



# AQUARENOVA

Innovating for the water health



## Active management of the Bas Gapeau aquifer to prevent saline water intrusion

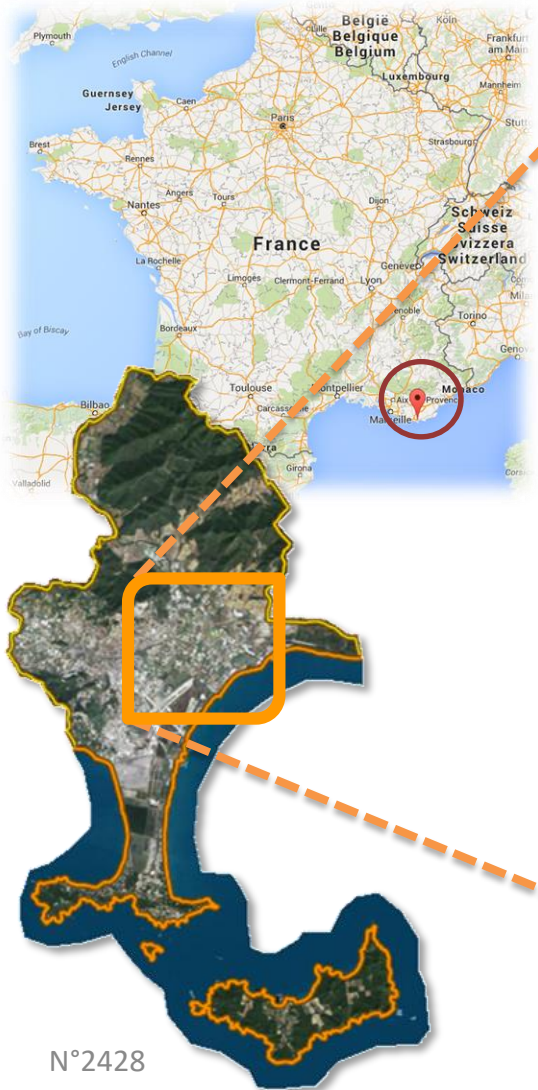
*DUZAN Alexandre* <sup>(1)</sup> (speaker),  
*MONFORT Isabelle* <sup>(2),(3)</sup>  
*AUSSIBAL Aurélien* <sup>(1)</sup>  
*CHARBONNIER Cyrille* <sup>(1)</sup>

- <sup>(1)</sup> SUEZ Water France
- <sup>(2)</sup> Ville de Hyères
- <sup>(3)</sup> Parc Naturel de Port Cros



# WATER RESOURCES OF HYERES-LES-PALMIERS GOLF HÔTEL & PÈRE ÉTERNEL WELL FIELDS

Annual abstraction : 5 Mm<sup>3</sup>/year



N°2428



25-29<sup>th</sup>  
September 2016

Montpellier, France  
CORULUM CONFERENCE CENTER

43<sup>rd</sup>  
IAH  
congress







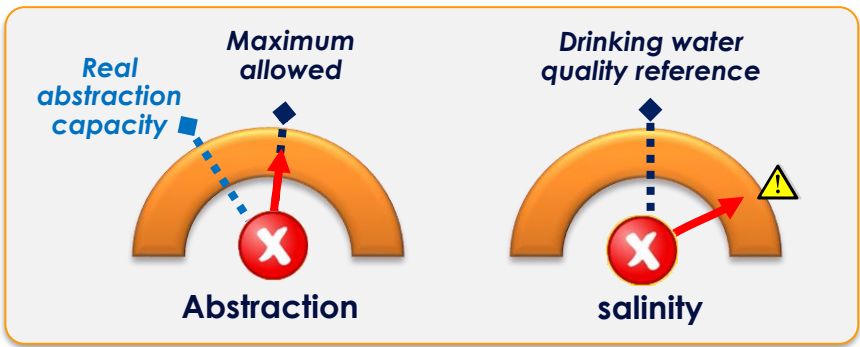
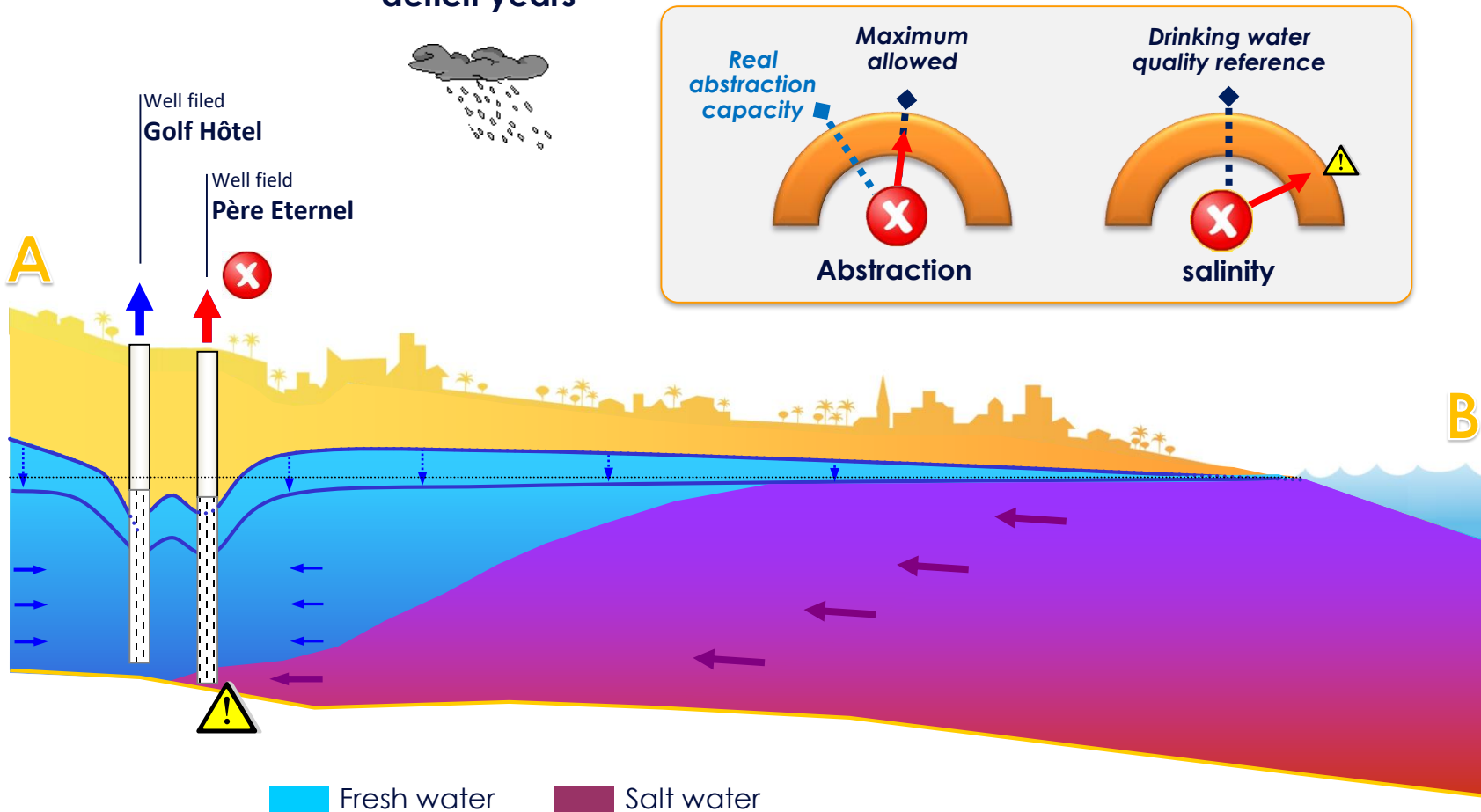
# BAS GAPEAU SALT WATER WEDGE

