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Deliverable #D6.4d

Minutes of the fourth AGREEMAR consortium meeting, 8-10 April 2025, Hammamet, Tunisia

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AGREEMAR

Adaptive agreements on benefits sharing for managed aquifer recharge in the Mediterranean region

Deliverable #D6.4d

Minutes of the fourth AGREEMAR consortium meeting

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Executive summary

This report summarizes the fourth AGREEMAR consortium meeting, focused on advancing Managed Aquifer Recharge (MAR) and sustainable water management in the Mediterranean. Partners reviewed project progress, shared scientific insights, and explored innovative MAR case studies. The meeting emphasized stakeholder engagement, policy recommendations, and future research directions. Field visits in Tunisia offered practical perspectives on MAR implementation.

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V0.1	07.05.2025	Catalin Stefan (TUD)	First draft version
V1.0	16.05.2025	Catalin Stefan (TUD)	With contributions and feedback from partners

Abstract

This report presents the outcomes of the fourth consortium meeting of the AGREEMAR project, a collaborative initiative focused on advancing Managed Aquifer Recharge (MAR) strategies and sustainable water resource management across the Mediterranean region. Held as part of the project's ongoing efforts, the meeting convened partners to assess project achievements, discuss scientific contributions, and strengthen stakeholder engagement. The sessions included a comprehensive review of key contributions, identified areas for improvement, and shared personal and collective lessons learned. Highlights also included case studies demonstrating innovative MAR applications and the development of policy recommendations to support broader adoption. Furthermore, the meeting facilitated dialogue on future research directions and collaborative opportunities among partners. Complementing the formal sessions, field trips to the Korba Lagoon, Korba MAR site, and Chiba Dam provided hands-on insights into the practical implementation of MAR technologies in Tunisia. The report concludes by summarizing major takeaways and outlining strategic steps for sustaining the impact of the AGREEMAR project beyond its current scope.

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1 Introduction

AGREEMAR is a research project funded by national funding agencies from five countries under the Partnership for Research and Innovation in the Mediterranean Area (PRIMA). The PRIMA Programme is supported under Horizon 2020 by the European Union's Framework for Research and Innovation. The project proposes an improved and integrated management of water resources centred on optimizing the storage of water in the subsurface with the aim of increasing water security in the Mediterranean region.

1.1 About the AGREEMAR project

The AGREEMAR project develops an integrated, participative and coordinated methodology to assess and map the feasibility of nature-based groundwater solutions such as managed aquifer recharge (MAR) for climate change adaptation in alignment to the IWRM principles. The project methodology includes several components:

1. development and demonstration of a combined mapping approach that integrates the demand for aquifer-dependent services, a realistic hydrological assessment of conventional and non-conventional water sources for MAR, and a GIS-based analysis for the selection of intrinsic sites suitable for MAR application;
2. development of a general participatory governance framework at regional level based on the results from the feasibility mapping and national policy analysis;
3. validation of the feasibility maps through numerical models at watershed and local scale to assess the improvements in reliability, vulnerability and resilience provided by the inclusion of MAR schemes in water management schemes;
4. implementation of co-created location-specific agreements for MAR benefits sharing, supported by scientific evidence (feasibility maps and modelling) and endorsed by cross-sectoral stakeholder groups;
5. a participative multi-actor approach for fostering the engagement of stakeholders from different societal sectors and actor groups in all stages of project development.

The applicability of AGREEMAR governance framework is demonstrated at island, regional and local scale on four case study areas from Tunisia, Cyprus, Portugal, and Spain. By selecting regions from EU and non-EU countries on both shores of the Mediterranean basin, AGREEMAR will foster intercultural and multidisciplinary collaboration and transfer between countries. The developed solutions are expected to close the gaps in the hydrological cycle and fulfil optimal water provisions for food security, domestic services and preservation of natural ecosystems in the Mediterranean region.

