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***USE OF A PUBLIC PERCEPTIONS STUDY
TO ASSIST POLICY MAKING FOR
RECLAIMED WATER REUSE***

Alexia Panayi

Engineering Technician (BSc, MSc Chemical Engineer, MBA)

Water Development Department

Ministry of Agriculture, Natural Resources and Environment

Republic of Cyprus

- Project Partners:



FREDERICK
RESEARCH CENTER



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OVERVIEW

- WASTEWATER TREATMENT PLANTS IN CYPRUS
- REUSE OF TREATED EFFLUENT IN CYPRUS
- QUANTITIES OF TREATED EFFLUENT IN CYPRUS
- SELLING RATES OF TREATED EFFLUENT IN CYPRUS
- QUALITY CONTROL OF THE TREATED EFFLUENT IN CYPRUS
- RESEARCH SIGNIFICANCE AND OBJECTIVES
- METHODOLOGY
- RESULTS
- CONCLUSIONS

WASTEWATER TREATMENT PLANTS IN CYPRUS

Existing Wastewater Treatment Plants (WWTPs)

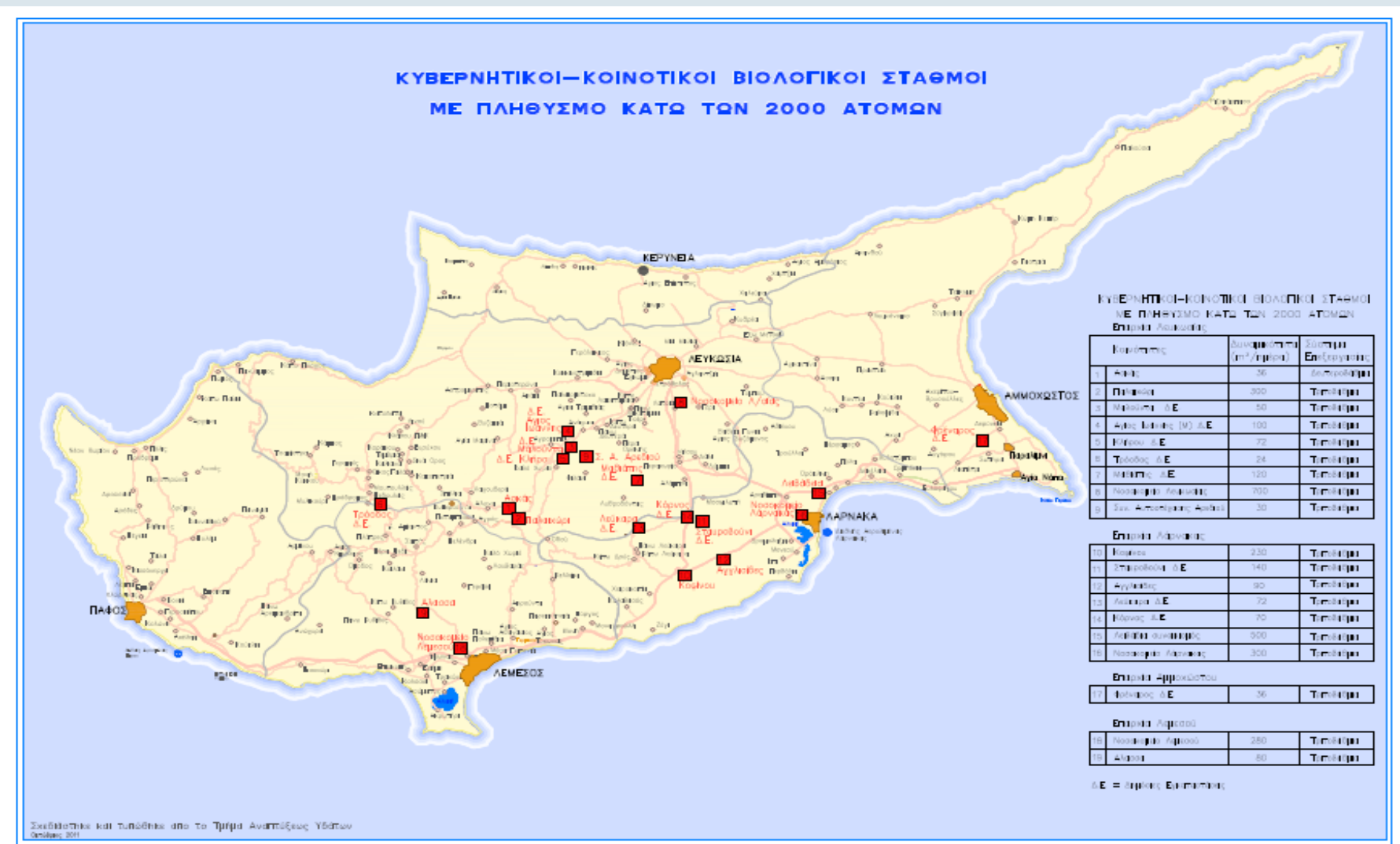
Type of Treatment: Mainly Tertiary Treatment - Activated Sludge with Sand Filtration and Chlorination

Two Urban WWTPs: Tertiary Treatment - Membrane Bioreactor with UV Disinfection

	Categories of WWTPs	Number of WWTPs	Total Capacity (m³/day)
1	Existing Urban WWTPs (>2000 p.e.)	8	165.700
2	Existing Rural WWTPs (> 2000 p.e.)	7	2.601
3	Existing Rural WWTPs (< 2000 p.e.)	4	506
4	Existing WWTPs for Refugee Housing	3	760
5	Existing WWTPs for Hospitals	3	1.280
6	Existing WWTPs for Military Camps	9	684
	TOTAL	34	

WASTEWATER TREATMENT PLANTS IN CYPRUS

Existing WWTPs for Rural Agglomerations < 2000p.e., for Refugee Housing, for Hospitals and for Military Camps



