RESERVOIR

Sustainable groundwater RESources managEment by integrating eaRth observation deriVed monitoring and flOw modelIng Results

PRIMA

GA no. 1924

DELIVERABLE D2.2

Proceedings of the first stakeholder/end-user workshop: including the workshop presentations and Stakeholder requirements list

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Responsible Partner:	UNIPV
Version:	4.0_UNIPV
Date:	30/10/20
Distribution Level (CO, PU)	PU

Acknowledgement

This project has received funding from the Partnership for Research and Innovation in the Mediterranean Area under the European Union's Horizon 2020 research and innovation programme under grant agreement No 1924.

Statement of originality

This document contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

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DOCUMENT REVISION HISTORY

Date	Version	Editor	Comments	Status
1/06/2020	1.0	C.Meisina		Draft
30/09/2020	2.0_CGA	C. Guardiola Albert		Draft
16/10/2020	2.0_UJ	K. Shatanawi		Draft
25/10/2020	2.0_DEU	A. Elçi		Draft
27/10/2020	3.0_UNIPV	R. Bonì, C. Meisina		Draft
28/10/2020	4.0_UA	R. Tomás		Draft
28/10/2020	4.0_DEU	A. Elçi		Draft
28/10/2020	4.0_UA	R. Tomás		Draft
28/10/2020	4.0_DEU	A. Elçi		Draft
28/10/2020	4.0_IGME	C. Guardiola Albert		Draft
29/10/2020	4.0_UA	R. Tomás		Draft
29/10/2020	4.0_CER	T. Letterio		Draft
29/10/2020	4.0_UNIPV	R. Bonì, C. Meisina		Final

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Participant	Name	Country
UNIPV	Università degli studi di Pavia	Italy
UNIPD	Università di Padova	Italy
IGME	Instituto Geológico y Minero de España	Spain
UA	Universidad de Alicante	Spain
DEU	Dokuz Eylul University	Turkey
UJ	The University of Jordan	Jordan

CER	Consorzio di Bonifica di secondo grado per il Canale Emiliano Romagnolo	Italy
RSCN-AWR	Royal Society for the Conservation of Nature - Azraq Wetland Reserve	Jordan

GLOSSARY

Acronym	**Description**
ARPAE	Agenzia regionale per la prevenzione, l´ambiente e l´energia dell´Emilia-Romagna
DSI	State Hydraulic Works, Turkey
EMUASA	Municipal Water and Sanitation Company of Murcia
GRB	Gediz River Basin
MWI	Ministry of Water and Irrigation
RER	Regione Emilia Romagna, Italy
SYGM	General Directorate of Water Management, Turkey

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1. INTRODUCTION, GOAL AND PURPOSE OF THIS DOCUMENT

The aim of RESERVOIR project is to provide new products and services for a sustainable groundwater management model to be developed and tested in four water-stressed Mediterranean pilot sites and then be applicable in other regions via an interdisciplinary approach.

The specific Project Objectives (PO) are the following:

PO1. Develop an innovative methodology for the hydrogeological characterization of large-scale aquifer systems using low-cost and non-intrusive data such as satellite-based Earth Observation (EO) techniques.

PO2. Integrate advanced EO techniques into numerical groundwater flow and geomechanical models to improve the knowledge about the current capacity to store water and the future response of aquifer systems to natural and human-induced stresses.

PO3. Enhance the knowledge about the impacts of agricultural and tourism activities on the water resources by quantifying the ground deformation during the monitored periods.

PO4. Engage water management authorities and provide models for an optimal management of the aquifer systems. We will engage 4 water authorities in 4 different countries through a series of face-to-face workshops. The water authorities will be involved in the conceptualization and design of guidelines for Groundwater Resource Management (GRM). Best practices of water management for agricultural and tourism purposes will be developed taking advantage of the knowledge and methodologies from the outputs of PO1, PO2 and PO3.

PO5. Dissemination and exchange of the generated knowledge among the experts and the managers in charge of land and groundwater management in the pilot sites to strengthen the aquifer resilience.

In order to achieve the objective PO4 the starting point of the RESERVOIR activities is the review of the background of the groundwater governance to identify the groundwater policies and regulation for each pilot site (Task T2.1 - Review of the groundwater regulation in the pilot sites - Task Leader: UNIPV).

The four pilot sites are:

1. The coastal aquifer of Comacchio in Italy;
2. The Alto Guadalentín aquifer in Spain;
3. The alluvial aquifer of the Gediz River Basin in Turkey;
4. The Azraq Wetland reserve in Jordan.

As stated in Deliverable 2.1. each pilot site has specific problems (Table 1.1).

Table 1-1 Details of pilot sites.

Pilot site name	Area (km^2)	Aquifer geology and type classification	Primary water usage	Main issues
COASTAL ACQUIFER OF EMILIA-ROMAGNA REGION (Italy)	1,055	Sedimentary Multi-layered aquifer system	Irrigation/drinking water	• saltwater intrusion in the phreatic aquifer; • natural and anthropogenic land subsidence; • land reclamation drainage systems; • soil salinization; • high demand of water during the peak tourist season; • insufficient aquifer recharge and sea level rise.
ALTO GUADALENTÍN BASIN (Spain)	273	Detrital, Sedimentary Multi-layered aquifer system	Irrigation / Drinking water	• over-exploitation; • high groundwater demand to sustain the most important economical wealth in the area; • groundwater pollution due to agriculture; • semiarid climate (insufficient recharge); • subsidence due to groundwater extraction.
GEDIZ RIVER BASIN (Turkey)	17,034	Alluvial aquifer	Irrigation / Drinking water	• over-exploitation of groundwater • unbalanced reliance on groundwater use • groundwater pollution and deterioration due to agriculture, interaction with polluted river water and geothermal water influence
AZRAQ WETLAND RESERVE (Jordan)	12,700	Complex aquifer systems ranging from quaternary deposits to deep sandstone aquifer complexes	Irrigation / Drinking water	Over-abstraction of groundwater

This deliverable presents the work description and results of the task T2.2 - *Development of a Stakeholder and end-user group and establishment user requirements for each pilot site*. In this task, a large number of stakeholders was involved in order to create an internationally proficient group, which will help to address the RESERVOIR activities.

The engagement of the stakeholders in each pilot site is aimed to:

(i) discuss the research gaps with regard the sustainable groundwater management through interviews with the local authorities, farmers and technicians and to perform user requirements analysis through direct distribution of the questionnaires,
(ii) present them the preliminary requirements identified through review undertaken in Task 2.1 and get their feedback,
(iii) disseminate the project objectives by starting a framework for communication and collaboration during the lifetime of the project.

1.1. Stakeholder engagement strategy

The Stakeholder engagement strategy developed by the RESERVOIR Consortium has the objective to overcome the limitations due to the impossibility to organize face-to-face meetings during a global pandemic. In particular, the methods that have been used to engage and/or consult with each of the stakeholder groups identified in Section 2, are:

- Interviews with stakeholder representatives and key informants implemented for each pilot site by e-mail and phone calls,
- RESERVOIR questionnaire developed by the RESERVOIR Consortium and translated into the mother tongue of the countries of each pilot site (Italian, Spanish, Turkish and Arab),
- Webinars organized in Italy and in Spain,
- Workshop organized in Jordan,
- Inception remote meeting via Google Meet for key stakeholders.

The content of the RESERVOIR questionnaire is as follows:

1) Which are the most relevant issues in your area:
    - saltwater intrusion in the phreatic aquifer;
    - natural and anthropogenic land subsidence;
    - land reclamation drainage systems;
    - soil salinization;
    - insufficient aquifer recharge;
    - sea level rise;
    - over-exploitation of groundwater;
    - high groundwater demand to sustain the most important economical wealth in the area;
    - groundwater pollution due to agriculture
    - other……

2) Which are the most relevant issues in your area related to groundwater management tools with particular regard to
   a) Technical instruments (e.g. surveying, groundwater quantity and quality monitoring and modelling, other diagnostic analyses);
   b) Managerial and planning instruments (e.g. land use and spatial planning, environmental impact assessment, groundwater protection zoning, definition of responsibilities and roles of various groundwater resources management entities);
   c) Regulatory instruments (e.g. groundwater property and rights, well licensing and registering, drilling accreditation, water legislation);
   d) Economic instruments (e.g. groundwater pricing, environmental taxes, tradable rights and groundwater markets).

3) Are there key data or information missing or highly uncertain in your area that interfere with the ability to manage groundwater effectively?
   - Groundwater levels (elevations)
   - Groundwater extraction data (pumping)
   - Surface water supply
   - Total water use
   - Change in groundwater storage
   - Water budget
   - Sustainable yield
   - Land subsidence data
   - Seawater intrusion
   - Water quality data
   - Recharge areas
   - Recharge potential
   - Climate forecasts
   - Groundwater-dependent ecosystems
   - Climate change effects
   - Other - please describe _____

4) How adequate do you consider the monitoring coverage in your area for groundwater decision-making purposes?
   4.1. Groundwater elevations
   Monitoring frequency (how often you collect these data) ……..
   Geographic representation (coverage of the data you collect) ……
   4.2. Water quality
   Monitoring frequency (how often you collect these data) ……
   Geographic representation (coverage of the data you collect) ……..

   * Very Inadequate, Mostly Inadequate, Somewhat Inadequate, Neither Adequate nor Inadequate, Somewhat Adequate, Mostly Adequate, Very Adequate

5) Does the area use one or more groundwater models? Which model (or model code) is (primarily) used?

……
……

6) For which applications is this model used?
   - o Long-term water planning
   - o Land-use planning
   - o Water budget
   - o Streamflow depletion
   - o Contaminant tracing
   - o Groundwater extraction planning
   - o Recharge planning
   - o Subsidence prediction and planning
   - o Environmental impact studies
   - o Other - Please specify _____

7) Which RESERVOIR topic(s) is/are of interest to you?
   - o Earth Observation (EO) products (ground deformation maps, mapping of subsiding areas and Subsidence Risk Index)
   - o methodology for hydrogeological characterisation using EO,
   - o advanced EO-based geomechanical model to quantify the aquifer storage,
   - o estimation of the water management index,
   - o scenarios to detect the optimal timing and quantity of groundwater abstraction for irrigation purposes and wetland protection,
   - o Guidelines for Groundwater Resource Management (GRM).

8) What would your motivation be to get engaged in RESERVOIR project?
   - o to stay informed about current activities of RESERVOIR
   - o to obtain up-to-date information for concrete decision-making
   - o to participate in studies in RESERVOIR
   - o to define relevant questions and research gaps
   - o to make research results available to a broader audience
   - o other, please specify:

9) At what stage of a research project would you be most interested to get involved? (multiple answers possible)
   - o development of the project plan
   - o data collection
   - o data analysis
   - o interpretation of results
   - o dissemination of results
   - o other, please specify:

10) How would you best be involved in a research project? (multiple answers possible)
    - o regular updates about the project (e.g. through a newsletter)
    - o annual meetings
    - o regular workshops
    - o digital tools: video conferences, shared documents and folders, etc.
    - o personal dialogues with project individuals
    - o participating in field work
    - o other, please……

11) Any other comments?

……
……
……..

Personal details
First name and last name:
Affiliation:
City and Country:
E-mail address:
Phone number:

2. LIST OF STAKEHOLDERS FOR EACH PILOT AREA

Who are the stakeholders? To answer these questions, the consortium drew up a list of the parties involved. The list of stakeholders may be updated during the course of the project when new interested individuals or organizations emerge.

The type of institutions has been classified as:

- Governmental organizations at the municipal, regional and country levels
- National and local authorities responsible for water and land use management
- Environmental Agency
- Water supply companies
- Non-profit relief organizations, including NGOs, United Nations, World Bank and also the European Commission
- Private civil engineering organizations
- Organizations involved in the development of GIS maps
- Insurance companies
- Research organizations including our Expert/Advisory Group members
- Regulatory institutions
- Other

2.1. THE COASTAL AQUIFER OF COMACCHIO, ITALY

The stakeholder engagement for the pilot site of the coastal aquifer of Comacchio, in Italy has been performed by one to one interviews, a first webinar via Google Meet with Regione Emilia Romagna and by a webinar via Google Meet on July 16th for all stakeholders. More than 15 entities have been invited at the webinar of July 16th. In this webinar, the aims and the expected impact of the RESERVOIR have been presented. Additional details about the organization of the webinars are provided in the section 2.1. Table 2.1. shows the list of the stakeholder invited at the webinar of July 16th. Among the stakeholder, the entities that have compiled the RESERVOIR questionnaire are highlighted in grey colour.

Table 2-1 List of Stakeholders.

Stakeholder /end user			Institutional e-mail (when available)
ID	**Name**	**Type (*)**	
1	Regione Emilia Romagna Direzione Generale Cura del territorio e dell'ambiente Servizio Geologico, Sismico e dei Suoli	Local Authorities (regional)	

2	RER Servizio tutela e risanamento acqua aria e agenti fisici della Regione Emilia-Romagna	Local Authorities (regional)	Ambpiani@Regione.Emilia-Romagna.it
3	ARPAE FERRARA Servizio Autorizzazioni e concessioni a Ferrara	Environmental Agency	
4	COMUNE DI FERRARA - Settore Pianificazione Territoriale	Governmental organizations at the municipal level	segr.sindaco@comune.fe.it
5	COMUNE DI COMACCHIO - Settore Territorio, Sviluppo Economico / Lavori Pubblici, Patrimonio, Demanio ed Ambiente	Governmental organizations at the municipal level	sindaco@comune.comacchio.fe.it
6	COMUNE DI CODIGORO Settore Ambiente, verde e rifiuti	Governmental organizations at the municipal level	segreteriasindaco@comune.codigoro.fe.it
7	COMUNE DI GORO Settore Area Tecnica	Governmental organizations at the municipal level	
8	COMUNE DI LAGOSANTO Settore LAVORI PUBBLICI, PATRIMONIO e MANUTENZIONE – AMBIENTE E TERRITORIO	Governmental organizations at the municipal level	
9	COMUNE DI MESOLA –Settore Edilizia, urbanistica e ambiente	Governmental organizations at the municipal level	Sindaco@comune.mesola.fe.it
10	CONSORZIO DI BONIFICA PIANURA DI FERRARA	Local Authorities	info@bonificaferrara.it
11	ENTE PARCO DELTA DEL PO	Local Authorities	parcodeltapo@cert.parcodeltapo.it
12	Regione Emilia Romagna - Direzione Generale Cura del territorio e dell'ambiente - Servizio Geologico, Sismico e dei Suoli	Local Authorities (regional)	
13	Consorzio di Bonifica Pianura di Ferrara	Local Authorities (regional)	
14	ARPA ER	Local Authorities (regional)	

15	Consorzio di Bonifica di Secondo Grado per il Canale Emiliano Romagnolo	Local Authorities (regional)	
16	Dipartimento di Ingegneria Civile, Chimica, Ambientale e dei Materiali - Università di Bologna	Particular interest	
17	Società Agricola Produzioni Orticole Benazzi	Farmer	
18	Azienda Agricola Visentini, Codigoro, Ferrara	Farmer	
19	Consorzi di Bonifica Delta del Po ed Adige Po	Local Authorities (regional)	
20	Consorzio di Bonifica Adige Euganeo di Este	Local Authorities (regional)	

2.2. THE ALTO GUADALENTÍN AQUIFER, SPAIN

The stakeholders have been engaged by inviting more than 200 entities and particulars who potentially could be interested in the RESERVOIR project to participate in a webinar performed on July 13th via Google Meet. In this webinar the main activities, characteristics, and objectives of the RESERVOIR project in the Alto Guadalentín were presented. This webinar, and the degree of participation, are described in detail in section 2. The list of stakeholders in the Alto Guadalentín pilot site is given in Table 2.2. Stakeholders included in the list does not included all assistants to the webinar, but only those who answered the questionnaires released at the end of the webinar. Among all stakeholders, the most related to the groundwater management of the Alto Guadalentín aquifer, due to its affection, relation, or knowledge, are highlighted with grey colour in Table 2.2. In any case, this list is not considered finished neither closed, as in the future additional entities or particulars may show their interest in the project and be included in the list.

Table 2-2 List of Stakeholders in the Alto Guadalentín aquifer.

Stakeholder /end user			**Institutional e-mail (when available)**
ID	**Name**	**Type (*)**	
1	Confederación Hidrográfica del Segura (Hydrografic Confederation of the Segura River)	Authority responsible for water management (**national/regional**)	oficina.planificacion@chsegura.es
2	Comunidad de regantes de Totana (Community of irrigators of Totana)	Irrigators association (**local**)	crtotana@trasvasetajosegura.org
3	Comunidad de regantes de Lorca (Community of irrigators of Lorca)	Irrigators association (**local**)	info@cr-lorca.es
4	EMUASA (Municipal Water and Sanitation Company of Murcia)	Water suppy company (**local**)	aguas@emuasa.es

5	AQUATEC, projects for the water sector (SUEZ)	Environmental engineering consulting company	
6	SUEZ	Environmental engineering consulting company	
7	INTECSA	Environmental engineering consulting company	general@intecsa-inarsa.es
8	Eduardo Lupiani Moreno	Environmental engineering consulting company	
9	WWF España	Non profit environmetal organization	aguascont@wwf.es
10	Diputación de Alicante	Authority responsible for water management (**regional**)	ciclohidrico@gmail.com
11	University of Alicante	Particular interest	
12	Miguel Hernández University	Particular interest	
13	Politecnic University of Valencia	Particular interest	
14	Complutense University of Madrid	Particular interest	
15	Instituto Geológico y Minero de España	Particular interest	
16	Asociación para la protección del acuífero Alto Guadalentín	Particular interest	
17	UDLAP	Particular interest	
18	Detektia Earth Surface Monitoring S.L.	Particular interest	

2.3. THE GEDIZ RIVER BASIN, TURKEY

Table 2-3 List of Stakeholders.

Stakeholder /end user			Institutional e-mail (when available)
ID	**Name**	**Type (*)**	
1	General Directorate of Water Management (SYGM)	Governmental at the country level	
2	General Directorate of State Hydraulic Works (DSI)	Governmental at the country level	
3	2nd Regional Directorate of State Hydraulic Works (DSI)	Governmental at the regional level	
4	Izmir Regional Directorate of ILBANK, Inc.	Governmental at the regional level	
5	Izmir Provincial Directorate of Environment and Urbanisation	Governmental at the regional level	
6	Manisa Provincial Directorate of Environment and Urbanisation	Governmental at the regional level	

7	Izmir Water and Sewerage Administration (IZSU)	Local authority responsible for water management and supply	
8	Manisa Water and Sewerage Administration (MASKI)	Local authority responsible for water management and supply	
9	Manisa Organized Industrial District (MOSB)	Industrial consumer	
10	Atatürk Organized Industrial District (AOSB)	Industrial consumer	
11	Salihli Organized Industrial District	Industrial consumer	
12	Kemalpaşa Organized Industrial District	Industrial consumer	
13	International Agricultural Research and Training Center (UTAEM)	Research organization	
14	Tübitak Marmara Research Center	Research organization	
15	Chamber of Environmental Engineers	NGO	
16	Chamber of Civil Engineers	NGO	
17	Chamber of Geological Engineers	NGO	
18	Dokuz Eylul University, Department of Geological Engineering	Research organization	
19	Dokuz Eylul University, Department of Civil Engineering	Research organization	
20	Dokuz Eylul University, Department of Geophysical Engineering	Research organization	
21	Izmir Institute of Technology, Department of Civil Engineering	Research organization	
22	Ege University, Department of Civil Engineering	Research organization	
23	Izmir Katip Çelebi University, Department of Civil Engineering	Research organization	
24	Celal Bayar University, Department of Civil Engineering	Research organization	
25	Ata İnşaat Mimarlık Mühendislik-Salihli Ltd.Şti.	Private company	
26	JEFSON Jeofizik Mühendislik ve Sondaj Hizmetleri Ltd.Şti.	Private company	

2.4. THE AZRAQ WETLAND RESERVE, JORDAN

Table 2-4 List of Stakeholders.

Stakeholder /end user			Institutional e-mail (when available)
ID	**Name**	**Type (*)**	
1	Ministry of Water and Irrigation (MWI)	National authority (policy makers)	
2			
3			
4			
5	Ministry of Environment	National authority (policy makers)	
6			
7	Ministry of Agriculture	National authority (policy makers)	
8	Ministry of Tourism and Antiquities	National authority (policy makers)	
9	Miyahuna Company/ Amman	Water supply company	
10	Myahuna Company/ Zarqa	Water supply company	
11	Aqaba Water Company	Water supply company	
12	Jordanian Engineers Association	Civil society organization	
13	Jordanian Geologists Association	Civil society organization	
14	Royal Society for the Conservation of Nature	Civil society organization	
15			
16	The University of Jordan	Research and academic organizations	

3. MEETING WITH STAKEHOLDERS

Once the stakeholders have been identified the consortium has to answer the following questions:

1. What is their role in the project?
2. What do they need? What are their expectations?
3. How important is the project to them?
4. What is their power and impact on the project?
5. What are their priorities?

In order to answer these questions, in task T2.2. workshops for each pilot site were planned to be organized during month 4 of the project. The main goal was also to discuss the research gaps with regard the sustainable groundwater management through interviews with the local authorities, farmers and technicians and to perform user requirements analysis.
The specific aims of the workshops should have been the following:

(i) to present the project, its objectives, activities and outputs;
(ii) to perform user requirements analysis through direct distribution of the questionnaires to answer the questions described above;
(iii) to present them the preliminary requirements identified through review undertaken in Task 2.1 and get their feedback.

The COVID-19 pandemic measures (lockdown, travel restrictions, social distancing and other measures adopted to limit the spread of the virus) have impeded most of the physical meetings. The project had to adapt to new ways of working. Therefore, information has been collected through:

- one-to-one interviews;
- online meeting with stakeholders.

Example of invitation letter for the online meetings are reported in the Annex 1.

A workshop took place at the University of Jordan on September 9, 2020, where stakeholders from different ministries, organizations, and companies in Jordan attended and participated effectively.

3.1. THE COASTAL AQUIFER OF COMACCHIO, ITALY

A first inception remote meeting has been organized to involve Regione Emilia Romagna (RER) in the RESERVOIR activities. The inception meeting was organized via Google Meet on 9th April, 2020 by UNIPV and UNIPD. The invited participants were 12 by including RER and CER. During this meeting RER communicated the recent installation of a piezometer to monitor the groundwater level at Goro-Gorino in proximity of an assestimeter, that is a tool to monitor in depth the ground deformation. The in-situ monitoring system data will be provided by RER.

