

# Case 3: Waterharmonica: Application of constructed wetlands to transfer treated wastewater into natural values in the Netherlands and Spain



Rob van den Boomen, Witteveen+Bos consulting engineers

Ruud Kampf, VU University

Lluís Sala, Consorci de la Costa Brava

Witteveen+Bos

vrije Universiteit amsterdam

CONSORCI DE LA COSTA BRAVA

## Content

- Problem identification
- Principles of the “Waterharmonica“
- Applications in the Netherlands
- Application in Spain
- Conclusions
- Key questions 1,2,3

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# Water Quality effluent versus surface water

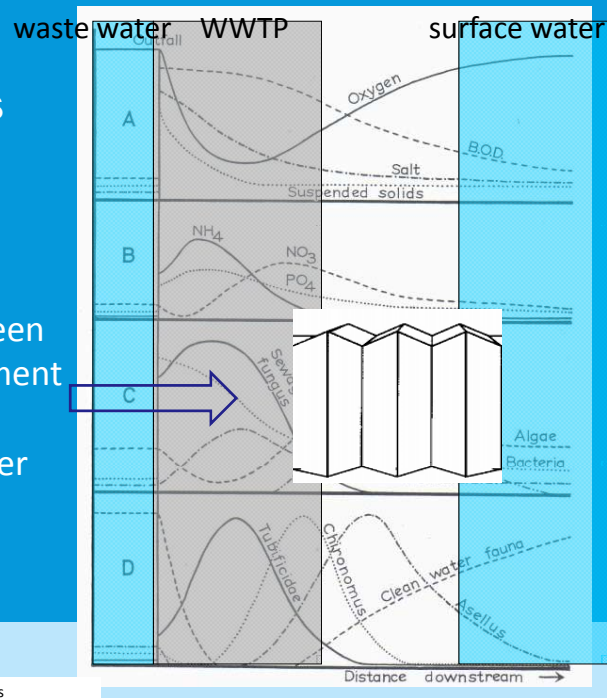
A physical – chemical

B nutrients

Bridge between  
sewage treatment  
and  
surface water

C micro-organisms

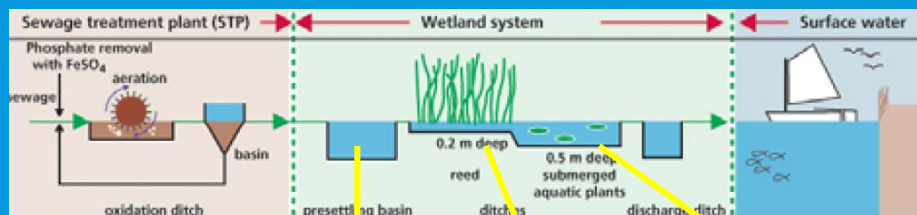
D macro-organisms



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Based on Hynes, 1960 The biology of polluted waters

# Principles of the Waterharmonica



components:	settling pond Daphnia	reed ditches	open water fish pond
processes:	sedimentation filtration nitrification	filtration denitrification	oxygen rhythm diversification

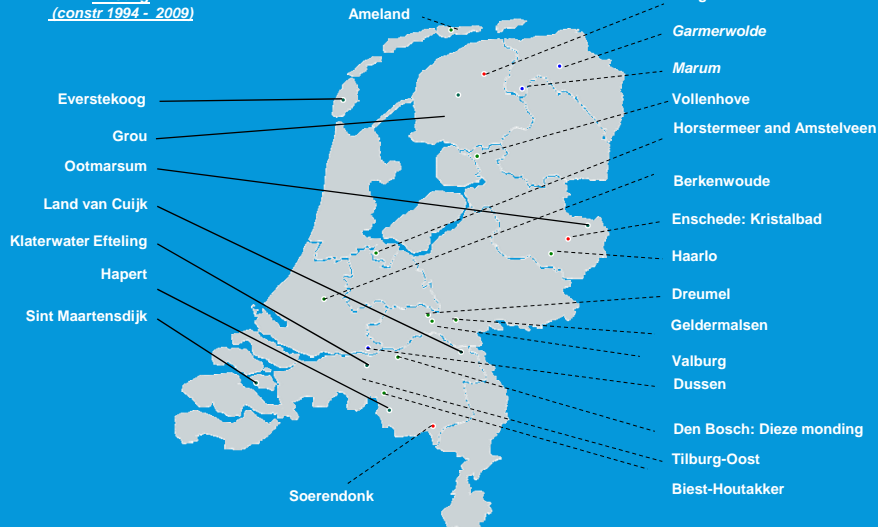
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# WATERHARMONICA systems in the Netherlands

PLANNED (2009 - ?)

Existing  
(constr 1994 - 2009)



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www.waterharmonica.nl

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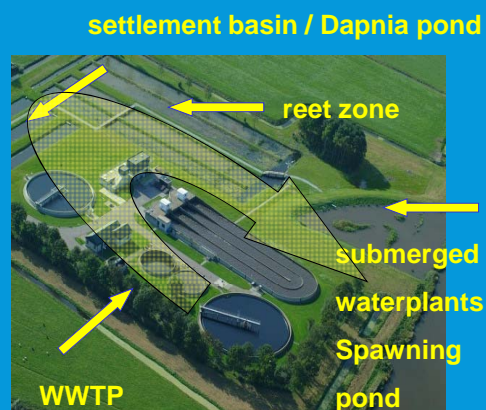
## WWTP- Waterharmonica Grou

