

Chapter 4: Simulating Residential Water Demand and Water Pricing Issues

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This chapter aims to simulate residential water demand in order to explore the importance of water for residential use. In addition, data on the water cost of supplying water in the residents of Asopos area from local distributors were collected. In order to capture the importance of water use specific parameters are examined and are used as indexes of water use. Some of these indexes are the population of the catchment, the number of households connected to the public water distribution system, m³ of water consumption per year to cover household needs etc. The chapter closes with recommendations for designing and applying a program of measures for the efficient water resources management as described by Article 11 of Water Framework Directive (WFD).

1. Residential area of Asopos RB

As it was emphasized in the previous chapters the first step in the implementation of the WFD is the economic characterization of water in the region requiring first of all that the economic significance of water is evaluated. This involves an assessment of the industrial, agricultural, residential and tourism water needs in the area. As the previous chapter covered the industrial and agricultural sectors the focus of this chapter is the residential and tourism. Hence, the current analysis will include information on the population connected to public water supply system vs those with self-supply, the total number of tourist days, employment and turnover in the tourism sector etc.

Regarding the residential area of Asopos RB, consisted of permanent residences, the selected indexes should reflect the economic importance of domestic water use in the specified area. Therefore, it is useful for these indexes to offer full data not only for the demand but also for the supply of water. The employed indexes for the evaluation of the economic importance of water supply in the residential case study area are the following:

i. Permanent population

Table 1 : Demographic data of Asopos RB

Prefecture	Municipality/ Commune	Municipal departments- Residential areas	Population
Viotias	M. Plataion	Kaparelli, Lefktra, Plataiai, Loutoufi, Melissochori	4,114
	M. Thivaion	Thiva, Ambelochori, Neochoraki, Elaion	23,476
	M. Tanagras	Arma, Asopia, Kallithea, Tanagra, Panagia	4,076
	M. Dervenochorion	Dafni, Pyli, Panakto, Prasino, Skourta, Stefani	2,119
	M. Oinofiton	Oinofita, Dilesi, Ag. Thomas, Kleidi	7,869
	M. Schimatariou	Schimatari, Oinoi, Plaka, Dilesi	7,092
	M. Erithron	Erithres	3,105
Attikis	M. Oropou	Oropos, Skala, Markopoulo, Nea Palatia, Sikamino, Chalkoutsis, Nea Politeia	12,347
	M. Avlona	Avlona, Asprochori	5,085
	M. Malakassas	Malakasa, Milesi	1,292
Total	Asopos River Basin		70,575

Source: National Statistical Service of Greece (2001 Census)¹

¹ http://www.statistics.gr/portal/page/portal/ESYE/PAGE-themes?p_param=A1602

In order to calculate the permanent residents of Asopos RB, the Municipalities/Communes that fall geographically within the RB were considered. The geographical distribution of Asopos RB was defined according to the National Programme for the Management and Protection of Water Resources (MoEPPW - NTUA, 2008). For the Municipalities/Communes that don't fall wholly within the territory of Asopos RB only the permanent population of the subsequent Municipal Departments and urban localities that are included in Asopos RB was calculated. Considering these the total permanent population of the RB is 70,575 residents (Table 1).

ii. Permanent main dwellings

Table 2: Dwellings in Asopos RB

Prefecture	Municipality/ Commune Urban (Ur) Agricultural (Ag) Lowland(Lo) Semi-mountainous (S-m)	Total dwellings	Regular dwellings				Non regular dwellings	Regular dwellings within collective residence
			Private-Public sector ownership and LEPrL*- LEPuL**			Residence for sale, rent etc		
			Main occupied residence	Second or vacation residence				
Viotias	Plataion (Ag,S-m,Lo)	2,599	1,541	927	97	34	0	
	Thivaion (Ur,ΑΓ,Π)	9,096	7,382	436	1,221	47	10	
	Tanagras (Ag,Lo)	1,344	1,035	167	79	61	2	
	Dervenochorion (Ag, S-m)	1,134	705	368	55	4	2	
	Oinofiton (Ur, Ag, Lo)	4,621	2,664	1,597	333	26	1	
	Schimatariou (Ur, Lo)	4,974	2,259	2,429	222	54	10	
Attikis	Erithron (Ur, Lo)	1,561	1,121	328	112	0	0	
	Oropou (Ag, Ur, Lo, S-m)	15,492	4,630	9,487	1,339	17	19	
	Avlona (Ur, S-m)	1,585	1,213	225	93	10	44	
	Malakasas (Ag, Lo)	817	450	303	56	5	3	
Total (%)	Asopos RB	43,223 (100%)	23,000 (53.2%)	16,267 (37.6%)	3,607 (8.4%)	258 (0.6%)	91 (0.2%)	

