

## **HYDROGRAPHIC CHANGES IN THE LOWER BASIN OF DIMBOVITA (THE LUNGULEȚU AREA-JUNCTION WITH COLENTINA) IN THE XVIII-XX CENTURIES**

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**Résumé.** Les changements hydrographiques dans le bassin inférieur de la rivière Dâmbovița (section Lungulețu –confluence avec la rivière Colentina), pendant les siècles XVIIIème-XX ème. Pendant le temps, le bassin inférieur de Dâmbovița (section Lungulețu - confluence avec la rivière Colentina ) a soutenu plusieurs changements ayant comme but la diminution de l'influence corrosive de grands débits dans la période des déluges dans la ville Bucarest. Par l'aménagement de la rivière Dâmbovița, on a essayé résoudre les problèmes de la gestion quantitative et qualitative des eaux en Bucarest, une ville dans un permanent progrès et élévation sans envisager les changements interposés dans l'écosystème constitutif de la région.

The lower basin of Dâmbovița overlaps the Titu and Vlăsiei Plains (Ilfov Plain, Bucharest Plain and Câlnaului Plain), has a general NNW-SSE orientation and its maximum altitude is of 106 m near Mogoșoaia. The flow length in the hydrographic basin of Dâmbovița (the Lungulețu area-junction with Colentina) is about of 62 km which is winding a floodplain with a length between 0,5 and 2 km with larges and relatively smooth interfluves, and with a weak breaking up, around 1 km/km<sup>2</sup> (Jordan, 1973, p. 31).

The north part of the lower basin of Dâmbovița partially overlaps with the subsiding Titu Plain where the floodplain and the minor channels are larges, with sand banks, ponds, swamps accompanied by larges interstream areas (Geography of Romania, V tome, page 299). To south, Dâmbovița passes through the Ilfov Plain, a transition area between Titu and Bucharest Plain.

In the Bucharest Plain, Dâmbovița has carved itself a flooplain of 1-2 km length, with concave shores, here and there shores with „peaks” which advance into the floodplain (it appears to be 15 on the Bucharest territory), the swampy

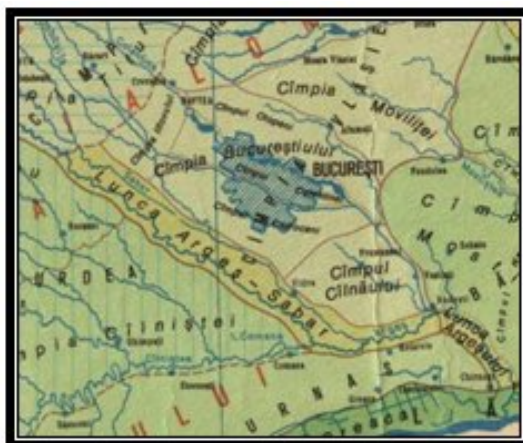


Fig. 1 - The sub-units of the Vlăsiei Plain (according to Posea and Badea, 1984)

depressions and the lakes relatively round situated in the concave area of the floodplain, called also „marshy valleys” (the former Ochiul –Boului Lake and the Tătarului Lake situated in the south of town). The minor relief includes plain and floodplain forms where you can find most of all „hillocks” for example Chiajna, Giulești, Hașdeu (they are many other islets) Mihai Viteazu, Patriarhie (85 m and 14 m relative altitude), Radu Vodă (75 m and 5 m relative altitude), Bucur (74 m and 4 m respectively), Troița (72 m), Movila Mare (67 m) and so on. There are many tablelands on the plains, at the peripheries of the valley appear suffusion processes, and in the specific spreading area of Bucharest in the anthropic excavations have formed lakes. The Dâmbovița earthworks are on the left side (with one exception at Glina), they are largely displayed and more widen out (t 4-2) on the Dâmbovița-Colentina Pasărea Plain, indicating a longitudinal cone profile (Geography of Romania, V tome, page 311).

The Câlnaului Plain continues to the Bucharest Plain to the south, it has a bigger gradient, about 1.5 ‰ (it is the forehead of an old cone), there are terraces, the rivers are deepening to 10-30 m, the plain and the terraces, and the highest have many tablelands. The discharger was very much modified by the people intervention, especially for the Bucharest requirements and its protection. There have been created, during the time, very many canals aiming to evacuate the high flood waters from Dâmbovița to Argeș and its affluent.

