Buletinul Ştiinţific al Universităţii "POLITEHNICA" din Timişoara

Seria HIDROTEHNICA

TRANSACTIONS on HYDROTECHNICS

Tom 55(69), Fascicola 1, 2010

THE APPEARANCE AND DEGREE OF FITTING OF THE RIVER BASIN TERRITORY OF ROMANIA

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Abstract – This paper aims to study the response to environmental planning, regarding the water courses from Romania. There is desired to achieve a statistics considering the evolution in time and space of hydro facilities and constructions, grouped by river basins and by types of hydraulic fittings, and further on to obtain a default interpretation by prevailing environmental quality impact. The specific positive and / or negative effects upon the environment are looked for.

Key words: catchment area, water courses, water arrangements, hydraulic developments, environment issues.

1. GENERAL CONSIDERATIONS

The emergence and evolution of hydro facilities and construction in general is linked to freshwater needs (and not only) of humans and nature. These needs that grown and diversified rapidly are mainly based on three factors: population growth, change and evolution of human structure and production activities and increase in the global living standards .

Studies show that global consumption of fresh water from rivers, lakes and groundwater basins is estimated at about 3,500 km^3 per year, of which 73% for agriculture, industry 22% and 5% for domestic needs.

The accelerated trend of urbanization, especially in developing countries leads to a significant increase in water quality needs, drinking and / or industrial.

All these studies lead to the idea that although water is a renewable resource that is found in limited quantities on a planetary level, the water resources need to be managed in order to cope with population demands.

The specific water consumption in Europe, for different countries is presented by fig.1.2 diagram, while the specific water resources is shown by the diagram in fig. 1.1.

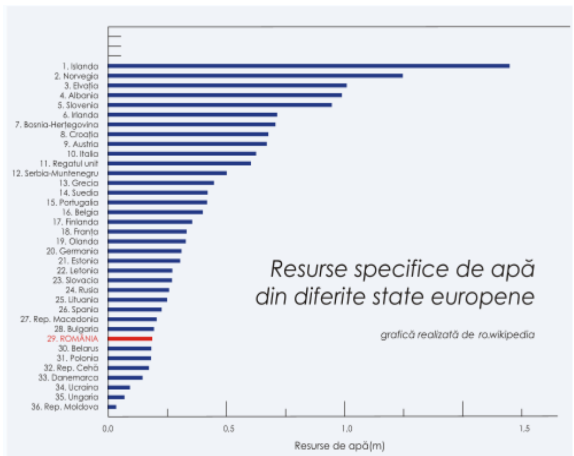

Fig. 1.1. Specific water resources in different European countries

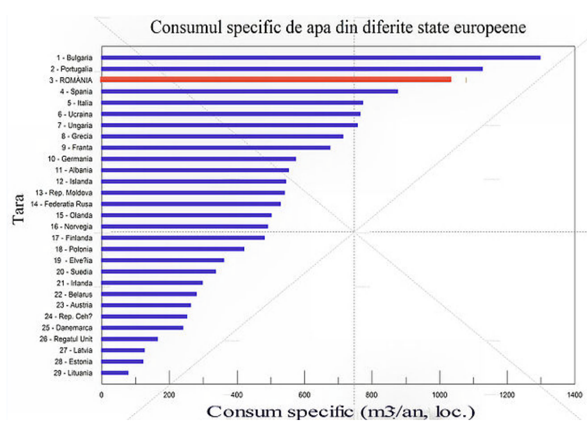

Fig. 1.2. Specific water consumption in different European countries

The water resources management is performed from ancient times and gradually led to the emergence and development of hydraulic constructions and arrangements.

At first hydraulic works were mainly intended for irrigation and water supply, but also for protecting the human settlements against floods, goals achieved by creating dams and canals. The earliest documentary

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on the creation of a lake by barraging a river course is about Kosheish Dam built on the river Nile (about 2900 BC). The early dated dams (towards the late fourth millennium BC) include a small weight dam in Jordan, at Iawa, forming an accumulation of fresh water.