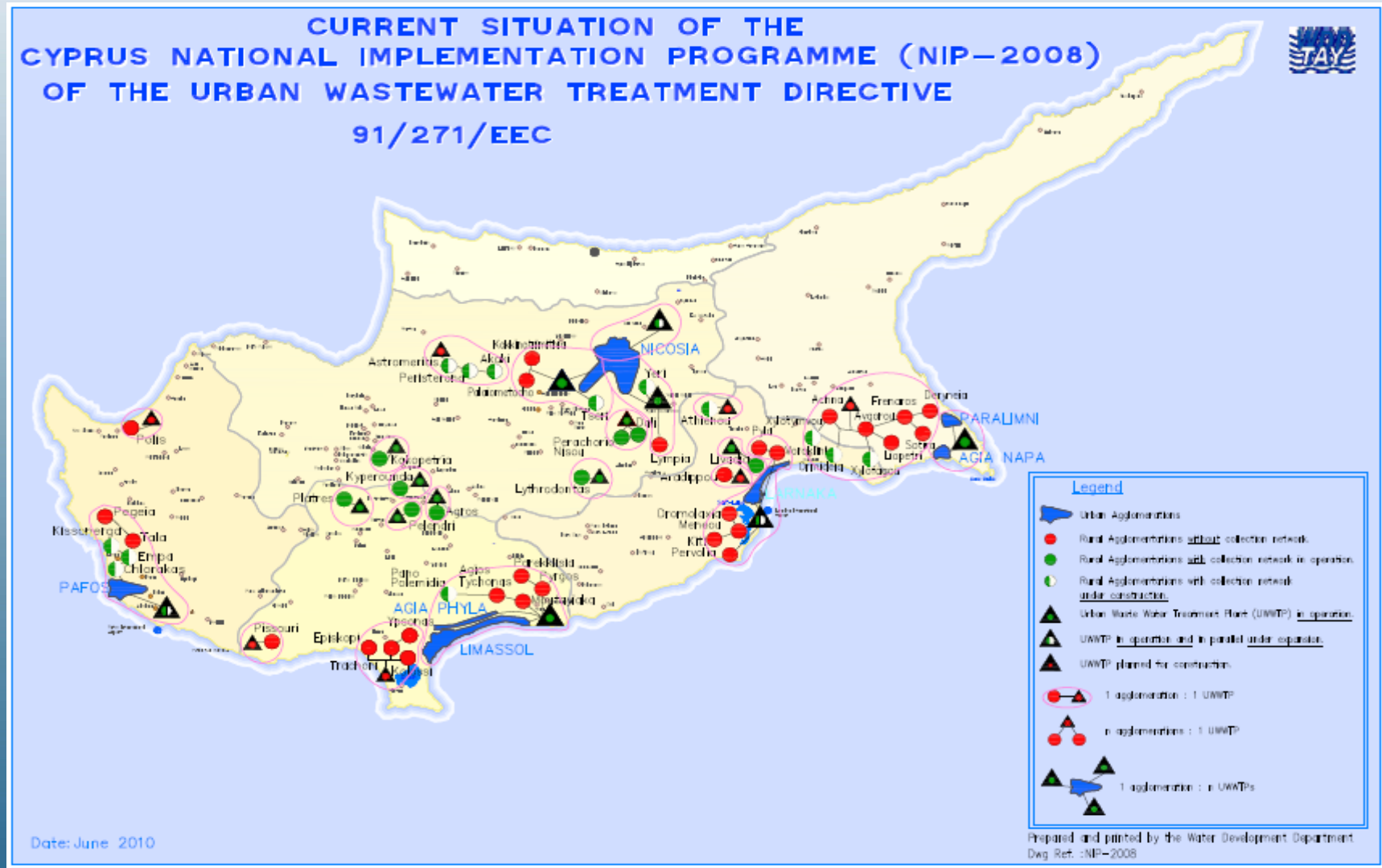
WASTEWATER TREATMENT PLANTS IN CYPRUS

Existing and Planned WWTPs for Urban and Rural Agglomerations > 2000p.e

- Based on **UWWTD 91/271/EEC** Cyprus has to create wastewater infrastructure for the proper collection, treatment and discharge of wastewater for ***all the agglomerations with population equivalent (p.e.) more than 2.000***, in order to protect the water bodies and finally the environment.
- This is being reflected through the Cyprus National Implementation Program (NIP). The last revised NIP, which was submitted to the European Commission in 2008, shows all the existing and planned WWTPs for the agglomerations with population equivalent more than 2.000. A total of **24 WWTPs** (see NIP – 2008 map).
 - 15 Existing WWTPs
 - 9 Planned for WWTPs
- Now there are 4 co-financed sewerage schemes that are under construction (see Four Co-Financed Sewerage Schemes map).
- The Water Development Department (WDD) is the competent authority for the implementation of the National Program, in coordination with the Urban Sewerage Boards for their assistance in implementing the Directive in cities.

