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D 5.5. Present and future water demand

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PU	Public	**X**
PP	Restricted to other programmed participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the consortium (including the Commission Services)	

1. INTRODUCTION

The hydrographical extent Buzau – Ialomita is a water management basin unit that covers a surface of 23 874 km² and includes the Buzau, Ialomita hydrographical river basins and the inter-rivers areas Ialomita - Buzau and Danube –Arges – Ialomita.

This area consists of a number of hydrographical river sub-basins: Ialomita, Buzau, Mostistea and Calmatui and at the same time the water uses from this area benefit from the water in three other neighbour hydrographical river basins: Arges, Siret and Danube.

This area's climate is temperate - continental, but because of the variety of the relief there can be distinguished three main climate types: mountain, hill and plain. The average annual temperature is 11.8ºC, with registered maximums of +40.5ºC (Braila, 1943) and minimums of - 38ºC (1929). The average multi-annual precipitations have values between 1000 and 1400 mm and the mountain area, 600 – 800 mm in the hill area and 300 – 550 in the plain area.

The main water streams in this extent are:

- Ialomita river (S = 10430 km²; L = 414 km);
- Buzau river (S=5564 km²; L=354 km);
- Prahova river (Ialomita's tributary stream) S = 3735 km²; L=169 km;
- Mostistea river (S = 1734 km²; L = 92 km);
- Calmatui river (S = 820 km²; L = 145 km).

The soils typical to this area are of a great variety, dictated by the relief and climate conditions. Also, the vegetation is very rich and varied.

The area's population is 2.454.196 inhabitants, from which 1.223.006 live in the urban area.

The main economic activities are the industry and agriculture. The industry is based upon the oil extracting and processing, the extractive industry, construction materials, wood processing, the textile industry, alimentation etc.

The agriculture has a great potential in this area, disposing of over 1.600.000 ha arable terrain in which there are cultivated: cereal, technical plants, grape-vine, fruit trees, etc.

2. WATER RESOURCES

2.1. Hydrological resources (natural)

The surface water hydrological resources (natural) are estimated at 2 272 km³/year, but they have not only a seasonable variation, but also a variation from one year to another. For instance, the Ialomita River multi-annual average stock is of 1.388 km³/year (44 m³/s) but during 1990, a year of powerful hydrological draught, this river's stock was of 0.704 km³/year (22.3m³/s). This situation is similar to Buzau River.

2.2. Surface water socio – economic resources

The water socio – economic resources consist of that part of natural resources (hydrological) that, through the means of an engineering infrastructure, are transformed in available resources to water supply in order to satisfy the usage water requirement. These resources are composed of natural available resources, in terms of the rivers from a well determined basin, based on the minimum monthly discharges with a 95% assurance and based upon the practical volumes and upon the water iron reserve from storage reservoirs.

Taking into account these conditions, the hydrographical area Buzau – Ialomita socio – economic water resources equal 0.8468 km³/year from which:

- Available in natural regime - 0.25580 km³/year
- Available in reservoirs – 0.591 km³/year.

