Governance of Managed Aquifer Recharge: Insights from the EU's Regulatory Framework

Manuel Sapiano

Energy and Water Agency

Malta

CIS Guidance Document

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

Why?

MAR is increasingly relevant as a Climate Change adaptation measure.

Need for ensuring a regulatory framework which ensures safe MAR.

Important Question:

Is additional legislation required at the EU Level to ensure safety of MAR?

Common Implementation Strategy

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

WG Groundwater

- Technical/Policy Level
- Discussions aim at informing EU policy development

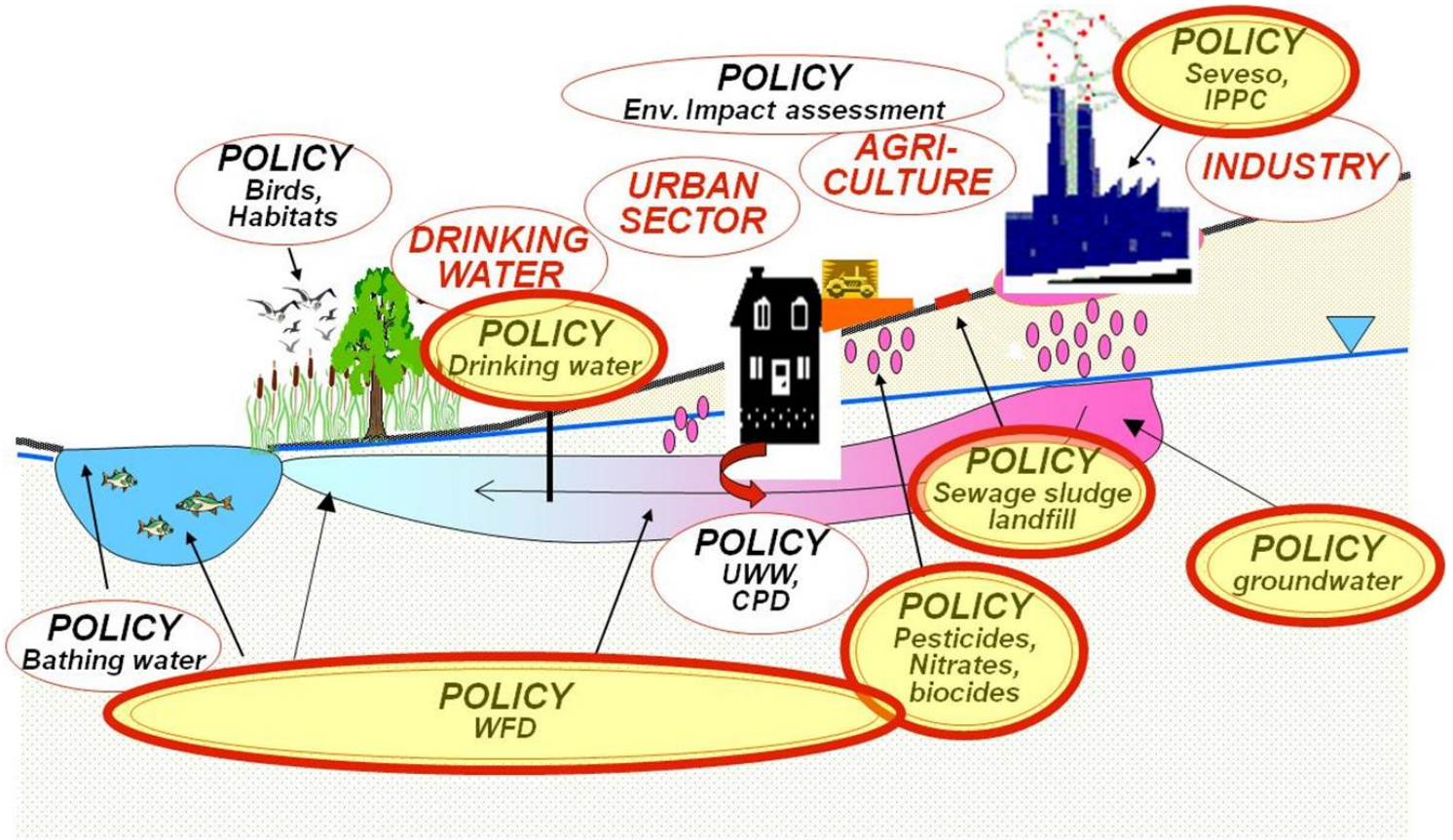
Mandate

“Explore the need and, if necessary, develop a guidance document on aquifer recharge practices that comply with the WFD and Groundwater Directive, in cooperation with the Ad-hoc Task Group on Water Reuse.”

EU Governance

Broad Legislative Framework, based on the Water Framework Directive (2000/60/EC).

Required to address a diverse water management context.

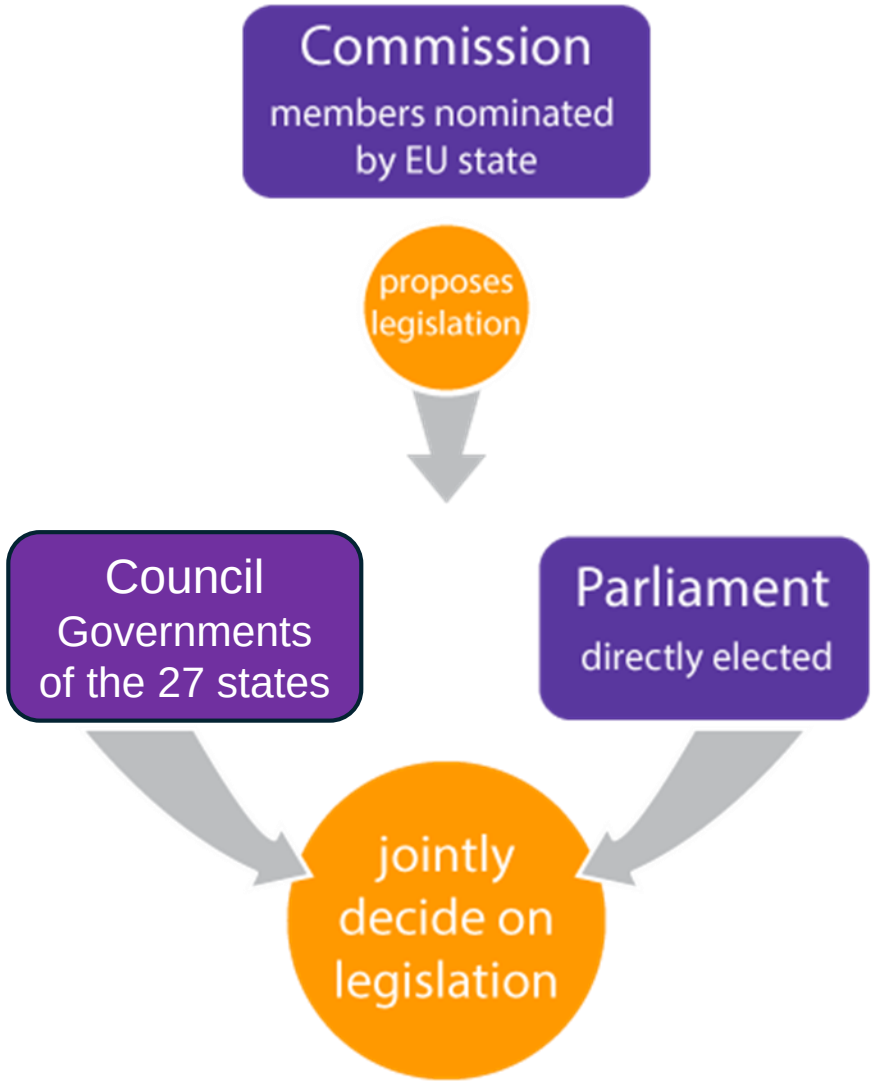


EU Governance

EU Legislation comes through a co-decision process between the EU Commission, Council and Parliament.

