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TRANSIT OF FLOOD WAVES THROUGH THE SOFTWARE MATHCAD PROFESSIONAL 14.0, BY NASAL ACCUMULATION, FIZES MIJLOCIU HYDROGRAPHICAL BASIN, CLUJ COUNTY.

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Abstract: Năsal accumulation, taken in the study, ensures through the barrier of the Fizes valley, the fastest and most efficient method of regularizing the outrush flow rates. In addition, it ensures a water glitter for the piscicultural activity.

Through the attenuation of flood waves in these accumulations, both the direct and indirect damages are avoided: the direct damages representing the value of the destructions or damages of the affected objectives and the value of the expenses made with the intervention operations for defending the endangering, evacuation and population help areas; indirect damages given by the losses registered in the economy.

The passage of flood waves through Năsal accumulation leads to their attenuation achieving in the downhill barrage sections much smaller attenuated levels and flow rates than the flood wave ones that lead to the diminishing in a great extent of the potential damages that could be produced in the lack of these works on the water courses.

In present paper is to present the results of the simulation with the program used in this application, software Mathcad 14.

Key words – Attenuation, Flood waves, Specialized software, Simulation.

INTRODUCTION

Flash floods are a phenomenon of fast and significant growing and decreasing of levels, and water flow rates; they occur after falling on the catchment areas of excessively high rainfall, which often overlap to a soil soaked by a rainfall recored before with a lower intensity.

Changes in levels or flows during a flood in a section of a water course, are given by the flow hydrograph levels, called the flood wave hydrograph or flood.

Flood wave moving normally in both the riverbed and the river bed are cause by major flooding in floodplain areas.

Flood wave may be a single peak or multiple peaks, depending on the sequence of rainfall occurrence in practice and therefore meet mono wave river type and multi-wave type [3].

Accumulations represent the works of water management which ensure the modification of the temporary regime of water flows by retaining a part of the inflow in certain periods and increasing the deflux in other periods. In this sense, we consider as accumulations: the set of artificial lakes and ponds created on the water courses, the non-permanent retentions for floods created both on the water course, the non-permanent retentions for the floods achieved both on the water courses and laterally (attenuation enclosures), the naturally created lakes so that the flow regime downhill and the alluviums retention works on the torrents can be managed.

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Accumulations represent the fastest and most efficacious way of flow rates regularization, regarding the water uses they comply with their requirements the best, and regarding the fight against the floods, accumulations present the advantage that they can control the flood flows from concentrated points [1].

The accumulations from the meadow area have barrages of small heights and large lengths usually built from earth and present the advantage that they are near the populated centres and the irrigated lands, but also the disadvantage that they require large barrage lengths and have great water losses through the evaporation and infiltrations; for attenuating the flood waves in the meadows of the large rivers people create accumulations through banking, called polders that have the shape of floodable enclosure compartments.

LOCALIZATION OF RESEARCHES

Nasal pond is located in Suciuas Valley, a tributary of Fizes, the basin of the Little Somes, land code II – 1.31.28.7, near Nasal area, the village Taga, Cluj County, at approx. 28 km from Gherla and 73 km from the city of Cluj - Napoca.

It is accessible from Gherla, on DJ 172A by Taga, and country road on approx. 8 km.

Photo . 1-2 -Overviews of Nasal accumulation, b.h. Fizes, Cluj county

According to the STAS 4273/1983, the work falls into the class-IV of importance, with a maximum height of 10 m, maximum volume of 1 million m3, with Nasal barrier height of 4.78 m and forms a accumulation with a volume of 545,768 m3. Important category: C - normal matter, which requires current tracking.

According to P100-92, against seismic movements protection, the dam is located in area F, the coefficient Ks = 0.06 and corner period Tc = 0.7 sec.

Construction of hydro are related:

