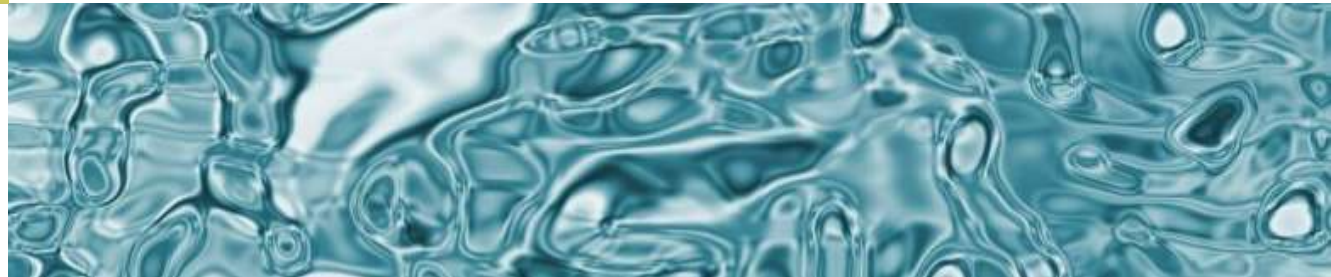


SAT-MAR pilot facility in Arenales aquifer (Spain): Clogging and water quality evaluation



Dr. Enrique Fernández Escalante (efernan6@tragsa.es)





Grupo Tragsa
Garantía Profesional Servicio Público

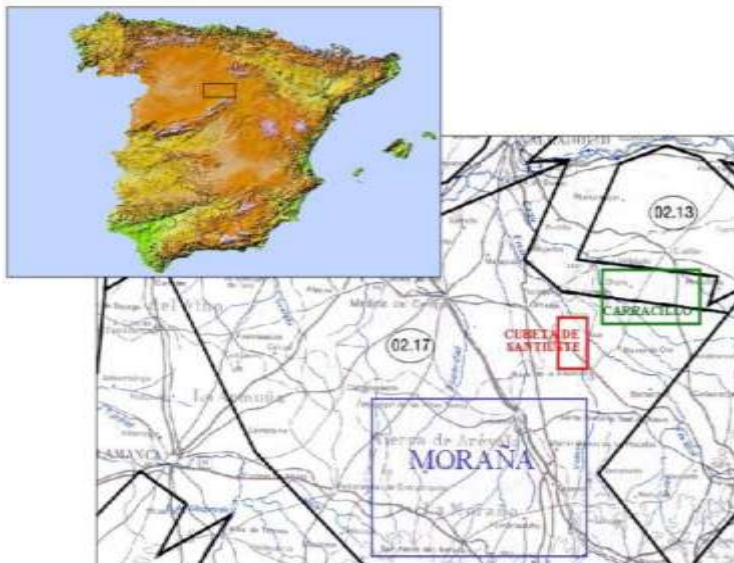


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- 1- CLOGGING CHARACTERIZATION
- 2- WATER QUALITY EVOLUTION
- 3- OTHER RELEVANT ASPECTS
- 4- PUBLICATIONS
- 5- CONCLUSIONS

