



FREEWAT

Free and Open Source Software Tools for Water Resource Management
EU HORIZON 2020 Project



 **ict4water.eu**

Dare valore all'acqua. La piattaforma EU H2020 FREEWAT per la gestione della risorsa idrica

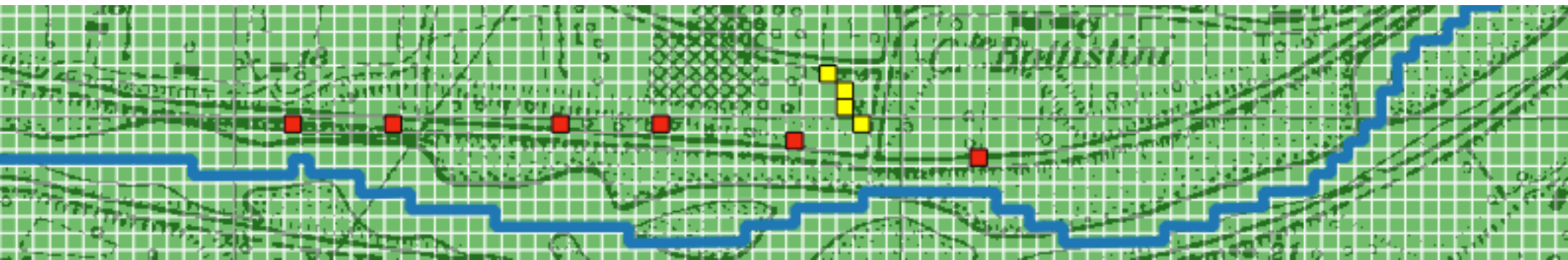
Scuola Superiore S. Anna

12 Luglio 2107 - Pisa

L'esperienza dell'approccio partecipato al caso di studio di Follonica.
Uno spazio comune per portare esperienze e valori dei partecipanti e
generare conoscenza condivisa sulla risorsa acqua.



Regione Toscana
Pio Positano - Marco Nannucci



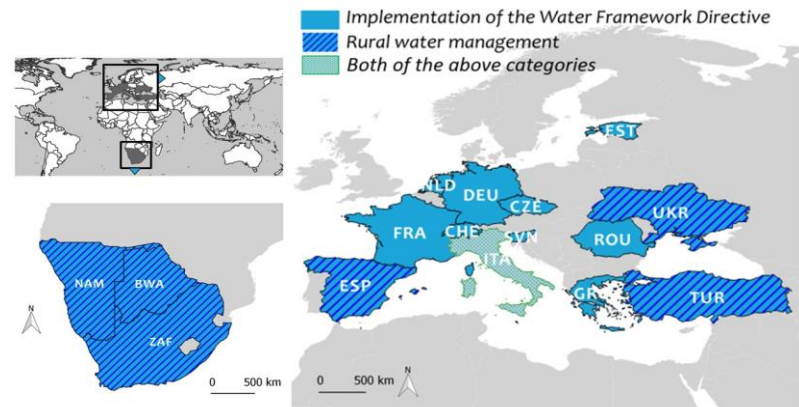
THE FREEWAT PROJECT

FREEWAT is an *HORIZON 2020* project financed by the EU Commission under the call WATER INNOVATION: BOOSTING ITS VALUE FOR EUROPE.

FREEWAT aims at simplifying the application of EU water-related Directives by means of an innovative *GIS-integrated open source and public domain ICT tool* (the *FREEWAT platform*) for the simulation of water quantity and quality in ground- and surface-water.

The *FREEWAT* platform aims at producing scientifically and technically sound decisions and policy making based on data and innovative data analysis tools. Policy makers may benefit from its application adopting a *participatory approach*, by involving stakeholders during the phase of River Basin Management Plan definition.

Partners

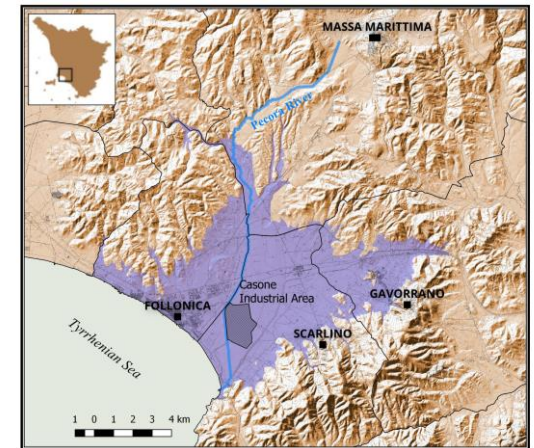


THE CASE STUDY

The *case study area* of Follonica-Scarlinto is located in the south part of Tuscany in a coastal plain at the end of the Pecora River valley. This area belongs to the “Colline Metallifere” pyrite-base metals district and starting from Etruscan-Roman times to present days there have been various mining and metallurgical activities in the area.