Generally results in a very balanced document.

CIS Process aims to develop a common understanding (between Commission, Member States and Stakeholder Representatives) on the application of legislation.

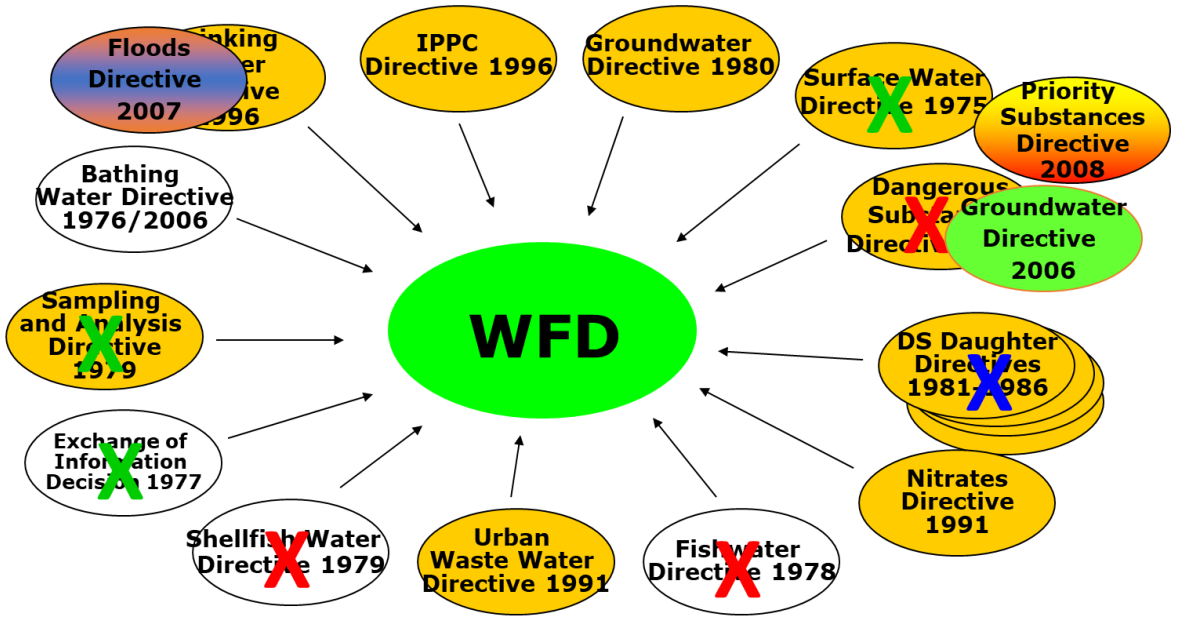


Water Framework Directive

Focuses on the achievement of good qualitative (chemical) and quantitative status of water bodies.

But also the protection of receptors (including groundwater dependent ecosystems).

Groundwater quality considerations are further outlined in the Groundwater Directive.



What is MAR?

Defining MAR:

Dillon (2009): "*the process of **intentionally** increasing recharge into aquifer for subsequent recovery for environmental benefits*"

UNESCO (2021): "*Managed Aquifer Recharge is the **purposeful** recharge of water to aquifers for subsequent recovery or environmental benefit. It is not a method for waste disposal.*"

What is MAR?

Definitions highlight the terms “intentionally” and “purposeful” - hence consider MAR as resulting from a planned process.

But

There are other activities which result in augmenting recharge to GWBs but are not primarily intended to result in aquifer recharge.

Guidance: Such activities are not considered as Managed Aquifer Recharge.

WFD (Dir 2000/60/EC)

Annex VI of the Directive (Part B) refers to “artificial recharge of aquifers” as one of the Supplementary Measures, which Member States may choose to adopt as part of the programme of measures under their respective River Basin Management Plan (RBMP).