1.2 The fourth meeting of project consortium

1.2.1 Meeting objectives

The objectives of the final project meeting in Tunisia included were to review project activities, deliverables and milestones, and conduct a critical analysis about the lessons learned from the project.

1.2.2 Meeting agenda

The meeting was scheduled for three days as following:

DAY 1

Venue: Hotel *Houda Yassmine Hammamet*, Hammamet (https://maps.app.goo.gl/PSzWjPZtFmrT2eqm6)

Date: Tuesday, 8 April 2025, 09:00-16:00

Time	Topic	Responsible
09:00 – 11:00	**Session 1: Project achievements** • Overview of key milestones & results • AGREEMAR contribution in MAR best practices and sustainable water resources management • Lessons learned from AGREEMAR • Discussion	**INAT/TUD**
11:00 – 11:30	*Coffee break*	
11:30 – 13:00	**Session 2: Scientific contributions and case studies** • Presentations from work package leaders (WP1–WP5) • Publications: published papers, planned papers, conferences and dissemination activities • Discussion	**All** WP1. adelphi WP2. ECoE / INAT WP3. UPV WP4. TUD WP5. adelphi
13:00 – 14:30	*Lunch break*	
14:30 – 16:00	**Session 3: Stakeholder engagement, MAR agreements and policy recommendations** • MAR agreements status and insights from stakeholders • Policy briefs and future roadmap • Discussion	**All** Cyprus: ECoE Portugal: LNEC Spain: UPV Tunisia: INAT
19:30	*Dinner*	

DAY 2

Venue: Hotel *Houda Yassmine Hammamet*, Hammamet (https://maps.app.goo.gl/PSzWjPZtFmrT2eqm6)

Date: Wednesday, 9 April 2025, 09:00-16:00

Time	Topic	Responsible
09:00 – 10:30	**Session 4: Future research projects and collaboration opportunities** • Synergies with other research projects: 20 min presentations of other (MAR) projects that might be inspiring for future proposals	**All** TUD / LNEC
10:30 – 11:00	*Coffee break*	
11:00 – 13:00	**Continue Session 4** • Future funding prospects: exploring HE, PRIMA, etc., calls • Deepening in one or two specific calls with a possible structure, partners to be involved • Discussion	**All** Present the previously identified relevant calls and discuss how to constitute a consortium and prepare a proposal together