- Earth dam
- Surface discharger
- Bottom drain outlet

- Power plant downstream ponds

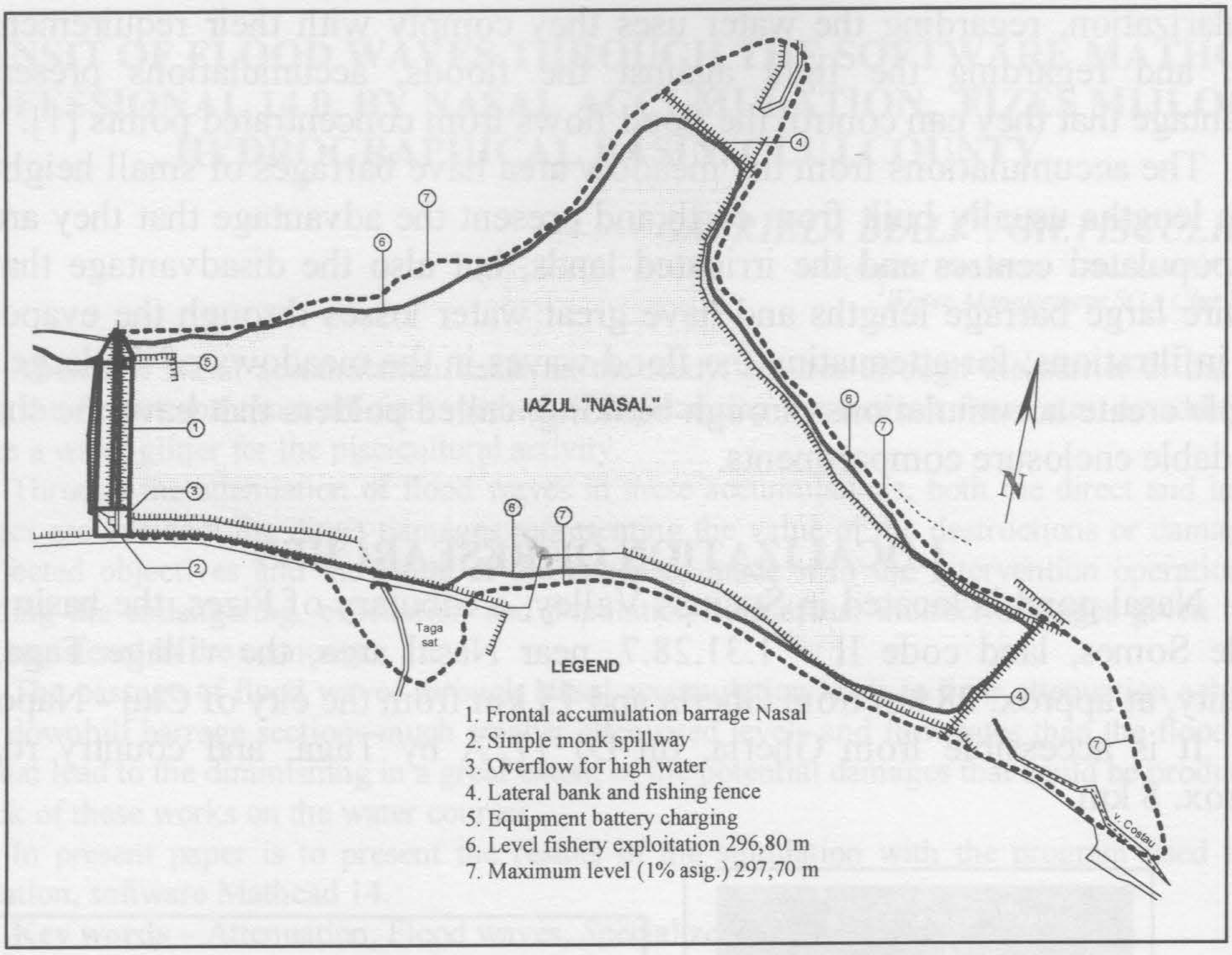


Figura 3 – Nasal accumulation, Fizes hydrographic basin

Main technical data of projected accumulation are:

- Catchments area .... 13.9 km^2
- Share crown .... 297.70 mdM
- Fishing quota level .... 296.50 mdM
- Maximum level .... 297.70 mdM
- The maximum surface .... 21.54 ha
- Volume of water at fish quota .... 314.559 m^3
- Maximum water volume .... 545.768 m^3
- The amount of mitigation .... 213.209 m^3

Characteristic hydrological data, according to a study prepared by INHGA shows:

- F .... 13.9 km^2
- L .... 4 km
- $Q_{max\ 10\%}$ .... 19 m^3/s
- $Q_{max\ 5\%}$ .... 28 m^3/s
- Qmax 1% .... 51 m^3/s
- $W_{max\ 5\%}$ .... 605.000 m^3/s
- $W_{max\ 1\%}$ .... 1.102.000 m^3/s
- Tt .... 25 ore
- Tcr .... 6 ore

- Y ……………………………………… 0.24

Nasal dam is built from the ground, trapezoidal section, with the following features designed :

- The length canopy ……………………….. 174 m
- Width of the canopy ……………………….. 4.0 m
- Maximum height ………………………………. 4.78 m
- Upstream embankment slope ………………….. 1:2.5
- Downstream embankment slope ………………… 1:4
- Share crown ……………………………… 297.70 mdM
- Height safety ………………………………… 1.20 m
- Average depth of motorway ……………….. 80 cm

Upstream of dam was consoled with a pitching concrete slabs 10 cm thick, cast in place, and the crest and downstream slope of green were strengthened through.

Arrester surface is located to the left bank of the dam and consists of a concrete channel length of 26 m and width of 8.60 m and is provided with a walkway from a concrete low supported by reinforced concrete abutment and files, which support and metal grates. Clear bottom cell is located behind the large central water arrester, has a length of 37 m and is made of concrete with Dn = 800 mm, and the body has a vertical height 4.50 m.

Power plant: a monk-type downstream pond is simple horizontally with body PREMO Dn = 400 mm tubes.

THE RESEARCH METHOD

Flood peak flow, having a random nature, is determined by a probabilistic calculation based on a sample of maximum flood flow recorded and is associated with a probability of occurrence, thus Qmax p%; distribution of maximum flow and corresponding probabilities, called the full curve of probabilities of occurrence [3].

Based on a series of floods recorded, it can draw the correlation between the maximum flow Qmax and flood volume W, correlation which represented a double logarithmic axes system knowing Qmax p% and using this correlation can be established Wp%.

To have a valid correlation between the two quantities, the coefficient r must meet the condition: r ³ 0,7; this coefficient is given by:

$$r = \frac{\sum_{i=1}^{n}(Q_i - \overline{Q})(W_i - \overline{W})}{\sqrt{\sum_{i=1}^{n}(Q_i - \overline{Q})^2 \cdot \sum_{i=1}^{n}(W_i - \overline{W})^2}} \qquad (1)$$

where Qi and Wi are concerned maximum flood flow volume i; n number of recorded floods; Q and W are respectively the recorded arithmetic mean of maximum flow volumes.

