LIFE04/ENV/GR/000099

WATER AGENDA

"Development and implementation of integrated water resources management policy to a river basin, through the application of a social wide local agreement, based on the principles of Agenda 21 and the provisions of Water Framework Directive 2000/60/EC."

PROJECT'S RESULTS ON

WATER RESOURCES' MANAGEMENT

IN A RIVER BASIN LEVEL

(Layman's Report)

JANUARY 2008

The project Life 04/GR/ENV/000099, entitled "Development and implementation of integrated water resources management policy to a river basin, through the application of a social wide local agreement, based on the principles of Agenda 21 and the provisions of Water Framework Directive 2000/60/EC", of total budget 1.403.235 €, was financed by the LIFE Programme of European Community and the project's partner scheme. The project's partner scheme consists of ANATOLIKI s.a. (beneficiary), the Region of Central Macedonia and the Regional Development Fund of Central Macedonia, the Municipality of Thermi, the National Technical University of Greece, the Hellenic Center of Environment and Sustainable Development, the Autonomous University of Barcelona and the Municipality of Milan. The project started in September 2004 and concluded in October 2007.

For more Information:

ANATOLIKI S.A.
Development Agency of Eastern Thessaloniki
Golden Center, 1st km. Thermi – Triadi
GR – 57001
Tel: +30 2310 463930 – 1
Fax: +30 2310 486203
S. Famellos, socrates@anatoliki.gr
E. Pavlidou, environment@anatoliki.gr
http://www.lifewateragenda.org

1. PROJECT'S AIM AND OBJECTIVES

Last years, the water resources management faces significant changes due to the increasing demand, the irrational management as well as to the climate change that affect the future status and utilization of water resources. A new legislative and administrative framework is under development in order to comply with the obligations set by European Environmental Policy.

Based on this new framework, the project LIFE04/ENV/GR/000099 – Water Agenda was implemented having as main goal the sustainable management of water resources in the Anthemountas River basin, in Northern Greece. Outcomes of the projects are a strategy for the rational water management in compliance with the provisions of Water Framework Directive 2000/60/EC and the development of a social local agreement, based on the principles of Agenda 21.

Objectives of the LIFE project have been:

- Development of a **sustainable water resources management** policy in the Anthemountas river basin, in Northern Greece, in order to reverse current trends of water resources degradation and depletion considering the development characteristics as well as the natural and human resources of the area.
- The configuration of a **social agreement** on water resources management among stakeholders and consumers in the area as well as the social motivation and supervision on its implementation
- The development of social, technical, administrative and financial tools to ensure the integrated water resources management in practice.
- The use of the experience and best practices on water basin management already developed in other European countries
- Improvements in water resources management, in Greece and other European and Mediterranean countries according to the provisions of **Water Framework Directive** 2000/60/EC and the principles of **Agenda 21**.

2. THE ANTHEMOUNTAS RIVER BASIN DISTRICT

The Anthemountas River basin is located at the Region of Central Macedonia in Greece, at the Chalkidiki Peninsula (Figure 1), covering an area of 320 km^2. Due to its vicinity to the urban center of Thessaloniki, it experiences an increasing urbanisation trend, which mostly affects the Municipality of Thermi and to a smaller degree the two others Municipalities of the Basin (Vasilika and Anthemountas) to a smaller degree. In terms of economic activities, current trends portray a marked increase in the tertiary sector (services). However, the primary sector is still dominant, especially in the Municipalities of Vasilika and Anthemountas.

Urbanization combined with the increased economic activities cause an increased demand for water of good quality and in sufficient quantity. The most important constraint for the management of water resources in the Anthemountas basin, is that water demand by far exceeds available renewable water recourses. Water needs are almost exclusively met through groundwater pumping, which are not measured regularly.

The mean precipitation at the Anthemountas river basin is approximately 550 mm/year and the minimum precipitation is 430 mm/year. Precipitation is higher at the mountainous areas at NW of the basin and it is reduced at the S-SE areas. Rainfalls are more frequent and intensive, from October to December and during May. The average humidity is about 70% with maximum value 78% and minimum 53%.