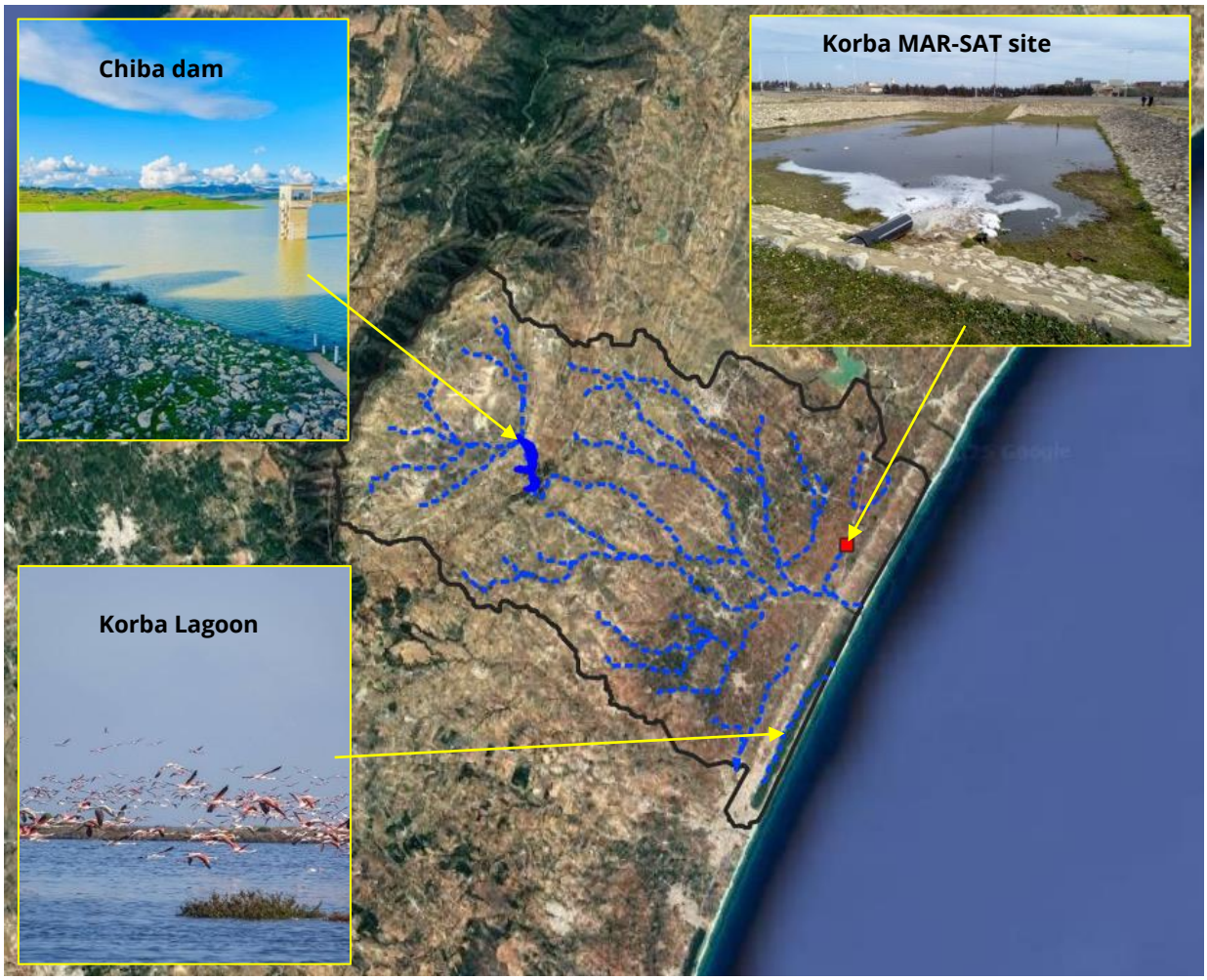
13:00 – 14:00	*Lunch break*	
14:00 – 15:30	**Continue Session 4**	**All**
15:30 – 16:00	**Session 5: Closing and next steps** • Summary of key takeaways • Final remarks & acknowledgments	**All** TUD / INAT
19:30	*Dinner*	

DAY 3

Venue: Korba, Nabeul governorate

Date: Thursday, 10 April 2025, 09:00-16:00

Time	Topic	Responsible
09:00 – 15:00	**Field visit to AGREEMAR pilot site in Korba** • Visit of Korba lagoon • Visit to Korba MAR-SAT site • Visit of Chiba dam • Discussions with local farmers & stakeholders	**INAT** Anis / Khaoula
15:00	*Lunch*	



2 Project meeting

2.1 Session 1: Project achievements

The first session of the meeting was moderated by project coordinator Catalin Stefan (TUD) who provided an overview of the previous meetings and the main achievements of the project, including the list of completed milestones and the published deliverables. As the last project meeting in Hammamet is scheduled very close to the official end of the project, all project outcomes have been already delivered and published in the reports.