The on-line meeting with the stakeholder for the pilot site of the coastal aquifer of Comacchio (Italy), was performed on 16th July. The webinar was organized by UNIPV, UNIPD and CER. First of all, more than 15

entities have been contacted by phone, then an email was sent to invite the stakeholders (see the Annex 1) by sharing the link of the webinar (link meet.google.com/fti-wzyf-imr). The record for the meeting is saved in Google Drive RESERVOIR and has been shared with the stakeholders. The aims of the webinar were:

I. Introduce the RESERVOIR goal;
II. Understand the interest for the project
III. To explore future further collaborations.

Furthermore, a document about the RESERVOIR presentation was shared with the stakeholders.

The meeting started on time at 10 am. The convener for the meeting was Prof. Claudia Meisina (University of Pavia), who firstly talked introducing the RESERVOIR project. The meeting was designed for a total length of 1 h, including the time for the roundtable.

The list of contents for the meeting was as follows:

- **10:00 h.** RESERVOIR project presentation. Claudia Meisina, University of Pavia.
- **10:05 h.** Description of the Italian pilot site. Claudia Meisina, University of Pavia.
- **10:17 h.** Stakeholder engagement of the municipalities through the RESERVOIR questionnaire. Roberto Genovesi, CER.
- **10:20 h.** Description of the RESERVOIR questionnaire. Roberta Bonì, University of Pavia.
- **10:29 h.** Presentation of the ARPA ER activities and interest for the RESERVOIR products. Marco Marcaccio, ARPA ER.
- **10:35 h.** Data collection for the GPS station. Claudia Meisina, University of Pavia.
- **10:38 h.** Problematic issue related to the groundwater extraction data for the pilot site because are pumping rate for irrigation purposes. Marco Marcaccio, ARPA ER.
- **10:39 h.** Description of the available estimated irrigation data. Roberto Genovesi, Canale Emiliano Romagnolo.
- **10:43 h.** Available data of ARPA ER network and question about the hydrogeological modelling. Andrea Chahoud, ARPA ER.
- **10:47 h.** Issue related to the modelling of the Italian pilot site. Pietro Teatini, University of Padova.
- **10:53 h.** Availability of the displacement rates at the assestimiter of Goro, Gorino. Necessity to disentangle and quantify the different components of the land subsidence. Luisa Perini, Direzione Generale Cura del territorio e dell'ambiente, Servizio Geologico, Sismico e dei Suoli.
- **10:56 h.** Necessity to verify the archive of the wells licensed for agricultural purposes. Paolo Severi, Regione Emilia Romagna, Direzione Generale Cura del territorio e dell'ambiente, Servizio Geologico, Sismico e dei Suoli.
- **11.02 h.** Interest of the CER to evaluate the contribution of the shallow groundwater management to mitigate the effect of the salinization and to the land subsidence rate. Tommaso Letterio, CER.
- **11.08 h.** Necessity to use the satellite-based maps to identify local study areas for the Italian pilot site. Pietro Teatini, University of Padova.
- **11.15 h.** Suggestion to evaluate the different components of the surface movements using the land cover information. Luisa Perini, Regione Emilia Romagna, Direzione Generale Cura del territorio e dell'ambiente, Servizio Geologico, Sismico e dei Suoli.

- **11.22 h.** Final conclusions. Claudia Meisina, University of Pavia.

During the RESERVOIR project presentation, led by Prof. Claudia Meisina, the stakeholders were able to understand the project aims, the proposed methodology and the expected outcomes.
Then, RESERVOIR online questionnaire (Figure 3.1.) was presented to describe the compilation of the interviews in order to engage the stakeholders.

Figure 3-1 Print screen of question 1 of the questionnaire developed for the Comacchio pilot site stakeholders.

After 38 minutes of presentation, a roundtable was opened to understand the interests and suggestions from the audience. The stakeholders discussed the lack of groundwater extraction data for the pilot site, in which the data are estimated and not directly measured.

Then, the stakeholders gave insight about the complexity to quantify the different contribution of the surface movements in order to disentangle the component of land subsidence due to different processes. Therefore, the topic of the discussion moved to address solutions to take into account of this suggestion.
The roundtable finished after 30 min of fruitful discussion.

3.2. THE ALTO GUADALENTÍN AQUIFER, SPAIN

On July 13th 2020 took place the meeting with the stakeholders for the study area of the Alto Guadalentin aquifer (Spain). The list of stakeholders for this study area is included in section 1.2 of the present document. Due to restrictions for personal meetings related with the COVID-19 pandemic the meeting was developed online in the Google Meet platform (link meet.google.com/tnm-yoyw-tzp). The record for the meeting is saved in the servers of the University of Alicante, from where it can be downloaded through the following link: https://vertice.cpd.ua.es/225186 and will be available through the webpage of the project. Some screenshots showing some of the presentations during the webinar for the Alto Guadalentín pilot are reported in the Annex 2.

The meeting started on time at 11 am. The convener for the meeting was Dr. Valdes-Abellan (University of Alicante), who firstly talked introducing the meeting, the legal considerations and the list of contents. The meeting was organized as a sequence of short presentations focused on different parts of the RESERVOIR project and the research topics. The meeting was designed for a total length of 2 hours, but it took some extra time due to the roundtable extended more than the expected, showing the interest of the assistants and stakeholders in the project and its results.

The list of contents for the meeting was as follows:

- **11:00 h**. **Presentation 1.** RESERVOIR project presentation. Roberto Tomás Jover, University of Alicante.
- **11:10 h**. **Presentation 2.** The Alto Guadalentin aquifer. Concepción Pla Bru, University of Alicante.
- **11:20 h**. **Presentation 3.** Groundwater resources management in the Alto Guadalentin aquifer. José Manzano Cerón, Head of the Hydraulic Public Domain Management Area. Guadalquivir Hydrographic Confederation.
- **11:30 h**. **Presentation 4.** Subsidence in the Alto Guadalentin valley. Roberto Tomás Jover, University of Alicante.
- **12:40 h**. **Presentation 5.** Monitoring strategy in the Alto Guadalentin. Pablo Ezquerro Martín, Spanish Geological Survey.
- **12:50 h**. **Presentation 6.** MODFLOW groundwater model of the Alto Guadalentin aquifer. Pablo Ezquerro Martín, Spanish Geological Survey.
- **13:00 h**. **Presentation 7.** Modelling application for the water management improvement. Carolina Guardiola-Albert, Spanish Geological Survey.

- **13:10 h**. **Presentation 8.** Participation in the RESERVOIR project. Carolina Guardiola Albert, Spanish Geological Survey.
- **13:20 h**. Open roundtable. Javier Valdés Abellán (convener), University of Alicante.

In the first presentation, led by Dr. Tomás, the assistants were able to know about the project and its features. The different partners along Europe and Asia, all the pilot areas and the main objectives of the project were exposed and explained.

The presentations number 2, 3 and 4 aimed to explain the pilot area of the Alto Guadalentin for a general public. First, the aquifer itself was described by Dr. Pla, highlighting the geology context and the main figures for its water balance. Following, J. Manzano explained the groundwater resources management of the aquifer, describing the most important users and final use of the water resources. It is worthy to highlight that the speaker J. Manzano does not belong to the RESERVOIR project team, but it belongs to the Segura River Authority which is the administration in charge of the water management in the area, and because of that, one of the most important stakeholders in the region. Finally, presentation 4, led by Dr. Tomás, exposed the problem of land subsidence in the region, providing some very basic numbers to seize the magnitude of the subsidence in the Alto Guadalentín. The information was completed with temporal data series of the most important indicators such as the groundwater level and the subsidence rate.

Presentations 5 and 6, led by Dr. Ezquerro, focused on more sophisticated features such as the monitoring strategy in the pilot area regarding subsidence with both on-site and satellite sources of information. In presentation 6, Dr. Ezquerro showed the existing groundwater model for the pilot area, highlighting the most important results that could be obtained to support groundwater management decisions.

The applications and usefulness of a calibrated groundwater model was explained to the audience by Dr. Guardiola-Albert in presentation 7. She showed the advantages and the importance of using such tools for groundwater management, especially in arid regions where water demands are high and even higher than sustainable limits.

Finally, in presentation 8, Dr. Guardiola-Albert, introduced all the possibilities to participate in the project. She introduced and explained the content of the questionnaire that would be passed to all participants and stakeholders after the webinar to be completed by the RESERVOIR meeting assistants. Afterwards, she also introduced the possibility of stakeholders to get involved in the project under different perspectives. For instance, from being updated with the last news and results to proposing topics of interest and potential use for the expected results from the RESERVOIR project.

After 1 hour and 50 minutes of presentations, a roundtable was opened to listen to and received comments and ideas from the audience. The stakeholders were interested in the subsidence ratio and its temporal evolution which shows a reduction in the rate during the last years. Following the chronological order, the discussion moved to the effects of the subsidence and the hypothetical recuperation of the surface level if the water management modifies and the groundwater level arises. Dr. Tomás explained that there are two ranges of subsidence: one that can be recovered and other that cannot, according to the elastic or inelastic

domains of the subsidence. Finally, the most important topics considered in the roundtable also evaluated the inclusion of the subsidence phenomenon as an additional factor in the groundwater management and the inclusion of limitations in some uses in the legal structure of the water demand in the region. The roundtable finished after 40 min of fruitful discussion.

The questionnaire was developed in Google Forms as it is a free tool which allowed to easily get summary statistics of the answers (Figure 3.2.). Participants were asked to accept the data protection and privacy policies included in the form. In addition, participants who answered the questionnaire were contacted by email or telephone to better delineate the main working lines of RESERVOIR project.

Figure 3-2 Print screen of question 1 of developed for the Alto Guadalentín stakeholders the questionnaire

3.3. THE GEDIZ RIVER BASIN, TURKEY

The questionnaire used by all partners of the consortium was translated into Turkish (Figure 3-33.3.) and one question was added to the original line of questions. The added question is question number 9 asking whether the participant has previous knowledge about groundwater flow modeling. Furthermore, some answer options in the questionnaire were slightly modified to adapt to local conditions in the Gediz River Basin (GRB).

The questionnaire was transformed into an online form using Google Forms (**Errore. L'origine riferimento non è stata trovata.**3.4.). The link to the online questionnaire was sent with an e-mail introducing the project and the objectives of the questionnaire study to 101 individuals who represent institutions, organizations, universities, and companies, which are in some way involved in water management issues of the GRB. A visual presentation of the project details was prepared (DOI: 10.13140/RG.2.2.26214.65604) and attached to the e-mail introducing the project and the questionnaire. The presentation contents were objectives and scope of the project, motivation of the study, key information about project partners, explanations of project work packages, and expected outcomes of the project. After distributing the questionnaire e-mails along with the project presentation, some key stakeholder members were contacted by telephone to emphasize the importance of their contribution to the project and encourage their participation in the questionnaire. The distribution took place from October 11th to October 14th, 2020. Answers to the questionnaire were accepted until October 16th, 2020.

31 individuals out of 101 potential stakeholder members responded to the online questionnaire. The respondents were mostly affiliated with governmental institutions, research organizations, and universities comprising of 17 entities. The list of represented stakeholders is provided in Section 2.3 of this deliverable and results of the questionnaires reported in Sections 4.1.3, 4.2.3, 4.3.3, and 4.4.3.

RESERVOIR
questionnaire

RESERVOIR

Sustainable groundwater RESources managEment by integrating eaRth observation deriVed monitoring and flOw modellng Results

PRIMA

GA no. 1924

RESERVOIR

STAKEHOLDERS QUESTIONNAIRE

(PAYDAŞ ANKETİ)

RESERVOIR Project – GA no. 1924

RESERVOIR
Questionnaire (Turkish)

1) Bölgenizde yeraltı suyu ile en çok ilgili olduğunu düşündüğünüz sorunlar nelerdir?

- Yeraltı suyunun fazla çekilmesi
- Doğal veya yapay nedenlerle zemin çökmesi/oturması
- Toprak tuzlanması
- Bölgedeki ekonomik faaliyetlerin sürdürülebilmesi için yüksek yeraltı suyu talebi
- Yetersiz yeraltı suyu beslenimi
- Yüzeysel akifere tuzlu su girişimi
- Arazi ıslahı için drenaj sistemlerin olması
- Tarım nedeniyle yeraltı suyu kirlenmesi
- Diğer nedenlerden dolayı yeraltı suyu kirlenmesi
- Diğer – lütfen belirtiniz …

2) Bölgenizde yeraltı suyu yönetimine ilişkin en önemli sorunların hangi araçlara olduğunu düşünüyorsunuz?

a) Teknik araçlar (örn. arazi ölçümleri, yeraltı suyu miktarının nicel ve nitel olarak izlenmesi ve modellenmesi, diğer tanı/teşhisle ilgili analizler)
b) Yönetim ve planlama araçları (örn. arazi kullanımı ve mekânsal planlama, çevre etki değerlendirmesi, yeraltı suyu koruma alanlarının oluşturulması, çeşitli yeraltı suyu yönetim kurum/kuruluşların sorumluluk ve görevlerinin tanımlanması)
c) Mevzuat araçları (örn. yönetmelikler, yeraltı suyu sahipliği ve hakları, kuyu ruhsatları ve kayıt, sondaj izinleri)
d) Ekonomi araçları (örn. içme ve kullanma suyunun fiyatlandırılması, su ve çevre ile ilgili vergiler, tarımsal sulama suyunun kullanımı ile ilgili masraflar)

3) Aşağıdakilerden hangisinde, bölgenizdeki yeraltı suyunun etkili yönetimini zorlaştıran önemli veri veya bilgi eksikliği/belirsizliği vardır?

- Yeraltı suyu seviyesi (derinliği)
- Yeraltı suyu çekim verisi (pompaj verisi)
- Yerüstü su (göl, baraj gölü, gölet, akarsu) arzı
- Toplam su tüketimi
- Yeraltı suyu rezervindeki değişim
- Su bütçesi
- Sürdürülebilir verim
- Zemin çökmesi (oturması) verisi
- Tuzlu su girişimi
- Yeraltı su kalitesi verisi
- Yeraltı suyunun beslendiği alanlar
- Yeraltı suyu beslenim miktarı
- İklim/Hava tahminleri
- Yeraltı suyuna bağlı ekosistemlerin/yaşam alanların varlığı
- Diğer – lütfen ifade ediniz _____

RESERVOIR Project – GA no. 1924 2

RESERVOIR
Questionnaire (Turkish)

4) Bölgenizde yeraltı suyuna ilişkin karar verme amaçlı yürütülen gözlem çalışmalarının yeterliliğini nasıl değerlendirirsiniz?
4.1. Yeraltı Suyu Seviye Gözlemleri
- Gözlem sıklığı (ölçümlerin hangi zaman aralıkları ile yapıldığı)
- Coğrafi temsili (ölçümlerin mekânsal kapsamı)

4.2. Yeraltı Suyu Kalite Gözlemleri
- Gözlem sıklığı (ölçümlerin hangi zaman aralıkları ile yapıldığı
- Coğrafi temsili (ölçümlerin mekânsal kapsamı)

* Çok yetersiz, genellikle yetersiz, biraz yetersiz, ne yetersiz ne de yeterli, biraz yeterli, genellikle yeterli, çok yeterli

5) Yeraltı suyu akım modelinin ne olduğunu biliyor musunuz?
- Evet
- Hayır

6) Bölgeniz için kullanılan bir yeraltı suyu akım modeli var mı? Hangi model (model programı) kullanılmaktadır?
- Evet, model adı…
- Hayır
- Bilmiyorum

7) Bölgeniz için geliştirilmiş yeraltı suyu akım modeli hangi amaçla kullanılmaktadır?
- Uzun dönem su planlaması
- Su bütçesinin belirlenmesi
- Akarsu akışındaki eksilmenin belirlenmesi
- Kirletici taşınımının izlenmesi
- Yeraltı suyu çekim planlanması
- Yeraltı suyu besleniminin planlanması
- Oturmayı öngörme ve önlem alma
- Çevresel etki değerlendirme çalışması
- Arazi kullanım planlaması
- Bilmiyorum
- Diğer – lütfen belirtiniz ….

8) Hangi RESERVOIR konusu/konuları ilginizi çekmiştir?
- Uydudan Yer Gözlem (YG) ürünleri (zemin deformasyon haritaları, çökme/oturma olan alanların haritalanması, zemin oturması risk indeksi)
- YG ile hidrojeolojik nitelendirme yaklaşımı
- Yeraltı suyu rezerv miktarını belirlemek için ileri YG-tabanlı geomekanik modeller
- Su yönetim indeksinin tahmin edilmesi
- Sulama amaçlı yeraltı suyu çekiminin en uygun miktar ve zamanlamasının tespiti için senaryoların oluşturulması
- Yeraltı suyu yönetimi için yönergelerin geliştirilmesi

9) RESERVOIR projesi ile nasıl bir ilginiz olmasını istersiniz?
- RESERVOIR'daki güncel etkinlikler hakkında bilgilenmek
- Kesin karar verme sürecinde kullanabileceğimiz en güncel bilgiyi alabilmek
- RESERVOIR çalışmalarına katılmak
- Araştırılması gereken konuları ve araştırma sorularını tanımlamak

RESERVOIR Project – GA no. 1924 3

RESERVOIR
Questionnaire (Turkish)

- RESERVOIR araştırma sonuçlarının daha geniş kitlelere yaygınlaşmasını sağlamak
- Diğer – lütfen ifade ediniz _____

10) Projemizin en çok hangi aşaması ile ilgilenmek isterdiniz?
(çoklu cevap verilebilir)
- Proje çalışma planının geliştirilmesi
- Veri toplanması
- Veri analizi
- Sonuçların yorumlanması
- Sonuçların yaygınlaştırması
- Diğer – lütfen belirtiniz ….

11) Bir araştırma projesine nasıl en iyi şekilde dâhil olabilirsiniz?
(çoklu cevap verilebilir)
- Proje ile ilgili düzenli bilgi alarak (örn. bir haber bülteni ile)
- Yıllık toplantılara katılarak
- Düzenli çalıştaylara katılarak
- Dijital araçları kullanarak: video konferanslar, çevrimiçi paylaşılan raporlar ve bilgiler
- Proje çalışanları ile doğrudan iletişim kurarak
- Saha çalışmalarına katılarak
- Diğer – lütfen belirtiniz ….

12) Diğer görüş ve önerileriniz:
……
……
……
……
……
……
……

Kişisel bilgiler
Adı Soyadı:
Kurum/Kuruluş:
Adres:
E-posta adresi:
Telefon numarası:

RESERVOIR Project – GA no. 1924 4

Figure 3-3 Turkish version of stakeholder questionnaire.

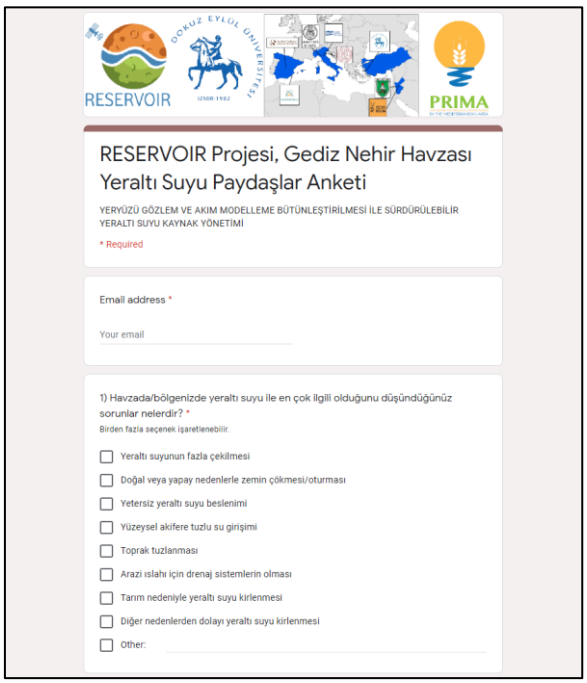

Figure 3-4 Screenshot of the initial section of the online GRB stakeholder questionnaire.

3.4. THE AZRAQ WETLAND RESERVE, JORDAN

A workshop took place at the University of Jordan on September 9, 2020, where stakeholders from different ministries, organizations, and companies in Jordan attended and participated effectively. This workshop aimed primarily identify the research gaps and feedback from the perspective of the stakeholders. A brief introduction on RESERVOIR project was presented to the attendees along with the project's methodology, and the expected outcomes. The workshop was interactive in nature where participants engaged in discussions with each other and the presenters. Towards the end of the workshop, a questionnaire was distributed to the attendees and the responses were analyzed afterwards. A summary of the key findings of the stakeholder engagement workshop and questionnaire are shown under the sections 4.1.4., 4.2.4., 4.3.4., and 4.4.4. The agenda and pictures of the workshops in Jordan, and screenshot of the on-line webinar for the Italian and Spanish pilot sites are reported in the Annex 2.

4. STAKEHOLDERS REQUIREMENTS

4.1. Main problems in the area in the groundwater management

4.1.1. THE COASTAL AQUIFER OF COMACCHIO, ITALY

In the coastal aquifer of the Comacchio pilot site (Italy), the analysis of the compiled RESERVOIR questionnaire gives insight about two major issues affecting the site that are the natural and anthropogenic land subsidence and the saltwater intrusion in the phreatic aquifer (Figure 4.1.). An important issue is also the soil salinization that is a relevant problem mainly pointed out by the farmers of the study area. 11% of the stakeholder reports the problem of the sea level rise, being localized in proximity of the Adriatic coastline. The entities involved in the monitoring of the groundwater resources of the study area signaled the problem of groundwater quality related to deep percolation of pollutants from agricultural areas (7%).
It's worth noting that local authorities report also the problem related to the high groundwater demand to sustain the most important economical wealth in the area and the lack of preparation against the climate change effects. Minor issues are related to the land reclamation drainage systems (4%) and insufficient aquifer recharge (2%).
The overview of the stakeholder considerations gives insight about how different actors engaged in the RESERVOIR project pointed out different problems all related to the sustainable groundwater management.

