



REPUBLIC OF CYPRUS

Ministry of Agriculture, Rural Development and Environment



WATER DEVELOPMENT  
DEPARTMENT

# THE IMPORTANCE OF WETLANDS IN CYPRUS

## Ecosystem Services and Ecological Assessment

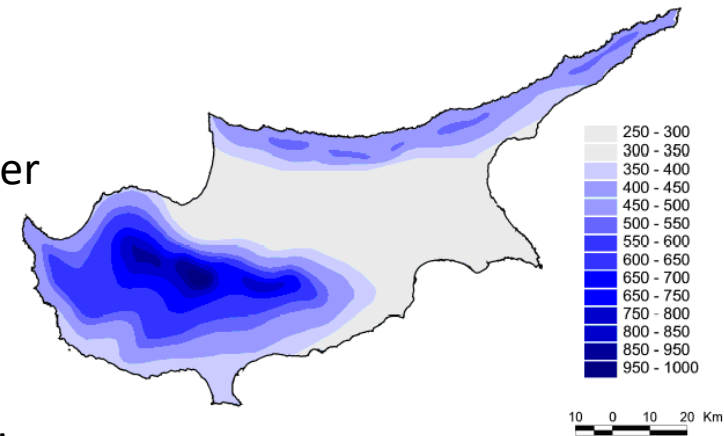
IAKOVOS TZIORTZIS  
BIOLOGIST  
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## Cyprus climate

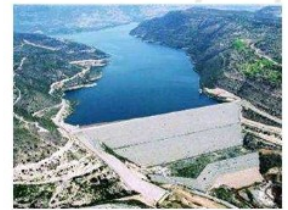
- Intense Mediterranean climate.
- Hot dry summers from mid-May to mid-September and rainy, rather changeable, winters from November to mid-March.
- The average annual total precipitation ranges from **300 mm** in the central plain and the flat southeastern parts to nearly **1,100 mm** at the top of the Troodos massif.
- Statistical analysis of precipitation in Cyprus reveals a drop in the last 30 years.
- The overall average aridity index is 0.295, classifying the entire island as **Semi-arid**.



# THE IMPORTANCE OF WETLANDS IN CYPRUS

## ➤ Water supply

- Water scarcity has been a problem since the old ages in Cyprus.
- The last decades **57 large dams** were constructed in/supplied by rivers (capacity  $\approx 332 \times 10^6 \text{ m}^3$ )
- Dams and groundwater reserves have been the main sources for the island, of good quality water.



**Polemidia Dam**  
Capacity: 3.4 MCM  
Year: 1965

**Yermasoyia Dam**  
Capacity: 13.5 MCM  
Year: 1968

**Asprokremmos Dam**  
Capacity: 52.4 MCM  
Year: 1982

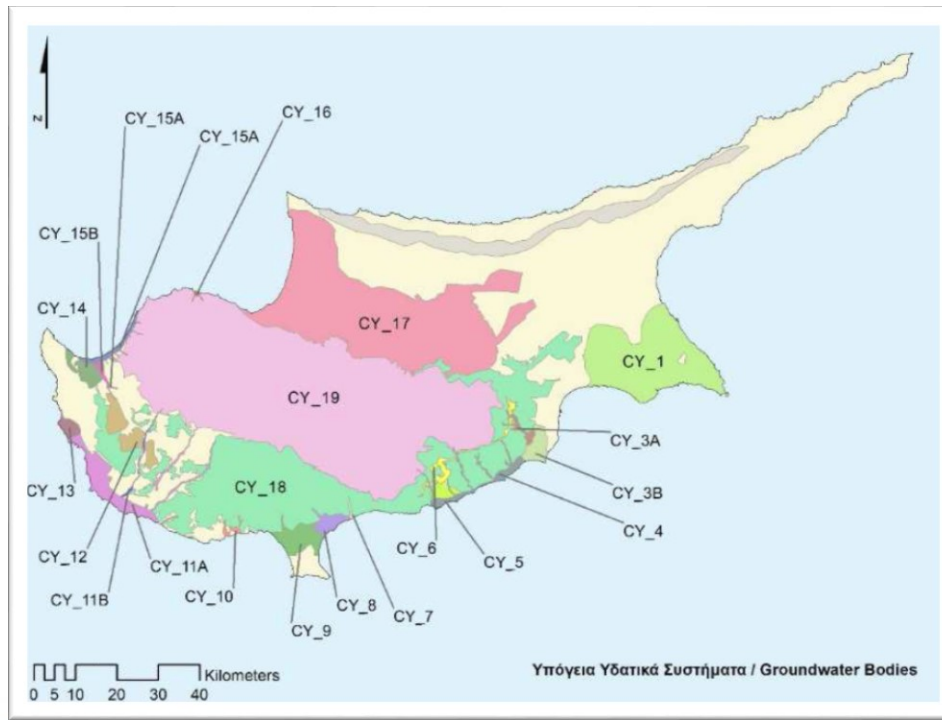
**Kouris Dam**  
Capacity: 115.0 MCM  
Year: 1988



# THE IMPORTANCE OF WETLANDS IN CYPRUS

## ➤ Water supply

- Major rivers of the island, comprise/feed important groundwater aquifers within their catchment and in coastal plains.
- Pumped water is used both for household and agriculture use.





# THE IMPORTANCE OF WETLANDS IN CYPRUS

## ➤ Water purification

- Healthy riverine ecosystems are widely known for their high capacity of water purification through biological processes – **Self purification**.
- Self purification is achieved within specific thresholds for each pollutant, which greatly depend on the river's health.
- Good water quality ending up in water reservoirs or the aquifer, is essential in order to provide water at a reasonable cost.