The first human intervention on the Dâmbovița course (considered by the specialists as the first hydrotechnic work of Romania) took place in 1774, Franz Joseph Sulzer being the project author and the accomplisher of the canal fragment built downstream to Lungulețu (as the waters were threatening almost 500 ha of

land) and the documentation was published in its work in 1782, „Geschichte des transalpinischen Daciens”. In 1774, as result of the catastrophic floods caused by the Dâmbovița overflowing, Alex Ipsilante ordered the building of a by-pass canal, with a length of 8 km.

The Canal, known in documentation as “The Ipsilante Ditch”, was made as a derivation of big waters to Sabar, through Ciorogârla, starting from Lungulețu and didn’t affect the current utilizations of Dâmbovița in Bucharest. The documents remind us that in Lungulețu was arranged a water gate made of wood, which has been found in good condition during the fitting out works made between 1882 and 1884. The old course of Dâmbovița, „Matca Veche” passing through Slobozia Moara, was carrying only the necessary flows for Bucharest.

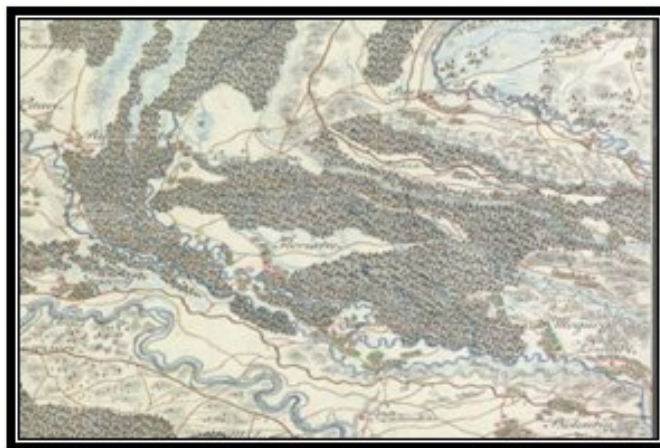


Fig.2 - Fragment from “Militairische carte Der kleinen oder oesterreichischen und grossen Wallachei....” Specht, (1790-1791)

In the map Specht “Militairische carte Der kleinen oder oesterreichischen und grossen Wallachei,....” (1790-1791) is indicated the Ipsilante Canal (“Schanzu bach”) having the south-east direction till the Brezoaiete locality (almost 5 km) and then to south (around 3 km) flowing into Ciorogârla. At “Santzu” (Lungulețu) Dâmbovița was separating from the canal, having a direction more to the east by comparison with the present one (almost at east of “Brezoja”-Brezoaia).

The Map of Rigas „H xarta the Elladoe” sheet 12 (1797) indicates the Canal of Ipsilante through a right line between Lungulețu (Ditches) on Dâmbovița and a point south of Ogrezeni on Argeș (Fig. 3).



Fig. 3 - Fragment from „H xarta the Elladae” Rigas, 1797

On this map the linear direction of the canal, around 25 km, intersects the Sabar and Ciorogârla valleys. In the written documentation discovered afterwards, appear „ditches” (plural) which it makes us believe that „the ditch” was not single.

In the Russian map (1835 and 1853) the hydrographic system was showed by a black line. In the afforested areas it is indicated as a white space indicating the river direction.



Fig. 4 - Fragment from “Carta Romaniei Meridionale”, Flighely/ Satmari, 1864

“Charta Romaniei Meridionale” (Fig 4) printed by Satmari indicates Dâmbovița meandering through Codrii Vlăsiei, but it doesn’t show the major changes by comparison with the map made by Specht. On the Argeș-Dâmbovița interstream area, between „Lunguleți (S. Șanția)” and „Trestieni” can be seen the canal “Șanțiu” with the general NNW-SSE direction which was taking down from

Dâmbovița, passing by Trestieni, continuing to the south, as a natural river bed, meandered passing by Zoița, Arcuda, beyond which it appears as “R Ciorughirla”. Also from Dâmbovița, at Lungulețu, it was taking down, a river “Râu Bâi” straightening directly to Răstoaca, and in front of Floresci de Josu joining again. The third course was the so called “Strâmba”, considered by Vâlsan (1915, p.191) „also a red bed left from Dâmbovița”, as those above mentioned, whose traces could be very well perceived between Poiana Lungă and “Bolintinul din Dealu”. Ciorogârla was joining with Sabar downstream the Chirca and the last one was flowing into Argeș, near “Podul de la Valea Dragului”.

Dâmbovița, the most important affluent of Argeș, was considered by Vâlsan (1915, p.190), as being artificial, the real course, passing by Cătunașu–Brezoaiele (the river bed can be seen on the Flihely/Satmari map (Fig 4).

Following the floods from 1864 and 1865 has been build the canal of Arcuda, having the superabundance function. Chiru (1893, p. 383) considered this canal from the “Ditches” but also those achieved in 1865, have enabled many works made afterwards for the Dâmbovița rectification and the Bucharest water supply.