## Salt water intrusion dynamic

Rainfall deficit years



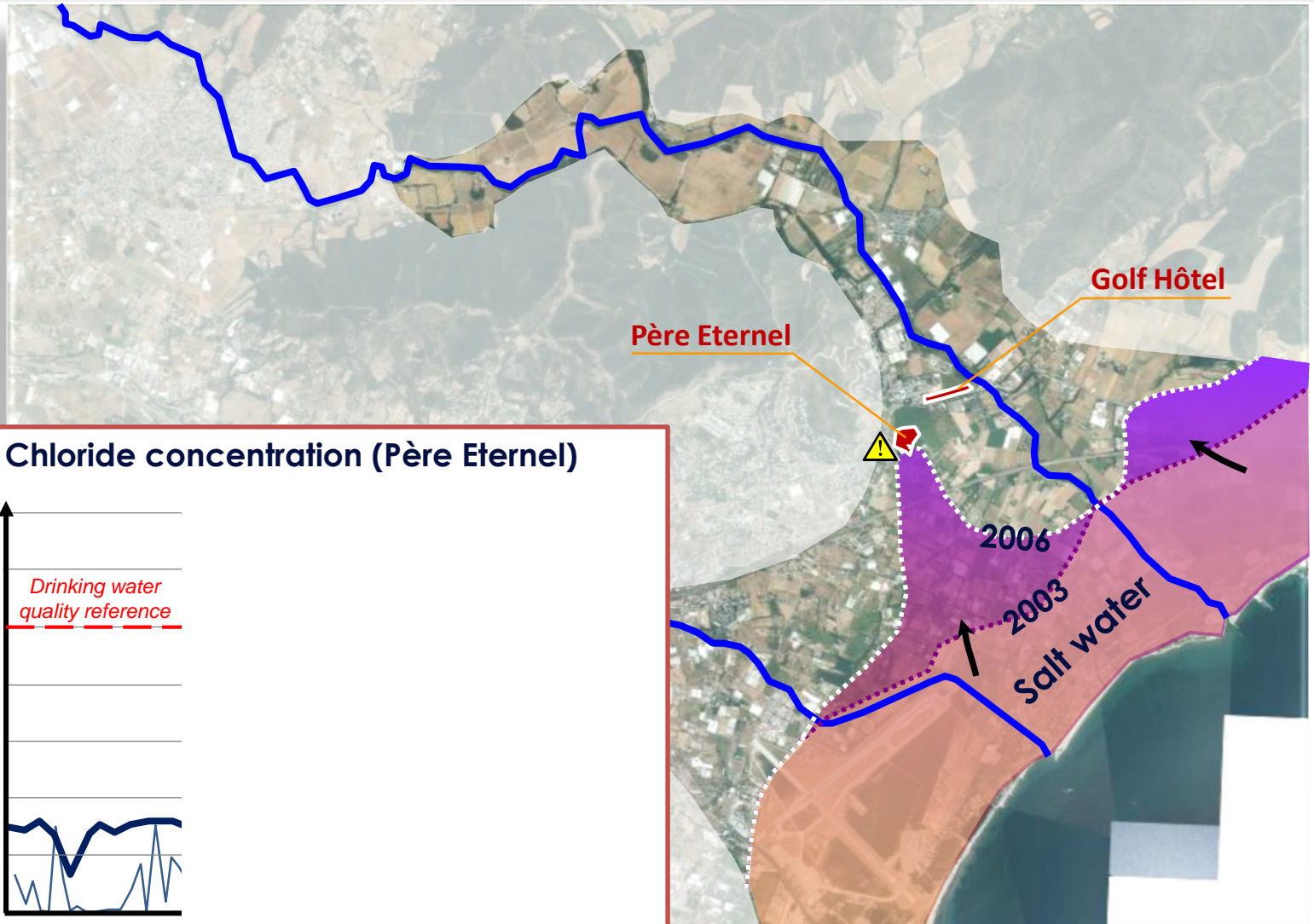
Annual abstraction capacity < 5 Mm<sup>3</sup>/year