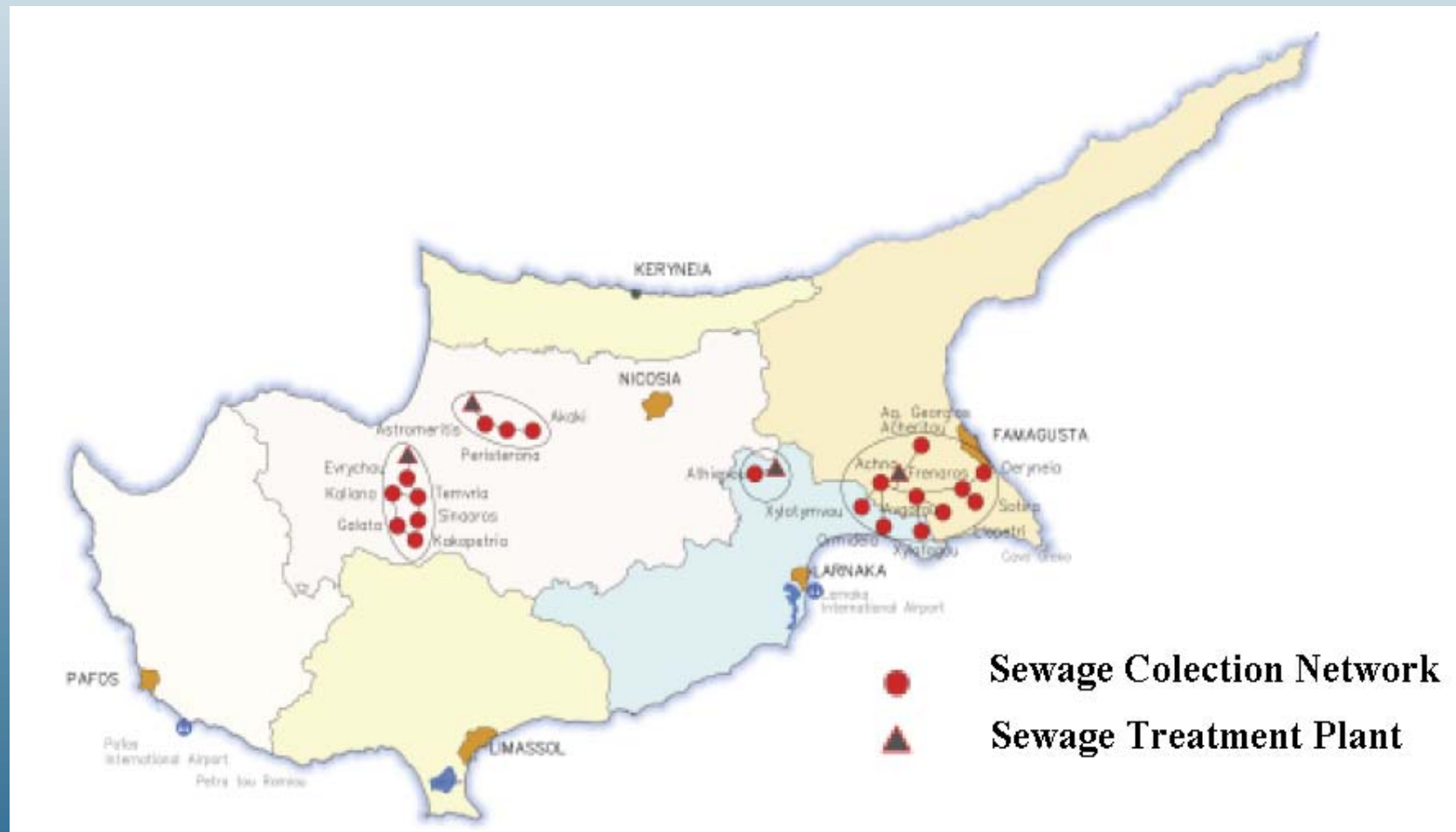
WASTEWATER TREATMENT PLANTS IN CYPRUS

Existing and Planned WWTPs for Urban and Rural Agglomerations > 2000p.e
(NIP -2008)



WASTEWATER TREATMENT PLANTS IN CYPRUS

Four Co-Financed Sewerage Schemes under construction



REUSE OF TREATED EFFLUENT IN CYPRUS

In Cyprus the treated effluent is reused for the following purposes :

- **IRRIGATION - 72% on average**

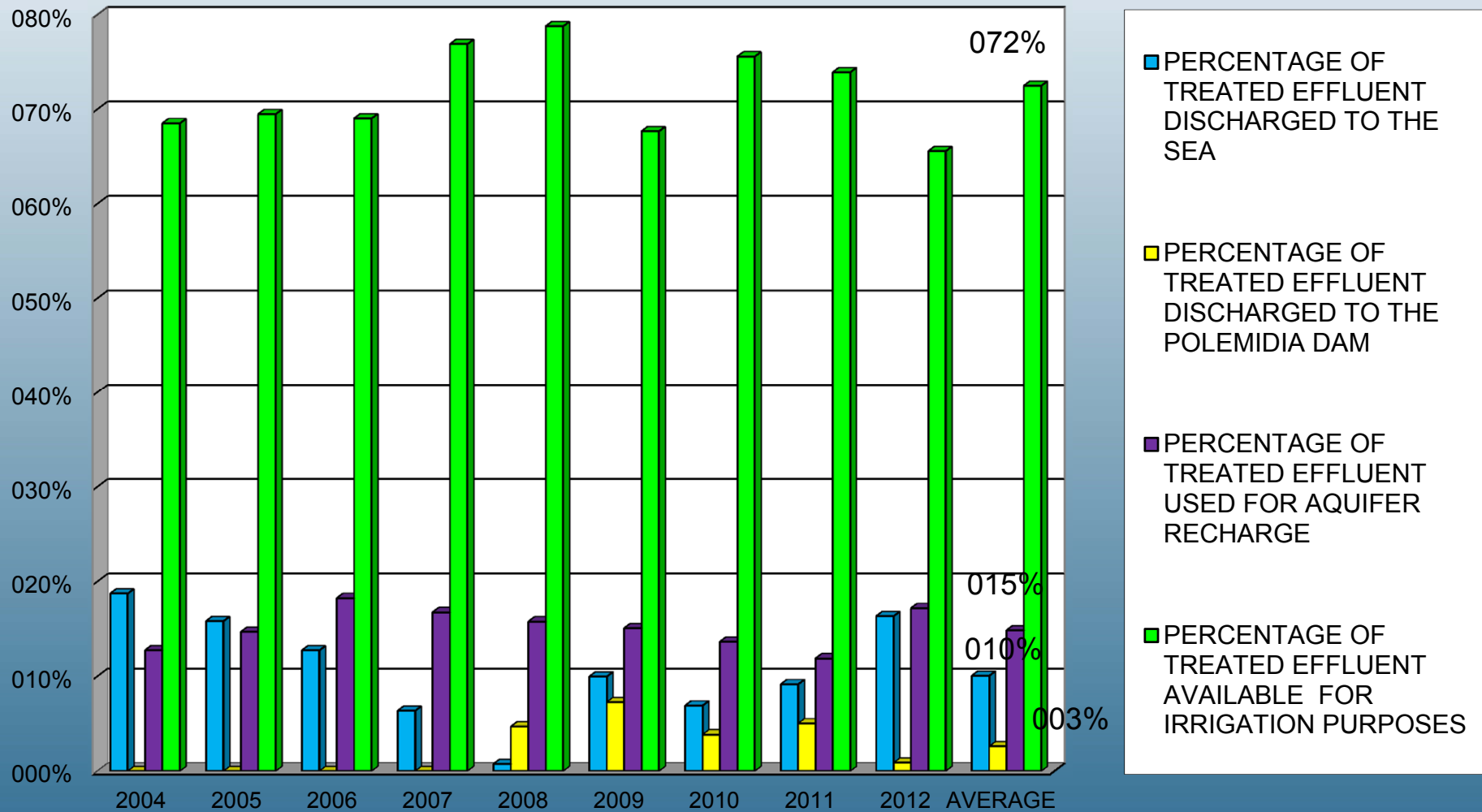
- ✓ Tree Crops
- ✓ Seasonal and Permanent Crops
- ✓ Fodder Crops
- ✓ No Leafy Vegetables (e.g. tomatoes, potatoes, peppers etc) - use of specific irrigations methods
- ✓ Green Areas