Since 1850 they have taken in consideration the rectification issue of the Dâmbovița course in the urban area. There have been taken away all the buildings too closed to the Dâmbovița banks (182 properties on the left side and 192 on the right side), the bridges have been modified, the banks have been consolidated (for example in 1852 in front of Radu Voda Monastery, in 1853 the suburb Cărămidari, etc), the course has been rectified, the bottom of the river has been deepened with 6 m, and it has been made two waterfalls (for the factories from Grozăvești and Vitan). In 1859 began the cleaning works for the Cișmigiu Lake.



Foto:Dâmbovița before beeing supplied with sewerage system near the with bridge (next to the Musical Theatre) photography by L. Angerer, 1856

The arrangement of the Dâmbovița river bed was made on a geometrized direction, cutting the numerous meanders of the river aiming to obtain a slope not so big, determining the diminution of the carrying capacity of the river bed from the upstream to the downstream region (Solacolu, 1988). The bottom of the canal was planked with an oaken floor board sustained by beams and pillars. Subsequently, the systematization was extended outside the town also, the Grozăvești waterfall was eliminated (1900) and the river bed was arranged upstream of Ciurel, where it was made a new waterfall and the plug for the canal bringing water to the Communal Factories of Grozăvești. This arrangement was due especially to the flood from 1893, when there were dislocated the embankments upstream of Conțești and the Dâmbovița and Ilfov waters arrived in town, having a flow of 125 m<sup>3</sup>/s (Vuzitaș, 1936, p. 990). In 1868, works have been made in the south region, at the Dâmbovița outlet from the town, on 10 km distance.

Reviewing the cartographic materials published at the beginning of the XX century, can be seen various changes made in the natural environment of the Dâmbovița lower basin. By comparison with the previous centuries, the town has extended upstream and downstream, and the workshop and factories along the river were many. Dâmbovița had the billows neglected and the waters dirty as is here where the main canals of domestic and industrial waters were flowing into. During the XX century this function (of main canal) has been amplified, the river emitting a repulsive smell and being dangerous from hygienic health point of view. In addition, the luster of water was too down by comparison with the embankments, having a small length of the water mirror (6-8 m). In Bucharest, the sewerage suffered a series of modifications during the time. Thus, at the beginning the waters flew down through open ditches, into the alley drains, some of them guided to the Dâmbovița. Later, it has been made deeper built ditches (80 cm), in the middle of streets. The streets were covered by *wood floorboards* and the waters were flowing down into the so called *mines* or *water houses*, a sort of recipients or dung holes. As the slopes were missing, the ditches were often getting stuck and the waters were stagnating (becoming real contagious centers); they were to be widened and deepened often, with big maintenance expenses, taking the measure of changing the sewerage way. In Bucharest the sewerage making starts in 1847 when there were built the first two *stone canals* for the waters flowing down – str. Bazarca and the flowing down of the Rahovei Bridge (Vuzitaș, 1936, p. 984) and in 1862 were built the first concrete canals.

The Bucharest sewerage achieved between 1881 and 1886 by B. Ziegler, was subsequently completed. Becoming insufficient has determined the authorities to create another project, which was made in 1909 by D. Germani, who made also the works. In this project the sewerage was adopted at levels, being considered

more efficient for the necessities at that time, the purifying station of domestic waters (waters which were going directly to Dâmbovița) being scheduled for subsequent achievement.

In 1879 was adopted the water supply project by filtering and distributing water from Dâmbovița, project finished in 1884 and achieved by Culmann and Ziegler. Simultaneously with the water supply and river bed arrangement works were made also the main urban sewerage system works represented by the two general main canals placed in the embankments. In 1888, from Arcuda was starting the first station of treating water, from where water was coming to the Grozăvești pumping station, on a aqueduct long of 15.5 km.

About the torrential rains from 1910 and 1934 is speaking Vuzitas (1936, p. 996), rains that “have caused the swelling, big enough, of Dâmbovița”, he considers that systematization of Dâmbovița upstream till the water gates from Brezoaia and downstream till the confluence with Argeș, represented a priority.

Between 1930 and 1932 it has been cleaned the alluvial deposits between Abator and Ciurel along 8438 m and between 1934 and 1936 was covered the central course of Dâmbovița, in the urban area with concrete floors in the central part of town. In 1950 was inaugurated the water plug from Crivina, built for the industrial necessities of Bucharest. The water collecting is made by the means of a dam long of 250 m, made into the river bed and of a plugging room where there is a sand trap basin. In 1969 was set working the Arcuda wells (the Arcuda plug and treating station collecting the water from Dâmbovița through the Brezoaiele dam, from where by the means of Dâmbovița canal arrives to Arcuda both for population supply and industry.

