



Constructed Wetlands as solutions for small scale communities: Experience from Thirasia Island, Greece

Challenge

- Small Aegean Island with permanent population of 319 inhabitants and significant increase in summer period (1,350 seasonal residents & tourists)
- Lack of wastewater treatment plant – Disposal of untreated wastewater in the sea
- Pollution outbreaks affecting natural environment & tourism



Applied solution

The WWTP of Thirasia was constructed in 2016 using innovative unconventional treatment methods, implemented for the first time in full scale, based on natural treatment processes using soft energy sources

Engineered Systems

Pre-treatment processes

- Screening & grit removal
- Sedimentation

Post-treatment processes

- Ultrafiltration
- Chlorination - dechlorination

Natural Systems

Solar photocatalysis

- Heterogeneous photocatalysis
- TiO₂ catalyst
- Sedimentation tanks

Constructed Wetlands

- 2 parallel subsurface flow beds

Technical demonstration

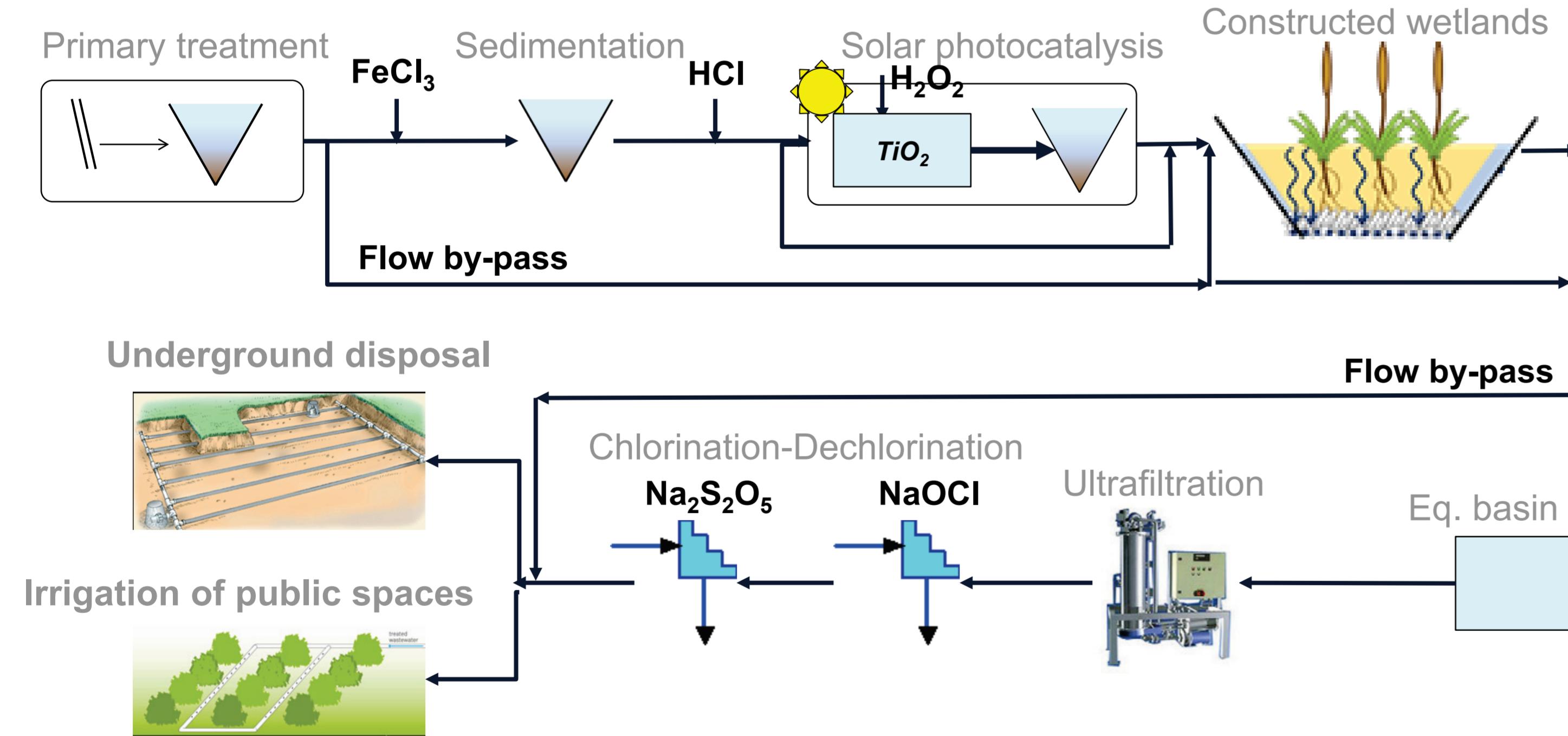


Figure 1: Flow chart of Thirasia WWTP

Primary treatment

