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Title: SWS pilot test site in Schinias

Final, but not yet approved by European Commission.

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Article Summary

The aim of the Schinias Pilot was to test SWS configurations coupled with novel pollution remediation techniques for the pumped water, including Reverse Osmosis (RO) and Advanced Oxidation Methods (Ozonation/alternative AOPs) to make use of water from karstic coastal aquifers and address a widespread problem in the Mediterranean: saltwater intrusion.

The coastal site of the Schinias Natural Park comprises of important ecosystems (coastal wetlands, sand dunes and a pine forest), but also accommodates greenhouses, requiring high quality water. Saltwater intrusion is a major issue in the upper aquifer. The Schinias case demonstrates how a currently unused resource, can be turned into a source for protection, regeneration and financial sustainability for the area as well as other similar ones throughout the Mediterranean.

In this context, the SWS configuration that has been designed and installed includes mainly the following components:

- ✓ The **water supply installations** that abstract and transfer the water from Makaria springs to the water processing unit.
- ✓ The **water processing unit** that has been designed, constructed, installed in place and tested by technicians.
- ✓ The **reinjection area installations** that consists of four wells, three vertical and one horizontal.

Article Keywords

SWS configuration, saltwater intrusion, coastal protected area, Schinias

Article content

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In this context, the SWS configuration that has been designed and installed (figure 1) can be described as follows:

With regard to the **water supply installations** (point A of figure 1) water from Makaria springs is abstracted and transferred through the Olympic Rowing Canal to the treatment unit (about 1700m). To install the water pipes and electricity cables for power supply in the bottom of the lake, divers were hired.

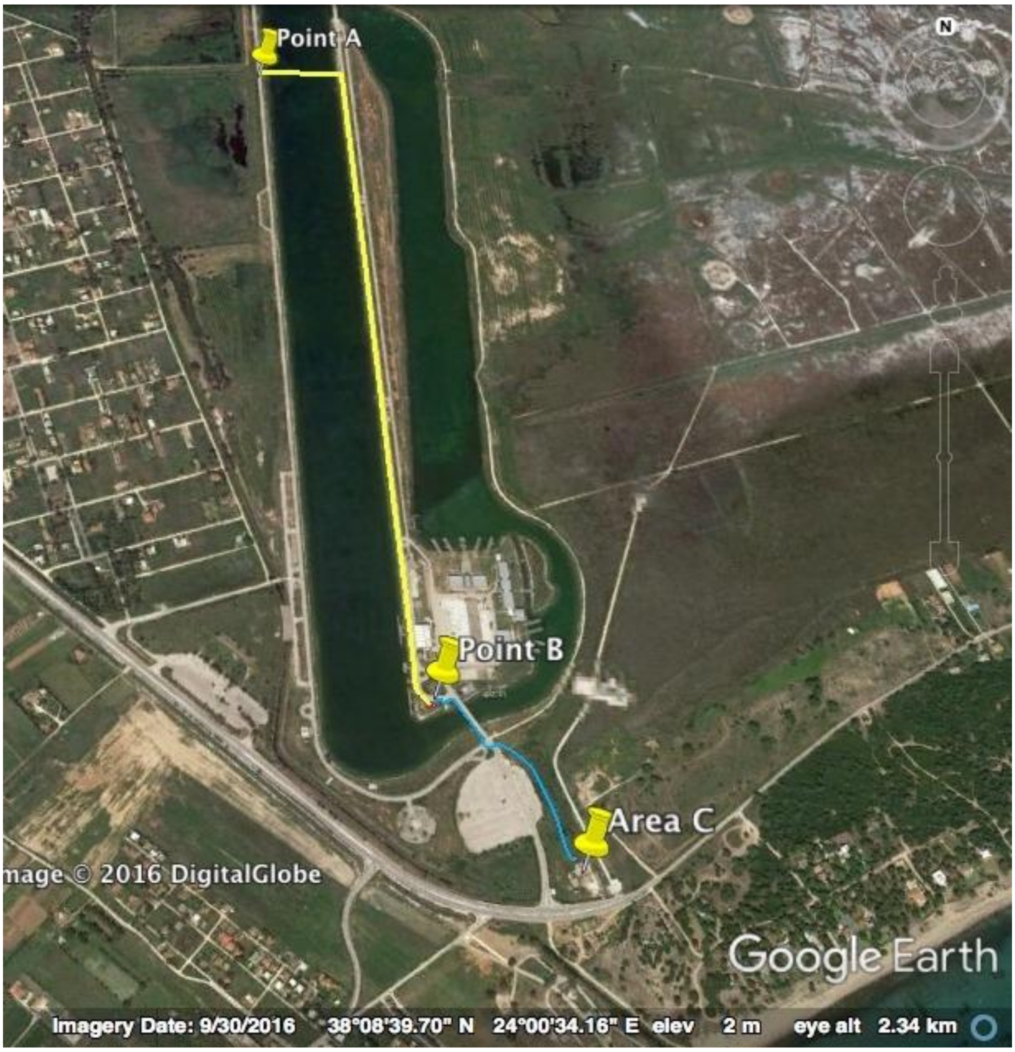

Figure 1. Schinias SWS configuration

The **water processing unit** has been designed, constructed, installed and tested by technicians. In particular:

- ✓ The **RO unit** was designed in collaboration with and produced by Lenntech BV (Delft, Netherlands). It was designed to process water of conductivity of about 4500μS/cm and temperatures between 15 and 30°C and to produce an outflow of 200μS/cm at 60m^3/day. The RO unit includes the following process: Sand filtration, Antiscalant dosing, 5 μm cartridge filter and Reverse Osmosis.