It is noted that this technical document understands that the term “artificial recharge” under the WFD refers to MAR.

Annex VI highlights the fact that Member States should decide on the need for MAR activities based on the assessments undertaken during the development of their RBMPs.

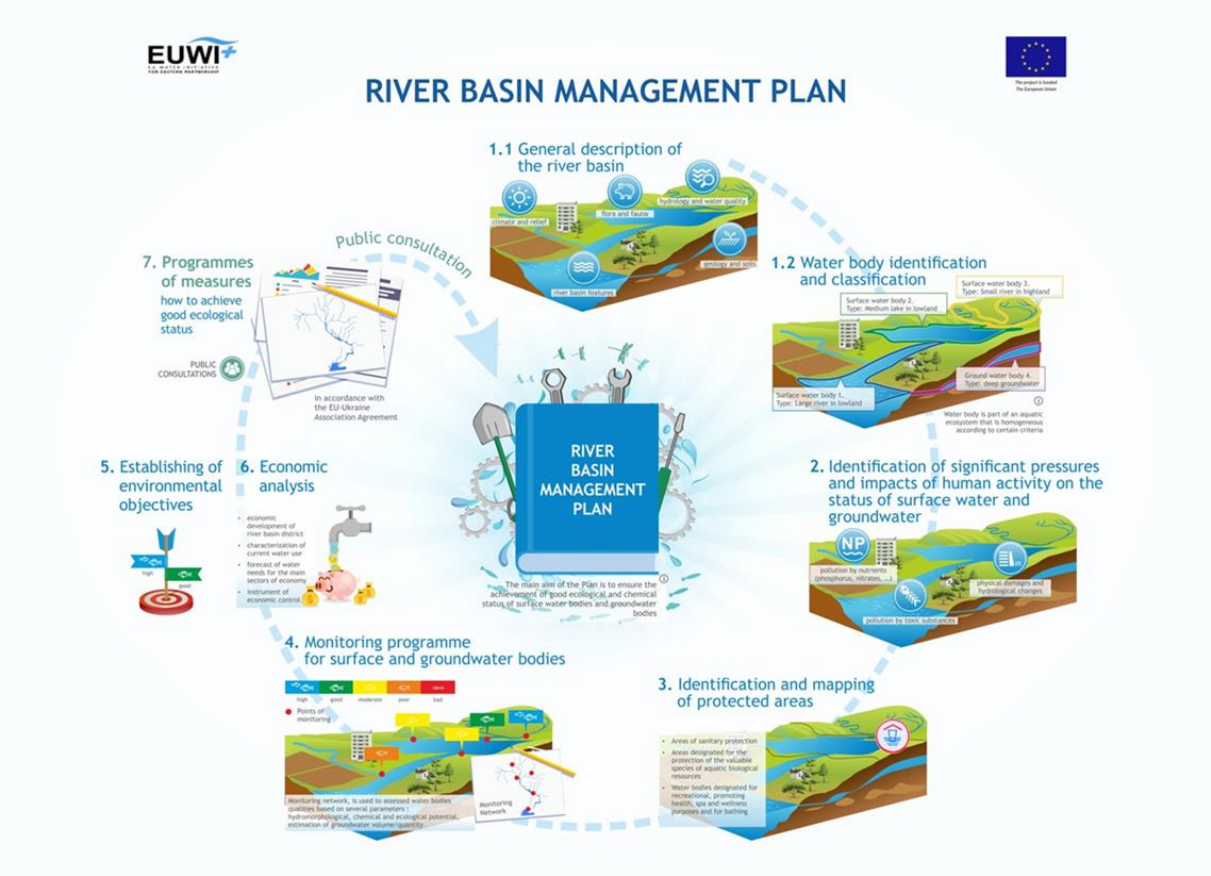
RBMPs?