Major goal: convert  
WWTP effluent to  
natural water

constructed in 2006

horizontal system:

- retention basin (with Daphnia)
- reetzone
- open water pond/Spawning pond



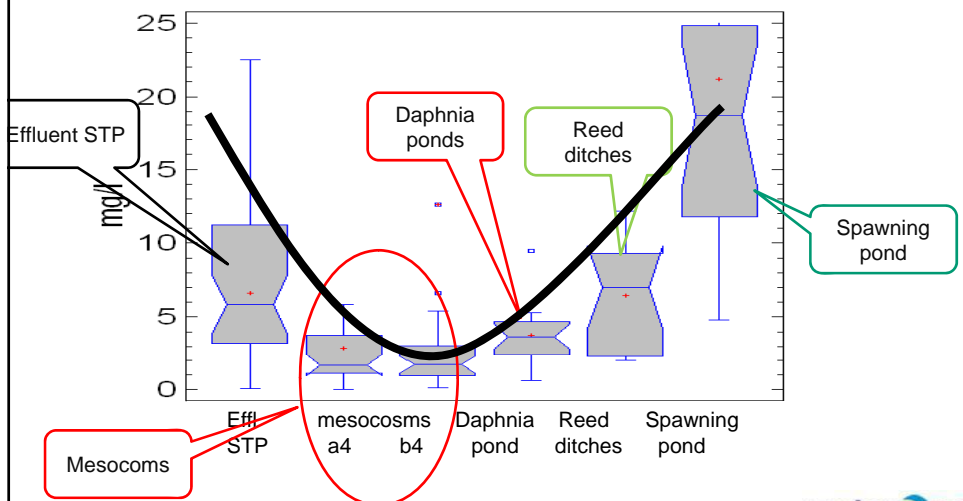
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## WWTP- Waterharmonica Grou

- wet area = 0,8 ha (total area 1,6 ha)
- volume = 4.700 m<sup>3</sup>
- hydraulic load = 1.000 m<sup>3</sup>/day
- residence time = approx. 4,5 days
- reduction P = 20% (from 1,0 to 0,8 mg/l)
- reduction N = 60%
- disinfection = 97-99 % (log 1,5)
- day-night oxygen
- fish in spawning pond
- conversion Suspended Solids

## Grou: Suspended solids

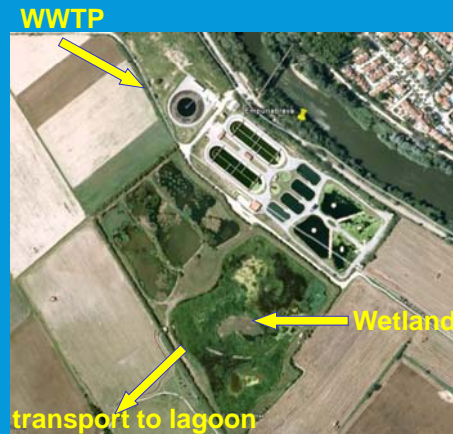


## WWTP- Empuriabrava

Major goal: Supply water in the 18-ha manmade Cortalet lagoon

constructed in 1998

horizontal system:  
3 reed/cattail cells + shallow pond



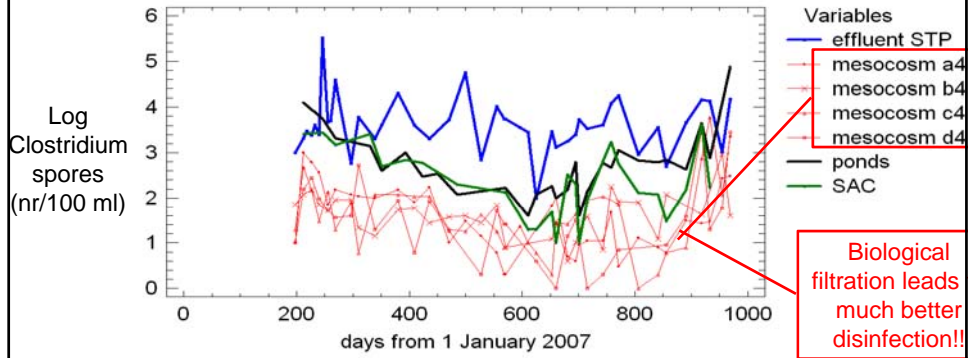
## WWTP- Empuriabrava

- wet area = approx. 7 ha
- volume = 25.000 m<sup>3</sup>
- hydraulic load = 1.500(w) - 6.500(s) m<sup>3</sup>/day
- residence time = approx. 4 days
- reduction P = 45%
- reduction N = 85%
- disinfection = 99 % (log 2)
- conversion Suspended Solids

# Empuriabrava wetland system



## Clostridium



## Result: building nature



## Conclusions

- constructed wetlands are a usefull bridge between waste water and surface water
- reduction of nutrients and pathogens
- conversion of suspended solids (bact -> algae)
- production of re-useable water
- demands space, but can be combined with nature, recreation, water storage

## Q1: Benefits of Ecol. Eng. Practices

- constructed wetlands are the bridge between technologists (at the WWTP) and ecologists (of the surface water)
- results in an integrated approach
- results in wetland development, natural purification, spawning areas

## Q2: Concept for measure benefits

- The Waterharmonica converts biological and chemical dead water into re-useable water
- effects on oxygen rhythm, nutrient reduction, tranposition of suspended solids
- development of recreation, education and nature

## Q3: How to promote the benefits?

- pilots
- full-scale applications