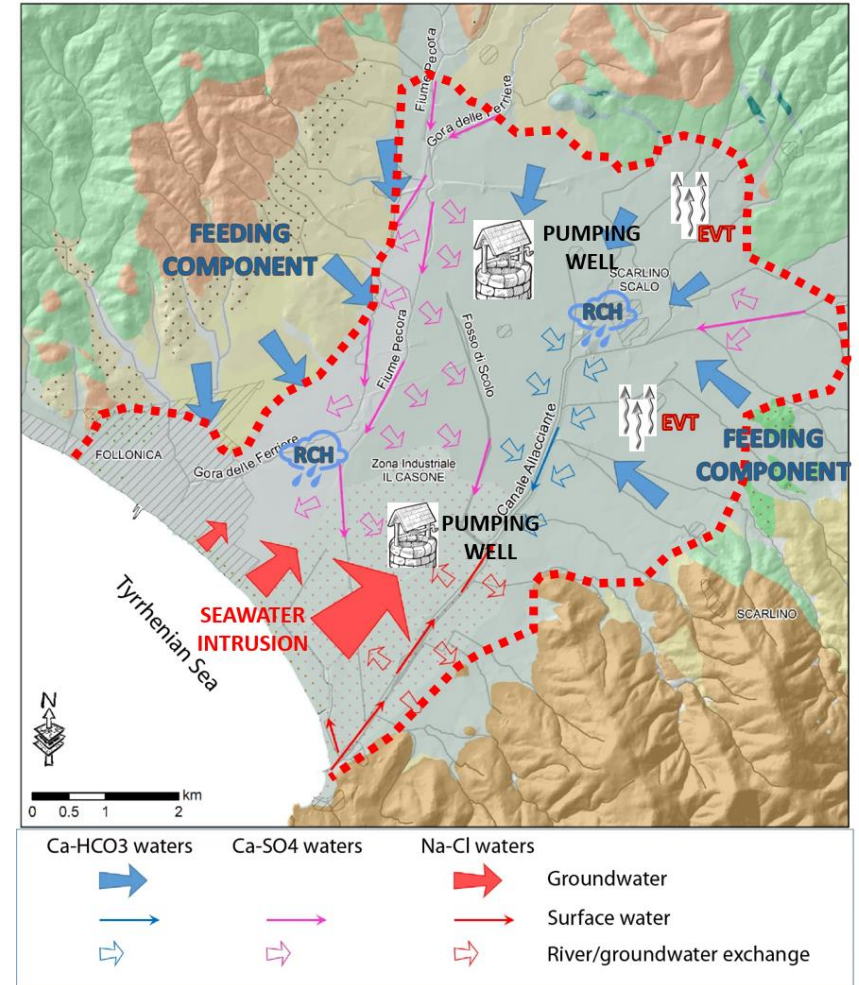
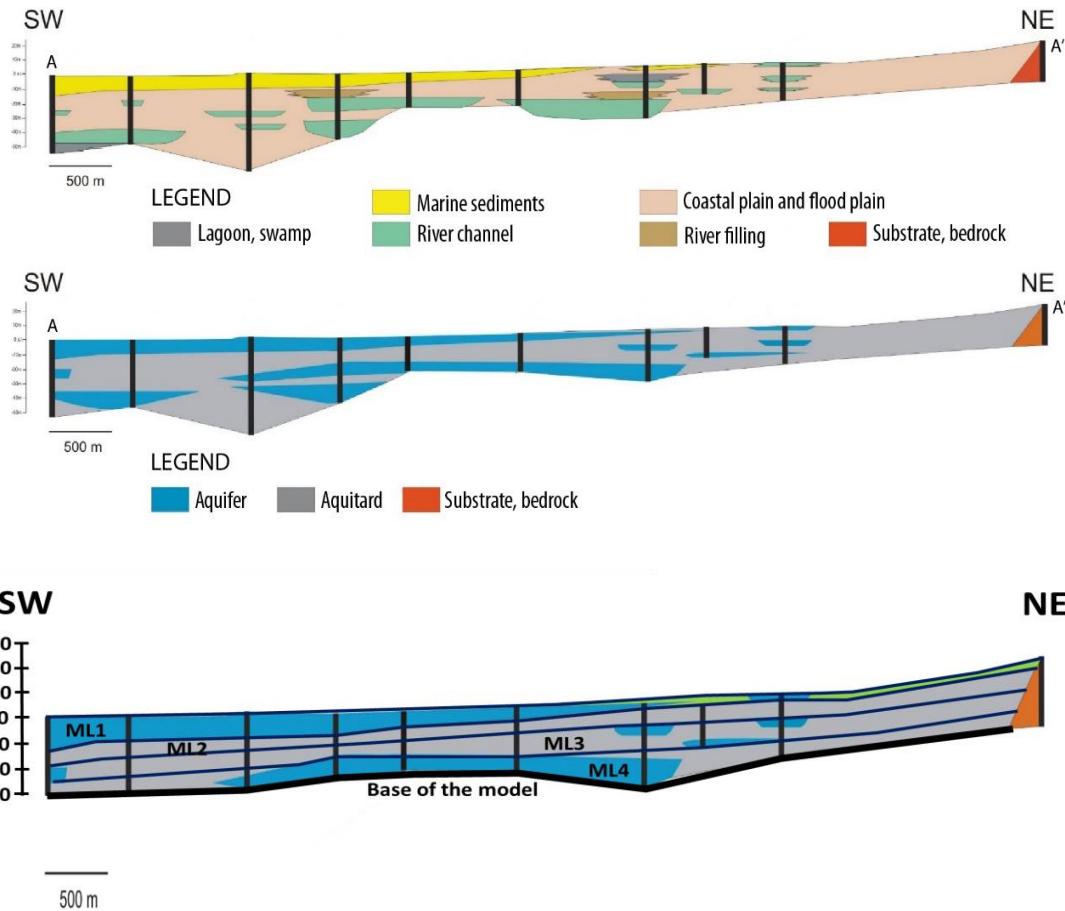
The Follonica-Scarlinto *aquifer system* is one of the groundwater reservoir characterized and defined by the Region of Tuscany under the EU Water Framework Directive 2000/60/EC, so many data about the aquifer were collected. The study area is affected by various issues but the numerical model created through FREEWAT platform was used to study in particular the aquifer over-exploitation problem, according to the River Basin Management Plan compiled by Northern Apennines District Authority, in application of the WFD.