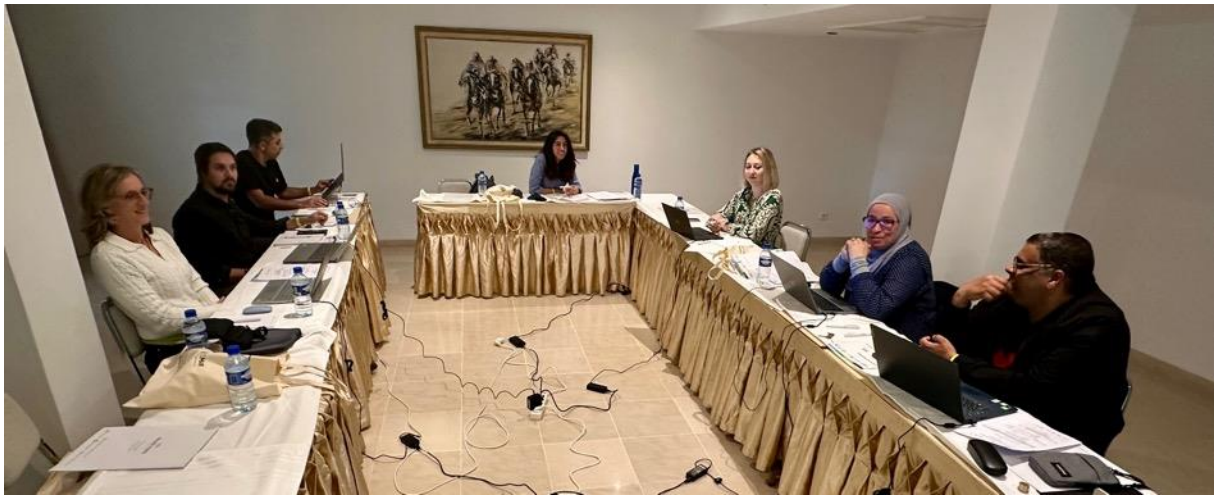


Figure 1. First day of the final project meeting in Tunisia

2.1.1 Key project contributions

The key contributions of the AGREEMAR project were summarised in the following points:

- detailed methodology for stakeholders' engagement
  → mapping, analysis, engagement strategy, tools, etc.
- strengthening the collaboration between researchers and stakeholders
  → co-creation of project outcomes
- sensibilisation of stakeholders on different aspects defining MAR success
  → MAR criteria matrix and mapping process ("warming-up phase" and "the trip is more important than the destination")
- advancing the methodology for MAR feasibility mapping and definition of guiding principles
  → possibly leading to future harmonisation of GIS-MCDA methodology
- multi-scale assessment of MAR impact
  → local (MODFLOW) and regional (AQUATOOL)
- training stakeholders on the use of groundwater models
  → providing direct support tools for decision making (free, non-commercial software)
  → when the stakeholders lack of expertise to participate in the modelling process, interact with them in the model conceptualization phase; they may prove insights that may prove useful for for example, establish boundary conditions (e.g., other sources of information, additional comments on limitation and uncertainty of base data)
- promotion of wastewater reuse for groundwater recharge
  → potential for upscaling (Portugal) and optimisation (Cyprus, Tunisia)
- gently pressuring stakeholders to commit more to MAR development
  → signing of agreements (declarations, chartas, letters of intent etc.).

2.1.2 Potential ideas for improvement

The project team identified also a series of ideas that could further improve the outcomes of the project or that could be used in future joint projects:

- validation of feasibility maps by groundwater models (local demo sites were already pre-selected)
- coupling / integration of modelling tools at local and regional scale (not really a must but potentially very useful)
- testing the exact same methodology at all case studies for comparison purposes (for example, criteria selection, mapping process)
- case studies successfully used as demo sites but more focus on integration of results (lesson learned?)
- exploitation of the upscaling and replication potential of the methods developed
- increase the innovation potential and go beyond conventional demonstration goals
- besides co-creation, define also co-ownership of project outcomes
- develop long-term vision and strategy for the case studies selected (living labs?) and consider consistent follow-up initiatives
- allocate more resources to the development of policy and technical briefs
- document better the reasons for failure to increase transparency and credibility
- consider MAR economics and involve more social aspects (i.e. theory of behaviour change)
- discuss social and economic potential benefits, or inventory them together with the stakeholders, when promoting MAR
- measure the impact of the engagement with the stakeholders (examples of metrics: number of views on the website, modelling tools accessed, LinkedIn connections etc.)
- economic valuation methods can help not only to compare technical solutions or for costs-benefits analysis but also to identify funding mechanisms and schemes that can then boost and support MAR research and implementation
- methods to disseminate the project results to address the needs of stakeholders and communicate project outcomes
- final project meeting should be about 6 months before the end of the project as to fine-tune the last project activities and expected outcomes

