



## RE-WATER Eco technologies for the waste-water management

co-funded by the Interreg V-A Greece-Italy 2014-2020

### PARTNERSHIP

1. Lead Beneficiary: Aquedotto Pugliese S.P.A.
2. Polytechnic University of Bari
3. Municipality of Gallipoli
4. University of Patras
5. Municipality of Patras

### Associated partners

1. Municipal Enterprise of water supply and sewerage of Patras
2. Apulia Region- Water Resources Section



### ACTIONS in brief:

- Installation of two pilot plants at the sewage treatment plants of the two municipalities: Gallipoli and Patras.
- Guidelines for a cross-border and sustainable wastewater management.
- Diffusion of RE-WATER's results to several groups of stakeholders
- Thematic workshops in Greece and Italy addressed to citizens, administrative and technical staff for wastewater treatment and reuse

### ABSTRACT

Fishing and tourism are important sources of income for the inhabitants of the Ionian and Adriatic coasts: the pollution of the marine ecosystem could undermine the standard of living of these communities, both in social, economic and environmental terms. The main expectation of RE-WATER is to improve the know-how for preventing marine pollution, as well as to sensitize citizens and policymakers about the reuse of wastewater for new purposes.

### OBJECTIVES

- Introduction of eco-technologies and processes in the management of wastewaters.
- Prevention of marine water pollution through the installation of innovative technology in wastewater treatment plants
- Improvement of the management and further reuse of urban wastewater.

### WORK PACKAGES

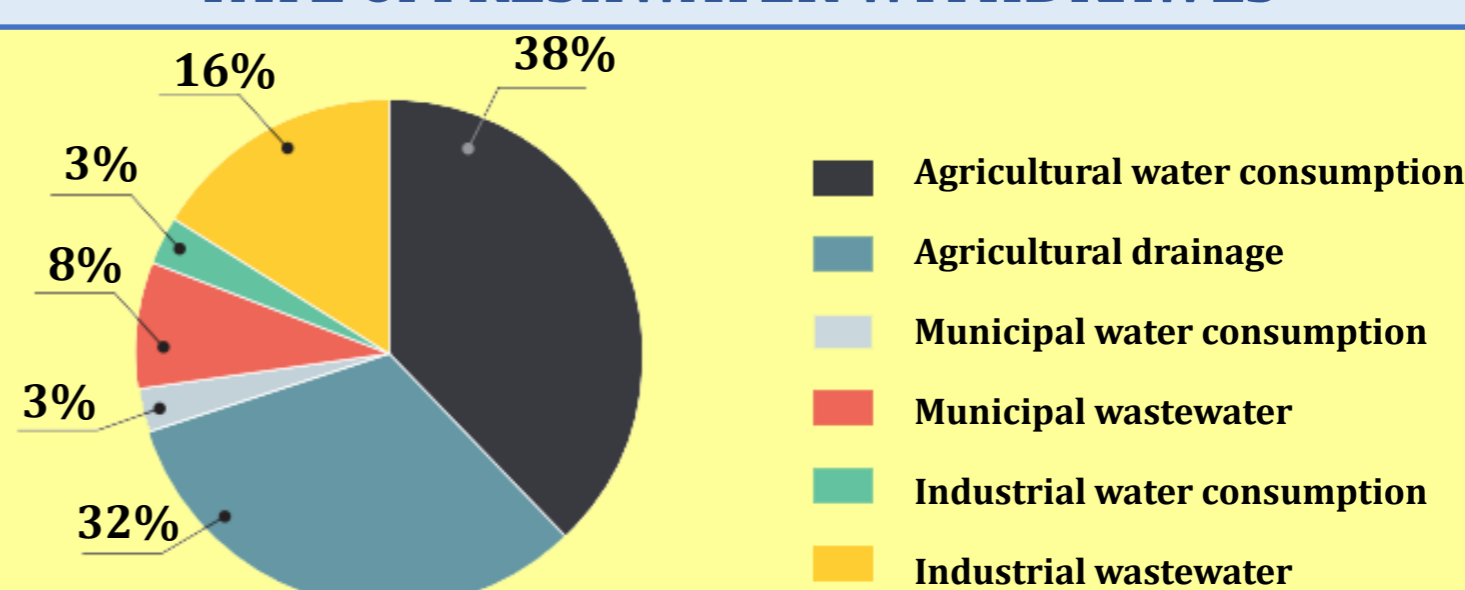
- WP1 - Management costs
- WP2 - Information and Publicity
- WP3 - Survey and planning
- WP4 - Pilot actions
- WP5 - Innovative Testing phase and monitoring of results

## CURRENT SITUATION AT THE SEWAGE TREATMENT PLANT OF PATRAS

- Patras is the 3<sup>rd</sup> largest city in Greece, with a population of 213,984 inhabitants (2011).
- The city of Patras has faced in the past an acute sewer problem, which was mainly due to the poor operation of its sewage network and to the disposal of untreated wastewater in the already severely overburdened Patras Gulf.
- With the construction of the largest part of the main sewage and rainwater drainage works (1990-2014) these problems have mainly been dealt with or are to be dealt with soon.