Source: National Statistical Service of Greece (2001 Census)²

*Legal Entity of Private Law (Company, Union etc.) (LEPrL) **Legal Entity of Public Law (Municipality, Social Insurance Organization etc.) (LEPuL)

² http://www.statistics.gr/portal/page/portal/ESYE/PAGE-themes?p_param=A1602

According to the National Statistical Service of Greece the term “Regular dwelling” is defined as the permanent and single-family housing which is consisted of at least one room and is used as the residence of one household. Occupied main regular dwelling is the residence in which the household resides during most of the year and it was occupied the day that census took place (17th -18th March 2001). Non regular dwellings are constructions made by crude materials of little value without a predefined plan (huts, trailers/caravans, storehouses etc), which are not regular dwellings but were occupied the day of census. A regular dwelling within a collective residence is the regular dwelling which is within a residence that is to be occupied or to service many individuals or groups of people. Examples are hotels, hospitals, jails, elderly homes or the residence of the director of the collective residence or of the personnel etc. Vacation residence is the regular dwelling which is normally further away from the main dwelling of the household and is used for resting or recreation during summer or on a seasonal basis. Second residence is the residence that is used by the household in parallel with the main dwelling without been a vacation residence.

Regarding the above terminology it is concluded that within Asopor RB there are 23,000 households (Table 2) which are permanently connected with the public system of water supply. The rest of residences (second or vacation residences, residences for rent or sale, non regular dwellings or regular which is part of a collective residence) are not counted in as it is likely that they are not connected with the public system of water supply or they are not permanent residences. It should be noted that the total number of residences (43,223) is the total of regular, non regular and regular within collective residence residences of the Municipal/Commune departments and localities (town or village) of these Municipalities/Communes that belong geographically to the Asopos RB.

iii. *Employment*

Table 3: Economically active and inactive population in Asopos RB

		Economically active population						Economically inactive	
		Total	Employed				Unemployed		
Prefecture	Municipality/ Commune	Total	Primary sector	Secondary sector	Tertiary sector	Did not state economic activity	Total		
Viotias	M. Plataion	1,829	1,723	883	384	441	15	106	2,045
	M. Thivaion	10,613	9,347	1,610	2,680	4,081	976	1,266	10,279
	M. Tanagras	2,193	2,077	1,157	380	447	93	116	1,595
	M. Dervenochorion	870	790	269	237	265	19	80	1,033
	M. Oinofiton	3,951	3,649	448	1,525	1,102	574	302	3,241
	M. Schimatariou	3,428	3,156	548	1,161	985	462	272	3,006
Attikis	M. Erithron	1,178	1,073	194	243	586	50	105	1,650
	M. Oropou	5,070	4,667	770	1,314	2,358	225	403	6,218
	M. Avlona	2,068	1,833	379	800	614	40	235	2,649
	M. Malakakas	564	522	31	167	313	11	42	750
Total (%)	Asopos RB	31,764	28,837	6,289	8,891	11,192	2,465	2,927	32,466
		(100%)	(90.8%)	(19.8%)	(28%)	(35.2%)	(7.8%)	(9.2%)	

Source: National Statistical Service of Greece (2001 Census)³

³ http://www.statistics.gr/portal/page/portal/ESYE/PAGE-themes?p_param=A0101

According to the Labour Force Survey of the National Statistical Service of Greece, the population of working age is divided into three mutually exclusive and exhaustive groups - persons in employment, unemployed persons and inactive persons. The employed are persons aged 10 years or older⁴, who during the reference week had worked, even for just one hour, for pay or profit or they have worked in the family business, or they were not at work but had a job or business from which they were temporarily absent. Unemployed are persons aged 10 years and over⁵ who were without work during the reference week (they were not classified as employed), were currently available for work and were either actively seeking work in the past four weeks or had already found a job to start within the next three months. They are distinguished between persons who had lost their job (for any reason) and young people who are looking for a job for the first time. The employed and unemployed people form the economically active population. Inactive are those persons who neither classified as employed nor as unemployed.