2.1.3 Lessons learned

Based on the three years of multi-disciplinary collaboration, a series of do's and don'ts have been drafted, which became an open list that can help the consortium in future projects:

Do	**Pay attention**	**Don't**
• Stakeholders engagement in all project phases • Validation of stakeholders needs and providing useful recommendations • Continued research at the case studies ("living labs") • Include partners on economics (costs-benefits analysis), economic indicators	• Be more concise, provide more practical solutions • Synchronise the engagement with stakeholders to avoid conflicting interests • Potential redundance of thematic layers, integration of economic and social aspects	• Never engage with stakeholders without a good, clear plan and strategy (difficult to build trust, easy to loose it) • Decision making based on evidence, less on perceptions

• Focus more on identification and characterisation of water availability for MAR • MAR can remove perception barriers (i.e. direct use of wastewater) and change water identity • Consultations with stakeholders from the proposal phase • Simple factsheets with project outcomes	• Water value (MAR is competing with other potential uses – especially direct use) • Recognise and be aware of the knowledge of stakeholders and the reality	

2.1.4 Personal learnings

The team conducted an interesting exercise to identify important benefits obtained at personal levels, either new skills or aspects learned from this project and that can be relevant for the future. The list is not exhaustive but provide several ideas received from the project team during the meeting:

- Understanding the stakeholders needs and provide necessary solutions
- Difficulty to define the limit of what to expect from stakeholders
- Better understanding the value, limitations and potential for MAR
- Awareness of potential political impact on the research topics
- Shared responsibility and ownership of the results
- Methodologies to disseminate project results
- Better understanding of MAR solutions
- Awareness of stakeholders knowledge and reality inertia
- Awareness of complex hydrological, social and economic conditions
- Adaptation of case study challenges
- Hydrological and hydrogeological modelling
- Constellation analysis and MAR governance
- Stakeholders mapping and analysis
- The relevance of social and economic dimensions

2.2 Session 2: Scientific contributions and case studies

During session 2, the scientific contributions of the project have been reviewed and discussed, including the project publications, key performance indicators, the project impact and the results at the case studies level. The list of publications resulted from the project includes (up to the date of submission of this report), 9 peer-reviewed articles and 24 conference contributions, with several publications still in preparation or under review. The detailed list of publications is available on the project website at: https://www.agreemar.inowas.com/publications/.

2.3 Session 3: Stakeholder engagement, MAR agreements and policy recommendations

During Session 3, the team discussed the general stakeholder engagement strategy and plan and revised the activities aimed at embedding stakeholders' contributions into the project. The final version of the strategy and plan is due to be published by the end of the project by adelphi, and the consortium discussed the content of the upcoming deliverable report.

Also, the main outcomes of the project, the MAR agreements have been discussed, with agreements being signed so far in Portugal and Cyprus, and on the way to be signed also in Tunisia. In Spain, the text of the

agreements has been discussed in a recent workshop but the document will not be signed by the key stakeholders.

2.3 Session 4: Future research projects and collaboration opportunities

A significant amount of time was dedicated to the identification of opportunities for future collaboration and for the utilisation of project results. A new call for proposal was found and collaborations between consortium members will possibly continue beyond the present project duration.

3 Field trips

On the third day, the project team conducted a field trip to the Tunisian demo site, which included visits to the Korba lagoon, to the Korba MAR site, and to the Chiba dam.

3.1 Korba Lagoon

The eastern fringe of the Cap Bon peninsula hosts a nearly continuous chain of coastal wetlands, including the Korba lagoon, which remains permanently inundated. These wetlands are elongated depressions parallel to the coastline, separated from the sea by narrow dune ridges and sandy beaches. The Korba lagoon is maintained by inflows of treated wastewater, currently discharged by the Korba wastewater treatment plant (WWTP Korba).