On the coefficient of correlation is required at least 20 ... 30 floods recorded in the same genesis (rain, nival, or mixed), for the calculation errors to be as small probability. The correlation coefficient for most rivers in our country uninfluenced by hydraulic works, has values between 0.8 and 0.9 which shows that the two random quantities are a good correlation.

Having registered a real flood wave of the flood wave can be obtained by calculating the probability p% similarity method (Figure 2.3) using the following proportionality relationship [3]:

$$Q_{pi} = \frac{Q_{\max\ p\%}}{Q_{\max\ M}} \cdot Q_{Mi} \qquad (2)$$

where Q_{pi}, Q_{Mi} are simulated flows, respectively measured when i; $Q_{\max\ p\%}$, $Q_{\max\ M}$, Maximum rate probability p% and the maximum flood flow measurements.

4. Calculation/simulation program. Results obtained and interpretation

4.1. Primary data of program entry

$F_{BH} = 13{,}9\ km^2$ –surface of the reception basin

$k = 0{,}28\ m^3/s$ – transformation coefficient of the rain intensity

$\alpha = 0{,}40$ – the global reduction coefficient

$I_{60.1\%} = 115$ mm/hour –the maximum hour intensity of the rain with the exceeding probability 1 %

$n = 0{,}45$ – reduction coefficient

$p_{calculation} = 5\ \%$; $p_{verification} = 1\ \%$

Flood wave parameters:

$a_\lambda = 0.33 \quad \lambda = 0.8 \quad h_{1\%} = 50mm$

$$T_c = \frac{h_{1\%} \cdot \lambda \cdot F_{BH} \cdot km^2}{Q_{1\%}} = 2.909hr \qquad (3)$$

$$T_t = \frac{T_c}{a_\lambda} = 8.816hr$$

$$\gamma = \frac{h_{1\%} \cdot F_{BH} \cdot km^2}{Q_{1\%} \cdot T_t} = 0.413 \qquad (4)$$

Verification flood hydrograph:

$\gamma = 0.413 \quad T_t = 8.816hr \quad T_c = 2.909hr$

$\gamma = 0.24 \quad T_t = 25hr \quad T_c = 6hr$ - correlation with the design data

Flood volume calculation and verification:

$Q_{\max c} = Qp_{\text{int erpP}}(P_{calculation}) \qquad Q_{\max v} = Qp_{\text{int erpP}}(P_{verification})$