Regarding the above terminology and data of Table 3, the total economically active population (labour force) of Asopos RB in 2001 was 31,764. Of these persons 28,837 are employed (90.8% of the total economically active population) and 2,927 are unemployed (9.2% of the total economically active population). It is worth noting that for the rest of the country in September 2009 the respective unemployment rate was 9.1%, while in particular for the Prefecture of Sterea Ellada it was 9,7%. Furthermore, from the total of employed people the 19.8% are employed in the primary sector, the 28% in the secondary sector, and the 35.2% in the tertiary sector while the 7.85 of employed people did not report a sector of economic activity.

⁴ This range is kept for comparative reasons with the previous census

⁵ Op.cit. 4

The total economically active and inactive population of Asopos RB ($31,764 + 32,466 = 64,230$) is calculated, as in the previous section, considering the permanent population of the individual Municipal/Commune departments and localities of Municipalities/Communes which are geographically included in Asopos RB.

iv. Competent bodies and method of water supply and sewerage

Competent bodies responsible for water supply and sewerage were also presented in Chapter 3 and therefore only a short reference is made here. It is reminded that in Greece the provision of water supply and sewerage is treated as a public service and that there are 214 companies of water supply and sewerage services in the country. The competent bodies/companies of water supply and sewerage are divided into three categories (Safarikas et al., 2006; Tsagarakis et al., 2003):

- (i) In the cities of Athens and Thessaloniki there are private, public and nonprofit companies of water supply and sewerage which possess a 20 year concession. These are the Athens Water Supply and Sewerage Company (EYDAP S.A) and the Thessaloniki Water Supply & Sewerage Co (EYATH S.A). They come under the jurisdiction of the MoEECC which approves their water pricing policy. Overall, the objective of the above companies is the supply of water and sewerage services in their territory as well as the research, construction, establishment, operation, exploitation/use, management, maintenance, expansion and renewal of the systems of supply and sewerage.
- (ii) In the cities with more than 10,000 residents the Municipal Enterprises for Water Supply and Sewerage (DEYA) operate as private companies that belong to the Local

Government according to the Law 1069/80. However, there are towns with a population of less than 10.000 residents in which DEYA are located. These companies are LEPrL, of public interest and of specific mission and are in accordance with the rules that govern the private economy. Every DEYA, has as objective the supply of water and sewerage to the consumers while it is responsible for: the quality of water, the early respond to a likely water shortage, the good condition of the water supply and sewerage system, the construction of water supply projects etc.

- (iii) In the rest of the areas (Towns/Municipalities with less than 10,000 residents) the competent bodies of water supply and sewerage services are the Municipalities. These Municipalities are about 830 and it is estimated that they serve about 12% of the country's population.

Focusing in the area of Asopos RB the above three mentioned separate systems of water supply and sewerage and combinations of these are found. More specifically, for the individual Communes and Municipalities of the Asopos RB the following competent bodies of water supply (Table 4), with their respective points of abstraction and methods of water treatment and supply, are observed:

Table 4: Competent bodies, points of abstraction and methods of water supply

Prefecture	Municipality/ Commune	Competent body of water supply	Abstraction points	Method of water treatment and supply
Viotias	M. Plataion	M. Plataion	Processed water by EYDAP S.A	Chlorination
	M. Thivaion	DEYA Thivas	Morno's aqueduct and 16* boreholes of EYDAP	Refinement →

			or EYATH	Chlorination
	M. Tanagras	M. Tanagras	4 municipal boreholes (P. Hiliass, Kallithea, Gipedo, P. Hiliass)	Chlorination
	M. Dervenochorion	M. Dervenochorion	Processed water by EYDAP S.A and Dafni's borehole	Refinement → Chlorination
	M. Oinofiton	M. Oinofiton	Raw water from Morno's Reservoir through EYDAP and local Municipal boreholes	Refinement
	M. Schimatariou	M. Schimatariou	Raw water from Iliki lake through EYDAP which is που additionally mixed with the water of two municipal boreholes (K.Ygeias - Trita Dilesiou)	Pre-chlorination → Flocculation/Coagulation → Refinement → Post-chlorination → Storage
	M. Erithron	M. Erithron	Processed water by EYDAP S.A	Disinfection → Flocculation/Coagulation → Sedimentation tank → Filtering → Post-chlorination
	M. Oropou	M. Oropou	Mavrosouvala's Association of Water Supply and Drilling Exploitation (15 boreholes, 100.000m ³ /day) **	Chlorination
	M. Avlona	M. Avlona	4 boreholes with 3 pumping stations: Skalezas, Pylas, Asprochoriou with pumping supply of 100m ³ /h, 80m ³ /h, 60m ³ /h respectively	Refinement → Chlorination
Attikis	M. Malakasas	M. Malakasas	Municipal boreholes of Mavrosouvala's Association of Water Supply and Drilling Exploitation	Chlorination