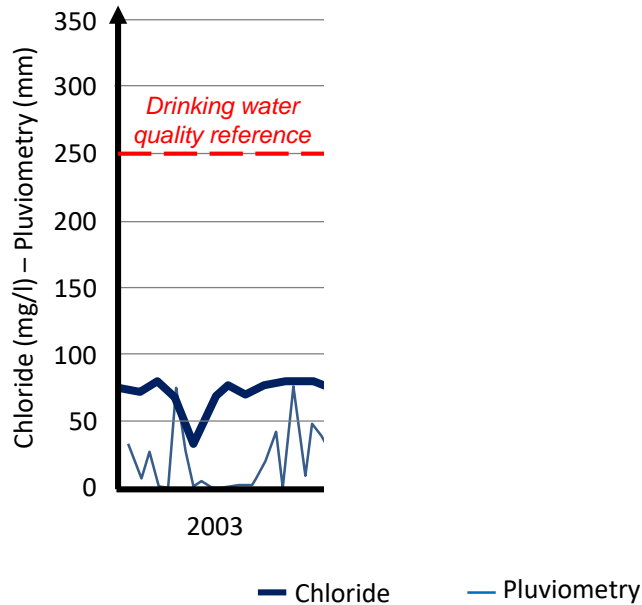


# BAS GAPEAU SALT WATER INTRUSION

Last event : 2003 - 2006



### Chloride concentration (Père Eternel)



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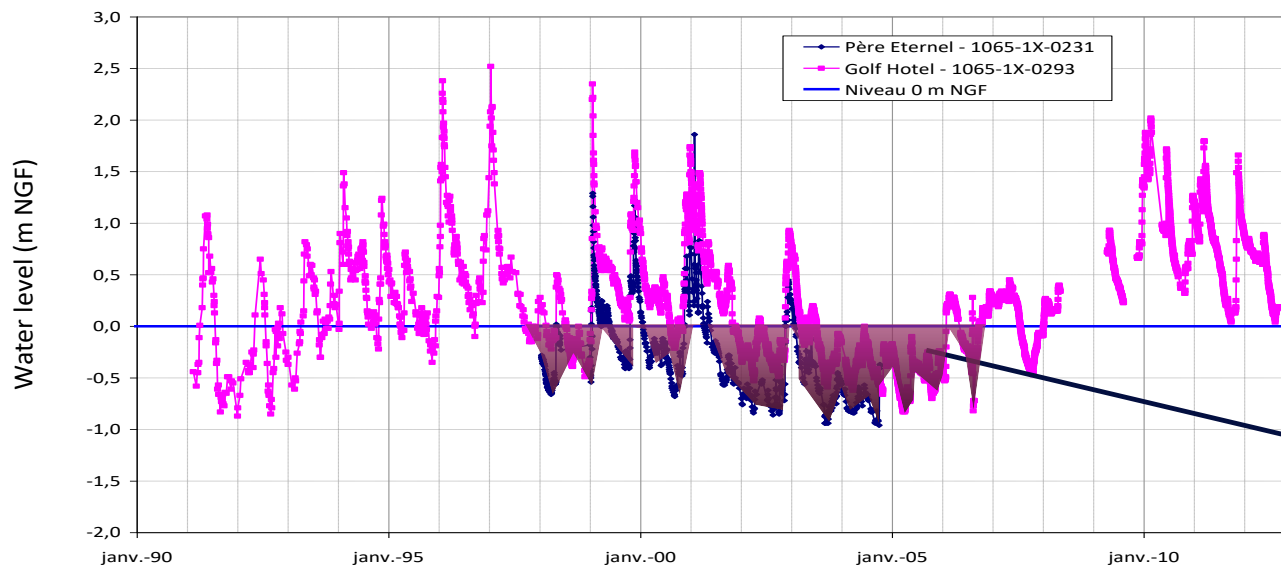




# BAS GAPEAU SALT WATER INTRUSION

## Causes & effects

### Causes

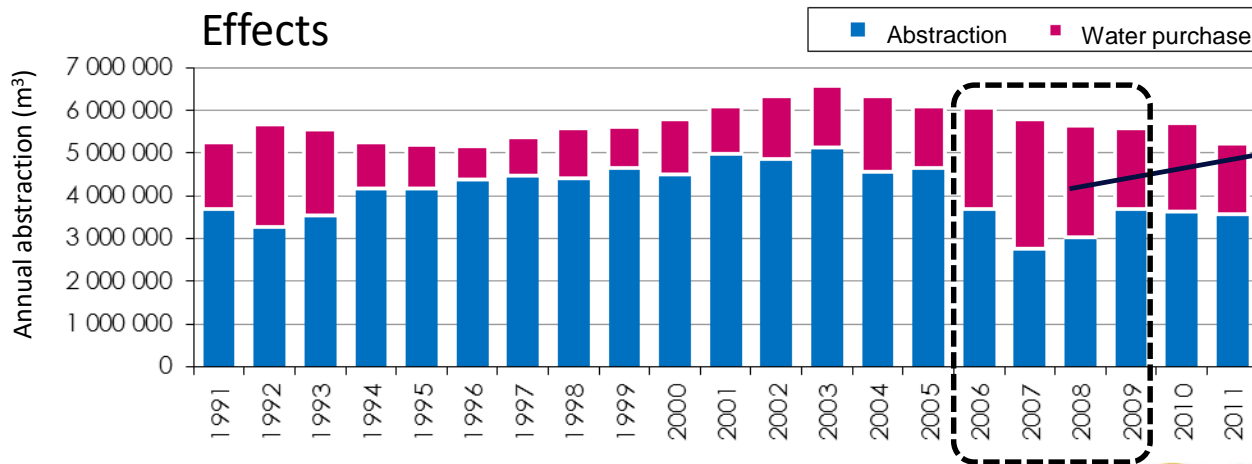


Groundwater level below Sea level

→ Salt water intrusion



### Effects



Père Eternel Shutdown (4 years)