The deficit in *quantity* of the resource is mainly caused by the huge industrial withdrawals, but civil water supply during the summer season it's also notable as the population of the area grows up to ten times more, due to seaside tourism.



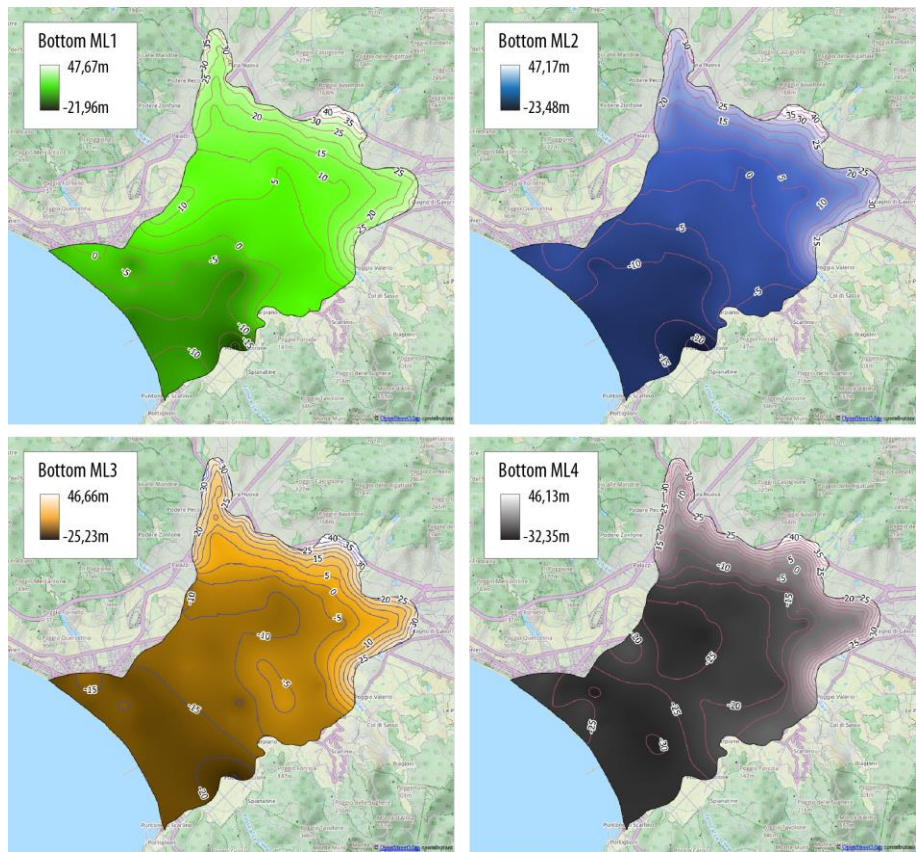
THE NUMERICAL MODEL

The application of the FREEWAT platform to the Follonica-Scarlinto aquifer obtained a groundwater flow numerical model based on a solid *conceptual model* of the aquifer system.