*They were operation till 1st of September 2009 where they stopped to supply the water network of the Municipality due to the problem of the findings of hexavalent chromium.

** LEPuL which was established having as objective the supply of water in the neighboring Communes and Municipalities with a charge of 0.12€/m³

v. *Water pricing policy for water supply for residential use*

As it has been also emphasized pricing of water consumption is very important since it is related to the credibility and quality of water supply as well as to the possibility of the development of new water management systems in order to satisfy future, quantitative and qualitative needs.

As reported in previous chapter on industrial water use, water suppliers such as EYDAP S.A, EYATH S.A, DEYA and Municipalities, follow a different water pricing policy which is ought to the fact that they differ in terms of operation and financial data. EYDAP S.A and EYATH S.A, as privatized state owned and nongovernmental companies, set the prices which should be approved by the state and should cover their cost of operation. The pricing that EYDAP S.A employs defines ten categories of water use and users and imposes successive/escalating or standard charge and a monthly fixed charge depending on three months consumption.

For the domestic water use that includes residential, urban areas a graduated charge is imposed such as: for monthly consumption 0-5 m³→0.4138 €/m³, for 5-20 m³→0.6471 €/m³, for 20-27 m³→1.8566 €/m³, for 27-35 m³→2.5992 €/m³, for more than 35 m³→3.2357 €/m³. In addition, the water bill of EYDAP S.A. discerns among four categories of users for the right of using the sewers (common consumers, public-municipal, industrial, charity) who are charged as a percentage of the water price (e.g., common consumers: 75% × value of consumed water). Finally, the bill includes charges that take the form of the Value Added Tax (V.A.T.) of 9% of the value of the consumed water and 19% of the rest of charges as well as 1% of the value of consumed water as a contribution to the fund for personnel insurance.

Every DEYA which operates as a private company sets the prices which have to be approved from the City Council and to cover the operational cost. Hence, for the calculation of the operational cost and the implementation of water pricing factors such as salaries, subsidies, taxes, depreciation of capital etc are considered. As such

In particular, Thiva's DEYA (the only DEYA in Asopos RB) applies a water policy that differentiates across the Municipal Departments that belong to Thiva's Municipality. Therefore, regarding the Municipal Department of Thiva for year 2008, Thiva's DEYA discerns six categories of water users and uses and imposes an escalated or fixed charge according to the type and amount of the consumption and an annual fixed cost of water supply (€60). The water bills are every two months as follows: for two months consumption from 0-30 m³→0.45 €/m³, for 31-60 m³→0.60 €/m³, for 61 m³ and over→1.00 €/m³. In addition, DEYA's water bill for the Municipal Department of Thiva discerns two categories of users regarding the right for sewer and use of sewer (domestic use, industrial use). In particular, regarding domestic users the percentage charge is the following: fee for sewer use→70% of the value of the consumed water, drainage fee →90% of the value of the consumed water.

For the rest of the Municipal Departments of the Municipality of Thiva that are included in Asopos RB (Eleonas, Neochoraki, Ambelochori) the DEYATH discerns into two categories of use (domestic and professional use) of a common however pricing and applies a four month billing. In particular, the water bills and the graduated charge is the following:

Municipal Department of Eleonas: for consumption from 0-50m³→0.15€/m³, for 51-90m³→0.18€/m³, for 91m³ and over→0.30€/m³. Annual fixed fee of water supply→21.00€

Municipal Department of Neochoraki: for consumption from 0-50 m³→0.18€/m³, for 51-90m³→0.24€/m³, for 91m³ and over→0.30€/m³. Annual fixed fee of water supply →21.00€

Municipal Department of Ambelochori: for consumption from 0-50 m³→0.22€/m³, for 51-90m³→0.32€/m³, for 91m³ and over 0.37€/m³. Annual fixed fee of water supply →30.00€

Finally, in all the Municipal Department of the Municipality of Thiva (Thiva, Eleona, Neochorakiou, Ambelochoriou) a charge of special fee 80% is imposed to all the bills excluding the State consumption and that of LEPuL and of the Municipality of Thiva. The value of the consumed water bears a V.A.T. 9% while the rest of the charges (fixed fees of water supply-sewerage-use of sewer, special fee 80%, materials, tasks etc) bear a V.A.T 19%.