Monitoring Station Code	Monitoring Station Name	BIOLOGICAL QUALITY	CHEMICAL - PHYSICO-CHEMICAL QUALITY	OVERALL ECOLOGICAL POTENTIAL
d1-2-4-61	Arminou	GOOD AND ABOVE	GOOD AND ABOVE	GOOD AND ABOVE
d1-3-9-50	Asprokremmos	GOOD AND ABOVE	GOOD AND ABOVE	GOOD AND ABOVE
d1-4-3-95	Kannaviou	GOOD AND ABOVE	GOOD AND ABOVE	GOOD AND ABOVE
d1-6-2-63	Mavrokolympos	GOOD AND ABOVE	GOOD AND ABOVE	GOOD AND ABOVE
d2-2-6-91	Evretou	GOOD AND ABOVE	GOOD AND ABOVE	GOOD AND ABOVE
d3-5-1-65	Xyliatos	GOOD AND ABOVE	GOOD AND ABOVE	GOOD AND ABOVE
d8-7-2-05	Leukara	GOOD AND ABOVE	GOOD AND ABOVE	GOOD AND ABOVE
d8-7-4-05	Dipotamos	GOOD AND ABOVE	GOOD AND ABOVE	GOOD AND ABOVE
d8-9-5-60	Kalavasos	GOOD AND ABOVE	GOOD AND ABOVE	GOOD AND ABOVE
d9-2-5-20	Germasogia	MODERATE	GOOD AND ABOVE	MODERATE
d9-4-3-95	Polemídia	BAD	MODERATE	BAD
d9-6-3-17	Pano Platres	GOOD AND ABOVE	GOOD AND ABOVE	GOOD AND ABOVE
d9-6-9-10	Kouris	GOOD AND ABOVE	GOOD AND ABOVE	GOOD AND ABOVE



# THE IMPORTANCE OF WETLANDS IN CYPRUS

## ➤ Biodiversity

Riverine ecosystems of Cyprus sustain diverse habitats and important species such as the critically endangered European eel *Anguilla anguilla*, the freshwater crab *Potamon potamios* and the Western Caspian Turtle *Mauremys rivulata*

### 5 habitat types

**3140** Hard oligo-mesotrophic waters with benthic vegetation of Chara spp.

**3290** Intermittently flowing Mediterranean rivers of the Paspalo-Agrostidion

**92A0** Salix alba and Populus alba galleries

**92C0** Platanus orientalis orientalis woods

**92D0** Southern riparian galleries and thickets (Nerio-Tamaricetea and Securinegion tinctoriae)

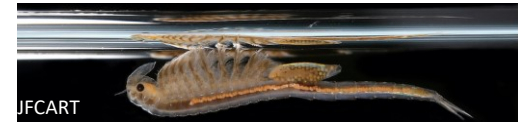
- 107 families of invertebrates
- 3 species of fish
- More than 120 macrophyte species
- More than 350 diatom species
- Support of several other species



## ➤ Biodiversity

Lacustrine ecosystems of Cyprus are biodiversity hotspots for Cyprus: **Natura 2000 sites**

- 4 Seasonal lakes/wetlands
- High seasonal variation (water volume and salinity)
- High “internal” heterogeneity (brackish to hyperaline)



e.g. Akrotiri

- 7 aquatic-related habitat types
- 1 fish species – *A. fasciatus*
- 13 species of aquatic macrophytes
- 308 bird species
- 19 reptile species
- 9 mammal species
- 3 amphibian species
- >12 species of zooplankton incl. *A. salina* and *Ph. spinosa*
- >20 phytoplankton species
- Support of terrestrial biodiversity



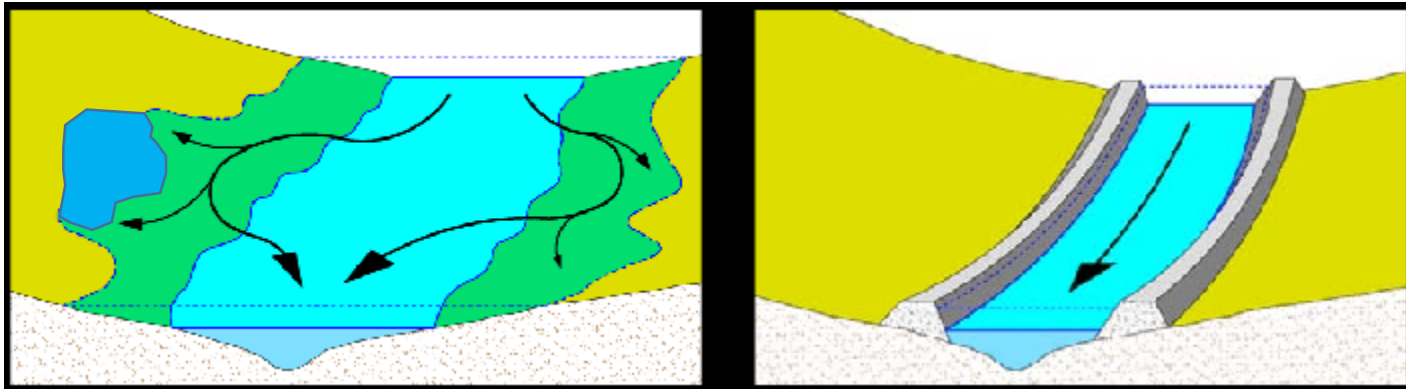


## ➤ Provision of fertile soils and water





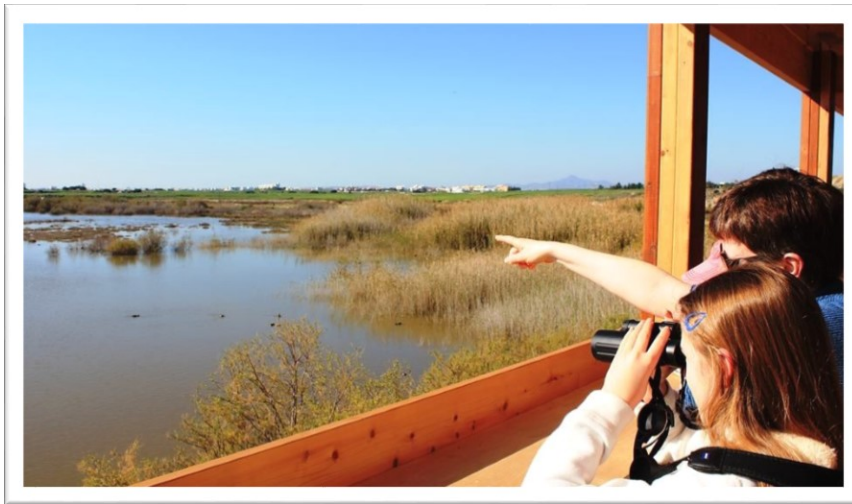
- **Provision of fertile soils and water**
- **Flood protection** (provided that hydromorphological features are sustained)