- ✓ The **AOP unit** utilises heterogeneous photocatalysis using titanium dioxide, TiO_2, as a catalyst, in order to confront organic pollution stemming from e.g. agricultural, stock-farming, other activities, random or systematic pollution events. AOPs, due to the formation of strong oxidative species, can achieve degradation of toxic organic pollutants without the production of any kind of residue, thus being considered as very effective and environmentally friendly methods. The AOP unit was designed to use a grade 304 stainless steel tank of 1m^3, in which the slurry of the catalyst and the treated water will be illuminated for certain contact time. The selected photocatalyst was a novel material; it is photocatalytically active fumed titanium dioxide granules (>99,5%) with particle size of about 20 μm.
- ✓ For the remote monitoring and control system, a programmable logic controller (PLC) was employed connected to a virtual private network (VPN) by means of a laptop computer and a 4G mobile internet wireless router. An alarm and fault messaging system was set up by means of a GSM SIM card.
- ✓ Regarding the disposal of outflow water, the RO unit produces a concentrate of 14500μS/cm at 26m^3/day. The most efficient way for RO concentrate disposal, both in terms of cost and environmental impact, is to dilute it with excess of feed water (>100M 60 m^3/day) and pump it to a stream of estimated flow rate at >1000 m^3/h. The mixing of the concentrate with the excess of feed water is expected to produce an outflow of 6620μS/cm at 5.4m^3/day.

The **SWS reinjection area** has been constructed and includes four wells as follows:

1. One Artificial Recharge (AR) Well in a depth of 23m, equipped with 3 piezometer nests for monitoring.
2. Two side wells in a depth of 12m at a distance of 16m from the central (AR well) screened with microfissured pipes.
3. One Horizontal Directional Drilling well at a length of 50m and maximum depth of 4.1m passing below the AR well, screened with PVC pipe.

The site selection was carefully selected based on through survey and investigation of the area as well as targeted measurements. Additionally, several pumping tests have been carried out to ensure the smooth operation of the site.

Article image

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Figure 2. Water processing unit, outside (up) and inside (down)

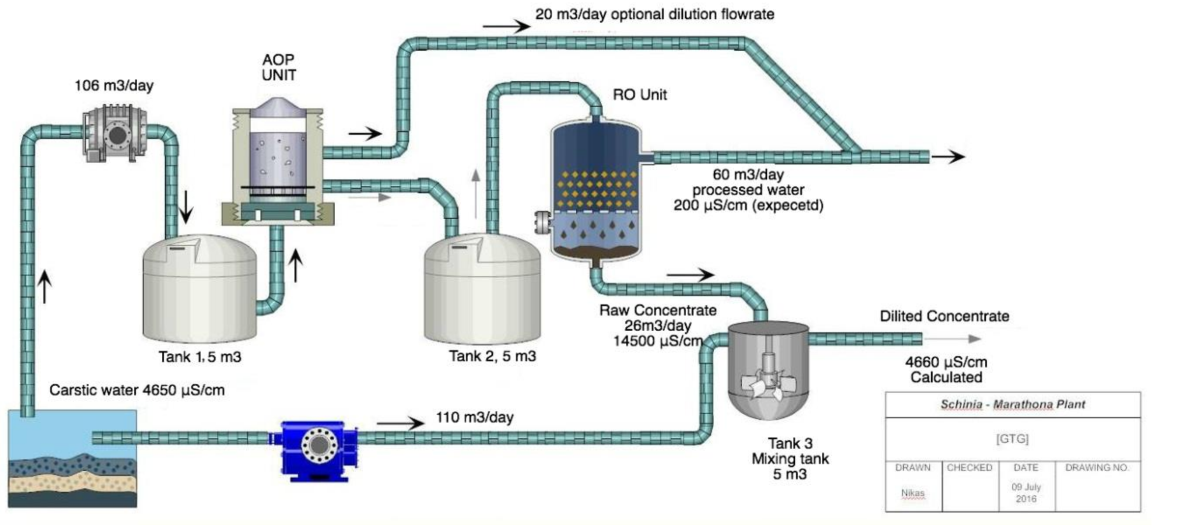

Figure 3. Treatment set-up

Figures 4. Drilling of the first side well

Figures 5. Horizontal Directional Drilling well

Figures 6. Installation of the reinjection point