Except of Leafy Vegetables, Bulbs and Condyles that are eaten raw

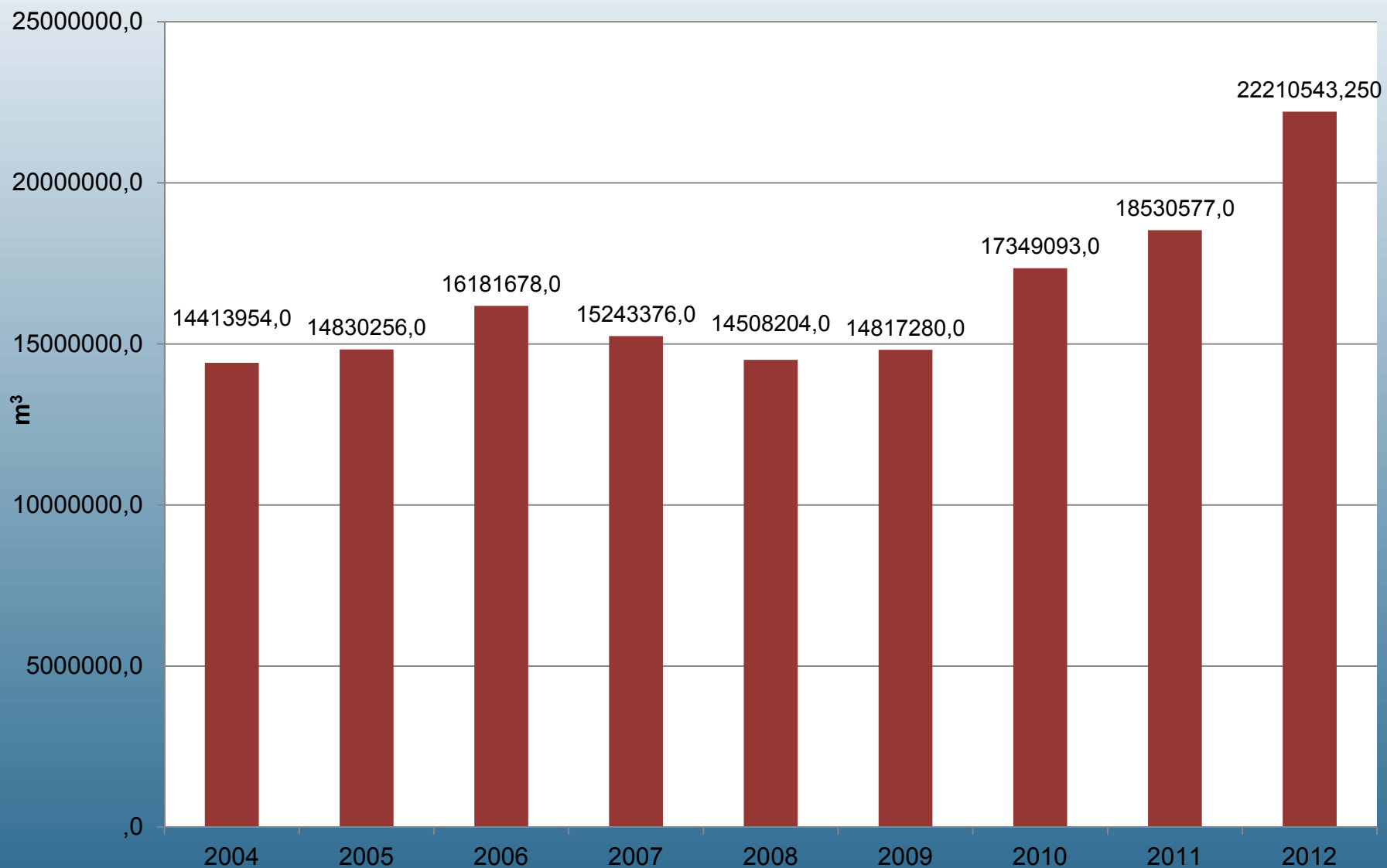
- **ENRICHMENT OF UNDERGROUND WATER - 15% on average**

DISCHARGE INTO THE SEA (10% on average) and POLEMIDIA DAM (3% on average) *Due to seasonal demand of water for irrigation and limited storage capacity, certain amounts of treated effluent are discharged to the sea and Polemidia Dam (non-potable), during the winter months*

USES AND PERCENTAGES OF TREATED EFFLUENT IN CYPRUS



ANNUAL QUANTITIES OF TREATED EFFLUENT IN CYPRUS



FUTURE QUANTITIES OF TREATED EFFLUENT IN CYPRUS

	2015	2025
URBAN WASTEWATER TREATMENT PLANTS	61.000.000	72.000.000
RURAL WASTEWATER TREATMENT PLANTS	4.000.000	14.000.000
TOTAL QUANTITIES (m³)	65.000.000	86.000.000

CURRENT SELLING RATES OF TREATED EFFLUENT IN CYPRUS

The rate of the treated effluent from the big wastewater treatment has been set by a ministerial decree as per the following table. These rates are charged by the government.