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- **Enrichment of coastal zone** (sediment and nutrients) – Akrotiri case



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- **Recreation – Environmental education**





- **Provision of fertile soils and water**
- **Flood protection** (provided that hydromorphological features are sustained)
- **Enrichment of coastal zone** (sediment and nutrients) – Akrotiri case
- **Recreation – Environmental education**
- **Provision of food source** (aquaculture, traditional fishing)





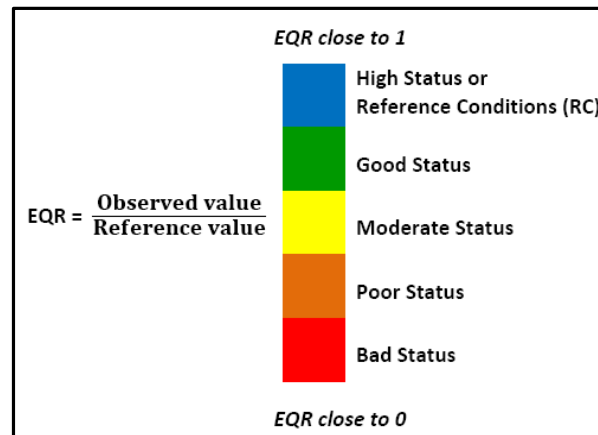
## SO, WHAT DO WE DO?

### WATER FRAMEWORK DIRECTIVE (WFD) 2000/60/EC

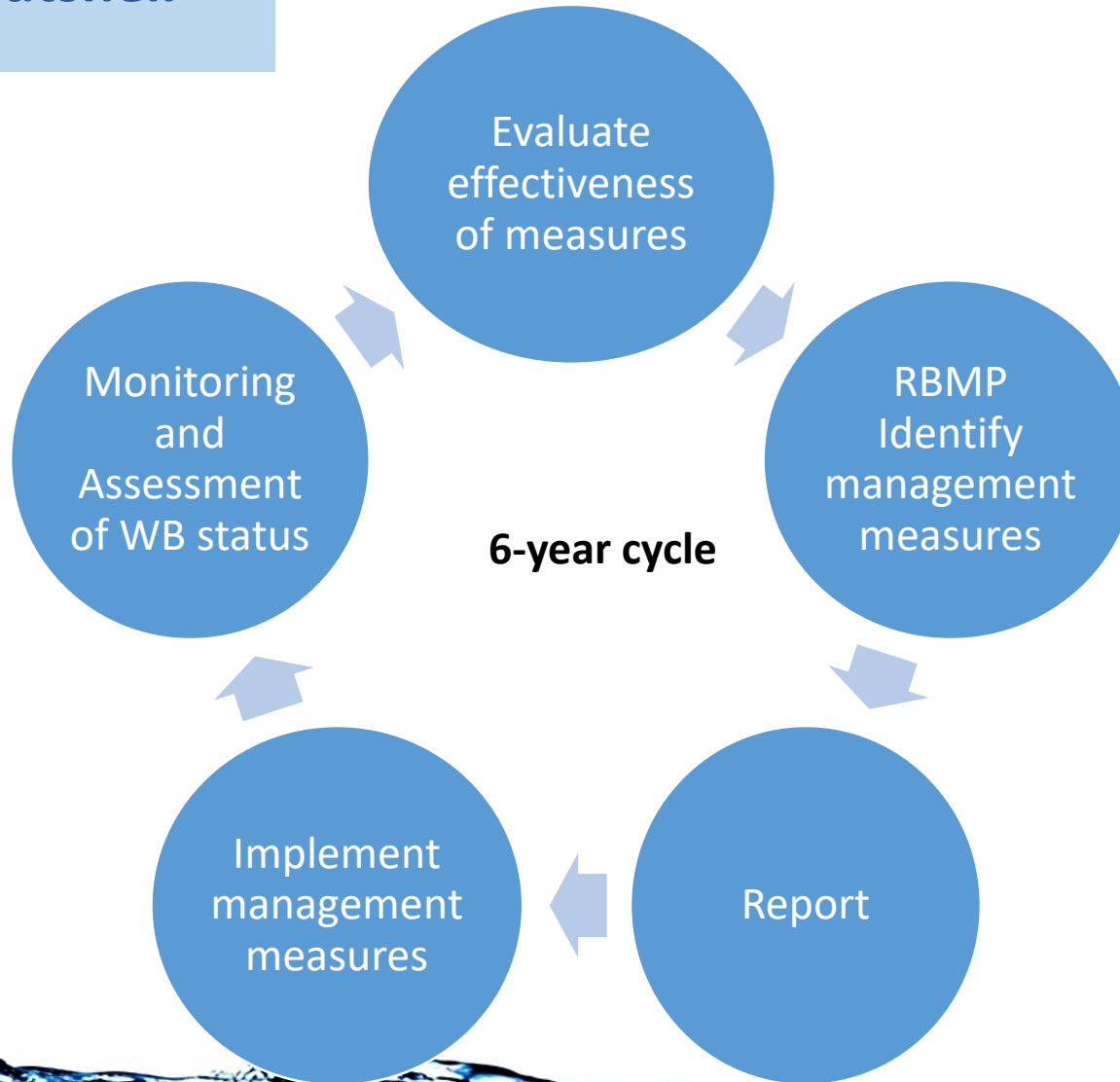
“Achieve **GOOD STATUS** for all waters (including inland surface waters, transitional and coastal waters and groundwater) ~~by 2015~~ by **2027**”

#### Monitoring of:

- **Biological** Quality Elements (BQE's)
- **Hydromorphological** Quality Elements supporting the biological elements
- **Chemical** and **Physicochemical** Quality Elements supporting the biological elements



