

Conclusion

Unintended aquifer recharge, namely when aquifer recharge results as a side-effect of activities intended for other purposes than recharge.

In such cases, the derogation under GWD Article 6(3) should not apply and hence all the provisions of GWD Article 6 should apply.

Therefore, it was recommended that a further action is undertaken under CIS Working Group Groundwater to analyse the regulatory framework for such unintended aquifer recharge activities and provide guidance to Member States on the application of GWD Article 6; this to ensure that such activities and measures can be implemented in a safe way which protects the status of groundwater resources and their receptors.



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International Water Resources Association (IWRA)
Marrakech, Morocco | 1-5 December 2025

Thank you!

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ACKNOWLEDGEMENTS
Drafting Group within Working Group – Groundwater, EU
Member State Representatives in CIS Process
Stakeholder Representatives, IAH MAR Commission

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