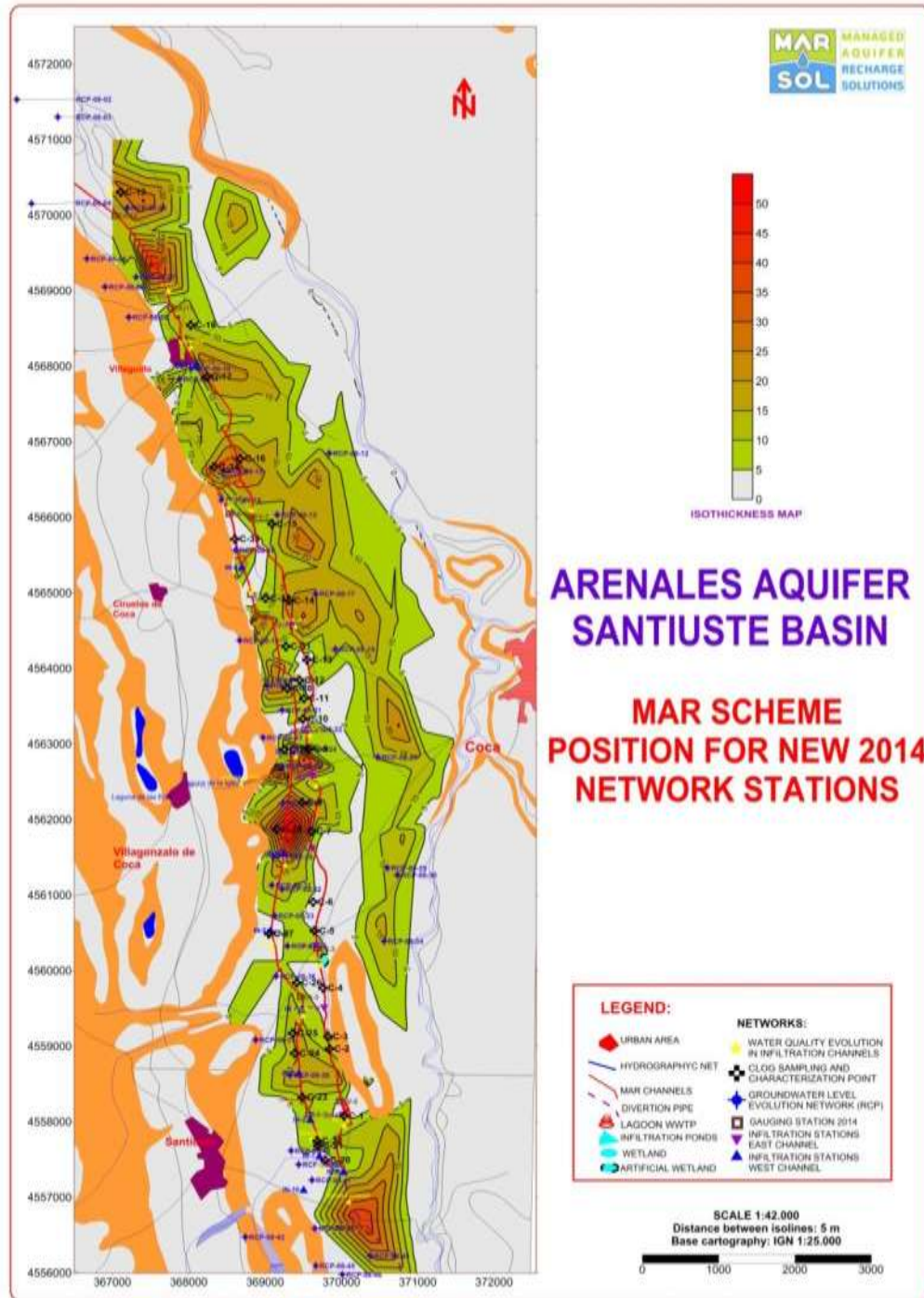


1- CLOGGING CHARACTERIZATION AND CARTOGRAPHY

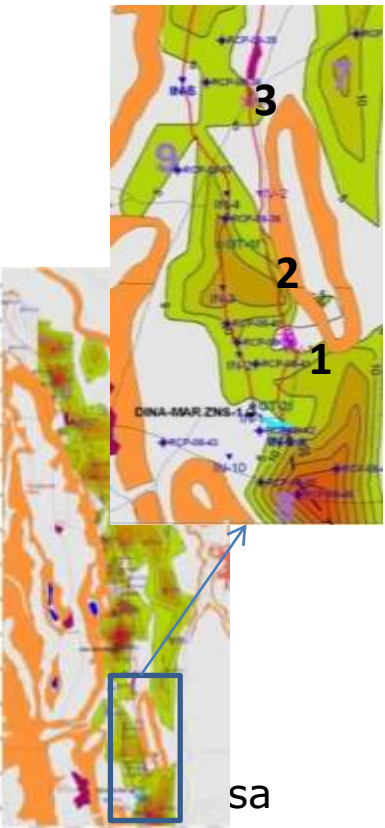


NEW PROPOSED NETWORKS:

1. CLOG SAMPLING AND CHARACTERIZATION
2. WATER QUALITY EVOLUTION ALONG INFILTRATION CHANNELS
3. GROUNDWATER LEVEL EVOLUTION
4. GAUGING STATIONS
5. INFILTRATION STATIONS