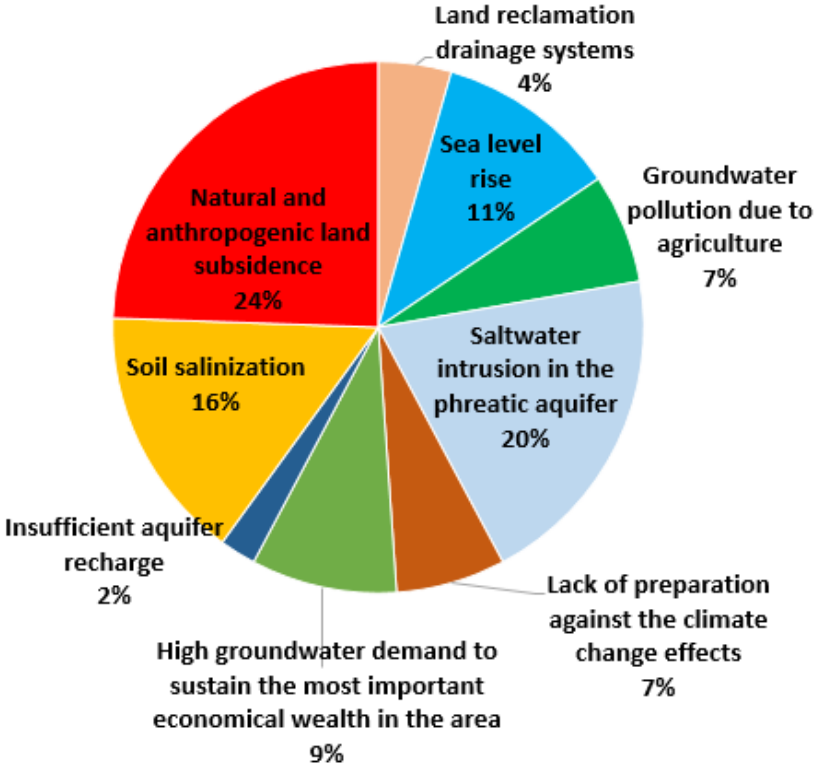

Figure 4-1 Main problems detected by stakeholders in the coastal aquifer of the Comacchio pilot site.

Regarding the groundwater management tools, the stakeholder interviews give insight about the lack of managerial and planning instruments and the technical instruments (Figure 4.2.).

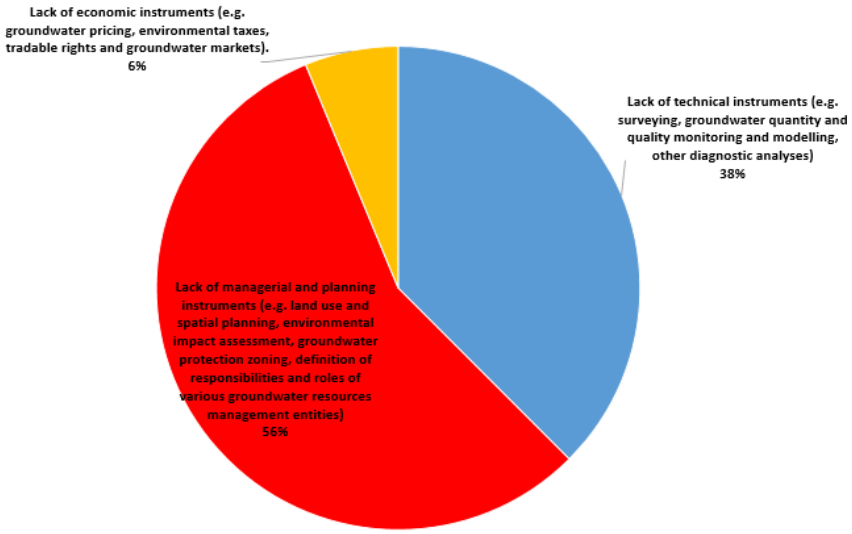

Figure 4-2 Most relevant issues related to groundwater management tools in the coastal aquifer of the Comacchio pilot site.

As far as the key data missed is concerned, the stakeholders reported that there is the lack of data for the water budget in the aquifer and about the groundwater extraction (Table 4.1). The local authorities of the study area highlight that the available data are values estimated and not measured. Indeed, the groundwater demand for irrigation is estimated considering the size of the cultivated area and the type of crops. Furthermore, the exact location of the extraction wells is missing. 17% of the stakeholders reported the lack of data about the climate changes effects and the seawater intrusion. Among the stakeholders, the technicians reported the lack of change in groundwater storage data. The stakeholder indicated also missed data for the surface water supply and irrigation rates, land subsidence data and recharge areas (Table 4.1).

Table 4-1 Key data missed in the coastal aquifer of the Comacchio pilot site.

	%
Groundwater extraction data (pumping)	17%
Surface water supply and irrigation rates	6%
Water budget in the aquifer	**22%**
Change in groundwater storage	11%
Land subsidence data	6%
Seawater intrusion	17%
Recharge areas	6%
Climate change effects	17%

Further considerations

Some key stakeholders were personally contacted (by phone) to develop an active and effective cooperation aimed to identify the major problems of the pilot site. With respect to **the main problems in the area related with the groundwater management**, the following conclusions have been drawn from these contacts:

- The main problems identified by the stakeholder are the natural and human-induced land subsidence and the seawater intrusion of the phreatic aquifer.
- The problem of the seawater intrusion of the phreatic aquifer affects the agriculture activities. Seawater intrusion causes a deterioration of groundwater quality and the farms cannot use the groundwater resources for irrigation due to the high salinity. Therefore, there is the necessity to deeply understand the interaction between the freshwater and saltwater.
- The problem of the land subsidence is mainly identified by some municipalities localized along the coastline. In particular, the municipalities of Goro-Gorino reports damage along the quayside due to land subsidence phenomena. Therefore, further investigations are necessary to understand the predisposing and triggering factors of land subsidence of this area.

4.1.2. THE ALTO GUADALENTÍN AQUIFER, SPAIN

Stakeholders considered that the principal problem in the area of the Alto Guadalentín aquifer is the over-exploitation of groundwater (Figure 4.3.). This consideration constitutes a real fact caused by the agricultural development occurred in the area, mainly concentrated in the last decades of the XX century (CHS 2007). In 2015 overexploitation was estimated in 22.2 hm^3/year (CHS 2015). Additionally, stakeholders considered that groundwater pollution due to agriculture returns is a major problem, which has been also recognized and officially declared by the Segura Hydrographic Demarcation (SHD), the organism responsible for the management of the water resources in the area. After these two most important problems, stakeholders also identified problems related to land subsidence, insufficient aquifer recharge, high groundwater demands to sustain the most important economic activity in the area, lack of preparation against climate change and problems related to public gardens watering (Figure 4.3.).

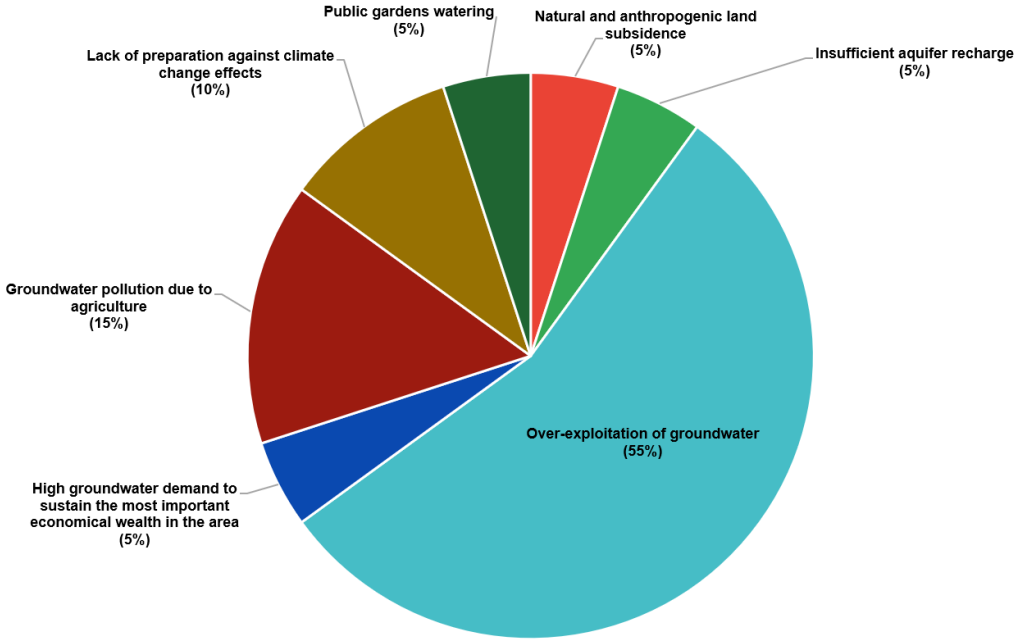

Figure 4-3 Main problems detected by stakeholders in the Alto Guadalentín aquifer.

Groundwater management tools are essential for decision makers to solve problems in the groundwater management. Regarding this topic, stakeholders highlighted that in the Alto Guadalentín aquifer the lack of managerial, planning, and technical instruments are the most relevant issues (Figure 4.4.). The lack of regulatory instruments which control groundwater property and rights, well licensing and registering and drilling accreditation needs also to be considered.

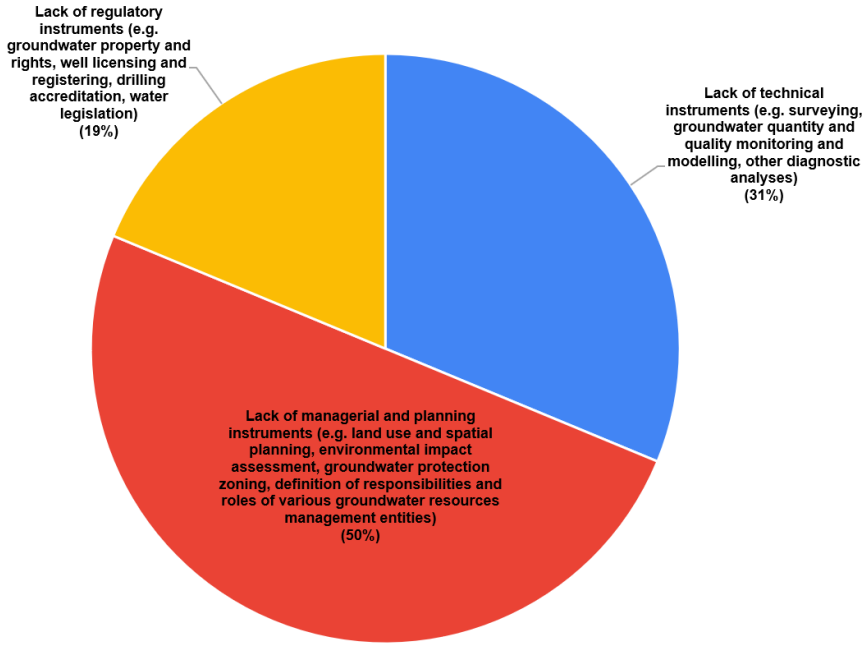

Figure 4-4 Most relevant issues related to groundwater management tools in the Alto Guadalentín aquifer.

This lack of managerial, planning, technical and regulatory instruments could be the consequence of a lack of well-organised key data, which allow an effective groundwater management. For instance, the majority of stakeholders (45%) considered that the principal missed information relates to groundwater extraction data (Table 4.2.). The lack of data about water quality was also reported by stakeholders (10%). Stakeholders also missed information about groundwater levels, surface water and irrigation rates, water budget, sustainable yield, land subsidence, recharge areas, and climate change and forecasts (Table 4.2.).

Table 4-2 Key data missed in the Alto Guadalentín aquifer.

	%
Groundwater levels (elevations)	5
Groundwater extraction data (pumping)	**45**
Surface water supply and irrigation rates	5
Water budget in the aquifer	5
Sustainable yield	5
Land subsidence data	5
Water quality data	10
Recharge areas	5
Climate forecasts	5
Climate change effects	5
Other	5

Further considerations

Some stakeholders were personally contacted (by phone or email) to further develop concrete lines of action within the project and to enhance their engagement with the RESERVOIR project-based on the questionnaires results. With respect to **the main problems in the area related with the groundwater management**, the following conclusions have been drawn from these contacts:

- Currently the water supply to the population is guaranteed.

- Although the main problem identified by the stakeholders is the overexploitation of the aquifer, it is considered that the quantitative problem of chemical contamination is equally important. In this pilot case, there is a rare phenomenon that is the intrusion of the waters of a deep aquifer with reducing waters, caused by the decrease in the piezometry. On the other hand, the nitrate problem, which is of the first magnitude in accordance with EU guidelines, cannot be minimized, and mitigation measures for this problem should be considered (e.g. reduction of water application for irrigation).

- The measures taken in the past have not been sufficient to reverse the state of overexploitation of the aquifer. These measures have been: (i) substitution of groundwater urban supplies with other origins, (ii) reduction of leaks, (iii) no increase in irrigated areas, (iv) irrigation efficiency, (v) flow meter installation, (vi) use of wastewater, (vii) use of desalinated water, (viii) piezometric and chemical control.

- Some of these management measures could be strengthened in the next planning cycle:
    - Regeneration of waste urban waters for irrigation
    - Increase irrigation efficiency, although this measure has been recently questioned (Perry et al. 2017).
    - Reduction of leaks in water distribution networks.
    - Reduction of the volume groundwater extracted from the Alto Guadalentín aquifer in accordance with the available reservoir and limit crops that are incompatible with the sustainability of the aquifer. This requires a design of policies aimed at reducing the weight of the agricultural sector based on the consumption of non-renewable water resources. Effective implementation of these policies requires social consensus and short-term implementation of these policies.
    - One alternative way to manage the overexploitation and contamination could be to fix a minimum piezometric level.
    - Control of subsidence caused by groundwater extraction is a new restriction to be incorporated into groundwater planning. This is of interest in the whole Segura River catchment because urgent actions taken in the drought plans do not consider the geotechnical and subsidence problems that can be triggered by new pumps.

- The technical tools that should be introduced or improved are:
    - Currently, the SHD controls 90% of extractions with satellite image interpretation methodologies by assigning different consumptions to controlled crops. There is not information on the amount of extractions controlled by flow meters, although it may not exceed 40% of the total volume. This control should reach 100% in order to perform optimal aquifer management. Furthermore, one proposal could be that these data were free and public.
    - Improving the piezometric and chemical monitoring network at real time (see section 3.2.2. for more information), and: (i) join this information with the management tool which stablishes the allowed extractions quantities, (ii) disseminate this information, and (iii) make it easily available for the public.
    - Improving information about the existence (or not) of illegal wells.
    - Conducting a complete hydrogeological characterization of the Alto Guadalentín aquifer and disseminate their results.
    - Modeling water quantity and quality and disseminate the results.
    - Studying of alternatives for the use of other resources.
    - Modeling plan and leak management in pressure water networks.
    - Developing a wastewater reuse project in sewage treatment plants.
    - Developing territory planning instruments and environmental and socio-economic impact estimates.

4.1.3. THE GEDIZ RIVER BASIN, TURKEY

In the first question of the questionnaire, stakeholders of the Gediz River Basin were asked what the most relevant problem in their area or the basin. They were allowed to select multiple answers. The most prevalent problem was the over-exploitation of groundwater, which was selected by 87 % of the stakeholders who participated in responding to the questionnaire. 71 % of the stakeholders considered groundwater pollution due to agricultural activities a relevant problem for the basin. Insufficient aquifer recharge and groundwater pollution due to other reasons were viewed as problems by 42% of the respondents. One of the other reasons mentioned was the contamination of groundwater by industrial and/or domestic wastewater discharges and leakage from sewer lines. Furthermore, one-third of the stakeholders believe that land subsidence is of concern in the Gediz River Basin. At this point, it should be noted that some of the stakeholders might not be directly affected by any of the suggested problems, in particular by land subsidence. Therefore, land subsidence might have been considered as a local issue rather than a widespread issue that affects the entire basin. Similarly, seawater intrusion in the phreatic aquifer is viewed as a relevant problem by 29% of the stakeholders. Issues such as soil salinization and land reclamation drainage systems received marginal responses. The issue of high groundwater demand to sustain economic activities in the area was not considered an important issue by any of the participants. A few stakeholders added other problems as relevant for their areas. These are unmanaged urbanization, environmental impacts of industrial areas, and the absence of wastewater treatment plants or their intermittent operations. A summary of the results for this question is shown in Figure 4.5.

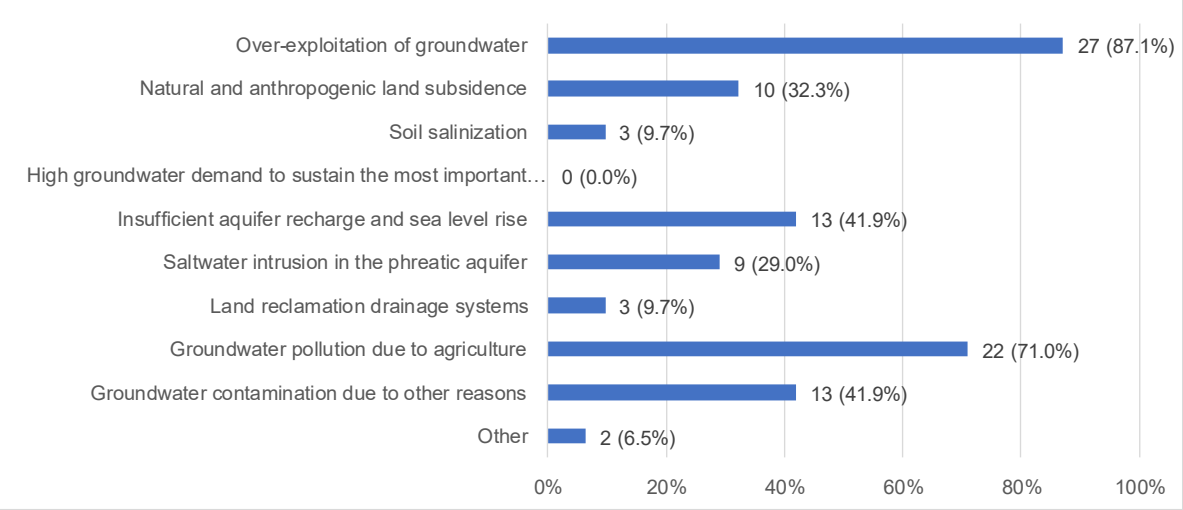

Figure 4-5 Most relevant problems in the GRB or the area according to stakeholders.

Concerning the most relevant issues related to various groundwater management tools, issues with respect to managerial and planning tools stood out with 52% of all stakeholders (Figure 4.6.). 19% of stakeholders consider technical instruments to have the most important problems. Similarly, problems related to regulatory instruments were viewed as important by 19% of the respondents. Economic instruments were considered as a problem by only 10% of the stakeholders. It is likely that economic instruments were thought

irrelevant for the Gediz River Basin since some instruments such as groundwater pricing and tradeable rights are not implemented in Turkey.

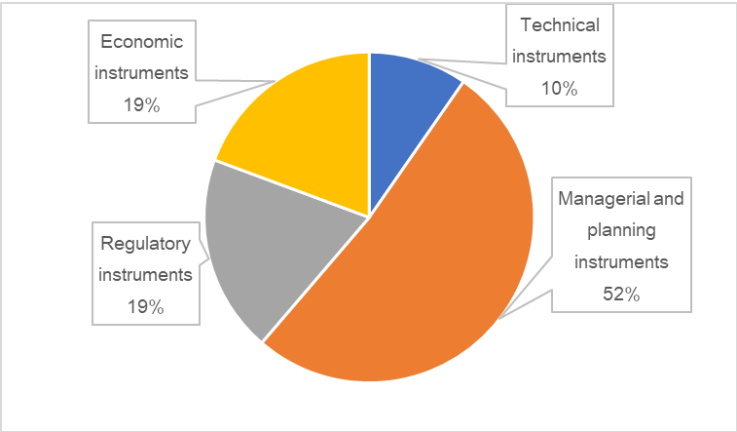

Figure 4-6 Most significant problems in the GRB related groundwater management tools.

The stakeholders were asked which concepts related to groundwater management lack information or have uncertainty in the data. Multiple selections of answers were possible. Most of the stakeholders (71 %) report groundwater extraction data, i.e. information about the amount of groundwater that is pumped out of the aquifer as lacking or uncertain in the Gediz River Basin. Also, about half of the stakeholders believe that uncertainty in information related to the total water consumption, changes in groundwater storage and water budget interfere with the ability to manage groundwater. The lack of information about groundwater recharge (areas and potential) is another issue identified as significant by 42 % of the stakeholders. The least uncertainty or lack of information was considered to be about land subsidence data (13 %) and climate forecasts (16 %). It is interesting to note that one stakeholder mentioned political influences as a challenge in groundwater management. Responses to this question by the participated stakeholders are illustrated in Figure 4.7.

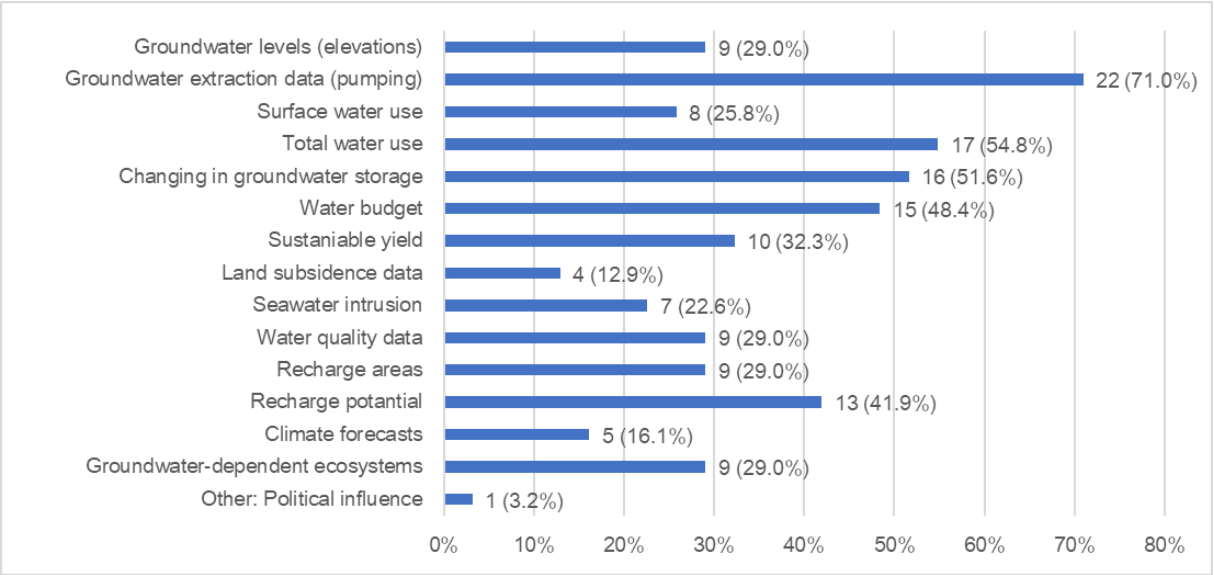

Figure 4-7 Missing or uncertain information interfering with the ability to manage groundwater in the GRB effectively.

4.1.4. THE AZRAQ WETLAND RESERVE, JORDAN

The questionnaire encompassed three questions which tackled the main groundwater problems in the target regions; namely the most relevant groundwater and groundwater management tools issues and the data scarcity and insufficiency in each region. According to the stakeholders, the most concerning groundwater issues in the Azraq Basin are the over-exploitation of groundwater and the high groundwater demand to sustain the most important economical wealth in the area. These two issues were selected equally by 53% of the respondents as the most pressing groundwater issues. The other important issues which were selected by the respondents are the insufficient aquifer recharge and sea level rise, groundwater pollution due to agriculture, and saltwater intrusion in the phreatic aquifer. The soil salinization, decision making in groundwater management, and water policies issues were of little significance while the natural and anthropogenic land subsidence and the land reclamation drainage systems were not recognized as relevant issues in the Azraq Basin. A summary of the most relevant issues in the Azraq Basin area (question 1 of the questionnaire) is presented in the accompanying Table 4.3. and Figure 4.8.