For the Municipalities/Communes that operate as the competent bodies of water supply and sewerage services, the water pricing policy that is applied is very heterogeneous. Every Municipalities/Commune applies a different pricing in water consumption by employing different criteria and by setting different financial, qualitative and quantitative targets. As a result, across the Municipalities/Communes of Asopos RB which operate as competent bodies of water supply for the domestic consumers, it is observed a different escalation regarding the consumed cubic meters of water, different charge for similar scales and different fixed charge. More analytically the water pricing policy that has been followed in the Municipalities/Communes for the pricing of domestic water consumption is as follows:

M. Schimatariou

M. Erithron

0-60 m³→0.60 €/m³
 61-120 m³→0.90 €/m³
 121-180 m³→1.46 €/m³
 181-240 m³→1.85 €/m³
 241 m³ and over→2.51 €/m³
 Fixed fee →15.68 €/six months

M. Avlona

0-40 m³→0.25 €/m³
 41-150 m³→0.35 €/m³
 151-300 m³→0.45 €/m³
 301-500 m³→0.80 €/m³
 Fixed fee →12 €/six months

M. Oinofiton

0-120 m³→0.29 €/m³
 121-999999 m³→0.44 €/m³
 Fixed fee →8.80 €/six months

M. Tanagras

0-300 m³→0.36 €/m³
 300 m³ and over →0.54 €/m³
 Fixed fee →13.21 €/six months

M. Malakasas

The required data of water pricing were not provided.

0-20 m³→0.50 €/m³
 21-50 m³→0.60 €/m³
 51-80 m³→0.70 €/m³
 81 m³ and over→0.80 €/m³
 Fixed fee →10 €/four months

M. Plataion

0-100 m³→0.70 €/m³
 101-180 m³→0.75 €/m³
 181 m³ and over→1.00 €/m³
 Fixed fee →15 €/six months

M. Oropion

0-120 m³→ 30€ fixed fee
 121-200 m³→0.70 €/m³
 201m³ and over →1.00 €/m³
 Fixed fee→30 €/six months

M. Dervenochorion

0-50 m³→ 1.00 €/m³
 51 m³ and over → 1.20 €/m³
 Fixed fee →8.00 €/six months

Table 5 :Water pricing in Asopos RB

Prefecture	Municipality/ Commune	Competent body of water supply	Fixed fee of water supply	Charge of the 100nd m ³ (€/m ³)
Viotias	M. Plataion	M. Plataion	15 €/six months	0.70 €/m ³
	M. Thivaion	DEYA Thivas	60€/years*, 21€/years**, 30€/years***	1.00€/m ³ *,0.30€/m ³ * *, 0.37€/m ³ ****
	M. Tanagras	M. Tanagras	13.21 €/six months	0.36 €/m ³
	M. Dervenochorion	M. Dervenochorion	8.00 €/six months	1.20 €/m ³
	M. Oinofiton	M. Oinofiton	8.80 €/six months	0.29 €/m ³
	M. Schimatariou	M. Schimatariou	15.68 €/six months	0.90 €/m ³
Attikis	M. Erithron	M. Erithron	10 €/four months	0.80 €/m ³
	M. Oropou	M. Oropou	30 €/six months	0-120 m ³ →30 €
	M. Avlona	M. Avlona	12 €/six months	0.35 €/m ³

	M. Malakasas	M. Malakasas	****	****
Average	Asopos RB	----	30.26 €/year	0.60 €/m³

*for the Municipal department of Thiva, **for the Municipal departments of Eleona and Neochorakiou, *** for the Municipal department of Ambelochoriou ****The Municipality of Malakasa did not provide us with the required data

vi. *Water consumption*

The 5-20% of water consumed on a daily bases in all the main water uses (industrial, domestic, irrigation) is used from the households through domestic water use. The domestic use of water is classified into indoor and outdoor water use. While the indoor water use is mainly dependent on the habits of the residents, the outdoor water use depends mainly on the size of the territory, its climate etc. From this percentage of domestic water use the 40% of water is discharge through the toilet. The rest of the quantity is used as follows: 25% is used in the bathroom, 20% for cloth and dish washing, 10% in the kitchen and 5% for cleaning. In Greece, 90% of the households have access to a network of water supply compared to 30% during ‘50s. The use of water for water supply has increased by 45% compared to 1980 and is still increasing. This increase has been related to the building, the use of appliances such as washing machines and contemporary facilities such as gardens, swimming pools etc⁶.