**SANTIUSTE MARSOL TRIPLET:
DECANTATION SYSTEM-BIOFILTER-ARTIFICIAL WETLAND (2 km)**

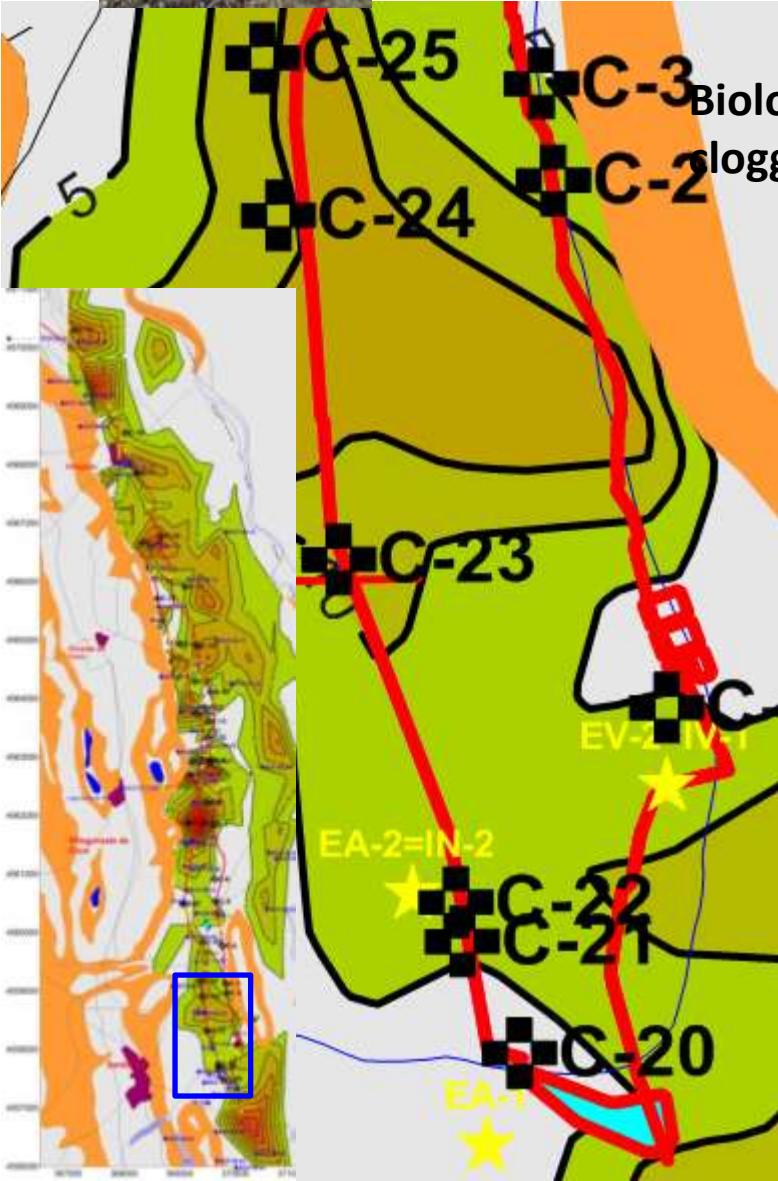


1. CLOG SAMPLING AND CHARACTERIZATION

Areas with physical clogging processes



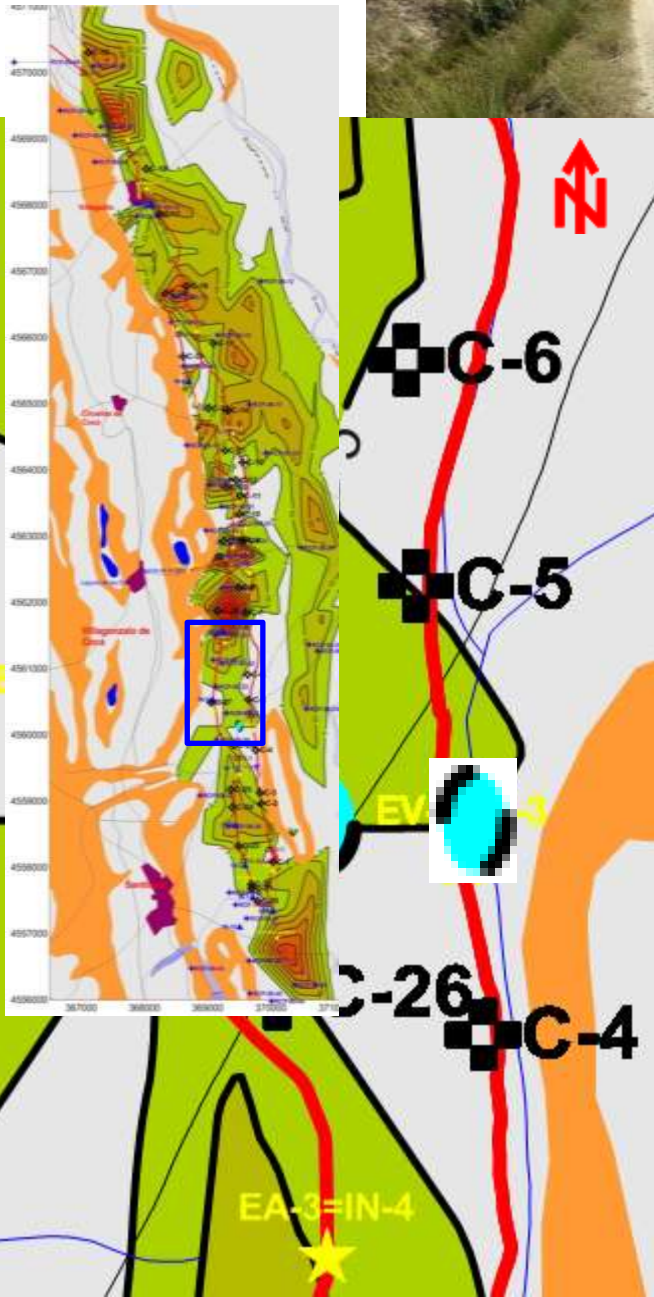
Biological and biophysics clogging processes



Areas with physical clogging processes



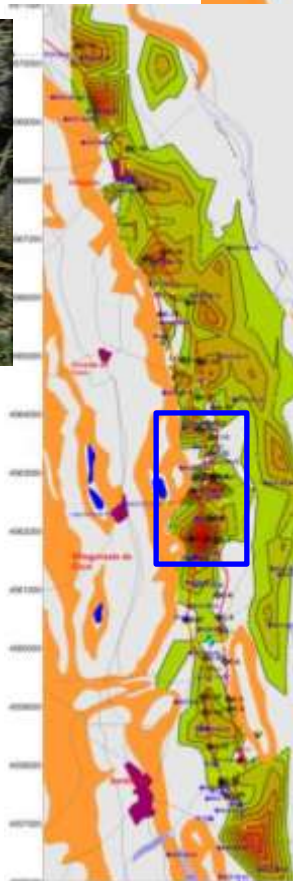
Physical-biological clogging processes



Areas with physical clogging processes



Biological and biophysics clogging processes





Areas with physical clogging processes








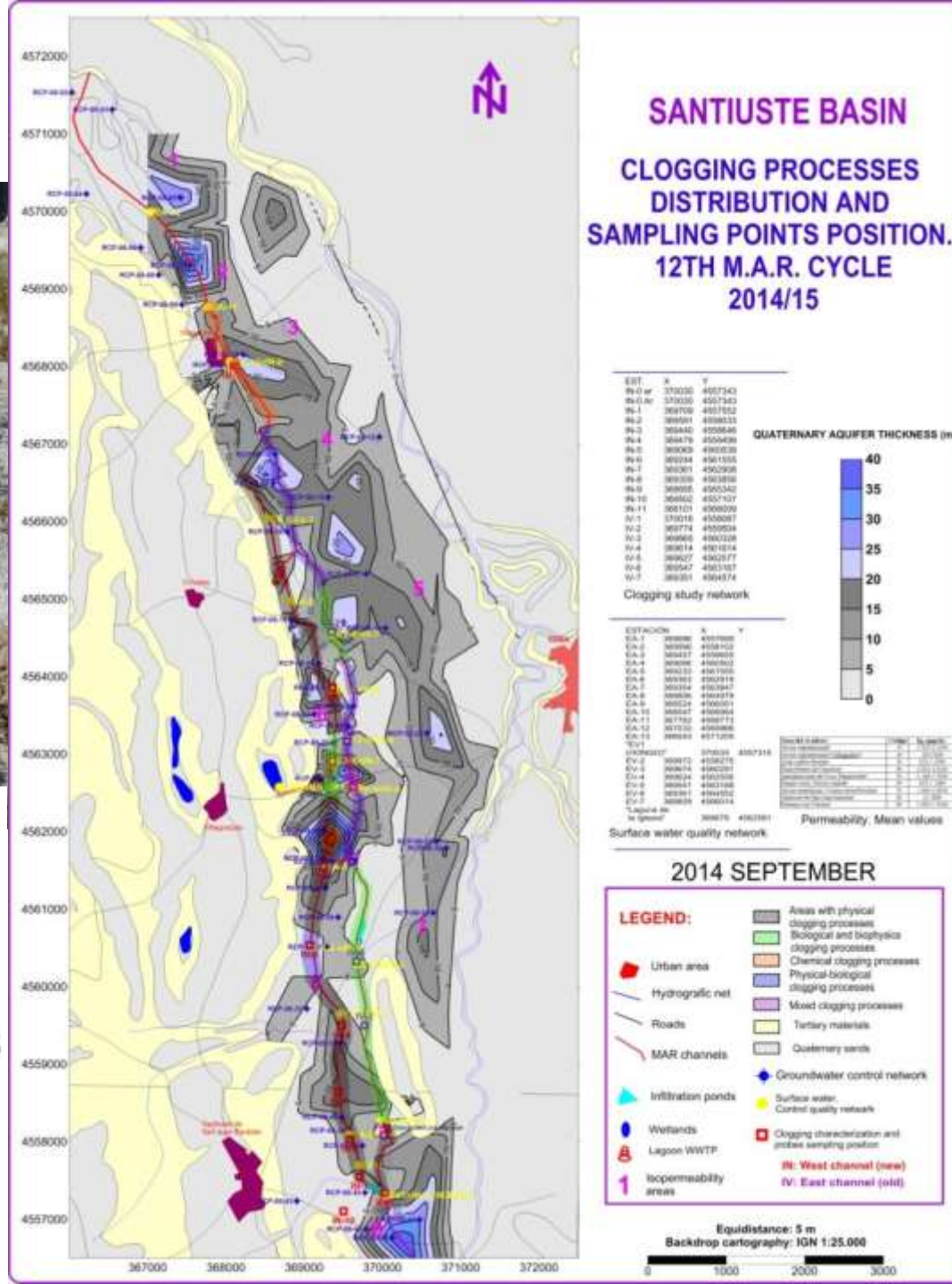
Biological and biophysics clogging processes