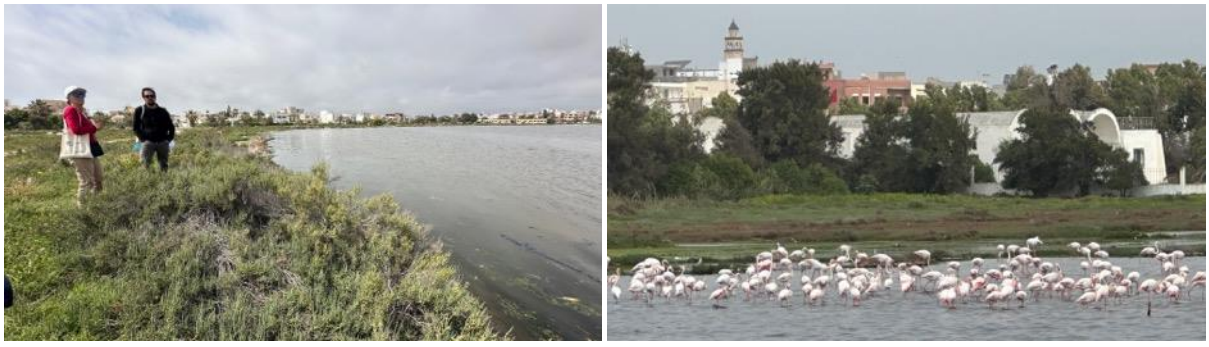


Figure 2. Korba Lagoon

During our meeting with the head of the NGO *Association Tunisienne de Protection de la Nature et de l'Environnement de Korba* (ATPNE-Korba), we discussed the ecological value of the lagoon, which provides essential habitats for halophytic vegetation, amphibians, and especially waterbirds. However, the site faces multiple threats. One of the most pressing concerns is the pollution and poor water quality directly linked to the discharges from WWTP Korba, which affect the ecological health of the lagoon. This is compounded by other pressures, including reduced natural freshwater inflow due to irregular rainfall, seasonal desiccation, urban encroachment, and insufficient public awareness about the site's vulnerability and importance.

The NGO emphasized the need for urgent action, including improving water treatment quality, raising local awareness, and implementing restoration and conservation strategies to safeguard the ecological richness of the lagoon.

3.2 Korba MAR site

The existing MAR site employs a Soil Aquifer Treatment (SAT) system composed of three infiltration ponds, each with an area of 1,500 m², designed to achieve a total recharge rate of 1,500 m³/day. However, the effectiveness of the system in significantly impacting groundwater levels has been limited. This is mainly due to several challenges, including clogging of the infiltration basins, insufficient availability of treated wastewater from the wastewater treatment plant (WWTP Korba), and the relatively small size of the basins. As a result, the MAR site has not been able to reverse the piezometric depression currently observed in the area.