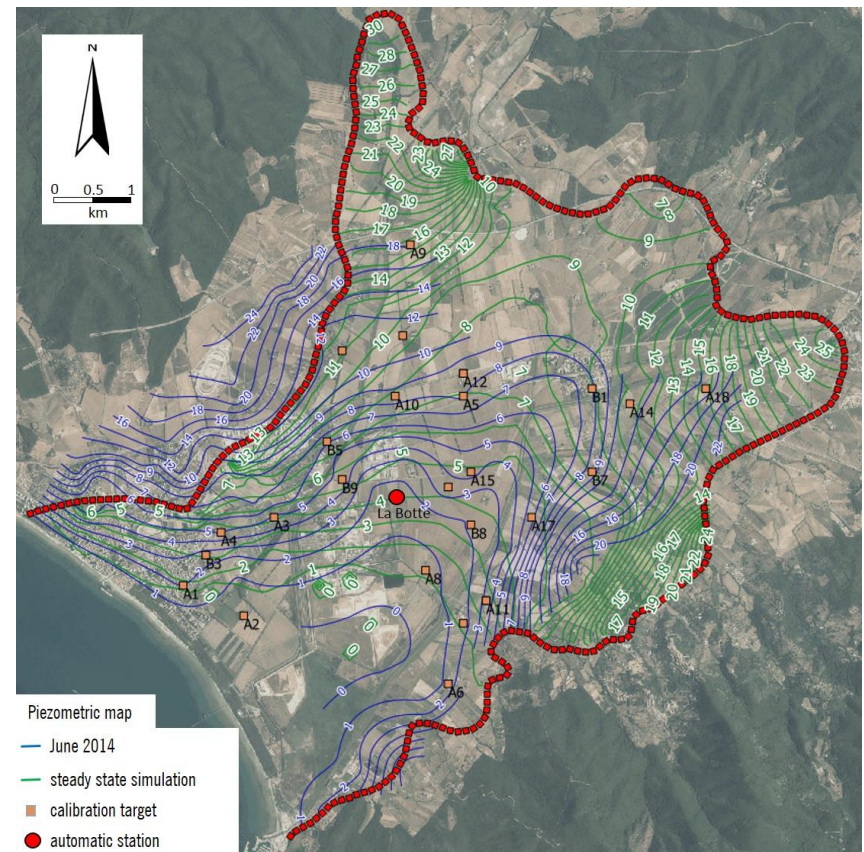


THE NUMERICAL MODEL

The numerical model, conveniently tuned, is able to forecast the response of the aquifer system to different solicitations and changes in the water balance simulating different scenarios. According to the problem and to the *water policy* to target, the case study was useful to investigate various design *solutions to increase the quantity* of the water resource and to provide a reliable support to decision makers.



Bottom values of the 4 Model Layers



THE PARTICIPATORY APPROACH

The participatory approach of the H2020 FREEWAT project, carried on through ***seven focus groups***, led the stakeholders to reach an agreement about scenarios to be explored with FREEWAT software platform.

Main components of the Focus Group

local decision makers and policy implementers

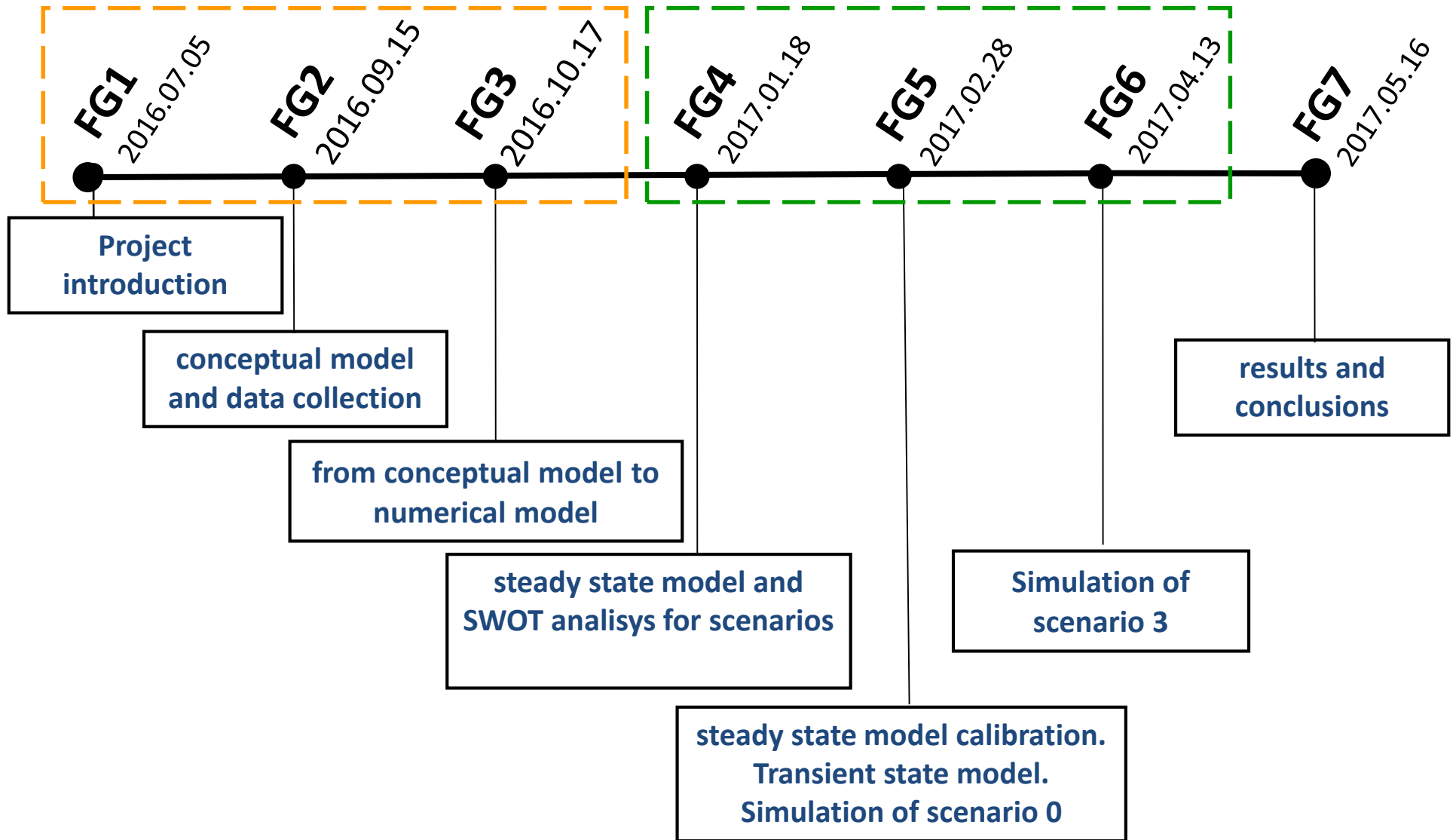
- *public universities and national research centres*
- *water utilities and industries*
- *citizens, geo-engineering companies and professional*
- *agro-food industry*
- *farmers associations*
- *environmental associations*
- *touristic operators*
- *energy managers*
- *labour unions*