CLOGGING CHARACTERIZATION: CARTOGRAPHY



-  Areas with physical clogging processes
-  Biological and biophysics clogging processes
-  Chemical clogging processes
-  Physical-biological clogging processes
-  Mixed clogging processes



**Biological and biophysics
clogging processes**

**Physical-biological
clogging processes**

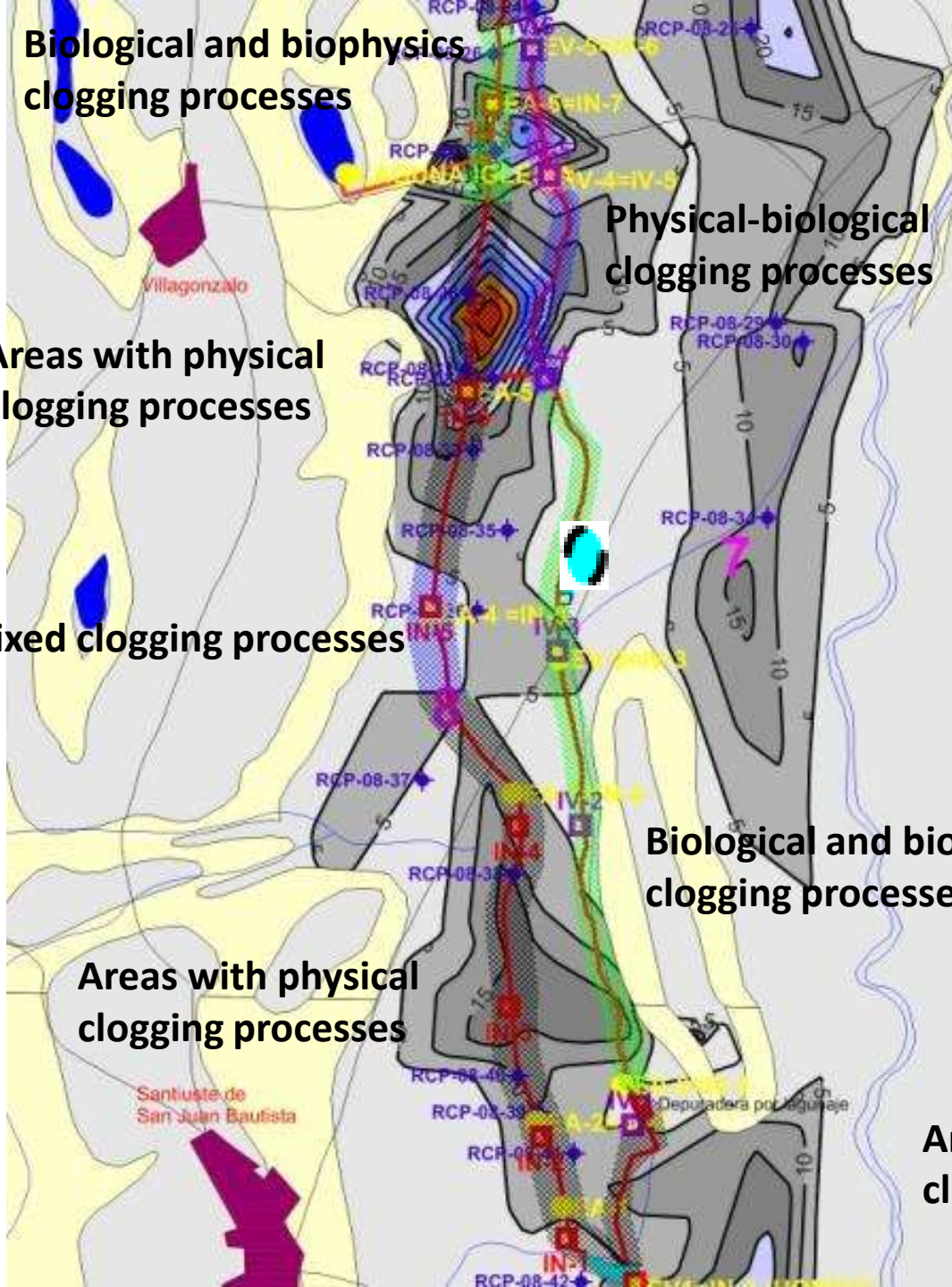
**Areas with physical
clogging processes**

