

Information on the best practices in the field of the inter-boundary risk management in the Prut River Basin regarding to the floods

The second workshop on the inter-boundary risk management, regarding to the floods, Geneva, March 19 - 20, 2015

- ▶ I. The Prut River - a tributary of the Danube.
- ▶ The Basin of the Prut River is located on the territory of Romania, Ukraine and the Republic of Moldova.
- ▶ According to long-term observations of the hydrological regime of the river, it was found that almost every year there are two pronounced peaks - a spring flood, provoked by the melting of snow in the Carpathian region and the summer floods generated as a result of heavy rains in the Carpathians.
- ▶ The greatest danger to Republic of Moldova, are sudden rain floods which are provoked by appropriate rainfalls in the Carpathians. It is enough to have in the catchment area in the Carpathians rainfalls for one day and the situation in the river becomes already threatening.
- ▶ Over the past decade, express floods entailed huge material losses in: 1969, 1980, 1998, 2006, 2008, 2010 respectively. The maximum flow flood in 2008 was $3600\text{m}^3 / \text{sec}$ and the minimum flow rate was $2,5\text{m}^3 / \text{sec}$ in 1904.
- ▶ The area of the hydrographic basin - 12000km^2
- ▶ The average of the annual drain - 2430 mln. m^3
- ▶ The volume of the flood: 0,1% sufficiency - 4400 mln m^3 1% sufficiency - 3000 mln m^3
- ▶ The average of the annual drain - $81 \text{ m}^3/\text{sec}$



- ▶ The volume of used water - 1430 mln m³
- ▶ The number of irrigated areas 140 thousands ha, in Romania - 70 thousands ha, in Republic of Moldova - 70 thousands ha
- ▶ The main water users and consumers:
 - ▶ Irrigation - 800 million m³
 - ▶ Water supply - 314 million m³
 - ▶ Fisheries - 54 million m³
 - ▶ Sanitary volume - 158 million m³
- ▶ Operating experience reservoir Costesti - Stanca during 37 years shows that one of the main drawbacks in the prevention and the passage of the flood on Prut River is the delaying receipt of information about the formation of the flood, the technical condition of the dam and of the hydro-system dilapidated levees dams (the last built was done over 40 years ago)
- ▶ Everyone knows about Kosteshti waterworks, drainage basin is located on the territory of Romania and Ukraine, and waterworks on the territory of Romania and Moldova.



II. The total volume of the reservoir at the maximum level 0,1 sufficiency 1.4 million m³

Including dead volume - 175 million m³

Amount of iron reserves - 110 million m³

Useful volume - 450 million m³

Total flood control volume - 665 million m³

The normal water level (NWL) - 90.8 m³

Elevation iron reserves - 81.5 m³

The maximum level of 1% sufficiency - 98.2 m³

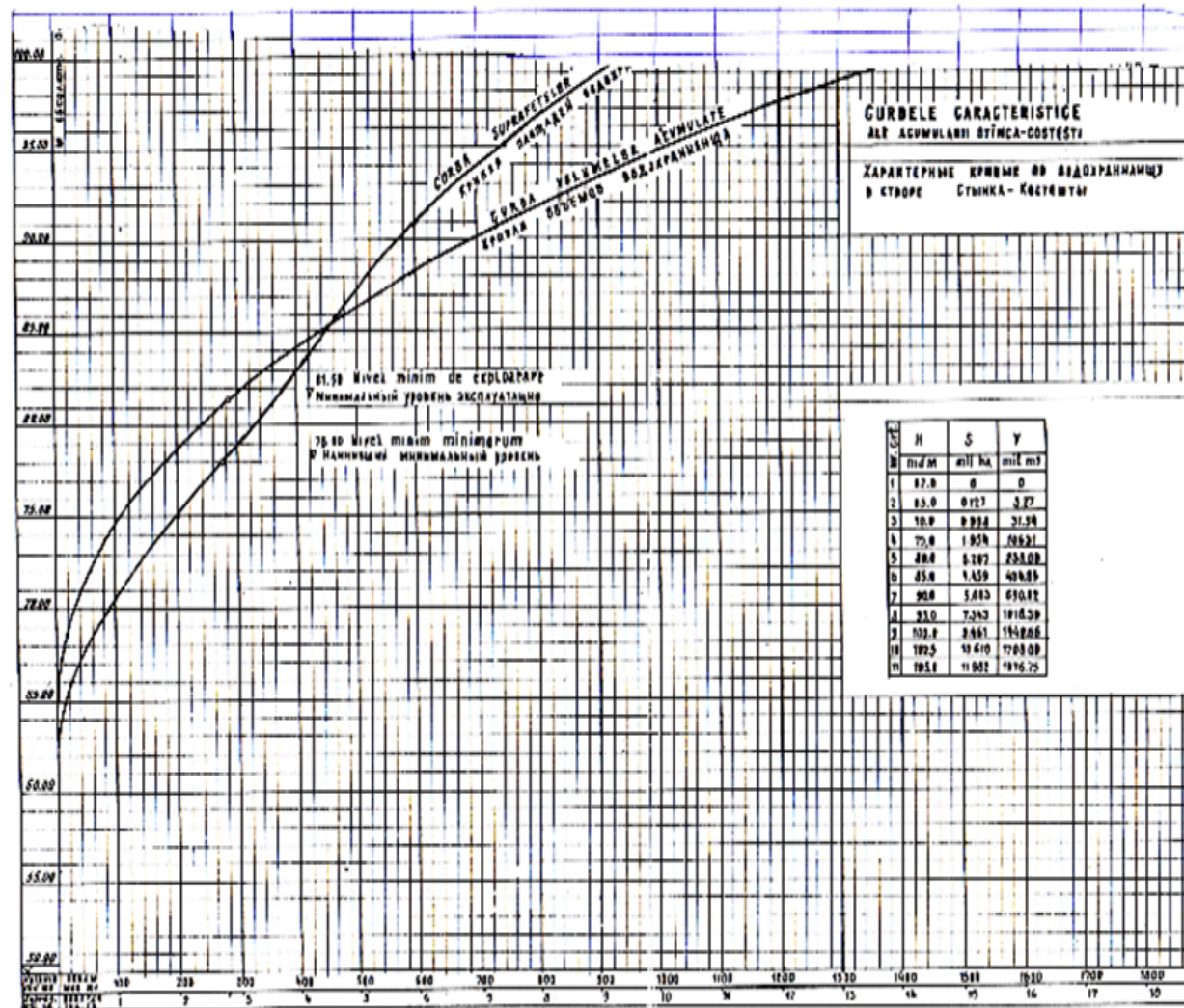
The maximum level of 0.1% of the supply - 99.5 m³