A/A	USE	Water Selling Rate	
		Existing Rate of Tertiary Treated Effluent	<i>Suggested Selling Rate of Fresh not filtered water from governmental</i>
		EURO Cent/ m ³	<i>EURO Cent/ m³</i>
1	For Irrigation divisions for agricultural production	5	15
	For Persons for agricultural production	7	17
2	For sports	15	34
3	For irrigation of hotels green areas and gardens	15	34
4	For irrigation of Golf Courses	21	34
5	For pumping from an underground aquifer recharged by treated effluent	8	
6	For over consumption for items 1 to 5	increase by 50%	56
7	For municipal parks, green areas etc for rural communities where a plant has been built within its limits and the quantity does not exceed the approved quantity of more than 10 %	free	

QUALITY CONTROL OF THE TREATED EFFLUENT IN CYPRUS

1. Quality Control for Urban and Rural Agglomerations above 2.000p.e.:

The Quality of the Treated Effluent is under control. Sampling and analysis are being executed by:

- ✓ Urban Sewerage Boards
- ✓ Water Development Department
Since WDD is responsible for the disposal of the treated effluent produced by the Urban Sewerage Boards (government policy)
- ✓ Department of Environment

} following the quality of the treated effluent according to the requirements of their Discharge Permits (Water Pollution Control Laws)

} following up whether every plant is meeting the requirements of the Discharge Permits (Water Pollution Control Laws)

2. Quality Control for Rural Agglomerations less than 2.000p.e.:

Sampling and analysis are being executed by Water Development Department, according to the quality specifications presented in the following table (*slide 15*).

QUALITY CONTROL OF THE TREATED EFFLUENT FOR URBAN AGGLOMERATIONS

The **quality characteristics** and the **frequency of analyses** of the treated effluent, according to the requirements of the Discharge Permits of Water Development Department and Urban Sewerage Boards for Urban agglomerations.

A/A	PARAMETERS	MAXIMUM PERMITTED VALUE	FREQUENCY OF ANALYSES – BY WDD	FREQUENCY OF ANALYSES – BY USB
1	BOD ₅	10 mg/l	4/year	1/15 days
2	COD	70 mg/l	4/year	1/15 days
3	Suspended Solids (SS)	10 mg/l	4/year	1/15 days
4	Conductivity	2500 µS/cm	4/year	1/15 days
5	Total Nitrogen (TN)	15 mg/l	4/year	1/15 days
6	Total Phosphorous (TP)	10 mg/l	4/year	1/15 days
7	Chlorides (Cl)	300 mg/l	4/year	1/month
8	Fat and Oil	5 mg/l	4/year	1/month
9	Zinc (Zn)	1 mg/l	2/year	2/year
10	Copper (Cu)	0,1 mg/l	2/year	2/year
11	Lead (Pb)	0,15 mg/l	2/year	2/year
12	Cadmium (Cd)	0,01 mg/l	2/year	2/year
13	Mercury (Hg)	0,005 mg/l	2/year	2/year
14	Chromium (Cr)	0,1 mg/l	2/year	2/year
15	Nickel (Ni)	0,2 mg/l	2/year	2/year
16	Boron (B)	1mg/l	2/year	2/year
17	E. Coli	5 E.Coli / 100ml	4/year	1/15 days
18	Eggs of Intestinal Worms	Nothing	4/year	4/year
19	Residual Chlorine	1 mg/l	4/year	1/15 days
20	pH	6.5-8,5	4/year	1/15 days
21	Toxicity		1/year	1/year

QUALITY CONTROL OF THE TREATED EFFLUENT FOR RURAL AGGLOMERATIONS LESS THAN 2000 P.E.

QUALITY SPECIFICATIONS OF THE TREATED EFFLUENT FROM MUNICIPAL WASTEWATER TREATMENT PLANTS FROM AGGLOMERATIONS LESS THAN 2000 P.E.

	SPECIES ALLOWED TO BE IRRIGATED	BOD ₅ mg/l	SUSPENDED SOLIDS mg/l	E. COLI /100ml	INTESTINAL WORMS***
1	All CROPS AND GREEN AREAS WITH RESTRICTED USE (a)	10*	10*	5* 15**	NIL
2	GREEN AREAS AND COOKED VEGETABLES (b)	10* 15**	10* 15**	50* 100**	NIL
3	GREEN AREAS WITH RESTRICTED USE BY THE PUBLIC	20* 30**	30* 45**	200* 1000**	NIL
4	FODDER CROPS	20* 30**	30* 45**	1000* 5000**	NIL
5	INDUSTRIAL CROPS	50* 70**	-	3000* 10000**	-

* 80% OF THE SAMPLES, 24 SAMPLES / YEAR

** MAXIMUM ACCEPTABLE VALUE

*** SAMPLING FREQUENCY ONCE A YEAR / SUMMER MONTHS

- (a) NO VEGETABLES WITH LEAVES, BULBS AND CONDYLES EATEN RAW
 (b) POTATOES, BEETROOTS

RESEARCH SIGNIFICANCE AND OBJECTIVES

- Cyprus suffers from chronic water shortage
 - Groundwater resources are limited
 - Variability in annual rainfall
 - Droughts are frequent and sometimes severe
- Reclaimed water can be a significant supplemental water supply
- However,
 - ✓ A careful assessment of the public acceptance is necessary, in order to implement a sustainable and successful water reuse scheme
- Research Objectives
 - ✓ Identify the areas of most concern among different possible user groups for reclaimed water in Cyprus
 - ✓ Suggest mechanisms that can promote a sound water reuse program on the island