→ Autonomy loss

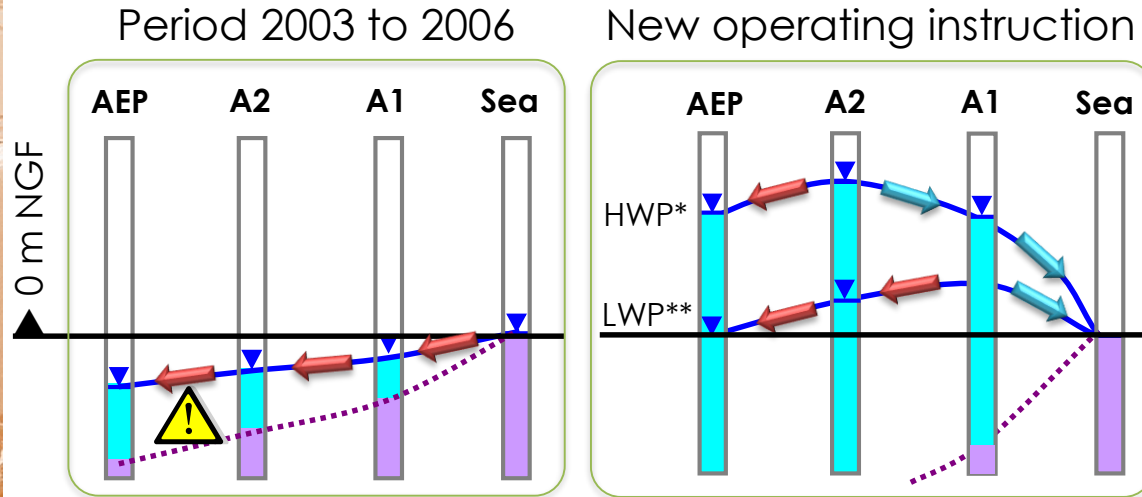




# AQUARENOVA PROJECT

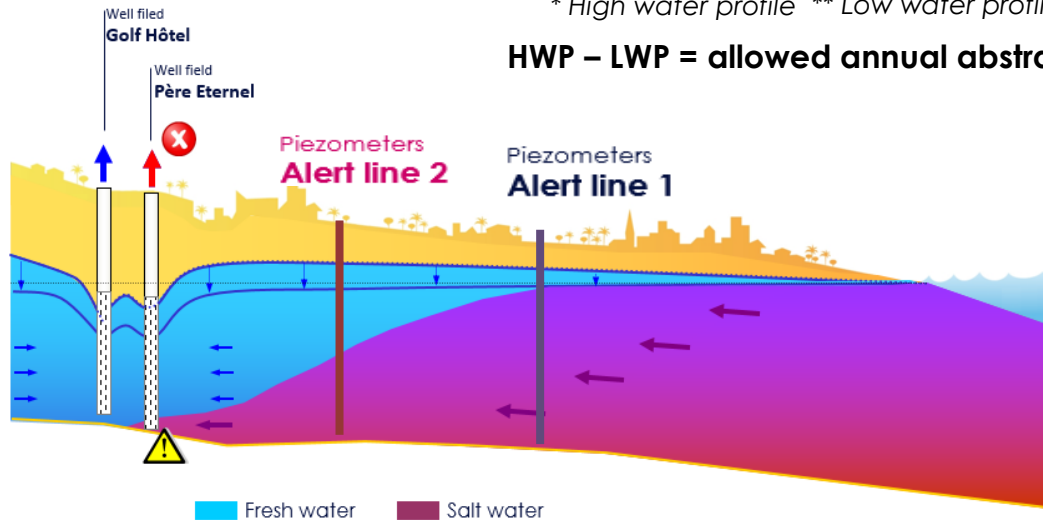
## Phase 1 : Implementation of the gradients method