3. ACTUAL INFRASTRUCTURES

3.1. Dams and Reservoirs

To satisfy usage water requirements and the water potential usage, in Buzau – Ialomita river basins there were achieved 11 more important reservoirs which sum 591 x 10^6 m³ practical volumes (*Figure 1, Table 1*).
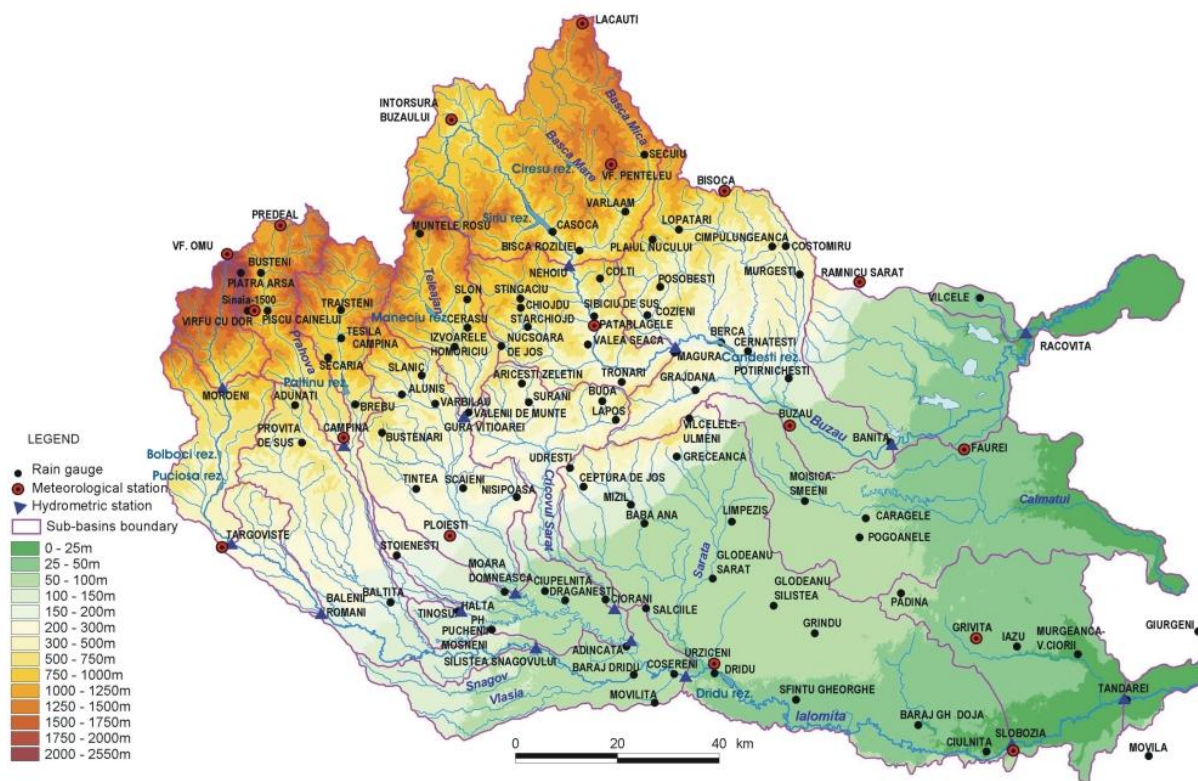

Figure 1. Buzau – Ialomita river basins

Table 1. The main reservoirs in Buzau – Ialomita river basins

Crt. no.	Name	Water stream	Practical volume ($\times 10^6$ m³)
1	Mariuta	Mostistea	9,6
2	Fundulea	Mostistea	19,00
3	Gurbanesti	Mostistea	36,00
4	Frasinet	Mostistea	88,00
5	Iezer	Mostistea	160,00
6	Colboci	Ialomita	19,40
7	Paltinu	Doftana	36,60
8	Maneciu	Telega	53,00
9	Pucioasa	Ialomita	19,40
10	Siriu	Buzau	112,00
11	Dridu	Ialomita	41,00
	TOTAL		591,00

3.2. Inter-basin diversions:

Along this area there are four discharge derivations that transit water volumes from the hydrographical area Buzau-Ialomita to other hydrographical basins.

Ialomita-Buzau diversion

It derives from the Ialomita River, to deep waters, 50 m³/s in Mostistei Valley, throughout a channel having 18 km longer

Ialomita – Ilfov diversion

It discharges from the Ialomita River into Ilfov River a discharge of 3.5 m³/s, through a channel having 6.04 km longer.

Voievozilor Valley diversion

It is a derivation of average waters from the Ialomita River into the Ilfov River with a discharge of 0.85 m³/s and a derived average volume of 26.25×10^6 m³/year.

Bilciuresti – Ghimpati diversion

Discharges of 10 m³/s derive from Ialomita River to Colentina River for the completion of Bucharest lakes.

4. WATER UTILITIES

The main Buzau - Ialomita area usable waters are the industrial and drinking-water supplies, irrigation waters, animal husbandry waters, pisciculture, tourism and the hydropower plant.

The water volume variation drawn for usable waters and river basins during 2002-2006 is the following (*Table 2*):

Table 2. Water drawing ($\times 10^6$ m³/year) –Ialomita and Buzau river basins

	2002	2003	2004	2005	2006
Drinking water	81.72	75.08	67.91	61.22	59.88
Industrial water	146.919	144.316	110.578	100.623	92.656
Irrigations	34.226	29.558	17.779	4.988	8.820
Live-stock	4.501	3.697	3.322	3.048	2.797
Pisciculture	33.79	30.72	42.965	49.88	65.823

As you can observe here, with the exceptions of water volumes drawn for pisciculture, for the other usable waters, the volumes drawn are decreasing.

Hydropower

In Buzau – Ialomita river basins there are 20 more important hydropower plants in function, which total installed power is 100MW, with an energy production for average hydrological year of 180 GWh/year.

The hydro-energy is non-consuming water use.