Table 4-3 The most relevant issues in the Azraq Groundwater Basin.

Question	Frequency (votes)	Percentage*
saltwater intrusion in the phreatic aquifer	3	20%
natural and anthropogenic land subsidence	0	0%
land reclamation drainage systems	0	0%
soil salinization	1	7%
insufficient aquifer recharge and sea level rise	5	33%
over-exploitation of groundwater	8	53%
high groundwater demand to sustain the most important economical wealth in the area	8	53%
groundwater pollution due to agriculture	4	27%
Other: surface water (rainfall issues), water policies, management plants, decision making	2	13%

* The percentage was calculated based on sample size = 15.

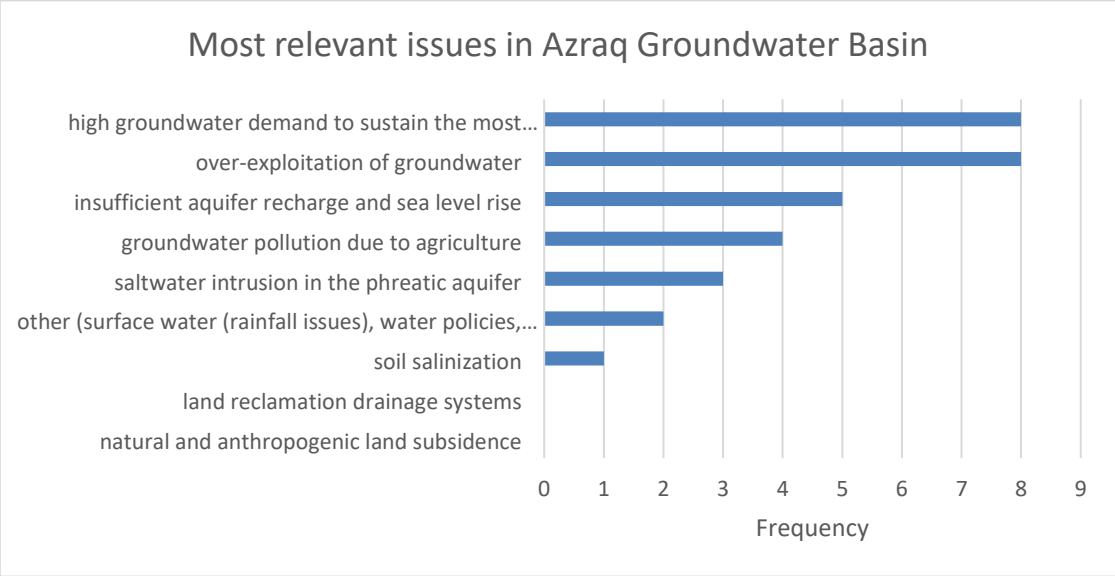

Figure 4-8 Most relevant problems in the Azraq Groundwater Basin according to stakeholders.

The questionnaire also addressed the most relevant issues pertaining to groundwater management tools in the study areas. The majority of participants believed that the technical instruments (e.g. surveying, groundwater quantity and quality monitoring and modelling, other diagnostic analyses) is the key issue in groundwater management tools in the Azraq Basin. Managerial and planning instruments (e.g. land use and spatial planning, environmental impact assessment, groundwater protection zoning, definition of responsibilities and roles of various groundwater resources management entities) and regulatory instruments (e.g. groundwater property and rights, well licensing and registering, drilling accreditation, water legislation) have also been acknowledged as core issues. Nevertheless, the economic instruments (e.g. groundwater pricing, environmental taxes, tradable rights and groundwater markets) and operation and maintenance of groundwater resources were of little significance from the stakeholders' perspectives. A summary of the most relevant issues in groundwater management tools in the Azraq Basin area (question 2 of the questionnaire) is presented in the accompanying Table 4.4 and Figure 4.9.

Table 4-4 The most relevant issues in groundwater management tools.

Question	Frequency (votes)	Percentage*
Technical instruments (e.g. surveying, groundwater quantity and quality monitoring and modelling, other diagnostic analyses)	7	47%
Managerial and planning instruments (e.g. land use and spatial planning, environmental impact assessment, groundwater protection zoning, definition of responsibilities and roles of various groundwater resources management entities)	6	40%
Regulatory instruments (e.g. groundwater property and rights, well licensing and registering, drilling accreditation, water legislation)	6	40%
Economic instruments (e.g. groundwater pricing, environmental taxes, tradable rights and groundwater markets)	2	13%
Other (operation and maintenance for groundwater resources)	2	13%

* The percentage was calculated based on sample size = 15.

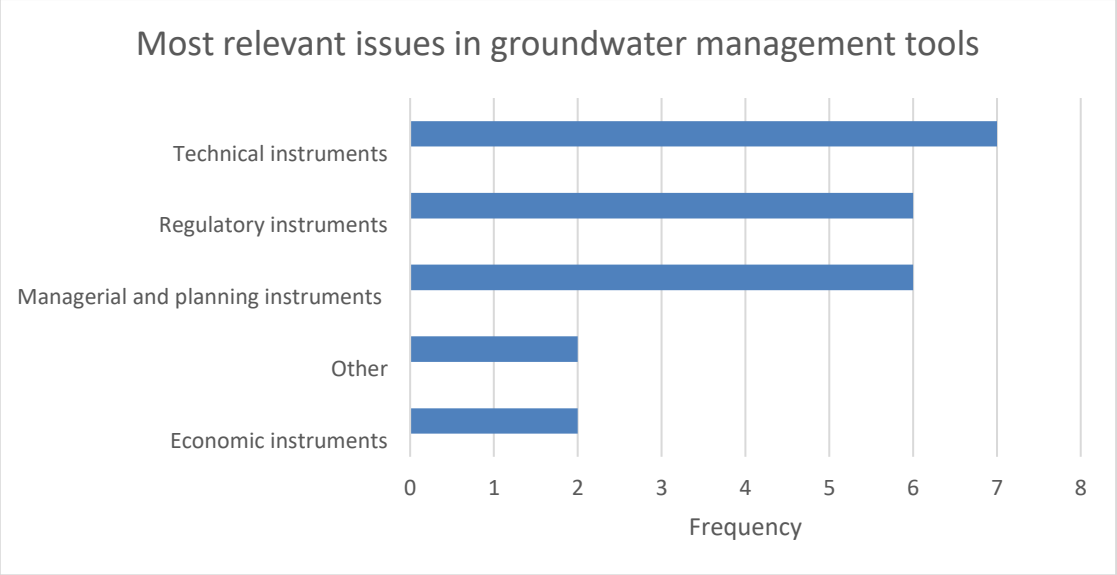

Figure 4-9 Most significant problems in the Azraq Groundwater Basin related groundwater management tools.

Finally, the stakeholders were asked for their opinion on the missing and uncertain groundwater management data by selecting one or more data categories with key gaps and major uncertainties. It was inferred that there is a major deficiency and uncertainty in the groundwater-dependent ecosystems, water quality data, and climate forecasts data categories. On the other hand, there is a moderate deficiency in groundwater extraction, change in groundwater storage, water budget, sustainable yield, recharge areas, and recharge potential yield data categories. The stakeholders also believed that data deficiency and uncertainty is minor in groundwater levels, surface water supply, seawater intrusion, and the rechargeable surface water data categories and insignificant in the total water use and land subsidence data categories. A

summary of the uncertain and missing groundwater management data in the Azraq Basin area (question 3 of the questionnaire) is presented in the accompanying Table 4.5 and Figure 4.10.

Table 4-5 Uncertain and missing groundwater management data in Azraq Basin.

Question	Frequency (votes)	Percentage*
Groundwater levels (elevations)	2	13%
Groundwater extraction data (pumping)	3	20%
Surface water supply	1	7%
Total water use	0	0%
Change in groundwater storage	3	20%
Water budget	3	20%
Sustainable yield	3	20%
Land subsidence data	0	0%
Seawater intrusion	1	7%
Water quality data	5	33%
Recharge areas	3	20%
Recharge potential	3	20%
Climate forecasts	5	33%
Groundwater-dependent ecosystems	6	40%
Other (rechargeable surface water amounts)	1	7%

* The percentage was calculated based on sample size = 15.

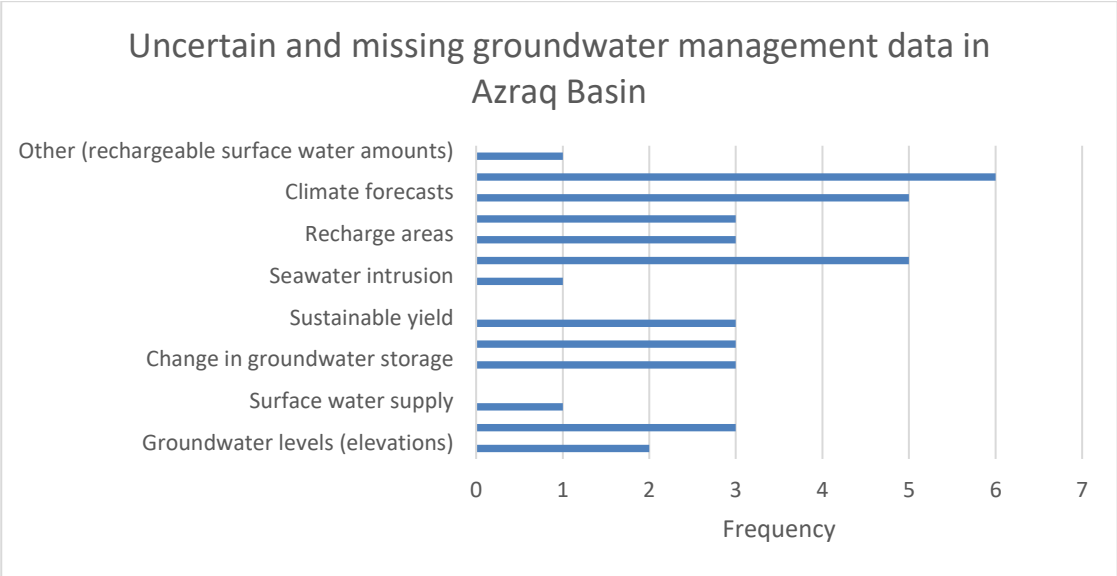

Figure 4-10 Uncertain and missing groundwater management data in Azraq Basin.

4.2. Adequacy of existing monitoring

4.2.1. THE COASTAL AQUIFER OF COMACCHIO, ITALY

Stakeholders' opinion about the groundwater elevations and water quality monitoring shows that the acquired data are neither adequate and inadequate both considering the frequency of the acquisitions and the points spatial distribution. The water quality monitoring points spatial distribution shows the higher percentage of stakeholders reporting inadequate data (Figure 4.11.). None of the respondents assesses that the monitoring of the groundwater level variation and water quality is very adequate, except one stakeholder that defined the frequency of the water quality monitoring as very adequate.

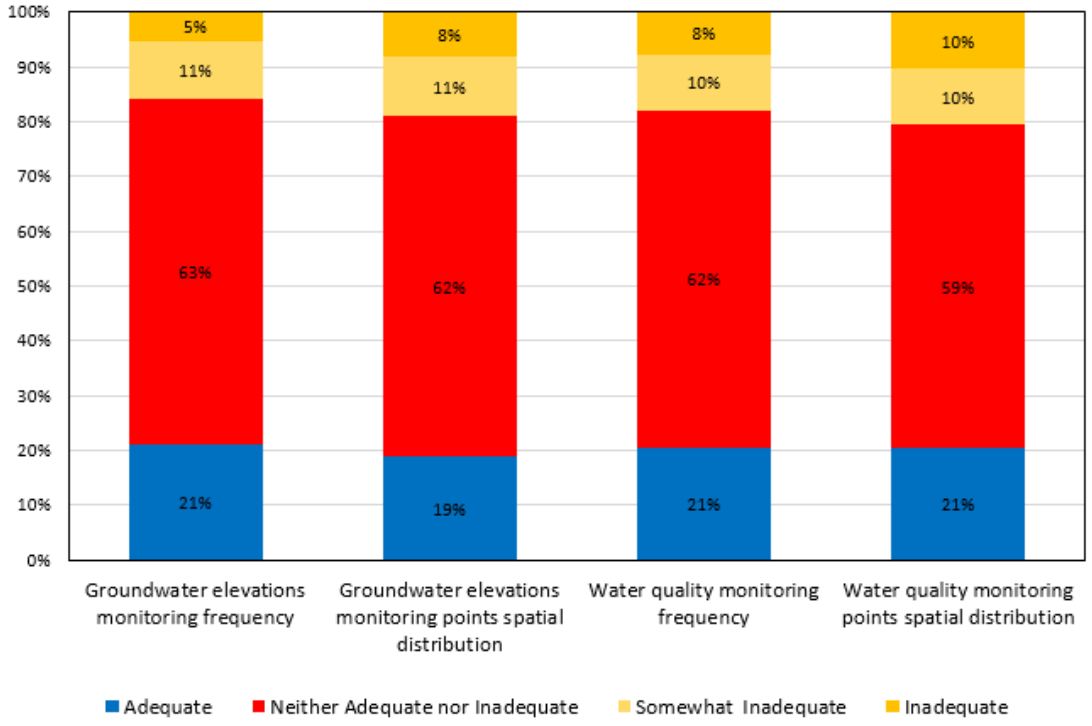

Figure 4-11 Adequacy of the monitoring coverage in the Comacchio coastal aquifer.

Further considerations

The entities which are involved in the groundwater monitoring (CER, ARPA ER, RER) have been involved as key stakeholders for the Comacchio coastal aquifer pilot site and were personally contacted (by phone or email). During the interviews, the adequacy of existing monitoring was discussed and difficulties have emerged from the definition of the adequacy or inadequacy of the monitoring. In fact, there are no benchmarks to evaluate the adequacy of the groundwater monitoring network both considering the frequency and the point spatial distribution, such as the piezometers density considering the extension of the monitored area. Therefore, efforts will be made to address this issue and this topic will be included in the guidelines for Groundwater Resource Management (GRM) that will be developed within WP7.

4.2.2. THE ALTO GUADALENTÍN AQUIFER, SPAIN

Stakeholders' opinion about the adequacy of the monitoring coverage for decision-making purpose in the study area points to an inadequate spatial distribution of both groundwater elevations (50%) and water quality (55%) monitoring points. However, stakeholders mostly consider adequate the monitoring frequency of piezometry (45%) and have doubts about the water quality measurement frequency (40% consider that the frequency is neither adequate or inadequate, 40% consider that the frequency is inadequate and 20% consider that the frequency is adequate) (Figure 4.12.).

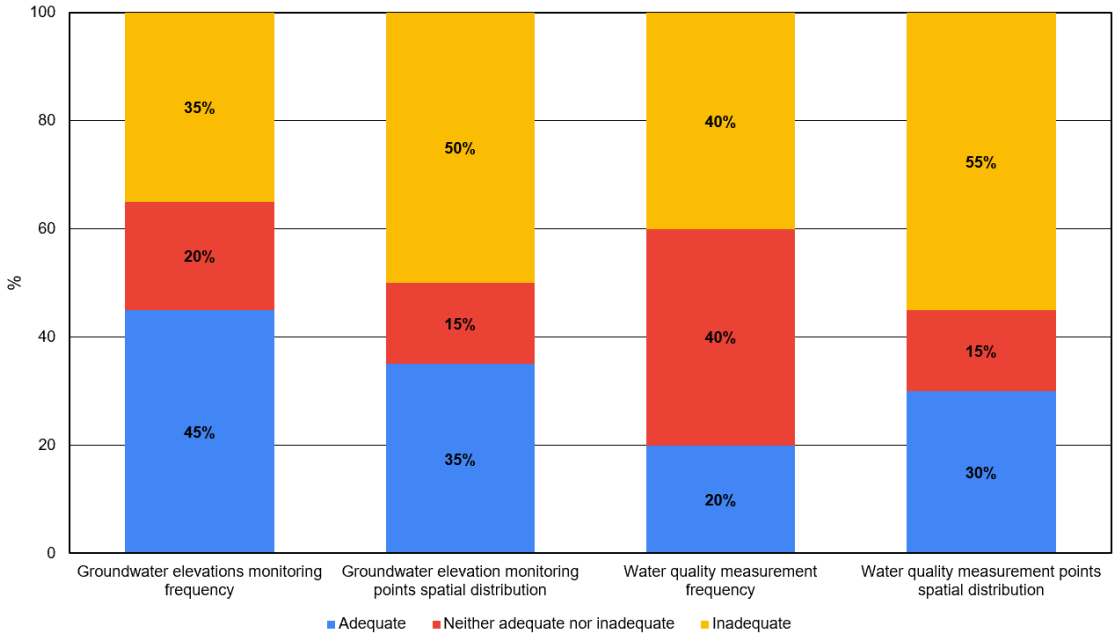

Figure 4-12 Adequacy of the monitoring coverage in the Alto Guadalentín aquifer.

Further considerations

As it was mentioned before, those stakeholders which were the most related to the pilot site, were personally contacted (by phone or email). The adequacy of existing monitoring was also discussed in these conversations. It can be concluded that the vision on the frequency and spatial distribution of piezometry and water quality measurements in the aquifer is disparate among the interested bodies. As a result, it could be helpful to obtain objective criteria for information on whether the monitoring network is adequate. These criteria could be based on the results of the mathematical model of the aquifer and a statistical study of the spatio-temporal variability of piezometry and the different chemical parameters of interest.

4.2.3. THE GEDIZ RIVER BASIN, TURKEY

The question about the adequacy of existing monitoring efforts in the Gediz River Basin received a mixed response from the stakeholders. In terms of groundwater elevation monitoring, the opinion was clearer. 75% of all stakeholders consider level monitoring as insufficient in terms of measurement frequency (Figure 4.13). An overwhelming majority (52%) see monitoring as mostly inadequate. On the contrary, none of the stakeholders consider level monitoring as very adequate, and only 16% consider it as mostly adequate. The opinions received for the spatial coverage of groundwater level monitoring are similar (Figure 4.14.). For example, 64% of the stakeholder consider it insufficient. Only 7% consider it as mostly adequate and 16% as somewhat adequate. None of the respondents assesses it as very adequate.

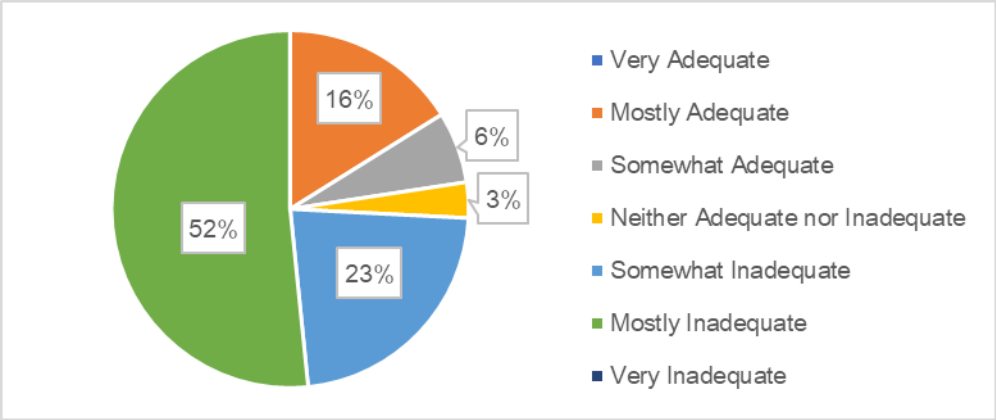

Figure 4-13 Sufficiency of groundwater elevation monitoring in terms of monitoring frequency.

The opinions about the adequacy of groundwater monitoring efforts in terms of groundwater quality vary significantly among the GRB stakeholders. Yet again, none of the stakeholders views the efforts as very adequate in monitoring frequency and spatial coverage. The frequency of groundwater sampling is considered as adequate by 32% of the respondents with most of them considering it as "somewhat adequate" (Figure 4.15.). On the other hand, the frequency of sampling is found to be mostly inadequate by 36% and somewhat inadequate by 16% of all stakeholders (total of 52%). There seems to be an indecisive group of stakeholders (16%) who consider sampling frequency as neither adequate nor inadequate. This response can also be interpreted as a satisfactory effort of groundwater sampling frequency.

The adequacy of groundwater quality sampling in terms of geographic representations is generally considered insufficient. It is shown in **Errore. L'origine riferimento non è stata trovata.**. that 29% find the spatial coverage as mostly inadequate, and 22% consider it as somewhat inadequate. It should be noted that 10% of stakeholders view the spatial coverage of sampling as mostly adequate.

In summary, the efforts in the monitoring of groundwater quality are regarded in general as more sufficient than groundwater elevation measurements (34% vs. 23%). The frequency of monitoring is considered slightly less adequate than spatial coverage (27% vs. 29%). It is also evident from the questionnaire results that the stakeholder perspective about groundwater quality monitoring is divided and there is no dominant opinion.

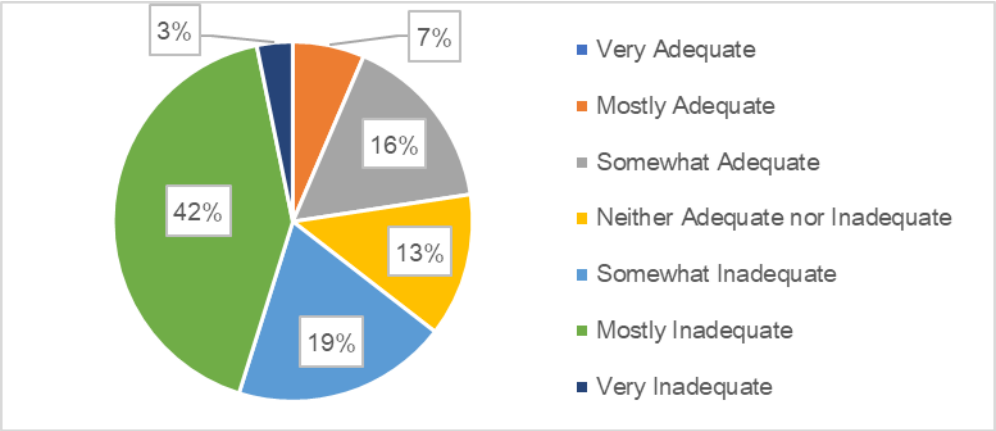

Figure 4-14 Sufficiency of groundwater elevation monitoring in terms of spatial coverage.