River Basin Management Plans

Focus on achievement of WFD Environmental Objectives (Article 4)

Core element: “Programme of Measures”

Provides flexibility to address River Basin specific challenges.



WFD

WFD Article 11(3)(f)

Each Member State will establish a programme of measures as part of the RBMP. This programme consists, among others, of the following 'basic measure' (Article 11(3)):

f. 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;

WFD

Whenever MAR techniques are applied (as supplementary measures) to contribute to achieving and maintaining good groundwater status, Article 11(3)(f) has to be considered.

Hence, controls intended to ensure the achievement of the Article 4 objectives are required to be in place.

These controls aim at ensuring compliance with the objectives of both the water body from which the recharge water is sourced as well as the groundwater body that is being recharged.

WFD

Important: Under Article 11(3)(f), the Directive does not exclude any type of water as the source of the artificial recharge (MAR) scheme 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*."

The Article 11(3) requirements should be construed as outlining that the use of MAR should not interfere with the key WFD principle to reduce progressive pollution and prevent further pollution (Article 1). The WFD does not fix quality limits for recharged water but specifies that the activity cannot compromise the achievement of the environmental objectives for water bodies.

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.

By introducing the concept of preventing 'inputs' instead of 'discharges', the GWD widens the scope of the pollution-preventive actions to cover all pollutants that enter groundwater, further supporting the achievement of the requirements of WFD Article 4(1)(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, …*"

Groundwater Directive

The prevent or limit concept is introduced under Article 6(1) of the GWD which requires that "*In order to achieve the objective of preventing or limiting inputs of pollutants into groundwater, …, Member States shall ensure that the programme of measures … includes:*
(a) all measures necessary to prevent inputs into groundwater of any hazardous substances, …
(b) for pollutants … which are not considered hazardous, … all measures necessary to limit inputs into groundwater so as to ensure that such inputs do not cause deterioration or significant and sustained upward trends in the concentration of pollutants in groundwater."

The above requirements are key factors to be considered in the context of authorisation of MAR activities, particularly for ensuring that the application of MAR does not result in the deterioration of or failure to achieve the chemical status of groundwater.

Groundwater Directive

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*".

Groundwater Directive

The GWD whilst recognizing MAR schemes as important tools for the achievement of good groundwater quantitative status, requires the enactment of all measures deemed necessary and reasonable to avoid compromising the achievement of environmental objectives (for the source of and the recharged groundwater body).

It also requires that the impact of MAR schemes on the chemical status of the augmented GWB be effectively monitored such that any management and/or regulatory decisions taken are based on a sound understanding of the real conditions of the GWB.

Groundwater Directive

GWD Article 6(3)(d), whilst allowing for an exemption to the obligation to avoid or limit inputs of pollutants in the case of recharge, requires this to be done in accordance with WFD Article 11(3)(f).

The latter imposes the granting of a prior authorisation, in view of ensuring compliance with the objectives set out under WFD Article 4 (as per WFD Article 11(1)).