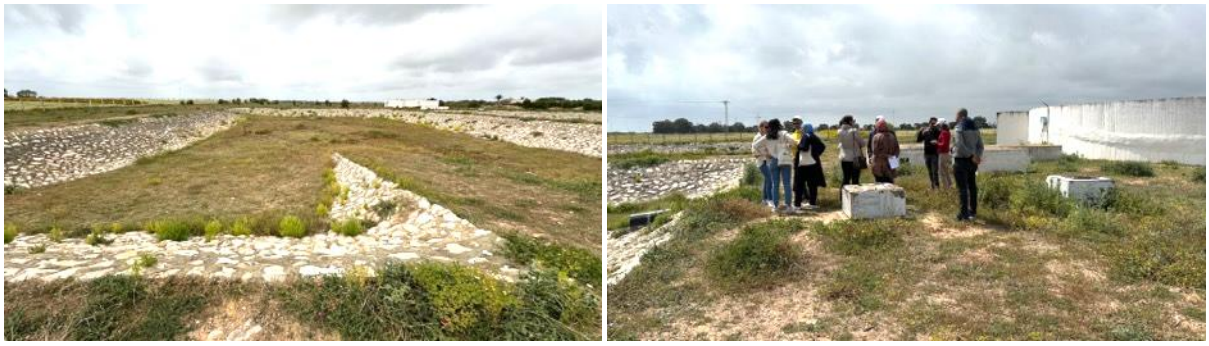


Figure 3. The visit at the Korba MAR site, currently not in operation

These issues highlight the need for improved coordination among stakeholders, including local authorities, the WWTP operators, and water resource managers, to ensure adequate water distribution, maintenance of the system, and long-term sustainability of the recharge operations.

3.3 Chiba dam

The Chiba dam, constructed in 1963, was initially designed for surface water retention to support irrigation in the region. It regulates runoff from an upstream catchment area of approximately 64 km², which remains largely in a natural state. The dam lies upstream of the Korba lagoon, a coastal wetland approximately 8.5 km long and 180 to 320 meters wide, with a surface area that fluctuates between 170 and 210 hectares. The lagoon is separated from the sea by a sandy barrier and is hydrologically connected in the north to the Sidi Othmane wadi via a channel.

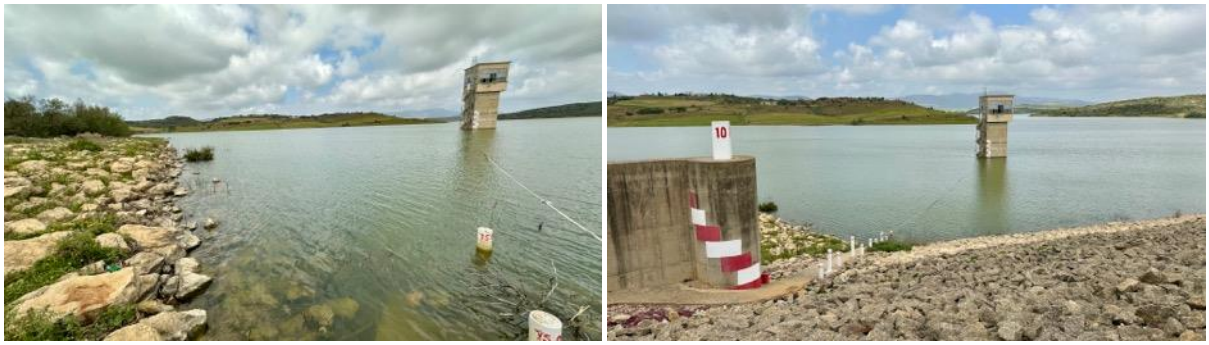


Figure 4. Visit at the Chiba dam

During our recent field visit, despite a prolonged drought period, we observed a small amount of water stored in the dam; however, in previous months, it had been completely dry. This highlights the increasing vulnerability of the system to climate variability and emphasizes the need for adaptive water management strategies.

5 Conclusions

The final AGREEMAR consortium meeting in Hammamet, Tunisia, brought together partners to reflect on achievements, share scientific insights, and consolidate lessons learned after three years of collaboration. The meeting provided a platform to assess the project's contributions to (MAR) development, including stakeholder engagement strategies, feasibility mapping methodologies, and the promotion of sustainable groundwater management practices. Through productive discussions and presentations, the consortium highlighted the project's success in strengthening science-policy-stakeholder interfaces, co-developing MAR agreements, and advancing regional capacity-building. Notable contributions included the harmonization of MAR mapping approaches, support for wastewater reuse in recharge schemes, and the establishment of site-specific governance frameworks. Field visits to the Korba Lagoon, Korba MAR-SAT site, and Chiba Dam offered hands-on perspectives on implementation challenges and opportunities, reinforcing the importance of continued coordination between researchers, water managers, and local communities. Looking ahead, the consortium identified several directions for future collaboration, including enhanced modelling integration, broader socio-economic evaluation, and sustained stakeholder engagement beyond the project's lifetime.

Acknowledgement

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