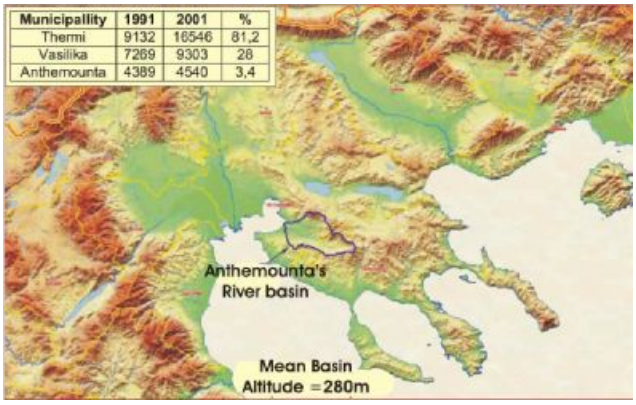


Figure 1: Anthemountas river basin - Population

Estimations of water balance revealed a dramatic water deficit at the basin, 17,5 and 16,5 million m^3 for 2005 and 2006 respectively, table 1, caused by increasing exploitation of the underground aquifers. Although, last years, many efforts were undertaken to reverse degradation of water resources, the problem could be confronted only by application of integrated water management policy.

Table 1. *Hydrological and water balance in Anthemountas basin (million m^3 /year)*

Year	Precipitation	Run off	Evaportranspiration	Infiltration	Consumption	Deficit
2005	213,00	40,99	166,88	5,14	22,67	**17,53**
2006	195,39	41,63	148,70	4,81	21,29	**16,47**

3. METHODOLOGY AND RESULTS

Based on the provisions of Water Framework Directive (WFD) 2000/60/E.C., the main actions and steps for its application in a river basin district were identified.

3.1. Identification and classification of water bodies

The identification and classification of water (surface and under ground) bodies was the first step for the application of WFD. The second step was the determination of environmental objectives based on the requirements of the WFD and other directives in force.