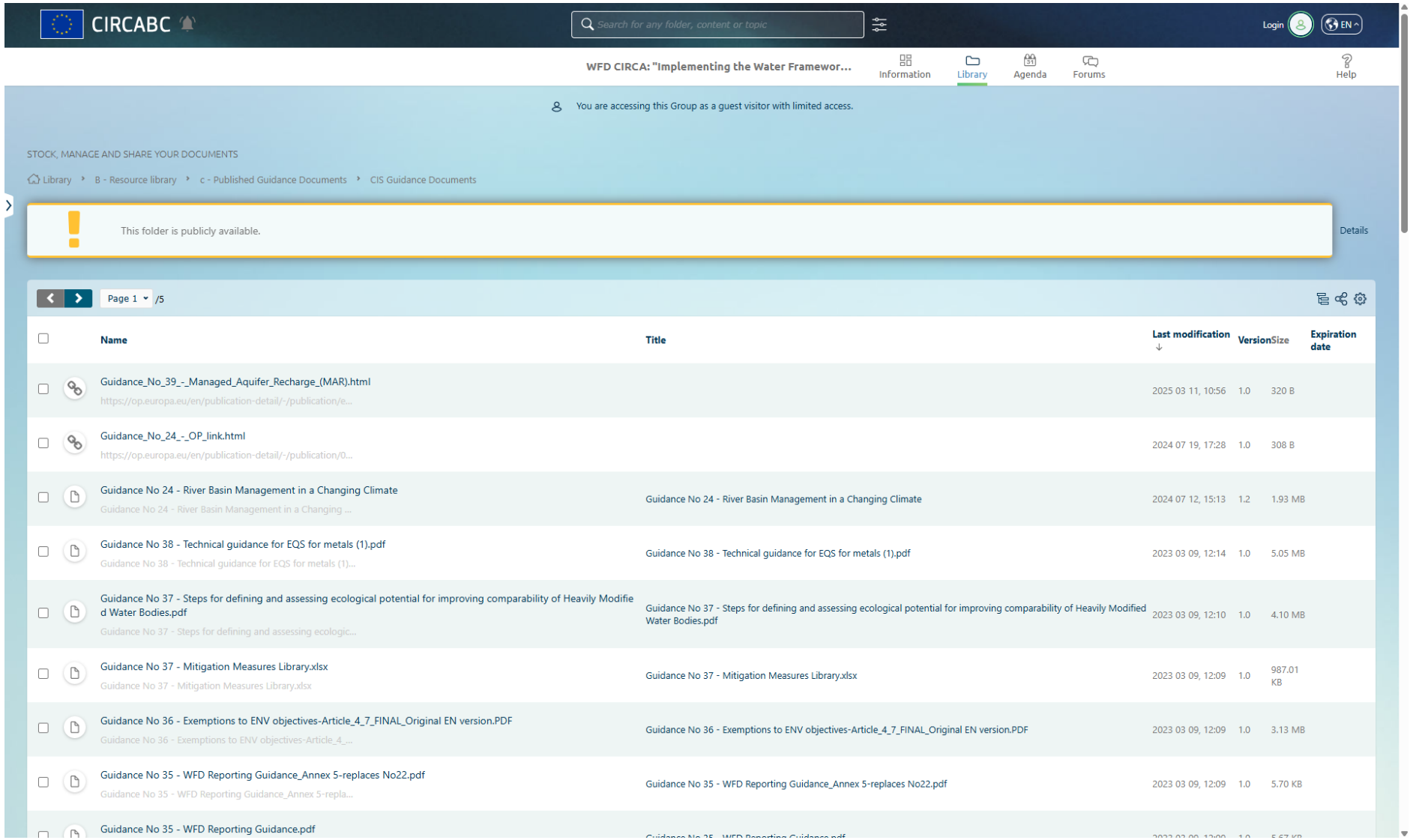
Compliance with the objectives under WFD Article 4 requires, for groundwater bodies, to limit or prevent the input of pollutants and avoid deterioration of status.

ECJ - Interpretation

Case C-535/18 Judgment of 28 May 2020, Land Nordrhein-Westfalen:

The judgment concludes that “*from the role and the importance of each monitoring site in the system for monitoring groundwater quality established by Directive 2000/60, in particular in point 2.4 of Annex V, that the failure to comply with one quality element at a single monitoring point is sufficient for a finding that there is a deterioration of the status of a body of groundwater for the purposes of Article 4(1) of that directive*”.

Common Understanding



Common Understanding

CIS Guidance Document No 15 – Groundwater Monitoring

This document provides guidance on establishing groundwater monitoring programmes to meet the requirements of the WFD and the GWD. These programmes include both the quantitative and chemical monitoring for status and trend assessment, monitoring to support groundwater body characterisation and drinking water protected area objectives.