In the interval 1985-1989 have been designed and achieved within the project “The complex arrangement of the Dâmbovița River” the following works: the accumulation of Lacul Morii, the arrangement of Dâmbovița River – the tub of clean water and the achievement of the worn water case.

In July 1985 started the complex arrangement of the Dâmbovița river in Bucharest (on 10,4 km along the Lacul Morii till downstream of Vitan-Bârzești) by which it was achieved: the complex arrangement between Dragomirești Deal and Podul Vitan, the collecting and transition of worn waters by two case long of 10 km (Ciurel-Vitan) placed under the river bed with clean water (with 20 -80 m<sup>3</sup>/s capacity), the creation of water luster at the level of embankments by reaching the river bed through hydrotechnic knots, the draining of subterranean waters from the left bank through a drain placed along the river bed, at the level of worn water collector and also ensuring high flood transition in safe conditions in the capital territory by deepening , reshaping and concreting the river bed in the town area. Practically two superposed rivers were arranged: at the superior level the clean

water open collector (Fig 6) and at the lower level the close collector for residual and raining waters (under the clean water vat).

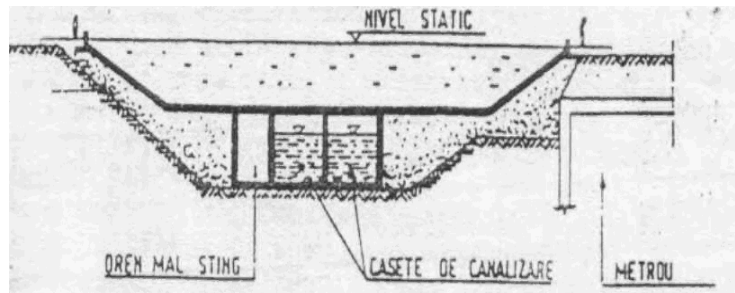


Fig. 6 - Transversal profile through the Dâmbovița river bed and the worn water cases (according to Popescu and Lăzărescu, 1988)

The central sewerage collector takes the flows through the domestic and rainy sewerage. The flow taken over varies between 27,8 m<sup>3</sup>/s (Ciurel section) and 75 m<sup>3</sup>/s (Vitan section). The sewerage system is flowing down into the collector in 7 points on the right bank and 15 points on the left bank. It is composed of two worn water cases. The urban drain was built on the left bank in order to prevent the level rising of the ground water layer as result of the reaches design at a level of Dâmbovița superior to the old one. On the right bank this function is achieved by the subway drain.

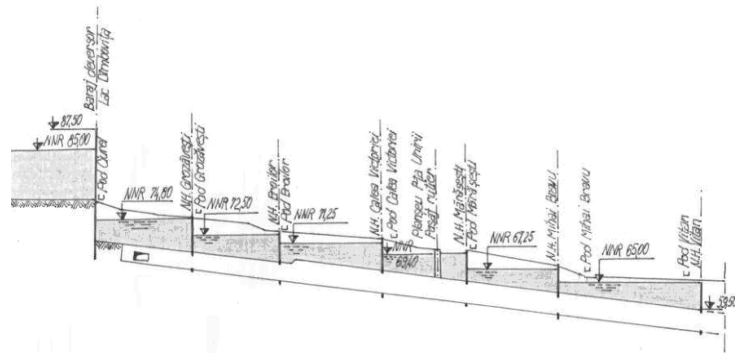


Fig. 7 - The longitudinal profile by arranging Dâmbovița river the Bucharest (according to Popescu and Lăzărescu, 1988)

The clean water vat has a length of 16-20 m at the bottom and 30-50 m at the embankment level, has 1,5-4,5 m depth and a transit capacity of 55 -120 m<sup>3</sup>/s. It's made of reinforced concrete water tight plates, at the upper level there is a



„breaking wave” beam and the billows has an inclination of 1:1,5. It has the function of conveying in transit all the range of flows withdrawing from Morii Lake. For small waters, the level is maintained at the embankments quota for a special urban effect. Downstream the Morii Lake, the river bed is devised in reaches through the hydrotechnic knots, resulting in lustres of water with depths between 1,5 and 4,5 m.