Average long-term power generation hydroelectric kW / hr 130

- During the flood, there is the output of drainage water for downstream slope of the dam reservoir Costesti - Stanca
- Piezometric wells indicate practically unimpeded water filtration through carburizing veil.
- The destruction of joints;
- Formation of voids under the expansion joints;
- unsatisfactory state of the hydro-mechanical and electrical equipment;

According to the technical project developed design institutes in Romania and the Republic of Moldova, it is necessary to make repairs to the dam of 27 million euros.

III. Graph of the areas and volumes of the water level in the reservoir Costesti - Stanca



IV. A short description of the project „EAST - AVERT“

„EAST - AVERT“ - the prevention and protection against flooding in the upper basins of the rivers Siret and Prut, by applying a modern monitoring system with automatic stations.

- The project „EAST - AVERT“ aims to develop the integrity of the system to prevent flooding by using hydrometric data provided by automatic stations and specialized software for the analysis and forecasting.
- The data is exchanged between the multilateral project participants, as well as between the technology the Costesti - Stanca dam and to the creation of automatic stations, controllers and forecasting centers.
- The task of the Republic of Moldova in this project is to restore and to equip with the monitoring t a forecasting center in Chisinau and drawing hazard maps of the Prut River. In Costesti - Stanca it will be created a dispatch center, equipped with high technology, which will investigate the obtained information on levels of the dams from other automatic stations that are set up along the river in the country as well as abroad.
- The dam will be equipped with numerous sensors level, which will transmit data of the state of the dam at the current time.
- The processing and the transmission of the data will be carried out by the central processor (type server) using a specialized software.
- The attention will be focussed on the information received from the sensors along the river for a correct analysis and, therefore, a very important factor is the exchange of information between the project participants. A result of exchange of the data on the dam between the project participants and between forecasting centers at the current time, will be made a prognosis of the expected level on the Prut River and it will be taken therefore a decision about the overflow dam.

A forecasting center in Chisinau will be equipped with technology for data processing and will receive information as from Costesti - Stanca, as from partners' automatic stations to subsequently process the data and incorporate them into the sample flood forecasting to calculate the probability of the risk of flooding of the Prut River floodplain. In the center of forecasting, the obtained monitoring data from Costesti - Stanca and by partners will be implemented on-line.

- The collection and processing will be carried out by using specialized software.

The project "EAST - AVERT" also provides:

- Restoration of joints between slabs upland flow
- Filling cavities under concrete slabs solution
- flattening the upper slope in the area of the two rocks that are located in the body of the dam.

V. The technical condition of the expansion joints



VII. The working to reduce the slope of the rock and further anti-filtering measures



VII. Conclusions

In our opinion, the main directions for flood prevention and better management of water resources in this case, must be:

- the construction of new regulatory waterworks in the basin;
- the maintenance in good technical condition of existing hydraulic components;
- the ensuring stable monitoring (on-line), the formation of floods on the stage of formation of heavy rains in the upper reaches of the river basin.

Study of the construction of rainwater structures (in the flood period) on the territory of Romania, Ukraine and the Republic of Moldova in the catchment area above the reservoir Costesti - Stanca:

- the monitoring implementation of the embankment dams to ensure they maintain the integrity- Adequate flood management in which must not be exceeded estimated waste amounts above $700 \text{ m}^3 / \text{sec}$;-
- Extension of the zone of the river in order to reconstruct the water - wetlands, based on the removal of the flood zone of dilapidated buildings;
- Revision of the operating rules of the reservoir in view of possible climate change.
- The reparation of the hydraulic structures and hydro-mechanical equipment of the hydro-system dams
- Anti-filtering activities;
- The restoration of expansion joints;
- Technical Analysis of the collector - drainage network and drainage pumping stations in the floodplain;
- Restoration of the drainage channels;
- Restoration of the power lines and transformer substations;
- The introduction of hydraulic model of the flood management of the Prut River in combination with the program of formation of flood forecasting in the upper reaches, including the management of water resources in low water (Ralph Olson) and throughput the space between the dykes (longitudinal scheme)
- The creation of water - wetlands on early drained land in the area of the Republic of Moldova, Cantemir district an area of about 300 ha;