$Q_{\max c} = 31.3m^3/s \qquad Q_{\max v} = 51.3m^3/s$

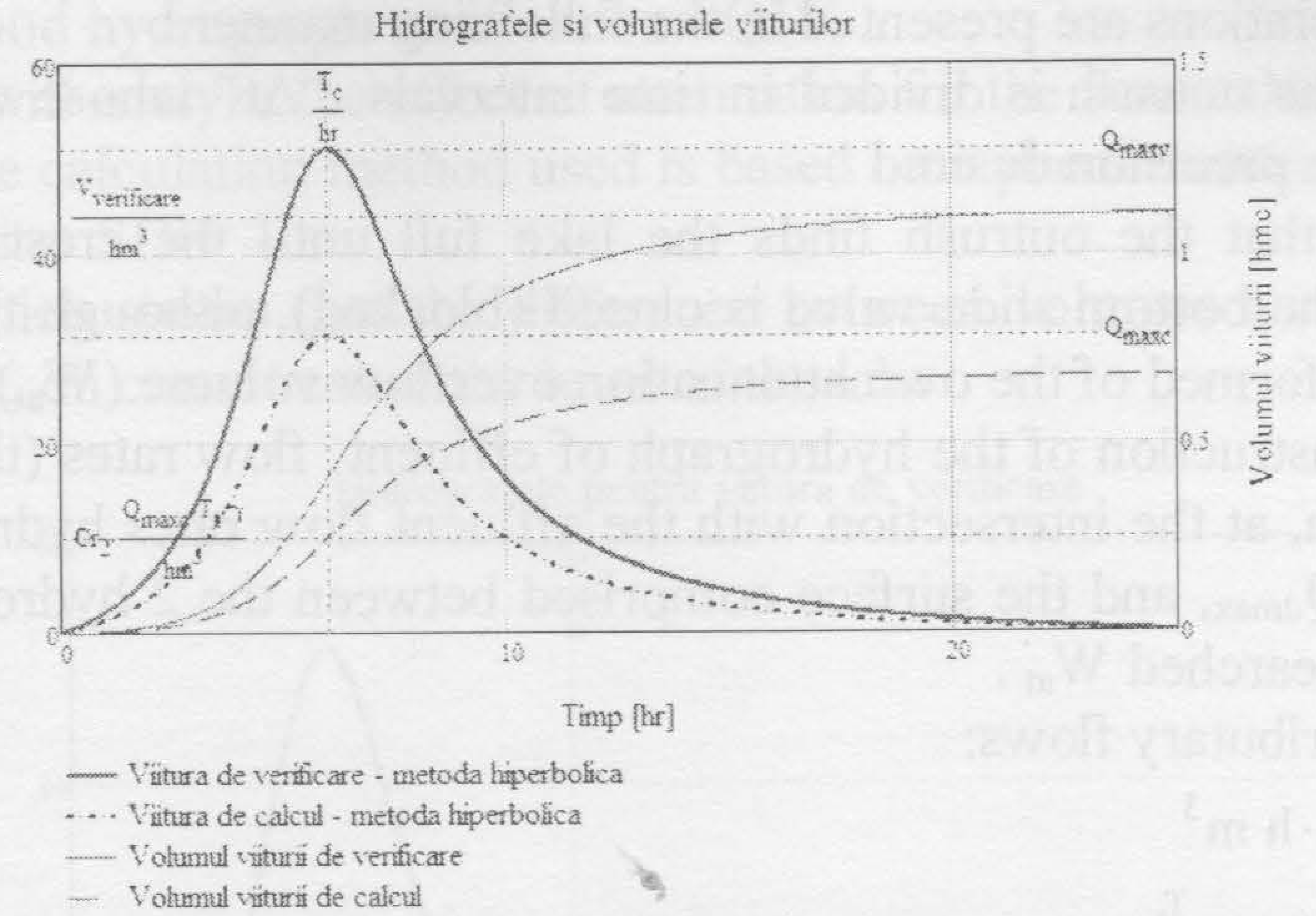


Figure 4 - Flood hydrographs and flood volumes in accumulation

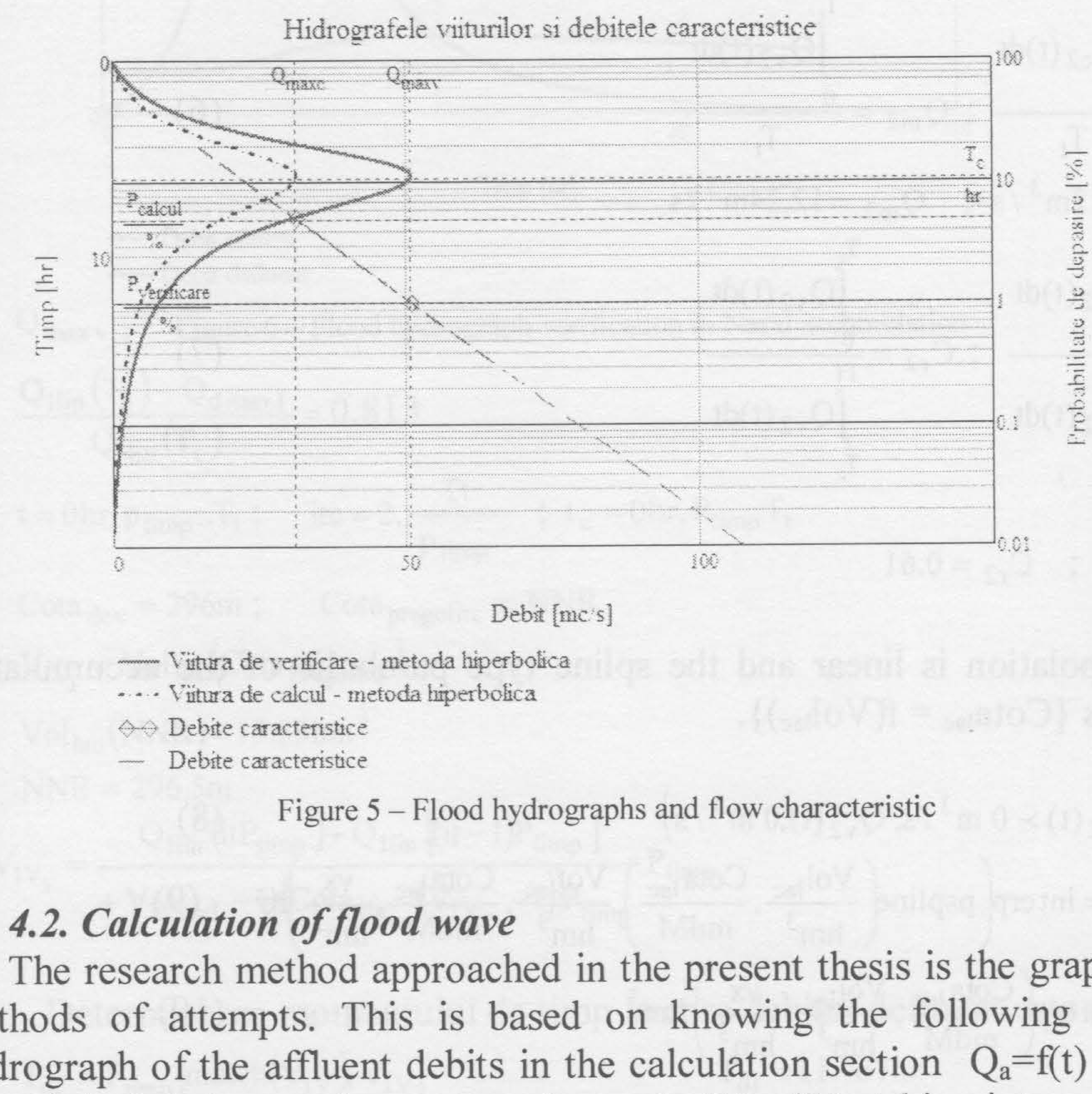


Figure 5 – Flood hydrographs and flow characteristic

4.2. Calculation of flood wave

The research method approached in the present thesis is the graphic-analytical methods of attempts. This is based on knowing the following elements: the hydrograph of the affluent debits in the calculation section Q_a=f(t) ; the superior part of the lake's capacity curve and namely W_{at}=f(h), taking into account that the lake is full until the overflow crest (NNR) ; the overflow key Q_d=f(h), built when we know the length of the overflow , giving values to "h" and calculating the "Q_d"; the key of the bottom discharge Q_g=f(h), built when we know the section of the bottom discharge and the depth of the weight centre of the section; from the last three curves, the curve Q_{def}=f(W_{at}) is built.