The domestic water consumption reflects successfully the size of water demand. In particular, for the Communes and Municipalities of Asopos RB the following annual water consumptions, reported in Table 6, in 2008 are observed.

⁶ <http://www.watersave.gr/site/index.php>

Table 6: Annual water consumption in Asopos RB (2008)

Prefecture	Municipality/ Commune	Annual water consumption (m³)
Viotias	M. Plataion	305,786 m ³
	M. Thivaion	2,100,000 m ³
	M. Tanagras	383,501 m ³
	M. Dervenochorion	220,000 m ³
	M. Oinofiton	775,794 m ³
	M. Schimatariou	1,650,924 m ³
	M. Erithron	321,925 m ³
Attikis	M. Oropou	4,000,000 m ³ *
	M. Avlona	567,000 m ³
	M. Malakasas	170,000 m ³ **
Total	Asopos RB	10,494,930 m³

*Approximate estimation, since the Municipality of Oropos does not have data on water consumption and the Association of Water and Drilling Exploitation of Mavrosouvala provided estimations of water consumption for 2008 since the system of tele-metering of the pumping station was not yet installed. **Estimation according to the population and the consumption of other similar Municipalities, since the Municipality of Malakasa did not provide the required data.

2. Area of tourism activity

Regarding the tourism area of Asopos RB, including vacation/holiday homes and tourist infrastructure or hotels, indexes and parameters are selected that show clearly the economic importance of water supply in the tourism sector. However, due the special characteristics of the area, the limited touristic development but also the lack of necessary data, the indexes and parameters that potentially can be used are limited. Nevertheless, the conclusions that are reached for the economic importance of water supply in the residential area of Asopos, could be hypothetically be valid and expand to the touristic area of Asopos RB.

This is due to the fact that tourism in the area is mostly characterized by holiday-makers that reside in holiday homes rather than tourists that use for their accommodation tourist units and hotel resorts. This is also due to the proximity of the area to urban places such as Athens which is a motivation for the construction of vacation and second residences. On the other hand, the industrial development of the area in combination with the environmental degradation that it brings is a disincentive for the development and location of touristic units and hotels.

Concluding, the tourist area of Asopos RB is mainly consisted of vacation or second residences. For that reason, the indexes of estimating the economic importance of water supply in the residential area such as water suppliers and water pricing policy can be also employed in the touristic study area. In addition, for a clearer characterization of the economic significance of water supply in the touristic area the following parameters are employed:

i. Holiday/vacation – Second residences

According to Table 2 where information of dwellings in Asopos RB is reported, the number of vacation or second residences is 16,267 and is the 37.6% of the total residences in Asopos RB. It is worth noting that from the total of second or vacation residences most of them are located in the coastal areas of the Municipalities. Table 7 reports the data of the Municipality of Oropos and the Municipality of Tanagra.

Table 7: Holiday/Vacation – Second residences of the Municipalities of Oropos and Tanagra

Municipality of	Holiday/Vacation or Second	Municipality of	Holiday/Vacation or Second
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Oropos	residences	Tanagra	residences
M.D. Markopoulou	2,158	M.D. Armatos	13
M.D. Neon Palation	2,314	M.D. Asopias	39
M.D. Skalas	3,649	M.D. Kallitheas	23
M.D. Sykaminou	857	M.D. Tanagras	92
M.D. Oropou	509	---	---
Total	9,487	Total	167

Hence, from the total of 16.267 vacation or second residences in Asopos RB, the 9.487 are located in the Municipality of Oropos and in particular 8.121 are located in the coastal areas of the Municipal Department (M.D.) (Markopoulo, Nea Palatia, Skala). On the contrary, only 167 vacation or second residences are located in the Municipality of Tanagra. This fact shows the high positive correlation that exists in the area between holiday residences and coastal areas (without industrial development) and at the same time, the high negative correlation that is observed in the area between vacation residences and lowland industrial areas.