There is also mentioned for the first time the occurring of a dam break, a flood protection embankment from Sadd el Kaffrara located 30 km south of Cairo. The dam had a height of 12 m and a length of 108 m, and was built from rocks with an earth core of 1m width, framed between two walls of 0.60 m each. The dam was not equipped with an overflow for high waters and thus it was broke by overrunning. This catastrophic event impressed the antiquity and led to a decrease in the rate of dams' erection in the last three millennia BC.

In Romania the first accumulations made by valleys' barraging and with temporary drainage of water courses, mend the emergence of a particular hydrotechnical construction called "fishing fence". This was seen on the Danube arms and assumed a leaky dam that cut across these arms.

Historically attested documents talk about: large number of ponds and fish ponds, dams executed by contour depression areas; structures created with the aim of retaining the water from precipitation; accumulations for daily regulation of water flow in order to help the log transport by rafting; water arrangements employed for the ore industry (ore crushing and washing; the significant accumulation of Rosia Montana is mentioned).

Nowadays, the water resources management in Romania is made by authorized institutions established following the territory partition according to the 11 main river basins as shown in figure 1.3. The covering percentage of these basins with respect to the entire Romanian territory is presented by the diagram in figure 1.4.

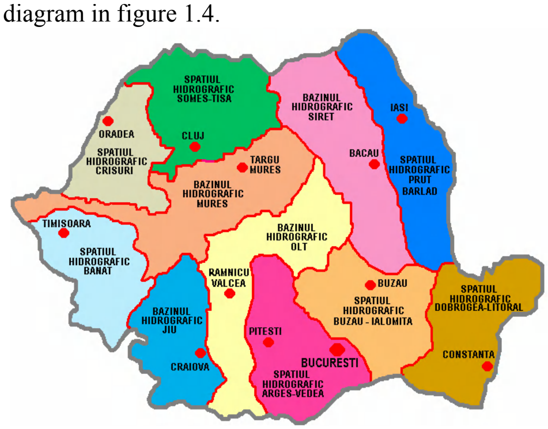

Fig. 1.3. River basins partition in Romania

The assets of the "Apele Romane" National Administration are roughly represented by the followings:
- 78,905 km of water courses;
- 295 600 hectares of land with waters;
- 270 reservoirs with a total volume of 14.5 billion cubic meters, of which 114 lakes with non-permanent storage;
- 7100 km embankments to protect villages and agricultural land;
- 6600 km and 1320 km of rivers adjustments and consolidation of banks;
- 157 channels feed pipe with a length of 1100 km;
- 59 pumping stations with an installed flow of 237cm/s;
- 49 doses of water and hydraulic components installed with a total flow of 249 cm / s;
- 178 other hydraulic works;
- 122 natural lakes.

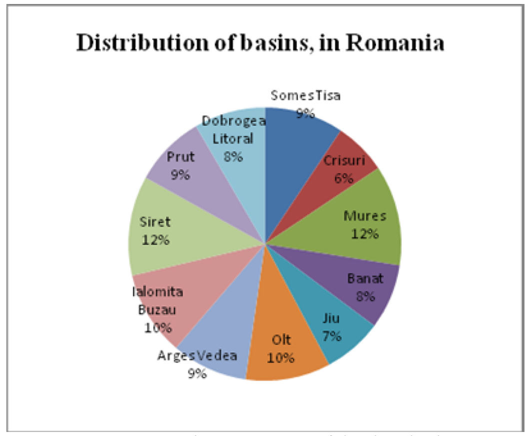

Fig. 1.4. Covering percentage of the river basins

Regarding the status of the reservoirs and their development degree, the nowadays situation in Romania is shown by the diagram in figure 1.5.

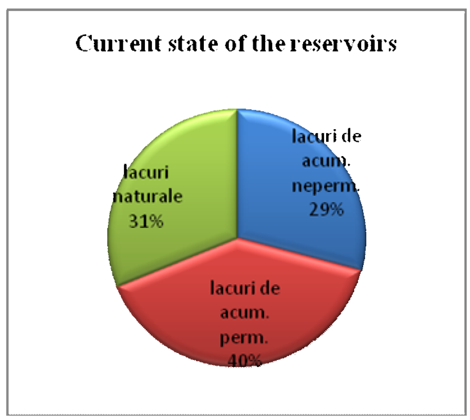

Fig. 1.5. Current state of the artificial water reservoirs in Romania

2. PRESENTATION OF THE GENERAL SITUATION OF RIVER BASINS IN ROMANIA

Banat water catchment

Comprises a length of 6296 km of water courses in the entire system, of which 35 km of supplying canals, 1037km of river regulations, 66 km of banks consolidation; 1085 km of embankments to protect villages and farming land, 44 km navigable channels.