# WFD in a nutshell



**A total of 60 major streams divided in 221 WB**

**Total length: 2623,1 km**

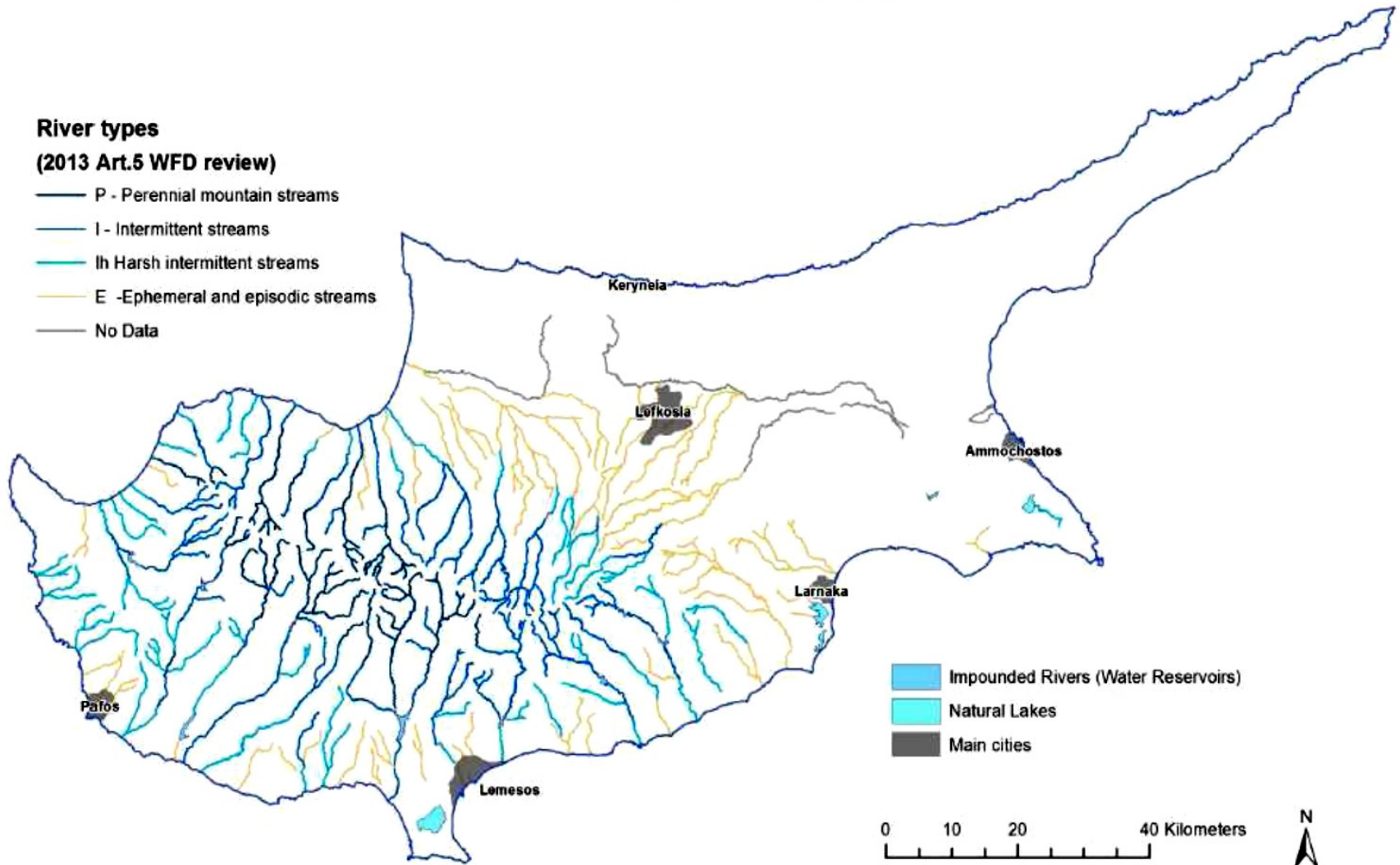
## TYPOLOGY

- 368,8 km - 14% Perennial WB
- 701,2 km - 27% Intermittent WB
- 567,2 km - 22% Harsh Intermittent WB
- 825,5 km - 31% Ephemeral WB
- 160,2 km - 6% No data