Mixed clogging processes

**Biological and biophysics
clogging processes**

**Areas with physical
clogging processes**

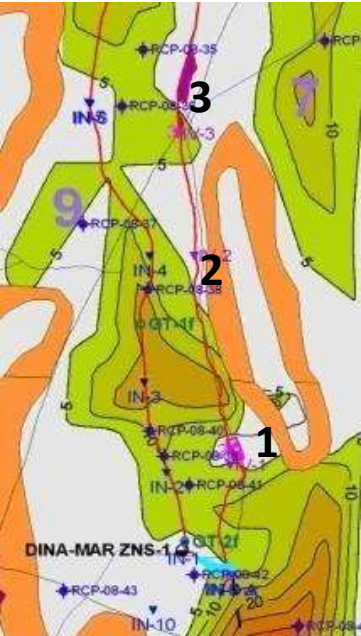
**Areas with physical
clogging processes**



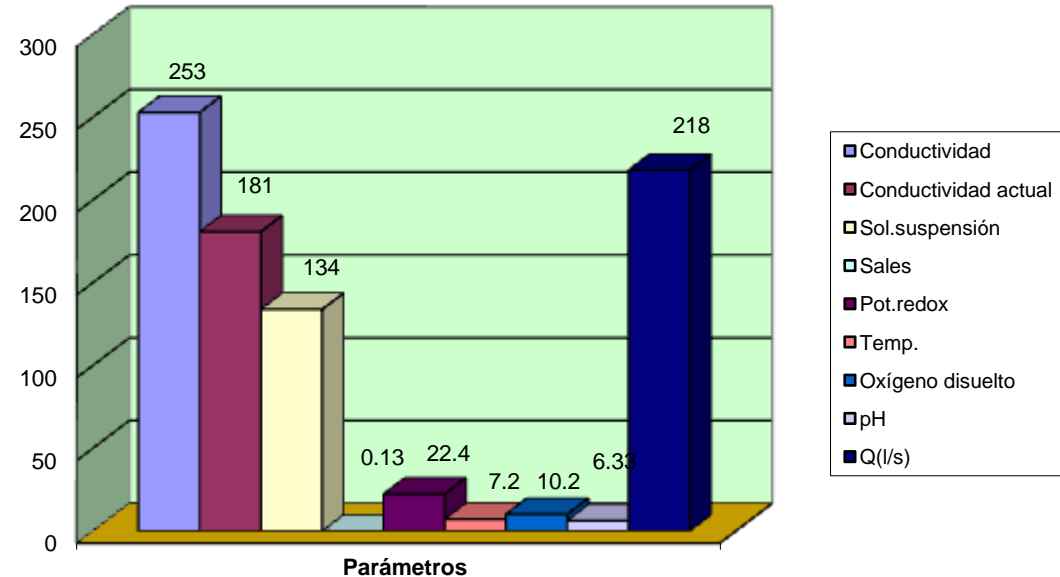
2-WATER QUALITY EVOLUTION ALONG THE "TRIPLET"

LAGOONING WWTP

WWTP by lagooning

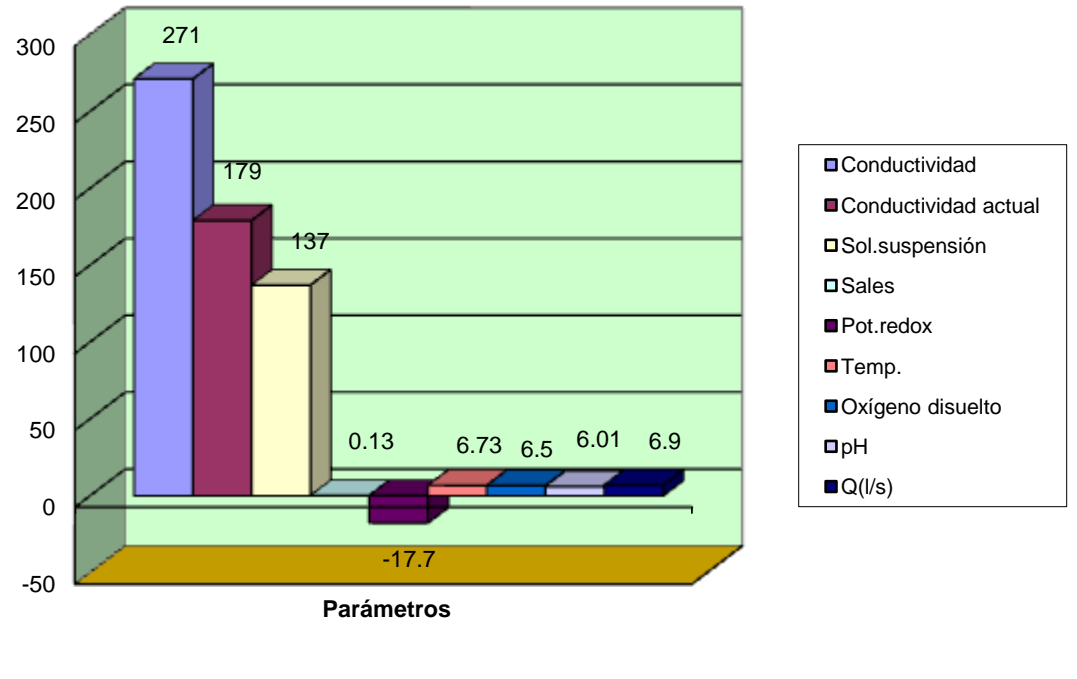


Parámetros medidos en la estación EV-1(HONGO)