### Dynamic control

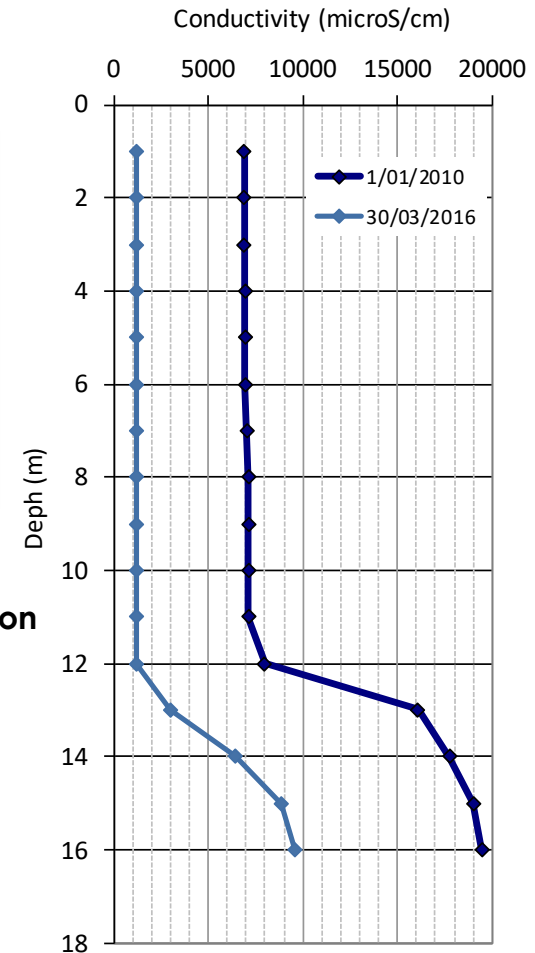


\* High water profile \*\* Low water profile

HWP - LWP = allowed annual abstraction



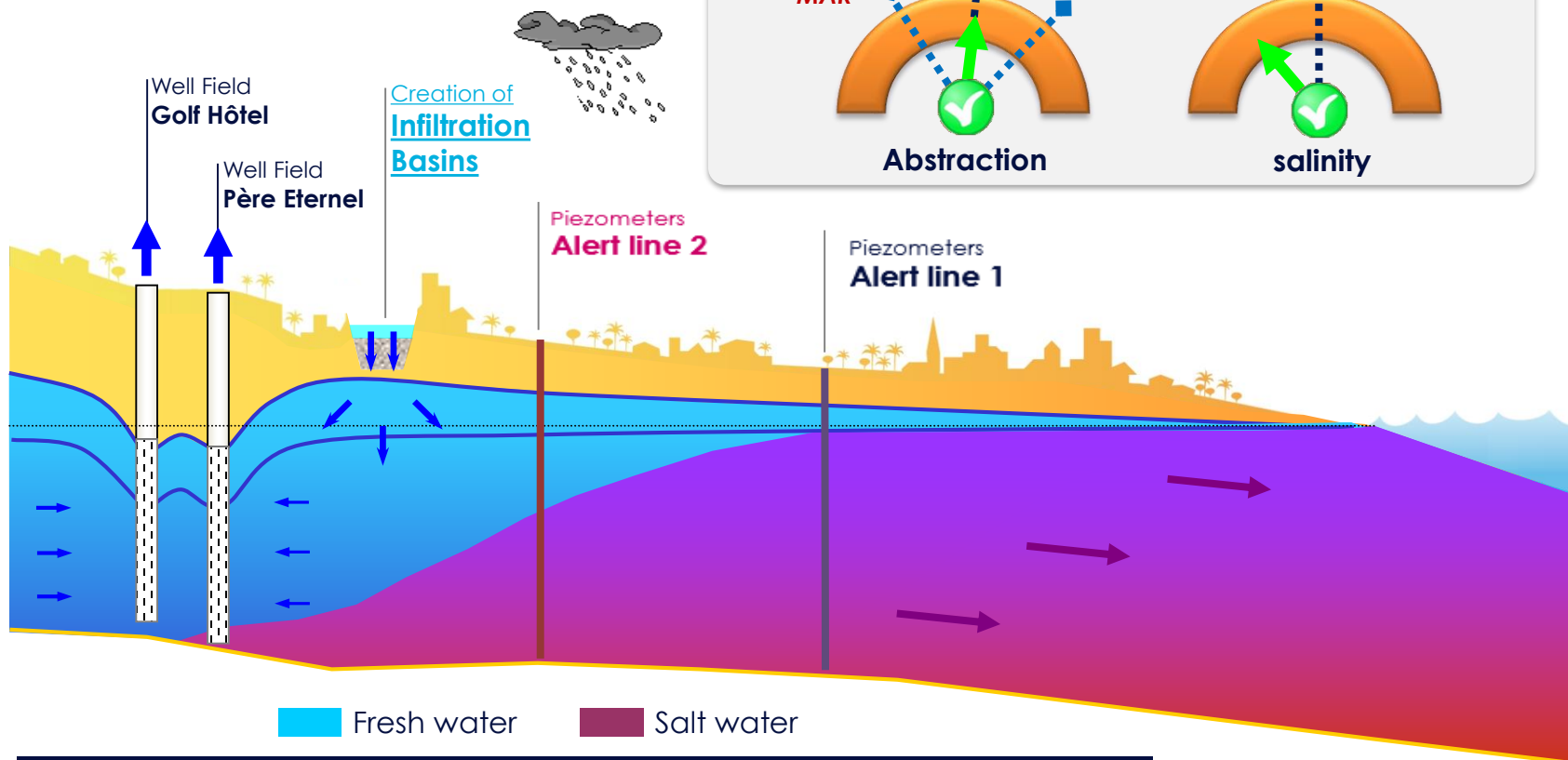
### Quality control



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## Phase 2 : MAR Project

▷ November to april aquifer recharging

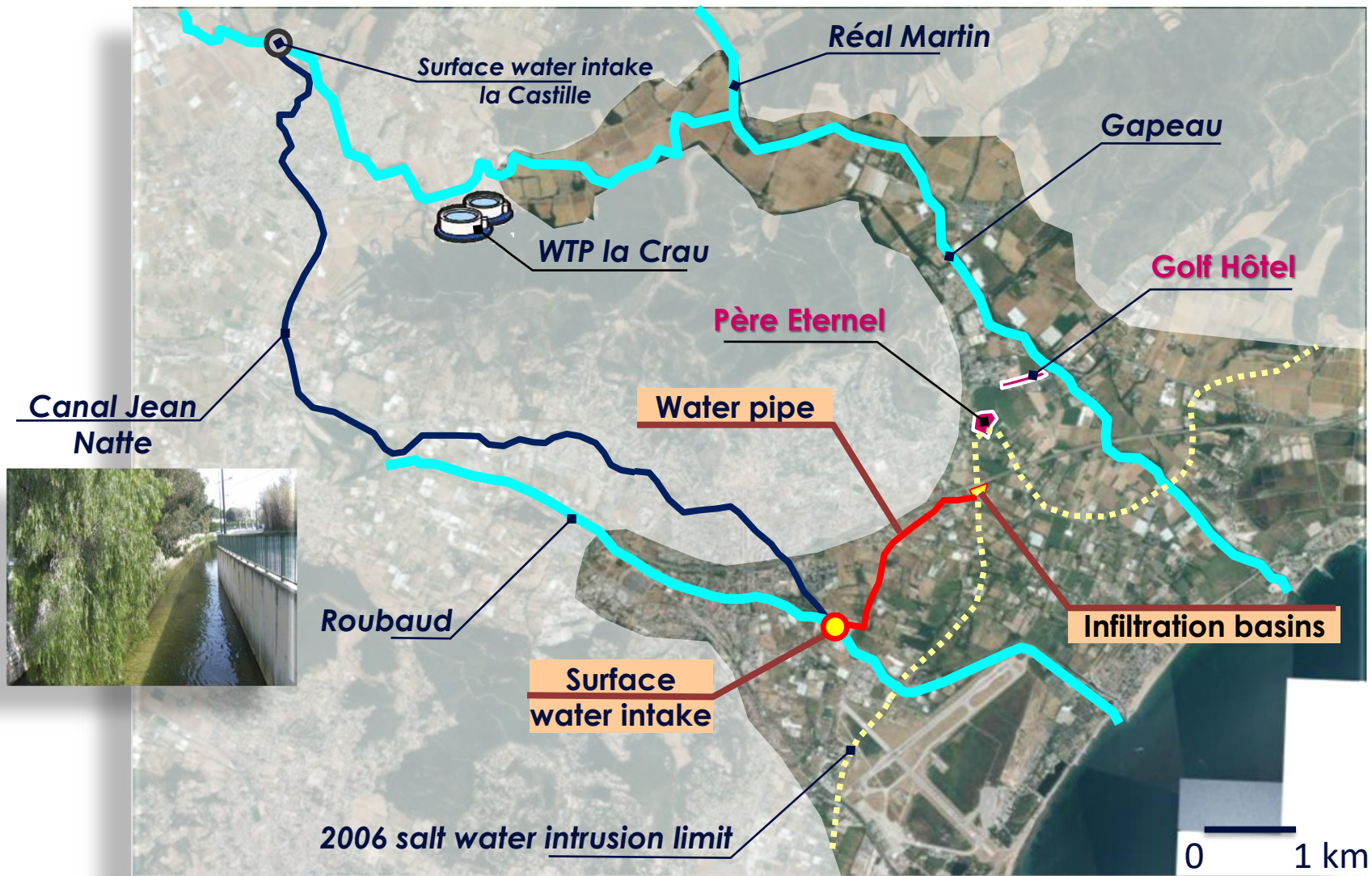


In periods of rainfall deficit, thanks to managed aquifer recharge (MAR) Production is maintained at more than 5 million m<sup>3</sup>/year



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## Phase 2 : Project location







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## Phase 2 : « Roubaud » surface water intake