Revised WFD river network and stream types

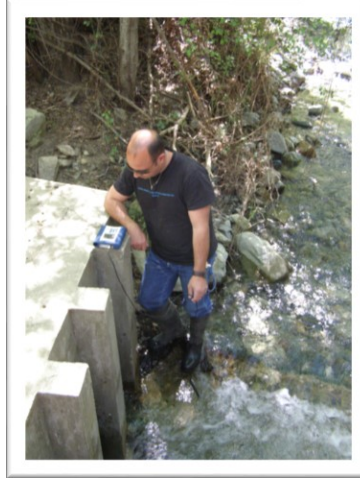




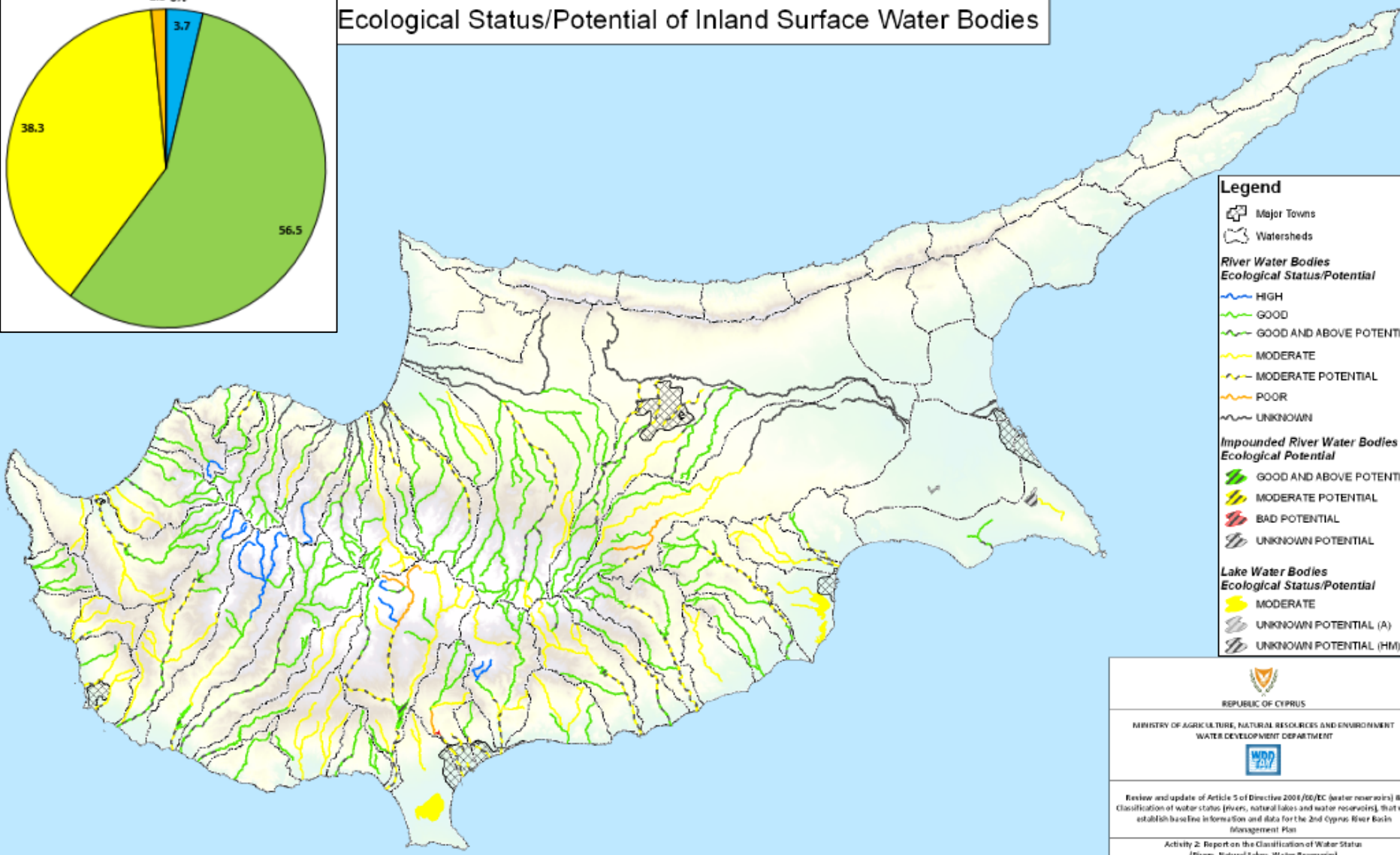
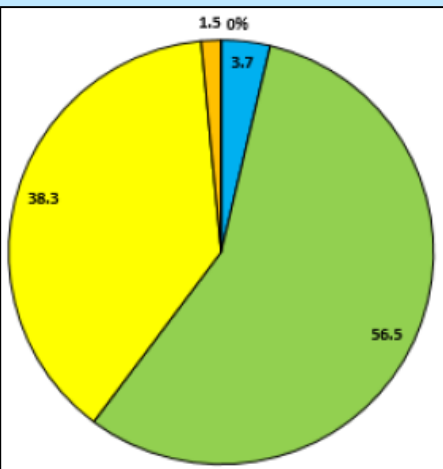
# CYPRUS RIVERS ASSESSMENT



Monitoring network of 81 station all over the island



# Ecological Status/Potential of Inland Surface Water Bodies



**Legend**

- Major Towns
- Watersheds

**River Water Bodies Ecological Status/Potential**

- HIGH
- GOOD
- GOOD AND ABOVE POTENTIAL
- MODERATE
- MODERATE POTENTIAL
- POOR
- UNKNOWN

**Impounded River Water Bodies Ecological Potential**

- GOOD AND ABOVE POTENTIAL
- MODERATE POTENTIAL
- BAD POTENTIAL
- UNKNOWN POTENTIAL

**Lake Water Bodies Ecological Status/Potential**

- MODERATE
- UNKNOWN POTENTIAL (A)
- UNKNOWN POTENTIAL (HM)

REPUBLIC OF CYPRUS

MINISTRY OF AGRICULTURE, NATURAL RESOURCES AND ENVIRONMENT  
WATER DEVELOPMENT DEPARTMENT

WDD  
2011

Review and update of Article 5 of Directive 2000/60/EC (water reserves) & Classification of water status (rivers, natural lakes and water reservoirs), that will establish baseline information and data for the 2nd Cyprus River Basin Management Plan

Activity 2: Report on the Classification of Water Status (Rivers, Natural Lakes, Water Reservoirs)

April 2016

Project Contractor:

I.A.CO Ltd  
Environmental & Water Consultants

ENVECO S.p.A.  
Environmental Engineering

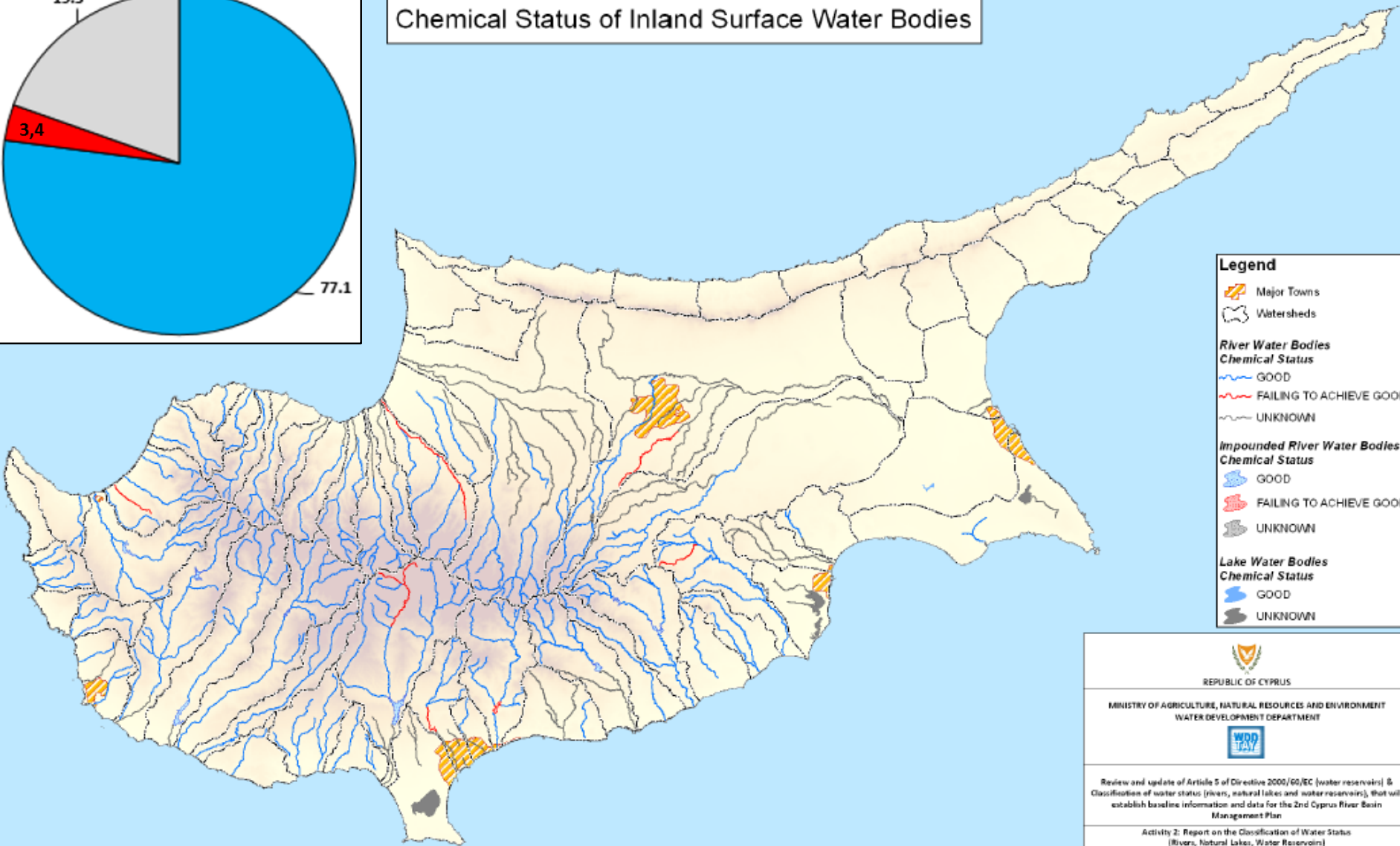
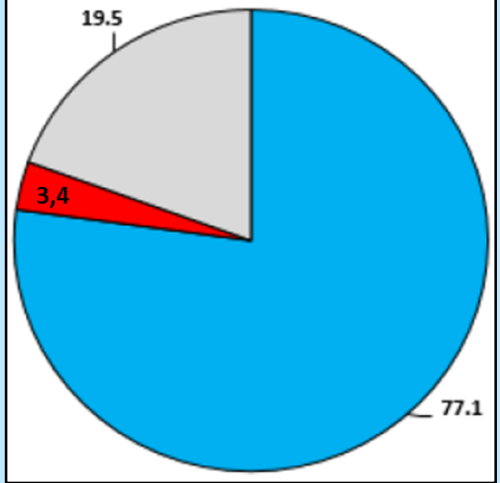
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ENVIRONMENTAL AND WATER CONSULTANTS LTD





# Chemical Status of Inland Surface Water Bodies



**Legend**

- Major Towns
- Watersheds

**River Water Bodies Chemical Status**

- GOOD
- FAILING TO ACHIEVE GOOD
- UNKNOWN

**Impounded River Water Bodies Chemical Status**

- GOOD
- FAILING TO ACHIEVE GOOD
- UNKNOWN

**Lake Water Bodies Chemical Status**

- GOOD
- UNKNOWN

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 WATER DEVELOPMENT DEPARTMENT

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April 2014

Project Contractor:

Signature:

ENVIRONMENTAL AND WATER CONSULTANTS LTD



# CYPRUS WATER RESERVOIRS ASSESSMENT

Monitoring programs in 13 Monitoring stations, since 2008







Sampling in reservoirs is taken place at the **deepest lake point**, using a **boat**



Sampling procedure starts by measuring the **euphotic zone** with a **Secchi disk**



**Vertical profiles** of 5 physical and chemical parameters (temperature, pH, DO, EC, turbidity) are measured *in situ* in the water column



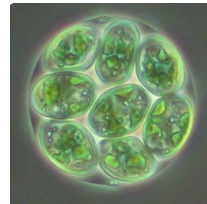
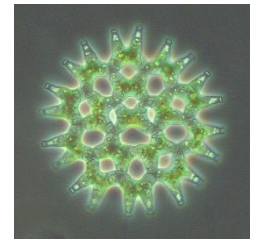
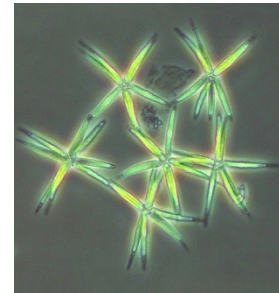
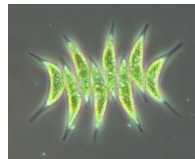
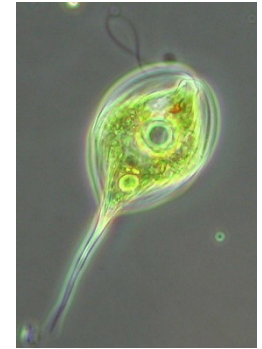
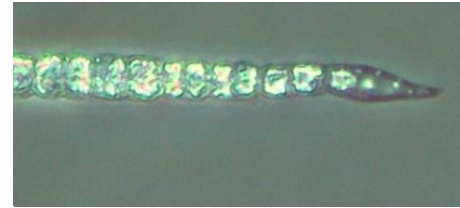
**Integrated water sample** of the euphotic zone is taken for phytoplankton quantitative analysis & other chemical analyses, using **Integrated Water Sampler**



**Living sample** is taken for phytoplankton qualitative analysis, using a **phytoplankton net**



## Biological quality element: Phytoplankton



Analysis with inverted microscope  
High biodiversity in most of the reservoirs  
Low biodiversity and phytoplankton blooms in 2 or 3 reservoirs with organic pollution (nutrients)





They are characterised as impounded rivers (Heavily Modified Water Bodies)

Annual **BIOLOGICAL potential** of 13 reservoirs, using phytoplankton:

Monitoring Station Code	Monitoring Station Name	2009	2010	2011	2012	2013	OVERALL BIOLOGICAL POTENTIAL	
d1-2-4-61	Arminou	0,93	0,84	0,84	0,70		0,83	GOOD AND ABOVE
d1-3-9-50	Asprokremmos	0,94	0,63	0,86	0,65		0,77	GOOD AND ABOVE
d1-4-3-95	Kannaviou	0,86	0,98	0,99	0,85	1,00	0,93	GOOD AND ABOVE
d1-6-2-63	Mavrokolympos			0,75	0,76		0,75	GOOD AND ABOVE
d2-2-6-91	Evretou	0,92	0,64	0,89	0,91		0,84	GOOD AND ABOVE
d3-5-1-65	Xyliatos			0,99	0,85		0,92	GOOD AND ABOVE
d8-7-2-05	Leukara	1,00	0,90	0,97	1,00		0,97	GOOD AND ABOVE
d8-7-4-05	Dipotamos	0,33	0,75	0,66	0,77		0,63	GOOD AND ABOVE
d8-9-5-60	Kalavastos	0,65	0,76	0,95	0,79		0,79	GOOD AND ABOVE
d9-2-5-20	Germasogeia	0,44	0,37	0,57	0,67		0,51	MODERATE
d9-4-3-95	Polemida	0,02	0,16	0,12	0,17		0,12	BAD
d9-6-9-10	Kouris	0,58	0,57	0,77	0,66		0,65	GOOD AND ABOVE
d9-6-3-17	Pano Platres					1,00	1,00	GOOD AND ABOVE

(data: 2<sup>nd</sup> RBMP)



## CHEMICAL – PHYSICOCHEMICAL classification of 13 reservoirs:

### 1 “moderate” potential (Polemídia)

Monitoring Station Code	Monitoring Station Name	pH	DO	EC	NH4-N	TP	Total Coliforms	As	B	Cr	Cu	Fe	Zn	Overall Physicochemical Potential	
d1-2-4-61	Arminou	BELOW GOOD	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	3,55	GOOD & ABOVE
d1-3-9-50	Asprokremmos	BELOW GOOD	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	3,55	GOOD & ABOVE
d1-4-3-95	Kannaviou	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	3,72	GOOD & ABOVE
d1-6-2-63	Mavrokolympos	GOOD & ABOVE	MODERATE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	3,55	GOOD & ABOVE
d2-2-6-91	Evretou	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	3,72	GOOD & ABOVE
d3-5-1-65	Xyliatos	BELOW GOOD	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	3,55	GOOD & ABOVE
d8-7-2-05	Leukara	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	3,72	GOOD & ABOVE
d8-7-4-05	Dipotamos	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	BELOW GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	3,55	GOOD & ABOVE
d8-9-5-60	Kalavastos	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	BELOW GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	3,55	GOOD & ABOVE
d9-2-5-20	Germasogia	BELOW GOOD	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	MODERATE	BELOW GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	3,05	GOOD & ABOVE
d9-4-3-95	Polemídia	BELOW GOOD	GOOD & ABOVE	BELOW GOOD	GOOD & ABOVE	POOR	BELOW GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	2,72	MODERATE
d9-6-3-17	Pano Platres	BELOW GOOD	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	3,55	GOOD & ABOVE
d9-6-9-10	Kouris	BELOW GOOD	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD & ABOVE	GOOD	GOOD	GOOD	GOOD	GOOD	GOOD	3,55	GOOD & ABOVE

(data: 2<sup>nd</sup> RBMP)





# CYPRUS WATER RESERVOIRS ASSESSMENT

Overall ECOLOGICAL potential:

11 “good and above” & 2 below “good”

Monitoring Station Code	Monitoring Station Name	BIOLOGICAL QUALITY	CHEMICAL - PHYSICO-CHEMICAL QUALITY	OVERALL ECOLOGICAL POTENTIAL
d1-2-4-61	Arminou	GOOD AND ABOVE	GOOD AND ABOVE	GOOD AND ABOVE
d1-3-9-50	Asprokremmos	GOOD AND ABOVE	GOOD AND ABOVE	GOOD AND ABOVE
d1-4-3-95	Kannaviou	GOOD AND ABOVE	GOOD AND ABOVE	GOOD AND ABOVE
d1-6-2-63	Mavrokolympos	GOOD AND ABOVE	GOOD AND ABOVE	GOOD AND ABOVE
d2-2-6-91	Evretou	GOOD AND ABOVE	GOOD AND ABOVE	GOOD AND ABOVE
d3-5-1-65	Xyliatos	GOOD AND ABOVE	GOOD AND ABOVE	GOOD AND ABOVE
d8-7-2-05	Leukara	GOOD AND ABOVE	GOOD AND ABOVE	GOOD AND ABOVE
d8-7-4-05	Dipotamos	GOOD AND ABOVE	GOOD AND ABOVE	GOOD AND ABOVE
d8-9-5-60	Kalavasos	GOOD AND ABOVE	GOOD AND ABOVE	GOOD AND ABOVE
d9-2-5-20	Germasogia	MODERATE	GOOD AND ABOVE	MODERATE
d9-4-3-95	Polemida	BAD	MODERATE	BAD
d9-6-3-17	Pano Platres	GOOD AND ABOVE	GOOD AND ABOVE	GOOD AND ABOVE
d9-6-9-10	Kouris	GOOD AND ABOVE	GOOD AND ABOVE	GOOD AND ABOVE

(data: 2<sup>nd</sup> RBMP)