THE PARTICIPATORY APPROACH

identifying the case study objectives

targeting water management issues



Focus Groups 1-3: identifying the case study objectives

1. understanding how *water management issue* was *perceived* in the study area and how much the stakeholders believed that *new technologies could improve* water management;
2. clearing the air of any possible *misunderstanding* about our commitment in this project as members of a public institution. This is useful to keep calm the climate of the group and have the possibility to make a good work altogether in a collaborative manner;
3. reaching a *shared awareness* of the available *data set* to build the numerical model. The missing data set were supplied by the stakeholders involved.



FREEWAT
Free and Open Source Software Tools for Water Resource Management
EU HORIZON 2020 Project

 **ict4water.eu**



WIRE
Water & Irrigated agriculture Resilient Europe
EIP Water Action Group
Pooling resources - Innovating water



ISTITUTO
DI SCIENZE
DELLA VITA
 Scuola Superiore
Sant'Anna

Focus Groups 1-3: identifying the case study objectives

4. the important *gap in quantity* of the water resource identified as the main water management problem by the *River Basin Management Plan* for this area emerged in very clear way during the focus group;
5. the stakeholders characterized the objective of the case study in finding an alternative source for the huge amount of withdrawals of the industrial activities, agriculture and tourism. Three components of the same problem: *to grant a constant and sustainable development of the economic activities* in the coastal plain of Follonica and Scarlino. For this reason even the social part of the society took part to the focus group through some of the labour unions.



Focus Groups 4-6: targeting water management issues

a) *identifying the measures to target among those foreseen by the River Basin Management Plan in the Programme of Measures.*

Programme of Measures

Direct	Agriculture	Climate change	Energy - hydr	Energy - non-	Fisheries and aqu	Flood protection	MIN	MAX	
	Forestry	Industry	Tourism & recreat	Transport	Urban development	Unknown/Other			
Direct measures - Planned				Upstream measures - Planned					
[01] POINT	[02] NUTR 1 interv.	[03] PEST	[04] CONTAM	[01] POINT 2 interv.	[02] NUTR 1 interv.	[03] PEST	[04] CONTAM 27 interv.		
[05] LONG	[06] HYDROM	[07] FLOW 1 interv.	[08] IRRIG	[05] LONG	[06] HYDROM 1 interv.	[07] FLOW 1 interv.	[08] IRRIG 1 interv.		
[09] PRIC.HH	[10] PRIC.IND	[11] PRIC.AGR	[12] ADV.AGR	[09] PRIC.HH	[10] PRIC.IND 1 interv.	[11] PRIC.AGR 1 interv.	[12] ADV.AGR		
[13] WAT.PROT	[14] KNOW	[15] EMISS	[16] IND.WWT	[13] WAT.PROT	[14] KNOW 1 interv.	[15] EMISS	[16] IND.WWT		
[17] SOIL	[18] ALIEN	[19] RECREAT	[20] FISHING	[17] SOIL	[18] ALIEN	[19] RECREAT	[20] FISHING		
[21] POLLUT	[22] FOREST	[23] RETENT	[24] CLIM.CHG	[21] POLLUT	[22] FOREST	[23] RETENT	[24] CLIM.CHG		

Extended list of measures

Direct measures - Additional measures				Upstream measures - Additional measures			
[01] POINT	[03] NUTR 1 interv.	[03] PEST	[04] CONTAM	[01] POINT	[02] NUTR 4 interv.	[03] PEST 2 interv.	[04] CONTAM
[05] LONG	[06] HYDROM	[07] FLOW 1 interv.	[08] IRRIG	[05] LONG	[06] HYDROM 1 interv.	[07] FLOW 1 interv.	[08] IRRIG 2 interv.
[09] PRIC.HH	[10] PRIC.IND	[11] PRIC.AGR	[12] ADV.AGR	[09] PRIC.HH	[10] PRIC.IND 1 interv.	[11] PRIC.AGR 1 interv.	[12] ADV.AGR
[13] WAT.PROT	[14] KNOW	[15] EMISS	[16] IND.WWT	[13] WAT.PROT	[14] KNOW 1 interv.	[15] EMISS	[16] IND.WWT
[17] SOIL	[18] ALIEN	[19] RECREAT	[20] FISHING	[17] SOIL	[18] ALIEN	[19] RECREAT	[20] FISHING
[21] POLLUT	[22] FOREST	[23] RETENT	[24] CLIM.CHG	[21] POLLUT	[22] FOREST	[23] RETENT	[24] CLIM.CHG