- Two coarse screens
- Bar spacing: 6mm & 15 mm
- Aerated grit chamber

Sedimentation

- Volume: 89.4 m³
- FeCl₃ is added for chemical precipitation of phosphorus

Ultrafiltration

- Membrane active area: 152 m²
- Pore size less than 0.01 µm

Solar photocatalysis

- Photocatalytic reactor
 - Volume: 61.6 m³
 - Addition of H₂O₂
 - Addition of HCl
- Sedimentation tank
 - Volume: 73.5 m³

Constructed Wetlands

- Area: 208.2 m²
- Bottom slope: 0.4%

Results

Inflow

- The operation of the plant started with an inflow rate of just 5 m³/day – limited connection of households
- Since the summer of 2017, the wastewater inflow ranged from 12 to 60 m³/d (about 60 households were connected to the plant)
- High flow peaks during summer (especially in 2018)

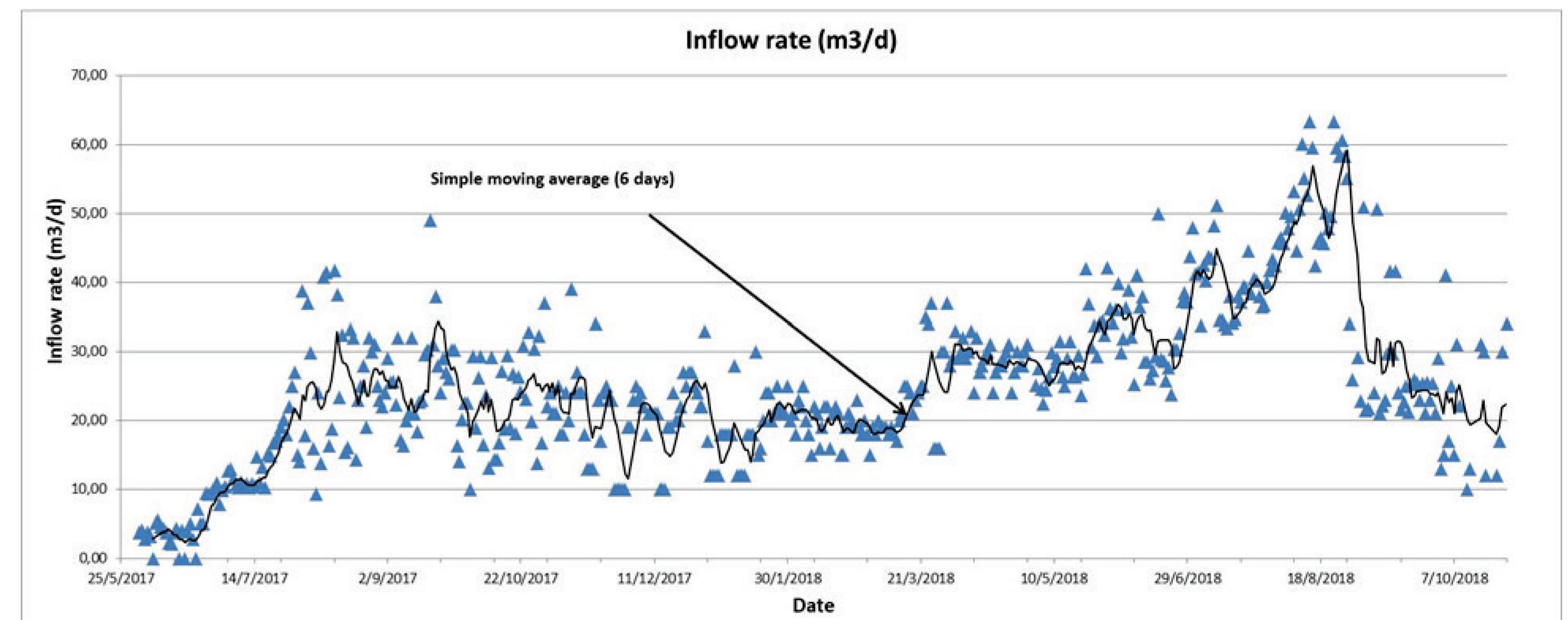


Figure 2: Inflow rate of wastewater into Thirasia WWTP

Monitoring & Evaluation

- 5 sampling points (after sedimentation, photocatalytic reactor, after secondary sedimentation, after wetland, after ultrafiltration & chlorination)
- Sampling period: November 2017 – December 2018