Data Entry	Face A'	Face B'
Population served	180.000 resi.	360.000 resi.
Average daily flow	36.000 m <sup>3</sup> /d	72.000 m <sup>3</sup> /d
Maximum daily flow	43.200 m <sup>3</sup> /d	86.400 m <sup>3</sup> /d
Maximum hourly flow	0,800 m <sup>3</sup> /s	1,500 m <sup>3</sup> /s
Minimum hourly flow	0,3 m <sup>3</sup> /s	0,600 m <sup>3</sup> /s
Organic load (BOD <sub>5</sub> )	11.700 kg/d	23.400 kg/d
Suspended Solids (SS)	14.400 kg/d	28.800 kg/d
Total nitrogen (Total N)	2.340 kg/d	4.680 kg/d
Total phosphorous (Total P)	468 kg/d	936 kg/d

### FATE of FRESHWATER WITHDRAWLS



UN Water, Wastewater: The Untapped Resource, UN World Water Development Report, 2017.

### 8% of freshwater withdrawals ends up as municipal wastewater.

The implementation of membrane filtration to treated municipal wastewater will facilitate the exploitation of large amounts of water worldwide (tertiary treatment).



## RESULTS OF NOT CHLORINATED SAMPLES

### Organic & microbial load

Parameters	Input	Concentrate	Permeate	Limits
<b>BOD</b>				
COD (mg/L O <sub>2</sub> )	50- 64	57- 92	17-34	125
E. Coli (CFU/100ml)	20.000	40.000	0	
Other coliforms, (CFU/100 ml)	110.000	2.830.000	5.100	
Total coliforms (CFU/100 ml)	130.000	2.870.000	5100*	500**
Enterococcus (CFU/100 ml)	16.000	16.000	0	

\*95% Removal, \*\*In the chlorinated effluent

### Concentration of Ions

	Input	Concentrate	Permeate	Limits
Total N, mg/L	8,3	8,25	7,8	15
NH <sub>3</sub> -N, mg/L	7,45	7,11	6,63	
NO <sub>2</sub> - N, mg/L	0	0	0	
NO <sub>3</sub> - N, mg/L	0,39	0	0,37	
Cl, mg/L	221	235	214	
Total P	0,36	0,63	0,22	1

### Physicochemical Analysis

	Input	Concentrate	Permeate
pH	7,3- 7,75	7,2- 7,8	7,3- 7,72
Color	21-25	90-95	140- 152
Conductivity, μS/cm	960-1153	1050-1159	1030-1159
Hardness, mg/L	396	443	453
Turbidity, NTU	6,65	7-9,79	0-3,39
Total solids, mg/L	418-747	533-733	392-701
Suspended solids, mg/L	4,4-12	27,5-31	0-2
Diluted solids, mg/L	410-742	506-727	390-701
Na, ppm	86,7	92,8	94,25
K, ppm	16,15	19,66	18,35
Fe, ppb	87	63	107
Mn, ppb	63	56	67

## INSTALLATION of PILOT SCALE UF MEMBRANE UNIT

- 8 UF membrane modules (hollow fiber)
- Two parallel treatment lines (4 modules each)
- **Pore size: 0.01 μm (size of bacteria > 1.0 μm)**
- Molecular Weight Cutoff: 50.000 Da
- **Permeate suspended solids < 2 mg/L**
- Permeate: 280 - 360 m<sup>3</sup>/d
- Retentate: 40 - 120 m<sup>3</sup>/d



## CONCLUSIONS

- A UF membrane system has been installed and tested for the tertiary treatment of part of Patras' sewage treatment plant effluent.
- The characteristics of the purchased equipment meet the criteria for the demonstration of the proposed technology.
- More than 96% of other coliforms and total coliforms contained in the input is retained by the membranes whereas no enterococcus and E. Coli are found in the permeate.
- The membrane system will be further tested and according to the measurements it will be decided if it is appropriate for the irrigation of the Park "Kokkinos Mylos" or other uses according to EU legislation.

## ACKNOWLEDGEMENTS

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