Common Understanding

CIS Guidance Document No 17 - Guidance on preventing or limiting direct and indirect inputs in the context of the Groundwater Directive 2006/118/EC

- Defining ‘Direct and Indirect inputs’
- Defining the ‘Prevent and Limit’ Requirements
- Role of the Saturated and Unsaturated Zones
- Definition of Points of Compliance

Prevent and Limit

According to the GWD, *"…substances to be prevented from entering groundwater are substances identified by Member Stats as being hazardous* (Article 6(1)(a)). *In identifying such substances, Member States shall in particular take account of hazardous substances belonging to the families or groups of pollutants referred to in points 1 to 6 of Annex VIII to Directive 2000/60/EC, as well as of substances belonging to the families or groups of pollutants referred to in points 7 to 9 of that Annex, where these are considered to be hazardous. Substances to be limited in groundwater such that pollution does not occur are all other pollutants".*

The GWD recognizes that it is not technically feasible to stop all inputs of hazardous substances, in particular the input of some small inputs of hazardous substances which are environmentally insignificant and thus do not present a risk to groundwater.

Role of Saturated and Unsaturated Zones

When considering the role of the saturated and unsaturated zones in the “further treatment” of recharge water, the guidance document notes in section 3.4 that “*When considering the need for measures to prevent and indirect input of a hazardous substance into groundwater, one can take into account the attenuation (fixation, degradation) of the substance in the unsaturated zone. To this end, all the geological, hydro-geochemical and biological processes should be taken into account, including changes in the water table at a particular site. Processes in the saturated zone are not relevant for assessing inputs of hazardous substances, since these substances should be prevented from entering the saturated zone …*”.

Role of Saturated and Unsaturated Zones

Furthermore, the document outlines that *“……When considering which measures would be necessary to limit an input, one can also take into account processes that will result in attenuation in the unsaturated as well as in the saturated zone. Such processes include fixation to soil particles, degradation, or dilution, such that no threat to receptors occurs and there is no significant and sustained upward trend in concentration. In addition, the potential for the substances to transform into a hazardous substance should be taken into account. If this were to occur, then the substance should be prevented from entering groundwater*”.

Common Understanding

CIS Guidance Document No 18 – Guidance on groundwater status and trend assessment

Guidance document No 18 sets rules for the status and trend assessment of GWBs. Artificial recharge both affects quantitative and chemical groundwater status. The document explains how to assess the water balance test to compare annual average abstraction against ‘available groundwater resource’ in the groundwater body.

Common Understanding

CIS Guidance Document No 26 – Guidance on risk assessment and the use of conceptual models in groundwater

The guidance document emphasises the importance of conceptual models, which can also be a key tool when trying to predict the impacts of MAR activities, as well as on the need to introduce a ‘risk assessment’ framework in the planning process for new developments which can have an impact on groundwater. This recommendation can also be extended to MAR activities, and can be considered for eventual inclusion in the development of a comprehensive MAR permitting process.