# CYPRUS WATER RESERVOIRS ASSESSMENT

## Overall STATUS:

Uncertainty Class:  
 1 = Low  
 2 = Medium  
 3 = High  
 4 = Very High

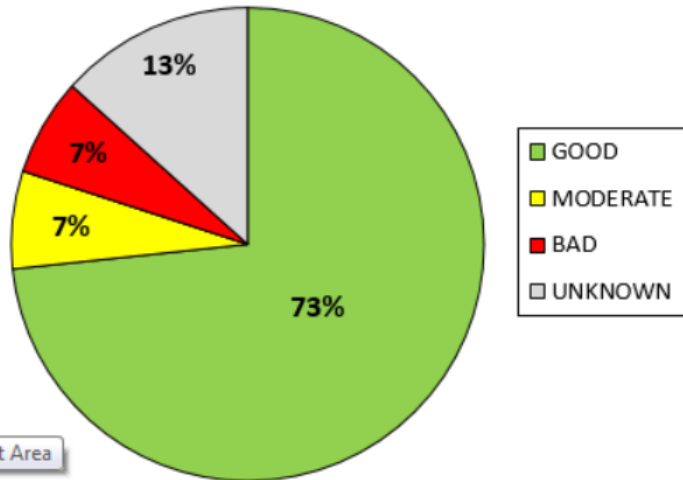
Water Body Code	Name	ECOLOGICAL POTENTIAL	Uncertainty Class	CHEMICAL STATUS	Uncertainty Class	OVERALL STATUS
CY_1-2-c_RP_HM_IR	Arminou	GOOD AND ABOVE	1	GOOD	1	GOOD AND ABOVE
CY_1-3-d_RIh_HM_IR	Asprokremmos	GOOD AND ABOVE	1	GOOD	3	GOOD AND ABOVE
CY_1-4-c_RI_HM_IR	Kannaviou	GOOD AND ABOVE	1	GOOD	3	GOOD AND ABOVE
CY_1-6-b_RIh_HM_IR	Mavrokolympos	GOOD AND ABOVE	1	GOOD	2	GOOD AND ABOVE
CY_2-2-e_RI_HM_IR	Evretou	GOOD AND ABOVE	1	GOOD	2	GOOD AND ABOVE
CY_3-5-b_RI_HM_IR	Xyliatos	GOOD AND ABOVE	1	GOOD	2	GOOD AND ABOVE
CY_3-7-i_RI_HM_IR	Akaki-Malounda	Unknown*	-	Unknown*	-	Unknown*
CY_6-1-b_RIh_HM_IR	Tamassos	Unknown*	-	Unknown*	-	Unknown*
CY_8-7-b_RI_HM_IR	Leukara	GOOD AND ABOVE	1	GOOD	3	GOOD AND ABOVE
CY_8-7-e_RI_HM_IR	Dipotamos	GOOD AND ABOVE	1	GOOD	3	GOOD AND ABOVE
CY_8-9-d_RI_HM_IR	Kalavasos	GOOD AND ABOVE	1	GOOD	1	GOOD AND ABOVE
CY_9-2-g_RI_HM_IR	Germasogia	MODERATE	1	FAILING TO ACHIEVE GOOD	1	MODERATE
CY_9-4-d_RI_HM_IR	Polemida	BAD	2	FAILING TO ACHIEVE GOOD	1	BAD
CY_9-6-j_RP_HM_IR	Pano Platres	GOOD AND ABOVE	4	GOOD	3	GOOD AND ABOVE
CY_9-6-s_RP_HM_IR	Kouris	GOOD AND ABOVE	1	GOOD	3	GOOD AND ABOVE

\* These are new water bodies and the monitoring program will be implemented in the next WFD management cycle.

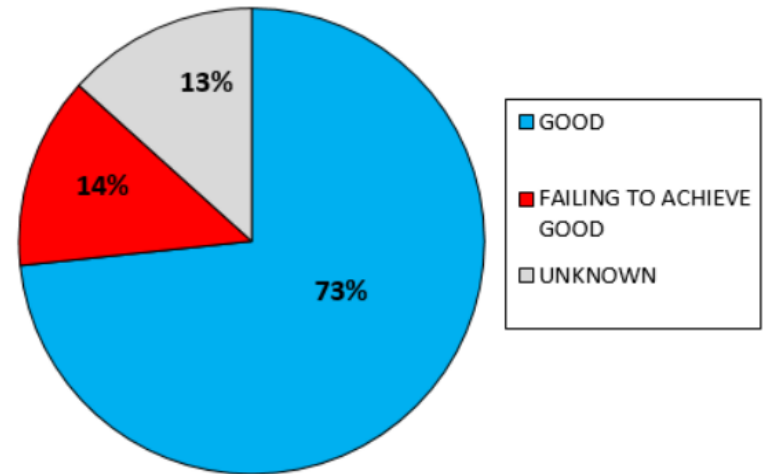
(data: 2<sup>nd</sup> RBMP)

## Ecological and Chemical status according to the 2<sup>nd</sup> RBMP

**Ecological Potential of Impounded River Water Bodies**  
(Percentage - % of number of Water Bodies)



**Chemical Status of Impounded River Water Bodies**  
(Percentage - % of number of Water Bodies)



(data: 2<sup>nd</sup> RBMP)



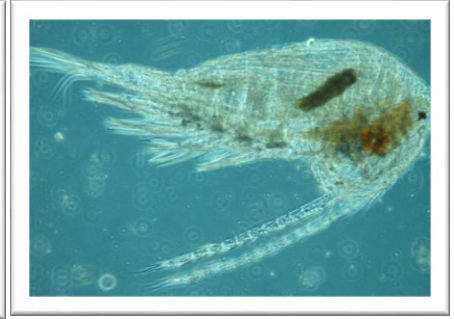
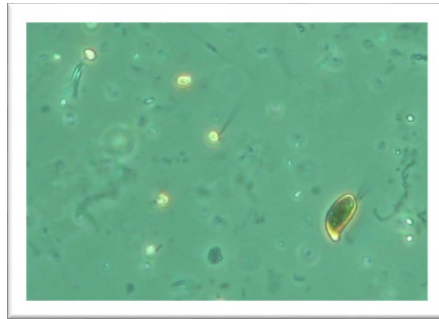
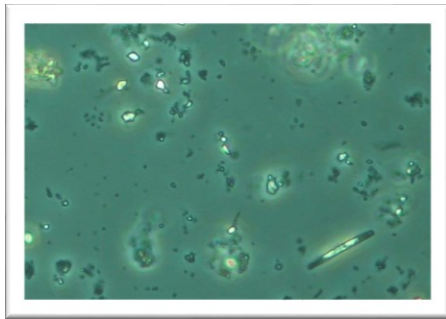


# CYPRUS LAKES ASSESSMENT

Monitoring programs in 7 Lakes, with 10 stations, since 2014



- 4 different types of lakes (salinity, hydrological regime, morphology)
- 2 of them are characterized as heavily modified
- Phytoplankton and zooplankton considered useful for assessment and are examined in the monitoring programs



- Large variability in the different parameters of the biological elements between the types, between lakes of the same type and within the same lake from year to year (strongly changing systems)
- **Salinity** (and the **hydrological status** extension) shapes the communities of salt lakes primarily and then the availability of nutrients





REPUBLIC OF CYPRUS

Ministry of Agriculture, Rural Development and Environment



WATER DEVELOPMENT  
DEPARTMENT

# Thank you

IAKOVOS TZIORTZIS  
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