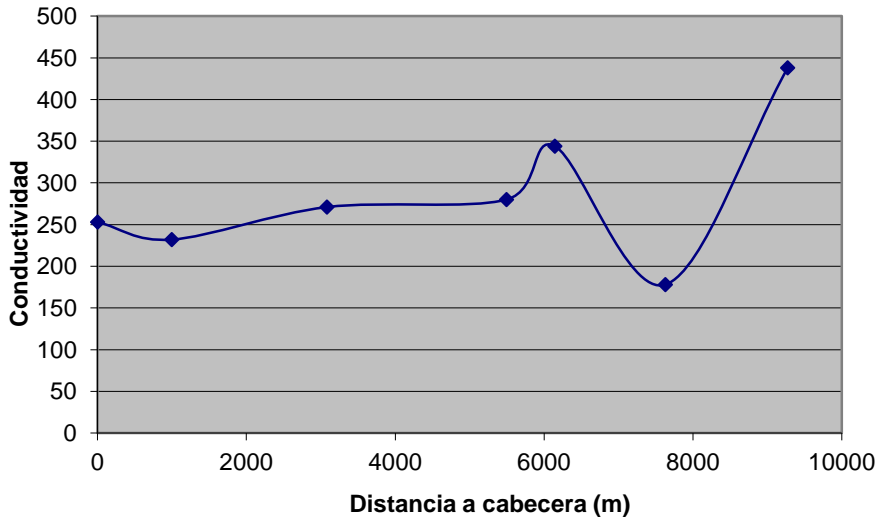


ARTIFICIAL WETLAND

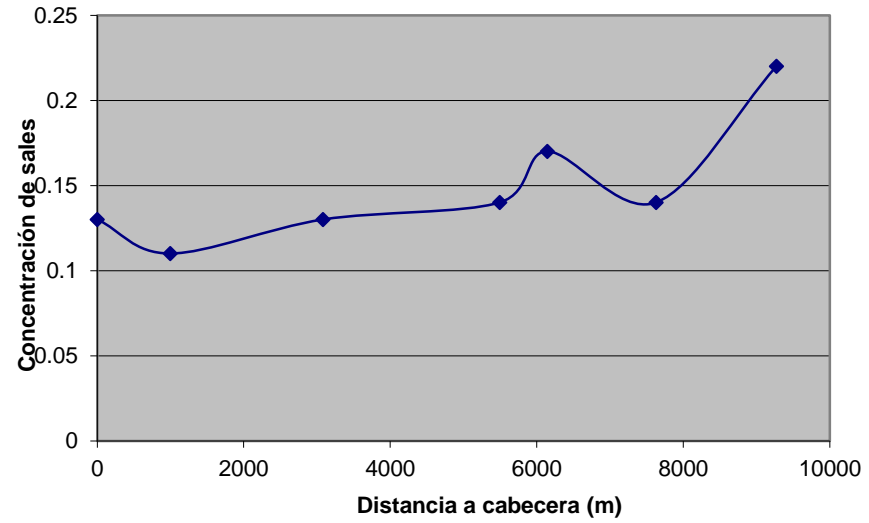
Parámetros medidos en la estación EV-3



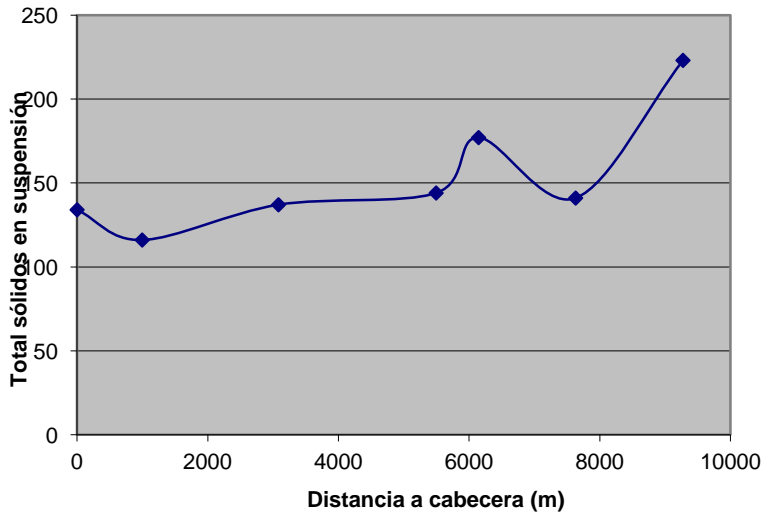
Conductiviy



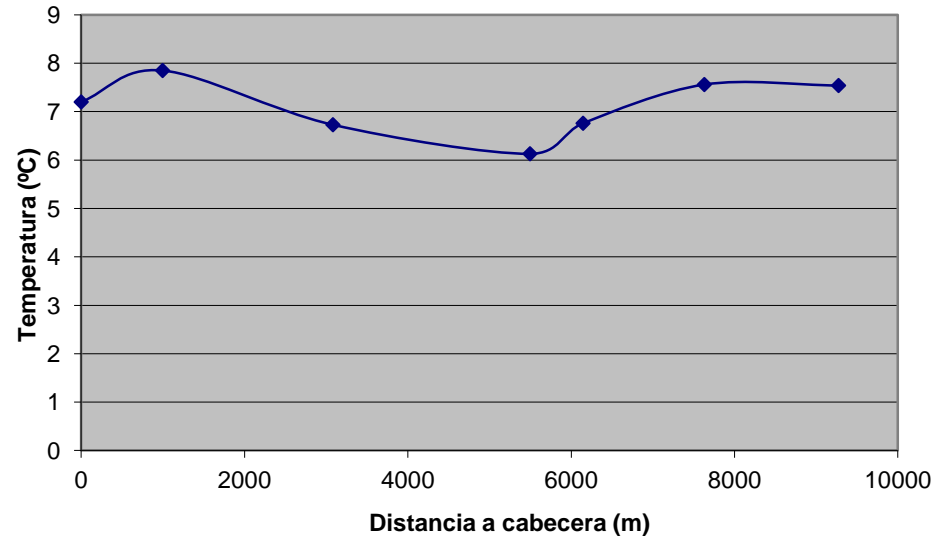
Concentración de sales medidas en el Canal Este