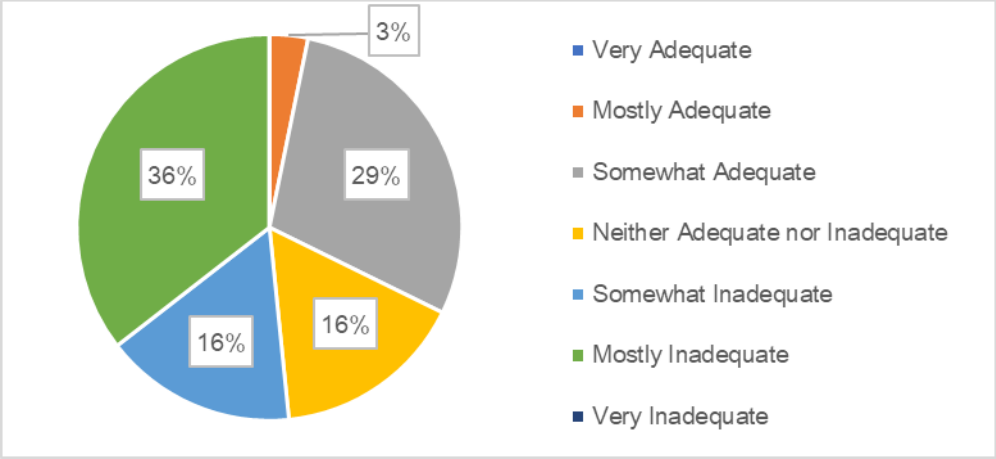

Figure 4-15 Sufficiency of groundwater quality monitoring in terms of monitoring frequency.

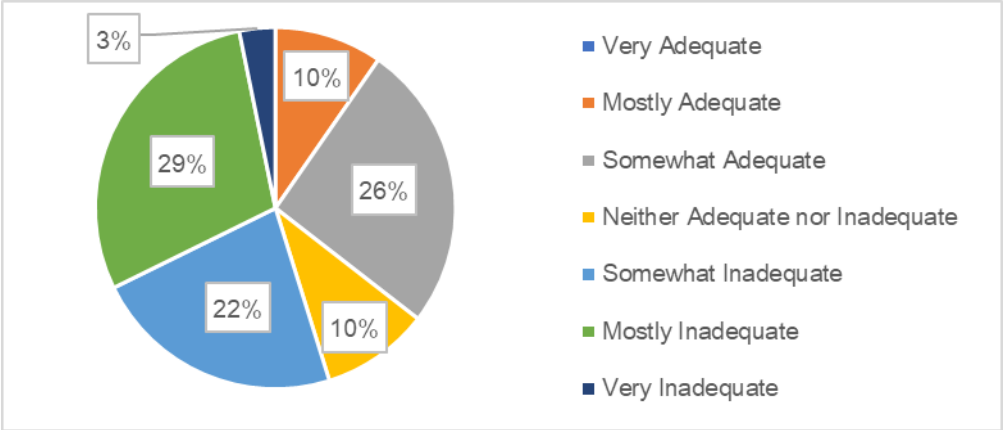

Figure 4-16 Sufficiency of groundwater quality monitoring in terms of spatial coverage.

4.2.4. THE AZRAQ WETLAND RESERVE, JORDAN

The adequacy of groundwater modeling for an ideal groundwater management decision-making was addressed in question 4 where the participants rated the adequacy of monitoring of different data categories. The responses were inconclusive regarding the groundwater elevations and the water quality data. On the other hand, the participants clearly demonstrated that there is a key deficiency in monitoring the geographic representation data.

4.3. Modelling use for groundwater management

4.3.1. THE COASTAL AQUIFER OF COMACCHIO, ITALY

The stakeholders responded that the modelling in the Coastal aquifer of Comacchio is mainly focused for the water budget, to predict and plan the land subsidence and for long-term planning (Figure 4.17.). The models were developed using MODFLOW, GROUNDWATER VISTAS. Furthermore, IRRINET is the model used to plan the water budget for irrigation purposes.

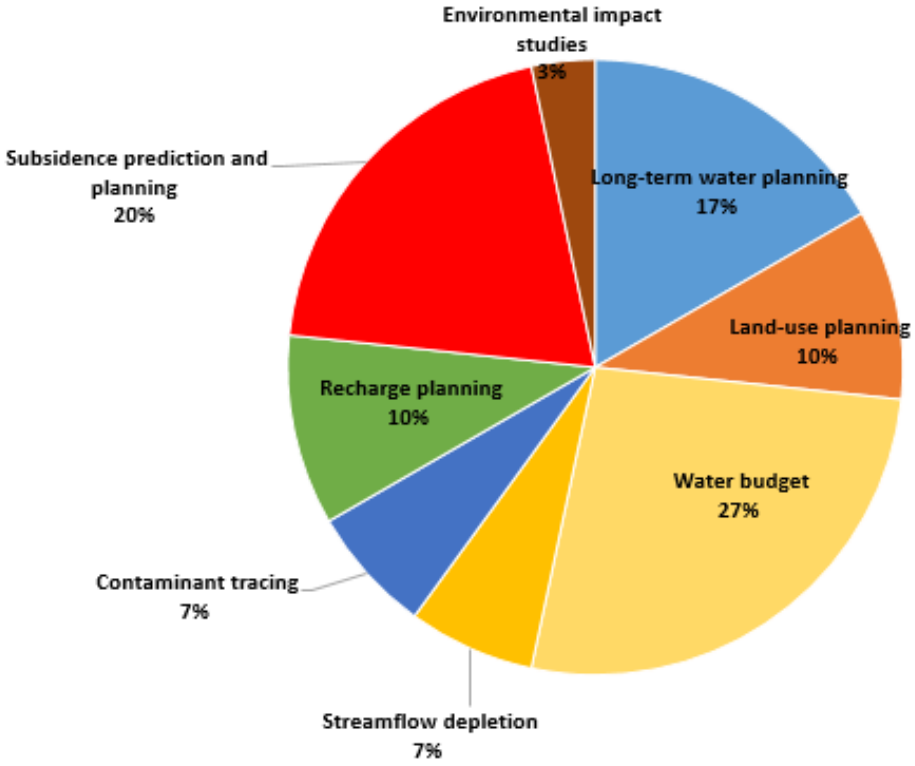

Figure 4-17 Applications of groundwater modelling for management in the Comacchio coastal aquifer.

Further considerations

Regarding the modelling, the analysis of the stakeholder interviews shows that different models were exploited in the past, taking into account the aims of the studies. In particular, MODFLOW models were

mainly applied to simulate the groundwater flow of the deep aquifers and IRRINET for the shallow aquifer used for irrigation purposes. Therefore, taking into account of the major issues of the study area (see paragraph 4.1.1.), detailed models will be developed for subareas defined within the Comacchio coastal aquifer pilot site.

4.3.2. THE ALTO GUADALENTÍN AQUIFER, SPAIN

90% of the stakeholders that participated in the RESERVOIR survey confirmed that they have previous knowledge about numerical groundwater modelling, but within them only 45% have information about the application for which the model is employed in the Alto Guadalentín aquifer (Figure 4.18.). Thus, most of them (46%) confirmed that modelling is employed for long-term water planning. Alternative uses of groundwater modelling in the area are the calculation of water budgets (18%), groundwater extraction planning (9%), subsidence prediction and planning (9%), environmental impact studies (9%) and research (9%).

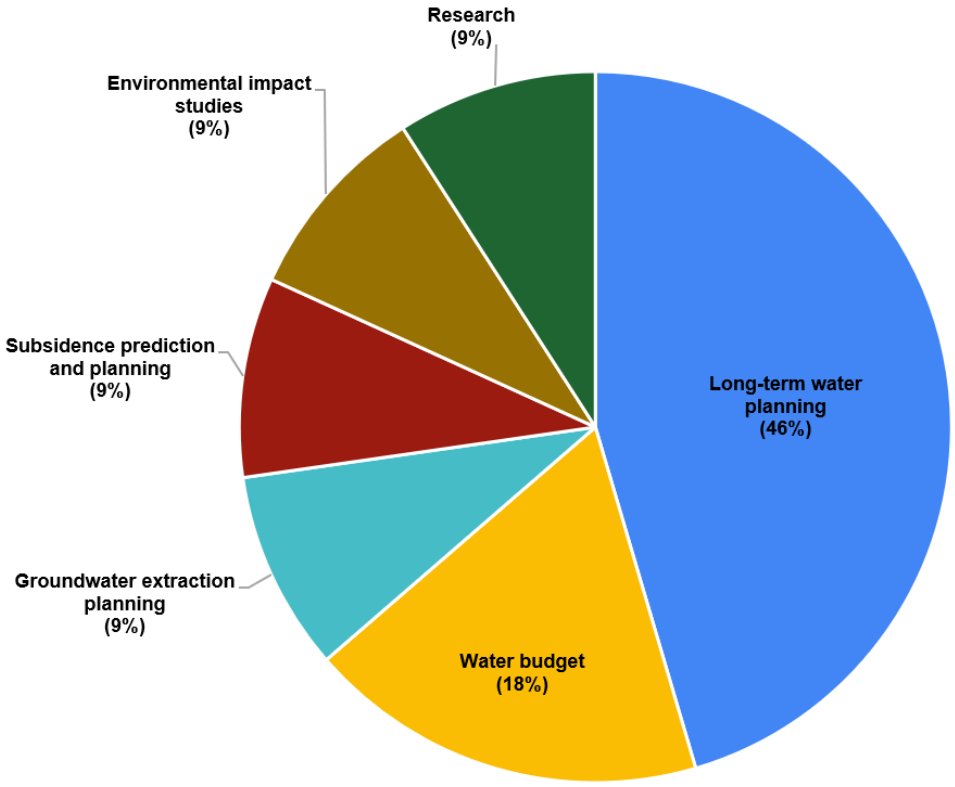

Figure 4-18 Applications of groundwater modelling for management in the Alto Guadalentín aquifer.

Further considerations

The most personal contacts performed with some stakeholders also allowed to tackle issues related with modelling use for groundwater management:

- It is already mentioned in former sections the importance of having real measurements of pumps, but here it must be highlighted that to develop a robust model with the less uncertainties as possible, it is important to include all existing extractions and flow meter data.
- These meetings reinforced the importance of having a groundwater model as a support management tool, which must be continuously updated.
- The design of alternatives and scenarios based on the periodic state of the aquifer to support decision-making for exploitation is also essential.
- All stakeholders agree with the idea of the RESERVOIR project about developing a tool to spread model results to make them accessible, free of charge and easy to understand. Raise awareness and dissemination campaigns should be planned to reach this aim.
- Likewise, and to the extent permitted by the coronavirus pandemic, meetings between aquifer water managers and modelers responsible for model development and maintenance should be about twice a year during the 2, 3 and 4 years of the project. These meetings would adapt the model to be useful as a tool to support groundwater management.

There have been several versions of the Alto Guadalentín groundwater numerical modelling (UPV, 2005; and Ezquerro et al., 2017). The big challenge is to join a subsidence module to the flow model, and this could require rebuilding the flow model.

4.3.3. THE GEDIZ RIVER BASIN, TURKEY

In the next section of the questionnaire about the use and purpose of groundwater flow modeling in the GRB, stakeholders were first asked whether they know what groundwater flow modeling is. Most of the stakeholders (84%) responded positively (Figure 4.19.). Furthermore, they were asked about the presence of any kind of groundwater flow model (analytical or numerical) that was developed for the GRB, and the name of the model, if it is known (Figure 4.20.). The majority of stakeholder stated that they have no knowledge about it, 23% confirmed the presence of a model, and the remaining 16% gave a definite negative response. Most of the respondents who confirmed the presence of a groundwater flow model stated MODFLOW as the name of the model. Hydrus, WEAP, and the recently released national modeling software Hidrotürk were mentioned in other answers even though these are not groundwater flow models, except for Hidrotürk, which has a separate module designed for groundwater flow simulations. It is important to note that actually, only one 2-D steady-state numerical groundwater flow model exists for the GRB that is based on MODFLOW (Elçi et al., 2015; DSI, 2014). Whether it is actively used by the State Hydraulic Works could not be confirmed.

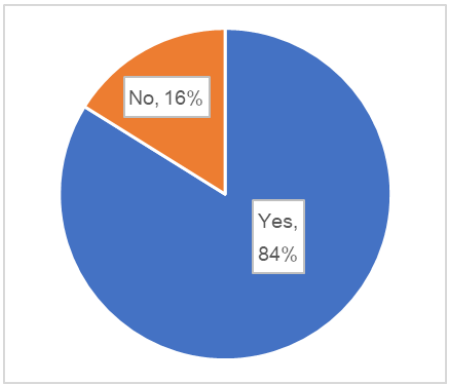

Figure 4-19 Distribution of GRB stakeholders who have previous knowledge about groundwater flow modelling.

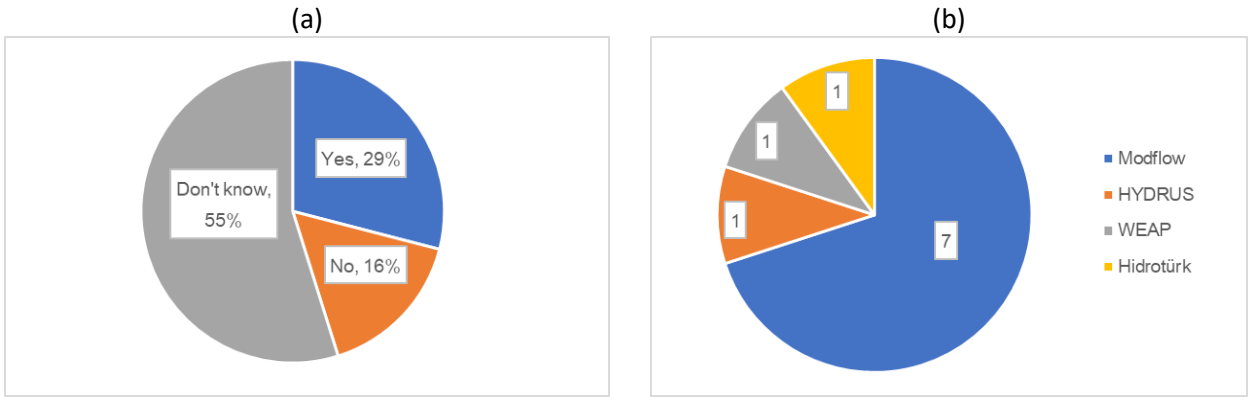

Figure 4-20 Stakeholder knowledge about a) presence of a groundwater flow model for the GRB, and b) the name of the model.

The last question in this section was the purpose of the application of the groundwater flow model that was developed for the GRB. It is interesting to note that a few of the stakeholders who could not confirm the presence of a model responded to this question by selecting a use. As can be seen from Figure 4.21., the results indicate that 48% of the respondents have no idea about the model's purpose. Long-term water planning (32%), water budget (26%), recharge planning (23%), and contaminant tracing (19%) were other uses that were selected by the respondents. The model uses that were not considered by the participated stakeholders were land subsidence prediction and planning, streamflow depletion, and environmental impact studies.

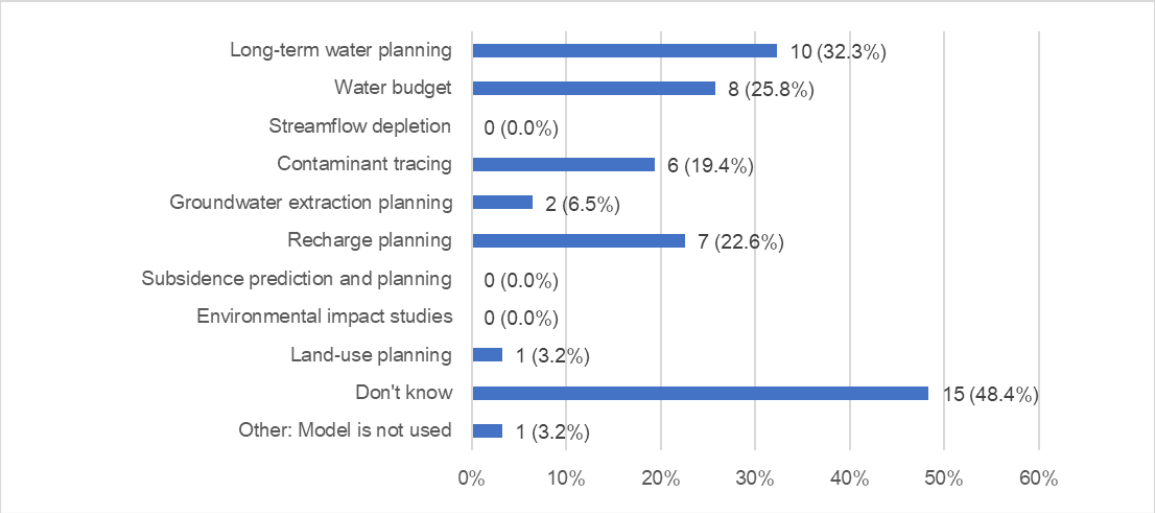

Figure 4-21 Applications of the groundwater flow model used for the GRB.

4.3.4. THE AZRAQ WETLAND RESERVE, JORDAN

Groundwater modeling was also covered in the questionnaire, and each participant was asked to select one application or more for groundwater models from their respective fields. Only a limited number of responses were received on the use and application of groundwater models. Nonetheless, most respondents indicated that MODFLOW is often deployed and that groundwater models are primarily used for groundwater extraction planning, long-term water planning, and environmental impact studies. To a lesser extent, groundwater models are used for contaminant tracing and streamflow depletion. A summary of the groundwater models applications in the Azraq Basin area (question 6 of the questionnaire) is presented in the accompanying Table 4.6. and Figure 4.22.

Table 4-6 Groundwater models application in the Azraq Groundwater Basin.

Question	Frequency (votes)	Percentage*
Long-term water planning	4	27
Land-use planning	1	7
Water budget	1	7
Streamflow depletion	2	13
Contaminant tracing	2	13
Groundwater extraction planning	4	27
Recharge planning	1	7
Subsidence prediction and planning	0	0
Environmental impact studies	3	20

* The percentage was calculated based on sample size = 15.

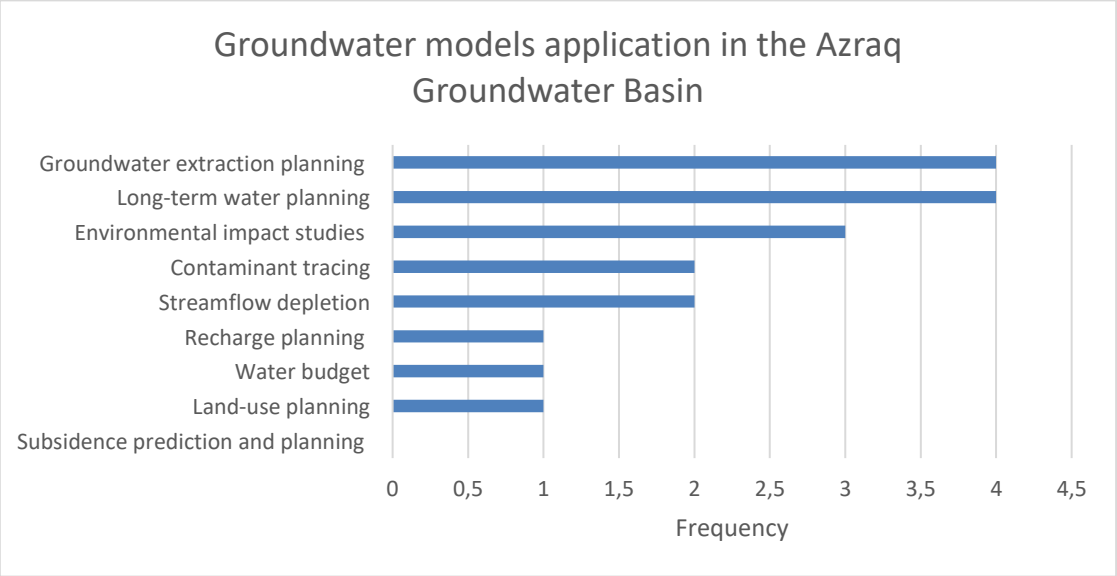

Figure 4-22 Groundwater models application in the Azraq Groundwater Basin.

4.4. Stakeholder engagement

Newsletters will be disseminated among all the stakeholders and future webinars will be also organized with their engagement. A smaller end-user group was formed for each pilot site.

4.4.1. THE COASTAL AQUIFER OF COMACCHIO, ITALY

The expectations and interest of the stakeholders engaged for the coastal Aquifer of Comacchio, are summarized in Table 4.7.

Table 4-7 Stakeholder classification and their role in the project. Level priority and Influence: L = low; M = medium; H = high.

ID	NAME	LOCATION	EXPECTATIONS	LEVEL PRIORITY	INFLUENCE	.... WHEN IN THE PROJET	INTERNAL/ EXTERNAL	POSITION / INTEREST	INFORMATION ACTIVITIES
1	Regione Emilia Romagna Direzione Generale Cura del territorio e dell'ambiente Servizio Geologico,	Bologna	To stay informed about current activities of RESERVOIR and to disseminate the project results	H	H	WP2, WP3, WP4, WP5, WP6, WP7 AND WP8	External	Development of the project plan and interpretation of the results	Annual meetings Regular workshops Participating in field work

	Sismico e dei Suoli								
2	Regione Emilia Romagna Direzione Generale Cura del territorio e dell'ambiente Servizio Geologico, Sismico e dei Suoli agenti fisici della Regione Emilia-Romagna	Bologna	To stay informed about current activities of RESERVOIR	H	H	WP2, WP5, WP6, WP7	External	Interpretation of the results	Annual meetings
3	ARPAE FERRARA Servizio Autorizzazioni e concessioni a Ferrara	Ferrara	To obtain up-to-date information for concrete decision-making	H	H	WP2, WP5, WP7 AND WP8	External	Dissemination of the results	Regular updates about the project (e.g. through a newsletter)
4	COMUNE DI GORO Settore Area Tecnica	Goro	To stay informed about current activities of RESERVOIR and to make research results available to a broader audience	H	H	WP2	External	Data collection	Regular updates about the project (e.g. through a newsletter)
5	COMUNE DI LAGOSANTO Settore LAVORI PUBBLICI, PATRIMONIO e MANUTENZIONE – AMBIENTE E TERRITORIO	Lagosanto	To obtain up-to-date information for concrete decision-making	M	M	WP2 and WP8	External	Data collection and dissemination of the results	Regular workshops Digital tools: video conferences, shared documents and folders, etc.
6	Consorzio di Bonifica Pianura di Ferrara	Ferrara	To participate in studies in RESERVOIR, to define relevant	H	H	WP2, WP3, WP4, WP5, WP6, WP7	External	Development of the project plan, data collection, data analysis, interpretation	Regular workshops Digital tools: video conferences,

			questions and research gaps and to make research results available to a broader audience			AND WP8		of results and dissemination of results	shared documents and folders, etc. Personal dialogues with project individuals Participating in field work
7	ARPA ER	Bologna	To stay informed about current activities of RESERVOIR and to participate in studies in RESERVOIR	H	H	WP2	External	Data collection, data analysis and interpretation of results	Annual meetings Regular workshops
8	Consorzio di Bonifica di Secondo Grado per il Canale Emiliano Romagnolo	Bologna		H	H		Internal		
9	Dipartimento di Ingegneria Civile, Chimica, Ambientale e dei Materiali - Università di Bologna	Bologna	To stay informed about current activities of RESERVOIR	L	L	WP2	External	Development of the project plan	Regular workshops Digital tools: video conferences, shared documents and folders, etc.
10	Società Agricola Produzioni Orticole Benazzi	Ferrara	To stay informed about current activities of RESERVOIR	M	M	WP8	External	Dissemination of results	Personal dialogues with project individuals
11	Azienda Agricola Visentini, Codigoro, Ferrara	Ferrara	To stay informed about current activities of RESERVOIR	M	M		External	Dissemination of results	Personal dialogues with project individuals
12	Consorzi di Bonifica Delta del Po ed Adige Po	Taglio di Po	To stay informed about current activities of RESERVOIR, to obtain up-to-	H	H	WP2 and WP8	External	Data collection and dissemination of results	Regular updates about the project (e.g. through a newsletter)

			date information for concrete decision-making and to make research results available to a broader audience						Regular workshops
13	Consorzio di Bonifica Adige Euganeo di Este	Este	To make research results available to a broader audience	H	H	WP8	External	Dissemination of results	Regular updates about the project (e.g. through a newsletter) Regular workshops Digital tools: video conferences, shared documents and folders, etc.