Extended list of measures

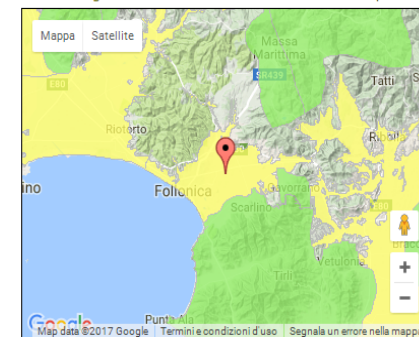
Northern Apennines District :: River Basin Management Plan

Waterbody sheet

General Information	Codice WISE	IT0932CT040
	Nome	Corpo idrico della Pianura di Follonica
Location	Regione	TOSCANA
	Category	Acquiferi
Characteristics	Type	DQ
	Basin area [sq.km]	76.9 kmq
Links	Aree protette	09ATO602516 (APOT_GW), 09ATO601793 (APOT_GW), 09ATO601950 (APOT_GW), 09ATO601440 (APOT_GW), 09ATO602558 (APOT_GW), 09ATO602678 (APOT_GW), 09ATO601339 (APOT_GW), 09ATO602494 (APOT_GW), 09ATO602602 (APOT_GW) (+ 7...)
	Connected SW	[IT09CI_R000TC171f] FOSSO CERRETELLA [IT09CI_R000TC202f] FOSSO DELL'ACQUA NERA (3) [IT09CI_R000TC041ca] CANALE ALLACCIANTE DI SCARLINO [IT09CI_R000TC300ca] FOSSO PETRAIA [IT09R000TC007AC] Costa di Piombino [IT09CI_R000TC343ca] GORA DELLE FERRIERE-FOSSO VENELLE [IT09CI_R000TC120f] FIUME PECORA MONTE [IT09CI_R000TC148ca] FOSSO ALLAOPPA [IT09CI_R000TC344ca] GORA DELLE FERRIERE (2) [IT09CI_R000TC121f] FIUME PECORA VALLE

Localizzazione geografica

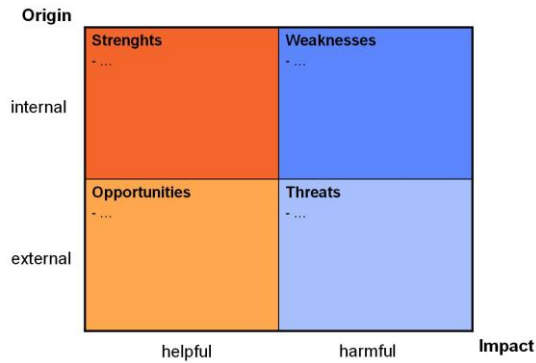
Cartografia Web GIS Piano di Gestione delle Acque



Nota: la mappa sopra riportata ha una funzione solamente indicativa. Per ogni esigenza di precisione geografica nella localizzazione del corpo idrico, si rimanda alla cartografia web-gis dedicata.

Focus Groups 4-6: targeting water management issues

b) selecting workgroup techniques: for this case study **SWOT Analysis** and **brainstorming** were adopted.



The scenarios

The community of the stakeholders chose two of the *four scenarios* that came out from the focus group.

The scenarios number

- * **0** desalination plant
- 1** well field displacement
- * **3** mine water drainage reuse