The calculation operations are presented in the following manner :

- the duration of the outrush is divided in time intervals "Δt" whose value is chosen according to the precision desired

- it is considered that the outrush finds the lake full until the crest of the overflow (NNR) and the bottom slide valve is closed (blocked), although the lake attenuation capacity is formed of the own attenuation overflow volume (W_{at})

- we aim at the construction of the hydrograph of effluent flow rates (the blue interrupted line), which, at the intersection with the affluent flow rates hydrograph gives us the value of Q_{dmax}, and the surface comprised between the 2 hydrographs represents exactly the searched W_{at} .

Calculation of the tributary flows:

$$Q_{max\,v} \cdot T_t \cdot \gamma = 1.102 \cdot h\ m^3$$

$$\int_0^{T_t} Q_{c2}(t)dt = 0.676 \cdot h\ m^3 \ ; \ \int_0^{T_t} Q_{v2}(t)dt = 1.102 \cdot h\ m^3 \qquad (5)$$

$$Q_{m1} = \frac{\int_0^{T_t} Q_{c2}(t)dt}{T_t} \ ; \ Q_{m2} = \frac{\int_0^{T_t} Q_{v2}(t)dt}{T_t} \qquad (6)$$

$$Q_{m1} = 7.512 m^3/s \ ; \quad Q_{m2} = 12.24 m^3/s$$

$$C_{r1} = \frac{\int_0^{T_c} Q_{c2}(t)dt}{\int_{T_c}^{Tt} Q_{c2}(t)dt} \ ; \ C_{r2} = \frac{\int_0^{T_c} Q_{v2}(t)dt}{\int_{T_c}^{Tt} Q_{v2}(t)dt} \qquad (7)$$

$$C_{r1} = 0.61 \quad ; \quad C_{r2} = 0.61$$

The interpolation is linear and the spline type parabolic of the accumulation characteristics $\{Cota_{lac} = f(Vol_{lac})\}$.

$$Q_{lin}(t) = if\left(Q_{v2}(t) \succ 0\ m^3/s, Q_{v2}(t), 0\ m^3/s\right) \qquad (8)$$

$$Cota\ ps_{lac}(vx) = interp\ pspline\left(\frac{Vol_{lac}}{hm^3}, \frac{Cota_{lac}}{mdM}\right), \frac{Vol_{lac}}{hm^3}, \frac{Cota_{lac}}{mdM}, \frac{vx}{hm^3}\Bigg)m \qquad (9)$$

$$Vol_{lac}(hx) = linterp\left(\frac{Cota_{lac}}{mdM}, \frac{Vol_{lac}}{hm^3}, \frac{vx}{hm^3}\right) hm^3 \qquad (10)$$

Flood wave attenuation in the lake

It will determine the appearance of waves diffluent q (t) when its dimensions spillway, the lake volume variation in height and hydrograph tributary flows.

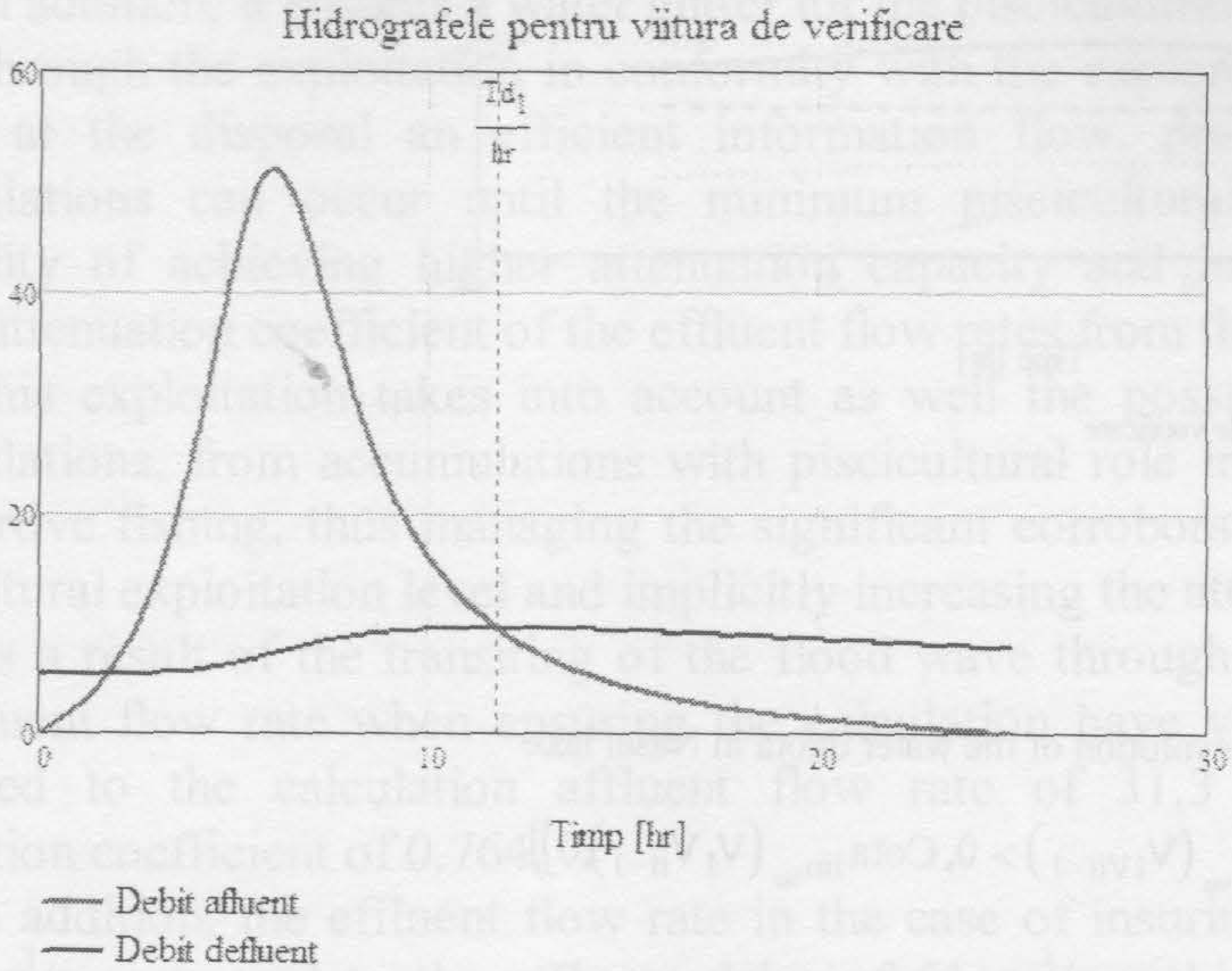
Based on the theme of the project schedules are prepared hydrograph flood calculation as follows:

Flood hydrograph verification - Q1%

It will analyze the effect of attenuation for the flow calculation and verification.

The calculation method used is based on a phenomenon characteristic equation: (QQ) dt = SDH

Which shows that the difference between volumes and affluent diffluent in a time dt, dh cannot cause the level of the lake.



$Q_{max\,v}$ = Figure 6 – Flood hydrograph verification in Nasal accumulation

$$\frac{Q_{1lin}(T_c) - Q_{d\,max1}}{Q_{1lin}(T_c)} = 0.813$$

$$t = 0hr, p_{timp} .. T_t \ ; \quad itc = 2..\frac{Tt}{p_{timp}} \ ; \ t_c = 0hr, P_{timp}\, T_t$$

$$Cota_{dev} = 296m \ ; \quad Cota_{pregolire} = NNR$$

$$V_{1V_1} = Vol_{lac}(Cota_{pregolire})$$

$$Vol_{lac}(NNR) = 13.33hm^3$$

$$NNR = 296.5m$$

$$V_{1V_{it}} = \frac{Q_{1lin}(itP_{timp}) + Q_{1lin}[(it-1)P_{timp}]}{+V_{1Vit=1} - Q(Cota_{lin_{lac}}(V_{1V_{IT}} - 1))P_{timp}} P_{timp}$$

Determinarea momentului de timp la care debitul defluent este maxim:

$$T_{d_1} = P_{timp}\,|match(V_{1V}), V_{1V}| \qquad T_{dl} = 11.767hr$$

$$T_{d_2} = P_{timp}\,|match(V_{2V}), V_{2V}| \qquad T_{d2} = 0.017hr$$

Determinarea cotei maxime si a debitelor afluente pentru viiturile considerate:

$$h_{L_1} = \max(cot\,a_{lin\,lac}(V_{1V}))$$

$$Q^d{}_{max_1} = Q(\max(cot\,a_{lin_{lac}}(V_{1V})))$$

Evolutia cotei apei in lac

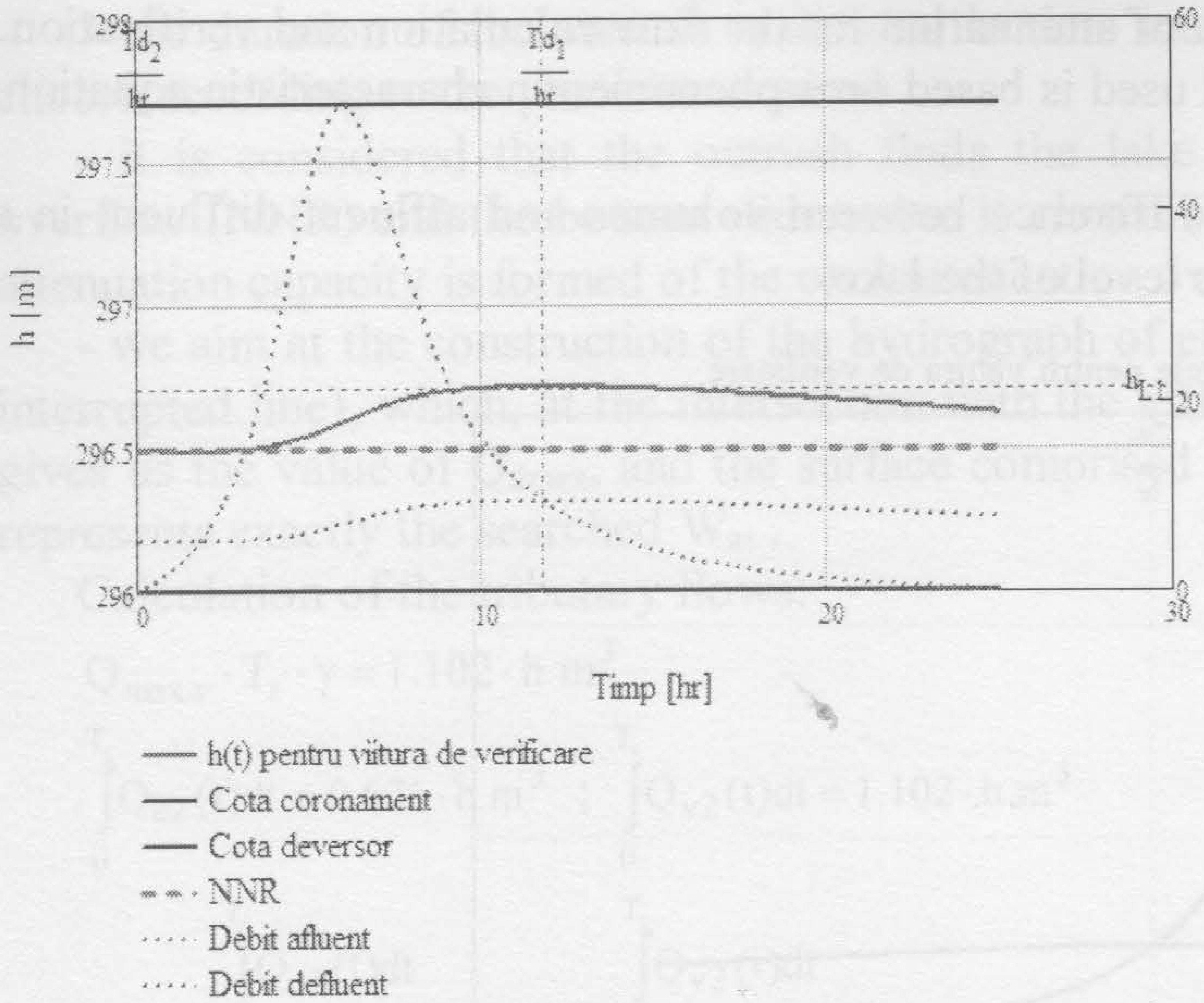


Figure 7 – The evolution of the water quota in Nasal lake

$$Q_{ccl_{it}} = Q\left(if\left(Cota_{lin_{lac}}\left(V_{1Vit-1}\right) > 0, Cota_{lin_{lac}}\left(V_1 V_{it-1}\right), 0\right)\right)$$