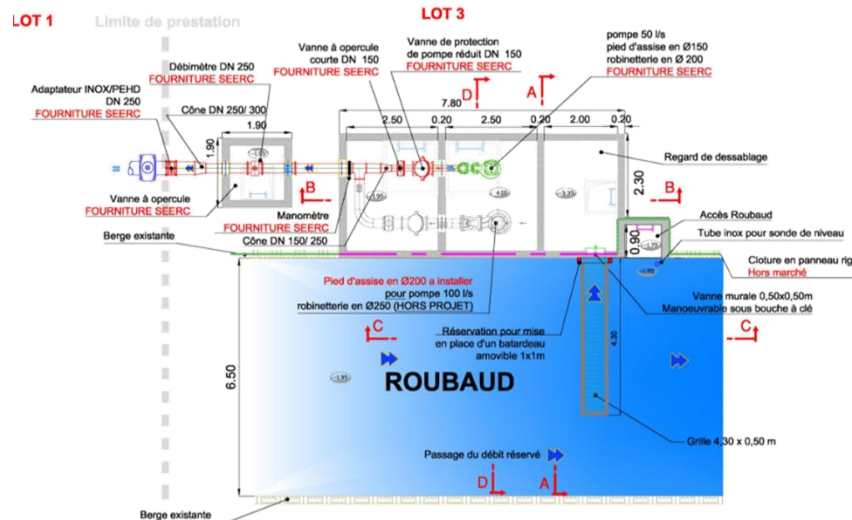


### QUANTITATIVE ASPECTS

- « Jean Natte » canal capacity : **270 l/s**
- Abstraction up to **150 l/s** from november to april
- « Roubaud instream flow » : **50 l/s** > **elver stake**

### QUALITATIVE ASPECTS

- Setting up a **Sirène station**® per site (Jean Natte and Roubaud)
- Continuous monitoring parameters (pumping stop if exceeded thresholds):
  - Hydrocarbons
  - UV absorbance
  - Turbidity
  - pH, temperature
  - Conductivity
  - dissolved oxygen
  - ammonium chlorides
  - Potassium, nitrate
  - Redox potential



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## Phase 2 : « Roubaud » surface water intake

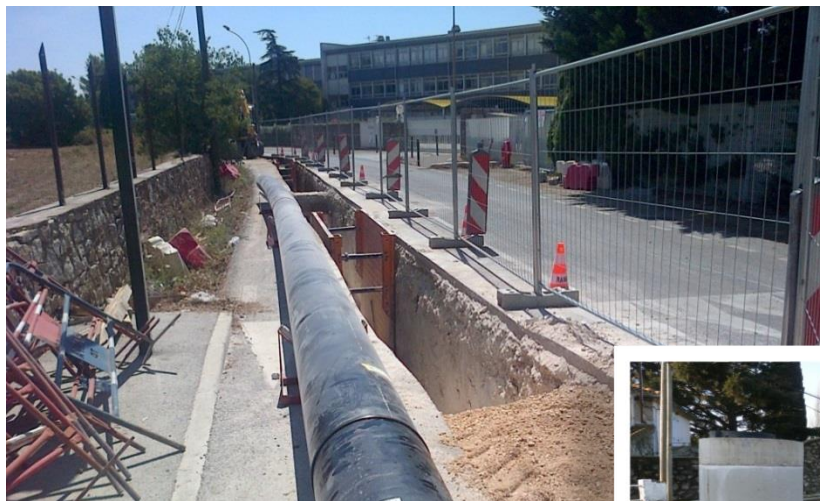


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# AQUARENOVA - Phase 2 : Water pipe between « Roubaud » surface water intake and infiltration basins



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### Characteristics :

Length : **2 200 m** / Pipe Diameter : **350 mm**

Material : **HDPE**

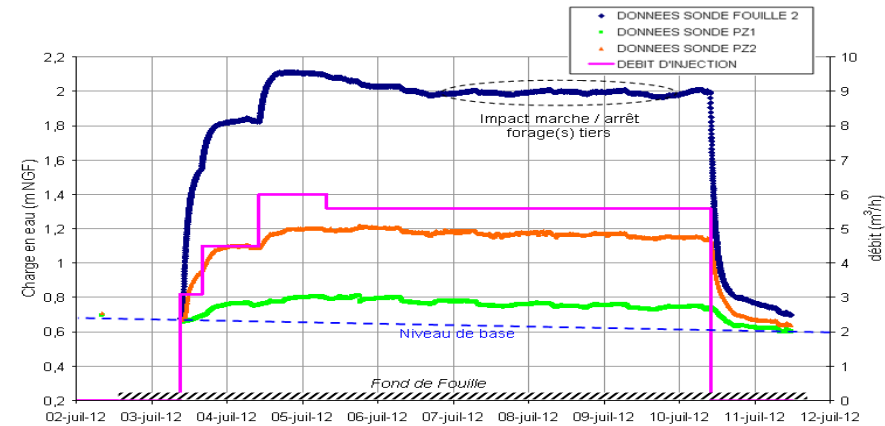
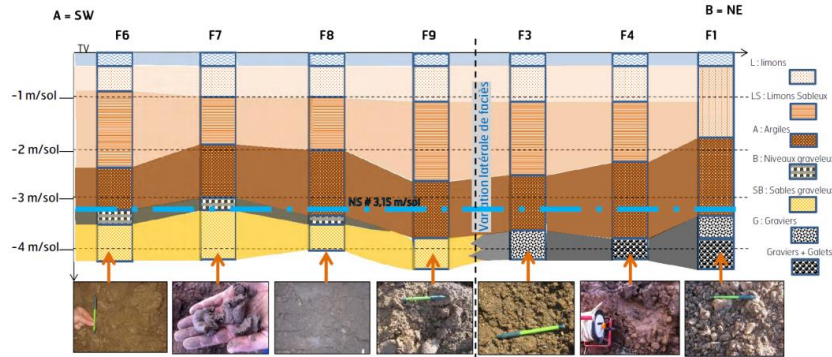






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## Phase 2 : Infiltration basins : feasibility studies