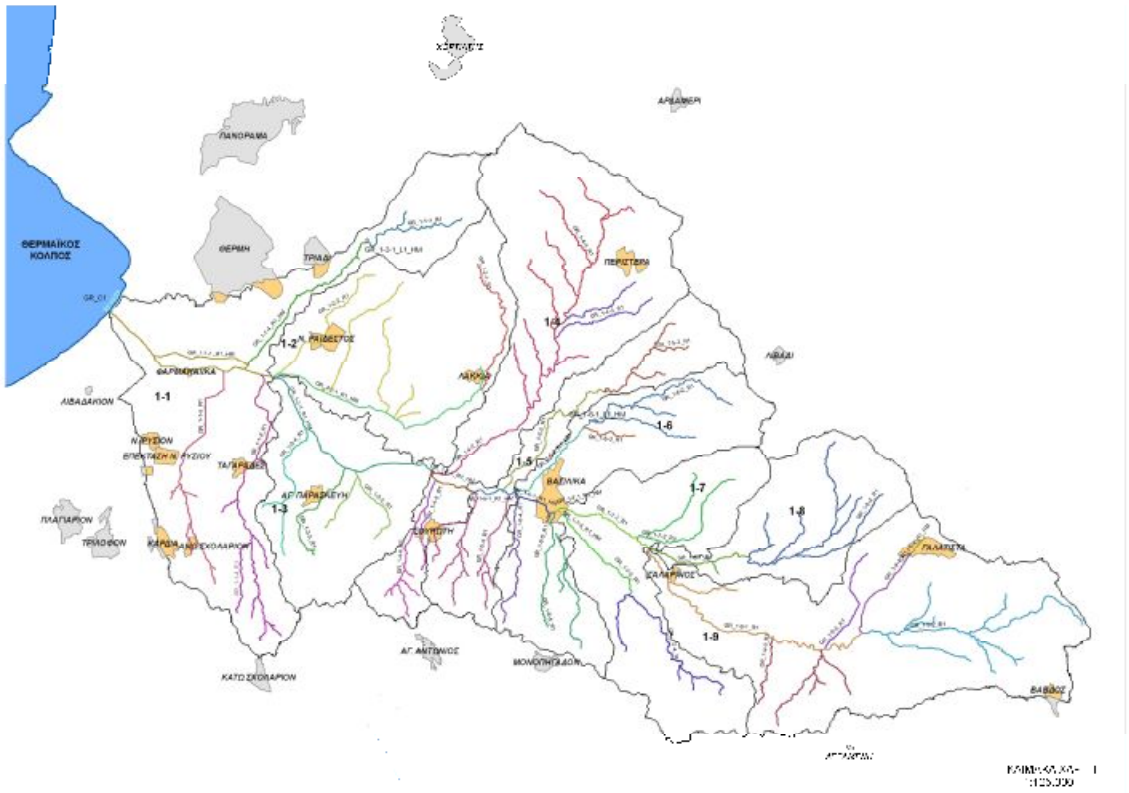


Figure 2: *Identification of water bodies in Anthemountas riverbasin.*

In the river basin of Anthemountas 46 inland surface water bodies, 1 coastal water body (figure 2) and 6 groundwater bodies were identified. The identification of water bodies was based on the following parameters:

- the topography, the hydro-morphological characteristics of the water bodies
- the quality characteristics of the water bodies,
- if the water body is artificial or heavily modified,
- if the water body is located in protected areas and
- the water body's specific use

The final step was the analysis of pressures at the area, mainly anthropogenic, and the assessment of their impact on the water bodies aiming at the classification of their quality characteristics as compared with the environmental objectives set.

3.2. Monitoring of water bodies

Based on the criteria, developed in the framework of the project for the evaluation of the quality characteristics it was concluded that the majority of surface water bodies had been affected by human origin pollution loads. More specific:

The reservoirs of Vasilika and Thermi are classified to a less than good quality status since they are affected by the pollution loads discharged and are characterized by high nutrient content, phosphorus and chlorophyll concentrations, which are close to the proposed limit values for classification to eutrophic state. The reservoir of Triadi has better quality characteristics with relatively low nutrient and chlorophyll concentrations and it is classifies to a good quality status.

Photo 1: *Thermi's artificial lake*

Photo 2: *Triadi's artificial lake*

Photo 3: *The Anthemountas river*

Photo 4: *Sampling programm*

With respect to the quality of the Anthemountas River it is also affected by the discharged pollution loads and it is characterised by high nutrient concentrations. During the humid period, the quality of the water is good, but it is significantly deteriorated during the arid period due to the low water renewal and the disposal of untreated wastewaters. Consequently the Anthemountas river is classified to a less than good quality status.

Quality status of groundwater bodies was evaluated based on the limit values of the parameter given in the new groundwater directive and more specifically the nitrates concentration, conductivity and pH, since monitoring data for pesticides were not available. According to the results, 73% of the monitored sites are classified in a good quality status, whereas the remaining 27% have a "bad quality" in terms of nitrates concentration. Regarding the groundwater sites the 83% of the ones used as sources of potable water 83% are classified in good quality status.

The quantitative status of the groundwater bodies was assessed, according to the water table monitoring program. The measurements show a decrease in aquifer's water level, which varies in different areas of the basin. In some areas the observed water level drop is one or two meters but in others it gets up to nine or ten meters. Decrease in water level in the down stream areas is also proved by salination of aquifers. However, the situation is different in the sub basin of Galatista (up stream area), where it seems that the aquifer's recharging rate is higher than the current pumping rate, thus no decrease in water level occurs. Consequently, the groundwater bodies in down stream area are in lower than good quantitative status, while in the upstream are in good.

3.3. Economic Analysis

The domestic water supply in the basin is provided by the relevant Municipal Water Services (Thermi, Vasilika and Anthemounta). Irrigation needs are mainly met through private drillings, while a relatively low percentage is covered through the Municipal Irrigation Networks, administered by the Water Services of the three Municipalities of the Basin. Only a small part of the industrial demand is covered using water from the potable water supply infrastructures, while most of the industrial needs are met through private drillings, as in the case of irrigation. Industrial wastewaters are treated in private plants.