5. THE MAIN WATER USERS AND INTALLED AND TAPED DISCHARGES DURING 2005 IN BUZAU AND IALOMITA RIVERS

The main water users and installed and taped discharges during 2005 in Buzau and Ialomita river basins are presented in the following table:

Table 3. Installed and taped discharges during 2005 in Buzau and Ialomita river basins

Crt. no.	User	$Q_{installed}$ (l/s)	Q_{taped} (Year 2005) (l/s)
1	PETROBRAZI PLOIESTI	2.352	342
2	ASTRA PLOIESTI	298	209
3	UPETROM PLOIESTI	350	104
4	PETROTEL LUKOIL	1.400	233
5	S.E.DOICESTI	7.326	1.200
6	RAM BUZAU	560	200
7	S.P.P BOLDESTI	1.450	104
8	AGRANA TANDAREI	200	120
9	APANOVA PLOIESTI	2.215	1.680
10	C.P.G. CAMPINA	550	478
11	HARTIE BUSTENI	1.013	249
12	HIDRO VALEA PRAHOVEI	260	216
13	UM PLOPENI	233	8
14	CARPAT CEMENT FIENI	405	39
15	EXPUR SLOBOZIA	114	100
16	STICLOVAL VALENI	280	57
17	RAFINARIA VEGA	280	43
18	STEAUA ROMANA CAMPINA	190	90
19	DALKIA TERMO PRAHOVA	453	125

6. THE ESTIMATION OF FUTURE WATER DEMAND OF USERS

6.1. Time horizon selection

It has to be added that in the present Romania does not have a forecast on the evolution of usable waters and, evidently, neither does it have a forecast on usable water requirements. At the present time, E.M.D.D., through the I.N.H.G.A. elaborates a series of studies that have as goal the substantiation of a development plan of hydrographical basins. According to Law no. 107/1996 – Water Law, with the ulterior completions and modifications, the development plan is a component of the DIRECTIVE PLAN OF DEVELOPMENT AND MANAGEMENT of hydrographical basin. This constitutes the planning instrument in the water field of hydrographical basin or group of hydrographical basin level. The directive schemes will be elaborated till the latest December 22, 2009.

The national strategic plan, the regional development strategies, the rural development strategy, the district strategy and area strategy don't excel as time horizon the year 2013, excepting the energetic strategy that has as time horizon the year 2020.

In consequence, in order to evaluate the future usable water demands in Buzau – Ialomita river basins we had to make a series of hypothesis, which in time might prove to be unrealistic.

To estimate the future usable water demands the elaboration of sceneries is necessary. The time horizon of the sceneries cannot generally outgrow 8 – 10 years. A bigger time horizon is not generally accepted because various uncertainties can interfere. The demographic evolution of this territory is difficult to be anticipated, even if in Romania there are sceneries that estimate, for example, a decrease of the population for 2050 year at around 15 million inhabitants. Evidently, this scenario does not take into account the globalization process, the possible growth or decrease of the inhabitants, due to migration. This fact is not to be neglected.

Pursuant to the estimation we have in mind, we will limit our research to the year 2025. Water demand estimation, over this time horizon, would be hazardous.

6.2. Scenery input data

First, we wish to underline that we won't only tackle the Ialomita and Buzau hydrographical river basins; we will also approach the problem of Buzau - Ialomita water resource management unit basin, which includes the Buzau-Ialomita hydrographical basins, the Arges – Ialomita – Danube and Ialomita – Buzau inter-rivers, because these areas are part of the water management basin unit, and on the other hand in these inter-rivers, generally poor in water resources, there is one of the most important water utility demand – irrigations.

Drinking-water population demand

The present population of the hydrographical area Buzau – Ialomita is 2 454 198 inhabitants, from which 1 223 006 (49.8%) live in the urban area and 1 231 192 live in the rural area.

Following the evolution of the population from this region during 2001-2006, it is noticeable a decrease of the population of 3.6% in 2006, in comparison to 2001. Realizing that, through different means, including the birth-rate growth, this decrease will stabilize and that, generally, the decrease will not out-grow 0.2% per year. It can be admitted that in 2025, the population in this area will be of 2 360 000 inhabitants.

Specific demand for dirking water per total inhabitants was, during 2002-2006 (*Table 2*), around of 28.2 m³/year/inhabitant. This low demand of dirking water is explained by the fact that only 1 584 596 inhabitants (from which 451 600 in the rural region) are connected to the water supply central systems. For this sector, the specific demand of water was of 44.66 m³/year/inhabitant.

Taking into account that till 2025, the urbanization rate will grow so that the population in the rural area will represent approximately 30% of the total population, it is to be concluded that the rural population in Buzau – Ialomita hydrographical area will be of 708 000 inhabitants, and the urban population of 1 652 000 inhabitants.