ii. Water consumption during May-September

The demand for water is not equally distributed during the year. Especially during the summer season (May-September) the demand and consumption of water increases considerably due to the specific climate conditions that prevail during that season (e.g., heat, drought). In specific areas of Asopos RB, water consumption during summer months increases doubles compared to consumption during the rest of the months. In addition, the positive correlation between holiday homes and coastal areas demonstrates the high positive correlation between water consumption and summer in such areas. The existence of many holiday homes/cottages, coastal or not, has as

a result for the population of the area to double or triple during summer and hence to observe high water consumption. In order to explore the contribution of the touristic study area to the water consumption it is useful to record the total water consumption during the summer months. Specifically, water consumption for the basin of Asopos during May-September 2008 is presented in Table 8.

Table 8 : Water consumption during May-September

Prefecture	Municipality/ Commune	Water consumption (m³)
Viotia	M. Plataion	200,258 m ³
	M. Thivaion	1,080,000 m ³
	M. Tanagras	200,000 m ³ *
	M. Dervenochorion	120,000 m ³
	M. Oinofiton	243,526 m ³
	M. Schimatariou	832,557 m ³
	M. Erithron	173,608 m ³
Attiki	M. Oropou	2,300,000 m ³ *
	M. Avlona	226,600 m ³
	M. Malakasas	90,000 m ³ *
Total	Asopos RB	5,466,549 m³

*These specific measurements are estimates due to lack or no access to monthly data of consumption. Estimates are calculated according to the population and consumption of similar districts.

3. Conclusions and policy recommendations

In this chapter an attempt was made to evaluate the economic significance of water supply in the residential and touristic area of Asopos RB. The economic evaluation of the significance of

water use is the first step of the first stage of WFD implementation. In this context and regarding our particular case study data provided by the responsible water providers (Municipalities, DEYA) were used to create informative indexes. It should be also noted that other important parameters such as “income” could not be employed due to lack of necessary data or of the possibility to be published by the competent bodies.

Overall, regarding the residential area the general conclusions are that:

- The total permanent population of Asopos RB is 70,575 residents which shows the importance for qualitative and optimal water supply in the area. The total permanent population could be also taken into consideration as long as other parameters and data that concern the area such as urban wastewater, urban water consumption, sewerage etc
- The total number of dwellings in Asopos RB reaches 43,223 residences from which at least 43.000 residences are considered to be connected to or going to be connected to the water supply network. In addition, the 23,000 regular residences are permanent residences and therefore it is regarded that are permanently connected with the network of water supply and consume water during the whole year. Finally, it is concluded that the main-permanent residences (23,000) combined with the vacation-second regular residences (16.267) of Asopos RB put the higher pressure on the total domestic water use.
- The economically active population of Asopos RB reaches the 31,764 (employed and unemployed) of which the 35.2% is occupied in the tertiary sector, the 28% in the secondary sector, the 19.8% in the primary sector and the 9.2% are unemployed. The economically non-active population is 32,466. However, due to the intense industrial development of some areas of the Asopos RB like that of Oinofita, Schimatari and Tanagra, in the economically active population of Asopos RB it should be also included the people who are working in the

area but reside in other areas. Exemplary is the Municipality of Oinofita where on a daily basis 15.000 industrial workers are transferred excursing therefore a pressure on water consumption.

- The competent bodies of water supply in Asopos RB include one DEYA and 9 Municipalities/Communes. However, some of these competent bodies provide their services in collaboration with EYDAP S.A. The way of water supply, treatment and the abstraction points differ among the competent bodies and that justifies different quality, available quantity and charge of water.
- Due to the different way of operation of the competent water supply bodies and the different financial data that are to be included in the estimation of the charge, what is observed is a diversified water pricing policy within Asopos RB. This diversification in water pricing is not only observed among the different systems of water supply (e.g., DEYA and Municipalities/Communes) but it is also observed within the same system of water provision (e.g., Municipalities/Communes). Since WFD asks for water pricing that also considers the environmental and the resource cost of water use, the competent bodies are called to adopt a water policy which is not solely based on the financial cost and which promotes cost recovery. It seems that the change in the water bills is the only and necessary solution of the problem of the partial recovery of the real cost of water supply. In this context, the charges need to reflect the real cost and should not only include the abstraction cost, the cost of transfer and network maintenance but also the environmental and resource cost. This does not necessarily mean higher charges for all sectors. The water pricing policy of the competent bodies should be primary socially equal. This can be achieved through the graduated charges, reliefs for the most vulnerable social groups and through the application