Table 2: *Cost recovery rate per Municipality and service*

Municipality/Service	2001	2002	2003	2004	Total (in 2004 values)
Thermi					
Domestic water supply	104%	101%	93%	77%	92%
Irrigation water supply	113%	117%	62%	58%	84%
Wastewater collection and treatment	96%	110%	88%	86%	95%
Vasilika					
Domestic water supply	105%	101%	74%	56%	78%
Irrigation water supply	23%	27%	21%	23%	23%
Wastewater collection and treatment	27%	10%	8%	4%	8%
Anthemountas					
Domestic water supply	70%	72%	89%	79%	77%
Irrigation water supply	186%	45%	17%	34%	59%
Wastewater collection and treatment	64%	51%	128%	193%	88%

Due to limitations in data availability and in accordance with the requirements of Article 5 of the WFD, the assessment of the current levels has been performed only for services provided by public service providers. Results on the cost recovery rate are presented in Table 2 and including annual cost recovery rate per service for each Municipality, as well as the total recovery for the period 2001-2004.

In brief, the main conclusions derived form the economic analysis of the current situation are that in most cases the recovery of costs is insufficient, there is a lack of homogeneity in tariffs and pricing methods, the capital cost is relatively low for all services and the operation and maintenance costs are continuously increasing.

During the LIFE project alternative pricing schemes for each municipal water service was developed. All schemes aimed at adequate recovery of financial costs and were designed on the basis of an assessment of water service costs for 2005. The pricing policy and the water tariffs were based on the following criteria:

1. Recovery of financial cost,
2. Water tariffs easy to apply, aiming at the minimization of possible difficulties during their application,
3. Data availability and reliability, ease of implementation, and public acceptability.

The evaluation of the proposed pricing schemes was based on two criteria: (a) the affordability of water charges and (b) the anticipated demand reduction as a result of price increase.

Regarding the potable water and sewerage services the proposed tariffs presented in the following table.

Table 3: Estimated household water tariffs

Tariff Element / Municipality	Thermi	Vassilika	Anthemountas
Domestic water supply			
Fixed charge	21	36	24
Volumetric charge (€/m³/yr)			
Two-part tariff (Uniform rate)	0.33	0.54	0.67
Increasing Block Tariff			
1st Block: 0-150m³/yr	0.28	0.49	0.61
2nd Block: 151-300m³/yr	0.33	0.59	0.74
3rd Block: >300m³/yr	0.55	0.98	1.23
Sewerage charges			
Fixed charge	40	-	5
Volumetric charge (€/m³/yr)	0.24	-	0.32

The development of alternative irrigation water pricing schemes was based on the need to address consumption metering and control. The examined scheme involved the introduction of volumetric, uniform rate, pricing. However and since metered abstraction data were considered unreliable, the estimated prices were indicative and derived from a theoretical water demand assessment. For improving the current cost recovery levels to the rate of 100% the ,prices should be approximately equal to 0.07 €/ m³ in Thermi, 0.15 €/m³ in Vassilika and 0.06 €/m³ in Anthemountas.

3.4. Water resources management policy in The Anthemountaw river basin.

Water management scenarios

Table 4: *Brief presentation of the main parameters that determine the contents of the scenarios*