4.4.2. THE ALTO GUADALENTÍN AQUIFER, SPAIN

The expectations and interest of the stakeholders engaged for the Alto Guadalentín aquifer, are summarized in Table 4.8.

Table 4-8 Stakeholder classification and their role in the project. Level priority and Influence: L = low; M = medium; H = high.

ID	NAME	LOCATION	EXPECTATIONS	LEVEL PRIORITY	INFLUENCE	WHEN IN THE PROJET	INTERNAL/ EXTERNAL	POSITION / INTEREST	INFORMATION ACTIVITIES
1	Confederación hidrográfica del Segura (Hydrografic Confederation of the Segura River)	Murcia	To obtain up-to-date information for concrete decision-making	**H**	H	WP2, WP3, WP4, WP5, WP6, WP7	External	Development of the project plan	Regular updates about the project (e.g. through a newsletter) Regular workshops
2	Comunidad de regantes de Totana (Community	Totana	To participate in studies in RESERVOIR	M	M	WP2, WP5, WP7	External	Development of the project plan	Regular workshops

	of irrigators of Totana)								
3	Comunidad de regantes de Lorca (Community of irrigators of Lorca)	Lorca	To obtain up-to-date information for concrete decision-making	M	M	WP2, WP5, WP7	External	Development of the project plan Data analysis Interpretation of results	Regular updates about the project (e.g. through a newsletter) Annual meetings Digital tools: video conferences, shared documents and folders, etc.
4	EMUASA (Municipal Water and Sanitation Company of Murcia)	Murcia	To stay informed about current activities of RESERVOIR To participate in studies in RESERVOIR	H	H	WP2, WP5, WP7	External	Interpretation of results Data analysis	Digital tools: video conferences, shared documents and folders, etc.
5	AQUATEC, projects for the water sector (SUEZ)	Murcia	To participate in studies in RESERVOIR	H	H	WP2, WP3, WP4, WP5, WP7	External	Development of the project plan Data analysis Interpretation of results	Regular updates about the project (e.g. through a newsletter) Regular workshops Digital tools: video conferences, shared documents and folders, etc. Personal dialogues with project individuals
6	SUEZ	Madrid	To stay informed about current activities of RESERVOIR	H	H	WPX	External	Development of the project plan	Regular updates about the project

								Data collection Data analysis Interpretation of results Dissemination of results	(e.g. through a newsletter) Digital tools: video conferences, shared documents and folders, etc.
7	INTECSA	Murcia	To participate in studies in RESERVOIR	H	H	WPX	External		Digital tools: video conferences, shared documents and folders, etc. Personal dialogues with project individuals
8	Eduardo Lupiani Moreno	Murcia	To stay informed about current activities of RESERVOIR	M	M	WP2, WP3, WP4, WP5, WP7	External	Development of the project plan Data analysis Interpretation of results	Regular updates about the project (e.g. through a newsletter) Annual meetings Regular workshops Digital tools: video conferences, shared documents and folders, etc. Personal dialogues with project individuals
9	WWF España	Madrid	To obtain up-to-date information for concrete decision-making	M	M	WP2, WP3, WP5, WP7	External	Dissemination of results	Personal dialogues with project individuals
10	Diputación de Alicante	Alicante	To participate in studies in RESERVOIR	M	M	WP2, WP3, WP4, WP5, WP7	External	Data collection Interpretation of results	Regular updates about the project (e.g. through a newsletter)

								Dissemination of results	Digital tools: video conferences, shared documents and folders, etc.
11	University of Alicante	Alicante	To participate in studies in RESERVOIR	M	M	WP2, WP5, WP7	External	Data analysis	Regular updates about the project (e.g. through a newsletter)
12	Miguel Hernández University	Orihuela	To make research results available to a broader audience	M	M	WP2, WP3, WP4, WP5, WP7	External	Dissemination of results	Regular updates about the project (e.g. through a newsletter)
13	Politecnic University of Valencia	Valencia	To stay informed about current activities of RESERVOIR	M	M	WP2, WP3, WP4, WP5, WP7	External	Data analysis Interpretation of results	Regular updates about the project (e.g. through a newsletter) Annual meetings Regular workshops Digital tools: video conferences, shared documents and folders, etc.
14	Complutense University of Madrid	Madrid	To obtain up-to-date information for concrete decision-making	L	L	WP2, WP3, WP4, WP5, WP7	External	Data analysis	Annual meetings Regular workshops Participating in field work
15	Instituto Geológico y Minero de España	Madrid	To obtain up-to-date information for concrete decision-making	H	H	WP2, WP3, WP4, WP5, WP6, WP7	External	Data collection Data analysis Interpretation of results Dissemination of results	Annual meetings Digital tools: video conferences, shared documents

									and folders, etc. Participating in field work
16	Asociación para la protección del acuífero Alto Guadalentín	Lorca	To participate in studies in RESERVOIR	M	M	WP7	External	Development of the project plan	Participating in field work
17	UDLAP	San Andrés Cholula	To stay informed about current activities of RESERVOIR	L	L	WP7	External	Dissemination of results	Regular updates about the project (e.g. through a newsletter)
18	Detektia Earth Surface Monitoring S.L.	Madrid	To participate in studies in RESERVOIR	L	L	WP3, WP4, WP6	External	Data collection Data analysis Interpretation of results	Regular updates about the project (e.g. through a newsletter) Annual meetings Regular workshops Digital tools: video conferences, shared documents and folders, etc. Personal dialogues with project individuals Participating in field work

4.4.3. THE GEDIZ RIVER BASIN, TURKEY

The objective of the questionnaire study was also to survey the willingness of stakeholders to engage in the project. The results suggest that most topics of the RESERVOIR project were of interest to a majority of the GRB stakeholders. The development of scenarios to detect the optimum timing and amount of groundwater abstraction for irrigation purposes was the most popular topic with 61% of respondents in favor of it (Figure 4.23.). This topic was followed by advanced EO-based geomechanical modeling to quantify aquifer storage (52%) and the production of EO-based land deformation maps and land subsidence maps (48%).

Figure 4.24. shows results for the question where stakeholders were asked their motivation to be engaged in the project. The selection of multiple choices was allowed. The majority (58%) would like to stay informed about the current activities of the project. 39% of the respondents want to be engaged by obtaining up-to-date information for concrete decision-making and by actually participating in project tasks.

Most of the GRB stakeholders who responded to the questionnaire would be interested to get involved in a research project (Figure 4.25.Figure 4-25). 65% of the respondents are interested in interpreting results. 61% of the respondents would be interested in getting involved with data analysis. It is evident from the questionnaire results that data collection is the least favored (19%) project stage.

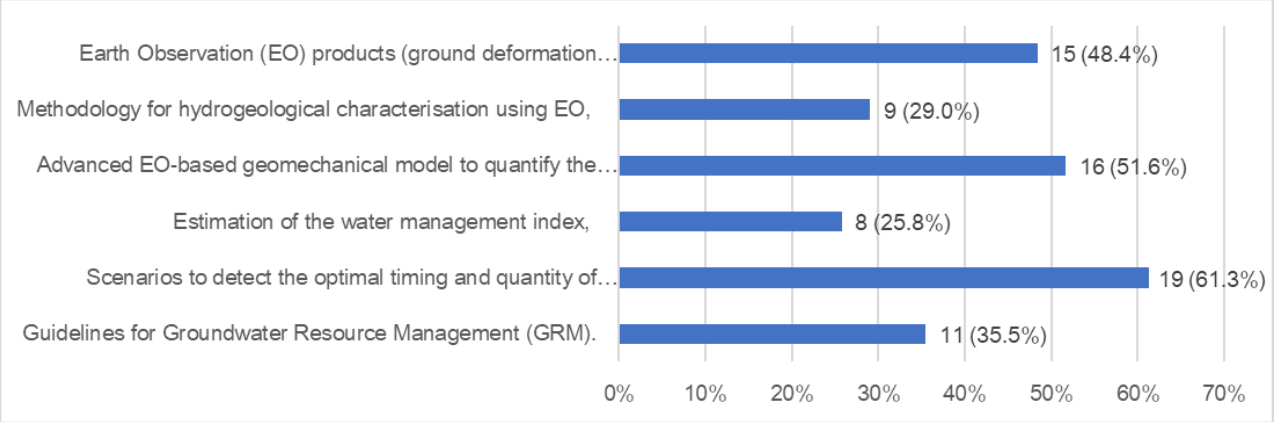

Figure 4-23 RESERVOIR topics of interest to GRB stakeholders.

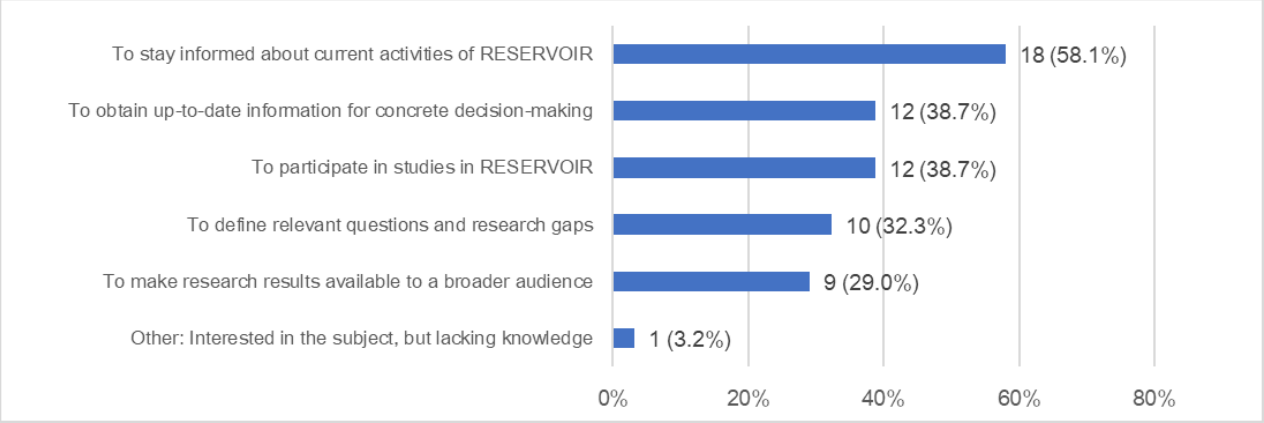

Figure 4-24 GRB stakeholder motivation for engagement in the project.

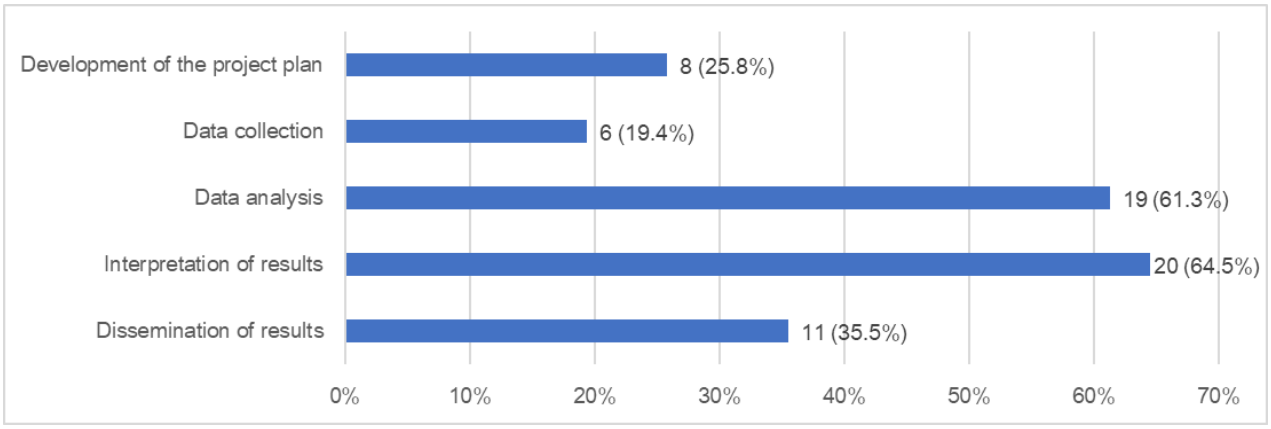

Figure 4-25 Stage of project that GRB stakeholders would be interested to get involved.

Summarized in Figure 4.26. is the stakeholders' preference for involvement in a research project. Again, the selection of multiple choices was allowed. An overwhelming majority of 74% indicated the use of digital tools to stay updated. 58% of respondents would be interested in receiving regular updates about the project. Personal dialogue with project staff (52%) and participating in field work (48%) are other preferred ways to get involved.

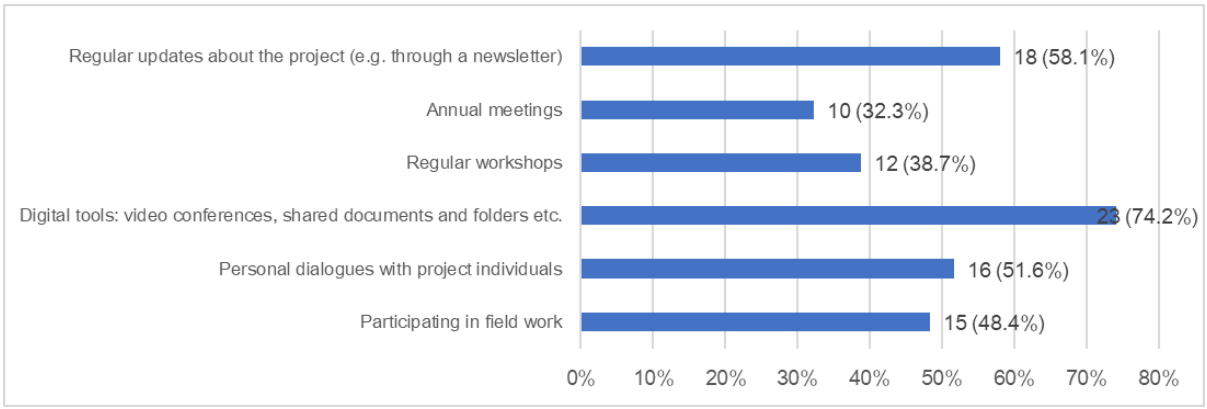

Figure 4-26 Involvement preference of GRB stakeholders.

4.4.4. THE AZRAQ WETLAND RESERVE, JORDAN

The expectations and interest of the stakeholders engaged for the Azraq Basin, are summarized in Table 4.9.

Table 4-9 Stakeholder classification and their role in the project

ID	NAME	ROLE/TITLE	LOCATION	EXPECTATIONS	LEVEL PRIORITY	INFLUENCE	.... WHEN IN THE PROJET	INTERNAL/ EXTERNAL	POSITION / INTEREST	INFORMATION ACTIVITIES
1	MOA-Water Havesting Directorate	Engineer	Jordan	to stay informed about current activities of RESERVOIR / to obtain up-to-date information for concrete decision-making/to make research results available to a broader audience	H	H	development of the project plan	External	-	-
2	JEA	Member of the Central Committee-Engineer	Jordan	to obtain up-to-date information for concrete decision-making	H	H	development of the project plan	External	estimation of the water management index	-
3	JVA- MWI	Engineer	Jordan	to obtain up-to-date information for concrete decision-making/to make research results available to a broader audience	H	H	development of the project plan/data collection/data analysis	External	Earth Observation (EO) products (ground deformation maps, mapping of subsiding areas and Subsidence Risk Index)/ advanced EO-based geomechanical model to quantify the aquifer storage	-
4	MOEnv (ministry of environment)	Engineer	Jordan	to stay informed about current activities of	H	H	development of the project plan/data collection/data analysis/Interpret	External	Earth Observation (EO) products (ground deformation maps, mapping	-

				RESERVOIR / to obtain up-to-date information for concrete decision-making/to make research results available to a broader audience			ation of results/Dissemination of results		of subsiding areas and Subsidence Risk Index)/ methodology for hydrogeological characterisation using EO/ advanced EO-based geomechanical model to quantify the aquifer storage/ estimation of the water management index/ scenarios to detect the optimal timing and quantity of groundwater abstraction for irrigation purposes and wetland protection/ Guidelines for Groundwater Resource Management (GRM).	
5	Ministry of environmental	Engineer	Jordan	to stay informed about current activities of RESERVOIR / to define relevant questions and research gaps/to make research results available to a broader audience	M	M	Interpretation of results	External	estimation of the water management index/ scenarios to detect the optimal timing and quantity of groundwater abstraction for irrigation purposes and wetland protection	-
6	Miyahuna	Engineer	Jordan	to participate in studies in RESERVOIR	L	M	Interpretation of results	External	Guidelines for Groundwater Resource Management (GRM)	-
7	RSCN	Chairman	Jordan	To stay informed	H	H	development of the project	Internal	methodology for hydrogeological	-

				about current activities of RESERVOIR /to obtain up-to-date informatio n for concrete decision-making/ to participate in studies in RESERVOIR / to define relevant questions and research gaps/to make research results available to a broader audience			plan/data collection/ data analysis/ interpretation of results/dissemina tion of results		characterisation using EO/scenarios to detect the optimal timing and quantity of groundwater abstraction for irrigation purposes and wetland protection/Guide lines for Groundwater Resource Management (GRM).	
8	RSCN	Member	Jordan	to stay informed about current activities of RESERVOIR / to obtain up-to-date informatio n for concrete decision-making/ to participate in studies in RESERVOIR / to define relevant questions and research gaps/ to make research results available to a broader audience	H	H	development of the project plan/data collection/ data analysis/ interpretation of results/dissemina tion of results	Internal	Earth Observation (EO) products (ground deformation maps, mapping of subsiding areas and Subsidence Risk Index)/ methodology for hydrogeological characterisation using EO/ advanced EO-based geomechanical model to quantify the aquifer storage/estimati on of the water management index/scenarios to detect the optimal timing and quantity of groundwater abstraction for irrigation purposes and wetland protection/	-

									Guidelines for Groundwater Resource Management (GRM).	
9	MWI	Engineer	Jordan	to participate in studies in RESERVOIR / to define relevant questions and research gaps/ make research results available to a broader audience	H	H	data collection/ data analysis/ interpretation of results/dissemination of results	External	Earth Observation (EO) products (ground deformation maps, mapping of subsiding areas and Subsidence Risk Index)/methodology for hydrogeological characterisation using EO/advanced EO-based geomechanical model to quantify the aquifer storage/ estimation of the water management index/scenarios to detect the optimal timing and quantity of groundwater abstraction for irrigation purposes and wetland protection/ Guidelines for Groundwater Resource Management (GRM).	-
10	MWI	Director of the Watersheds Directorate	Jordan	to participate in studies in RESERVOIR	H	H	data collection/ data analysis	External	estimation of the water management index/Guidelines for Groundwater Resource Management (GRM)	-
11	Miyahuna	Engineer	Jordan	to stay informed about current activities of RESERVOIR / to obtain	M	M	data collection	External	Earth Observation (EO) products (ground deformation maps, mapping of subsiding areas and	-

				up-to-date information for concrete decision-making					Subsidence Risk Index)/ methodology for hydrogeological characterisation using EO/ advanced EO-based geomechanical model to quantify the aquifer storage/	
12	Aqaba water	Engineer	Jordan	to stay informed about current activities of RESERVOIR / to obtain up-to-date information for concrete decision-making/to participate in studies in RESERVOIR / to define relevant questions and research gaps/to make research results available to a broader audience	M	M	data collection/ data analysis/ interpretation of results/dissemination of results	External	"Earth Observation (EO) products (ground deformation maps, mapping of subsiding areas and Subsidence Risk Index)/ methodology for hydrogeological characterisation using EO/advanced EO-based geomechanical model to quantify the aquifer storage/estimation of the water management index/scenarios to detect the optimal timing and quantity of groundwater abstraction for irrigation purposes and wetland protection/Guidelines for Groundwater Resource Management (GRM).	-
13	The University of Jordan	Associate Researcher	Jordan	to stay informed about current activities of RESERVOIR / to obtain up-to-date	H	H	interpretation of results/dissemination of results	Internal	Earth Observation (EO) products (ground deformation maps, mapping of subsiding areas and Subsidence Risk	-

				information for concrete decision-making/to make research results available to a broader audience					Index)//estimation of the water management index/scenarios to detect the optimal timing and quantity of groundwater abstraction for irrigation purposes and wetland protection/Guidelines for Groundwater Resource Management (GRM).	

NOTE: Level priority and Influence: L= low; M= medium; H= high.

5. CONCLUSIONS

The analysis of the stakeholder engagement activities performed by the RESERVOIR Consortium gives insight about the different issues due to the groundwater management for the four pilot sites. In particular, the main issue in all the pilot sites is the over-exploitation of the groundwater except for the Coastal aquifer of Comacchio, in Italy (Table 5.1). Furthermore, other issues are the groundwater pollution due to the agricultural activities and the high groundwater demand to sustain the most important economical wealth for the GRB and the Azraq basin, respectively. Instead, for the Comacchio coastal aquifer the main issues are the natural and anthropogenic land subsidence and the saltwater intrusion in the phreatic aquifer.