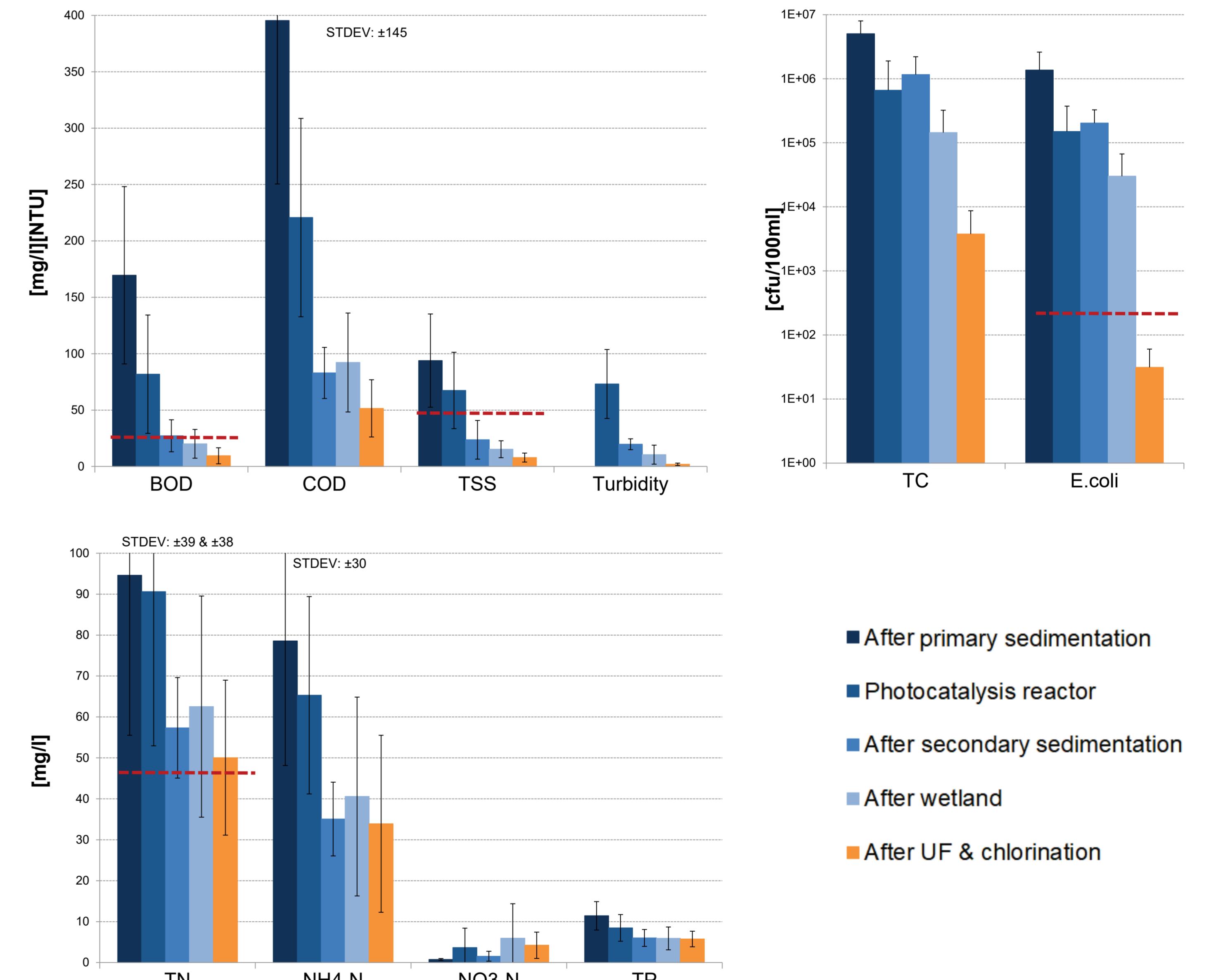


Figure 3: Average pollutant concentrations at Thirasia WWTP, starting after pre-treatment; Red dotted line: Greek reuse legislation limits for restricted irrigation

- All pollutant concentrations in the WWTP effluent, except TN, are within the limits of the Greek reuse legislation for restricted irrigation and groundwater recharge
- TN concentration slightly higher than TN limit
- All effluent samples below limits since July 2018

Benefits:

- Reliable performance and improved quality of treated WW
- Reuse of reclaimed water for restricted irrigation & groundwater recharge
- Environmental protection
- Low operational & maintenance costs