Scenario «Business As Usual", "BAU" in the year 2020	
Influences of the Common Agriculture Policy CAP	CAP constitutes the main regulator of rural activity also after 2013 and the changes that occur in rural land are connected directly and exclusively with the economic parameters of the production itself. Products, which are in effect detached from any aids, will be abandoned at a low or high percentage depending on the revenue of the producer. Also, products for which there is an increase of production per unit of land extent will tend to occupy smaller areas in the Anthemountas basin. The agro-environmental measures that are forecasted by the EU are not applied or are applied defectively in the Anthemountas basin and consequently they are not taken into account in the revenue of producer.
Engineering work	No work that increases the supply of water (apart from the connection of the Municipality of Thermi with Thessaloniki Water Company, is materialized. Water availability is regulated mainly from the natural, hydrologic processes of the basin. In the region, the existing installations of secondary treatment of wastewater are in operation and there are also irrigation dams that exist since 2006. Any new work concerns only flood-preventing interventions (e.g. delimitation of streams) and the protection of consumer (e.g. replacement of water supply networks)
WFD 2000/60/EC	The application of WFD has not applied. The Directive is only applied at central planning level.
Scenario "Engineering" in the year 2020	
Influences of CAP	As in "BAU"
Engineering work	In the Anthemountas basin, projects that increase the availability of water in the basin are undertaken. Reservoirs are being constructed and the existing wastewater treatment works with secondary treatment are upgraded with tertiary treatment units so that the treated effluent can be reused for irrigation. Small dams are also constructed, as well as collective irrigation networks. Water availability is therefore regulated from the natural, hydrologic processes of the basin as well as from engineering interventions. Projects that contribute to the improvement of water quality rather than water quantity, are also being constructed (e.g. sewerage networks)
WFD 2000/60/EC	Directive 2000/60 EU is applied fully with regard to the improvement of quality of water (groundwater) (sewerage networks are extended). A monitoring system for physical and chemical parameters in underground and surface water bodies, is in place. WFD is not applied with regard to the recuperation of cost mainly from the agriculture.
Scenario "Hand in Hand" in the year 2020	
Influences of CAP	Common Agriculture Policy constitutes the main regulator of rural activity also after 2013 and the changes that occur in rural land are connected directly and exclusively with economical parameters of the production and with other aids that are related to the geo-environmental measures and the processes for multiple compliance. It becomes acceptable however that as in the BAU scenario, products for which the detachment (decoupling) between production and aids is in effect, will be abandoned at low or high percentage depending on the revenue of the producer. The agro-environmental measures that are forecasted by the EU are applied in the Anthemountas basin and consequently they are taken into account in the revenue of the producer.
Engineering work	As in "Engineering"
WFD 2000/60/EC	Directive 2000/60 EU is applied fully with regard to the improvement of water quality (groundwater) - (sewerage networks are extended). A monitoring system for physical and chemical parameters in underground and surface water bodies is in place. WFD is applied to a great extent in the agricultural systems of "Integrated Management" or in other words, systems of "Integrated Agriculture".

The aim of scenario development during the LIFE 04/ENV/GR/000099 project has been the provision of alternative storylines regarding the freshwater demand and availability within the Anthemountas basin by the year 2020. The scenario has been formulated according to environmental, social and economical parameters for which it is assumed that they will have a strong impact on local water demand within the next 15 years. A "worst case" and a "best case" version has been developed for each scenario. The scenarios were used as a key tools for the development of the water management strategy and for the implementation of the Public consultation.

The water management scenarios are presented in table 4 and their impact on water balance in table 5:

Table 5: *Water balance in Anthemountas basin for each sub-scenario in the year 2020.*

Scenario case*		Water balance in 2020	deficit / surplus (m^3)
BAU	Worst case	negative	-21.000.000
	Best case	negative	-10.600.000
Engineering	Worst case	negative	-13.400.000
	Best case	balance	21.000
Hand in Hand	Worst case	negative	-13.200.000
	Best case	positive	1.600.000

**Each scenario has two cases: the best case with the minimum water demand and the worst with the maximum water demand*

Public Participation Process

During Life project a **Public Participation (PP)** Process among stakeholders, consumers and civil society was designed and established in the area. Aim of this process has been the development of an integrated water resources management policy and the achievement of social consensus that will lead to the formulation of a social local agreement on water resources management. The projects outcomes and particularly the developed scenarios were the key elements for the formation of the water policy.