The number of stakeholder engaged ranges from 13 up to 31 stakeholders for the pilot sites.

Furthermore, for all the pilot sites a very adequate monitoring system of the groundwater level variations and of the groundwater quality is not evident. The analysis of the adequate monitoring system seems to be of difficult interpretation for the stakeholders. The results highlight the necessity to introduce and define parameters to evaluate the adequacy of the monitoring system both considering the spatio-temporal sampling of the measurements. Therefore, in the framework of the RESERVOIR project efforts will be made to address this issue. Overall, the main problem is the adequate spatial distribution of the groundwater level variations monitoring.

The stakeholders' knowledge about the modelling for groundwater management in all pilot sites shows that the models are mainly used for long-term planning and for water budget. It is worth noting that models were not previously developed for the land subsidence prediction and planning for the GRB in Turkey and for the Azraq basin. The RESERVOIR results will provide new products aimed to address this issue. The big challenge for the Alto Guadalentín aquifer is to join a subsidence module to the flow model. For the Comacchio pilot

site, there is the necessity to deeply understand the interaction between the freshwater and saltwater and to distinguish the different components of the land subsidence.

The stakeholders engaged belong to different entities. In particular, the stakeholders of the Coastal aquifer of Comacchio pilot site are Local Authorities (regional), Environmental Agency and Farmers. For the Alto Guadalentín aquifer pilot site, the stakeholders are Authority responsible for water management (national/regional), Irrigators association (local), Water supply company (local), Environmental engineering consulting company and Non-profit environmental organization. For the Gediz River Basin pilot site, the stakeholders are governmental at the country level, governmental at the regional level, local authority responsible for water management and supply, industrial consumer, research organization, NGO, municipality and private company. For the Azraq wetland reserve pilot site, the stakeholders are national authority (policy makers), water supply company, civil society organization and research and academic organizations.

Table 5-1 Summary of the stakeholder engagement activities for all pilot sites

Pilot site name	Number of stakeholders	Main problems in the area in the groundwater management	Adequacy of existing monitoring	Modelling use for groundwater management	Interest of the stakeholder
COASTAL ACQUIFER OF EMILIA-ROMAGNA REGION (Italy)	13	• natural and anthropogenic land subsidence • the saltwater intrusion in the phreatic aquifer	Neither adequate and inadequate	Modelling for the water budget, to predict and plan the land subsidence and for long-term planning.	• Earth Observation (EO) products (ground deformation maps, mapping of subsiding areas and Subsidence Risk Index) • Scenarios to detect the optimal timing and quantity of groundwater abstraction for irrigation purposes and wetland protection, • Guidelines for Groundwater Resource Management (GRM).

ALTO GUADALENTÍN BASIN (Spain)	18	over-exploitation of groundwater	Inadequate spatial distribution of both groundwater elevations and water quality	Modelling is employed for long-term water planning.	• Earth Observation (EO) products (ground deformation maps, mapping of subsiding areas) • EO-based geomechanical modeling to quantify aquifer storage • Guidelines for Groundwater Resource Management (GRM).
GEDIZ RIVER BASIN (Turkey)	31	• over-exploitation of groundwater • groundwater pollution due to agricultural activities	Mostly inadequate	Modelling for long-term water planning water budget, recharge planning, and contaminant tracing	• Development of scenarios to detect the optimum timing and amount of groundwater abstraction for irrigation purposes. • EO-based geomechanical modeling to quantify aquifer storage • The production of EO-based land deformation maps and land subsidence maps
AZRAQ WETLAND RESERVE (Jordan)	13	• over-exploitation of groundwater	key deficiency in monitoring the geographic representation data.	Modelling for groundwater extraction planning, long-term	• Guidelines for Groundwater Resource

		• high groundwater demand to sustain the most important economical wealth in the area		water planning, and environmental impact studies.	Management (GRM). • Earth Observation (EO) products (ground deformation maps, mapping of subsiding areas) • Scenarios to detect the optimal timing and quantity of groundwater abstraction for irrigation purposes and wetland protection.

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ANNEX 1

Invitation letter for the webinar for the Comacchio pilot site (Italy) 02/07/2020

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Pavia, 22/05/2020

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CONSORZIO DI BONIFICA PIANURA DI FERRARA

[redacted]

Spett.

ENTE PARCO DELTA DEL PO

[redacted]

OGGETTO : Invito al meeting virtuale per la presentazione del progetto PRIMA RESERVOIR

l'Università degli Studi di Pavia è capofila di un Progetto PRIMA «*Sustainable groundwater RESources managEment by integrating eaRth observation derIVed monitoring and fIOw modelling Results* (**RESERVOIR**)», della durata di 48 mesi a partire da marzo 2020. Il Consorzio del progetto è costituito dall'Instituto Geológico y Minero de España, l'Universidad de Alicante, la Dokuz Eylul University, University of Jordan, Consorzio di Bonifica di secondo grado per il Canale Emiliano Romagnolo (CER) e la Royal Society for the Conservation of Nature - Azraq Wetland Reserve (Giordania).

L'obiettivo del progetto RESERVOIR è migliorare la gestione sostenibile delle acque sotterranee per le aree del Mediterraneo soggette a stress idrico al fine di salvaguardare le risorse disponibili. Ciò sarà realizzato sviluppando un approccio multidisciplinare basato sull'integrazione di dati da satellite, dati idrogeologici, geologici e socioeconomici con modelli idrogeologici e geomeccanici. La metodologia sarà testata su quattro siti rappresentativi situati nell'arco del Mediterraneo, in cui le falde acquifere sono vulnerabili alla siccità, sono soggette a periodi di siccità importanti e sono altamente sfruttate per le esigenze dell'agricoltura e del turismo. In particolare gli obiettivi sono:

- Generare una rete di monitoraggio della deformazione del suolo superficiale basata su dati da satellite,

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- Utilizzare le informazioni del monitoraggio per migliorare lo studio della falda acquifera attraverso tecniche innovative di modellizzazione,

- Studiare le subsidenze lungo le coste che possono contribuire all'intrusione salina nelle falde acquifere costiere e all'aumento del rischio idraulico;

- Utilizzare le tendenze globali dei cambiamenti climatici per prevedere e gestire i futuri scenari climatici e i loro potenziali effetti sulle risorse sotterranee,

- Sviluppare un piano di gestione delle acque sotterranee (ed in parte superficiali) che tenga conto dei numerosi processi che possono influire gestione sostenibile delle risorse idriche sotterranee e superficiali.

Uno dei 4 siti campioni è costituito dall'acquifero costiero del Comacchio.

Ha già dato il suo supporto il Servizio Geologico, Sismico e dei Suoli della Regione Emilia Romagna.

In questo quadro, il Consorzio del progetto RESERVOIR sta cercando di organizzare un gruppo di stakeholders / utenti finali per raccogliere le esperienze e aumentare l' efficacia del progetto e la valutazione dell'impatto sociale-economico che lo stesso potrà avere nel territorio.

In qualità di coordinatore del progetto sarò lieta di raccogliere la sua preziosa esperienza per aiutarci a:

- promuovere la partecipazione delle parti interessate / utenti finali al progetto, al fine di aumentare l'applicazione dei risultati di RESERVOIR e l'impatto positivo sulla comunità;

- verificare l'inserimento del progetto nel contesto programmatico nazionale/regionale/locale (PdGPo, PTA).

- discutere del settore specifico e della possibilità di migliorare la ricerca per quanto riguarda lo stato di conoscenza della risorsa idrica e dei fenomeni che la governano;

- avviare un framework per la comunicazione e la collaborazione durante la vita del progetto;

- diffusione dei risultati del progetto.

A tale proposito si vuole organizzare un workshop con tutti i possibili stakeholders, che quotidianamente vivono il territorio e sono direttamente interessati dalle criticità e/o potenzialità della risorsa acqua in tutti i suoi aspetti, finalizzato a

(i) presentare gli obiettivi del progetto avviando un framework per la comunicazione e la collaborazione durante la vita del progetto;

Università di Pavia - Dipartimento di Scienze della Terra e dell'Ambiente
Via A. Ferrata n. 1, 27100 Pavia (Italia) - T +39 0382 98 5769 - F +39 0382 98 5890
http://sites.unipv.eu/site/home.html – claudia.comoline@unipv.it – PEC: amministrazione-centrale@cert.unipv.it

UNIVERSITÀ DI PAVIA
Dipartimento di
Scienze della Terra
e dell'Ambiente

(ii) migliorare le conoscenze sulle problematiche connesse alla gestione delle acque sotterranee e superficiali nel territorio;

(iii) capire il livello di interesse per il progetto e esplorare le possibilità di collaborazione.

Stante la situazione legata all'emergenza sanitaria connessa al COVID-19 si prevede di organizzare il workshop on line attraverso la piattaforma Google Meet nella prima-seconda settimana di Giugno. A questo scopo chiedo agli Enti in indirizzo di confermare la loro disponibilità, indicando la persona referente per i contatti.

In caso di conferma, i referenti saranno contattati nelle prossime settimane per chiedere la loro opinione sulle questioni più rilevanti del progetto e per chiedere la loro collaborazione per le attività in arrivo..

In attesa di una sua risposta in merito porgo cordiali saluti

Il Coordinatore del progetto

Prof Claudia Meisina

Università di Pavia - Dipartimento di Scienze della Terra e dell'Ambiente
Via A. Ferrata n. 1, 27100 Pavia (Italia) - T +39 0382 98 5769 - F +39 0382 98 5890
http://sites.unipv.eu/site/home.html – claudia.meisina@unipv.it – PEC amministrazione-ambiente@certunipv.it

Email for the invitation at the webinar for the Comacchio pilot site (Italy) 02/07/2020

UNIVERSITÀ DI PAVIA

Meisina Claudia <clamei04@unipv.it>

INVITO WEBINAR 16 LUGLIO PROGETTO RESERVOIR

Meisina Claudia <claudia.meisina@unipv.it> 2 luglio 2020 16:52

Gentilissimi

l'Università degli Studi di Pavia è capofila di un Progetto PRIMA «*Sustainable groundwater RESources managEment by integrating eaRth observation deriVed monitoring and flOw modelling Results* (RESERVOIR)», della durata di 48 mesi a partire da marzo 2020. Il Consorzio del progetto è costituito dall'Instituto Geológico y Minero de España, l'Universidad de Alicante, la Dokuz Eylul University, University of Jordan, Consorzio di Bonifica di secondo grado per il Canale Emiliano Romagnolo (CER) e la Royal Society for the Conservation of Nature - Azraq Wetland Reserve (Giordania) (https://www.facebook.com/Reservoir-Project-104777871209651/).

L'obiettivo del progetto RESERVOIR è migliorare la gestione sostenibile delle acque sotterranee per le aree del Mediterraneo soggette a stress idrico al fine di salvaguardare le risorse disponibili. Ciò sarà realizzato sviluppando un approccio multidisciplinare basato sull'integrazione di dati da satellite, dati idrogeologici, geologici e socioeconomici con modelli idrogeologici e geomeccanici. Uno dei 4 siti campioni è costituito dall'acquifero costiero del Comacchio.

In questo quadro, il Consorzio del progetto RESERVOIR sta cercando di organizzare un gruppo di stakeholders / utenti finali per raccogliere le esperienze e aumentare l' efficacia del progetto e la valutazione dell'impatto sociale-economico che lo stesso potrà avere nel territorio.

Facendo seguito al colloquio telefonico avuto con alcuni di voi nei giorni scorsi vi propongo di partecipare ad un webinar della durata di un'ora che si terrà il 16 luglio alle ore 10.00 sulla piattaforma Google Meet al seguente link meet.google.com/fti-wzyf-imr

Il webinar ha lo scopo di

(i) presentare gli obiettivi del progetto;

(ii) capire il livello di interesse per il progetto e esplorare le possibilità di collaborazione.

Al fine di ottimizzare al meglio il webinar vi sottopongo un breve questionario al link

https://docs.google.com/forms/d/e/1FAIpQLSdeX-F8IY13shyWG8xYR7GufordFKVrzFHpLaEJGzYspzQ60w/viewform?usp=sf_link

La compilazione del questionario richiede qualche minuto.

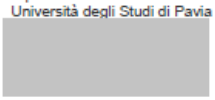
In allegato trovate anche una breve presentazione del progetto.

E' gradita una conferma della vostra presenza tramite e-mail.

Nel ringraziarvi per la disponibilità vi porgo cordiali saluti.

Claudia Meisina

--
Claudia Meisina
Dipartimento di Scienze della Terra e dell'Ambiente
Università degli Studi di Pavia



RESERVOIR_webinar_16 luglio.pdf
1214K

Example of email sent by the RESERVOIR team to notify at the stakeholder the webinar recording and to invite to fill the RESERVOIR questionnaire for the Comacchio pilot site

UNIVERSITÀ DI PAVIA

Meisina Claudia [redacted]

progetto RESERVOIR

Tommaso Letterio [redacted] 5 agosto 2020 09:09

[redacted]

Buongiorno dott. [redacted]

sono Tommaso Letterio del Consorzio di Bonifica Canale Emiliano Romagnolo, le scrivo in merito al progetto RESERVOIR per il quale venne contatto per le vie brevi qualche settimana fa.

Come da accordi le invio in allegato il link del webinar di presentazione del progetto tenutosi il 16/7:
link_Video (fino al minuto 18)
Come da accordi sarà nostra premura ricontattarla nelle prossime settimane.

Poi le invio il link ed il file di un questionario del quale le chiederemmo cortesemente la compilazione, in qualità di esperto dei temi trattati nell'area di studio:
link_questionario (o file allegato)

Grazie e Cordiali Saluti

Tommaso Letterio

Consorzio di Bonifica di Secondo Grado per il Canale Emiliano Romagnolo

[redacted]

RESERVOIR_questionnaire IT (1).docx
175K

Email for the invitation at the webinar for the Alto Guadalentín pilot site

Seminario web proyecto RESERVOIR 13 de julio

Carolina Guardiola Albert
Mar 16/06/2020 10:00
Para: Carolina Guardiola Albert
Cco: [redacted]

RESERVOIR_webinar_13_julio.... 1 MB

El Instituto Geológico y Minero de España y la Universidad de Alicante, tienen el placer de invitarles a participar en el webinar gratuito que tendrá lugar el día 13 de julio a las 11:00 h en el marco del proyecto europeo RESERVOIR (Sustainable groundwater RESources managEment by integrating eaRth observation deriVed monitoring and flOw modelling Results).

El webinar tiene como objetivo principal presentar el proyecto a potenciales agentes involucrados en diferentes aspectos de la gestión del ciclo integral del agua en la zona del Alto Guadalentín, o zonas próximas, para identificar y discutir posibles intereses o aspectos clave orientados a determinar un modelo de gestión sostenible del agua subterránea en la zona de estudio. También se explicará la forma de participar activamente en las distintas fases del proyecto, así como de recibir información de los resultados que se vayan obteniendo.

El programa del webinar es el siguiente:

11:00 h. Presentación del proyecto. Roberto Tomás Jover, Universidad de Alicante.

11:10 h. El acuífero del Alto Guadalentín. Concepción Pla Bru, Universidad de Alicante.

11:20 h. Gestión de los recursos hídricos subterráneos del acuífero Alto Guadalentín. José Manzano Cerón Jefe de Área de Gestión del Dominio Público Hidráulico.

11:30 h. Subsidencia del terreno en el valle del Alto Guadalentín. Roberto Tomás Jover, Universidad de Alicante.

12:40 h. Monitorización del Alto Guadalentín. Pablo Ezquerro Martín, Instituto Geológico y Minero de España.

12:50 h. Modelo MODFLOW del Alto Guadalentín. Pablo Ezquerro Martín, Instituto Geológico y Minero de España.

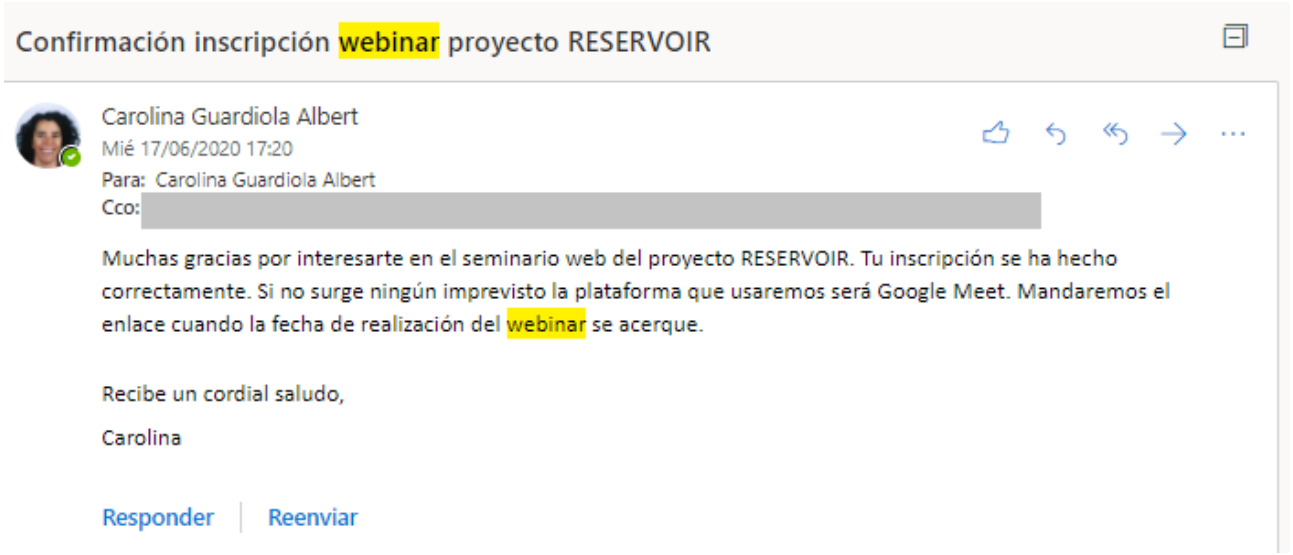
13:00 h. Aplicación de los modelos para la mejora de la gestión. Carolina Guardiola Albert, Instituto Geológico y Minero de España.

13:10 h. Participación en el proyecto RESERVOIR. Carolina Guardiola Albert, Instituto Geológico y Minero de España.

13:20 h. Mesa redonda. Moderador: Javier Valdés Abellán, Universidad de Alicante.

La inscripción es gratuita previo registro a través del siguiente e-mail: c.guardiola@igme.es

Email confirming the correct inscription to the webinar for the Alto Guadalentín pilot site



Confirmación inscripción webinar proyecto RESERVOIR

Carolina Guardiola Albert
Mié 17/06/2020 17:20
Para: Carolina Guardiola Albert
Cco: [redacted]

Muchas gracias por interesarte en el seminario web del proyecto RESERVOIR. Tu inscripción se ha hecho correctamente. Si no surge ningún imprevisto la plataforma que usaremos será Google Meet. Mandaremos el enlace cuando la fecha de realización del webinar se acerque.

Recibe un cordial saludo,

Carolina

Responder | Reenviar

Email with the link to the webinar for the Alto Guadalentín pilot site

Carolina Guardiola Albert
Jue 16/07/2020 12:02
Para: 'c.guardiola@igme.es'
Cco: [redacted]

Buenos días,

Desde el proyecto RESERVOIR nos ponemos de nuevo en contacto con vosotros para informaros del seminario web que tuvo lugar el pasado 13 de julio de 2020. En primer lugar queremos agradeceros a todos aquellos que habéis mostrado interés en el mismo por vuestro apoyo.

Como la página web del proyecto está en construcción, os hacemos llegar las presentaciones y la grabación del seminario a través de los siguientes enlaces:

Grabación: https://vertice.cpd.ua.es/225186

Presentaciones en pdf: https://www.dropbox.com/sh/hna2mukwschhkcm/AACk3T4f4uice3Uf7R5f4-Wba?dl=0

Además, a los que queráis estar informados sobre los avances del proyecto, o deseéis participar de algún modo en el proyecto, os invitamos a responder un cuestionario al que se puede acceder con el enlace que copio a continuación. Sé que algunos ya lo habéis completado, apreciamos mucho vuestra colaboración. El cuestionario estará activo hasta el 31 de julio. Los resultados de esta encuesta son de gran ayuda en la fase inicial del proyecto en la que estamos:

https://docs.google.com/forms/d/e/1FAIpQLSfu0Zjga95nKzN39yl57KJhW03mcXsUA2jCuZTAfXaf4owH8A/viewform?usp=sf_link

Un cordial saludo,

Carolina Guardiola Albert

Invitation to the webinar through Linkedin.

Invitation to the webinar through Twitter.

Statistic of the tweet of the webinar in Twitter.

Example of personalized e-mail sent to GRB stakeholders to introduce the project by attaching a presentation file and to invite them to fill out the stakeholder requirements questionnaire

10/28/2020 Gmail - Gediz Nehir Havzası Yeraltı Sularına İlişkin bir Araştırma Projesi Hakkında Bilgilendirme

Gmail

RESERVOIR Projesi <reservoir.deu@gmail.com>

Gediz Nehir Havzası Yeraltı Sularına İlişkin bir Araştırma Projesi Hakkında Bilgilendirme

RESERVOIR Projesi <reservoir.deu@gmail.com> Mon, Oct 19, 2020 at 8:26 PM
To [redacted]

Sayın Dr [redacted]

Üniversitemizde yürütülmekte olan, "Yeryüzü Gözlem ve Akım Modelleme Bütünleştirilmesi ile Sürdürülebilir Yeraltı Suyu Kaynak Yönetimi (RESERVOIR)" isimli uluslararası bilimsel araştırma projesi, geçen sene PRIMA vakfı tarafından desteklenmeye hak kazanmış ve çalışmalar 28 Şubat 2020 tarihinde resmen başlamıştır.

Projenin konusunu, hedeflerini ve aşamalarını özetleyen bir sunu dosyası bu e-postanın ekinde iletilmektedir. Anket kapsamında Gediz Havzasındaki paydaşların konu ile ilgili görüşlerinin ve bu çalışmadan beklentilerinin öğrenilmesi amaçlanmaktadır. Ayrıca paydaşların proje çıktılarından doğrudan faydalanabilmeleri için ilgili kurum/kuruluş temsilcilerinin de yer aldığı kullanıcı gruplarının oluşturulması hedeflenmektedir. Bu nedenle, hazırlanan anketteki soruların tarafınızdan cevaplandırılması büyük önem arz etmektedir. Ayrıca bu e-postayı konuyla ilgili olduğunu düşündüğünüz kişilere de iletebilirsiniz.

Anketi cevaplamanız için yaklaşık 3 dakikalık sürenin yeterli olacağı düşünülmektedir. (--> ANKET BAĞLANTISI)

Zaman ayırdığınız ve destek verdiğiniz için şimdiden çok teşekkür eder, saygılar sunarım.