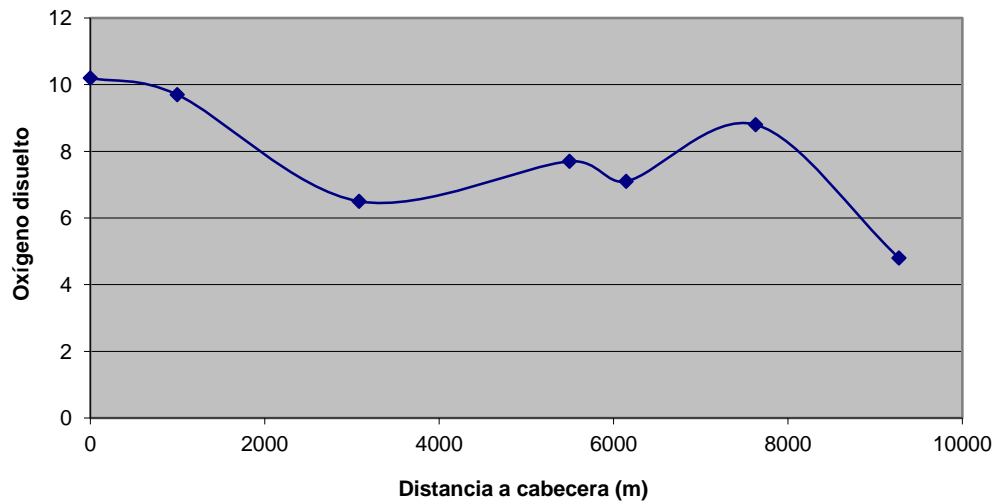
TSS



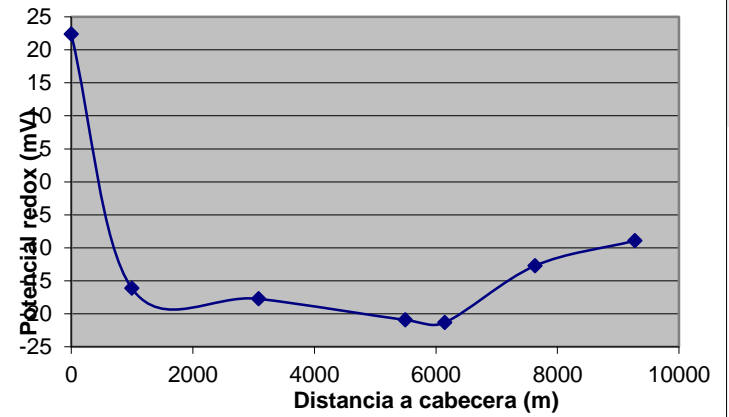
Temperatura medida en el Canal Este



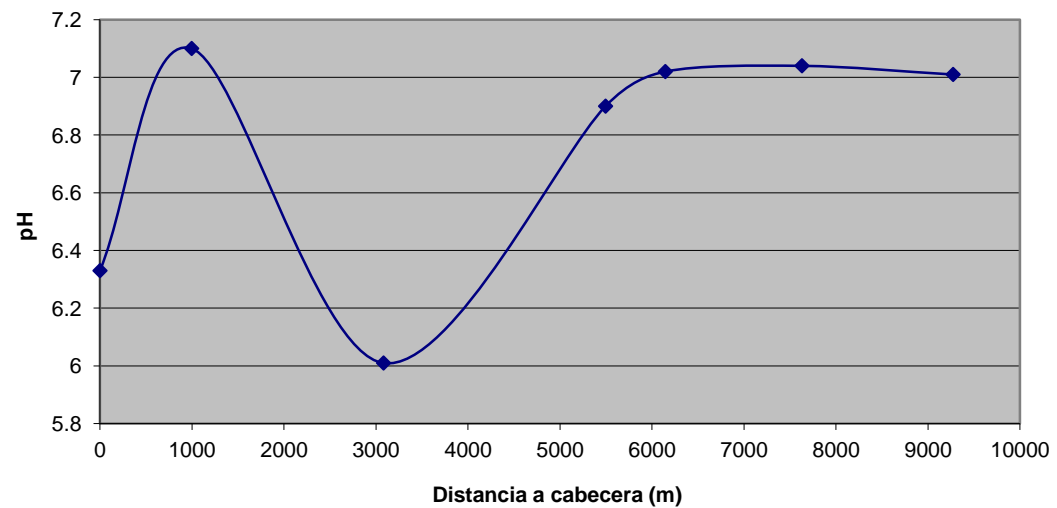
Oxígeno disuelto medido en el Canal Este



Potencial redox medido en el Canal Este



pH medido en el Canal Este



CARRACILLO MARSOL TRIPLET. REPLICATION FOR RIVER WATER CAPTURE DECANTATION SYSTEM-BIOFILTER-ARTIFICIAL WETLAND



Infiltration pond

- New „triplet“ scheme (stagnation pond-biofilter-artificial wetland)
- System to check MAR water quality evolution

Working on the tasks 6.1 (Site operation), 6.2 (Conductions and piping), 6.3 (Studies for gas clogging), 6.5 (Artificial wetlands) and 6.6 (modelling)