METHODOLOGY – QUESTIONNAIRE DEVELOPMENT

- Three different questionnaires, for each target group, were prepared.
- The questionnaires comprised of 40 questions.
- While the majority of questions were common in all three questionnaires, a number of questions were customized to each target group.
- Generally the questions included in the questionnaire stating the level of agreement on a **5 – point Likert Scale** to a series of statements regarding perceptions, attitudes or knowledge on water reuse issues.
- Other types of questions included in the questionnaire:
 - Rank-type questions
 - Multiple-choice questions

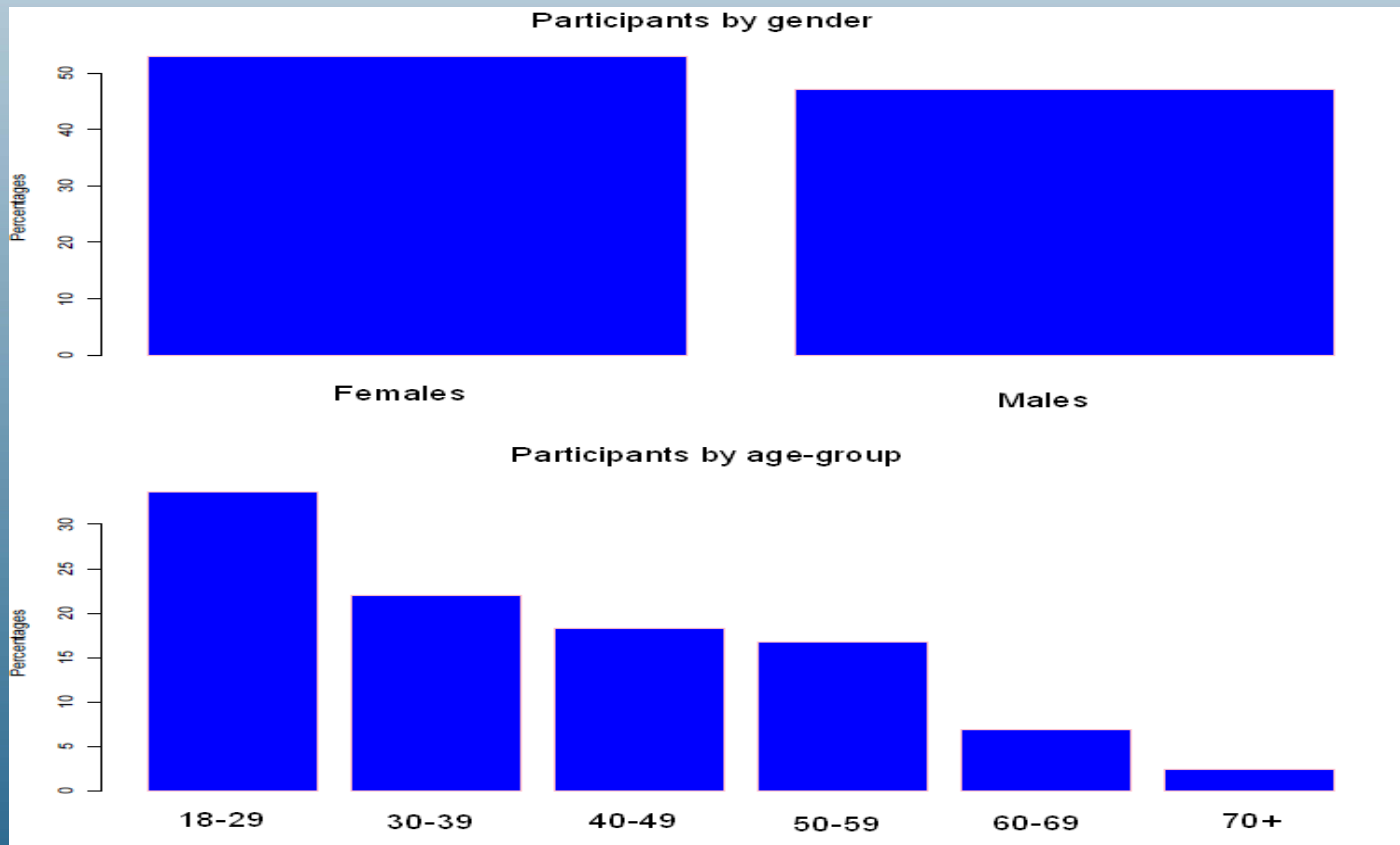
METHODOLOGY – SAMPLING PROCEDURE

- Target groups
 - ✓ 1000 people in total sampled
 - 100 Farmers
 - 100 Water Experts from public and private sector
 - 800 General Public
 - 560 Urban (70%)
 - 240 Rural (30%)

*An overall quota of **70:30** was set, in order to approximately reflect the urban – rural distribution of the population in Cyprus*