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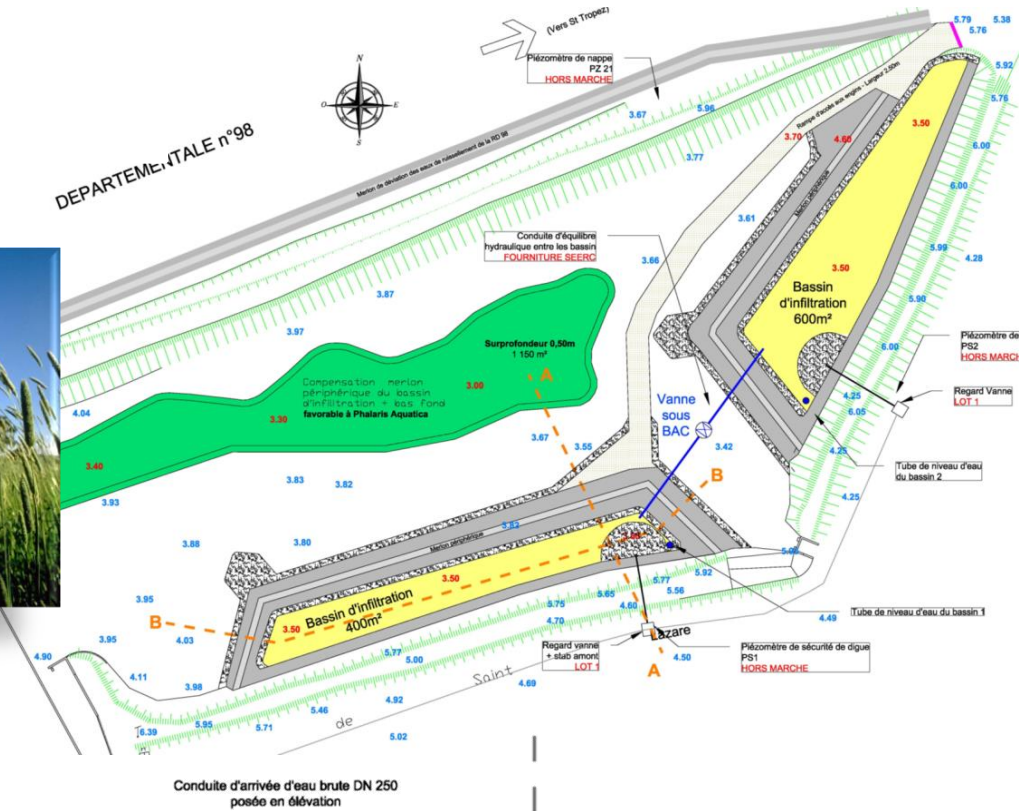
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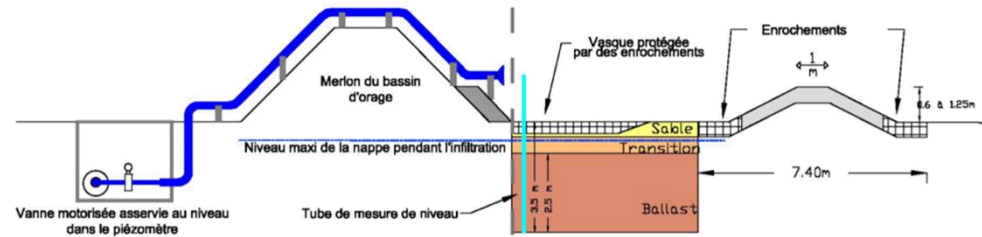
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## Phase 2 : Infiltration basins : execution of works



### Site constraints :

- maintaining the storm basin function
- do not clog the infiltration area
- preservation of the protected species (*Phalaris Aquatica*)
- risks of pollution-induced RD 98







# AQUARENOVA

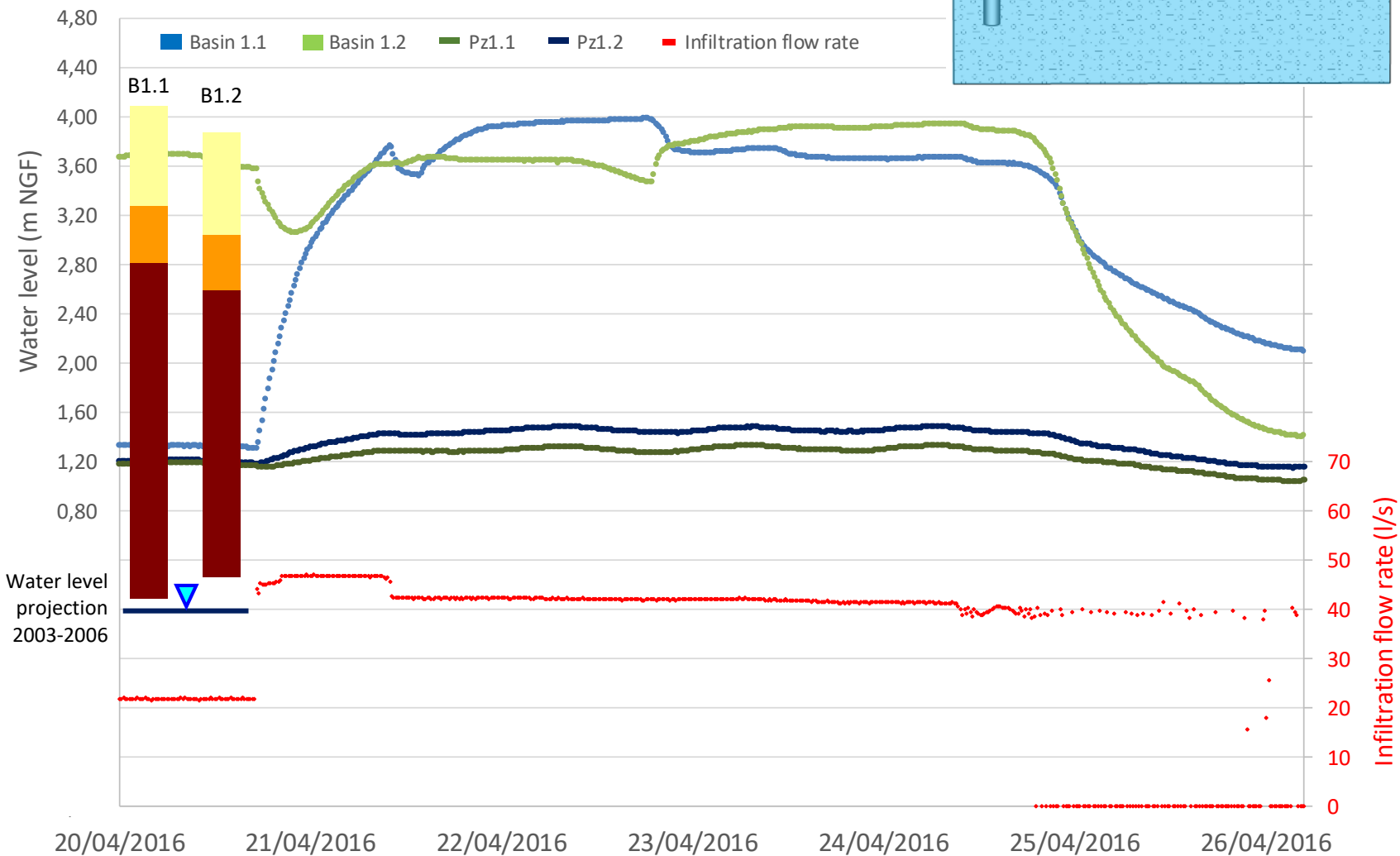
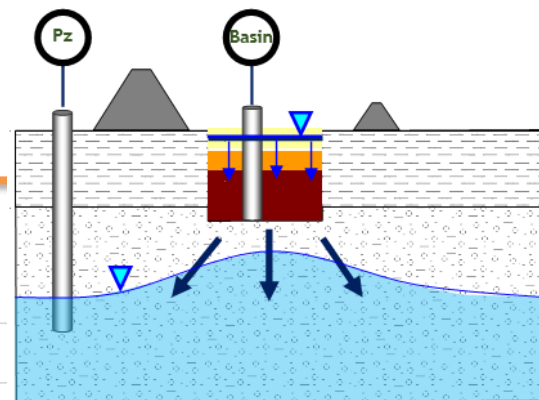
## Phase 2 : Infiltration tests (november 2015)