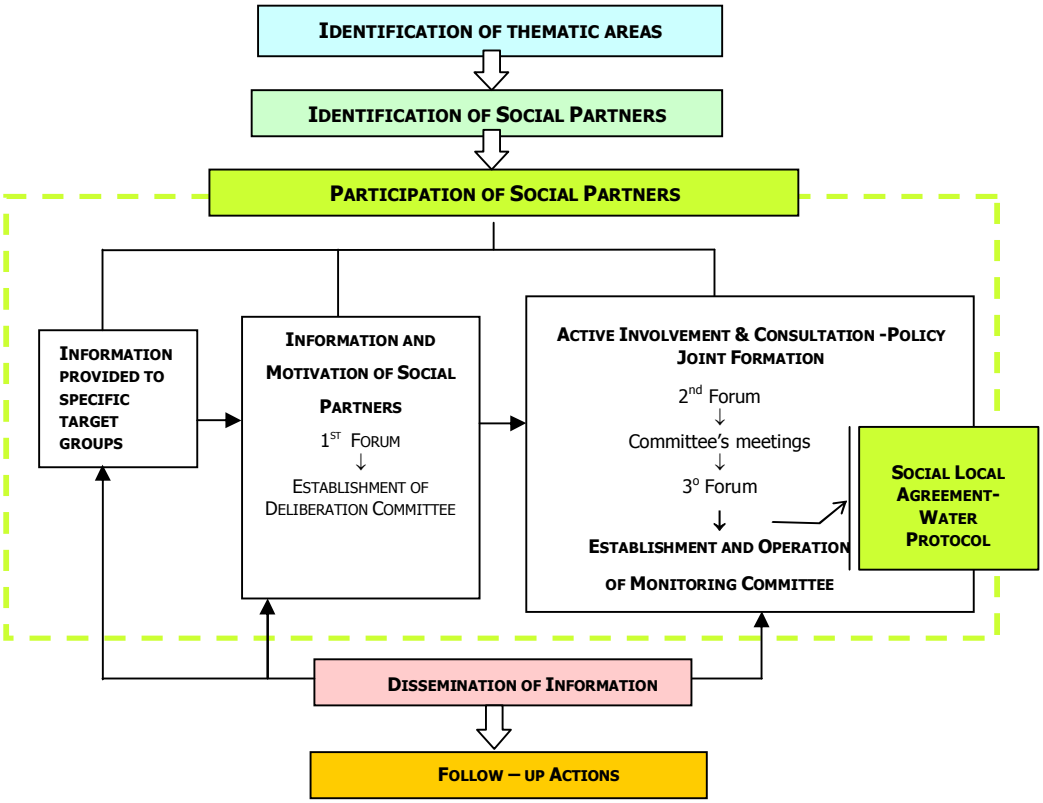


Figure 3: *Stages of Public Participation Process*

The methodology developed for the PP process (figure 3) was based on bibliographical sources and similar case studies of Agenda 21. Additionally, the social, economic and environmental characteristics of the area were taken into account. The proposed approach consists of 5 stages that are described in figure 3.

The main events and actions of the process were:

- Information of social partners of the basin district and of the greater area, in order to achieve their active participation in the process, through implementation of the 1st and 2nd open fora nd the use of dissemination and communication tools. The interested parties and the citizens of the area were invited to participate in a deliberation committee for the formation of an integrated water management policy for the basin.
- Consultation and active involvement of the local society in the PP process and in the decision making, for formation of the water policy and of the water protocol, trough participation in the three open meetings (fora) and six meetings of the deliberation committee.

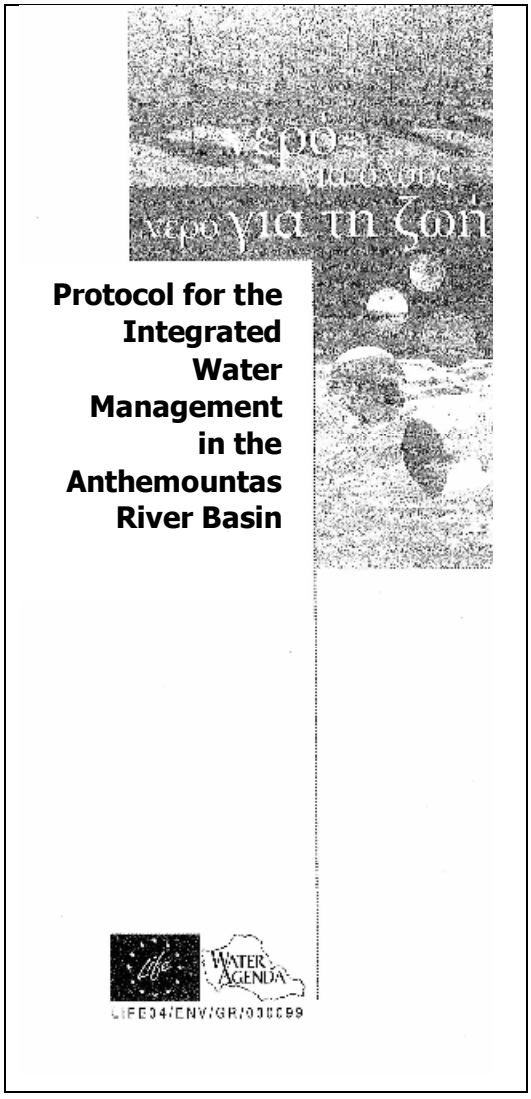

Photo 5, 6 : *Public Participation meetings (fora)*


Photo 7, 8 : *Meetings of Deliberation Committee*

Outcome of the PP process was the development of an integrated water management policy for the Anthemountas Basin, which became concrete in the water protocol (Table 6). The commitment for the application of this policy was taken by the ratification of the protocol.