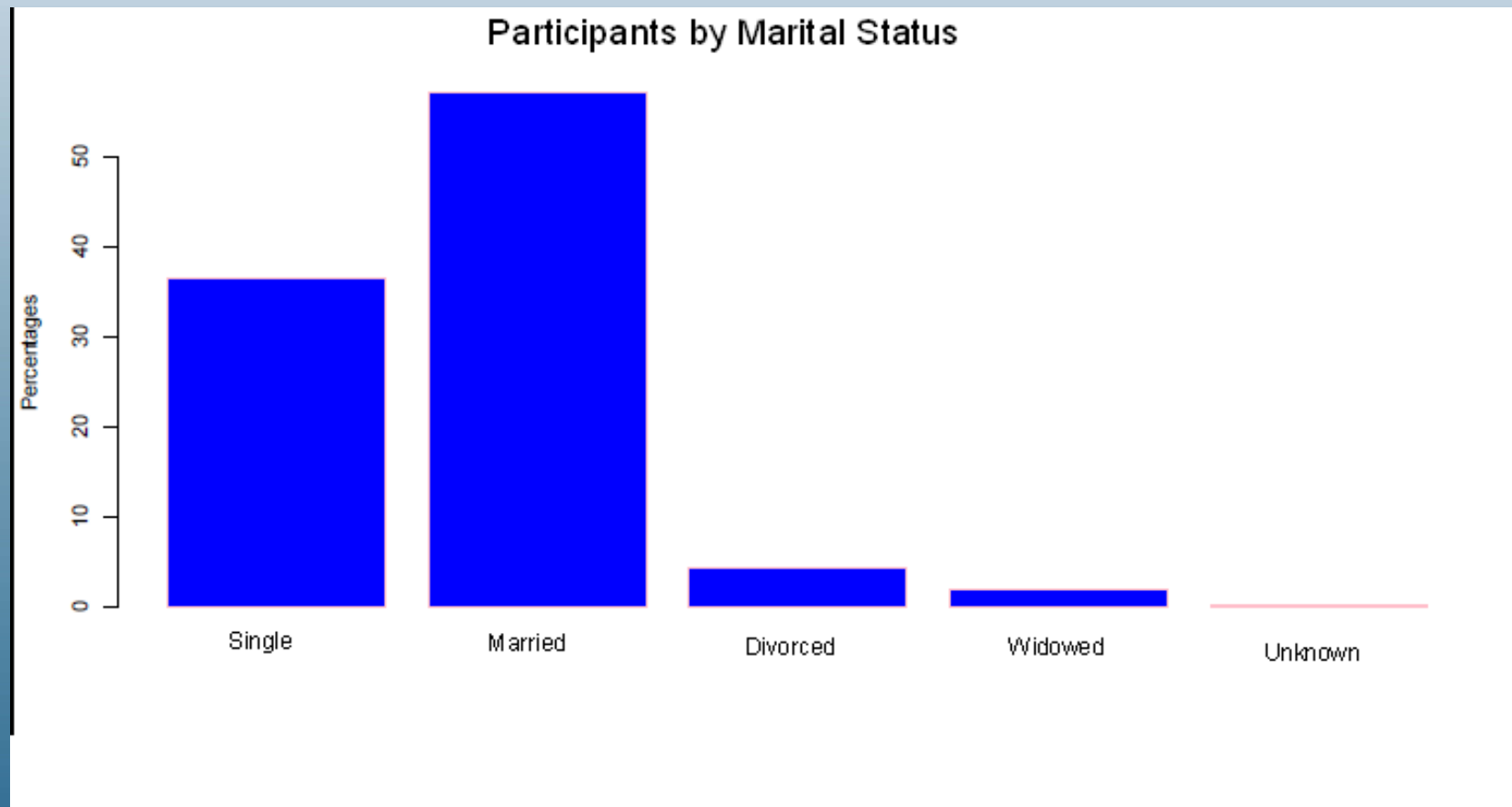
METHODOLOGY – QUOTA SAMPLING

Quotas were also set in terms of *gender and age-group*, in order for the final sample to reflect the demographic composition of the population in Cyprus (published in census 2011) i.e. 50:50 – male:female & equal representation of *early* (18-29), *middle* (30-49) and *late* working-life (over 50).