# AQUARENOVA

## Phase 2 : Infiltration tests (november 2015)





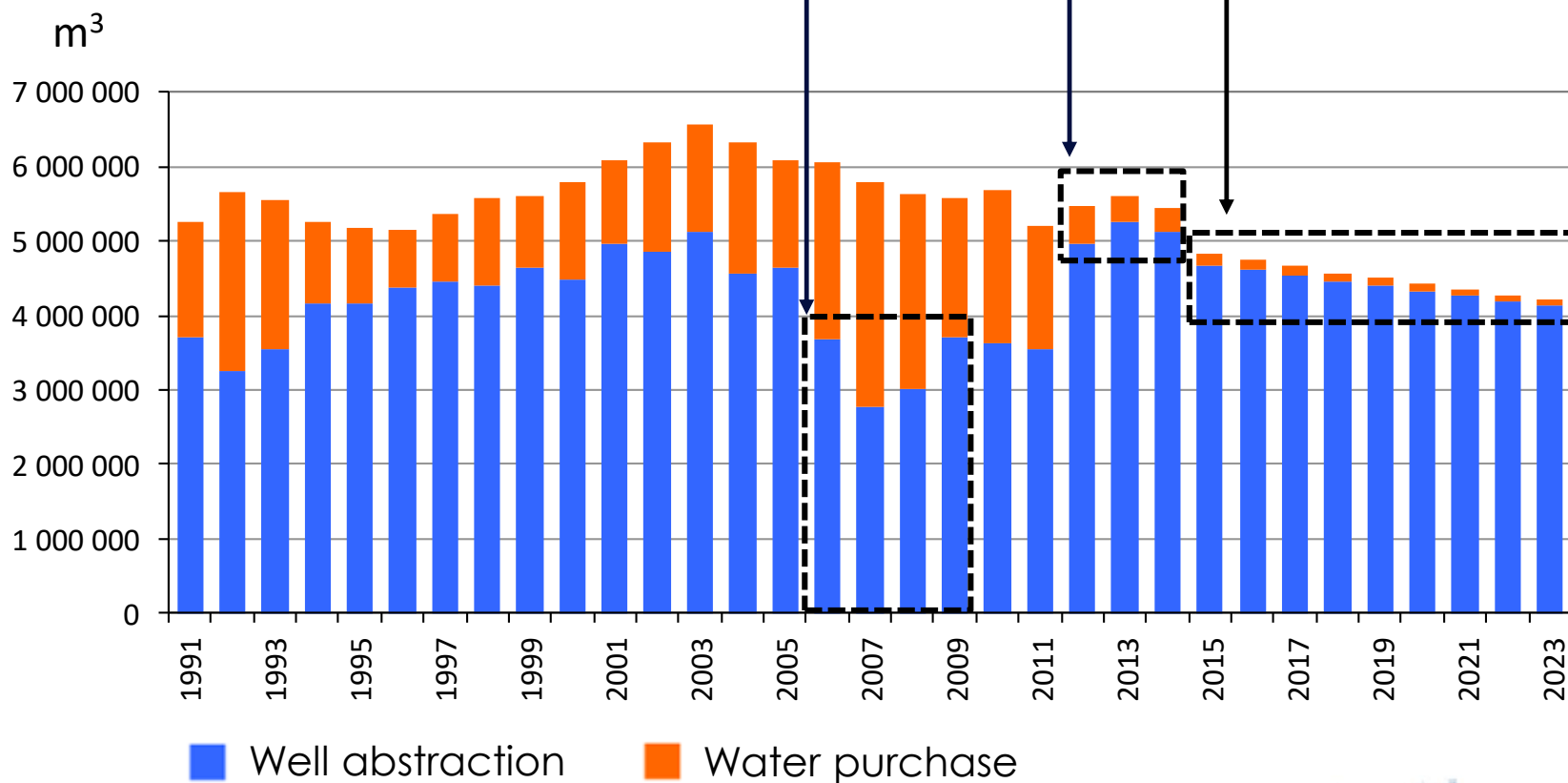
# AQUARENOVA

## Current and expected results

▷ **PHASE 2** : MAR - OPERATIONAL IMPLEMENTATION : **NOVEMBER 2015**

▷ **PHASE 1** : ESTABLISHMENT OF GRADIENTS METHOD **2012**

▷ PÈRE ETERNEL SHUT DOWN **2006 - 2009**





VILLE D'HYÈRES  
DES PALMIERS

Thank you....