The main thematic areas that were discussed during the deliberation and included in the water policy and in the protocol were the following:

- Protection of water quality
- Confrontation of natural water hazards
- Appropriate water intervention and infrastructures.
- Rational water resources management and increasing of water availability
- Water resources and urbanization
- Cost analysis and pricing of water services - principles and application.
- Research and monitoring of the water resources,
- Educational and informative activities,
- Public participation and volunteerism,
- Establishment and operation of a water management body.
- Monitoring and evaluation of the water policy application.



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CHAPTER I – GENERAL PROVISIONS

Article 1 - Aims

Article 2 – Basic obligations

Article 3 – Incorporation of aims in other sectorial policies

Article 4 – Participation of the regional and local authorities

Article 5 – Establishment and operation of water management body

CHAPTER II – SPECIFIC MEASURES

Article 6 – Prevention of the quality of surface and underground water

Article 7 – Prevention of the water reverses

Article 8 - Good quality of potable water

Article 9 – Prevention from the natural water threats - flood prevention

Article 10 – Rational management of water demand and increasing of its offer

Article 11 – Urbanization and land planning

Article 12 – Exploitation of geothermal floods

Article 13 – Supplementary measures

CHAPTER *III – RESEARCH, EDUCATION AND INFORMATION*

Article 13 - Research, Applications and long term monitoring

Article 14 – Monitoring and informative system

Article 15 – Education and information

Article 16 – Organize public participation and deliberation – Supporting volunteerism actions

CHAPTER *IV – APPLICATION, AUDOT &EVALUATION*

Article 17 – Protocol application

Article 18 – Monitoring committee establishment

Article 19 – Audit of obligations observance

Article 20 – Evaluation of the protocol's provisions effectiveness

CHAPTER *V – FINAL PROVISIONS*

Article 21 – Correlation between the water protocol and the deliberation process

Article 22 – Signing and ratification

Table 6: *Contents of the Protocol for the rational water resources management in the Anthemountas River Basin*

During the Public participation process, the most suitable and effective dissemination means were identified, having always in mind the characteristics of local society. Due to the wide span of the groups the following means were selected as the most effective: Advertisements and articles in the local newspapers, News releases, information boards and use of posters in facilities of the area (municipal offices, local buses etc), Telephone communication, Internet and special events. The above tools and practices have been used during the whole PP process and helped on informing the local population, not only for the project and the water resources current state, but for the development of the PP procedure as well.


Photo 9, 10 : *Informative meetings with farmers*



Photo 10, 11, 12 : *Educational events*


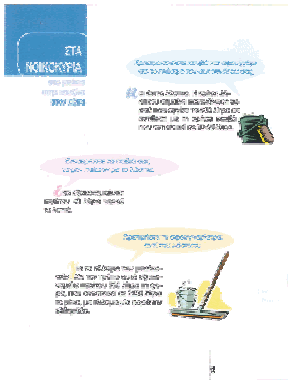

Photo 13: *Leaflet for water rational use*

Photo 14: *Informative tablets*

Use of PP process in the environmental management is a nonstop and dynamic process that should not stop once the initial targets are achieved. It should not aiming to achieve high numbers of participants while being executed, but maintain the experience gained and the results in the long-term.

3.6. Dissemination of the project

The project LIFE WATER AGENDA has contributed and will contribute to the recognition and application of the provisions and recommendations of the water framework directive, to the development of technical and methodological application tools and to the strengthening of thepublic participation in decision making. The project's results were widely disseminated with several means, demonstration actions and events, production of leaflets and of a special issue and through project's web-site as well.