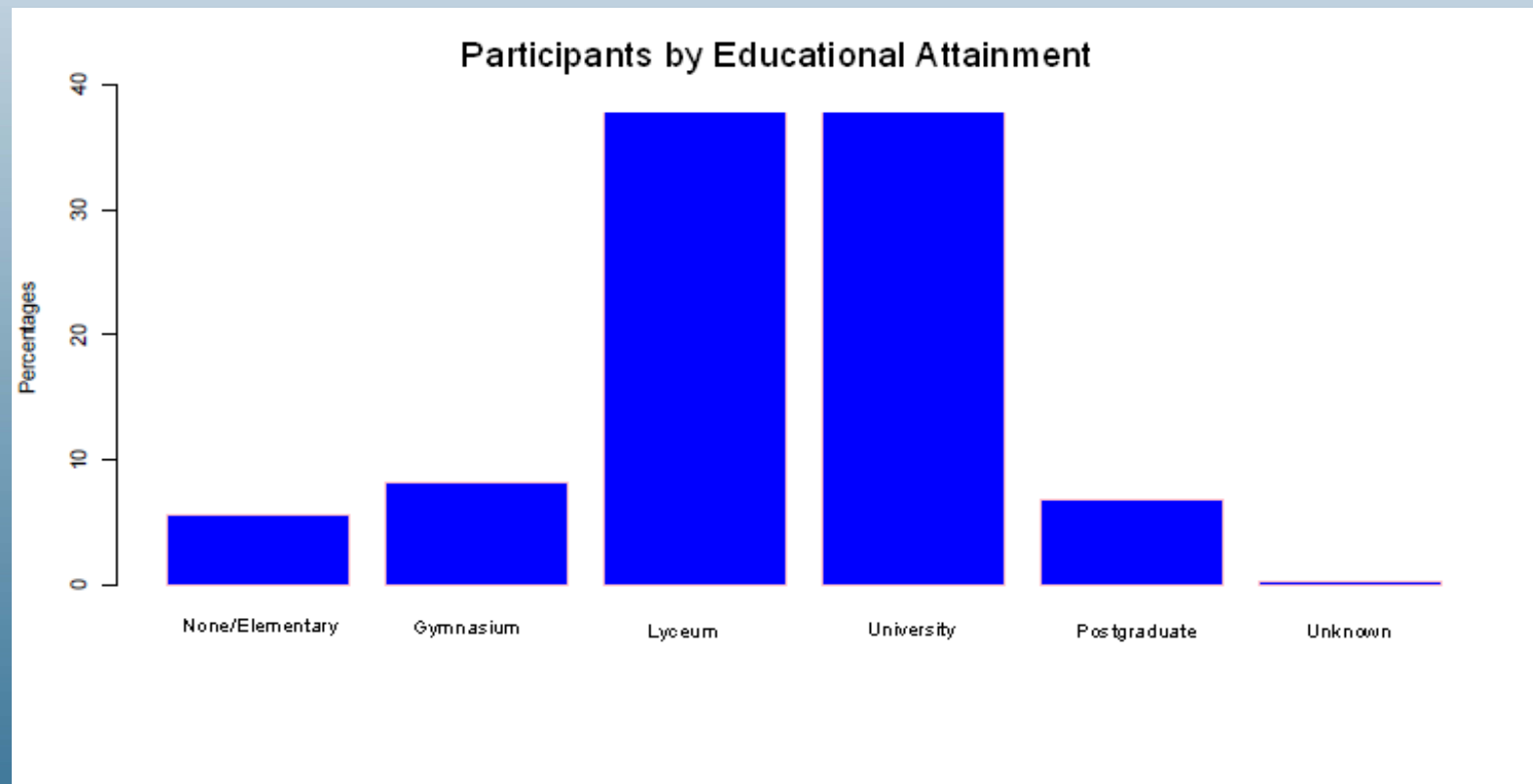
METHODOLOGY – QUOTA SAMPLING

Other basic demographic characteristics



METHODOLOGY – QUOTA SAMPLING

Other basic demographic characteristics



KEY RESULTS

- ✓ Education / Knowledge
- ✓ Economic Factors
- ✓ Social / Cultural Practices and Restrictions
- ✓ Trust in Processes and Institutions

The ***select results presented*** are limited to the items that:

- Show statistical significance according to the methodology described above.
- Better guide us in suggesting appropriate action / policy measures for a successful water recycling scheme to be implemented in Cyprus.

RESULTS – EDUCATION/KNOWLEDGE

- Results obtained show that a significant percentage of people have serious misconceptions of wastewater treatment and reuse.
 - 50% of survey participants (excluding water experts) are not aware of the origin of recycled water and 35% of the public ignore the mere existence of wastewater treatment plants.
 - Almost 80% of the public, 55% of farmers, and even 35% of water experts listed the “enforcement of water savings measures at home” as one of the top three measures for achieving overall water savings in the country.
 - ***Translation:*** *Water Authorities in Cyprus have been engaged in a long-term campaign promoting water savings measures at home.*
 - Only 10% of the public and 15% of farmers thought that “revisiting our agricultural policy” would be a meaningful measure for water savings in Cyprus, in contrast with 40% of water experts

RESULTS – EDUCATION/KNOWLEDGE

- Almost half of the respondents disagreed with the statement that “there is proper training / education / awareness on the topic of recycled water in Cyprus”
- Wish for more education
 - 80% of the public would like to know more about water recycling
 - 80% of respondents believe that environmental education in schools is a more effective measure for promoting water reuse schemes.

RESULTS – ECONOMIC FACTORS

- While 70% of respondents consider water bills high enough already, an equal percentage of people is **willing to pay** up to an additional 10%, if this were to promote a sound water recycling scheme.
- From the respondents who were not willing to pay more for a water recycling scheme,
 - More than 70% feel that it is the government's responsibility to treat wastewater, out of taxes already paid.
 - 80% of the public and 90% of farmers justify this by saying that water bills are already high enough, as opposed to only 40% of water experts who share a similar view.
- Mechanisms for promotion
 - 70% of the people think that subsidies would better help promote water reuse schemes, while 50% of the people feel that direct enforcement or fines would not help increase recycled water use.
- *The Economics field will be revisited, in view of latest development in the country*

RESULTS – SOCIAL/CULTURAL PRACTICES AND RESTRICTIONS

- While more than 80% of respondents accept recycled water for such uses as landscape irrigation and fire-fighting, this acceptance fell to 50% for crop irrigation use, 45% for groundwater recharge, and to 30% for augmentation of water in reservoir dams (non-potable).
 - ***Translation:*** This was an expected outcome since people are willing to accept a use that is as distant from their everyday lives as possible.
- 90% of the public want products produced with recycled water to be accordingly labelled in stores
- Reluctance to buy products produced with Recycled Water
 - 45% of the public
 - 35% of the farmers
 - 15% of water experts

RESULTS – SOCIAL/CULTURAL PRACTICES AND RESTRICTIONS

- Sensitivity to Children:
 - Trust sending children to a school that uses Recycled Water
 - 80% of water experts
 - 45% of general public
 - 35% of farmers
 - Visiting a park irrigated by Recycled Water with their children
 - 100% of water experts
 - 70% of general public

Translation: Possibly due to the fact that people feel that they are more in direct control of their children.

RESULTS – TRUST IN PROCESSES AND INSTITUTIONS

- While 70% of water experts feel that the authorities have the necessary knowledge for managing recycled water, only 33% of the general public and 48% of farmers share the same view.
- Only 20% of the participants believe that there is adequate control and proper checks for recycled water quality
- Only 30% of the public trust the authorities.
- Scientists are trusted more than the authorities by the general public (50% versus 33%), by farmers (68% versus 40%), and by water experts (85% versus 50%).
- 60% of respondents do not trust that the government will do what is necessary for a more successful water recycling program, even after probable price increases.

RESEARCH CONCLUSIONS

- In order to implement a sustainable and successful water reuse scheme in Cyprus, based on the results above, certain possible measures should be adopted:
 - ✓ Emphasis should be placed on education, since people seem to have serious misconceptions about wastewater treatment and reuse in Cyprus.
 - ✓ Any educational program should be best be conducted through academic institutions, instead of any governmental entity, since trust to authorities is not very high.
 - ✓ Emphasis should be given to public image enhancement of the authorities.
 - ✓ An increase in water recycling fees could be accepted in Cyprus. If this fee increase is coupled with a proper educational campaign, acceptance by the public becomes even higher.
 - ✓ Economic instruments employed should follow market-based mechanisms and subsidies, rather than direct enforcement or taxation.



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Thank you



for your attention!

For more information on our work on the topic, please visit

<http://recycled-water-perceptions.i4-services.com>

Or contact us:

- Dr. Christos Anastasiou
Frederick Research Center
c.anastasiou@frederick.ac.cy
- Mrs Alexia Panayi
Water Development Department
apanayi@wdd.moa.gov.cy
- Mr. Petros Grafias
Frederick Research Center
eng.gp@frederick.ac.cy
- Mr. Nicos Middleton
Cyprus University of Technology
nicos.middleton@cut.ac.cy