Biofilter in a MAR channel



Treatment by lagooning



● Piezometer
● Oxidantefector
● Multisensor /Termosensetor



3- OTHER RELEVANT ASPECTS

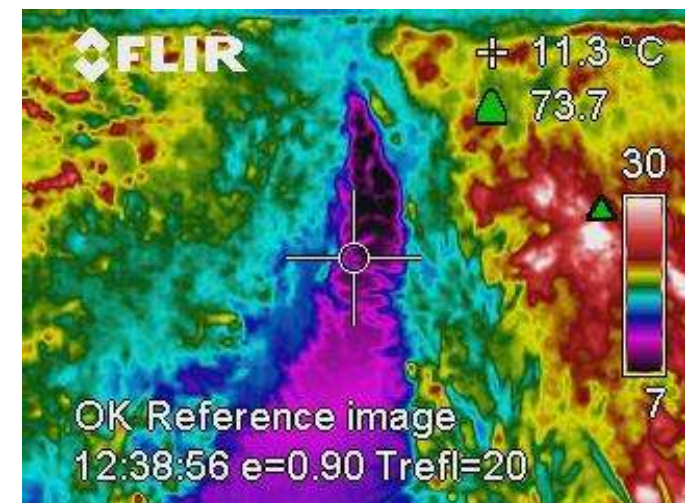
NEW STUDIES IN THE APPLICATION OF THERMOGRAPHY FOR CLOGGING CHARACTERIZATION AND SAT-MAR



INFRA-RED CAMERA THERMOGRAPHY:

- Clogging preferential areas
- Possible relations thermography-infiltration rates
- Lagoon WWTP-infiltration channel relations.
- Mixture processes, cold islands...

NEW TESTS AT ALCAZARÉN SAT-MAR FACILITIES





**Emergent pollutants
& synergistic combinations
refrain new experiences**

**New experiences require detailed and,
in some cases, expensive studies**

SOME OTHER ACTIVITIES TO BE TESTED IN SPAIN

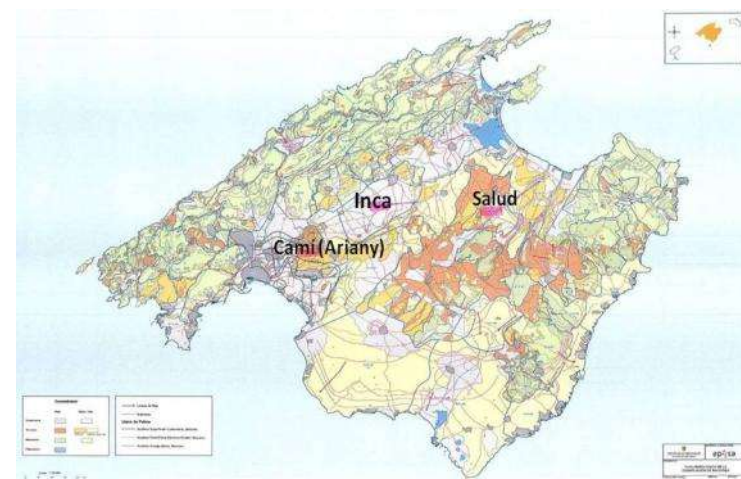
- SAT-MAR RELATED ACTIVITY (QUANTITY)

- MAR Borehole attached to irrigation ponds as a security and design criteria for future
- Design willing to divert into the aquifer $1 \text{ m}^3/\text{s}$ during a 3 hour overflow (karstic aq.)



MAR borehole associated to an Irrigation pond

- STUDIES FOR CASES WITH AN EXTRA RECLAIMED WATER VOLUME FOR IRRIGATION



Irrigation with excessive reclaimed water in Majorca Island

Maria de la Salut. Majorca Island (EARSAC project)

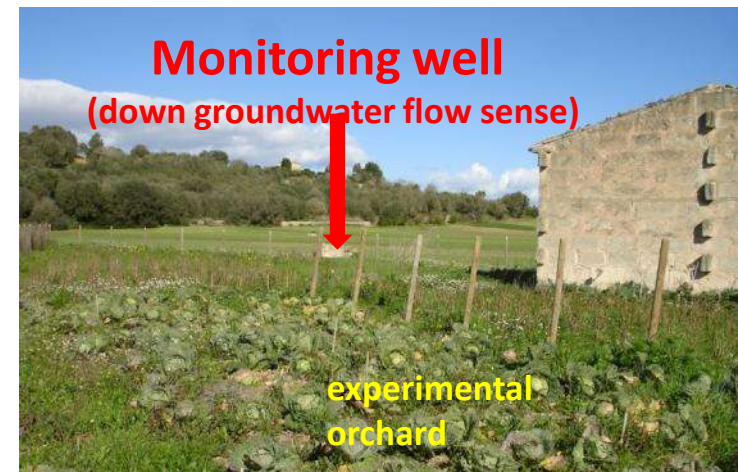
Irrigation excessive with reclaimed water



"Lax" or "free" structure:
Direct N & P consumption



Reclaimed water
spillway



Monitoring well

(down groundwater flow sense)

experimental
orchard

- Employ of inflatable structures (as for levees)
- Interaction studies

4- Publications



Sostenibilidad RECARGABLE:



**La llave en
el almacén**



9 788461 587049



Rechargeable SUSTAINABILITY:



**The key is
the storage**



9 788461 587049



**2002-2012, UNA DÉCADA DE RECARGA GESTIONADA.
ACUÍFERO DE LA CUBETA DE SANTIUSTE
(CASTILLA Y LEÓN)**



Enrique Fernández Escalante / Grupo Tragsa



7



Edita:



Con el apoyo de:



Project related background



9 788461 689101

5- Conclusions

1. MAR technique is a ***Driving force*** appropriate for environmental purposes and to palliate some adverse climate change impacts.
2. Excellent opportunities for a bigger **presence in IWRM schemes**, specially for **opportunistic (temporal) cases**.
3. Devices must be **“tailor made”** according to aquifers characteristics
4. **Private initiatives and industry** are becoming promoters of **MAR activity**
5. **SAT-MAR has severe opposition** due to emergent pollutants and the synergistic effect of spill compounds. There are many other obstacles to overcome so as to improve its acceptance
6. **Technical solutions** for current SAT-MAR problems are **complex** and require:
 - a) **High doses of *hydro-imagination***
 - b) **Research**
 - c) **Patience**
 - d) **Overcome innovation obstacles**



www.marsol.eu



Thank you!
2014 Dec.