Specifically, the project's dissemination was a horizontal action and carried out according to schedule. Several actions were implemented, some of which are presented below:

1. A web site has been developed (www.lifewateragenda.org) and its content is regularly updated. On this site the virtual water park is hosted. The project's deliverables and other useful information can be freely downloaded.
2. Edition of project's poster and brochure.
3. Organization of two one-day meetings, in Athens on 24th of November 2006 and in Kos on 6th of December 2007, with main issues the application of WFD and the Public participation process.
4. A special issue – book that includes the project's results was edited and distributed.
5. The partner scheme participated with eight scientific papers in six international conferences in Greece.
6. Six publications in three technical issues and many others in the local and national press.

Photo 15: Dissemination means: Web page, virtual water park, poster, brochure & project's special issue

4. ENVIRONMENTAL BENEFITS

The identification of water bodies status and the measures proposed in the frame of the developed water policy, in order to confront the current pressures, and mainly the local agreement for the application of this policy will significantly contribute in the protection and improvement of water resources in the Anthemountas river basin. The keystone for receiving mid - term benefits from the project, was the reveal of the problem and the sensitization of the local society and stakeholders about current water status and future trends on water management in the studied area. Moreover, the conscious and significant participation of them in the development and application of an integrated water management policy guarantees their motivation and involvement during its application.

The long-term expected environmental benefits from the application of project's results in the region are:

- The application of the sustainable **water resources management** in Anthemountas river basin.
- The improvement of the quality and quantity of the surface and ground water bodies
- The protection from the salination of underground aquifers and the desertification of coastal areas
- The realistic and substantial contribution to confrontation of similar problems in other basins.
- The support for application of water reuse techniques and methods in primary and secondary sector.

- The sensitization of the local society on the protection of water and environment in general.
- Motivation of local society in the active involvement during the decision making process

The expected results could be applied not only in the targeted area of the basin but also in others Greek basins as well as in Euro- Mediterranean countries that face similar problems and are also obliged to comply with provisions of WFD.

The project cost – benefit ratio was quite low as the total cost of the project compared with its results was low. Actions such as the assessment, monitoring and evaluation of the parameters that affected on the water resources and the setting of measures about the water resources management in the hydrological basin according the directive 2000/60 are mandatory actions with multiply positive environmental benefits.

The project's value for money in the area could be presented considering the value of the water for the different economic sectors in the targeted area as well as in the greater area. The average annual primary's sector's income (Agricultural and livestock-farming) for the area is about $45{,}6 \times 10^6$ Euro per year. To this figure we have to add both the income from the secondary sector as well as from the services sector. The last one serves nearly 1/3 from 1 million inhabitants of Thessaloniki city. Furthermore, the area is characterized by high urban development. The improvement of the quality of water resources along with the protection and increase of the water reserves, through an environmental friendly management, will play very important role for the further development and improvement of the economy of the area.

The quantification of the environmental benefits from the pilot application of the WFD was not completed in the frame of the project. Although, it has to be mentioned that in the framework of the project the sensitization of the stakeholders and of the local society was achieved aiming at the protection and reverse of the deterioration threats of this valuable heritage, of water.

5. TRANSFERABILITY OF THE PROJECT'S RESULTS

The Life project is not concern the development of technology that could be transferred and reproduced identical or to be commercialized, since it is referred to the development of a methodology about the application of Directive 2000/60/EU in a river basin and of public participation process and consensus.

The transferability of project could be achieved through the utilization of project's results to other river basins even more to their application in environmental management in general. In any case, the applicability of the developed methothology, partially or totally could and have to be adjusted in the conditions and characteristics of the area to be implemented.

The project's results include technical, financial, administrative and social solutions confronting the issue of water resources management problems, thus providing flexibility in its transfer and

reproduction for other river basins. The variety of the Anthemountas basin's hydrological characteristics (all kind of water bodies as well as of the human activities) and the similarity with other basins located in Greece and Mediterranean areas, gives high probability in the transfer of its results.

High added value for the project and its reproduction gives the public participation procedure as well as the bottom-up approach in the development of the integrated water management policy that includes useful and effective tools for the solution of environmental and other problems.

ACKNOWLEDGMENT

The project LIFE04/ENV/GR/000099 was co financed by the LIFE Programme of European Community and project's Partner Scheme.