Jiu water catchment

Area administered by the Jiu Waters Department covers a surface of 18,975 km^2, and a hydrographic network with a total length of 5,884 kilometers, of which 4,933 kilometers in undeveloped flow regime and 951 km under arranged regime.

Olt water catchment

The basin has an area of 24,050 km^2, with a hydrographic network length of 9,872 km and with an average density of 0.410 km/km^2. A significant draining phenomenon occurs on about 15.3% from the length of this river network. In order to ensure the water supply towards the various consumers 62 significant accumulations of a usable volume of about 1,800 million m^3 were developed.

Flooding combat works: 294 km of bank protections, 854 km of water courses regulation, 910 km of embankments.

Arges-Vedea water catchment

The Arges-Vedea hydrographic area is located in the south of the country and covers a surface of 20,911 square kilometers. Its sub-basins include Arges (12,590km^2), Vedea (5,430km^2), Calmatui (1,413km^2) and the Danube side basin (2025km^2).

The hydrographic network has an average density of 0.36 km/km^2, ranging from 0.67 km/km^2 in the upper area to 0.507 km/km^2 in the middle area and to 0.03 km/km^2 in the lower area.

Buzau-Ialomita water catchment

Area - 22,289 km^2, of which: Buzau 5,264 km^2, Ialomita 10,350 km^2, Calmatui 1,668 km^2, Mostiştea 1,758 km^2, Danube 7,165 km^2. The total length of the water courses – 5,424 km, of which the main courses length represent: Buzau 308 km, Ialomita 400 km, Prahova 176 km, Calmatui 144 km, Mostiştea 98 km. The main specific assets are: 17 dams, 4 water treatment plants with an installed flow of 4.4 m^3/s, 4 water intakes, 9 pumping stations totaling an installed flow of 111.7 m^3/s, 226 km canals and pipelines for water supply and derivation, 442 km regulating works and banks protections, 678 km of embankment works, 4 hydrological stations, 49 hydrometric stations, 110 pluviometric stations, monitoring sections.

Mures water catchment

The Mures Water Management System, a branch of Mures Waters Department, manages quantitatively and qualitatively the Mures upper river basin with an area of 11,865 km^2, representing approximately 43% of the entire river basin. The total length of the river system is 7,401 km which from 589.0 km of arranged flow and 379.0 km of framed watercourse.

Somes-Tisa water catchment

Tisa river 61 km, Somes river length 376 km, Crasna river length 134 km, Tur river length 68 km. The surface water resources of the basin represent about 6,580 mil.m^3 while the groundwater resources cover about 470 mil. m^3.

Crisuri water catchment

The total area of Crisuri basin covers 25,537 km^2 from which 14,860 km^2 are in Romania (6.3% of the country) and are represented by the following main sub-basins: Crisul Alb 4,240 km^2, 4,237 km^2 Crisul Negru, Crisul Repede 2,986 km^2, 2,005 km^2 Barcau, 1,392 km^2 Jer. The Romanian part of the basin contains a number of 365 coded water courses, the total length of hydrographic network being 5,785 km (7.3% of the total length of river network of the country and with an average density of 0.39 km/km^2).

Prut-Barlad water catchment

The Prut river basin drains an area of over 20,267 km^2 of land and totalizes a length of 7,777 km of water courses, which from 417 rivers. Its main specific assets are: 49 accumulation lakes with surface larger than 0.5km^2, 262 fish ponds, 116 water courses, 1,084 km regularizations, 1,173 km embankments, 2 water outlets with significant discharges, 9 major water outlets and 6 derivations.

Siret water catchment

Siret river has a catchment area of 28,116 km^2 with a length of 10,280 km of water courses system and an average density of 0.37 km/km^2. Draining phenomenon occurs on about 8.3% of the system length. The total water resource catchment area is theoretically 6,868 mil.m3/year, while the specific resource is 2746 m^3/inhabitant/year, which places this basin over the Romanian average. 14 types of water units are defined for the Siret basin area, which from two types of non-permanent rivers, two lakes and five types of reservoirs.