were focused on the *comparison of alternative water management strategies*

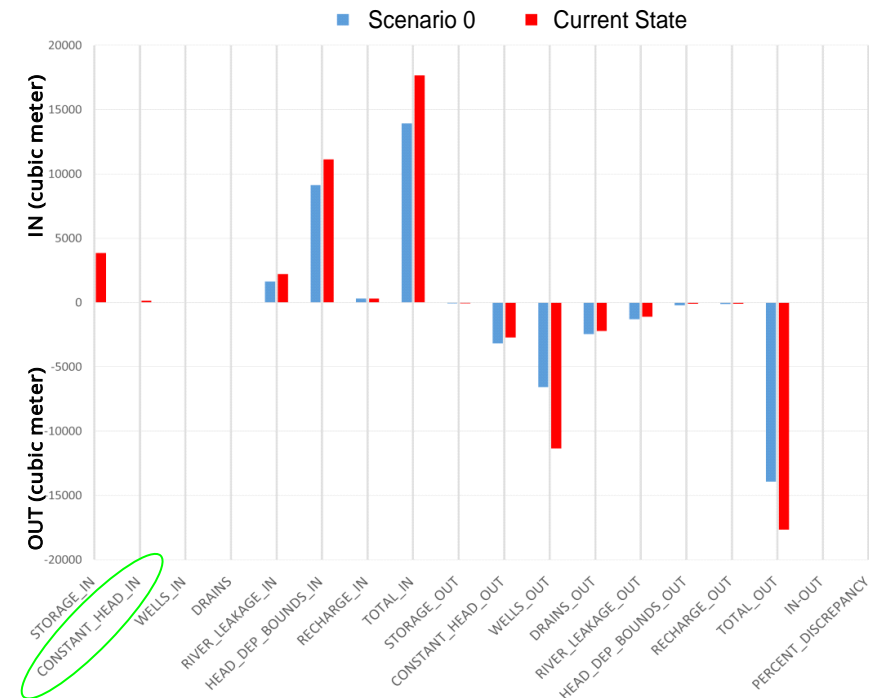
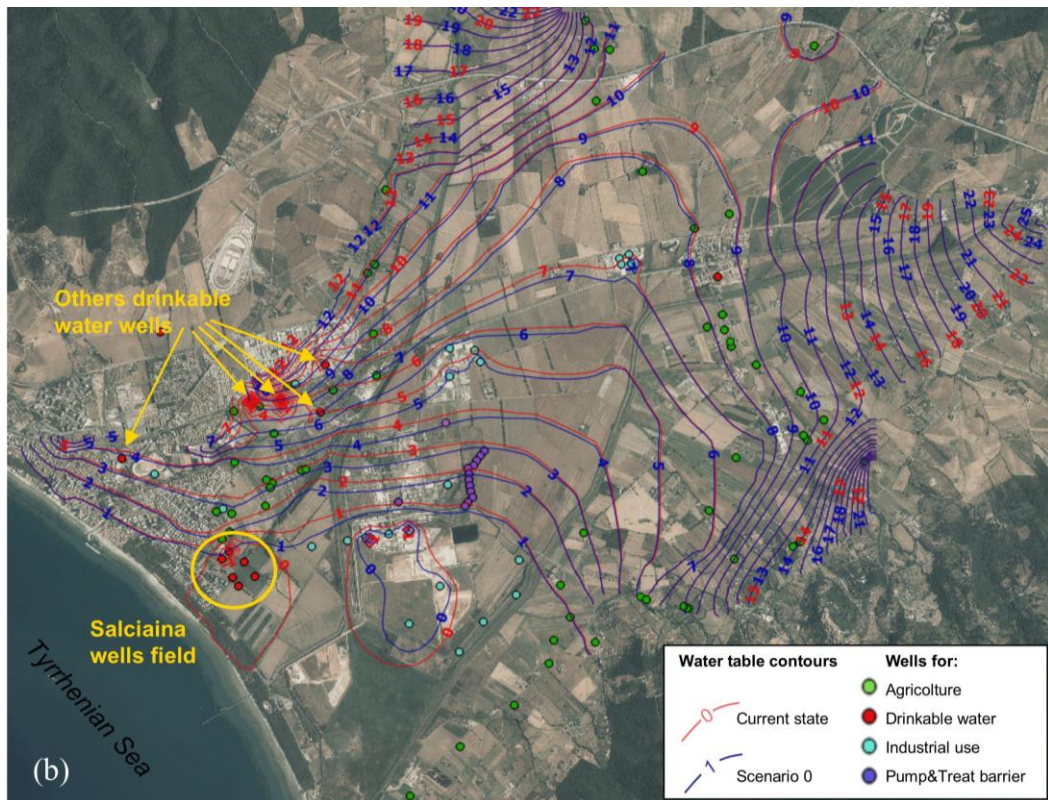
The scenario number

- 2** very hard summer drought conditions

was centred on *possible future changes to the system*

The scenarios

Scenario 0 : the construction of a desalination plant in order to improve the quantity of the resource. This scenario was based on the fulfilment of a part of the measures foreseen by the *Programme of Measures* of the River Basin Management Plan for the Northern Apennines District.



Water budget and comparison between two hydraulic heads simulated with FREEWAT in transient condition (low level condition sp12: July-September 2012). Constant-Head-In represents seawater intrusion.