of the principal “the polluter pays” so as the real cost of water not to burden unfairly and wholly the society. Furthermore, due to the special characteristics of Asopos RB (serious industrial pollution) the adjustment of the water pricing should be applied on a common and uniform base. As a result, in order to achieve a full cost recovery of the real cost of water in the whole area of Asopos, the competent bodies should apply a uniform water policy that includes common graduated charges and fixed fees. In addition, the common water pricing in Asopos RB should also include charges to the industries in order to gather the necessary sources for the construction of remediation works of Asopos’ ecosystem and rehabilitation of the area. In order to implement the above a necessary condition is the revision and amendment of the legal framework. The creation of the new legal framework which will be applied in the area should include, apart from the adjustments in the water pricing, the necessary measures of rehabilitation and protection of the area as well as the legal and monetary penalties in case of pollutant related activity. The current water pricing that is applied in the area of Asopos presents an average fixed fee of water supply of €30.26 per year and average charge of the 100th m³ of €0.60 per m³.

- The water consumption in the residential area of Asopos reflects the need and the demand for domestic water use. However, the recorded measurements cannot be considered absolutely accurate. In reality the specific measurements should be considered of less magnitude in m³ than the real water consumptions. This happens because the reported values are either measurements based on water metering installed in the households or measurements based on water metering installed in water abstraction points. These measurements are normally smaller than the real water consumptions since they cannot include any water leaks as a result of damages in the network, of leaks during transfer, abstraction etc. The annual consumption

in Asopos RB for 2008 is 10,494,930 m³. However, it should be noted that this number is not absolutely accurate since water simulations in few cases took place due to lack of data.

Regarding the touristic area of Asopos the most important conclusions are the following:

- The tourism development including hotels, accommodation to rent, camping and other tourist units, in the area is limited and takes place only in specific districts. This is mainly caused by the intense industrial development and the pollution that it brings creating disincentives for the touristic development. On the contrary, the tourist development in the area in terms of holiday and vacation residences is of particular interest. There are 16,267 holiday or second residences which correspond to the 37.6% of the total of residences in Asopos. However, these residences are not equally distributed across the district but are mainly concentrated in the coastal areas. Obviously the existence of a high number of vacation or second residences puts more pressure on the demand for water consumption.
- Water consumption during summer and particularly during May-September, shows a rising trend. This fact is partly due to the special climatic conditions of the specific time period and to the increase of water consumers during that specific time. For example, the Municipality of Schimatari that reports a consumption of 89,716.2 m³ in February 2008, in September 2008 it equals 213,090 m³. The total water consumption in Asopos RB during May-September 2008 is 5,466,549 m³ and is about 50% of the annual consumption. A response to moderate water use during summer in the area could be the implementation of a seasonal graduated water charge by the competent bodies of water supply. According to the seasonal diversified percentages or seasonal percentages, the charges are higher during peak seasons (summer) and lower during periods of low demand (winter).

Concluding, this chapter with a focus on the residential water users presented an assessment of the financial cost of water service operators. Financial costs are likely to need a number of adjustments before economic costs can be identified: typically, adjustments for transfers and taxes but also adjustment for the environmental and resource costs caused by water service operators' activities. Environmental cost attributed to the water service operators in the area is not available. However, there are costs which water service operators incur because they operate within a polluted environment or an environment from which raw water resources are currently depleted by other water users (EUREAU, 2004). Hence, the water service operator may incur additional water treatment costs or additional cost of transportation.

In any case, the costs of operating within a polluted environment should not be recovered from water service users but from the polluters who caused them and in case of Asopos is the industrial and then the agricultural sector. Hence, as mentioned previously a program of measures should be considered which would charge industrial sector, as in the case of any other user, respectively with the total cost that generates. As it will be presented in Chapters 6 and 7 the total cost of for example ecosystem degradation is estimated from €882,200 to €2,690,000 per year using different methods of estimation. Finally, it is expected that full cost recovery through charges and measures will motivate the adoption of green investments and the decrease of pollution to the social optimal level.

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