Dobrogea – Seaside water catchment

The Dobrogea - Seaside Water Administration manages an area of 16,501 km^2 (the Counties of Constanta, Tulcea and partly Braila) that is structured on the Danube and Seaside sub-basins.

The hydrographic network lengths 1,623 km of inland water courses (842 km belong to the Seaside basin and 781 km to the Danube basin) and 341.5 km of river Danube.

The natural lakes, of a total area of 15,500 hectares, are the lakes located on the Big Island of Braila, Danube's right bank and coastal lakes of which very important is the therapeutic Techirghiol Lake, took over under the administration in the year of 2000.

A very important component of the landscape is represented by the Black Sea beaches, which from the tourist resort beaches represent an area of about 230 ha.

The embankment works measure 192.6 km, of which 127.8 km represent the Danube defensive line, aside the specific works of other owners. A particular importance have the dike works of the Seaside sub-basin, with a length of 64.7 km, and the Razim - Sinoe protection works. The water courses regulation works totalize a length of 163.2 km, of which 18.2 km in the Danube sub-basin and 145.0 km in the Seaside sub-basin.

The Dobrogea - Seaside Water Administration also manages specific hydro works for levels control in the major coastal lakes, such as the weirs of Periboina, Edighiol, Ovidiu, tannery and Mangalia. The administration also owns 35 dams, of which 32 are of non-permanent accumulation. The non-permanent reservoirs are located in the Danube - Black Sea basin, with their specific role in high waters attenuation and in solid flow retention, but also in limiting the effects of any pollution incidents, given that the basin is crossed by the canal route for oil pipelines. The permanent reservoirs are part of the Techirghiol lake protection, with a role in stopping the influx of fresh water in the lake.

3. EFFECTS OF WATER ARRANGEMENTS IN HYDROGRAPHIC BASINS

By arranging the water courses following various solutions, several specific effects were obviously produced. The interference upon the humans and living nature need of water can be summarized through the following main actions:

- catchment, storage and transport of water from rivers, lakes or groundwater in order to supply it at the right place and moment, as needed;
- the appropriate treatment / cleaning of water in order to reuse it under best quality standards;
- the employment of appropriate technology by accomplishing hydrotechnical developments and constructions that would lead to a decrease in the water specific consumption in agriculture, industry, households, etc.;
- the improvement navigation conditions by the inland waterways;
- the production of green energy by the help of hydro-power plants, much more environmental friendly than other sources of electricity generation;
- the diminish of high waters and floods destructive effects;
- protection against erosion and land degradation due to alluvial phenomena, through specific water courses arrangements;
- beaches and shore line protection against erosion or flooding during storms;
- marine waters desalination;
- development of water related tourism.

The specific spreading and size of hydrotechnical developments and constructions are very well known. A meaningful example is represented by the vast hydrotechnical works that close the Zuiderzee bay and estuary in the Netherlands (developed between 1918 and 1990). This complex arrangement led to the pull off from the sea influence (acting by catastrophic floods) of a 3,750 km^2 area with an inestimable economical, social and ecological value.

In terms of environmental impact the following events can be distinguished:

- Functional effects: consisting of flow regulation, water quality improvement, flood protection. These effects are usually controlled and modified directly;
- Environmental effects: refer to direct and indirect actions upon living creatures in time;
- Geophysical effects: changes in geographical, geo-morphological and hydrological natural state;
- Social-economic impacts: changing in land employment in relation to its present or potential economic value (the appearance or disappearance of human settlements, changing of people occupation, tourism and recreation, etc.).

4. CONCLUSIONS

In order to obtain adequate positive results, the water arrangements and constructions design and accomplishment, regardless of their type, should be done in close relation to environmental factors, geographic area, climate change and also in relation to the present and perspective level of regional development. It is necessary to consider and study the behavior in time of similar hydro developments and to correct any noticed deficiencies.

An improved efficiency is reached by correlating the global factors, if possible, and not just at the river basin.

It is obvious that the hydrotechnical developments impact upon environment cannot be eliminated, but it sure can be reduced in terms of quality and quantity, leading to a bearable impact.

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