The scenarios

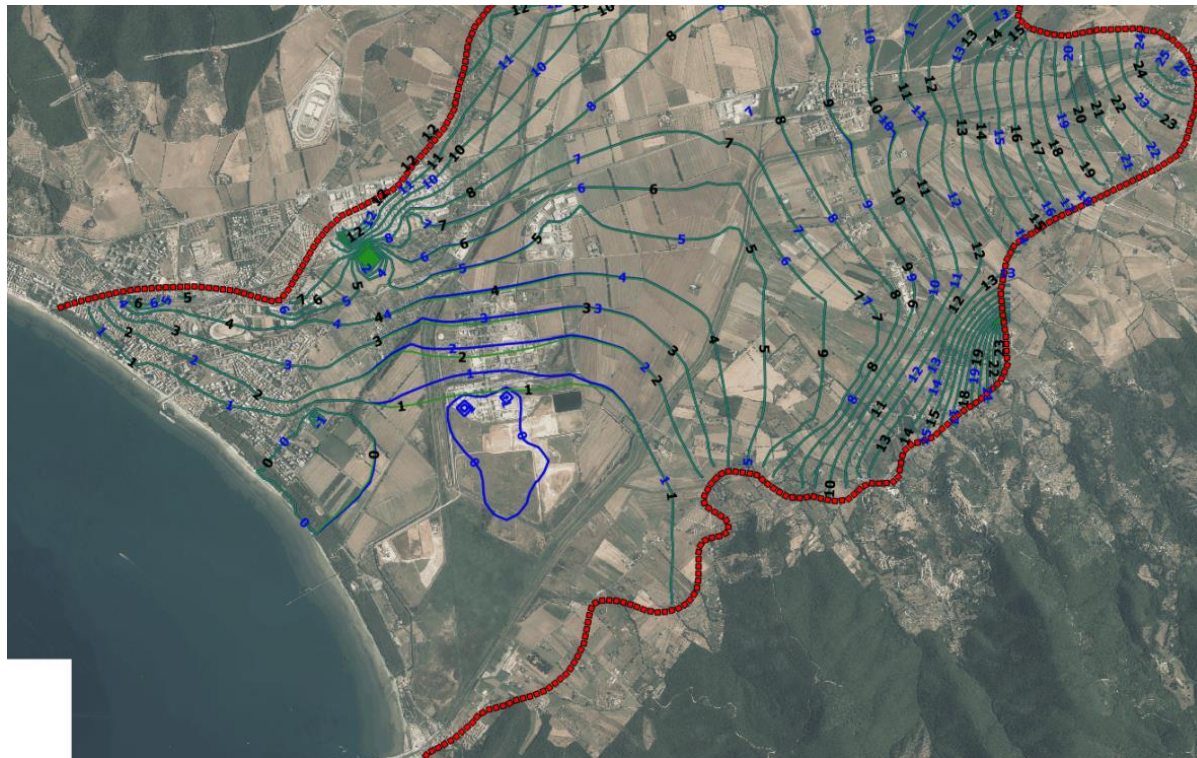
Scenario 1 : the removal of Salciaina wells field used for drinkable water supply and the building of *a new well field far from the coastal area*. The aim of this scenario is to demonstrate the utility of this project solution in reducing the phenomenon of saline intrusion.

Scenario 2 : the simulation of an hypothetical future event of piezometric level in *very hard summer drought conditions* following a winter very poor of rains. This scenario was intended to identify the best solutions (e.g.: drilling new wells? limiting the withdrawals? and where?) to address such a crisis situation.

These scenarios were not chosen by focus group participants, so they were not implemented in FREEWAT model.

The scenarios

Scenario 3 : the reuse of Gavorrano Mine drainage water for industrial purpose instead of instead of withdrawals from wells located in the central industrial areal in the middle of the plain. The aim of this scenario is to demonstrate the utility of this project solution in reducing water table depression and sea water intrusion.



 **current state**
 **Scenario-3**

comparison between two water tables simulated with FREEWAT in transient conditions (low level condition sp24 - July-September 2015) using 50% of the mine drainage water for industrial porpouse (total amount of the industrial area needs = 3524 m³/day)

Focus Groups 7:

Results and Feedback from the stakeholders

- FREEWAT is an important tool in order *to improve the knowledge* of a study area or of a problem and *to organize and share data*;
- *no software licenses costs*;
- FREEWAT project gave the opportunity *to organize the big amount of data collected* for the Follonica-Scarlinto aquifer basin;
- the scenario of the reuse of mine drainage water instead of industrial withdrawals is a very useful starting point *to increase opportunities for productive activities* in a very responsible manner for society and environment and also capable to generate new "decent work*" and *long-lasting jobs*;
- tools like FREEWAT are important to produce new work that is not only "decent" but also "green" because this is the most successful way to make *work sustainable* and *long-lasting*;
- relevance of the results of FREEWAT for the management of water resources in *touristic season planning*;
- some engineers of local industries are interested in *using FREEWAT platform as a modeling tool*. They want also to use the numerical model produced by this case study *to start new model implementations*.



* definition of the United Nations Economic and Social Council and of the International Labour Organization

Conclusions and new challenges for the future

- more *awareness* about benefits in using *numerical modeling*
- usefulness of *participatory approach*
- *Policy Briefs* for decision makers
- to enhance *quality* and *quantity of data* to improve the numerical model;
- to grow up *water resource monitoring*;
- to pass *from the case study to a real application* in the study area;
- *to get more involved decision makers* who have now to receive FREEWAT suggestions for a new kind of water management;
- *to get more involved the agriculture world* of local stakeholders even if they are not so used to employ and understand tools for numerical modeling like FREEWAT.



FREEWAT
Free and Open Source Software Tools for Water Resource Management
EU HORIZON 2020 Project

 **ict4water.eu**



WIRE
Water & Irrigated agriculture Resilient Europe
EIP Water Action Group
Pooling resources - Innovating water



ISTITUTO
DI SCIENZE
DELLA VITA
 Scuola Superiore
Sant'Anna

Grazie

Link alla pagina del caso studio FREEWAT sul sito di Regione Toscana
www.regione.toscana.it/-/progetto-freewat

Sito del progetto: www.freewat.eu



FREEWAT
Free and Open Source Software Tools for Water Resource Management
EU HORIZON 2020 Project

 **ict4water.eu**



WIRE
Water & Irrigated agriculture Resilient Europe
EIP Water Action Group
Pooling resources - Innovating water



ISTITUTO
DI SCIENZE
DELLA VITA
 Scuola Superiore
Sant'Anna