$$h_{L_1} = 296.718\text{m}$$

$$h_{L_1} - Cota_{coronament} = -98\text{cm}$$

$$Q_{d_{max1}} = 9.533 \frac{m^3}{s}$$

$$NNR = 296.5\text{m}$$

$$Cota_{coronament} = 297.7\text{m}$$

Hidrografele pentru viitura de calcul

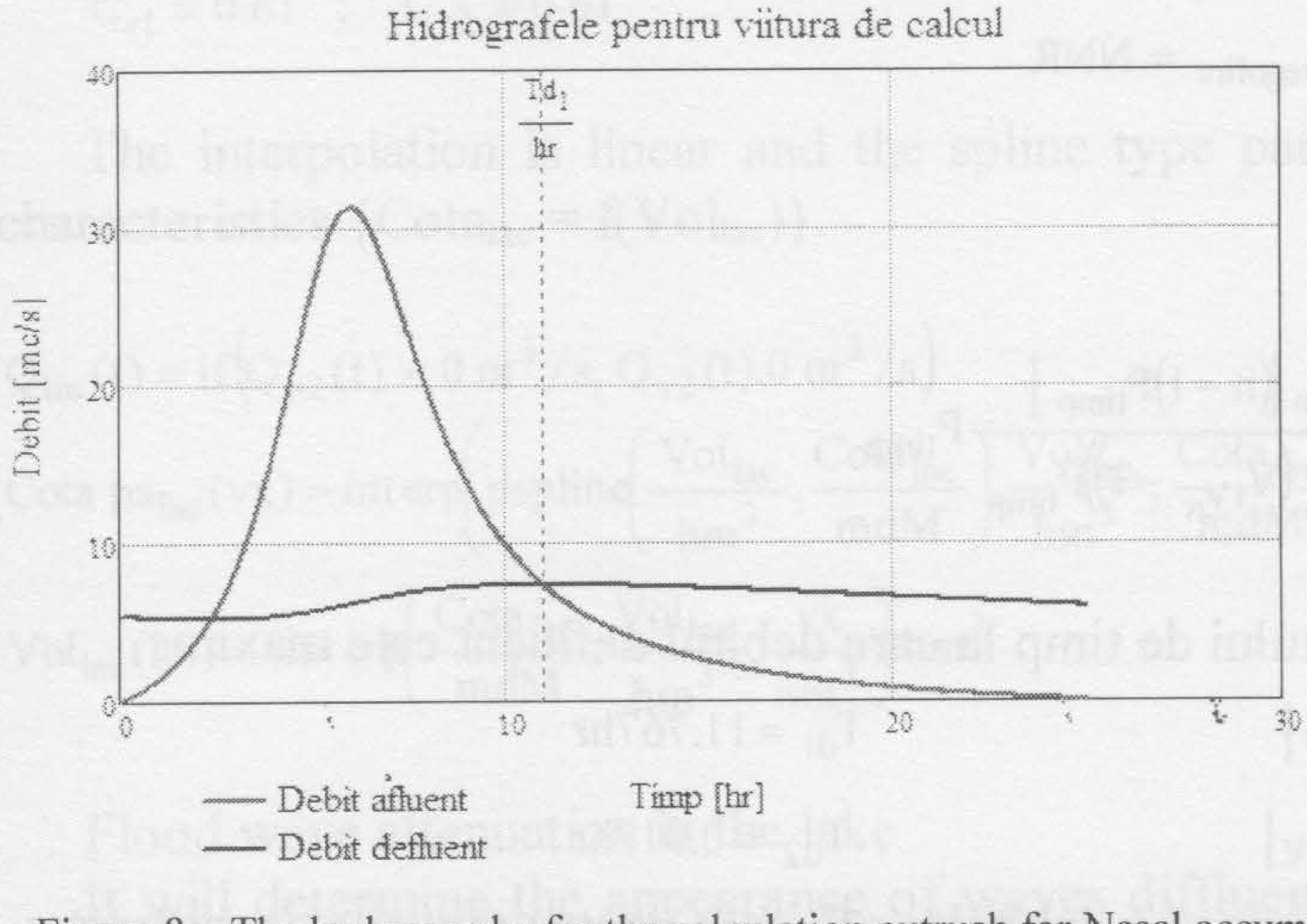


Figure 8 – The hydrographs for the calculation outrush for Nasal accumulation

$$Q_{max\,c} = 31.3\ m^3/s \qquad Q_{d_{max1}} = 7.372\ m^3/s$$

$$\frac{Q_{1lin}(T_c)-Q_{dmax1}}{Q_{1lin}(T_c)}=0.764$$ - Attenuation coefficient

CONCLUSIONS

Nasal accumulation, taken in the study, ensures through the barrier of the Fizes valley, the fastest and most efficient method of regularizing the outrush flow rates. In addition, it ensures a water glitter for the piscicultural activity.

Through the exploitation in conformity with the exploitation regulations and having at the disposal an efficient information flow, pre-discharges of these accumulations can occur until the minimum piscicultural level, creating the possibility of achieving higher attenuation capacity and implicitly achieving a higher attenuation coefficient of the effluent flow rates from the accumulation.

This exploitation takes into account as well the possibility of using these accumulations, from accumulations with piscicultural role in accumulations used for sportive fishing, thus managing the significant corroboration of the minimum piscicultural exploitation level and implicitly increasing the attenuation volumes.

As a result of the transiting of the flood wave through Nasal accumulation, the effluent flow rate when ensuring the calculation have values of 7.373 m^3/s compared to the calculation affluent flow rate of 31.3 m^3/s, achieving an attenuation coefficient of 0.764.

In addition, the effluent flow rate in the case of insuring the checking is of 9.533 m^3/s compared to the affluent debit of 51 m^3/s, achieving a value of the attenuation coefficient of 0.813.

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TRANZITAREA UNDELOR DE VIITURĂ CU AJUTORUL PROGRAMULUI MATHCAD PROFESSIONAL 14.0, PRIN ACUMULAREA NĂSAL DIN BAZINUL HIDROGRAFIC FIZEŞUL MIJLOCIU, JUDEȚUL CLUJ

Rezumat: Acumularea Nasal, luată în studiu, realizează prin bararea văii Fizeşului metoda cea mai rapidă şi eficientă de regularizare a debitelor de viitură. De asemenea, asigură luciu de apă pentru activitatea piscicolă. Prin realizarea atenuării undelor de viitură în aceste acumulări se evită atât pagubele directe, cât şi pagubele indirecte: pagubele directe reprezentând valoarea distrugerilor sau avariilor obiectivelor afectate şi valoarea cheltuielilor făcute cu operațiunile de intervenție pentru apărarea zonelor periclitate, de evacuare şi ajutorare a populației; pagubele indirecte date de pierderile înregistrate în economie. Trecerea undelor de viitură prin acumularea Năsal duce la atenuarea acestora realizându-se, în secțiunile aval de baraj, debite şi niveluri atenuate, mult mai

mici decât cele de viitură. Interpolarea este liniară şi parabolica tip spline a caracteristicilor acumulării. În prezenta lucrare sunt expuse rezultate ale simulării cu software Mathcad 14 şi programele proprii folosite în aceasta aplicaţie.

CZU: 912(498)

IDENTIFICATION OF AREAS OF PREVENTIVE EVACUATION AND ACCOMMODATION OF POPULATION, ANIMALS AND PROPERTY NECESSARY FOR THE DEFENSE PLAN OF THE BACIU COMMUNE, CLUJ COUNTY

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Abstract. By this study a delineation of areas for the evacuation of population was achieved, which, after further checking on the ground, can be introduced into the flood defense plans. These areas were selected using geographic information systems, by analyzing the digital elevation model, and taking into account the slope and sunshine exposure of the ground, as well as the proximity to the exposed locality. These characteristics were quantified by means of a proportional and objective rating, so that the evacuation areas were highlighted at the end of the analysis by the highest scores obtained.
Key words. Aspect, Evacuation areas, Slope, Score.

INTRODUCTION

For the factors implied in flood risk management there are duties and responsibilities established by law, specific to their operating sector. In the national strategy are presented only their duties related to the prevention, protection and reduction of flood effects, those which require an organized, correlated or simultaneous implementation of the actions and measures designed to achieve the objectives.

In different fields of action, the flood management activities constitute a complex of problems including policies, plans and programs on short, medium and long term, aiming to protect life, property and environment against the natural phenomenon of risk.

One of the roles of county and local councils in flood management activities is to organize and to coordinate the evacuation of people from the flood endangered area, to previously established places and to assure the necessities in food, drugs, and health care.

The local council is responsible for mobilizing the community in the actions of supplying food and water, clothes and their distribution, as well as in the restoring the basic services in the affected localities.

We believe that at county level a spatial database and an integrated information system have to be created, which should be shared by institutions, companies, public administrations, etc. in order to ensure interoperability and data exchange. The management of spatial database can be accomplished optimally and efficiently based on access levels and the users can be individuals or legal.