--
Prof.Dr. Alper Elçi
RESERVOIR Projesi
DEÜ Araştırma Grubu Sorumlusu

E-posta: reservoir.deu@gmail.com

RESERVOIR proje tanıtımı.pdf
1380K

ANNEX 2

Photos of the Workshop organized by the University of Jordan and the Royal Society for the Conservation of Nature - Azraq Wetland Reserve in Jordan to involve the stakeholders.


كلية
الأمير الحسين بن عبدالله الثاني
للدراسات الدولية


RESERVOIR
Sustainable
groundwater
RESources
managEment by
integrating eaRth
obserVation derived
monitoring and flOw
modeling Results
كلية
الأمير الحسين بن عبدالله الثاني
للدراسات الدولية

Agenda of the Workshop organized in Jordan.

ورشة العمل التعريفية بمشروع

Sustainable groundwater RESources managEment by integrating eaRth observation deriVed monitoring and flOw modeling Results

الإدارة المستدامة لمصادر المياه الجوفية من خلال نمذجة البيانات

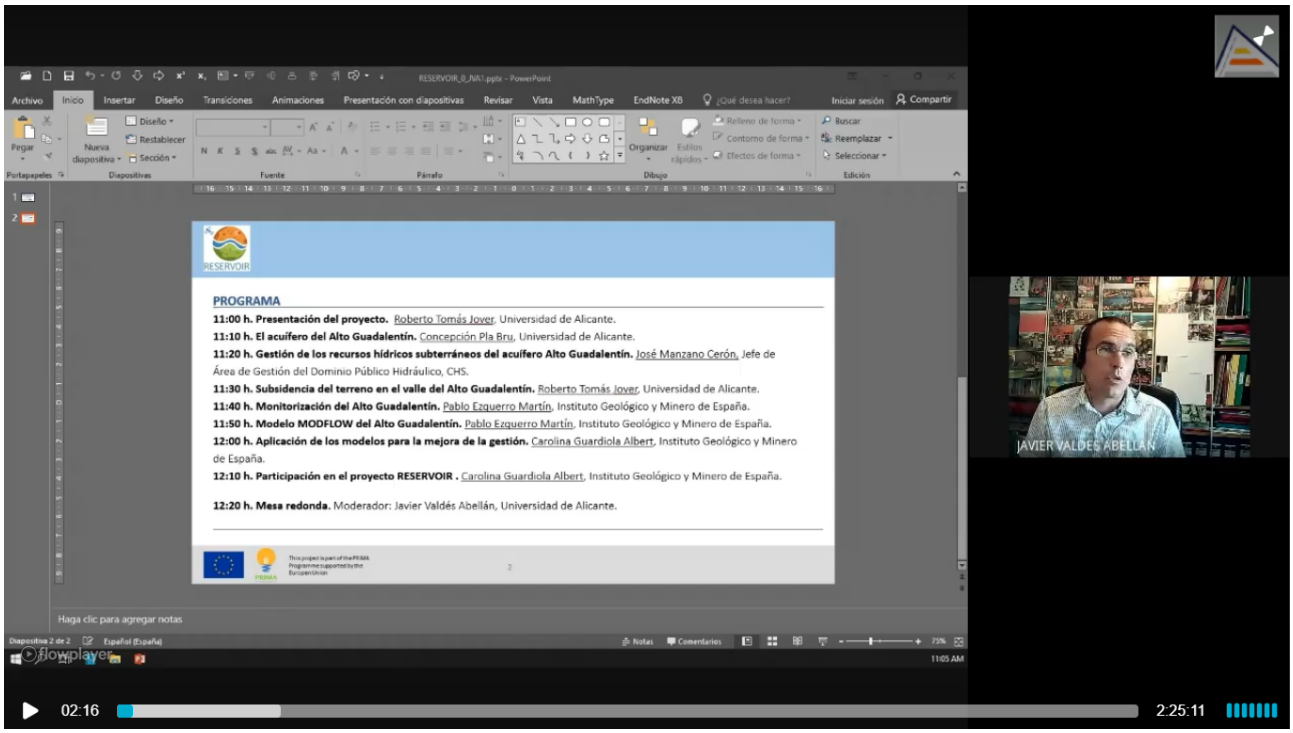
كلية الأمير حسين للدراسات الدولية/ الجامعة الأردنية

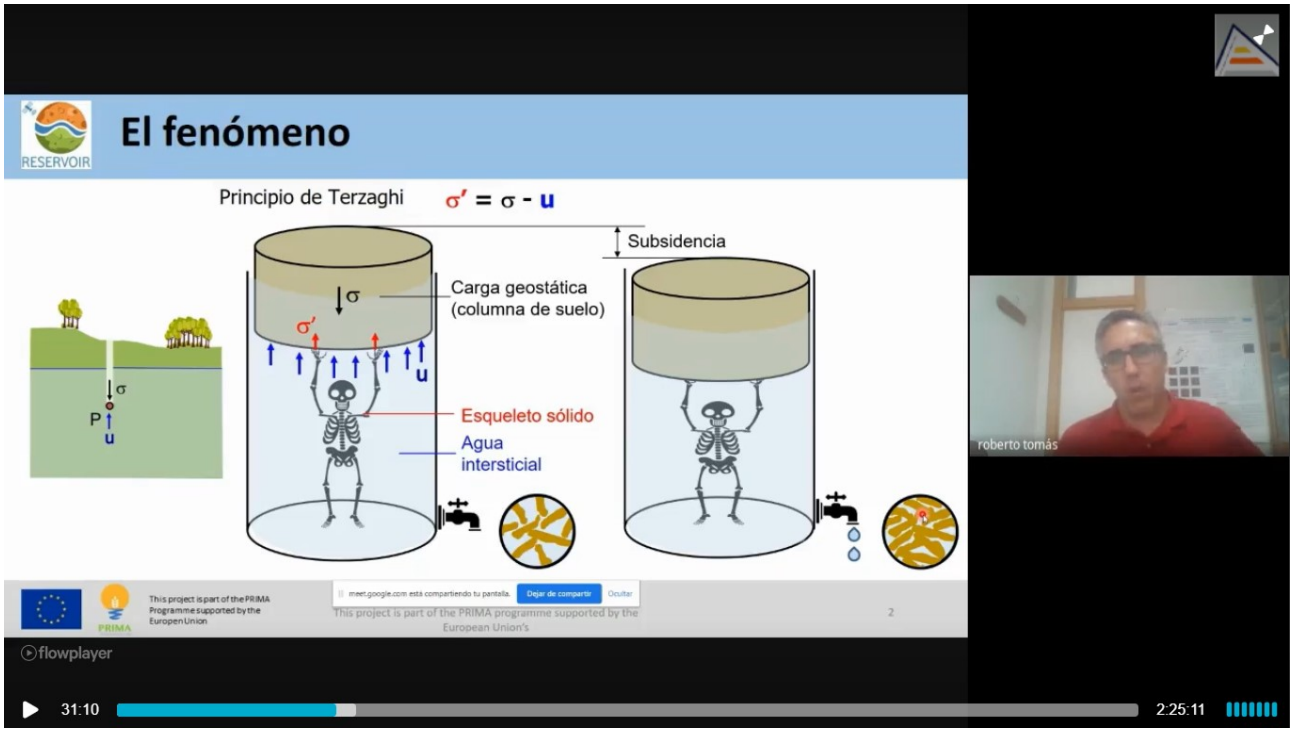
الأربعاء 2020/9/9

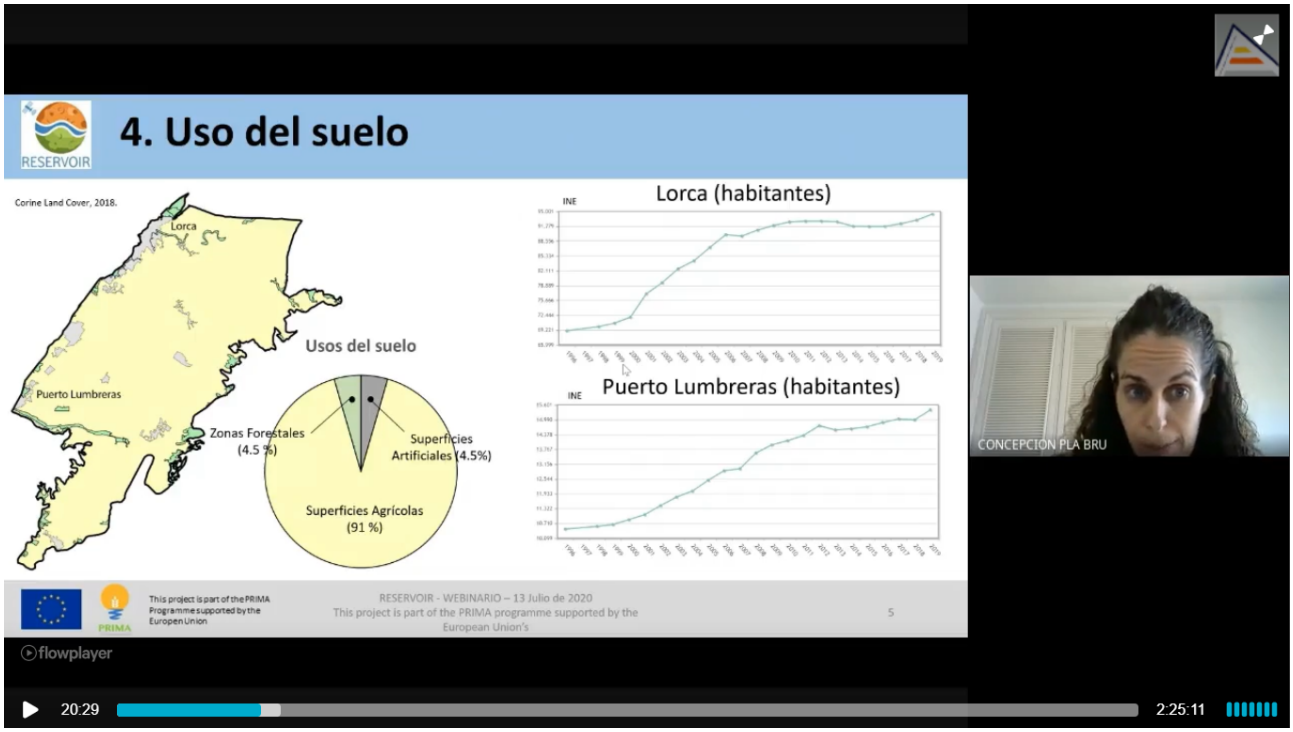
تسجيل الحضور	10:00 – 09:30
افتتاح الورشة	10:30 –10:00
استراحة قهوة	11:00 – 10:30
محاضرات تعريفية	12:30 – 11:00
مناقشة/ تعبئة الأستبانات	1:00– 12:30
غداء	2:00 – 1:00

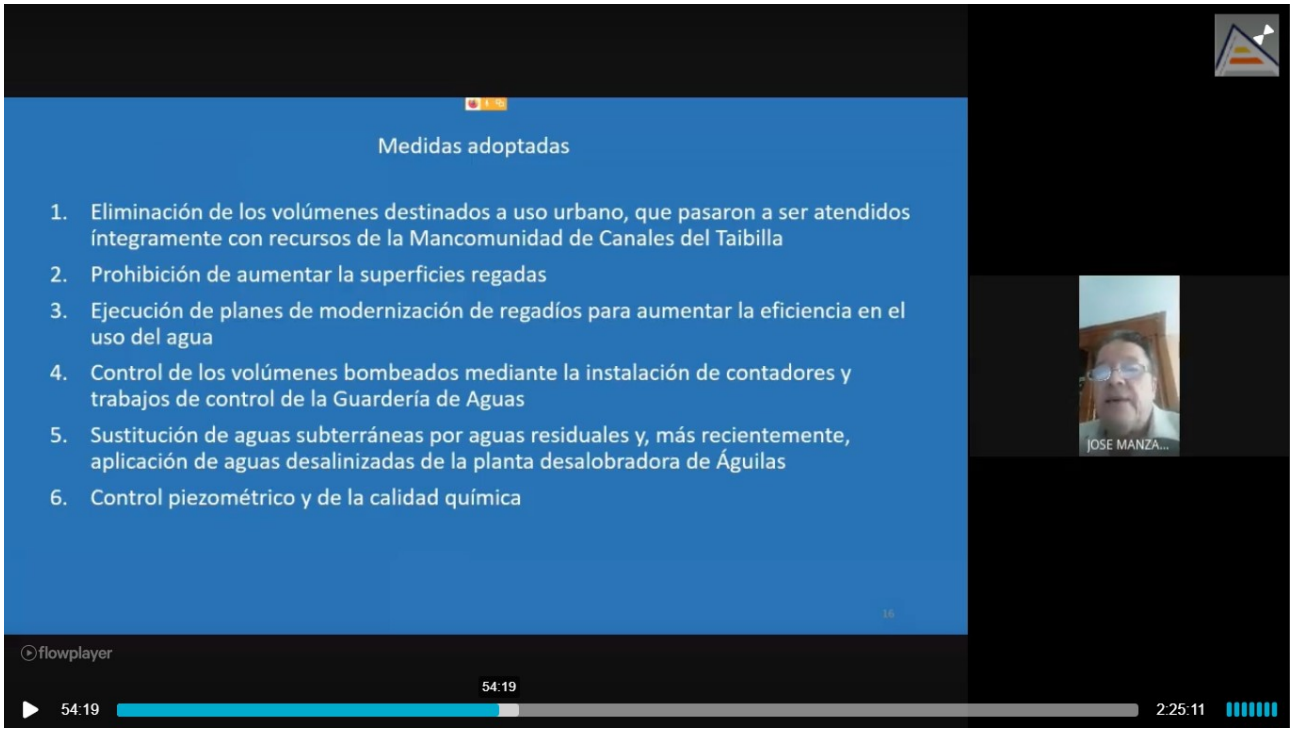
Screenshot showing the presentation during the webinar for the Italian pilot site.

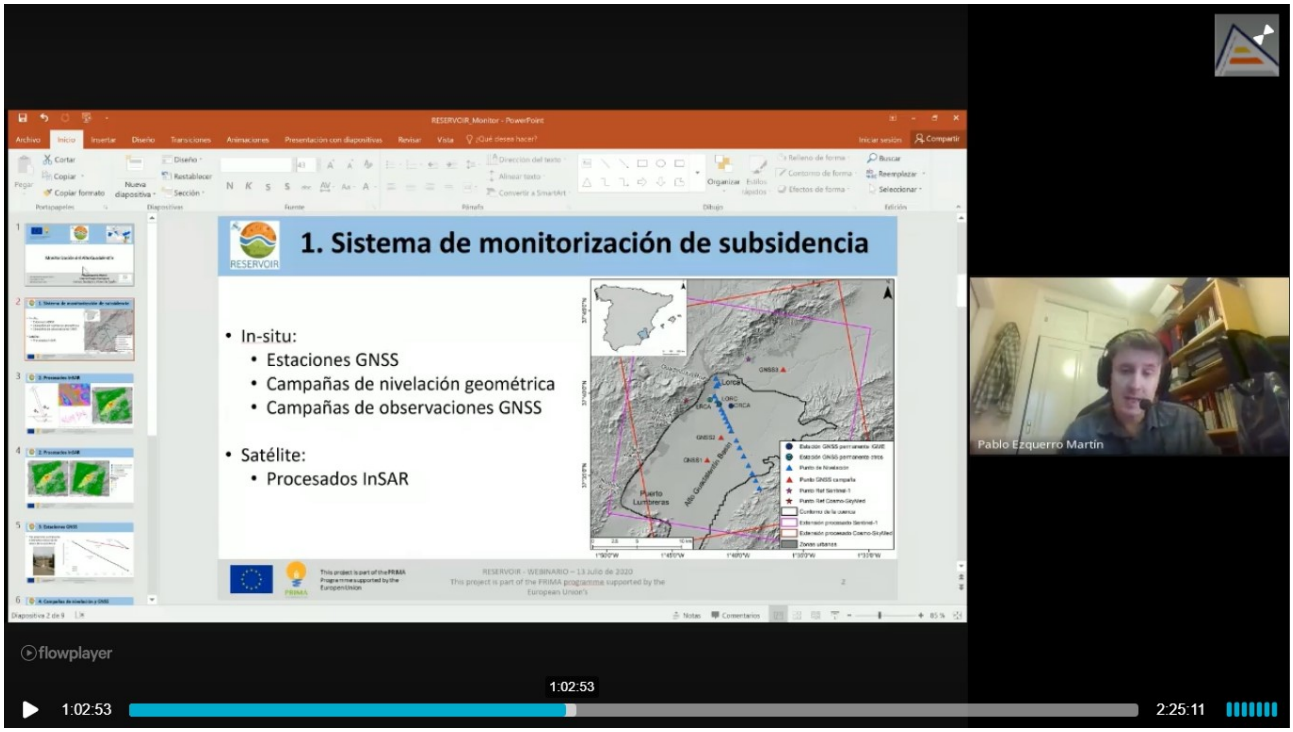
Different screenshots showing some of the presentations during the webinar for the Alto Guadalentín pilot site.

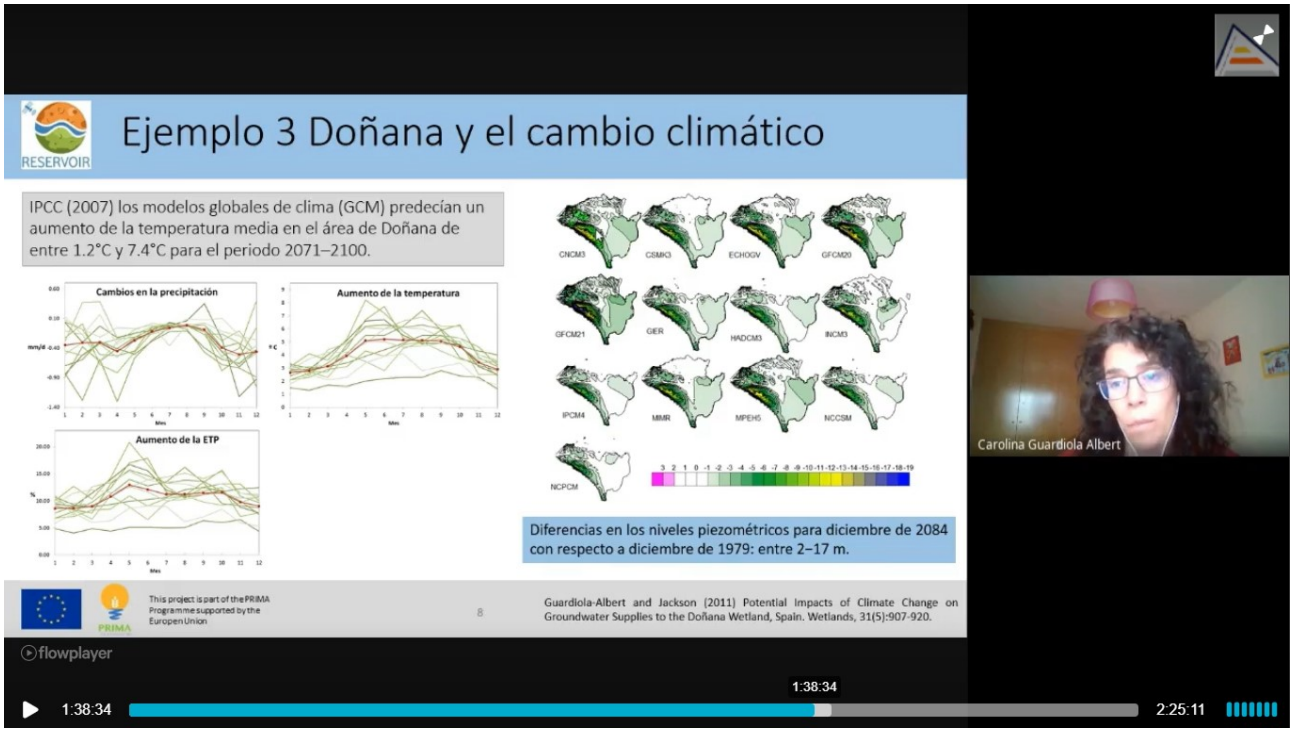



El fenómeno
Principio de Terzaghi
σ′ = σ - u
Subsidencia
Carga geostática
(columna de suelo)
Esqueleto sólido
Agua
intersticial
roberto tomás
flowplayer
31:10
2:25:11


4. Uso del suelo
Corine Land Cover, 2018.
Lorca
Puerto Lumbreras
Usos del suelo
Zonas Forestales
(4.5 %)
Superficies
Artificiales (4.5%)
Superficies Agrícolas
(91 %)
Lorca (habitantes)
INE
Puerto Lumbreras (habitantes)
INE
CONCEPCIÓN PLA BRU
flowplayer
20:29
2:25:11


Medidas adoptadas
1. Eliminación de los volúmenes destinados a uso urbano, que pasaron a ser atendidos íntegramente con recursos de la Mancomunidad de Canales del Taibilla
2. Prohibición de aumentar la superficies regadas
3. Ejecución de planes de modernización de regadíos para aumentar la eficiencia en el uso del agua
4. Control de los volúmenes bombeados mediante la instalación de contadores y trabajos de control de la Guardería de Aguas
5. Sustitución de aguas subterráneas por aguas residuales y, más recientemente, aplicación de aguas desalinizadas de la planta desalobradora de Águilas
6. Control piezométrico y de la calidad química
JOSE MANZA...
flowplayer
54:19
54:19
2:25:11


1. Sistema de monitorización de subsidencia
• In-situ:
• Estaciones GNSS
• Campañas de nivelación geométrica
• Campañas de observaciones GNSS
• Satélite:
• Procesados InSAR
Pablo Ezquerro Martín
flowplayer
1:02:53
1:02:53
2:25:11


Ejemplo 3 Doñana y el cambio climático
IPCC (2007) los modelos globales de clima (GCM) predecían un aumento de la temperatura media en el área de Doñana de entre 1.2°C y 7.4°C para el periodo 2071–2100.
Cambios en la precipitación
Aumento de la temperatura
Aumento de la ETP
CNCM3
CSMP3
ECHOGV
GFCM20
GFCM21
GIER
HADCM3
INCM3
IPCM4
MMR
MPEH5
NCCSM
NCPCM
Diferencias en los niveles piezométricos para diciembre de 2084 con respecto a diciembre de 1979: entre 2–17 m.
This project is part of the PRIMA Programme supported by the European Union
8
Guardiola-Albert and Jackson (2011) Potential Impacts of Climate Change on Groundwater Supplies to the Doñana Wetland, Spain. Wetlands, 31(5):907-920.
Carolina Guardiola Albert
flowplayer
1:38:34
1:38:34
2:25:11