Foto: Dâmbovița River seen from Biology Faculty to Opera House, October, 2007)

The hydrotechnic knots devise the river bed in reaches, eliminating the continuous slope of Dâmbovița of 1:1000 m (1 m level falling on the entire route of Bucharest) and thus resulting in lustres of water with an horizontal surface. They are placed in 6 points (Fig. 7) Grozăvești, Eroilor bridge, P-ța Națiunilor Unite, Pod Mărășești, Mihai Bravu are, Vitan Bârzești, equipped with water gate – clack, conceived with one or three valves and with threshold of different heights.

The regularization of Dâmbovița is made now through accumulation both from itself and its affluent and from the existing branches, which either are supplying Dâmbovița at small waters, either are taking over a part of its big waters guiding them to the neighbored rivers. The accumulation Morii Lake (was built at the end of 1980's) has a total volume of 19 mil m<sup>3</sup>, is spread on a surface of 220 ha and has a permanent retention volume of 15 mil.m<sup>3</sup>. The evacuator of big waters from the Morii Lake ensures regularized flows for the arranged river bed of the Dâmbovița River on the route fit out in the Bucharest town. Upstream, the Morii Lake is delimitedated by dams following the Dâmbovița river bed till the Chiajna town.

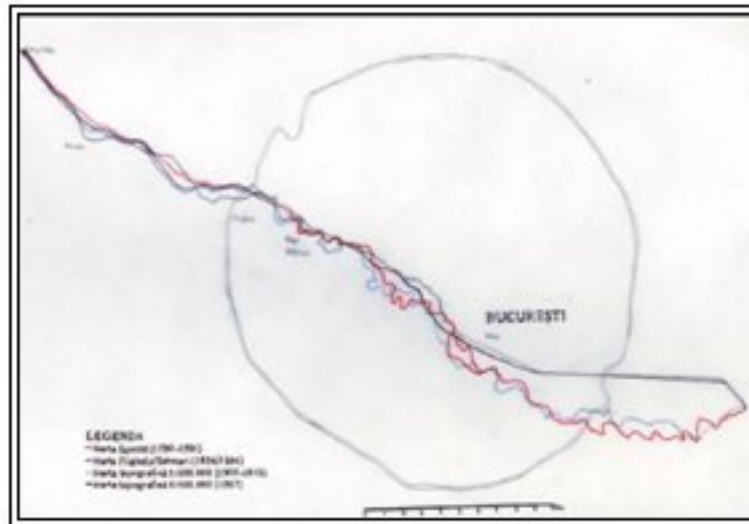


Fig. 8 - Hydrographic changes in the lower basin of Dâmbovița in the XVIII-XX centuries

Between Dâmbovița (where the canal Brezoaiele starts from) and Ciorogarla valley is working a little branch, by which, when there is a surplus of waters on the Dâmbovița river, is flowing down o part of the flow to the Ciorogarla valley. The branch Dragomirești-Chitila conveys water to Colentina, and the branch Glina-Argeș is going to connect the Glina filter station with the Argeș River (where the works are suspended). The Branch Racare brings water from the lower course of Ilfov to te Dâmbovița river bed. The branch Dragomirești (the Canal Argeș-Grozăvești) is linked to Colentina through a canal of 8,3 km length. The aqueducts Crivina-Arcuda and Crivina-Roșu convey water from Argeș to the Arcuda and Roșu treating stations. The Arcuda branch has the function of flowing down the big waters of the Dâmbovița into Argeș.

The initial project for the complex arrangement of Dâmbovită foresaw the achievement of the Văcărești Lake in the south area of capital aiming to build a favorable microclimate and also a pleasure base for Bucharest citizens. Placed at the outlet of Dâmbovița from town, on the right bank, between the high terrace and the billow built from ground, this space was never filled with water, both due to the work unachieved and to the studies which have proved that the increase of the phreatic level would caused the filling with water of the dwelling basements from that area.

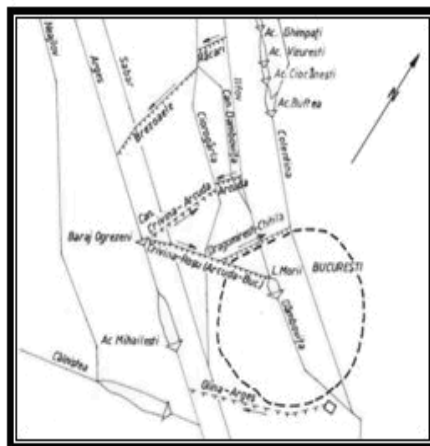


Fig. 9 - The arrangement Scheme of Dâmbovița River (according to Solacolu, 1988)

In conclusion, by arranging the Dâmbovița River it was aimed to solve the quantitative and qualitative managing problems of waters in Bucharest, town in a continuous development and modernization without taking into account the changes appeared in the natural ecosystem of the area.

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