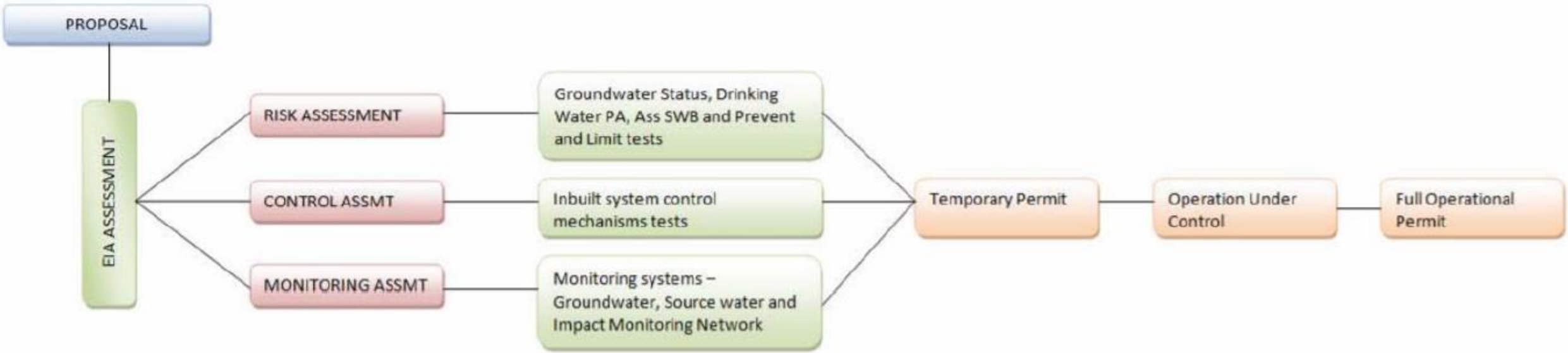
Authorising MAR

The WFD introduces the requirement for the prior authorisation of artificial recharge or the augmentation of groundwater bodies. However, the Directive does not provide clear guidelines as to the structure of the prior authorisation process, except for the requirement that the artificial recharge or GWB augmentation scheme is not to result in the deterioration in status of the GWB.

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

Authorising MAR

Authorisation structure based on the outcomes of the EU MARSOL project:



Authorising MAR

Authorisation framework is based on the following three principles:

1. The undertaking of a risk assessment to determine the potential adverse impacts on the status of a GWB which could arise as a result of the MAR scheme;
2. The establishment of control mechanisms to ensure the reliable performance of the MAR scheme; and
3. Monitoring of the performance of the MAR scheme and its impact on the augmented GWB.

Authorising MAR

Authorisation structure based on the risk management framework developed for the EU Water Reuse Regulation

Focuses on:

(i) Role of the MAR scheme operator
(ii) Role of the Competent Authority
(iii) Role of stakeholders / end-users
(iv) Prior authorisation process for MAR schemes
(v) Development of a MAR risk management plan

Authorising MAR

Reference is also made to the risk management framework proposed under the MIR concept proposed under:

‘Fernández Escalante, E.; Henao Casas, J.D.; San Sebastián Sauto, J.; Calero Gil, R. Monitored and Intentional Recharge (MIR): A Model for Managed Aquifer Recharge (MAR) Guideline and Regulation Formulation. Water 2022, 14, 3405. https://doi.org/10.3390/w14213405’

which provides an added focus to the social acceptance of MAR, and therefore provides interesting opportunities for strengthening the above authorisation frameworks.

GAPS in Existing Legislation

- Use of the term “artificial recharge” which is broad. But by requiring prior authorisation – the WFD however recognizes the intention to undertake MAR

- 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

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;
- 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’.

Guidance Document 39

The Guidance Document led to an analysis of whether the regulatory framework under the WFD and the GWD is sufficient to ensure the application of safe ‘Managed Aquifer Recharge’.

It is the opinion of CIS Working Group Groundwater, that both directives provide a sufficiently robust legal framework to regulate MAR, and that hence new legislation on MAR at EU level is not required.

Unintended Recharge

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 dependent ecosystems

Document Structure

1. Purpose and scope of the Guidance
2. General Principles of MAR techniques
3. EU Legislative Context
4. Regulatory assessment of the requirements and exemptions within EU Legislation
5. Defining key requirements for MAR authorisations, for the application of a risk-based approach
6. Gap assessment between existing legislation and MAR principles
7. Key conclusions and recommendations

Document Structure

Annex 1 Best-practice examples from Member States
Annex 2 MAR project references
Annex 3 Activities resulting in unintentional aquifer recharge
Annex 4 Outline of the Australian MAR guidelines
Annex 5 Outline of the Monitored and Intentional recharge (MIR) concept.

Acknowledgements

Drafting Group within Working Group – Groundwater

Member State Representatives in CIS Process

Stakeholder Representatives

IAH MAR Commission

Thank-you for your attention

manuel.sapiano@gov.mt