To be able to estimate the drinking-water population demand in horizon 2025, there are taken into account:
-   the urban population will be connected to the water supply central systems in proportion of 100%, and the average water demand per inhabitant is estimated at 300m³/year/inhabitant, being necessary the drawing of a water volume equal to 495.6×10^6 m³.
-   it was calculated that the rural population will be connected to the water alimentation central systems in proportion of 90%; the water demand will be an average of 50 m³/year/ inhabitant, being necessary the drawing of a water volume equal to 35.4 x10^6 m³.

Industry water demand

Lacking an industrial strategy for such a horizon it is admitted that the industry will vary and improve, a fact that drives to the diminishing of water demand.

The specific industrial water demands in 2025 will be equal to the one in 1998, which means an average of 170 m^3/year/ inhabitant industrial water, which means a drawing water volume necessity of $401 \times 10^6\,m^3$/year.

Agriculture water demand

The agriculture water requirement consists of the requirement for culture irrigation, water for the live stock farms and the pisciculture.

Irrigation water demand

This requirement is more difficult to be estimated. On one hand it is expected that because of temperature raising and precipitation decrease, the irrigation rate will grow. Unfortunately, there are not many studies for this domain. But such study development for the climate and soils in this region are imposed, especially because the eventual climate change will also bring changes for the vegetation period. On the other hand, the requirement for irrigations can decrease in the condition of a certain agriculture management system.

It is estimated that, the arranged irrigation surface, summing 804783 ha, can diminish to an economic irrigated surface, which in present is difficult to estimate. In addition, having in view the fact that in this region there is one of the best agriculture lands of Europe, but affected by drought in the last years (Southern and Central Baragan), it is expected that new irrigation surfaces are settled, with water coming from the future Siret – Baragan channel.

Taking all this into account and on the basis of the data we have till the present, we will consider that the surfaces to be irrigated in the year 2025 will sum up approximately 700000 ha, giving un some Danube pumping, which means that through compensation the actual irrigation surfaces will stay the approximately the same. Lacking studies and research regarding future irrigation rate, it is admitted that they will sum up 2500 m^3/year/ha, for calculated average year with an insurance of 80%.

Consequently, the necessary drawing water volumes are estimated for 2025 at $1750 \times 106\,m^3$.

It is added that in the Buzau - Ialomita area inner-rivers only 122100 ha are irrigated. They demand a water volume of $305 \times 106\,m^3$. The rest of the surfaces are to be irrigated from the Danube and the future Siret – Baragan channel.

To estimate a probable evolution of utility water requirements for the 2025 time horizon the following presumptions have been made:

Zootechnical farms water demand

From 1989 statistical data, when zootechnical farms were developed sufficiently, it issues that the number of animals/inhabitant was of 1.70 and with a 17m³/year/animal average water demand.

Considering that these parameters will be available for 2025, results that:
- the number of animals will be: 4 012 mil. animals;
- the necessary water volume will be: $68 \times 10^6\,m³$/year.

Pisciculture water demand

From statistical data it results that in Buzau – Ialomita area approximately 16 500 ha are fitted out for pisciculture. The drawn water volumes are necessary for the filling of the settlements in February – March period, the covering of water loss and the insurance for refreshing water. Out of the data we dispose of, we conclude that the necessary water volume for this process is an average of 20 000m³/year/ha. Consequently, for the total surface of pisciculture settlements there is a 330 x $10^6\,m³$/year necessary water volume to be drawn.

Hydropower demand

The only projected hydropower settlement, possible to be fished until 2025, is the one from Surduc, with an installed power of 57 MW and Nehoiasu – Surduc (actually in execution) with an installed power of 110 MW, but its parameters are conditioned by the first settlement.

This utility is non - water consuming and does not need special drawn.

7. CONCLUSIONS

From the data presented, it results that at the end of 2025, it is estimated that the Buzau – Ialomita river basins utility water demand will equal 2.679×106 m^3/year, from which on utilities:

-   population – 531.0×10^6 m^3/year (200 x 10^6 m^3 from inland rivers)
-   zootechnical – 68×10^6 m^3/year
-   pisciculture – 330.0×10^6 m^3/year
-   irrigation from inner-rivers – 305.0×10^6 m^3/year
-   Danube irrigations – $1.445.0 \times 10^6$ m^3/year.

If the drawn water volumes from the Danube are excluded, it results that the Buzau – Ialomita area utility water demand (year 2025) is estimated at $1.034.0 \times 106$ m3 (from Buzau and Ialomita area).